NATURAL RESOURCES

Low-Temperature Geothermal Resources of Washington

J. Eric Schuster and
R. Gordon Bloomquist

WASHINGTON
DIVISION OF GEOLOGY
AND EARTH RESOURCES

Open File Report 94-11
June 1994

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Jennifer M. Belcher - Commissioner of Public Lands
Kaleen Cottingham - Supervisor

Low-Temperature Geothermal Resources of Washington

J. Eric Schuster and
R. Gordon Bloomquist

WASHINGTON
DIVISION OF GEOLOGY
AND EARTH RESOURCES

Open File Report 94-11
June 1994

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Jennifer M. Belcher - Commissioner of Public Lands
Kaleen Cottingham - Supervisor

Division of Geology and Earth Resources

WASHINGTON DEPARTMENT OF NATURAL RESOURCES
Jennifer M. Belcher—*Commissioner of Public Lands*
Kaleen Cottingham—*Supervisor*

DIVISION OF GEOLOGY AND EARTH RESOURCES
Raymond Lasmanis—*State Geologist*
J. Eric Schuster—*Assistant State Geologist*

This report is available from:

Publications
Washington Department of Natural Resources
Division of Geology and Earth Resources
P.O. Box 47007
Olympia, WA 98504-7007

Price	$ 4.16
Tax *(WA residents only)*	$ .34
Total	$ 4.50

Mail orders must be prepaid; please add $1.00 to each order for postage and handling.

Make checks payable to the Department of Natural Resources.

Printed on recycled paper
Printed in the United States of America

Contents

ILLUSTRATIONS

TABLES

APPENDICES

PLATES *(accompany text)*

Low-Temperature Geothermal Resources of Washington

J. Eric Schuster
Washington State Department of Natural Resources
Division of Geology and Earth Resources
PO Box 47007, Olympia, WA 98504-7007

R. Gordon Bloomquist
Washington State Energy Office
PO Box 43165
Olympia, WA 98504-3165

ABSTRACT

This report presents information on the location, physical characteristics, and water chemistry of low-temperature geothermal resources in Washington. The database includes 941 thermal (>20°C or 68°F) wells, 34 thermal springs, lakes, and fumaroles, and 238 chemical analyses.

Most thermal springs occur in the Cascade Range, and many are associated with stratovolcanoes. In contrast, 97 percent of thermal wells are located in the Columbia Basin of southeastern Washington. Some 83.5 percent are located in Adams, Benton, Franklin, Grant, Walla Walla, and Yakima Counties. Yakima County, with 259 thermal wells, has the most.

Thermal wells do not seem to owe their origin to local sources of heat, such as cooling magma in the Earth's upper crust, but to moderate to deep circulation of ground water in extensive aquifers of the Columbia River Basalt Group and interflow sedimentary deposits, under the influence of a moderately elevated (41°C/km) average geothermal gradient.

Thermal well waters are quite dilute, averaging only 260 ppm total for eight major chemical species (Na, K, Ca, Mg, HCO_3, CO_3, Cl, and SO_4). All thermal well waters have HCO_3 as the dominant anion. The dominant cations are either Na+K or Ca+Mg, with Na+K dominant somewhat more commonly. Thermal springs are less dilute, averaging 1570 total ppm. N+K is the chief cation, and the chief anions are either HCO_3+CO_3 or $Cl+SO_4$, with the latter somewhat more common.

At least 250 of Washington's thermal wells are publicly owned, and many of these are located near public buildings that might be economically heated through the use of geothermal water-source heat pumps. However, the common collocation of the resource and potential users is no guarantee of development. Today, development is being slowed by a lack of widespread knowledge of the availability of low-temperature geothermal resources, by a lack of knowledge about the reliability and efficiency of geothermal water-source heat pumps, by a legal and institutional framework that does not always facilitate using ground water for space heating, and by the generally high front-end capital costs of geothermal water-source heat pump systems. We suggest ways to lessen some of these limitations.

INTRODUCTION

During the late 1970s and early 1980s, the Washington Division of Geology and Earth Resources conducted a multifaceted program of geothermal resource evaluation. The program was made possible by the financial support and encouragement of the U.S. Department of Energy's State-Coupled Program. At that time, the main focus was the discovery, evaluation, and commercialization of high-temperature geothermal resources that could be used to generate electricity. Thus, the Division's program emphasized the Cascade Range (Fig. 1), where high-temperature geothermal resources probably exist, as evidenced by the stratovolcanoes, Mount Baker, Glacier Peak, Mount Rainier, Mount St. Helens, and Mount Adams (Plate 1). However, for several reasons, there have been no significant discoveries or development of high-temperature geothermal resources in the Cascades. First, competing energy prices have been low for the last decade or more. Second, the areas around the stratovolcanoes are largely undevelopable because the land is preserved as national parks, wilderness areas, or national monuments or is dedicated to other uses. Third, logistical problems associated with attempts to develop high-temperature geothermal resources near a stratovolcano would be very challenging.

Investigations conducted during the late 1970s and early 1980s included:

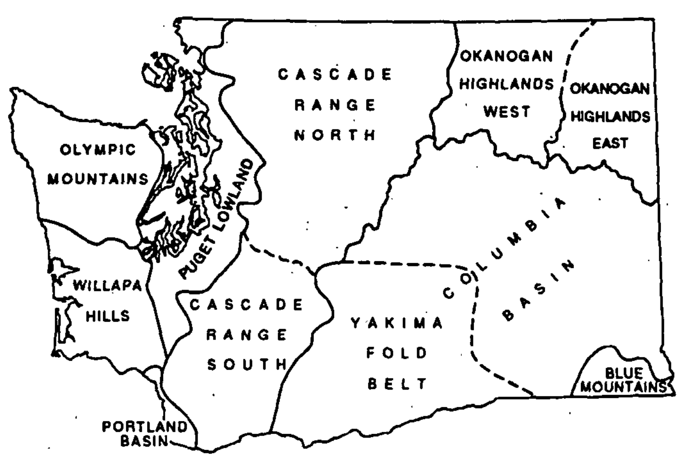


Figure 1. Physiographic provinces of Washington.

- description, sampling, and chemical analysis of thermal and mineral springs,
- several episodes of heat-flow/temperature-gradient drilling in the Cascade Range, which was practically unknown thermally at the time,
- temperature-gradient/heat-flow measurements in the holes drilled for that purpose in the Cascades,
- extensive temperature-gradient measurements in existing drill holes all over the state, but most extensively in the Columbia Basin,
- regional gravity studies in the Cascades,
- geohydrologic studies in the Yakima and Moses Lake–Ritzville–Connell areas of the Columbia Basin (see Plate 2 and Fig. 7),
- geologic mapping and geochemical investigations in areas of young volcanism in the Cascades,
- soil mercury studies in the Mount St. Helens area, and
- the compilation of a bibliography of geothermal reports for Washington State.

These investigations, through 1983, are summarized by Korosec (1984). After 1983, two more U.S. Department of Energy contracts supported temperature-gradient/heat-flow investigations in the Cascades, but the high tide of geothermal exploration had passed.

An important accomplishment of that time was the publication of a 1:500,000-scale map depicting the distribution and nature of geothermal resources in Washington (Korosec and others, 1981). The map data were compiled by the staffs of the Washington Division of Geology and Earth Resources and the Washington State Energy Office, and the map was cartographically prepared and printed through the efforts of the National Oceanic and Atmospheric Administration, all under the sponsorship of the U.S. Department of Energy. Similar maps were produced for most of the western states.

Washington's map locates and provides basic data for 31 thermal springs, 29 mineral springs, and 338 thermal wells. The springs are mostly located in the Cascade Range, many clearly associated with stratovolcanoes. Most of the warm wells are located in the central, southwestern, and southern parts of the Columbia Basin in south-central Washington.

Even though the 1981 geothermal resources map has served very well, there has been a need for several years to make another inventory of geothermal resources. Of the 45 references from which well and spring data were taken for the tables in the appendices, 23 were released after 1981. The most productive of the new or much-expanded sources of data are the unpublished water well reports held in the Yakima and Spokane regional offices of the Washington State Department of Ecology and the U.S. Geological Survey's WATSTORE database.

The large amount of data available now that was not available or not consulted in 1981 is reflected in the size of the geothermal database reported herein. The current database reports only thermal wells, springs, lakes, and fumaroles (except for two cooler wells; see explanation under DATA SOURCES); no nonthermal mineral springs are reported, although they were on the 1981 map. The current database comprises 941 wells and 34 springs, spring systems, lakes, and fumaroles (Table 1). The number of spring systems, lakes, and fumaroles reported here is not much larger than the number reported in 1981, but the number of warm wells is almost 3 times larger. The increase results from the more comprehensive nature of the sources of data consulted for this report and the fact that there are many more wells in existence than there were in 1981.

In some ways it is unfortunate that occurrences cooler than 20°C could not be included in this database. Much can be learned by studying how cold wells are interspersed (or not) with warm wells, and by comparing their relative depths and other attributes. However, adding the cool wells would have added thousands of wells to the database.

This low-temperature geothermal resource assessment was funded by the U.S. Department of Energy, and similar assessments are being done in many of the western states. The program is being administered jointly by University of Utah Research Institute, Idaho Water Resources Research Institute, and Oregon Institute of Technology. Funds available limited field data-gathering, but we sampled 18 municipal, commercial, and school wells for chemical analysis by the laboratory of the University of Utah Research Institute. Therefore, this assessment relied primarily on compilation of a bibliography and index of geothermal resources and development (Christie, 1994) and a thorough review of existing data sources.

Table 1. Thermal wells, springs, lakes, and fumaroles in Washington, by county. *The six-county area referred to in the text and below* covers Adams, Benton, Franklin, Grant, Walla Walla, and Yakima Counties

County	Thermal wells	Thermal springs lakes, fumaroles
Adams	113	0
Asotin	9	0
Benton	123	0
Chelan	1	0
Clark	2	0
Clallam	0	2
Columbia	5	0
Cowlitz	0	1
Douglas	7	0
Franklin	60	0
Garfield	3	0
Grant	118	0
Grays Harbor	2	0
King	1	3
Kittitas	12	1
Klickitat	35	2
Lewis	8	2
Lincoln	30	0
Okanogan	5	2
Pierce	0	3
Skamania	6	7
Snohomish	0	4
Spokane	13	0
Walla Walla	113	2
Whatcom	1	3
Whitman	15	0
Yakima	259	2
Totals	941	34
Six counties	786 (83.5%)	4 (11.8%)

DATA SOURCES

The limits established by the U.S. Department of Energy for inclusion of data in this database are (1) a temperature at least 10°C above the mean annual surface temperature, here taken as 20°C, and (2) a temperature gradient of at least 25°C/km.

As used in this report, the word *thermal* signifies a water temperature at or above 20°C, and the words *nonthermal, cool,* or *mineral* refer to wells and (or) springs below 20°C.

Because regional temperature gradients in Washington exceed 25°C/km everywhere except western Washington (Table 2) and western Washington's regional gradient is almost 25°C/km, we assumed that the gradient limitation would be met for all data and concentrated only on the temperature limit.

The temperature limitation was observed except for two wells (well GR014, the Wahluke School well, and well WA086, the Walla Walla Community College well). These wells are included because temperatures above 20°C were reported in earlier databases, because the Walla Walla Community College well has been used for years as a heat source for a heat pump, and because we sampled both for chemical analyses.

Every well found in every known database that met the 20°C temperature cutoff is listed in the present database, with the exception of oil and gas test wells. There are a few oil and gas test wells in the present database, but they are included by virtue of having been reported in published databases that were used as data sources. More than 400 oil and gas test wells have been drilled in Washington, most of them in western Washington. Inequilibrium bottom-hole temperatures are reported in the oil and gas records of the Division of Geology and Earth Resources for many of these wells. We have not calculated equilibrium temperatures from these data for two reasons. First, western Washington oil and gas wells are in a low temperature-gradient region where the 20°C isotherm is deep and less attractive economically than in higher-gradient eastern Washington. Second, in eastern Washington there are only a few modern wells that would provide good data, so we are probably not missing a significant source of data. Furthermore, temperature gradients for deeper eastern Washington wells in the database fall within the 30°–50°C/km gradient band and seem to be entirely normal (see Fig. 8).

We carefully checked one source of data against another and tried to use the original source or the latest independently generated source of data when data sources were in disagreement. As previously noted, the budget allowed only limited field verification of data. Each chemical analysis reported in Appendix B comes from a single source of data and is a single, not composite, analysis. If an analysis failed to pass a charge-balance test (that is, fall within ten percent of 1.00), it was eliminated from this database. Mass balance was not used as a criterion for rejection of analyses. (See Appendix B.)

We checked the accuracy of the data in Appendix A for 18 wells we sampled, and we found the data to be approximately 80 percent accurate. Some of the references, such as Smith (1901) and Landes (1905), are quite old, and it would be unrealistic to expect that wells reported in these references would still exist, still exhibit the conditions originally reported (particularly with respect to artesian head), or still have the same name or ownership. We included the old wells in the database because they represent thermal conditions that should still exist, even if not precisely as reported in the early literature.

Table 2. Regional temperature gradients and heat flow in Washington. The Northern Rocky Mountains province is shown as Okanogan Highlands west and east on Figure 1, and the Coastal province as the combined Puget Lowland, Olympic Mountains, and Willapa Hills. (From Blackwell and others, 1985)

Physiographic province	Regional temperature gradient (°C/km)	Heat flow, (mW/m²)
Columbia Basin	41.1	61.1
Northern Rocky Mountains	26.0	74.9
Cascade Range, high heat-flow zone	64	100
Coastal province	24.5	39.8

Readers should verify the data reported here before making significant development decisions. If, for example, a heat-pump installation is contemplated for a particular well reported here, minimum data verification should include:

- determining the temperature and flow from the well,
- measuring pH,
- having a new chemical analysis done to guide the selection of pipe and other materials, and
- verifying that water rights allow the proposed development.

As noted above, an exhaustive bibliography and index of geothermal resources and development in Washington State was compiled as part of the present effort to update the state's geothermal resource database. For the compilation, Rebecca Christie, a staff librarian for the Division of Geology and Earth Resources, used the resources of the libraries of the Division of Geology and Earth Resources, the Washington State Library, the Washington State Energy Office, the Washington State Department of Ecology, the Geo-Heat Center of the Oregon Institute of Technology, and the Geothermal Resources Council in Davis, CA. We recommend the bibliography as a starting point for anyone interested in learning about, searching for, or developing geothermal resources in Washington. We made extensive use of the bibliography to assure that we did not overlook important sources of data.

In order to facilitate assessment and development of geothermal resources in the future, this database has been established on the geographic information system (GIS) of the Washington State Energy Office (WSEO). The GIS allows users to easily combine and evaluate the geothermal data with many other kinds of spatial data. WSEO is, for example, cooperating with the State Superintendent of Public Instruction's office to study the occurrence of warm wells near school buildings, especially those that are about to be remodeled, in order to evaluate the practicality of heating some of the schools with geothermal water-source heat pumps.

ACKNOWLEDGMENTS

We thank Ruth Kroneman and Mike Adams of the University of Utah Research Institute for providing chemical analyses and information and advice about the analyses. Phil Crane and Gene Potts of the Washington State Department of Ecology Central Regional Office in Yakima provided access and help with the extensive collection of water well reports housed in that office, and Dan Weis of Ecology's Eastern Regional Office in Spokane helped with that office's equally extensive collection of water well reports. Luis Fuste of the U.S. Geological Survey's Water Resources Division in Tacoma, WA, sent the latest WATSTORE data. Don Saul of the Washington State Energy Office established the database on the Energy Office's geographic information system and patiently made several updates. He also generated Figure 2. Rebecca Christie helped us to be reasonably confident that we had found all important sources of data. Many well owners allowed us, always cheerfully, to sample their wells for chemical analysis. Carl F. T. Harris did the layout and final cartography on Plates 1 and 2. Jari Roloff and Kitty Reed did editing and report layout. This report benefited from reviews by Gene Culver of Oregon Institute of Technology and Howard Ross of the University of Utah Research Institute. Through their help, all these people have undoubtedly made this report better than it otherwise would have been.

DATA FORMAT

This report is available in three forms: (1) as a paper report, (2) on disk (5.25-inch 1.2MB or 3.5-inch 1.44MB) for IBM-compatible personal computers, and (3) as an ARC-INFO geographic information system (GIS) coverage and associated database. In the IBM disk version, the text is offered in ASCII and WordPerfect 5.1 formats (the figures and plates are not included), and Appendix A (Descriptive and thermal data for wells and springs), Appendix B (Chemical data for wells and springs), and Appendix C (Convectively heated(?) wells) are present as Lotus 1-2-3 ".WK1" files. The Lotus files are readable by most spreadsheet programs. The paper and disk versions are available from the Washington Division of Geology and Earth Resources at the address given for author Schuster. For details about the ARC-INFO coverage, contact the Washington State Energy Office at the address listed above for author Bloomquist.

Appendices A and B form the main body of this report. Generally, both tables include data fields that the University of Utah Research Institute requested all the investigators in the different states to use. The I.D., Site Name, Twp N, Rng, Sec, and Part Sec are repeated from Appendix A so that occurrences can be easily correlated between the two tables. See the notes in Appendix B for information on the significance of charge balance and mass balance and how they were calculated. Briefly, these two calculations are indications of the quality and (or) completeness of chemical analyses.

FLUID CHEMISTRY

New Fluid Sampling

Appendix B presents more than 200 chemical analyses from thermal wells and springs. We collected 18 of these analyses, dated 1994 and with no reference in Appendix B, and the University of Utah Research Institute analyzed them as part of the present investigation. Several criteria guided the selection of the 18 sampled wells. All but one of these wells are in the six-county (Adams, Benton, Franklin, Grant, Walla Walla, and Yakima County) area of the Columbia Basin where most of the state's warm wells are located (Figs. 1 and 2). We concentrated our sampling effort here because

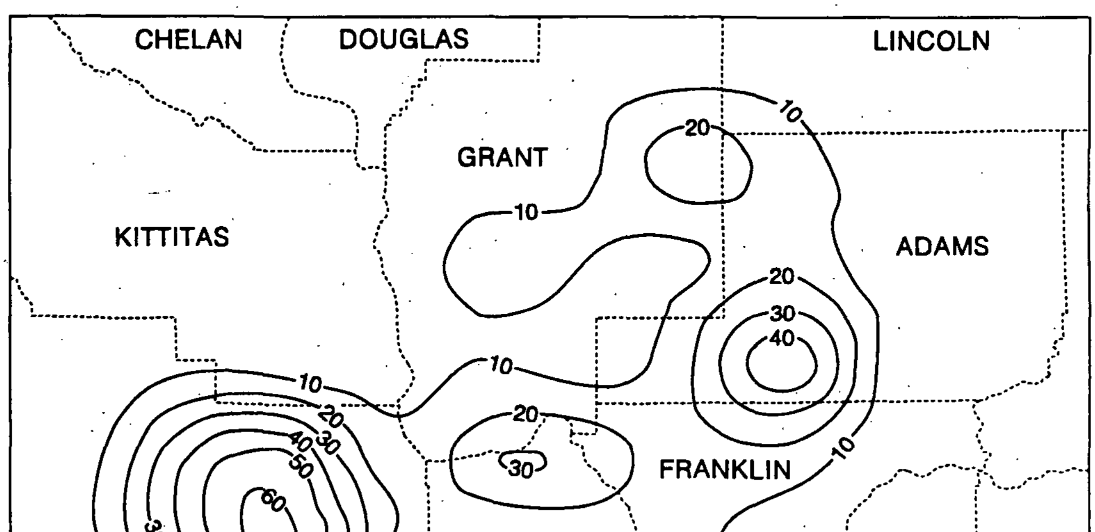


Figure 2. Areal density of thermal well and spring occurrences in Washington. Contours show the number of thermal wells and springs per 500 km^2 (193 mi^2). Only the part of the state shown reaches a density as high as 10 occurrences per 500 km^2.

of the many possibilities for early development that might be assisted by the availability of good chemical analyses and because we could conveniently and economically sample these wells.

Further, we wanted at least some of the samples to come from areas that did not have good chemical representation in the database. We avoided irrigation and domestic wells—irrigation wells because they were not in use during the winter and spring months when we had to do the sampling, and both irrigation and domestic wells because, in many instances, they do not offer much prospect for development because of potential water rights limitations and (or) lack of a significant nearby heat load. Publicly owned (mostly municipal) wells used year-round and located near potential heat loads were attractive targets for sampling because they offer good possibilities for early development.

We sampled 12 municipal wells (AD008, BE022, GR056, GR060, GR063, KS011, YA018, YA050, YA051, YA068, YA074, and YA141), one domestic water association well (FR010), one well at the Washington State University Irrigated Agriculture Research and Extension Center near Prosser (BE039), one school well (GR014), and three wells currently used for their heat, two as heat sources for heat pumps (WA086 and YA226) and one used for a car wash (YA211).

Observations

Several general observations can be made about the fluid chemistry. First, well waters are very dilute. Figure 3 shows the average concentration of eight major chemical species in statewide thermal wells and thermal springs and in cool wells in the six-county area of the Columbia Basin. The average total for these eight major chemical species for thermal wells is only 260 ppm. All of the well waters for which there are analyses in Appendix B are potable, at least with respect to inorganic constituents.

Figure 4 plots Na+K as a percentage of major cations against HCO_3+ CO_3 as a percentage of major anions for statewide thermal springs and wells and for six-county area cool wells and springs. All thermal well waters have HCO_3 as the dominant anion. They may have either Na+K or Ca+Mg as the dominant cation, with Na+K dominant somewhat more commonly.

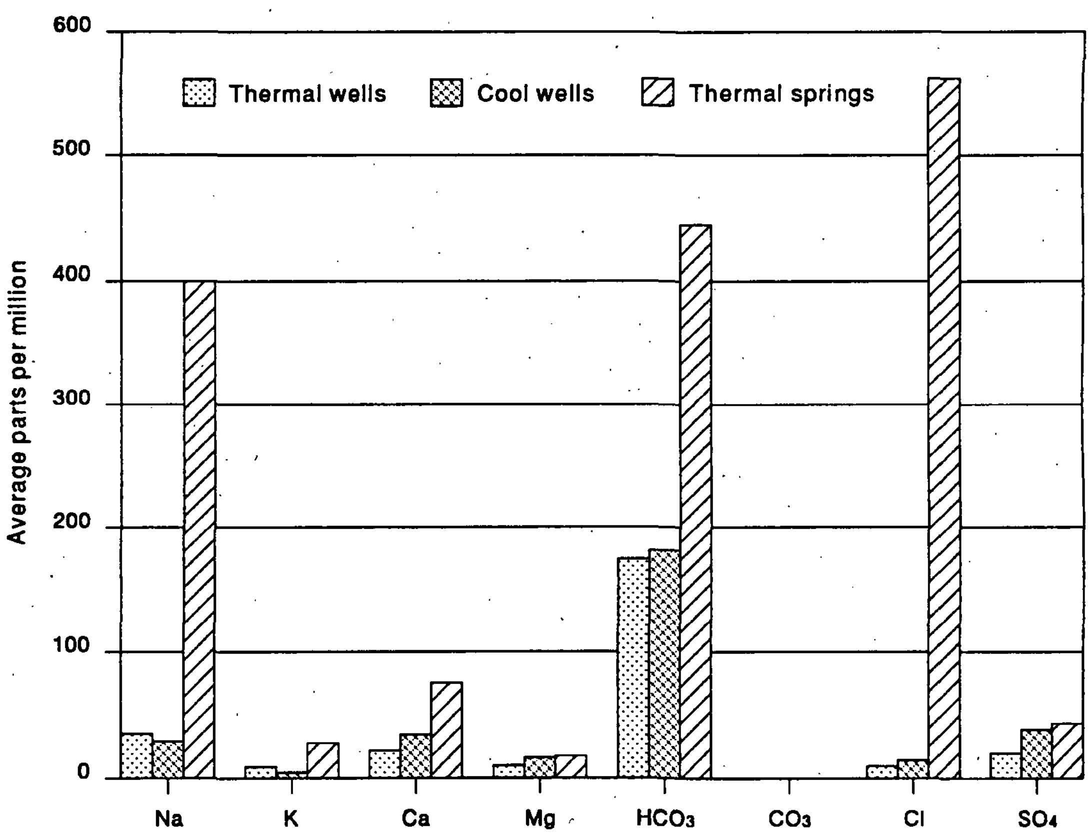


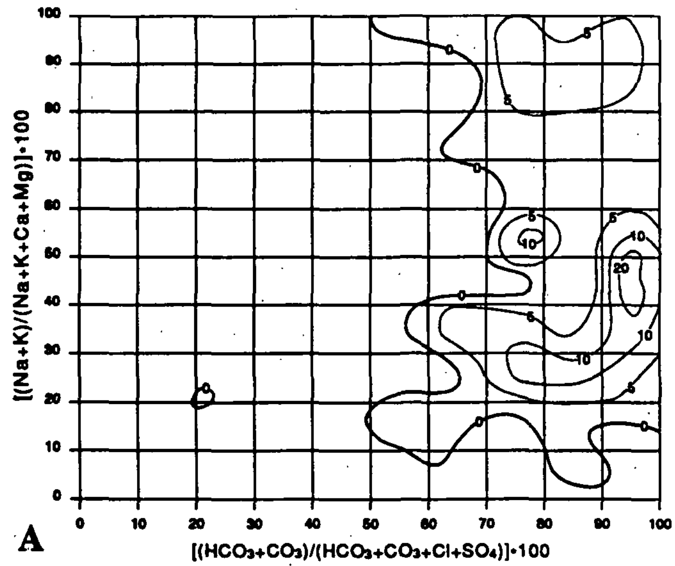
Figure 3. Average concentrations of major chemical species in thermal wells and thermal springs statewide and in cool wells in the six-county area (Adams, Benton, Franklin, Grant, Walla Walla, and Yakima Counties) of the southwestern and south-central Columbia Basin. The graph represents 204 analyses from thermal wells, 134 analyses from cool wells in the six-county area, and 34 analyses from thermal springs.

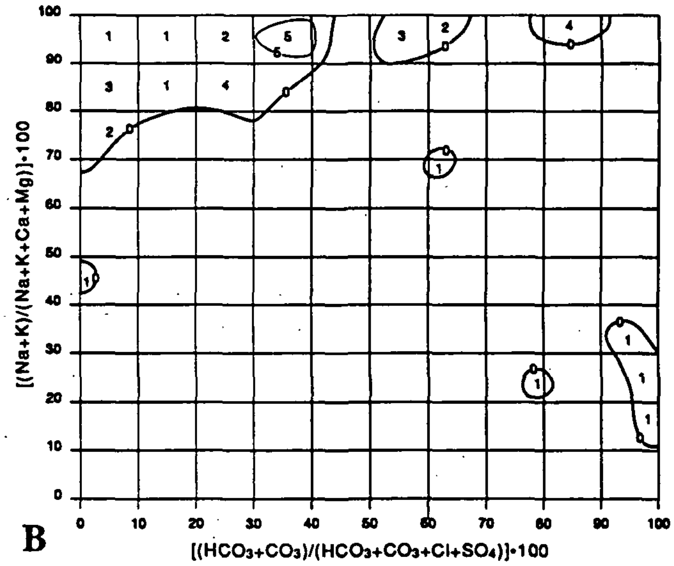
Although they are not tabulated in this report, we plotted 134 water analyses from cool wells in the six-county area in Figure 4C in order to compare them with the thermal wells (Fig. 4A) and springs (Fig. 4B). All of the analyses from cool wells are from Van Denburgh and Santos (1965). The thermal and cool wells are similar. Most of the cool wells are HCO_3 dominated. Like the thermal wells, the cool wells may be dominated by either Na+K or Ca+Mg, but in the cool wells Ca+Mg dominance is somewhat more common.

The thermal springs differ from the wells. Na+K is the chief cation, and the chief anions are HCO_3+CO_3 or Cl+SO_4, with Cl+SO_4 somewhat more dominant. The springs are also much less dilute than the well waters. The major chemical species in the springs have an average total of 1,570 ppm.

The wells and springs are located in different geologic provinces. Most of the springs are in the andesitic volcanic terrain of the Cascade Range, whereas the wells are in the basaltic and continental sedimentary terrain of the Columbia Basin. Because they exceed 20°C at the Earth's surface and are less dilute than the well waters, the springs must be waters that have circulated more deeply in the crust or circulated in areas of higher geothermal gradients or local heat sources. These differences are, presumably, responsible for the differences in chemistry.

We did not concentrate on the interpretation of geothermometers during this investigation. First, the geology of the Columbia Basin (Schuster, 1994a,b; Reidel and Fecht, 1994a,b; Gulick, in press; Schuster, in press) and what is known about the regional geothermal gradient (about 40°C/km; Blackwell and others, 1985) suggest that there are





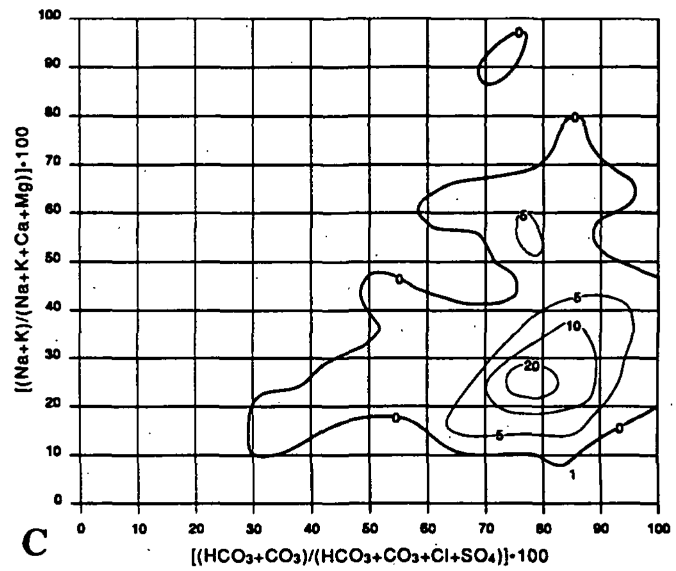


Figure 4. Na+K as a percentage of major cations plotted against HCO_3+CO_3 as a percentage of major anions for statewide thermal wells, statewide thermal springs, and six-county cool wells. Percentages were calculated from concentrations in milli-equivalents per liter. The heavy-line contour encloses all points, and the other contours enclose areas where 5, 10, or 20 points occur per 1 percent of the area of the plot. **A**. Thermal wells, statewide; 204 analyses. **B**. Thermal springs, statewide; 34 analyses. Because there are so few analyses represented, this plot also shows the number of individual chemical analyses that plot in each 1 percent area. **C**. Cool wells, six-county area of Columbia Basin; 134 analyses.

no shallow heat sources (igneous intrusives) beneath the Columbia Basin, and thus no areas with extremely high temperature gradients or other high-temperature geothermal manifestations. The last extrusive igneous activity, the waning flows of the Columbia River Basalt Group, occurred about 6 million years ago (Fig. 5). Also, the dilute ground waters of the Columbia Basin differ from hot-spring waters on which the empirical geothermometers are based, so calculating geothermometers in an effort to try to determine whether high temperatures exist at depth may not be a valid exercise.

The database presented here has been compiled from a variety of sources spanning more than 90 years. The data were collected by many people for many reasons, and there are certainly errors, such as incorrect well depths and chemical analyses representing mixed shallow and deep aquifers, and many other inconsistencies. Taken together, the limitations make this data set a rather poor one to use for making specific interpretations for specific locations. This database is better used on a sort of statistical basis, where one can try to recognize general trends and the "big picture" without trying to get specific.

GEOLOGIC, HEAT-FLOW, AND HYDROLOGIC SETTING

Plates 1 and 2 and Table 1 clearly show that geothermal resources in Washington are not randomly distributed. Thermal springs are largely confined to the Cascade Range (27 of 34 are in the Cascades), and most are spatially associated with a stratovolcano or a fault, where water is heated during deep circulation. Thermal wells, on the other hand, are strongly associated with the Columbia River Basalt Group (Fig. 6) and the Columbia Basin—the Columbia River Basalt Group and the Columbia Basin are almost co-extensive and the terms are used interchangeably herein. This area includes the various subbasins that form the western, southwestern, and south-central parts of the Columbia Basin in Washington. This area of subbasins bounded by faulted folds is referred to as the Yakima fold belt (Fig. 1). Some 97 percent of the state's 941 thermal wells are located in areas underlain by rocks of the Columbia River Basalt Group or suprabasalt sediments.

Because it is not practical to pursue exploration and development of high-temperature geothermal resources in the Cascade Range, and because Washington's thermal wells are strongly concentrated in the Columbia Basin, discussion will focus on the resources of the basin. Moreover, there is a strong tendency for thermal wells to occur in the western, southwestern, and south-central parts of the Washington portion of the Columbia Basin (Fig. 2). Adams, Benton, Franklin, Grant, Walla Walla, and Yakima Counties account for

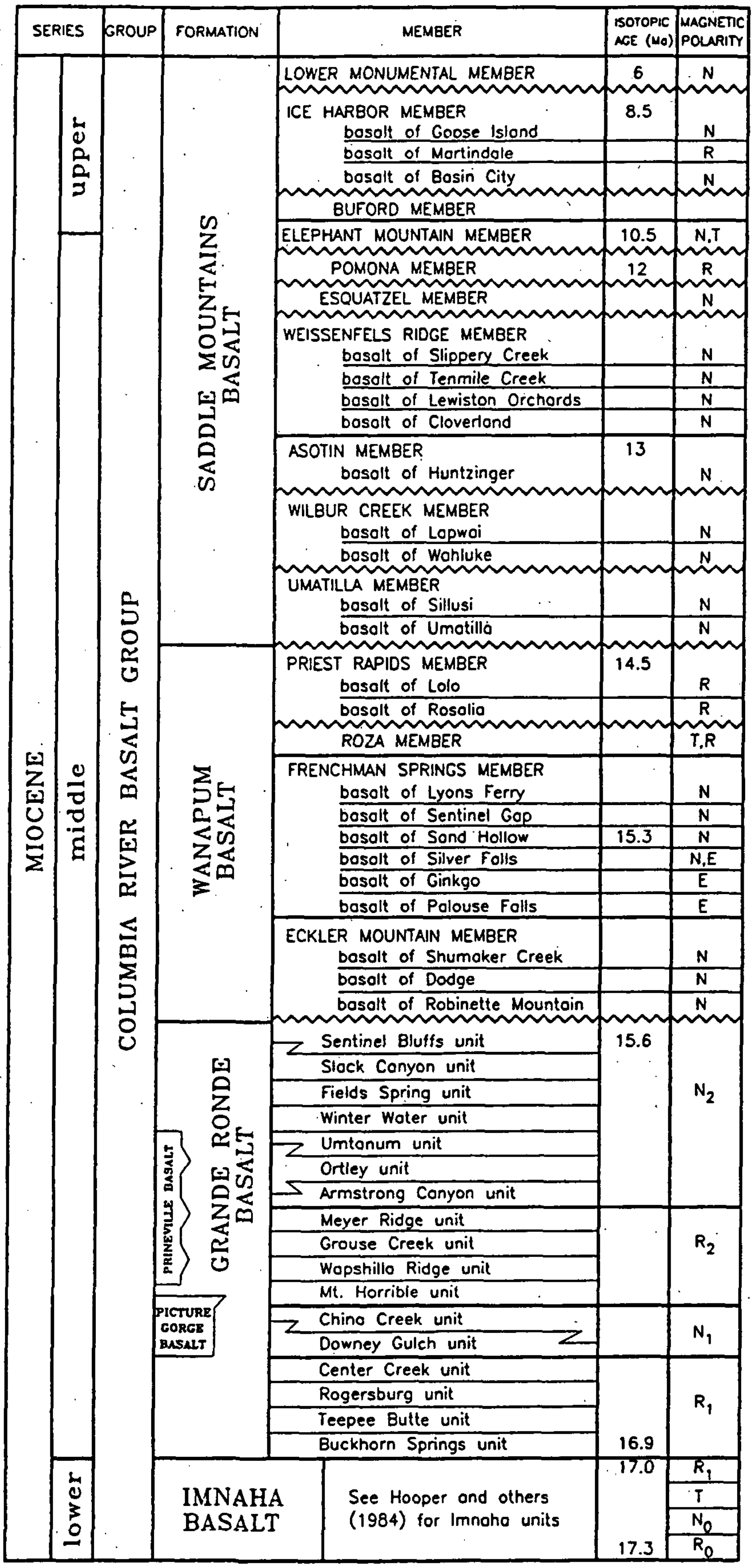


Figure 5. Generalized nomenclature and stratigraphic relations of the Columbia River Basalt Group. Sedimentary interbeds occur at many of the unconformities, shown by jagged horizontal lines between units. Modified from Reidel and others (1989).

786 (83.5 percent) of Washington's thermal wells. Yakima County alone contains 259 thermal wells, and Adams, Benton, Grant, and Walla Walla Counties each contain more than 100, followed by Franklin County with 60.

The Columbia River Basalt Group is a thick succession of tholeiitic basalts that was erupted from fissures in southeastern Washington, northeastern Oregon, and western Idaho between about 17 million and 6 million years ago (Fig. 5). More than 300 lava flows once covered (and mostly still do) an area of about 164,000 km^2 (63,000 mi^2) and have an aggregate volume of about 174,000 km^3 (42,000 mi^3). The largest flows exceeded 2,000 km^3 (500 mi^3) each, and some flows advanced more than 750 km (460 mi) from their source areas to the Pacific Ocean (Tolan and others, 1989). As time went on eruptions became less frequent and generally less voluminous, and part of the basin subsided. The thickest accumulation of basalts is in the area of Richland, Kennewick, and Pasco (Plate 2), close to the geographic center of the area covered by the basalts. Interflow sediments are present between many pairs of flows.

Both during volcanism and after eruptions ceased, the Yakima fold belt developed. The fold belt is a series of sharply defined anticlinal crests that trend northwest, west, and southwest. Most of the anticlines are broken by faults. There are broad, flat, basinal synclines between the fold crests, and some synclines contain as much as 400 m of suprabasalt sediments derived from the Cascades to the west and deposited by the Yakima River and smaller streams and derived from highlands to the north and east and deposited by the Columbia River.

By the end of Grande Ronde Basalt time, about 15.6 million years ago, more than 90 percent of the Columbia River Basalt Group had been erupted (Tolan and others, 1989; Fig. 5). While the gentle westward and southwestward slope of the surface of the Grande Ronde Basalt seen in Figure 7 in the northern and eastern parts of the basin (Pullman–Connell–Coulee City–Cheney area) had already developed and guided the basalt flows toward the west, most of the rest of the structural relief developed after Grande Ronde Basalt time. The eastward slope at the west edge of the area shown in Figure 7 is due to postbasalt uplift of the Cascades, and the culmination in southeastern Washington is the Blue Mountains, which developed after the Grande Ronde Basalt was emplaced.

Flow units of the Columbia River Basalt Group are commonly separated by unconformities (Fig. 5), and, especially near the western margin of the subsiding basin of basalt deposition, sedimentary interbeds between basalt flows are common. In the western, southwestern, and south-central parts of the Columbia

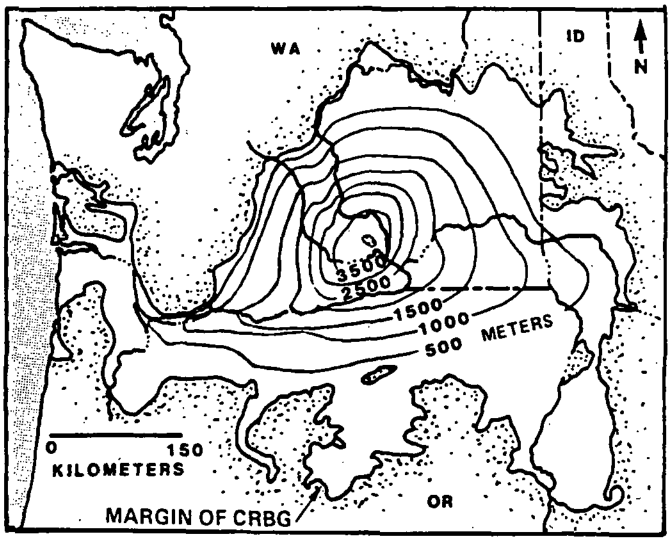


Figure 6. Extent of the Columbia River Basalt Group and thickness of the Grande Ronde Basalt. The Grande Ronde Basalt thickness contours are in meters. From Reidel and others (1989).

Basin in Washington these interbeds and some postbasalt sediments are collectively known as the Ellensburg Formation. Deposition of Ellensburg sediments and younger sedimentary units accounts for as much as 400 m of postbasalt sedimentary rocks in some of the subbasins of the Yakima fold belt.

Within the Columbia River Basalt Group many flow bottoms are pillowed, rubbly, or mixed with subjacent sediments, and many flow tops are rubbly, oxidized, vesicular, and (or) scoriaceous. The flow tops and bottoms and interflow sediments are generally quite porous and permeable and make good aquifers. Many of the flows and the associated aquifers are of great lateral extent. In contrast, the interiors of most flows, although jointed, are of low permeability and act as aquitards.

The recharge areas for these extensive aquifers are on the western side of the basin in the Cascades foothills and on the eastern side in the Palouse hills and the mountains of eastern Idaho. The ridges of the Yakima fold belt are not significant recharge areas because the area is arid.

The combination of basinal shape, laterally extensive aquifers that are confined between relatively impermeable basalt flows, and recharge areas to the east and west means that the hydrologic gradients slope into the deepest part of the basin near Pasco and into the subbasins of the Yakima fold belt. In these areas the deeper aquifers are confined and under artesian pressure.

Columbia Basin heat flow and temperature gradients are certainly factors in the occurrence of warm wells. Table 2 shows the average heat flows and temperature gradients for the physiographic provinces of Washington, and Figure 8 is a temperature-depth plot of Washington's thermal wells and six-county cool wells. Compared to the Northern Rocky Mountains province and the high heat-flow zone of the Cascades province, the Columbia Basin does not have high heat flow. In fact, heat flow in the Columbia Basin is approximately equal to the worldwide average. However, because the thermal conductivity of the rocks is relatively low, the Columbia Basin has a higher-than-worldwide-average temperature gradient. At 41°C/km, it also has the highest regional temperature gradient in Washington except for the high heat flow zone of the Cascades. With this gradient and an average surface temperature of 15°C, which is reasonable for the warmer areas of the basin, the 20°C isotherm can be reached in a well only 122 meters deep. For comparison, if the gradient were only 20°C/km and the average surface temperature 10°C, it would take a well 500 meters deep to reach the 20°C isotherm. A productive aquifer must also be intersected, of course, if a useful well is to be had.

Most of Washington's thermal wells are located in the Columbia Basin, and more particularly, in a six-county area in the western, southwestern, and south-central parts of the Columbia Basin, for the following reasons:

- There are more deep wells than in other parts of the

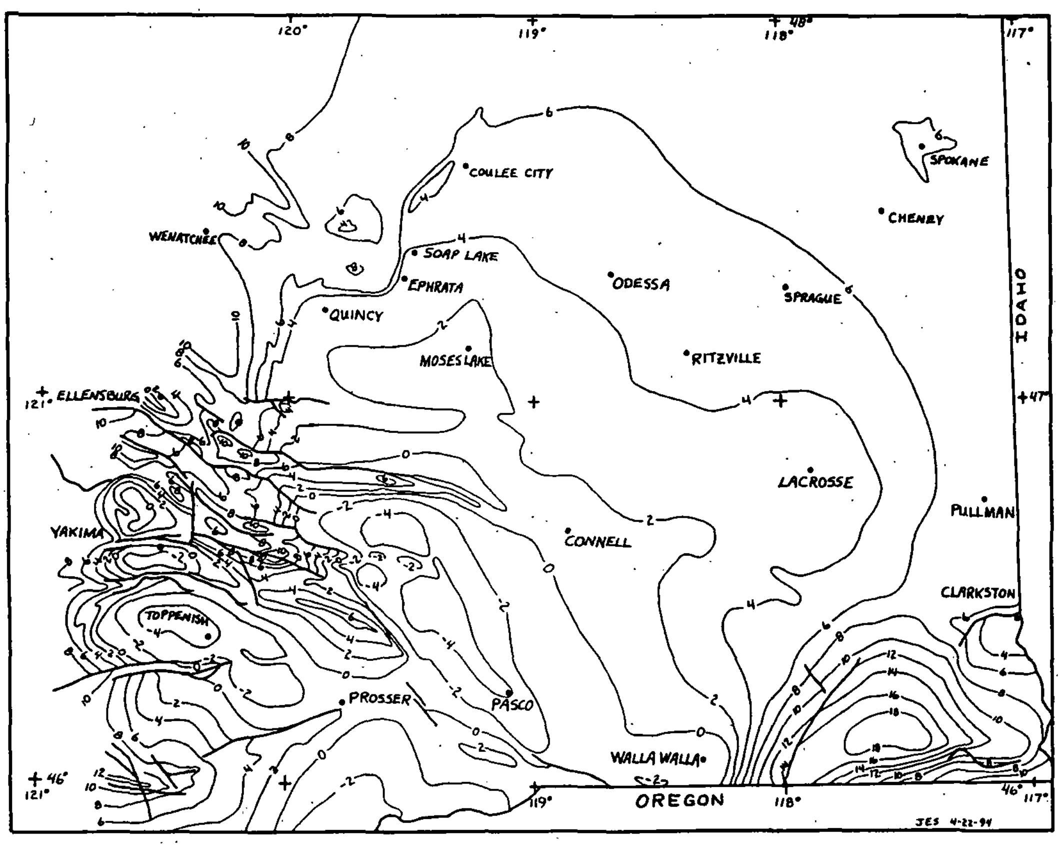


Figure 7. Structure contours on the top of the Grande Ronde Basalt. Contours are in hundreds of meters above sea level. (Modified from Bentley, 1985).

state, which provides more opportunity for penetrating thermal aquifers.

- At 41°C/km, the regional geothermal gradient is favorable.
- The hydrologic setting is favorable. Laterally extensive aquifers, low vertical permeability, complex basinal structural shape, and recharge areas to the west and far to the east provide for the depth of circulation and residence time necessary to produce thermal ground water.

We may generalize to say that the typical thermal well in Washington occurs in the Columbia Basin, especially the six-county area, has a temperature gradient within a normal range of 30°–50°C/km, and is heated by conduction. That is, the heat reached the well by conduction through the Earth's crust from the mantle below, in the same way that heat moves through any solid body, such as a block of steel or concrete.

In addition to these normal or typical thermal wells, there are 192 wells across the state (Appendix C), including 140 wells in the six-county area, that do not fit the scenario above. These wells are too warm to have been heated conductively in a gradient of 50°C/km. More specifically, the wells have temperatures higher than that calculated by the following formula: T = 15°C + (0.05°C/m) (depth), where depth is in meters.

Of the 140 wells, four have "B" gradients (gradients calculated from bottom-hole temperatures and estimated mean annual surface temperatures) in excess of 150°C/km, and errors in the data are suspected. Twenty additional wells (located in Townships 12–14 N. and Ranges 25–27 E.) on the Hanford Reservation of northern Benton County are warm because they have been used for the disposal of heated fluids (S. P. Reidel, Westinghouse Hanford Co., oral commun., April 1994; Newcomb and others, 1972, p. 32-35). These 24 wells are not considered further.

In the remaining 116 six-county wells, the anomalous temperatures may be due to some natural cause. Some of these wells are located in areas where mapped geologic structures might be responsible for the circulation of warmer, deeper water to the higher levels penetrated by the wells. Others occur where there are no mapped geologic structures or significant thicknesses of suprabasalt sedimentary deposits that might provide for enhanced vertical permeability. For these wells no ready explanation for their anomalously high temperatures is currently available. Most of the wells occur in basinal areas of the Yakima fold belt where the available information indicates that many of the wells penetrate mostly suprabasalt sedimentary rocks. Some combination of vertical permeability in these rocks and leakage from the confined basalt aquifers below may be responsible for the abnormal temperatures of the wells.

Perhaps suprabasalt sediments are the most important factor in providing vertical permeability and allowing upward movement of leakage from deeper, confined aquifers. There are "B" gradients and standing water levels in the database for some of the 116 wells, and Table 3 shows their average "B" gradients and standing water levels. In Table 3, these wells are called "convectively heated(?) thermal wells". The table compares these wells with others, both within and outside of the six-county area, whose temperatures can be accounted for by heating under the influence of "normal" conductive temperature gradients between 30° and 50°C/km. Average "B" gradients and standing water levels are significantly higher for the anomalously warm wells.

The higher "B" gradients could be due to errors in the database, local heat sources in the crust, or variations in deep crustal heat flow and temperature gradients from place to place. The higher standing water levels might be due to wells being drilled into shallower aquifers and have no relation to a higher temperature gradient, but if the shallower standing water levels are due to wells being developed in shallower aquifers, these wells should not produce higher average "B" gradients. The higher "B" gradients and shallower standing water levels occurring together suggests that some kind of convective water movement from deeper, warmer aquifers

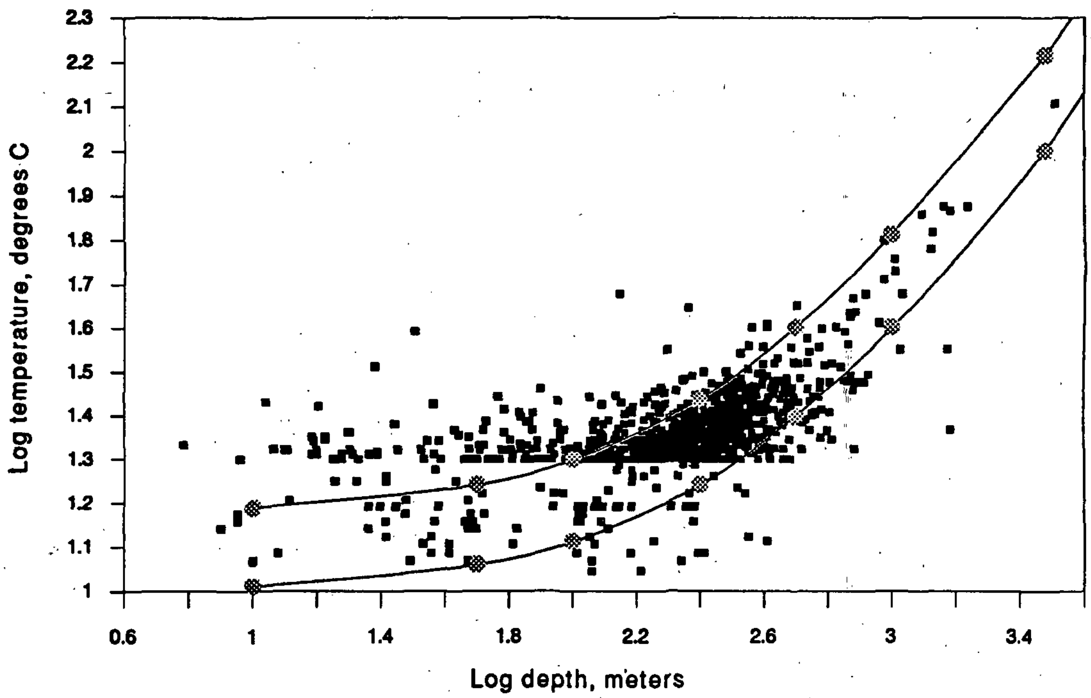


Figure 8. Temperature-depth plot of Washington's thermal wells and six-county cool wells, with the zone of normal temperature gradients, 30°–50°C/km, shown between the two curved lines. Wells falling within the normal gradient zone may be heated by normal, conductive geothermal gradients. Those falling below the zone may be cooled by waters from upper, cooler aquifers flowing down the wells. Wells above the normal gradient band are too warm to have been heated by a normal range of gradients. These wells may be warmed by artificial warm-water recharge or by warm water leaking from deeper aquifers and reaching the wells because of higher-than-normal vertical permeability provided by faults and folds or the inherently greater permeability of suprabasalt sediments.

Table 3. Comparison of "B" gradients and standing water levels from convectively heated(?) thermal wells and from conductively heated(?) thermal wells. "B" gradients are temperature gradients calculated from bottom-hole temperatures and estimated mean annual surface temperatures. *Convectively heated(?) thermal wells* are defined as those in Appendices A and C that are too warm to have been heated by conductive heat transfer under the influence of a conductive temperature gradient in the range of 30°–50°C/km. More specifically, the wells have temperatures higher than yielded by the formula, T = 15°C + (0.05°C/m)(depth), where the well depth is in meters. From this number of wells some were excluded—(1) those on the Hanford Reservation that are known to be warm because of artificial recharge, and (2) wells with "B" gradients higher than 150°C/km, where gradients could be due to errors in the data. *Conductively heated(?) thermal wells* are defined as those in Appendix A that are at or cooler than a temperature that falls within the normal temperature gradient band shown on Figure 8. Their temperatures are equal to or less than those yielded by the formula above. These wells are probably heated by a normal conductive temperature gradient in the range of 30°–50°C/km. Those wells at temperatures below the 30°–50°C/km gradient band of Figure 8 may be cooled by water from a shallow aquifer(s) flowing down the well. n = number of wells; s.d. = standard deviation.

	"B" gradient (°C/km)	Standing water level (meters)		"B" gradient (°C/km)	Standing water level (meters)		"B" gradient (°C/km)	Standing water level (meters)
All wells, statewide	n = 374 mean = 47.5 s.d. = 15.7	n = 524 mean = 63.0 s.d. = 56.5	Convectively heated(?) wells, statewide	n = 40 mean = 79.9 s.d. = 20.1	n = 108 mean = 31.1 s.d. = 35.4	Conductively heated(?) wells, statewide	n = 334 mean = 43.7 s.d. = 9.3	n = 416 mean = 71.4 s.d. = 58.0
All wells, six-county area	n = 319 mean = 47.3 s.d. = 14.4	n = 452 mean = 64.2 s.d. = 55.8	Convectively heated(?) wells, six-county area	n = 33 mean = 76.6 s.d. = 18.4	n = 83 mean = 30.8 s.d. = 35.8	Conductively heated(?) wells, six-county area	n = 286 mean = 43.9 s.d. = 9.1	n = 369 mean = 71.7 s.d. = 56.8
All wells, statewide outside six-county area	n = 55 mean = 49.1 s.d. = 21.3	n = 72 mean = 56.0 s.d. = 60.0	Convectively heated(?) wells, statewide outside six-county area	n = 7 mean = 95.2 s.d. = 20.7	n = 25 mean = 32.0 s.d. = 34.0	Conductively heated(?) wells, statewide outside six-county area	n = 48 mean = 42.4 s.d. = 10.2	n = 47 mean = 68.7 s.d. = 66.5

produces a "mound" of warmer ground water in the areas of these wells. Higher "B" gradients and higher standing water levels would also be produced by injection of warm fluids into the wells, as on the Hanford Reservation.

Whether these anomalous wells are warmed artificially or naturally is not known. We point out their existence to emphasize the fact that some wells in the six-county area, many of which seem to be associated with the suprabasalt sediment-filled subbasins of the Yakima fold belt, have apparent average temperature gradients of about 77°C/km rather than 41°C/km. These wells constitute an even more attractive low-temperature geothermal resource than the "normal" thermal wells because the 20°C isotherm can be reached in a well, on average, only 65 meters deep.

LEGAL AND INSTITUTIONAL SETTING

Geothermal resources are related to water and mineral resources, to the surface and subsurface estates, and to water rights and mineral titles. In establishing the regulatory framework within which geothermal resources are developed, legislative bodies must first describe the physical properties that distinguish geothermal resources from water and mineral resources, thus allowing for a clear establishment of ownership, leasing, taxation, and development regulations, and then establish the relationship between geothermal resources, ground water, subsurface minerals, and other established resources. Ideally, the framework would look forward to future leases, exploration, and development activities while looking backward in order to place geothermal resources into the framework of leases, reservations, and property titles inherited from the past.

Ownership and Leasing

The federal Geothermal Steam Act of 1970 (Public Law 91-581) defines geothermal resources as follows:

Geothermal steam and associated geothermal resources means (i) all products of geothermal processes embracing indigenous steam, hot water, and hot brines; (ii) steam and other gas, hot water, and other brines resulting from water, gas, or other fluids artificially introduced into geothermal formations; (iii) heat or other associated energy found in geothermal formations; and (iv) any by-product derived from them (30 U.S.C. 1001).

On federal lands under the control of the U.S. Forest Service, Bureau of Land Management, or other agency, the federal government claims ownership of all geothermal resources, whether it holds the mineral estate jointly with the surface estate or holds a mineral reservation where the estates have been severed. It is unclear, however, whether federal ownership extends to ground water useful for direct-application purposes where the estates have been severed. The states have primary control of ground water, absent the establishment of a federal enclave.

The Federal Land Policy and Management Act (FLPMA) (15 U.S.C. 1600, et seq.; 43 U.S.C. 170, et seq.) requires the Secretary of the Interior to inventory resources and prepare land-use plans on the basis of those resource assessments. If energy facilities are not included in the plans, conflicting or pre-emptive land uses could prevent development of prime geothermal resource sites. Where energy development is specifically included as an accepted land use, federal agencies must develop a procedure to allow for private energy-resource development. Although FLPMA authorizes sale of public lands for such development, leasing is by far the most common method by which private developers may gain access to public lands.

Surface rights and a priority right to explore, develop, and use geothermal resources on federal lands are acquired through an "Offer to Lease and Leases for Geothermal Resource", issued by the Bureau of Land Management pursuant to the Geothermal Steam Act of 1970 (amended 1988).

In Washington State, the Revised Code of Washington (RCW) defines "geothermal resource" as follows:

Geothermal resource means only that natural heat energy of the earth from which it is technologically practical to produce electricity commercially and the *medium by which such heat energy is extracted from the earth, including liquids or gases, as well as any minerals contained in any natural or injected brines, and associated gas, but excluding oil, hydrocarbon gas, or other hydrocarbon substances (Chapter 79.76 RCW).*

Washington's definition thus restricts geothermal resources to those "from which it is technologically practical to produce electricity commercially". Geothermal resources with temperatures below those required for commercial electrical production are considered ground-water resources in Washington, and they are regulated by the Washington State Department of Ecology (DOE). All geothermal resources discussed in this report are considered by the State of Washington to be ground-water resources and are available through appropriation.

The State claims ownership of all ground-water resources underlying State and school lands. In order to gain access to low-temperature geothermal resources below these lands, a commercial lease must be obtained.

The Washington Department of Natural Resources (DNR) manages most State lands—the exception being lands managed by the Washington Department of Fish and Wildlife, Parks and Recreation Commission, and small holdings by other State agencies. Access to non-DNR lands for exploration and development is by permit obtained from the local office of the agency managing the lands.

DNR is responsible for issuing leases on State trust lands for low-temperature geothermal exploration and development for direct use. A Plan of Operation is required by DNR for these activities.

Permitting and Development Requirements

Water rights

In response to the growing concern about the State's ground-water resources, the Washington DOE is legislatively mandated to coordinate the development of ground-water management programs. Local governments are responsible for developing DOE-approved ground-water management plans. Activities within ground-water management areas must comply with ordinances/regulations established as part of a ground-water management plan.

A water-rights permit from DOE is required before any water well can be constructed. When an application is received, DOE will inspect the site, require publication of a public notice of intent, and attempt to resolve any protests that may be filed. A permit allowing construction of the project may be issued if water is deemed to be available, no existing water rights are affected, and the project is found to not be detrimental to the public welfare. Information required for the permit application includes: a section map, identification of the source of the water supply, an explanation of how the water will be used, the exact location of the point of withdrawal, a legal description of the property on which the water is to be used, and the signature of the legal owner. A final certificate of water rights is issued only after the project is complete and the water is put to use.

As of early 1994, DOE was 3 to 4 years behind in adjudicating water rights, and in some areas, a total ban on new water rights is in effect, pending the outcome of legal challenges.

In 1992, the Washington State Energy Strategy Committee recommended that DOE should assess and revise its procedures for granting water rights to protect water resources while allowing development of these geothermal energy resources.

DOE also regulates the drilling of water wells within the state, regardless of land ownership. The construction of water wells must conform to RCW 18.104 to ensure the protection of public resource aquifers. DOE releases the following:

- Minimum Standards for Construction and Maintenance of Wells, Chapter 173-160 WAC;
- Rules and Regulations Governing the Regulation and Licensing of Well Contractors and Operators, Chapter 173-162 WAC; and
- Water Well Construction Act (197), Chapter 18 RCW.

Discharge and reinjection

Disposal of geothermal water after heat extraction is an increasingly important area of concern to the State and developers alike. The National Pollutant Discharge Elimination System (NPDES) or State Waste Discharge Permit, Water Quality Certification, and (or) Short-Term Modification of Water Quality Standards ensure that water quality will not be adversely affected. According to DOE, a NPDES permit is required whenever a discharge will be made into any surface water of the state. The State Waste Discharge Permit is required for virtually all discharges, for example, onto land surfaces or by subsurface injection.

The State Water Pollution Control Act generally prohibits the discharge by any person of any material that "shall cause or tend to cause pollution" of the waters of the state. Pollution is defined broadly to include any alteration of the physical, chemical, or biological properties of water or any *change in temperature*, taste, color, turbidity, or odor, or the discharge of any substance likely to create a nuisance or a detriment to any conceivable beneficial use (RCW 10.48.010). "Discharge of pollutants" has been broadly construed to include discharges of materials that *existed* in the water before it was brought into a facility and used.[1]

The State's policy is to maintain the highest possible standards to ensure the purity of all waters of the state by requiring the use of all known, available, and reasonable methods by industries and others to prevent and control the pollution of Washington's water. Permits issued by DOE under NPDES and the State Waste Discharge Permit Program require the use of "all known, available, and reasonable methods of treatment" (AKART) before discharge. The Water Pollution Control Act requires sources to use AKART regardless of the effect of existing discharges on water quality (Backer, 1992).

[1] (Crown Zellerbach *v.* State Department of Ecology, Pollution Control Hearing Board (PCHB) Nos. 85-223 and 85-242 [1986].) In this case, the PCHB held that discharge of solids into the receiving water constituted "discharge of pollutants," even though the solids were naturally occurring and were brought in with the plant's intake water.

Some developers have recently indicated that they are not pursuing geothermal direct-use projects because of the difficulty of obtaining a discharge permit and inconsistencies in interpretation of discharge requirements by DOE personnel. If widespread development of the state's low-temperature geothermal resources is to take place, questions relating to obtaining water rights and discharge permits must be resolved.

Secondary Beneficial Uses of Ground Water

In 1982, the Washington State Department of Health allowed the City of Ephrata to reintroduce ground water that had first passed through a heat pump, back into the city's domestic water supply system. This precedent-setting project was the first in the U.S. to receive such permission. Health departments in several other states followed Washington's lead in allowing for the construction and operation of these so-called dual-function water supply systems. Several potential project developers have recently reported that the Department of Health appears to have reversed itself and is now informing developers that such practice is not permissible.

The Washington State Energy Office (WSEO), in response to a recommendation of the Energy Strategy Committee, has recently formed the Energy Strategy Interagency Task Force that will, among other things, address issues relating to the use of the state's low-temperature geothermal resources including:

- water rights,
- discharge of geothermal water and reinjection, and
- secondary beneficial use of geothermal water in domestic water supply systems.

District Heating System Regulation

Washington State has adopted a comprehensive legislative and regulatory scheme to encourage the development of district heating systems that use geothermal and other renewable resources and high-efficiency cogeneration. Washington's legislation and implementing regulations achieve two important objectives for district heating systems that use certain preferred heat resources:

- They grant local government entities clear and broad authority to undertake and finance such systems.
- They provide private district heating developers with a simplified regulatory framework and market incentives to encourage development.

Local governments, including counties, cities, towns, and certain utility districts, are covered by Washington's 1983 "Heating Systems" statute (Washington Revised Code Annotated, Chapter 35.97). The statute authorizes these entities to construct, purchase, acquire, extend, maintain, and operate heating systems using preferred resources such as biomass, *geothermal*, cogeneration, solar, and waste heat to supply their citizens or others with heating services. The statute was amended in 1987 to allow additional local government entities to become involved and additional heat sources, such as sewage effluent, to be included as "preferred resources".

The statute confers on these public entities full power to regulate and control the use, distribution, and price of heat supplied through their systems, free from Washington Utilities and Transportation Commission (UTC) jurisdiction. It also grants expansive authority to finance heating systems through such mechanisms as local improvement-district bonds and warrants, special assessments, and revenue bonds and to exercise other authorities needed to further the statutory objectives. In short, the statute addresses most of the central concerns of local governments considering district heating development and clarifies their authority in areas where uncertainty might otherwise discourage development.

Washington's private district heating developers are subject to a different legislative scheme set forth in the State's 1983 "Heat Supplier" statute (Washington Revised Code Annotated, Chapter 80.62). That statute rests on a legislative finding that traditional public-utility regulation may pose unnecessary barriers to the use of preferred heating resources, but that some minimal regulation may be needed to protect heating-system customers. Reflecting these findings, the statute adopts a streamlined "operating permit" system that is considerably less burdensome to suppliers than traditional regulation, but retains basic customer protections appropriate to the competitive environment for heating services.

Under this system, private suppliers proposing to furnish heat from such resources as *geothermal*, biomass, waste heat, and cogeneration are exempted from the Washington Utilities and Transportation Commission's general jurisdiction. They are subject only to limited jurisdiction conferred by the statute that consists principally of the legislature's direction to the UTC to grant a nonexclusive operating permit to provide heating services within a designated service territory to a prospective heat supplier that demonstrates that:

- It is qualified and financially responsible to provide the services offered.
- Its proposed system design is adequate to provide those services.
- Its proposed customer contract specifies the term of service and the rates or rate formula, and otherwise assures adequate service.

The 1983 statute was amended in 1987 to include additional resources under the exemption.

To minimize regulatory delays and costs, encourage competition, and allow suppliers to earn market-based returns, the statute circumscribes the UTC's authority to approve heating rates. It directs the UTC to base rate approvals not on traditional calculations of the supplier's cost of service or rate of return on investment, but on the reasonableness of the proposed rates in relation to rates charged for comparable heating services available in the area. Instead of imposing the low fixed utility rate of return reflecting the historically low risk profiles of conventional utilities, this approach offers suppliers an incentive to provide low-cost services and capture any corresponding market rewards. To increase this incentive and enhance certainty and predictability, the statute further provides that rates less than 80 percent of rates for comparable services will be automatically approved.

Summary

The legal and institutional framework relating to the development of the state's low-temperature geothermal resources needs serious review and revision if geothermal resources are to play a major role in meeting the state's future energy requirements. If developers cannot obtain water rights or, where available, obtain them in a timely manner, potential projects will be lost or forced to use conventional fuels. Disposal and injection requirements are becoming serious concerns to potential developers and may affect their ability to pursue projects. Equally serious is the apparent reversal of policy by the Department of Health in regard to secondary use of water for domestic purposes once it has been passed through a heat pump. All three of these issues need to be addressed and resolved by the new Energy Strategy Interagency Task Force.

Washington has adopted a comprehensive legislative and regulatory framework to encourage developing district energy systems based on preferred resources such as geothermal. If resolution of the other issues reflects the same desire to encourage development, the resulting framework should be a model for the entire nation.

PAST AND CURRENT LOW-TEMPERATURE GEOTHERMAL USES

The direct use of geothermal resources in Washington State had its modern beginning in the late 1800s, but its benefits had been enjoyed by the native Indians for centuries before. In the early 1880s, Theodore Moritz, a settler in the Quillayute Valley, was out hunting and came across an Indian who had broken his leg. Moritz took the injured man home and nursed him until he could travel. In gratitude, the Indian told him of some wonderful curative "fire chuck" (hot water) that bubbled from the ground where Indians had gone for years to cure their ailments. The Indian led Moritz to what is now Sol Duc Hot Springs, and Moritz later returned to build a cabin and file a claim with the U.S. Land Office. Word spread of the healing waters and mud, and people began making the 2-day horseback trip from Port Angeles.

In 1903, Michael Earles, owner of the Puget Sound Mills and Timber Company, accompanied a group of people to Sol Duc. Earles had been told by his doctor that he was dying. He was advised by his doctor to travel to Carlsbad, New Mexico, but was too weak for the long journey. The mineral water at Sol Duc cured him, and in gratitude he decided to build a facility to help others. In 1910, Earles bought the site from the heirs of Theodore Moritz and founded the Sol Duc Hot Springs Company. Sol Duc soon became the most noted pleasure and health resort on the Pacific Coast. Earles spent a half million dollars creating the resort, which opened on May 15, 1912, and which, during its peak year, handled 10,000 guests from all over the U.S. and as far away as Europe. Guests drank the mineral water and bathed in tubs, showers, mud, or vapor. The temperature of the hot springs was reported to be 60°C, and the waters contained sodium, potassium, magnesium, silicon, iron, and other minerals. The waters were also bottled and sold as delicious draught with marvelous healing qualities to be enjoyed at home (Kellogg, 1975).

In addition to the hotel, a three-story sanitarium, complete with operating room, appliances for surgical cases, a laboratory, and an x-ray machine, had beds for 100 patients.

On May 26, 1916, after only 3 years of operation, the resort was destroyed by fire started when sparks from a defective flue landed on the roof of the main hotel building. When the caretaker tried to put out the fire, he discovered that the water was still turned off for the winter (Kellogg, 1975).

The fire at Sol Duc did not, however, signal the end of the growing interest in hot spring resorts. Although Sol Duc never again achieved its earlier grandeur, it was modestly rebuilt and is now part of Olympic National Park. Nearby Olympic Hot Springs also saw considerable development in the early 1900s, only to be returned to its natural state by the Park Service in 1973. In addition, other resorts were built at Longmire and Ohanapecosh Hot Springs, both now part of Mount Rainier National Park, and at North Bonneville and Carson, both located in the Columbia River Gorge (Bloomquist, 1979).

Renewed interest in Washington's geothermal energy resource began in the mid to late 1970s as a result of the oil embargo of 1973 and, later, the oil crisis of 1979. The primary emphasis was on discovery, evaluation, and commercialization of high-temperature resources that could be harnessed to generate electricity. A majority of the activity was centered in the Cascade Range, where it was thought these resources would be most likely to occur. More than a million acres were once under lease application throughout the Cascade Range of Washington, but due to environmental concerns, delays in completing environmental impact studies by the U.S. Forest Service, and a surplus of low-cost electricity throughout the 1980s, few leases were actually granted, and no major exploration programs were completed by industry.

Direct-use geothermal resources, however, were found to be abundant, widespread, and easy to access and increasingly cost effective. A detailed assessment program carried out by the Washington State Department of Natural Resources, Division of Geology and Earth Resources identified 338 wells throughout the Columbia Basin yielding water at temperatures at or above 20°C (Korosec and others, 1981). WSEO, working cooperatively with DNR, identified a number of promising development projects. In 1980, WSEO began the design of what was to become the nation's first major dual purpose geothermal heat-pump project. The system used water at 30°C from a 550-m-deep municipal well in Ephrata that pumped 140 l/s. In 1980, with assistance from WSEO and the Oregon Institute of Technology Geo-Heat Center, the City of Ephrata applied for a grant under the Department of Housing and Urban Development's Innovative Community Energy Conservation Program. The $468,000 grant made possible the construction of the new geothermal heat pump plant designed to provide all of the heating and cooling requirements of the Grant County Courthouse and Courthouse Annex, the retrofit of the Courthouse complex, and a demonstration project in the nearby June's Court low-income housing project (Bloomquist, 1983).

The heat pump system was designed to remove approximately 7.5°C. The water was then returned to the municipal system. The two-stage heat pump was capable of supplying 52°–65°C water to the Grant County Courthouse's central heating system, which cut its energy consumption by 80 percent and resulted in an 85 per cent decrease in the courthouse fuel bill. The June's Court project consisted of retrofitting a number of units to use geothermal heat pumps. Both projects were completed in 1983 and received national awards from the U.S. Department of Energy and from the American Society of Heating and Refrigeration Engineers. The uniqueness and importance of the system also resulted in commendations from the Governor and the Washington State Legislature. This project marked the first acceptance by state health regulators of the domestic use of water that had passed through a heat pump, and it was the model for the acceptance of such systems throughout much of the U.S..

The Ephrata project served as the catalyst for several additional projects, including the Yakima County Detention Center, the Washington State Department of Social and Health Services office in Yakima, several schools, including two community colleges, and numerous commercial and residential installations. Studies completed by WSEO and DNR initially identified 22 cities in central and eastern Washington with proximity to geothermal resources that would meet temperature and flow requirements for district heating. Water chemistry was also found to be acceptable for development with only minor concerns related to material selection. Geothermal district heating feasibility studies were completed in six cities by 1985, using HEATPLAN, a computer program developed by WSEO for this purpose. All six cities—Yakima, Ephrata, Moses Lake, West Richland, Grandview, and Sunnyside—were found to have heat-load densities high enough to technically and economically support geothermal district heating systems.

However, 1985 also saw a dramatic decrease in prices of competing energy supplies, with natural gas prices dropping to less than half of projected levels. Low natural gas and oil prices, coupled with a significant surplus in electrical generation capacity, removed any economic incentive for developing capital-intensive geothermal systems or for energy conservation by utilities. In addition, DOE found itself farther and farther behind in adjudicating water rights and, in many areas, a total moratorium on new water rights was put in place, stopping some projects that were still attractive from both energy and economic perspectives.

RESOURCE POTENTIAL AND COLLOCATION OF RESOURCES AND USERS

The 1990s have, however, brought new interest in geothermal resources development in Washington State. California Energy Company has filed lease applications in both the northern and southern Cascades (D. McClain, C E Exploration, Portland, OR, oral commun., 1993). Seattle City Light, the state's largest municipal utility, has begun to reassess its position on future geothermal development. Puget Sound Power and Light, the state's largest investor-owned utility, has agreed to purchase electricity generated from geothermal resources in California. And the Bonneville Power Administration, with support from the Northwest Power Planning Council, initiated a program to demonstrate the technical, economic, and environmental acceptability of geothermal electric generation in the Northwest. In 1993, Conservation and Renewable Energy Systems was founded by a number of public utilities to pursue development of renewable energy projects.

However, by far the greatest interest remains in developing the state's tremendous low-temperature geothermal potential, most of which is in the Columbia Basin (Fig. 1), specifically Adams, Benton, Franklin, Grant, Walla Walla, and Yakima Counties. This new interest stems from the fact that more and more of the state's electrical utilities are discovering that low-temperature geothermal, when coupled with new high-efficiency water-source heat pumps, can be an extremely attractive demand-side measure. Such systems not only reduce total energy consumption in comparison to electrical resistance or air-to-air heat pump heating systems, but can also reduce electricity demand as much as 50 percent, thus significantly reducing the need to build new generation facilities. Water-source heat pumps have also become a major element in many utility programs designed to maintain market share, being the only technology readily available to them that competes favorably with extremely cost-competitive natural gas. Many manufacturers of water-source heat pumps claim coefficients of performance (COP) that exceed 4.5 and, when coupled with geothermal sources, may exceed 6.0. For example, the Grant County Courthouse complex in Ephrata routinely achieves a COP of 5.8.

The future for low-temperature geothermal development in Washington State is extremely positive, especially in light of the abundance and widespread occurrence of the resource and increasing interest in renewable energy development by utilities and state and federal governments. In fact, the Clinton administration's Global Change Action Item #26 gives considerable attention to the need for and desirability of developing low-temperature geothermal heat sources. But probably most important is the renewed interest on the part of the state's public and investor-owned utilities and an increasing desire on the part of state and municipal governments to expand the use of renewable energy resources wherever technically and economically feasible. This common interest on the part of utilities and government provides a natural mechanism for targeting further assessment and development activities.

Because there are still significant problems associated with obtaining new water rights, development activities are being directed toward sites where thermal wells already exist, where such wells are under the control of a government entity, and where the water is used or is usable year-round. Development is also being focused on sites where significant new construction or redevelopment is or will be taking place, for example, educational and correctional facilities. A quick analysis of our database shows that 22 cities of 5,000+ population are located within 8 km of a thermal well. These cities all have significant potential for developing geothermal-based district heating systems. Further analysis locates 24 schools that have construction or remodeling projects planned or under way, totaling about 150,000 m^2 and with an aggregate budget of over $100 million. These 24 schools have a total of 259 thermal wells within 8 km, many of which are owned by the municipality, county, port district, state agency, or the school district itself. In fact, of the 941 thermal wells identified statewide, 250 are under government ownership.

But the availability of low-temperature geothermal resources and the collocation of a need for thermal energy does not guarantee that development can or will take place. Decision-makers, as well as those who advise them, for example, architectural and engineering firms, must be made aware of the availability of geothermal resources and the reliability of the use of geothermal water-source heat pumps. Regulators in the Departments of Ecology and Health must be convinced of the benefits and extremely low risk associated with installations that either reinject the water or use it in a secondary manner once it has passed through the heat pump. And, finally, mechanisms must be put in place that ensure that the generally high front-end capital cost of these systems is not a deterrent to development. Many utilities are adopting incentive programs, either in the form of rebates or long-term lease arrangements, that encourage the development of geothermal heat-pump systems. The cost of such systems can also be significantly reduced through advancements in drilling technology and improvements in system efficiency.

RECOMMENDATIONS

Our top recommendation is to (1) match existing thermal wells, especially publicly owned wells that produce large quantities of water year-round, with closely collocated proposed new construction or remodeling of public buildings, such as schools, (2) determine which projects could make advantageous use of the geothermal resource to heat and/or cool the building, and (3) encourage and facilitate such applications. This work would occur mostly in the Columbia Basin, because most thermal wells are located there, and it would lead to significant development of low-temperature geothermal resources, perhaps without any additional drilling or exploration.

Our second recommendation is to station one or two investigators in the Columbia Basin, especially in Adams, Benton, Franklin, Grant, Walla Walla, and Yakima Counties, to find and visit new wells to (1) measure downhole temperature gradients (or accurate flowing temperatures if gradients cannot be measured, as for example, in flowing artesian wells), (2) obtain well-test data, (3) obtain drill cuttings for measurement of thermal conductivity and geochemistry, and (4) collect water samples for chemical analysis. With the trend toward fully cased and sealed wells that tap a single deep aquifer, this work would facilitate the formulation of a data set that would determine regional and local distribution of heat flow and temperature gradients, better define the chemistry and stratigraphy of the deeper aquifers, build accurate statistics about the volumes and temperatures of water available from wells, and assist formulation of exploration strategies that would minimize unproductive drilling.

Our third recommendation is to institute a long-term effort to (1) inform the people of the state about uses of low-temperature geothermal resources, (2) work with public policy makers to make certain that the legal and institutional framework encourages the wise use of low-temperature geothermal resources, and (3) advocate for use of geothermal resources in place of fossil fuels.

REFERENCES CITED

Note: Numbered references are cited by number in the data tables found in the appendices. All unpublished materials are available for inspection at the Washington Division of Geology and Earth Resources' Olympia office.

1. Barnett, D. B., 1986, The 1985 geothermal gradient drilling project for the State of Washington: Washington Division of Geology and Earth Resources Open File Report 86-2, 34 p.

— Backer, T. E., editor, 1992, Washington environmental laws handbook, second edition: Preston, Thorgrimson, Shidler, Gates and Ellis, Government Institute, Inc. [Rockville, Md.], 421 p.

— Bentley, R. D., 1985, Structure contour maps on the top of the Grande Ronde, eastern Washington and northern Idaho: privately published by the author, 2 sheets, scale 1:250,000.

2. Biggane, J. H., 1982, The low-temperature geothermal resource and stratigraphy of portions of Yakima County, Washington: Washington Division of Geology and Earth Resources Open File Report 82-6, 128 p., 58 figs., 4 pl., 11 tables, appendix.

3. Biggane, J. H., 1983, Geophysical logs from water wells in the Yakima area, Washington: Washington Division of Geology and Earth Resources Open File Report 83-2, 50 p.

4. Blackwell, D. D., 1980, Heat flow and geothermal gradient measurements in Washington to 1979 and temperature-depth data collected during 1979: Washington Division of Geology and Earth Resources Open File Report 80-9, 524 p. [unpaginated].

5. Blackwell, D. D., 1993, Southern Methodist University, Dallas, Texas, Heat-flow data for Washington (on disk), unpublished data.

6. Blackwell, D. D.; Steele, J. L.; Kelley, S. A., 1985, Heat flow and geothermal studies in the State of Washington: Washington Division of Geology and Earth Resources Open File Report 85-6, 77 p.

— Bloomquist, R. G., 1979, Geothermal energy in Washington—Site data base and development status: Oregon Institute of Technology Geo-Heat Utilization Center, 192 p.

— Bloomquist, R. G., 1983, Ephrata attracts national attention—Governor dedicates innovative geothermal system: Washington State Energy Office Newsletter, v. 6, no. 2, p. 1, 12.

— Bloomquist, R. G.; Black, G. L.; Parker, D. S.; Sifford, A.; Simpson, S. J.; Street, L. V., 1985, Evaluation and ranking of geothermal resources for electrical generation or electrical offset in Idaho, Montana, Oregon, and Washington: Bonneville Power Administration, 252 p.

— Bloomquist, R. G.; Nimmons, J. T.; Rafferty, K., 1988, District heating development guide—Legal, institutional, and marketing issues, v. 1: Washington State Energy Office, WAOENG-87-17/1 (Rev.), 268 p.

7. Bortleson, G. C.; Cox, S. E., 1986, Occurrence of dissolved sodium in ground waters in basalts underlying the Columbia Plateau, Washington: U.S. Geological Survey Water-Resources Investigations Report 85-4005, 24 p., 5 pl.

8. Bowen, R. G., 1992, Geothermal Consultant, Portland, Ore., unpublished data.

9. Brown, J. C., 1979, Geology and water resources of Klickitat County: Washington State Department of Ecology Water Supply Bulletin 50, 413 p., 8 pl., scale 1:94,000.

10. Campbell, N. P., 1993, Yakima Valley College, Yakima, WA, unpublished data.

— Christie, R. A., 1994, Bibliography and index of geothermal resources and development in Washington State, with selected general works: Washington Division of Geology and Earth Resources Open File Report 94-1, 56 p.

11. Cline, D. R., 1976, Reconnaissance of the water resources of the upper Klickitat River basin, Yakima Indian Reservation, Washington: U.S. Geological Survey Open-File Report 75-518, 54 p.

15. Griffin, W. C.; Sceva, J. E.; Swenson, H. A.; Mundorff, M. J., 1962, Water resources of the Tacoma area Washington: U.S. Geological Survey Water-Supply Paper 1499-B, 101 p., 4 pl.

— Gulick, C. W., compiler, in press, Geologic map of the Connell 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources open-file report.

16. Hearn, P. P., Jr.; Steinkampf, W. C.; Bortleson, G. C.; Drost, B. W., 1985, Geochemical controls on dissolved sodium in basalt aquifers of the Columbia Plateau, Washington: U.S. Geological Survey Water-Resources Investigations Report 84-4304, 38 p., 1 pl.

— Hem, J. D., 1985, Study and interpretation of the chemical characteristics of natural water: U.S. Geological Survey Water-Supply Paper 2254, third edition, 263 p., 3 pl.

— Hooper, P. R.; Kleck, W. D.; Knowles, C. R.; Reidel, S. P.; Thiessen, R. L., 1984, Imnaha Basalt, Columbia River Basalt Group: Journal of Petrology, v. 25, part 2, p. 473-500.

— Kellogg, Bert, 1975, Olympic hot springs and Sol Duc hot springs, Text of photo collection at the North Olympic Library System, Port Angeles, Washington.

— Kindle, C. H., 1991, Geothermal fluid sampling techniques. *In* Lienau, P. J.; Lunis, B. C., editors, Geothermal direct use engineering and design guidebook: Geo-Heat Center, Oregon Institute of Technology, p. 99-113.

17. Korosec, M. A., 1980, Table of thermal and mineral spring locations in Washington: Washington Division of Geology and Earth Resources Open File Report 80-11, 6 p.

18. Korosec, M. A., 1982, Table of chemical analyses for thermal and mineral spring and well waters collected in 1980 and 1981: Washington Division of Geology and Earth Resources Open File Report 82-3, 5 p.

19. Korosec, M. A., 1983a, Chemical analyses for thermal and mineral springs examined in 1982–1983: Washington Division of Geology and Earth Resources Open File Report 84-1, 8 p.

20. Korosec, M. A., 1983b, The 1983 temperature gradient and heat flow drilling project for the State of Washington: Washington Division of Geology and Earth Resources Open File Report 83-12, 11 p.

— Korosec, M. A., 1984, Summary of geothermal exploration activity in the State of Washington from 1978 to 1983: Washington Division of Geology and Earth Resources Open File Report 84-2, 42 p.

21. Korosec, M. A.; Schuster, J. E.; Blackwell, D. D.; Daneš, Z. F.; Clayton, G. A., 1980, The 1979–1980 geothermal resource assessment program in Washington: Washington Division of Geology and Earth Resources Open File Report 81-3, 267 p., 1 map, scale 1:24,000.

22. Korosec, M. A.; Kaler, K. L.; Schuster, J. E.; Bloomquist, R. G.; Simpson, S. J.; Blackwell, D. D., 1981, Geothermal resources of Washington: Washington Division of Geology and Earth Resources Geologic Map GM-25, 1 sheet, scale 1:500,000.

23. Korosec, M. A.; Phillips, W. M.; Schuster, J. E., 1982, The low temperature geothermal resources of eastern Washington: Washington Division of Geology and Earth Resources Open File Report 82-1, 20 p., 2 figs., 1 table.

24. Korosec, M. A.; Phillips, W. M.; Schuster, J. E.; Daneš, Z. F.; Biggane, J. H.; Hammond, P. E.; Clayton, G. A., 1983, The 1980–1982 geothermal resource assessment program in Washington; with chapters on thermal springs, gravity investigations, heat-flow drilling, low-temperature resources in eastern Washington, geology of the south Cascades and White Pass areas, and targets for geothermal resource exploration: Washington Division of Geology and Earth Resources Open File Report 83-7, 299 p.

25. Korosec, M. A.; Kaler, K. L., 1980, Well temperature information and locations in the State of Washington: Washington Division of Geology and Earth Resources Open File Report 80-7, 89 p. [unpaginated], 2 pl., scale 1:500,000.

26. Korosec, M. A.; Phillips, W. M., 1982, WELLTHERM: Temperature, depth, and geothermal gradient data for wells in Washington State: Washington Division of Geology and Earth Resources Open File Report 82-2, 3 p., 74-p. table.

27. Landes, Henry, 1905, Preliminary report on the underground waters of Washington: U.S. Geological Survey Water Supply Paper 111, 85 p.

28. Luzier, J. E., 1969, Ground-water occurrence in the Goldendale area, Klickitat County, Washington: U. S. Geological Survey Hydrologic Investigations Atlas HA-313, 1 sheet, scale 1:62,500.

29. Mariner, R. H.; Presser, T. S.; Evans, W. C.; Pringle, M. K., 1989, Discharge rates of thermal fluids in the Cascade Range of Oregon and Washington and their relationship to the geologic environment. *In* Muffler, L. J. P.; Weaver, C. S.; Blackwell, D. D., editors, Proceedings of workshop XLIV, Geological, geophysical, and tectonic setting of the Cascade Range: U.S. Geological Survey Open-File Report 89-178, p. 663-694.

30. Newcomb, R. C., 1965, Geology and ground-water resources of the Walla Walla River basin Washington–Oregon: Washington Division of Water Resources Water Supply Bulletin 21, 151 p., 3 pl.

31. Newcomb, R. C., 1972, Quality of the ground water in basalt of the Columbia River Group, Washington, Oregon, and Idaho: U.S. Geological Survey Water-Supply Paper 1999-N, 71 p., 1 pl., scale 1:1,000,000.

— Newcomb, R. C.; Strand, J. R.; Frank, F. J., 1972, Geology and ground-water characteristics of the Hanford Reservation of the U.S. Atomic Energy Commission, Washington: U.S. Geological Survey Professional Paper 717, 78 p., 3 pl.

32. Reed, M. J.; Mariner, R. H.; Brook, C. A.; Sorey, M. L., 1983, Selected data for low-temperature (less than 90 degrees C) geothermal systems in the United States; reference data for U.S. Geological Survey Circular 892: U. S. Geological Survey Open-File Report 83-250, 129 p.

— Reidel, S. P.; Fecht, K. R., compilers, 1994a, Geologic map of the Priest Rapids 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources Open File Report 94-13, 22 p., 1 pl.

— Reidel, S. P.; Fecht, K. R., compilers, 1994b, Geologic map of the Richland 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources Open File Report 94-8, 21 p. 1 pl.

— Reidel, S. P.; Tolan, T. L.; Hooper, P. R.; Beeson, M. H.; Fecht, K. R.; Bentley, R. D.; Anderson, James Lee, 1989, The Grande Ronde Basalt, Columbia River Basalt Group; Stratigraphic descriptions and correlations in Washington, Oregon, and Idaho. *In* Reidel, S. P.; Hooper, P. R., editors, Volcanism and tectonism in the Columbia River flood-basalt province: Geological Society of America Special Paper 239, p. 21-53.

33. Robinette, M. S.; Robinette, M. J.; Brown, J. C., 1977, Geophysical investigations of Washington's ground-water resources, annual report 1975/1976: Washington State University College of Engineering Research Report No. 77/15-6, 56 p., 5 maps. (Also Washington State Department of Ecology Project Interim Report 76-075 and Project Completion Report 76-069.)

34. Schuster, J. E., 1981, Geothermal energy potential of the Yakima valley area, Washington. *In* Bloomquist, R. G., editor, Proceedings of the Geothermal Symposium—Low temperature utilization, heat pump applications, district heating, September 24, 1980: Washington State Energy Office WAOENG 81-05, p. XI 1 - XI 10.

— Schuster, J. E., compiler, 1994a, Geologic map of the Walla Walla 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources Open File Report 94-3, 18 p., 1 pl.

— Schuster, J. E., compiler, 1994b, Geologic map of the east half of the Toppenish 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources Open File Report 94-10, 15 p., 1 pl.

— Schuster, J. E., compiler, in press, Geologic map of the east half of the Yakima 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources open-file report.

35. Smith, G. O., 1901, Geology and water resources of a portion of Yakima County, Wash.: U.S. Geological Survey Water-Supply and Irrigation Paper No. 55, 68 p.

36. Stearns, N. D.; Stearns, H. T.; Waring, G. A., 1937, Thermal springs in the United States: U. S. Geological Survey Water-Supply Paper 679-B, 206 p., 1 pl., scale 1:7,000,000.

37. Stoffel, K. L.; Widness, Scott, 1983a, Fluid-temperature logs for selected wells in eastern Washington: Washington Division of Geology and Earth Resources Open File Report 83-15, 351 p.

38. Stoffel, K. L.; Widness, Scott, 1983b, Geophysical logs of selected wells in eastern Washington: Washington Division of Geology and Earth Resources Open File Report 83-14, 81 p.

39. Taylor, G. C., Jr., 1944, Factual data pertaining to wells and springs in the Columbia Basin Project area, Washington: U.S. Geological Survey unpublished report, 85 p.

— Tolan, T. L.; Reidel, S. P.; Beeson, M. H.; Anderson, James Lee; Fecht, K. R.; Swanson, D. A., 1989, Revisions to the estimates of the areal extent and volume of the Columbia River Basalt Group. *In* Reidel, S. P.; Hooper, P. R., editors, Volcanism and tectonism in the Columbia River flood-basalt province: Geological Society of America Special Paper 239, p. 1-20.

40. U.S. Geological Survey, 1993, WATSTORE database records as of July 20, 1993.

41. Van Denburgh, A. S.; Santos, J. F., 1965, Ground water in Washington, its chemical and physical quality: Washington Division of Water Resources Water Supply Bulletin 24, 93 p.

42. Washington State Department of Ecology, Central Regional Office, Yakima, Washington, unpublished water well reports as of April 12, 1993.

43. Washington State Department of Ecology, Central Regional Office, Yakima, Washington, unpublished water well report, January 18, 1994.

44. Washington State Department of Ecology, Eastern Regional Office, Spokane, Washington, unpublished water well reports as of May 3, 1993.

45. Widness, Scott, 1983, Low temperature geothermal resource evaluation of the Moses Lake–Ritzville–Connell area, Washington: Washington Division of Geology and Earth Resources Open File Report 83-11. 27 p. ■

Appendix A. Descriptive and Thermal Data for Wells and Springs

EXPLANATION OF COLUMN HEADINGS AND ENTRIES:

The I.D. number for a site consists of a two-letter county code followed by a three-digit serial number. An "S" at the end means the site is a spring, spring system, lake, lava dome, or area of fumaroles. All other entries are wells. County codes: AD, Adams; AS, Asotin; BE, Benton; CH, Chelan; CL, Clallam; CK, Clark; CO, Columbia; CZ, Cowlitz; DO, Douglas; FR, Franklin; GA, Garfield; GR, Grant; GY, Grays Harbor; KI, King; KS, Kittitas; KT, Klickitat; LE, Lewis; LI, Lincoln; OK, Okanogan; PI, Pierce; SK, Skamania; SN, Snohomish; SP, Spokane; WA, Walla Walla, WH, Whatcom; WT, Whitman; YA, Yakima.

Site name is, in most instances, the name of a city, company, or governmental organization if the site is publicly or company owned, or the name of an individual if the site is a private irrigation or domestic well.

An **asterisk (*)** before the site name column indicates that there is a chemical analysis (or analyses) in Appendix B

Date: date when one or more of the entries in the table was determined, as reported in one of the cited references

Latitude (°N) and Longitude (°W) are given in decimal degrees. The location of each site was plotted on a scale-stable 1:100,000-scale U.S. Geological Survey topographic base map, usually at the center of the quarter-quarter of a section. If the base map showed a well or spring in that quarter-quarter section, the occurrence was plotted at that location. A transparent gridded overlay was used to identify quarter-quarter boundaries. When all locations had been plotted, they were digitized at the Washington State Energy Office and the latitudes and longitudes calculated by the Geographic Information System. The information was then downloaded back into the Lotus 1-2-3 file that constitutes Appendix A.

Within each county, entries are sorted by **township, range, and section**.

Partial section: Written as quarter-section of quarter-section, using the system of the U.S. Geological Survey Water Resources Division where the section is divided into 16 quarter-quarters that are lettered in the same manner as sections in a township are numbered The pattern is shown below.

D	C	B	A
E	F	G	H
M	L	K	J
N	P	Q	R

NE4, NW4, SW4, and SE4 signify the northeast, northwest, southwest, and southeast quarters of a section, respectively. W2 and E2 are west one-half and east one-half.

Temperature type: B, bottom-hole or near-bottom-hole temperature; F, flowing temperature; M, maximum temperature; S, temperature measured short of well bottom; and "-", other or unknown.

Depth type: D, drilled depth or near drilled depth; L, logged depth; and "-", other or unknown.

Gradient type: A, gradient estimated from linear segment of well temperature log; B, gradient estimated from a bottom-hole temperature or the deepest logged temperature and an estimated or calculated mean annual surface temperature; S, gradient determined by fitting a straight line through "families" of bottom-hole temperatures.

Flow type: N, natural; P, pumped, bailed, or air-driven; "-", other, no flow, or unknown.

SWL: Standing water level, meters from surface. A, flowing artesian.

References: Numbers correspond to the numbered references in the REFERENCES CITED section.

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
		ADAMS COUNTY																			
AD001	*	CMSTP&P RR	1961/05/04	46.804	119.342	15	28E	08	E	20.0	B	126	D	-	63	-	-	38	-	73	22,25,26,40,41
AD002	*	US Bureau of Reclamation	1971/10/06	46.794	119.299	15	28E	15	D	24.2	B	264	D	-	46	-	-	795	-	114	22,25,26,40
AD003		DH 4	-	46.757	119.360	15	28E	30	L	75.2	B	1456	D	-	43	31	-	-	-	-	2,22,25,26
AD004		E. Col. Basin Irr. Dist.	-	46.740	119.273	15	28E	35	P	24.4	B	253	D	-	49	-	-	-	-	-	22,25,26,33
AD005	*	Othello City 2	1955/08/02	46.824	119.167	15	29E	03	C	22.8	F	212	D	-	51	-	-	-	-	69	22,25,26,40
AD006	*	Othello City 4	1970/10/27	46.817	119.156	15	29E	03	J	20.8	F	276	D	-	32	-	-	3785	-	69	22,25,26,40
AD007		Othello City 5	-	46.814	119.167	15	29E	03	P	29.4	B	298	D	-	57	65	-	-	-	-	22,25,26,33,37,38,45
AD008	*	Othello City 6	1994/04/07	46.824	119.177	15	29E	04	A	27.8	F	368	D	-	36	-	-	13248	P	60	22,25,26,37,38,40,45
AD009	*	Othello City 1	1942/04/27	46.824	119.177	15	29E	04	A	20.0	B	171	D	-	47	-	-	341	P	73	22,25,26,40,41
AD010		Weaver, Howard	-	46.819	119.206	15	29E	05	-	20.0	F	75	D	-	-	-	-	473	P	-	44
AD011		Taylor, John D.	-	46.789	119.228	15	29E	18	-	20.0	F	77	D	-	-	-	-	170	P	-	44
AD012		Lyle, Elwyn & Rex	-	46.815	118.922	15	31E	04	J	24.4	F	330	D	-	-	-	-	7646	P	95	44
AD013		McKay, Ed	-	46.815	118.954	15	31E	05	L	26.8	B	404	D	-	36	49	-	-	-	-	22,25,26,37,38,45

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
AD014		Lyle, Elwyn	1983/05/26	46.800	118.944	15	31E	08	J	22.5	-	369	-	-	-	-	-	-	-	122	40
AD015		Lyle, Elwyn & Rex	1983/07/29	46.797	118.959	15	31E	08	N	25.0	-	314	-	-	-	-	-	-	-	88	40
AD016		Lyle Bros 3	-	46.803	118.895	15	31E	11	E	20.5	B	214	D	32	34	-	-	-	-	-	6,22,25,26
AD017		DNR Lyle 2	-	46.793	118.922	15	31E	16	A	21.1	F	412	D	-	-	-	-	7055	P	140	44
AD018		DNR Lyle 1	1983/05/26	46.793	118.938	15	31E	16	D	28.5	F	430	D	-	-	-	-	5924	P	134	40,44
AD019		Johnson, Arthur	-	46.779	118.965	15	31E	19	A	27.6	B	342	D	-	40	49	-	-	-	-	22,25,26,33,37,38,45
AD020		Kummer, Clarence, 4	-	46.742	118.959	15	31E	32	M	26.0	B	365	D	-	-	48	-	-	-	-	37,45
AD021		Tomkin	-	46.821	118.753	15	32E	02	A	25.0	B	252	D	-	52	-	-	-	-	-	24
AD022		Damon, Don	-	46.820	118.800	15	32E	04	B	21.9	B	266	D	-	43	49	-	-	-	-	22,25,26,37,45
AD023	*	Phillips, Robert, 4	1983/08/02	46.799	118.838	15	32E	07	J	25.4	F	579	D	-	-	-	-	-	-	181	7,15,40
AD024		Adams, Mrs. M. E.	-	46.806	118.827	15	32E	08	C	22.2	F	182	D	-	-	-	-	378	P	86	44
AD025		Phillips, Robert, 5	1982/08/09	46.803	118.832	15	32E	08	E	26.0	-	604	-	-	-	-	-	-	-	191	40
AD026		Stelger	-	46.788	118.806	15	32E	16	F	20.0	B	180	D	-	44	49	-	-	-	-	22,25,26,45
AD027		DNR Hatton	-	46.785	118.811	15	32E	16	M	21.1	F	457	D	-	-	-	-	2438	P	124	44
AD028		Hart	-	46.743	118.768	15	32E	35	E	27.6	B	310	D	-	50	-	-	-	-	-	22,25,26
AD029		Hart, Cyril	-	46.744	118.758	15	32E	35	G	22.9	B	308	D	-	-	49	-	-	-	-	37,45
AD030		—	-	46.822	118.631	15	33E	02	A	25.0	B	69	-	-	189	-	-	-	-	-	22,25
AD031		Tompkins, Robert	-	46.822	118.632	15	33E	02	A	25.0	B	252	D	-	52	-	-	-	-	-	26,37,45
AD032		Watson	-	46.753	118.528	15	34E	27	R	20.9	S	177	L	-	50	-	-	-	-	-	22,25,26
AD033		Blauert, Fred. A., 2	1983/08/26	46.751	118.302	15	36E	33	A	20.0	-	155	-	-	-	-	-	5678	-	21	40
AD034		Blauert, Fred	-	46.749	118.290	15	36E	34	F	25.4	B	213	D	-	63	-	-	-	-	-	22,25,26,37,38,45
AD035		Chef Reddy Frozen Foods	1983/08/22	46.839	119.172	16	29E	34	D	25.0	-	317	-	-	-	-	-	3861	-	63	40
AD036	*	Othello City 3	1977/05/11	46.829	119.156	16	29E	34	R	25.0	B	275	D	-	49	65	-	5072	P	85	22,25,26,37,40,41,44,45
AD037		Kliphardt, G. W.	-	46.866	119.000	16	30E	24	D	26.1	B	220	D	65	63	65	-	-	-	-	22,25,26,37,45
AD038		Kliphardt, Fredrick	1983/08/30	46.851	119.006	16	30E	26	A	30.0	-	323	-	-	-	-	-	-	-	91	40
AD039		Kliphardt	-	46.851	119.006	16	30E	26	A	26.2	B	192	D	34	72	-	-	-	-	-	6,22,25,26
AD040		Andrews 2	-	46.845	119.028	16	30E	27	J	25.2	B	207	D	91	64	-	-	-	-	-	6,22,25,26
AD041		DNR Damon 2	-	46.830	118.991	16	30E	36	K	20.6	B	211	D	-	40	-	-	-	-	-	22,25,26,37,45
AD042		DNR Damon	-	46.830	118.991	16	30E	36	K	25.8	B	241	D	-	57	65	-	14383	P	54	22,25,26,33,37,44,45
AD043		Damon Ranch	1983/05/24	46.872	118.884	16	31E	14	K	26.0	-	408	-	-	-	-	-	-	-	104	40
AD044		Lyle	-	46.880	118.906	16	31E	15	B	24.1	B	316	D	-	38	-	-	-	-	-	22,25,26
AD045		Lyle, Rex	-	46.880	118.906	16	31E	15	B	22.6	B	201	D	-	-	32	-	-	-	-	37,45
AD046		Wholman	-	46.880	118.916	16	31E	15	D	26.2	B	230	D	59	57	32	94	-	-	-	5,26,45
AD047		Lyle, Rex (South)	-	46.869	118.906	16	31E	15	Q	27.5	B	410	D	-	37	32	-	-	-	-	22,25,26,33,37,38,45
AD048		Brown, Beverly	1982/09/08	46.826	118.933	16	31E	33	P	20.0	-	165	-	-	-	-	-	-	-	105	40
AD049		Damon, Don	-	46.830	118.877	16	31E	35	J	24.4	F	275	D	-	-	-	-	4164	P	118	44
AD050		Phillips, D. E., 12	1983/08/02	46.895	118.768	16	32E	11	D	23.0	F	429	D	-	-	-	-	9084	P	122	40,44
AD051		Phillips, D. E., 12	-	46.894	118.768	16	32E	11	D	28.2	B	321	D	-	51	32	-	-	-	-	22,25,26,33,37,45
AD052		Phillips, D. Everett	-	46.873	118.729	16	32E	13	J	21.7	F	272	D	-	-	-	-	7948	P	98	44
AD053		Phillips, D. Everett	-	46.880	118.751	16	32E	14	A	22.9	F	233	D	-	-	-	-	11355	P	104	44
AD054		Phillips, Beatrice house well	-	46.880	118.763	16	32E	14	C	21.1	B	155	D	-	56	32	-	-	-	-	22,25,26,33,37,45
AD055		Phillips, D. E., 11	1983/05/27	46.880	118.768	16	32E	14	D	24.5	-	399	-	-	-	-	-	4921	-	89	40
AD056		Phillips, D. E., 11	-	46.880	118.768	16	32E	14	D	20.0	B	314	D	-	25	-	-	-	-	-	22,25,26,33,37,45

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
AD057		Phillips, D. E., 17	-	46.880	118.790	16	32E	15	D	34.0	B	440	D	-	49	32	-	-	-	-	22,25,26,33,37,38,45
AD058		Phillips, Robert, 3	1983/08/03	46.876	118.842	16	32E	18	G	26.0	-	469	-	-	-	-	-	-	-	147	40
AD059		Phillips, R. V.	-	46.854	118.832	16	32E	20	N	29.2	B	372	D	-	46	32	-	-	-	-	22,25,26,33,37,45
AD060		Phillips, D. E.	-	46.861	118.811	16	32E	21	E	24.4	F	448	D	-	-	-	-	5488	P	176	44
AD061		Phillips, D. E., 10	-	46.861	118.800	16	32E	21	G	27.4	B	283	D	-	-	32	-	-	-	-	22,25,26,37,45
AD062		Phillips, D. Everett	-	46.865	118.747	16	32E	24	D	20.6	F	252	D	-	-	-	-	3785	P	100	44
AD063		Phillips, D. Everett	-	46.851	118.729	16	32E	25	A	22.2	F	248	D	-	-	-	-	13058	P	102	44
AD064		Phillips, D. E., 2	-	46.850	118.747	16	32E	25	D	29.1	B	432	D	-	40	32	-	-	-	-	22,25,26,37,45
AD065		—	-	46.839	118.747	16	32E	25	N	30.4	B	709	D	-	26	32	-	-	-	-	2,22,25
AD066		Phillips, D. E., 16	-	46.839	118.747	16	32E	25	N	31.4	B	382	D	-	50	32	-	-	-	-	26,37,38,45
AD067		Phillips, D. E., 7	-	46.831	118.790	16	32E	34	E	43.4	B	772	D	70	41	38	-	-	-	-	2,22,25,26,37,38,45
AD068		Phillips, A	-	46.831	118.790	16	32E	34	E	24.0	B	370	D	-	-	-	-	-	-	-	5,45
AD069		Phillips, D. E.	-	46.835	118.764	16	32E	35	C	21.1	F	275	D	-	-	-	-	11355	P	119	44
AD070		Phillips, D. E., 9	-	46.835	118.769	16	32E	35	D	24.2	B	272	D	-	44	32	-	-	-	-	22,25,26,37,45
AD071		Davis, David A.	1983/08/02	46.880	118.700	16	33E	17	B	20.0	-	183	-	-	-	-	-	95	-	124	40
AD072		Baumann Farms	-	46.827	118.470	16	35E	31	Q	22.4	B	600	D	-	-	-	-	-	-	-	37,38,45
AD073		Bauman, Richard	-	46.828	118.461	16	35E	32	N	21.0	B	214	D	-	-	-	-	-	-	-	45
AD074		Phillips, D. E.	1983/05/24	46.997	118.905	17	31E	03	B	23.5	-	415	-	-	-	-	-	-	-	99	40
AD075		Phillips, D. E., C-12	1983/07/29	46.982	118.872	17	31E	12	D	27.8	B	592	D	-	27	27	-	-	-	37	22,25,26,37,38,40,45
AD076		Kulm, Ed	-	46.987	118.798	17	32E	04	Q	22.8	F	274	D	-	-	-	-	8422	P	159	44
AD077		Kulm, Art	-	46.993	118.851	17	32E	06	E	20.0	F	280	D	-	-	-	-	10976	P	120	44
AD078		—	-	46.973	118.739	17	32E	12	P	21.0	B	227	D	-	40	-	-	-	-	-	6,22,25
AD079		DNR CRB	-	46.961	118.766	17	32E	14	M	23.2	B	189	D	43	54	-	68	-	-	-	5,26,45
AD080		Lobe, Gary, 2	1983/08/02	46.999	118.724	17	33E	06	D	26.5	-	366	-	-	-	-	-	-	-	207	40
AD081		City of Lind	-	46.973	118.612	17	33E	12	P	21.0	B	226	D	-	40	-	-	-	-	-	26
AD082		Benge	-	46.942	118.148	17	37E	27	D	21.9	-	168	L	-	59	-	-	-	-	-	22,25,26,38
AD083		Warden Hutterian Brethern	1983/08/03	47.066	118.978	18	31E	07	E	21.5	-	357	-	-	-	-	-	-	-	93	40
AD084		Wollmon, Jaeole K.	-	47.048	118.936	18	31E	16	M	20.0	F	155	D	-	-	-	-	9462	P	31	44
AD085		Hutterites	-	47.055	118.973	18	31E	18	C	21.8	B	240	D	-	37	-	-	-	-	-	6,22,25,26
AD086		Phillips-Lanamn Ranch, Inc.	1983/07/29	47.001	118.942	18	31E	32	R	21.0	-	384	-	-	-	-	-	10598	-	62	40
AD087		Phillips, D. E., C-33	-	47.012	118.937	18	31E	33	D	30.2	B	728	D	-	25	27	-	-	-	-	26,37,38,45
AD088		—	-	47.012	118.937	18	31E	33	D	30.0	B	771	D	-	-	-	-	-	-	-	2
AD089	*	Jungblom Ranch	1983/08/01	47.012	118.937	18	31E	33	D	36.6	F	732	D	-	-	-	-	-	-	64	7,15,40
AD090		Lobe, Gary L.	-	47.084	118.850	18	32E	06	D	22.2	F	270	D	-	-	-	-	3785	P	198	44
AD091		Hutterian Bretheren	-	47.059	118.846	18	32E	07	P	21.7	B	240	D	-	-	27	-	-	-	-	45
AD092		Franz, Agatha	-	47.025	118.802	18	32E	28	C	20.0	F	188	D	-	-	-	-	3785	P	105	44
AD093		Harder, Carl H.	-	47.079	118.041	18	38E	04	N	21.1	F	161	D	-	-	-	-	5602	P	79	44
AD094		Kagele, Norman	-	47.123	118.861	19	31E	24	G	20.1	B	165	D	-	49	-	-	-	-	-	22,25,26,33,37,45
AD095		Weber, Dave	1983/05/23	47.110	118.903	19	31E	27	G	26.0	-	430	-	-	-	-	-	-	-	130	40
AD096		S & K Farms	-	47.121	118.734	19	32E	24	K	20.8	B	243	D	-	35	40	-	-	-	-	22,25,26,37,45
AD097		J & M Farms	1983/07/30	47.117	118.744	19	32E	24	N	32.5	B	695	D	-	30	-	-	-	-	195	2,22,25,26,33,37,38,40,45
AD098		Kagele, Norman	-	47.103	118.850	19	32E	30	N	21.1	B	165	D	-	-	40	-	-	-	-	45
AD099		Graber, Rose	-	47.101	118.752	19	32E	35	A	20.0	F	196	D	-	-	-	-	3974	P	60	44

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
AD100	*	Warden Hutterian Brethern, 7	1983/08/03	47.147	118.709	19	33E	07	R	24.3	F	527	D	-	-	-	-	-	-	133	7,15,40
AD101		Hoefel, Paul, 2	1983/08/30	47.147	118.694	19	33E	08	Q	42.3	B	745	D	-	39	38	-	-	-	177	2,22,25,26,33,37,38,40,45
AD102		Hoefel, Paul	-	47.147	118.694	19	33E	08	Q	20.7	B	231	D	-	36	40	-	-	-	-	22,25,26,37,45
AD103		Kagele, Melvin	1983/08/04	47.130	118.566	19	34E	20	B	22.5	B	341	D	-	34	-	-	-	-	180	22,25,26,40
AD104		Gering, Gale	-	47.153	118.287	19	36E	09	K	21.1	B	229	D	-	41	-	-	-	-	-	22,25,26,37,38
AD105		Galbreath Land & Livestock	1983/08/03	47.129	118.305	19	36E	20	H	20.5	-	314	-	-	-	-	-	5337	-	191	40
AD106		Galbreath Land & Livestock 2	1983/05/26	47.131	118.292	19	36E	21	C	22.5	-	390	-	-	-	-	-	5223	-	170	40
AD107		Heineman, Don, 2	-	47.091	118.276	19	36E	34	N	20.8	B	102	D	-	96	-	-	-	-	-	22,25,26,37
AD108		—	-	47.143	117.972	19	38E	13	F	21.1	-	201	L	83	55	-	-	-	-	-	22,25,26
AD109		Raugust, W. C.	1983/08/30	47.224	118.785	20	32E	15	L	21.0	-	317	-	-	-	-	-	-	-	-	40
AD110		Weber, John	-	47.250	118.501	20	34E	02	Q	21.0	B	202	D	-	50	-	-	-	-	-	22,25,26,37,45
AD111		Hardung	-	47.234	118.447	20	35E	17	D	20.9	B	232	D	90	39	-	-	-	-	-	6,22,25,26
AD112		Ahern, Cliff	-	47.218	118.362	20	35E	24	D	20.5	B	157	D	-	61	-	-	-	-	-	22,25,26,33,37
AD113		Kagele, Richard	1983/08/31	47.204	118.388	20	35E	27	A	22.0	-	384	-	-	-	-	-	-	-	231	40
		ASOTIN COUNTY																			
AS001	*	Washington Water Power Co., 2	1960/05/24	46.369	117.066	10	46E	05	Q	23.3	-	553	D	-	-	-	-	-	-	19	31,40,41
AS002		Washington Water Power Co.	-	46.373	117.082	10	46E	06	J	21.7	F	326	D	-	-	-	-	7570	P	82	44
AS003		Norman, Joe, & Gary Beach	-	46.355	117.066	10	46E	08	Q	20.0	F	79	D	-	-	-	-	772	P	34	44
AS004		Asotin City	-	46.340	117.045	10	46E	16	Q	22.2	F	164	D	-	-	-	-	3028	P	20	44
AS005		Asotin City 1	1982/06/21	46.337	117.055	10	46E	21	D	22.0	-	164	-	-	-	-	-	-	-	20	40
AS006		Washington Water Power Co.	-	46.410	117.062	11	46E	29	A	24.4	F	280	D	-	-	-	-	-	P	-	44
AS007		Washington Water Power Co.	-	46.397	117.069	11	46E	29	P	22.2	F	336	D	-	-	-	-	14762	P	87	44
AS008	*	Washington Water Power Co., 5	1962/10/30	46.398	117.087	11	46E	30	Q	23.3	B	406	D	-	28	-	-	-	-	136	22,25,26,31,40
AS009		Wash. W. Power, Clark. Hts., 7	1983/08/10	46.391	117.076	11	46E	32	E	26.2	B	405	D	36	35	-	56	13248	-	118	5,22,25,26,38,40
		BENTON COUNTY																			
BE001	*	S P & S Ry	-	45.864	119.792	04	24E	03	B	20.6	F	121	D	-	71	-	-	-	-	-	22,25,26,31
BE002		Sandpiper Land Co.	-	45.891	119.714	05	25E	29	G	20.0	F	107	D	-	-	-	-	378	P	52	42
BE003		Sandpiper Land Co.	-	45.884	119.722	05	25E	29	N	20.0	F	75	D	-	-	-	-	144	P	22	42
BE004		Paterson or G. Tom Powers	-	45.953	119.599	05	26E	05	D	26.3	B	305	D	-	47	-	-	5787	P	83	22,25,26,42
BE005	*	US Army Corps of Engineers	1971/09/24	45.941	119.353	05	28E	06	R	21.5	F	170	D	-	56	-	-	1893	-	6	22,25,26,40
BE006		Columbia R.	-	45.991	119.789	06	24E	22	H	22.5	B	195	D	-	44	-	-	-	-	-	6,22,25,26
BE007		Epstein	-	46.008	119.556	06	26E	15	E	23.9	F	293	D	-	-	-	-	14383	P	110	42
BE008		Craig	-	46.004	119.556	06	26E	15	M	24.2	B	210	D	-	58	-	-	-	-	-	22,25,26
BE009		Blair	-	46.010	119.001	06	30E	12	Q	21.1	B	305	D	31	29	-	-	-	-	-	6,22,25,26
BE010		HundredCirclesFarm,IrrigroDiv	-	45.993	119.116	06	30E	19	D	23.3	F	248	D	-	-	-	-	378	P	193	42
BE011		Irrigro	-	45.983	119.116	06	30E	19	N	20.5	S	177	L	-	48	-	-	-	-	-	22,25,26,37
BE012		Horrigan Farms	-	46.111	119.838	07	24E	08	B	23.4	B	338	D	-	36	-	-	-	-	-	22,25,26,38
BE013		Horrigon Farms, Inc.	-	46.066	119.775	07	24E	26	B	20.0	F	162	D	-	-	-	-	757	P	90	42
BE014		DOE Paterson	-	46.045	119.641	07	25E	36	N	30.3	B	222	D	-	83	-	-	-	-	-	22,25,26
BE015	*	WDOE Tst./Obs., Piezometer C	1972/11/01	46.045	119.640	07	25E	36	N	22.0	-	230	-	-	-	-	-	2612	-	114	40
BE016		DNR John Barber	1984/04/18	46.045	119.641	07	25E	36	N	21.5	-	262	-	-	-	-	-	8441	-	113	40

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
BE017		DOE Paterson	-	46.045	119.640	07	25E	36	N	22.5	B	254	D	-	41	-	-	-	-	-	22,25,26
BE018		DNR Baker	-	46.045	119.635	07	25E	36	P	21.8	B	262	D	-	38	-	-	-	-	-	22,25,26
BE019		Moon, John	1982/08/26	46.130	119.587	07	26E	05	B	22.0	-	326	-	-	-	-	-	-	-	130	40
BE020		Moon	-	46.129	119.587	07	26E	05	B	22.1	B	148	D	-	68	-	-	-	-	-	22,25,26
BE021		DOE Horse Heaven	-	46.055	119.373	07	27E	36	A	29.4	B	369	D	-	39	-	-	-	-	-	26,38
BE022	*	Prosser City 5	1994/01/19	46.205	119.749	08	24E	01	K	24.0	F	391	D	-	26	-	-	6813	P	41	2,6,22,25,26,33,40,42
BE023		Bleyhl, Carl	-	46.195	119.832	08	24E	08	H	27.8	F	59	D	-	-	-	-	727	P	0	42
BE024		Long, Tallman, & Long	1982/08/25	46.180	119.801	08	24E	15	F	24.0	-	125	-	-	-	-	-	227	-	64	40
BE025		DNR Gould	-	46.141	119.629	08	25E	36	B	25.9	B	408	D	35	38	-	56	-	-	225	5,26,42
BE026		—	1984/04/18	46.185	119.576	08	26E	16	D	20.0	-	329	-	-	-	-	-	-	-	-	40
BE027		Sharp, Pete	1982/08/27	46.212	119.371	08	27E	01	A	22.5	-	47	-	-	-	-	-	-	-	34	40
BE028		Schleer, Carl	1988/09/15	46.193	119.365	08	28E	07	M	20.5	-	134	-	-	-	-	-	-	-	69	40
BE029		Bar 80 Ranch/Pete Sharp	1982/08/27	46.189	119.359	08	28E	07	P	20.5	-	133	-	-	-	-	-	1514	-	43	40
BE030		St. Joseph's Catholic Church	1988/04/11	46.207	119.128	08	29E	01	F	21.0	-	28	-	-	-	-	-	189	-	-	40
BE031	*	Mott, Studer	1970/11/17	46.168	119.160	08	29E	22	A	23.0	F	244	D	-	45	-	-	-	-	122	22,25,26,40
BE032		Burk, Vern	-	46.159	119.050	08	30E	22	M	21.1	F	69	D	-	-	-	-	492	N	A	42
BE033		Noel, Jim	-	46.156	119.050	08	30E	22	N	21.1	F	69	D	-	-	-	-	-	N	A	42
BE034		Salvinia Farms/Harper Farms	-	46.257	119.827	09	24E	21	D	21.7	F	241	D	-	-	-	-	4542	P	98	42
BE035		WSU Prosser Experiment Station	-	46.294	119.732	09	25E	06	K	27.8	B	366	D	-	43	34	-	5678	P	162	2,22,25,26,38,42
BE036		Goroch, Chester	-	46.278	119.727	09	25E	07	J	21.1	F	215	D	-	-	-	-	2650	P	127	42
BE037		Gammie,William/Whitstran Ranch	-	46.282	119.684	09	25E	09	H	20.0	F	457	D	-	-	-	-	-	-	138	42
BE038		Olsen Bros.	-	46.270	119.657	09	25E	14	DorC	20.0	F	142	D	-	-	-	-	2460	P	15	42
BE039	*	WA State U.,I.A.R.E.C.,well 2	1994/01/19	46.258	119.736	09	25E	19	B	20.0	F	143	D	-	-	-	-	341	P	69	-
BE040		Clark, Roy	-	46.249	119.644	09	25E	23	J	20.0	F	18	D	-	-	-	-	114	P	8	42
BE041		Ball, Lenn and Vern	1983/07/20	46.226	119.689	09	25E	33	AorB	21.0	F	218	D	-	-	-	-	-	N	A	40,42
BE042		Valley View Orchards	-	46.290	119.615	09	26E	06	N	22.8	F	-	-	-	-	-	-	1961	P	157	42
BE043		Bauder, Milo	-	46.255	119.581	09	26E	20	A	23.3	F	209	D	-	-	-	-	7684	P	21	42
BE044	*	Christen	1970/10/12	46.234	119.544	09	26E	27	K	21.5	B	204	D	-	47	-	-	-	-	137	22,25,26,40
BE045		Peterson, Jean	-	46.296	119.405	09	27E	02	E	20.0	F	123	D	-	-	-	-	1041	P	55	42
BE046		Edmunds, Gary	-	46.296	119.400	09	27E	02	F	20.0	F	130	D	-	-	-	-	-	-	43	42
BE047		Gelles, David S.	1988/04/19	46.274	119.469	09	27E	08	N	20.5	-	195	-	-	-	-	-	-	-	-	40
BE048		DNR Benton 40	-	46.270	119.448	09	27E	16	D	23.3	B	94	D	185	122	-	293	-	-	-	5,26
BE049		Harrison 4 W	1982/08/28	46.255	119.449	09	27E	21	D	22.5	-	252	-	-	-	-	-	-	-	-	40
BE050		DNR Kid 3	-	46.248	119.402	09	27E	23	L	29.1	B	370	D	43	46	-	69	-	-	-	5,26
BE051		DNR 79-07	-	46.234	119.387	09	27E	25	M	23.8	B	322	D	-	30	-	-	-	-	-	26,38
BE052		Davin Land & Livestock, Inc.	1983/05/17	46.270	119.331	09	28E	17	AorB	26.7	F	336	D	-	-	-	-	10182	P	52	40,42
BE053		Bauder	-	46.222	119.287	09	28E	34	H	21.1	B	271	D	-	34	-	-	-	-	-	22,25,26
BE054		The Quadrant Corporation	-	46.215	119.255	09	28E	36	P	28.3	F	368	D	-	-	-	-	4542	P	27	42
BE055		DNR Anderson	-	46.312	119.759	10	24E	36	F	29.8	B	273	D	62	65	-	99	-	-	-	5,26
BE056		Nakamura	-	46.326	119.636	10	25E	25	E	20.6	B	184	D	36	45	-	-	-	-	-	6,22,25,26
BE057		J & R Orchards	-	46.305	119.699	10	25E	33	N	21.8	B	276	D	-	36	34	-	-	-	-	2,22,25,26
BE058		Schwendig, Harvey	1983/07/21	46.323	119.568	10	26E	28	L	24.5	-	282	-	-	-	-	-	2763	-	155	40
BE059		Champion Orchards	-	46.315	119.573	10	26E	33	D	22.8	F	255	D	-	-	-	-	1741	P	137	42

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
BE060		Inland Desert Fruit Company	-	46.312	119.568	10	26E	33	F	24.4	F	255	D	-	-	-	-	2366	P	126	42
BE061		Hanford 56E4C	-	46.329	119.431	10	27E	28	A	20.9	B	140	D	-	46	-	-	-	-	-	5,26
BE062		Hanford S-30	-	46.357	119.269	10	28E	14	B	39.7	B	605	D	42	42	-	67	-	-	-	5,26
BE063		DH 3	-	46.353	119.269	10	28E	14	G	47.8	B	1080	D	35	33	-	53	-	-	-	2,4,5,22,25,26
BE064		Battelle Pacific Northwest Labs	1988/09/14	46.339	119.279	10	28E	23	E	20.5	-	15	-	-	-	-	-	1893	-	14	40
BE065		Rattlesnake Unit No. 1	-	46.435	119.789	11	24E	15	R	128.0	S	3248	D	37	40	31	60	-	-	-	2,4,5,22,25,26
BE066		DC 12	-	46.468	119.542	11	26E	03	-	53.7	B	1018	D	-	42	-	-	-	-	-	12
BE067		VO-SOC 1	-	46.420	119.592	11	26E	20	N	40.1	B	671	D	37	-	-	56	-	-	-	5
BE068	*	US Government	1970/11/19	46.391	119.534	11	26E	34	R	24.0	F	305	D	-	39	-	-	1317	-	244	22,25,26,40
BE069		Hanford 2-E14	-	46.430	119.276	11	28E	23	D	26.2	B	288	D	39	42	-	60	-	-	-	5,26
BE070		DC 15	-	46.395	119.270	11	28E	35	-	51.5	B	945	D	-	41	-	-	-	-	-	12
BE071		Berk, Delbert	-	46.561	119.798	12	24E	03	B	22.2	F	387	D	-	-	-	-	13414	P	10	42
BE072		Tramel, J. D.	-	46.561	119.835	12	24E	05	A	23.0	B	254	D	-	43	-	-	-	-	-	2,26,37
BE073		Tramel, J. D.	-	46.541	119.814	12	24E	09	E2E2	22.2	F	310	D	-	-	-	-	13475	P	107	42
BE074	*	Roberts Bros.	1970/09/11	46.507	119.850	12	24E	20	N	26.0	F	366	D	-	38	-	-	-	-	-	22,25,26,40
BE075		Robert, Robin	1983/07/28	46.503	119.861	12	24E	30	B	26.0	-	390	-	-	-	-	-	11317	-	35	40
BE076	*	US Government	1977/04/27	46.550	119.573	12	26E	04	N	21.4	F	117	D	-	80	-	-	-	-	108	22,25,26,40
BE077		US Government	1976/04/08	46.546	119.605	12	26E	07	B	20.7	F	126	D	-	69	-	-	-	-	82	22,25,26,40
BE078	*	US Government	1976/04/08	46.536	119.605	12	26E	07	Q	20.4	F	99	D	-	85	-	-	-	-	88	22,25,26,40
BE079	*	US Government	1979/04/19	46.536	119.589	12	26E	08	P	21.2	F	98	D	-	94	-	-	-	-	88	22,25,26,40
BE080	*	AEC	1979/04/17	46.539	119.568	12	26E	09	L	22.0	-	113	-	-	-	-	-	-	-	108	40
BE081	*	US Government	1976/04/08	46.543	119.495	12	26E	12	H	21.0	F	158	D	-	57	-	-	-	-	91	22,25,26,40
BE082		—	1982/04/21	46.532	119.495	12	26E	13	A	20.5	-	-	-	-	-	-	-	-	-	-	40
BE083	*	US Government	1979/04/17	46.528	119.494	12	26E	13	H	20.0	-	38	-	-	-	-	-	-	-	34	40
BE084	*	US Government	1978/04/20	46.532	119.531	12	26E	14	D	21.1	F	117	D	-	78	-	-	-	-	105	22,25,26,40
BE085	*	US Government	1977/04/28	46.532	119.547	12	26E	15	C	21.7	F	134	D	-	74	-	-	-	-	95	22,25,26,40
BE086	*	US Government	1979/04/20	46.525	119.537	12	26E	15	J	21.0	-	98	-	-	-	-	-	-	-	-	40
BE087	*	US Government	1976/04/08	46.528	119.614	12	26E	18	E	20.5	F	177	D	-	48	-	-	-	-	68	22,25,26,40
BE088	*	US Government	1982/04/21	46.528	119.604	12	26E	18	G	21.0	F	85	D	-	103	-	-	-	-	65	22,25,26,40
BE089		—	1981/04/21	46.507	119.509	12	26E	24	N	20.5	-	207	-	-	-	-	-	-	-	-	40
BE090		Maple Leaf Farms, Inc.	-	46.500	119.581	12	26E	29	G	24.4	F	253	D	-	-	-	-	1703	P	52	42
BE091		DB 8	-	46.556	119.482	12	27E	06	-	24.8	B	244	D	-	42	-	-	-	-	-	12
BE092		US Government	1978/04/19	46.525	119.447	12	27E	16	M	20.5	F	65	L	-	131	-	-	-	-	39	22,25,26,40
BE093	*	AEC	1979/04/16	46.532	119.484	12	27E	18	C	21.5	-	51	-	-	-	-	-	-	-	44	40
BE094		DC 7	-	46.484	119.375	12	27E	36	-	72.2	B	1243	D	-	49	-	-	-	-	-	12
BE095		Casper, William	-	46.540	119.362	12	28E	07	M	21.1	F	124	D	-	-	-	-	64	P	113	44
BE096	*	US Government	1970/08/27	46.587	119.769	13	24E	25	E	24.2	F	237	D	-	51	-	-	-	-	-	22,25,26,40,41
BE097		699-52-115	-	46.585	119.759	13	24E	25	-	20.6	B	213	D	-	45	-	-	-	-	-	12
BE098	*	US Govt./Meeker	-	46.586	119.779	13	24E	26	G	20.0	F	215	L	-	43	-	-	-	-	-	22,25,26,41
BE099	*	—	1951/12/01	46.586	119.779	13	24E	26	G	20.0	-	185	-	-	-	-	-	-	-	-	40
BE100	*	US Government	1951/11/29	46.577	119.769	13	24E	36	D	24.0	F	333	D	-	36	-	-	5110	-	66	22,25,26,40,41
BE101	*	US Government	-	46.638	119.639	13	25E	01	N	23.0	F	241	D	-	46	-	-	-	-	-	22,25,26,31

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
BE102	*	US Government	1983/06/03	46.638	119.671	13	25E	03	Q	21.0	-	16	-	-	-	-	-	-	-	12	40
BE103	*	Hanford, 199-B4-4	1977/04/27	46.631	119.644	13	25E	11	H	39.1	F	32	L	-	847	-	-	-	-	23	22,25,26,40
BE104		DB 12	-	46.614	119.694	13	25E	16	-	20.5	B	215	D	-	29	-	-	-	-	-	12
BE105		US Government	1981/04/23	46.580	119.660	13	25E	26	N	20.0	-	183	-	-	-	-	-	-	-	90	40
BE106	*	US Govt./McGee, Chester	1977/04/27	46.586	119.737	13	25E	30	G	30.6	F	338	D	-	44	-	-	5185	-	65	22,25,26,40,41
BE107		699-53-103	-	46.585	119.738	13	25E	30	-	28.7	B	299	D	-	49	-	-	-	-	-	12
BE108		DC 5	-	46.570	119.673	13	25E	34	-	62.8	B	945	D	-	37	-	-	-	-	-	12
BE109		DH 1		46.590	119.499	13	26E	25	AorB	21.9	B	183	D	37	54	-	64	-	-	-	4,5,22,25
BE110	*	US Government	1979/04/17	46.565	119.602	13	26E	31	R	20.0	-	98	-	-	-	-	-	-	-	97	40
BE111		ARH DC 1	-	46.576	119.517	13	26E	35	A	75.0	B	1725	D	-	37	31	-	-	-	-	2,26
BE112		DDH 1	-	46.576	119.517	13	26E	35	A	21.9	S	183	L	37	38	-	-	-	-	-	26
BE113	*	US Government	1969/07/14	46.572	119.517	13	26E	35	H	25.0	-	-	-	-	-	-	-	-	-	-	40
BE114		Hanford DC 6	-	46.586	119.395	13	27E	26	G	60.2	B	1324	D	-	37	31	-	-	-	-	2,26
BE115		—	1984/06/06	46.590	119.443	13	27E	28	C	21.0	-	168	-	-	-	-	-	-	-	-	40
BE116		DB 10	-	46.585	119.461	13	27E	29		26.4	B	257	D	-	43	-	-	-	-	-	12
BE117		Hanford [illegible]	[illegible]	46.[illegible]	119.533	14	26E	14	M	32.5	F	24	L	-	854	-	-	-	-	17	22,25,26,40
BE118	*	US Government	[illegible]	46.631	119.533	14	26E	23	D	24.0		28	-	-	-	-	-	-	-	26	40
BE119		Hanford 199-N-15	1977/04/27	46.674	119.565	14	26E	28	G	20.7	F	24	D	-	363	-	-	-	-	16	22,25,26,40
BE120	*	Hanford 199-K-19	1979/04/18	46.656	119.592	14	26E	32	L	22.0	-	16	-	-	-	-	-	-	-	6	40
BE121		US Government	1979/04/18	46.704	119.475	14	27E	18	H	22.5	-	17	-	-	-	-	-	-	-	12	40
BE122		DC-14	-	46.672	119.462	14	27E	29	-	57.2	B	1017	D	-	45	-	-	-	-	-	12
BE123	*	US Government	1979/04/17	46.659	119.438	14	27E	33	G	20.5	-	20	-	-	-	-	-	-	-	10	40
		CHELAN COUNTY																			
CH001		Norco No. 1	-	47.367	120.298	22	20E	26	M	35.7	S	1495	L	28	27	-	62	-	-	-	4,5,22,25,26
		CLARK COUNTY																			
CK001		Evergreen School District 114	1980/08/19	45.613	122.533	02	02E	35	M	22.0	-	77	-	-	-	-	-	1079	-	48	40
CK002		Cody, L.	-	45.638	122.266	02	04E	24	N	24.1	M	90	D	-	-	-	-	-	-	-	5
		CLALLAM COUNTY																			
CL001S	*	Olympic Hot Springs	-	47.977	123.687	29	08W	27	K	48.5	-	-	-	-	-	-	-	-	-	-	19,32
CL002S	*	Sol Duc Hot Springs	-	47.969	123.861	29	09W	32	C	51.0	-	-	-	-	-	-	-	-	-	-	19,21,32
		COLUMBIA COUNTY																			
CO001		Barton, George	-	46.235	117.963	09	39E	22	C	21.1	F	305	D	-	-	-	-	4	P	274	44
CO002		Ferrell, L.	-	46.555	118.005	12	38E	01	E	22.0	-	241	L	-	41	-	-	-	-	-	22,25,26,37
CO003	*	Ferrel, Robert	1961/01/27	46.583	118.017	13	38E	26	E	20.0	F	74	D	-	108	-	-	-	-	-	22,25,26,40,41
CO004		US Army Corps of Engineers	-	46.580	118.024	13	38E	27	J	23.3	F	116	D	-	-	-	-	1060	P	5	44
CO005		US Army Corps of Engineers	1983/08/26	46.580	118.034	13	38E	27	L	23.9	F	116	D	-	-	-	-	1790	P	19	40,44
		COWLITZ COUNTY																			
CZ001S		Green River Soda Springs	-	46.379	122.266	10	04E	02	G	25.0	-	-	-	-	-	-	-	-	-	-	17,22

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
		DOUGLAS COUNTY																			
DO001		Welch	-	47.244	120.011	20	22E	12	B	22.0	B	264	D	26	33	-	41	-	-	-	5,26
DO002		La Bonte, Lloyd L.	1982/07/28	47.241	120.011	21	22E	12	G	20.0	-	234	-	-	-	-	-	5299	-	80	40
DO003		Fleming & Evenhus	-	47.386	120.129	22	22E	19	E	20.0	F	83	D	-	-	-	-	8	P	72	42
DO004		Welch, Dean	-	47.386	120.129	22	22E	19	E	22.8	F	226	D	-	-	-	-	6832	P	176	42
DO005		Sagebrush Flats	-	47.460	119.674	23	25E	27	L	33.0	B	396	D	-	-	-	-	-	-	-	37
DO006		DNR Pixlee	-	47.483	119.594	23	26E	20	D	29.3	S	363	L	-	50	-	-	-	-	-	22,25,26,33
DO007		Isaak, John	-	47.813	119.268	27	28E	26	C	20.0	F	247	D	-	-	-	-	-	P	158	42
		FRANKLIN COUNTY																			
FR001		Dixon, Norman, 2	1988/04/15	46.295	119.143	09	29E	02	G	22.1	F	144	D	-	-	-	-	379	-	34	7,15,40
FR002	*	Pasco Navy Base/Port of Pasco	1970/08/28	46.263	119.098	09	30E	18	HorJ	21.0	F	315	D	-	29	-	-	2271	-	22	22,25,26,40
FR003		N.P. R.R./A. Miller ice plant	-	46.247	119.088	09	30E	20	L	21.1	F	314	D	-	29	-	-	1855	P	20	39
FR004		Western Farm Service	1988/09/07	46.235	119.046	09	30E	27	F	20.5	-	37	-	-	-	-	-	151	-	-	40
FR005		Nakamura	-	46.279	118.985	09	31E	07	E	24.6	-	168	L	33	75	-	-	-	-	-	22,25,26
FR006		Hageman, Marvin	1988/09/14	46.360	119.179	10	29E	09	R	20.0	-	118	-	-	-	-	-	76	-	81	40
FR007		US Bureau of Reclamation	-	46.339	119.012	10	30E	23	H	20.0	F	194	D	-	-	-	-	57	P	81	44
FR008		Jones & Russell,Eddie & Connie	1983/07/20	46.333	118.766	10	32E	23	J	23.0	-	91	-	-	-	-	-	95	-	46	40
FR009		Foster, Chris	1983/05/23	46.470	119.155	11	29E	03	H	22.0	-	168	-	-	-	-	-	95	-	122	40
FR010	*	West 15 Domestic Water, Inc.	1994/01/20	46.461	119.196	11	29E	05	R	28.0	F	305	D	-	-	-	-	360	P	160	40,44
FR011		Bergland Farms	1988/09/09	46.475	119.228	11	29E	06	C	23.0	-	20	-	-	-	-	-	38	-	7	40
FR012		Sunset Domestic Water Assoc.	-	46.444	119.177	11	29E	16	A	22.2	F	293	D	-	-	-	-	246	P	163	44
FR013		White Bluff/Greg Allen	1988/04/12	46.417	119.215	11	29E	20	N	25.0	-	285	-	-	-	-	-	212	-	170	40
FR014		Turner, Richard	1983/07/25	46.390	119.236	11	29E	31	N	24.5	-	227	-	-	-	-	-	-	-	148	40
FR015		Clearwater Domestic Assoc.	-	46.389	119.199	11	29E	32	R	21.1	F	113	D	-	-	-	-	57	P	103	44
FR016		Circle H Land, 3	1983/05/18	46.462	118.942	11	31E	04	P	21.5	-	399	-	-	-	-	-	13248	-	125	40
FR017		Nakamura, H.	-	46.425	118.931	11	31E	21	H	24.8	B	356	D	-	34	-	-	-	-	-	22,25,26,38
FR018		Hummel, Ed.	1988/04/13	46.399	118.937	11	31E	33	B	22.0	-	213	-	-	-	-	-	-	-	53	40
FR019		Rowe Farms	-	46.402	118.842	11	32E	29	N	29.6	B	333	D	-	53	-	-	-	-	-	23
FR020		USBR Drainage Obs.	1988/02/21	46.557	119.128	12	29E	01	E	22.5	-	15	-	-	-	-	-	-	-	-	40
FR021		Stephens, Alvin E.	-	46.555	119.204	12	29E	05	-	20.0	F	136	D	-	-	-	-	76	P	26	44
FR022		Rohfeld, Richard	-	46.554	119.223	12	29E	06	K	20.0	F	72	D	-	-	-	-	-	P	64	44
FR023		Washburn, Hiram E.& Rachel A.	-	46.522	119.191	12	29E	16	N	21.1	F	112	D	-	-	-	-	25	P	87	44
FR024		Casey, Michael	1988/09/12	46.526	119.202	12	29E	17	K	23.0	-	146	-	-	-	-	-	30	-	119	40
FR025		Winebarger, Jim	-	46.518	119.133	12	29E	23	A	22.2	F	175	D	-	-	-	-	23	P	123	44
FR026	*	US Bureau of Reclamation	1953/01/01	46.500	119.186	12	29E	28	F	20.0	F	213	D	-	38	-	-	204	-	150	22,25,26,40
FR027		N. 16 Dom. Water Assoc., Inc.	-	46.489	119.160	12	29E	34	B	21.1	F	169	D	-	-	-	-	91	P	129	44
FR028		Coordes, Henry	1988/09/13	46.538	118.926	12	31E	10	M	22.5	-	293	-	-	-	-	-	-	-	183	40
FR029		Greenfield Farm/Mel McLane	1988/02/27	46.626	119.315	13	28E	09	L	25.0	-	247	-	-	-	-	-	-	-	178	40
FR030		Lowe, Walter	1988/02/26	46.629	119.278	13	28E	11	E	22.0	-	222	-	-	-	-	-	-	-	186	40
FR031	*	US Bureau of Reclamation	1983/07/26	46.608	119.257	13	28E	13	N	29.5	F	341	D	-	46	-	-	322	-	145	22,25,26,40
FR032		US Bureau of Reclamation	1983/07/22	46.629	119.199	13	29E	08	H	20.5	F	138	D	-	-	-	-	114	P	130	40,44

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
FR033		Bailie	-	46.612	119.120	13	29E	13	K	22.6	B	210	D	48	43	-	77	-	-	-	5,26
FR034		Price, Anthon	-	46.618	119.194	13	29E	16	D	23.9	F	227	D	-	-	-	-	303	P	126	44
FR035		Wahluke Water Association,Inc.	-	46.618	119.194	13	29E	16	D	27.8	F	318	D	-	-	-	-	227	P	127	44
FR036		Bailie, Leon	1988/04/14	46.593	119.147	13	29E	23	P	23.5	-	214	-	-	-	-	-	-	-	23	40
FR037		Connell City 8	1983/07/21	46.644	118.875	13	31E	01	E	21.1	F	404	D	-	-	-	-	9118	P	101	40,44
FR038		Loeber, E. C.	-	46.618	118.892	13	31E	14	C	20.6	F	369	D	-	-	-	-	7570	P	102	44
FR039		Connell City, E. C. Loeber	-	46.605	118.883	13	31E	14	R	20.0	F	306	D	-	-	-	-	757	P	107	44
FR040		Pepiots, Inc.	-	46.571	118.909	13	31E	34	G	22.2	F	400	D	-	-	-	-	1136	P	176	44
FR041		Cockrans	-	46.581	118.604	13	34E	30	M	32.2	B	355	D	56	57	-	-	-	-	-	22,25,26
FR042		USBR Block 24 Obs.	1988/09/17	46.677	119.315	14	28E	28	C	21.5	-	6	-	-	-	-	-	-	-	-	40
FR043	*	US Govt./Othello AFB	1967/02/13	46.721	119.178	14	29E	09	A	23.3	B	263	D	58	47	-	-	197	-	172	6,22,25,26,40,41
FR044		Michel, John	1988/09/14	46.681	119.226	14	29E	19	Q	21.0	-	128	-	-	-	-	-	-	-	68	40
FR045		Alexander, H. D.	1988/09/14	46.651	119.215	14	29E	32	N	26.7	F	182	D	-	-	-	-	19	P	130	40,44
FR046		Rathbun, Corrin	-	46.713	118.959	14	31E	08	M	46.8	B	758	D	-	46	38	-	-	-	-	2,26,37,38,45
FR047		Rathbun, Corrin, 3	-	46.713	118.922	14	31E	09	J	22.2	B	332	D	-	28	48	-	-	-	-	22,25,26,37,38,45
FR048		Kummer Farms	-	46.705	118.911	14	31E	15	C	20.3	B	413	D	-	-	-	-	-	-	-	37,38, 45
FR049		Wirth, Earl W.	-	46.669	118.891	14	31E	26	L	22.2	F	274	D	-	-	-	-	265	P	134	44
FR050		Andrews, Clyde	-	46.669	118.901	14	31E	27	J	25.2	B	207	D	-	-	50	-	-	-	-	45
FR051		Connell City	-	46.658	118.860	14	31E	36	H	23.3	F	337	D	-	-	-	-	2790	P	108	44
FR052	*	Connell City 4	1970/09/24	46.655	118.860	14	31E	36	J	25.0	F	337	D	-	39	-	-	-	-	-	22,25,26,40
FR053		Hart, Frank	-	46.722	118.763	14	32E	02	P	27.2	B	242	D	50	63	50	-	-	-	-	22,25,26,37,45
FR054		Hart	-	46.701	118.748	14	32E	13	E	25.6	-	187	L	-	73	-	-	-	-	-	22,25,26
FR055		Hart, Dick	-	46.701	118.748	14	32E	13	E	23.7	B	232	D	-	-	50	-	-	-	-	37,45
FR056		Welch, Norman A. & Dean	-	46.671	118.847	14	32E	30	F	22.8	F	238	D	-	-	-	-	2460	P	91	44
FR057		Connell City 6	-	46.662	118.854	14	32E	31	D	29.4	B	305	D	38	57	50	-	-	-	-	22,25,26
FR058		Hudlow, Floyd S.	-	46.705	118.720	14	33E	18	B	20.0	F	165	D	-	-	-	-	341	P	148	44
FR059		Heider, Walter	-	46.680	118.689	14	33E	21	N	28.2	B	351	D	-	44	50	-	-	-	-	22,25,26,37,38,45
FR060		Gillis, Vernon	1983/08/03	46.680	118.354	14	36E	19	N	29.5	B	287	D	-	42	-	-	76	-	-	22,25,26,40
		GARFIELD COUNTY																			
GA001		Scott, Jim	-	46.521	117.760	12	40E	14	J	21.1	F	317	D	-	-	-	-	34	P	268	44
GA002	*	Pomeroy City 4	1960/05/24	46.476	117.601	12	42E	31	L	23.0	F	304	D	-	36	-	-	-	-	-	22,25,26,40,41
GA003		Burne, Diane	-	46.569	117.543	13	42E	33	G	20.0	F	47	D	-	-	-	-	204	P	-	44
		GRANT COUNTY																			
GR001		Pacific First Bank 2	-	46.645	119.844	13	24E	05	F	25.6	F	457	D	-	-	-	-	-	-	10	44
GR002		Pacific First Bank 1	-	46.645	119.844	13	24E	05	F	26.1	F	393	D	-	-	-	-	-	-	9	44
GR003		Pacific First Bank 3	-	46.645	119.844	13	24E	05	F	24.4	F	461	D	-	-	-	-	-	-	24	44
GR004		DNR East Priest Rapids, 1	1983/07/28	46.706	119.892	14	23E	13	D	23.5	-	296	-	-	-	-	-	-	-	82	40
GR005		Baney, Curt	-	46.692	119.908	14	23E	23	C	21.1	F	195	D	-	-	-	-	-	-	38	44
GR006		Gearhart, Frank	1983/07/27	46.678	119.898	14	23E	26	A	22.5	-	125	-	-	-	-	-	76	-	43	40
GR007	*	US Army/AEC Hanford 90	1971/10/08	46.735	119.639	14	25E	01	D	27.5	F	285	D	-	54	-	-	511	-	55	22,25,26,40,41
GR008		Hanford 93-93	-	46.735	119.639	14	25E	01	D	25.6	B	68	D	-	43	-	-	-	-	-	5,26

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
GR009		Barker, Paul	1983/07/26	46.735	119.655	14	25E	02	C	20.5	-	136	-	-	-	-	-	-	-	17	40
GR010		Arnold, Greg	-	46.696	119.734	14	25E	18	Q	27.8	F	172	D	-	-	-	-	57	P	39	44
GR011	*	US Govt./AEC Hanford 6	1958/01/07	46.692	119.692	14	25E	21	B	22.2	F	159	D	-	63	-	-	984	-	72	22,25,26,40,41
GR012		US Army Corps of Engineers	-	46.674	119.702	14	25E	28	E	22.8	F	198	D	-	-	-	-	946	P	146	44
GR013	*	US Army	1959/10/28	46.691	119.381	14	27E	24	C	30.0	F	425	D	-	42	-	-	379	-	117	22,25,26,40,41
GR014	*	Wahluke School	1994/01/20	46.743	119.898	15	23E	35	R	17.0	F	129	-	-	-	-	-	379	-	107	40
GR015		Mattawa City	1983/07/27	46.740	119.909	15	23E	35	P	21.5	-	303	-	-	-	-	-	3785	-	80	40
GR016		DH 5	-	46.754	119.758	15	24E	25	P	23.3	B	1534	D	-	41	31	-	-	-	-	26
GR017		DH 5	-	46.759	119.820	15	24E	28	-	73.5	B	1525	D	-	41	-	-	-	-	-	12
GR018		Bird, Duane	1982/08/19	46.746	119.644	15	25E	35	H	20.0	-	128	-	-	-	-	-	114	-	104	40
GR019	*	AEC Hanford 7	1958/01/07	46.743	119.425	15	27E	34	L	21.7	F	194	D	-	49	-	-	265	-	83	22,25,26,40,41
GR020		Myrick, Norman A. & Edith E.		46.912	119.892	16	23E	01	D	22.2	F	312	D	-	-	-	-	3785	P	200	44
GR021		Grant County PUD 2		46.861	119.941	16	23E	21	J	20.6	F	108	D	-	-	-	-	2044	P	6	44
GR022		Grant County PUD 2	[illegible]	46.861	119.941	16	23E	21	J	21.5	-	53	-	-	-	-	-	689	-	3	40
GR023	*	US Government		46.909	119.754	16	24E	01	G	23.5	F	244	D	-	47	-	-	-	-	-	22,25,26,41
GR024	*	US Air Force		46.908	119.754	16	24E	01	G	24.5	F	279	D	-	45	-	-	-	-	-	22,25,26,41
GR025	*	US Air Force	[illegible]	46.908	119.754	16	24E	01	G	23.5	-	279	-	-	-	-	-	1154	-	214	40
GR026		Royal City 1	1983/07/27	46.901	119.626	16	25E	01	Q	20.5	-	277	-	-	-	-	-	1893	-	162	40
GR027		Weitzel, Paul	1983/07/30	46.956	119.901	17	23E	23	A	24.0	-	276	-	-	-	-	-	38	-	183	40
GR028		Metro Mortgage	-	46.996	119.633	17	25E	01	F	25.3	B	239	D	-	56	-	-	-	-	-	22,25,26,37
GR029		US Bureau of Reclamation	1982/08/18	46.926	119.490	17	27E	31	D	20.8	F	247	D	-	36	-	-	1211	-	61	22,25,26,40
GR030		—	-	46.993	118.989	17	30E	01	G	23.0	F	299	D	-	37	-	-	-	-	-	22,25,26
GR031		Warden City	-	46.972	119.036	17	30E	10	P	27.8	F	253	D	-	-	-	-	12036	P	53	44
GR032	*	US Government	1982/08/11	46.917	119.054	17	30E	33	K	23.3	-	299	D	-	-	-	-	-	-	-	40,41
GR033	*	US Army Corps of Engineers	1960/01/24	46.917	119.054	17	30E	33	K	23.5	F	306	D	-	33	-	-	946	P	64	22,25,26,40,41,44
GR034		George City	-	47.087	119.857	18	24E	06	A	20.0	F	54	D	-	-	-	-	3785	P	8	44
GR035		Washington	-	47.054	119.680	18	25E	15	E	25.6	F	297	D	-	46	-	-	-	-	-	22,25,26
GR036		Quiney	-	47.054	119.680	18	25E	15	E	22.4	S	270	L	-	39	-	-	-	-	-	22,25,26
GR037		DOE George	-	47.054	119.681	18	25E	15	E	29.3	-	488	L	35	35	-	-	-	-	-	22,25,26,38
GR038	*	WDOE Tst./Obs., Backfilled	1978/02/17	47.054	119.681	18	25E	15	E	25.5	-	491	-	-	-	-	-	4391	-	117	40
GR039		Metro Mortgage 11A	-	47.036	119.644	18	25E	23	J	21.2	-	190	L	-	48	-	-	-	-	-	22,25,26
GR040		Farm Man	-	47.018	119.681	18	25E	27	N	21.2	B	228	D	-	36	-	-	-	-	-	6,22,25,26
GR041		Bradshaw	-	47.029	119.691	18	25E	28	B	22.4	B	212	D	-	49	-	-	-	-	-	22,25,26
GR042		Metro Mortgage	-	47.011	119.612	18	26E	31	F	20.4	B	216	D	46	49	-	-	-	-	-	6,26
GR043		Metro Mortgage 20	-	47.007	119.606	18	26E	31	K	22.5	B	215	D	40	49	-	-	-	-	-	22,25,26
GR044		Clarno, Roy	1983/05/20	47.014	119.590	18	26E	32	C	20.5	-	137	-	-	-	-	-	9311	-	12	40
GR045		Sparks, Dave, 6	1983/05/18	47.007	119.542	18	26E	34	K	21.0	-	20	-	-	-	-	-	681	-	8	40
GR046		Shinn, F.	-	47.005	119.529	18	26E	35	SW4	23.2	B	165	D	50	68	-	79	-	-	-	5,26
GR047		Tokunaga, Joe	1983/07/28	47.024	119.271	18	28E	26	F	22.5	-	244	-	-	-	-	-	7570	-	42	40
GR048		American Potato Company	-	47.078	119.222	18	29E	06	K	20.0	F	210	D	-	-	-	-	4542	P	43	44
GR049		American Potato Company, 2	-	47.075	119.222	18	29E	06	Q	21.7	B	205	D	-	47	45	-	-	-	-	22,25,26,33,37,38,45
GR050		Hirai, Tom	1983/07/29	47.160	119.706	19	25E	08	A	23.0	-	220	-	-	-	-	-	9349	-	6	40

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
GR051		Grant County Land Co.	-	47.095	119.658	19	25E	35	M	20.6	F	223	D	-	-	-	-	7097	P	20	44
GR052		DNR 76-10 East Cole 2	1983/08/29	47.099	119.637	19	26E	36	E	20.0	-	157	-	-	-	-	-	6245	-	76	40
GR053		DNR	-	47.098	119.627	19	26E	36	G	21.1	F	158	D	-	-	-	-	227	P	47	44
GR054		Lauzier, Paul	-	47.101	119.488	19	27E	31	D	25.0	M	233	L	-	56	-	-	-	-	-	22,25,26,33,37
GR055		Moses Lake City 28	-	47.166	119.311	19	28E	04	L	20.9	F	227	D	-	37	-	-	-	-	-	26
GR056	*	Moses Lake City 14	1994/04/07	47.144	119.280	19	28E	15	A	26.7	F	312	D	-	-	-	-	5678	P	85	44
GR057		Moses Lake City 3	1955/08/02	47.133	119.285	19	28E	15	Q	22.2	F	277	D	-	37	-	-	5299	-	8	22,25,26,40
GR058	*	Moses Lake City 7	1960/05/16	47.129	119.274	19	28E	23	D	23.8	B	292	D	-	42	45	-	-	-	4	22,25,26,31,37,40,45
GR059		Moses Lake City 5	-	47.122	119.259	19	28E	23	J	20.0	F	290	D	-	-	-	-	4239	P	31	44
GR060	*	Moses Lake City 10	1994/04/07	47.115	119.291	19	28E	27	C	21.1	F	211	D	-	-	-	-	4353	P	30	44
GR061		Moses Lake City	-	47.111	119.280	19	28E	27	H	20.8	F	319	D	-	-	-	-	7456	P	5	44
GR062		Moses Lake City	-	47.104	119.280	19	28E	27	R	21.4	F	211	D	-	42	-	-	-	-	-	26
GR063	*	Moses Lake City 4	1994/04/07	47.105	119.307	19	28E	28	Q	20.0	F	294	D	-	32	-	-	3785	P	30	6,22,25,26
GR064		Westlake City	-	47.107	119.339	19	28E	29	M	21.1	F	212	D	-	-	-	-	3406	P	1	44
GR065		Moses Lake City 31	-	47.108	119.339	19	28E	29	M	20.6	B	140	D	-	58	-	-	-	-	-	26,37,45
GR066		Fode, Roy, 2	1983/07/29	47.172	119.157	19	29E	03	B	22.5	-	366	-	-	-	-	-	-	-	77	40
GR067		Fode 1	-	47.169	119.162	19	29E	03	F	25.4	B	321	D	-	42	-	-	-	-	-	22,25,26
GR068		Fode, Roy, 2	-	47.169	119.162	19	29E	03	F	29.0	B	322	D	-	-	45	-	-	-	-	33,37,45
GR069		Shinn, Frank, 2	-	47.169	119.173	19	29E	04	H	25.7	B	281	D	-	46	45	-	-	-	-	22,25,26,33,37,45
GR070		Abrams	-	47.151	119.173	19	29E	09	J	20.5	S	98	L	-	88	-	-	-	-	-	22,25,26
GR071		Jett-Aero 2	-	47.136	119.131	19	29E	14	J	21.5	B	218	D	-	44	45	-	-	-	-	26,33,37,45
GR072		Masto Farms	-	47.143	119.152	19	29E	15	A	21.1	B	289	D	-	40	45	-	-	-	-	33,37,38,45
GR073		Carnation	-	47.133	119.189	19	29E	16	N	28.8	B	191	D	-	88	-	-	-	-	-	22,25,26
GR074		Richards, Arch W.	1983/07/30	47.169	119.040	19	30E	03	E	22.2	F	335	D	-	-	-	-	8327	P	112	40,44
GR075		Ottmar, Arthur	1983/09/06	47.150	119.099	19	30E	07	L	23.0	-	284	-	-	-	-	-	7570	-	93	40
GR076		American Potato	-	47.140	118.994	19	30E	13	F	20.6	B	202	D	-	38	-	-	-	-	-	6,22,25,26,45
GR077		Radach Farms	1983/05/17	47.136	119.035	19	30E	15	L	24.0	-	360	-	-	-	-	-	-	-	113	40
GR078		Schmidt, Reuben	-	47.136	119.083	19	30E	17	M	21.9	B	225	D	-	44	45	-	-	-	-	22,25,26,33,37,45
GR079		Abram 1/Jett-Aero 1	-	47.129	119.083	19	30E	20	D	25.8	B	311	D	-	44	45	-	-	-	-	22,25,26,33
GR080		Hagman Construction	-	47.212	119.995	20	23E	19	F	28.9	F	299	D	-	-	-	-	1892	P	6	44
GR081	*	Quincy City 1	1955/08/03	47.236	119.855	20	24E	07	R	21.0	F	131	D	-	69	-	-	4353	-	84	22,25,26,40
GR082	*	Wenatchee Apple Land Co.	-	47.228	119.828	20	24E	09	E	20.0	F	105	D	-	-	-	-	5545	P	69	39
GR083		Auburn Packing Co., Inc.	-	47.178	119.764	20	24E	36	N	20.0	F	64	D	-	-	-	-	1514	P	12	44
GR084		Updegrave, V./Neveal, G.	1983/07/29	47.198	119.516	20	26E	26	JorK	21.0	F	161	D	-	-	-	-	5678	P	65	40,44
GR085	*	Moses Lake City 21	1983/07/29	47.183	119.322	20	28E	32	HorJ	22.2	-	217	D	-	-	-	-	3501	-	33	40,41
GR086		Cole, E. B.	-	47.242	119.215	20	29E	07	H	24.0	B	215	D	-	56	45	-	-	-	-	22,25,26,33,37,38,45
GR087		Reinke Farms	-	47.201	119.120	20	29E	25	C	26.3	B	406	D	-	32	45	-	-	-	-	22,25,26,33,37,38,45
GR088		Powers, Tom	-	47.187	119.130	20	29E	35	A	26.6	B	293	D	-	40	45	-	-	-	-	22,25,26,33,37,45
GR089		Claassen, C. C.	-	47.212	119.056	20	30E	21	F	26.4	B	323	D	54	39	-	-	13248	P	72	6,22,25,26,44
GR090		Claassen, Clint	-	47.212	119.051	20	30E	21	G	28.7	B	470	D	-	34	35	-	-	-	-	22,25,26,37,38,45
GR091		Franz, Herb, 2	-	47.216	119.003	20	30E	23	A	21.9	B	219	D	-	43	35	-	-	-	-	22,25,26,33,37,45
GR092		Franz, Herb, 1	-	47.212	119.019	20	30E	23	E	34.9	B	337	D	101	68	35	-	-	-	-	22,25,26,33,37,45

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
GR093		Jantz, Joe	-	47.190	119.046	20	30E	28	R	28.6	B	181	D	-	91	-	-	-	-	-	22,25,26,45
GR094		Stuckey, J. Jantz	-	47.190	119.046	20	30E	28	R	20.4	B	178	D	-	47	35	-	-	-	-	22,25,26,33,37,45
GR095		Neibaur/West	-	47.180	119.072	20	30E	32	K	21.1	S	383	L	-	-	-	-	-	-	-	33,37,38,45
GR096		Schorzman, Art & L.M. Etienne	-	47.283	119.857	21	24E	30	J	20.0	F	86	D	-	-	-	-	57	P	46	44
GR097		Ephrata City EPW-1	-	47.341	119.583	21	26E	05	Q	32.0	F	-	-	-	-	-	-	-	-	-	24
GR098	*	Ephrata City	1955/07/22	47.330	119.594	21	26E	08	M	30.0	-	305	-	-	-	-	-	2903	-	41	40
GR099		Ephrata City	-	47.330	119.594	21	26E	08	M	30.0	F	305	D	-	59	-	-	-	-	-	22,25,26
GR100	*	Ephrata City 5	1955/07/22	47.326	119.594	21	26E	08	N	28.0	F	137	D	-	116	-	-	2407	-	17	26,40
GR101		Ephrata City	-	47.317	119.524	21	26E	14	L	20.0	F	311	D	-	-	-	-	2725	P	61	44
GR102		Ephrata City 10	1983/09/02	47.320	119.535	21	26E	15	H	25.5	F	564	D	-	-	-	-	10598	P	66	40,44
GR103		Ephrata City	-	47.323	119.556	21	26E	16	A	21.1	F	415	D	-	-	-	-	5299	P	7	44
GR104	*	Ephrata City 2	1955/07/22	47.323	119.562	21	26E	16	B	29.0	-	79	-	-	-	-	-	6056	-	7	40
GR105	*	Ephrata City	1955/07/22	47.305	119.573	21	26E	21	E	25.5	F	188	D	-	72	-	-	-	-	-	22,25,26,40
GR106		Hansen, Charles L.	-	47.349	119.291	21	28E	03	NW4	20.6	F	204	D	-	-	-	-	5678	P	67	44
GR107		Hutterites	1983/09/01	47.343	119.041	21	30E	03	E	22.5	-	408	-	-	-	-	-	-	-	131	40
GR108		—	-	47.325	119.039	21	30E	10	M	30.0	B	640	-	-	28	-	-	-	-	-	22,25
GR109	*	Schell, Harvey, 2	1983/09/01	47.296	119.002	21	30E	23	J	31.1	F	407	D	-	-	-	-	8516	P	117	16,40,44
GR110		Schell, Harvey	-	47.285	119.008	21	30E	26	G	21.4	B	171	D	-	54	35	-	-	-	-	6,22,25,26,45
GR111	*	Soap Lake City	1955/07/22	47.385	119.486	22	27E	19	N	27.0	F	142	D	-	106	-	-	-	-	2	22,25,26,40
GR112		King, Bud	-	47.373	119.007	22	30E	26	G	25.0	B	476	D	35	52	-	-	11355	P	110	22,25,26,33,38,44
GR113		Lester, Edna M.	1982/07/27	47.512	119.412	23	27E	10	B	20.5	-	253	-	-	-	-	-	53	-	231	40
GR114		Schafer, Jerry	-	47.463	119.294	23	28E	27	E	22.8	-	196	L	-	60	-	-	-	-	-	22,25,26,38
GR115		DNR	-	47.494	119.188	23	29E	16	D	20.0	F	285	D	-	-	-	-	9830	P	64	44
GR116		—	-	47.647	119.247	25	28E	24	L	29.2	B	189	-	-	91	-	-	-	-	-	22,25
GR117		Dormaier	-	47.640	119.242	25	28E	25	B	23.0	B	177	D	-	62	-	-	-	-	-	6,22,25,26
GR118		Bolyard, James L.	-	47.640	119.268	25	28E	26	C	24.4	F	72	D	-	-	-	-	6813	P	26	44
		GRAYS HARBOR COUNTY																			
GY001		North Beach School District	1980/07/01	47.233	124.207	20	12W	08	P	20.5	-	71	-	-	-	-	-	-	-	-	40
GY002		VO-MO 1	-	47.238	124.204	20	12W	08	-	35.6	B	1067	L	27	-	-	36	-	-	-	4,5
		KING COUNTY																			
KI001S	*	Lester Hot Springs	-	47.207	121.547	20	10E	21	M	46.5	-	-	-	-	-	-	-	19	-	-	19,21,29,32
KI002		Valley View Christian Church	1987/09/22	47.371	122.177	22	05E	28	C	21.5	-	72	-	-	-	-	-	42	-	59	40
KI003S	*	Goldmeyer Hot Springs	-	47.486	121.366	23	11E	14	B	50.0	-	-	-	-	-	-	-	-	-	-	19,29,32
KI004S	*	Scenic Hot Springs	-	47.711	121.140	26	13E	28	Q	47.0	-	-	-	-	-	-	-	-	-	-	18,19,29,32
		KITTITAS COUNTY																			
KS001		USGS/WDOE Burbank Creek	1978/08/16	46.772	120.436	15	19E	22	L	24.3	B	184	D	-	93	-	-	6056	P	12	2,22,25,26,40,42
KS002		Larson Fruit	-	46.768	120.437	15	19E	22	P	31.5	B	393	D	-	50	-	-	-	-	-	2,26,38
KS003		Larson Fruit Co.	-	46.769	120.426	15	19E	22	R	20.0	F	127	D	-	-	-	-	-	N?	A?	42
KS004		Larson Orchards	1983/07/12	46.769	120.426	15	19E	22	R	26.5	-	390	-	-	-	-	-	8706	-	60	40
KS005		Nash, Chet	-	46.746	120.404	15	19E	35	H	20.0	F	21	D	-	-	-	-	163	P	14	42

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
KS006		Badger/Bollinger	-	46.889	120.391	16	19E	12	K	20.0	B	333	D	48	33	-	46	-	-	-	5,26
KS007	*	USGS/WDOE Umtanum	1978/03/02	46.852	120.458	16	19E	28	C	28.6	B	310	D	-	51	-	-	3634	-	7	22,25,26,38,40
KS008		Orcutt, Leland	-	46.991	120.354	17	20E	05	K	22.8	F	137	D	-	-	-	-	2271	P	34	42
KS009S		Clerf Spring	-	46.999	120.372	17	20E	06	A	20.0	-	-	-	-	-	-	-	4164	-	-	36
KS010		Palelek, Ron	1982/07/29	46.937	119.987	17	23E	30	H	26.0	-	61	-	-	-	-	-	114	-	38	40
KS011	*	Ellensburg City, Mt.Stuart well	1994/04/07	47.009	120.556	18	18E	35	E	20.6	F	272	L	-	32	-	-	3217	P	15	22,25,26,38
KS012[1]		Central Washington University	1994/01/18	47.013	120.525	18	18E	36	B	28.4	B	262	D	-	61	-	-	-	-	-	6,22,25,26
KS013		Clerf, Howard	1983/07/12	47.029	120.305	18	20E	27	A	21.0	F	142	D	-	-	-	-	7570	P	67	40,42
		KLICKITAT COUNTY																			
KT001		Bingen City 2	-	45.719	121.467	03	11E	30	H	20.5	M	88	D	-	-	-	-	-	-	-	5
KT002		Heaney	-	45.701	121.410	03	11E	34	K	21.4	M	104	D	37	-	-	58	-	-	-	5
KT003		Mott, J.	-	45.737	121.182	03	13E	21	B	22.4	M	150	D	29	-	-	53	-	-	-	5
KT004		Daniel, L	-	45.698	121.235	03	13E	31	M	22.1	M	174	D	26	-	-	42	-	-	-	5
KT005		US Army Corps of Engineers	-	45.724	120.693	03	17E	28	C	22.2	F	238	D	-	-	-	-	2271	P	28	42
KT006		Riggleman Orchards	-	45.864	121.463	04	11E	05	E	21.1	F	279	D	-	-	-	-	738	P	226	42
KT007		Jelenewski, Tom	-	45.825	121.360	04	12E	19	D	21.1	F	47	D	-	-	-	-	57	P	18	42
KT008		J. Neils Lumber Co	-	45.821	121.151	04	13E	23	E	27.0	F	168	D	-	-	-	-	303	N	A	28
KT009S	*	Klickitat Mineral Springs	-	45.823	121.114	04	13E	24	A	29.0	-	-	-	-	-	-	-	-	-	-	17,22,32
KT010		DNR 81 Klickitat	-	45.821	121.130	04	13E	24	E	20.1	B	120	D	51	56	-	71	-	-	-	5,26
KT011	*	Gas Ice Corp. 10	1966/03/24	45.821	121.114	04	13E	24	H	27.2	F	90	D	-	167	-	-	341	N	A	22,25,26,28,31,40
KT012	*	Gas Ice Corp. 2	1964/10/21	45.824	121.104	04	14E	19	C	23.0	F	61	D	-	177	-	-	-	-	-	22,25,26,31,40
KT013		Barrett, Charles M.	1982/08/25	45.852	120.777	04	16E	11	D	21.5	-	329	-	-	-	-	-	5678	-	-	40
KT014		Barrett	-	45.852	120.777	04	16E	11	D	20.9	-	187	L	-	48	-	-	-	-	-	26
KT015		Goldendale City 1	-	45.827	120.808	04	16E	16	Q	24.6	B	271	D	-	-	-	-	-	-	0	9,38
KT016		Berk Bros.	-	45.894	120.290	05	20E	27	B	23.1	B	276	D	41	43	-	-	-	-	-	6,22,25,26
KT017		DOE Horse Heaven West	-	45.916	120.191	05	21E	16	L	27.6	B	457	D	49	38	-	78	-	-	-	5,26,37
KT018		Matsen	-	45.894	120.035	05	22E	27	A	28.2	B	321	D	42	48	-	-	-	-	-	6,22,25,26,33
KT019		Matsen, A. M.	-	45.894	120.035	05	22E	27	A	22.2	F	262	D	-	-	-	-	6836	P	22	42
KT020		Matsen, A. M.	-	45.894	120.035	05	22E	27	A	21.1	F	236	D	-	-	-	-	3406	P	17	42
KT021		Rinta, John, 1	1983/07/19	45.883	120.045	05	22E	27	P	24.0	-	248	-	-	-	-	-	9463	-	35	40
KT022		Powers, Tom	-	45.915	119.870	05	23E	13	J	27.2	B	330	D	-	43	-	-	-	-	-	22,25,26,38
KT023		Hiner, Gene	1982/03/31	45.911	119.869	05	23E	13	R	25.0	-	442	-	-	-	-	-	10674	-	39	40
KT024		McBride, Clarence	-	45.893	119.968	05	23E	29	D	25.5	B	267	D	-	51	-	-	8024	N	A	22,25,26,38
KT025		McBride Ranch, 2	1983/07/19	45.893	119.989	05	23E	30	D	24.0	-	257	-	-	-	-	-	17600	-	38	40
KT026S	*	Fish Hatchery Warm Spring	-	46.039	121.179	06	13E	04	H	23.8	-	-	-	-	-	-	-	-	-	-	11
KT027	*	Smith, G.	1970/12/11	46.014	119.905	06	23E	11	N	23.3	F	272	D	-	37	-	-	-	-	A	22,25,26,40,42
KT028		Andrews, Robert	1970/12/11	46.014	119.894	06	23E	11	Q	23.5	F	272	D	-	-	-	-	9462	N	A	9,40
KT029	*	Smith, George	-	46.014	119.894	06	23E	11	Q	21.0	F	204	D	-	44	-	-	-	-	-	22,25,26,31
KT030	*	—	1962/04/30	46.014	119.895	06	23E	11	Q	21.0	-	63	-	-	-	-	-	-	-	-	40
KT031	*	Andrews/Smith	1970/10/22	46.006	119.910	06	23E	15	H	21.0	F	193	L	-	47	-	-	1438	-	0	22,25,26,40
KT032		Andrews	-	46.006	119.910	06	23E	15	H	25.2	S	275	L	-	48	-	-	-	-	-	22,25,26
KT033		DNR Feezell	-	45.999	119.942	06	23E	16	P	22.0	F	290	D	-	-	-	-	10787	P	12	9

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
KT034		DNR	-	45.999	119.932	06	23E	16	R	22.2	F	290	D	-	-	-	-	7570	P	20	42
KT035		Andrews, Robert	-	45.988	119.911	06	23E	22	J	23.0	B	318	D	-	35	-	-	-	-	-	26,38
KT036		Andrews, Robert	1983/07/19	45.995	119.874	06	23E	24	B	24.5	-	294	-	-	-	-	-	15140	-	44	40
KT037		DNR Mercer N.	-	45.962	119.879	06	23E	36	F	20.8	B	190	D	49	41	-	78	-	-	-	5,26
		LEWIS COUNTY																			
LE001		SU 8	-	46.545	122.847	12	01W	07	A	25.2	B	565	D	33	30	-	36	-	-	-	4,5,22,25,26
LE002		SU 11	-	46.538	122.826	12	01W	08	J	21.3	B	409	D	35	33	-	37	-	-	-	4,5,22,25,26
LE003		SU 12	-	46.538	122.826	12	01W	08	J	25.7	B	578	D	27	31	-	31	-	-	-	4,5,22,25,26
LE004		SU 14	-	46.538	122.836	12	01W	08	L	25.6	B	578	L	34	-	-	36	-	-	-	4,5
LE005		SU 37	-	46.534	122.841	12	01W	08	N	24.7	B	540	D	34	31	-	36	-	-	-	4,5,22,25,26
LE006		SU 4	-	46.535	122.820	12	01W	09	N	28.8	B	760	L	33	-	-	36	-	-	-	4,5
LE007		SU 902	-	46.527	122.826	12	01W	17	H	31.2	B	847	L	33	-	-	36	-	-	-	4,5
LE008		Longview 10	-	46.525	122.833	12	01W	17	-	30.0	-	792	L	26	27	-	-	-	-	-	22,25,26
LE009S		Packwood Hot Spring	-	46.579	121.705	13	09E	32	-	38.0	-	-	-	-	-	-	-	-	-	-	17,22,32
LE010S	*	Ohanapecosh Hot Springs (USGS)	-	46.737	121.561	14	10E	04	C	50.0	-	-	-	-	-	-	-	110	-	-	29
		LINCOLN COUNTY																			
LI001	*	Odessa Oil Test Piezometer A	1972/09/13	47.327	118.913	21	31E	10	M	30.5	-	224	-	-	-	-	-	-	-	71	40
LI002		Basalt Explorer	-	47.326	118.913	21	31E	10	M	65.8	S	1343	L	42	40	38	70	-	-	-	4,5,22,25,26,33,37,38,45
LI003		Schafer, Jerry	-	47.299	118.885	21	31E	23	F	21.0	B	293	D	-	-	35	-	-	-	-	45
LI004		Schibel, Don	-	47.303	118.864	21	31E	24	C	20.6	B	194	D	-	-	35	-	-	-	-	45
LI005		Sahible	-	47.287	118.860	21	31E	25	B	28.3	B	195	D	-	84	-	-	-	-	-	22,25,26
LI006		Kissler, Bob	-	47.277	118.960	21	31E	30	R	23.8	B	264	D	-	41	35	-	-	-	-	22,25,26,37,45
LI007		Kissler	-	47.273	118.957	21	31E	32	D	21.1	B	211	D	-	42	-	-	-	-	-	5,6,22,25,26
LI008		Schaffer, Jerry	-	47.301	118.755	21	32E	23	F	24.1	B	299	D	-	41	40	-	-	-	-	22,25,26,37,45
LI009		Fink, Reuben	1983/06/03	47.274	118.840	21	32E	31	C	20.0	-	227	-	-	-	-	-	3785	-	82	40
LI010		Kramer, Robert A.	1983/08/04	47.294	118.539	21	34E	21	K	21.0	-	225	-	-	-	-	-	4164	-	112	40
LI011		Hardung, Joe	-	47.275	118.546	21	34E	33	C	24.9	S	253	L	-	55	-	-	-	-	-	22,25,26,37
LI012		Weizel, LeeRoy	-	47.274	118.511	21	34E	34	A	20.0	F	234	D	-	-	-	-	7229	P	124	44
LI013		Weizel, L. R.	-	47.270	118.511	21	34E	34	H	22.2	F	197	D	-	-	-	-	2650	P	60	44
LI014		Iverson	-	47.329	118.449	21	35E	07	G	20.1	B	128	D	-	65	-	-	-	-	-	6,22,25,26
LI015	*	Sprague City	1983/08/02	47.296	117.985	21	38E	23	L	21.4	F	153	D	-	-	-	-	3217	-	42	7,15,40
LI016		Jantz, Merlin K.	1983/08/05	47.395	118.696	22	33E	17	N	21.5	-	188	-	-	-	-	-	-	-	61	40
LI017		Weishaar	-	47.514	118.787	23	32E	04	J	28.7	B	212	D	-	83	-	-	-	-	-	22,25,26
LI018		Weishaar	-	47.488	118.814	23	32E	17	G	21.2	B	206	D	37	49	-	-	-	-	-	22,25,26
LI019		Zagelow	-	47.499	118.637	23	33E	10	J	21.6	S	232	L	-	46	-	-	-	-	-	22,25,26
LI020		USGS/WDOE Almira	-	47.577	118.933	24	31E	16	E	21.8	B	227	D	48	37	-	-	-	-	-	5,6,22,25,26
LI021		Schmierer, Alvin	-	47.554	118.627	24	33E	23	P	27.0	B	310	D	-	48	-	-	-	-	-	22,25,26,38
LI022		Nealey, Darwin	-	47.538	118.583	24	34E	30	P	21.0	B	231	D	-	43	-	-	-	-	-	26,37
LI023		USGS/WDOE Davenport	-	47.578	118.272	24	36E	16	A	21.9	B	225	D	59	55	-	93	-	-	-	5,26
LI024	*	Wilbur SEC	1983/08/31	47.614	118.754	25	32E	35	P	21.3	F	348	D	-	-	-	-	-	-	79	7,15,40

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
LI025	*	Davenport City 6	1983/08/10	47.648	118.153	25	37E	21	L	24.0	F	297	D	-	-	-	-	8327	P	67	16,40,44
LI026		Davenport City 5	-	47.648	118.154	25	37E	21	L	24.0	S	227	L	-	57	-	-	-	-	-	22,25,26
LI027		Reardan City	-	47.671	117.880	25	39E	15	D	20.0	S	259	L	28	35	-	-	-	-	-	26,37
LI028		Washington Water Power Co.	-	47.870	118.480	27	34E	01	E	25.8	M	151	D	-	-	-	-	-	-	-	5
LI029		DDH-SF15	-	47.819	118.132	27	37E	22	P	31.7	M	258	D	35	-	-	-	-	-	-	5
LI030		Taylor	-	47.816	118.099	27	37E	26	A	23.8	-	358	D	40	36	-	-	-	-	-	5,26
OKANOGAN COUNTY																					
OK001		DOE TST3	-	48.151	119.675	31	25E	27	Q	22.7	M	44	D	-	-	-	-	-	-	-	5
OK002		Ayres, Bob	-	48.589	119.567	36	26E	28	K	21.1	F	12	D	-	-	-	-	568	P	7	42
OK003		Gildroy	-	48.680	119.498	37	26E	25	NE4	20.6	M	134	D	-	-	-	-	-	-	-	5
OK004S		Poison Lake	-	48.819	119.451	38	27E	05	J	50.0	-	-	-	-	-	-	-	-	-	-	17,22
OK005		Zissel, Charles	-	48.794	119.256	38	28E	14	H	20.0	F	9	D	-	-	-	-	38	P	2	42
OK006		Zosel, Ralph	-	48.962	119.409	40	27E	15	R	20.0	F	9	D	-	-	-	-	19	P	4	42
OK007S		Hot Lake	-	48.973	119.476	40	27E	18	A	50.0	-	-	-	-	-	-	-	-	-	-	17,22
PIERCE COUNTY																					
PI001S	*	Longmire Springs	-	46.752	121.813	15	08E	29	R	22.0	-	-	-	-	-	-	-	2	-	-	14
PI002S		Mount Rainier Fumaroles	-	46.855	121.756	16	08E	23	K	72.0	-	-	-	-	-	-	-	-	-	-	17,22
PI003S	*	Spring	-	47.114	122.597	19	02E	19	Q	24.4	-	-	-	-	-	-	-	-	-	-	15
SKAMANIA COUNTY																					
SK001S	*	Bonneville Hot Springs	-	45.656	121.958	02	07E	16	M	36.3	-	-	-	-	-	-	-	80	-	-	17,18,19,22,32
SK002S	*	Rock Creek Hot Springs	-	45.721	121.926	03	07E	27	B	33.5	-	-	-	-	-	-	-	-	-	-	18
SK003		North Bonneville 2	-	45.652	121.960	02	07E	39	E	35.5	B	198	D	143	131	-	190	-	-	-	5,26
SK004		North Bonneville 3	-	45.651	121.958	02	07E	39	K	26.4	B	155	D	91	106	-	120	-	-	-	5,26
SK005		Bonneville drill hole 2	-	45.646	121.955	02	07E	39	Q	28.2	F	-	-	-	-	-	-	-	-	-	18
SK006S		Shiperds Hot Springs	-	45.739	121.805	03	08E	21	C	42.0	-	-	-	-	-	-	-	100	-	-	17,22
SK007		DNR 81-Carson	-	45.735	121.805	03	08E	21	F	27.8	B	113	D	168	166	-	265	-	-	-	5,26
SK008S	*	St. Martin Hot Springs	-	45.728	121.794	03	08E	21	R	49.0	-	-	-	-	-	-	-	-	-	-	14,19,21,29,32
SK009		Green Life 1	-	45.703	121.854	03	08E	31	M	41.0	B	914	D	25	33	-	-	-	-	-	8
SK010S		Collins Hot Springs	-	45.698	121.719	03	09E	31	Q	50.0	-	-	-	-	-	-	-	-	-	-	17,22,32
SK011		Trout Creek Drill Hole	-	45.812	121.954	04	07E	21	P	36.3	B	357	D	89	-	-	141	-	-	-	1,5
SK012S		Mount St. Helens lava dome	-	46.200	122.187	08	05E	09	A	88.0	-	-	-	-	-	-	-	-	-	-	17,22
SK013S		Orr Creek Warm Springs	-	46.344	121.609	10	10E	19	NE4	22.0	-	-	-	-	-	-	-	100	-	-	17,22
SNOHOMISH COUNTY																					
SN002S	*	Kennedy Hot Springs(USGS)	-	48.119	121.193	30	12E	01	H	38.0	-	-	-	-	-	-	-	-	-	-	29,32
SN003S	*	Gamma Hot Spring	-	48.151	121.062	31	13E	36	D	65.0	-	-	-	-	-	-	-	-	-	-	19,29
SN004S	*	Sulphur Creek Hot Springs	-	48.255	121.180	32	13E	19	C	37.0	-	-	-	-	-	-	-	-	-	-	19,21
SPOKANE COUNTY																					
SP001		Cheney City 4	-	47.487	117.582	23	41E	13	E	22.2	F	651	D	-	-	-	-	-	-	82	44
SP002		Cheney City 5	-	47.480	117.593	23	41E	14	Q	33.1	B	651	D	-	34	-	-	5488	P	72	22,25,26,38,44

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
SP003		Cheney City	-	47.481	117.593	23	41E	14	Q	29.1	-	341	L	-	56	-	-	-	-	-	22,25,26
SP004		Anderberg, Gary	-	47.505	117.397	23	43E	08	B	20.0	F	154	D	-	-	-	-	757	P	55	44
SP005	*	US Government	1958/07/22	47.556	117.749	24	40E	22	L	20.5	-	105	-	-	-	-	-	-	-	-	40
SP006	*	Fairchild AFB, 2	1958/07/22	47.595	117.628	24	41E	03	N	20.5	-	123	-	-	-	-	-	3785	-	3	40
SP007	*	US Government	1958/07/22	47.660	117.714	25	40E	14	R	20.0	-	109	-	-	-	-	-	-	-	-	40
SP008	*	US Government	1958/07/22	47.616	117.746	25	40E	34	P	21.0	-	60	-	-	-	-	-	-	-	-	40
SP009	*	US Government	1958/07/23	47.687	117.561	25	41E	01	R	20.0	-	127	-	-	-	-	-	-	-	-	40
SP010	*	US Army, Fort George Wright	1958/07/22	47.680	117.472	25	42E	11	E	20.0	-	18	-	-	-	-	-	5678	-	5	40
SP011	*	Washington Water Power Co.,1-3	1977/10/12	47.669	117.306	25	43E	13	A	21.0	-	34	-	-	-	-	-	2460	-	18	40
SP012	*	US Air Force	1958/07/22	47.732	117.536	26	42E	20	N	20.0	-	49	-	-	-	-	-	-	-	-	40
SP013		Fossen & Gisselburg	-	47.708	117.512	26	42E	33	W2	20.0	F	163	D	-	-	-	-	189	P	128	44
		WALLA WALLA COUNTY																			
WA001		Byerly, Richard	1983/05/16	46.024	118.749	06	32E	01	Q	21.5	-	351	-	-	-	-	-	-	-	-	40
WA002S		Warm Spr. Canyon Warm Spr.	-	46.024	118.772	06	32E	02	Q	22.0	-	-	-	-	-	-	-	-	-	-	32
WA003S		Emmett Lynch warm spring	-	46.020	118.770	06	32E	11	B	22.2	-	-	-	-	-	-	-	189	-	-	30
WA004		Fulgham	-	46.026	118.624	06	33E	01	K	31.8	B	305	D	69	67	-	73	2271	P	14	4,5,22,25,26,44
WA005		McDole, Joe	-	46.024	118.723	06	33E	06	R	25.6	F	398	D	-	-	-	-	1552	P	26	44
WA006		Demaris, Eugene & Leland	-	46.012	118.723	06	33E	07	J	20.0	F	46	D	-	-	-	-	1325	P	7 44	
WA007		Fulgham	-	46.017	118.673	06	33E	10	NW4	31.8	B	305	D	70	67	-	-	-	-	-	23
WA008		Herman, J.	-	46.005	118.697	06	33E	16	D	20.0	F	222	D	-	-	-	-	1287	P	5	44
WA009		Miller	-	46.033	118.520	06	34E	02	B	25.1	-	175	L	-	75	-	-	-	-	-	22,25,26
WA010		Bing/Frost Ranch Ltd.	-	46.026	118.577	06	34E	05	J	25.6	F	366	D	-	-	-	-	5867	P	70	44
WA011		Chvatal, Ed.	-	46.033	118.603	06	34E	06	B	36.0	B	484	D	-	48	-	-	-	-	-	22,25,26,33,38
WA012		Chvatal, Ed.	-	46.022	118.613	06	34E	06	N	37.8	F	544	D	-	-	-	-	2650	P	32	44
WA013		—	-	46.018	118.608	06	34E	07	C	40.2	B	407	D	-	64	-	-	-	-	-	6
WA014		Gilbert-Merry	-	46.007	118.608	06	34E	07	P	40.7	B	407	D	78	71	-	-	-	-	-	22,25,26
WA015		Thomas,Sherman/ *dba* Lowden Ranch	1983/08/13	46.008	118.598	06	34E	07	R	45.0	F	506	D	-	-	-	-	3785	P	42	40,44
WA016		Bing/Frost Ranch Ltd.	-	46.018	118.582	06	34E	08	B	40.0	F	366	D	-	-	-	-	4258	P	74	44
WA017		Welch, E. C.	-	46.022	118.369	06	35E	01	R	20.0	F	195	D	-	-	-	-	2971	P	18	44
WA018		Burlingame, E. C.	-	46.022	118.426	06	35E	03	N	20.0	F	416	D	-	-	-	-	38	P	10	30
WA019		Hart, Harley D.	-	46.018	118.453	06	35E	08	A	20.0	F	21	D	-	-	-	-	757	P	3	44
WA020	*	Jaussand, Art	1958/08/01	46.008	118.421	06	35E	10	P	25.0	F	350	D	-	37	-	-	7570	-	50	22,25,26,30,31,40,41
WA021		McAuslan	-	46.015	118.369	06	35E	12	H	21.7	F	214	D	-	42	-	-	757	P	0	22,25,26,30
WA022		Wilson, I. E.	-	46.011	118.380	06	35E	12	L	20.0	F	381	D	-	-	-	-	1703	P	18	44
WA023		Estes or Durand	-	46.006	118.383	06	35E	12	N	24.4	F	180	D	-	56	-	-	1136	P	31	22,25,26,30,31
WA024		Thomas, George	-	46.009	118.372	06	35E	12	R	22.2	F	194	D	-	-	-	-	2271	P	11	44
WA025		Dept. Ecology	-	46.003	118.474	06	35E	18	A	20.3	-	155	L	-	54	-	-	-	-	-	22,25,26
WA026		Dept. Ecology	-	46.004	118.473	06	35E	18	A	36.1	B	396	D	42	61	-	-	-	-	-	22,25,26
WA027	*	WDOE Tst./Obs., Piezometer A	1973/07/12	46.004	118.474	06	35E	18	A	25.5	-	75	-	-	-	-	-	-	-	13	40
WA028		College Place	-	46.004	118.474	06	35E	18	A	26.1	B	399	D	46	35	-	-	-	-	-	26
WA029		—	-	46.004	118.474	06	35E	18	A	21.3	B	399	D	-	46	-	-	-	-	-	6

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
WA030		Walla Walla	-	46.004	118.474	06	35E	18	A	21.3	-	178	L	-	52	-	-	-	-	-	22,25,26
WA031		Crass, Billy J.	-	46.030	118.323	06	36E	04	E	23.3	F	240	D	-	-	-	-	2725	P	78	44
WA032		Hanlon, Terry D.	-	46.022	118.322	06	36E	04	N	22.2	F	195	D	-	-	-	-	57	P	88	44
WA033		Grieb, Bert	-	46.022	118.322	06	36E	04	N	21.1	F	252	D	-	-	-	-	1904	P	88	44
WA034		Richardson, Ross & Zella L.	-	46.026	118.342	06	36E	05	M	21.4	F	188	D	-	48	-	-	1703	P	15	22,25,26,30,44
WA035		Baker	-	46.022	118.328	06	36E	05	R	27.2	F	554	D	-	36	-	-	5980	P	38	22,25,26,30,44
WA036		Courtney, Jess	-	46.026	118.363	06	36E	06	M	22.0	F	186	D	-	54	-	-	1892	P	2	22,25,26,30
WA037		Brown, Lyle R.	-	46.022	118.363	06	36E	06	N	21.7	F	189	D	-	-	-	-	2975	P	3	44
WA038		Barnett, C. W.	-	46.023	118.348	06	36E	06	R	20.0	F	248	D	-	-	-	-	757	P	57	44
WA039		Border, Lester A.	-	46.018	118.353	06	36E	07	B	20.0	F	168	D	-	-	-	-	757	P	33	44
WA040		Ruzicka or Prusia	-	46.018	118.363	06	36E	07	D	22.2	F	171	D	-	58	-	-	1136	P	4	22,25,26,30
WA041		Bossini, Louis	1982/06/23	46.015	118.363	06	36E	07	E	20.0	-	184	-	-	-	-	-	1514	-	37	40
WA042		Logan, John D.		46.011	118.363	06	36E	07	M	20.0	F	299	D	-	-	-	-	2176	P	2	44
WA043		[illegible]		[illegible]	118.315	06	[illegible]	09	L	22.0	F	352	D	-	28	-	-	4542	P	32	22,25,26,30,31
WA044	*	[illegible]		[illegible]	118.315	06	[illegible]	09	P	21.2	F	628	D	-	-	-	-	-	P	35	30,31
WA045		[illegible]		[illegible]	118.911	07	31E	10	J	22.8	F	123	D	-	-	-	-	659	P	12	44
WA046		[illegible]		[illegible]	118.757	07	32E	01	NW4	20.0	F	34	D	-	-	-	-	76	P	15	44
WA047		Pac. Gas Trans. Co. 1		46.054	118.843	07	32E	29	N	26.7	F	195	D	-	-	-	-	57	P	47	44
WA048		Pac. Gas Trans. Co. 2		46.054	118.843	07	32E	29	N	21.1	F	145	D	-	-	-	-	170	P	47	44
WA049	*	Byerley Farm, Inc.	1971/09/20	46.039	118.747	07	32E	36	QorR	24.0	F	310	D	-	39	-	-	7570	P	24	22,25,26,40,44
WA050		Taggart	-	46.066	118.623	07	33E	24	Q	23.2	-	434	L	-	26	-	-	-	-	-	22,25,26
WA051		Harpe, William	-	46.059	118.639	07	33E	26	H	24.4	F	335	D	-	-	-	-	3406	P	47	44
WA052		Harpe, William	-	46.052	118.640	07	33E	26	R	23.3	F	284	D	-	-	-	-	1355	P	35	44
WA053		L. W. Weidert Farms, Inc.	-	46.053	118.738	07	33E	30	N	25.6	F	276	D	-	-	-	-	6056	P	81	44
WA054		McDole, Joseph and Amalie	-	46.053	118.723	07	33E	30	R	22.8	F	280	D	-	-	-	-	1892	P	51	44
WA055		McDole Farms	-	46.042	118.723	07	33E	31	J	27.8	F	412	D	-	-	-	-	-	-	-	44
WA056		McDole, Joe, 3	-	46.042	118.728	07	33E	31	K	27.7	B	269	D	-	58	-	-	-	-	34	22,25,26,37,44
WA057		Fulgham, Hilda M.	-	46.041	118.644	07	33E	35	K	30.6	F	310	D	-	-	-	-	2839	P	9	44
WA058		Baker, Charles	-	46.051	118.510	07	34E	25	N	20.0	F	336	D	-	-	-	-	1703	P	6	30
WA059		Kelly, Howard J.	-	46.042	118.501	07	34E	36	-	26.7	F	37	D	-	-	-	-	568	P	8	44
WA060		Washington State Penitentiary	-	46.081	118.369	07	35E	13	R	33.3	F	493	D	-	-	-	-	3002	P	125	44
WA061		—	-	46.069	118.406	07	35E	23	M	20.0	B	175	-	-	46	-	-	-	-	-	22,25
WA062		McKinnon, Jack C.	-	46.069	118.406	07	35E	23	M	20.0	F	49	D	-	-	-	-	511	P	7	44
WA063	*	Bonneville Power Admin.	1946/11/21	46.069	118.406	07	35E	23	M	20.0	F	157	D	-	51	-	-	1294	P	18	22,25,26,30,31,40,41
WA064		Hydro Irrigation	-	46.067	118.393	07	35E	23	SE4	20.6	F	174	D	-	-	-	-	3028	P	46	44
WA065		Gluck/BPA	-	46.069	118.385	07	35E	24	M	20.0	B	175	D	-	46	-	-	-	-	-	26
WA066		Arbini, James	-	46.059	118.379	07	35E	25	F	20.0	F	207	D	-	39	-	-	1136	P	5	22,25,26,30
WA067		Columbo	-	46.052	118.379	07	35E	25	P	20.6	F	188	D	-	42	-	-	1325	P	3	22,25,26,30
WA068		Whitman Nat'l. Monument	-	46.044	118.463	07	35E	32	F	25.6	F	230	D	-	-	-	-	291	P	11	44
WA069		Walla Walla College	-	46.044	118.439	07	35E	33	G	21.1	F	232	D	-	-	-	-	3974	P	14	44
WA070		Walla Walla College Farm	-	46.044	118.434	07	35E	33	GorH	22.8	F	305	D	-	-	-	-	5893	P	52	44
WA071	*	Walla Walla College	-	46.044	118.432	07	35E	33	H	24.0	F	217	L	-	55	-	-	-	-	-	22,25,26,31

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
WA072		Walla Walla College Farm	-	46.041	118.442	07	35E	33	L	21.1	F	306	D	-	-	-	-	4164	P	41	44
WA073		DNR Christian	-	46.040	118.421	07	35E	34	L	24.0	S	219	L	47	55	-	-	-	-	-	22,25,26
WA074		State of Washington	-	46.037	118.426	07	35E	34	N	21.1	F	222	D	-	-	-	-	3047	P	30	44
WA075		Walla Walla College	-	46.048	118.390	07	35E	35	A	20.5	B	310	D	27	27	-	-	-	-	-	5,22,25,26
WA076		Walla Walla College	-	46.048	118.390	07	35E	35	A	20.0	F	183	D	-	-	-	-	-	N	A	30
WA077		Walla Walla College Farm	-	46.048	118.400	07	35E	35	C	20.0	F	245	D	-	-	-	-	1173	P	28	44
WA078		Manuel or Magnoni	-	46.047	118.379	07	35E	36	C	20.6	F	195	D	-	41	-	-	378	P	A	22,25,26,30
WA079	*	College Place	1972/05/24	46.044	118.379	07	35E	36	F	20.5	-	213	-	-	-	-	-	1703	-	11	40
WA080	*	College Place City	1960/05/24	46.044	118.379	07	35E	36	F	20.0	-	216	-	-	-	-	-	2801	-	-	40
WA081		Richards	-	46.043	118.379	07	35E	36	F	21.1	F	186	D	-	48	-	-	-	-	A	22,25,26,30
WA082	*	College Place	-	46.044	118.379	07	35E	36	F	20.4	F	247	D	-	34	-	-	568	P	19	22,25,26,30
WA083	*	College Place	-	46.044	118.379	07	35E	36	F	20.6	F	216	D	-	37	-	-	6813	P	A	22,25,26,30
WA084		Stone Creek Sanitarium	-	46.037	118.372	07	35E	36	R	21.1	F	189	D	-	48	-	-	568	P	16	22,25,26,30
WA085		Foundation FM, 3	1982/06/22	46.106	118.291	07	36E	10	B	20.5	-	284	-	-	-	-	-	-	-	-	40
WA086	*	Walla Walla Comm. Coll.	1994/01/20	46.080	118.275	07	36E	14	P	13.0	F	407	L	-	36	-	-	4542	P	-	22,25,26,37
WA087		Walla Walla Golf Course	-	46.084	118.337	07	36E	17	L	39.1	B	716	D	-	36	-	-	-	-	-	6,22,25,26
WA088		Walla Walla Golf Course	-	46.084	118.337	07	36E	17	L	20.9	S	225	L	35	40	-	56	-	-	-	5,22,25,26
WA089		Blue Mountain Asphalt Co.	-	46.073	118.364	07	36E	19	E	20.0	F	48	D	-	-	-	-	114	P	5	44
WA090		D & K Farms	-	46.073	118.358	07	36E	19	F	30.2	B	471	D	-	38	-	-	-	-	-	6,22,25,26
WA091		DKFF	-	46.073	118.358	07	36E	19	F	20.6	B	250	D	-	-	-	-	-	-	-	5
WA092		General Foods Corp.	-	46.073	118.358	07	36E	19	F	24.4	F	343	D	-	-	-	-	3785	P	18	30
WA093		D & K Frozen Foods, Inc.	-	46.073	118.358	07	36E	19	F	21.7	F	69	D	-	-	-	-	643	P	9	44
WA094		Rodgers Can.	-	46.066	118.348	07	36E	19	R	28.8	F	485	D	-	33	-	-	4164	P	29	22,25,26,30
WA095	*	Rogers Canning	1972/05/24	46.066	118.348	07	36E	19	R	26.5	-	485	-	-	-	-	-	4277	-	29	40
WA096		Whitman College	-	46.073	118.327	07	36E	20	H	22.2	F	366	D	-	27	-	-	2680	P	20	22,25,26,44
WA097	*	Whitman College	1972/05/24	46.073	118.327	07	36E	20	H	23.0	-	366	-	-	-	-	-	2680	-	20	40
WA098	*	Walla Walla City 5	1960/07/29	46.051	118.306	07	36E	28	R	23.5	F	332	D	-	48	-	-	6510	-	40	22,25,26,40,41,44
WA099		Walla Walla Country Club	-	46.040	118.348	07	36E	31	J	21.1	F	523	D	-	-	-	-	5678	P	32	30
WA100		Chisholm, J. J.	-	46.037	118.364	07	36E	31	N	20.0	F	183	D	-	-	-	-	1514	P	A	30
WA101		Walla Walla City 7	-	46.048	118.321	07	36E	33	D	30.2	B	425	D	75	40	-	53	-	-	-	4,5,6,22,25,26
WA102		Walla Walla School Dist. 140	-	46.044	118.316	07	36E	33	F	22.2	F	287	D	-	-	-	-	2082	P	40	44
WA103		Smith, Jerry D.	-	46.040	118.306	07	36E	33	J	20.6	F	183	D	-	-	-	-	783	P	39	44
WA104		Peterson, Ross	-	46.177	118.900	08	31E	14	F	24.5	-	336	L	37	37	-	-	-	-	-	22,25,26,37
WA105		Ireland, Ken	1982/08/30	46.155	118.932	08	31E	21	R	22.0	-	38	-	-	-	-	-	114	-	8	40
WA106		McGregor	1970/09/09	46.133	118.912	08	31E	34	H	25.4	F	146	D	-	92	-	-	-	-	-	22,25,26,40
WA107		McGregor Feedlot	-	46.137	118.901	08	31E	35	C	25.6	F	154	D	-	-	-	-	3785	P	46	44
WA108		Gluck, Bill, 2	-	46.153	118.681	08	33E	21	R	31.0	B	237	D	-	-	-	-	-	-	-	37
WA109		Gluck	-	46.155	118.683	08	33E	21	SE4	24.1	B	290	D	38	42	-	60	-	-	-	4,5,22,25,26
WA110		Walla Walla College	-	46.135	118.390	08	35E	35	A	20.5	B	310	L	27	-	-	-	-	-	-	4
WA111		Power	-	46.268	118.753	09	32E	13	C	22.2	B	215	D	35	47	-	55	-	-	-	4,5,26
WA112		Union Pacific RR	-	46.329	118.744	10	32E	24	R	22.2	F	64	D	-	-	-	-	288	P	44	44
WA113		Grote	-	46.426	118.394	11	35E	14	Q	28.4	-	283	L	-	58	-	-	-	-	-	22,25,26

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
WA114		Western Farm Service	-	46.409	118.446	11	35E	28	D	25.0	F	305	D	-	-	-	-	378	P	237	44
WA115		Anderson, Don	-	46.494	118.264	12	36E	26	H	22.5	-	182	L	-	58	-	-	-	-	-	22,25,26,37
		WHATCOM COUNTY																			
WH001S		Dorr Fumarole Field	-	48.788	121.802	38	08E	17	D	90.0	-	-	-	-	-	-	-	-	-	-	17,22
WH002S		Sherman Crater Fumaroles	-	48.770	121.813	38	08E	19	G	130.0	-	-	-	-	-	-	-	-	-	-	17,22
WH003S	*	Baker Hot Springs	-	48.764	121.670	38	09E	20	M	44.0	-	-	-	-	-	-	-	-	-	-	18,19,21,29
WH004		Baker Hot Springs drill hole	-	48.764	121.670	38	09E	20	M	47.9	F	141	D	200	-	-	-	38	N	A	20
		WHITMAN COUNTY																			
WT001		Moehrie, Bill	-	46.505	117.139	12	45E	23	M	20.0	F	79	D	-	-	-	-	30	P	64	44
WT002		Dubois, L. D.	1983/03/29	46.617	118.149	13	37E	15	A	21.5	-	259	-	-	-	-	-	-	-	91	40
WT003		Peterson, Crump, & Kimball	1983/08/26	46.627	117.976	13	39E	07	E	26.5	-	192	-	-	-	-	-	23	-	152	40
WT004		Roy Davis Estate	-	46.619	117.215	13	44E	12	Q	20.0	F	56	D	-	-	-	-	57	P	24	44
WT005		Pullman City	-	46.733	117.166	14	45E	05	B	20.0	F	50	L	-	160	-	-	-	-	-	22,25,26
WT006	*	Pullman City	-	46.733	117.177	14	45E	05	D	20.0	F	50	D	-	-	-	-	-	-	-	31
WT007		Pullman City	-	46.733	117.177	14	45E	05	D	21.0	F	51	L	-	176	-	-	-	-	-	22,25,26,31
WT008		Steiger, Alan	-	46.761	117.504	15	42E	27	H	20.0	F	95	D	-	-	-	-	231	P	63	44
WT009	*	Pullman City	-	46.737	117.177	15	45E	32	N	20.0	-	70	D	-	-	-	-	-	-	-	31
WT010	*	Colfax City, Clay St. well	-	46.896	117.357	16	43E	11	G	23.5	F	183	L	-	77	-	-	-	-	-	22,25,26,31
WT011		Colfax City 4	1983/08/25	46.874	117.368	16	43E	14	N	21.0	-	229	-	-	-	-	-	2120	-	104	40
WT012		Schlomer, John G.	-	46.957	117.878	17	39E	22	AorB	22.2	F	136	D	-	-	-	-	57	P	40	44
WT013		Storment, Daryl	-	46.936	117.859	17	39E	26	K	22.2	F	117	D	-	-	-	-	34	P	-	44
WT014		Colfax City, E. Glenwood well	-	46.930	117.279	17	44E	32	A	21.0	-	-	-	-	-	-	-	-	-	-	31
WT015		Tekoa City	-	47.224	117.072	20	45E	24?	B?	24.4	F	54	D	-	-	-	-	-	-	-	27
		YAKIMA COUNTY																			
YA001		Sharp, Jack	-	46.082	120.017	07	22E	23	B	23.4	B	300	D	35	38	-	-	-	-	-	22,25,26,33
YA002S		Mount Adams Fumaroles	-	46.203	121.493	08	10E	01	Q	50.0	-	-	-	-	-	-	-	-	-	-	17,22
YA003		Mabton	-	46.209	120.000	08	22E	01	G	23.0	B	329	D	36	33	-	-	-	-	-	2,22,25,26
YA004		Flower	-	46.191	120.013	08	22E	11	J	22.0	B	166	D	43	62	-	-	4928	P	-	2,22,25,26,37
YA005		Boast Farms	-	46.169	120.049	08	22E	22	D	20.0	F	266	D	-	-	-	-	-	-	82	42
YA006		Johnson, Ray Y.	-	46.162	120.048	08	22E	22	M	22.2	F	309	D	-	-	-	-	-	-	83	42
YA007		Leyendekker, Arthur	-	46.158	120.048	08	22E	23	N	23.9	F	311	D	-	-	-	-	9462	P	81	42
YA008		Green Acre Farms, Inc.	-	46.301	120.645	09	17E	01	D	27.8	F	572	D	-	-	-	-	6813	P	162	42
YA009		John, Mary	1973/11/27	46.269	120.169	09	21E	15	H	21.0	-	13	-	-	-	-	-	151	-	1	40
YA010		Shinn	-	46.236	120.164	09	21E	26	M	28.5	B	295	D	-	43	52	-	-	-	-	2,6,22,25,26
YA011		Del Monte	1974/05/22	46.232	120.169	09	21E	27	R	22.0	B	35	D	-	286	-	-	-	-	5	2,22,25,40
YA012		—	-	46.279	120.021	09	22E	11	J	20.3	B	166	D	43	43	52	-	-	-	-	2,6,22,25
YA013		Van De Graff Orchards, Inc.	1982/08/19	46.275	120.011	09	22E	12	P	21.0	-	95	-	-	-	-	-	2271	-	6	40
YA014		Ramirez, Christi	-	46.267	120.001	09	22E	13	H	20.0	F	49	D	-	-	-	-	378	P	15	42
YA015		Washington Fruit & Produce	-	46.300	119.880	09	23E	01	B	21.1	F	85	D	-	-	-	-	3535	P	36	42
YA016		Grandview City, well no. 14	-	46.262	119.888	09	23E	13	SW4	22.8	F	291	D	-	-	-	-	7570	P	57	42

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
YA017		Grandview City, well no. 4	-	46.250	119.917	09	23E	22	J	21.2	B	429	D	-	-	-	-	-	-	-	2
YA018	*	Grandview City, well no. 15	1994/01/19	46.250	119.928	09	23E	22	L	26.0	F	394	D	-	-	-	-	7570	P	49	42
YA019		John Haas, Inc.	-	46.224	119.991	09	23E	31	F	21.1	F	121	D	-	-	-	-	1325	P	11	42
YA020		White Swan Fairgrounds	1989/09/13	46.377	120.719	10	17E	05	Q	20.0	-	59	-	-	-	-	-	-	-	10	40
YA021		—	-	46.359	120.666	10	17E	14	D	22.0	B	35	D	-	-	-	-	-	-	-	2
YA022	*	Showaway, Ida	1974/04/11	46.359	120.666	10	17E	14	D	20.5	B	23	D	-	370	-	-	-	-	3	22,25,40
YA023		Decker, Bert C., 2	1974/06/13	46.337	120.661	10	17E	23	L	20.3	B	213	D	-	39	39	-	6056	-	29	2,22,25,26,40
YA024		Decker, Bert, Jr., (Decker 3)	1989/09/15	46.323	120.651	10	17E	26	J	24.5	F	305	D	-	39	-	-	3478	-	28	2,22,25,26,40
YA025		Decker, Bert C.	1989/09/26	46.319	120.677	10	17E	27	Q	29.0	B	460	D	-	30	39	-	5678	-	60	2,22,25,40
YA026		Decker & Sons (Decker 4)	1989/09/15	46.330	120.698	10	17E	28	B	24.5	B	268	D	-	39	39	-	6813	-	32	2,22,25,26,40
YA027		Napyer, Louis	1989/09/12	46.330	120.703	10	17E	28	C	20.0	-	99	-	-	-	-	-	64	-	63	40
YA028		Shellenberger, Norman 3	1989/09/14	46.314	120.657	10	17E	35	B	24.5	B	245	D	-	38	39	-	6435	-	75	2,22,25,26,40
YA029		Green Acre Farms, Inc	1989/08/23	46.305	120.630	10	17E	36	R	23.5	F	297	D	-	-	-	-	-	-	113	40,42
YA030		[illegible]		46.3[illegible]	120.592	10	18E	05	Q	20.6	B	202	D	-	37	34	-	-	-	-	2,6,22,25,26
YA031	*	Decker Ranch (Decker 7)	1989/09/26	46.305	120.624	10	18E	31	N	23.8	B	318	D	-	37	39	-	-	-	82	2,22,25,26,40
YA032		Corpus, Laura	[illegible]	46.359	120.440	10	19E	16	A	20.0	-	18	-	-	-	-	-	38	-	5	40
YA033		Eisenberg, Chuck	1992/08/04	46.337	120.446	10	19E	21	K	20.5	-	19	-	-	-	-	-	38	-	3	40
YA034		Oneil, Viola		46.319	120.488	10	19E	30	Q	20.2	F	254	D	-	-	-	-	-	-	-	10
YA035		Oneal, Karl	1989/07/19	46.319	120.483	10	19E	30	R	23.0	-	254	-	-	-	-	-	160	-	-	40
YA036		Gibson, Joann	-	46.315	120.477	10	19E	32	D	21.1	F	64	D	-	-	-	-	64	P	8	42
YA037	*	Toppenish City 7	1974/09/19	46.381	120.326	10	20E	04	L	23.5	B	312	D	-	34	-	-	8895	-	-	2,22,25,26,40
YA038		Yakima Indian Nation Land Ent.	-	46.381	120.332	10	20E	04	M	20.0	F	19	D	-	-	-	-	1136	P	3	42
YA039		Gamache, Amos	1992/08/05	46.377	120.371	10	20E	06	N	27.0	-	11	-	-	-	-	-	227	-	4	40
YA040	*	Toppenish City 6	1974/09/19	46.373	120.316	10	20E	09	A	20.6	B	256	D	-	27	-	-	-	-	-	2,6,22,25,26,40,41
YA041		Brownlee, Larry	1992/08/04	46.326	120.332	10	20E	28	E	20.5	-	16	-	-	-	-	-	76	-	3	40
YA042		Duim, Garrett	1983/07/15	46.384	120.168	10	21E	03	H	23.0	-	236	-	-	-	-	-	-	-	21	40
YA043		Granger City	1968/04/16	46.341	120.183	10	21E	22	E	21.1	F	77	D	-	-	-	-	3785	N	A	10,42
YA044	*	Phillips, Lena	1974/05/23	46.316	120.195	10	21E	33	B	21.0	-	13	-	-	-	-	-	227	-	2	40
YA045	*	Sunnyside City 4	1970/10/06	46.325	120.011	10	22E	25	F	20.0	B	480	D	-	-	-	-	4542	-	23	2,40
YA046		Sunnyside City 3	1983/07/19	46.325	120.011	10	22E	25	F	21.0	-	354	-	-	-	-	-	1400	-	4	40
YA047		DNR Snipes Mountain	-	46.326	120.121	10	22E	30	E	20.6	F	270	D	-	-	-	-	6245	P	9	42
YA048		Luther, Joe	-	46.326	120.105	10	22E	30	H	22.2	F	91	D	-	-	-	-	568	P	12	42
YA049		Newhouse, Steve & John	1983/07/19	46.312	120.116	10	22E	31	F	21.5	-	128	-	-	-	-	-	189	-	14	40
YA050	*	Sunnyside City 7	1994/04/08	46.311	120.016	10	22E	36	E	24.4	F	322	D	-	-	-	-	4164	P	3	40,42
YA051	*	Sunnyside City 6	1994/04/08	46.322	119.998	10	23E	30	M	24.0	F	145	D	-	-	-	-	3406	P	A	-
YA052		Evans, Bill	-	46.315	119.875	10	23E	36	A	26.7	B	401	D	-	37	34	-	-	-	-	2,3,22,25,26,37
YA053		White, John	-	46.312	119.880	10	23E	36	G	23.0	B	284	D	-	39	34	-	3785	P	150	2,22,25,26,42
YA054S		Simcoe Soda Springs	-	46.452	120.958	11	15E	09	P	32.0	-	-	-	-	-	-	-	-	-	-	32
YA055		Pace, W. B.	-	46.406	120.762	11	16E	25	Q	25.4	B	333	D	-	40	34	-	-	-	-	2,22,25,26,33
YA056		Goudy, Steve	1989/08/22	46.395	120.803	11	16E	34	K	22.5	-	137	-	-	-	-	-	45	-	106	40
YA057	*	Gowdy, Albert A.	1982/08/18	46.395	120.803	11	16E	34	K	23.5	B	139	D	-	68	34	-	57	-	105	2,22,25,26,40
YA058	*	Mount Adams Seed	1974/06/13	46.473	120.640	11	17E	01	F	24.2	B	358	D	-	34	34	-	2631	-	34	2,22,25,26,40

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
YA059		Decker & Sons 6	1989/08/31	46.466	120.661	11	17E	02	LorP	25.5	B	265	D	-	51	34	-	6435	-	29	2,22,25,26,40
YA060	*	Stephenson, C. and H.	1989/09/14	46.468	120.682	11	17E	03	L	25.5	B	301	D	-	44	34	-	4391	-	59	2,22,25,26,40
YA061		Dufault, Maurice	1974/10/01	46.436	120.656	11	17E	14	Q	21.0	-	-	-	-	-	-	-	-	-	-	40
YA062		Stephenson	-	46.442	120.705	11	17E	16	F	31.6	B	302	D	-	62	-	-	-	-	-	2,6,22,25,26
YA063		Stephenson, C. and H.	1989/08/09	46.443	120.693	11	17E	16	H	20.8	B	233	D	-	38	34	-	76	-	4	2,22,25,26,40
YA064		Adams, Dee	1989/09/15	46.432	120.745	11	17E	19	C	21.5	-	154	-	-	-	-	-	49	-	118	40
YA065	*	Siegner, Monte	1974/10/01	46.450	120.582	11	18E	09	N	23.0	B	122	D	-	90	-	-	-	-	-	2,22,25,26,40
YA066		*Poireir, Ray*	*1974/07/10*	*46.443*	*120.588*	*11*	*18E*	*17*	*H*	*20.5*	-	-	-	-	-	-	-	-	-	-	40
YA067	*	Carlson, Sarah	1974/03/06	46.410	120.535	11	18E	26	L	26.4	B	16	D	-	900	-	-	38	-	4	2,22,25,40
YA068	*	Harrah City	1994/01/19	46.410	120.540	11	18E	26	M	27.5	F	448	D	-	-	-	-	1211	P	7	42
YA069		Rowe, Maurice	1974/07/10	46.407	120.614	11	18E	30	Q	21.5	-	-	-	-	-	-	-	-	-	91	40
YA070		Knight, Rick	1974/07/11	46.396	120.546	11	18E	34	J	22.0	-	-	-	-	-	-	-	-	-	-	40
YA071		Barkes, Ray	1971/03/18	46.392	120.556	11	18E	34	P	20.0	F	156	D	-	-	-	-	-	-	-	10
YA072		CL & Frank	1974/09/30	46.458	120.498	11	19E	07	E	20.5	-	-	-	-	-	-	-	-	-	5	40
YA073		Wapato Irrigation Project	1989/08/25	46.446	120.413	11	19E	14	D	23.0	-	20	-	-	-	-	-	227	-	6	40
YA074	*	Wapato City, well no. 5	1994/01/19	46.439	120.413	11	19E	14	M	21.0	F	305	D	-	-	-	-	5678	P	2	42
YA075		Wapato City	-	46.446	120.419	11	19E	15	A	20.8	B	179	D	-	41	48	-	-	-	-	2,6,22,25,26
YA076		Johnson, F.	1977/09/19	46.467	120.268	11	20E	01	M	28.1	B	457	D	-	38	-	-	-	-	-	2,3,10,22,25,26
YA077		Lynch, B.	1977/06/08	46.464	120.252	11	20E	01	R	21.5	B	351	D	-	27	-	-	-	-	-	2,3,10,22,25,26
YA078		Everts & Walsh, John & Don	1982/06/10	46.471	120.273	11	20E	02	H	23.5	-	206	-	-	-	-	-	132	-	69	40
YA079		Strothers, Kelly	-	46.471	120.294	11	20E	03	H	20.0	F	242	D	-	-	-	-	-	-	111	42
YA080		Young, James	1977/03/22	46.468	120.326	11	20E	04	L	22.2	F	155	D	-	-	-	-	-	-	-	10
YA081		Green, Clayton, & Babcock	-	46.464	120.336	11	20E	05	R	21.1	F	183	D	-	-	-	-	6900	P	53	42
YA082		Peters, Charles A.	1967/03/02	46.475	120.357	11	20E	06	A	22.0	F	190	D	-	49	-	-	-	-	-	10,22,25,26
YA083		Morrison Fruit Co., Inc.	-	46.457	120.304	11	20E	10	F	20.0	F	108	D	-	-	-	-	-	-	46	42
YA084		Narduzzi, Ermanno	-	46.453	120.273	11	20E	11	J	22.2	F	198	D	-	-	-	-	2271	P	27	42
YA085		Rashford, George B.	-	46.453	120.257	11	20E	12	K	22.2	F	248	D	-	-	-	-	1892	P	76	42
YA086		Schmidt Orchards, Inc.	-	46.439	120.268	11	20E	13	M	23.3	F	230	D	-	-	-	-	4731	P	43	42
YA087		Soost Brothers	1977/06/30	46.435	120.252	11	20E	13	R	29.2	S	366	D	-	52	-	-	-	-	-	2,3,10,22,25,26
YA088		Weatherly, B.	-	46.474	120.215	11	21E	05	B	28.5	B	379	D	-	42	40	-	-	-	-	2,22,25,26
YA089		Dahl, T.	-	46.467	120.241	11	21E	06	L	29.2	B	364	D	-	47	40	-	-	-	-	2,3,22,25,26
YA090		Valley Farms	-	46.464	120.241	11	21E	06	P	25.6	F	364	D	-	-	-	-	4164	P	98	42
YA091		Dahl, T.	-	46.464	120.236	11	21E	06	Q	29.6	B	393	D	-	45	40	-	4164	P	-	2,3,22,25,26
YA092		Clyde	-	46.460	120.231	11	21E	07	A	33.1	B	510	D	-	41	40	-	-	-	-	2
YA093		Lynch, Bob	-	46.457	120.241	11	21E	07	F	30.6	F	-	-	-	-	-	-	1400	P	116	42
YA094		Roza Investment Co.	1983/07/15	46.457	120.241	11	21E	07	F	27.5	-	494	-	-	-	-	-	1590	-	149	40
YA095		Garretson	-	46.458	120.223	11	21E	08	NW4	33.1	B	510	D	31	41	34	52	-	-	-	2,5,26
YA096		Clyde, Pat	-	46.446	120.200	11	21E	16	C	24.7	B	269	D	-	-	-	-	-	-	-	3
YA097		DNR Ramsier	1979/11/13	46.435	120.200	11	21E	16	P	28.1	S	427	D	41	52	40	65	-	-	-	2,3,5,10,26
YA098		Clyde	-	46.446	120.216	11	21E	17	B	24.8	B	273	D	41	47	-	-	-	-	-	5,26
YA099		Gammie, W./Lloyd Garretson Co.	1980/11/12	46.446	120.226	11	21E	17	D	36.1	F	593	D	-	-	-	-	2574	P	127	10,42
YA100		Schmidt, Dave	-	46.435	120.216	11	21E	17	Q	28.9	F	489	D	-	-	-	-	1287	P	120	42

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
YA101		Leach, Meier, Olsen	-	46.435	120.231	11	21E	18	R	22.8	F	175	D	-	-	-	-	5678	P	60	42
YA102		Schmidt, Dave	-	46.440	120.239	11	21E	18	-	28.9	F	-	-	-	-	-	-	1310	P	120	42
YA103		J J & G Investment	-	46.431	120.210	11	21E	20	A	25.0	F	242	D	-	-	-	-	530	P	98	42
YA104		Baldwin, John	-	46.431	120.226	11	21E	20	D	20.6	F	313	D	-	-	-	-	-	-	82	42
YA105		Hanrahan, P.	1977/06/20	46.424	120.226	11	21E	20	M	22.2	-	207	D	-	54	40	-	-	-	-	2,3,10,22,25,26
YA106		Ambrose Farms	-	46.432	120.195	11	21E	21	B	27.0	B	279	D	-	53	40	-	-	-	-	2,22,25,26
YA107		—	-	46.424	120.189	11	21E	21	J	20.0	F	184	D	-	-	-	-	1665	P	104	42
YA108		Van Leuven, Miles	-	46.432	120.184	11	21E	22	D	20.0	F	261	D	-	-	-	-	-	-	116	42
YA109		Houghton Farms	-	46.428	120.184	11	21E	22	E	20.0	F	261	D	-	-	-	-	1703	P	116	42
YA110		Sandlin, J.	-	46.428	120.174	11	21E	22	G	24.0	B	304	D	33	40	40	-	-	-	-	2,22,25,26
YA111		Sandlin Farms, Inc., 2	1983/06/09	46.428	120.174	11	21E	22	G	35.2	B	553	D	29	42	40	44	4164	P	132	2,3,5,26,40,42
YA112		Best, Peter C.	-	46.424	120.174	11	21E	22	K	25.6	B	335	D	-	43	40	-	1136	P	121	2,22,25,26,42
YA113		De La Chapelle, Charles	1982/08/21	46.413	120.158	11	21E	26	F	25.5	-	291	-	-	-	-	-	3785	-	114	40
YA114		Gay, H.	-	46.395	120.132	11	21E	36	K	21.5	B	213	D	-	45	40	-	-	-	-	2,3,22,25,26
YA115		Monson, Arvid	1982/08/20	46.421	120.121	11	22E	19	N	21.0	-	257	-	-	-	-	-	49	-	126	40
YA116		—	-	46.421	120.079	11	22E	21	N	22.3	B	207	D	-	46	37	-	-	-	-	2,6,22,25,26
YA117		Evans Fruit	-	46.408	120.026	11	22E	26	K	30.7	B	469	D	-	40	37	-	-	-	191	2,3,26,42
YA118		Spauld R.	-	46.409	120.079	11	22E	28	M	21.5	B	210	D	43	43	-	67	-	-	-	5,26
YA119		Rowe Farms	-	46.406	120.100	11	22E	29	N	29.6	B	340	D	-	53	-	-	-	-	-	22,25,26
YA120		Rowe Farms	-	46.406	120.100	11	22E	29	N	29.6	B	434	D	-	-	37	-	-	-	-	2,3
YA121		De La Chapelle, 2	-	46.416	120.116	11	22E	30	C	29.9	B	324	D	49	57	-	79	5299	P	173	5,26,42
YA122		De La Chapelle, C.	-	46.413	120.110	11	22E	30	G	47.8	B	829	D	-	43	31	-	-	-	-	2,22,25,26
YA123		Shelton, C. L.	1973/06/06	46.539	120.773	12	16E	12	N	25.2	B	269	D	-	53	41	-	3558	P	-	2,3,5,10,22,25,26
YA124		White	-	46.531	120.816	12	16E	15	E	21.5	B	179	D	-	59	-	-	-	-	-	26
YA125		Ridout, Tom	-	46.535	120.859	12	16E	17	D	20.0	F	110	D	-	-	-	-	68	P	28	42
YA126		Cohodas-Lancaster-Frank Co.	-	46.553	120.709	12	17E	04	N	24.4	F	340	D	-	-	-	-	3134	P	106	42
YA127		Palmer, Don	-	46.559	120.714	12	17E	05	H	21.7	F	87	D	-	-	-	-	163	P	59	42
YA128		Catlin, Ida	-	46.556	120.714	12	17E	05	J	20.0	F	113	D	-	-	-	-	76	P	68	42
YA129		Hull Ranches, Inc.	-	46.531	120.667	12	17E	14	E	21.1	F	291	D	-	-	-	-	6056	P	31	42
YA130	*	Wiley, Robert	1972/05/22	46.535	120.693	12	17E	16	A	22.2	B	265	D	-	39	41	-	4921	-	21	2,22,25,26,40
YA131		Valley Roz Orchards, Inc.	1989/08/17	46.509	120.540	12	18E	23	N	26.0	-	418	-	-	-	-	-	-	-	-	40
YA132		Eyle, Alex	1989/08/29	46.505	120.535	12	18E	26	C	24.5	-	130	-	-	-	-	-	-	-	117	40
YA133	*	Hansen Fruit	1974/06/14	46.501	120.551	12	18E	27	G	23.6	B	305	D	-	38	34	-	-	-	-	2,22,25,26,40
YA134	*	Hansen Fruit	1974/06/14	46.501	120.546	12	18E	27	H	29.6	B	311	D	-	57	34	-	5450	-	70	2,22,25,26,40
YA135		Keller, Walter	1989/08/30	46.494	120.562	12	18E	27	N	23.5	-	338	-	-	-	-	-	-	-	-	40
YA136		St. Clair, Ray, 2	1965/04/01	46.480	120.610	12	18E	31	R	22.2	B	479	D	-	-	-	-	4164	-	64	2,40
YA137	*	Mount Adams Seed, 2	1974/05/23	46.487	120.588	12	18E	32	H	25.2	B	358	D	-	37	34	-	2631	-	66	2,22,25,26,40
YA138		St. Clair	-	46.484	120.598	12	18E	32	L	27.9	B	379	D	39	40	34	-	-	-	-	2,6,22,25,26
YA139		Nyberg, Herbert	1974/05/23	46.490	120.567	12	18E	33	A	25.6	B	290	D	-	47	34	-	5299	-	64	2,22,25,26,40
YA140		Mount Adams Seed, 3	1970/05/11	46.490	120.572	12	18E	33	B	28.0	B	323	D	-	51	34	-	-	-	-	2,10,22,25,26
YA141	*	Moxee City 1	1994/04/08	46.551	120.382	12	19E	01	Q	31.1	F	396	D	-	45	41	-	2271	P	A	2,22,25,26,40
YA142		East Valley School District	1994/04/08	46.552	120.380	12	19E	01	Q	13.0	F	180	D	-	61	41	-	1041	P	104	2,6,22,25,26,42

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
YA143		Odom, Matt	1990/03/01	46.537	120.445	12	19E	09	Q	23.3	F	43	D	-	-	-	-	76	P	6	10,42
YA144		Laird, Robert	-	46.537	120.445	12	19E	09	Q	23.3	F	52	D	-	-	-	-	189	P	6	42
YA145		Bruwllett?	-	46.537	120.408	12	19E	11	P	26.7	F	362	D	-	-	-	-	3830	P	33	42
YA146		DNR Gangle	-	46.533	120.440	12	19E	16	A	22.0	B	153	D	-	58	-	-	-	-	-	26
YA147		Miocene Petroleum	-	46.533	120.471	12	19E	17	C	33.3	S	546	L	-	39	-	-	-	-	-	18,26
YA148		Olson, Dale	-	46.519	120.444	12	19E	21	B	20.0	F	-	-	-	-	-	-	2233	P	62	42
YA149		Stark West Orchards	1968/10/03	46.508	120.450	12	19E	21	P	20.0	F	110	D	-	-	-	-	2498	P	56	10,42
YA150		Stepniewski	-	46.494	120.418	12	19E	27	R	20.6	-	163	L	42	47	-	-	-	-	-	26
YA151		Deeringhoff, F. E.	-	46.551	120.325	12	20E	04	P	23.3	F	191	D	-	-	-	-	-	-	-	35
YA152		Buwalda and Haines	-	46.561	120.352	12	20E	05	D	20.7	F	194	D	-	-	-	-	962	N	A	35
YA153		Holland No. 2	-	46.554	120.352	12	20E	05	M	23.7	F	209	D	-	-	-	-	595	N	A	35
YA154		Regimbal	-	46.551	120.342	12	20E	05	Q	22.9	F	210	D	-	-	-	-	1852	N	A	35
YA155		Holland 1	-	46.551	120.342	12	20E	05	Q	24.4	F	224	D	-	-	-	-	3398	N	A	35
YA156		Clark 1	-	46.561	120.357	12	20E	06	A	22.9	F	287	D	-	-	-	-	2277	N	A	35
YA157		Peck, J. W.	-	46.556	120.364	12	20E	06	-	23.3	F	252	D	-	-	-	-	-	-	-	27
YA158		Ellens 1	-	46.544	120.357	12	20E	07	H	22.9	F	255	D	-	-	-	-	221	N	A	35
YA159		Dickson	-	46.548	120.337	12	20E	08	A	21.5	F	160	D	-	-	-	-	-	-	-	35
YA160		Gano, James H.	-	46.547	120.347	12	20E	08	C	25.6	F	259	D	-	-	-	-	-	-	-	35
YA161		Longevin 2	-	46.544	120.347	12	20E	08	F	22.6	F	255	D	-	-	-	-	1370	N	A	35
YA162		Longevin 1	-	46.544	120.346	12	20E	08	F	22.3	F	194	D	-	-	-	-	680	N	A	35
YA163		Haines	-	46.541	120.336	12	20E	08	J	22.3	F	275	D	-	-	-	-	1672	N	A	35
YA164		Sauve, J.	-	46.537	120.336	12	20E	08	R	24.0	F	311	D	-	-	-	-	807	N	A	35
YA165		Walters, David	-	46.542	120.344	12	20E	08	-	27.2	F	366	D	-	-	-	-	-	-	-	27
YA166		Bradford	-	46.548	120.326	12	20E	09	C	22.9	F	190	D	-	-	-	-	1536	P	1	35
YA167		Allwardt	-	46.537	120.325	12	20E	09	P	22.3	F	247	D	-	-	-	-	1087	N	A	35
YA168		Allwardt, Mona and Carl	-	46.537	120.325	12	20E	09	P	20.0	F	294	D	-	-	-	-	2650	P	1	42
YA169		Hill, E. S.	-	46.542	120.322	12	20E	09	-	23.3	F	191	D	-	-	-	-	-	-	-	27
YA170		S. Martinez Livestock, Inc.	-	46.537	120.252	12	20E	12	R	30.0	F	824	D	-	-	-	-	-	-	4	42
YA171		Charron, S.	-	46.522	120.258	12	20E	13	Q	27.9	B	376	D	36	42	40	-	-	-	-	2,3,22,25,26
YA172		Roy Farms, Inc.	-	46.533	120.294	12	20E	15	A	25.6	F	640	D	-	-	-	-	-	-	27	42
YA173		—	-	46.533	120.331	12	20E	16	D	21.0	B	154	-	-	58	-	-	-	-	-	22,25
YA174		DNR Elephant Mountain	-	46.526	120.326	12	20E	16	L	29.2	B	418	D	42	44	40	66	-	-	-	2,5,26
YA175		Brulotte, L.	-	46.533	120.362	12	20E	18	B	20.6	F	316	D	-	-	-	-	5678	P	17	42
YA176		Logan	-	46.497	120.310	12	20E	27	M	27.5	B	409	D	48	35	-	-	-	-	-	2,6,22,25,26
YA177		Logan, W.	-	46.493	120.310	12	20E	27	N	30.8	B	396	D	-	46	48	-	-	-	-	2,3,22,25,26,33
YA178		Clinger, Jasper	-	46.503	120.336	12	20E	29	AorH	24.4	F	118	D	-	-	-	-	4	P	114	42
YA179		Brooks, Lonnie	1983/07/15	46.486	120.357	12	20E	31	H	27.2	F	354	D	-	-	-	-	946	P	57	40,42
YA180		Estes, M.	-	46.479	120.310	12	20E	34	N	25.9	B	274	D	-	51	48	-	-	-	-	2,3,22,25,26
YA181		Estes, Marvin	1978/03/09	46.479	120.310	12	20E	34	N	33.1	B	430	D	-	49	48	-	-	-	44	2,3,10,22,25,26,42
YA182		DNR Cheyne Rd.	1979/10/19	46.479	120.263	12	20E	36	P	29.0	L	547	D	46	49	-	51	2082	P	-	2,3,5,10,26,42
YA183		DNR	-	46.526	120.200	12	21E	16	L	25.1	B	235	D	46	-	-	65	-	-	-	2,5
YA184		DNR Martinez	-	46.526	120.200	12	21E	16	L	26.7	S	230	L	48	55	-	-	11544	P	25	26,42

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
YA185		Martinez, D.	-	46.525	120.221	12	21E	17	L	28.3	B	473	D	-	33	-	-	-	-	-	2,3,22,25,26
YA186		S. Martinez Livestock, Inc.	-	46.522	120.221	12	21E	17	P	21.1	F	245	D	-	-	-	-	3936	P	64	42
YA187		Martinez Livestock, Inc., 4	1983/07/14	46.522	120.216	12	21E	17	Q	27.0	-	472	-	-	-	-	-	-	-	5	40
YA188		Martinez, 1	-	46.509	120.234	12	21E	19	SE4	21.7	F	288	D	-	-	-	-	4164	P	64	42
YA189		Martinez, D. T., 1	-	46.518	120.226	12	21E	20	D	24.4	B	315	D	-	39	-	-	-	-	-	2,3,6
YA190		Griswald, P.	-	46.508	120.221	12	21E	20	P	25.2	B	315	D	-	39	40	-	-	-	-	2,6,22,25,26,33
YA191		Martinez, Simon	-	46.511	120.180	12	21E	22	L	21.1	F	202	D	-	-	-	-	8172	P	26	42
YA192		Ekerich, W. M.	-	46.497	120.220	12	21E	29	L	22.2	F	259	D	-	-	-	-	2271	P	122	42
YA193		Marley Orchards	-	46.551	120.022	12	22E	02	R	23.1	-	267	L	-	42	-	-	-	-	-	22,25,26
YA194		Changala, Steve	-	46.521	120.011	12	22E	13	P	30.7	B	518	D	37	40	42	53	7059	P	53	2,5,26,42
YA195		Marley Orch. Black Rock Ranch	-	46.518	120.064	12	22E	21	A	31.1	F	747	D	-	-	-	-	-	-	114	42
YA196		Marley Orchards	1983/07/14	46.508	120.079	12	22E	21	N	23.0	-	436	-	-	-	-	-	-	-	-	40
YA197		Marley Orchards	-	46.507	120.064	12	22E	21	R	22.8	B	270	D	-	-	42	-	5488	P	-	2,3
YA198		Changala, S.	-	46.504	120.090	12	22E	29	B	23.0	B	430	D	-	26	-	-	2650	P	-	2,3,22,25,26,33
YA199		DNR Black Rock 1	-	46.525	119.939	12	23E	16	J	25.6	B	351	D	-	58	42	-	7930	P	136	2,3,26,42
YA200		Black Rock	-	46.525	119.944	12	23E	16	K	25.0	B	225	D	51	-	-	-	-	-	-	5
YA201		—	-	46.522	119.971	12	23E	17	P	20.3	S	206	L	-	40	42	-	-	-	-	2,26
YA202		Pyramid Orchards, 1	1983/07/13	46.601	120.763	13	16E	24	H	27.5	-	448	-	-	-	-	-	2271	-	43	40
YA203		Pyramid Orchards, Inc.	-	46.600	120.771	13	16E	24	-	25.6	F	376	D	-	-	-	-	2332	P	24	42
YA204		Barcott, Mark	-	46.624	120.674	13	17E	11	N	26.7	F	123	D	-	-	-	-	102	P	79	42
YA205		Pyramid Orchards	1983/07/13	46.602	120.758	13	17E	19	E	28.0	-	244	-	-	-	-	-	341	-	107	40
YA206		Clark, Christopher	-	46.602	120.705	13	17E	21	G	20.6	F	107	D	-	-	-	-	140	P	70	42
YA207		Lowary, Kim	-	46.602	120.674	13	17E	23	E	24.4	F	73	D	-	-	-	-	102	P	58	42
YA208		Carrell	-	46.634	120.511	13	18E	12	A	24.8	B	201	D	-	61	-	-	-	-	-	2,6,22,25,26
YA209		Nob Hill Water Co., 3	1983/07/13	46.613	120.621	13	18E	18	K	22.5	F	320	D	-	-	-	-	9932	P	84	40,42
YA210		Yakima County Detention Center	-	46.602	120.621	13	18E	19	G	23.3	F	248	D	-	-	-	-	7040	P	12	42
YA211	*	Yakima Creamery well	1994/01/18	46.598	120.516	13	18E	24	K	27.0	F	513	D	-	43	43	-	-	N	A	2,18,26
YA212		Congdon Orchards	1984/11/08	46.587	120.595	13	18E	29	H	32.8	F	617	D	-	-	-	-	946	N	A	10,42
YA213		Wilson, George	-	46.580	120.600	13	18E	29	Q	26.7	F	386	D	-	-	-	-	1274	N	A	13,35
YA214		Hull Orchards, Inc.	-	46.566	120.632	13	18E	31	N	21.1	F	354	D	-	-	-	-	2324	P	56	42
YA215		Nob Hill Water Assoc.	-	46.575	120.597	13	18E	32	NE4	21.1	F	259	D	-	-	-	-	-	N	A	42
YA216		Yakima City, Kissel Park Well	1991/04/24	46.576	120.547	13	18E	35	D	20.6	F	357	D	-	-	-	-	-	N	A	10,42
YA217		Ostrander, Terry L.	-	46.623	120.463	13	19E	09	N	21.1	F	180	D	-	-	-	-	-	-	105	42
YA218		Yakima Sheep Co.	-	46.623	120.427	13	19E	10	R	20.0	F	104	D	-	-	-	-	-	-	29	42
YA219		Yakima County Dump	-	46.611	120.395	13	19E	13	L	24.4	F	-	-	-	-	-	-	2650	P	101	42
YA220		Terrace Heights	-	46.608	120.390	13	19E	13	Q	25.0	B	251	D	-	47	41	-	-	-	-	2,22,25,26
YA221		Watkins 3	-	46.619	120.405	13	19E	14	A	20.3	B	211	D	27	39	41	39	-	-	-	2,5,26
YA222		Hardy, Dorothy	-	46.619	120.457	13	19E	16	C	20.0	F	146	D	-	-	-	-	1628	P	68	42
YA223		Yakima County, well no. 3	1993/12/13	46.609	120.463	13	19E	16	N	43.3	B	738	D	-	42	-	-	568	N	A	43
YA224		Country Club Dist. Water Co.	-	46.608	120.447	13	19E	16	R	23.9	F	456	D	-	-	-	-	4769	P	31	42
YA225		Cascade Lumber Company (1925)	-	46.614	120.497	13	19E	18	-	21.1	F	764	D	-	-	-	-	568	N?	A?	42
YA226	*	Yakima County (heat pump well)	1994/01/18	46.605	120.505	13	19E	19	D	20.0	F	249	D	-	-	-	-	-	-	12	42

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat (°N)	Long (°W)	Twp N	Rng	Sec	Part sec	Temp (°C)	Temp type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	SWL (m)	References
YA227		Yakima Country Club, Inc.	-	46.601	120.437	13	19E	22	F	22.8	F	220	D	-	-	-	-	3596	P	28	42
YA228		Country Club	-	46.594	120.442	13	19E	22	M	20.0	B	82	D	70	91	-	-	-	-	-	2,6,22,25,26
YA229		Rasmussen	-	46.604	120.384	13	19E	24	A	20.0	B	230	D	26	35	41	-	-	-	-	2,22,25,26
YA230		Yakima Sheep Co.	-	46.604	120.389	13	19E	24	B	44.5	B	230	D	-	-	-	-	1514	P	114	2,42
YA231		Sundquist Fruit	-	46.594	120.379	13	20E	19	N	22.1	B	255	D	-	40	41	-	13342	P	80	2,3,22,25,26,42
YA232		Champoux	-	46.601	120.352	13	20E	20	F	23.3	B	215	D	52	52	41	77	-	-	-	2,5,26
YA233		Fay, Gerald	1983/07/13	46.586	120.337	13	20E	28	E	22.5	-	206	-	-	-	-	-	-	-	85	40
YA234		Yergen, R.	-	46.590	120.364	13	20E	30	A	24.2	B	289	D	-	42	41	-	-	-	-	2,3,26
YA235		Clark 4	-	46.568	120.368	13	20E	31	K	22.9	F	293	D	-	-	-	-	335	N	A	35
YA236		Clark 3	-	46.568	120.374	13	20E	31	L	24.2	F	305	D	-	-	-	-	883	N	A	35
YA237		Clark 2	-	46.568	120.373	13	20E	31	L	24.6	F	313	D	-	-	-	-	255	N	A	35
YA238		Coombs	-	46.568	120.331	13	20E	33	L	23.2	B	227	D	39	48	41	-	-	-	-	2,22,25,26
YA239		Coombs, B., 2	-	46.568	120.337	13	20E	33	M	30.2	B	446	D	-	41	41	-	-	-	-	2,3,26
YA240		Larson Fruit	-	46.565	120.336	13	20E	33	N	27.8	F	496	D	-	-	-	-	-	-	45	42
YA241		Smith, Darrell, W.	-	46.564	120.300	13	20E	34	R	21.1	F	184	D	-	-	-	-	341	P	92	42
YA242		Martinez	-	46.572	120.173	13	21E	34	H	21.2	B	290	D	33	40	-	52	-	-	-	5,26
YA243		Martinez, D. T., 2	-	46.572	120.173	13	21E	34	H	23.8	B	313	D	-	41	-	-	-	-	-	2,3,6,22,25,26
YA244		Changala, S., 2	-	46.619	120.009	13	22E	13	B	30.7	B	517	D	-	-	-	-	-	-	-	2
YA245		DNR 81 Tieton	-	46.674	121.029	14	14E	25	E	24.2	B	153	D	93	92	-	87	-	-	-	5,26
YA246		Rowe Farms, Inc.	-	46.697	120.642	14	17E	13	Q	20.6	F	207	D	-	-	-	-	-	-	78	42
YA247		Muzzall, Steve	-	46.689	120.648	14	17E	24	F	23.3	F	75	D	-	-	-	-	57	P	64	42
YA248		Fisher, Harland	-	46.696	120.537	14	18E	14	Q	20.0	F	111	D	-	-	-	-	76	P	36	42
YA249		French, Bruce	1983/07/12	46.700	120.564	14	18E	15	L	20.5	-	235	-	-	-	-	-	95	-	126	40
YA250		Bauman, Ed.	-	46.696	120.564	14	18E	15	P	21.1	F	75	D	-	-	-	-	163	P	19	42
YA251		Zirkle, W. H.	-	46.689	120.601	14	18E	20	G	29.5	B	325	D	-	52	-	-	-	-	-	2,3,22,25,26,37
YA252		Strawn Nursing	1982/06/09	46.660	120.611	14	18E	32	E	20.5	-	24	-	-	-	-	-	341	-	7	40
YA253		Eberle, Robert	-	46.653	120.605	14	18E	32	Q	22.2	F	17	D	-	-	-	-	114	P	1	42
YA254		WA State Hwy. 539	1982/08/17	46.714	120.415	14	19E	11	L	20.0	-	190	-	-	-	-	-	144	-	116	40
YA255		Roche Fruit Company	-	46.695	120.462	14	19E	16	N	23.2	B	268	D	-	46	-	-	-	-	-	2,3,22,25,26
YA256		Roche Fruit Co.	-	46.695	120.478	14	19E	17	P	27.8	F	460	D	-	-	-	-	4164	N	A	42
YA257		—	-	46.688	120.468	14	19E	20	H	21.7	F	123	D	-	-	-	-	2506	P	-	42
YA258	*	US Army, Yakima Firing Cen., 1	1955/10/05	46.677	120.452	14	19E	28	B	21.0	B	183	D	-	54	-	-	-	-	4	2,22,25,26,40,41
YA259		—	-	46.755	120.637	15	17E	25	R	29.2	B	598	-	-	29	-	-	-	-	-	34
YA260		DNR Wenas	-	46.751	120.638	15	17E	36	A	30.1	B	598	D	34	33	30	-	-	-	-	2,26

[1] On January 18, 1994, well KS012 was reported to flow at 7–13°C. by Phil Hamilton, Central Washington University Facilities Manager (oral commun.).

Appendix B. Chemical Data for Thermal Wells and Springs

EXPLANATION OF COLUMN HEADINGS AND ENTRIES:

See the notes in Appendix A for explanations of I.D. and Partial section.

Lower-case letters at the ends of I.D. numbers signify different analyses for the same well or spring system.

Date is the date when the water sample was collected for chemical analysis.

Chemical species: nd, not detected; na, not analyzed.

Conduct. is conductivity.

TDS: Total dissolved solids, measured by evaporating a sample to dryness.

Charge balance: An indication of the quality and (or) completeness of a chemical analysis. Analyses with charge balances more than 10 per cent greater than or less than 1.00 have been excluded from this table. Charge balances were calculated using a worksheet from Kindle (1991, p. 113) with a corrected conversion factor for HCO_3 supplied by Mike Adams, University of Utah Research Institute (oral commun., August 10, 1993). Aqueous solutions are electrically neutral, so chemical analyses that are reasonably complete and of good quality should reflect that neutrality by yielding charge balances near 1.00. Charge balance is the ratio of the sums of the negative (anion) and positive (cation) ionic charges, quantified as milli-equivalents per liter, detected in the fluid (Kindle, 1991, p. 109):

$$\text{Charge balance} = \frac{\text{Sum of anion concentrations (meq/l)}}{\text{Sum of cation concentrations (meq/l)}}$$

The conversion factors to convert concentrations in milligrams per liter to milli-equivalents per liter are listed below. For dilute solutions (below about 7,000 mg/l) milligrams per liter and parts per million are approximately equal and may be used interchangeably (Hem, 1985, p. 55).

Anion	Factor	Cation	Factor
HCO_3	0.0167	Ca	0.0499
CO_3	0.0333	Fe	0.0358
SO_4	0.0208	K	0.0256
F	0.0526	Li	0.144
NO_3	0.0161	Mg	0.0823
Cl	0.0282	Na	0.0435

Mass balance is also an indication of quality and (or) completeness of an analysis. Mass balance is the ratio of total dissolved solids, determined by evaporating a water sample to dryness, to the sum of individually analyzed chemical species (Kindle, 1991, p. 109):

$$\text{Mass balance} = \frac{\text{Total dissolved solids (mg/l)}}{\text{Sum of individually analyzed species (mg/l)}}$$

Mass balances were calculated using a worksheet from Kindle (1991, p. 113). A correction factor of 0.4917 was applied to the concentration of HCO_3 because it is partly volatile (Mike Adams, University of Utah Research Institute, oral commun., August 10, 1993). Mass balances should, ideally, approach values of 1.00 for high-quality, complete analyses. When they are significantly greater than 1.00 it may be because SiO_2 (which is non-ionic in solution and does not affect the charge balance calculation) is not reported. When SiO_2 is reported, departures from 1.00 must be caused by failure to report some significant chemical species and (or) analytical inaccuracy. If the charge balance is within 10 per cent of 1.00 and SiO_2 is reported, then departures from 1.00 of the mass balance must be caused by offsetting anion and cation analytical errors, incomplete analyses, or inaccurate SiO_2 or TDS measurements. When no TDS is reported, the mass balance is listed as zero in the table. Mass balance was not used as a criterion for excluding analyses from this table.

References: Numbers correspond to the numbered references in the References Cited section.

Samples dated 1994 were collected for this study and analyzed by the University of Utah Research Institute, Earth Science Laboratory.

I.D.	Site name	Date	Twp N	Rge	Sec	Part sec	pH	Conduct. µmhos/cm	TDS (ppm)	Na	K	Ca	Mg	Fe	Al	SiO_2	B	Li	HCO_3	SO_4	Cl	F	H_2S	CO_3	NO_3	Charge balance	Mass balance	References
										Chemical species (ppm)																		
	ADAMS COUNTY																											
AD001	CMSP&P RR	1960/10/18	15	28E	08	E	7.9	416	292	34	10	30	14.0	0.6	-	65	-	-	196	41.0	10.0	0.6	-	0	0.7	1.01	0.97	41
AD002	US Bureau of Reclamation	1971/10/06	15	28E	15	D	7.7	-	316	54	29	10	4.7	-	-	68	0.07	0.34	180	49.0	13.0	0.8	-	-	-	1.10	1.00	40
AD005	Othello City 2	1955/08/02	15	29E	03	C	8.4	-	279	77	13	4	1.8	-	-	54	0.05	-	170	23.0	16.0	-	-	-	-	0.93	1.02	40
AD006	Othello City 4	1970/10/27	15	29E	03	J	8.2	-	288	70	13	8	4.8	-	-	56	0.06	0.02	180	30.0	14.0	1.8	-	-	-	0.99	1.01	40
AD008	Othello City 6	1994/04/07	15	29E	04	A	8.9	455	350	90	9	6	3.8	-	-	86	-	-	161	32.0	20.0	4.2	-	17	-	0.99	1.01	—
AD009	Othello City 1	1942/04/27	15	29E	04	A	-	397	287	78	12	4	3.5	0.0	-	52	-	-	183	28.0	15.0	2.6	-	0	0.1	1.01	1.01	41
AD023	Phillips, Robert, 4	1983/05/20	15	32E	07	J	8.3	348	-	57	7	9	4.9	0.0	-	66	-	-	172	18.0	9.8	1.8	-	0	0.2	1.03	0.00	16
AD036	Othello City 3	1961/05/04	16	29E	34	R	8.6	393	294	81	12	3	0.8	0.0	-	62	-	-	170	27.0	14.0	2.8	-	6	0.0	1.02	1.01	41

Appendix B. Chemical data for thermal wells and springs *(continued)*

I.D.	Site name	Date	Twp N	Rge	Sec	Part sec	pH	Conduct. µmhos/cm	TDS (ppm)	Chemical species (ppm) Na	K	Ca	Mg	Fe	Al	SiO_2	B	Li	HCO_3	SO_4	Cl	F	H_2S	CO_3	NO_3	Charge balance	Mass balance	References
AD089	Jungblom Ranch	1983/05/19	18	31E	33	D	9.3	400	-	89	7	2	0.1	0.1	-	110	-	-	172	12.0	13.0	4.1	-	22	0.1	1.07	0.00	16
AD100	Warden Hutterian Brethern, 7	1983/05/25	19	33E	07	R	8.8	310	-	62	8	4	1.7	0.0	-	66	-	-	172	7.8	6.8	2.6	-	5	0.1	1.08	0.00	16
	ASOTIN COUNTY																											
AS001a	Wash. Water Power Co., 2	1959/10/28	10	46E	05	Q	8.4	-	202	42	10	7	0.2	-	-	65	-	-	110	8.9	7.8	1.1	-	-	-	0.95	1.03	40
AS001b	Wash. Water Power Co., 2	1959/10/28	10	46E	05	Q	8.4	248	199	42	10	7	0.2	0.0	-	65	-	-	113	8.9	7.8	1.1	-	5	0.1	1.04	0.98	41
AS008a	Wash. Water Power Co., 5	1962/10/30	11	46E	30	Q	8.2	-	241	49	11	11	1.0	-	-	66	-	-	130	25.0	12.0	0.9	-	-	-	1.01	1.00	40
AS008b	Wash. Water Power Co., 5	1962/10/30	11	46E	30	Q	8.3	303	-	49	11	11	1.0	0.0	0.20	66	-	-	128	25.0	12.0	0.9	-	2	0.0	1.02	0.00	31
	BENTON COUNTY																											
BE001	S P & S Ry	1966/07/18	04	24E	03	B	8.0	460	306	92	7	9	0.7	1.0	-	48	-	-	225	0.0	34.0	1.6	-	0	0.1	1.02	1.01	31
BE005	US Army Corps of Engineers	1971/09/24	05	28E	06	R	8.2	-	355	98	18	7	1.9	0.0	0.00	60	0.10	0.27	210	35.0	32.0	1.7	-	-	-	0.99	0.99	40
BE015a	WDOE Tst./Obs., Piezometer C	1972/08/03	07	25E	36	N	8.2	-	317	88	14	8	1.4	-	0.01	61	-	-	220	18.0	17.0	1.1	-	-	-	0.98	1.00	40
BE015b	WDOE Tst./Obs., Piezometer C	1972/08/04	07	25E	36	N	8.2	-	321	92	14	5	1.4	-	0.01	61	-	-	230	18.0	18.0	1.2	-	-	-	1.02	0.99	40
BE015c	WDOE Tst./Obs., Piezometer C	1972/10/05	07	25E	36	N	8.2	-	298	81	14	6	1.7	-	0.01	52	-	-	210	24.0	16.0	1.1	-	-	-	1.05	1.00	40
BE022	Prosser City 5	1994/01/19	08	24E	01	K	6.8	505	332	107	13	2	nd	nd	nd	73	0.25	nd	264	nd	13.0	2.3	na	16	na	1.07	0.93	—
BE031	Mott, Studer	1970/11/17	08	29E	22	A	7.3	-	922	58	17	100	72.0	-	-	53	0.03	0.03	180	510.0	16.0	0.4	-	-	-	1.01	1.01	40
BE039	WSU, IAREC, well 2	1994/01/19	09	25E	19	B	6.2	315	222	29	9	21	6.9	nd	nd	43	0.05	nd	162	18.0	7.2	0.6	na	nd	na	1.06	1.03	—
BE044	Christen	1970/10/12	09	26E	27	K	7.8	-	286	32	9	30	12.0	-	-	59	0.16	0.02	160	54.0	12.0	0.4	-	-	-	1.01	1.00	40
BE068	US Government	1970/11/19	11	26E	34	R	8.8	-	394	120	15	1	0.0	-	-	75	0.49	0.02	150	0.0	81.0	8.5	-	-	-	0.93	1.05	40
BE074	Roberts Bros.	1970/09/11	12	24E	20	N	8.0	-	202	21	8	18	11.0	-	-	56	0.02	0.02	170	0.2	3.8	0.6	-	-	-	1.02	1.00	40
BE076	US Government	1977/04/27	12	26E	04	N	7.7	-	262	17	5	43	15.0	0.0	0.10	50	0.02	0.01	170	39.0	8.3	0.4	-	-	-	0.92	1.00	40
BE078	US Government	1976/04/08	12	26E	07	Q	7.7	-	307	28	7	51	16.0	0.0	0.01	39	0.02	0.01	240	30.0	16.0	0.4	-	-	-	0.97	1.01	40
BE079	US Government	1979/04/19	12	26E	08	P	7.9	-	254	23	6	40	11.0	-	-	43	-	-	180	28.0	14.0	0.4	-	-	-	0.99	1.00	40
BE080	AEC	1979/04/17	12	26E	09	L	7.8	-	255	21	6	40	13.0	-	-	47	-	-	180	32.0	7.7	0.4	-	-	-	0.95	1.00	40
BE081	US Government	1976/04/08	12	26E	12	H	8.0	-	270	41	8	25	7.9	0.0	0.01	48	0.03	0.02	180	45.0	3.6	0.6	-	-	-	1.04	1.01	40
BE083	US Government	1979/04/17	12	26E	13	H	7.9	-	272	31	6	35	12.0	-	-	43	-	-	140	59.0	16.0	0.6	-	-	-	0.95	1.00	40
BE084	US Government	1978/04/20	12	26E	14	D	7.8	-	286	21	6	50	15.0	-	-	40	-	-	200	47.0	8.2	0.5	-	-	-	0.95	1.00	40
BE085a	US Government	1976/04/09	12	26E	15	C	7.8	-	276	25	6	41	12.0	0.0	0.01	40	0.02	0.01	210	41.0	7.3	0.4	-	-	-	1.07	1.00	40
BE085b	US Government	1977/04/28	12	26E	15	C	7.7	-	280	24	6	46	14.0	0.0	0.10	44	0.02	0.01	210	34.0	7.7	0.5	-	-	-	0.96	1.00	40
BE085c	US Government	1978/04/20	12	26E	15	C	7.8	-	278	24	6	47	14.0	-	-	42	-	-	210	33.0	7.8	0.5	-	-	-	0.95	1.00	40
BE085d	US Government	1979/04/20	12	26E	15	C	7.8	-	278	25	6	41	12.0	-	-	46	-	-	220	32.0	7.6	0.5	-	-	-	1.07	1.00	40
BE086	US Government	1979/04/20	12	26E	15	J	8.0	-	259	21	5	38	12.0	-	-	45	-	-	200	33.0	6.3	0.4	-	-	-	1.08	1.00	40
BE087	US Government	1976/04/08	12	26E	18	E	7.8	-	203	16	4	28	12.0	0.1	0.01	30	0.02	0.01	140	27.0	16.0	0.4	-	-	-	1.05	1.00	40
BE088	US Government	1979/04/19	12	26E	18	G	7.8	-	220	19	4	32	9.8	-	-	45	-	-	150	24.0	12.0	0.5	-	-	-	1.01	1.00	40
BE093	AEC	1979/04/16	12	27E	18	C	7.9	-	256	31	7	32	11.0	-	-	45	-	-	140	50.0	11.0	0.6	-	-	-	0.92	1.00	40
BE096a	US Government	1951/11/30	13	24E	25	E	7.8	-	233	27	9	19	12.0	-	-	65	-	-	190	1.8	5.8	0.5	-	-	-	1.02	1.00	40
BE096b	US Government	1951/11/30	13	24E	25	E	7.8	291	215	27	9	19	12.0	0.0	-	65	-	-	189	1.8	5.8	0.5	-	0	0.1	1.02	0.92	41

Appendix B. Chemical data for thermal wells and springs *(continued)*

										Chemical species (ppm)																		
I.D.	Site name	Date	Twp N	Rge	Sec	Part sec	pH	Conduct. µmhos/cm	TDS (ppm)	Na	K	Ca	Mg	Fe	Al	SiO_2	B	Li	HCO_3	SO_4	Cl	F	H_2S	CO_3	NO_3	Charge balance	Mass balance	References
BE096c	US Government	1970/08/27	13	24E	25	E	8.0	-	212	26	7	18	11.0	-	-	56	0.09	0.02	180	0.2	4.4	0.7	-	-	-	1.01	1.00	40
BE098	US Govt./Meeker	1951/12/01	13	24E	26	G	7.8	292	218	27	7	20	12.0	0.1	-	60	-	-	193	1.5	5.5	0.5	-	0	0.0	1.03	0.96	41
BE099	—	1951/12/01	13	24E	26	G	7.8	-	228	27	7	20	12.0	-	-	60	-	-	190	1.5	5.5	0.5	-	-	-	1.02	1.01	40
BE100a	US Government	1951/11/29	13	24E	36	D	7.7	277	213	29	7	18	11.0	0.0	-	64	-	-	184	1.8	5.4	0.6	-	0	0.1	1.02	0.94	41
BE100b	US Government	1951/11/29	13	24E	36	D	7.7	-	227	29	7	18	11.0	-	-	64	-	-	180	1.8	5.4	0.6	-	-	-	1.00	1.01	40
BE101	US Government	1953/09/21	13	25E	01	N	7.6	296	216	22	11	19	11.0	0.1	-	39	-	-	143	23.0	8.0	0.4	-	0	0.0	1.01	1.06	31
BE102	US Government	1979/04/18	13	25E	03	Q	7.5	-	196	9	5	33	7.5	-	-	37	-	-	120	42.0	3.9	0.2	-	-	-	1.08	1.00	40
BE103	Hanford, 199-B4-4	1977/04/27	13	25E	11	H	7.6	-	218	10	5	43	5.9	0.0	0.10	46	0.02	0.01	120	42.0	6.6	0.2	-	-	-	0.96	1.00	40
BE106a	US Govt./McGee, Chester	1951/12/01	13	25E	30	G	7.8	-	224	30	10	17	9.4	-	-	62	0.05	-	180	1.6	4.8	0.6	-	-	-	1.01	1.00	40
BE106b	US Govt./McGee, Chester	1953/09/02	13	25E	30	G	7.7	289	216	30	6	18	10.0	0.1	-	64	-	-	180	2.1	5.2	0.7	-	0	0.2	1.01	0.96	41
BE106c	US Govt./McGee, Chester	1953/09/02	13	25E	30	G	7.7	-	225	30	6	18	10.0	-	-	64	-	-	180	2.1	5.2	0.7	-	-	-	1.01	1.00	40
BE106d	US Govt./McGee, Chester	1954/10/28	13	25E	30	G	7.4	-	226	30	8	17	9.4	-	-	67	-	-	180	2.1	5.1	0.6	-	-	-	1.03	0.99	40
BE106e	US Govt./McGee, Chester	1956/10/24	13	25E	30	G	8.0	-	220	30	8	17	9.3	-	-	62	-	-	180	0.4	4.8	0.7	-	-	-	1.02	1.00	40
BE106f	US Govt./McGee, Chester	1970/08/27	13	25E	30	G	8.1	-	211	30	9	16	8.9	-	-	56	0.11	0.02	170	0.0	4.4	0.7	-	-	-	0.98	1.01	40
BE106g	US Govt./McGee, Chester	1970/09/08	13	25E	30	G	8.1	-	211	30	8	16	8.8	-	-	57	0.07	0.02	170	0.0	4.5	0.7	-	-	-	0.99	1.01	40
BE106h	US Govt./McGee, Chester	1977/04/27	13	25E	30	G	8.0	-	209	29	8	17	9.2	0.1	0.10	55	0.02	0.02	170	1.4	4.5	0.8	-	-	-	0.99	1.00	40
BE110	US Government	1979/04/17	13	26E	31	R	8.0	-	260	14	4	41	17.0	-	-	43	-	-	120	62.0	20.0	0.4	-	-	-	0.93	1.00	40
BE113a	US Government	1969/05/10	13	26E	35	H	8.5	-	256	79	8	2	0.3	-	-	53	0.06	-	210	0.4	3.9	1.0	-	-	-	0.97	1.02	40
BE113b	US Government	1969/07/14	13	26E	35	H	8.9	-	401	130	3	0	0.0	-	-	67	0.38	-	160	21.0	68.0	11.0	-	-	-	0.98	1.06	40
BE118	US Government	1979/04/18	14	26E	23	D	7.7	-	220	12	4	39	8.4	-	-	40	-	-	110	46.0	16.0	0.2	-	-	-	1.00	1.00	40
BE120	Hanford 199-K-19	1979/04/18	14	26E	32	L	8.1	-	145	3	2	34	4.3	-	-	14	-	-	87	42.0	2.6	0.2	-	-	-	1.07	1.00	40
BE123	US Government	1979/04/17	14	27E	33	G	7.8	-	147	4	3	34	4.5	-	-	26	-	-	120	14.0	2.6	0.1	-	-	-	1.02	1.00	40
	CLALLAM COUNTY																											
CL001Sa	Olympic Hot Springs	-	29	08W	27	K	9.5	-	244	72	1	1	-	-	-	66	0.80	-	175	5.0	11.0	1.2	14.0	-	-	1.06	0.95	32
CL001Sb	Olympic Hot Springs	-	29	08W	27	K	9.5	-	-	72	1	1	LD	-	-	66	0.82	0.04	175	5.0	11.0	1.2	-	-	-	1.06	0.00	19
CL002Sa	*Sol Duc Hot Springs (1)*	-	29	09W	32	C	7.9	380	-	75	2	1	0.0	-	-	80	1.30	0.10	137	34.0	20.0	1.0	-	-	-	1.06	0.00	21
CL002Sb	Sol Duc Hot Springs (2)	-	29	09W	32	C	8.4	360	-	74	3	1	0.0	-	-	-	1.30	0.10	129	35.0	18.0	1.0	-	-	-	1.03	0.00	21
CL002Sc	Sol Duc Hot Springs	-	29	09W	32	C	9.5	-	-	80	1	1	-	0.0	-	60	1.40	0.05	181	7.0	21.0	1.7	-	-	-	1.08	0.00	19
CL002Sd	Sol Duc Hot Springs	-	29	09W	32	C	9.5	-	262	80	1	1	-	-	-	60	1.40	-	181	7.0	21.0	1.7	10.0	-	-	1.09	0.96	32
	COLUMBIA COUNTY																											
CO003a	Ferrel, Robert	1954/08/02	13	38E	26	E	7.5	-	260	9	3	23	9.6	0.1	0.02	-	0.03	-	122	11.0	10.6	-	-	-	-	1.07	2.07	31
CO003b	Ferrel, Robert	1961/01/27	13	38E	26	E	7.6	-	189	9	6	24	8.8	-	-	67	-	-	140	2.8	2.0	0.5	-	-	-	1.00	1.00	40
CO003c	Ferrel, Robert	1961/01/27	13	38E	26	E	7.6	227	194	9	6	24	8.8	0.0	-	67	-	-	140	2.8	2.0	0.5	-	-	-	1.00	1.03	31,41
	FRANKLIN COUNTY																											
FR002	Pasco Navy Base/ Port of Pasco	1970/08/28	09	30E	18	J	8.6	-	346	120	11	2	0.5	-	-	54	0.10	0.02	280	0.0	15.0	1.8	-	-	-	0.92	1.01	40
FR010	West 15 Domestic Water, Inc.	1994/01/20	11	29E	05	R	6.5	510	320	95	12	2	nd	0.1	nd	47	0.24	nd	154	19.0	46.0	4.8	na	6	na	1.04	1.04	—
FR026	US Bureau of Reclamation	1953/01/01	12	29E	28	F	8.0	-	173	46	6	9	4.6	-	-	-	-	-	120	35.0	11.0	1.0	-	-	-	1.03	1.00	40
FR031	US Bureau of Reclamation	1970/11/10	13	28E	13	N	8.6	-	288	78	17	1	0.4	-	-	67	0.12	0.02	180	19.0	14.0	2.2	-	-	-	1.00	1.00	40

Appendix B. Chemical data for thermal wells and springs *(continued)*

										Chemical species (ppm)																		
I.D.	Site name	Date	Twp N	Rge	Sec	Part sec	pH	Conduct. µmhos/cm	TDS (ppm)	Na	K	Ca	Mg	Fe	Al	SiO_2	B	Li	HCO_3	SO_4	Cl	F	H_2S	CO_3	NO_3	Charge balance	Mass balance	References
FR043a	US Govt./Othello AFB	1955/09/29	14	29E	09	A	8.1	-	264	44	8	20	9.9	-	-	55	-	-	190	24.0	11.0	0.9	-	-	-	1.03	0.99	40
FR043b	US Govt./Othello AFB	1956/09/13	14	29E	09	A	8.1	-	269	44	8	20	10.0	-	-	56	-	-	190	25.0	13.0	1.0	-	-	-	1.05	1.00	40
FR043c	US Govt./Othello AFB	1960/10/19	14	29E	09	A	8.0	-	270	43	8	21	11.0	-	-	56	-	-	180	29.0	10.0	1.0	-	-	-	0.98	1.01	40
FR043d	US Govt./Othello AFB	1960/10/19	14	29E	09	A	8.0	411	282	43	8	21	11.0	0.0	-	56	-	-	185	29.0	10.0	1.0	-	-	-	1.00	1.04	41
FR043e	US Govt./Othello AFB	1962/10/09	14	29E	09	A	7.9	-	269	45	8	20	10.0	-	-	57	-	-	190	24.0	11.0	1.0	-	-	-	1.02	1.00	40
FR043f	US Govt./Othello AFB	1964/04/29	14	29E	09	A	7.8	-	280	44	8	22	11.0	-	-	57	-	-	180	33.0	14.0	1.0	-	-	-	1.00	1.00	40
FR043g	US Govt./Othello AFB	1965/01/26	14	29E	09	A	7.9	-	275	43	8	21	12.0	-	-	55	-	-	190	31.0	13.0	1.0	-	-	-	1.03	0.99	40
FR043h	US Govt./Othello AFB	1967/02/13	14	29E	09	A	8.1	-	243	44	8	20	11.0	-	-	28	-	-	180	28.0	14.0	1.0	-	-	-	1.01	1.00	40
FR052	Connell City 4	1970/09/24	14	31E	36	J	8.8	-	273	72	9	3	0.3	-	-	70	0.07	0.02	140	27.0	11.0	1.7	-	-	-	0.93	1.04	40
	GARFIELD COUNTY																											
GA002a	Pomeroy City 4	1959/10/28	12	42E	31	L	8.0	-	157	10	6	16	2.3	-	-	74	-	-	90	3.1	1.8	0.4	-	-	-	1.05	1.00	40
GA002b	Pomeroy City 4	1959/10/28	12	42E	31	L	8.0	162	154	10	6	16	2.3	0.0	-	74	-	-	90	3.1	1.8	0.4	-	-	-	1.05	0.98	31,41
	GRANT COUNTY																											
GR007a	US Army/AEC Hanford 90	1952/08/07	14	25E	01	D	7.9	-	270	47	19	12	4.5	-	-	75	-	-	160	25.0	9.7	0.4	-	-	-	1.00	1.00	40
GR007b	US Army/AEC Hanford 90	1952/08/07	14	25E	01	D	7.9	330	265	47	19	12	4.5	0.2	-	75	-	-	157	25.0	9.7	0.4	-	-	-	0.98	0.98	31,41
GR007c	US Army/AEC Hanford 90	1954/10/28	14	25E	01	D	7.7	-	230	20	12	24	9.3	-	-	61	-	-	140	27.0	6.2	0.5	-	-	-	0.99	1.01	40
GR007d	US Army/AEC Hanford 90	1970/09/17	14	25E	01	D	8.1	-	215	17	11	24	8.6	-	-	56	0.03	0.02	140	24.0	5.0	0.4	-	-	-	1.02	1.00	40
GR007e	US Army/AEC Hanford 90	1971/10/08	14	25E	01	D	7.8	-	238	17	17	24	8.5	-	-	64	0.00	0.11	140	31.0	5.4	0.4	-	-	-	1.02	1.01	40
GR011a	US Govt./AEC Hanford 6	1954/10/28	14	25E	21	B	7.6	313	250	21	7	28	11.0	0.1	-	69	-	-	156	25.0	7.4	0.3	-	-	-	0.99	1.02	41
GR011b	US Govt./AEC Hanford 6	1954/10/28	14	25E	21	B	7.6	-	245	21	7	28	11.0	-	-	69	-	-	160	25.0	7.4	0.3	-	-	-	1.01	0.99	40
GR011c	US Govt./AEC Hanford 6	1958/01/07	14	25E	21	B	7.8	-	173	21	6	30	9.6	-	-	-	-	-	150	23.0	7.0	0.3	-	-	-	0.95	1.01	40
GR013a	US Army	1959/10/28	14	27E	24	C	8.0	457	322	80	26	7	0.4	-	-	63	-	-	216	29.0	12.0	1.2	-	-	-	1.02	0.99	31,41
GR013b	US Army	1959/10/28	14	27E	24	C	8.0	-	325	80	26	7	0.4	-	-	63	-	-	220	29.0	12.0	1.2	-	-	-	1.03	0.99	40
GR014	Wahluke School	1994/01/20	15	23E	35	R	5.9	220	142	6	3	23	8.2	0.1	nd	50	nd	nd	105	15.0	4.8	0.3	na	nd	na	1.01	0.87	—
GR019a	AEC Hanford 7	1958/01/07	15	27E	34	L	7.8	330	262	40	18	13	6.0	0.1	-	-	-	-	152	26.0	8.2	0.4	-	-	-	1.00	1.41	31,41
GR019b	AEC Hanford 7	1958/01/07	15	27E	34	L	7.8	-	186	40	18	13	6.0	-	-	-	-	-	150	26.0	8.2	0.4	-	-	-	0.99	1.00	40
GR025a	US Air Force	1959/11/17	16	24E	01	G	7.7	-	384	45	10	38	24.0	-	-	57	-	-	250	68.0	19.0	0.7	-	-	-	1.01	1.00	40
GR025b	US Air Force	1959/12/12	16	24E	01	G	7.9	-	383	45	10	40	24.0	-	-	50	-	-	250	70.0	18.0	0.8	-	-	-	1.00	1.01	40
GR025c	US Air Force	1960/01/24	16	24E	01	G	7.9	-	383	45	10	40	24.0	-	-	51	-	-	250	69.0	19.0	0.6	-	-	-	1.00	1.00	40
GR025d	US Air Force	1963/03/28	16	24E	01	G	7.9	-	397	49	11	40	24.0	-	-	48	-	-	250	82.0	20.0	0.6	-	-	-	1.01	1.00	40
GR023	US Government	1960/01/24	16	24E	01	G	7.9	566	384	45	10	40	24.0	0.3	-	51	-	-	252	69.0	19.0	0.6	-	-	-	1.00	1.00	31,41
GR024a	US Air Force	1959/11/17	16	24E	01	G	7.7	575	380	45	10	38	24.0	0.2	-	57	-	-	250	68.0	19.0	0.7	-	-	-	1.01	0.99	31,41
GR024b	US Air Force	1959/12/12	16	24E	01	G	7.9	581	366	45	10	40	24.0	0.2	-	50	-	-	254	70.0	18.0	0.8	-	-	-	1.01	0.96	31,41
GR032a	US Government	1960/01/24	17	30E	33	K	8.4	317	270	57	10	9	1.9	0.5	-	79	-	-	161	15.0	6.5	1.3	-	-	-	0.98	1.04	31,41
GR032b	US Government	1960/01/24	17	30E	33	K	8.4	-	263	57	10	9	1.9	-	-	79	-	-	160	15.0	6.5	1.3	-	-	-	0.98	1.02	40
GR033a	US Army Corps of Engineers	1959/10/28	17	30E	33	K	8.4	321	264	57	10	8	2.1	0.2	-	78	-	-	162	15.0	7.2	1.2	-	-	-	0.99	1.02	31,41
GR033b	US Army Corps of Engineers	1959/10/28	17	30E	33	K	8.4	-	262	57	10	8	2.1	-	-	78	-	-	160	15.0	7.2	1.2	-	-	-	0.98	1.02	40
GR033c	US Army Corps of Engineers	1962/10/30	17	30E	33	K	8.2	-	263	59	10	9	2.0	0.0	-	76	-	-	170	14.0	8.0	1.2	-	-	-	1.00	1.00	40

Appendix B. Chemical data for thermal wells and springs *(continued)*

										Chemical species (ppm)																		
I.D.	Site name	Date	Twp N	Rge	Sec	Part sec	pH	Conduct. µmhos/cm	TDS (ppm)	Na	K	Ca	Mg	Fe	Al	SiO_2	B	Li	HCO_3	SO_4	Cl	F	H_2S	CO_3	NO_3	Charge balance	Mass balance	References
GR038	WDOE Tst./Obs., Backfilled	1978/02/17	18	25E	15	E	7.0	-	262	50	7	16	6.7	-	-	67	-	-	160	25.0	11.0	1.2	-	-	-	0.97	1.00	40
GR056	Moses Lake City 14	1994/04/07	19	28E	15	A	7.0	370	303	81	10	1	0.9	0.1	-	80	-	0.04	164	6.6	19.0	3.7	-	12	-	1.02	1.03	—
GR058	Moses Lake City 7	1960/05/16	19	28E	23	D	8.4	-	-	56	-	-	-	-	-	-	-	-	160	-	-	-	-	-	-	1.10	0.00	40
GR060	Moses Lake City 10	1994/04/07	19	28E	27	C	7.5	412	317	87	12	3	1.3	-	-	51	-	0.05	180	33.0	20.0	1.2	-	2	-	1.00	1.06	—
GR063	Moses Lake City 4	1994/04/07	19	28E	28	Q	7.0	493	360	92	16	11	5.2	0.0	0.66	56	0.24	0.06	219	41.0	24.0	1.2	-	-	-	0.97	1.01	—
GR081	Quincy City 1	1955/08/03	20	24E	07	R	7.5	-	243	25	4	32	10.0	-	-	50	-	-	150	29.0	17.0	-	-	-	-	0.99	1.01	40
GR082	Wenatchee Apple Land Co.	-	20	24E	09	E	-	-	272	19	4	37	15.0	0.0	-	42	-	-	156	37.0	17.0	0.4	-	-	-	0.97	1.10	39
GR085a	Moses Lake City 21	1951/03/30	20	28E	32	HorJ	8.0	-	238	35	12	17	8.6	-	-	49	-	-	160	25.0	8.9	0.6	-	-	-	1.03	1.01	40
GR085b	Moses Lake City 21	1951/03/30	20	28E	32	HorJ	8.0	315	222	35	12	17	8.6	0.0	-	49	-	-	156	25.0	8.9	0.6	-	-	-	1.01	0.95	41
GR098	Ephrata City	1955/07/22	21	26E	08	M	7.9	-	193	22	3	16	13.0	-	-	46	-	-	150	12.0	7.0	-	-	-	-	1.02	1.00	40
GR100	Ephrata City 5	1955/07/22	21	26E	08	N	7.6	-	168	12	2	19	12.0	-	-	46	-	-	130	6.0	7.0	-	-	-	-	0.99	1.00	40
GR104	Ephrata City 2	1955/07/22	21	26E	16	B	-	-	187	14	5	17	14.0	-	-	50	0.01	-	150	6.0	7.0	-	-	-	-	1.03	1.00	40
GR105	Ephrata City	1955/07/22	21	26E	21	E	8.1	-	191	12	4	17	12.0	-	-	64	0.01	-	130	8.0	7.0	-	-	-	-	1.03	1.02	40
GR109	Schell, Harvey	1982/09/08	21	30E	23	J	8.6	372	-	55	11	16	2.4	0.0	-	68	-	-	130	35.0	20.0	0.9	-	3	0.1	0.98	0.00	7,16
GR111	Soap Lake city	1955/07/22	22	27E	19	N	7.9	-	218	24	5	17	12.0	-	-	58	0.01	-	150	18.0	8.0	-	-	-	-	1.03	1.01	40
	KING COUNTY																											
KI001Sa	Lester Hot Springs (F-1)	-	20	10E	21	M	-	-	-	112	3	8	0.2	-	-	66	-	0.33	-	-	200.0	-	-	-	-	1.04	0.00	21,24
KI001Sb	Lester Hot Springs	-	20	10E	21	M	9.2	-	339	105	2	5	0.0	-	-	61	-	-	61	19.0	115.0	1.6	5.7	-	-	0.97	0.98	32
KI003S	Goldmeyer Hot Springs	-	23	11E	14	B	8.5	-	391	125	3	6	0.0	-	-	56	-	-	61	40.0	130.0	0.9	0.6	-	-	0.95	1.00	32
KI004Sa	Scenic Hot Springs	-	26	13E	28	Q	9.1	-	168	49	1	2	0.0	-	-	44	-	-	75	13.0	22.0	0.7	1.3	-	-	0.97	0.99	32
KI004Sb	Scenic Hot Springs (C-1)	-	26	13E	28	Q	9.3	140	-	32	1	2	-	-	-	37	-	-	44	13.0	14.0	0.6	-	-	-	0.95	0.00	18,24
	KITTITAS COUNTY																											
KS007	USGS/WDOE Umtanum	1978/03/02	16	19E	28	C	8.5	-	157	22	3	14	5.2	-	-	48	-	-	120	1.9	3.3	0.6	-	-	-	1.01	1.00	40
KS011	Ellensburg City Mt. Stuart well	1994/04/07	18	18E	35	E	7.1	185	146	31	2	9	1.3	0.0	-	48	0.07	-	116	1.6	5.0	0.4	-	-	-	1.08	0.93	—
	KLICKITAT COUNTY																											
KT009Sa	Klickitat Mineral Springs	-	04	13E	24	A	5.9	-	-	64	10	120	100.0	-	-	140	-	-	1070	-	4.2	0.3	-	-	-	1.04	0.00	24
KT009Sb	Klickitat Mineral Springs	-	04	13E	24	A	6.1	-	637	34	4	38	38.0	-	-	103	-	-	415	-	4.0	0.8	-	-	-	1.07	1.49	32
KT011a	Gas-Ice Corp. 10	1964/10/21	04	13E	24	H	6.6	1410	964	63	10	120	106.0	11.0	-	121	0.11	-	1060	3.4	3.5	0.4	-	-	-	0.99	1.00	31
KT011b	Gas Ice Corp. 10	1964/10/21	04	13E	24	H	6.6	-	953	63	10	120	110.0	-	-	120	0.11	-	1060	3.4	3.5	0.4	-	-	-	0.99	1.00	40
KT012a	Gas Ice Corp. 2	1964/10/21	04	14E	19	C	6.4	-	319	30	4	27	25.0	-	-	89	0.03	-	280	0.0	3.2	1.1	-	-	-	1.00	1.01	40
KT012b	Gas-Ice Corp. 2	1964/10/21	04	14E	19	C	6.4	429	325	30	4	27	25.0	2.8	-	89	0.03	-	284	-	3.2	1.1	-	-	0.2	0.99	1.01	31
KT026S	Fish Hatchery Warm Spring	-	06	13E	04	H	-	-	-	160	16	110	95.0	2.2	-	-	-	-	1130	2.6	49.0	0.4	-	-	-	0.98	0.00	24
KT027a	Smith, G.	1970/10/21	06	23E	11	N	8.1	-	255	64	15	6	2.4	-	-	56	0.13	0.02	210	0.2	9.1	1.0	-	-	-	1.04	0.99	40
KT027b	Smith, G.	1970/12/11	06	23E	11	N	8.1	-	252	64	15	6	2.7	-	-	52	0.01	0.04	210	0.0	9.2	1.0	-	-	-	1.03	0.99	40
KT029	Smith, George	1962/04/30	06	23E	11	Q	8.1	344	-	55	11	12	4.1	0.0	-	57	-	-	195	2.2	9.8	1.0	-	-	0.6	1.01	0.00	31
KT030	—	1962/04/30	06	23E	11	Q	8.1	-	248	55	11	12	4.1	-	-	57	-	-	200	2.2	9.8	1.0	-	-	-	1.03	0.99	40

Appendix B. Chemical data for thermal wells and springs *(continued)*

I.D.	Site name	Date	Twp N	Rge	Sec	Part sec	pH	Conduct. μmhos/cm	TDS (ppm)	Chemical species (ppm) Na	K	Ca	Mg	Fe	Al	SiO_2	B	Li	HCO_3	SO_4	Cl	F	H_2S	CO_3	NO_3	Charge balance	Mass balance	References
KT031	Andrews/Smith	1970/10/22	06	23E	15	H	7.9	-	254	64	13	7	2.7	-	-	57	0.07	0.02	210	0.2	8.6	1.0	-	-	-	1.03	0.99	40
	LEWIS COUNTY																											
LE010S	Ohanapecosh Hot Springs (USGS)	-	14	10E	04	C	6.8	-	-	920	52	60	4.9	0.0	-	100	12.00	2.90	1060	170.0	880.0	5.2	-	-	-	1.03	0.00	24
	LINCOLN COUNTY																											
LI001	Odessa Oil Test Piezometer A	1972/08/08	21	31E	10	M	8.2	-	356	100	7	8	2.6	-	-	87	-	-	210	19.0	16.0	13.0	-	-	-	0.99	1.00	40
LI015	Sprague City	1982/07/21	21	38E	23	L	8.4	248	-	34	5	15	3.6	0.0	-	63	-	-	145	5.0	3.0	0.9	-	3	0.2	1.04	0.00	7,16
LI024	Wilbur SEC	1982/09/09	25	32E	35	P	8.2	270	-	39	5	12	5.3	0.0	-	57	-	-	151	7.0	4.6	0.8	-	-	0.1	0.99	0.00	7,16
LI025	Davenport City 6	1982/07/21	25	37E	21	L	8.2	288	-	40	5	15	5.8	0.0	-	50	-	-	174	11.0	4.3	0.9	-	-	0.1	1.07	0.00	7,16
	PIERCE COUNTY																											
PI001S	Longmire Springs	-	15	08E	29	R	7.4	-	-	487	41	492	-	-	-	-	-	-	-	-	1657.0	-	-	-	-	1.00	0.00	14
PI003S	Spring	-	19	02E	19	Q	6.8	95	57	5	1	9	2.9	0.0	-	10	-	-	44	5.4	3.0	-	-	-	0.4	1.00	0.98	15
	SKAMANIA COUNTY																											
SK001Sa	Bonneville Hot Springs (A-3)	-	02	07E	16	M	9.9	790	-	134	1	30	-	-	-	50	-	-	-	72.0	187.0	0.6	-	-	-	0.93	0.00	18,24
SK001Sb	Bonneville Hot Springs	-	02	07E	16	M	9.5	-	505	145	1	31	0.0	-	-	46	2.00	-	39	80.0	180.0	0.7	0.5	-	-	0.94	1.00	32
SK002S	Rock Creek Hot Springs (A-1)	-	03	07E	27	B	9.7	400	-	80	0	12	-	-	-	41	-	-	31	40.0	85.0	0.7	-	-	-	0.93	0.00	18,24
SK008Sa	St. Martin Hot Springs	-	03	08E	21	R	7.0	-	-	291	6	104	-	-	-	20	-	-	-	-	636.0	-	-	-	-	1.00	0.00	14
SK008Sb	St. Martin Hot Springs	-	03	08E	21	R	8.5	-	1210	360	6	76	0.3	-	-	48	2.90	-	19	16.0	690.0	0.7	-	-	-	1.03	1.00	32
SK008Sc	St. Martin Hot Springs (A-1)	-	03	08E	21	R	-	2350	-	360	6	73	0.5	-	-	57	-	0.30	-	-	756.0	-	-	-	-	1.09	0.00	21,24
	SNOHOMISH COUNTY																											
SN001Sa	Garland Min. Sprs (Main) (GLA-1)	-	28	11E	25	C	6.9	17000	-	2640	188	318	90.0	1.0	-	107	24.40	8.10	2050	170.0	4250.0	1.3	-	-	-	1.09	0.00	19
SN001Sb	Garland Mineral Springs	-	28	11E	25	C	6.5	-	-	2500	200	390	87.0	5.4	-	105	64.00	9.40	2600	160.0	3600.0	1.6	-	-	-	1.04	0.00	24
SN001Sc	Garland Mineral Springs	-	28	11E	25	C	6.5	-	8380	2500	200	390	87.0	-	-	105	64.00	-	2600	160.0	3600.0	1.6	-	-	-	1.06	1.00	32
SN002S	Kennedy Hot Springs (USGS)	-	30	12E	01	H	6.3	-	2600	670	72	190	48.0	-	-	175	7.50	-	1660	2.0	625.0	1.2	-	-	-	1.02	1.00	32
SN003S	Gamma Hot Spring	-	31	13E	36	D	6.1	-	-	510	80	71	2.8	-	-	141	9.00	2.80	398	30.0	755.0	1.4	-	-	-	1.01	0.00	19
SN004Sa	Sulphur Creek Hot Springs	-	32	13E	19	C	9.4	-	-	100	2	1	-	-	-	76	0.55	0.14	154	21.0	51.0	3.9	-	-	-	1.04	0.00	19
SN004Sb	Sulphur Creek Hot Springs (A-1)	-	32	13E	19	C	7.6	480	-	102	3	2	0.0	-	-	100	0.60	0.10	102	60.0	54.0	3.0	-	-	-	1.01	0.00	21
	SPOKANE COUNTY																											
SP005	US Government	1958/07/22	24	40E	22	L	7.6	-	201	14	3	30	10.0	-	-	45	-	-	150	21.0	3.8	0.3	-	-	-	1.02	1.00	40
SP006	Fairchild AFB, 2	1958/07/22	24	41E	03	N	7.8	-	166	13	2	21	8.6	-	-	47	-	-	130	10.0	1.8	0.4	-	-	-	1.03	0.99	40
SP007	US Government	1958/07/22	25	40E	14	R	7.5	-	171	14	2	20	12.0	-	-	42	-	-	140	8.1	5.2	0.7	-	-	-	1.02	0.99	40

Appendix B. Chemical data for thermal wells and springs *(continued)*

I.D.	Site name	Date	Twp N	Rge	Sec	Part sec	pH	Conduct. µmhos/cm	TDS (ppm)	Na	K	Ca	Mg	Fe	Al	SiO_2	B	Li	HCO_3	SO_4	Cl	F	H_2S	CO_3	NO_3	Charge balance	Mass balance	References
										Chemical species (ppm)																		
SP008	US Government	1958/07/22	25	40E	34	P	7.2	-	192	16	2	32	7.8	-	-	49	-	-	150	5.2	4.5	0.4	-	-	-	0.93	1.01	40
SP009	US Government	1958/07/23	25	41E	01	R	7.2	-	192	11	2	28	13.0	-	-	47	-	-	170	6.4	2.5	0.3	-	-	-	1.02	0.99	40
SP010	US Army, Fort George Wright	1958/07/22	25	42E	11	E	7.5	-	121	2	1	28	7.8	-	-	13	-	-	110	11.0	3.8	0.3	-	-	-	1.01	1.00	40
SP011	Wash. Water Power Co., 1-3	1977/10/03	25	43E	13	A	7.8	-	138	2	2	32	14.0	0.0	-	-	-	-	150	12.0	1.7	0.1	-	-	-	0.97	1.00	40
SP012	US Air Force	1958/07/22	26	42E	20	N	7.8	-	162	4	2	36	12.0	-	-	17	-	-	150	14.0	3.2	0.1	-	-	-	0.96	1.00	40
	WALLA WALLA COUNTY																											
WA020a	Jaussand, Art	1958/08/01	06	35E	10	P	8.2	226	186	32	9	12	1.7	0.0	-	72	-	-	126	3.2	6.5	0.7	-	-	-	1.02	0.94	31,41
WA020b	Jaussand, Art	1958/08/01	06	35E	10	P	8.2	-	199	32	9	12	1.7	-	-	72	-	-	130	3.2	6.5	0.7	-	-	-	1.05	0.99	40
WA027a	WDOE Tst./Obs., Piezometer A	1973/03/07	06	35E	18	A	8.3	-	229	43	10	6	0.6	-	-	89	-	-	140	4.1	5.2	1.2	-	-	-	1.06	1.01	40
WA027b	WDOE Tst./Obs., Piezometer A	1973/07/12	06	35E	18	A	8.7	-	228	40	8	7	1.1	-	-	93	-	-	120	3.6	4.2	1.1	-	-	-	0.95	1.05	40
WA044	Baker & Baker	1946/11/29	06	36E	09	P	-	186	161	8	3	16	9.8	0.1	-	60	-	-	108	5.7	3.8	0.6	-	-	0.4	1.02	1.00	30
WA049	Byerley Farm, Inc.	1971/09/20	07	32E	36	Q	7.9	-	260	48	16	10	2.9	-	-	80	0.78	0.25	160	3.8	20.0	1.3	-	-	-	1.04	0.99	40
WA063	Bonneville Power Admin.	1946/11/21	07	35E	23	M	-	214	177	31	8	11	2.1	0.0	-	55	-	-	125	3.8	3.6	0.6	-	-	0.1	1.01	1.00	30
WA071	Walla Walla College	1954/08/04	07	35E	33	H	7.6	-	-	17	4	15	5.6	0.1	0.07	-	0.14	-	116	3.8	1.6	-	-	-	-	1.00	0.00	31
WA079	College Place	1970/10/23	07	35E	36	F	8.2	-	190	22	5	19	5.1	-	-	62	-	0.02	130	5.6	3.9	0.5	-	-	-	0.98	1.01	40
WA080	College Place City	1959/10/22	07	35E	36	F	8.2	-	194	21	5	20	5.5	-	-	65	-	-	140	5.4	4.2	0.5	-	-	-	1.04	0.99	40
WA082	College Place	1952/04/20	07	35E	36	F	8.1	233	195	22	6	20	5.8	0.0	-	65	-	-	141	5.8	4.2	0.6	-	-	0.1	1.02	0.98	30
WA083	College Place	1959/10/22	07	35E	36	F	8.2	229	200	21	5	20	5.5	0.0	-	65	-	-	136	5.4	4.2	0.5	-	-	-	1.01	1.03	30,41
WA086	Walla Walla Comm. Coll.	1994/01/20	07	36E	14	P	5.7	165	120	6	2	14	7.0	nd	nd	46	0.11	nd	90	3.2	4.2	0.4	na	nd	na	1.07	0.94	—
WA095	Rogers Canning	1970/10/21	07	36E	19	R	8.1	-	177	23	6	13	3.6	-	-	68	-	0.02	120	3.6	2.8	0.8	-	-	-	1.05	0.99	40
WA097	Whitman College	1970/10/22	07	36E	20	H	8.0	-	192	25	6	17	5.5	-	-	61	-	0.02	140	6.6	1.9	0.9	-	-	-	1.01	1.00	40
WA098a	Walla Walla City 5	1960/07/29	07	36E	28	R	8.2	245	193	29	6	16	5.3	0.1	-	62	-	-	148	5.0	3.0	1.0	-	-	-	1.03	0.97	41
WA098b	Walla Walla City 5	1960/07/29	07	36E	28	R	8.2	-	200	29	6	16	5.3	-	-	62	-	-	150	5.0	3.0	1.0	-	-	-	1.04	1.00	40
	WHATCOM COUNTY																											
WH003Sa	Baker Hot Springs (A-1)	-	38	09E	20	M	7.9	820	-	179	12	6	0.2	-	-	125	3.10	0.40	157	95.0	109.0	3.0	-	-	-	0.93	0.00	21,24
WH003Sb	Baker Hot Springs (Main) (BKA-2)	-	38	09E	20	M	8.3	730	-	146	8	5	-	-	-	105	0.91	0.30	106	95.0	111.0	3.0	-	-	-	1.02	0.00	19
WH003Sc	Baker Hot Springs(B-1)	-	38	09E	20	M	8.0	780	-	154	11	6	0.3	-	-	90	2.70	0.30	124	90.0	99.0	3.0	-	-	-	0.94	0.00	21,24
WH003Sd	Baker Hot Springs	-	38	09E	20	M	8.6	-	-	170	10	6	0.2	-	-	103	2.70	0.36	165	87.0	110.0	3.2	-	-	-	0.98	0.00	19
	WHITMAN COUNTY																											
WT006	Pullman City	1955/06/22	14	45E	05	D	7.8	-	226	14	4	20	15.2	0.1	0.06	-	0.56	-	178	3.4	6.7	-	-	-	-	1.10	1.50	31
WT009	Pullman City	1955/06/22	15	45E	32	N	7.5	-	206	18	4	20	15.7	0.0	-	-	0.01	-	184	2.3	6.7	-	-	-	-	1.05	1.32	31
WT010a	Colfax City Clay St. well	1955/08/18	16	43E	11	G	7.7	-	209	21	2	19	13.5	0.1	0.02	-	0.02	-	172	5.4	3.5	-	-	-	-	1.02	1.40	31
WT010b	Colfax City Clay St. well	1958/06/20	16	43E	11	G	7.4	280	204	22	2	25	9.0	0.1	0.03	-	-	-	185	3.8	4.6	-	-	-	-	1.10	1.29	31

Appendix B. Chemical data for thermal wells and springs *(continued)*

I.D.	Site name	Date	Twp N	Rge	Sec	Part sec	pH	Conduct. µmhos/cm	TDS (ppm)	Chemical species (ppm) Na	K	Ca	Mg	Fe	Al	SiO_2	B	Li	HCO_3	SO_4	Cl	F	H_2S	CO_3	NO_3	Charge balance	Mass balance	References
YAKIMA COUNTY																												
YA018	Grandview City, well no. 15	1994/01/19	09	23E	22	L	7.0	415	310	90	10	0	nd	0.0	nd	84	0.27	nd	166	nd	23.0	4.1	na	19	na	1.02	0.99	—
YA022	Showaway, Ida	1974/04/11	10	17E	14	D	-	-	202	19	5	34	16.0	1.5	-	-	-	-	210	4.9	18.0	1.3	-	-	-	1.04	1.00	40
YA031	Decker Ranch (Decker 7)	1974/05/20	10	18E	31	N	-	-	182	31	5	19	14.0	0.1	-	-	-	-	220	1.6	3.3	0.7	-	-	-	1.07	0.99	40
YA037	Toppenish City 7	1974/09/19	10	20E	04	L	-	-	116	24	5	14	4.2	0.1	-	-	-	-	130	0.7	2.6	0.6	-	-	-	1.03	1.01	40
YA040a	Toppenish City 6	1959/10/19	10	20E	09	A	7.8	-	160	19	4	13	2.2	0.1	-	68	-	-	100	0.3	1.0	0.6	-	-	-	0.98	1.02	40
YA040b	Toppenish City 6	1959/10/19	10	20E	09	A	7.8	171	158	19	4	13	2.2	0.1	-	68	-	-	105	0.3	1.0	0.6	-	-	-	1.03	0.99	41
YA040c	Toppenish City 6	1971/02/03	10	20E	09	A	8.0	-	162	20	4	12	3.5	-	-	68	-	0.02	110	0.0	2.0	0.5	-	-	-	1.04	0.99	40
YA044	Phillips, Lena	1974/05/23	10	21E	33	B	-	-	200	25	4	31	13.0	0.3	-	-	-	-	210	17.0	7.7	0.2	-	-	-	1.07	0.99	40
YA045	Sunnyside City 4	1970/10/06	10	22E	25	F	7.6	-	223	16	7	29	9.7	-	-	62	0.02	0.02	160	16.0	4.8	0.5	-	-	-	1.01	1.00	40
YA050	Sunnyside City 7	1994/04/08	10	22E	36	E	6.5	290	220	21	9	24	10.7	0.1	-	69	-	-	183	-	10.0	0.4	-	-	-	1.05	0.94	—
YA051	Sunnyside City 6	1994/04/08	10	23E	30	M	5.9	322	256	15	7	31	14.5	0.1	-	61	-	-	161	30.00	12.0	0.4	-	-	-	1.03	1.02	—
YA057	Gowdy, Albert A	1974/06/14	11	16E	34	K	-	-	201	30	5	23	16.0	2.2	-	-	-	-	210	18.0	2.8	0.5	-	-	-	1.00	1.00	40
YA058	Mount Adams Seed	1974/06/13	11	17E	01	F	-	-	-	24	4	18	5.9	0.1	-	-	-	-	140	1.0	5.0	0.7	-	-	-	1.00	0.00	40
YA060	Stephenson, C and H	1974/05/21	11	17E	03	L	-	-	145	27	4	16	8.8	0.1	-	-	-	-	170	1.4	4.4	0.8	-	-	-	1.08	0.99	40
YA065	Siegner, Monte	1974/10/01	11	18E	09	N	-	-	142	25	4	20	7.4	0.1	-	-	-	-	160	0.8	4.5	0.7	-	-	-	1.02	1.00	40
YA067	Carlson, Sarah	1974/03/06	11	18E	26	L	-	-	160	21	5	24	10.0	0.4	-	-	-	-	130	22.0	11.0	0.2	-	-	-	0.96	1.02	40
YA068	Harrah City	1994/01/19	11	18E	26	M	6.8	325	218	35	7	19	10.9	0.2	nd	95	0.14	nd	199	nd	6.0	1.1	na	nd	na	0.99	0.80	—
YA074	Wapato City, well no. 5	1994/01/19	11	19E	14	M	5.7	190	158	20	4	12	4.2	0.1	nd	79	0.14	nd	112	na	3.6	0.5	na	nd	na	1.04	0.89	—
YA130	Wiley, Robert	1971/09/23	12	17E	16	A	7.8	-	178	24	4	11	3.4	-	-	71	-	0.03	120	0.0	2.2	0.8	-	-	-	1.06	1.01	40
YA133	Hansen Fruit	1974/06/14	12	18E	27	G	-	-	157	22	4	20	14.0	0.1	-	-	-	-	180	1.5	6.3	0.7	-	-	-	1.01	1.00	40
YA134	Hansen Fruit	1974/06/14	12	18E	27	H	-	-	168	35	5	19	6.8	0.1	-	-	-	-	170	4.1	11.0	1.2	-	-	-	1.04	1.01	40
YA137	Mount Adams Seed, 2	1974/05/23	12	18E	32	H	-	-	136	25	4	19	6.4	0.1	-	-	-	-	140	0.8	10.0	0.7	-	-	-	1.00	1.01	40
YA141a	Moxee City, 1	1962/11/02	12	19E	01	Q	8.4	-	180	56	3	5	0.9	-	-	30	0.01	-	160	0.0	4.5	1.7	-	-	-	1.02	1.00	40
YA141b	Moxee City, 1	1994/04/08	12	19E	01	Q	6.5	260	230	57	3	5	1.0	0.1	-	36	-	-	168	-	7.1	1.4	-	-	-	1.07	1.19	—
YA211a	Yakima Creamery well	1994/01/18	13	18E	24	K	6.6	235	126	49	nd	2	nd	0.1	nd	nd	nd	nd	117	nd	5.4	1.3	na	7	na	1.06	1.03	—
YA211a	Yakima Creamery well, rerun	1994/01/18	13	18E	24	K	6.6	235	126	50	1	1	1.0	nd	nd	20	nd	nd	117	nd	5.4	1.3	na	7	na	1.01	0.87	—
YA211b	Yakima Creamery well	1994/04/08	13	18E	24	K	6.6	210	148	50	nd	2	0.7	nd	nd	31	0.19	nd	129	nd	5.7	1.1	na	3	na	1.07	0.94	—
YA211c	Yakima Creamery well	1994/01/18	13	18E	24	K	6.6	210	146	52	nd	2	0.4	nd	nd	18	0.30	nd	124	nd	6.1	1.1	na	4	na	1.03	1.01	—
YA226	Yakima County (heat pump well)	1994/01/18	13	19E	19	D	7.0	155	92	19	3	11	0.3	nd	nd	40	0.35	nd	75	5.4	4.8	0.4	na	3	na	1.08	0.74	—
YA258a	US Army, Yakima Firing Cen., 1	1951/04/20	14	19E	28	B	8.0	-	187	19	6	15	11.0	-	-	56	-	-	150	0.7	4.1	0.5	-	-	-	1.01	1.00	40
YA258b	US Army, Yakima Firing Cen., 1	1951/04/20	14	19E	28	B	8.0	235	179	19	6	15	11.0	0.0	-	56	-	-	151	0.7	4.1	0.5	-	-	-	1.01	0.96	31
YA258c	US Army, Yakima Firing Cen., 1	1953/09/29	14	19E	28	B	7.8	-	187	19	4	16	11.0	-	-	59	-	-	150	0.7	3.8	0.5	-	-	-	1.01	1.00	40
YA258d	US Army, Yakima Firing Cen., 1	1953/09/29	14	19E	28	B	7.8	244	176	19	4	16	11.0	0.2	-	59	-	-	149	0.7	3.8	0.5	-	-	-	1.00	0.94	31,41
YA258e	US Army, Yakima Firing Cen., 1	1955/10/05	14	19E	28	B	8.1	-	175	19	4	16	9.4	-	-	50	-	-	150	0.2	3.5	0.5	-	-	-	1.05	0.99	40

Appendix B. Chemical data for thermal wells and springs *(continued)*

I.D.	Site name	Date	Twp N	Rge	Sec	Part sec	pH	Conduct. µmhos/cm	TDS (ppm)	Chemical species (ppm) Na	K	Ca	Mg	Fe	Al	SiO_2	B	Li	HCO_3	SO_4	Cl	F	H_2S	CO_3	NO_3	Charge balance	Mass balance	References
YA258f	US Army, Yakima Firing Cen., 1	1959/03/30	14	19E	28	B	7.8	-	177	18	4	17	11.0	-	-	51	-	-	150	0.5	3.5	0.6	-	-	-	1.00	0.99	40
YA258g	US Army, Yakima Firing Cen., 1	1960/09/14	14	19E	28	B	7.9	220	174	19	4	15	11.0	0.0	-	52	-	-	147	0.8	4.0	0.6	-	-	0.2	1.02	0.97	31
YA258h	US Army, Yakima Firing Cen., 1	1960/09/14	14	19E	28	B	7.9	-	178	19	4	15	11.0	-	-	52	-	-	150	0.8	4.0	0.6	-	-	-	1.04	0.99	40
YA258i	US Army, Yakima Firing Cen., 1	1967/02/28	14	19E	28	B	8.1	-	183	20	4	16	10.0	-	-	56	-	-	150	0.4	4.0	0.6	-	-	-	1.03	0.99	40

Appendix C. Convectively Heated(?) Wells

This table lists the wells, statewide, that are too warm to have been heated conductively in a range of temperature gradients between 30° and 50°C/km. The formula, T = 15°C + (0.05°C/m)(depth *in meters*), calculates the predicted temperature of each well in the table, assuming that the well was heated conductively in a gradient of 50°C/km and the mean annual surface temperature is 15°C. This calculated temperature is a reasonable maximum temperature for conductively heated wells in the Columbia Basin. Warmer wells may be heated convectively, that is, by the movement of warmer waters into the well from below. Other explanations, such as errors in the data, local heat sources, and artificial recharge, are possible. Other information for these wells is included in Appendices A and B. Wells have the same I.D. in all three appendices.

I.D.	Predicted temp (°C)	Measured temp (°C)	Depth (m)
AD010	18.7	20.0	75
AD011	18.9	20.0	77
AD030	18.4	25.0	69
AD037	26.0	26.1	220
AD039	24.6	26.2	192
AD107	20.1	20.8	102
AS003	19.0	20.0	79
BE003	18.7	20.0	75
BE023	17.9	27.8	59
BE024	21.3	24.0	125
BE027	17.4	22.5	47
BE030	16.4	21.0	28
BE032	18.4	21.1	69
BE033	18.4	21.1	69
BE040	15.9	20.0	18
BE048	19.7	23.3	94
BE055	28.7	29.8	273
BE064	15.8	20.5	15
BE076	20.9	21.4	117
BE078	20.0	20.4	99
BE079	19.9	21.2	98
BE080	20.7	22.0	113
BE083	16.9	20.0	38
BE084	20.9	21.1	117
BE086	19.9	21.0	98
BE088	19.3	21.0	85
BE092	18.3	20.5	65
BE093	17.5	21.5	51
BE102	15.8	21.0	16
BE103	16.6	39.1	32
BE108	62.3	62.8	945
BE110	19.9	20.0	98
BE117	16.2	32.5	24
BE118	16.4	24.0	28
BE119	16.2	20.7	24
BE120	15.8	22.0	16
BE121	15.8	22.5	17
BE123	16.0	20.5	20
CK001	18.9	22.0	77
CK002	19.5	24.1	90
CO003	18.7	20.0	74
CO004	20.8	23.3	116
CO005	20.8	23.9	116
DO003	19.1	20.0	83
FR004	16.8	20.5	37
FR005	23.4	24.6	168
FR008	19.6	23.0	91
FR011	16.0	23.0	20
FR015	20.7	21.1	113
FR020	15.8	22.5	15
FR022	18.6	20.0	72
FR023	20.6	21.1	112
FR024	22.3	23.0	146

I.D.	Predicted temp (°C)	Measured temp (°C)	Depth (m)
FR042	15.3	21.5	6
FR045	24.1	26.7	182
FR053	27.1	27.2	242
FR054	24.4	25.6	187
FR060	29.3	29.5	287
GA003	17.4	20.0	47
GR006	21.3	22.5	125
GR008	18.4	25.6	68
GR010	23.6	27.8	172
GR021	20.4	20.6	108
GR022	17.6	21.5	53
GR031	27.7	27.8	253
GR034	17.7	20.0	54
GR045	16.0	21.0	20
GR070	19.9	20.5	98
GR073	24.5	28.8	191
GR083	18.2	20.0	64
GR092	31.9	34.9	337
GR093	24.1	28.6	181
GR096	19.3	20.0	86
GR100	21.9	28.0	137
GR104	19.0	29.0	79
GR105	24.4	25.5	188
GR111	22.1	27.0	142
GR116	24.5	29.2	189
GR118	18.6	24.4	72
GY001	18.6	20.5	71
KI002	18.6	21.5	72
KS001	24.2	24.3	184
KS005	16.1	20.0	21
KS008	21.9	22.8	137
KS010	18.1	26.0	61
KS012	28.1	28.4	262
KT001	19.4	20.5	88
KT002	20.2	21.4	104
KT007	17.4	21.1	47
KT008	23.4	27.0	168
KT011	19.5	27.2	90
KT012	18.1	23.0	61
KT030	18.2	21.0	63
LI001	26.2	30.5	224
LI005	24.7	28.3	195
LI017	25.6	28.7	212
LI028	22.6	25.8	151
LI029	27.9	31.7	258
OK001	17.2	22.7	44
OK002	15.6	21.1	12
OK005	15.5	20.0	9
OK006	15.5	20.0	9
SK003	24.9	35.5	198
SK004	22.8	26.4	155
SK007	20.7	27.8	113
SK011	32.9	36.3	357

I.D.	Predicted temp (°C)	Measured temp (°C)	Depth (m)
SP005	20.3	20.5	105
SP008	18.0	21.0	60
SP010	15.9	20.0	18
SP011	16.7	21.0	34
SP012	17.4	20.0	49
WA004	30.3	31.8	305
WA006	17.3	20.0	46
WA007	30.3	31.8	305
WA009	23.8	25.1	175
WA013	35.4	40.2	407
WA014	35.4	40.7	407
WA015	40.3	45.0	506
WA016	33.3	40.0	366
WA019	16.1	20.0	21
WA023	24.0	24.4	180
WA026	34.8	36.1	396
WA027	18.8	25.5	75
WA045	21.2	22.8	123
WA046	16.7	20.0	34
WA047	24.7	26.7	195
WA057	30.5	30.6	310
WA059	16.8	26.7	37
WA062	17.4	20.0	49
WA089	17.4	20.0	48
WA093	18.4	21.7	69
WA105	16.9	22.0	38
WA106	22.3	25.4	146
WA107	22.7	25.6	154
WA108	26.9	31.0	237
WA112	18.2	22.2	64
WH004	22.0	47.9	141
WT001	19.0	20.0	79
WT003	24.6	26.5	192
WT004	17.8	20.0	56
WT005	17.5	20.0	50
WT006	17.5	20.0	50
WT007	17.6	21.0	51
WT008	19.7	20.0	95
WT009	18.5	20.0	70
WT012	21.8	22.2	136
WT013	20.9	22.2	117
WT015	17.7	24.4	54
YA009	15.6	21.0	13
YA011	16.8	22.0	35
YA013	19.7	21.0	95
YA014	17.4	20.0	49
YA015	19.3	21.1	85
YA020	17.9	20.0	59
YA021	16.8	22.0	35
YA022	16.2	20.5	23
YA032	15.9	20.0	18
YA033	15.9	20.5	19
YA036	18.2	21.1	64
YA038	15.9	20.0	19
YA039	15.6	27.0	11
YA041	15.8	20.5	16
YA043	18.8	21.1	77
YA044	15.6	21.0	13
YA048	19.6	22.2	91
YA049	21.4	21.5	128
YA051	22.3	24.0	145
YA056	21.9	22.5	137
YA057	22.0	23.5	139
YA062	30.1	31.6	302
YA065	21.1	23.0	122
YA067	15.8	26.4	16
YA073	16.0	23.0	20
YA127	19.3	21.7	87
YA132	21.5	24.5	130
YA143	17.1	23.3	43
YA144	17.6	23.3	52
YA178	20.9	24.4	118
YA184	26.5	26.7	230
YA204	21.2	26.7	123
YA205	27.2	28.0	244
YA206	20.3	20.6	107
YA207	18.7	24.4	73
YA228	19.1	20.0	82
YA230	26.5	44.5	230
YA245	22.7	24.2	153
YA247	18.7	23.3	75
YA250	18.7	21.1	75
YA252	16.2	20.5	24
YA253	15.8	22.2	17
YA257	21.2	21.7	123

WASHINGTON STATE DEPARTMENT OF
Natural Resources

JENNIFER M. BELCHER
Commissioner of Public Lands
KALEEN COTTINGHAM
Supervisor

August 18, 1994

Mr. Howard P. Ross, Project Manager
Earth Science Laboratory
University of Utah Research Institute
391 Chipeta Way, Suite C
Salt Lake City, UT 84108-1295

Dear Howard:

This is to let you know that the enclosed letter and a copy of our geothermal report were mailed on August 12 to each member of Washington State's congressional delegation and to State legislators from Adams, Benton, Franklin, Grant, Walla Walla, and Yakima Counties. Those counties are where most of our thermal wells are located. I also had copies sent to the State Superintendent of Public Instruction and the Director of the Department of Community, Trade and Economic Development.

Please let me know if I can help with any geothermal matters that crop up in the future.

Sincerely,

Eric

J. Eric Schuster,
Assistant State Geologist
Division of Geology and Earth Resources

copy - Paul Lienau, O.I.T.
- Gordon Bloomquist, W.S.E.O.

STATE OF WASHINGTON

August 5, 1994

The Honorable Slade Gorton
Member of Congress
730 Hart Senate Office Building
Washington, D.C. 20510

Dear Senator Gorton:

We enclose, for your information, a copy of a recently completed report on the low-temperature geothermal resources of Washington. The report was prepared jointly by the Department of Natural Resources and the Washington State Energy Office. The work was funded by the U.S. Department of Energy, and similar reports were completed in a number of western states.

The report identifies thermal wells in the state that could serve as heat sources for water-source heat pumps. These heat pumps are capable of heating and cooling buildings very efficiently, thus reducing demand for conventional energy sources, especially electricity. The report describes historic and current uses of geothermal resources in Washington and the legal and institutional setting; illustrates the geologic, heat-flow, and hydrologic setting; and presents databases on the physical and chemical characteristics of 941 wells and 34 springs where water temperature ranges from 20°C (68°F) to 130°C (266°F). More than 83 percent of the thermal wells are located in Adams, Benton, Franklin, Grant, Walla Walla, and Yakima counties.

It's our hope that this report will increase awareness and use of Washington's low-temperature geothermal resources, thus helping to ensure a less expensive and more reliable energy supply for Washington's citizens.

Copies of this report are available through the DNR Division of Geology and Earth Resources at 206-902-1450. The staff of both our departments will also be happy to answer questions or supply you with additional information.

Sincerely,

JENNIFER M. BELCHER
Commissioner of Public Lands

Sincerely,

JUDITH MERCHANT, Director
Washington State Energy Office

JB:rc

Enclosure

WASHINGTON STATE DEPARTMENT OF
Natural Resources

JENNIFER M. BELCHER
Commissioner of Public Lands
KALEEN COTTINGHAM
Supervisor

July 14, 1994

Mr. Howard P. Ross, Project Manager
Earth Science Laboratory
University of Utah Research Institute
391 Chipeta Way, Suite C
Salt Lake City, UT 84108-1295

RE: Quarterly Report, Second Quarter 1994, State of WA-OIT-GHC Standard Contract for Geothermal Energy Research Development and Data Base Compilation.

Dear Howard:

During the second quarter of calendar 1994 the low-temperature inventory project for the State of Washington has been substantially completed.

The final report has been prepared and is now being distributed as Washington Division of Geology and Earth Resources Open File Report 94-11, including copies to UURI and OIT. Please let me know if you need more copies. I earlier sent you color copies of the State and Columbia Basin geothermal maps for use in presentations or for wall decoration. I have drafted a cover letter so we can send copies to Washington's Congressional delegation under signature of the Commissioner of Public Lands and the Director of the Washington State Energy Office. Those copies will be sent as soon as I get the signed cover letter back from the Commissioner and the Director. I also plan to send copies to State Legislators from Adams, Benton, Franklin, Grant, Walla Walla, and Yakima Counties, the counties in the Columbia Basin where most of our warm wells are, and to the Department of Community, Trade and Economic Development and the Superintendent of Public Instruction. The report will, of course, be sent to major libraries as are all of our reports, and it will remain available for purchase by the public over the long term. We will send our final billing in August.

That's about it! Thanks very much for the chance to make a brief foray back into geothermal. It is nice to once again have up-to-date material to distribute to people who inquire about geothermal energy in Washington, and Gordon and I hope the report will be a catalyst to help get the legal and institutional framework improved and encourage people to use geothermal to a greater extent.

It has been a pleasure working with you and your staff. I hope we will have an opportunity to do more geothermal work in the future.

Sincerely,

Eric

J. Eric Schuster,
Assistant State Geologist
Division of Geology and Earth Resources

copy - Dr. Paul Lienau, Director
GeoHeat Center, Oregon Institute of Technology
Klamath Falls, OR 97601
- Dr. Gordon Bloomquist, WSEO

WASHINGTON STATE DEPARTMENT OF
Natural Resources

JENNIFER M. BELCHER
Commissioner of Public Lands

KALEEN COTTINGHAM
Supervisor

October 4, 1993

Mr. Howard P. Ross, Project Manager
Earth Science Laboratory
University of Utah Research Institute
391 Chipeta Way, Suite C
Salt Lake City, UT 84108-1295

RE: Quarterly Report, Third Quarter 1993, State of WA-OIT-GHC Standard Contract for Geothermal Energy Research Development and Data Base Compilation.

Dear Howard:

We have accomplished the following during the third quarter of calendar 1993:

♦ I attended the July 7-10 meeting of principal investigators in Salt Lake City. I gained a lot of insight and practical help from the meeting. In addition, I enjoyed meeting the new geothermal investigators and some of the old ones that I hadn't seen for more than ten years.

♦ I received a significant number of warm well and water chemistry records from the U.S. Geological Survey's WATSTORE database. Much of July and August was spent entering and editing the WATSTORE data and "cleaning up" previous data. The database for Washington now includes 937 wells and 34 springs or spring groups at or above 20 degrees C. and 217 water analyses of good quality (charge balances within 10 percent of unity). These data have been drawn from 44 published and unpublished references.

♦ All wells and springs have been plotted on scale-stable overlays to scale-stable 1:100,000-scale base maps. Plotting precision is generally plus or minus 1/8 mile; that is, wells can generally be plotted to a quarter of a quarter of a section. The map overlays and database (on disk) were delivered to the Washington State Energy Office (WSEO) on September 1 for digitizing and incorporation into their geographic information system (GIS). Digitizing was to have begun on September 27. The two 1:100,000-scale quadrangles WSEO digitized earlier as a trial were to be re-digitized because I added a number of new wells and applied a new numbering scheme that uses a county code and serial number instead of just a serial number.

The three files that constitute the database, with still-incomplete and inconsistent latitude and longitude, are enclosed as hard-copy and on disk (Lotus 1-2-3 files). Accurate

1111 WASHINGTON ST SE ▮ PO BOX 47000 ▮ OLYMPIA, WA 98504-7000

and consistent latitude and longitude will be calculated by the GIS and incorporated into the database.

A billing for the third quarter of 1993 will follow at the end of October or in early November.

I believe the following tasks remain to be done:

- Edit and release the geothermal bibliography as an open-file report.
- Incorporate the data into the WSEO GIS and generate appropriate plots (maps) for the final report.
- Select or help select high priority sites for further study and/or development.
- Write final report and release the report, maps(s), and database as an open-file report. Make the data base and bibliography available on disk.
- Distribute the report and/or a summary of it to potential users, elected officials, and decision makers.
- Collect additional water samples, as needed, for analysis by University of Utah Research Institute.

Please let me know if I have omitted any significant tasks.

Enclosed you will find the following: 1.) a spreadsheet containing descriptive and thermal data for wells and springs (file name GEOTHDB1.WK1), 2.) a spreadsheet containing chemical analyses for wells and springs (file name GEOTHDB3.WK1), 3.) a "spreadsheet" listing sources of data (file name GEOTHDB3.WK1), and 4.) a computer disk containing all of the above as Lotus 1-2-3 files.

Please let me know if I can supply additional information.

Sincerely,

J. Eric Schuster

J Eric Schuster,
Assistant State Geologist
Division of Geology and Earth Resources

copy - Dr. Paul Lienau, Director
GeoHeat Center, Oregon Institute of Technology
Klamath Falls, OR 97601
- Dr. Gordon Bloomquist, WSEO

GEOTHERMAL DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON--DESCRIPTIVE AND THERMAL DATA FOR WELLS AND SPRINGS
File Name = GEOTHDB1.WK1 Last updated September 01, 1993, by J E S.

I.D. (NEW)	*	SITE NAME	DATE	LAT. N.	LONG. W.	TWP N	RNG	SEC	PART SEC.	TEMP deg C	TEMP TYPE	DEPTH m	DEPTH TYPE	GRADIENTS(Deg C/Km) A	B	S	HEAT FLOW mW/sq m	FLOW l/m	FLOW TYPE	S.W.L. m	REFERENCES
AD00																					
AD000		ADAMS COUNTY																			
AD001	*	CMSTP&P RR	1961/05/04	464812	1192039	15	28E	08	E	20.0	B	126	D	-	63	-	-	38	-	73	22,25,26,40,41
AD002	*	US Bureau of Reclamation	1971/10/06	464737	1191807	15	28E	15	D	24.2	B	264	D	-	46	-	-	795	-	114	22,25,26,40
AD003		DH 4		- -	-	15	28E	30	L	75.2	B	1456	D	-	43	31	-	-	-	-	2,22,25,26
AD004		E. Col. Basin Irr. Dist.		- -	-	15	28E	35	P	24.4	B	253	D	-	49	-	-	-	-	-	22,25,26,33
AD005	*	Othello City 2	1955/08/02	464934	1191007	15	29E	03	C	22.8	F	212	D	-	51	-	-	-	-	69	22,25,26,40
AD006	*	Othello City 4	1970/10/27	464905	1190914	15	29E	03	J	20.8	F	276	D	-	32	-	-	3785	-	69	22,25,26,40
AD007		Othello City 5		- -	-	15	29E	03	P	29.4	B	298	D	-	57	65	-	-	-	-	22,25,26,33,37,38,44
AD008		Othello City 6	1983/07/27	464928	1191030	15	29E	04	A	26.5	B	368	D	-	36	-	-	9463	-	60	22,25,26,37,38,40,44
AD009	*	Othello City 1	1942/04/27	464929	1191030	15	29E	04	A	20.0	B	171	D	-	47	-	-	341	P	73	22,25,26,40,41
AD010		Weaver, Howard		- -	-	15	29E	05	-	20.0	F	75	D	-	-	-	-	473	P	-	43
AD011		Taylor, John D.		- -	-	15	29E	18	-	20.0	F	77	D	-	-	-	-	170	P	-	43
AD012		Lyle, Elwyn & Rex		- -	-	15	31E	04	J	24.4	F	330	D	-	-	-	-	7646	P	95	43
AD013		McKay, Ed		- -	-	15	31E	05	L	26.8	B	404	D	-	36	49	-	-	-	-	22,25,26,37,38,44
AD014		Lyle, Elwyn	1983/05/26	464807	1185641	15	31E	08	J	22.5	-	369	-	-	-	-	-	-	-	122	40
AD015		Lyle, Elwyn & Rex	1983/07/29	464746	1185739	15	31E	08	N	25.0	-	314	-	-	-	-	-	-	-	88	40
AD016		Lyle Bros 3		- -	-	15	31E	11	E	20.5	B	214	D	32	34	-	-	-	-	-	6,22,25,26
AD017		DNR Lyle 2		- -	-	15	31E	16	A	21.1	F	412	D	-	-	-	-	7055	P	140	43
AD018		DNR Lyle 1	1983/05/26	464737	1185616	15	31E	16	D	28.5	F	430	D	-	-	-	-	5924	P	134	40,43
AD019		Johnson, Arthur		- -	-	15	31E	19	A	27.6	B	342	D	-	40	49	-	-	-	-	22,25,26,33,37,38,44
AD020		Kummer, Clarence, 4		- -	-	15	31E	32	M	26.0	B	365	D	-	-	48	-	-	-	-	37,44
AD021		Tomkin		- -	-	15	32E	02	A	25.0	B	252	D	-	52	-	-	-	-	-	24
AD022		Damon, Don		- -	-	15	32E	04	B	21.9	B	266	D	-	43	49	-	-	-	-	22,25,26,37,44
AD023	*	Phillips, Robert, 4	1983/08/02	464752	1185008	15	32E	07	J	25.4	F	579	D	-	-	-	-	-	-	181	7,15,40
AD024		Adams, Mrs. M. E		- -	-	15	32E	08	C	22.2	F	182	D	-	-	-	-	378	P	86	43
AD025		Phillips, Robert, 5	1982/08/09	464803	1184953	15	32E	08	E	26.0	-	604	-	-	-	-	-	-	-	191	40
AD026		Stelger		- -	-	15	32E	16	F	20.0	B	180	D	-	44	49	-	-	-	-	22,25,26,44
AD027		DNR Hatton		- -	-	15	32E	16	M	21.1	F	457	D	-	-	-	-	2438	P	124	43
AD028		Hart		- -	-	15	32E	35	E	27.6	B	310	D	-	50	-	-	-	-	-	22,25,26
AD029		Hart, Cyril		- -	-	15	32E	35	G	22.9	B	308	D	-	-	49	-	-	-	-	37,44
AD030		-----		- -	-	15	33E	02	A	25.0	B	69	-	-	189	-	-	-	-	-	22,25
AD031		Tompkins, Robert		- -	-	15	33E	02	A	25.0	B	252	D	-	52	-	-	-	-	-	26,37,44
AD032		Watson		- -	-	15	34E	27	R	20.9	S	177	L	-	50	-	-	-	-	-	22,25,26
AD033		Blauert, Fred. A., 2	1983/08/26	464507	1181755	15	36E	33	A	20.0	-	155	-	-	-	-	-	5678	-	21	40
AD034		Blauert, Fred		- -	-	15	36E	34	F	25.4	B	213	D	-	63	-	-	-	-	-	22,25,26,37,38,44
AD035		Chef Reddy Frozen Foods	1983/08/22	465024	1191024	16	29E	34	D	25.0	-	317	-	-	-	-	-	3861	-	63	40
AD036	*	Othello City 3	1977/05/11	464947	1190926	16	29E	34	R	25.0	B	275	D	-	49	65	-	5072	P	85	22,25,26,37,40,41,43,44
AD037		Kliphardt, G. W.		- -	-	16	30E	24	D	26.1	B	220	D	65	63	65	-	-	-	-	22,25,26,37,44
AD038		Kliphardt, Fredrick	1983/08/30	465108	1190016	16	30E	26	A	30.0	-	323	-	-	-	-	-	-	-	91	40
AD039		Kliphardt		- -	-	16	30E	26	A	26.2	B	192	D	34	72	-	-	-	-	-	6,22,25,26
AD040		Andrews 2		- -	-	16	30E	27	J	25.2	B	207	D	91	64	-	-	-	-	-	6,22,25,26
AD041		DNR Damon 2		- -	-	16	30E	36	K	20.6	B	211	D	-	40	-	-	-	-	-	22,25,26,37,44
AD042		DNR Damon		- -	-	16	30E	36	K	25.8	B	241	D	-	57	65	-	14383	P	54	22,25,26,33,37,43,44
AD043		Damon Ranch	1983/05/24	465225	1185313	16	31E	14	K	26.0	-	408	-	-	-	-	-	-	-	104	40
AD044		Lyle		- -	-	16	31E	15	B	24.1	B	316	D	-	38	-	-	-	-	-	22,25,26
AD045		Lyle, Rex		- -	-	16	31E	15	B	22.6	B	201	D	-	-	32	-	-	-	-	37,44
AD046		Wholman		- 46-52 75	118-55 10	16	31E	15	D	26.2	B	230	D	59	57	32	94	-	-	-	5,26,44
AD047		Lyle, Rex (South)		- -	-	16	31E	15	Q	27.5	B	410	D	-	37	32	-	-	-	-	22,25,26,33,37,38,44
AD048		Brown, Beverly	1982/09/08	464925	1185600	16	31E	33	P	20.0	-	165	-	-	-	-	-	-	-	105	40
AD049		Damon, Don		- -	-	16	31E	35	J	24.4	F	275	D	-	-	-	-	4164	P	118	43
AD050		Phillips, D. E., 12	1983/08/02	465346	1184608	16	32E	11	D	23.0	F	429	D	-	-	-	-	9084	P	122	40,43
AD051		Phillips, D. E., 12		- -	-	16	32E	11	D	28.2	B	321	D	-	51	32	-	-	-	-	22,25,26,33,37,44
AD052		Philips, D. Everett		- -	-	16	32E	13	J	21.7	F	272	D	-	-	-	-	7948	P	98	43
AD053		Philips, D. Everett		- -	-	16	32E	14	A	22.9	F	233	D	-	-	-	-	11355	P	104	43
AD054		Phillips, Beatrice house well		- -	-	16	32E	14	C	21.1	B	155	D	-	56	32	-	-	-	-	22,25,26,33,37,44
AD055		Philips, D. E., 11	1983/05/27	465243	1184611	16	32E	14	D	24.5	-	399	-	-	-	-	-	4921	-	89	40
AD056		Philips, D. E., 11		- 465243	1184611	16	32E	14	D	20.0	B	314	D	-	25	-	-	-	-	-	22,25,26,33,37,44
AD057		Phillips, D. E., 17		- -	-	16	32E	15	D	34.0	B	440	D	-	49	32	-	-	-	-	22,25,26,33,37,38,44
AD058		Phillips, Robert, 3	1983/08/03	465239	1185032	16	32E	18	G	26.0	-	409	-	-	-	-	-	-	-	147	40

GEOTHERMAL DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON--DESCRIPTIVE AND THERMAL DATA FOR WELLS AND SPRINGS
File Name = GEOTHDB1.WK1 Last updated September 01, 1993, by J E S

I.D. (NEW)	*	SITE NAME	DATE	LAT N.	LONG W	TWP N	RNG	SEC.	PART. SEC.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENTS(Deg C/Km) A	B	S	HEAT FLOW mW/sq m	FLOW l/m	FLOW TYPE	S.W.L. m	REFERENCES
AD059		Phillips, R. V.		- -	-	16	32E	20	N	29.2	B	372	D	-	46	32	-	-	-	-	22,25,26,33,37,44
AD060		Phillips, D. E		- -	-	16	32E	21	E	24.4	F	448	D	-	-	-	-	5488	P	176	43
AD061		Phillips, D. E., 10		- -	-	16	32E	21	G	27.4	B	283	D	-	-	32	-	-	-	-	22,25,26,37,44
AD062		Phillips, D. Everett		- -	-	16	32E	24	D	20.6	F	252	D	-	-	-	-	3785	P	100	43
AD063		Phillips, D. Everett		- -	-	16	32E	25	A	22.2	F	248	D	-	-	-	-	13058	P	102	43
AD064		Phillips, D. E., 2		- -	-	16	32E	25	D	29.1	B	432	D	-	40	32	-	-	-	-	22,25,26,37,44
AD065		-----		- -	-	16	32E	25	N	30.4	B	709	D	-	26	32	-	-	-	-	2,22,25
AD066		Phillips, D. E., 16		- -	-	16	32E	25	N	31.4	B	382	D	-	50	32	-	-	-	-	26,37,38,44
AD067		Phillips, D. E., 7		- -	-	16	32E	34	E	43.4	B	772	D	70	41	38	-	-	-	-	2,22,25,26,37,38,44
AD068		Phillips, A		- 46-49.97	118-47.35	16	32E	34	E	24.0	B	370	D	-	-	-	-	-	-	-	5,44
AD069		Phillips, D. E		- -	-	16	32E	35	C	21.1	F	275	D	-	-	-	-	11355	P	119	43
AD070		Phillips, D. E., 9		- -	-	16	32E	35	D	24.2	B	272	D	-	44	32	-	-	-	-	22,25,26,37,44
AD071		Davis, David A	1983/08/02	465251	1184207	16	33E	17	B	20.0	-	183	-	-	-	-	-	95	-	124	40
AD072		Baumann Farms		- -	-	16	35E	31	Q	22.4	B	600	D	-	-	-	-	-	-	-	37,38,44
AD073		Bauman, Richard		- -	-	16	35E	32	N	21.0	B	214	D	-	-	-	-	-	-	-	44
AD074		Phillips, D. E	1983/05/24	465944	1185421	17	31E	03	B	23.5	-	415	-	-	-	-	-	-	-	99	40
AD075		Phillips, D. E., C-12	1983/07/29	465900	1185226	17	31E	12	D	27.8	B	592	D	-	27	27	-	-	-	37	22,25,26,37,38,40,44
AD076		Kulm, Ed		- -	-	17	32E	04	Q	22.8	F	274	D	-	-	-	-	8422	P	159	43
AD077		Kulm, Art		- -	-	17	32E	06	E	20.0	F	280	D	-	-	-	-	10976	P	120	43
AD078		-----		- -	-	17	32E	12	P	21.0	B	227	D	-	40	-	-	-	-	-	6,22,25
AD079		DNR CRB		- 46-57.60	118-47.17	17	32E	14	M	23.2	B	189	D	43	54	-	68	-	-	-	5,26,44
AD080		Lobe, Gary, 2	1983/08/02	465947	1184332	17	33E	06	D	26.5	-	366	-	-	-	-	-	-	-	207	40
AD081		City of Lind		- -	-	17	33E	12	P	21.0	B	226	D	-	40	-	-	-	-	-	26
AD082		Benge		- -	-	17	37E	27	D	21.9	-	168	L	-	59	-	-	-	-	-	22,25,26,38
AD083		Warden Hutterian Brethern	1983/08/03	470356	1185844	18	31E	07	E	21.5	-	357	-	-	-	-	-	-	-	93	40
AD084		Wollmon, Jaeole K		- -	-	18	31E	16	M	20.0	F	155	D	-	-	-	-	9462	P	31	43
AD085		Hutterites		- -	-	18	31E	18	C	21.8	B	240	D	-	37	-	-	-	-	-	6,22,25,26
AD086		Phillips-Lanamn Ranch, Inc	1983/07/29	470001	1185624	18	31E	32	R	21.0	-	384	-	-	-	-	-	10598	-	62	40
AD087		Phillips, D. E., C-33		- -	-	18	31E	33	D	30.2	B	728	D	-	25	27	-	-	-	-	26,37,38,44
AD088		-----		- -	-	18	31E	33	D	30.0	B	771	D	-	-	-	-	-	-	-	2
AD089	*	Jungblom Ranch	1983/08/01	470046	1185616	18	31E	33	D	36.6	F	732	D	-	-	-	-	-	-	64	7,15,40
AD090		Lobe, Gary L		- -	-	18	32E	06	D	22.2	F	270	D	-	-	-	-	3785	P	198	43
AD091		Hutterian Bretheren		- -	-	18	32E	07	P	21.7	B	240	D	-	-	27	-	-	-	-	44
AD092		Franz, Agatha		- -	-	18	32E	28	C	20.0	F	188	D	-	-	-	-	3785	P	105	43
AD093		Harder, Carl H		- -	-	18	38E	04	N	21.1	F	161	D	-	-	-	-	5602	P	79	43
AD094		Kagele, Norman		- -	-	19	31E	24	G	20.1	B	165	D	-	49	-	-	-	-	-	22,25,26,33,37,44
AD095		Weber, Dave	1983/05/23	470630	1185416	19	31E	27	G	26.0	-	430	-	-	-	-	-	-	-	130	40
AD096		S & K Farms		- -	-	19	32E	24	K	20.8	B	243	D	-	35	40	-	-	-	-	22,25,26,37,44
AD097		J & M Farms	1983/07/30	470657	1184436	19	32E	24	N	32.5	B	695	D	-	30	-	-	-	-	195	2,22,25,26,33,37,38,40,44
AD098		Kagele, Norman		- -	-	19	32E	30	N	21.1	B	165	D	-	-	40	-	-	-	-	44
AD099		Graber, Rose		- -	-	19	32E	35	A	20.0	F	196	D	-	-	-	-	3974	P	60	43
AD100	*	Warden Hutterian Brethern, 7	1983/08/03	470844	1184227	19	33E	07	R	24.3	F	527	D	-	-	-	-	-	-	133	7,15,40
AD101		Hoefel, Paul, 2	1983/08/30	470849	1184130	19	33E	08	Q	42.3	B	745	D	-	39	38	-	-	-	177	2,22,25,26,33,37,38,40,44
AD102		Hoefel, Paul		- -	-	19	33E	08	Q	20.7	B	231	D	-	36	40	-	-	-	-	22,25,26,37,44
AD103		Kagele, Melvin	1983/08/04	470754	1183351	19	34E	20	B	22.5	B	341	D	-	34	-	-	-	-	180	22,25,26,40
AD104		Gering, Gale		- -	-	19	36E	09	K	21.1	B	229	D	-	41	-	-	-	-	-	22,25,26,37,38
AD105		Galbreath Land & Livestock	1983/08/03	470746	1181818	19	36E	20	H	20.5	-	314	-	-	-	-	-	5337	-	191	40
AD106		Galbreath Land & Livestock 2	1983/05/26	470746	1181726	19	36E	21	C	22.5	-	390	-	-	-	-	-	5223	-	170	40
AD107		Heineman, Don, 2		- -	-	19	36E	34	N	20.8	B	102	D	-	96	-	-	-	-	-	22,25,26,37
AD108		-----		- -	-	19	38E	13	F	21.1	-	201	L	83	55	-	-	-	-	-	22,25,26
AD109		Raugust, W. C.	1983/08/30	471320	1184712	20	32E	15	L	21.0	-	317	-	-	-	-	-	-	-	-	40
AD110		Weber, John		- -	-	20	34E	02	Q	21.0	B	202	D	-	50	-	-	-	-	-	22,25,26,37,44
AD111		Hardung		- -	-	20	35E	17	D	20.9	B	232	D	90	39	-	-	-	-	-	6,22,25,26
AD112		Ahern, Cliff		- -	-	20	35E	24	D	20.5	B	157	D	-	61	-	-	-	-	-	22,25,26,33,37
AD113		Kagele, Richard	1983/08/31	471219	1182309	20	35E	27	A	22.0	-	384	-	-	-	-	-	-	-	231	40
AS00																					
AS000		ASOTIN COUNTY																			
AS001	*	Washington Water Power Co., 2	1960/05/24	462214	1170351	10	46E	05	Q	23.3	-	553	D	-	-	-	-	-	-	19	31,40,41
AS002		Washington Water Power Co.		- -	-	10	46E	06	J	21.7	F	326	D	-	-	-	-	7570	P	82	43
AS003		Norman, Joe, & Gary Beach		- -	-	10	46E	08	Q	20.0	F	79	D	-	-	-	-	772	P	34	43

GEOTHERMAL DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON--DESCRIPTIVE AND THERMAL DATA FOR WELLS AND SPRINGS.
File Name = GEOTHDB1.WK1 Last updated September 01, 1993, by J.E.S.

I.D. (NEW)	*	SITE NAME	DATE	LAT. N.	LONG. W.	TWP. N.	RNG.	SEC.	PART. SEC.	TEMP. deg.C	TEMP TYPE	DEPTH m	DEPTH TYPE	GRADIENTS(Deg.C/Km) A	B	S	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REFERENCES
AS004		Asotin City		- -	-	10	46E	16	Q	22.2	F	164	D	-	-	-	-	3028	P	20	43
AS005		Asotin City 1	1982/06/21	462014	1170317	10	46E	21	D	22.0	-	164	-	-	-	-	-	-	-	20	40
AS006		Washington Water Power Co.		- -	-	11	46E	29	A	24.4	F	280	D	-	-	-	-	-	P	-	43
AS007		Washington Water Power Co.		- -	-	11	46E	29	P	22.2	F	336	D	-	-	-	-	14762	P	87	43
AS008	*	Washington Water Power Co., 5	1962/10/30	462348	1170504	11	46E	30	Q	23.3	B	406	D	-	28	-	-	-	-	136	22,25,26,31,40
AS009		Wash. W. Power, Clark. Hts., 7	1983/08/10	46-23.49	117-04.52	11	46E	32	E	26.2	B	405	D	36	35	-	56	13248	-	118	5,22,25,26,38,40
BE00																					
BE000		BENTON COUNTY																			
BE001	*	S P & S Ry		- -	-	04	24E	03	B	20.6	F	121	D	-	71	-	-	-	-	-	22,25,26,31
BE002		Sandpiper Land Co.		- -	-	05	25E	29	G	20.0	F	107	D	-	-	-	-	378	P	52	42
BE003		Sandpiper Land Co.		- -	-	05	25E	29	N	20.0	F	75	D	-	-	-	-	144	P	22	42
BE004		Paterson or G. Tom Powers		- -	-	05	26E	05	D	26.3	B	305	D	-	47	-	-	5787	P	83	22,25,26,42
BE005	*	US Army Corps of Engineers	1971/09/24	455623	1192111	05	28E	06	R	21.5	F	170	D	-	56	-	-	1893	-	6	22,25,26,40
BE006		Columbia R.		- -	-	06	24E	22	H	22.5	B	195	D	-	44	-	-	-	-	-	6,22,25,26
BE007		Epstein		- -	-	06	26E	15	E	23.9	F	293	D	-	-	-	-	14383	P	110	42
BE008		Craig		- -	-	06	26E	15	M	24.2	B	210	D	-	58	-	-	-	-	-	22,25,26
BE009		Blair		- -	-	06	30E	12	Q	21.1	B	305	D	31	29	-	-	-	-	-	6,22,25,26
BE010		HundredCirclesFarm,IrrigroDiv		- -	-	06	30E	19	D	23.3	F	248	D	-	-	-	-	378	P	193	42
BE011		Irrigro		- -	-	06	30E	19	N	20.5	S	177	L	-	48	-	-	-	-	- -	22,25,26,37
BE012		Horrigan Farms		- -	-	07	24E	08	B	23.4	B	338	D	-	36	-	-	-	-	-	22,25,26,38
BE013		Horrigon Farms, Inc.		- -	-	07	24E	26	B	20.0	F	162	D	-	-	-	-	757	P	90	42
BE014		DOE Paterson		- -	-	07	25E	36	N	30.3	B	222	D	-	83	-	-	-	-	-	22,25,26
BE015	*	WDOE Tst./Obs., Piezometer C	1972/11/01	460237	1193830	07	25E	36	N	22.0	-	230	-	-	-	-	-	2612	-	114	40
BE016		DNR John Barber	1984/04/18	460237	1193829	07	25E	36	N	21.5	-	262	-	-	-	-	-	8441	-	113	40
BE017		DOE Paterson		- -	-	07	25E	36	N	22.5	B	254	D	-	41	-	-	-	-	-	22,25,26
BE018		DNR Baker		- -	-	07	25E	36	P	21.8	B	262	D	-	38	-	-	-	-	-	22,25,26
BE019		Moon, John	1982/08/26	460751	1193517	07	26E	05	B	22.0	-	326	-	-	-	-	-	-	-	130	40
BE020		Moon		- -	-	07	26E	05	B	22.1	B	148	D	-	63	-	-	-	-	-	22,25,26
BE021		DOE Horse Heaven		- -	-	07	27E	36	A	29.4	B	369	D	-	39	-	-	-	-	-	26,38
BE022		Prosser City 5	1983/07/20	461223	1194506	08	24E	01	J	25.2	B	391	D	-	26	-	-	7759	-	23	2,6,22,25,26,33,40,42
BE023		Bleyhl, Carl		-	-	08	24E	08	H	27.8	F	59	D	-	-	-	-	727	P	0	42
BE024		Long, Tallman, & Long	1982/08/25	461049	1194800	08	24E	15	F	24.0	-	125	-	-	-	-	-	227	-	64	40
BE025		DNR Gould		- 46-08.38	11-37.78	08	25E	36	B	25.9	B	408	D	35	38	-	56	-	-	225	5,26,42
BE026		---	1984/04/18	461123	1193453	08	26E	16	D	20.0	-	329	-	-	-	-	-	-	-	-	40
BE027		Sharp, Pete	1982/08/27	461245	1192215	08	27E	01	A	22.5	-	47	-	-	-	-	-	-	-	34	40
BE028		Schleer, Carl	1988/09/15	461138	1192148	08	28E	07	M	20.5	-	134	-	-	-	-	-	-	-	69	40
BE029		Bar 80 Ranch/Pete Sharp	1982/08/27	461127	1192137	08	28E	07	P	20.5	-	133	-	-	-	-	-	1514	-	43	40
BE030		St. Joseph's Catholic Church	1988/04/11	461221	1190745	08	29E	01	F	21.0	-	28	-	-	-	-	-	189	-	-	40
BE031	*	Mott, Studer	1970/11/17	461004	1190930	08	29E	22	A	23.0	F	244	D	-	45	-	-	-	-	122	22,25,26,40
BE032		Burk, Vern		- -	-	08	30E	22	M	21.1	F	69	D	-	-	-	-	492	N	A	42
BE033		Noel, Jim		- -	-	08	30E	22	N	21.1	F	69	D	-	-	-	-	-	N	A	42
BE034		Salvinia Farms/Harper Farms		- -	-	09	24E	21	D	21.7	F	241	D	-	-	-	-	4542	P	98	42
BE035		WSU Prosser Experiment Station		- -	-	09	25E	06	K	27.8	B	366	D	-	43	34	-	5678	P	162	2,22,25,26,38,42
BE036		Goroch, Chester		- -	-	09	25E	07	J	21.1	F	215	D	-	-	-	-	2650	P	127	42
BE037		Gammie,William/Whitstran Ranch		- -	-	09	25E	09	H	20.0	F	457	D	-	-	-	-	-	-	138	42
BE038		Olsen Bros		- -	-	09	25E	14	DorC	20.0	F	142	D	-	-	-	-	2460	P	15	42
BE039		Clark, Roy		- -	-	09	25E	23	J	20.0	F	18	D	-	-	-	-	114	P	8	42
BE040		Ball, Lenn and Vern	1983/07/20	461342	1194124	09	25E	33	AorB	21.0	F	218	D	-	-	-	-	-	N	A	40,42
BE041		Valley View Orchards		- -	-	09	26E	06	N	22.8	F	-	-	-	-	-	-	1961	P	157	42
BE042		Bauder, Milo		- -	-	09	26E	20	A	23.3	F	209	D	-	-	-	-	7684	P	21	42
BE043	*	Christen	1970/10/12	461350	1193227	09	26E	27	K	21.5	B	204	D	-	47	-	-	-	-	137	22,25,26,40
BE044		Peterson, Jean		- -	-	09	27E	02	E	20.0	F	123	D	-	-	-	-	1041	P	55	42
BE045		Edmunds, Gary		- -	-	09	27E	02	F	20.0	F	130	D	-	-	-	-	-	-	43	42
BE046		Gelles, David S.	1988/04/19	461631	1192809	09	27E	08	N	20.5	-	195	-	-	-	-	-	-	-	-	40
BE047		DNR Benton 40		- 46-16.17	119-26.78	09	27E	16	D	23.3	B	94	D	185	122	-	293	-	-	-	5,26
BE048		Harrison 4 W	1982/08/28	461522	1192654	09	27E	21	D	22.5	-	252	-	-	-	-	-	-	-	-	40
BE049		DNR Kid 3		- 46-14.82	119-24.17	09	27E	23	L	29.1	B	370 D		43	46	-	69	-	-	-	5,26
BE050		DNR 79-07		- -	-	09	27E	25	M	23.8	B	322	D	-	30	-	-	-	-	-	26,38
BE051		Davin Land & Livestock, Inc.	1983/05/17	461611	1191950	09	28E	17	AorB	26.7	F	336	D	-	-	-	-	10182	P	52	40,42
BE052		Bauder		- -	-	09	28E	34	H	21.1	B	271	D	-	34	-	-	-	-	-	22,25,26

GEOTHERMAL DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON--DESCRIPTIVE AND THERMAL DATA FOR WELLS AND SPRINGS.
File Name = GEOTHDB1.WK1 Last updated September 01, 1993, by J.E.S.

I.D. (NEW)	*	SITE NAME	DATE	LAT. N.	LONG. W.	TWP. N	RNG.	SEC.	PART. SEC.	TEMP. deg.C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENTS(Deg.C/Km) A	B	S	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REFERENCES
BE053		The Quadrant Corporation	-	-	-	09	28E	36	P	28.3	F	368	D	-	-	-	-	4542	P	27	42
BE054		DNR Anderson	-	46-18.70	119-45.43	10	24E	36	F	29.8	B	273	D	62	65	-	99	-	-	-	5,26
BE055		Nakamura	-	-	-	10	25E	25	E	20.6	B	184	D	36	45	-	-	-	-	-	6,22,25,26
BE056		J & R Orchards	-	-	-	10	25E	33	N	21.8	B	276	D	-	36	34	-	-	-	-	2,22,25,26
BE057		Schwendig, Harvey	1983/07/21	461920	1193409	10	26E	28	L	24.5	-	282	-	-	-	-	-	2763	-	155	40
BE058		Champion Orchards	-	-	-	10	26E	33	D	22.8	F	255	D	-	-	-	-	1741	P	137	42
BE059		Inland Desert Fruit Company	-	-	-	10	26E	33	F	24.4	F	255	D	-	-	-	-	2366	P	126	42
BE060		Hanford 56E4C	-	46-19.70	119-26.00	10	27E	28	A	20.9	B	140	D	-	46	-	-	-	-	-	5,26
BE061		Hanford S-30	-	46-21.73	119-16.13	10	28E	14	B	39.7	B	605	D	42	42	-	67	-	-	-	5,26
BE062		DH 3	-	46-21.12	119-16.19	10	28E	14	G	47.8	B	1080	D	35	33	-	53	-	-	-	2,4,5,22,25,26
BE063		Battelle PacificNorthwestLabs	1988/09/14	462025	1191653	10	28E	23	E	20.5	-	15	-	-	-	-	-	1893	-	14	40
BE064		Rattlesnake Unit No. 1	-	46-26.0	119-47.0	11	24E	15	R	128.0	S	3248	D	37	40	31	60	-	-	-	2,4,5,22,25,26
BE065		DC 12	-	-	-	11	26E	03	-	53.7	B	1018	D	-	42	-	-	-	-	-	12
BE066		VO-SOC 1	-	46-25.17	119-35.38	11	26E	20	N	40.1	B	671	D	37	-	-	56	-	-	-	5
BE067	*	US Government	1970/11/19	462328	1193201	11	26E	34	R	24.0	F	305	D	-	39	-	-	1317	-	244	22,25,26,40
BE068		Hanford 2-E14	-	46-25.68	119-16.62	11	28E	23	D	26.2	B	288	D	39	42	-	60	-	-	-	5,26
BE069		DC 15	-	-	-	11	28E	35	-	51.5	B	945	D	-	41	-	-	-	-	-	12
BE070		Berk, Delbert	-	-	-	12	24E	03	B	22.2	F	387	D	-	-	-	-	13414	P	10	42
BE071		Tramel, J. D.	-	-	-	12	24E	05	A	23.0	B	254	D	-	43	-	-	-	-	-	2,26,37
BE072		Tramel, J. D.	-	-	-	12	24E	09	E2E2	22.2	F	310	D	-	-	-	-	13475	P	107	42
BE073	*	Roberts Bros.	1970/09/11	463024	1195112	12	24E	20	N	26.0	F	366	D	-	38	-	-	-	-	-	22,25,26,40
BE074		Robert, Robin	1983/07/28	463010	1195130	12	24E	30	B	26.0	-	390	-	-	-	-	-	11317	-	35	40
BE075	*	US Government	1977/04/27	463300	1193430	12	26E	04	N	21.4	F	117	D	-	80	-	-	-	-	108	22,25,26,40
BE076		US Government	1976/04/08	463330	1193621	12	26E	07	B	20.7	F	126	D	-	69	-	-	-	-	82	22,25,26,40
BE077	*	US Government	1976/04/08	463210	1193620	12	26E	07	Q	20.4	F	99	D	-	85	-	-	-	-	88	22,25,26,40
BE078	*	US Government	1979/04/19	463211	1193517	12	26E	08	P	21.2	F	98	D	-	94	-	-	-	-	88	22,25,26,40
BE079	*	AEC	1979/04/17	463225	1193409	12	26E	09	L	22.0	-	113	-	-	-	-	-	-	-	108	40
BE080	*	US Government	1976/04/08	463235	1192935	12	26E	12	H	21.0	F	158	D	-	57	-	-	-	-	91	22,25,26,40
BE081		-----	1982/04/21	463200	1192932	12	26E	13	A	20.5	-	-	-	-	-	-	-	-	-	-	40
BE082	*	US Government	1979/04/17	463146	1192939	12	26E	13	H	20.0	-	38	-	-	-	-	-	-	-	34	40
BE083	*	US Government	1978/04/20	463200	1193150	12	26E	14	D	21.1	F	117	D	-	78	-	-	-	-	105	22,25,26,40
BE084	*	US Government	1977/04/28	463200	1192855	12	26E	15	C	21.7	F	134	D	-	74	-	-	-	-	95	22,25,26,40
BE085	*	US Government	1979/04/20	463133	1193215	12	26E	15	J	21.0	-	98	-	-	-	-	-	-	-	-	40
BE086	*	US Government	1976/04/08	463141	1193650	12	26E	18	E	20.5	F	177	D	-	48	-	-	-	-	68	22,25,26,40
BE087	*	US Government	1982/04/21	463144	1193623	12	26E	18	G	21.0	F	85	D	-	103	-	-	-	-	65	22,25,26,40
BE088		----	1981/04/21	463021	1193036	12	26E	24	N	20.5	-	207	-	-	-	-	-	-	-	-	40
BE089		Maple Leaf Farms, Inc.	-	-	-	12	26E	29	G	24.4	F	253	D	-	-	-	-	1703	P	52	42
BE090		DB 8	-	-	-	12	27E	06	-	24.8	B	244	D	-	42	-	-	-	-	-	12
BE091		US Government	1978/04/19	463124	1192656	12	27E	16	M	20.5	F	65	L	-	131	-	-	-	-	39	22,25,26,40
BE092	*	AEC	1979/04/16	463200	1192856	12	27E	18	C	21.5	-	51	-	-	-	-	-	-	-	44	40
BE093		DC 7	-	-	-	12	27E	36	-	72.2	B	1243	D	-	49	-	-	-	-	-	12
BE094		Casper, William	-	-	-	12	28E	07	M	21.1	F	124	D	-	-	-	-	64	P	113	43
BE095	*	US Government	1970/08/27	463510	1194608	13	24E	25	E	24.2	F	237	D	-	51	-	-	-	-	-	22,25,26,40,41
BE096		699-52-115	-	-	-	13	24E	25	-	20.6	B	213	D	-	45	-	-	-	-	-	12
BE097	*	US Govt./Meeker	-	-	-	13	24E	26	G	20.0	F	215	L	-	43	-	-	-	-	-	22,25,26,41
BE098	*	----	1951/12/01	463513	1194640	13	24E	26	G	20.0	-	185	-	-	-	-	-	-	-	-	40
BE099	*	US Government	1951/11/29	463438	1194608	13	24E	36	D	24.0	F	333	D	-	36	-	-	5110	-	66	22,25,26,40,41
BE100	*	US Government	-	-	-	13	25E	01	N	23.0	F	241	D	-	46	-	-	-	-	-	22,25,26,31
BE101	*	US Government	1983/06/03	463820	1194024	13	25E	03	Q	21.0	-	16	-	-	-	-	-	-	-	12	40
BE102	*	Hanford, 199-B4-4	1977/04/27	463748	1193842	13	25E	11	H	39.1	F	32	L	-	847	-	-	-	-	23	22,25,26,40
BE103		DB 12	-	-	-	13	25E	16	-	20.5	B	215	D	-	29	-	-	-	-	-	12
BE104		US Government	1981/04/23	463440	1193949	13	25E	26	N	20.0	-	183	-	-	-	-	-	-	-	90	40
BE105	*	US Govt./McGee, Chester	1977/04/27	463505	1194415	13	25E	30	G	30.6	F	338	D	-	44	-	-	5185	-	65	22,25,26,40,41
BE106		699-53-103	-	-	-	13	25E	30	-	28.7	B	299	D	-	49	-	-	-	-	-	12
BE107		DC 5	-	-	-	13	25E	34	-	62.8	B	945	D	-	37	-	-	-	-	-	12
BE108		DH 1		46-35.0	119-31.0	13	26E	25	AorB	21.9	B	183	D	37	54	-	64	-	-	-	4,5,22,25
BE109	*	US Government	1979/04/17	463351	1193609	13	26E	31	R	20.0	-	98	-	-	-	-	-	-	-	97	40
BE110		ARH DC 1	-	-	-	13	26E	35	A	75.0	B	1725	D	-	37	31	-	-	-	-	2,26
BE111		DDH 1	-	-	-	13	26E	35	A	21.9	S	183	L	37	38	-	-	-	-	-	26
BE112	*	US Government	1969/07/14	463419	1193116	13	26E	35	H	25.0	-	-	-	-	-	-	-	-	-	-	40

I.D. (NEW)	*	SITE NAME	DATE	LAT. N.	LONG. W.	TWP. N.	RNG.	SEC.	PART. SEC.	TEMP. deg.C	TEMP TYPE	DEPTH m	DEPTH TYPE	GRADIENTS(Deg.C/Km) A	B	S	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REFERENCES
BE113		Hanford DC 6		- -	-	13	27E	26	G	60.2	B	1324	D	-	37	31	-	-	-	-	2,26
BE114		——	1984/06/06	463518	1192741	13	27E	28	C	21.0	-	168	-	-	-	-	-	-	-	-	40
BE115		DB 10		- -	-	13	27E	29	-	26.4	B	257	D	-	43	-	-	-	-	-	12
BE116		Hanford 107D-2	1978/04/18	464201	1193208	14	26E	14	M	32.5	F	24	L	-	854	-	-	-	-	17	22,25,26,40
BE117	*	US Government	1979/04/18	464135	1193200	14	26E	23	D	24.0	-	28	-	-	-	-	-	-	-	26	40
BE118		Hanford 199-N-15	1977/04/27	464030	1193351	14	26E	28	G	20.7	F	24	D	-	363	-	-	-	-	16	22,25,26,40
BE119	*	Hanford 199-K-19	1979/04/18	463921	1193513	14	26E	32	L	22.0	-	16	-	-	-	-	-	-	-	6	40
BE120		US Government	1979/04/18	464211	1192835	14	27E	18	H	22.5	-	17	-	-	-	-	-	-	-	12	40
BE121		DC-14		- -	-	14	27E	29	-	57.2	B	1017	D	-	45	-	-	-	-	-	12
BE122	*	US Government	1979/04/17	463928	1192614	14	27E	33	G	20.5	-	20	-	-	-	-	-	-	-	10	40
CH00																					
CH000		CHELAN COUNTY																			
CH001		Norco No. 1		- 47-22.11	120-18.00	22	20E	26	M	35.7	S	1495	L	28	27	-	62	-	-	-	4,5,22,25,26
CK00																					
CK000		CLARK COUNTY																			
CK001		Evergreen School District 114	1980/08/19	453650	1223157	02	02E	35	M	22.0	-	77	-	-	-	-	-	1079	-	48	40
CK002		Cody, L.		- 45-38.34	121-15.87	02	04E	24	N	24.1	M	90	D	-	-	-	-	-	-	-	5
CL00																					
CL000		CLALLAM COUNTY																			
CL001S	*	Olympic Hot Springs		- 47-58.60	123-40.90	29	08W	27	K	48.5	-	-	-	-	-	-	-	-	-	-	19,32
CL002S	*	Sol Duc Hot Springs		- 47-58.10	123-51.80	29	09W	32	C	51.0	-	-	-	-	-	-	-	-	-	-	19,21,32
CO00																					
CO000		COLUMBIA COUNTY																			
CO001		Barton, George		- -	-	09	39E	22	C	21.1	F	305	D	-	-	-	-	4	P	274	43
CO002		Ferrell, L.		- -	-	12	38E	01	E	22.0	-	241	L	-	41	-	-	-	-	-	22,25,26,37
CO003	*	Ferrel, Robert	1961/01/27	463502	1180100	13	38E	26	E	20.0	F	74	D	-	108	-	-	-	-	-	22,25,26,40,41
CO004		US Army Corps of Engineers		- -	-	13	38E	27	J	23.3	F	116	D	-	-	-	-	1060	P	5	43
CO005		US Army Corps of Engineers	1983/08/26	463450	1180205	13	38E	27	L	23.9	F	116	D	-	-	-	-	1790	P	19	40,43
CZ00																					
CZ000		COWLITZ COUNTY																			
CZ001S		Green River Soda Springs		- -	-	10	04E	02	G	25.0	-	-	-	-	-	-	-	-	-	-	17,22
DO00																					
DO000		DOUGLAS COUNTY																			
DO001		Welch		- 47-14.65	120-00.78	20	22E	12	B	22.0	B	264	D	26	33	-	41	-	-	-	5,26
DO002		La Bonte, Lloyd L.	1982/07/28	471946	1200049	21	22E	12	G	20.0	-	234	-	-	-	-	-	5299	-	80	40
DO003		Fleming & Evenhus		- -	-	22	22E	19	E	20.0	F	83	D	-	-	-	-	8	P	72	42
DO004		Welch, Dean		- -	-	22	22E	19	E	22.8	F	226	D	-	-	-	-	6832	P	176	42
DO005		Sagebrush Flats		- -	-	23	25E	27	L	33.0	B	396	D	-	-	-	-	-	-	-	37
DO006		DNR Pixlee		- -	-	23	26E	20	D	29.3	S	363	L	-	50	-	-	-	-	-	22,25,26,33
DO007		Isaak, John		- -	-	27	28E	26	C	20.0	F	247	D	-	-	-	-	-	P	158	42
FR00																					
FR000		FRANKLIN COUNTY																			
FR001		Dixon, Norman, 2	1988/04/15	461742	1190836	09	29E	02	G	22.1	F	144	D	-	-	-	-	379	-	34	7,15,40
FR002	*	Pasco Navy Base/Port of Pasco	1970/08/28	461538	1190554	09	30E	18	HorJ	21.0	F	315	D	-	29	-	-	2271	-	22	22,25,26,40
FR003		N.P.R.R./A. Miller ice plant		- -	-	09	30E	20	L	21.1	F	314	D	-	29	-	-	1855	P	20	39
FR004		Western Farm Service	1988/09/07	461405	1190250	09	30E	27	F	20.5	-	37	-	-	-	-	-	151	-	-	40
FR005		Nakamura		- -	-	09	31E	07	E	24.6	-	168	L	33	75	-	-	-	-	-	22,25,26
FR006		Hageman, Marvin	1988/09/14	462133	1191041	10	29E	09	R	20.0	-	118	-	-	-	-	-	76	-	81	40
FR007		US Bureau of Reclamation		- -	-	10	30E	23	H	20.0	F	194	D	-	-	-	-	57	P	81	43
FR008		Jones & Russell,Eddie & Connie	1983/07/20	462000	1184559	10	32E	23	J	23.0	-	91	-	-	-	-	-	95	-	46	40
FR009		Foster, Chris	1983/05/23	462813	1190908	11	29E	03	H	22.0	-	168	-	-	-	-	-	95	-	122	40
FR010		West 15 Domestic Water, Inc.	1988/09/09	462740	1191150	11	29E	05	R	30.0	F	305	D	-	-	-	-	360	P	160	40,43
FR011		Bergland Farms	1988/09/09	462832	1191337	11	29E	06	C	23.0	-	20	-	-	-	-	-	38	-	7	40
FR012		Sunset Domestic Water Assoc.		- -	-	11	29E	16	A	22.2	F	293	D	-	-	-	-	246	P	163	43
FR013		White Bluff/Greg Allen	1988/04/12	462501	1191251	11	29E	20	N	25.0	-	285	-	-	-	-	-	212	-	170	40
FR014		Turner, Richard	1983/07/25	462321	1191415	11	29E	31	N	24.5	-	227	-	-	-	-	-	-	-	148	40
FR015		Clearwater Domestic Assoc.		- -	-	11	29E	32	R	21.1	F	113	D	-	-	-	-	57	P	103	43
FR016		Circle H Land, 3	1983/05/18	462737	1185625	11	31E	04	P	21.5	-	399	-	-	-	-	-	13248	-	125	40
FR017		Nakamura, H.		- -	-	11	31E	21	H	24.8	B	356	D	-	34	-	-	-	-	-	22,25,26,38
FR018		Hummel, Ed.	1988/04/13	462357	1185617	11	31E	33	B	22.0	-	213	-	-	-	-	-	-	-	53	40

I.D. (NEW)	*	SITE NAME	DATE	LAT. N.	LONG. W.	TWP. N.	RNG.	SEC.	PART. SEC.	TEMP. deg.C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENTS(Deg C/Km) A	B	S	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REFERENCES
FR019		Rowe Farms		- -	-	11	32E	29	N	29.6	B	333	D	-	53	-	-	-	-	-	23
FR020		USBR Drainage Obs.	1988/02/21	463319	1190750	12	29E	01	E	22.5	-	15	-	-	-	-	-	-	-	-	40
FR021		Stephens, Alvin E.		- -	-	12	29E	05	-	20.0	F	136	D	-	-	-	-	76	P	26	43
FR022		Rohfeld, Richard		- -	-	12	29E	06	K	20.0	F	72	D	-	-	-	-	-	P	64	43
FR023		Washburn, Hiram E.& Rachel A.		- -	-	12	29E	16	N	21.1	F	112	D	-	-	-	-	25	P	87	43
FR024		Casey, Michael	1988/09/12	463124	1191203	12	29E	17	K	23.0	-	146	-	-	-	-	-	30	-	119	40
FR025		Winebarger, Jim		- -	-	12	29E	23	A	22.2	F	175	D	-	-	-	-	23	P	123	43
FR026	*	US Bureau of Reclamation	1953/01/01	462955	1191110	12	29E	28	F	20.0	F	213	D	-	38	-	-	204	-	150	22,25,26,40
FR027		N. 16 Dom. Water Assoc., Inc.		- -	-	12	29E	34	B	21.1	F	169	D	-	-	-	-	91	P	129	43
FR028		Coordes, Henry	1988/09/13	463222	1185534	12	31E	10	M	22.5	-	293	-	-	-	-	-	-	-	183	40
FR029		Greenfield Farm/Mel McLane	1988/02/27	463729	1191852	13	28E	09	L	25.0	-	247	-	-	-	-	-	-	-	178	40
FR030		Lowe, Walter	1988/02/26	463751	1191636	13	28E	11	E	22.0	-	222	-	-	-	-	-	-	-	186	40
FR031	*	US Bureau of Reclamation	1983/07/26	463621	1191536	13	28E	13	N	29.5	F	341	D	-	46	-	-	322	-	145	22,25,26,40
FR032		US Bureau of Reclamation	1983/07/22	463747	1191202	13	29E	08	H	20.5	F	138	D	-	-	-	-	114	P	130	40,43
FR033		Bailie		- 46-36.77	119-07.28	13	29E	13	K	22.6	B	210	D	48	43	-	77	-	-	-	5,26
FR034		Price, Anthon		- -	-	13	29E	16	D	23.9	F	227	D	-	-	-	-	303	P	126	43
FR035		Wahluke Water Association,Inc.		- -	-	13	29E	16	D	27.8	F	318	D	-	-	-	-	227	P	127	43
FR036		Bailie, Leon	1988/04/14	463538	1190843	13	29E	23	P	23.5	-	214	-	-	-	-	-	-	-	23	40
FR037		Connell City 8	1983/07/21	463835	1185224	13	31E	01	E	21.1	F	404	D	-	-	-	-	9118	P	101	40,43
FR038		Loeber, E. C.		- -	-	13	31E	14	C	20.6	F	369	D	-	-	-	-	7570	P	102	43
FR039		Connell City, E. C. Loeber		- -	-	13	31E	14	R	20.0	F	306	D	-	-	-	-	757	P	107	43
FR040		Pepiots, Inc.		- -	-	13	31E	34	G	22.2	F	400	D	-	-	-	-	1136	P	176	43
FR041		Cockrans		- -	-	13	34E	30	M	32.2	B	355	D	56	57	-	-	-	-	-	22,25,26
FR042		USBR Block 24 Obs.	1988/09/17	464042	1191847	14	28E	28	C	21.5	-	6	-	-	-	-	-	-	-	-	40
FR043	*	US Govt./Othello AFB	1967/02/13	464321	1191048	14	29E	09	A	23.3	B	263	D	58	47	-	-	197	-	172	6,22,25,26,40,41
FR044		Michel, John	1988/09/14	464043	1191322	14	29E	19	Q	21.0	-	128	-	-	-	-	-	-	-	68	40
FR045		Alexander, H. D.	1988/09/14	463904	1191300	14	29E	32	N	26.7	F	182	D	-	-	-	-	19	P	130	40,43
FR046		Rathbun, Corrin		- -	-	14	31E	08	M	46.8	B	758	D	-	46	38	-	-	-	-	2,26,37,38,44
FR047		Rathbun, Corrin, 3		- -	-	14	31E	09	J	22.2	B	332	D	-	28	48	-	-	-	-	22,25,26,37,38,44
FR048		Kummer Farms		- -	-	14	31E	15	C	20.3	B	413	D	-	-	-	-	-	-	-	37,38,44
FR049		Wirth, Earl W.		- -	-	14	31E	26	L	22.2	F	274	D	-	-	-	-	265	P	134	43
FR050		Andrews, Clyde		- -	-	14	31E	27	J	25.2	B	207	D	-	-	50	-	-	-	-	44
FR051		Connell City		- -	-	14	31E	36	H	23.3	F	337	D	-	-	-	-	2790	P	108	43
FR052	*	Connell City 4	1970/09/24	463915	1185130	14	31E	36	J	25.0	F	337	D	-	39	-	-	-	-	-	22,25,26,40
FR053		Hart, Frank		- -	-	14	32E	02	P	27.2	B	242	D	50	63	50	-	-	-	-	22,25,26,37,44
FR054		Hart		- -	-	14	32E	13	E	25.6	-	187	L	-	73	-	-	-	-	-	22,25,26
FR055		Hart, Dick		- -	-	14	32E	13	E	23.7	B	232	D	-	-	50	-	-	-	-	37,44
FR056		Welch, Norman A. & Dean		- -	-	14	32E	30	F	22.8	F	238	D	-	-	-	-	2460	P	91	43
FR057		Connell City 6		- -	-	14	32E	31	D	29.4	B	305	D	38	57	50	-	-	-	-	22,25,26
FR058		Hudlow, Floyd S.		- -	-	14	33E	18	B	20.0	F	165	D	-	-	-	-	341	P	148	43
FR059		Heider, Walter		- -	-	14	33E	21	N	28.2	B	351	D	-	44	50	-	-	-	-	22,25,26,37,38,44
FR060		Gillis, Vernon	1983/08/03	464046	1182110	14	36E	19	N	29.5	B	287	D	-	42	-	-	76	-	-	22,25,26,40
GA00																					
GA000		GARFIELD COUNTY																			
GA001		Scott, Jim		- -	-	12	40E	14	J	21.1	F	317	D	-	-	-	-	34	P	268	43
GA002	*	Pomeroy City 4	1960/05/24	-	-	12	42E	31	L	23.0	F	304	D	-	36	-	-	-	-	-	22,25,26,40,41
GA003		Burne, Diane		- -	-	13	42E	33	G	20.0	F	47	D	-	-	-	-	204	P	-	43
GR00																					
GR000		GRANT COUNTY																			
GR001		Pacific First Bank 2		- -	-	13	24E	05	F	25.6	F	457	D	-	-	-	-	-	-	10	43
GR002		Pacific First Bank 1		- -	-	13	24E	05	F	26.1	F	393	D	-	-	-	-	-	-	9	43
GR003		Pacific First Bank 3		- -	-	13	24E	05	F	24.4	F	461	D	-	-	-	-	-	-	24	43
GR004		DNR East Priest Rapids, 1	1983/07/28	464217	1195322	14	23E	13	D	23.5	-	296	-	-	-	-	-	-	-	82	40
GR005		Baney, Curt		- -	-	14	23E	23	C	21.1	F	195	D	-	-	-	-	-	-	38	43
GR006		Gearhart, Frank	1983/07/27	464039	1195350	14	23E	26	A	22.5	-	125	-	-	-	-	-	76	-	43	40
GR007	*	US Army/AEC Hanford 90	1971/10/08	464406	1193818	14	25E	01	D	27.5	F	285	D	-	54	-	-	511	-	55	22,25,26,40,41
GR008		Hanford 93-93		- 46-44.05	119-38.36	14	25E	01	D	25.6	B	68	D	-	43	-	-	-	-	-	5,26
GR009		Barker, Paul	1983/07/26	464407	1193918	14	25E	02	C	20.5	-	136	-	-	-	-	-	-	-	17	40
GR010		Arnold, Greg		- -	-	14	25E	18	Q	27.8	F	172	D	-	-	-	-	57	P	39	43
GR011	*	US Govt./AEC Hanford 6	1958/01/07	464137	1194136	14	25E	21	B	22.2	F	159	D	-	63	-	-	984	-	72	22,25,26,40,41

GEOTHERMAL DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON--DESCRIPTIVE AND THERMAL DATA FOR WELLS AND SPRINGS.
File Name = GEOTHDB1.WK1 Last updated September 01, 1993, by J.E.S.

I.D. (NEW)	*	SITE NAME	DATE	LAT. N	LONG. W.	TWP. N.	RNG.	SEC.	PART. SEC.	TEMP. deg.C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENTS (Deg.C/Km) A	B	S	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REFERENCES
GR012		US Army Corps of Engineers	-	-	-	14	25E	28	E	22.8	F	198	D	-	-	-	-	946	P	146	43
GR013	*	US Army	1959/10/28	464135	1192245	14	27E	24	C	30.0	F	425	D	-	42	-	-	379	-	117	22,25,26,40,41
GR014		Wahluke School	1983/07/27	464431	1195344	15	23E	35	J	23.0	-	129	-	-	-	-	-	379	-	107	40
GR015		Mattawa City	1983/07/27	464422	1195423	15	23E	35	P	21.5	-	303	-	-	-	-	-	3785	-	80	40
GR016		DH 5	-	-	-	15	24E	25	P	23.3	B	1534	D	-	41	31	-	-	-	-	26
GR017		DH 5	-	-	-	15	24E	28	-	73.5	B	1525	D	-	41	-	-	-	-	-	12
GR018		Bird, Duane	1982/08/19	464440	1193832	15	25E	35	H	20.0	-	128	-	-	-	-	-	114	-	104	40
GR019	*	AEC Hanford 7	1958/01/07	464427	1192535	15	27E	34	L	21.7	F	194	D	-	49	-	-	265	-	83	22,25,26,40,41
GR020		Myrick, Norman A. & Edith E.	-	-	-	16	23E	01	D	22.2	F	312	D	-	-	-	-	3785	P	200	43
GR021		Grant County PUD, 2	-	-	-	16	23E	21	J	20.6	F	108	D	-	-	-	-	2044	P	6	43
GR022		Grant County PUD, 2	1983/07/27	465139	1195633	16	23E	21	J	21.5	-	53	-	-	-	-	-	689	-	3	40
GR023	*	US Government	-	-	-	16	24E	01	G	23.5	F	244	D	-	47	-	-	-	-	-	22,25,26,41
GR024	*	US Air Force	-	-	-	16	24E	01	G	24.5	F	279	D	-	45	-	-	-	-	-	22,25,26,41
GR025	*	US Air Force	1963/03/28	465428	1194517	16	24E	01	G	23.5	-	279	-	-	-	-	-	1154	-	214	40
GR026		Royal City 1	1983/07/27	465358	1193738	16	25E	01	Q	20.5	-	277	-	-	-	-	-	1893	-	162	40
GR027		Weitzel, Paul	1983/07/30	465725	1195356	17	23E	23	A	24.0	-	276	-	-	-	-	-	38	-	183	40
GR028		Metro Mortgage	-	-	-	17	25E	01	F	25.3	B	239	D	-	56	-	-	-	-	-	22,25,26,37
GR029		US Bureau of Reclamation	1982/08/18	465533	1192920	17	27E	31	D	20.8	F	247	D	-	36	-	-	1211	-	61	22,25,26,40
GR030		----	-	-	-	17	30E	01	G	23.0	F	299	D	-	37	-	-	-	-	-	22,25,26
GR031		Warden City	-	-	-	17	30E	10	P	27.8	F	253	D	-	-	-	-	12036	P	53	43
GR032	*	US Government	1982/08/11	-	-	17	30E	33	K	23.3	-	299	D	-	-	-	-	-	-	-	40,41
GR033	*	US Army Corps of Engineers	1960/01/24	465501	1190311	17	30E	33	K	23.5	F	306	D	-	33	-	-	946	P	64	22,25,26,40,41,43
GR034		George City	-	-	-	18	24E	06	A	20.0	F	54	D	-	-	-	-	3785	P	8	43
GR035		Washington	-	-	-	18	25E	15	E	25.6	F	297	D	-	46	-	-	-	-	-	22,25,26
GR036		Quincy	-	-	-	18	25E	15	E	22.4	S	270	L	-	39	-	-	-	-	-	22,25,26
GR037		DOE George	-	-	-	18	25E	15	E	29.3	-	488	L	35	35	-	-	-	-	-	22,25,26,38
GR038	*	WDOE Tst./Obs., Backfilled	1978/02/17	470308	1194058	18	25E	15	E	25.5	-	491	-	-	-	-	-	4391	-	117	40
GR039		Metro Mortgage 11A	-	-	-	18	25E	23	J	21.2	-	190	L	-	48	-	-	-	-	-	22,25,26
GR040		Farm Man	-	-	-	18	25E	27	N	21.2	B	228	D	-	36	-	-	-	-	-	6,22,25,26
GR041		Bradshaw	-	-	-	18	25E	28	B	22.4	B	212	D	-	49	-	-	-	-	-	22,25,26
GR042		Metro Mortgage	-	-	-	18	26E	31	F	20.4	B	216	D	46	49	-	-	-	-	-	6,26
GR043		Metro Mortgage 20	-	-	-	18	26E	31	K	22.5	B	215	D	40	49	-	-	-	-	-	22,25,26
GR044		Clamo, Roy	1983/05/20	470049	1193521	18	26E	32	C	20.5	-	137	-	-	-	-	-	9311	-	12	40
GR045		Sparks, Dave, 6	1983/05/18	470018	1193235	18	26E	34	K	21.0	-	20	-	-	-	-	-	681	-	8	40
GR046		Shinn, F.	-	47-00.26	119-31.73	18	26E	35	SW4	23.2	B	165	D	50	68	-	79	-	-	-	5,26
GR047		Tokunaga, Joe	1983/07/28	470120	1191619	18	28E	26	F	22.5	-	244	-	-	-	-	-	7570	-	42	40
GR048		American Potato Company	-	-	-	18	29E	06	K	20.0	F	210	D	-	-	-	-	4542	P	43	43
GR049		American Potato Company, 2	-	-	-	18	29E	06	Q	21.7	B	205	D	-	47	45	-	-	-	-	22,25,26,33,37,38,44
GR050		Hirai, Tom	1983/07/29	470930	1194212	19	25E	08	A	23.0	-	220	-	-	-	-	-	9349	-	6	40
GR051		Grant County Land Co.	-	-	-	19	25E	35	M	20.6	F	223	D	-	-	-	-	7097	P	20	43
GR052		DNR 76-10 East Cole 2	1983/08/29	470559	1193026	19	26E	36	E	20.0	-	157	-	-	-	-	-	6245	-	76	40
GR053		DNR	-	-	-	19	26E	36	G	21.1	F	158	D	-	-	-	-	227	P	47	43
GR054		Lauzier, Paul	-	-	-	19	27E	31	D	25.0	M	233	L	-	56	-	-	-	-	-	22,25,26,33,37
GR055		Moses Lake City 28	-	-	-	19	28E	04	L	20.9	F	227	D	-	37	-	-	-	-	-	26
GR056		Moses Lake City 14	-	-	-	19	28E	15	A	25.0	F	312	D	-	-	-	-	6056	P	23	43
GR057		Moses Lake City 3	1955/08/02	470803	1191705	19	28E	15	Q	22.2	F	277	D	-	37	-	-	5299	-	8	22,25,26,40
GR058	*	Moses Lake City 7	1960/05/16	470750	1191633	19	28E	23	D	23.8	B	292	D	-	42	45	-	-	-	4	22,25,26,31,37,40,44
GR059		Moses Lake City 5	-	-	-	19	28E	23	J	20.0	F	290	D	-	-	-	-	4239	P	31	43
GR060		Moses Lake City	-	-	-	19	28E	27	C	20.6	F	211	D	-	-	-	-	8327	P	A	43
GR061		Moses Lake City	-	-	-	19	28E	27	H	20.8	F	319	D	-	-	-	-	7456	P	5	43
GR062		Moses Lake City 10	-	-	-	19	28E	27	R	21.4	F	211	D	-	42	-	-	-	-	-	26
GR063		Moses Lake City 4	-	-	-	19	28E	28	K	22.6	B	294	D	-	32	-	-	-	-	-	6,22,25,26
GR064		Westlake City	-	-	-	19	28E	29	M	21.1	F	212	D	-	-	-	-	3406	P	1	43
GR065		Moses Lake City 31	-	-	-	19	28E	29	M	20.6	B	140	D	-	58	-	-	-	-	-	26,37,44
GR066		Fode, Roy, 2	1983/07/29	471024	1190922	19	29E	03	B	22.5	-	366	-	-	-	-	-	-	-	77	40
GR067		Fode 1	-	-	-	19	29E	03	F	25.4	B	321	D	-	42	-	-	-	-	-	22,25,26
GR068		Fode, Roy, 2	-	-	-	19	29E	03	F	29.0	B	322	D	-	-	45	-	-	-	-	33,37,44
GR069		Shinn, Frank, 2	-	-	-	19	29E	04	H	25.7	B	281	D	-	46	45	-	-	-	-	22,25,26,33,37,44
GR070		Abrams	-	-	-	19	29E	09	J	20.5	S	98	L	-	88	-	-	-	-	-	22,25,26
GR071		Jett-Aero 2	-	-	-	19	29E	14	J	21.5	B	218	D	-	44	45	-	-	-	-	26,33,37,44

GEOTHERMAL DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON--DESCRIPTIVE AND THERMAL DATA FOR WELLS AND SPRINGS.
File Name = GEOTHDB1.WK1 Last updated September 01, 1993, by J.E.S.

I.D. (NEW)	*	SITE NAME	DATE	LAT. N.	LONG. W.	TWP. N.	RNG.	SEC.	PART. SEC.	TEMP. deg.C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENTS(Deg.C/Km) A	B	S	HEAT FLOW mW/sq m	FLOW l/m	FLOW TYPE	S.W.L. m	REFERENCES
GR072		Masto Farms	-	-	-	19	29E	15	A	21.1	B	289	D	-	40	45	-	-	-	-	33,37,38,44
GR073		Carnation	-	-	-	19	29E	16	N	28.8	B	191	D	-	88	-	-	-	-	-	22,25,26
GR074		Richards, Arch W.	1983/07/30	471000	1190218	19	30E	03	E	22.2	F	335	D	-	-	-	-	8327	P	112	40,43
GR075		Ottmar, Arthur	1983/09/06	470902	1190549	19	30E	07	L	23.0	-	284	-	-	-	-	-	7570	-	93	40
GR076		American Potato	-	-	-	19	30E	13	F	20.6	B	202	D	-	38	-	-	-	-	-	6,22,25,26,44
GR077		Radach Farms	1983/05/17	470814	1190201	19	30E	15	L	24.0	-	360	-	-	-	-	-	-	-	113	40
GR078		Schmidt, Reuben	-	-	-	19	30E	17	M	21.9	B	225	D	-	44	45	-	-	-	-	22,25,26,33,37,44
GR079		Abram 1/Jett-Aero 1	-	-	-	19	30E	20	D	25.8	B	311	D	-	44	45	-	-	-	-	22,25,26,33
GR080		Hagman Construction	-	-	-	20	23E	19	F	28.9	F	299	D	-	-	-	-	1892	P	6	43
GR081	*	Quincy City 1	1955/08/03	471412	1195124	20	24E	07	R	21.0	F	131	D	-	69	-	-	4353	-	84	22,25,26,40
GR082	*	Wenatchee Apple Land Co.	-	-	-	20	24E	09	E	20	F	105	D	-	-	-	-	5545	P	69	39
GR083		Auburn Packing Co., Inc.	-	-	-	20	24E	36	N	20.0	F	64	D	-	-	-	-	1514	P	12	43
GR084		Updegrave, V./Neveal, G.	1983/07/29	471147	1193053	20	26E	26	JorK	21.0	F	161	D	-	-	-	-	5678	P	65	40,43
GR085	*	Moses Lake City 21	1983/07/29	471101	1191911	20	28E	32	HorJ	22.2	-	217	D	-	-	-	-	3501	-	33	40,41
GR086		Cole, E. B.	-	-	-	20	29E	07	H	24.0	B	215	D	-	56	45	-	-	-	-	22,25,26,33,37,38,44
GR087		Reinke Farms	-	-	-	20	29E	25	C	26.3	B	406	D	-	32	45	-	-	-	-	22,25,26,33,37,38,44
GR088		Powers, Tom	-	-	-	20	29E	35	A	26.6	B	293	D	-	40	45	-	-	-	-	22,25,26,33,37,44
GR089		Claassen, C. C.	-	-	-	20	30E	21	F	26.4	B	323	D	54	39	-	-	13248	P	72	6,22,25,26,43
GR090		Claassen, Clint	-	-	-	20	30E	21	G	28.7	B	470	D	-	34	35	-	-	-	-	22,25,26,37,38,44
GR091		Franz, Herb, 2	-	-	-	20	30E	23	A	21.9	B	219	D	-	43	35	-	-	-	-	22,25,26,33,37,44
GR092		Franz, Herb, 1	-	-	-	20	30E	23	E	34.9	B	337	D	101	68	35	-	-	-	-	22,25,26,33,37,44
GR093		Jantz, Joe	-	-	-	20	30E	28	R	28.6	B	181	D	-	91	-	-	-	-	-	22,25,26,44
GR094		Stuckey, J. Jantz	-	-	-	20	30E	28	R	20.4	B	178	D	-	47	35	-	-	-	-	22,25,26,33,37,44
GR095		Neibaur/West	-	-	-	20	30E	32	K	21.1	S	383	L	-	-	-	-	-	-	-	33,37,38,44
GR096		Schorzman, Art & L.M. Etienne	-	-	-	21	24E	30	J	20.0	F	86	D	-	-	-	-	57	P	46	43
GR097		Ephrata City EPW-1	-	-	-	21	26E	05	Q	32.0	F	-	-	-	-	-	-	-	-	-	24
GR098	*	Ephrata City	1955/07/22	471948	1193536	21	26E	08	M	30.0	-	305	-	-	-	-	-	2903	-	41	40
GR099		Ephrata City	-	-	-	21	26E	08	M	30.0	F	305	D	-	59	-	-	-	-	-	22,25,26
GR100	*	Ephrata City 5	1955/07/22	471935	1193530	21	26E	08	N	28.0	F	137	D	-	116	-	-	2407	-	17	26,40
GR101		Ephrata City	-	-	-	21	26E	14	L	20.0	F	311	D	-	-	-	-	2725	P	61	43
GR102		Ephrata City 10	1983/09/02	471907	1193209	21	26E	15	H	25.5	F	564	D	-	-	-	-	10598	P	66	40,43
GR103		Ephrata City	-	-	-	21	26E	16	A	21.1	F	415	D	-	-	-	-	5299	P	7	43
GR104	*	Ephrata City 2	1955/07/22	471923	1193338	21	26E	16	B	29.0	-	79	-	-	-	-	-	6056	-	7	40
GR105	*	Ephrata City	1955/07/22	-	-	21	26E	21	E	25.5	F	188	D	-	72	-	-	-	-	-	22,25,26,40
GR106		Hansen, Charles L.	-	-	-	21	28E	03	NW4	20.6	F	204	D	-	-	-	-	5678	P	67	43
GR107		Hutterites	1983/09/01	472032	1190225	21	30E	03	E	22.5	-	408	-	-	-	-	-	-	-	131	40
GR108		----	-	-	-	21	30E	10	M	30.0	B	640	-	-	28	-	-	-	-	-	22,25
GR109	*	Schell, Harvey, 2	1983/09/01	471745	1185959	21	30E	23	J	31.1	F	407	D	-	-	-	-	8516	P	117	16,40,43
GR110		Schell, Harvey	-	-	-	21	30E	26	G	21.4	B	171	D	-	54	35	-	-	-	-	6,22,25,26,44
GR111	*	Soap Lake City	1955/07/22	472318	1192903	22	27E	19	N	27.0	F	142	D	-	106	-	-	-	-	2	22,25,26,40
GR112		King, Bud	-	-	-	22	30E	26	G	25.0	B	476	D	35	52	-	-	11355	P	110	22,25,26,33,38,43
GR113		Lester, Edna M.	1982/07/27	473045	1192438	23	27E	10	B	20.5	-	253	-	-	-	-	-	53	-	231	40
GR114		Schafer, Jerry	-	-	-	23	28E	27	E	22.8	-	196	L	-	60	-	-	-	-	-	22,25,26,38
GR115		DNR	-	-	-	23	29E	16	D	20.0	F	285	D	-	-	-	-	9830	P	64	43
GR116		----	-	-	-	25	28E	24	L	29.2	B	189	-	-	91	-	-	-	-	-	22,25
GR117		Dormaier	-	-	-	25	28E	25	B	23.0	B	177	D	-	62	-	-	-	-	-	6,22,25,26
GR118		Bolyard, James L.	-	-	-	25	28E	26	C	24.4	F	72	D	-	-	-	-	6813	P	26	43
GY00																					
GY000		GRAYS HARBOR COUNTY	NTY																		
GY001		North Beach School District	1980/07/01	471403	1241229	20	12W	08	P	20.5	-	71	-	-	-	-	-	-	-	-	40
GY002		VO-MO 1	-	47-14.27	124-11.47	20	12W	08	-	35.6	B	1067	L	27	-	-	36	-	-	-	4,5
KI00																					
KI000		KING COUNTY																			
KI001S	*	Lester Hot Springs	-	47-12.50	121-32.20	20	10E	21	M	46.5	-	-	-	-	-	-	-	19	-	-	19,21,29,32
KI002		Valley View Christian Church	1987/09/22	472220	1221036	22	05E	28	C	21.5	-	72	-	-	-	-	-	42	-	59	40
KI003S	*	Goldmeyer Hot Springs	-	47-29.00	121-23.10	23	11E	14	B	50.0	-	-	-	-	-	-	-	-	-	-	19,29,32
KI004S	*	Scenic Hot Springs	-	47-42.40	121-08.50	26	13E	28	Q	47.0	-	-	-	-	-	-	-	-	-	-	18,19,29,32
KS00																					
KS000		KITTITAS COUNTY																			
KS001		USGS/WDOE Burbank Creek	1978/08/16	464614	1202610	15	19E	22	L	24.3	B	184	D	-	93	-	-	6056	P	12	2,22,25,26,40,42

GEOTHERMAL DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON--DESCRIPTIVE AND THERMAL DATA FOR WELLS AND SPRINGS.
File Name = GEOTHDB1.WK1 Last updated September 01, 1993, by J.E.S.

I.D. (NEW)	*	SITE NAME	DATE	LAT. N.	LONG. W.	TWP. N.	RNG.	SEC.	PART. SEC.	TEMP. deg.C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENTS(Deg.C/Km) A	GRADIENTS(Deg.C/Km) B	S	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REFERENCES
KS002		Larson Fruit		- -	-	15	19E	22	P	31.5	B	393	D	-	50	-	-	-	-	-	2,26,38
KS003		Larson Fruit Co.		- -	-	15	19E	22	R	20.0	F	127	D	-	-	-	-	-	N?	A?	42
KS004		Larson Orchards	1983/07/12	464606	1202532	15	19E	22	R	26.5	-	390	-	-	-	-	-	8706	-	60	40
KS005		Nash, Chet		- -	-	15	19E	35	H	20.0	F	21	D	-	-	-	-	163	P	14	42
KS006		Badger/Bollinger		- 46-53.37	120-23.45	16	19E	12	K	20.0	B	333	D	48	33	-	46	-	-	-	5,26
KS007	*	USGS/WDOE Umtanum	1978/03/02	465111	1202727	16	19E	28	C	28.6	B	310	D	-	51	-	-	3634	-	7	22,25,26,38,40
KS008		Orcutt, Leland		- -	-	17	20E	05	K	22.8	F	137	D	-	-	-	-	2271	P	34	42
KS009S		Clerf Spring		- -	-	17	20E	06	A	20.0	-	-	-	-	-	-	-	4164	-	-	36
KS010		Palelek, Ron	1982/07/29	465617	1195918	17	23E	30	H	26.0	-	61	-	-	-	-	-	114	-	38	40
KS011		Ellensburg City		- -	-	18	18E	35	E	20.8	-	272	L	-	32	-	-	-	-	-	22,25,26,38
KS012		Central Washington University		- -	-	18	18E	36	B	28.4	B	262	D	-	61	-	-	-	-	-	6,22,25,26
KS013		Clerf, Howard	1983/07/12	470151	1201829	18	20E	27	A	21.0	F	142	D	-	-	-	-	7570	P	67	40,42
KT00																					
KT000		KLICKITAT COUNTY																			
KT001		Bingen City 2		- 45-43.15	121-28.32	03	11E	30	H	20.5	M	88	D	-	-	-	-	-	-	-	5
KT002		Heaney		- 45-42.12	121-24.66	03	11E	34	K	21.4	M	104	D	37	-	-	58	-	-	-	5
KT003		Mott, J.		- 45-44.23	121-10.94	03	13E	21	B	22.4	M	150	D	29	-	-	53	-	-	-	5
KT004		Daniel, L.		- 45-42.10	121-14.11	03	13E	31	M	22.1	M	174	D	26	-	-	42	-	-	-	5
KT005		US Army Corps of Engineers		- -	-	03	17E	28	C	22.2	F	238	D	-	-	-	-	2271	P	28	42
KT006		Riggleman Orchards		- -	-	04	11E	05	E	21.1	F	279	D	-	-	-	-	738	P	226	42
KT007		Jeleniewski, Tom		- -	-	04	12E	19	D	21.1	F	47	D	-	-	-	-	57	P	18	42
KT008		J. Neils Lumber Co.		- -	-	04	13E	23	E	27.0	F	168	D	-	-	-	-	303	N	A	28
KT009S	*	Klickitat Mineral Springs		- 45-49.30	121-08.00	04	13E	24	A	29.0	-	-	-	-	-	-	-	-	-	-	17,22,32
KT010		DNR 81 Klickitat		- 45-49.40	121-07.72	04	13E	24	E	20.1	B	120	D	51	56	-	71	-	-	-	5,26
KT011	*	Gas Ice Corp. 10	1966/03/24	454914	1210658	04	13E	24	H	27.2	F	90	D	-	167	-	-	341	N	A	22,25,26,28,31,40
KT012	*	Gas Ice Corp. 2	1964/10/21	454925	1210618	04	14E	19	C	23.0	F	61	D	-	177	-	-	-	-	-	22,25,26,31,40
KT013		Barrett, Charles M.	1982/08/25	455108	1204629	04	16E	11	D	21.5	-	329	-	-	-	-	-	5678	-	-	40
KT014		Barrett		- -	-	04	16E	11	D	20.9	-	187	L	-	48	-	-	-	-	-	26
KT015		Goldendale City 1		- -	-	04	16E	16	Q	24.6	B	271	D	-	-	-	-	-	-	0	9,38
KT016		Berk Bros.		- -	-	05	20E	27	B	23.1	B	276	D	41	43	-	-	-	-	-	6,22,25,26
KT017		DOE Horse Heaven West		- 45-55.00	120-11.49	05	21E	16	L	27.6	B	457	D	49	38	-	78	-	-	-	5,26,37
KT018		Matsen		- -	-	05	22E	27	A	28.2	B	321	D	42	48	-	-	-	-	-	6,22,25,26,33
KT019		Matsen, A. M.		- -	-	05	22E	27	A	22.2	F	262	D	-	-	-	-	6836	P	22	42
KT020		Matsen, A. M.		- -	-	05	22E	27	A	21.1	F	236	D	-	-	-	-	3406	P	17	42
KT021		Rinta, John, 1	1983/07/19	455257	1200248	05	22E	27	P	24.0	-	248	-	-	-	-	-	9463	-	35	40
KT022		Powers, Tom		- -	-	05	23E	13	J	27.2	B	330	D	-	43	-	-	-	-	-	22,25,26,38
KT023		Hiner, Gene	1982/03/31	455444	1195204	05	23E	13	R	25.0	-	442	-	-	-	-	-	10674	-	39	40
KT024		McBride, Clarence		- -	-	05	23E	29	D	25.5	B	267	D	-	51	-	-	8024	N	A	22,25,26,38
KT025		McBride Ranch, 2	1983/07/19	455340	1195926	05	23E	30	D	24.0	-	257	-	-	-	-	-	17600	-	38	40
KT026S	*	Fish Hatchery Warm Spring		- -	-	06	13E	04	H	23.8	-	-	-	-	-	-	-	-	-	-	11
KT027	*	Smith, G.	1970/12/11	460045	1195221	06	23E	11	N	23.3	F	272	D	-	37	-	-	-	-	A	22,25,26,40,42
KT028		Andrews, Robert	1970/12/11	460045	1195355	06	23E	11	Q	23.5	F	272	D	-	-	-	-	9462	N	A	9,40
KT029	*	Smith, George		- -	-	06	23E	11	Q	21.0	F	204	D	-	44	-	-	-	-	-	22,25,26,31
KT030	*	——	1962/04/30	460143	1195341	06	23E	11	Q	21.0	-	63	-	-	-	-	-	-	-	-	40
KT031	*	Andrews/Smith	1970/10/22	460016	1195429	06	23E	15	H	21.0	F	193	L	-	47	-	-	1438	-	0	22,25,26,40
KT032		Andrews		- -	-	06	23E	15	H	25.2	S	275	L	-	48	-	-	-	-	-	22,25,26
KT033		DNR Feezell		- -	-	06	23E	16	P	22.0	F	290	D	-	-	-	-	10787	P	12	9
KT034		DNR		- -	-	06	23E	16	R	22.2	F	290	D	-	-	-	-	7570	P	20	42
KT035		Andrews, Robert		- -	-	06	23E	22	J	23.0	B	318	D	-	35	-	-	-	-	-	26,38
KT036		Andrews, Robert	1983/07/19	455938	1195223	06	23E	24	B	24.5	-	294	-	-	-	-	-	15140	-	44	40
KT037		DNR Mercer N.		- 45-57.73	119-52.50	06	23E	36	F	20.8	B	190	D	49	41	-	78	-	-	-	5,26
LE00																					
LE000		LEWIS COUNTY																			
LE001		SU 8		- 46-32.68	122-50.81	12	01W	07	A	25.2	B	565	D	33	30	-	36	-	-	-	4,5,22,25,26
LE002		SU 11		- 46-32.18	122-49.46	12	01W	08	J	21.3	B	409	D	35	33	-	37	-	-	-	4,5,22,25,26
LE003		SU 12		- 46-32.35	122-49.46	12	01W	08	J	25.7	B	578	D	27	31	-	31	-	-	-	4,5,22,25,26
LE004		SU 14		- 46-32.28	122-50.20	12	01W	08	L	25.6	B	578	L	34	-	-	36	-	-	-	4,5
LE005		SU 37		- 46-31.93	122-50.52	12	01W	08	N	24.7	B	540	D	34	31	-	36	-	-	-	4,5,22,25,26
LE006		SU 4		- 46-31.99	122-48.66	12	01W	09	N	28.8	B	760	L	33	-	-	36	-	-	-	4,5
LE007		SU 902		- 46-31.65	122-50.07	12	01W	17	H	31.2	B	847	L	33	-	-	36	-	-	-	4,5

GEOTHERMAL DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON--DESCRIPTIVE AND THERMAL DATA FOR WELLS AND SPRINGS.
File Name = GEOTHDB1.WK1 Last updated September 01, 1993, by J.E.S.

I.D. (NEW)	*	SITE NAME	DATE	LAT. N.	LONG. W.	TWP. N.	RNG.	SEC.	PART. SEC.	TEMP. deg.C	TEMP TYPE	DEPTH m	DEPTH TYPE	GRADIENTS(Deg.C/Km) A	B	S	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REFERENCES
LE008		Longview 10	-	-	-	12	01W	17	-	30.0	-	792	L	26	27	-	-	-	-	-	22,25,26
LE009S		Packwood Hot Spring	-	46-34.50	121-42.40	13	09E	32	-	38.0	-	-	-	-	-	-	-	-	-	-	17,22,32
LE010S	*	Ohanapecosh Hot Springs(USGS)	-	46-44.5	121-33.5	14	10E	04	C	50.0	-	-	-	-	-	-	-	110	-	-	29
LI00																					
LI000		LINCOLN COUNTY																			
LI001	*	Odessa Oil Test Piezometer A	1972/09/13	471936	1185444	21	31E	10	M	30.5	-	224	-	-	-	-	-	-	-	71	40
LI002		Basalt Explorer	-	47-20.0	118-55.0	21	31E	10	M	65.8	S	1343	L	42	40	38	70	-	-	-	4,5,22,25,26,33,37,38,44
LI003		Schafer, Jerry	-	-	-	21	31E	23	F	21.0	B	293	D	-	-	35	-	-	-	-	44
LI004		Schibel, Don	-	-	-	21	31E	24	C	20.6	B	194	D	-	-	35	-	-	-	-	44
LI005		Sahible	-	-	-	21	31E	25	B	28.3	B	195	D	-	84	-	-	-	-	-	22,25,26
LI006		Kissler, Bob	-	-	-	21	31E	30	R	23.8	B	264	D	-	41	35	-	-	-	-	22,25,26,37,44
LI007		Kissler	-	47-16.36	118-57.42	21	31E	32	D	21.1	B	211	D	-	42	-	-	-	-	-	5,6,22,25,26
LI008		Schaffer, Jerry	-	-	-	21	32E	23	F	24.1	B	299	D	-	41	40	-	-	-	-	22,25,26,37,44
LI009		Fink, Reuben	1983/06/03	471627	1185024	21	32E	31	C	20.0	-	227	-	-	-	-	-	3785	-	82	40
LI010		Kramer, Robert A.	1983/08/04	471737	1183219	21	34E	21	K	21.0	-	225	-	-	-	-	-	4164	-	112	40
LI011		Hardung, Joe	-	-	-	21	34E	33	C	24.9	S	253	L	-	55	-	-	-	-	-	22,25,26,37
LI012		Weizel, LeeRoy	-	-	-	21	34E	34	A	20.0	F	234	D	-	-	-	-	7229	P	124	43
LI013		Weizel, L. R.	-	-	-	21	34E	34	H	22.2	F	197	D	-	-	-	-	2650	P	60	43
LI014		Iverson	-	-	-	21	35E	07	G	20.1	B	128	D	-	65	-	-	-	-	-	6,22,25,26
LI015	*	Sprague City	1983/08/02	471749	1175852	21	38E	23	L	21.4	F	153	D	-	-	-	-	3217	-	42	7,15,40
LI016		Jantz, Merlin K.	1983/08/05	472347	1184141	22	33E	17	N	21.5	-	188	-	-	-	-	-	-	-	61	40
LI017		Weishaar	-	-	-	23	32E	04	J	28.7	B	212	D	-	83	-	-	-	-	-	22,25,26
LI018		Weishaar	-	-	-	23	32E	17	G	21.2	B	206	D	37	49	-	-	-	-	-	22,25,26
LI019		Zagelow	-	-	-	23	33E	10	J	21.6	S	232	L	-	46	-	-	-	-	-	22,25,26
LI020		USGS/WDOE Almira	-	47-34.55	118-56.07	24	31E	16	E	21.8	B	227	D	48	37	-	-	-	-	-	5,6,22,25,26
LI021		Schmierer, Alvin	-	-	-	24	33E	23	P	27.0	B	310	D	-	48	-	-	-	-	-	22,25,26,38
LI022		Nealey, Darwin	-	-	-	24	34E	30	P	21.0	B	231	D	-	43	-	-	-	-	-	26,37
LI023		USGS/WDOE Davenport	-	47-34.70	118-16.37	24	36E	16	A	21.9	B	225	D	59	55	-	93	-	-	-	5,26
LI024	*	Wilbur SEC	1983/08/31	473648	1184519	25	32E	35	P	21.3	F	348	D	-	-	-	-	-	-	79	7,15,40
LI025	*	Davenport City 6	1983/06/10	473848	1180919	25	37E	21	L	24.0	F	297	D	-	-	-	-	8327	P	67	16,40,43
LI026		Davenport City 5	-	-	-	25	37E	21	L	24.0	S	227	L	-	57	-	-	-	-	-	22,25,26
LI027		Reardan City	-	-	-	25	39E	15	D	20.0	S	259	L	28	35	-	-	-	-	-	26,37
LI028		Washington Water Power Co.	-	47-52.09	118-28.76	27	34E	01	E	25.8	M	151	D	-	-	-	-	-	-	-	5
LI029		DDH-SF15	-	47-49.08	118-07.77	27	37E	22	P	31.7	M	258	D	35	-	-	-	-	-	-	5
LI030		Taylor	-	47-48.87	118-05.92	27	37E	26	A	23.8	-	358	D	40	36	-	-	-	-	-	5,26
OK00																					
OK000		OKANOGAN COUNTY																			
OK001		DOE TST3	-	48-10.54	119-40.38	31	25E	27	Q	22.7	M	44	D	-	-	-	-	-	-	-	5
OK002		Ayres, Bob	-	-	-	36	26E	28	K	21.1	F	12	D	-	-	-	-	568	P	7	42
OK003		Gildroy	-	48-40.84	119-29.92	37	26E	25	NE4	20.6	M	134	D	-	-	-	-	-	-	-	5
OK004S		Poison Lake	-	-	-	38	27E	05	J	50.0	-	-	-	-	-	-	-	-	-	-	17,22
OK005		Zissel, Charles	-	-	-	38	28E	14	H	20.0	F	9	D	-	-	-	-	38	P	2	42
OK006		Zosel, Ralph	-	-	-	40	27E	15	R	20.0	F	9	D	-	-	-	-	19	P	4	42
OK007S		Hot Lake	-	-	-	40	27E	18	A	50.0	-	-	-	-	-	-	-	-	-	-	17,22
PI00																					
PI000		PIERCE COUNTY																			
PI001S	*	Longmire Springs	-	-	-	15	08E	29	R	22.0	-	-	-	-	-	-	-	2	-	-	14
PI002S		Mount Rainier Fumaroles	-	-	-	16	08E	23	K	72.0	-	-	-	-	-	-	-	-	-	-	17,22
PI003S	*	Spring	-	-	-	19	02E	19	Q	24.4	-	-	-	-	-	-	-	-	-	-	15
SK00																					
SK000		SKAMANIA COUNTY																			
SK001S	*	Bonneville Hot Springs	-	45-39.40	121-57.50	02	07E	16	M	36.3	-	-	-	-	-	-	-	80	-	-	17,18,19,22,32
SK002S	*	Rock Creek Hot Springs	-	-	-	03	07E	27	B	33.5	-	-	-	-	-	-	-	-	-	-	18
SK003		North Bonneville 2	-	45-38.90	121-57.24	02	07E	39	E	35.5	B	198	D	143	131	-	190	-	-	-	5,26
SK004		North Bonneville 3	-	45-39.16	121-57.61	02	07E	39	K	26.4	B	155	D	91	106	-	120	-	-	-	5,26
SK005		Bonneville drill hole 2	-	-	-	02	07E	39	Q	28.2	F	-	-	-	-	-	-	-	-	-	18
SK006S		Shiperds Hot Springs	-	-	-	03	08E	21	C	42.0	-	-	-	-	-	-	-	100	-	-	17,22
SK007		DNR 81-Carson	-	45-44.07	121-48.24	03	08E	21	F	27.8	B	113	D	168	166	-	265	-	-	-	5,26
SK008S	*	St. Martin Hot Springs	-	45-43.70	121-47.70	03	08E	21	R	49.0	-	-	-	-	-	-	-	-	-	-	14,19,21,29,32
SK009		Green Life 1	-	-	-	03	08E	31	M	41.0	B	914	D	25	33	-	-	-	-	-	8

GEOTHERMAL DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON--DESCRIPTIVE AND THERMAL DATA FOR WELLS AND SPRINGS.
File Name = GEOTHDB1.WK1 Last updated September 01, 1993, by J.E.S.

I.D. (NEW)	*	SITE NAME	DATE	LAT. N.	LONG. W.	TWP. N.	RNG.	SEC.	PART. SEC.	TEMP. deg.C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENTS(Deg.C/Km) A	B	S	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REFERENCES
SK010S		Collins Hot Springs	-	-	-	03	09E	31	Q	50.0	-	-	-	-	-	-	-	-	-	-	17,22,32
SK011		Trout Creek Drill Hole	-	45-48.70	121-57.25	04	07E	21	P	36.3	B	357	D	89	-	-	141	-	-	-	1,5
SK012S		Mount St. Helens lava dome	-	-	-	08	05E	09	A	88.0	-	-	-	-	-	-	-	-	-	-	17,22
SK013S		Orr Creek Warm Springs	-	-	-	10	10E	19	NE4	22.0	-	-	-	-	-	-	-	100	-	-	17,22
SN00																					
SN000		SNOHOMISH COUNTY																			
SN001S	*	Garland Mineral Springs	-	47-53.35	121-20.50	28	11E	25	C	29.0	-	-	-	-	-	-	-	100	-	-	29,17,19,22,32
SN002S	*	Kennedy Hot Springs(USGS)	-	48-07.1	121-11.5	30	12E	01	H	38.0	-	-	-	-	-	-	-	-	-	-	29,32
SN003S	*	Gamma Hot Spring	-	48-09.1	121-03.7	31	13E	36	D	65.0	-	-	-	-	-	-	-	-	-	-	19,29
SN004S	*	Sulphur Creek Hot Springs	-	-	-	32	13E	19	C	37.0	-	-	-	-	-	-	-	-	-	-	19,21
SP00																					
SP000		SPOKANE COUNTY																			
SP001		Cheney City 4	-	-	-	23	41E	13	E	22.2	F	651	D	-	-	-	-	-	-	82	43
SP002		Cheney City 5	-	-	-	23	41E	14	Q	33.1	B	651	D	-	34	-	-	5488	P	72	22,25,26,38,43
SP003		Cheney City	-	-	-	23	41E	14	Q	29.1	-	341	L	-	56	-	-	-	-	-	22,25,26
SP004		Anderberg, Gary	-	-	-	23	43E	08	B	20.0	F	154	D	-	-	-	-	757	P	55	43
SP005	*	US Government	1958/07/22	473320	1174459	24	40E	22	L	20.5	-	105	-	-	-	-	-	-	-	-	40
SP006	*	Fairchild AFB, 2	1958/07/22	473542	1173739	24	41E	03	N	20.5	-	123	-	-	-	-	-	3785	-	3	40
SP007	*	US Government	1958/07/22	473948	1174353	25	40E	14	R	20.0	-	109	-	-	-	-	-	-	-	-	40
SP008	*	US Government	1958/07/22	473654	1174444	25	40E	34	P	21.0	-	60	-	-	-	-	-	-	-	-	40
SP009	*	US Government	1958/07/23	474110	1173346	25	41E	01	R	20.0	-	127	-	-	-	-	-	-	-	-	40
SP010	*	US Army, Fort George Wright	1958/07/22	474047	1172806	25	42E	11	E	20.0	-	18	-	-	-	-	-	5678	-	5	40
SP011	*	Washington Water Power Co.,1-3	1977/10/12	474005	1171826	25	43E	13	A	21.0	-	34	-	-	-	-	-	2460	-	18	40
SP012	*	US Air Force	1958/07/22	474355	1173209	26	42E	20	N	20.0	-	49	-	-	-	-	-	-	-	-	40
SP013		Fossen & Gisselburg	-	-	-	26	42E	33	W2	20.0	F	163	D	-	-	-	-	189	P	128	43
WA00																					
WA000		WALLA WALLA COUNTY																			
WA001		Byerly, Richard	1983/05/16	460128	1184445	06	32E	01	Q	21.5	-	351	-	-	-	-	-	-	-	-	40
WA002S		Warm Spr. Canyon Warm Spr.	-	46-01.43	118-46.23	06	32E	02	Q	22.0	-	-	-	-	-	-	-	-	-	-	32
WA003S		Emmett Lynch warm spring	-	-	-	06	32E	11	B	22.2	-	-	-	-	-	-	-	189	-	-	30
WA004		Fulgham	-	46-01.46	118-37.30	06	33E	01	K	31.8	B	305	D	69	67	-	73	2271	P	14	4,5,22,25,26,43
WA005		McDole, Joe	-	-	-	06	33E	06	R	25.6	F	398	D	-	-	-	-	1552	P	26	43
WA006		Demaris, Eugene & Leland	-	-	-	06	33E	07	J	20.0	F	46	D	-	-	-	-	1325	P	7	43
WA007		Fulgham	-	-	-	06	33E	10	NW4	31.8	B	305	D	70	67	-	-	-	-	-	23
WA008		Herman, J.	-	-	-	06	33E	16	D	20.0	F	222	D	-	-	-	-	1287	P	5	43
WA009		Miller	-	-	-	06	34E	02	B	25.1	-	175	L	-	75	-	-	-	-	-	22,25,26
WA010		Bing/Frost Ranch Ltd.	-	-	-	06	34E	05	J	25.6	F	366	D	-	-	-	-	5867	P	70	43
WA011		Chvatal, Ed.	-	-	-	06	34E	06	B	36.0	B	484	D	-	48	-	-	-	-	-	22,25,26,33,38
WA012		Chvatal, Ed.	-	-	-	06	34E	06	N	37.8	F	544	D	-	-	-	-	2650	P	32	43
WA013		----	-	-	-	06	34E	07	C	40.2	B	407	D	-	64	-	-	-	-	-	6
WA014		Gilbert-Merry	-	-	-	06	34E	07	P	40.7	B	407	D	78	71	-	-	-	-	-	22,25,26
WA015		Thomas,Sherman/dbaLowden Ranch	1983/08/13	460029	1183546	06	34E	07	R	45.0	F	506	D	-	-	-	-	3785	P	42	40,43
WA016		Bing/Frost Ranch Ltd.	-	-	-	06	34E	08	B	40.0	F	366	D	-	-	-	-	4258	P	74	43
WA017		Welch, E. C.	-	-	-	06	35E	01	R	20.0	F	195	D	-	-	-	-	2971	P	18	43
WA018		Burlingame, E. C.	-	-	-	06	35E	03	N	20.0	F	416	D	-	-	-	-	38	P	10	30
WA019		Hart, Harley D.	-	-	-	06	35E	08	A	20.0	F	21	D	-	-	-	-	757	P	3	43
WA020	*	Jaussand, Art	1958/08/01	460024	1182518	06	35E	10	P	25.0	F	350	D	-	37	-	-	7570	-	50	22,25,26,30,31,40,41
WA021		McAuslan	-	-	-	06	35E	12	H	21.7	F	214	D	-	42	-	-	757	P	0	22,25,26,30
WA022		Wilson, I. E.	-	-	-	06	35E	12	L	20.0	F	381	D	-	-	-	-	1703	P	18	43
WA023		Estes or Durand	-	-	-	06	35E	12	N	24.4	F	180	D	-	56	-	-	1136	P	31	22,25,26,30,31
WA024		Thomas, George	-	-	-	06	35E	12	R	22.2	F	194	D	-	-	-	-	2271	P	11	43
WA025		Dept. Ecology	-	-	-	06	35E	18	A	20.3	-	155	L	-	54	-	-	-	-	-	22,25,26
WA026		Dept. Ecology	-	-	-	06	35E	18	A	36.1	B	396	D	42	61	-	-	-	-	-	22,25,26
WA027	*	WDOE Tst./Obs., Piezometer A	1973/07/12	460014	1182818	06	35E	18	A	25.5	-	75	-	-	-	-	-	-	-	13	40
WA028		College Place	-	-	-	06	35E	18	A	26.1	B	399	D	46	35	-	-	-	-	-	26
WA029		----	-	-	-	06	35E	18	A	21.3	B	399	D	-	46	-	-	-	-	-	6
WA030		Walla Walla	-	-	-	06	35E	18	A	21.3	-	178	L	-	52	-	-	-	-	-	22,25,26
WA031		Crass, Billy J.	-	-	-	06	36E	04	E	23.3	F	240	D	-	-	-	-	2725	P	78	43
WA032		Hanlon, Terry D.	-	-	-	06	36E	04	N	22.2	F	195	D	-	-	-	-	57	P	88	43
WA033		Grieb, Bert	-	-	-	06	36E	04	N	21.1	F	252	D	-	-	-	-	1904	P	88	43

GEOTHERMAL DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON--DESCRIPTIVE AND THERMAL DATA FOR WELLS AND SPRINGS.
File Name = GEOTHDB1.WK1 Last updated September 01, 1993, by J.E.S.

I.D. (NEW)	*	SITE NAME	DATE	LAT. N.	LONG. W.	TWP. N.	RNG.	SEC.	PART. SEC.	TEMP. deg.C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENTS(Deg.C/Km) A	B	S	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REFERENCES
WA034		Richardson, Ross & Zella L.	-	-	-	06	36E	05	M	21.4	F	188	D	-	48	-	-	1703	P	15	22,25,26,30,43
WA035		Baker	-	-	-	06	36E	05	R	27.2	F	554	D	-	36	-	-	5980	P	38	22,25,26,30,43
WA036		Courtney, Jess	-	-	-	06	36E	06	M	22.0	F	186	D	-	54	-	-	1892	P	2	22,25,26,30
WA037		Brown, Lyle R.	-	-	-	06	36E	06	N	21.7	F	189	D	-	-	-	-	2975	P	3	43
WA038		Barnett, C. W.	-	-	-	06	36E	06	R	20.0	F	248	D	-	-	-	-	757	P	57	43
WA039		Border, Lester A.	-	-	-	06	36E	07	B	20.0	F	168	D	-	-	-	-	757	P	33	43
WA040		Ruzicka or Prusia	-	-	-	06	36E	07	D	22.2	F	171	D	-	58	-	-	1136	P	4	22,25,26,30
WA041		Bossini, Louis	1982/06/23	460054	1182149	06	36E	07	E	20.0	-	184	-	-	-	-	-	1514	-	37	40
WA042		Logan, John D.	-	-	-	06	36E	07	M	20.0	F	299	D	-	-	-	-	2176	P	2	43
WA043		Baker	-	-	-	06	36E	09	L	22.0	F	352	D	-	28	-	-	4542	P	32	22,25,26,30,31
WA044	*	Baker & Baker	-	-	-	06	36E	09	P	23.2	F	628	D	-	-	-	-	-	P	35	30,31
WA045		OR WA RR & Nav. Co	-	-	-	07	31E	10	J	22.8	F	123	D	-	-	-	-	659	P	12	43
WA046		Martin, William C.	-	-	-	07	32E	01	NW4	20.0	F	34	D	-	-	-	-	76	P	15	43
WA047		Pac. Gas Trans. Co., 1	-	-	-	07	32E	29	N	26.7	F	195	D	-	-	-	-	57	P	47	43
WA048		Pac. Gas Trans. Co., 2	-	-	-	07	32E	29	N	21.1	F	145	D	-	-	-	-	170	P	47	43
WA049	*	Byerley Farm, Inc.	1971/09/20	460211	1184449	07	32E	36	QorR	24.0	F	310	D	-	39	-	-	7570	P	24	22,25,26,40,43
WA050		Taggart	-	-	-	07	33E	24	Q	23.2	-	434	L	-	26	-	-	-	-	-	22,25,26
WA051		Harpe, William	-	-	-	07	33E	26	H	24.4	F	335	D	-	-	-	-	3406	P	47	43
WA052		Harpe, William	-	-	-	07	33E	26	R	23.3	F	284	D	-	-	-	-	1355	P	35	43
WA053		L. W. Weidert Farms, Inc.	-	-	-	07	33E	30	N	25.6	F	276	D	-	-	-	-	6056	P	81	43
WA054		McDole, Joseph and Amalie	-	-	-	07	33E	30	R	22.8	F	280	D	-	-	-	-	1892	P	51	43
WA055		McDole Farms	-	-	-	07	33E	31	J	27.8	F	412	D	-	-	-	-	-	-	-	43
WA056		McDole, Joe, 3	-	-	-	07	33E	31	K	27.7	B	269	D	-	58	-	-	-	-	34	22,25,26,37,43
WA057		Fulgham, Hilda M.	-	-	-	07	33E	35	K	30.6	F	310	D	-	-	-	-	2839	P	9	43
WA058		Baker, Charles	-	-	-	07	34E	25	N	20.0	F	336	D	-	-	-	-	1703	P	6	30
WA059		Kelly, Howard J.	-	-	-	07	34E	36	-	26.7	F	37	D	-	-	-	-	568	P	8	43
WA060		Washington State Penitentiary	-	-	-	07	35E	13	R	33.3	F	493	D	-	-	-	-	3002	P	125	43
WA061		——	-	-	-	07	35E	23	M	20.0	B	175	-	-	46	-	-	-	-	-	22,25
WA062		McKinnon, Jack C.	-	-	-	07	35E	23	M	20.0	F	49	D	-	-	-	-	511	P	7	43
WA063	*	Bonneville Power Admin.	1946/11/21	460407	1182420	07	35E	23	M	20.0	F	157	D	-	51	-	-	1294	P	18	22,25,26,30,31,40,41
WA064		Hydro Irrigation	-	-	-	07	35E	23	SE4	20.6	F	174	D	-	-	-	-	3028	P	46	43
WA065		Gluck/BPA	-	-	-	07	35E	24	M	20.0	B	175	D	-	46	-	-	-	-	-	26
WA066		Arbini, James	-	-	-	07	35E	25	F	20.0	F	207	D	-	39	-	-	1136	P	5	22,25,26,30
WA067		Columbo	-	-	-	07	35E	25	P	20.6	F	188	D	-	42	-	-	1325	P	3	22,25,26,30
WA068		Whitman Nat'l. Monument	-	-	-	07	35E	32	F	25.6	F	230	D	-	-	-	-	291	P	11	43
WA069		Walla Walla College	-	-	-	07	35E	33	G	21.1	F	232	D	-	-	-	-	3974	P	14	43
WA070		Walla Walla College Farm	-	-	-	07	35E	33	GorH	22.8	F	305	D	-	-	-	-	5893	P	52	43
WA071	*	Walla Walla College	-	-	-	07	35E	33	H	24.0	F	217	L	-	55	-	-	-	-	-	22,25,26,31
WA072		Walla Walla College Farm	-	-	-	07	35E	33	L	21.1	F	306	D	-	-	-	-	4164	P	41	43
WA073		DNR Christian	-	-	-	07	35E	34	L	24.0	S	219	L	47	55	-	-	-	-	-	22,25,26
WA074		State of Washington	-	-	-	07	35E	34	N	21.1	F	222	D	-	-	-	-	3047	P	30	43
WA075		Walla Walla College	-	46-02.93	118-22.30	07	35E	35	A	20.5	B	310	D	27	27	-	-	-	-	-	5,22,25,26
WA076		Walla Walla College	-	-	-	07	35E	35	A	20.0	F	183	D	-	-	-	-	-	N	A	30
WA077		Walla Walla College Farm	-	-	-	07	35E	35	C	20.0	F	245	D	-	-	-	-	1173	P	28	43
WA078		Manuel or Magnoni	-	-	-	07	35E	36	C	20.6	F	195	D	-	41	-	-	378	P	A	22,25,26,30
WA079	*	College Place	1972/05/24	460237	1182254	07	35E	36	F	20.5	-	213	-	-	-	-	-	1703	-	11	40
WA080	*	College Place City	1960/05/24	460243	1182254	07	35E	36	F	20.0	-	216	-	-	-	-	-	2801	-	-	40
WA081		Richards	-	-	-	07	35E	36	F	21.1	F	186	D	-	48	-	-	-	-	A	22,25,26,30
WA082	*	College Place	-	-	-	07	35E	36	F	20.4	F	247	D	-	34	-	-	568	P	19	22,25,26,30
WA083	*	College Place	-	-	-	07	35E	36	F	20.6	F	216	D	-	37	-	-	6813	P	A	22,25,26,30
WA084		Stone Creek Sanitarium	-	-	-	07	35E	36	R	21.1	F	189	D	-	48	-	-	568	P	16	22,25,26,30
WA085		Foundation FM, 3	1982/06/22	460626	1181726	07	36E	10	B	20.5	-	284	-	-	-	-	-	-	-	-	40
WA086		Walla Walla Comm. Coll.	-	-	-	07	36E	14	P	26.5	-	407	L	-	36	-	-	-	-	-	22,25,26,37
WA087		Walla Walla Golf Course	-	-	-	07	36E	17	L	39.1	B	716	D	-	36	-	-	-	-	-	6,22,25,26
WA088		Walla Walla Golf Course	-	46-05.39	118-20.30	07	36E	17	L	20.9	S	225	L	35	40	-	56	-	-	-	5,22,25,26
WA089		Blue Mountain Asphalt Co.	-	-	-	07	36E	19	E	20.0	F	48	D	-	-	-	-	114	P	5	43
WA090		D & K Farms	-	-	-	07	36E	19	F	30.2	B	471	D	-	38	-	-	-	-	-	6,22,25,26
WA091		DKFF	-	46-04.39	118-21.51	07	36E	19	F	20.6	B	250	D	-	-	-	-	-	-	-	5
WA092		General Foods Corp.	-	-	-	07	36E	19	F	24.4	F	343	D	-	-	-	-	3785	P	18	30
WA093		D & K Frozen Foods, Inc.	-	-	-	07	36E	19	F	21.7	F	69	D	-	-	-	-	643	P	9	43

GEOTHERMAL DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON–DESCRIPTIVE AND THERMAL DATA FOR WELLS AND SPRINGS.
File Name = GEOTHDB1.WK1 Last updated September 01, 1993, by J.E.S.

I.D. (NEW)	* SITE NAME	DATE	LAT. N.	LONG. W.	TWP. N.	RNG.	SEC.	PART. SEC.	TEMP. deg.C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENTS(Deg.C/Km) A	B	S	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REFERENCES
WA094	Rodgers Can.		- -	-	07	36E	19	R	28.8	F	485	D	-	33	-	-	4164	P	29	22,25,26,30
WA095	* Rogers Canning	1972/05/24	460357	1182048	07	36E	19	R	26.5	-	485	-	-	-	-	-	4277	-	29	40
WA096	Whitman College		- -	-	07	36E	20	H	22.2	F	366	D	-	27	-	-	2680	P	20	22,25,26,43
WA097	* Whitman College	1972/05/24	460421	1181944	07	36E	20	H	23.0	-	366	-	-	-	-	-	2680	-	20	40
WA098	* Walla Walla City 5	1960/07/29	460311	1181820	07	36E	28	R	23.5	F	332	D	-	48	-	-	6510	-	40	22,25,26,40,41,43
WA099	Walla Walla Country Club		- -	-	07	36E	31	J	21.1	F	523	D	-	-	-	-	5678	P	32	30
WA100	Chisholm, J. J.		- -	-	07	36E	31	N	20.0	F	183	D	-	-	-	-	1514	P	A	30
WA101	Walla Walla City 7		- 46-02.89	118-19.29	07	36E	33	D	30.2	B	425	D	75	40	-	53	-	-	-	4,5,6,22,25,26
WA102	Walla Walla School Dist. 140		- -	-	07	36E	33	F	22.2	F	287	D	-	-	-	-	2082	P	40	43
WA103	Smith, Jerry D.		- -	-	07	36E	33	J	20.6	F	183	D	-	-	-	-	783	P	39	43
WA104	Peterson, Ross		- -	-	08	31E	14	F	24.5	-	336	L	37	37	-	-	-	-	-	22,25,26,37
WA105	Ireland, Ken	1982/08/30	460912	1185555	08	31E	21	R	22.0	-	38	-	-	-	-	-	114	-	8	40
WA106	McGregor	1970/09/09	460756	1185405	08	31E	34	H	25.4	F	146	D	-	92	-	-	-	-	-	22,25,26,40
WA107	McGregor Feedlot		- -	-	08	31E	35	C	25.6	F	154	D	-	-	-	-	3785	P	46	43
WA108	Gluck, Bill, 2		- -	-	08	33E	21	R	31.0	B	237	D	-	-	-	-	-	-	-	37
WA109	Gluck		- 46-09.31	118-40.99	08	33E	21	SE4	24.1	B	290	D	38	42	-	60	-	-	-	4,5,22,25,26
WA110	Walla Walla College		- 46-02.9	118-22.3	08	35E	35	A	20.5	B	310	L	27	-	-	-	-	-	-	4
WA111	Power		- 46-16.04	118-45.21	09	32E	13	C	22.2	B	215	D	35	47	-	55	-	-	-	4,5,26
WA112	Union Pacific RR		- -	-	10	32E	24	R	22.2	F	64	D	-	-	-	-	288	P	44	43
WA113	Grote		- -	-	11	35E	14	Q	28.4	-	283	L	-	58	-	-	-	-	-	22,25,26
WA114	Western Farm Service		- -	-	11	35E	28	D	25.0	F	305	D	-	-	-	-	378	P	237	43
WA115	Anderson, Don		- -	-	12	36E	26	H	22.5	-	182	L	-	58	-	-	-	-	-	22,25,26,37
WH00																				
WH000	WHATCOM COUNTY																			
WH001S	Dorr Fumarole Field		- -	-	38	08E	17	D	90.0	-	-	-	-	-	-	-	-	-	-	17,22
WH002S	Sherman Crater Fumaroles		- -	-	38	08E	19	G	130.0	-	-	-	-	-	-	-	-	-	-	17,22
WH003S	* Baker Hot Springs		- 48-45.8	121-40.2	38	09E	20	M	44.0	-	-	-	-	-	-	-	-	-	-	18,19,21,29
WH004	Baker Hot Springs drill hole		- -	-	38	09E	20	M	47.9	F	141	D	200	-	-	-	38	N	A	20
WT00																				
WT000	WHITMAN COUNTY																			
WT001	Moehrie, Bill		- -	-	12	45E	23	M	20.0	F	79	D	-	-	-	-	30	P	64	43
WT002	Dubois, L. D.	1983/03/29	463700	1180849	13	37E	15	A	21.5	-	259	-	-	-	-	-	-	-	91	40
WT003	Peterson, Crump, & Kimball	1983/08/26	463742	1175823	13	39E	07	E	26.5	-	192	-	-	-	-	-	23	-	152	40
WT004	Roy Davis Estate		- -	-	13	44E	12	Q	20.0	F	56	D	-	-	-	-	57	P	24	43
WT005	Pullman City		- -	-	14	45E	05	B	20.0	F	50	L	-	160	-	-	-	-	-	22,25,26
WT006	* Pullman City		- -	-	14	45E	05	D	20.0	F	50	D	-	-	-	-	-	-	-	31
WT007	Pullman City		- -	-	14	45E	05	D	21.0	F	51	L	-	176	-	-	-	-	-	22,25,26,31
WT008	Steiger, Alan		- -	-	15	42E	27	H	20.0	F	95	D	-	-	-	-	231	P	63	43
WT009	* Pullman City		- -	-	15	45E	32	N	20.0	-	70	D	-	-	-	-	-	-	-	31
WT010	* Colfax City, Clay St. well		- -	-	16	43E	11	G	23.5	F	183	L	-	77	-	-	-	-	-	22,25,26,31
WT011	Colfax City 4	1983/08/25	465220	1172204	16	43E	14	N	21.0	-	229	-	-	-	-	-	2120	-	104	40
WT012	Schlomer, John G.		- -	-	17	39E	22	AorB	22.2	F	136	D	-	-	-	-	57	P	40	43
WT013	Storment, Daryl		- -	-	17	39E	26	K	22.2	F	117	D	-	-	-	-	34	P	-	43
WT014	Colfax City, E. Glenwood well		- -	-	17	44E	32	A	21.0	-	-	-	-	-	-	-	-	-	-	31
WT015	Tekoa City		- -	-	20	45E	24?	B?	24.4	F	54	D	-	-	-	-	-	-	-	27
YA00																				
YA000	YAKIMA COUNTY																			
YA001	Sharp, Jack		- -	-	07	22E	23	B	23.4	B	300	D	35	38	-	-	-	-	-	22,25,26,33
YA002S	Mount Adams Fumaroles		- -	-	08	10E	01	Q	50.0	-	-	-	-	-	-	-	-	-	-	17,22
YA003	Mabton		- -	-	08	22E	01	G	23.0	B	329	D	36	33	-	-	-	-	-	2,22,25,26
YA004	Flower		- -	-	08	22E	11	J	22.0	B	166	D	43	62	-	-	4928	P	-	2,22,25,26,37
YA005	Boast Farms		- -	-	08	22E	22	D	20.0	F	266	D	-	-	-	-	-	-	82	42
YA006	Johnson, Ray Y.		- -	-	08	22E	22	M	22.2	F	309	D	-	-	-	-	-	-	83	42
YA007	Leyendekker, Arthur		- -	-	08	22E	23	N	23.9	F	311	D	-	-	-	-	9462	P	81	42
YA008	Green Acre Farms, Inc.		- -	-	09	17E	01	D	27.8	F	572	D	-	-	-	-	6813	P	162	42
YA009	John, Mary	1973/11/27	461602	1201020	09	21E	15	H	21.0	-	13	-	-	-	-	-	151	-	1	40
YA010	Shinn		- -	-	09	21E	26	M	28.5	B	295	D	-	43	52	-	-	-	-	2,6,22,25,26
YA011	Del Monte	1974/05/22	461358	1201002	09	21E	27	R	22.0	B	35	D	-	286	-	-	-	-	5	2,22,25,40
YA012	—		- -	-	09	22E	11	J	20.3	B	166	D	43	43	52	-	-	-	-	2,6,22,25
YA013	Van De Graff Orchards, Inc.	1982/08/19	461630	1200044	09	22E	12	P	21.0	-	95	-	-	-	-	-	2271	-	6	40

GEOTHERMAL DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON--DESCRIPTIVE AND THERMAL DATA FOR WELLS AND SPRINGS.
File Name = GEOTHDB1.WK1 Last updated September 01, 1993, by J.E.S.

I.D. (NEW)	*	SITE NAME	DATE	LAT. N.	LONG. W.	TWP. N.	RNG.	SEC.	PART. SEC.	TEMP. deg.C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENTS(Deg.C/Km) A	B	S	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REFERENCES
YA014		Ramirez, Christi	-	-	-	09	22E	13	H	20.0	F	49	D	-	-	-	-	378	P	15	42
YA015		Washington Fruit & Produce	-	-	-	09	23E	01	B	21.1	F	85	D	-	-	-	-	3535	P	36	42
YA016		Grandview City	-	-	-	09	23E	13	SW4	22.8	F	291	D	-	-	-	-	7570	P	57	42
YA017		Grandview City	-	-	-	09	23E	22	J	21.2	B	429	D	-	-	-	-	-	-	-	2
YA018		Grandview City	-	-	-	09	23E	22	L	26.1	F	394	D	-	-	-	-	9640	P	49	42
YA019		John Haas, Inc.	-	-	-	09	23E	31	F	21.1	F	121	D	-	-	-	-	1325	P	11	42
YA020		White Swan Fairgrounds	1989/09/13	462238	1204312	10	17E	05	Q	20.0	-	59	-	-	-	-	-	-	-	10	40
YA021		----	-	-	-	10	17E	14	D	22.0	B	35	D	-	-	-	-	-	-	-	2
YA022	*	Showaway, Ida	1974/04/11	462122	1204005	10	17E	14	D	20.5	B	23	D	-	370	-	-	-	-	3	22,25,40
YA023		Decker, Bert C., 2	1974/06/13	462009	1203949	10	17E	23	L	20.3	B	213	D	-	39	39	-	6056	-	29	2,22,25,26,40
YA024		Decker, Bert, Jr., (Decker 3)	1989/09/15	461916	1203910	10	17E	26	J	24.5	F	305	D	-	39	-	-	3478	-	28	2,22,25,26,40
YA025		Decker, Bert C.	1989/09/26	461904	1204028	10	17E	27	Q	29.0	B	460	D	-	30	39	-	5678	-	60	2,22,25,40
YA026		Decker & Sons (Decker 4)	1989/09/15	461954	1204146	10	17E	28	B	24.5	B	268	D	-	39	39	-	6813	-	32	2,22,25,26,40
YA027		Napyer, Louis	1989/09/12	461943	1204321	10	17E	28	C	20.0	-	99	-	-	-	-	-	64	-	63	40
YA028		Shellenberger, Norman, 3	1989/09/14	461850	1203930	10	17E	35	B	24.5	B	245	D	-	38	39	-	6435	-	75	2,22,25,26,40
YA029		Green Acre Farms, Inc.	1989/08/23	461812	1203739	10	17E	36	R	23.5	F	297	D	-	-	-	-	-	-	113	40,42
YA030		Darrow	-	-	-	10	18E	05	Q	20.6	B	202	D	-	37	34	-	-	-	-	2,6,22,25,26
YA031	*	Decker Ranch (Decker 7)	1989/09/26	461821	1203734	10	18E	31	N	23.8	B	318	D	-	37	39	-	-	-	82	2,22,25,26,40
YA032		Corpus, Laura	1973/11/27	462137	1202617	10	19E	16	A	20.0	-	18	-	-	-	-	-	38	-	5	40
YA033		Eisenbeis, Chuck	1992/08/04	462020	1202651	10	19E	21	K	20.5	-	19	-	-	-	-	-	38	-	3	40
YA034		Oneil, Viola	-	-	-	10	19E	30	Q	20.2	F	254	D	-	-	-	-	-	-	-	10
YA035		Oneal, Karl	1989/07/19	461906	1202852	10	19E	30	R	23.0	-	254	-	-	-	-	-	160	-	-	40
YA036		Gibson, Joann	-	-	-	10	19E	32	D	21.1	F	64	D	-	-	-	-	64	P	8	42
YA037	*	Toppenish City 7	1974/09/19	462244	1201942	10	20E	04	L	23.5	B	312	D	-	34	-	-	8895	-	-	2,22,25,26,40
YA038		Yakima Indian Nation Land Ent	-	-	-	10	20E	04	M	20.0	F	19	D	-	-	-	-	1136	P	3	42
YA039		Gamache, Amos	1992/08/05	462234	1202219	10	20E	06	N	27.0	-	11	-	-	-	-	-	227	-	4	40
YA040	*	Toppenish City 6	1974/09/19	-	-	10	20E	09	A	20.6	B	256	D	-	27	-	-	-	-	-	2,6,22,25,26,40,41
YA041		Brownlee, Larry	1992/08/04	461931	1202118	10	20E	28	E	20.5	-	16	-	-	-	-	-	76	-	3	40
YA042		Dulm, Garrett	1983/07/15	462309	1201002	10	21E	03	H	23.0	-	236	-	-	-	-	-	-	-	21	40
YA043		Granger City	1968/04/16	-	-	10	21E	22	E	21.1	F	77	D	-	-	-	-	3785	N	A	10,42
YA044	*	Phillips, Lena	1974/05/23	461859	1201148	10	21E	33	B	21.0	-	13	-	-	-	-	-	227	-	2	40
YA045	*	Sunnyside City 4	1970/10/06	461934	1200037	10	22E	25	F	20.0	B	480	D	-	-	-	-	4542	-	23	2,40
YA046		Sunnyside City 3	1983/07/19	461937	1200035	10	22E	25	F	21.0	-	354	-	-	-	-	-	1400	-	4	40
YA047		DNR Snipes Mountain	-	-	-	10	22E	30	E	20.6	F	270	D	-	-	-	-	6245	P	9	42
YA048		Luther, Joe	-	-	-	10	22E	30	H	22.2	F	91	D	-	-	-	-	568	P	12	42
YA049		Newhouse, Steve & John	1983/07/19	461847	1200708	10	22E	31	F	21.5	-	128	-	-	-	-	-	189	-	14	40
YA050		Sunnyside Port District/City 7	1982/06/10	461842	1200100	10	22E	36	E	24.5	F	322	D	-	-	-	-	2271	P	3	40,42
YA051		Evans, Bill	-	-	-	10	23E	36	A	26.7	B	401	D	-	37	34	-	-	-	-	2,3,22,25,26,37
YA052		White, John	-	-	-	10	23E	36	G	23.0	B	284	D	-	39	34	-	3785	P	150	2,22,25,26,42
YA053S		Simcoe Soda Springs	-	46-27.10	120-57.40	11	15E	09	P	32.0	-	-	-	-	-	-	-	-	-	-	32
YA054		Pace, W. B.	-	-	-	11	16E	25	Q	25.4	B	333	D	-	40	34	-	-	-	-	2,22,25,26,33
YA055		Goudy, Steve	1989/08/22	462340	1204803	11	16E	34	K	22.5	-	137	-	-	-	-	-	45	-	106	40
YA056	*	Gowdy, Albert A.	1982/08/18	462340	1204814	11	16E	34	K	23.5	B	139	D	-	68	34	-	57	-	105	2,22,25,26,40
YA057	*	Mount Adams Seed	1974/06/13	462811	1203822	11	17E	01	F	24.2	B	358	D	-	34	34	-	2631	-	34	2,22,25,26,40
YA058		Decker & Sons 6	1989/08/31	462759	1203934	11	17E	02	LorP	25.5	B	265	D	-	51	34	-	6435	-	29	2,22,25,26,40
YA059	*	Stephenson, C. and H.	1989/09/14	462758	1204101	11	17E	03	L	25.5	B	301	D	-	44	34	-	4391	-	59	2,22,25,26,40
YA060		Dufault, Maurice	1974/10/01	462602	1203913	11	17E	14	Q	21.0	-	-	-	-	-	-	-	-	-	-	40
YA061		Stephenson	-	-	-	11	17E	16	F	31.6	B	302	D	-	62	-	-	-	-	-	2,6,22,25,26
YA062		Stephenson, C. and H.	1989/08/09	462637	1204130	11	17E	16	H	20.8	B	233	D	-	38	34	-	76	-	4	2,22,25,26,40
YA063		Adams, Dee	1989/09/15	462557	1204446	11	17E	19	C	21.5	-	154	-	-	-	-	-	49	-	118	40
YA064	*	Siegner, Monte	1974/10/01	462656	1203455	11	18E	09	N	23.0	B	122	D	-	90	-	-	-	-	-	2,22,25,26,40
YA065		Poireir, Ray	1974/07/10	462637	1203508	11	18E	17	H	20.5	-	-	-	-	-	-	-	-	-	-	40
YA066	*	Carlson, Sarah	1974/03/06	462442	1203214	11	18E	26	L	26.4	B	16	D	-	900	-	-	38	-	4	2,22,25,40
YA067		Harrah City	-	-	-	11	18E	26	M	32.8	F	448	D	-	-	-	-	189	N	A	42
YA068		Rowe, Maurice	1974/07/10	462421	1203641	11	18E	30	Q	21.5	-	-	-	-	-	-	-	-	-	91	40
YA069		Knight, Rick	1974/07/11	462342	1203238	11	18E	34	J	22.0	-	-	-	-	-	-	-	-	-	-	40
YA070		Barkes, Ray	1971/03/18	-	-	11	18E	34	P	20.0	F	156	D	-	-	-	-	-	-	-	10
YA071		CL & Frank	1974/09/30	462727	1202955	11	19E	07	E	20.5	-	-	-	-	-	-	-	-	-	5	40
YA072		Wapato Irrigation Project	1989/08/25	462643	1202454	11	19E	14	D	23.0	-	20	-	-	-	-	-	227	-	6	40
YA073		Wapato City	-	-	-	11	19E	14	M	22.2	F	305	D	-	-	-	-	5678	P	2	42

GEOTHERMAL DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON--DESCRIPTIVE AND THERMAL DATA FOR WELLS AND SPRINGS.
File Name = GEOTHDB1.WK1 Last updated September 01, 1993, by J.E.S.

I.D. (NEW)	*	SITE NAME	DATE	LAT. N.	LONG. W.	TWP. N.	RNG.	SEC.	PART. SEC.	TEMP. deg.C	TEMP TYPE	DEPTH m	DEPTH TYPE	GRADIENTS(Deg C/Km) A	B	S	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REFERENCES
YA074		Wapato City	-	-	-	11	19E	15	A	20.8	B	179	D	-	41	48	-	-	-	-	2,6,22,25,26
YA075		Johnson, F.	1977/09/19	-	-	11	20E	01	M	28.1	B	457	D	-	38	-	-	-	-	-	2,3,10,22,25,26
YA076		Lynch, B.	1977/06/08	-	-	11	20E	01	R	21.5	B	351	D	-	27	-	-	-	-	-	2,3,10,22,25,26
YA077		Everts & Walsh, John & Don	1982/06/10	462810	1201628	11	20E	02	H	23.5	-	206	-	-	-	-	-	132	-	69	40
YA078		Strothers, Kelly	-	-	-	11	20E	03	H	20.0	F	242	D	-	-	-	-	-	-	111	42
YA079		Young, James	1977/03/22	-	-	11	20E	04	L	22.2	F	155	D	-	-	-	-	-	-	-	10
YA080		Green, Clayton, & Babcock	-	-	-	11	20E	05	R	21.1	F	183	D	-	-	-	-	6900	P	53	42
YA081		Peters, Charles A.	1967/03/02	-	-	11	20E	06	A	22.0	F	190	D	-	49	-	-	-	-	-	10,22,25,26
YA082		Morrison Fruit Co., Inc.	-	-	-	11	20E	10	F	20.0	F	108	D	-	-	-	-	-	-	46	42
YA083		Narduzzi, Ermanno	-	-	-	11	20E	11	J	22.2	F	198	D	-	-	-	-	2271	P	27	42
YA084		Rashford, George B.	-	-	-	11	20E	12	K	22.2	F	248	D	-	-	-	-	1892	P	76	42
YA085		Schmidt Orchards, Inc.	-	-	-	11	20E	13	M	23.3	F	230	D	-	-	-	-	4731	P	43	42
YA086		Soost Brothers	1977/06/30	-	-	11	20E	13	R	29.2	S	366	D	-	52	-	-	-	-	-	2,3,10,22,25,26
YA087		Weatherly, B.	-	-	-	11	21E	05	B	28.5	B	379	D	-	42	40	-	-	-	-	2,22,25,26
YA088		Dahl, T.	-	-	-	11	21E	06	L	29.2	B	364	D	-	47	40	-	-	-	-	2,3,22,25,26
YA089		Valley Farms	-	-	-	11	21E	06	P	25.6	F	364	D	-	-	-	-	4164	P	98	42
YA090		Dahl, T.	-	-	-	11	21E	06	Q	29.6	B	393	D	-	45	40	-	4164	P	-	2,3,22,25,26
YA091		Clyde	-	-	-	11	21E	07	A	33.1	B	510	D	-	41	40	-	-	-	-	2
YA092		Lynch, Bob	-	-	-	11	21E	07	F	30.6	F	-	-	-	-	-	-	1400	P	116	42
YA093		Roza Investment Co.	1983/07/15	462722	1201437	11	21E	07	F	27.5	-	494	-	-	-	-	-	1590	-	149	40
YA094		Garretson	-	46-27.53	120-13.50	11	21E	08	NW4	33.1	B	510	D	31	41	34	52	-	-	-	2,5,26
YA095		Clyde, Pat	-	-	-	11	21E	16	C	24.7	B	269	D	-	-	-	-	-	-	-	3
YA096		DNR Ramsier	1979/11/13	46-26.10	120-12.15	11	21E	16	P	28.1	S	427	D	41	52	40	65	-	-	-	2,3,5,10,26
YA097		Clyde	-	46-26.70	120-13.75	11	21E	17	B	24.8	B	273	D	41	47	-	-	-	-	-	5,26
YA098		Gammie, W./Lloyd Garretson Co.	1980/11/12	-	-	11	21E	17	D	36.1	F	593	D	-	-	-	-	2574	P	127	10,42
YA099		Schmidt, Dave	-	-	-	11	21E	17	Q	28.9	F	489	D	-	-	-	-	1287	P	120	42
YA100		Leach, Meier, Olsen	-	-	-	11	21E	18	R	22.8	F	175	D	-	-	-	-	5678	P	60	42
YA101		Schmidt, Dave	-	-	-	11	21E	18	-	28.9	F	-	-	-	-	-	-	1310	P	120	42
YA102		J J & G Investment	-	-	-	11	21E	20	A	25.0	F	242	D	-	-	-	-	530	P	98	42
YA103		Baldwin, John	-	-	-	11	21E	20	D	20.6	F	313	D	-	-	-	-	-	-	82	42
YA104		Hanrahan, P.	1977/06/20	-	-	11	21E	20	M	22.2	-	207	D	-	54	40	-	-	-	-	2,3,10,22,25,26
YA105		Ambrose Farms	-	-	-	11	21E	21	B	27.0	B	279	D	-	53	40	-	-	-	-	2,22,25,26
YA106		----	-	-	-	11	21E	21	J	20.0	F	184	D	-	-	-	-	1665	P	104	42
YA107		Van Leuven, Miles	-	-	-	11	21E	22	D	20.0	F	261	D	-	-	-	-	-	-	116	42
YA108		Houghton Farms	-	-	-	11	21E	22	E	20.0	F	261	D	-	-	-	-	1703	P	116	42
YA109		Sandlin, J.	-	-	-	11	21E	22	G	24.0	B	304	D	33	40	40	-	-	-	-	2,22,25,26
YA110		Sandlin Farms, Inc., 2	1983/06/09	46-25.84	120-10.53	11	21E	22	G	35.2	B	553	D	29	42	40	44	4164	P	132	2,3,5,26,40,42
YA111		Best, Peter C.	-	-	-	11	21E	22	K	25.6	B	335	D	-	43	40	-	1136	P	121	2,22,25,26,42
YA112		De La Chapelle, Charles	1982/08/21	462451	1200921	11	21E	26	F	25.5	-	291	-	-	-	-	-	3785	-	114	40
YA113		Gay, H.	-	-	-	11	21E	36	K	21.5	B	213	D	-	45	40	-	-	-	-	2,3,22,25,26
YA114		Monson, Arvid	1982/08/20	462510	1200723	11	22E	19	N	21.0	-	257	-	-	-	-	-	49	-	126	40
YA115		----	-	-	-	11	22E	21	N	22.3	B	207	D	-	46	37	-	-	-	-	2,6,22,25,26
YA116		Evans Fruit	-	-	-	11	22E	26	K	30.7	B	469	D	-	40	37	-	-	-	191	2,3,26,42
YA117		Spauld R.	-	46-24.57	120-04.51	11	22E	28	M	21.5	B	210	D	43	43	-	67	-	-	-	5,26
YA118		Rowe Farms	-	-	-	11	22E	29	N	29.6	B	340	D	-	53	-	-	-	-	-	22,25,26
YA119		Rowe Farms	-	-	-	11	22E	29	N	29.6	B	434	D	-	-	37	-	-	-	-	2,3
YA120		De La Chapelle, 2	-	46-25.00	20-07.13	11	22E	30	C	29.9	B	324	D	49	57	-	79	5299	P	173	5,26,42
YA121		De La Chapelle, C.	-	-	-	11	22E	30	G	47.8	B	829	D	-	43	31	-	-	-	-	2,22,25,26
YA122		Shelton, C. L.	1973/06/06	46-32.38	120-46.36	12	16E	12	N	25.2	B	269	D	-	53	41	-	3558	P	-	2,3,5,10,22,25,26
YA123		White	-	-	-	12	16E	15	E	21.5	B	179	D	-	59	-	-	-	-	-	26
YA124		Ridout, Tom	-	-	-	12	16E	17	D	20.0	F	110	D	-	-	-	-	68	P	28	42
YA125		Cohodas-Lancaster-Frank Co.	-	-	-	12	17E	04	N	24.4	F	340	D	-	-	-	-	3134	P	106	42
YA126		Palmer, Don	-	-	-	12	17E	05	H	21.7	F	87	D	-	-	-	-	163	P	59	42
YA127		Catlin, Ida	-	-	-	12	17E	05	J	20.0	F	113	D	-	-	-	-	76	P	68	42
YA128		Hull Ranches, Inc.	-	-	-	12	17E	14	E	·21.1	F	291	D	-	-	-	-	6056	P	31	42
YA129	*	Wiley, Robert	1972/05/22	463201	1204130	12	17E	16	A	22.2	B	265	D	-	39	41	-	4921	-	21	2,22,25,26,40
YA130		Valley Roz Orchards, Inc.	1989/08/17	463025	1203226	12	18E	23	N	26.0	-	418	-	-	-	-	-	-	-	-	40
YA131		Eyle, Alex	1989/08/29	463018	1203207	12	18E	26	C	24.5	-	130	-	-	-	-	-	-	-	117	40
YA132	*	Hansen Fruit	1974/06/14	463007	1203311	12	18E	27	G	23.6	B	305	D	-	38	34	-	-	-	-	2,22,25,26,40
YA133	*	Hansen Fruit	1974/06/14	463008	1203237	12	18E	27	H	29.6	B	311	D	-	57	34	-	5450	-	70	2,22,25,26,40

I.D. (NEW)	*	SITE NAME	DATE	LAT. N.	LONG. W.	TWP. N.	RNG.	SEC.	PART. SEC.	TEMP. deg.C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENTS(Deg.C/Km) A	B	S	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REFERENCES
YA134		Keller, Walter	1989/08/30	462937	1203336	12	18E	27	N	23.5	-	338	-	-	-	-	-	-	-	-	40
YA135		St. Clair, Ray, 2	1965/04/01	462842	1203635	12	18E	31	R	22.2	B	479	D	-	-	-	-	4164	-	64	2,40
YA136	*	Mount Adams Seed, 2	1974/05/23	462907	1203511	12	18E	32	H	25.2	B	358	D	-	37	34	-	2631	-	66	2,22,25,26,40
YA137		St. Clair	-	-	-	12	18E	32	L	27.9	B	379	D	39	40	34	-	-	-	-	2,6,22,25,26
YA138		Nyberg, Herbert	1974/05/23	462930	1203355	12	18E	33	A	25.6	B	290	D	-	47	34	-	5299	-	64	2,22,25,26,40
YA139		Mount Adams Seed, 3	1970/05/11	-	-	12	18E	33	B	28.0	B	323	D	-	51	34	-	-	-	-	2,10,22,25,26
YA140	*	Moxee City	1962/11/02	463306	1202255	12	19E	01	Q	30.0	B	404	D	-	45	41	-	3312	-	-	2,22,25,26,40
YA141		Odom, Matt	1990/03/01	-	-	12	19E	09	Q	23.3	F	43	D	-	-	-	-	76	P	6	10,42
YA142		Laird, Robert	-	-	-	12	19E	09	Q	23.3	F	52	D	-	-	-	-	189	P	6	42
YA143		Bruwlett?	-	-	-	12	19E	11	P	26.7	F	362	D	-	-	-	-	3830	P	33	42
YA144		DNR Gangle	-	-	-	12	19E	16	A	22.0	B	153	D	-	58	-	-	-	-	-	26
YA145		Miocene Petroleum	-	-	-	12	19E	17	C	33.3	S	546	L	-	39	-	-	-	-	-	18,26
YA146		Olson, Dale	-	-	-	12	19E	21	B	20.0	F	-	-	-	-	-	-	2233	P	62	42
YA147		Stark West Orchards	1968/10/03	-	-	12	19E	21	P	20.0	F	110	D	-	-	-	-	2498	P	56	10,42
YA148		Stepniewski	-	-	-	12	19E	27	R	20.6	-	163	L	42	47	-	-	-	-	-	26
YA149		Deeringhoff, F. E.	-	-	-	12	20E	04	P	23.3	F	191	D	-	-	-	-	-	-	-	35
YA150		Buwalda and Haines	-	-	-	12	20E	05	D	20.7	F	194	D	-	-	-	-	962	N	A	35
YA151		Holland No. 2	-	-	-	12	20E	05	M	23.7	F	209	D	-	-	-	-	595	N	A	35
YA152		Regimbal	-	-	-	12	20E	05	Q	22.9	F	210	D	-	-	-	-	1852	N	A	35
YA153		Holland 1	-	-	-	12	20E	05	Q	24.4	F	224	D	-	-	-	-	3398	N	A	35
YA154		Clark 1	-	-	-	12	20E	06	A	22.9	F	287	D	-	-	-	-	2277	N	A	35
YA155		Peck, J. W.	-	-	-	12	20E	06	-	23.3	F	252	D	-	-	-	-	-	-	-	27
YA156		Ellens 1	-	-	-	12	20E	07	H	22.9	F	255	D	-	-	-	-	221	N	A	35
YA157		Dickson	-	-	-	12	20E	08	A	21.5	F	160	D	-	-	-	-	-	-	-	35
YA158		Gano, James H.	-	-	-	12	20E	08	C	25.6	F	259	D	-	-	-	-	-	-	-	35
YA159		Longevin 2	-	-	-	12	20E	08	F	22.6	F	255	D	-	-	-	-	1370	N	A	35
YA160		Longevin 1	-	-	-	12	20E	08	F	22.3	F	194	D	-	-	-	-	680	N	A	35
YA161		Haines	-	-	-	12	20E	08	J	22.3	F	275	D	-	-	-	-	1672	N	A	35
YA162		Sauve, J.	-	-	-	12	20E	08	R	24.0	F	311	D	-	-	-	-	807	N	A	35
YA163		Walters, David	-	-	-	12	20E	08	-	27.2	F	366	D	-	-	-	-	-	-	-	27
YA164		Bradford	-	-	-	12	20E	09	C	22.9	F	190	D	-	-	-	-	1536	P	1	35
YA165		Allwardt	-	-	-	12	20E	09	P	22.3	F	247	D	-	-	-	-	1087	N	A	35
YA166		Allwardt, Mona and Carl	-	-	-	12	20E	09	P	20.0	F	294	D	-	-	-	-	2650	P	1	42
YA167		Hill, E. S.	-	-	-	12	20E	09	-	23.3	F	191	D	-	-	-	-	-	-	-	27
YA168		S. Martinez Livestock, Inc.	-	-	-	12	20E	12	R	30.0	F	824	D	-	-	-	-	-	-	4	42
YA169		Charron, S.	-	-	-	12	20E	13	Q	27.9	B	376	D	36	42	40	-	-	-	-	2,3,22,25,26
YA170		Roy Farms, Inc.	-	-	-	12	20E	15	A	25.6	F	640	D	-	-	-	-	-	-	27	42
YA171		----	-	-	-	12	20E	16	D	21.0	B	154	-	-	58	-	-	-	-	-	22,25
YA172		DNR Elephant Mountain	-	46-31.56	120-19.54	12	20E	16	L	29.2	B	418	D	42	44	40	66	-	-	-	2,5,26
YA173		Brulotte, L.	-	-	-	12	20E	18	B	20.6	F	316	D	-	-	-	-	5678	P	17	42
YA174		Logan	-	-	-	12	20E	27	M	27.5	B	409	D	48	35	-	-	-	-	-	2,6,22,25,26
YA175		Logan, W.	-	-	-	12	20E	27	N	30.8	B	396	D	-	46	48	-	-	-	-	2,3,22,25,26,33
YA176		Clinger, Jasper	-	-	-	12	20E	29	AorH	24.4	F	118	D	-	-	-	-	4	P	114	42
YA177		Brooks, Lonnie	1983/07/15	462914	1202122	12	20E	31	H	27.2	F	354	D	-	-	-	-	946	P	57	40,42
YA178		Estes, M.	-	-	-	12	20E	34	N	25.9	B	274	D	-	51	48	-	-	-	-	2,3,22,25,26
YA179		Estes, Marvin	1978/03/09	-	-	12	20E	34	N	33.1	B	430	D	-	49	48	-	-	-	44	2,3,10,22,25,26,42
YA180		DNR Cheyne Rd.	1979/10/19	46-28.64	120-15.78	12	20E	36	P	29.0	L	547	D	46	49	-	51	2082	P	-	2,3,5,10,26,42
YA181		DNR	-	46-31.52	120-11.94	12	21E	16	L	25.1	B	235	D	46	-	-	65	-	-	-	2,5
YA182		DNR Martinez	-	-	-	12	21E	16	L	26.7	S	230	L	48	55	-	-	11544	P	25	26,42
YA183		Martinez, D.	-	-	-	12	21E	17	L	28.3	B	473	D	-	33	-	-	-	-	-	2,3,22,25,26
YA184		S. Martinez Livestock, Inc.	-	-	-	12	21E	17	P	21.1	F	245	D	-	-	-	-	3936	P	64	42
YA185		Martinez Livestock, Inc., 4	1983/07/14	463118	1201258	12	21E	17	Q	27.0	-	472	-	-	-	-	-	-	-	5	40
YA186		Martinez, 1	-	-	-	12	21E	19	SE4	21.7	F	288	D	-	-	-	-	4164	P	64	42
YA187		Martinez, D. T., 1	-	-	-	12	21E	20	D	24.4	B	315	D	-	39	-	-	-	-	-	2,3,6
YA188		Griswald, P.	-	-	-	12	21E	20	P	25.2	B	315	D	-	39	40	-	-	-	-	2,6,22,25,26,33
YA189		Martinez, Simon	-	-	-	12	21E	22	L	21.1	F	202	D	-	-	-	-	8172	P	26	42
YA190		Ekerich, W. M.	-	-	-	12	21E	29	L	22.2	F	259	D	-	-	-	-	2271	P	122	42
YA191		Marley Orchards	-	-	-	12	22E	02	R	23.1	-	267	L	-	42	-	-	-	-	-	22,25,26
YA192		Changala, Steve	-	46-31.25	120-00.71	12	22E	13	P	30.7	B	518	D	37	40	42	53	7059	P	53	2,5,26,42
YA193		Marley Orch. Black Rock Ranch	-	-	-	12	22E	21	A	31.1	F	747	D	-	-	-	-	-	-	114	42

I.D. (NEW)	SITE NAME	DATE	LAT. N.	LONG. W.	TWP. N.	RNG.	SEC.	PART. SEC.	TEMP. deg.C	TEMP TYPE	DEPTH m	DEPTH TYPE	GRADIENTS(Deg.C/Km) A	B	S	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REFERENCES
YA194	Marley Orchards	1983/07/14	463027	1200452	12	22E	21	N	23.0	-	436	-	-	-	-	-	-	-	-	40
YA195	Marley Orchards	-	-	-	12	22E	21	R	22.8	B	270	D	-	-	42	-	5488	P	-	2,3
YA196	Changala, S.	-	-	-	12	22E	29	B	23.0	B	430	D	-	26	-	-	2650	P	-	2,3,22,25,26,33
YA197	DNR Black Rock 1	-	-	-	12	23E	16	J	25.6	B	351	D	-	58	42	-	7930	P	136	2,3,26,42
YA198	Black Rock	-	46-31.43	119-56.65	12	23E	16	K	25.0	B	225	D	51	-	-	-	-	-	-	5
YA199	—	-	-	-	12	23E	17	P	20.3	S	206	L	-	40	42	-	-	-	-	2,26
YA200	Pyramid Orchards, 1	1983/07/13	463606	1204549	13	16E	24	H	27.5	-	448	-	-	-	-	-	2271	-	43	40
YA201	Pyramid Orchards, Inc.	-	-	-	13	16E	24	-	25.6	F	376	D	-	-	-	-	2332	P	24	42
YA202	Barcott, Mark	-	-	-	13	17E	11	N	26.7	F	123	D	-	-	-	-	102	P	79	42
YA203	Pyramid Orchards	1983/07/13	463603	1204532	13	17E	19	E	28.0	-	244	-	-	-	-	-	341	-	107	40
YA204	Clark, Christopher	-	-	-	13	17E	21	G	20.6	F	107	D	-	-	-	-	140	P	70	42
YA205	Lowary, Kim	-	-	-	13	17E	23	E	24.4	F	73	D	-	-	-	-	102	P	58	42
YA206	Carrell	-	-	-	13	18E	12	A	24.8	B	201	D	-	61	-	-	-	-	-	2,6,22,25,26
YA207	Nob Hill Water Co., 3	1983/07/13	463642	1203710	13	18E	18	K	22.5	F	320	D	-	-	-	-	9932	P	84	40,42
YA208	Yakima County Detention Center	-	-	-	13	18E	19	G	23.3	F	248	D	-	-	-	-	7040	P	12	42
YA209	Yakima Creamery well	-	-	-	13	18E	24	K	33.9	B	513	D	-	43	43	-	-	-	-	2,18,26
YA210	Congdon Orchards	1984/11/08	-	-	13	18E	29	H	32.8	F	617	D	-	-	-	-	946	N	A	10,42
YA211	Wilson, George	-	-	-	13	18E	29	Q	26.7	F	386	D	-	-	-	-	1274	N	A	13,35
YA212	Hull Orchards, Inc.	-	-	-	13	18E	31	N	21.1	F	354	D	-	-	-	-	2324	P	56	42
YA213	Nob Hill Water Assoc.	-	-	-	13	18E	32	NE4	21.1	F	259	D	-	-	-	-	-	N	A	42
YA214	Yakima City, Kissel Park Well	1991/04/24	-	-	13	18E	35	D	20.6	F	357	D	-	-	-	-	-	N	A	10,42
YA215	Ostrander, Terry L.	-	-	-	13	19E	09	N	21.1	F	180	D	-	-	-	-	-	-	105	42
YA216	Yakima Sheep Co.	-	-	-	13	19E	10	R	20.0	F	104	D	-	-	-	-	-	-	29	42
YA217	Yakima County Dump	-	-	-	13	19E	13	L	24.4	F	-	-	-	-	-	-	2650	P	101	42
YA218	Terrace Heights	-	-	-	13	19E	13	Q	25.0	B	251	D	-	47	41	-	-	-	-	2,22,25,26
YA219	Watkins 3	-	46-37.10	120-24.30	13	19E	14	A	20.3	B	211	D	27	39	41	39	-	-	-	2,5,26
YA220	Hardy, Dorothy	-	-	-	13	19E	16	C	20.0	F	146	D	-	-	-	-	1628	P	68	42
YA221	Country Club Dist. Water Co.	-	-	-	13	19E	16	R	23.9	F	456	D	-	-	-	-	4769	P	31	42
YA222	Cascade Lumber Company (1925)	-	-	-	13	19E	18	-	21.1	F	764	D	-	-	-	-	568	N?	A?	42
YA223	Yakima County(heat pump well)	-	-	-	13	19E	19	D	23.3	F	249	D	-	-	-	-	-	-	12	42
YA224	Yakima Country Club, Inc.	-	-	-	13	19E	22	F	22.8	F	220	D	-	-	-	-	3596	P	28	42
YA225	Country Club	-	-	-	13	19E	22	M	20.0	B	82	D	70	91	-	-	-	-	-	2,6,22,25,26
YA226	Rasmussen	-	-	-	13	19E	24	A	20.0	B	230	D	26	35	41	-	-	-	-	2,22,25,26
YA227	Yakima Sheep Co.	-	-	-	13	19E	24	B	44.5	B	230	D	-	-	-	-	1514	P	114	2,42
YA228	Sundquist Fruit	-	-	-	13	20E	19	N	22.1	B	255	D	-	40	41	-	13342	P	80	2,3,22,25,26,42
YA229	Champoux	-	46-36.15	120-21.20	13	20E	20	F	23.3	B	215	D	52	52	41	77	-	-	-	2,5,26
YA230	Fay, Gerald	1983/07/13	463510	1202129	13	20E	28	E	22.5	-	206	-	-	-	-	-	-	-	85	40
YA231	Moxee School District No. 90	-	-	-	13	20E	29	D	22.8	B	180	D	-	61	41	-	1041	P	104	2,6,22,25,26,42
YA232	Yergen, R.	-	-	-	13	20E	30	A	24.2	B	289	D	-	42	41	-	-	-	-	2,3,26
YA233	Clark 4	-	-	-	13	20E	31	K	22.9	F	293	D	-	-	-	-	335	N	A	35
YA234	Clark 3	-	-	-	13	20E	31	L	24.2	F	305	D	-	-	-	-	883	N	A	35
YA235	Clark 2	-	-	-	13	20E	31	L	24.6	F	313	D	-	-	-	-	255	N	A	35
YA236	Coombs	-	-	-	13	20E	33	L	23.2	B	227	D	39	48	41	-	-	-	-	2,22,25,26
YA237	Coombs, B., 2	-	-	-	13	20E	33	M	30.2	B	446	D	-	41	41	-	-	-	-	2,3,26
YA238	Larson Fruit	-	-	-	13	20E	33	N	27.8	F	496	D	-	-	-	-	-	-	45	42
YA239	Smith, Darrell, W.	-	-	-	13	20E	34	R	21.1	F	184	D	-	-	-	-	341	P	92	42
YA240	Martinez	-	46-34.35	120-10.29	13	21E	34	H	21.2	B	290	D	33	40	-	52	-	-	-	5,26
YA241	Martinez, D. T., 2	-	-	-	13	21E	34	H	23.8	B	313	D	-	41	-	-	-	-	-	2,3,6,22,25,26
YA242	Changala, S., 2	-	-	-	13	22E	13	B	30.7	B	517	D	-	-	-	-	-	-	-	2
YA243	DNR 81 Tieton	-	46-40.39	121-01.76	14	14E	25	E	24.2	B	153	D	93	92	-	87	-	-	-	5,26
YA244	Rowe Farms, Inc.	-	-	-	14	17E	13	Q	20.6	F	207	D	-	-	-	-	-	-	78	42
YA245	Muzzall, Steve	-	-	-	14	17E	24	F	23.3	F	75	D	-	-	-	-	57	P	64	42
YA246	Fisher, Harland	-	-	-	14	18E	14	Q	20.0	F	111	D	-	-	-	-	76	P	36	42
YA247	French, Bruce	1983/07/12	464201	1203353	14	18E	15	L	20.5	-	235	-	-	-	-	-	95	-	126	40
YA248	Bauman, Ed.	-	-	-	14	18E	15	P	21.1	F	75	D	-	-	-	-	163	P	19	42
YA249	Zirkle, W. H.	-	-	-	14	18E	20	G	29.5	B	325	D	-	52	-	-	-	-	-	2,3,22,25,26,37
YA250	Strawn Nursing	1982/06/09	463941	1203645	14	18E	32	E	20.5	-	24	-	-	-	-	-	341	-	7	40
YA251	Eberle, Robert	-	-	-	14	18E	32	Q	22.2	F	17	D	-	-	-	-	114	P	1	42
YA252	WA State Hwy. 539	1982/08/17	464245	1202451	14	19E	11	L	20.0	-	190	-	-	-	-	-	144	-	116	40
YA253	Roche Fruit Company	-	-	-	14	19E	16	N	23.2	B	268	D	-	46	-	-	-	-	-	2,3,22,25,26

I.D. (NEW)	*	SITE NAME	DATE	LAT. N.	LONG. W.	TWP. N.	RNG.	SEC.	PART. SEC.	TEMP. deg.C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENTS(Deg.C/Km) A	B	S	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REFERENCES
YA254		Roche Fruit Co.	-	-	-	14	19E	17	P	27.8	F	460	D	-	-	-	-	4164	N	A	42
YA255		----	-	-	-	14	19E	20	H	21.7	F	123	D	-	-	-	-	2506	P	-	42
YA256	*	US Army, Yakima Firing Cen., 1	1955/10/05	464036	1202709	14	19E	28	B	21.0	B	183	D	-	54	-	-	-	-	4	2,22,25,26,40,41
YA257		----	-	-	-	15	17E	25	R	29.2	B	598	-	-	29	-	-	-	-	-	34
YA258		DNR Wenas	-	-	-	15	17E	36	A	30.1	B	598	D	34	33	30	-	-	-	-	2,26

NOTES:

The I.D. number for a site consists of a two-letter county code *followed by a three-digit serial number. When the I.D. number* has an "S" at the end the site is a spring, spring system, lake, lava dome, or area of fumaroles. Otherwise the site is a well. The county codes are: AD - Adams, AS - Asotin, BE - Benton, CH - Chelan, CL - Clallam, CK - Clark, CO - Columbia, CZ - Cowlitz, DO - CZ - Cowlitz, DO - Douglas, FR - Franklin, GA - Garfield, GR - Grant, GY - Grays Harbor, Grant, GY - Grays Harbor, KI - King, KS - Kittitas, KT - Klickitat, LE - Lewis, LI - Lincoln, OK - Okanogan, PI - Pierce, SK - Skamania, SN - Snohomish, SP - Spokane, WA - Walla Walla, WH - Whatcom, WT - Whitman, YA - Yakima.

For those wells and springs with an asterisk (*) before the site name there is a chemical analysis (or analyses) in the table "CHEMICAL DATA FOR WELLS AND SPRINGS".

Latitude and Longitude are given in decimal degrees.

PARTIAL SECTION: Written as quarter-section of quarter-section, using the system of the U.S.G.S. Water Resources Branch where the section is divided into sixteen quarter-quarters which are lettered in the same manner as sections in a township. The pattern is shown below.

D C B A
E F G H
M L K J
N P Q R.

NE4, NW4, SW4, and SE4 signify the northeast, northwest, southwest, and southeast quarters of a section, respectively. W2 and E2 are *west one-half and east one-half. Locations were plotted at* the center of the sixteenth section unless the 1:100,000-scale showed a well, spring, etc., in that sixteenth section, in which case the location was plotted at the well, spring, etc.

TEMPERATURE TYPE: B = bottom-hole temperature or near-bottom-hole temperature; F = flowing temperature; M = maximum temperature; S = temperature measured short of well bottom, and - = other or unknown.

DEPTH TYPE: D = drilled depth or near drilled depth; L = logged depth; - = other or unknown.

GRADIENT TYPE: A = gradient estimated from linear segment of well log; B = gradient estimated from a bottom-hole temperature or the deepest logged temperature and an estimated or calculated mean annual surface temperature; S = statistically determined gradient.

FLOW TYPE: A = artesian; N = natural; P = pumped, bailed, or air-driven; - = other, no flow, or unknown.

S.W.L.: Static water level, meters from surface.

REFERENCES: See file named GEOTHDB5.WK1.

I.D. (NEW)	SITE NAME	DATE	TWP. N.	RGE.	SEC.	PART. SEC.	pH	CONDUCT umhos/cm	TDS ppm	Na ppm	K ppm	Ca ppm	Mg ppm	Fe ppm	Al ppm	SiO2 ppm	B ppm	Li ppm	HCO3 ppm	SO4 ppm	Cl ppm	F ppm	H2S ppm	CO3 ppm	NO3 ppm	CHARGE BALANCE	MASS BALANCE	REF.
AD00																												
AD000	ADAMS COUNTY																											
AD001	CMSP&P RR	1960/10/18	15	28E	08	E	7.9	416	292	34	10	30	14.0	0.6	-	65	-	-	196	41.0	10.0	0.6	-	0	0.7	1.01	0.97	41
AD002	US Bureau of Reclamation	1971/10/06	15	28E	15	D	7.7	-	316	54	29	10	4.7	-	-	68	0.07	0.34	180	49.0	13.0	0.8	-	-	-	1.10	1.00	40
AD005	Othello City 2	1955/08/02	15	29E	03	C	8.4	-	279	77	13	4	1.8	-	-	54	0.05	-	170	23.0	16.0	-	-	-	-	0.93	1.02	40
AD006	Othello City 4	1970/10/27	15	29E	03	J	8.2	-	288	70	13	8	4.8	-	-	56	0.06	0.02	180	30.0	14.0	1.8	-	-	-	0.99	1.01	40
AD009	Othello City 1	1942/04/27	15	29E	04	A	-	397	287	78	12	4	3.5	0.0	-	52	-	-	183	28.0	15.0	2.6	-	0	0.1	1.01	1.01	41
AD023	Phillips, Robert, 4	1983/05/20	15	32E	07	J	8.3	348	-	57	7	9	4.9	0.0	-	66	-	-	172	18.0	9.8	1.8	-	0	0.2	1.03	0.00	16
AD036	Othello City 3	1961/05/04	16	29E	34	R	8.6	393	294	81	12	3	0.8	0.0	-	62	-	-	170	27.0	14.0	2.8	-	6	0.0	1.02	1.01	41
AD089	Jungblom Ranch	1983/05/19	18	31E	33	D	9.3	400	-	89	7	2	0.1	0.1	-	110	-	-	172	12.0	13.0	4.1	-	22	0.1	1.07	0.00	16
AD100	Warden Hutterian Brethern, 7	1983/05/25	19	33E	07	R	8.8	310	-	62	8	4	1.7	0.0	-	66	-	-	172	7.8	6.8	2.6	-	5	0.1	1.08	0.00	16
AS00																												
AS000	ASOTIN COUNTY																											
AS001a	Washington Water Power Co., 2	1959/10/28	10	46E	05	Q	8.4	-	202	42	10	7	0.2	-	-	66	-	-	110	8.9	7.8	1.1	-	-	-	0.95	1.03	40
AS001b	Washington Water Power Co., 2	1959/10/28	10	46E	05	Q	8.4	248	199	42	10	7	0.2	0.0	-	65	-	-	113	8.9	7.8	1.1	-	5	0.1	1.04	0.98	41
AS008a	Washington Water Power Co., 5	1962/10/30	11	46E	30	Q	8.2	-	241	49	11	11	1.0	-	-	66	-	-	130	25.0	12.0	0.9	-	-	-	1.01	1.00	40
AS008b	Washington Water Power Co., 5	1962/10/30	11	46E	30	Q	8.3	303	-	49	11	11	1.0	0.0	0.20	66	-	-	128	25.0	12.0	0.9	-	2	0.0	1.02	0.00	31
BE00																												
BE000	BENTON COUNTY																											
BE001	S P & S Ry	1966/07/18	04	24E	03	B	8.0	460	306	92	7	9	0.7	1.0	-	48	-	-	225	0.0	34.0	1.6	-	0	0.1	1.02	1.01	31
BE005	US Army Corps of Engineers	1971/09/24	05	28E	06	R	8.2	-	355	98	18	7	1.9	0.0	0.00	60	0.10	0.27	210	35.0	32.0	1.7	-	-	-	0.99	0.99	40
BE015a	WDOE Tst./Obs., Piezometer C	1972/08/03	07	25E	36	N	8.2	-	317	88	14	8	1.4	-	0.01	61	-	-	220	18.0	17.0	1.1	-	-	-	0.98	1.00	40
BE015b	WDOE Tst./Obs., Piezometer C	1972/08/04	07	25E	36	N	8.2	-	321	92	14	5	1.4	-	0.01	61	-	-	230	18.0	18.0	1.2	-	-	-	1.02	0.99	40
BE015c	WDOE Tst./Obs., Piezometer C	1972/10/05	07	25E	36	N	8.2	-	298	81	14	6	1.7	-	0.01	52	-	-	210	24.0	16.0	1.1	-	-	-	1.05	1.00	40
BE031	Mott, Studer	1970/11/17	08	29E	22	A	7.3	-	922	58	17	100	72.0	-	-	53	0.03	0.03	180	510.0	16.0	0.4	-	-	-	1.01	1.01	40
BE043	Christen	1970/10/12	09	26E	27	K	7.8	-	286	32	9	30	12.0	-	-	59	0.16	0.02	160	54.0	12.0	0.4	-	-	-	1.01	1.00	40
BE067	US Government	1970/11/19	11	26E	34	R	8.8	-	394	120	15	1	0.0	-	-	75	0.49	0.02	150	0.0	81.0	8.5	-	-	-	0.93	1.05	40
BE073	Roberts Bros.	1970/09/11	12	24E	20	N	8.0	-	202	21	8	18	11.0	-	-	56	0.02	0.02	170	0.2	3.8	0.6	-	-	-	1.02	1.00	40
BE075	US Government	1977/04/27	12	26E	04	N	7.7	-	262	17	5	43	15.0	0.0	0.10	50	0.02	0.01	170	39.0	8.3	0.4	-	-	-	0.92	1.00	40
BE077	US Government	1976/04/08	12	26E	07	Q	7.7	-	307	28	7	51	16.0	0.0	0.01	39	0.02	0.01	240	30.0	16.0	0.4	-	-	-	0.97	1.01	40
BE078	US Government	1979/04/19	12	26E	08	P	7.9	-	254	23	6	40	11.0	-	-	43	-	-	180	28.0	14.0	0.4	-	-	-	0.99	1.00	40
BE079	AEC	1979/04/17	12	26E	09	L	7.8	-	255	21	6	40	13.0	-	-	47	-	-	180	32.0	7.7	0.4	-	-	-	0.95	1.00	40
BE080	US Government	1976/04/08	12	26E	12	H	8.0	-	270	41	8	25	7.9	0.0	0.01	48	0.03	0.02	180	45.0	3.6	0.6	-	-	-	1.04	1.01	40
BE082	US Government	1979/04/17	12	26E	13	H	7.9	-	272	31	6	35	12.0	-	-	43	-	-	140	59.0	16.0	0.6	-	-	-	0.95	1.00	40
BE083	US Government	1978/04/20	12	26E	14	D	7.8	-	286	21	6	50	15.0	-	-	40	-	-	200	47.0	8.2	0.5	-	-	-	0.95	1.00	40
BE084a	US Government	1976/04/09	12	26E	15	C	7.8	-	276	25	6	41	12.0	0.0	0.01	40	0.02	0.01	210	41.0	7.3	0.4	-	-	-	1.07	1.00	40
BE084b	US Government	1977/04/28	12	26E	15	C	7.7	-	280	24	6	46	14.0	0.0	0.10	44	0.02	0.01	210	34.0	7.7	0.5	-	-	-	0.96	1.00	40
BE084c	US Government	1978/04/20	12	26E	15	C	7.8	-	278	24	6	47	14.0	-	-	42	-	-	210	33.0	7.8	0.5	-	-	-	0.95	1.00	40
BE084d	US Government	1979/04/20	12	26E	15	C	7.8	-	278	25	6	41	12.0	-	-	46	-	-	220	32.0	7.6	0.5	-	-	-	1.07	1.00	40
BE085	US Government	1979/04/20	12	26E	15	J	8.0	-	259	21	5	38	12.0	-	-	45	-	-	200	33.0	6.3	0.4	-	-	-	1.08	1.00	40
BE086	US Government	1976/04/08	12	26E	18	E	7.8	-	203	16	4	28	12.0	0.1	0.01	30	0.02	0.01	140	27.0	16.0	0.4	-	-	-	1.05	1.00	40
BE087	US Government	1979/04/19	12	26E	18	G	7.8	-	220	19	4	32	9.8	-	-	45	-	-	150	24.0	12.0	0.5	-	-	-	1.01	1.00	40
BE092	AEC	1979/04/16	12	27E	18	C	7.9	-	256	31	7	32	11.0	-	-	45	-	-	140	50.0	11.0	0.6	-	-	-	0.92	1.00	40
BE095a	US Government	1951/11/30	13	24E	25	E	7.8	-	233	27	9	19	12.0	-	-	65	-	-	190	1.8	5.8	0.5	-	-	-	1.02	1.00	40
BE095b	US Government	1951/11/30	13	24E	25	E	7.8	291	215	27	9	19	12.0	0.0	-	65	-	-	189	1.8	5.8	0.5	-	0	0.1	1.02	0.92	41
BE095c	US Government	1970/08/27	13	24E	25	E	8.0	-	212	26	7	18	11.0	-	-	56	0.09	0.02	180	0.2	4.4	0.7	-	-	-	1.01	1.00	40
BE097	US Govt./Meeker	1951/12/01	13	24E	26	G	7.8	292	218	27	7	20	12.0	0.1	-	60	-	-	193	1.5	5.5	0.5	-	0	0.0	1.03	0.96	41
BE098	----	1951/12/01	13	24E	26	G	7.8	-	228	27	7	20	12.0	-	-	60	-	-	190	1.5	5.5	0.5	-	-	-	1.02	1.01	40
BE099a	US Government	1951/11/29	13	24E	36	D	7.7	277	213	29	7	18	11.0	0.0	-	64	-	-	184	1.8	5.4	0.6	-	0	0.1	1.02	0.94	41
BE099b	US Government	1951/11/29	13	24E	36	D	7.7	-	227	29	7	18	11.0	-	-	64	-	-	180	1.8	5.4	0.6	-	-	-	1.00	1.01	40
BE100	US Government	1953/09/21	13	25E	01	N	7.6	296	216	22	11	19	11.0	0.1	-	39	-	-	143	23.0	8.0	0.4	-	0	0.0	1.01	1.06	31
BE101	US Government	1979/04/18	13	25E	03	Q	7.5	-	196	9	5	33	7.5	-	-	37	-	-	120	42.0	3.9	0.2	-	-	-	1.08	1.00	40
BE102	Hanford, 199-B4-4	1977/04/27	13	25E	11	H	7.6	-	218	10	5	43	5.9	0.0	0.10	46	0.02	0.01	120	42.0	6.6	0.2	-	-	-	0.96	1.00	40
BE105a	US Government/McGee, Chester	1951/12/01	13	25E	30	G	7.8	-	224	30	10	17	9.4	-	-	62	0.05	-	180	1.6	4.8	0.6	-	-	-	1.01	1.00	40
BE105b	US Government/McGee, Chester	1953/09/02	13	25E	30	G	7.7	289	216	30	6	18	10.0	0.1	-	64	-	-	180	2.1	5.2	0.7	-	0	0.2	1.01	0.96	41
BE105c	US Government/McGee, Chester	1953/09/02	13	25E	30	G	7.7	-	225	30	6	18	10.0	-	-	64	-	-	180	2.1	5.2	0.7	-	-	-	1.01	1.00	40
BE105d	US Government/McGee, Chester	1954/10/28	13	25E	30	G	7.4	-	226	30	8	17	9.4	-	-	67	-	-	180	2.1	5.1	0.6	-	-	-	1.03	0.99	40
BE105e	US Government/McGee, Chester	1956/10/24	13	25E	30	G	8.0	-	220	30	8	17	9.3	-	-	62	-	-	180	0.4	4.8	0.7	-	-	-	1.02	1.00	40
BE105f	US Government/McGee, Chester	1970/08/27	13	25E	30	G	8.1	-	211	30	9	16	8.9	-	-	56	0.11	0.02	170	0.0	4.4	0.7	-	-	-	0.98	1.01	40
BE105g	US Government/McGee, Chester	1970/09/08	13	25E	30	G	8.1	-	211	30	8	16	8.8	-	-	57	0.07	0.02	170	0.0	4.5	0.7	-	-	-	0.99	1.01	40
BE105h	US Government/McGee, Chester	1977/04/27	13	25E	30	G	8.0	-	209	29	8	17	9.2	0.1	0.10	55	0.02	0.02	170	1.4	4.5	0.8	-	-	-	0.99	1.00	40
BE109	US Government	1979/04/17	13	26E	31	R	8.0	-	260	14	4	41	17.0	-	-	43	-	-	120	62.0	20.0	0.4	-	-	-	0.93	1.00	40
BE112a	US Government	1969/05/10	13	26E	35	H	8.5	-	256	79	8	2	0.3	-	-	53	0.06	-	210	0.4	3.9	1.0	-	-	-	0.97	1.02	40
BE112b	US Government	1969/07/14	13	26E	35	H	8.9	-	401	130	3	0	0.0	-	-	67	0.38	-	160	21.0	68.0	11.0	-	-	-	0.98	1.06	40
BE117	US Government	1979/04/18	14	26E	23	D	7.7	-	220	12	4	39	8.4	-	-	40	-	-	110	46.0	16.0	0.2	-	-	-	1.00	1.00	40
BE119	Hanford 199-K-19	1979/04/18	14	26E	32	L	8.1	-	145	3	2	34	4.3	-	-	14	-	-	87	42.0	2.6	0.2	-	-	-	1.07	1.00	40
BE122	US Government	1979/04/17	14	27E	33	G	7.8	-	147	4	3	34	4.5	-	-	26	-	-	120	14.0	2.6	0.1	-	-	-	1.02	1.00	40
CL00																												
CL000	CLALLAM COUNTY																											

GEOTHERMAL DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON -- CHEMICAL DATA FOR WELLS AND SPRINGS.
File Name = GEOTHDB3.WK1 Last updated September 03, 1993, by J.E.S.

I.D. (NEW)	SITE NAME	DATE	TWP. N.	RGE.	SEC.	PART. SEC.	pH	CONDUCT umhos/cm	TDS ppm	Na ppm	K ppm	Ca ppm	Mg ppm	Fe ppm	Al ppm	SiO2 ppm	B ppm	Li ppm	HCO3 ppm	SO4 ppm	Cl ppm	F ppm	H2S ppm	CO3 ppm	NO3 ppm	CHARGE BALANCE	MASS BALANCE	REF.
CL001Sa	Olympic Hot Springs	-	29	08W	27	K	9.5	-	244	72	1	1	-	-	-	66	0.80	-	175	5.0	11.0	1.2	14.0	-	-	1.06	0.95	3
CL001Sb	Olympic Hot Springs	-	29	08W	27	K	9.5	-	-	72	1	1	LD	-	-	66	0.82	0.04	175	5.0	11.0	1.2	-	-	-	1.06	0.00	1
CL002Sa	Sol Duc Hot Springs(1)	-	29	09W	32	C	7.9	380	-	75	2	1	0.0	-	-	80	1.30	0.10	137	34.0	20.0	1.0	-	-	-	1.06	0.00	2
CL002Sb	Sol Duc Hot Springs(2)	-	29	09W	32	C	8.4	360	-	74	3	1	0.0	-	-	-	1.30	0.10	129	35.0	18.0	1.0	-	-	-	1.03	0.00	2
CL002Sc	Sol Duc Hot Springs	-	29	09W	32	C	9.5	-	-	80	1	1	-	0.0	-	60	1.40	0.05	181	7.0	21.0	1.7	-	-	-	1.08	0.00	1
CL002Sd	Sol Duc Hot Springs	-	29	09W	32	C	9.5	-	262	80	1	1	-	-	-	60	1.40	-	181	7.0	21.0	1.7	10.0	-	-	1.09	0.96	3
CO00																												
CO000	COLUMBIA COUNTY																											
CO003a	Ferrel, Robert	1954/08/02	13	38E	26	E	7.5	-	260	9	3	23	9.6	0.1	0.02	-	0.03	-	122	11.0	10.6	-	-	-	-	1.07	2.07	3
CO003b	Ferrel, Robert	1961/01/27	13	38E	26	E	7.6	-	189	9	6	24	8.8	-	-	67	-	-	140	2.8	2.0	0.5	-	-	-	1.00	1.00	4
CO003c	Ferrel, Robert	1961/01/27	13	38E	26	E	7.6	227	194	9	6	24	8.8	0.0	-	67	-	-	140	2.8	2.0	0.5	-	-	-	1.00	1.03	31,4
FR00																												
FR000	FRANKLIN COUNTY																											
FR002	Pasco Navy Base/Port of Pasco	1970/08/28	09	30E	18	J	8.6	-	346	120	11	2	0.5	-	-	54	0.10	0.02	280	0.0	15.0	1.8	-	-	-	0.92	1.01	4
FR026	US Bureau of Reclamation	1953/01/01	12	29E	28	F	8.0	-	173	46	6	9	4.6	-	-	-	-	-	120	35.0	11.0	1.0	-	-	-	1.03	1.00	4
FR031	US Bureau of Reclamation	1970/11/10	13	28E	13	N	8.6	-	288	78	17	1	0.4	-	-	67	0.12	0.02	180	19.0	14.0	2.2	-	-	-	1.00	1.00	4
FR043a	US Govt./Othello AFB	1955/09/29	14	29E	09	A	8.1	-	264	44	8	20	9.9	-	-	55	-	-	190	24.0	11.0	0.9	-	-	-	1.03	0.99	4
FR043b	US Govt./Othello AFB	1956/09/13	14	29E	09	A	8.1	-	269	44	8	20	10.0	-	-	56	-	-	190	25.0	13.0	1.0	-	-	-	1.05	1.00	4
FR043c	US Govt./Othello AFB	1960/10/19	14	29E	09	A	8.0	-	270	43	8	21	11.0	-	-	56	-	-	180	29.0	10.0	1.0	-	-	-	0.98	1.01	4
FR043d	US Govt./Othello AFB	1960/10/19	14	29E	09	A	8.0	411	282	43	8	21	11.0	0.0	-	56	-	-	185	29.0	10.0	1.0	-	-	-	1.00	1.04	4
FR043e	US Govt./Othello AFB	1962/10/09	14	29E	09	A	7.9	-	269	45	8	20	10.0	-	-	57	-	-	190	24.0	11.0	1.0	-	-	-	1.02	1.00	4
FR043f	US Govt./Othello AFB	1964/04/29	14	29E	09	A	7.8	-	280	44	8	22	11.0	-	-	57	-	-	180	33.0	14.0	1.0	-	-	-	1.00	1.00	4
FR043g	US Govt./Othello AFB	1965/01/26	14	29E	09	A	7.9	-	275	43	8	21	12.0	-	-	55	-	-	190	31.0	13.0	1.0	-	-	-	1.03	0.99	4
FR043h	US Govt./Othello AFB	1967/02/13	14	29E	09	A	8.1	-	243	44	8	20	11.0	-	-	28	-	-	180	28.0	14.0	1.0	-	-	-	1.01	1.00	4
FR052	Connell City 4	1970/09/24	14	31E	36	J	8.8	-	273	72	9	3	0.3	-	-	70	0.07	0.02	140	27.0	11.0	1.7	-	-	-	0.93	1.04	4
GA00																												
GA000	GARFIELD COUNTY																											
GA002a	Pomeroy City 4	1959/10/28	12	42E	31	L	8.0	-	157	10	6	16	2.3	-	-	74	-	-	90	3.1	1.8	0.4	-	-	-	1.05	1.00	4
GA002b	Pomeroy City 4	1959/10/28	12	42E	31	L	8.0	162	154	10	6	16	2.3	0.0	-	74	-	-	90	3.1	1.8	0.4	-	-	-	1.05	0.98	31,4
GR00																												
GR000	GRANT COUNTY																											
GR007a	US Army/AEC Hanford 90	1952/08/07	14	25E	01	D	7.9	-	270	47	19	12	4.5	-	-	75	-	-	160	25.0	9.7	0.4	-	-	-	1.00	1.00	4
GR007b	US Army/AEC Hanford 90	1952/08/07	14	25E	01	D	7.9	330	265	47	19	12	4.5	0.2	-	75	-	-	157	25.0	9.7	0.4	-	-	-	0.98	0.98	31,4
GR007c	US Army/AEC Hanford 90	1954/10/28	14	25E	01	D	7.7	-	230	20	12	24	9.3	-	-	61	-	-	140	27.0	6.2	0.5	-	-	-	0.99	1.01	4
GR007d	US Army/AEC Hanford 90	1970/09/17	14	25E	01	D	8.1	-	215	17	11	24	8.6	-	-	56	0.03	0.02	140	24.0	5.0	0.4	-	-	-	1.02	1.00	4
GR007e	US Army/AEC Hanford 90	1971/10/08	14	25E	01	D	7.8	-	238	17	17	24	8.5	-	-	64	0.00	0.11	140	31.0	5.4	0.4	-	-	-	1.02	1.01	4
GR011a	US Govt./AEC Hanford 6	1954/10/28	14	25E	21	B	7.6	313	250	21	7	28	11.0	0.1	-	69	-	-	156	25.0	7.4	0.3	-	-	-	0.99	1.02	4
GR011b	US Govt./AEC Hanford 6	1954/10/28	14	25E	21	B	7.6	-	245	21	7	28	11.0	-	-	69	-	-	160	25.0	7.4	0.3	-	-	-	1.01	0.99	4
GR011c	US Govt./AEC Hanford 6	1958/01/07	14	25E	21	B	7.8	-	173	21	6	30	9.6	-	-	-	-	-	150	23.0	7.0	0.3	-	-	-	0.95	1.01	4
GR013a	US Army	1959/10/28	14	27E	24	C	8.0	457	322	80	26	7	0.4	-	-	63	-	-	216	29.0	12.0	1.2	-	-	-	1.02	0.99	31,4
GR013b	US Army	1959/10/28	14	27E	24	C	8.0	-	325	80	26	7	0.4	-	-	63	-	-	220	29.0	12.0	1.2	-	-	-	1.03	0.99	4
GR019a	AEC Hanford 7	1958/01/07	15	27E	34	L	7.8	330	262	40	18	13	6.0	0.1	-	-	-	-	152	26.0	8.2	0.4	-	-	-	1.00	1.41	31,4
GR019b	AEC Hanford 7	1958/01/07	15	27E	34	L	7.8	-	186	40	18	13	6.0	-	-	-	-	-	150	26.0	8.2	0.4	-	-	-	0.99	1.00	4
GR025a	US Air Force	1959/11/17	16	24E	01	G	7.7	-	384	45	10	38	24.0	-	-	57	-	-	250	68.0	19.0	0.7	-	-	-	1.01	1.00	4
GR025b	US Air Force	1959/12/12	16	24E	01	G	7.9	-	383	45	10	40	24.0	-	-	50	-	-	250	70.0	18.0	0.8	-	-	-	1.00	1.01	4
GR025c	US Air Force	1960/01/24	16	24E	01	G	7.9	-	383	45	10	40	24.0	-	-	51	-	-	250	69.0	19.0	0.6	-	-	-	1.00	1.00	4
GR025d	US Air Force	1963/03/28	16	24E	01	G	7.9	-	397	49	11	40	24.0	-	-	48	-	-	250	82.0	20.0	0.6	-	-	-	1.01	1.00	4
GR023	US Government	1960/01/24	16	24E	01	G	7.9	566	384	45	10	40	24.0	0.3	-	51	-	-	252	69.0	19.0	0.6	-	-	-	1.00	1.00	31,4
GR024a	US Air Force	1959/11/17	16	24E	01	G	7.7	575	380	45	10	38	24.0	0.2	-	57	-	-	250	68.0	19.0	0.7	-	-	-	1.01	0.99	31,4
GR024b	US Air Force	1959/12/12	16	24E	01	G	7.9	581	366	45	10	40	24.0	0.2	-	50	-	-	254	70.0	18.0	0.8	-	-	-	1.01	0.96	31,4
GR032a	US Government	1960/01/24	17	30E	33	K	8.4	317	270	57	10	9	1.9	0.5	-	79	-	-	161	15.0	6.5	1.3	-	-	-	0.98	1.04	31,4
GR032b	US Government	1960/01/24	17	30E	33	K	8.4	-	263	57	10	9	1.9	-	-	79	-	-	160	15.0	6.5	1.3	-	-	-	0.98	1.02	4
GR033a	US Army Corps of Engineers	1959/10/28	17	30E	33	K	8.4	321	264	57	10	8	2.1	0.2	-	78	-	-	162	15.0	7.2	1.2	-	-	-	0.99	1.02	31,4
GR033b	US Army Corps of Engineers	1959/10/28	17	30E	33	K	8.4	-	262	57	10	8	2.1	-	-	78	-	-	160	15.0	7.2	1.2	-	-	-	0.98	1.02	4
GR033c	US Army Corps of Engineers	1962/10/30	17	30E	33	K	8.2	-	263	59	10	9	2.0	0.0	-	76	-	-	170	14.0	8.0	1.2	-	-	-	1.00	1.00	4
GR038	WDOE Tst./Obs., Backfilled	1978/02/17	18	25E	15	E	7.0	-	262	50	7	16	6.7	-	-	67	-	-	160	25.0	11.0	1.2	-	-	-	0.97	1.00	4
GR058	Moses Lake City 7	1960/05/16	19	28E	23	D	8.4	-	-	56	-	-	-	-	-	-	-	-	160	-	-	-	-	-	-	1.10	0.00	4
GR081	Quincy City 1	1955/08/03	20	24E	07	R	7.5	-	243	25	4	32	10.0	-	-	50	-	-	150	29.0	17.0	-	-	-	-	0.99	1.01	4
GR082	Wenatchee Apple Land Co.	-	20	24E	09	E	-	-	272	19	4	37	15.0	0.0	-	42	-	-	156	37.0	17.0	0.4	-	-	-	0.97	1.10	3
GR085a	Moses Lake City 21	1951/03/30	20	28E	32	HorJ	8.0	-	238	35	12	17	8.6	-	-	49	-	-	160	25.0	8.9	0.6	-	-	-	1.03	1.01	4
GR085b	Moses Lake City 21	1951/03/30	20	28E	32	HorJ	8.0	315	222	35	12	17	8.6	0.0	-	49	-	-	156	25.0	8.9	0.6	-	-	-	1.01	0.95	4
GR098	Ephrata City	1955/07/22	21	26E	08	M	7.9	-	193	22	3	16	13.0	-	-	46	-	-	150	12.0	7.0	-	-	-	-	1.02	1.00	4
GR100	Ephrata City 5	1955/07/22	21	26E	08	N	7.6	-	168	12	2	19	12.0	-	-	46	-	-	130	6.0	7.0	-	-	-	-	0.99	1.00	4
GR104	Ephrata City 2	1955/07/22	21	26E	16	B	-	-	187	14	5	17	14.0	-	-	50	0.01	-	150	6.0	7.0	-	-	-	-	1.03	1.00	4
GR105	Ephrata City	1955/07/22	21	26E	21	E	8.1	-	191	12	4	17	12.0	-	-	64	0.01	-	130	8.0	7.0	-	-	-	-	1.03	1.02	4
GR109	Schell, Harvey	1982/09/08	21	30E	23	J	8.6	372	-	55	11	16	2.4	0.0	-	68	-	-	130	35.0	20.0	0.9	-	3	0.1	0.98	0.00	7,1
GR111	Soap Lake city	1955/07/22	22	27E	19	N	7.9	-	218	24	5	17	12.0	-	-	58	0.01	-	150	18.0	8.0	-	-	-	-	1.03	1.01	4
KI00																												
KI000	KING COUNTY																											

GEOTHERMAL DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON – CHEMICAL DATA FOR WELLS AND SPRINGS.
File Name = GEOTHDB3.WK1 Last updated September 03, 1993, by J.E.S.

I.D. (NEW)	SITE NAME	DATE	TWP. N.	RGE.	SEC.	PART. SEC.	pH	CONDUCT umhos/cm	TDS ppm	Na ppm	K ppm	Ca ppm	Mg ppm	Fe ppm	Al ppm	SiO2 ppm	B ppm	Li ppm	HCO3 ppm	SO4 ppm	Cl ppm	F ppm	H2S ppm	CO3 ppm	NO3 ppm	CHARGE BALANCE	MASS BALANCE	REF.
KI001Sa	Lester Hot Springs(F-1)	-	20	10E	21	M	-	-	-	112	3	8	0.2	-	-	66	-	0.33	-	-	200.0	-	-	-	-	1.04	0.00	21,24
KI001Sb	Lester Hot Springs	-	20	10E	21	M	9.2	-	339	105	2	5	0.0	-	-	61	-	-	61	19.0	115.0	1.6	5.7	-	-	0.97	0.98	32
KI003S	Goldmeyer Hot Springs	-	23	11E	14	B	8.5	-	391	125	3	6	0.0	-	-	56	-	-	61	40.0	130.0	0.9	0.6	-	-	0.95	1.00	32
KI004Sa	Scenic Hot Springs	-	26	13E	28	Q	9.1	-	168	49	1	2	0.0	-	-	44	-	-	75	13.0	22.0	0.7	1.3	-	-	0.97	0.99	32
KI004Sb	Scenic Hot Springs(C-1)	-	26	13E	28	Q	9.3	140	-	32	1	2	-	-	-	37	-	-	44	13.0	14.0	0.6	-	-	-	0.95	0.00	18,24
KS00																												
KS000	KITTITAS COUNTY																											
KS007	USGS/WDOE Umtanum	1978/03/02	16	19E	28	C	8.5	-	157	22	3	14	5.2	-	-	48	-	-	120	1.9	3.3	0.6	-	-	-	1.01	1.00	40
KT00																												
KT000	KLICKITAT COUNTY																											
KT009Sa	Klickitat Mineral Springs	-	04	13E	24	A	5.9	-	-	64	10	120	100.0	-	-	140	-	-	1070	-	4.2	0.3	-	-	-	1.04	0.00	24
KT009Sb	Klickitat Mineral Springs	-	04	13E	24	A	6.1	-	637	34	4	38	38.0	-	-	103	-	-	415	-	4.0	0.8	-	-	-	1.07	1.49	32
KT011a	Gas-Ice Corp. 10	1964/10/21	04	13E	24	H	6.6	1410	964	63	10	120	106.0	11.0	-	121	0.11	-	1060	3.4	3.5	0.4	-	-	-	0.99	1.00	31
KT011b	Gas Ice Corp. 10	1964/10/21	04	13E	24	H	6.6	-	953	63	10	120	110.0	-	-	120	0.11	-	1060	3.4	3.5	0.4	-	-	-	0.99	1.00	40
KT012a	Gas Ice Corp. 2	1964/10/21	04	14E	19	C	6.4	-	319	30	4	27	25.0	-	-	89	0.03	-	280	0.0	3.2	1.1	-	-	-	1.00	1.01	40
KT012b	Gas-Ice Corp. 2	1964/10/21	04	14E	19	C	6.4	429	325	30	4	27	25.0	2.8	-	89	0.03	-	284	-	3.2	1.1	-	-	0.2	0.99	1.01	31
KT026S	Fish Hatchery Warm Spring	-	06	13E	04	H	-	-	-	160	16	110	95.0	2.2	-	-	-	-	1130	2.6	49.0	0.4	-	-	-	0.98	0.00	24
KT027a	Smith, G.	1970/10/21	06	23E	11	N	8.1	-	255	64	15	6	2.4	-	-	56	0.13	0.02	210	0.2	9.1	1.0	-	-	-	1.04	0.99	40
KT027b	Smith, G.	1970/12/11	06	23E	11	N	8.1	-	252	64	15	6	2.7	-	-	52	0.01	0.04	210	0.0	9.2	1.0	-	-	-	1.03	0.99	40
KT029	Smith, George	1962/04/30	06	23E	11	Q	8.1	344	-	55	11	12	4.1	0.0	-	57	-	-	195	2.2	9.8	1.0	-	-	0.6	1.01	0.00	31
KT030	——	1962/04/30	06	23E	11	Q	8.1	-	248	55	11	12	4.1	-	-	67	-	-	200	2.2	9.8	1.0	-	-	-	1.03	0.99	40
KT031	Andrews/Smith	1970/10/22	06	23E	15	H	7.9	-	254	64	13	7	2.7	-	-	57	0.07	0.02	210	0.2	8.6	1.0	-	-	-	1.03	0.99	40
LE00																												
LE000	LEWIS COUNTY																											
LE010S	Ohanapecosh Hot Springs(USGS)	-	14	10E	04	C	6.8	-	-	920	52	60	4.9	0.0	-	100	12.00	2.90	1060	170.0	880.0	5.2	-	-	-	1.03	0.00	24
LI00																												
LI000	LINCOLN COUNTY																											
LI001	Odessa Oil Test Piezometer A	1972/08/08	21	31E	10	M	8.2	-	356	100	7	8	2.6	-	-	87	-	-	210	19.0	16.0	13.0	-	-	-	0.99	1.00	40
LI015	Sprague City	1982/07/21	21	38E	23	L	8.4	248	-	34	5	15	3.6	0.0	-	63	-	-	145	5.0	3.0	0.9	-	3	0.2	1.04	0.00	7,16
LI024	Wilbur SEC	1982/09/09	25	32E	35	P	8.2	270	-	39	5	12	5.3	0.0	-	57	-	-	151	7.0	4.6	0.8	-	-	0.1	0.99	0.00	7,16
LI025	Davenport City 6	1982/07/21	25	37E	21	L	8.2	288	-	40	5	15	5.8	0.0	-	50	-	-	174	11.0	4.3	0.9	-	-	0.1	1.07	0.00	7,16
PI00																												
PI000	PIERCE COUNTY																											
PI001S	Longmire Springs	-	15	08E	29	R	7.4	-	-	487	41	492	-	-	-	-	-	-	-	-	1657.0	-	-	-	-	1.00	0.00	14
PI003S	Spring	-	19	02E	19	Q	6.8	95	57	5	1	9	2.9	0.0	-	10	-	-	44	5.4	3.0	-	-	-	0.4	1.00	0.98	15
SK00																												
SK000	SKAMANIA COUNTY																											
SK001Sa	Bonneville Hot Springs(A-3)	-	02	07E	16	M	9.9	790	-	134	1	30	-	-	-	50	-	-	-	72.0	187.0	0.6	-	-	-	0.93	0.00	18,24
SK001Sb	Bonneville Hot Springs	-	02	07E	16	M	9.5	-	505	145	1	31	0.0	-	-	46	2.00	-	39	80.0	180.0	0.7	0.5	-	-	0.94	1.00	32
SK002S	Rock Creek Hot Springs(A-1)	-	03	07E	27	B	9.7	400	-	80	0	12	-	-	-	41	-	-	31	40.0	85.0	0.7	-	-	-	0.93	0.00	18,24
SK008Sa	St. Martin Hot Springs	-	03	08E	21	R	7.0	-	-	291	6	104	-	-	-	20	-	-	-	-	636.0	-	-	-	-	1.00	0.00	14
SK008Sb	St. Martin Hot Springs	-	03	08E	21	R	8.5	-	1210	360	6	76	0.3	-	-	48	2.90	-	19	16.0	690.0	0.7	-	-	-	1.03	1.00	32
SK008Sc	St. Martin Hot Springs(A-1)	-	03	08E	21	R	-	2350	-	360	6	73	0.5	-	-	57	-	0.30	-	-	756.0	-	-	-	-	1.09	0.00	21,24
SN00																												
SN000	SNOHOMISH COUNTY																											
SN001Sa	Garland Min. Sprs(Main)(GLA-1)	-	28	11E	25	C	6.9	17000	-	2640	188	318	90.0	1.0	-	107	24.40	8.10	2050	170.0	4250.0	1.3	-	-	-	1.09	0.00	19
SN001Sb	Garland Mineral Springs	-	28	11E	25	C	6.5	-	-	2500	200	390	87.0	5.4	-	105	64.00	9.40	2600	160.0	3600.0	1.6	-	-	-	1.04	0.00	24
SN001Sc	Garland Mineral Springs	-	28	11E	25	C	6.5	-	8380	2500	200	390	87.0	-	-	105	64.00	-	2600	160.0	3600.0	1.6	-	-	-	1.06	1.00	32
SN002S	Kennedy Hot Springs(USGS)	-	30	12E	01	H	6.3	-	2600	670	72	190	48.0	-	-	175	7.50	-	1660	2.0	625.0	1.2	-	-	-	1.02	1.00	32
SN003S	Gamma Hot Spring	-	31	13E	36	D	6.1	-	-	510	80	71	2.8	-	-	141	9.00	2.80	398	30.0	755.0	1.4	-	-	-	1.01	0.00	19
SN004Sa	Sulphur Creek Hot Springs	-	32	13E	19	C	9.4	-	-	100	2	1	-	-	-	76	0.55	0.14	154	21.0	51.0	3.9	-	-	-	1.04	0.00	19
SN004Sb	Sulphur Creek Hot Springs(A-1)	-	32	13E	19	C	7.6	480	-	102	3	2	0.0	-	-	100	0.60	0.10	102	60.0	54.0	3.0	-	-	-	1.01	0.00	21
SP00																												
SP000	SPOKANE COUNTY																											
SP005	US Government	1958/07/22	24	40E	22	L	7.6	-	201	14	3	30	10.0	-	-	45	-	-	150	21.0	3.8	0.3	-	-	-	1.02	1.00	40
SP006	Fairchild AFB, 2	1958/07/22	24	41E	03	N	7.8	-	166	13	2	21	8.6	-	-	47	-	-	130	10.0	1.8	0.4	-	-	-	1.03	0.99	40
SP007	US Government	1958/07/22	25	40E	14	R	7.5	-	171	14	2	20	12.0	-	-	42	-	-	140	8.1	5.2	0.7	-	-	-	1.02	0.99	40
SP008	US Government	1958/07/22	25	40E	34	P	7.2	-	192	16	2	32	7.8	-	-	49	-	-	150	5.2	4.5	0.4	-	-	-	0.93	1.01	40
SP009	US Government	1958/07/23	25	41E	01	R	7.2	-	192	11	2	28	13.0	-	-	47	-	-	170	6.4	2.5	0.3	-	-	-	1.02	0.99	40
SP010	US Army, Fort George Wright	1958/07/22	25	42E	11	E	7.5	-	121	2	1	28	7.8	-	-	13	-	-	110	11.0	3.8	0.3	-	-	-	1.01	1.00	40
SP011	Washington Water Power Co.,1-3	1977/10/03	25	43E	13	A	7.8	-	138	2	2	32	14.0	0.0	-	-	-	-	150	12.0	1.7	0.1	-	-	-	0.97	1.00	40
SP012	US Air Force	1958/07/22	26	42E	20	N	7.8	-	162	4	2	36	12.0	-	-	17	-	-	150	14.0	3.2	0.1	-	-	-	0.96	1.00	40
WA00																												
WA000	WALLA WALLA COUNTY																											
WA020a	Jaussand, Art	1958/08/01	06	35E	10	P	8.2	226	186	32	9	12	1.7	0.0	-	72	-	-	126	3.2	6.5	0.7	-	-	-	1.02	0.94	31,41
WA020b	Jaussand, Art	1958/08/01	06	35E	10	P	8.2	-	199	32	9	12	1.7	-	-	72	-	-	130	3.2	6.5	0.7	-	-	-	1.05	0.99	40
WA027a	WDOE Tst./Obs., Piezometer A	1973/03/07	06	35E	18	A	8.3	-	229	43	10	6	0.6	-	-	89	-	-	140	4.1	5.2	1.2	-	-	-	1.06	1.01	40
WA027b	WDOE Tst./Obs., Piezometer A	1973/07/12	06	35E	18	A	8.7	-	228	40	8	7	1.1	-	-	93	-	-	120	3.6	4.2	1.1	-	-	-	0.95	1.05	40
WA044	Baker & Baker	1946/11/29	06	36E	09	P	-	186	161	8	3	16	9.8	0.1	-	60	-	-	108	5.7	3.8	0.6	-	-	0.4	1.02	1.00	30

GEOTHERMAL DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON -- CHEMICAL DATA FOR WELLS AND SPRINGS.

File Name = GEOTHDB3.WK1 Last updated September 03, 1993, by J.E.S.

I.D. (NEW)	SITE NAME	DATE	TWP. N.	RGE.	SEC.	PART. SEC.	pH	CONDUCT umhos/cm	TDS ppm	Na ppm	K ppm	Ca ppm	Mg ppm	Fe ppm	Al ppm	SiO2 ppm	B ppm	Li ppm	HCO3 ppm	SO4 ppm	Cl ppm	F ppm	H2S ppm	CO3 ppm	NO3 ppm	CHARGE BALANCE	MASS BALANCE	REF.
WA049	Byerley Farm, Inc.	1971/09/20	07	32E	36	Q	7.9	-	260	48	16	10	2.9	-	-	80	0.78	0.25	160	3.8	20.0	1.3	-	-	-	1.04	0.99	4
WA063	Bonneville Power Admin.	1946/11/21	07	35E	23	M	-	214	177	31	8	11	2.1	0.0	-	55	-	-	125	3.8	3.6	0.6	-	-	0.1	1.01	1.00	3
WA071	Walla Walla College	1954/08/04	07	35E	33	H	7.6	-	-	17	4	15	5.6	0.1	0.07	-	0.14	-	116	3.8	1.6	-	-	-	-	1.00	0.00	3
WA079	College Place	1970/10/23	07	35E	36	F	8.2	-	190	22	5	19	5.1	-	-	62	-	0.02	130	5.6	3.9	0.5	-	-	-	0.98	1.01	4
WA080	College Place City	1959/10/22	07	35E	36	F	8.2	-	194	21	5	20	5.5	-	-	65	-	-	140	5.4	4.2	0.5	-	-	-	1.04	0.99	4
WA082	College Place	1952/04/20	07	35E	36	F	8.1	233	195	22	6	20	5.8	0.0	-	65	-	-	141	5.8	4.2	0.6	-	-	0.1	1.02	0.98	3
WA083	College Place	1959/10/22	07	35E	36	F	8.2	229	200	21	5	20	5.5	0.0	-	65	-	-	136	5.4	4.2	0.5	-	-	-	1.01	1.03	30,4
WA095	Rogers Canning	1970/10/21	07	36E	19	R	8.1	-	177	23	6	13	3.6	-	-	68	-	0.02	120	3.6	2.8	0.8	-	-	-	1.05	0.99	4
WA097	Whitman College	1970/10/22	07	36E	20	H	8.0	-	192	25	6	17	5.5	-	-	61	-	0.02	140	6.6	1.9	0.9	-	-	-	1.01	1.00	4
WA098a	Walla Walla City 5	1960/07/29	07	36E	28	R	8.2	245	193	29	6	16	5.3	0.1	-	62	-	-	148	5.0	3.0	1.0	-	-	-	1.03	0.97	4
WA098b	Walla Walla City 5	1960/07/29	07	36E	28	R	8.2	-	200	29	6	16	5.3	-	-	62	-	-	150	5.0	3.0	1.0	-	-	-	1.04	1.00	4
WH00																												
WH000	WHATCOM COUNTY																											
WH003Sa	Baker Hot Springs(A-1)	-	38	09E	20	M	7.9	820	-	179	12	6	0.2	-	-	125	3.10	0.40	157	95.0	109.0	3.0	-	-	-	0.93	0.00	21,2
WH003Sb	Baker Hot Springs(Main)(BKA-2)	-	38	09E	20	M	8.3	730	-	146	8	5	-	-	-	105	0.91	0.30	106	95.0	111.0	3.0	-	-	-	1.02	0.00	1
WH003Sc	Baker Hot Springs(B-1)	-	38	09E	20	M	8.0	780	-	154	11	6	0.3	-	-	90	2.70	0.30	124	90.0	99.0	3.0	-	-	-	0.94	0.00	21,2
WH003Sd	Baker Hot Springs	-	38	09E	20	M	8.6	-	-	170	10	6	0.2	-	-	103	2.70	0.36	165	87.0	110.0	3.2	-	-	-	0.98	0.00	1
WT00																												
WT000	WHITMAN COUNTY																											
WT006	Pullman City	1955/06/22	14	45E	05	D	7.8	-	226	14	4	20	15.2	0.1	0.06	-	0.56	-	178	3.4	6.7	-	-	-	-	1.10	1.50	3
WT009	Pullman City	1955/06/22	15	45E	32	N	7.5	-	206	18	4	20	15.7	0.0	-	-	0.01	-	184	2.3	6.7	-	-	-	-	1.05	1.32	3
WT010a	Colfax City Clay St. well	1955/08/18	16	43E	11	G	7.7	-	209	21	2	19	13.5	0.1	0.02	-	0.02	-	172	5.4	3.5	-	-	-	-	1.02	1.40	3
WT010b	Colfax City Clay St. well	1958/06/20	16	43E	11	G	7.4	280	204	22	2	25	9.0	0.1	0.03	-	-	-	185	3.8	4.6	-	-	-	-	1.10	1.29	3
YA00																												
YA000	YAKIMA COUNTY																											
YA022	Showaway, Ida	1974/04/11	10	17E	14	D	-	-	202	19	5	34	16.0	1.5	-	-	-	-	210	4.9	18.0	1.3	-	-	-	1.04	1.00	4
YA031	Decker Ranch (Decker 7)	1974/05/20	10	18E	31	N	-	-	182	31	5	19	14.0	0.1	-	-	-	-	220	1.6	3.3	0.7	-	-	-	1.07	0.99	4
YA037	Toppenish City 7	1974/09/19	10	20E	04	L	-	-	116	24	5	14	4.2	0.1	-	-	-	-	130	0.7	2.6	0.6	-	-	-	1.03	1.01	4
YA040a	Toppenish City 6	1959/10/19	10	20E	09	A	7.8	-	160	19	4	13	2.2	0.1	-	68	-	-	100	0.3	1.0	0.6	-	-	-	0.98	1.02	4
YA040b	Toppenish City 6	1959/10/19	10	20E	09	A	7.8	171	158	19	4	13	2.2	0.1	-	68	-	-	105	0.3	1.0	0.6	-	-	-	1.03	0.99	4
YA040c	Toppenish City 6	1971/02/03	10	20E	09	A	8.0	-	162	20	4	12	3.5	-	-	68	-	0.02	110	0.0	2.0	0.5	-	-	-	1.04	0.99	4
YA044	Phillips, Lena	1974/05/23	10	21E	33	B	-	-	200	25	4	31	13.0	0.3	-	-	-	-	210	17.0	7.7	0.2	-	-	-	1.07	0.99	4
YA045	Sunnyside City 4	1970/10/06	10	22E	25	F	7.6	-	223	18	7	29	9.7	-	-	62	0.02	0.02	180	16.0	4.8	0.5	-	-	-	1.01	1.00	4
YA056	Gowdy, Albert A.	1974/06/14	11	16E	34	K	-	-	201	30	5	23	16.0	2.2	-	-	-	-	210	18.0	2.8	0.5	-	-	-	1.00	1.00	4
YA057	Mount Adams Seed	1974/06/13	11	17E	01	F	-	-	-	24	4	18	5.9	0.1	-	-	-	-	140	1.0	5.0	0.7	-	-	-	1.00	0.00	4
YA059	Stephenson, C. and H.	1974/05/21	11	17E	03	L	-	-	145	27	4	16	8.8	0.1	-	-	-	-	170	1.4	4.4	0.8	-	-	-	1.08	0.99	4
YA064	Slegner, Monte	1974/10/01	11	18E	09	N	-	-	142	25	4	20	7.4	0.1	-	-	-	-	160	0.8	4.5	0.7	-	-	-	1.02	1.00	4
YA066	Carlson, Sarah	1974/03/06	11	18E	26	L	-	-	160	21	5	24	10.0	0.4	-	-	-	-	130	22.0	11.0	0.2	-	-	-	0.96	1.02	4
YA129	Wiley, Robert	1971/09/23	12	17E	16	A	7.8	-	178	24	4	11	3.4	-	-	71	-	0.03	120	0.0	2.2	0.8	-	-	-	1.06	1.01	4
YA132	Hansen Fruit	1974/06/14	12	18E	27	G	-	-	157	22	4	20	14.0	0.1	-	-	-	-	180	1.5	6.3	0.7	-	-	-	1.01	1.00	4
YA133	Hansen Fruit	1974/06/14	12	18E	27	H	-	-	168	35	5	19	6.8	0.1	-	-	-	-	170	4.1	11.0	1.2	-	-	-	1.04	1.01	4
YA136	Mount Adams Seed, 2	1974/05/23	12	18E	32	H	-	-	136	25	4	19	6.4	0.1	-	-	-	-	140	0.8	10.0	0.7	-	-	-	1.00	1.01	4
YA140	Moxee City	1962/11/02	12	19E	01	Q	8.4	-	180	56	3	5	0.9	-	-	30	0.01	-	160	0.0	4.5	1.7	-	-	-	1.02	1.00	4
YA256a	US Army, Yakima Firing Cen., 1	1951/04/20	14	19E	28	B	8.0	-	187	19	6	15	11.0	-	-	56	-	-	150	0.7	4.1	0.5	-	-	-	1.01	1.00	4
YA256b	US Army, Yakima Firing Cen., 1	1951/04/20	14	19E	28	B	8.0	235	179	19	6	15	11.0	0.0	-	56	-	-	151	0.7	4.1	0.5	-	-	-	1.01	0.96	3
YA256c	US Army, Yakima Firing Cen., 1	1953/09/29	14	19E	28	B	7.8	-	187	19	4	16	11.0	-	-	59	-	-	150	0.7	3.8	0.5	-	-	-	1.01	1.00	4
YA256d	US Army, Yakima Firing Cen., 1	1953/09/29	14	19E	28	B	7.8	244	176	19	4	16	11.0	0.2	-	59	-	-	149	0.7	3.8	0.5	-	-	-	1.00	0.94	31,4
YA256e	US Army, Yakima Firing Cen., 1	1955/10/05	14	19E	28	B	8.1	-	175	19	4	16	9.4	-	-	50	-	-	150	0.2	3.5	0.5	-	-	-	1.05	0.99	4
YA256f	US Army, Yakima Firing Cen., 1	1959/03/30	14	19E	28	B	7.8	-	177	18	4	17	11.0	-	-	51	-	-	150	0.5	3.5	0.6	-	-	-	1.00	0.99	4
YA256g	US Army, Yakima Firing Cen., 1	1960/09/14	14	19E	28	B	7.9	220	174	19	4	15	11.0	0.0	-	52	-	-	147	0.8	4.0	0.6	-	-	0.2	1.02	0.97	3
YA256h	US Army, Yakima Firing Cen., 1	1960/09/14	14	19E	28	B	7.9	-	178	19	4	15	11.0	-	-	52	-	-	150	0.8	4.0	0.6	-	-	-	1.04	0.99	4
YA256i	US Army, Yakima Firing Cen., 1	1967/02/28	14	19E	28	B	8.1	-	183	20	4	16	10.0	-	-	56	-	-	150	0.4	4.0	0.6	-	-	-	1.03	0.99	4

NOTES:

See the notes for file GEOTHDB1.WK1 for explanations of I.D. numbers and partial sections.

Lower-case letters at the ends of I.D. numbers signify different analyses for the same well or spring system.

COND. is conductivity.

TDS is total dissolved solids, measured by evaporating a sample to dryness.

CHARGE BALANCE is an indication of the quality and/or completeness of a chemical analysis. Analyses with charge balances more than 10 per cent greater than or less than 1.00 have been excluded from this table.

Charge balances were calculated using a worksheet from Kindle (1991, p. 113) with a corrected conversion factor for HCO3 supplied by Mike Adams, University of Utah Research Institute (personal communication, August 10, 1993).

I.D. (NEW)	SITE NAME	DATE	TWP. N.	RGE.	SEC.	PART. SEC.	pH	CONDUCT umhos/cm	TDS ppm	Na ppm	K ppm	Ca ppm	Mg ppm	Fe ppm	Al ppm	SiO2 ppm	B ppm	Li ppm	HCO3 ppm	SO4 ppm	Cl ppm	F ppm	H2S ppm	CO3 ppm	NO3 ppm	CHARGE BALANCE	MASS BALANCE	REF.

Aqueous solutions are electrically neutral in nature, so chemical analyses that are reasonably complete and of good quality should relect that neutrality by yielding charge balances near 1.00. Charge balance is the ratio of the sums of the negative (anion) and positive (cation) ionic charges, quantified as milli-equivalents per liter, detected in the fluid (Kindle, 1991, p. 109).

$$\text{Charge Balance} = \frac{\text{Sum of anion concentrations (meq/L)}}{\text{Sum of cation concentrations (meq/L)}}$$

The conversion factors to convert concentrations in milligrams per liter (or parts per million) to milli-equivalents per liter are listed below.

Anion	Factor	Cation	Factor
HCO3	0.0167	Ca	0.0499
CO3	0.0333	Fe	0.0358
SO4	0.0208	K	0.0256
F	0.0526	Li	0.144
NO3	0.0161	Mg	0.0823
Cl	0.0282	Na	0.0435

MASS BALANCE is also an indication of quality and/or completeness of an analysis. Mass balance is the ratio of total dissolved solids, determined by evaporating a water sample to dryness, to the sum of individually analyzed chemical species (Kindle 1991, p. 109).

$$\text{Mass Balance} = \frac{\text{Total dissolved solids (mg/L)}}{\text{Sum of individual solid concentrations(mg/L)}}$$

Mass balances were calculated using a worksheet from Kindle (1991, p. 113). A correction factor of 0.4917 was applied to the concentration of HCO3 because it is partly volatile (Mike Adams, University of Utah Research Institute, personal communication, August 10, 1993).

Mass balances should, ideally, approach values of 1.00 for high quality, complete analyses. When they are significantly greater than 1.00 it is often because SiO2 (which is non-ionic in solution and doesn't affect the charge balance calculation) is not reported. When SiO2 is reported, departures from 1.00 must be caused by failure to report some significant chemical species and/or analytical inaccuracy. If the charge balance is within 10 per cent of 1.00 and SiO2 is reported, then departures from 1.00 of the mass balance must be caused by offsetting anion and cation analytical errors, incomplete analyses, or inaccurate SiO2 or TDS measurements.

When no TDS is reported the mass balance is zero.

Mass balance was not used as a criterion for exclusion of analyses from this table.

REFERENCES: See file named GEOTHDB5.WK1.

GEOTHERMAL REFERENCES, TO ACCOMPANY FILES GEOTHDB1.WK1 AND GEOTHDB3.WK1.

File Name = GEOTHDB5.WK1. Last updated September 01, 1993. J.E.S.

REFERENCES:

1. Barnett, D. B., 1986, The 1985 geothermal gradient drilling project for the State of Washington: Washington Division of Geology and Earth Resources Open File Report 86-2, 34 p.
2. Biggane, J. H., 1982, The low-temperature geothermal resource and stratigraphy of portions of Yakima County, Washington: Washington Division of Geology and Earth Resources Open File Report 82-6, 128 p., 58 figs., 4 pl., 11 tables, appendix.
3. Biggane, J. H., 1983, Geophysical logs from water wells in the Yakima area, Washington: Washington Division of Geology and Earth Resources Open File Report 83-2, 50 p.
4. Blackwell, D. D., 1980, Heat flow and geothermal gradient measurements in Washington to 1979 and temperature-depth data collected during 1979: Washington Division of Geology and Earth Resources Open File Report 80-9, 524 p. [unpaginated].
5. Blackwell, D. D., 1993, Southern Methodist University, Dallas, Texas, Heat-flow data for Washington on disk, unpublished data.
6. Blackwell, D. D., and others, 1985, Heat flow and geothermal studies in the State of Washington: Washington Division of Geology and Earth Resources Open File Report 85-6, 77 p.
7. Bortleson, G. C.; Cox, S. E., 1986, Occurrence of dissolved sodium in ground waters in basalts underlying the Columbia Plateau, Washington: U.S. Geological Survey Water-Resources Investigations Report 85-4005, 24 p., 5 plates.
8. Bowen, R. G., 1992, Geothermal Consultant, Portland, OR, unpublished data.
9. Brown, J. C., 1979, Geology and water resources of Klickitat County: Washington State Department of Ecology Water Supply Bulletin 50, 413 p., 8 pl., scale 1:94,000.
10. Campbell, N. P., 1993, Yakima Valley College, Yakima, WA, unpublished data.
11. Cline, D. R., 1976, Reconnaissance of the water resources of the upper Klickitat River basin, Yakima Indian Reservation, Washington: U.S. Geological Survey Open-File Report 75-518, 54 p.
12. Ertec Western, Inc., 1981, Revisions to: Assessment of volcanic and geothermal activity in the Pasco Basin and vicinity, Volume I, Narrative report: Ertec Western, Inc., Long Beach, CA, Project Number 81-199 for Rockwell International, Rockwell Hanford Operations, Energy Systems Group, Richland, WA 99352, 119 p.
13. Foxworthy, B. L., 1962, Geology and ground-water resources of the Ahtanum Valley, Yakima County, Washington: U.S. Geological Survey Water-Supply Paper 1598, 100 p.
14. Gizienski, S. F.; McEuen, R. B.; Birkhahn, P. C., 1975, Regional

evaluation of the geothermal resource potential in central Washington State: Woodward-Gizienski and Associates, 113 p., 4 plates, scale 1:1,000,000.

15. Griffin, W. C., and others, 1962, Water resources of the Tacoma area Washington: U. S. Geological Survey Water-Supply Paper 1499-B, 101 p., 4 plates.
16. Hearn, P. P., and others, 1985, Geochemical controls on dissolved sodium in basalt aquifers of the Columbia Plateau, Washington: *U.S. Geological Survey Water-Resources Investigations Report* 84-4304, 38 p., 1 plate.
17. Korosec, M. A., 1980, Table of thermal and mineral spring locations in Washington: Washington Division of Geology and Earth Resources Open File Report 80-11, 6 p.
18. Korosec, M. A., 1982, Table of chemical analyses for thermal and mineral spring and well waters collected in 1980 and 1981: Washington Division of Geology and Earth Resources Open File Report 82-3, 5 p.
19. Korosec, M. A., 1983a, Chemical analyses for thermal and mineral springs examined in 1982-1983: Washington Division of Geology and Earth Resources Open File Report 84-1, 8 p.
20. Korosec, M. A., 1983b, The 1983 temperature gradient and heat flow drilling project for the State of Washington: Washington Division of Geology and Earth Resources Open File Report 83-12, 11 p.
21. Korosec, M. A.; and others, 1980, The 1979-1980 geothermal resource assessment program in Washington: Washington Division of Geology and Earth Resources Open File Report 81-3, 267 p., 1 map, scale 1:24,000.
22. Korosec, M. A., and others, 1981, Geothermal resources of Washington: Washington Division of Geology and Earth Resources Geologic Map GM-25, 1 sheet, scale 1:500,000.
23. Korosec, M. A., and others, 1982, The low temperature geothermal resources of eastern Washington: Washington Division of Geology and Earth Resources Open File Report 82-1, 20 p., 2 figs., 1 table.
24. Korosec, M. A., and others, 1983, The 1980-1982 geothermal resource assessment program in Washington; with chapters on thermal springs, gravity investigations, heat-flow drilling, low-temperature resources in eastern Washington, geology of the south Cascades and White Pass areas, and targets for geothermal resource exploration: Washington Division of Geology and Earth Resources Open File Report 83-7, 299 p.
25. Korosec, M. A.; Kaler, K. L., 1980, Well temperature information and locations in the State of Washington: Washington Division of

Geology and Earth Resources Open File Report 80-7, 89 p. [unpaginated], 2 pl., scale 1:500,000.

26. Korosec, M. A.; Phillips, W. M., 1982, WELLTHERM: Temperature, depth, and geothermal gradient data for wells in Washington State: Washington Division of Geology and Earth Resources Open File Report 82-2, 3 p., 74-p. table.
27. Landes, Henry, 1905, Preliminary report on the underground waters of Washington: U.S. Geological Survey Water Supply Paper 111, 85 p.
28. Luzier, J. E., 1969, Ground-water occurrence in the Goldendale area, Klickitat County, Washington: U. S. Geological Survey Hydrologic Investigations Atlas HA-313, 1 sheet, scale 1:62,500.
29. Mariner, R. H.; Presser, T. S.; Evans, W. C.; Pringle, M. K., 1989, Discharge rates of thermal fluids in the Cascade Range of Oregon and Washington and their relationship to the geologic environment. IN Muffler, L. J. P.; Weaver, C. S.; Blackwell, D. D., editors, Proceedings of workshop XLIV, Geological, geophysical, and tectonic setting of the Cascade Range: U.S. Geological Survey Open-File Report 89-178, p. 663-694.
30. Newcomb, R. C., 1965, Geology and ground-water resources of the Walla Walla River basin Washington-Oregon: Washington Division of Water Resources Water Supply Bulletin 21, 151 p., 3 plates.
31. Newcomb, R. C., 1972, Quality of the ground water in basalt of the Columbia River Group, Washington, Oregon, and Idaho: U.S. Geological Survey Water-Supply Paper 1999-N, 71 p., 1 plate, scale 1:1,000,000.
32. Reed, M. J., and others, 1983, Selected data for low-temperature (less than 90 degrees C) geothermal systems in the United States; reference data for U.S. Geological Survey Curcular 892: U. S. Geological Survey Open-File Report 83-250, 129 p.
33. Robinette, M. S., and others, 1977, Geophysical investigations of Washington's ground-water resources, annual report 1975/1976: Washington State University College of Engineering Research Report No. 77/15-6, 56 p., 5 maps. (Also Washington State Department of Ecology Project Interim Report 76-075 and Project Completion Report 76-069.)
34. Schuster, J. E., 1981, Geothermal energy potential of the Yakima valley area, Washington. In Bloomquist, R. G., editor, Proceedings of the Geothermal Symposium--Low temperature utilization, heat pump applications, district heating, September 24, 1980: Washington State Energy Office WAOENG 81-05, p. XI 1 - XI 10.
35. Smith, G. O., 1901, Geology and water resources of a portion of Yakima County, Wash.: U.S. Geological Survey Water-Supply and

Irrigation Paper No. 55, 68 p.

36. Stearns, N. D., and others, 1937, Thermal springs in the United States: U. S. Geological Survey Water-Supply Paper 679-B, 206 p., 1 plate, scale 1:7,000,000.
37. Stoffel, K. L.; Widness, Scott, 1983a, Fluid-temperature logs for selected wells in eastern Washington: Washington Division of Geology and Earth Resources Open File Report 83-15, 351 p.
38. Stoffel, K. L.; Widness, Scott, 1983b, Geophysical logs of selected wells in eastern Washington: Washington Division of Geology and Earth Resources Open File Report 83-14, 81 p.
39. Taylor, G. C., Jr., 1944, Factual data pertaining to wells and springs in the Columbia Basin Project area, Washington: U.S. Geological Survey unpublished report, 85 p.
40. U.S. Geological Survey, 1993, WATSTORE database records as of July 20, 1993.
41. Van Denburgh, A. S.; Santos, J. F., 1965, Ground water in Washington, its chemical and physical quality: Washington Division of Water Resources Water Supply Bulletin 24, 93 p.
42. Washington State Department of Ecology, Central Regional Office, Yakima, Washington, unpublished water well reports as of April 12, 1993.
43. Washington State Department of Ecology, Eastern Regional Office, Spokane, Washington, unpublished water well reports as of May 3, 1993.
44. Widness, Scott, 1983, Low temperature geothermal resource evaluation of the Moses Lake-Ritzville-Connell area, Washington: Washington Division of Geology and Earth Resources Open File Report 83-11. 27 p.

Not Cited:

Fugro, Inc., 1980, Assessment of volcanic and geothermal activity in the Pasco Basin and vicinity, Volume I, Narrative report: Fugro, Inc., Long Beach, CA, Project Number 79-265 for Rockwell International, Rockwell Hanford Operations, Energy Systems Group, Richland, WA 99352, 230 p. 8 plates.

Include in references:

Kindle, C. H., 1991, Geothermal fluid sampling techniques. IN Lienau, P. J.; Lunis, B. C., editors, Geothermal direct use engineering and design guidebook: Geo-Heat Center, Oregon Institute of Technology, p. 99-113.

Howard Ross
copy

UNIVERSITY OF UTAH RESEARCH INSTITUTE
UURI
391 CHIPETA WAY, SUITE C
SALT LAKE CITY, UTAH 84108-1295
TELEPHONE 801-524-3422

June 7, 1994

Mr. J. Eric Schuster
Assistant State Geologist
Washington State Department of Natural Resources
1111 Washington St. SE
P.O. Box 47000
Olympia, WA 98504-7000

Dear Eric:

Thank you for the opportunity to review a draft of your final report "Low-Temperature Geothermal Resources of Washington" which has sections (not included) by Gordon Bloomquist. This will be a good report, Eric. It covers all of the intended topics, plus additional appropriate material. It gave me a good basic understanding of Washington's low-temperature resources, temperature gradients, hydrology, usage and potential, all in about 25 pages. Some general comments follow.

I did find the report difficult to read in several places, due mainly to complex and lengthy sentence structure. Some of the awkward parts and some suggestions for changes are indicated in the margins of the text. On page 4, the map scale of Figure 1 is indicated as 1:100,000, but it should be more like 1:10,000,000. Degree symbols are missing in several places. Would the acknowledgements be better placed before or after the text? The use of subheadings may help the reader in large blocks of text.It appears that References Cited also contains additional references - do these occur in the data tables?

It may not be necessary to number the references, but I note that you do refer to some by number. The numbers may change if numbers are assigned to several references which do not have numbers. Is the use of (;) between authors in the listing standard for WDNR reports? It is not generally used by major journals. Your recommendations for future work are rather general, but seem appropriate. I get the feeling that much of the six-county area is favorable, and priorities are governed by the collocation of potential users. Please consider these comments as you finalize your report, and call me if you have any questions.

Sincerely,

Howard

Howard P. Ross
Project Manager/Low-Temperature Program

WASHINGTON STATE DEPARTMENT OF
Natural Resources

JENNIFER M. BELCHER
Commissioner of Public Lands

KALEEN COTTINGHAM
Supervisor

May 11, 1994

Mr. Howard P. Ross, Project Manager
Earth Science Laboratory
University of Utah Research Institute
391 Chipeta Way, Suite C
Salt Lake City, UT 84108-1295

Dear Howard:

Enclosed please find an almost complete draft of the final report for your review and comment. I have tried to stay reasonably close to the outline you supplied in your November 4, 1993, memo. The report lacks the two main tables, DESCRIPTIVE AND THERMAL DATA FOR WELLS AND SPRINGS, and CHEMICAL DATA FOR THERMAL WELLS AND SPRINGS, but you have seen them before. The chemistry table is not complete, because I am waiting for an additional ten analyses being done by U.U.R.I. The report also lacks three sections that Gordon Bloomquist is writing: LEGAL AND INSTITUTIONAL SETTING, CURRENT LOW-TEMPERATURE GEOTHERMAL USES, and RESOURCE POTENTIAL AND COLLOCATION OF RESOURCES AND USERS. It also lacks a SUMMARY which I will be writing when Gordon has finished his sections.

The comments above make the report sound quite incomplete, but it is really quite close to being finished, and I think it is amply far along for your review and comments. I will appreciate any guidance you wish to provide. You may, of course, use parts of this draft report for your own reporting requirements, because the parts now finished will probably not change much unless reviewers find things that need to be added or corrected. I will appreciate any comments, corrections, or suggestions you wish to make.

Sincerely,

Eric

J. Eric Schuster,
Assistant State Geologist
Division of Geology and Earth Resources

copy - Paul Lienau, O.I.T.
- Gordon Bloomquist, W.S.E.O.

1111 WASHINGTON ST SE ▮ PO BOX 47000 ▮ OLYMPIA, WA 98504-7000

W-DNR 6/1/94

FINAL REPORT FORMAT
LOW-TEMPERATURE GEOTHERMAL RESOURCE ASSESSMENT: 1993

Report Requirements: A final summary report, not to exceed 50 pages. Description of all tasks and results. Document new data. Geothermal resource map of state (1:1,000,000) or acceptable alternative.

CONTENTS

Cover Page
ACKNOWLEDGMENTS
DISCLAIMER (standard DOE statement)
ABSTRACT

1.0 INTRODUCTION
- Previous geothermal assessment
- Need for a new assessment
- Overview of program, funding route, etc.

2.0 DATA SOURCES
- Selection criteria
- Error and duplicate record checking
- Reference to/explanation of bibliography
- ACKNOWLEDGEMENTS

3.0 DATA FORMAT
- General organization of tables or spreadsheets
- Methods of data entry (manual or imported from external files)
- Procedures for using the data (hardcopy and diskettes)

4.0 FLUID CHEMISTRY
- New samples, results, implications
- Observations from other database entries (observations, interpretations, implications)

5.0 ~~DISCUSSION~~ GEOLOGIC, HEAT-FLOW, AND HYDROLOGIC SETTING
- Resource potential (qualitative discussion)
- Collocation of resources and users (preliminary observations)

LEGAL AND INSTUTIONAL CONSIDERATIONS

6.0 SUMMARY
- CURRENT LOW-TEMPERATURE GEOTHERMAL USES
- RESOURCE POTENTIAL AND COLLOCATION OF RESOURCES AND USERS

7.0 RECOMMENDATIONS
- Priority areas for Phase 2 studies
- Future studies needed

8.0 REFERENCES / BIBLIOGRAPHY

APPENDICES
- Tables, etc.

State Geothermal Resource Map (1:1,000,000 or acceptable alternative)
Other Figures: Histogram of occurrences v.s. temperature
State outline map, page size, with resource areas.

WASHINGTON STATE DEPARTMENT OF
Natural Resources

JENNIFER M. BELCHER
Commissioner of Public Lands

KALEEN COTTINGHAM
Supervisor

November 17, 1993

Dr. Howard P. Ross, Project Manager
Earth Science Laboratory
University of Utah Research Institute
391 Chipeta Way, Suite C
Salt Lake City, Utah 84108-1295

Dear Howard:

Pursuant to your memo of November 4, 1993, here is the best I can do at this time to supply the information needed on your Table 1, Geothermal Database Summary.

Total Database Entries	-	1993 = 971
		1981 = 368
Moderate Temp. Wells	-	1993 = 1
		1981 = 1
Low Temp. Wells/Springs	-	1993 = 970
		1981 = 367
Low Temp. Resource Areas	-	1993 = 17 +/-
		1981 = 10 +/-
Direct Heat Utilization	-	1993 = 3 or more
		1981 = 0
Greenhouses, Aquaculture,		1993 = 0 ?
Industrial Processes	-	1981 = 0 ?
Areas, Multiple Residence Heating	-	1993 = 0 ?
Areas, Potential Near-Term Direct Heat Util.	-	1993 = 49 +
Areas, Possible New Binary Power Develop.	-	1993 = 0
Areas, High Priority Resource Study	-	1993 = 3 counties.

Regarding the Moderate Temperature Wells, there are more than four hundred oil and gas test wells in Washington, and some are deep enough to exceed 100 degrees C. Only one has been logged in thermal equilibrium and yielded a temperature above 100 degrees C. I have not attempted to convert any of the "oil patch" inequilibrium temperature logs to estimated equilibrium temperatures.

Regarding the Low Temperature Resource Areas, I defined them by identifying groups of wells above 20 degrees C. in the areas shown in light gray on the 1981 map. The light

1111 WASHINGTON ST SE ▮ PO BOX 47000 ▮ OLYMPIA, WA 98504-7000

gray areas represented areas "favorable for exploration for, and development of, thermal water of sufficient temperature (20 degrees C. and higher) for direct heat application". These areas are: North Bonneville-Carson, E. Klickitat and S. Benton Counties, Walla Walla-Touchet, Yakima Valley, Ephrata, Moses Lake, Othello, Cunningham, Connell, and the Hanford Reservation. Those ten areas are still there on the 1993 map, and to them I would add seven more, namely: Jackson Prairie gas storage field, central Benton County, SW Franklin County, Clarkston, NW Adams County, an area west of Spokane, and the Black Rock Valley in NE Yakima County.

Regarding the Direct Heat Utilization, I know of only three direct heat utilization facilities: the courthouse in Ephrata, the Yakima County? jail, and Walla Walla Community College. There may be more. Gordon Bloomquist is out of town until November 29. I will see if he can add more sites then. Two of the three were being planned in 1981, but none was in operation.

Regarding Greenhouses, Aquaculture, and Industrial Processes, as far as I know there are no greenhouses, aquaculture, or industrial processes using geothermal heat sources.

Regarding the Areas of Multiple Residence Heating, I know of no multiple-residence heating installations.

Regarding the Areas of Potential Near-Term Direct Heat Utilization, 49 is a minimum number. I got it by identifying municipalities (36), school districts (5), colleges (4), ports and P.U.D.'s (2), county facilities (1), and state facilities (1) where there are warm wells. There are, undoubtedly, many federally-owned, other state-owned, and probably many privately-owned wells that have significant heat loads nearby.

Regarding the Areas of High Priority for Resource Study, I defined the priority areas very broadly as the three counties (Yakima, Walla Walla, and Benton) where there are more warm wells apparently near potential users than in other counties, and, at the same time, no closed ground-water basins. These areas will probably be refined considerably when I have had a chance to work with Gordon and consider more factors.

Finally, let me take this opportunity to confirm what I told Paul Lienau on the telephone earlier. That is, even though the database work is moving along, I can certainly use a no-cost contract extension, because it is difficult for Gordon to find time to help me select the priority areas for further study or development, and that is preventing me from taking water samples and getting the final report writing started.

Please let me know if I can amplify or clarify any of the above.

Sincerely,

Eric

J. Eric Schuster, Assistant State Geologist
Division of Geology and Earth Resources

copy: Paul Lienau
Gordon Bloomquist

HR

UNIVERSITY OF UTAH RESEARCH INSTITUTE
UURI
EARTH SCIENCE LABORATORY
391 CHIPETA WAY, SUITE C
SALT LAKE CITY, UTAH 84108—1295
TELEPHONE 801-524-3422

July 16, 1992

Mr. Paul J. Lienau
Geo-Heat Center
Oregon Institute of Technology
3201 Campus Drive
Klamath Falls, OR 97601

Dear Paul:

Enclosed is a letter of response for the State of Washington Low-Temperature Program statement of work (SOW) written by J. Eric Schuster, Assistant State Geologist, and the Washington Principal Investigator. Eric's letter restates and elaborates on our SOW and breaks out the cooperative effort with the Washington State Energy Office (WSEO). Budget information, travel policy and resumes are also included. OIT-GHC and EG&G should respond directly to Eric with any questions regarding the above information.

Paul, I have been receiving inquiries from the state team P.I.'s who submitted responses to me from 30 to 60 days ago, regarding the status of their subcontracts. Is EG&G waiting until all responses are in before completing the OIT-GHC contract modifications? If so, this intent to save a limited amount of paperwork is severely cramping the work period, budgets, and planning for a number of state teams. These teams are being asked to complete a large amount of work, including original data gathering, in a limited timeframe and on limited budgets. Delays in getting the contracts signed pose an additional burden to Principal Investigators with university responsibilities who planned to use the summer period, and students between quarters, to work on this project.

Paul, please help expedite these subcontracts before more time is lost. All subcontract information already reviewed and approved by EG&G should go into one contract modification for OIT-GHC, with other contract modifications later, as required. There may be a substantial delay in getting agreement on a SOW and budget and supporting information for the Nevada state team, and this should not hold up any other subcontracts.

I will try to telephone you to discuss this problem when you return from vacation (and before I leave on vacation, July 23).

Sincerely,

Howard

Howard P. Ross
Project Manager

HR/mt
Enclosure

cc: P.M. Wright

ADDENDUM TO STANDARD CONTRACT AGREEMENT
for
STATE GEOTHERMAL ENERGY RESEARCH,DEVELOPMENT,
AND DATABASE COMPILATION

between

THE OREGON STATE SYSTEM OF HIGHER EDUCATION
OREGON INSTITUTE OF TECHNOLOGY

and

THE WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND EARTH RESOURCES

WASHINGTON

STATEMENT OF WORK

1.0 INTRODUCTION

The United States Department of Energy - Geothermal Division (DOE/GD) supports the development of indigenous and environmentally advantageous energy alternatives to the traditional fuels. There is a very large, nearly unused supply of low- and moderate-temperature geothermal resources in the United States that could be brought on line over the next decade. The increased use of Geothermal Heat Pumps (GHPs) could also reduce the need for traditional fossil fuel consumption for space heating and cooling.

The U.S. Congress has appropriated funds for a program of Low-Temperature Geothermal Resources and Technology Transfer and DOE/GD has funded EG&G, Idaho to establish contracts with the Oregon Institute of Technology - Geo-Heat Center (OIT-GHC), the Idaho Water Resources Research Institute (IWRRI) and the University of Utah Research Institute (UURI) to implement this program.

Important parts of this program are to bring the inventory of the nation's low- and moderate-temperature resources up to date, to complete a collocation study of these resources and communities and other potential users, and to collect and disseminate information necessary to expand the use of GHPs. OIT-GHC will have the lead role in the collocation study and will establish subcontracts with the state resource teams. UURI will work with the State Teams on gathering, documenting, and assembly of low- and moderate-temperature hydrothermal resource data and will assist in technical monitoring of the State Team efforts and publications. IWRRI will be responsible for establishing the hydrothermal resource data for Idaho and for performing geothermal reservoir evaluations throughout the western United States.

The technical tasks described herein may be considered Phase I of the Low-Temperature Geothermal Resources and Technology Transfer program. If Phase I proves successful, and additional funds are appropriated by Congress, the program may be expanded and continued. Phase II would likely include detailed resource evaluations of priority areas identified in Phase I.

Funding for the Low-Temperature Geothermal Resources and Technology Transfer Program is limited, and the success and continuation of the program is dependent upon a productive Phase I effort. Participating State Teams are encouraged to seek state or organization cost shares (in cost or in-kind) to enhance this contract effort.

2.0 TECHNICAL TASKS

The following technical tasks will be accomplished under this subcontract.

2.1 Complete an updated inventory of low- and moderate-temperature resources for the State of Washington, current to June 1, 1992. Review drilling records and other information to identify new resources and verify temperatures and flow rates of springs and wells which may have changed substantially since the previous statewide geothermal resource inventory. Identify geological, geophysical, geochemical, and hydrologic studies which relate to these resources. The minimum temperature for a low-temperature resource is defined to be 10°C above the mean annual air temperature at the surface and should increase by 25°C/km. Occurrences to 150°C will be included.

2.2 Conduct a fluid geochemistry study of the more important resource areas for which existing data are questionable or unavailable. UURI will provide up to ten (10) quantitative fluid chemical analyses for each state in support of this study.

2.3 Complete a computer database listing compatible with Lotus 123 format tabulating for each occurrence: name, location (T,R,S), county, longitude, latitude, depth, flow, temperature, chemistry, and other data as appropriate and available.

2.4 Review OIT-GHC geothermal resource and demographic data for the State of Washington for accuracy and completeness, as part of the collocation study.

2.5 Assist OIT-GHC, UURI, and IWRRI in studies to prioritize low- and moderate-temperature resource areas for new development. Develop conceptual geologic models and groundwater data for selected resources.

3.0 REPORTS, DATA, AND OTHER DELIVERABLES

3.1 A geothermal database listing in hardcopy and diskette form will be submitted to UURI. The listing will include all known low- and moderate- temperature spring and well occurrences in the State of Washington. Principal facts will include location, depth (well), flow rate (if known), etc.

3.2 Letter reports and memoranda reviewing collocation data and priority rankings will be submitted to OIT-GHC and UURI.

3.3 A final summary report, not to exceed 50 pages, describing all tasks and their results, and documenting any new temperature, geologic, geochemical or geophysical data will be submitted to UURI, OIT-GHC, and IWRRI. This report may incorporate interim letter reports and memoranda as appendices. The report will include a geothermal resource occurrence map of the state, black and white, scale 1:1,000,000 or acceptable alternative.

3.4 Interim progress reports will be submitted to UURI and OIT-GHC quarterly.

4.0 SCHEDULE OF PERFORMANCE AND REPORTING

4.1 The period of performance for this agreement will terminate December 31, 1993, unless modified by letter agreement and signed by the State of Washington, Department of Natural Resources, OIT-GHC, and UURI.

4.2 A review of the OIT-GHC collocation study will be completed and a letter report or memorandum of comment submitted to OIT-GHC and UURI within one month after receipt of the draft document from OIT-GHC.

4.3 A preliminary database listing of geothermal resource occurrences will be submitted to UURI within four months after the execution of this agreement.

4.4 A final database listing of geothermal resource occurrences will be submitted to UURI within twelve months after the execution of this agreement.

4.5 A final report documenting all new data and activities completed under this agreement will be submitted to UURI not later than December 31, 1993.

5.0 RESPONSIBLE PARTIES

5.1 The Principal Investigator for this agreement will be J. Eric Schuster, Washington Division of Natural Resources.

5.2 The Technical Project Managers for this agreement will be Howard P. Ross, UURI and Paul J. Lienau, OIT-GHC.

5.3 The Contracting Officer for this agreement will be Douglas Yates, OIT.

6.0 FUNDING

This contract agreement provides for funding not to exceed $35,000.00 for the completion of all technical tasks and submittal of all required deliverables.

HR copy w/o complete travel policy 7/16/92

WASHINGTON STATE DEPARTMENT OF
Natural Resources

BRIAN BOYLE
Commissioner of Public Lands

Division of Geology & Earth Resources
P.O. Box 47007
Olympia, WA 98504-7007
(206) 459-6372
FAX (206) 459-6380

July 13, 1992

Dr. Howard P. Ross
Project Manager
University of Utah Research Institute
Earth Science Laboratory
391 Chipeta Way, Suite C
Salt Lake City, UT 84108-1295
Telephone: 801-524-3444
FAX: 801-524-3453

Re: Addendum to Standard Contract Agreement for State Geothermal Energy Research, Development, and Database Compilation

Dear Dr. Ross:

This is a response to your letter of April 28, 1992, and its enclosed proposed Statement of Work for participation by the Washington State Department of Natural Resources, Division of Geology and Earth Resources (DGER) in the Department of Energy-Geothermal Division's (DOE/GD) Low Temperature Geothermal Resources and Technology Transfer Program for updating the state's low- and moderate-temperature geothermal resource database. We are pleased to be able to cooperate with the Washington State Energy Office (WSEO) in responding to your proposed statement of work. The vehicle of cooperation between WSEO and DGER will be an Interagency Agreement.

The following response is, in essence, an expanded recapitulation of the Statement of Work enclosed with your April 28 letter. Our intention is to respond to each and every point of the Statement of Work, and if we have failed to do so satisfactorily, we will appreciate hearing about it so we can make corrections. In the material that follows the paragraphs of the Statement of Work are repeated (enclosed in quotation marks), followed by further explanatory information, if necessary, and by an indication of what portion of the work will be done by WSEO and what part by DGER.

"2.0 TECHNICAL TASKS"

"The following technical tasks will be accomplished under this subcontract."

"2.1 Complete an updated inventory of low- and moderate-temperature resources for the State of Washington, current to June 1, 1992. Review drilling records and other information to identify new resources and verify temperatures and flow rates of springs and wells which may have changed substantially since the previous statewide geothermal resource inventory. Identify geological, geophysical, geochemical, and hydrologic studies which relate to these resources. The minimum temperature for a low-temperature resource is defined to be 10°C above the mean annual air temperature at the surface and should increase by 25°C/km. Occurrences to 150°C will be included."

WSEO will assist in the inventory of low- and moderate-temperature geothermal resources through the updating of site data files developed during previous statewide geothermal assessments. DGER will begin the inventory process by reviewing all available published information and incorporating all references into an updated dBase III+ computerized bibliography of geothermal resources in Washington, with some coverage of legal and institutional setting and uses of low- and moderate-temperature geothermal resources. Major sources of bibliographic data will include existing published or open-filed bibliographies, GEOREF, the DGER library, and the WSEO library.

DGER will review existing literature and WSEO's existing site data files to generate a preliminary inventory. The preliminary inventory will be supplemented by adding wells from the drilling records of the Washington Department of Ecology (WADOE) for those counties that are known to have ground waters warmer than 10°C above the mean annual air temperature. For the most part the pertinent well records are housed in the Yakima and Spokane regional offices of the WADOE, and there are many thousands of well records to review. Supplemental data will be collected from personnel of the WADOE, from drillers, from local officials, and from current users of low- and moderate-temperature geothermal resources. These data will be incorporated into a Lotus 123 database, as covered in paragraph 2.3 below.

"2.2 Conduct a fluid geochemistry study of the more important resource areas for which existing data are questionable or unavailable. University of Utah Research Institute (UURI) will provide up to ten (10) quantitative fluid chemical analyses for each state in support of this study."

DGER will conduct the sampling as necessary. We assume that UURI will make available any special gear or instructions needed to sample the waters in a satisfactory manner. We are not prepared to do any downhole sampling.

"2.3 Complete a computer database listing compatible with Lotus 123 format tabulating for each occurrence: name, location (T, R, S), county, longitude, latitude, depth, flow, temperature, chemistry, and other data as appropriate and available."

DGER will complete the database listing, and WSEO will create a geographic-information-system data layer containing the locations of low- and moderate-temperature geothermal resources using Arc Info and plot the 1:1,000,000-scale geothermal occurrence map of the state called for in paragraph 3.3 below.

"2.4 Review Oregon Institute of Technology Geo-Heat Center (OIT-GHC) geothermal resource and demographic data for the State of Washington for accuracy and completeness, as part of the collocation study."

DGER and WSEO will address this task jointly.

"2.5 Assist OIT-GHC, UURI, and IWRRI in studies to prioritize low- and moderate-temperature resource areas for new development. Develop conceptual geologic models and ground water data for selected resources."

DGER and WSEO will address this task jointly. Both will assist in the development of conceptual geologic models and ground water data. (It should be pointed out that the Washington Department of Ecology has statutory authority to investigate ground water, so DGER and WSEO are not in a position to conduct detailed ground water investigations, but both can provide the level of detail on ground water that would be expected of ordinary geologists.) WSEO will take the lead in assisting OIT and others in studies to prioritize low- and moderate-temperature resource areas for new development.

As an aid in establishing priorities, WSEO will analyze in detail the heat load density of up to 5 of the most promising urban areas in the state using HEATPLAN/HEATMAP software developed by WSEO, and they will also evaluate the performance history of 3 to 5 geothermal heat pump installations in the state (for example, Grant County Court House in Ephrata, Yakima County Jail, Walla Walla Community College, and Clark College).

<u>**"3.0 REPORTS, DATA, AND OTHER DELIVERABLES"**</u>

"3.1 A geothermal database listing in hardcopy and diskette form will be submitted to UURI. The listing will include all known low- and moderate-temperature spring and well occurrences in the State of Washington. Principal facts will include location, depth (well), flow rate (if known), etc."

DGER will supply this deliverable.

"3.2 Letter reports and memoranda reviewing collocation data and priority rankings will be submitted to OIT-GHC and UURI."

DGER and WSEO will cooperate to supply requested letter reports and memoranda.

"3.3 A final summary report, not to exceed 50 pages, describing all tasks and their results, and documenting any new temperature, geologic, geochemical, or geophysical data will be submitted to UURI, OIT-GHC, and IWRRI. This report may incorporate interim letter reports and memoranda as appendices. The report will include a geothermal resource occurrence map of the state, black and white, scale 1:1,000,000 or acceptable alternative."

DGER will take primary responsibility for the final summary report. We will submit all materials to UURI, OIT-GHC, and IWRRI, and we intend to open-file the geothermal bibliography, the low- and moderate-temperature geothermal database, the geothermal resource occurrence map, and the final summary report.

"3.4 Interim progress reports will be submitted to UURI and OIT-GHC quarterly." DGER and WSEO will submit these reports cooperatively.

"4.0 SCHEDULE OF PERFORMANCE AND REPORTING"

"4.1 The period of performance for this agreement will terminate December 31, 1993, unless modified by letter agreement and signed by the State of Washington, Department of Natural Resources, OIT-GHC, and UURI.

"4.2 A review of the OIT-GHC collocation study will be completed and a letter report or memorandum of comment submitted to OIT-GHC and UURI within one month after receipt of the draft document from OIT-GHC.

"4.3 A preliminary database listing of geothermal resource occurrences will be submitted to UURI within ~~three~~ four HPR months after the execution of this agreement.

"4.4 A final database listing of geothermal resource occurrences will be submitted to UURI within twelve months after the execution of this agreement.

"4.5 A final report documenting all new data and activities completed under this agreement will be submitted to UURI not later than December 31, 1993.

"5.0 RESPONSIBLE PARTIES"

"5.1 The Principal Investigator for this agreement will be J. Eric Schuster,..." Assistant State Geologist, Washington Department of Natural Resources, Division of Geology and Earth Resources. Rebecca Christie of DGER will generate the updated bibliography and assist with data entry, and Dr. R. Gordon Bloomquist of WSEO will lead that office's participation in this project. Resumes for these three are attached (Appendix C).

"5.2 The Technical Project Managers for this agreement will be Howard P. Ross, UURI, and Paul J. Lienau, OIT-GHC.

"5.3 The Contracting Officer for this agreement will be Douglas Yates, OIT."

6.0 ITEMS REQUIRED BY EG&G, IDAHO, INC.

1. "A current copy of the agency's negotiation agreement that addresses indirect rates." Attached as Appendix A.

2. "A copy of the agency's official (typed and formal) travel policy. (We would also need to see a very detailed estimate of the point of departure and destination, number of travelers, number of days duration, etc.)"

Travel policy document is attached as Appendix B. It is impossible to estimate exactly the destinations of travel, because it may be necessary to travel to any of the cities in eastern and southern Washington where low- and moderate-temperature geothermal resources occur. The following outline can be offered at this time. We know that at least one week (5 days) of travel from Olympia to each of the eastern Washington offices of the Washington Department of Ecology (located in Yakima and Spokane) will be necessary for the purpose of reviewing and making copies of pertinent well records. The budget which follows includes funds for four to six additional trips of a total of 20 days duration to any cities of eastern or southern Washington for the purpose of interviewing officials and well owners for added well information or for visiting important resource sites to confirm the resource data and/or to collect additional data. Totals for travel are 30 days in travel status with a reimbursement rate of $26 per day for meals and up to $48 per day for lodging in Spokane and up to $40 per day for lodging in all other areas of eastern and southern Washington (the lower rate is used to calculate the budget), and up to 3600 miles at $0.27/mile for State-owned sedans. We anticipate that the Principal Investigator will be doing most of the travel, and it is probable that only one person will be traveling at any one time. The budget includes $250 of travel for WSEO in connection with analyzing the heat load density of up to 5 of the most promising urban areas and evaluating the performance history of 3 to 5 heap pump installations in eastern and southern Washington

3. "Resumes of the proposed performers to address education and experience."

Resumes for J. Eric Schuster, Rebecca A. Christie, R. Gordon Bloomquist, and Robert G. O"Brien are attached as Appendix C.

4. Cost Proposal.

PROPOSED BUDGET

<u>Federal Funds</u>

Salaries:

DGER: Rebecca Christie, Librarian, 240 hours @ $11.69/hr	$2,806	
Eric Schuster, Asst. State Geologist, 646.5 hours @ $23.15/hr	14,967	
WSEO: Gordon Bloomquist, Geothermal Programs Geologist, 120 hours @ $25.16/hr	3,019	
	--------	
subtotal		$20,792

Benefits:			
DGER: 28 percent of salaries		$4,977	
WSEO: 24.91 percent of salaries		752	
		--------	
	subtotal		$5,729
Travel:			
DGER: Per Diem, 30 days @ $66/day		$1,980	
Mileage, 3600 miles @ $0.27/mile		972	
WSEO:		250	
		--------	
	subtotal		$3,202
Goods and Services:			
DGER: Supplies and materials		$500	
WSEO: Rent		$270	
Personnel		24	
		--------	
	subtotal		$794
Indirect Costs:			
DGER: 10.00 percent of total direct costs		$2,620	
WSEO: 43.17 percent of total direct costs		$1,863	
		--------	
	subtotal		$4,483

	Total Federal cost		$35,000

State Matching Funds

Salaries:			
DGER: Katherine Reed, Geologist/Editor, 80 hr. @ $19.97/hr		$1,598	
Jari Roloff, Editorial Asst., 40 hr. @ $11.96/hr		478	
Nancy Eberle, Cartographer 2, 80 hr. @ $17.22/hr		1,378	
Connie Manson, Sr. Librarian, 20 hr. @ $18.08/hr		362	
Barbara Preston, Admin. Asst. 2, 40 hr. @ $12.84/hr		514	
WSEO: Robert O'Brien, ES3, 174 hr @ $20.28/hr		3,529	
		--------	
	subtotal		$7,859
Benefits:			
DGER: 28 percent of salaries		$1,212	
WSEO: 24.91 percent of salaries		879	
		--------	
	subtotal		$2,091

Travel:		
WSEO:		$265
Goods and Services:		
WSEO: Rent	$376	
Personnel	28	
	--------	
subtotal		$404
Indirect Costs:		
WSEO: 43.17 percent of total direct costs		$2,192
		--------
total State matching contribution		$12,811

5. Auditing Information.

The Department of Natural Resources has had regular audits. Federal agencies have audits performed by the State Auditor's Office. The representative from the State Auditor's Office who performs these audits is Beverly Doupe, telephone (206) 753-6322.

Respectfully submitted by

J. Eric Schuster

J. Eric Schuster
Assistant State Geologist
Division of Geology and Earth Resources
(206) 459-6372

Approved by

Raymond Lasmanis

Raymond Lasmanis
State Geologist
Division of Geology and Earth Resources

JES

File Name = GEOTHDOE

APPENDIX A

Current copy of the agency's negotiation agreement
that addresses indirect rates.

WASHINGTON STATE DEPARTMENT OF
Natural Resources

BRIAN BOYLE
Commissioner of Public Lands
OLYMPIA, WA 98504

RECEIVED JUL - 3 1991 GEOLOGY AND EARTH RESOURCES

MEMORANDUM

June 28, 1991

To: Division Managers, Federal Grant Project Coordinators

From: DH Don Hansen, Manager
Financial Services Division

Subject: FY92 Indirect Cost Rate

An updated Indirect Cost Rate has been negotiated and approved for the agency at a rate of 10%. This rate is effective from July 1, 1991 through June 30, 1993.

If you have any questions, please contact Sandy Williams at 753-1346.

DH:sw

cc: Rose Amurao

APPENDIX B

The agency's official (typed and formal) travel policy.

DRAFT

TABLE OF CONTENTS

DATE: PAGE: OF

CANCELS: New SEE ALSO: Tsk 1-1
Pro 2-2

POLICY

Approved By:

POL-1 CONTROL OVER TRAVEL

This policy applies to all Department officers and employees placed in travel status on official business.

1. Control Over Travel

Each Regional/Division Manager will establish a positive system for control over travel within their Region/Division that meets the requirements of Section 4.2.1 of the Office of Financial Management (OFM) Manual.

2. Travel Status Defined

An employee is in travel status when the number of travel hours before and/or after the employee's regularly scheduled working hours of any one day total three or more hours.

3. Approval of Out of State Travel

Out of state travel up to 150 miles from the Washington border (except Canada) may be approved by Regional/Division Managers or authorized designee without the use of an Out-of-State Travel Request Form RES 25-2501 (F-20) or a Travel Authorization Form (A-40). All other out of state travel must be approved by the Regional/Division Manager, the Department Deputy Supervisor and the Commissioner or Department Supervisor on an Out-of-State Travel Request Form or Travel Authorization Form.

APPENDIX C

Resumes for J. Eric Schuster, Rebecca A. Christie,
R. Gordon Bloomquist, and Robert G. O'Brien.

RESUME
for
J. Eric Schuster

May 27, 1992

WORK ADDRESS: Division of Geology and Earth Resources, Department of Natural Resources, P. O. Box 47007, Olympia, WA 98504-7007, Telephone (206) 459-6372, FAX (206) 459-6380.

HOME ADDRESS: 6022 Margo Place, Tumwater, WA 98504-5233, Telephone (206) 943-2851.

BIRTH DATE AND PLACE: December 9, 1943, Spokane, WA.

CITIZENSHIP: United States of America. SOCIAL SECURITY NUMBER: 531-52-9473.

EDUCATION:

1950-1962 Attended public schools in St. John, WA. Graduated from high school in 1962 as class salutatorian.

1962-1966 Attended Washington State University, Pullman, WA. Graduated in 1966 with a Bachelor of Science degree in Geology. Graduated with distinction.

1966-1970 Attended University of Wyoming, Laramie, WY. Was awarded a three-year National Defense Education Act fellowship. Graduated in 1972 with a Master of Science degree in Geology. Thesis: Distribution of copper and the platinum group in mafic rocks of the Sierra Madre, Carbon County, Wyoming.

PROFESSIONAL EXPERIENCE:

1966 Teaching assistant in Geology Department at Washington State University (spring semester).

1966 Exploration geologist in Yukon Territory, Canada, for Watts, Griffis, and McOuat, Consulting Geologists (summer).

1966-1969 Field mapping for thesis project in preCambrian metasedimentary and mafic intrusive rocks of the Sierra Madre, Carbon County, Wyoming (summers).

1969 Teaching assistant in Geology Department at University of Wyoming (fall semester).

1970-1974 Geologist 2, Washington State Department of Natural Resources, Division of Mines and Geology (changed to Division of Geology and Earth Resources in 1973). Responsibilities included geologic mapping in refolded Paleozoic metasedimentary rocks in Stevens County, northeastern Washington, and assessment of geothermal energy resources.

1974-1976 Geologist 3, Washington State Department of Natural Resources, Division of Geology and Earth Resources. Responsibilities included those listed above for Geologist 2 as well as preparation of geothermal grant proposals and contract administration.

1976-Present Assistant State Geologist and Assistant Division Manager, Washington State Department of Natural Resources, Division of Geology and Earth Resources. Responsibilities include: Management--direct the day to day operations of the Division of Geology and Earth Resources under the policy guidance and review of the State Geologist/Division Manager; directly supervise nine staff members; five of these, in lead positions, supervise a staff of 16 additional people; organization chart attached. Publications--Control overall scheduling, logistics, planning, and quality for Division publications; review all maps and reports being prepared for publication to insure that they meet Division objectives and general style criteria and are of high technical quality. Budget--Assist in preparing the Division's budget requests; set up Division allotments (about $2 million per year); track and control Division expenditures. Geologic work--Compile geologic maps at 1:100,000 scale for southeastern Washington and release as Division open-file reports; prepare 1:250,000-scale geologic map and accompanying text for publication as a full-color state geologic map quadrant; perform peer reviews on geologic maps and reports; keep up with developments in geology; write and review proposals for outside funding of projects; write a history of the Division; answer public inquiries on the geology and geothermal resources of Washington; routinely use MS-DOS, WordPerfect, and Lotus 1-2-3 programs on personal computers.

WORK SPECIALTIES: Management (of staff, publications, and budget), geologic compilation and mapping, geothermal energy resources.

PROFESSIONAL ASSOCIATION: Sigma Xi

PERSONAL REFERENCES:

Raymond Lasmanis, State Geologist, Washington State Division of Geology and Earth Resources, Department of Natural Resources, P. O. Box 47007, Olympia, WA 98504-7007, Telephone (206) 459-6372, FAX (206) 459-6380.

Wayne Schaub, Pastor, Tumwater United Methodist Church, 1401 Lake Park Drive S.W., Tumwater, WA 98502, Telephone (206) 786-1416.

Stephen P. Reidel, Geologist, Westinghouse Hanford Co., Mail Stop H2-59, P. O. Box 1970, Richland, WA 99352, Telephone (509) 376-9932, FAX (509) 376-6476.

PUBLICATIONS:

Reidel, S. P.; Fecht, K. R.; Schuster, J. E., compilers, in preparation, Geologic map of the Richland 1:100,000 quadrangle, Washington, and the Washington portion of the Hermiston 1:100,000 quadrangle: Washington Division of Geology and Earth Resources Open File Report.

Schuster, J. E., compiler, in preparation, Geologic map of the Clarkston 1:100,000 quadrangle, Washington-Idaho, and the Washington portion of the Orofino 1:100,000 quadrangle: Washington Division of Geology and Earth Resources Open File Report.

Schuster, J. E., compiler, in preparation, Geologic map of the east half of the Toppenish 1:100,000 quadrangle, Washington, and the east half of the Washington portion of the Goldendale 1:100,000 quadrangle: Washington Division of Geology and Earth Resources Open File Report.

Schuster, J. E., compiler, in preparation, Geologic map of the Walla Walla 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources Open File Report.

Schuster, J. E., and others, compilers, in preparation, Geologic map of Washington--Southeast quadrant: Washington Division of Geology and Earth Resources Geologic Map, scale 1:250,000.

Schuster, J. E., compiler, 1992, Geologic map of Washington: Washington Division of Geology and Earth Resources geologic map, 1 sheet, scale approx. 1:2,250,000.

Schuster, J. E., 1992, History of cooperative topographic mapping in Washington: Washington Geology, v. 20, no. 1, p. 41.

Schuster, J. E., 1991, Geological activities during the hiatus, 1892-1901: Washington Geology, v. 19, no. 2, p. 25-27.

Schuster, J. E., 1991, Geologic work grinds to a halt--Politics and finances - 1891-1893: Washington Geology, v. 19, no. 1, p. 43-48.

Schuster, J. E., 1990, Early efforts of the Washington Mining Bureau: Washington Geologic Newsletter, v. 18, no. 4, p. 17-20.

Schuster, J. E., 1990, How the Washington State "geological survey" got its start in 1890: Washington Geologic Newsletter, v. 18, no. 2, p. 18-19.

Schuster, J. E., 1990, State geologic map progress: Washington Geologic Newsletter, v. 18, no. 4, p. 25-27.

Schuster, J. E., 1989, Support for graduate student mappers: Washington Geologic Newsletter, v. 17, no. 4, p. 28-29.

Repetski, J. E.; Dutro, J. T., Jr.; Schuster, J. E., 1989, Upper Metaline limestone is Ordovician [abstract]: Geological Society of America Abstracts with Programs, v. 21, no. 5, p. 133.

Schuster, J. E.; Repetski, J. E.; Carter, Claire; Dutro, J. T., Jr., 1989, Nature of the Metaline Formation-Ledbetter Formation contact and age of the Metaline Formation in the Clugston Creek area, Stevens County, Washington--A reinterpretation: Washington Geologic Newsletter, v. 17, no. 4, p. 13-20.

Schuster, J. E., 1988, State geologic map progress: Washington Geologic Newsletter, v. 16, no. 4, p. 20-23.

Schuster, J. E., editor, 1987, Selected papers on the geology of Washington: Washington Division of Geology and Earth Resources Bulletin 77, 395 p.

Schuster, J. E., 1986, Geologic map of Washington--A progress report: Washington Geologic Newsletter, v. 14, no. 3, p. 26.

Schuster, J. E., 1986, Geologic map of Washington, a progress report [abstract]: Northwest Petroleum Association Symposium, May 16, 1986, 1 p.

Schuster, J. E., 1984, State geologic map program; graduate student mapping project: Washington Geologic Newsletter, v. 12, no. 1, p. 22-23.

Korosec, M. A.; Phillips, W. M.; Schuster, J. E., 1983, The low temperature geothermal resources of eastern Washington. In Korosec, M. A.; Phillips, W. M.; Schuster, J. E.; and others, The 1980-1982 geothermal resource assessment program in Washington: National Technical Information Service DOE/ET/27014-T6, p. 159-179.

Korosec, M. A.; Phillips, W. M.; Schuster, J. E., 1983, The low temperature geothermal resources of eastern Washington. In Korosec, M. A.; Phillips, W. M.; Schuster, J. E.; and others, The 1980-1982 geothermal resource assessment program in Washington: Washington Division of Geology and Earth Resources Open File Report 83-7, p. 159-179.

Korosec, M. A.; Phillips, W. M.; Schuster, J. E.; and others, 1983, The 1980-1982 geothermal resource assessment program in Washington: National Technical Information Service DOE/ET/27014-T6, 299 p.

Korosec, M. A.; Phillips, W. M.; Schuster, J. E.; and others, 1983, The 1980-1982 geothermal resource assessment program in Washington: Washington Division of Geology and Earth Resources Open File Report 83-7, 299 p.

Korosec, M. A.; Schuster, J. E., 1983, Heat-flow drilling in Washington during 1981. In Korosec, M. A.; Phillips, W. M.; Schuster, J. E.; and others, The 1980-1982 geothermal resource assessment program in Washington: National Technical Information Service DOE/ET/27014-T6, p. 120-158.

Korosec, M. A.; Schuster, J. E., 1983, Heat-flow drilling in Washington during 1981. In Korosec, M. A.; Phillips, W. M.; Schuster, J. E.; and others, The 1980-1982 geothermal resource assessment program in Washington: Washington Division of Geology and Earth Resources Open File Report 83-7, p. 120-158.

Schuster, J. E., 1983, Division to start work on new state geologic map: Washington Geologic Newsletter, v. 11, no. 4, p. 6-7.

Blackwell, D. D.; Steele, J. L.; Priest, G. R.; Black, G. L.; Schuster, J. E.; Korosec, M. A., 1982, Heat flow, gravity and magmatism in the Cascade Range of the Pacific Northwest [abstract]: Eos (American Geophysical Union Transactions), v. 63, no. 45, p. 1091.

Korosec, M. A.; Phillips, W. M.; Schuster, J. E., 1982, The low temperature geothermal resources of eastern Washington: Washington Division of Geology and Earth Resources Open File Report 82-1, 20 p.

Korosec, M. A.; Phillips, W. M.; Schuster, J. E., 1982, The low temperature geothermal resources of eastern Washington. In Ruscetta, C. A., editor, Geothermal direct heat program, Roundup Technical Conference proceedings, State coupled resource assessment program: University of Utah Research Institute ESL-98; U.S. Department of Energy DOE/ID/12078-71, Vol. I, p. 273-291.

Korosec, M. A.; Kaler, Keith L.; Schuster, J. E.; and others, compilers, 1981, Geothermal resources of Washington: Washington Division of Geology and Earth Resources Geologic Map GM-25, 1 sheet, scale 1:500,000.

Schuster, J. E., 1981, Geothermal energy potential of the Yakima valley area, Washington. In Bloomquist, R. G., editor, Proceedings of the Geothermal Symposium--Low temperature utilization, heat pump applications, district heating, September 24, 1980: Washington State Energy Office WAOENG 81-05, p. XI 1 - XI 10.

Schuster, J. E., 1981, A geothermal exploration philosophy for Mount St. Helens, (and other Cascade volcanoes?). In Ruscetta, C. A.; Foley, Duncan, editors, Geothermal direct heat program; Glenwood Springs Technical Conference proceedings; Volume 1: University of Utah Research Institute ESL-59, p. 297- 300.

Schuster, J. E., 1981, A proposal to Bonneville Power Administration for 1981-1983 Washington State geothermal resource assessment program. In Bloomquist, R. G., compiler, A proposal for Northwest geothermal development: Washington State Energy Office, Appendix II.

Schuster, J. E.; Korosec, M. A., 1981, Preliminary report on heat-flow drilling in Washington during 1981: Washington Division of Geology and Earth Resources Open File Report 81-8, 36 p.

Blackwell, D. D.; Steele, J. L.; Schuster, J. E.; Korosec, M. A., 1980, The regional thermal setting of the Mt. St. Helens volcano [abstract]: Eos (American Geophysical Union Transactions), v. 61, no. 46, p. 1134.

Korosec, M. A.; Schuster, J. E., 1980, Geothermal assessment for the State of Washington [abstract]. In Pacific Northwest metals and minerals conference 1980, Abstracts: American Institute of Mining, Metallurgical and Petroleum Engineers, p. 43.

Korosec, M. A.; Schuster, J. E., 1980, Geothermal assessment of Mount St. Helens, Washington, 1979. In Korosec, M. A.; Schuster, J. E.; and others, The 1979-1980 geothermal resource assessment program in Washington: Washington Division of Geology and Earth Resources Open File Report 81-3, p. 123-131.

Korosec, M. A.; Schuster, J. E., 1980, Geothermal investigations in the Camas area, Washington, 1979. In Korosec, M. A.; Schuster, J. E.; and others, The 1979-1980 geothermal resource assessment program in Washington: Washington Division of Geology and Earth Resources Open File Report 81-3, p. 117-122.

Korosec, M. A.; Schuster, J. E., 1980, Pre-eruption geothermal assessment activities at Mount St. Helens, Washington [abstract]: Eos (American Geophysical Union Transactions), v. 61, no. 46, p. 1134.

Korosec, M. A.; Schuster, J. E.; and others, 1980, The 1979-1980 geothermal resource assessment program in Washington: Washington Division of Geology and Earth Resources Open File Report 81-3, 270 p.

Schuster, J. E.; Korosec, M. A., 1980, Geothermal resource assessment in Washington. In U.S. Department of Energy Division of Geothermal Energy, Resource assessment/commercialization planning meeting, Salt Lake City, Utah, January 21-24, 1980: U.S. Department of Energy, p. 146-152.

Schuster, J. E.; Korosec, M. A., 1980, The Washington State geothermal resources assessment program of the Department of Natural Resources, Division of Geology and Earth Resources. In Bloomquist, R. G.; Wonstolen, Ken, editors, Proceedings of the geothermal symposium--Potential, legal issues, economics, financing: Washington State Energy Office WAOENG-80-16, 5 p.

Schuster, J. E.; Blackwell, D. D.; Hammond, P. E.; Huntting, M. T., 1978, Heat flow studies in the Steamboat Mountain-Lemei Rock area, Skamania County, Washington: Washington Division of Geology and Earth Resources Information Circular 62, 56 p.

Schuster, J. E., 1977, Moses Coulee flash flood: Washington Geologic Newsletter, v. 5, no. 4, p. 3-4.

Schuster, J. E., 1976, Geology of the Clugston Creek area, Stevens County, Washington: Washington Division of Geology and Earth Resources Open File Report 76-8, 26 p.

Schuster, J. E., 1976, Geology of the contact between the Metaline Limestone and Ledbetter Slate in the Clugston Creek area, Stevens County, Washington [abstract]: Geological Society of America Abstracts with Programs, v. 8, no. 3, p. 408.

Schuster, J. E., 1976, Some developments in mineral exploration in Washington during 1975--Geothermal: Washington Geologic Newsletter, v. 4, no. 1, p. 7.

Schuster, J. E.; Blackwell, D. D.; Hammond, P. E.; Huntting, M. T., 1976, Heat-flow studies in Steamboat Mountain-Lemei Rock area, Skamania County, Washington [abstract]: American Association of Petroleum Geologists Bulletin, v. 60, no. 8, p. 1410.

Houston, R. S.; Schuster, J. E.; Ebbett, B. E., 1975, Preliminary report on the distribution of copper and platinum group metals in mafic igneous rocks of the Sierra Madre, Wyo.: U.S. Geological Survey Open-File Report 75-85, 129 p.

Schuster, J. E., 1975, Geothermal activities in Washington: Washington Geologic Newsletter, v. 3, no. 4, p. 12-13.

Schuster, J. E., 1974, Geothermal energy potential of Washington. In Washington Division of Geology and Earth Resources, Energy resources of Washington: Washington Division of Geology and Earth Resources Information Circular 50, p. 1-19.

Schuster, J. E., 1974, Geothermal lease applications: Washington Geologic Newsletter, v. 2, no. 3, p. 2-4.

Schuster, J. E., 1974, The search for hot rocks: Rocks and Minerals, v. 49, no. 2, p. 78-81.

Schuster, J. E., 1974, The search for hot rocks--Geothermal exploration, Northwest: Geothermal Energy, v. 2, no. 5, p. 58-60.

Blackwell, D. D.; Bowen, R. G.; Schuster, J. E., 1973, Heat flow and Cenozoic tectonic history of the northwestern United States [abstract]: Geological Society of America Abstracts with Programs, v. 5, no. 1, p. 12-13.

Schuster, J. E., 1973, Directory of Washington mining operations, 1971-72: Washington Division of Mines and Geology Information Circular 48, 97 p.

Schuster, J. E., 1973, Geothermal energy in Washington: Washington Geologic Newsletter, v. 1, no. 4, p. 2-4.

Schuster, J. E., 1973, A learning guide on the geology of the Cispus Environmental Center area, Lewis County, Washington: Washington Division of Geology and Earth Resources Open File Report 73-4, 53 p.

Schuster, J. E., 1973, The search for hot rocks--Geothermal exploration, Northwest: Washington Division of Geology and Earth Resources Reprint 11, 3 p.

Schuster, J. E., 1973, The search for hot rocks--Geothermal exploration, Northwest: Pacific Search, v. 7, no. 7, p. 8-11.

Schuster, J. E., 1973, Tower Rock--A southwestern Washington landmark: Washington Geologic Newsletter, v. 1, no. 2, p. 3-4.

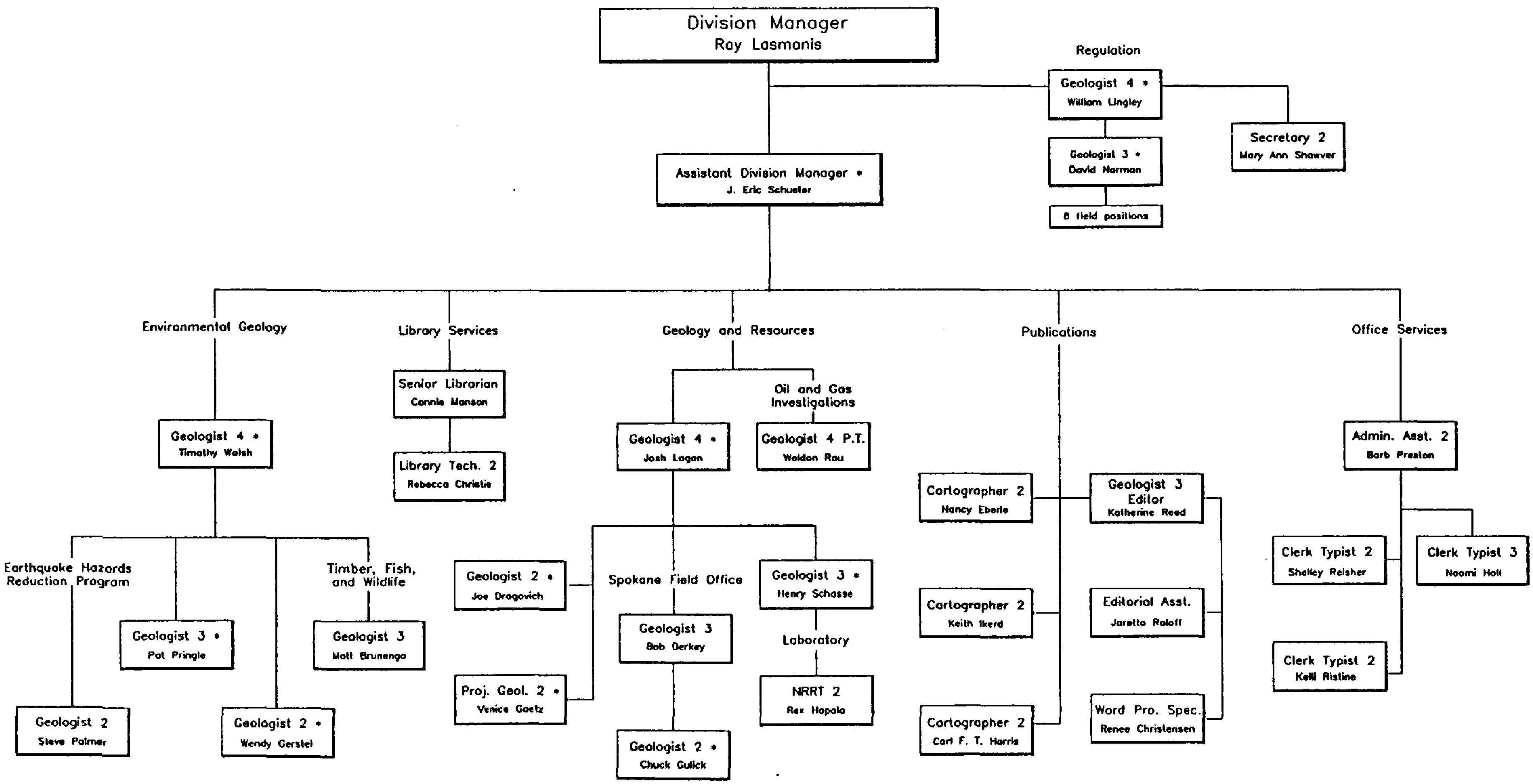
Schuster, J. E., 1972, Distribution of copper and the platinum group in mafic rocks of the Sierra Madre, Carbon County, Wyoming: University of Wyoming Master of Science thesis, 109 p., 2 plates.

Schuster, J. E., 1972, Geothermal exploration in Washington. In Proceedings of the Thermal Power Conference: Washington State University, p. 225-246.

ORGANIZATION CHART

DIVISION OF GEOLOGY AND EARTH RESOURCES

April 1992



* Geologic duties include State Geologic Map

REBECCA A. CHRISTIE

802 Puget St. NE
Olympia, Washington 98506-4122
(206) 786-6935
(206) 459-6372 work

EXPERIENCE

8/90 - present — Washington State Department of Natural Resources, Division of Geology and Earth Resources

4/92 - present	Librarian
8/90 - 3/92	Library Technician

Work with users in a specialized technical collection of books, documents, journals, and maps. Provide reference services; search databases. Responsible for interlibrary loans, acquisitions, and circulation. Organized and indexed a collection of unpublished research materials.

5/90 - 11/90 — Librarian (Substitute), Pierce County Library

Provided reference services, bibliographic instruction, readers' advisory, and other assistance to users at branch reference center.

6/90 - 8/90 — Librarian, The Olympian

Maintained clipping, photograph, microfilm, and map files for active newsroom library. Provided research assistance to staff. Strengthened reference collection. Revised subject authority indexing of newspaper articles.

4/90 - 7/90 — Conservator's Assistant, Washington State Division of Archives and Records Management

Cleaned, deacidified, and repaired archival documents; conservation treatment and repair of books; indexed and entered information into database.

8/89 - 12/89 — Conservation Intern, William Stanley Hoole Special Collections Library, The University of Alabama

Designed and conducted a condition survey of materials housed in the Rare Book Room; analyzed and documented conservation treatment needs. Deacidified, repaired, and encapsulated archival materials.

8/88 - 5/89 — Graduate Assistant, The Institute for the Book Arts, School of Library and Information Studies, The University of Alabama

Maintained departmental Book Arts library. Designed and printed broadsides and other typographic compositions.

8/81 - 5/88 Library Assistant, Yolo County Library, Woodland, California

Assisted users in locating, selecting, and using library materials; provided reference services; compiled bibliographies; advised on collection development. Performed all aspects of circulation work; verified bibliographic information; responsible for various records-management and collection maintenance functions.

10/87 - 2/88 Student Assistant, Preservation and Conservation Department, Shields Library, University of California, Davis

Appraised condition of books and completed appropriate conservation treatment.

EDUCATION

M.L.S. 12/89 The University of Alabama, Tuscaloosa, School of Library and Information Studies

B.A. 6/88 University of California, Davis, College of Letters and Science
Major - Art Studio; Minor - English (High Honors)

CONTINUING EDUCATION

10/90 University of Washington Extension, 'Space design for library technologies'

HONORS

3/89 - 6/89 Chapbook included in the exhibition 'Schooled Books: Education in the Book Arts' at the Thomas J. Watson Library, The Metropolitan Museum of Art, New York.

6/88 Awarded 'Citation for Outstanding Performance' in Art Studio, University of California, Davis.

PROFESSIONAL AFFILIATIONS

American Library Association
Geoscience Information Society
Guild of Book Workers
Conservation Associates of the Pacific Northwest

Washington State Library Commission Professional Librarian's Certification

PERSONAL DATA

Name: R. Gordon Bloomquist
Permanent Address:
6206 Tiger Tail Drive SW
Olympia, WA 98502

Social Security Number: 562-58-5182
Telephone:
Home: (206) 352-7162
Work: (206) 586-5074

Post-Secondary Institutions Attended

Date	Institution	Degrees and Dates
1973-1977	University of Stockholm	Ph.D. 1977
1970-1973	Portland State University	Ed. Certificate 1971
1969-1970	University of Stockholm MS 1970	
1966-1968	University of Oregon	
1964-1966	Portland State University	BS 1966
1963-1964	University of Oregon	
1962-1963	Grays Harbor College Assoc. Sci. 1963	
1961-1962	University of Oregon	

Undergraduate Major: Geology
Graduate Major: Masters-Geology
Doctors-Geology
Geochemistry

Undergraduate Minor: Biology
Graduate Minor: Masters - Environmental Problems
Doctors

Doctor's dissertation title: Chemical Characteristics of Interstitial Waters from the Southern Baltic Sea.

Master's thesis title: A Review and Analysis of the Use of Grain-Size Parameters, Percentage of Heavy Minerals, and Particle Shape in the Determination of Depositional Environment.

Distinctions

International District Heating and Cooling Association 1991 Public Service Leadership Award
International District Heating and Cooling Association 1987 Spark Plug Award
Washington State Energy Office KUDOS Award 1986, 1990
Editorial Board, *Geothermics*, 1985 - 1989
Graduate Research Grants (University of Stockholm) 1973, 1974, 1975, 1976
Smitts Fellowship (Sweden) 1974
Royal Research Fellowship (Sweden) January 1975 - June 1977

Professional Affiliations & Activities

Visiting Professor, International School of Geothermics, Pisa, Italy, 1990 & 1991 & 1992
Charter Member, International Geothermal Association (IGA)
- Member, IGA Board of Directors 1989-1992
- Chairman, IGA Education Committee 1991-Present

Member, International Geothermal Association (IGA)
- Member, IGA Board of Directors, 1989-92

Member, Geothermal Resources Council
- President, GRC, 1988
- Member, GRC Board of Directors 1985-1992
- Member, Executive Committee, GRC, 1986-1992
- Member, International Committee, GRC, 1986-1987
- Chairman, Annual Meeting Advisory Committee, GRC, 1986-1992
- Member, Educational Committee, GRC, 1983-1991
- Member, GRC Legal and Institutional Technical Committee
- Co-chairman, 1983 GRC Annual Meeting Technical Program
- Co-chairman, Poster Session, 1980 and 1981 annual meetings of GRC
- Member, 1985 and 1990 GRC Annual Meeting Committee
- Member, Membership Committee, GRC, 1984
- Charter Member, Pacific Northwest Section GRC
- President, Pacific Northwest Section GRC, 1982-83, 1983-84, and 1984-85
- Member of Executive Committee, Pacific Northwest Section GRC, 1986-1988

Professional Affiliations & Activities (continued)

Chairman, ASTM Subcommittee E-45 on Geothermal, 1985-1988
Chairman, Pacific Northwest Utilities Conference Committee Geothermal Subcommittee, 1983
Member, Technical Advisory Committee, Geothermal Education Office, 1990-Present
Member, International District Heating and Cooling Association (IDHCA)
Technical Session Co-chairman, International District Heating & Cooling Annual Meeting, 1991
Member, North American District Heating and Cooling Institute (NADHCI)
Member, Board of Directors, NADHCI, 1986-1988
Member, Board of Directors, Western Section of International District Heating & Cooling Association, 1990-Present
Member, USDOE/HUD District Heating Technical Assistance Team, 1980-1982

Congressional and Legislative Activities

Presented testimony before the U.S. Senate Energy and Natural Resources Committee 1979, 1981, 1982, 1983, and 1984-1986. U.S. Senate Finance Committee, 1983; U.S. House of Representatives Subcommittee on Energy Conservation and Power, 1983; U.S. House of Representatives Interior and Insular Affairs Committee, 1987.

Presented testimony on numerous occasions before the Washington State Senate Committee on Energy and Utilities, and the Washington State House of Representatives Committees on Energy and Utilities, and Ways and Means.
Chairman, Washington State Interagency Geothermal Development Council
Co-chairman, Symposium on the Geothermal Potential of the Cascade Mountain Range, May 1981
Co-chairman, Symposium - Geothermal Energy in the Pacific Northwest: Marketing and Financing
Member, International Association of Sedimentologists

Consulting

Lake County California/California Energy Commission — 1991 & 1992
Technical adviser on the development of strategies to reverse depletion of The Geysers geothermal reservoir.

City of San Francisco — 1988 - 1989
Bureau of Energy Conservation

Technical evaluation of the district heating/cooling potential of the Mission Bay development site. Adviser to the City of San Francisco on district heating/cooling development, contractor selection, and oversight of work in progress.

California Energy Commission/Town of Mammoth Lakes, CA — 1988

Adviser to the Commission on the geothermal potential of the proposed site selection of drilling targets and determination of the potential for developing a viable geothermal district heating system.

Asea Stal Geoenergy — 1985-1986
Lund, Sweden

Adviser on investment opportunities in U.S. geothermal development, including resource potential and most appropriate conversion technology. Also served as adviser on development of new generating equipment.

Government of Canada — 1984

Prepared an analysis of the legal, regulatory, and financial framework developed for geothermal development in the U.S.

Pillsbury, Madison & Sutro, Attorneys — 1983
San Francisco, California

Adviser on legal questions related to the leasing of both federal and private property for geothermal exploration and development.

Employment History

Employer: Washington State Energy Office
809 Legion Way SE
Olympia, WA 98504

Supervisor: Jim Harding

From: February 1980 to Present

Duties: Hydrothermal energy program director. Responsible for all policy decisions related to hydrothermal energy development and utilization, including development of legislation and implementing rules and regulations. Provide potential developers with technical assistance in the areas of resource assessment and utilization.

Program manager for Olympia, Metro (Seattle), and Tacoma district heating and cooling feasibility studies. Chairman of the Olympia Assessment Work Group and member of the Assessment Work Groups for Seattle, Washington; Tacoma, Washington; and Portland, Oregon.

Principal investigator and program manager on regional evaluation of the effects of PURPA on power development in the Northwest and the development of an acquisition program for the Bonneville Power Administration.

Principal investigator and program manager on regional geothermal assessment project funded by the U.S. Department of Energy Bonneville Power Administration. The project involves assessment of the geothermal resource potential for electrical generation or offset through district heating in Washington, Oregon, Idaho, and Montana.

Employer: Oregon Institute of Technology
Geo-Heat Center
Klamath Falls, OR 97601

Supervisor: Paul J. Lienau

From: September 1979 to February 1980; on indefinite leave.

Title: Assistant Professor

Duties: Principal investigator and program manager of research project funded by the U.S. Department of Energy entitled "Northwest Regional Planning Support for the Development of Direct-Use Geothermal Energy." The project involved the assessment and monitoring of all factors affecting geothermal development in Washington, Oregon, and Alaska.

Employer: Oregon Institute of Technology
Geo-Heat Center
Klamath Falls, OR 97601

Supervisor: Don Karr

From: December 1977 to August 1979

Title: Research Associate

Duties: Geothermal assessment in the state of Washington.

Employer: Department of Geology
University of Stockholm
Box 6801 Kungstensgatan 45
113 86 Stockholm, Sweden

Supervisor: Docent Rolf Hallberg

From: August 1973 to June 1977

Duties: Six months spent aboard ship doing seismic profiling. One year under contract to military research performing geochemical and sedimentological analysis. Remainder of time spent teaching graduate and undergraduate geochemistry and sedimentology, and performing various geochemical analyses of sediments for the Swedish Environmental Protection Agency.

Publications

Implementing PURPA: Renewable Resource Development in the Pacific Northwest, 1990.

Meeting the Northwest's Energy Needs Through Competitive Bidding, 1990.

Geothermal: A Regulatory Guide to Leasing, Permitting, and Licensing in Idaho, Montana, Oregon, and Washington, 1991.

Publications (continued)

Assessment of Geothermal Resources for Electric Generation in the Pacific Northwest, Washington State Energy Office, 1989.

Innovative Design of New Geothermal Generating Plants, Washington State Energy Office, 1989.

Geothermal Direct Use Engineering and Design Guide Book, Oregon Institute of Technology, 1989.

Power Sales to Electric Utilities--PURPA Qualifying Facility Development in Washington State, Washington State Energy Office, Olympia, WA, 1989.

District Heating Development Guide: Legal, Institutional, and Marketing Issues, Vol. I, Washington State Energy Office, 1987.

PURPA Influence on Contemporary Geothermal Power Plants, ASME/GRC, 1988.

A Review and Analysis of the Adequacy of the U.S. Legal, Institutional, and Financial Framework for Geothermal Development, *Geothermics*, Pergaman Press Ltd., 1986.

Geothermal Energy Development in Washington--A Guide to the Federal, State, and Local Regulatory Process, Washington State Energy Office, 1986.

Evaluation and Ranking of Geothermal Resources for Electrical Generation or Electrical Offset in Idaho, Montana, Oregon, and Washington, Vol. I and II, published by the Washington State Energy Office, 1985.

A Review and Analysis of the Adequacy of the Legal and Institutional Framework for Geothermal Development in Washington State, Washington State Energy Office, 1985.

Ranking Direct Use Geothermal Resources in the Northwest Based on Developability and Cost, Geothermal Resource Council *Transactions*, Vol. No. 9, 1985.

Estimating the Levelized Cost of Geothermal Electricity, Geothermal Resource Council *Transactions*, Vol. No. 9, 1985.

Estimating Development Costs of Geothermal Electricity, Geothermal Resource Council *Transactions*, Vol. 9, 1985.

Geothermal Resources in the Cascades: Accessible/Developable--The Institutional Setting, Energy on Tap, Geothermal Resource Council 1983 Annual Meeting Transactions, Volume 7.

Washington: A Guide to Geothermal Energy Development, published by Oregon Institute of Technology Geo-Heat Utilization Center.

Editor; Proceedings of the Geothermal Symposium - Potential, Legal Issues, Economics, Financing, June 2, 1980. Published by Washington State Energy Office.

Editor; Proceedings of the Geothermal Symposium - Low Temperature Utilization, Heat Pump Application, District Heating. September 24, 1981. Published by Washington State Energy Office.

Geothermal Policy in Washington - An Overview. Published in Proceedings of the Symposium on the Geothermal Potential of the Cascade Mountain Range. Geothermal Resource Council.

Testimony before the Subcommittee on Energy Resources and Materials Production of the Committee on Energy and Natural Resources, U. S. Senate. Ninety-sixth Congress First Session on S. 1330 - A Bill Entitled "Omnibus Geothermal Energy Development of 1979," and S. 1388 - A Bill to Establish a Forgivable Loan Program for Geothermal Reservoir Confirmation, to Amend Existing Geothermal Leasing and Permitting Laws, and for other purposes. U. S. Government Printing Office Publication No. 96-50, P. 107-112.

Publications (continued)

Testimony before the Subcommittee on Energy and Mineral Resources of the Energy and Natural Resources Committee, U. S. Senate, on S 669, the "Geothermal Steam Act Amendments of 1981," and S 1516, the "Geothermal steam Act of 1981," October 27, 1981. Publication No. 97-57 Part 1.

Testimony before the Subcommittee on Public Lands and Reserved Water of the Energy and Natural Resources Committee, U. S. Senate on S. 669, the "Geothermal Steam Act Amendment of 1981," and S. 1516, the "Geothermal Steam Act of 1981." Hearing on Protection of Geothermal Resources in Yellowstone National Park and Other Units of the National Park System, December 12, 1981. Publication No. 97-57 Part 2.

Use of Resources, Report of Swedish United National International Seminar on Environment, Development, and Peace.

ROBERT G. O'BRIEN, P.E.
5019--157th Avenue, S.E.
Bellevue, Washington 98006
(206) 649-9426 or FAX (206) 643-7085

SUMMARY

Extensive experience in energy management, facilities engineering, and environmental abatement activities. Headed the U.S. Army's world-wide utilities program. Recognized for leadership, dedication, ability, and innovative management, having saved the U.S. government millions of dollars by developing and implementing programs for efficient energy use in military facilities.

OBJECTIVE

Manage and coordinate energy utilization activities for public and private commercial activities.

PROFESSIONAL HISTORY

UNITED STATES ARMY, Engineering & Housing Support Center, Ft. Belvoir & Pentagon, Virginia

Chief of Utilities Engineering Division 1986-1991
Directed a staff of 52 and a program budget more than $2 billion. Responsible for army-wide utilities (heating, air conditioning, refrigeration, electrical, energy use, domestic & waste water, and solid waste services) policy, planning, and providing support to Army staff, Congress, and installations world-wide. Covered maintenance, repair, operation, and modernization programs.

U.S. ARMY, Installation Support Activity, Europe, Heidelberg, Germany

Deputy to the Commander 1985-1986
Assisted the Commander in directing 300 professional military and civilian staff who provided facilities engineering and energy utilization support to all Army installations in Europe.

HEADQUARTERS, DEPARTMENT OF THE ARMY, Office of the Chief of Engineers, Washington, D.C.

Chief of the Utilities Branch 1983-1985
Supervised facilities world-wide and set policies for engineering operations, design, construction, maintenance and repair of utilities plants and systems. Managed the Army's fixed facilities energy utilization program.

SEATTLE DISTRICT CORPS OF ENGINEERS, Engineering Design Branch, Seattle, Washington

Assistant Chief for Military Programs 1982-1983
Supervised project management for military construction in Oregon, Washington, Idaho, and Montana. Covered Architect-Engineer selection, negotiation, design, performance, and construction. Assisted Chief in technical, financial, and administrative management of 130 engineers and technicians involved in military and civil works project designs.

PROFESSIONAL HISTORY (CONTINUED)

HEADQUARTERS, U.S. ARMY EUROPE, Facilities Engineering Division, Heidelberg, Germany

Chief of Utilities Branch 1976-1982
Responsible for the effective operation, planning, programming, energy utilization, and environmental management of Army's $255 million utilities program in Europe. Managed a $100 million fuel acquisition program.

CORPS OF ENGINEERS AND U.S. ARMY ACTIVITIES, Oregon, Washington, D.C., and locations in Germany

Chief of: Engineering Division; Repairs and Utilities Division; Utilities Branch; Refrigeration Engineering Branch; and Mechanical Section. Deputy Facilities Engineer. Mechanical Design Engineer (HVAC and piping). 1959-1976
Responsible for engineering design including HVAC systems, supervision, and activity management involving facilities, equipment, building systems, grounds maintenance, airfields, roads, safety, and fire protection. Positions included most levels of Army engineering activities from the installation to headquarters in Europe and the United States.

CREDENTIALS

Registered Professional Engineer (Mechanical Engineering) in Oregon and Washington.

Master of Science Degree in Sanitary Engineering, Washington State University, 1972.

Bachelor of Science Degree in Mechanical Engineering, Oregon State University, 1959.

AWARDS

Engineer of the Year Award for the U.S. Army, from the National Society of Professional Engineers, in recognition of innovative measures to enhance management effectiveness of Army facilities throughout Europe, 1982.

Department of the Army Meritorious Civilian Service Awards (Army's second highest honorary award) for:

- Dynamic leadership and dedication to duty by the U.S. Army in Europe in 1982.
- Exemplary supervisory leadership, professional ability, and dedication in support of U.S. Army utilities activities by the Chief of Engineers in 1989.

Outstanding Property Manager of the Year Award for the U.S. Army, from the National Property Management Association, 1989.

U.S. Department of Energy Federal Energy Efficiency Award for "exceptional accomplishments in energy efficiency in the federal sector", 1990.

REFERENCES

Available upon request.

NATURAL RESOURCES

Low-Temperature Geothermal Resources of Washington

J. Eric Schuster and
R. Gordon Bloomquist

WASHINGTON
DIVISION OF GEOLOGY
AND EARTH RESOURCES

Open File Report 94-11
June 1994

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Jennifer M. Belcher - Commissioner of Public Lands
Kaleen Cottingham - Supervisor

DRAFT 6/10/94

Low-Temperature Geothermal Resources of Washington

J. Eric Schuster
Washington State Department of Natural Resources
Division of Geology and Earth Resources
PO Box 47007, Olympia, WA 98504-7007

R. Gordon Bloomquist
Washington State Energy Office
PO Box 43165
Olympia, WA 98504-3165

INTRODUCTION

During the late 1970s and early 1980s, the Washington Division of Geology and Earth Resources conducted a multifaceted program of geothermal resource evaluation. The program was made possible by the financial support and encouragement of the U.S. Department of Energy's State-Coupled Program. At that time the main focus was the discovery, evaluation, and commercialization of high-temperature geothermal resources that could be used to generate electricity. Thus, the Division's program emphasized the Cascade Range, where high-temperature geothermal resources probably exist, as evidenced by the stratovolcanoes, Mount Baker, Glacier Peak, Mount Rainier, Mount St. Helens, and Mount Adams (Fig. 1). However for several reasons, there have been no significant discoveries or development of high-temperature geothermal resources in the Cascades. First, competing energy prices have been low for the last decade or more. Second, the areas around the stratovolcanoes are largely undevelopable because the land is preserved as national parks, wilderness areas, or national monuments or is dedicated to other uses. Third, logistical problems associated with attempts to develop high-temperature geothermal resources near a stratovolcano would be very challenging.

Investigations conducted during the late 1970s and early 1980s included:

- description, sampling, and chemical analysis of thermal and mineral springs,
- several episodes of heat-flow/temperature-gradient drilling in the Cascade Range, which was practically unknown thermally at the time,

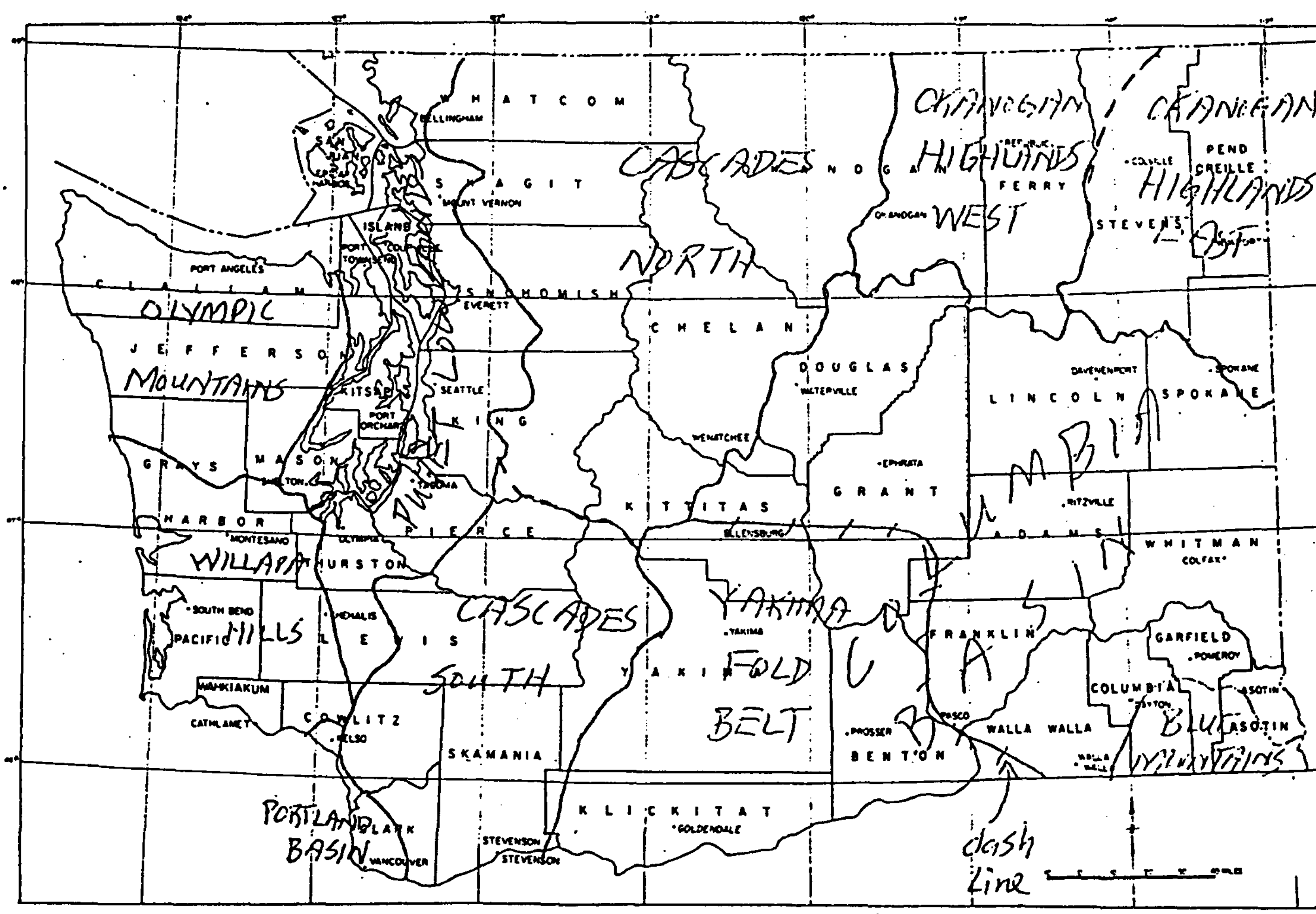


Figure 1. Physiographic provinces, counties, and major cities in Washington.

- temperature-gradient/heat-flow measurements in the holes drilled for that purpose in the Cascades,
- extensive temperature-gradient measurements in existing drill holes all over the state, but most extensively in the Columbia Basin,
- regional gravity studies in the Cascades,
- geohydrologic studies in the Yakima and Moses Lake–Ritzville–Connell areas of the Columbia Basin,
- geologic mapping and geochemical investigations in areas of young volcanism in the Cascades,
- soil mercury studies in the Mount St. Helens area, and
- the compilation of a bibliography of geothermal reports for Washington State.

These investigations, through 1983, are summarized by Korosec (1984). After 1983, two more U.S. Department of Energy contracts supported temperature-gradient/heat-flow investigations in the Cascades, but the high tide of geothermal exploration had passed.

An important accomplishment of that time was the publication of a 1:500,000-scale map depicting the distribution and nature of geothermal resources in Washington (Korosec and others, 1981). The map data were compiled by the staffs of the Washington Division of Geology and Earth Resources and the Washington State Energy Office, and the map was cartographically prepared and printed through the efforts of the National Oceanic and Atmospheric Administration, all under the sponsorship of the U.S. Department of Energy. Similar maps were produced for most of the western states.

Washington's map locates and provides basic data for 31 thermal springs, 29 mineral springs, and 338 thermal wells. The springs are mostly located in the Cascade Mountains, many clearly associated with stratovolcanoes. Most of the warm wells are located in the central, southwestern, and southern parts of the Columbia Basin in south-central Washington.

Even though the 1981 geothermal resources map has served very well, there has been a need for several years to make another inventory of geothermal resources. Of the 45 references from which well and spring data were taken for the tables in the Appendix, 23 were released after 1981. The most productive of the new or much-expanded sources of data are the unpublished water well reports held in the Yakima and Spokane regional offices of the Washington State Department of Ecology and the U.S. Geological Survey's WATSTORE database.

The large amount of data available now that was not available or not consulted in 1981 is reflected in the size of the geothermal database reported herein. The current database reports only thermal wells, springs, lakes, and fumaroles (except for two cooler wells; see explanation below); no nonthermal mineral springs are reported, although they were on the 1981 map. The current database comprises 941 wells and 34 springs, spring systems, lakes, and fumaroles (Table 1). The number of spring systems, lakes, and fumaroles reported here is not much larger than the number reported in 1981, but the number of warm wells is almost 3 times larger. The increase results from the more comprehensive nature of the sources of data consulted for this report and the fact that there are many more wells in existence than there were in 1981.

In some ways it is unfortunate that occurrences cooler than 20°C could not be included in this database (see below). Much can be learned by studying how cold wells are interspersed (or not) with warm wells, and by comparing their relative depths and other attributes. However, adding the cool wells would have added thousands of wells to the database.

This low-temperature geothermal resource assessment was funded by the U.S. Department of Energy, and similar assessments are being done in many of the western states. The program is being administered jointly by University of Utah Research Institute, Idaho Water Resources Research Institute, and Oregon Institute of Technology. Funds available limited field data-gathering, but we sampled 18 municipal, commercial, and school wells for chemical analysis by the laboratory of the University of Utah Research Institute. Therefore, this assessment relied primarily on compilation of a bibliography and index of geothermal resources and development (Christie, 1994), and a thorough review of existing data sources.

DATA SOURCES

The limits established by the U.S. Department of Energy for inclusion of data in this database are (1) a temperature at least 10°C above the mean annual surface temperature, here taken as 20°C, and (2) a temperature gradient of at least 25°C/km.

Table 1. Thermal wells, springs, lakes, and fumaroles in Washington, by county. The six-county area referred to in the text covers Adams, Benton, Franklin, Grant, Walla Walla, and Yakima Counties

County	Thermal wells	Thermal springs lakes, fumaroles
Adams	113	0
Asotin	9	0
Benton	123	0
Chelan	1	0
Clark	2	0
Clallam	0	2
Columbia	5	0
Cowlitz	0	1
Douglas	7	0
Franklin	60	0
Garfield	3	0
Grant	118	0
Grays Harbor	2	0
King	1	3
Kittitas	12	1
Klickitat	35	2
Lewis	8	2
Lincoln	30	0
Okanogan	5	2
Pierce	0	3
Skamania	6	7
Snohomish	0	4
Spokane	13	0
Walla Walla	113	2
Whatcom	1	3
Whitman	15	0
Yakima	259	2
Totals	941	34
Six Counties	786	4
	83.5%	11.8%

As used in this report, the word *thermal* signifies a water temperature at or above 20°C, and the words *nonthermal, cool,* or *mineral* refer to wells and (or) springs below 20°C.

Because regional temperature gradients in Washington exceed 25°C/km everywhere except western Washington (Table 2) and western Washington's regional gradient is almost 25°C/k, we assumed that the gradient limitation would be met for all data and concentrated only on the temperature limit.

The temperature limitation was observed except for two wells (well GR014, the Wahluke School well, and well WA086, the Walla Walla Community College well). These wells are included because temperatures above 20°C were reported in earlier databases, because one of them (the Walla Walla Community College well) has been used for years as a heat source for a heat pump, and because we sampled both for chemical analyses.

Every well found in every known database that met the 20°C temperature cutoff is listed in the present database, with the exception of oil and gas test wells. There are a few oil and gas test wells in the present database, but they are included by virtue of having been reported in published databases that were used as data sources. More than 400 oil and gas test wells have been drilled in Washington, most of them in western Washington. Inequilibrium bottom-hole temperatures are reported in the oil and gas records of the Division of Geology and Earth Resources for many of these wells. We have not calculated equilibrium temperatures from these data for two reasons. First, western Washington oil and gas wells are in a low temperature-gradient region where the 20°C isotherm is deep and less attractive economically than in higher-gradient eastern Washington. Second, in eastern Washington there are only a few modern wells that would provide good data, so we are probably not missing a significant source of data. Furthermore, temperature gradients for deeper eastern Washington wells in the database fall within the 30-50°C/km gradient band and seem to be entirely normal (See Fig. 8.)

We carefully checked one source of data against another and tried to use the original source or the latest independently generated source of data when data sources were in disagreement. As previously noted, the budget allowed only limited field verification of data. Each chemical analysis reported in Appendix B comes from a single source of data and is a single, not composite, analysis. If an analysis failed to pass a charge-balance test, described later, it was eliminated from the database.

We checked the accuracy of the data in Appendix A for 18 wells we sampled, and we found the data to be approximately 80 percent accurate. Some of the references, such as Smith (1901) and Landes (1905), are quite old, and it would be unrealistic to expect that wells reported in these references would still exist, still exhibit the conditions originally reported (particularly with respect to artesian head), or still have the same name or ownership. We included the old wells in the database because they represent thermal conditions that should still exist, even if not precisely as reported in the early literature.

Readers should verify the data reported here before making significant development decisions. If, for example, a heat-pump installation is contemplated for a particular well reported here, minimum data verification should include:

- determining the temperature and flow from the well,
- measuring pH,
- having a new chemical analysis done to guide the selection of pipe and other materials, and
- verifying that water rights allow the proposed development.

As noted above, an exhaustive bibliography and index of geothermal resources and development in Washington State was compiled as part of the present effort to update the state's geothermal resource database. For the compilation, Rebecca Christie, a staff librarian for the Division of Geology and Earth Resources, used the resources of the libraries of the Division of Geology and Earth Resources, the Washington State Library, the Washington State Energy Office, the Washington State Department of Ecology, the Geo-Heat Center of the Oregon Institute of Technology, and the Geothermal Resources Council in Davis, CA. We recommend the bibliography as a starting point for anyone interested in learning about, searching for, or developing geothermal resources in Washington. We made extensive use of the bibliography to assure that we did not overlook important sources of data.

In order to facilitate assessment and development of geothermal resources in the future, this database has been established on the geographic information system (GIS) of the Washington State Energy Office. The GIS allows users to easily combine and evaluate the geothermal data with many other kinds of spatial data. The Washington State Energy Office is, for example, cooperating with the State Superintendent of Public Instruction's office to study the occurrence of warm wells near school buildings, especially those that are about to be remodeled, in order to evaluate the practicality of heating some of the schools with geothermal water-source heat pumps.

ACKNOWLEDGMENTS

We thank Ruth Kroneman and Mike Adams of the University of Utah Research Institute for providing chemical analyses and information and advice about the analyses. Phil Crane and Gene Potts of the Washington State Department of Ecology Central Regional Office in Yakima for provided access and help with the extensive collection of water well reports housed in that office, and Dan Weis of Ecology's Eastern Regional Office in Spokane helped with that office's equally extensive collection of water well reports. Luis Fuste of the U.S. Geological Survey's Water Resources Division in Tacoma, Washington, sent the latest WATSTORE data. Don Saul of the Washington State Energy Office established the

Table 2. Regional temperature gradients and heat flow in Washington. The Northern Rocky Mountains province is shown as Okanogan Highlands west and east on Figure 1, and the Coastal province as the combined Puget Lowlands, Olympic Mountains, and Willapa Hills. (From Blackwell and others, 1985)

Physiographic province	Regional temperature gradient (°C/km)	Heat flow, (mW/m^2)
Columbia Basin	41.1	61.1
Northern Rocky Mountains	26.0	74.9
Cascade Mountains, high heat-flow zone	64	100
Coastal provinces	24.5	39.8

database on the Energy Office's geographic information system and patiently made several updates. Rebecca Christie helped us to be reasonably confident that we hadn't overlooked any important sources of data. Many well owners allowed us, always cheerfully, to sample their wells for chemical analysis. This report benefitted from reviews by Gene Culver of Oregon Institute of Technology and Howard Ross of the University of Utah Research Institute. Through their help, these people have undoubtedly made this report better than it otherwise would have been.

DATA FORMAT

This report is available in three forms: (1) as a paper report, (2) on disk (5.25-inch 1.2MB or 3.5-inch 1.44MB) for IBM-compatible personal computers, and (3) as an ARC-INFO geographic information system (GIS) coverage and associated database. In the IBM disk version, the text is offered in ASCII and WordPerfect formats (the figures and plates are not included), and Appendix A (Descriptive and thermal data for wells and springs), Appendix B (Chemical data for wells and springs), and Appendix C (Convectively heated[?] wells) are present as Lotus 1-2-3 ".WK1" files. The Lotus files are readable by most spreadsheet programs. The paper and disk versions are available from the Washington Division of Geology and Earth Resources at the address listed above for author Schuster. For details about the ARC-INFO coverage, contact the Washington State Energy Office at the address listed above for author Bloomquist.

Appendices A and B form the main body of this report. Appendix A lists descriptive and thermal data for wells and springs. Appendix B lists chemical data. Generally, both tables include data fields that the University of Utah Research Institute requested all of the investigators in the different states to use.

In Appendix A, the Site Name is, in most instances, the name of a city, company, or governmental organization if the site is publicly or company owned, or the name of an individual if the site is a private irrigation or domestic well.

The latitude (Lat. N.) and longitude (Long. W.) require some explanation. The location of each site was plotted on a scale-stable 1:100,000-scale U.S. Geological Survey topographic base map, usually at the center of the quarter-quarter of a section. If the base map showed a well or spring in that quarter-quarter section, the occurrence was plotted at that location. A transparent gridded overlay was employed to identify quarter-quarter boundaries. When all locations had been plotted they were digitized at the Washington State Energy Office and the latitudes and longitudes calculated by the geographic information system. The latitudes and longitudes were then downloaded back into the Lotus 1-2-3 file that constitutes Appendix A. See the notes in Appendix A for further explanation.

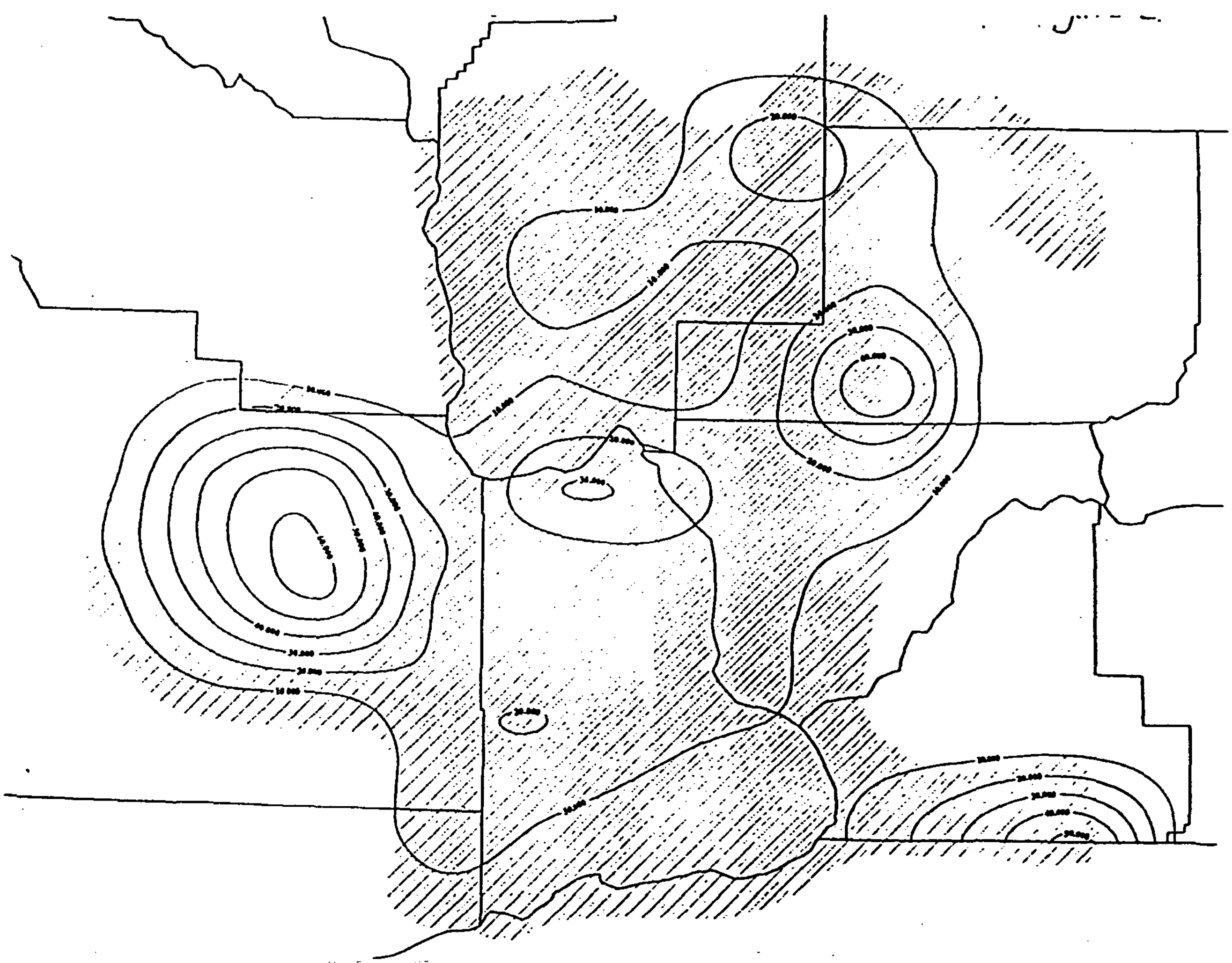


Figure 2. Areal density of thermal well and spring occurrences in Washington. Contours show the number of thermal wells and springs per 500 km^2 (193 mi^2). Only the part of the state shown reaches a density as high as 10 occurrences per 500 km^2.

Appendix B lists chemical data for those occurrences having good quality chemical analyses. The I.D., Site Name, Twp. N., Rng., Sec., and Part. Sec. are repeated from Appendix A so that occurrences can be easily correlated between the two tables. See the notes in Appendix B for information on the significance of charge balance and mass balance and how they were calculated. Briefly, these two calculations are indications of the quality and (or) completeness of chemical analyses. Analyses with charge balances that failed to fall within ten percent of 1.00 were rejected. Mass balance was not used as a criterion for rejection of analyses.

FLUID CHEMISTRY

New Fluid Sampling

Appendix B presents more than 200 chemical analyses from thermal wells and springs. We collected 18 of these analyses, dated 1994 and with no reference (Ref.) in Appendix B, and the University of Utah Research Institute analyzed them as part of the present investigation. Several criteria guided the selection of the 18 sampled wells. All but one of the wells we sampled are within the six-county (Adams, Benton, Franklin, Grant, Walla Walla, and Yakima County) area of the Columbia Basin where most of the state's warm wells are located (Figs. 1 and 2). We concentrated our sampling effort here because of the many possibilities for early development that might be assisted by the availability of good chemical analyses and because we could conveniently and economically sample these wells.

Further, we wanted at least some of the samples to come from areas that did not have good chemical representation in the database. We avoided irrigation and domestic wells—irrigation wells because they were not in use during the winter and spring months when we had to do the sampling, and both irrigation and domestic wells because, in many cases, they don't offer much prospect for development because of potential water rights limitations and (or) lack of a significant nearby heat load. Publicly owned (mostly municipal) wells used year-round and located near potential heat loads were attractive targets for sampling because they offer good possibilities for early development.

We sampled 12 municipal wells (AD008, BE022, GR056, GR060, GR063, KS011, YA018, YA050, YA051, YA068, YA074, and YA141), one domestic water association well (FR010), one well at the Washington State University Irrigated Agriculture Research and Extension Center near Prosser (BE039), one school well (GR014), and three wells currently used for their heat, two as heat sources for heat pumps (WA086 and YA226) and one used for a car wash (YA211).

Observations

Several general observations can be made about the fluid chemistry. First, well waters are very dilute. Figure 3 shows the average concentration of the major chemical species (Na, K, Ca, Mg, HCO_3, CO_3, Cl, and SO_4) in statewide thermal wells and thermal springs and in cool wells in the six-county area of the Columbia Basin. The average total for the eight major chemical species for thermal wells is only 260 ppm. All of the well waters for which there are analyses in Appendix B are potable, at least with respect to inorganic constituents.

Figure 4 plots Na+K as a percentage of major cations against HCO_3+CO_3 as a percentage of major anions for statewide thermal springs and wells and for six-county area cool wells and springs. All thermal well waters have HCO_3 as the dominant anion. They may have either Na+K or Ca+Mg as the dominant cation, with Na+K dominant somewhat more commonly.

Although they are not reported here, we plotted 134 water analyses from cool wells in the six-county area in Figure 4c in order to compare them with the thermal wells (Fig. 4a) and springs (Fig. 4b). All of the analyses from cool wells are from

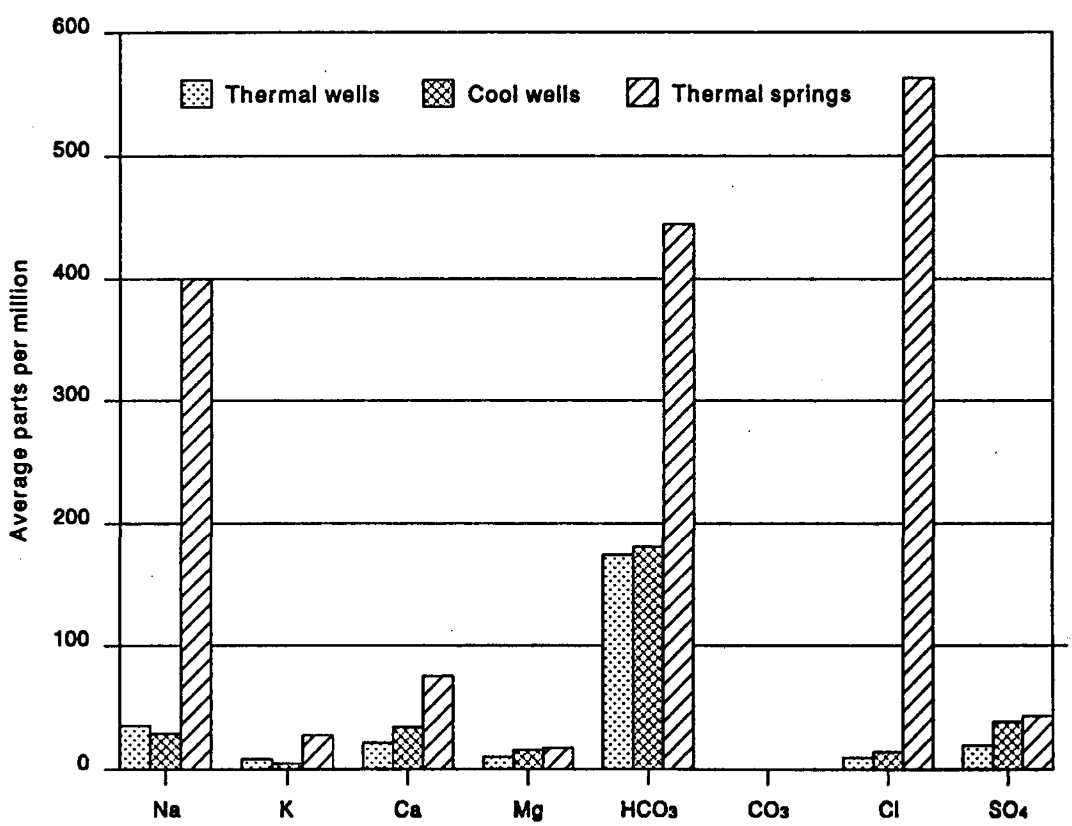


Figure 3. Average concentrations of major chemical species in thermal wells and thermal springs statewide and in cool wells in the six-county area (Adams, Benton, Franklin, Grant, Walla Walla, and Yakima Counties) of the southwestern and south-central Columbia Basin. The graph represents 204 analyses from thermal wells, 134 analyses from cool wells in the six-county area, and 34 analyses from thermal springs.

Van Denburgh and Santos (1965). The thermal and cool wells are similar. Most of the cool wells are HCO_3 dominated. Like the thermal wells, the cool wells may be dominated by either Na+K or Ca+Mg, but in the cool wells Ca+Mg dominance is somewhat more common.

The thermal springs differ from the wells. Na+K is the chief cation, and the chief anions are HCO_3+CO_3 or $Cl+SO_4$, with $Cl+SO_4$ dominant somewhat more frequently. The springs are also much less dilute than the well waters. The major chemical species in the springs have an average total of 1570 ppm.

The wells and springs are located in different geologic provinces. Most of the springs are located in the andesitic volcanic terrain of the Cascade Mountains, whereas the wells are in the basaltic and continental sedimentary terrain of the Columbia Basin. Because they exceed 20°C at the earth's surface and are less dilute than the well waters, the springs must arise from waters that have circulated more deeply in the crust or circulated in areas of higher geothermal gradients or local heat sources. These differences are, presumably, responsible for the differences in chemistry.

We have not concentrated on the interpretation of geothermometers during this investigation. First, the geology of the Columbia Basin (Schuster, 1994; Reidel and Fecht, in press a, b; Gulick, in press; Schuster, in press a, b) and what is known about the regional geothermal gradient (about 40°C/km; Blackwell and others, 1985) suggest that there are no shallow heat sources (igneous intrusives) beneath the Columbia Basin, and thus no areas with extremely high temperature gradients or other high-temperature geothermal manifestations. The last extrusive igneous activity, the waning flows of the Columbia River Basalt Group, occurred about 6 million years ago (Fig. 5). Also, the dilute ground waters of the Columbia Basin differ from hot-spring waters on which the empirical geothermometers are based, so calculating geothermometers in an effort to try to determine whether high temperatures exist at depth may not be a valid exercise.

The database presented here has been compiled from a variety of sources spanning more than 90 years. The data were collected by many people for many reasons, and there are certainly errors, such as incorrect well depths and chemical analyses representing mixed shallow and deep aquifers, and many other inconsistencies. Taken together, the limitations make this data set a rather poor one to use for making specific interpretations for specific locations. This database is better used on a sort of statistical basis, where one can try to recognize general trends and the "big picture" without trying to get too specific.

Finally, in terms of discovering useful geothermal resources, there is no need to explore for higher temperatures; the known wells are quite adequate to "fuel" a considerable

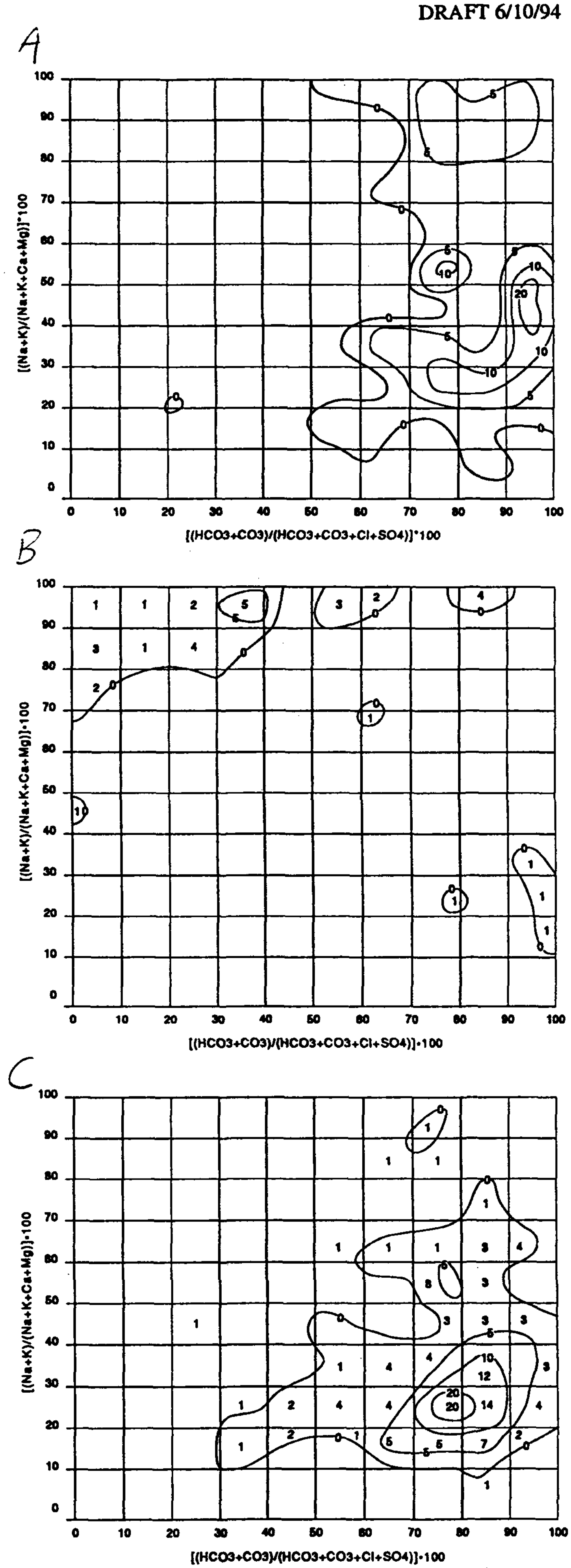


Figure 4. Na+K as a percentage of major cations plotted against HCO_3+CO_3 as a percentage of major anions for statewide thermal wells, statewide thermal springs, and six-county cool wells. Percentages were calculated from concentrations in milli-equivalents per liter. The heavy-line contour encloses all points, and the other contours enclose areas where 5, 10, or 20 points occur per 1 percent of the area of the plot. **A.** Thermal wells, statewide; 204 analyses. **B.** Thermal springs, statewide; 34 analyses. **C.** Cool wells, six-county area of Columbia Basin; 134 analyses.

SERIES	GROUP	FORMATION	MEMBER	ISOTOPIC AGE (Ma)	MAGNETIC POLARITY
MIOCENE, upper	COLUMBIA RIVER BASALT GROUP	SADDLE MOUNTAINS BASALT	LOWER MONUMENTAL MEMBER	6	N
			ICE HARBOR MEMBER	8.5	
			basalt of Goose Island		N
			basalt of Martindale		R
			basalt of Basin City		N
			BUFORD MEMBER		
MIOCENE, middle			ELEPHANT MOUNTAIN MEMBER	10.5	N,T
			POMONA MEMBER	12	R
			ESQUATZEL MEMBER		N
			WEISSENFELS RIDGE MEMBER		
			basalt of Slippery Creek		N
			basalt of Tenmile Creek		N
			basalt of Lewiston Orchards		N
			basalt of Cloverland		N
			ASOTIN MEMBER	13	
			basalt of Huntzinger		N
			WILBUR CREEK MEMBER		
			basalt of Lapwai		N
			basalt of Wahluke		N
			UMATILLA MEMBER		
			basalt of Sillusi		N
			basalt of Umatilla		N
		WANAPUM BASALT	PRIEST RAPIDS MEMBER	14.5	
			basalt of Lolo		R
			basalt of Rosalia		R
			ROZA MEMBER		T,R
			FRENCHMAN SPRINGS MEMBER		
			basalt of Lyons Ferry		N
			basalt of Sentinel Gap		N
			basalt of Sand Hollow	15.3	N
			basalt of Silver Falls		N,E
			basalt of Ginkgo		E
			basalt of Palouse Falls		E
			ECKLER MOUNTAIN MEMBER		
			basalt of Shumaker Creek		N
			basalt of Dodge		N
			basalt of Robinette Mountain		N
		GRANDE RONDE BASALT (PRINEVILLE BASALT; PICTURE GORGE BASALT)	Sentinel Bluffs unit	15.6	N_2
			Slack Canyon unit		
			Fields Spring unit		
			Winter Water unit		
			Umtanum unit		
			Ortley unit		
			Armstrong Canyon unit		
			Meyer Ridge unit		R_2
			Grouse Creek unit		
			Wapshilla Ridge unit		
			Mt. Horrible unit		
			China Creek unit		N_1
			Downey Gulch unit		
			Center Creek unit		R_1
			Rogersburg unit		
			Teepee Butte unit		
			Buckhorn Springs unit	16.9	
MIOCENE, lower		IMNAHA BASALT	See Hooper and others (1984) for Imnaha units	17.0	R_1
					T
					N_0
				17.3	R_0

Figure 5. Generalized nomenclature and stratigraphic relations of the Columbia River Basalt Group. Sedimentary interbeds occur at many of the unconformities, shown by jagged horizontal lines between units. Modified from Reidel and others (1989).

amount of low-temperature development, especially heat pumps.

GEOLOGIC, HEAT-FLOW, AND HYDROLOGIC SETTING

It is clear from Plates 1 and 2 and Table 1 that geothermal resources in Washington are not randomly distributed. Thermal springs are largely confined to the Cascade Mountains (27 of 34 are in the Cascades), and most are spatially associated with a stratovolcano or a fault that probably provides for heating by means of deep circulation of water. Thermal wells, on the other hand, are strongly associated with the Columbia River Basalt Group (Fig. 6) and the Columbia Basin—the Columbia River Basalt Group and the Columbia Basin are almost co-extensive and the terms are used interchangeably herein. This area includes the various subbasins that form the western, southwestern, and south-central parts of the Columbia Basin in Washington. This area of subbasins bounded by faulted folds is referred to as the Yakima fold belt (Fig. 1). Some 97 percent of the state's 941 thermal wells are located in areas underlain by rocks of the Columbia River Basalt Group or suprabasalt sediments.

Because it is not practical to pursue exploration and development of high-temperature geothermal resources in the Cascade Mountains, and because Washington's thermal wells are strongly concentrated in the Columbia Basin, discussion will focus on the resources of the basin. Moreover, there is a strong tendency for thermal wells to occur in the western, southwestern, and south-central parts of the Washington portion of the Columbia Basin (Fig. 2). Adams, Benton, Franklin, Grant, Walla Walla, and Yakima Counties account for 786 (83.5 percent) of Washington's thermal wells. Yakima County alone contains 259 thermal wells, and Adams, Benton, Grant, and Walla Walla Counties each contain more than 100, followed by Franklin County with 60.

The Columbia River Basalt Group is a thick succession of tholeiitic basalts that was erupted from fissures in southeastern Washington, northeastern Oregon, and western Idaho between about 17 million and 6 million years ago (Fig. 5). More than 300 lava flows once covered (and mostly still do) an area of about 164,000 km^2 (63,000 mi^2) and have an aggregate volume of about 174,000 km^3 (42,000 mi^3). The largest flows exceeded 2,000 km^3 (500 mi^3) each, and some flows advanced more than 750 km (460 mi) from their source areas to the Pacific Ocean (Tolan and others, 1989). As time went on eruptions became less frequent and generally less voluminous, and part of the basin subsided. The thickest accumulation of basalts is in the area of Richland, Kennewick, and Pasco, close to the geographic center of the area covered by the basalts. Interflow sediments are present between many pairs of flows.

Also as time went on, both during the volcanism and after the eruptions ceased, the Yakima fold belt developed. The Yakima fold belt is a series of sharply defined anticlinal crests that trend northwest, west, and southwest. Most of the anticlines are broken by faults. There are broad, flat, basinal synclines between the fold crests, and some synclines contain as much as 400 meters of suprabasalt sediments derived from the Cascades to the west and deposited by the Yakima River and smaller streams and derived from highlands to the north and east and deposited by the Columbia River. The structural situation is illustrated by Figure 7.

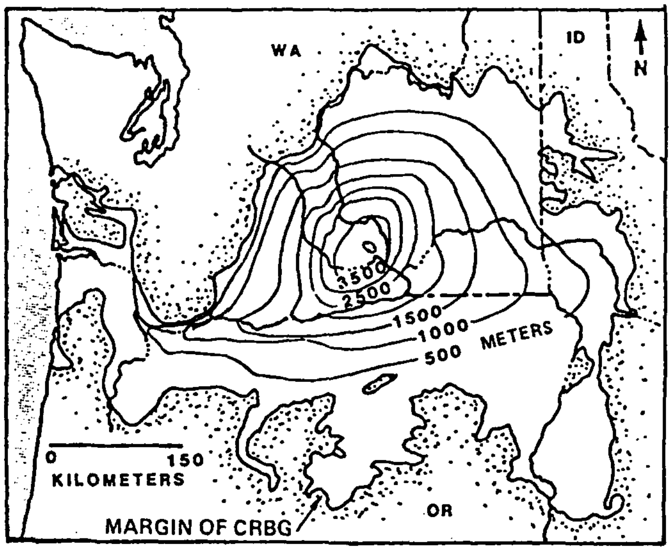
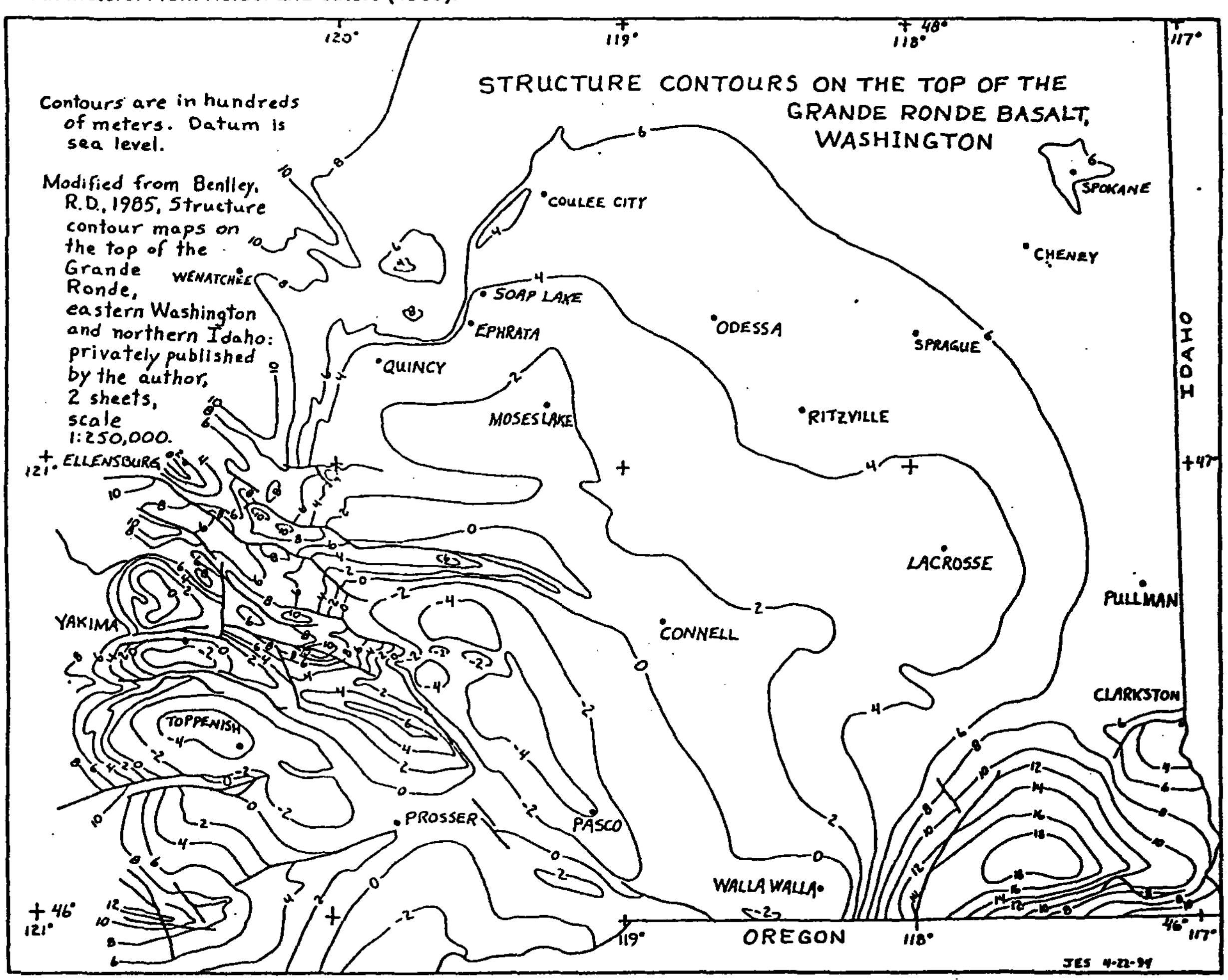


Figure 6. Extent of the Columbia River Basalt Group and thickness of the Grande Ronde Basalt. The Grande Ronde Basalt thickness contours are in meters. From Reidel and others (1989).

By the end of the eruptions of the Grande Ronde Basalt about 15.6 million years ago, more than 90 percent of the Columbia River Basalt Group had been erupted (Tolan and others, 1989; Fig. 5). While the gentle westward and southwestward slope of the surface of the Grande Ronde Basalt seen in Figure 7 in the northern and eastern parts of the basin (Pullman–Connell–Coulee City–Cheney area) developed earlier and guided the basalt flows toward the west, most of the rest of the structural relief developed after Grande Ronde Basalt time. The eastward slope at the west edge of the area shown in Figure 7 is due to postbasalt uplift of the Cascades, and the culmination in southeastern Washington is the Blue Mountains, which developed after the Grande Ronde Basalt was emplaced.

Flow units of the Columbia River Basalt Group are commonly separated by unconformities (Fig. 5), and, especially near the western margin of the subsiding basin of basalt deposition, there are commonly sedimentary interbeds between basalt flows. In the western, southwestern, and south-central parts of the Columbia Basin in Washington these interbeds and some postbasalt sediments are collectively known as the Ellensburg Formation. Deposition of Ellensburg Formation sediments and later sedimentary units accounts for as much as 400 meters of postbasalt sedimentary rocks in some of the subbasins of the Yakima fold belt.

Within the Columbia River Basalt Group many flow bottoms are pillowed, rubbly, or mixed with subjacent sediments, and many flow tops are rubbly, oxidized, vesicular, and (or) scoriaceous. The flow tops and bottoms and interflow sedi-



ments are generally quite porous and permeable and make good aquifers. Because many of the flows are of great lateral extent, the associated aquifers are also of great lateral extent. In contrast, the interiors of flows, although usually jointed, are often of low permeability and act as aquitards.

The recharge areas for these extensive aquifers are on the western side of the basin in the Cascades foothills and on the eastern side in the Palouse hills and the mountains of eastern Idaho. The ridges of the Yakima fold belt are not significant recharge areas because the area is arid. Also because the area is arid, there have been more and deeper wells drilled than in better-watered parts of the state.

The combination of basinal shape, laterally extensive aquifers that are confined between relatively impermeable basalt flows, and recharge areas to the east and west means that the hydrologic gradients slope into the deepest part of the basin near Pasco and into the subbasins of the Yakima fold belt. In these areas the deeper aquifers are confined and under artesian pressure.

Columbia Basin heat flow and temperature gradients are certainly factors in the occurrence of warm wells. Table 2 shows the average heat flows and temperature gradients for the physiographic provinces of Washington, and Figure 8 is a temperature-depth plot of Washington's thermal wells. Compared to the Northern Rocky Mountains province and the high heat flow zone of the Cascades province, the Columbia Basin does not have high heat flow. In fact, heat flow in the Columbia Basin is approximately equal to the worldwide average. However, because the thermal conductivity of the rocks is relatively low, the Columbia Basin has a higher-than-worldwide-average temperature gradient. At 41°C/km, it also has the highest regional temperature gradient in Washington except for the high heat flow zone of the Cascades. With this gradient and an average surface temperature of 15°C, which is reasonable for the warmer areas of the basin, the 20°C isotherm can be reached in a well only 122 meters deep. For comparison, if the gradient were only 20°C/km and the average surface temperature 10°C, it would take a well 500 meters deep to reach the 20°C isotherm. A productive aquifer must also be intersected, of course, if a useful well is to be had.

It seems probable that most of Washington's thermal wells occur in the Columbia Basin, and more particularly, in a six-county area in the western, southwestern, and south-central parts of the Columbia Basin, for the following reasons:

- There are more deep wells than in other parts of the state, which provides more opportunity for penetrating thermal aquifers.
- At 41°C/km, the regional geothermal gradient is favorable.
- The hydrologic setting is favorable. Laterally extensive aquifers, low vertical permeability, complex basinal structural shape, and recharge areas to the west and far to the east provide for the depth of circulation and residence time necessary to produce thermal ground water.

We may generalize to say that the typical thermal well in Washington occurs in the Columbia Basin, especially the six-county area, has a temperature gradient within a normal range of 30–50°C/km, and is heated by conduction. That is, the heat reached the well by conduction through the earth's crust from the mantle below, in the same way that heat moves through any solid body, such as a block of steel or concrete.

In addition to these normal or typical thermal wells, there are 192 wells across the state (Appendix C), including 140 wells in the six-county area, that don't fit the scenario above. These wells are too warm to have been heated conductively in a gradient of 50°C/km. More specifically, the wells have temperatures higher than that calculated by the following formula: $T = 15°C + (0.05°C/m)(\text{depth})$, where depth is in meters.

Of the 140 wells, four have "B" gradients in excess of 150°C/km, and errors in the data are suspected. Twenty additional wells (located in Townships 12–14 N. and Ranges 25–27 E.) on the Hanford Reservation of northern Benton County are warm because they have been used for the disposal of heated fluids (S. P. Reidel, Westinghouse Hanford Co., oral

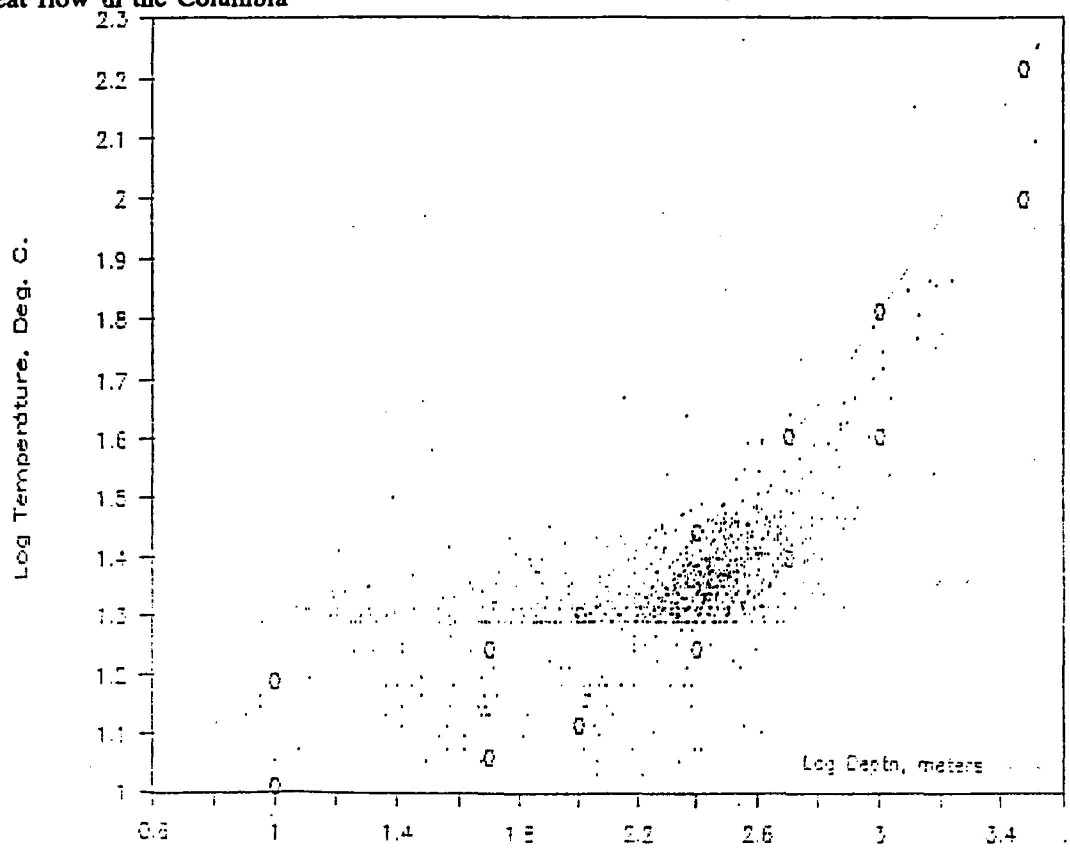


Figure 8. Temperature-depth plot of Washington's thermal wells and six-county cool wells, with the zone of normal temperature gradients, 30–50°C/km, shown between the two curved lines. Wells falling within the normal gradient zone may be heated by normal, conductive geothermal gradients. Those falling below the zone may be cooled by waters from upper, cooler aquifers flowing down the wells. Wells above the normal gradient band are too warm to have been heated by a normal range of gradients. These wells may be warmed by artificial warm-water recharge or by warm water leaking from deeper aquifers and reaching the wells because of higher-than-normal vertical permeability provided by faults and folds or the inherently greater permeability of supra-basalt sediments.

commun., April, 1994; Newcomb and others, 1972, p. 32-35). These 24 wells are not considered further.

In the remaining 116 six-county wells, the anomalous temperatures may be due to some natural cause. Some of these wells are located in areas where mapped geologic structures might be responsible for the circulation of warmer, deeper water to the higher levels penetrated by the wells. Others occur where there are no mapped geologic structures or significant thicknesses of suprabasalt sedimentary deposits that might provide for enhanced vertical permeability. For these wells no ready explanation for their anomalously high temperatures is currently available. Most of the wells occur in basinal areas of the Yakima fold belt where the available information indicates that many of the wells penetrate mostly suprabasalt sedimentary rocks. Some combination of vertical permeability in these rocks and leakage from the confined basalt aquifers below may be responsible for the abnormal temperatures of the wells.

Perhaps suprabasalt sediments are the most important factor in providing vertical permeability and allowing the rise of leakage from deeper, confined aquifers. There are "B" gradients (gradients calculated from bottom-hole temperatures and estimated mean annual surface temperatures) and standing water levels in the database for some of the 116 wells, and Table 3 shows their average "B" gradients and standing water levels. In Table 3, these wells are called "convectively heated(?) thermal wells". The table compares these wells with others, both within and outside of the six-county area, whose temperatures can be accounted for by heating under the influence of "normal" conductive temperature gradients between 30 and 50°C/km. Average "B" gradients and standing water levels are significantly higher for the anomalously warm wells.

The higher "B" gradients could be due to errors in the database, local heat sources in the crust, or variations in deep crustal heat flow and temperature gradients from place to place. The higher standing water levels might be due to wells being drilled into shallower aquifers and have no relationship to a higher temperature gradient, but if the shallower standing water levels are due to wells being developed in shallower aquifers, these wells should not produce higher average "B" gradients. The higher "B" gradients and shallower standing water levels occurring together suggests that some kind of convective water movement from deeper, warmer aquifers produces a "mound" of warmer ground water in the areas of these wells. Alternatively, higher "B" gradients and higher standing water levels would also be produced by injection of warm fluids into the wells, as on the Hanford Reservation.

Whether these anomalous wells are warmed artificially or naturally is not known. We point out their existence to emphasize the fact that some wells in the six-county area, many of which seem to be associated with the suprabasalt sediment-filled subbasins of the Yakima fold belt, have apparent average temperature gradients of about 77°C/km rather than 41°C/km. These wells constitute an even more attractive low-temperature geothermal resource than the "normal" thermal wells because the 20°C isotherm can be reached in a well, on average, only 65 meters deep.

LEGAL AND INSTITUTIONAL SETTING

Ownership and Leasing

The Federal Geothermal Steam Act of 1970 (Public Law 91-581) defines geothermal resources as follows:

> *Geothermal steam and associated geothermal resources means (i) all products of geothermal processes embracing indigenous steam, hot water, and hot brines; (ii) steam and other gas, hot water, and other brines resulting from water, gas, or other fluids artificially introduced into geothermal formations; (iii) heat or other associated energy found in geothermal formations; and (iv) any by-product derived from them (30 USC 1001).*

On federal lands under contract of the U.S. Forest Service, Bureau of Land Management, or another relevant agency, the federal government claims ownership of all geothermal resources, whether it holds the mineral estate jointly with the surface estate or holds a mineral reservation where the estates have been severed. It is unclear, however, whether federal ownership extends to ground water useful for direct-application purposes where the estates have been severed. In most cases, the state has primary control of ground water; absent the establishment of a federal enclave.

The Federal Land Policy and Management Act (FLPMA) (15 USC 1600, et seq: 43 USC 170, et seq.) requires the Secretary of Interior to inventory resources and prepare land-use plans based on those resource assessments. If energy facilities are not included in the plans, conflicting or preemptive land uses could prevent development of prime geothermal resource sites. Where energy development is specifically included as an accepted use, federal agencies must develop a procedure to allow for private energy-resource development. Although FLPMA authorizes sale of public lands for such development, leasing is by far the most common method by which private developers may gain access to private lands.

Surface rights and a priority right to explore, develop, and use geothermal resources on federal lands are acquired through an "Offer to Lease and Leases for Geothermal Resource," issued by the Bureau of Land Management pursuant to the Geothermal Steam Act of 1970 (amended 1988) (Public Law 91-581).

In Washington State, the Revised Code of Washington (RCW) defines "geothermal resource" as follows:

'Geothermal resource' means only that natural heat energy of the earth from which it is technologically practical to produce electricity commercially and the medium by which such heat energy is extracted from the earth, including liquids or gases, as well as any minerals contained in any natural or injected brines, and associated gas, but excluding oil, hydrocarbon gas, or other hydrocarbon substances (Chapter 79.76 RCW).

Washington's definition thus restricts geothermal resources to those "from which it is technologically practical to produce electricity commercially." Geothermal resources with temperatures below those required for commercial electrical production are considered groundwater resources in Washington, and are regulated by the Washington Department of Ecology. It is clear from the above that all geothermal resources considered in this report are considered by the state of Wash-

Table 3. Comparison of "B" gradients and standing water levels from convectively-heated(?) thermal wells and from conductively-heated(?) thermal wells. "B" gradients are temperature gradients calculated from bottom-hole temperatures and estimated mean annual surface temperatures. *Convectively heated(?) thermal wells* are defined as those in Appendices A and C that are too warm to have been heated by conductive heat transfer under the influence of a conductive temperature gradient in the range of 30–50°C/km. More specifically, the wells have temperatures higher than yielded by the formula, T = 15°C + (0.05°C/m)(Depth), where the well depth is in meters. From this number of wells some were excluded—(1) those on the Hanford Reservation that are known to be warm because of artificial recharge, and (2) wells with "B" gradients higher than 150°C/km, where gradients could be due to errors in the data. *Conductively heated(?) thermal wells* are defined as those in Appendix A that are at or cooler than a temperature that falls within the normal temperature gradient band shown on Figure 8. Their temperatures are equal to or less than those yielded by the formula above. These wells are probably heated by a normal conductive temperature gradient in the range of 30–50°C/km. Those wells at temperatures below the 30–50°C/km gradient band of Figure 8 may be cooled by water from a shallow aquifer(s) flowing down the well. n = number of wells; s.d. = standard deviation.

	"B" gradient (°C/km)	Standing water level (meters)		"B" gradient (°C/km)	Standing water level (meters)		"B" gradient (°C/km)	Standing water level (meters)
All wells, statewide	n = 374 mean = 47.5 s.d. = 15.7	n = 524 mean = 63.0 s.d. = 56.5	Convectively heated wells, statewide	n = 40 mean = 79.9 s.d. = 20.1	n = 108 mean = 31.1 s.d. = 35.4	Conductively heated wells, statewide	n = 334 mean = 43.7 s.d. = 9.3	n = 416 mean = 71.4 s.d. = 58.0
All wells, six-county area	n = 319 mean = 47.3 s.d. = 14.4	n = 452 mean = 64.2 s.d. = 55.8	Convectively heated wells, six-county area	n = 33 mean = 76.6 s.d. = 18.4	n = 83 mean = 30.8 s.d. = 35.8	Conductively heated wells, six-county area	n = 286 mean = 43.9 s.d. = 9.1	n = 369 mean = 71.7 s.d. = 56.8
All wells, statewide outside six-county area	n = 55 mean = 49.1 s.d. = 21.3	n = 72 mean = 56.0 s.d. = 60.0	Convectively heated wells, statewide not six-county area	n = 7 mean = 95.2 s.d. = 20.7	n = 25 mean = 32.0 s.d. = 34.0	Conductively heated wells, statewide not six-county area	n = 48 mean = 42.4 s.d. = 10.2	n = 47 mean = 68.7 s.d. = 66.5

ington to be groundwater resources. Such resources are available through appropriation.

The state claims ownership of all groundwater resources underlying state and school lands. In order to gain access to low-temperature geothermal resources below these lands, a commercial easement must be obtained.

The Washington Department of Natural Resources (DNR) manages the majority of state lands, with the only exception being lands managed by the Washington Department of Wildlife, Parks and Recreation Commission, and small holdings by other state agencies. Access to non-DNR lands for the purpose of exploration and development may be allowed once a permit is obtained from the local office of the agency managing the lands.

The DNR is responsible for issuing leases on state trust lands for the purpose of geothermal exploration and development for direct use. A Plan of Operation is required by DNR for such exploration and development activities.

Permitting and Development Requirements

Water rights

In response to the growing concern about the state's groundwater resources, the Washington Department of Ecology is legislatively mandated to coordinate the development of ground-water management programs. Local governments are responsible for developing Ecology-approved ground-water management plans. Activities within ground-water management areas are required to comply with ordinances/regulations established as part of a ground-water management plan.

A water-rights permit from Ecology is required before the construction of any water well. Upon application, Ecology will inspect the site, require publication of a public notice, and attempt to resolve any protests that may be filed. A permit allowing construction of the project may be issued if water is deemed to be available, no existing water rights are affected, and the project is found to not be detrimental to the public welfare. Information required for the permit application includes: a sector map????????, the source of the water supply, how the water will be used, the exact location of the point of withdrawal, a legal description of the property on which the water is to be used, a description of the proposed water use, and the signature of the legal owner.

A final certificate of water rights is issued only after the project is complete and the water is put to use.

As of early 1994, the Department of Ecology found itself 3 to 4 years behind in the adjudication of water rights and, in some areas, a total ban on new water rights is in effect pending the outcome of legal challenges.

The 1992 Washington State Energy Strategy concluded that the Department of Ecology should revise its procedures so as to provide for the protection of water resources while capturing the values of these energy resources.??????????

Ecology also regulates the drilling of all water wells within the state, regardless of land ownership. The construction of water wells must conform to RCW 18.104 to ensure the protection of public resources acquifers. Ecology publishes the following:

- Minimum Standards for Construction Maintenance of Wells, Chapter 173-160 WAC
- Rules and Regulations Governing the Regulations and Licensing of Well Contractors and Operators, Chapter 173-162 WAC
- Water Well Construction Act (197????????, Chapter 18 RCW

Discharge and reinjection

Disposal of geothermal water after heat extraction is an increasingly important area of concern to the State and developers alike.

The National Pollutant Discharge Elimination System (NPDES) or State Waste Discharge Permit, Water Quality Certification, and (or) Short-Term Modification of Water Quality Standards ensure that water quality will not be adversely affected. According to Ecology, a NPDES permit is required whenever a discharge will be made into surface water of the state. The State Waste Discharge Permit is required for virtually all discharges, for example, onto land surfaces or by subsurface injection.

The Water Pollution Control Act generally prohibits the discharge by any person of any matter that "shall cause or tend to cause pollution" of the waters of the state. Pollution is defined broadly to include any alteration of the physical, chemical, or biological properties of water of any *change in temperatures*, task color, turbidity, or odor, or the discharge of any substance likely to create a nuisance or a detriment to any conceivable beneficial use (RCW 10.48.010).??????? "Discharge of pollutants" has been broadly construed to include discharges of materials that *existed* in the water before it was brought into a facility and used (Crown Zellerbach *v.* State Department of Ecology, Pollution Control Hearing Board (PCHB) Nos. 85-223 and 85-242 [1986]) In this case, the PCHB held that discharge of solids into the receiving water constituted "discharge of pollutants," even though the solids were naturally occurring and were brought in with the plant's intake water.

The State's policy is to maintain the highest possible standards to ensure the purity of all waters of the state by requiring the use of all known, available, and reasonable methods by industries and others to prevent and control the pollution of the water of the state. Permits issued by Ecology under NPDES and the state waste discharge permit program (cap??) require the use of "all known, available, and reasonable methods of treatment" (AKART) before discharge. The Water Pollution Control Act requires sources to use AKART regardless of the effect of existing discharges on water quality (Backer, 1992).

A number of developers have recently indicated that geothermal direct-use projects are not being pursued due to problems associated with ~~obtainment of~~ [obtaining?] a discharge permit and inconsistencies in interpretation of discharge requirements by Department of Ecology personnel.

If widespread development of the state's low-temperature geothermal resources is to take place, questions relating to ~~the obtainment of~~ [obtaining?] water rights and discharge permits must be resolved.

Secondary Beneficial Uses of Groundwater

In 1982, the Washington State Department of Health allowed the City of Ephrata to reintroduce ground water that had first passed through a heat pump, back into the city's domestic water supply system. This precedent-setting project was the first in the U.S. to receive such permission. Health departments in several other states followed Washington's lead in allowing for the construction and operation of these so-called dual-function water supply systems. Unfortunately, a number of potential project developers have recently reported that the Department of Health appears to have reversed itself and is now informing developers that such practice is not permissible.

The Washington State Energy Office, in response to a recommendation of the Energy Strategy Committee, has recently formed the Energy Strategy Interagency Task Force that will, among other things, address issues relating to the use of the state's low-temperature geothermal resources including:

- water rights and reinjection,
- discharge of geothermal water and reinjection, and
- secondary beneficial use of geothermal water in domestic water supply systems.

District Heating System Regulation

Washington State has adopted a comprehensive legislative and regulatory scheme to encourage the development of district heating systems based on the use of geothermal and other renewable resources and high-efficiency cogeneration. Washington's legislation and implementing regulations achieve two important objectives for district heating systems that ~~utilize~~ [use] certain preferred heat resources: they grant local government entities clear and broad authority to undertake and finance such systems, and they provide private district heating developers with a simplified regulatory framework and market incentives to encourage development.

Local government entities, including counties, cities, towns, and certain utility districts, are covered by Washington's 1983 "Heating Systems" statute (Wash. Rev. Code Ann., Ch. 35.97). To supply their inhabitants or others with heating services, the statute authorizes these entities to construct, purchase, acquire, extend, maintain, and operate heating systems using preferred resources such as biomass, *geothermal*, cogeneration, solar, and waste heat. The statute was amended in 1987 to allow additional local government entities to become involved and additional heat sources included as "preferred resources."

The statute confers on these public entities full power to regulate and control the use, distribution, and price of heat supplied through their systems, free from Washington Utilities and Transportation Commission (UTC) jurisdiction. It also grants expansive authority to finance heating systems through such mechanisms as local improvement-district bonds and warrants, special assessments, and revenue bonds, and to exercise other authorities needed to further the statutory objectives. In short, the statute addresses most of the central concerns of local government entities considering district heating development and clarifies their authority in areas where uncertainty might otherwise discourage development.

Washington's private district heating developers are subject to a different legislative scheme set forth in the state's 1983 "Heat Supplier" statute (Wash. Rev. Code Ann., Ch. 80.62). That statute rests on a legislative finding that traditional public-utility regulation may pose unnecessary barriers to the use of preferred heating resources, but that some minimal regulation may be needed to protect heating-system customers. Reflecting these findings, the statute adopts a streamlined "operating permit" system that is considerably less burdensome to suppliers than traditional regulation, but retains basic customer protections appropriate to the competitive environment for heating services.

Under this system, private suppliers proposing to furnish heat from such resources as *geothermal*, biomass, waste heat, and cogeneration are exempted from the Washington Utilities and Transportation Commission's general jurisdiction and subjected only to the limited jurisdiction conferred by the statute. That jurisdiction consists principally of the legislature's direction to the UTC to grant a nonexclusive operating permit to provide heating services within a designated service territory to a prospective heat supplier that demonstrates that:

(1) It is qualified and financially responsible to provide the services offered,

(2) Its proposed system design is adequate to provide those services, and

(3) Its proposed customer contract specifies the term of service and the rates or rate formula, and otherwise assures adequate service.

The 1983 statute was also amended in 1987 to include additional resources under the exemption.

To minimize regulatory delays and costs, encourage competition, and allow suppliers to earn market-based returns, the statute circumscribes the UTC's authority to approve heating rates. It directs the UTC to base rate approvals not on traditional calculations of the supplier's cost of service or rate of return on investment, but on the reasonableness of the proposed rates in relation to rates charged for comparable heating services available in the area. Instead of imposing the low fixed utility rate of return reflecting the historically low risk profiles of conventional utilities, this approach offers suppliers an incentive to provide low-cost services and capture any corresponding market rewards. To increase this incentive and enhance certainty and predictability, the statute further provides that rates less than 80 percent of rates for comparable services will be automatically approved.

The legal and institutional framework relating to the development of the state's low-temperature geothermal resources is in need of serious review and possible revision if geothermal is to play a major role in meeting the state's future energy requirements. The inability of developers to obtain water rights or, where available, to obtain them in a timely manner, has resulted in the loss of a number of potential projects. These projects were forced to use conventional fuels. In a similar manner, disposal and injection requirements are becoming a serious concern to potential developers, and equally serious is what appears to be a reversal of policy by the Department of Health in regard to secondary use of water for domestic purposes once it has been passed through a heat pump. Hopefully, all three of these issues can be addressed and resolved by the new Energy Strategy Interagency Task Force.

On the other hand, Washington has adopted one of the most comprehensive legislative and regulatory frameworks to encourage the development of district energy systems based on preferred resources such as geothermal. If the other issues are resolved with the same desire to encourage development, the resulting framework should be a model for the entire nation.

PAST AND CURRENT LOW-TEMPERATURE GEOTHERMAL USES

The direct use of geothermal resources in Washington State had its modern beginning in the late 1800s, but its benefits had been enjoyed by the native Indians for centuries before. In the early 1880s, Theodore Moritz, a settler in the Quillayute Valley, was out hunting and came across an Indian who had broken his leg. Mr. Moritz took the injured man home and nursed him until be could travel. In gratitude, the Indian told him of some wonderful curative "fire chuck" (hot water) that bubbled from the ground where Indians had gone for years to cure their ailments. The Indian led Moritz to what is now Sol Duc Hot Springs, and Moritz later returned to build a cabin and file a claim with the U.S. Land Office. Word spread of the healing waters and mud, and people began making the 2-day horseback trip from Port Angeles.

In 1903, Michael Earles, owner of the Puget Sound Mills and Timber Company, accompanied a group of people to Sol Duc. Earles had been told by his doctor that he was dying and was advised by his doctor to travel to Carlsbad, but was too weak for the long journey. The mineral water at Sol Duc cured him, and in gratitude he decided to build a place to help others. In 1910, Earles bought the site from the heirs of Theodore Moritz and founded the Sol Duc Hot Springs Company. Sol Duc soon became the most noted pleasure and health resort on the Pacific Coast. Michael Earles spent fully a half million dollars in creating the resort, which was opened on May 15, 1912, and which, during its peak year, handled 10,000 guests from all over the U.S. and from as far away as Europe. Guests at the resort drank the mineral water and bathed in the water in tubs, showers, mud, or vapor. The temperature of the hot springs was reported to be 60°C, and the waters contained sodium, potassium, magnesium, silicon, iron, and other minerals. The mineral waters were also bottled and sold as delicious draught with marvelous healing qualities to be enjoyed at home (Kellogg, 1975).

In addition to the hotel, there was also a three-story sanitarium complete with operating room, appliances for surgical cases, a laboratory, and an x-ray. The sanitarium had beds for 100 patients.

On May 26, 1916, after only 3 years of operation, the fabulous resort was destroyed by fire started when sparks from a defective flue landed on the roof of the main hotel building. Although the caretaker tried to put out the fire, he discovered that the water had been turned off for the winter (Kellogg, 1975).

The fire at Sol Duc did not, however, signal the end of the growing interest in hot spring resorts. Although Sol Duc was never again to achieve its earlier grandeur, it was modestly re-built and is now part of Olympic National Park. Nearby Olympic Hot Springs also saw considerable development in the early 1900s, only to be returned to its natural state by the Park Service in 1973.

Other resorts were built at Longmire and Ohanapecosh Hot Springs, now part of Mt. Rainier National Park, and at North Bonneville and Carson, both located in the Columbia River Gorge (Bloomquist, 1979).

Renewed interest in Washington's geothermal resource began in the mid to late 1970s as a result of the oil embargo of 1973 and oil crisis of 1979. The primary emphasis was on the discovery, evaluation, and commercialization of high-temperature resources that could be harnessed to generate electricity. A majority of the activity was centered in the Cascade Range, where it was thought that high-temperature geothermal resources would be most likely to occur. Over a million acres were once under lease application throughout the Cascade Mountains of Washington, but due to environmental concerns, delays in completing environmental impact studies by the U.S. Forest Service, and a surplus of low-cost electricity throughout the 1980s, few leases were actually granted and no major exploration programs were completed by industry.

Direct-use geothermal resources, however, were found to be abundant, widespread, easy to access, and increasingly cost effective. A detailed assessment program carried out by the Washington State Department of Natural Resources, Division of Geology and Earth Resources (DNR) identified 338 warm water wells (wells at a temperature at or above 20°C throughout the Columbia Basin (Korosec and others, 1981). The Washington State Energy Office (WSEO), working cooperatively with DNR, identified a number of promising development projects. In 1980, WSEO began the design of what was to become the nation's first major dual purpose geothermal heat-pump project. The system was based on the use of a 30°C, 550 m, 140 ~~liters per second~~ [l/s?], municipal well in Ephrata. In 1980, with assistance from WSEO and the Oregon Institute of Technology Geo-Heat Center, the City of Ephrata applied for a grant under the Department of Housing and Urban Development's Innovative Community Energy Conservation Program. The $468,000 grant allowed for the construction of the new geothermal heat pump plant designed to provide all of the heating and cooling requirements of the Grant County Courthouse and Courthouse Annex, the retrofit of the Courthouse complex, and a demonstration project in the nearby June's Court low-income housing project (Bloomquist, 1983).

The heat pump system was designed to remove approximately 7.5°C from a 30°C city water well. The water was then returned to the municipal system. The two-stage heat pump was capable of supplying 52°C to 65°C water to the Grant County Courthouse's central heating system, resulting in an 80 percent decrease in energy consumption and an 85 per cent decrease in the Courthouse fuel bill. The June's Court project consisted of retrofitting a number of units to use geothermal heat pumps. Both projects were completed in 1983, and received national awards from the U.S. Department of Energy and from the American Society of Heating and Refrigeration Engineers (ASHRE). The uniqueness and importance of the system also resulted in commendations from the Governor and the Washington State Legislature. This project also marked the first acceptance by state health regulators of the domestic use of water that had passed through a heat pump and served as the model for the acceptance of such systems throughout much of the U.S.

The Ephrata project served as the catalyst for several additional projects, including the Yakima County Jail, the Washington State Department of Social and Health Services Office in Yakima, several schools, including two community colleges, and numerous commercial and residential installations. Studies completed by WSEO and DNR initially identified 22 cities in central and eastern Washington with proximity to geothermal resources that would meet temperature and flow requirements for district heating. Chemistry of the resource was also found to be acceptable for development with only minor concerns related to material selection. Geothermal district heating feasibility studies were completed in six cities by 1985, using HEATPLAN, a new computer program developed by WSEO for this purpose. The six cities, Yakima, Ephrata, Moses Lake, West Richland, Grandview, and Sunnyside, were all found to have heat-load densities high enough to technically and economically support geothermal district heating systems.

However, 1985 also saw one of the most dramatic decreases in competing energy prices, with natural gas dropping to less than half of projected levels. The low natural gas and oil prices, coupled with a significant surplus in electrical generation capacity, removed any economic incentive for the development of capital-intensive geothermal systems by developers or incentives for energy conservation by utilities. In addition, the Washington State Department of Ecology (DOE) found itself further and further behind in adjudicating water rights and, in many areas, a total moratorium on new water rights was put in place, often stopping projects that were still attractive from both an energy and economic perspective.

RESOURCE POTENTIAL AND COLLOCATION??? OF RESOURCES AND USERS

The 1990s have, however, brought new interest in geothermal resources development in Washington State. California Energy Company has filed lease applications in both the northern and southern Cascades (McClain, D., C E??? Exploration, 1993, oral commun.). Seattle City Light, the state's largest municipal utility, has begun a reassessment of its position on future geothermal development. Puget Sound Power and Light, the state's largest investor-owned utility, entered into an agreement to purchase electricity generated from geothermal resources in California. And the Bonneville Power Administration (BPA), with support from the Northwest Power Planning Council, initiated a program to demonstrate the technical, economic, and environmental acceptability of geothermal electric generation in the Northwest. In 1993, CARES (Conservation and Renewable Energy Systems) was founded by a number of public utilities to pursue the development of renewable energy projects. However, by far the greatest interest remains in the development of the state's tremendous low-temperature geothermal potential found mostly in the Columbia Basin counties of Adams, Benton, Franklin, Grant, Walla Walla, and Yakima (Fig. 1). This new interest stems from the fact that more and more of the state's electrical utilities are discovering that low-temperature geothermal, when coupled with new high efficiency water-source heat pumps, can be an extremely attractive demand-side measure. The installation of such systems not only reduces total energy consumption in comparison to electrical resistance or air-to-air heat pump heating systems, but can reduce demand by up to 50 percent, thus significantly reducing the need to build new generation facilities. Water-source heat pumps have also become a major element in many utility programs designed to maintain market share, being the only technology readily available to them that compares favorably with extremely cost-competitive natural gas. Many manufacturers of water-source heat pumps claim coefficients of performance (COPs) exceeding 4.5 and, when coupled with geothermal sources, may exceed 6.0. For example, the Grant County Courthouse complex in Ephrata routinely achieves a COP of 5.8.

The future for low-temperature geothermal development in Washington State must be seen as extremely positive, especially in light of the abundant and areally widespread occurrence of the resource and the new and increasing interest in renewable energy development by utilities and the state and federal governments. In fact, the Clinton Administration's Global Change Action Item #26 gives considerable attention to the need and desirability of developing low-temperature geothermal heat sources. But probably most important is the renewed interest on the part of the state's public- and investor-owned utilities and an increasing desire on the part of state and municipal government to expand the use of renewable energy resources wherever technically and economically feasible. This common interest on the part of utilities and government provides a natural mechanism for targeting further assessment and development activities.

Because there are still significant problems associated with obtaining new water rights, development activities are being directed toward sites where thermal wells already exist, where such wells are under the control of a government entity, and where the water is used or is usable year-round, that is, non-irrigation wells. Development is also being focused on sites where significant new construction or redevelopment is or will be taking place, for example, schools, correctional facilities, and institutions of higher education. For example, from a quick analysis of the database, 63 cities of 5,000+ population are found to be located within 8 kilometers of a thermal well. These 63 cities all have significant potential for the development of geothermal-based district heating systems. Further analysis locates 24 schools that have construction or remodeling projects planned or underway, totaling about 150,000 m^2 and with an aggregate budget of over $100 million. These 24 schools have a total of 259 thermal wells within 8 km, many of which are owned by the municipality, county, port district, state agency, or the school district itself. In fact, out of the 941 thermal wells identified, 250 are under government ownership.

But the availability of low-temperature geothermal resources and the collocation of a need for thermal energy is in no way a guarantee that development can or will take place. Decision-makers, as well as those who advise them, for example, architectural and engineering firms, must be made aware of the availability of geothermal resources and the reliability of the use of geothermal water-source heat pumps. Regulators in the Department of Ecology and Department of Health must be convinced of the benefits and extremely low risk associated with installations that either reinject the water or use it in a secondary manner once it has passed through the heat pump. And, finally, mechanisms must be put in place that ensure that the generally high front-end capital cost of these systems is not a deterrent to development. Many utilities are adopting incentive programs that encourage the development of geothermal heat-pump systems, either in the form of rebates or long-term lease arrangements. The cost of such systems can also be significantly reduced through advancements in drilling technology and improvements in system efficiency.

SUMMARY

[To be written by J.E.S.]

RECOMMENDATIONS

Our top recommendation is to (1) match existing thermal wells, especially publicly owned wells that produce large quantities of water year-round, with closely collocated proposed new construction or remodeling of public buildings, such as schools, (2) determine which projects could make advantageous use of the geothermal resource to heat and/or cool the building, and (3) encourage and facilitate such applications. This work would occur mostly in the Columbia Basin, because most thermal wells are located there, and it would lead to significant development of low-temperature geothermal resources, perhaps without any additional drilling or exploration.

Our second recommendation is to station one or two investigators in the Columbia Basin, especially in the six-county area, to find and visit new wells to (1) measure downhole temperature gradients (or accurate flowing temperatures if gradients cannot be measured, as for example, in flowing artesian wells), (2) obtain well-test data, (3) obtain drill cuttings for measurement of thermal conductivity and geochemistry, and (4) collect water samples for chemical analysis. With the trend toward fully cased and sealed wells that tap a single deep aquifer, this work would allow the formulation of a data set that would determine regional and local distribution of heat flow and temperature gradients, better define the chemistry and stratigraphy of the deeper aquifers, build accurate statistics about the volumes and temperatures of water available from wells, and allow formulation of exploration strategies that would minimize unproductive drilling.

Our third recommendation is to institute a long-term effort to (1) inform the people of the state about uses of low-temperature geothermal resources, (2) work with public policy makers to make certain that the legal and institutional framework encourages the wise use of low-temperature geothermal resources, and (3) advocate for use of geothermal resources in place of fossil fuels.

REFERENCES CITED

Note: Numbered references are cited by number in the data tables found in the Appendix.

1. Barnett, D. B., 1986, The 1985 geothermal gradient drilling project for the State of Washington: Washington Division of Geology and Earth Resources Open File Report 86-2, 34 p.

— Backer, T. E., editor, 1992, Washington environmental laws handbook, Second Edition, Preston, Thorgrimson, Shidler, Gates and Ellis, Government Institute, Inc. [Rockville, Md.], 421 p.??

— Bentley, R. D., 1985, Structure contour maps on the top of the Grande Ronde, eastern Washington and northern Idaho: privately published by the author, 2 sheets, scale 1:250,000.

2. Biggane, J. H., 1982, The low-temperature geothermal resource and stratigraphy of portions of Yakima County, Washington: Washington Division of Geology and Earth Resources Open File Report 82-6, 128 p., 58 figs., 4 pl., 11 tables, appendix.

3. Biggane, J. H., 1983, Geophysical logs from water wells in the Yakima area, Washington: Washington Division of Geology and Earth Resources Open File Report 83-2, 50 p.

4. Blackwell, D. D., 1980, Heat flow and geothermal gradient measurements in Washington to 1979 and temperature-depth data collected during 1979: Washington Division of Geology and Earth Resources Open File Report 80-9, 524 p. [unpaginated].

5. Blackwell, D. D., 1993, Southern Methodist University, Dallas, Texas, Heat-flow data for Washington on disk, unpublished data.

6. Blackwell, D. D.; Steele, J. L.; Kelley, S. A., 1985, Heat flow and geothermal studies in the State of Washington: Washington Division of Geology and Earth Resources Open File Report 85-6, 77 p.

— Bloomquist, R. G., 1979, Geothermal energy in Washington—Site data base and development status: Oregon Institute of Technology Geo-Heat Utilization Center, 192 p.

— Bloomquist, R. G., 1983, Ephrata attracts national attention—Governor dedicates innovative geothermal system: Washington State Energy Office Newsletter, v. 6, no. 2, p. 1,12.

— Bloomquist, R. G.; Black, G. L.; Parker, D. S.; Sifford, A.; Simpson, S. J.; Street, L. V., 1985, Evaluation and ranking of geothermal resources for electrical generation or electrical offset in Idaho, Montana, Oregon, and Washington: Bonneville Power Administration, 252 p.

— Bloomquist, R. G.; Nimmons, J. T.; Rafferty, K., 1987, District heating development guide—Legal, institutional, and marketing issues: Washington State Energy Office [Olympia, Wash.], p. 86-87.

7. Bortleson, G. C.; Cox, S. E., 1986, Occurrence of dissolved sodium in ground waters in basalts underlying the Columbia Plateau, Washington: U.S. Geological Survey Water-Resources Investigations Report 85-4005, 24 p., 5 pl.

8. Bowen, R. G., 1992, Geothermal Consultant, Portland, OR, unpublished data.

9. Brown, J. C., 1979, Geology and water resources of Klickitat County: Washington State Department of Ecology Water Supply Bulletin 50, 413 p., 8 pl., scale 1:94,000.

10. Campbell, N. P., 1993, Yakima Valley College, Yakima, WA, unpublished data.

— Christie, R. A., 1994, Bibliography and index of geothermal resources and development in Washington State, with selected general works: Washington Division of Geology and Earth Resources Open File Report 94-1, 56 p.

11. Cline, D. R., 1976, Reconnaissance of the water resources of the upper Klickitat River basin, Yakima Indian Reservation, Washington: U.S. Geological Survey Open-File Report 75-518, 54 p.

12. Ertec Western, Inc., 1981, Revisions to: Assessment of volcanic and geothermal activity in the Pasco Basin and vicinity, Volume I, Narrative report: Ertec Western, Inc., Long Beach, CA, Project Number 81-199 for Rockwell International, Rockwell Hanford Operations, Energy Systems Group, Richland, WA 99352, 119 p.

13. Foxworthy, B. L., 1962, Geology and ground-water resources of the Ahtanum Valley, Yakima County, Washington: U.S. Geological Survey Water-Supply Paper 1598, 100 p.

14. Gizienski, S. F.; McEuen, R. B.; Birkhahn, P. C., 1975, Regional evaluation of the geothermal resource potential in central Washington State: Woodward-Gizienski and Associates, 113 p., 4 pl., scale 1:1,000,000.

15. Griffin, W. C.; Sceva, J. E.; Swenson, H. A.; Mundorff, M. J., 1962, Water resources of the Tacoma area Washington: U.S. Geological Survey Water-Supply Paper 1499-B, 101 p., 4 pl.

— Gulick, C. W., compiler, in press, Geologic map of the Connell 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources open-file report.

16. Hearn, P. P., Jr.; Steinkampf, W. C.; Bortleson, G. C.; Drost, B. W., 1985, Geochemical controls on dissolved sodium in basalt aquifers of the Columbia Plateau, Washington: U.S. Geological Survey Water-Resources Investigations Report 84-4304, 38 p., 1 pl.

— Hem, J. D., 1985, Study and interpretation of the chemical characteristics of natural water: U.S. Geological Survey Water-Supply Paper 2254, Third Edition, 263 p., 3 pl.

— Hooper, P. R.; Kleck, W. D.; Knowles, C. R.; Reidel, S. P.; Thiessen, R. L., 1984, Imnaha Basalt, Columbia River Basalt Group: Journal of Petrology, v. 25, part 2, p. 473-500.

— Kellogg, Bert, 1975, Olympic hot springs and Sol Duc hot springs, Text of photo collection at the North Olympic Library System, Port Angeles, Washington.

— Kindle, C. H., 1991, Geothermal fluid sampling techniques. *In* Lienau, P. J.; Lunis, B. C., editors, Geothermal direct use engineering and design guidebook: Geo-Heat Center, Oregon Institute of Technology, p. 99-113.

17. Korosec, M. A., 1980, Table of thermal and mineral spring locations in Washington: Washington Division of Geology and Earth Resources Open File Report 80-11, 6 p.

18. Korosec, M. A., 1982, Table of chemical analyses for thermal and mineral spring and well waters collected in 1980 and 1981: Washington Division of Geology and Earth Resources Open File Report 82-3, 5 p.

19. Korosec, M. A., 1983a, Chemical analyses for thermal and mineral springs examined in 1982–1983: Washington Division of Geology and Earth Resources Open File Report 84-1, 8 p.

20. Korosec, M. A., 1983b, The 1983 temperature gradient and heat flow drilling project for the State of Washington: Washington Division of Geology and Earth Resources Open File Report 83-12, 11 p.

— Korosec, M. A., 1984, Summary of geothermal exploration activity in the State of Washington from 1978 to 1983: Washington Division of Geology and Earth Resources Open File Report 84-2, 42 p.

21. Korosec, M. A.; Schuster, J. E.; Blackwell, D. D.; Daneš, Z. F.; Clayton, G. A., 1980, The 1979–1980 geothermal resource assessment program in Washington: Washington Division of Geology and Earth Resources Open File Report 81-3, 267 p., 1 map, scale 1:24,000.

22. Korosec, M. A.; Kaler, K. L.; Schuster, J. E.; Bloomquist, R. G.; Simpson, S. J.; Blackwell, D. D., 1981, Geothermal resources of Washington: Washington Division of Geology and Earth Resources Geologic Map GM-25, 1 sheet, scale 1:500,000.

23. Korosec, M. A.; Phillips, W. M.; Schuster, J. E., 1982, The low temperature geothermal resources of eastern Washington: Washington Division of Geology and Earth Resources Open File Report 82-1, 20 p., 2 figs., 1 table.

24. Korosec, M. A.; Phillips, W. M.; Schuster, J. E.; Daneš, Z. F.; Biggane, J. H.; Hammond, P. E.; Clayton, G. A., 1983, The 1980–1982 geothermal resource assessment program in Washington; with chapters on thermal springs, gravity investigations, heat-flow drilling, low-temperature resources in eastern Washington, geology of the south Cascades and White Pass areas, and targets for geothermal resource exploration: Washington Division of Geology and Earth Resources Open File Report 83-7, 299 p.

25. Korosec, M. A.; Kaler, K. L., 1980, Well temperature information and locations in the State of Washington: Washington Division of Geology and Earth Resources Open File Report 80-7, 89 p. [unpaginated], 2 pl., scale 1:500,000.

26. Korosec, M. A.; Phillips, W. M., 1982, WELLTHERM: Temperature, depth, and geothermal gradient data for wells in Washington State: Washington Division of Geology and Earth Resources Open File Report 82-2, 3 p., 74-p. table.

27. Landes, Henry, 1905, Preliminary report on the underground waters of Washington: U.S. Geological Survey Water Supply Paper 111, 85 p.

28. Luzier, J. E., 1969, Ground-water occurrence in the Goldendale area, Klickitat County, Washington: U. S. Geological Survey Hydrologic Investigations Atlas HA-313, 1 sheet, scale 1:62,500.

29. Mariner, R. H.; Presser, T. S.; Evans, W. C.; Pringle, M. K., 1989, Discharge rates of thermal fluids in the Cascade Range of Oregon and Washington and their relationship to the geologic environment. *In* Muffler, L. J. P.; Weaver, C. S.; Blackwell, D. D., editors, Proceedings of workshop XLIV, Geological, geophysical, and tectonic setting of the Cascade Range: U.S. Geological Survey Open-File Report 89-178, p. 663-694.

— McClain, D., 1993, Personal comments, CE?? Exploration.??

30. Newcomb, R. C., 1965, Geology and ground-water resources of the Walla Walla River basin Washington–Oregon: Washington Division of Water Resources Water Supply Bulletin 21, 151 p., 3 pl.

31. Newcomb, R. C., 1972, Quality of the ground water in basalt of the Columbia River Group, Washington, Oregon, and Idaho: U.S. Geological Survey Water-Supply Paper 1999-N, 71 p., 1 pl., scale 1:1,000,000.

— Newcomb, R. C.; Strand, J. R.; Frank, F. J., 1972, Geology and ground-water characteristics of the Hanford Reservation of the U.S. Atomic Energy Commission, Washington: U.S. Geological Survey Professional Paper 717, 78 p., 3 pl.

32. Reed, M. J.; Mariner, R. H.; Brook, C. A.; Sorey, M. L., 1983, Selected data for low-temperature (less than 90 degrees C) geothermal systems in the United States; reference data for U.S. Geological Survey Circular 892: U. S. Geological Survey Open-File Report 83-250, 129 p.

— Reidel, S. P.; Fecht, K. R., compilers, in press a, Geologic map of the Priest Rapids 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources open-file report.

— Reidel, S. P.; Fecht, K. R., compilers, in press b, Geologic map of the Richland 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources open-file report.

— Reidel, S. P.; Tolan, T. L.; Hooper, P. R.; Beeson, M. H.; Fecht, K. R.; Bentley, R. D.; Anderson, James Lee, 1989, The Grande Ronde Basalt, Columbia River Basalt Group; Stratigraphic descriptions and correlations in Washington, Oregon, and Idaho. *In* Reidel, S. P.; Hooper, P. R., editors, Volcanism and tectonism in the Columbia River flood-basalt province: Geological Society of America Special Paper 239, p. 21-53.

33. Robinette, M. S.; Robinette, M. J.; Brown, J. C., 1977, Geophysical investigations of Washington's ground-water resources, annual report 1975/1976: Washington State University College of Engineering Research Report No. 77/15-6, 56 p., 5 maps. (Also Washington State Department of Ecology Project Interim Report 76-075 and Project Completion Report 76-069.)

34. Schuster, J. E., 1981, Geothermal energy potential of the Yakima valley area, Washington. *In* Bloomquist, R. G., editor, Proceedings of the Geothermal Symposium—Low temperature utilization, heat pump applications, district heating, September 24, 1980: Washington State Energy Office WAOENG 81-05, p. XI 1 - XI 10.

— Schuster, J. E., compiler, 1994, Geologic map of the Walla Walla 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources Open File Report 94-3, 18 p., 1 pl.

— Schuster, J. E., compiler, in press a, Geologic map of the east half of the Toppenish 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources open-file report.

— Schuster, J. E., compiler, in press b, Geologic map of the east half of the Yakima 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources open-file report.

— Schuster, J. Eric, Bloomquist, R. Gordon, 1994, Low temperature geothermal resources of Washington, Washington State Department of Natural Resources, Division of Geology and Earth Resources, Washington Division of Geology and Earth Resources, Open File Report 94-1

35. Smith, G. O., 1901, Geology and water resources of a portion of Yakima County, Wash.: U.S. Geological Survey Water-Supply and Irrigation Paper No. 55, 68 p.

36. Stearns, N. D.; Stearns, H. T.; Waring, G. A., 1937, Thermal springs in the United States: U. S. Geological Survey Water-Supply Paper 679-B, 206 p., 1 pl., scale 1:7,000,000.

37. Stoffel, K. L.; Widness, Scott, 1983a, Fluid-temperature logs for selected wells in eastern Washington: Washington Division of Geology and Earth Resources Open File Report 83-15, 351 p.

38. Stoffel, K. L.; Widness, Scott, 1983b, Geophysical logs of selected wells in eastern Washington: Washington Division of Geology and Earth Resources Open File Report 83-14, 81 p.

39. Taylor, G. C., Jr., 1944, Factual data pertaining to wells and springs in the Columbia Basin Project area, Washington: U.S. Geological Survey unpublished report, 85 p.

— Tolan, T. L.; Reidel, S. P.; Beeson, M. H.; Anderson, James Lee; Fecht, K. R.; Swanson, D. A., 1989, Revisions to the estimates of the areal extent and volume of the Columbia River Basalt Group. *In* Reidel, S. P.; Hooper, P. R., editors, Volcanism and tectonism in the Columbia River flood-basalt province: Geological Society of America Special Paper 239, p. 1-20.

40. U.S. Geological Survey, 1993, WATSTORE database records as of July 20, 1993.

41. Van Denburgh, A. S.; Santos, J. F., 1965, Ground water in Washington, its chemical and physical quality: Washington Division of Water Resources Water Supply Bulletin 24, 93 p.

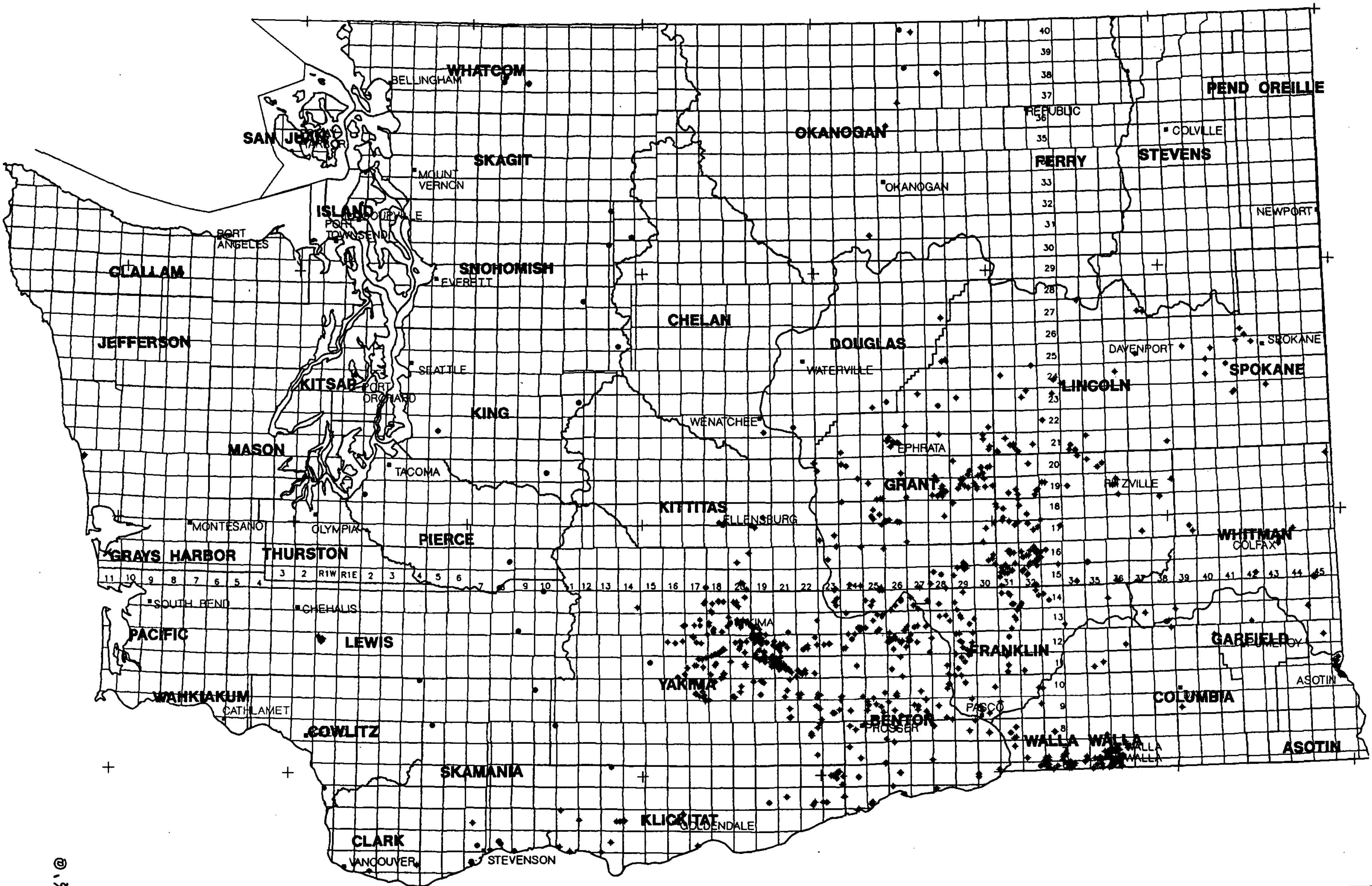
42. Washington State Department of Ecology, Central Regional Office, Yakima, Washington, unpublished water well reports as of April 12, 1993.

43. Washington State Department of Ecology, Central Regional Office, Yakima, Washington, unpublished water well report, January 18, 1994.

44. Washington State Department of Ecology, Eastern Regional Office, Spokane, Washington, unpublished water well reports as of May 3, 1993.

45. Widness, Scott, 1983, Low temperature geothermal resource evaluation of the Moses Lake–Ritzville–Connell area, Washington: Washington Division of Geology and Earth Resources Open File Report 83-11. 27 p.

Plate 1



WHATCOM
BELLINGHAM
SAN JUAN
SKAGIT
MOUNT VERNON
OKANOGAN
OKANOGAN
REPUBLIC
FERRY
STEVENS
COLVILLE
PEND OREILLE
NEWPORT
ISLAND
PORT TOWNSEND
PORT ANGELES
CLALLAM
SNOHOMISH
EVERETT
JEFFERSON
CHELAN
DOUGLAS
WATERVILLE
DAVENPORT
SPOKANE
SPOKANE
LINCOLN
KITSAP
SEATTLE
PORT ORCHARD
KING
WENATCHEE
EPHRATA
MASON
TACOMA
GRANT
RITZVILLE
KITTITAS
ELLENSBURG
MONTESANO
OLYMPIA
PIERCE
WHITMAN
COLFAX
GRAYS HARBOR
THURSTON
SOUTH BEND
CHEHALIS
PACIFIC
LEWIS
YAKIMA
YAKIMA
FRANKLIN
GARFIELD
POMEROY
ASOTIN
COLUMBIA
WAHKIAKUM
CATHLAMET
PASCO
BENTON
PROSSER
COWLITZ
WALLA WALLA
WALLA WALLA
ASOTIN
SKAMANIA
KLICKITAT
GOLDENDALE
CLARK
VANCOUVER
STEVENSON

WASHINGTON STATE DEPARTMENT OF
Natural Resources

JENNIFER M. BELCHER
Commissioner of Public Lands
KALEEN COTTINGHAM
Supervisor

June 10, 1994

Mr. Howard P. Ross, Project Manager
Earth Science Laboratory
University of Utah Research Institute
391 Chipeta Way, Suite C
Salt Lake City, UT 84108-1295

Dear Howard:

As promised, here is a later draft of the report (without the data tables) that includes Gordon's sections, changes as a result of your review, and a draft of Plate 1.

Sincerely,

Eric

J. Eric Schuster,
Assistant State Geologist
Division of Geology and Earth Resources

copy - Paul Lienau, O.I.T.

1111 WASHINGTON ST SE ▮ PO BOX 47000 ▮ OLYMPIA, WA 98504-7000

WASHINGTON STATE DEPARTMENT OF
Natural Resources

JENNIFER M. BELCHER
Commissioner of Public Lands
KALEEN COTTINGHAM
Supervisor

June 3, 1994

Mr. Howard P. Ross, Project Manager
Earth Science Laboratory
University of Utah Research Institute
391 Chipeta Way, Suite C
Salt Lake City, UT 84108-1295

Dear Howard:

Enclosed please find a later (June 1) draft of the final report. I send it not for review, but so you will have the information to use in your own report to USDOE, if necessary. However, if you find things that need clarification or correction, please let me know. This time the report includes the two main tables, DESCRIPTIVE AND THERMAL DATA FOR WELLS AND SPRINGS, and CHEMICAL DATA FOR THERMAL WELLS AND SPRINGS, and a third, smaller table to list wells that are too warm for conductive heating in a "normal" geothermal gradient. The figures are not final yet, and I will go down to the Energy Office this morning to pick up text for Gordon Bloomquist's sections of the report. I will send a draft of those pages just as soon as we have incorporated them into the body of the report. Other than that, and a summary, which I will write, the report is complete and looking pretty much as it will when we release it as an open-file report. We will probably move the summary to the front so it can serve as an executive summary.

Sincerely,

Eric

J. Eric Schuster,
Assistant State Geologist
Division of Geology and Earth Resources

copy - Paul Lienau, O.I.T.
- Gordon Bloomquist, W.S.E.O.

N A T U R A L   R E S O U R C E S

LOW-TEMPERATURE GEOTHERMAL RESOURCES OF WASHINGTON

by
J. Eric Schuster and
R. Gordon Bloomquist

Washington
Division of Geology
and Earth Resources

Open File Report 94-9
June 1994

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Jennifer M. Belcher - Commissioner of Public Lands
Kaleen Cottingham - Supervisor

Division of Geology and Earth Resources

DRAFT 6/1/94

N A T U R A L   R E S O U R C E S

LOW-TEMPERATURE GEOTHERMAL RESOURCES OF WASHINGTON

by
J. Eric Schuster and
R. Gordon Bloomquist

Washington
Division of Geology
and Earth Resources

Open File Report 94-9
June 1994

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Jennifer M. Belcher - Commissioner of Public Lands
Kaleen Cottingham - Supervisor

Division of Geology and Earth Resources

DRAFT 6/1/94

Low-Temperature Geothermal Resources of Washington

J. Eric Schuster
Washington State Department of Natural Resources
Division of Geology and Earth Resources
PO Box 47007, Olympia, WA 98504-7007

R. Gordon Bloomquist
Washington State Energy Office
PO Box 43165
Olympia, WA 98504-3165

INTRODUCTION

During the late 1970s and early 1980s, the Washington Division of Geology and Earth Resources conducted a multifaceted program of geothermal resource evaluation. The program was made possible by the financial support and encouragement of the U.S. Department of Energy's State-Coupled Program. At that time, the main focus was the discovery, evaluation, and commercialization of high-temperature geothermal resources, those that could be used to generate electricity. Therefore the Division's program concentrated on the Cascade Range, where high-temperature geothermal resources probably exist, most obviously evidenced by the stratovolcanoes, Mount Baker, Glacier Peak, Mount Rainier, Mount St. Helens, and Mount Adams (Fig. 1). However for several reasons, there have been no significant discoveries or development of high-temperature geothermal resources in the Cascades. First, competing energy prices have been low for the last decade or more. Second, the areas around the stratovolcanoes are largely undevelopable because the land is preserved as national parks, wilderness areas, or national monuments or is dedicated to other uses. Third, logistical problems associated with attempts to develop high-temperature geothermal resources near a stratovolcano would be very challenging.

Investigations conducted during the late 1970s and early 1980s included:

- description, sampling, and chemical analysis of thermal and mineral springs,

Figure 1. Physiographic provinces, counties, and major cities in Washington.

- several episodes of heat-flow/temperature-gradient drilling in the Cascade Range, which was practically unknown thermally at the time,
- temperature-gradient/heat-flow measurements in the holes drilled for that purpose in the Cascades,
- extensive temperature-gradient measurements in existing drill holes all over the state, but most extensively in the Columbia Basin,
- regional gravity studies in the Cascades,
- geohydrologic studies in the Yakima and Moses Lake–Ritzville–Connell areas of the Columbia Basin,
- geologic mapping and geochemical investigations in areas of young volcanism in the Cascades,
- soil mercury studies in the Mount St. Helens area, and
- the compilation of a bibliography of geothermal reports for Washington State.

These investigations, through 1983, are summarized by Korosec (1984). After 1983, two more U.S. Department of Energy contracts supported temperature-gradient/heat-flow investigations in the Cascades, but the high tide of geothermal exploration had passed.

An important accomplishment of that time was the publication of a 1:500,000-scale map depicting the distribution and nature of geothermal resources in Washington (Korosec and others, 1981). The map data were compiled by the staffs of the Washington Division of Geology and Earth Resources and the Washington State Energy Office, and the map was cartographically prepared and printed through the efforts of the National Oceanic and Atmospheric Administration, all under the sponsorship of the U.S. Department of Energy. Similar maps were produced for most of the western states.

Washington's map locates and provides basic data for 31 thermal springs, 29 mineral springs, and 338 thermal wells. The springs are mostly located in the Cascade Mountains, many clearly associated with stratovolcanoes. Most of the warm wells are located in the central, southwestern, and southern parts of the Columbia Basin in south-central Washington.

Even though the 1981 geothermal resources map has served very well, there has been a need for several years to make another inventory of geothermal resources. Of the 45 references from which well and spring data were taken for the tables in the Appendix, 23 were released after 1981. The most productive of the new or much-expanded sources of data are the unpublished water well reports held in the Yakima and Spokane regional offices of the Washington State Department of Ecology and the U.S. Geological Survey's WATSTORE database.

The large amount of data available now that was not available or not consulted in 1981 is reflected in the size of the geothermal database reported herein. The current database reports only thermal wells, springs, lakes, and fumaroles (except for two cooler wells; see explanation below); no nonthermal mineral springs are reported, although they were on the 1981 map. The current database comprises 941 wells and 34 springs, spring systems, lakes, and fumaroles (Table 1). The number of spring systems, lakes, and fumaroles reported here is not much larger than the number reported in 1981, but the number of warm wells is almost 3 times larger. The increase results from the more comprehensive nature of the sources of data consulted for this report and the fact that there are many more wells in existence than there were in 1981.

Table 1. Thermal wells, springs, lakes, and fumaroles in Washington, by county. The six-county area referred to in the text covers Adams, Benton, Franklin, Grant, Walla Walla, and Yakima Counties

County	Thermal wells	Thermal springs lakes, fumaroles
Adams	113	0
Asotin	9	0
Benton	123	0
Chelan	1	0
Clark	2	0
Clallam	0	2
Columbia	5	0
Cowlitz	0	1
Douglas	7	0
Franklin	60	0
Garfield	3	0
Grant	118	0
Grays Harbor	2	0
King	1	3
Kittitas	12	1
Klickitat	35	2
Lewis	8	2
Lincoln	30	0
Okanogan	5	2
Pierce	0	3
Skamania	6	7
Snohomish	0	4
Spokane	13	0
Walla Walla	113	2
Whatcom	1	3
Whitman	15	0
Yakima	259	2
Totals	941	34
Six Counties	786	4
	83.5%	11.8%

In some ways it is unfortunate that occurrences cooler than 20°C could not be included in this database (see below). Much can be learned by studying how cold wells are interspersed (or not) with warm wells, and by comparing their relative depths and other attributes. However, adding the cool wells would have added thousands of wells to the database.

This geothermal resource assessment was funded by the U.S. Department of Energy, and similar assessments are being done in many of the western states. The program is being administered jointly by University of Utah Research Institute, Idaho Water Resources Research Institute, and Oregon Institute of Technology. Funds available limited field data-gathering, but we sampled 18 municipal, commercial, and school wells for chemical analysis by the laboratory of the University of Utah Research Institute. Therefore, this assessment relied primarily on compilation of a bibliography and index of geothermal resources and development (Christie, 1994), and a thorough review of existing data sources.

DATA SOURCES

The limits established by the U.S. Department of Energy for inclusion of data in this database are (1) a temperature at least 10°C above the mean annual surface temperature, here taken as 20°C, and (2) a temperature gradient of at least 25°C/km.

Table 2. Regional temperature gradients and heat flow in Washington. The Northern Rocky Mountains province is shown as Okanogan Highlands west and east on Figure 1, and the Coastal province as the combined Puget Lowlands, Olympic Mountains, and Willapa Hills. (From Blackwell and others, 1985)

Physiographic province	Regional temperature gradient (°C/km)	Heat flow, (mW/m²)
Columbia Basin	41.1	61.1
Northern Rocky Mountains	26.0	74.9
Cascade Mountains, high heat-flow zone	64	100
Coastal provinces	24.5	39.8

As used in this report, the word *thermal* signifies a water temperature at or above 20°C, and the words *nonthermal*, *cool*, or *mineral* refer to wells and (or) springs below 20°C.

Because regional temperature gradients in Washington exceed 25°C/km everywhere except western Washington (Table 2) and western Washington's regional gradient is almost 25°C/k, we assumed that the gradient limitation would be met for all data and concentrated only on the temperature limit.

The temperature limitation was observed except for two wells (well GR014, the Wahluke School well, and well WA086, the Walla Walla Community College well) that were left in the database because they had been reported as having temperatures above 20°C in earlier databases, because one of them (the Walla Walla Community College well) has been used for years as a heat source for a heat pump, and because we sampled both for chemical analyses.

Every well found in every known database that met the 20°C temperature cutoff is listed in the present database, with the exception of oil and gas test wells. There are a few oil and gas test wells in the present database, but they are included by virtue of having been reported in published databases that were used as data sources. There have been more than 400 oil and gas test wells drilled in Washington, most of them in western Washington. Inequilibrium bottom-hole temperatures are reported in the oil and gas records of the Division of Geology and Earth Resources for many of these wells. We have not calculated equilibrium temperatures from these data for two reasons. First, western Washington oil and gas wells are in a low temperature-gradient region where the 20°C isotherm is deep enough to make drilling wells for low-temperature geothermal purposes less attractive economically than in higher-gradient eastern Washington. Second, in eastern Washington there are only a few modern wells that would provide good data, so we are probably not missing out on a significant source of data. Furthermore, in eastern Washington, temperature gradients in the deeper wells that are in the database fall within the 30–50°C/km gradient band and seem to be entirely normal (Fig. 8).

We carefully checked one source of data against another and tried to use the original source or the most modern independently generated source of data when data sources were in disagreement. As previously noted, the budget allowed only limited field verification of data. Each chemical analysis reported in Appendix B comes from a single source of data and is a single, not composite, analysis. If an analysis failed to pass a charge-balance test, described later, it was eliminated from the database.

We checked the accuracy of the data in Appendix A for 18 wells we sampled, and we found the data to be approximately 80 percent accurate. Some of the references, such as Smith (1901) and Landes (1905), are quite old, and it would be unrealistic to expect that wells reported in these references would still exist, still exhibit the conditions originally reported (particularly with respect to artesian head), or still have the same name or ownership. We included the old wells in the database because they represent thermal conditions that should still exist, even if not precisely as reported in the early literature.

Readers should verify the data reported here before making significant development decisions. If, for example, a heat-pump installation is contemplated for a particular well reported here, minimum data verification should include:

- determining the temperature and flow from the well,
- measuring pH,
- having a new chemical analysis done to guide the selection of pipe and other materials, and
- verifying that water rights allow the proposed development.

As noted above, an exhaustive bibliography and index of geothermal resources and development in Washington State was compiled as part of the present effort to update the state's geothermal resource database. For the compilation, Rebecca Christie, a staff librarian for the Division of Geology and Earth Resources, used the resources of the libraries of the Division of Geology and Earth Resources, the Washington State Library, the Washington State Energy Office, the Washington State Department of Ecology, the Geo-Heat Center of the Oregon Institute of Technology, and the Geothermal Resources Council in Davis, CA. We recommend the bibliography as a starting point for anyone interested in learning about, searching for, or developing geothermal resources in Washington. We made extensive use of the bibliography to assure that we did not overlook important sources of data.

In order to facilitate assessment and development of geothermal resources in the future, this database has been established on the geographic information system (GIS) of the Washington State Energy Office. The GIS allows users to easily combine and evaluate the geothermal data with many other kinds of spatial data. The Washington State Energy Office is, for example, cooperating with the State Superintendent of Public Instruction's office to study the occurrence of warm wells near school buildings, especially those that are about to be remodeled, in order to evaluate the practicality of heating some of the schools with geothermal water-source heat pumps.

ACKNOWLEDGMENTS

We thank Ruth Kroneman and Mike Adams of the University of Utah Research Institute for providing chemical analyses and information and advice about the analyses, Phil Crane and Gene Potts of the Washington State Department of Ecology Central Regional Office in Yakima for providing access and help with the extensive collection of water well reports housed in that office, Dan Weis of Ecology's Eastern Regional Office in Spokane for help with that office's equally extensive collection of water well reports, Luis Fuste of the U.S. Geological Survey's Water Resources Division in Tacoma, WA, for sending the latest WATSTORE data, Don Saul of the Washington State Energy Office for establishing the

database on the Energy Office's GIS and patiently making several updates, Rebecca Christie for helping us to be reasonably confident that we haven't overlooked any important sources of data, and the many well owners who allowed us, always cheerfully, to sample their wells for chemical analysis. The report benefitted from a review by Gene Culver of the Oregon Institute of Technology. Their help has undoubtedly made this report better than it otherwise would have been.

DATA FORMAT

This report is available in three forms: (1) as a paper report, (2) on disk (5.25-inch 1.2MB or 3.5-inch 1.44MB) for IBM-compatible personal computers, and (3) as an ARC-INFO GIS coverage and associated database. In the IBM disk version, the text is offered in ASCII and WordPerfect formats (the figures and plates are not included), and Appendix A (Descriptive and thermal data for wells and springs), Appendix B (Chemical data for wells and springs), and Appendix C (Convectively heated[?] wells) are present as Lotus 1-2-3 ".WK1" files. The Lotus files are readable by most spreadsheet programs. The paper and disk versions are available from the Washington Division of Geology and Earth Resources at the address listed above for author Schuster. For details about the ARC-INFO coverage, contact the Washington State Energy Office at the address listed above for author Bloomquist.

Appendices A and B form the main body of this report. Appendix A lists descriptive and thermal data for wells and springs. Appendix B lists chemical data. Generally, both tables include data fields that the University of Utah Research Institute requested all of the investigators in the different states to use.

In Appendix A, the Site Name is, in most instances, the name of a city, company, or governmental organization if the site is publicly or company owned, or the name of an individual if the site is a private irrigation or domestic well.

The latitude (Lat. N.) and longitude (Long. W.) require some explanation. The location of each site was plotted on a scale-stable 1:100,000-scale U.S. Geological Survey topographic base map, usually at the center of the quarter-quarter of a section. If the base map showed a well or spring in that quarter-quarter section, the occurrence was plotted at that location. A transparent gridded overlay was employed to identify quarter-quarter boundaries. When all locations had been plotted they were digitized at the Washington State Energy Office and the latitudes and longitudes calculated by the geographic information system. The latitudes and longitudes were then downloaded back into the Lotus 1-2-3 file that constitutes Appendix A. See the notes in Appendix A for further explanation.

Appendix B lists chemical data for those occurrences having good quality chemical analyses. The I.D., Site Name, Twp. N., Rng., Sec., and Part. Sec. are repeated from Appendix A so

Figure 2. Areal density of thermal well and spring occurrences in Washington. Contours show the number of thermal wells and springs per 500 km^2 (193 mi^2). Only the part of the state shown reaches a density as high as 10 occurrences per 500 km^2.

that occurrences can be easily correlated between the two tables. See the notes in Appendix B for information on the significance of charge balance and mass balance and how they were calculated. Briefly, these two calculations are indications of the quality and (or) completeness of chemical analyses. Analyses with charge balances that failed to fall within ten percent of 1.00 were rejected. Mass balance was not used as a criterion for rejection of analyses.

FLUID CHEMISTRY

Appendix B presents more than 200 chemical analyses from thermal wells and springs. We collected 18 of these analyses, dated 1994 and with no reference (Ref.) in Appendix B, and the University of Utah Research Institute analyzed them as part of the present investigation. Several criteria guided the selection of the 18 sampled wells. All but one of the wells we sampled are within the six-county (Adams, Benton, Franklin, Grant, Walla Walla, and Yakima County) area of the Columbia Basin where most of the state's warm wells are located (Figs. 1 and 2). We concentrated our sampling effort here because of the many possibilities for early development that might be assisted by the availability of good chemical analyses and because we could conveniently and economically sample these wells.

Further, we wanted at least some of the samples to come from areas that did not have good chemical representation in the database. We avoided irrigation and domestic wells—irrigation wells because they were not in use during the winter and spring months when we had to do the sampling, and both irrigation and domestic wells because, in many cases, they don't offer much prospect for development because of potential water rights limitations and (or) lack of a significant nearby heat load. Publicly owned (mostly municipal) wells used year-round and located near potential heat loads were attractive targets for sampling because they offer good possibilities for early development.

We sampled 12 municipal wells (AD008, BE022, GR056, GR060, GR063, KS011, YA018, YA050, YA051, YA068, YA074, and YA141), one domestic water association well (FR010), one well at the Washington State University Irrigated Agriculture Research and Extension Center near Prosser (BE039), one school well (GR014), and three wells currently used for their heat, two as heat sources for heat pumps (WA086 and YA226) and one used for a car wash (YA211).

Several general observations can be made about the fluid chemistry. First, well waters are very dilute. Figure 3 shows the average concentration of the major chemical species (Na, K, Ca, Mg, HCO_3, CO_3, Cl, and SO_4) in statewide thermal wells and thermal springs and in cool wells in the six-county area of the Columbia Basin. The average total for the eight major chemical species for thermal wells is only 260 ppm. All of the well waters for which there are analyses in Appendix B are potable, at least with respect to inorganic constituents.

Figure 4 plots Na+K as a percentage of major cations against HCO_3+CO_3 as a percentage of major anions for statewide thermal springs and wells and for six-county cool wells and springs. All thermal well waters have HCO_3 as the dominant anion. They may have either Na+K or Ca+Mg as the dominant cation, with Na+K dominant somewhat more commonly.

Although they are not reported here, we plotted 134 water analyses from cool wells in the six-county area in Figure 4c in order to compare them with the thermal wells (Fig. 4a) and springs (Fig. 4b). All of the analyses from cool wells are from Van Denburgh and Santos (1965). The thermal and cool wells are similar. Most of the cool wells are HCO_3 dominated. Like the thermal wells, the cool wells may be dominated by either Na+K or Ca+Mg, but in the cool wells Ca+Mg dominance is somewhat more common.

The thermal springs differ from the wells. Na+K is the chief cation, and the chief anions are HCO_3+CO_3 or Cl+SO_4,

Figure 3. Average concentrations of major chemical species in thermal wells and thermal springs statewide and in cool wells in the six-county area (Adams, Benton, Franklin, Grant, Walla Walla, and Yakima Counties) of the southwestern and south-central Columbia Basin. The graph represents 204 analyses from thermal wells, 134 analyses from cool wells in the six-county area, and 34 analyses from thermal springs.

with Cl+SO_4 dominant somewhat more frequently. The springs are also much less dilute than the well waters. The major chemical species in the springs have an average total of 1570 ppm.

The wells and springs are located in different geologic provinces. Most of the springs are located in the andesitic volcanic terrain of the Cascade Mountains, whereas the wells are in the basaltic and continental sedimentary terrain of the Columbia Basin. Because they exceed 20°C at the earth's surface and are less dilute than the well waters, the springs must arise from waters that have circulated more deeply in the crust or circulated in areas of higher geothermal gradients or local heat sources. These differences are, presumably, responsible for the differences in chemistry.

We have not concentrated on the interpretation of geothermometers during this investigation. First, the geology of the Columbia Basin (Schuster, 1994; Reidel and Fecht, in press a, b; Gulick, in press; Schuster, in press a, b) and what is known about the regional geothermal gradient (about 40°C/km; Blackwell and others, 1985) suggest that there are no shallow heat sources (igneous intrusives) beneath the Columbia Basin, and thus no areas with extremely high temperature gradients or other high-temperature geothermal manifestations. The last extrusive igneous activity, the waning flows of the Columbia River Basalt Group, occurred about 6 million years ago (Fig. 5). Also, the dilute ground waters of the Columbia Basin differ from hot-spring waters on which the empirical geothermometers are based, so calculating geothermometers in an effort to try to determine whether high temperatures exist at depth may not be a valid exercise.

The database presented here has been compiled from a variety of sources spanning more than 90 years. The data were collected by many people for many reasons, and there are certainly errors, such as incorrect well depths and chemical analyses representing mixed shallow and deep aquifers, and many other inconsistencies. Taken together, the limitations make this data set a rather poor one to use for making specific interpretations for specific locations. This database is better used on a sort of statistical basis, where one can try to recognize general trends and the "big picture" without trying to get too specific.

Finally, in terms of discovering useful geothermal resources, there is no need to explore for higher temperatures; the known wells are quite adequate to "fuel" a considerable amount of low-temperature development, especially heat pumps.

GEOLOGIC, HEAT-FLOW, AND HYDROLOGIC SETTING

It is clear from Plates 1 and 2 and Table 1 that geothermal resources in Washington are not randomly distributed. Ther-

Figure 4. Na+K as a percentage of major cations plotted against HCO_3+CO_3 as a percentage of major anions for statewide thermal wells, statewide thermal springs, and six-county cool wells. Percentages were calculated from concentrations in milli-equivalents per liter. The heavy-line contour encloses all points, and the other contours enclose areas where 5, 10, or 20 points occur per 1 percent of the area of the plot. **A**. Thermal wells, statewide; 204 analyses. **B**. Thermal springs, statewide; 34 analyses. **C**. Cool wells, six-county area of Columbia Basin; 134 analyses.

Figure 5. Generalized nomenclature and stratigraphic relations of the Columbia River Basalt Group. Sedimentary interbeds occur at many of the unconformities, shown by jagged horizontal lines between units. Modified from Reidel and others (1989).

mal springs are largely confined to the Cascade Mountains (27 of 34 are in the Cascades), and most are spatially associated with a stratovolcano or a fault that probably provides for heating by means of deep circulation of water. Thermal wells, on the other hand, are strongly associated with the Columbia River Basalt Group (Fig. 6) and the Columbia Basin—the Columbia River Basalt Group and the Columbia Basin are almost coextensive and the terms are used interchangeably herein. This area includes the various subbasins that form the western, southwestern, and south-central parts of the Columbia Basin in Washington. This area of subbasins bounded by faulted folds is referred to as the Yakima fold belt (Fig. 1). Some 97 percent of the state's 941 thermal wells are located in areas underlain by rocks of the Columbia River Basalt Group or suprabasalt sediments.

Because it is not practical to pursue exploration and development of high-temperature geothermal resources in the Cascade Mountains, and because Washington's thermal wells are strongly concentrated in the Columbia Basin, discussion will focus on the resources of the basin. Moreover, there is a strong tendency for thermal wells to occur in the western, southwestern, and south-central parts of the Washington portion of the Columbia Basin (Fig. 2). Adams, Benton, Franklin, Grant, Walla Walla, and Yakima Counties account for 786 (83.5 percent) of Washington's thermal wells. Yakima County alone contains 259 thermal wells, and Adams, Benton, Grant, and Walla Walla Counties each contain more than 100, followed by Franklin County with 60.

The Columbia River Basalt Group is a thick succession of tholeiitic basalts that was erupted from fissures in southeastern Washington, northeastern Oregon, and western Idaho between about 17 million and 6 million years ago (Fig. 5). More than 300 lava flows once covered (and mostly still do) an area of about 164,000 km^2 (63,000 mi^2) and have an aggregate volume of about 174,000 km^3 (42,000 mi^3). The largest flows exceeded 2,000 km^3 (500 mi^3) each, and some flows advanced more than 750 km (460 mi) from their source areas to the Pacific Ocean (Tolan and others, 1989). As time went on eruptions became less frequent and generally less voluminous, and part of the basin subsided. The thickest accumulation of basalts is in the area of Richland, Kennewick, and Pasco, close to the geographic center of the area covered by the basalts. Interflow sediments are present between many pairs of flows.

Also as time went on, both during the volcanism and after the eruptions ceased, the Yakima fold belt developed. The Yakima fold belt is a series of sharply defined anticlinal crests that trend northwest, west, and southwest. Most of the anticlines are broken by faults. There are broad, flat, basinal synclines between the fold crests, and some synclines contain as much as 400 meters of suprabasalt sediments derived from the Cascades to the west and deposited by the Yakima River and smaller streams and derived from highlands to the north and east and deposited by the Columbia River. The structural situation is illustrated by Figure 7.

By the end of the eruptions of the Grande Ronde Basalt about 15.6 million years ago, more than 90 percent of the Columbia River Basalt Group had been erupted (Tolan and others, 1989; Fig. 5). While some or most of the gentle westward and southwestward slope of the surface of the Grande Ronde Basalt seen in Figure 7 in the northern and eastern parts of the basin (Pullman–Connell–Coulee City–Cheney area) developed earlier and guided the basalt flows toward the west, most of the rest of the structural relief developed after Grande Ronde Basalt time. The eastward slope at the west edge of the area shown in Figure 7 is due to postbasalt uplift of the Cascades, and the culmination in southeastern Washington is the Blue Mountains, which developed after the Grande Ronde Basalt was emplaced.

As illustrated in Figure 5, many flow units of the Columbia River Basalt Group are separated by unconformities, and, especially near the western margin of the subsiding basin of basalt deposition, there are commonly sedimentary interbeds between basalt flows. In the western, southwestern, and south-central parts of the Columbia Basin in Washington these interbeds and some postbasalt sediments are collectively known as the Ellensburg Formation. Deposition of Ellensburg Formation sediments and later sedimentary units accounts for as much as 400 meters of postbasalt sedimentary rocks in some of the subbasins of the Yakima fold belt.

Within the Columbia River Basalt Group many flow bottoms are pillowed, rubbly, or mixed with subjacent sediments, and many flow tops are rubbly, oxidized, vesicular, and (or) scoriaceous. The flow tops and bottoms and interflow sediments are generally quite porous and permeable and make good aquifers. Because many of the flows are of great lateral extent, the associated aquifers are also of great lateral extent. In contrast, the interiors of flows, although usually jointed, are often of low permeability and act as aquitards.

The recharge areas for these extensive aquifers are on the western side of the basin in the Cascades foothills and on the eastern side in the Palouse hills and the mountains of eastern Idaho. The ridges of the Yakima fold belt are not significant recharge areas because the area is arid. Also because the area is arid, there have been more and deeper wells drilled than in better-watered parts of the state.

The combination of basinal shape, laterally extensive aquifers that are confined between relatively impermeable basalt flows, and recharge areas to the east and west means that the hydrologic gradients slope into the deepest part of the basin near Pasco and into the subbasins of the Yakima fold belt. In these areas the deeper aquifers are confined and under artesian pressure.

Columbia Basin heat flow and temperature gradients are certainly factors in the occurrence of warm wells. Table 2 shows the average heat flows and temperature gradients for the physiographic provinces of Washington, and Figure 8 is a temperature-depth plot of Washington's thermal wells. Compared to the Northern Rocky Mountains province and the high heat flow zone of the Cascades province, the Columbia Basin does not have high heat flow. In fact, heat flow in the Columbia Basin is approximately equal to the worldwide average. However, because the thermal conductivity of the rocks is relatively low, the Columbia Basin has a higher-than-worldwide-average temperature gradient. At 41°C/km, it also has the highest regional temperature gradient in Washington except for the high heat flow zone of the Cascades. With this gradient and an average surface temperature of 15°C, which is reasonable for the warmer areas of the basin, the 20°C isotherm can be reached in a well only 122 meters deep. For comparison, if the gradient were only 20°C/km and the average surface temperature 10°C, it would take a well 500 meters deep to reach the 20°C isotherm. A productive aquifer must also be intersected, of course, if a useful well is to be had.

It seems probable that most of Washington's thermal wells occur in the Columbia Basin, and more particularly, in a six-county area in the western, southwestern, and south-central parts of the Columbia Basin, for the following reasons:

- There are more deep wells than in other parts of the state, which provides more opportunity for penetrating thermal aquifers.
- At 41°C/km, the regional geothermal gradient is favorable.
- The hydrologic setting is favorable. Laterally extensive aquifers, low vertical permeability, complex basinal structural shape, and recharge areas to the west and far to the east provide for the depth of circulation and residence time necessary to produce thermal ground water.

We may generalize to say that the typical thermal well in Washington occurs in the Columbia Basin, especially the six-county area, has a temperature gradient within a normal range of 30–50°C/km, and is heated by conduction. That is, the heat reached the well by conduction through the earth's crust from the mantle below, in the same way that heat moves through any solid body, such as a block of steel or concrete.

In addition to these normal or typical thermal wells, there are 192 wells across the state (Appendix C), including 140 wells in the six-county area, that don't fit the scenario above. These wells are too warm to have been heated conductively in

Figure 6. Extent of the Columbia River Basalt Group and thickness of the Grande Ronde Basalt. The Grande Ronde Basalt thickness contours are in meters. From Reidel and others (1989).

a gradient of 50°C/km. More specifically, the wells have temperatures higher than that calculated by the following formula: T = 15°C + (0.05°C/m)(depth), where depth is in meters.

Of the 140 wells, four have "B" gradients in excess of 150°C/km, and errors in the data are suspected. Twenty additional wells (located in Townships 12–14 N. and Ranges 25–27 E.) on the Hanford Reservation of northern Benton County are warm because they have been used for the disposal of heated fluids (S. P. Reidel, Westinghouse Hanford Co., oral commun., April, 1994; Newcomb and others, 1972, p. 32-35). These 24 wells are not considered further.

In the remaining 116 six-county wells, the anomalous temperatures may be due to some natural cause. Some of these wells are located in areas where mapped geologic structures might be responsible for the circulation of warmer, deeper water to the higher levels penetrated by the wells. Others occur where there are no mapped geologic structures or significant thicknesses of suprabasalt sedimentary deposits that might provide for enhanced vertical permeability. For these wells no ready explanation for their anomalously high temperatures is currently available. Most of the wells occur in basinal areas of the Yakima fold belt where the available information indicates that many of the wells penetrate mostly suprabasalt sedimentary rocks. Some combination of vertical permeability in these rocks and leakage from the confined basalt aquifers below may be responsible for the abnormal temperatures of the wells.

Perhaps suprabasalt sediments are the most important factor in providing vertical permeability and allowing the rise of leakage from deeper, confined aquifers. There are "B" gradients (gradients calculated from bottom-hole temperatures and estimated mean annual surface temperatures) and standing water levels in the database for some of the 116 wells, and Table 3 shows their average "B" gradients and standing water levels. In Table 3, these wells are called "convectively heated(?) thermal wells". The table compares these wells with others, both within and outside of the six-county area, whose temperatures can be accounted for by heating under the influence of "normal" conductive temperature gradients between 30 and 50°C/km. Average "B" gradients and standing water levels are significantly higher for the anomalously warm wells.

The higher "B" gradients could be due to errors in the database, local heat sources in the crust, or variations in deep crustal heat flow and temperature gradients from place to place. The higher standing water levels might be due to wells being drilled into shallower aquifers and have no relationship to a higher temperature gradient, but if the shallower standing water levels are due to wells being developed in shallower aquifers, these wells should not produce higher average "B" gradients. The higher "B" gradients and shallower standing water levels occurring together suggests that some kind of convective water movement from deeper, warmer aquifers produces a "mound" of warmer ground water in the areas of these wells. Alternatively, higher "B" gradients and higher standing water levels would also be produced by injection of warm fluids into the wells, as on the Hanford Reservation.

Whether these anomalous wells are warmed artificially or naturally is not known. We point out their existence to emphasize the fact that some wells in the six-county area, many of which seem to be associated with the suprabasalt sediment-filled subbasins of the Yakima fold belt, have apparent average temperature gradients of about 77°C/km rather than

Figure 7. Structure contours on the top of the Grande Ronde Basalt. Contours are in hundreds of meters above sea level. (Modified from Bentley, 1985).

41°C/km. These wells constitute an even more attractive low-temperature geothermal resource than the "normal" thermal wells because the 20°C isotherm can be reached in a well, on average, only 65 meters deep.

LEGAL AND INSTITUTIONAL SETTING

[A summary of the chief laws and regulations that will govern the development of low-temperature geothermal resources in Washington, and what limitations and opportunities they present. Include suggestions for changes. By R.G.B.]

CURRENT LOW-TEMPERATURE GEOTHERMAL USES

[A review of existing low-temperature geothermal installations in Washington, additional uses that appear to have good potential, and the flow-temperature-chemical requirements of low-temperature uses that are good candidates for future development. By R.G.B.]

RESOURCE POTENTIAL AND COLLOCATION OF RESOURCES AND USERS

[A qualitative discussion of resources potential and preliminary observations about collocation of resources and users. By R.G.B.]

SUMMARY

[To be written by J.E.S.]

RECOMMENDATIONS

Our top recommendation is to (1) match existing thermal wells, especially publicly owned wells that produce large quantities of water year-round, with closely collocated proposed new construction or remodeling of public buildings, such as schools, (2) determine which projects could make advantageous use of the geothermal resource to heat and/or cool the building, and (3) encourage and facilitate such applications. This work would occur mostly in the Columbia Basin, because most thermal wells are located there, and it would lead to significant development of low-temperature geothermal resources, perhaps without any additional drilling or exploration.

Our second recommendation is to station one or two investigators in the Columbia Basin, especially in the six-county area, to (1) measure downhole temperature gradients (or accurate flowing temperatures if gradients cannot be measured, as for example, in flowing artesian wells), (2) obtain well-test data, (3) obtain drill cuttings for measurement of thermal conductivity and geochemistry, and (4) sample wells for chemical analysis. With the trend toward fully cased and sealed wells that tap a single deep aquifer, this work would allow the formulation of a data set that would determine regional and local distribution of heat flow and temperature gradients, better define the chemistry and stratigraphy of the deeper aquifers, build accurate statistics about the volumes and temperatures of water available from wells, and allow formulation of exploration strategies that would minimize unproductive drilling.

Our third recommendation is to institute a long-term effort to (1) inform the people of the state about uses of low-temperature geothermal resources, (2) work with public policy makers to make certain that the legal and institutional framework encourages the wise use of low-temperature geothermal resources, and (3) advocate for use of geothermal resources in place of fossil fuels.

REFERENCES CITED

Note: Numbered references are cited by number in the data tables found in the Appendix.

1. Barnett, D. B., 1986, The 1985 geothermal gradient drilling project for the State of Washington: Washington Division of Geology and Earth Resources Open File Report 86-2, 34 p.

— Bentley, R. D., 1985, Structure contour maps on the top of the Grande Ronde, eastern Washington and northern Idaho: privately published by the author, 2 sheets, scale 1:250,000.

Figure 8. Temperature-depth plot of Washington's thermal wells and six-county cool wells, with the zone of normal temperature gradients, 30–50°C/km, shown between the two curved lines. Wells falling within the normal gradient zone may be heated by normal, conductive geothermal gradients. Those falling below the zone may be cooled by waters from upper, cooler aquifers flowing down the wells. Wells above the normal gradient band are too warm to have been heated by a normal range of gradients. These wells may be warmed by artificial warm-water recharge or by warm water leaking from deeper aquifers and reaching the wells because of higher-than-normal vertical permeability provided by faults and folds or the inherently greater permeability of supra-basalt sediments.

Table 3. Comparison of "B" gradients and standing water levels from convectively-heated(?) thermal wells and from conductively-heated(?) thermal wells. "B" gradients are temperature gradients calculated from bottom-hole temperatures and estimated mean annual surface temperatures. *Convectively heated(?) thermal wells* are defined as those in Appendices A and C that are too warm to have been heated by conductive heat transfer under the influence of a conductive temperature gradient in the range of 30–50°C/km. More specifically, the wells have temperatures higher than yielded by the formula, T = 15°C + (0.05°C/m)(Depth), where the well depth is in meters. From this number of wells some were excluded—(1) those on the Hanford Reservation that are known to be warm because of artificial recharge, and (2) wells with "B" gradients higher than 150°C/km, where gradients could be due to errors in the data. *Conductively heated(?) thermal wells* are defined as those in Appendix A that are at or cooler than a temperature that falls within the normal temperature gradient band shown on Figure 8. Their temperatures are equal to or less than those yielded by the formula above. These wells are probably heated by a normal conductive temperature gradient in the range of 30–50°C/km. Those wells at temperatures below the 30–50°C/km gradient band of Figure 8 may be cooled by water from a shallow aquifer(s) flowing down the well. n = number of wells; s.d. = standard deviation.

	"B" gradient (°C/km)	Standing water level (meters)		"B" gradient (°C/km)	Standing water level (meters)		"B" gradient (°C/km)	Standing water level (meters)
All wells,	n = 374	n = 524	Convectively	n = 40	n = 108	Conductively	n = 334	n = 416
statewide	mean = 47.5	mean = 63.0	heated wells,	mean = 79.9	mean = 31.1	heated wells,	mean = 43.7	mean = 71.4
	s.d. = 15.7	s.d. = 56.5	statewide	s.d. = 20.1	s.d. = 35.4	statewide	s.d. = 9.3	s.d. = 58.0
All wells,	n = 319	n = 452	Convectively	n = 33	n = 83	Conductively	n = 286	n = 369
six-county area	mean = 47.3	mean = 64.2	heated wells,	mean = 76.6	mean = 30.8	heated wells,	mean = 43.9	mean = 71.7
	s.d. = 14.4	s.d. = 55.8	six-county area	s.d. = 18.4	s.d. = 35.8	six-county area	s.d. = 9.1	s.d. = 56.8
All wells,	n = 55	n = 72	Convectively heated	n = 7	n = 25	Conductively heated	n = 48	n = 47
statewideoutside	mean = 49.1	mean = 56.0	wells, statewide	mean = 95.2	mean = 32.0	wells, statewide	mean = 42.4	mean = 68.7
six-county area	s.d. = 21.3	s.d. = 60.0	not six-county area	s.d. = 20.7	s.d. = 34.0	not six-county area	s.d. = 10.2	s.d. = 66.5

2. Biggane, J. H., 1982, The low-temperature geothermal resource and stratigraphy of portions of Yakima County, Washington: Washington Division of Geology and Earth Resources Open File Report 82-6, 128 p., 58 figs., 4 pl., 11 tables, appendix.

3. Biggane, J. H., 1983, Geophysical logs from water wells in the Yakima area, Washington: Washington Division of Geology and Earth Resources Open File Report 83-2, 50 p.

4. Blackwell, D. D., 1980, Heat flow and geothermal gradient measurements in Washington to 1979 and temperature-depth data collected during 1979: Washington Division of Geology and Earth Resources Open File Report 80-9, 524 p. [unpaginated].

5. Blackwell, D. D., 1993, Southern Methodist University, Dallas, Texas, Heat-flow data for Washington on disk, unpublished data.

6. Blackwell, D. D.; Steele, J. L.; Kelley, S. A., 1985, Heat flow and geothermal studies in the State of Washington: Washington Division of Geology and Earth Resources Open File Report 85-6, 77 p.

7. Bortleson, G. C.; Cox, S. E., 1986, Occurrence of dissolved sodium in ground waters in basalts underlying the Columbia Plateau, Washington: U.S. Geological Survey Water-Resources Investigations Report 85-4005, 24 p., 5 pl.

8. Bowen, R. G., 1992, Geothermal Consultant, Portland, OR, unpublished data.

9. Brown, J. C., 1979, Geology and water resources of Klickitat County: Washington State Department of Ecology Water Supply Bulletin 50, 413 p., 8 pl., scale 1:94,000.

10. Campbell, N. P., 1993, Yakima Valley College, Yakima, WA, unpublished data.

— Christie, R. A., 1994, Bibliography and index of geothermal resources and development in Washington State, with selected general works: Washington Division of Geology and Earth Resources Open File Report 94-1, 56 p.

11. Cline, D. R., 1976, Reconnaissance of the water resources of the upper Klickitat River basin, Yakima Indian Reservation, Washington: U.S. Geological Survey Open-File Report 75-518, 54 p.

12. Ertec Western, Inc., 1981, Revisions to: Assessment of volcanic and geothermal activity in the Pasco Basin and vicinity, Volume I, Narrative report: Ertec Western, Inc., Long Beach, CA, Project Number 81-199 for Rockwell International, Rockwell Hanford Operations, Energy Systems Group, Richland, WA 99352, 119 p.

13. Foxworthy, B. L., 1962, Geology and ground-water resources of the Ahtanum Valley, Yakima County, Washington: U.S. Geological Survey Water-Supply Paper 1598, 100 p.

14. Gizienski, S. F.; McEuen, R. B.; Birkhahn, P. C., 1975, Regional evaluation of the geothermal resource potential in central Washington State: Woodward-Gizienski and Associates, 113 p., 4 pl., scale 1:1,000,000.

15. Griffin, W. C.; Sceva, J. E.; Swenson, H. A.; Mundorff, M. J., 1962, Water resources of the Tacoma area Washington: U. S. Geological Survey Water-Supply Paper 1499-B, 101 p., 4 pl.

— Gulick, C. W., compiler, in press, Geologic map of the Connell 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources open-file report.

16. Hearn, P. P., Jr.; Steinkampf, W. C.; Bortleson, G. C.; Drost, B. W., 1985, Geochemical controls on dissolved sodium in basalt aquifers of the Columbia Plateau, Washington: U.S. Geological Survey Water-Resources Investigations Report 84-4304, 38 p., 1 pl.

— Hem, J. D., 1985, Study and interpretation of the chemical characteristics of natural water: U.S. Geological Survey Water-Supply Paper 2254, Third Edition, 263 p., 3 pl.

— Hooper, P. R.; Kleck, W. D.; Knowles, C. R.; Reidel, S. P.; Thiessen, R. L., 1984, Imnaha Basalt, Columbia River Basalt Group: Journal of Petrology, v. 25, part 2, p. 473-500.

— Kindle, C. H., 1991, Geothermal fluid sampling techniques. *In* Lienau, P. J.; Lunis, B. C., editors, Geothermal direct use engineering and design guidebook: Geo-Heat Center, Oregon Institute of Technology, p. 99-113.

17. Korosec, M. A., 1980, Table of thermal and mineral spring locations in Washington: Washington Division of Geology and Earth Resources Open File Report 80-11, 6 p.

18. Korosec, M. A., 1982, Table of chemical analyses for thermal and mineral spring and well waters collected in 1980 and 1981: Washington Division of Geology and Earth Resources Open File Report 82-3, 5 p.

19. Korosec, M. A., 1983a, Chemical analyses for thermal and mineral springs examined in 1982–1983: Washington Division of Geology and Earth Resources Open File Report 84-1, 8 p.

20. Korosec, M. A., 1983b, The 1983 temperature gradient and heat flow drilling project for the State of Washington: Washington Di-

vision of Geology and Earth Resources Open File Report 83-12, 11 p.

— Korosec, M. A., 1984, Summary of geothermal exploration activity in the State of Washington from 1978 to 1983: Washington Division of Geology and Earth Resources Open File Report 84-2, 42 p.

21. Korosec, M. A.; Schuster, J. E.; Blackwell, D. D.; Daneš, Z. F.; Clayton, G. A., 1980, The 1979–1980 geothermal resource assessment program in Washington: Washington Division of Geology and Earth Resources Open File Report 81-3, 267 p., 1 map, scale 1:24,000.

22. Korosec, M. A.; Kaler, K. L.; Schuster, J. E.; Bloomquist, R. G.; Simpson, S. J.; Blackwell, D. D., 1981, Geothermal resources of Washington: Washington Division of Geology and Earth Resources Geologic Map GM-25, 1 sheet, scale 1:500,000.

23. Korosec, M. A.; Phillips, W. M.; Schuster, J. E., 1982, The low temperature geothermal resources of eastern Washington: Washington Division of Geology and Earth Resources Open File Report 82-1, 20 p., 2 figs., 1 table.

24. Korosec, M. A.; Phillips, W. M.; Schuster, J. E.; Daneš, Z. F.; Biggane, J. H.; Hammond, P. E.; Clayton, G. A., 1983, The 1980–1982 geothermal resource assessment program in Washington; with chapters on thermal springs, gravity investigations, heat-flow drilling, low-temperature resources in eastern Washington, geology of the south Cascades and White Pass areas, and targets for geothermal resource exploration: Washington Division of Geology and Earth Resources Open File Report 83-7, 299 p.

25. Korosec, M. A.; Kaler, K. L., 1980, Well temperature information and locations in the State of Washington: Washington Division of Geology and Earth Resources Open File Report 80-7, 89 p. [unpaginated], 2 pl., scale 1:500,000.

26. Korosec, M. A.; Phillips, W. M., 1982, WELLTHERM: Temperature, depth, and geothermal gradient data for wells in Washington State: Washington Division of Geology and Earth Resources Open File Report 82-2, 3 p., 74-p. table.

27. Landes, Henry, 1905, Preliminary report on the underground waters of Washington: U.S. Geological Survey Water Supply Paper 111, 85 p.

28. Luzier, J. E., 1969, Ground-water occurrence in the Goldendale area, Klickitat County, Washington: U. S. Geological Survey Hydrologic Investigations Atlas HA-313, 1 sheet, scale 1:62,500.

29. Mariner, R. H.; Presser, T. S.; Evans, W. C.; Pringle, M. K., 1989, Discharge rates of thermal fluids in the Cascade Range of Oregon and Washington and their relationship to the geologic environment. *In* Muffler, L. J. P.; Weaver, C. S.; Blackwell, D. D., editors, Proceedings of workshop XLIV, Geological, geophysical, and tectonic setting of the Cascade Range: U.S. Geological Survey Open-File Report 89-178, p. 663-694.

30. Newcomb, R. C., 1965, Geology and ground-water resources of the Walla Walla River basin Washington–Oregon: Washington Division of Water Resources Water Supply Bulletin 21, 151 p., 3 pl.

31. Newcomb, R. C., 1972, Quality of the ground water in basalt of the Columbia River Group, Washington, Oregon, and Idaho: U.S. Geological Survey Water-Supply Paper 1999-N, 71 p., 1 pl., scale 1:1,000,000.

— Newcomb, R. C.; Strand, J. R.; Frank, F. J., 1972, Geology and ground-water characteristics of the Hanford Reservation of the U.S. Atomic Energy Commission, Washington: U.S. Geological Survey Professional Paper 717, 78 p., 3 pl.

32. Reed, M. J.; Mariner, R. H.; Brook, C. A.; Sorey, M. L., 1983, Selected data for low-temperature (less than 90 degrees C) geothermal systems in the United States; reference data for U.S. Geological Survey Circular 892: U. S. Geological Survey Open-File Report 83-250, 129 p.

— Reidel, S. P.; Fecht, K. R., compilers, in press a, Geologic map of the Priest Rapids 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources open-file report.

— Reidel, S. P.; Fecht, K. R., compilers, in press b, Geologic map of the Richland 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources open-file report.

— Reidel, S. P.; Tolan, T. L.; Hooper, P. R.; Beeson, M. H.; Fecht, K. R.; Bentley, R. D.; Anderson, James Lee, 1989, The Grande Ronde Basalt, Columbia River Basalt Group; Stratigraphic descriptions and correlations in Washington, Oregon, and Idaho. *In* Reidel, S. P.; Hooper, P. R., editors, Volcanism and tectonism in the Columbia River flood-basalt province: Geological Society of America Special Paper 239, p. 21-53.

33. Robinette, M. S.; Robinette, M. J.; Brown, J. C., 1977, Geophysical investigations of Washington's ground-water resources, annual report 1975/1976: Washington State University College of Engineering Research Report No. 77/15-6, 56 p., 5 maps. (Also Washington State Department of Ecology Project Interim Report 76-075 and Project Completion Report 76-069.)

34. Schuster, J. E., 1981, Geothermal energy potential of the Yakima valley area, Washington. *In* Bloomquist, R. G., editor, Proceedings of the Geothermal Symposium—Low temperature utilization, heat pump applications, district heating, September 24, 1980: Washington State Energy Office WAOENG 81-05, p. XI 1 - XI 10.

— Schuster, J. E., compiler, 1994, Geologic map of the Walla Walla 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources Open File Report 94-3, 18 p., 1 pl.

— Schuster, J. E., compiler, in press a, Geologic map of the east half of the Toppenish 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources open-file report.

— Schuster, J. E., compiler, in press b, Geologic map of the east half of the Yakima 1:100,000 quadrangle, Washington: Washington Division of Geology and Earth Resources open-file report.

35. Smith, G. O., 1901, Geology and water resources of a portion of Yakima County, Wash.: U.S. Geological Survey Water-Supply and Irrigation Paper No. 55, 68 p.

36. Stearns, N. D.; Stearns, H. T.; Waring, G. A., 1937, Thermal springs in the United States: U. S. Geological Survey Water-Supply Paper 679-B, 206 p., 1 pl., scale 1:7,000,000.

37. Stoffel, K. L.; Widness, Scott, 1983a, Fluid-temperature logs for selected wells in eastern Washington: Washington Division of Geology and Earth Resources Open File Report 83-15, 351 p.

38. Stoffel, K. L.; Widness, Scott, 1983b, Geophysical logs of selected wells in eastern Washington: Washington Division of Geology and Earth Resources Open File Report 83-14, 81 p.

39. Taylor, G. C., Jr., 1944, Factual data pertaining to wells and springs in the Columbia Basin Project area, Washington: U.S. Geological Survey unpublished report, 85 p.

— Tolan, T. L.; Reidel, S. P.; Beeson, M. H.; Anderson, James Lee; Fecht, K. R.; Swanson, D. A., 1989, Revisions to the estimates of the areal extent and volume of the Columbia River Basalt Group. *In* Reidel, S. P.; Hooper, P. R., editors, Volcanism and tectonism in the Columbia River flood-basalt province: Geological Society of America Special Paper 239, p. 1-20.

40. U.S. Geological Survey, 1993, WATSTORE database records as of July 20, 1993.

41. Van Denburgh, A. S.; Santos, J. F., 1965, Ground water in Washington, its chemical and physical quality: Washington Division of Water Resources Water Supply Bulletin 24, 93 p.

42. Washington State Department of Ecology, Central Regional Office, Yakima, Washington, unpublished water well reports as of April 12, 1993.

43. Washington State Department of Ecology, Central Regional Office, Yakima, Washington, unpublished water well report, January 18, 1994.

44. Washington State Department of Ecology, Eastern Regional Office, Spokane, Washington, unpublished water well reports as of May 3, 1993.

45. Widness, Scott, 1983, Low temperature geothermal resource evaluation of the Moses Lake–Ritzville–Connell area, Washington: Washington Division of Geology and Earth Resources Open File Report 83-11. 27 p.

Appendix A. Descriptive and Thermal Data for Wells and Springs

NOTES:

1. The I.D. number for a site consists of a two-letter county code followed by a three-digit serial number. An "S" at the end means the site is a spring, spring system, lake, lava dome, or area of fumaroles. All other entries are wells. The county codes are: AD, Adams; AS, Asotin; BE, Benton; CH, Chelan; CL, Clallam; CK, Clark; CO, Columbia; CZ, Cowlitz; DO, Douglas; FR, Franklin; GA, Garfield; GR, Grant; GY, Grays Harbor; KI, King; KS, Kittitas; KT, Klickitat; LE, Lewis; LI, Lincoln; OK, Okanogan; PI, Pierce; SK, Skamania; SN, Snohomish; SP, Spokane; WA, Walla Walla, WH, Whatcom; WT, Whitman; YA, Yakima.
2. An asterisk (*) before the site name column indicates that there is a chemical analysis (or analyses) in Appendix B.
3. The **Date** column lists the date when one or more of the entries in the table was determined, as reported in one of the cited references.
4. **Latitude** and **Longitude** are given in decimal degrees.
5. Partial section – Written as quarter-section of quarter-section, using the system of the U.S. Geological Survey Water Resources Branch where the section is divided into 16 quarter-quarters which are lettered in the same manner as sections in a township are numbered. The pattern is shown below.

   D C B A

   E F G H

   M L K J

   N P Q R.

   NE4, NW4, SW4, and SE4 signify the northeast, northwest, southwest, and southeast quarters of a section, respectively. W2 and E2 are west one-half and east one-half.
6. **Within each county, entries are sorted by township, range, and section.**
7. **Temperature type:** B, bottom-hole or near-bottom-hole temperature; F, flowing temperature; M, maximum temperature; S, temperature measured short of well bottom; and "-", other or unknown.
8. **Depth type:** D, drilled depth or near drilled depth; L, logged depth; and "-", other or unknown.
9. **Gradient type:** A, gradient estimated from linear segment of well temperature log; B, gradient estimated from a bottom-hole temperature or the deepest logged temperature and an estimated or calculated mean annual surface temperature; S, gradient determined by fitting a straight line through "families" of bottom-hole temperatures.
10. **Flow type:** N, natural; P, pumped, bailed, or air-driven; "-", other, no flow, or unknown.
11. S.W.L.: Standing water level, meters from surface. A, flowing artesian.
12. References: Reference numbers correspond to the numbered references in the References Cited section.
13. On January 18, 1994, well KS012 was reported to flow at 7–13°C. by Phil Hamilton, Central Washington University Facilities Manager (oral commun.).

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
		ADAMS COUNTY																			
AD001	*	CMSTP&P RR	1961/05/04	46.804	119.342	15	28E	08	E	20.0	B	126	D	-	63	-	-	38	-	73	22,25,26,40,41
AD002	*	US Bureau of Reclamation	1971/10/06	46.794	119.299	15	28E	15	D	24.2	B	264	D	-	46	-	-	795	-	114	22,25,26,40
AD003		DH 4	-	46.757	119.360	15	28E	30	L	75.2	B	1456	D	-	43	31	-	-	-	-	2,22,25,26
AD004		E. Col. Basin Irr. Dist.	-	46.740	119.273	15	28E	35	P	24.4	B	253	D	-	49	-	-	-	-	-	22,25,26,33
AD005	*	Othello City 2	1955/08/02	46.824	119.167	15	29E	03	C	22.8	F	212	D	-	51	-	-	-	-	69	22,25,26,40
AD006	*	Othello City 4	1970/10/27	46.817	119.156	15	29E	03	J	20.8	F	276	D	-	32	-	-	3785	-	69	22,25,26,40
AD007		Othello City 5	-	46.814	119.167	15	29E	03	P	29.4	B	298	D	-	57	65	-	-	-	-	22,25,26,33,37,38,45
AD008	*	Othello City 6	1994/04/07	46.824	119.177	15	29E	04	A	27.8	F	368	D	-	36	-	-	13248	P	60	22,25,26,37,38,40,45
AD009	*	Othello City 1	1942/04/27	46.824	119.177	15	29E	04	A	20.0	B	171	D	-	47	-	-	341	P	73	22,25,26,40,41
AD010		Weaver, Howard	-	46.819	119.206	15	29E	05	-	20.0	F	75	D	-	-	-	-	473	P	-	44
AD011		Taylor, John D.	-	46.789	119.228	15	29E	18	-	20.0	F	77	D	-	-	-	-	170	P	-	44
AD012		Lyle, Elwyn & Rex	-	46.815	118.922	15	31E	04	J	24.4	F	330	D	-	-	-	-	7646	P	95	44
AD013		McKay, Ed	-	46.815	118.954	15	31E	05	L	26.8	B	404	D	-	36	49	-	-	-	-	22,25,26,37,38,45
AD014		Lyle, Elwyn	1983/05/26	46.800	118.944	15	31E	08	J	22.5	-	369	-	-	-	-	-	-	-	122	40
AD015		Lyle, Elwyn & Rex	1983/07/29	46.797	118.959	15	31E	08	N	25.0	-	314	-	-	-	-	-	-	-	88	40
AD016		Lyle Bros 3	-	46.803	118.895	15	31E	11	E	20.5	B	214	D	32	34	-	-	-	-	-	6,22,25,26

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
AD017		DNR Lyle 2	-	46.793	118.922	15	31E	16	A	21.1	F	412	D	-	-	-	-	7055	P	140	44
AD018		DNR Lyle 1	1983/05/26	46.793	118.938	15	31E	16	D	28.5	F	430	D	-	-	-	-	5924	P	134	40,44
AD019		Johnson, Arthur	-	46.779	118.965	15	31E	19	A	27.6	B	342	D	-	40	49	-	-	-	-	22,25,26,33,37,38,45
AD020		Kummer, Clarence, 4	-	46.742	118.959	15	31E	32	M	26.0	B	365	D	-	-	48	-	-	-	-	37,45
AD021		Tomkin	-	46.821	118.753	15	32E	02	A	25.0	B	252	D	-	52	-	-	-	-	-	24
AD022		Damon, Don	-	46.820	118.800	15	32E	04	B	21.9	B	266	D	-	43	49	-	-	-	-	22,25,26,37,45
AD023	*	Phillips, Robert, 4	1983/08/02	46.799	118.838	15	32E	07	J	25.4	F	579	D	-	-	-	-	-	-	181	7,15,40
AD024		Adams, Mrs. M. E.	-	46.806	118.827	15	32E	08	C	22.2	F	182	D	-	-	-	-	378	P	86	44
AD025		Phillips, Robert, 5	1982/08/09	46.803	118.832	15	32E	08	E	26.0	-	604	-	-	-	-	-	-	-	191	40
AD026		Steiger	-	46.788	118.806	15	32E	16	F	20.0	B	180	D	-	44	49	-	-	-	-	22,25,26,45
AD027		DNR Hatton	-	46.785	118.811	15	32E	16	M	21.1	F	457	D	-	-	-	-	2438	P	124	44
AD028		Hart	-	46.743	118.768	15	32E	35	E	27.6	B	310	D	-	50	-	-	-	-	-	22,25,26
AD029		Hart, Cyril	-	46.744	118.758	15	32E	35	G	22.9	B	308	D	-	-	49	-	-	-	-	37,45
AD030		—	-	46.822	118.631	15	33E	02	A	25.0	B	69	-	-	189	-	-	-	-	-	22,25
AD031		Tompkins, Robert	-	46.822	118.632	15	33E	02	A	25.0	B	252	D	-	52	-	-	-	-	-	26,37,45
AD032		Watson	-	46.753	118.528	15	34E	27	R	20.9	S	177	L	-	50	-	-	-	-	-	22,25,26
AD033		Blauert, Fred. A., 2	1983/08/26	46.751	118.302	15	36E	33	A	20.0	-	155	-	-	-	-	-	5678	-	21	40
AD034		Blauert, Fred	-	46.749	118.290	15	36E	34	F	25.4	B	213	D	-	63	-	-	-	-	-	22,25,26,37,38,45
AD035		Chef Reddy Frozen Foods	1983/08/22	46.839	119.172	16	29E	34	D	25.0	-	317	-	-	-	-	-	3861	-	63	40
AD036	*	Othello City 3	1977/05/11	46.829	119.156	16	29E	34	R	25.0	B	275	D	-	49	65	-	5072	P	85	22,25,26,37,40,41,44,45
AD037		Kliphardt, G. W.	-	46.866	119.000	16	30E	24	D	26.1	B	220	D	65	63	65	-	-	-	-	22,25,26,37,45
AD038		Kliphardt, Fredrick	1983/08/30	46.851	119.006	16	30E	26	A	30.0	-	323	-	-	-	-	-	-	-	91	40
AD039		Kliphardt	-	46.851	119.006	16	30E	26	A	26.2	B	192	D	34	72	-	-	-	-	-	6,22,25,26
AD040		Andrews 2	-	46.845	119.028	16	30E	27	J	25.2	B	207	D	91	64	-	-	-	-	-	6,22,25,26
AD041		DNR Damon 2	-	46.830	118.991	16	30E	36	K	20.6	B	211	D	-	40	-	-	-	-	-	22,25,26,37,45
AD042		DNR Damon	-	46.830	118.991	16	30E	36	K	25.8	B	241	D	-	57	65	-	14383	P	54	22,25,26,33,37,44,45
AD043		Damon Ranch	1983/05/24	46.872	118.884	16	31E	14	K	26.0	-	408	-	-	-	-	-	-	-	104	40
AD044		Lyle	-	46.880	118.906	16	31E	15	B	24.1	B	316	D	-	38	-	-	-	-	-	22,25,26
AD045		Lyle, Rex	-	46.880	118.906	16	31E	15	B	22.6	B	201	D	-	-	32	-	-	-	-	37,45
AD046		Wholman	-	46.880	118.916	16	31E	15	D	26.2	B	230	D	59	57	32	94	-	-	-	5,26,45
AD047		Lyle, Rex (South)	-	46.869	118.906	16	31E	15	Q	27.5	B	410	D	-	37	32	-	-	-	-	22,25,26,33,37,38,45
AD048		Brown, Beverly	1982/09/08	46.826	118.933	16	31E	33	P	20.0	-	165	-	-	-	-	-	-	-	105	40
AD049		Damon, Don	-	46.830	118.877	16	31E	35	J	24.4	F	275	D	-	-	-	-	4164	P	118	44
AD050		Phillips, D. E., 12	1983/08/02	46.895	118.768	16	32E	11	D	23.0	F	429	D	-	-	-	-	9084	P	122	40,44
AD051		Phillips, D. E., 12	-	46.894	118.768	16	32E	11	D	28.2	B	321	D	-	51	32	-	-	-	-	22,25,26,33,37,45
AD052		Phillips, D. Everett	-	46.873	118.729	16	32E	13	J	21.7	F	272	D	-	-	-	-	7948	P	98	44
AD053		Phillips, D. Everett	-	46.880	118.751	16	32E	14	A	22.9	F	233	D	-	-	-	-	11355	P	104	44
AD054		Phillips, Beatrice house well	-	46.880	118.763	16	32E	14	C	21.1	B	155	D	-	56	32	-	-	-	-	22,25,26,33,37,45
AD055		Phillips, D. E., 11	1983/05/27	46.880	118.768	16	32E	14	D	24.5	-	399	-	-	-	-	-	4921	-	89	40
AD056		Phillips, D. E., 11	-	46.880	118.768	16	32E	14	D	20.0	B	314	D	-	25	-	-	-	-	-	22,25,26,33,37,45
AD057		Phillips, D. E., 17	-	46.880	118.790	16	32E	15	D	34.0	B	440	D	-	49	32	-	-	-	-	22,25,26,33,37,38,45
AD058		Phillips, Robert, 3	1983/08/03	46.876	118.842	16	32E	18	G	26.0	-	469	-	-	-	-	-	-	-	147	40
AD059		Phillips, R. V.	-	46.854	118.832	16	32E	20	N	29.2	B	372	D	-	46	32	-	-	-	-	22,25,26,33,37,45
AD060		Phillips, D. E.	-	46.861	118.811	16	32E	21	E	24.4	F	448	D	-	-	-	-	5488	P	176	44

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m^2)	Flow (l/m)	Flow type	S.W.L. (m)	References
AD061		Phillips, D. E., 10	-	46.861	118.800	16	32E	21	G	27.4	B	283	D	-	-	32	-	-	-	-	22,25,26,37,45
AD062		Phillips, D. Everett	-	46.865	118.747	16	32E	24	D	20.6	F	252	D	-	-	-	-	3785	P	100	44
AD063		Phillips, D. Everett	-	46.851	118.729	16	32E	25	A	22.2	F	248	D	-	-	-	-	13058	P	102	44
AD064		Phillips, D. E., 2	-	46.850	118.747	16	32E	25	D	29.1	B	432	D	-	40	32	-	-	-	-	22,25,26,37,45
AD065		—	-	46.839	118.747	16	32E	25	N	30.4	B	709	D	-	26	32	-	-	-	-	2,22,25
AD066		Phillips, D. E., 16	-	46.839	118.747	16	32E	25	N	31.4	B	382	D	-	50	32	-	-	-	-	26,37,38,45
AD067		Phillips, D. E., 7	-	46.831	118.790	16	32E	34	E	43.4	B	772	D	70	41	38	-	-	-	-	2,22,25,26,37,38,45
AD068		Phillips, A	-	46.831	118.790	16	32E	34	E	24.0	B	370	D	-	-	-	-	-	-	-	5,45
AD069		Phillips, D. E.	-	46.835	118.764	16	32E	35	C	21.1	F	275	D	-	-	-	-	11355	P	119	44
AD070		Phillips, D. E., 9	-	46.835	118.769	16	32E	35	D	24.2	B	272	D	-	44	32	-	-	-	-	22,25,26,37,45
AD071		Davis, David A.	1983/08/02	46.880	118.700	16	33E	17	B	20.0	-	183	-	-	-	-	-	95	-	124	40
AD072		Baumann Farms	-	46.827	118.470	16	35E	31	Q	22.4	B	600	D	-	-	-	-	-	-	-	37,38,45
AD073		Bauman, Richard	-	46.828	118.461	16	35E	32	N	21.0	B	214	D	-	-	-	-	-	-	-	45
AD074		Phillips, D. E.	1983/05/24	46.997	118.905	17	31E	03	B	23.5	-	415	-	-	-	-	-	-	-	99	40
AD075		Phillips, D. E., C-12	1983/07/29	46.982	118.872	17	31E	12	D	27.8	B	592	D	-	27	27	-	-	-	37	22,25,26,37,38,40,45
AD076		Kulm, Ed	-	46.987	118.798	17	32E	04	Q	22.8	F	274	D	-	-	-	-	8422	P	159	44
AD077		Kulm, Art	-	46.993	118.851	17	32E	06	E	20.0	F	280	D	-	-	-	-	10976	P	120	44
AD078		—	-	46.973	118.739	17	32E	12	P	21.0	B	227	D	-	40	-	-	-	-	-	6,22,25
AD079		DNR CRB	-	46.961	118.766	17	32E	14	M	23.2	B	189	D	43	54	-	68	-	-	-	5,26,45
AD080		Lobe, Gary, 2	1983/08/02	46.999	118.724	17	33E	06	D	26.5	-	366	-	-	-	-	-	-	-	207	40
AD081		City of Lind	-	46.973	118.612	17	33E	12	P	21.0	B	226	D	-	40	-	-	-	-	-	26
AD082		Benge	-	46.942	118.148	17	37E	27	D	21.9	-	168	L	-	59	-	-	-	-	-	22,25,26,38
AD083		Warden Hutterian Brethern	1983/08/03	47.066	118.978	18	31E	07	E	21.5	-	357	-	-	-	-	-	-	-	93	40
AD084		Wollmon, Jaeole K.	-	47.048	118.936	18	31E	16	M	20.0	F	155	D	-	-	-	-	9462	P	31	44
AD085		Hutterites	-	47.055	118.973	18	31E	18	C	21.8	B	240	D	-	37	-	-	-	-	-	6,22,25,26
AD086		Phillips-Lanamn Ranch, Inc.	1983/07/29	47.001	118.942	18	31E	32	R	21.0	-	384	-	-	-	-	-	10598	-	62	40
AD087		Phillips, D. E., C-33	-	47.012	118.937	18	31E	33	D	30.2	B	728	D	-	25	27	-	-	-	-	26,37,38,45
AD088		—	-	47.012	118.937	18	31E	33	D	30.0	B	771	D	-	-	-	-	-	-	-	2
AD089	*	Jungblom Ranch	1983/08/01	47.012	118.937	18	31E	33	D	36.6	F	732	D	-	-	-	-	-	-	64	7,15,40
AD090		Lobe, Gary L.	-	47.084	118.850	18	32E	06	D	22.2	F	270	D	-	-	-	-	3785	P	198	44
AD091		Hutterian Bretheren	-	47.059	118.846	18	32E	07	P	21.7	B	240	D	-	-	27	-	-	-	-	45
AD092		Franz, Agatha	-	47.025	118.802	18	32E	28	C	20.0	F	188	D	-	-	-	-	3785	P	105	44
AD093		Harder, Carl H.	-	47.079	118.041	18	38E	04	N	21.1	F	161	D	-	-	-	-	5602	P	79	44
AD094		Kagele, Norman	-	47.123	118.861	19	31E	24	G	20.1	B	165	D	-	49	-	-	-	-	-	22,25,26,33,37,45
AD095		Weber, Dave	1983/05/23	47.110	118.903	19	31E	27	G	26.0	-	430	-	-	-	-	-	-	-	130	40
AD096		S & K Farms	-	47.121	118.734	19	32E	24	K	20.8	B	243	D	-	35	40	-	-	-	-	22,25,26,37,45
AD097		J & M Farms	1983/07/30	47.117	118.744	19	32E	24	N	32.5	B	695	D	-	30	-	-	-	-	195	2,22,25,26,33,37,38,40,45
AD098		Kagele, Norman	-	47.103	118.850	19	32E	30	N	21.1	B	165	D	-	-	40	-	-	-	-	45
AD099		Graber, Rose	-	47.101	118.752	19	32E	35	A	20.0	F	196	D	-	-	-	-	3974	P	60	44
AD100	*	Warden Hutterian Brethern, 7	1983/08/03	47.147	118.709	19	33E	07	R	24.3	F	527	D	-	-	-	-	-	-	133	7,15,40
AD101		Hoefel, Paul, 2	1983/08/30	47.147	118.694	19	33E	08	Q	42.3	B	745	D	-	39	38	-	-	-	177	2,22,25,26,33,37,38,40,45
AD102		Hoefel, Paul	-	47.147	118.694	19	33E	08	Q	20.7	B	231	D	-	36	40	-	-	-	-	22,25,26,37,45
AD103		Kagele, Melvin	1983/08/04	47.130	118.566	19	34E	20	B	22.5	B	341	D	-	34	-	-	-	-	180	22,25,26,40
AD104		Gering, Gale	-	47.153	118.287	19	36E	09	K	21.1	B	229	D	-	41	-	-	-	-	-	22,25,26,37,38

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
AD105		Galbreath Land & Livestock	1983/08/03	47.129	118.305	19	36E	20	H	20.5	-	314	-	-	-	-	-	5337	-	191	40
AD106		Galbreath Land & Livestock 2	1983/05/26	47.131	118.292	19	36E	21	C	22.5	-	390	-	-	-	-	-	5223	-	170	40
AD107		Heineman, Don, 2	-	47.091	118.276	19	36E	34	N	20.8	B	102	D	-	96	-	-	-	-	-	22,25,26,37
AD108		—	-	47.143	117.972	19	38E	13	F	21.1	-	201	L	83	55	-	-	-	-	-	22,25,26
AD109		Raugust, W. C.	1983/08/30	47.224	118.785	20	32E	15	L	21.0	-	317	-	-	-	-	-	-	-	-	40
AD110		Weber, John	-	47.250	118.501	20	34E	02	Q	21.0	B	202	D	-	50	-	-	-	-	-	22,25,26,37,45
AD111		Hardung	-	47.234	118.447	20	35E	17	D	20.9	B	232	D	90	39	-	-	-	-	-	6,22,25,26
AD112		Ahern, Cliff	-	47.218	118.362	20	35E	24	D	20.5	B	157	D	-	61	-	-	-	-	-	22,25,26,33,37
AD113		Kagele, Richard	1983/08/31	47.204	118.388	20	35E	27	A	22.0	-	384	-	-	-	-	-	-	-	231	40
		ASOTIN COUNTY																			
AS001	*	Washington Water Power Co., 2	1960/05/24	46.369	117.066	10	46E	05	Q	23.3	-	553	D	-	-	-	-	-	-	19	31,40,41
AS002		Washington Water Power Co.	-	46.373	117.082	10	46E	06	J	21.7	F	326	D	-	-	-	-	7570	P	82	44
AS003		Norman, Joe, & Gary Beach	-	46.355	117.066	10	46E	08	Q	20.0	F	79	D	-	-	-	-	772	P	34	44
AS004		Asotin City	-	46.340	117.045	10	46E	16	Q	22.2	F	164	D	-	-	-	-	3028	P	20	44
AS005		Asotin City 1	1982/06/21	46.337	117.055	10	46E	21	D	22.0	-	164	-	-	-	-	-	-	-	20	40
AS006		Washington Water Power Co.	-	46.410	117.062	11	46E	29	A	24.4	F	280	D	-	-	-	-	-	P	-	44
AS007		Washington Water Power Co.	-	46.397	117.069	11	46E	29	P	22.2	F	336	D	-	-	-	-	14762	P	87	44
AS008	*	Washington Water Power Co., 5	1962/10/30	46.398	117.087	11	46E	30	Q	23.3	B	406	D	-	28	-	-	-	-	136	22,25,26,31,40
AS009		Wash. W. Power, Clark. Hts., 7	1983/08/10	46.391	117.076	11	46E	32	E	26.2	B	405	D	36	35	-	56	13248	-	118	5,22,25,26,38,40
		BENTON COUNTY																			
BE001	*	S P & S Ry	-	45.864	119.792	04	24E	03	B	20.6	F	121	D	-	71	-	-	-	-	-	22,25,26,31
BE002		Sandpiper Land Co.	-	45.891	119.714	05	25E	29	G	20.0	F	107	D	-	-	-	-	378	P	52	42
BE003		Sandpiper Land Co.	-	45.884	119.722	05	25E	29	N	20.0	F	75	D	-	-	-	-	144	P	22	42
BE004		Paterson or G. Tom Powers	-	45.953	119.599	05	26E	05	D	26.3	B	305	D	-	47	-	-	5787	P	83	22,25,26,42
BE005	*	US Army Corps of Engineers	1971/09/24	45.941	119.353	05	28E	06	R	21.5	F	170	D	-	56	-	-	1893	-	6	22,25,26,40
BE006		Columbia R.	-	45.991	119.789	06	24E	22	H	22.5	B	195	D	-	44	-	-	-	-	-	6,22,25,26
BE007		Epstein	-	46.008	119.556	06	26E	15	E	23.9	F	293	D	-	-	-	-	14383	P	110	42
BE008		Craig	-	46.004	119.556	06	26E	15	M	24.2	B	210	D	-	58	-	-	-	-	-	22,25,26
BE009		Blair	-	46.010	119.001	06	30E	12	Q	21.1	B	305	D	31	29	-	-	-	-	-	6,22,25,26
BE010		HundredCirclesFarm,IrrigroDiv	-	45.993	119.116	06	30E	19	D	23.3	F	248	D	-	-	-	-	378	P	193	42
BE011		Irrigro	-	45.983	119.116	06	30E	19	N	20.5	S	177	L	-	48	-	-	-	-	-	22,25,26,37
BE012		Horrigan Farms	-	46.111	119.838	07	24E	08	B	23.4	B	338	D	-	36	-	-	-	-	-	22,25,26,38
BE013		Horrigon Farms, Inc.	-	46.066	119.775	07	24E	26	B	20.0	F	162	D	-	-	-	-	757	P	90	42
BE014		DOE Paterson	-	46.045	119.641	07	25E	36	N	30.3	B	222	D	-	83	-	-	-	-	-	22,25,26
BE015	*	WDOE Tst./Obs., Piezometer C	1972/11/01	46.045	119.640	07	25E	36	N	22.0	-	230	-	-	-	-	-	2612	-	114	40
BE016		DNR John Barber	1984/04/18	46.045	119.641	07	25E	36	N	21.5	-	262	-	-	-	-	-	8441	-	113	40
BE017		DOE Paterson	-	46.045	119.640	07	25E	36	N	22.5	B	254	D	-	41	-	-	-	-	-	22,25,26
BE018		DNR Baker	-	46.045	119.635	07	25E	36	P	21.8	B	262	D	-	38	-	-	-	-	-	22,25,26
BE019		Moon, John	1982/08/26	46.130	119.587	07	26E	05	B	22.0	-	326	-	-	-	-	-	-	-	130	40
BE020		Moon	-	46.129	119.587	07	26E	05	B	22.1	B	148	D	-	68	-	-	-	-	-	22,25,26
BE021		DOE Horse Heaven	-	46.055	119.373	07	27E	36	A	29.4	B	369	D	-	39	-	-	-	-	-	26,38
BE022	*	Prosser City 5	1994/01/19	46.205	119.749	08	24E	01	K	24.0	F	391	D	-	26	-	-	6813	P	41	2,6,22,25,26,33,40,42

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
BE023		Bleyhl, Carl	-	46.195	119.832	08	24E	08	H	27.8	F	59	D	-	-	-	-	727	P	0	42
BE024		Long, Tallman, & Long	1982/08/25	46.180	119.801	08	24E	15	F	24.0	-	125	-	-	-	-	-	227	-	64	40
BE025		DNR Gould	-	46.141	119.629	08	25E	36	B	25.9	B	408	D	35	38	-	56	-	-	225	5,26,42
BE026		—	1984/04/18	46.185	119.576	08	26E	16	D	20.0	-	329	-	-	-	-	-	-	-	-	40
BE027		Sharp, Pete	1982/08/27	46.212	119.371	08	27E	01	A	22.5	-	47	-	-	-	-	-	-	-	34	40
BE028		Schleer, Carl	1988/09/15	46.193	119.365	08	28E	07	M	20.5	-	134	-	-	-	-	-	-	-	69	40
BE029		Bar 80 Ranch/Pete Sharp	1982/08/27	46.189	119.359	08	28E	07	P	20.5	-	133	-	-	-	-	-	1514	-	43	40
BE030		St. Joseph's Catholic Church	1988/04/11	46.207	119.128	08	29E	01	F	21.0	-	28	-	-	-	-	-	189	-	-	40
BE031	*	Mott, Studer	1970/11/17	46.168	119.160	08	29E	22	A	23.0	F	244	D	-	45	-	-	-	-	122	22,25,26,40
BE032		Burk, Vern	-	46.159	119.050	08	30E	22	M	21.1	F	69	D	-	-	-	-	492	N	A	42
BE033		Noel, Jim	-	46.156	119.050	08	30E	22	N	21.1	F	69	D	-	-	-	-	-	N	A	42
BE034		Salvinia Farms/Harper Farms	-	46.257	119.827	09	24E	21	D	21.7	F	241	D	-	-	-	-	4542	P	98	42
BE035		WSU Prosser Experiment Station	-	46.294	119.732	09	25E	06	K	27.8	B	366	D	-	43	34	-	5678	P	162	2,22,25,26,38,42
BE036		Goroch, Chester	-	46.278	119.727	09	25E	07	J	21.1	F	215	D	-	-	-	-	2650	P	127	42
BE037		Gammie,William/Whitstran Ranch	-	46.282	119.684	09	25E	09	H	20.0	F	457	D	-	-	-	-	-	-	138	42
BE038		Olsen Bros.	-	46.270	119.657	09	25E	14	DorC	20.0	F	142	D	-	-	-	-	2460	P	15	42
BE039	*	WA State U.,I.A.R.E.C.,well 2	1994/01/19	46.258	119.736	09	25E	19	B	20.0	F	143	D	-	-	-	-	341	P	69	-
BE040		Clark, Roy	-	46.249	119.644	09	25E	23	J	20.0	F	18	D	-	-	-	-	114	P	8	42
BE041		Ball, Lenn and Vern	1983/07/20	46.226	119.689	09	25E	33	AorB	21.0	F	218	D	-	-	-	-	-	N	A	40,42
BE042		Valley View Orchards	-	46.290	119.615	09	26E	06	N	22.8	F	-	-	-	-	-	-	1961	P	157	42
BE043		Bauder, Milo	-	46.255	119.581	09	26E	20	A	23.3	F	209	D	-	-	-	-	7684	P	21	42
BE044	*	Christen	1970/10/12	46.234	119.544	09	26E	27	K	21.5	B	204	D	-	47	-	-	-	-	137	22,25,26,40
BE045		Peterson, Jean	-	46.296	119.405	09	27E	02	E	20.0	F	123	D	-	-	-	-	1041	P	55	42
BE046		Edmunds, Gary	-	46.296	119.400	09	27E	02	F	20.0	F	130	D	-	-	-	-	-	-	43	42
BE047		Gelles, David S.	1988/04/19	46.274	119.469	09	27E	08	N	20.5	-	195	-	-	-	-	-	-	-	-	40
BE048		DNR Benton 40	-	46.270	119.448	09	27E	16	D	23.3	B	94	D	185	122	-	293	-	-	-	5,26
BE049		Harrison 4 W	1982/08/28	46.255	119.449	09	27E	21	D	22.5	-	252	-	-	-	-	-	-	-	-	40
BE050		DNR Kid 3	-	46.248	119.402	09	27E	23	L	29.1	B	370	D	43	46	-	69	-	-	-	5,26
BE051		DNR 79-07	-	46.234	119.387	09	27E	25	M	23.8	B	322	D	-	30	-	-	-	-	-	26,38
BE052		Davin Land & Livestock, Inc.	1983/05/17	46.270	119.331	09	28E	17	AorB	26.7	F	336	D	-	-	-	-	10182	P	52	40,42
BE053		Bauder	-	46.222	119.287	09	28E	34	H	21.1	B	271	D	-	34	-	-	-	-	-	22,25,26
BE054		The Quadrant Corporation	-	46.215	119.255	09	28E	36	P	28.3	F	368	D	-	-	-	-	4542	P	27	42
BE055		DNR Anderson	-	46.312	119.759	10	24E	36	F	29.8	B	273	D	62	65	-	99	-	-	-	5,26
BE056		Nakamura	-	46.326	119.636	10	25E	25	E	20.6	B	184	D	36	45	-	-	-	-	-	6,22,25,26
BE057		J & R Orchards	-	46.305	119.699	10	25E	33	N	21.8	B	276	D	-	36	34	-	-	-	-	2,22,25,26
BE058		Schwendig, Harvey	1983/07/21	46.323	119.568	10	26E	28	L	24.5	-	282	-	-	-	-	-	2763	-	155	40
BE059		Champion Orchards	-	46.315	119.573	10	26E	33	D	22.8	F	255	D	-	-	-	-	1741	P	137	42
BE060		Inland Desert Fruit Company	-	46.312	119.568	10	26E	33	F	24.4	F	255	D	-	-	-	-	2366	P	126	42
BE061		Hanford 56E4C	-	46.329	119.431	10	27E	28	A	20.9	B	140	D	-	46	-	-	-	-	-	5,26
BE062		Hanford S-30	-	46.357	119.269	10	28E	14	B	39.7	B	605	D	42	42	-	67	-	-	-	5,26
BE063		DH 3	-	46.353	119.269	10	28E	14	G	47.8	B	1080	D	35	33	-	53	-	-	-	2,4,5,22,25,26
BE064		Battelle PacificNorthwestLabs	1988/09/14	46.339	119.279	10	28E	23	E	20.5	-	15	-	-	-	-	-	1893	-	14	40
BE065		Rattlesnake Unit No. 1	-	46.435	119.789	11	24E	15	R	128.0	S	3248	D	37	40	31	60	-	-	-	2,4,5,22,25,26
BE066		DC 12	-	46.468	119.542	11	26E	03	-	53.7	B	1018	D	-	42	-	-	-	-	-	12

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
BE067		VO-SOC 1	-	46.420	119.592	11	26E	20	N	40.1	B	671	D	37	-	-	56	-	-	-	5
BE068	*	US Government	1970/11/19	46.391	119.534	11	26E	34	R	24.0	F	305	D	-	39	-	-	1317	-	244	22,25,26,40
BE069		Hanford 2-E14	-	46.430	119.276	11	28E	23	D	26.2	B	288	D	39	42	-	60	-	-	-	5,26
BE070		DC 15	-	46.395	119.270	11	28E	35	-	51.5	B	945	D	-	41	-	-	-	-	-	12
BE071		Berk, Delbert	-	46.561	119.798	12	24E	03	B	22.2	F	387	D	-	-	-	-	13414	P	10	42
BE072		Tramel, J. D.	-	46.561	119.835	12	24E	05	A	23.0	B	254	D	-	43	-	-	-	-	-	2,26,37
BE073		Tramel, J. D.	-	46.541	119.814	12	24E	09	E2E2	22.2	F	310	D	-	-	-	-	13475	P	107	42
BE074	*	Roberts Bros.	1970/09/11	46.507	119.850	12	24E	20	N	26.0	F	366	D	-	38	-	-	-	-	-	22,25,26,40
BE075		Robert, Robin	1983/07/28	46.503	119.861	12	24E	30	B	26.0	-	390	-	-	-	-	-	11317	-	35	40
BE076	*	US Government	1977/04/27	46.550	119.573	12	26E	04	N	21.4	F	117	D	-	80	-	-	-	-	108	22,25,26,40
BE077		US Government	1976/04/08	46.546	119.605	12	26E	07	B	20.7	F	126	D	-	69	-	-	-	-	82	22,25,26,40
BE078	*	US Government	1976/04/08	46.536	119.605	12	26E	07	Q	20.4	F	99	D	-	85	-	-	-	-	88	22,25,26,40
BE079	*	US Government	1979/04/19	46.536	119.589	12	26E	08	P	21.2	F	98	D	-	94	-	-	-	-	88	22,25,26,40
BE080	*	AEC	1979/04/17	46.539	119.568	12	26E	09	L	22.0	-	113	-	-	-	-	-	-	-	108	40
BE081	*	US Government	1976/04/08	46.543	119.495	12	26E	12	H	21.0	F	158	D	-	57	-	-	-	-	91	22,25,26,40
BE082		—	1982/04/21	46.532	119.495	12	26E	13	A	20.5	-	-	-	-	-	-	-	-	-	-	40
BE083	*	US Government	1979/04/17	46.528	119.494	12	26E	13	H	20.0	-	38	-	-	-	-	-	-	-	34	40
BE084	*	US Government	1978/04/20	46.532	119.531	12	26E	14	D	21.1	F	117	D	-	78	-	-	-	-	105	22,25,26,40
BE085	*	US Government	1977/04/28	46.532	119.547	12	26E	15	C	21.7	F	134	D	-	74	-	-	-	-	95	22,25,26,40
BE086	*	US Government	1979/04/20	46.525	119.537	12	26E	15	J	21.0	-	98	-	-	-	-	-	-	-	-	40
BE087	*	US Government	1976/04/08	46.528	119.614	12	26E	18	E	20.5	F	177	D	-	48	-	-	-	-	68	22,25,26,40
BE088	*	US Government	1982/04/21	46.528	119.604	12	26E	18	G	21.0	F	85	D	-	103	-	-	-	-	65	22,25,26,40
BE089		—	1981/04/21	46.507	119.509	12	26E	24	N	20.5	-	207	-	-	-	-	-	-	-	-	40
BE090		Maple Leaf Farms, Inc.	-	46.500	119.581	12	26E	29	G	24.4	F	253	D	-	-	-	-	1703	P	52	42
BE091		DB 8	-	46.556	119.482	12	27E	06	-	24.8	B	244	D	-	42	-	-	-	-	-	12
BE092		US Government	1978/04/19	46.525	119.447	12	27E	16	M	20.5	F	65	L	-	131	-	-	-	-	39	22,25,26,40
BE093	*	AEC	1979/04/16	46.532	119.484	12	27E	18	C	21.5	-	51	-	-	-	-	-	-	-	44	40
BE094		DC 7	-	46.484	119.375	12	27E	36	-	72.2	B	1243	D	-	49	-	-	-	-	-	12
BE095		Casper, William	-	46.540	119.362	12	28E	07	M	21.1	F	124	D	-	-	-	-	64	P	113	44
BE096	*	US Government	1970/08/27	46.587	119.769	13	24E	25	E	24.2	F	237	D	-	51	-	-	-	-	-	22,25,26,40,41
BE097		699-52-115	-	46.585	119.759	13	24E	25	-	20.6	B	213	D	-	45	-	-	-	-	-	12
BE098	*	US Govt./Meeker	-	46.586	119.779	13	24E	26	G	20.0	F	215	L	-	43	-	-	-	-	-	22,25,26,41
BE099	*	—	1951/12/01	46.586	119.779	13	24E	26	G	20.0	-	185	-	-	-	-	-	-	-	-	40
BE100	*	US Government	1951/11/29	46.577	119.769	13	24E	36	D	24.0	F	333	D	-	36	-	-	5110	-	66	22,25,26,40,41
BE101	*	US Government	-	46.638	119.639	13	25E	01	N	23.0	F	241	D	-	46	-	-	-	-	-	22,25,26,31
BE102	*	US Government	1983/06/03	46.638	119.671	13	25E	03	Q	21.0	-	16	-	-	-	-	-	-	-	12	40
BE103	*	Hanford, 199-B4-4	1977/04/27	46.631	119.644	13	25E	11	H	39.1	F	32	L	-	847	-	-	-	-	23	22,25,26,40
BE104		DB 12	-	46.614	119.694	13	25E	16	-	20.5	B	215	D	-	29	-	-	-	-	-	12
BE105		US Government	1981/04/23	46.580	119.660	13	25E	26	N	20.0	-	183	-	-	-	-	-	-	-	90	40
BE106	*	US Govt./McGee, Chester	1977/04/27	46.586	119.737	13	25E	30	G	30.6	F	338	D	-	44	-	-	5185	-	65	22,25,26,40,41
BE107		699-53-103	-	46.585	119.738	13	25E	30	-	28.7	B	299	D	-	49	-	-	-	-	-	12
BE108		DC 5	-	46.570	119.673	13	25E	34	-	62.8	B	945	D	-	37	-	-	-	-	-	12
BE109		DH 1		46.590	119.499	13	26E	25	AorB	21.9	B	183	D	37	54	-	64	-	-	-	4,5,22,25
BE110	*	US Government	1979/04/17	46.565	119.602	13	26E	31	R	20.0	-	98	-	-	-	-	-	-	-	97	40

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
BE111		ARH DC 1	-	46.576	119.517	13	26E	35	A	75.0	B	1725	D	-	37	31	-	-	-	-	2,26
BE112		DDH 1	-	46.576	119.517	13	26E	35	A	21.9	S	183	L	37	38	-	-	-	-	-	26
BE113	*	US Government	1969/07/14	46.572	119.517	13	26E	35	H	25.0	-	-	-	-	-	-	-	-	-	-	40
BE114		Hanford DC 6	-	46.586	119.395	13	27E	26	G	60.2	B	1324	D	-	37	31	-	-	-	-	2,26
BE115		—	1984/06/06	46.590	119.443	13	27E	28	C	21.0	-	168	-	-	-	-	-	-	-	-	40
BE116		DB 10	-	46.585	119.461	13	27E	29	-	26.4	B	257	D	-	43	-	-	-	-	-	12
BE117		Hanford 107D-2	1978/04/18	46.700	119.533	14	26E	14	M	32.5	F	24	L	-	854	-	-	-	-	17	22,25,26,40
BE118	*	US Government	1979/04/18	46.693	119.533	14	26E	23	D	24.0	-	28	-	-	-	-	-	-	-	26	40
BE119		Hanford 199-N-15	1977/04/27	46.674	119.565	14	26E	28	G	20.7	F	24	D	-	363	-	-	-	-	16	22,25,26,40
BE120	*	Hanford 199-K-19	1979/04/18	46.656	119.592	14	26E	32	L	22.0	-	16	-	-	-	-	-	-	-	6	40
BE121		US Government	1979/04/18	46.704	119.475	14	27E	18	H	22.5	-	17	-	-	-	-	-	-	-	12	40
BE122		DC-14	-	46.672	119.462	14	27E	29	-	57.2	B	1017	D	-	45	-	-	-	-	-	12
BE123	*	US Government	1979/04/17	46.659	119.438	14	27E	33	G	20.5	-	20	-	-	-	-	-	-	-	10	40
		CHELAN COUNTY																			
CH001		Norco No. 1	-	47.367	120.298	22	20E	26	M	35.7	S	1495	L	28	27	-	62	-	-	-	4,5,22,25,26
		CLARK COUNTY																			
CK001		Evergreen School District 114	1980/08/19	45.613	122.533	02	02E	35	M	22.0	-	77	-	-	-	-	-	1079	-	48	40
CK002		Cody, L.	-	45.638	122.266	02	04E	24	N	24.1	M	90	D	-	-	-	-	-	-	-	5
		CLALLAM COUNTY																			
CL001S	*	Olympic Hot Springs	-	47.977	123.687	29	08W	27	K	48.5	-	-	-	-	-	-	-	-	-	-	19,32
CL002S	*	Sol Duc Hot Springs	-	47.969	123.861	29	09W	32	C	51.0	-	-	-	-	-	-	-	-	-	-	19,21,32
		COLUMBIA COUNTY																			
CO001		Barton, George	-	46.235	117.963	09	39E	22	C	21.1	F	305	D	-	-	-	-	4	P	274	44
CO002		Ferrell, L.	-	46.555	118.005	12	38E	01	E	22.0	-	241	L	-	41	-	-	-	-	-	22,25,26,37
CO003	*	Ferrel, Robert	1961/01/27	46.583	118.017	13	38E	26	E	20.0	F	74	D	-	108	-	-	-	-	-	22,25,26,40,41
CO004		US Army Corps of Engineers	-	46.580	118.024	13	38E	27	J	23.3	F	116	D	-	-	-	-	1060	P	5	44
CO005		US Army Corps of Engineers	1983/08/26	46.580	118.034	13	38E	27	L	23.9	F	116	D	-	-	-	-	1790	P	19	40,44
		COWLITZ COUNTY																			
CZ001S		Green River Soda Springs	-	46.379	122.266	10	04E	02	G	25.0	-	-	-	-	-	-	-	-	-	-	17,22
		DOUGLAS COUNTY																			
DO001		Welch	-	47.244	120.011	20	22E	12	B	22.0	B	264	D	26	33	-	41	-	-	-	5,26
DO002		La Bonte, Lloyd L.	1982/07/28	47.241	120.011	21	22E	12	G	20.0	-	234	-	-	-	-	-	5299	-	80	40
DO003		Fleming & Evenhus	-	47.386	120.129	22	22E	19	E	20.0	F	83	D	-	-	-	-	8	P	72	42
DO004		Welch, Dean	-	47.386	120.129	22	22E	19	E	22.8	F	226	D	-	-	-	-	6832	P	176	42
DO005		Sagebrush Flats	-	47.460	119.674	23	25E	27	L	33.0	B	396	D	-	-	-	-	-	-	-	37
DO006		DNR Pixlee	-	47.483	119.594	23	26E	20	D	29.3	S	363	L	-	50	-	-	-	-	-	22,25,26,33
DO007		Isaak, John	-	47.813	119.268	27	28E	26	C	20.0	F	247	D	-	-	-	-	-	P	158	42
		FRANKLIN COUNTY																			
FR001		Dixon, Norman, 2	1988/04/15	46.295	119.143	09	29E	02	G	22.1	F	144	D	-	-	-	-	379	-	34	7,15,40

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
FR002	*	Pasco Navy Base/Port of Pasco	1970/08/28	46.263	119.098	09	30E	18	HorJ	21.0	F	315	D	-	29	-	-	2271	-	22	22,25,26,40
FR003		N.P. R.R./A. Miller ice plant	-	46.247	119.088	09	30E	20	L	21.1	F	314	D	-	29	-	-	1855	P	20	39
FR004		Western Farm Service	1988/09/07	46.235	119.046	09	30E	27	F	20.5	-	37	-	-	-	-	-	151	-	-	40
FR005		Nakamura	-	46.279	118.985	09	31E	07	E	24.6	-	168	L	33	75	-	-	-	-	-	22,25,26
FR006		Hageman, Marvin	1988/09/14	46.360	119.179	10	29E	09	R	20.0	-	118	-	-	-	-	-	76	-	81	40
FR007		US Bureau of Reclamation	-	46.339	119.012	10	30E	23	H	20.0	F	194	D	-	-	-	-	57	P	81	44
FR008		Jones & Russell,Eddie & Connie	1983/07/20	46.333	118.766	10	32E	23	J	23.0	-	91	-	-	-	-	-	95	-	46	40
FR009		Foster, Chris	1983/05/23	46.470	119.155	11	29E	03	H	22.0	-	168	-	-	-	-	-	95	-	122	40
FR010	*	West 15 Domestic Water, Inc.	1994/01/20	46.461	119.196	11	29E	05	R	28.0	F	305	D	-	-	-	-	360	P	160	40,44
FR011		Bergland Farms	1988/09/09	46.475	119.228	11	29E	06	C	23.0	-	20	-	-	-	-	-	38	-	7	40
FR012		Sunset Domestic Water Assoc.	-	46.444	119.177	11	29E	16	A	22.2	F	293	D	-	-	-	-	246	P	163	44
FR013		White Bluff/Greg Allen	1988/04/12	46.417	119.215	11	29E	20	N	25.0	-	285	-	-	-	-	-	212	-	170	40
FR014		Turner, Richard	1983/07/25	46.390	119.236	11	29E	31	N	24.5	-	227	-	-	-	-	-	-	-	148	40
FR015		Clearwater Domestic Assoc.	-	46.389	119.199	11	29E	32	R	21.1	F	113	D	-	-	-	-	57	P	103	44
FR016		Circle H Land, 3	1983/05/18	46.462	118.942	11	31E	04	P	21.5	-	399	-	-	-	-	-	13248	-	125	40
FR017		Nakamura, H.	-	46.425	118.931	11	31E	21	H	24.8	B	356	D	-	34	-	-	-	-	-	22,25,26,38
FR018		Hummel, Ed.	1988/04/13	46.399	118.937	11	31E	33	B	22.0	-	213	-	-	-	-	-	-	-	53	40
FR019		Rowe Farms	-	46.402	118.842	11	32E	29	N	29.6	B	333	D	-	53	-	-	-	-	-	23
FR020		USBR Drainage Obs.	1988/02/21	46.557	119.128	12	29E	01	E	22.5	-	15	-	-	-	-	-	-	-	-	40
FR021		Stephens, Alvin E.	-	46.555	119.204	12	29E	05	-	20.0	F	136	D	-	-	-	-	76	P	26	44
FR022		Rohleld, Richard	-	46.554	119.223	12	29E	06	K	20.0	F	72	D	-	-	-	-	-	P	64	44
FR023		Washburn, Hiram E.& Rachel A.	-	46.522	119.191	12	29E	16	N	21.1	F	112	D	-	-	-	-	25	P	87	44
FR024		Casey, Michael	1988/09/12	46.526	119.202	12	29E	17	K	23.0	-	146	-	-	-	-	-	30	-	119	40
FR025		Winebarger, Jim	-	46.518	119.133	12	29E	23	A	22.2	F	175	D	-	-	-	-	23	P	123	44
FR026	*	US Bureau of Reclamation	1953/01/01	46.500	119.186	12	29E	28	F	20.0	F	213	D	-	38	-	-	204	-	150	22,25,26,40
FR027		N. 16 Dom. Water Assoc., Inc.	-	46.489	119.160	12	29E	34	B	21.1	F	169	D	-	-	-	-	91	P	129	44
FR028		Coordes, Henry	1988/09/13	46.538	118.926	12	31E	10	M	22.5	-	293	-	-	-	-	-	-	-	183	40
FR029		Greenfield Farm/Mel McLane	1988/02/27	46.626	119.315	13	28E	09	L	25.0	-	247	-	-	-	-	-	-	-	178	40
FR030		Lowe, Walter	1988/02/26	46.629	119.278	13	28E	11	E	22.0	-	222	-	-	-	-	-	-	-	186	40
FR031	*	US Bureau of Reclamation	1983/07/26	46.608	119.257	13	28E	13	N	29.5	F	341	D	-	46	-	-	322	-	145	22,25,26,40
FR032		US Bureau of Reclamation	1983/07/22	46.629	119.199	13	29E	08	H	20.5	F	138	D	-	-	-	-	114	P	130	40,44
FR033		Baille	-	46.612	119.120	13	29E	13	K	22.6	B	210	D	48	43	-	77	-	-	-	5,26
FR034		Price, Anthon	-	46.618	119.194	13	29E	16	D	23.9	F	227	D	-	-	-	-	303	P	126	44
FR035		Wahluke Water Association,Inc.	-	46.618	119.194	13	29E	16	D	27.8	F	318	D	-	-	-	-	227	P	127	44
FR036		Bailie, Leon	1988/04/14	46.593	119.147	13	29E	23	P	23.5	-	214	-	-	-	-	-	-	-	23	40
FR037		Connell City 8	1983/07/21	46.644	118.875	13	31E	01	E	21.1	F	404	D	-	-	-	-	9118	P	101	40,44
FR038		Loeber, E. C.	-	46.618	118.892	13	31E	14	C	20.6	F	369	D	-	-	-	-	7570	P	102	44
FR039		Connell City, E. C. Loeber	-	46.605	118.883	13	31E	14	R	20.0	F	306	D	-	-	-	-	757	P	107	44
FR040		Pepiots, Inc.	-	46.571	118.909	13	31E	34	G	22.2	F	400	D	-	-	-	-	1136	P	176	44
FR041		Cockrans	-	46.581	118.604	13	34E	30	M	32.2	B	355	D	56	57	-	-	-	-	-	22,25,26
FR042		USBR Block 24 Obs.	1988/09/17	46.677	119.315	14	28E	28	C	21.5	-	6	-	-	-	-	-	-	-	-	40
FR043	*	US Govt./Othello AFB	1967/02/13	46.721	119.178	14	29E	09	A	23.3	B	263	D	58	47	-	-	197	-	172	6,22,25,26,40,41
FR044		Michel, John	1988/09/14	46.681	119.226	14	29E	19	Q	21.0	-	128	-	-	-	-	-	-	-	68	40
FR045		Alexander, H. D.	1988/09/14	46.651	119.215	14	29E	32	N	26.7	F	182	D	-	-	-	-	19	P	130	40,44

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
FR046		Rathbun, Corrin	-	46.713	118.959	14	31E	08	M	46.8	B	758	D	-	46	38	-	-	-	-	2,26,37,38,45
FR047		Rathbun, Corrin, 3	-	46.713	118.922	14	31E	09	J	22.2	B	332	D	-	28	48	-	-	-	-	22,25,26,37,38,45
FR048		Kummer Farms	-	46.705	118.911	14	31E	15	C	20.3	B	413	D	-	-	-	-	-	-	-	37,38, 45
FR049		Wirth, Earl W.	-	46.669	118.891	14	31E	26	L	22.2	F	274	D	-	-	-	-	265	P	134	44
FR050		Andrews, Clyde	-	46.669	118.901	14	31E	27	J	25.2	B	207	D	-	-	50	-	-	-	-	45
FR051		Connell City	-	46.658	118.860	14	31E	36	H	23.3	F	337	D	-	-	-	-	2790	P	108	44
FR052	*	Connell City 4	1970/09/24	46.655	118.860	14	31E	36	J	25.0	F	337	D	-	39	-	-	-	-	-	22,25,26,40
FR053		Hart, Frank	-	46.722	118.763	14	32E	02	P	27.2	B	242	D	50	63	50	-	-	-	-	22,25,26,37,45
FR054		Hart	-	46.701	118.748	14	32E	13	E	25.6	-	187	L	-	73	-	-	-	-	-	22,25,26
FR055		Hart, Dick	-	46.701	118.748	14	32E	13	E	23.7	B	232	D	-	-	50	-	-	-	-	37,45
FR056		Welch, Norman A. & Dean	-	46.671	118.847	14	32E	30	F	22.8	F	238	D	-	-	-	-	2460	P	91	44
FR057		Connell City 6	-	46.662	118.854	14	32E	31	D	29.4	B	305	D	38	57	50	-	-	-	-	22,25,26
FR058		Hudlow, Floyd S.	-	46.705	118.720	14	33E	18	B	20.0	F	165	D	-	-	-	-	341	P	148	44
FR059		Heider, Walter	-	46.680	118.689	14	33E	21	N	28.2	B	351	D	-	44	50	-	-	-	-	22,25,26,37,38,45
FR060		Gillis, Vernon	1983/08/03	46.680	118.354	14	36E	19	N	29.5	B	287	D	-	42	-	-	76	-	-	22,25,26,40
		GARFIELD COUNTY																			
GA001		Scott, Jim	-	46.521	117.760	12	40E	14	J	21.1	F	317	D	-	-	-	-	34	P	268	44
GA002	*	Pomeroy City 4	1960/05/24	46.476	117.601	12	42E	31	L	23.0	F	304	D	-	36	-	-	-	-	-	22,25,26,40,41
GA003		Burne, Diane	-	46.569	117.543	13	42E	33	G	20.0	F	47	D	-	-	-	-	204	P	-	44
		GRANT COUNTY																			
GR001		Pacific First Bank 2	-	46.645	119.844	13	24E	05	F	25.6	F	457	D	-	-	-	-	-	-	10	44
GR002		Pacific First Bank 1	-	46.645	119.844	13	24E	05	F	26.1	F	393	D	-	-	-	-	-	-	9	44
GR003		Pacific First Bank 3	-	46.645	119.844	13	24E	05	F	24.4	F	461	D	-	-	-	-	-	-	24	44
GR004		DNR East Priest Rapids, 1	1983/07/28	46.706	119.892	14	23E	13	D	23.5	-	296	-	-	-	-	-	-	-	82	40
GR005		Baney, Curt	-	46.692	119.908	14	23E	23	C	21.1	F	195	D	-	-	-	-	-	-	38	44
GR006		Gearhart, Frank	1983/07/27	46.678	119.898	14	23E	26	A	22.5	-	125	-	-	-	-	-	76	-	43	40
GR007	*	US Army/AEC Hanford 90	1971/10/08	46.735	119.639	14	25E	01	D	27.5	F	285	D	-	54	-	-	511	-	55	22,25,26,40,41
GR008		Hanford 93-93	-	46.735	119.639	14	25E	01	D	25.6	B	68	D	-	43	-	-	-	-	-	5,26
GR009		Barker, Paul	1983/07/26	46.735	119.655	14	25E	02	C	20.5	-	136	-	-	-	-	-	-	-	17	40
GR010		Arnold, Greg	-	46.696	119.734	14	25E	18	Q	27.8	F	172	D	-	-	-	-	57	P	39	44
GR011	*	US Govt./AEC Hanford 6	1958/01/07	46.692	119.692	14	25E	21	B	22.2	F	159	D	-	63	-	-	984	-	72	22,25,26,40,41
GR012		US Army Corps of Engineers	-	46.674	119.702	14	25E	28	E	22.8	F	198	D	-	-	-	-	946	P	146	44
GR013	*	US Army	1959/10/28	46.691	119.381	14	27E	24	C	30.0	F	425	D	-	42	-	-	379	-	117	22,25,26,40,41
GR014	*	Wahluke School	1994/01/20	46.743	119.898	15	23E	35	R	17.0	F	129	-	-	-	-	-	379	-	107	40
GR015		Mattawa City	1983/07/27	46.740	119.909	15	23E	35	P	21.5	-	303	-	-	-	-	-	3785	-	80	40
GR016		DH 5	-	46.754	119.758	15	24E	25	P	23.3	B	1534	D	-	41	31	-	-	-	-	26
GR017		DH 5	-	46.759	119.820	15	24E	28	-	73.5	B	1525	D	-	41	-	-	-	-	-	12
GR018		Bird, Duane	1982/08/19	46.746	119.644	15	25E	35	H	20.0	-	128	-	-	-	-	-	114	-	104	40
GR019	*	AEC Hanford 7	1958/01/07	46.743	119.425	15	27E	34	L	21.7	F	194	D	-	49	-	-	265	-	83	22,25,26,40,41
GR020		Myrick, Norman A. & Edith E.	-	46.912	119.892	16	23E	01	D	22.2	F	312	D	-	-	-	-	3785	P	200	44
GR021		Grant County PUD, 2	-	46.861	119.941	16	23E	21	J	20.6	F	108	D	-	-	-	-	2044	P	6	44
GR022		Grant County PUD, 2	1983/07/27	46.861	119.941	16	23E	21	J	21.5	-	53	-	-	-	-	-	689	-	3	40

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
GR023	*	US Government	-	46.908	119.754	16	24E	01	G	23.5	F	244	D	-	47	-	-	-	-	-	22,25,26,41
GR024	*	US Air Force	-	46.908	119.754	16	24E	01	G	24.5	F	279	D	-	45	-	-	-	-	-	22,25,26,41
GR025	*	US Air Force	1963/03/28	46.908	119.754	16	24E	01	G	23.5	-	279	-	-	-	-	-	1154	-	214	40
GR026		Royal City 1	1983/07/27	46.901	119.626	16	25E	01	Q	20.5	-	277	-	-	-	-	-	1893	-	162	40
GR027		Weitzel, Paul	1983/07/30	46.956	119.901	17	23E	23	A	24.0	-	276	-	-	-	-	-	38	-	183	40
GR028		Metro Mortgage	-	46.996	119.633	17	25E	01	F	25.3	B	239	D	-	56	-	-	-	-	-	22,25,26,37
GR029		US Bureau of Reclamation	1982/08/18	46.926	119.490	17	27E	31	D	20.8	F	247	D	-	36	-	-	1211	-	61	22,25,26,40
GR030		—	-	46.993	118.989	17	30E	01	G	23.0	F	299	D	-	37	-	-	-	-	-	22,25,26
GR031		Warden City	-	46.972	119.036	17	30E	10	P	27.8	F	253	D	-	-	-	-	12036	P	53	44
GR032	*	US Government	1982/08/11	46.917	119.054	17	30E	33	K	23.3	-	299	D	-	-	-	-	-	-	-	40,41
GR033	*	US Army Corps of Engineers	1960/01/24	46.917	119.054	17	30E	33	K	23.5	F	306	D	-	33	-	-	946	P	64	22,25,26,40,41,44
GR034		George City	-	47.087	119.857	18	24E	06	A	20.0	F	54	D	-	-	-	-	3785	P	8	44
GR035		Washington	-	47.054	119.680	18	25E	15	E	25.6	F	297	D	-	46	-	-	-	-	-	22,25,26
GR036		Quincy	-	47.054	119.680	18	25E	15	E	22.4	S	270	L	-	39	-	-	-	-	-	22,25,26
GR037		DOE George	-	47.054	119.681	18	25E	15	E	29.3	-	488	L	35	35	-	-	-	-	-	22,25,26,38
GR038	*	WDOE Tst./Obs., Backfilled	1978/02/17	47.054	119.681	18	25E	15	E	25.5	-	491	-	-	-	-	-	4391	-	117	40
GR039		Metro Mortgage 11A	-	47.036	119.644	18	25E	23	J	21.2	-	190	L	-	48	-	-	-	-	-	22,25,26
GR040		Farm Man	-	47.018	119.681	18	25E	27	N	21.2	B	228	D	-	36	-	-	-	-	-	6,22,25,26
GR041		Bradshaw	-	47.029	119.691	18	25E	28	B	22.4	B	212	D	-	49	-	-	-	-	-	22,25,26
GR042		Metro Mortgage	-	47.011	119.612	18	26E	31	F	20.4	B	216	D	46	49	-	-	-	-	-	6,26
GR043		Metro Mortgage 20	-	47.007	119.606	18	26E	31	K	22.5	B	215	D	40	49	-	-	-	-	-	22,25,26
GR044		Clarno, Roy	1983/05/20	47.014	119.590	18	26E	32	C	20.5	-	137	-	-	-	-	-	9311	-	12	40
GR045		Sparks, Dave, 6	1983/05/18	47.007	119.542	18	26E	34	K	21.0	-	20	-	-	-	-	-	681	-	8	40
GR046		Shinn, F.	-	47.005	119.529	18	26E	35	SW4	23.2	B	165	D	50	68	-	79	-	-	-	5,26
GR047		Tokunaga, Joe	1983/07/28	47.024	119.271	18	28E	26	F	22.5	-	244	-	-	-	-	-	7570	-	42	40
GR048		American Potato Company	-	47.078	119.222	18	29E	06	K	20.0	F	210	D	-	-	-	-	4542	P	43	44
GR049		American Potato Company, 2	-	47.075	119.222	18	29E	06	Q	21.7	B	205	D	-	47	45	-	-	-	-	22,25,26,33,37,38,45
GR050		Hirai, Tom	1983/07/29	47.160	119.706	19	25E	08	A	23.0	-	220	-	-	-	-	-	9349	-	6	40
GR051		Grant County Land Co.	-	47.095	119.658	19	25E	35	M	20.6	F	223	D	-	-	-	-	7097	P	20	44
GR052		DNR 76-10 East Cole 2	1983/08/29	47.099	119.637	19	26E	36	E	20.0	-	157	-	-	-	-	-	6245	-	76	40
GR053		DNR	-	47.098	119.627	19	26E	36	G	21.1	F	158	D	-	-	-	-	227	P	47	44
GR054		Lauzier, Paul	-	47.101	119.488	19	27E	31	D	25.0	M	233	L	-	56	-	-	-	-	-	22,25,26,33,37
GR055		Moses Lake City 28	-	47.166	119.311	19	28E	04	L	20.9	F	227	D	-	37	-	-	-	-	-	26
GR056	*	Moses Lake City 14	1994/04/07	47.144	119.280	19	28E	15	A	26.7	F	312	D	-	-	-	-	5678	P	85	44
GR057		Moses Lake City 3	1955/08/02	47.133	119.285	19	28E	15	Q	22.2	F	277	D	-	37	-	-	5299	-	8	22,25,26,40
GR058	*	Moses Lake City 7	1960/05/16	47.129	119.274	19	28E	23	D	23.8	B	292	D	-	42	45	-	-	-	4	22,25,26,31,37,40,45
GR059		Moses Lake City 5	-	47.122	119.259	19	28E	23	J	20.0	F	290	D	-	-	-	-	4239	P	31	44
GR060	*	Moses Lake City 10	1994/04/07	47.115	119.291	19	28E	27	C	21.1	F	211	D	-	-	-	-	4353	P	30	44
GR061		Moses Lake City	-	47.111	119.280	19	28E	27	H	20.8	F	319	D	-	-	-	-	7456	P	5	44
GR062		Moses Lake City	-	47.104	119.280	19	28E	27	R	21.4	F	211	D	-	42	-	-	-	-	-	26
GR063	*	Moses Lake City 4	1994/04/07	47.105	119.307	19	28E	28	Q	20.0	F	294	D	-	32	-	-	3785	P	30	6,22,25,26
GR064		Westlake City	-	47.107	119.339	19	28E	29	M	21.1	F	212	D	-	-	-	-	3406	P	1	44
GR065		Moses Lake City 31	-	47.108	119.339	19	28E	29	M	20.6	B	140	D	-	58	-	-	-	-	-	26,37,45
GR066		Fode, Roy, 2	1983/07/29	47.172	119.157	19	29E	03	B	22.5	-	366	-	-	-	-	-	-	-	77	40

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
GR067		Fode 1	-	47.169	119.162	19	29E	03	F	25.4	B	321	D	-	42	-	-	-	-	-	22,25,26
GR068		Fode, Roy, 2	-	47.169	119.162	19	29E	03	F	29.0	B	322	D	-	-	45	-	-	-	-	33,37,45
GR069		Shinn, Frank, 2	-	47.169	119.173	19	29E	04	H	25.7	B	281	D	-	46	45	-	-	-	-	22,25,26,33,37,45
GR070		Abrams	-	47.151	119.173	19	29E	09	J	20.5	S	98	L	-	88	-	-	-	-	-	22,25,26
GR071		Jett-Aero 2	-	47.136	119.131	19	29E	14	J	21.5	B	218	D	-	44	45	-	-	-	-	26,33,37,45
GR072		Masto Farms	-	47.143	119.152	19	29E	15	A	21.1	B	289	D	-	40	45	-	-	-	-	33,37,38,45
GR073		Carnation	-	47.133	119.189	19	29E	16	N	28.8	B	191	D	-	88	-	-	-	-	-	22,25,26
GR074		Richards, Arch W.	1983/07/30	47.169	119.040	19	30E	03	E	22.2	F	335	D	-	-	-	-	8327	P	112	40,44
GR075		Ottmar, Arthur	1983/09/06	47.150	119.099	19	30E	07	L	23.0	-	284	-	-	-	-	-	7570	-	93	40
GR076		American Potato	-	47.140	118.994	19	30E	13	F	20.6	B	202	D	-	38	-	-	-	-	-	6,22,25,26,45
GR077		Radach Farms	1983/05/17	47.136	119.035	19	30E	15	L	24.0	-	360	-	-	-	-	-	-	-	113	40
GR078		Schmidt, Reuben	-	47.136	119.083	19	30E	17	M	21.9	B	225	D	-	44	45	-	-	-	-	22,25,26,33,37,45
GR079		Abram 1/Jett-Aero 1	-	47.129	119.083	19	30E	20	D	25.8	B	311	D	-	44	45	-	-	-	-	22,25,26,33
GR080		Hagman Construction	-	47.212	119.995	20	23E	19	F	28.9	F	299	D	-	-	-	-	1892	P	6	44
GR081	*	Quincy City 1	1955/08/03	47.236	119.855	20	24E	07	R	21.0	F	131	D	-	69	-	-	4353	-	84	22,25,26,40
GR082	*	Wenatchee Apple Land Co.	-	47.228	119.828	20	24E	09	E	20.0	F	105	D	-	-	-	-	5545	P	69	39
GR083		Auburn Packing Co., Inc.	-	47.178	119.764	20	24E	36	N	20.0	F	64	D	-	-	-	-	1514	P	12	44
GR084		Updegrave, V./Neveal, G.	1983/07/29	47.198	119.516	20	26E	26	JorK	21.0	F	161	D	-	-	-	-	5678	P	65	40,44
GR085	*	Moses Lake City 21	1983/07/29	47.183	119.322	20	28E	32	HorJ	22.2	-	217	D	-	-	-	-	3501	-	33	40,41
GR086		Cole, E. B.	-	47.242	119.215	20	29E	07	H	24.0	B	215	D	-	56	45	-	-	-	-	22,25,26,33,37,38,45
GR087		Reinke Farms	-	47.201	119.120	20	29E	25	C	26.3	B	406	D	-	32	45	-	-	-	-	22,25,26,33,37,38,45
GR088		Powers, Tom	-	47.187	119.130	20	29E	35	A	26.6	B	293	D	-	40	45	-	-	-	-	22,25,26,33,37,45
GR089		Claassen, C. C.	-	47.212	119.056	20	30E	21	F	26.4	B	323	D	54	39	-	-	13248	P	72	6,22,25,26,44
GR090		Claassen, Clint	-	47.212	119.051	20	30E	21	G	28.7	B	470	D	-	34	35	-	-	-	-	22,25,26,37,38,45
GR091		Franz, Herb, 2	-	47.216	119.003	20	30E	23	A	21.9	B	219	D	-	43	35	-	-	-	-	22,25,26,33,37,45
GR092		Franz, Herb, 1	-	47.212	119.019	20	30E	23	E	34.9	B	337	D	101	68	35	-	-	-	-	22,25,26,33,37,45
GR093		Jantz, Joe	-	47.190	119.046	20	30E	28	R	28.6	B	181	D	-	91	-	-	-	-	-	22,25,26,45
GR094		Stuckey, J. Jantz	-	47.190	119.046	20	30E	28	R	20.4	B	178	D	-	47	35	-	-	-	-	22,25,26,33,37,45
GR095		Neibaur/West	-	47.180	119.072	20	30E	32	K	21.1	S	383	L	-	-	-	-	-	-	-	33,37,38,45
GR096		Schorzman, Art & L.M. Etienne	-	47.283	119.857	21	24E	30	J	20.0	F	86	D	-	-	-	-	57	P	46	44
GR097		Ephrata City EPW-1	-	47.341	119.583	21	26E	05	Q	32.0	F	-	-	-	-	-	-	-	-	-	24
GR098	*	Ephrata City	1955/07/22	47.330	119.594	21	26E	08	M	30.0	-	305	-	-	-	-	-	2903	-	41	40
GR099		Ephrata City	-	47.330	119.594	21	26E	08	M	30.0	F	305	D	-	59	-	-	-	-	-	22,25,26
GR100	*	Ephrata City 5	1955/07/22	47.326	119.594	21	26E	08	N	28.0	F	137	D	-	116	-	-	2407	-	17	26,40
GR101		Ephrata City	-	47.317	119.524	21	26E	14	L	20.0	F	311	D	-	-	-	-	2725	P	61	44
GR102		Ephrata City 10	1983/09/02	47.320	119.535	21	26E	15	H	25.5	F	564	D	-	-	-	-	10598	P	66	40,44
GR103		Ephrata City	-	47.323	119.556	21	26E	16	A	21.1	F	415	D	-	-	-	-	5299	P	7	44
GR104	*	Ephrata City 2	1955/07/22	47.323	119.562	21	26E	16	B	29.0	-	79	-	-	-	-	-	6056	-	7	40
GR105	*	Ephrata City	1955/07/22	47.305	119.573	21	26E	21	E	25.5	F	188	D	-	72	-	-	-	-	-	22,25,26,40
GR106		Hansen, Charles L.	-	47.349	119.291	21	28E	03	NW4	20.6	F	204	D	-	-	-	-	5678	P	67	44
GR107		Hutterites	1983/09/01	47.343	119.041	21	30E	03	E	22.5	-	408	-	-	-	-	-	-	-	131	40
GR108		—	-	47.325	119.039	21	30E	10	M	30.0	B	640	-	-	28	-	-	-	-	-	22,25
GR109	*	Schell, Harvey, 2	1983/09/01	47.296	119.002	21	30E	23	J	31.1	F	407	D	-	-	-	-	8516	P	117	16,40,44
GR110		Schell, Harvey	-	47.285	119.008	21	30E	26	G	21.4	B	171	D	-	54	35	-	-	-	-	6,22,25,26,45

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
GR111	*	Soap Lake City	1955/07/22	47.385	119.486	22	27E	19	N	27.0	F	142	D	-	106	-	-	-	-	2	22,25,26,40
GR112		King, Bud	-	47.373	119.007	22	30E	26	G	25.0	B	476	D	35	52	-	-	11355	P	110	22,25,26,33,38,44
GR113		Lester, Edna M.	1982/07/27	47.512	119.412	23	27E	10	B	20.5	-	253	-	-	-	-	-	53	-	231	40
GR114		Schafer, Jerry	-	47.463	119.294	23	28E	27	E	22.8	-	196	L	-	60	-	-	-	-	-	22,25,26,38
GR115		DNR	-	47.494	119.188	23	29E	16	D	20.0	F	285	D	-	-	-	-	9830	P	64	44
GR116		—	-	47.647	119.247	25	28E	24	L	29.2	B	189	-	-	91	-	-	-	-	-	22,25
GR117		Dormaier	-	47.640	119.242	25	28E	25	B	23.0	B	177	D	-	62	-	-	-	-	-	6,22,25,26
GR118		Bolyard, James L.	-	47.640	119.268	25	28E	26	C	24.4	F	72	D	-	-	-	-	6813	P	26	44
		GRAYS HARBOR COUNTY																			
GY001		North Beach School District	1980/07/01	47.233	124.207	20	12W	08	P	20.5	-	71	-	-	-	-	-	-	-	-	40
GY002		VO-MO 1	-	47.238	124.204	20	12W	08	-	35.6	B	1067	L	27	-	-	36	-	-	-	4,5
		KING COUNTY																			
KI001S	*	Lester Hot Springs	-	47.207	121.547	20	10E	21	M	46.5	-	-	-	-	-	-	-	19	-	-	19,21,29,32
KI002		Valley View Christian Church	1987/09/22	47.371	122.177	22	05E	28	C	21.5	-	72	-	-	-	-	-	42	-	59	40
KI003S	*	Goldmeyer Hot Springs	-	47.486	121.366	23	11E	14	B	50.0	-	-	-	-	-	-	-	-	-	-	19,29,32
KI004S	*	Scenic Hot Springs	-	47.711	121.140	26	13E	28	Q	47.0	-	-	-	-	-	-	-	-	-	-	18,19,29,32
		KITTITAS COUNTY																			
KS001		USGS/WDOE Burbank Creek	1978/08/16	46.772	120.436	15	19E	22	L	24.3	B	184	D	-	93	-	-	6056	P	12	2,22,25,26,40,42
KS002		Larson Fruit	-	46.768	120.437	15	19E	22	P	31.5	B	393	D	-	50	-	-	-	-	-	2,26,38
KS003		Larson Fruit Co.	-	46.769	120.426	15	19E	22	R	20.0	F	127	D	-	-	-	-	-	N?	A?	42
KS004		Larson Orchards	1983/07/12	46.769	120.426	15	19E	22	R	26.5	-	390	-	-	-	-	-	8706	-	60	40
KS005		Nash, Chet	-	46.746	120.404	15	19E	35	H	20.0	F	21	D	-	-	-	-	163	P	14	42
KS006		Badger/Bollinger	-	46.889	120.391	16	19E	12	K	20.0	B	333	D	48	33	-	46	-	-	-	5,26
KS007	*	USGS/WDOE Umtanum	1978/03/02	46.852	120.458	16	19E	28	C	28.6	B	310	D	-	51	-	-	3634	-	7	22,25,26,38,40
KS008		Orcutt, Leland	-	46.991	120.354	17	20E	05	K	22.8	F	137	D	-	-	-	-	2271	P	34	42
KS009S		Clerf Spring	-	46.999	120.372	17	20E	06	A	20.0	-	-	-	-	-	-	-	4164	-	-	36
KS010		Palelek, Ron	1982/07/29	46.937	119.987	17	23E	30	H	26.0	-	61	-	-	-	-	-	114	-	38	40
KS011	*	Ellensburg City, Mt.Stuart well	1994/04/07	47.009	120.556	18	18E	35	E	20.6	F	272	L	-	32	-	-	3217	P	15	22,25,26,38
KS012		Central Washington University	1994/01/18	47.013	120.525	18	18E	36	B	28.4	B	262	D	-	61	-	-	-	-	-	6,22,25,26
KS013		Clerf, Howard	1983/07/12	47.029	120.305	18	20E	27	A	21.0	F	142	D	-	-	-	-	7570	P	67	40,42
		KLICKITAT COUNTY																			
KT001		Bingen City 2	-	45.719	121.467	03	11E	30	H	20.5	M	88	D	-	-	-	-	-	-	-	5
KT002		Heaney	-	45.701	121.410	03	11E	34	K	21.4	M	104	D	37	-	-	58	-	-	-	5
KT003		Mott, J.	-	45.737	121.182	03	13E	21	B	22.4	M	150	D	29	-	-	53	-	-	-	5
KT004		Daniel, L.	-	45.698	121.235	03	13E	31	M	22.1	M	174	D	26	-	-	42	-	-	-	5
KT005		US Army Corps of Engineers	-	45.724	120.693	03	17E	28	C	22.2	F	238	D	-	-	-	-	2271	P	28	42
KT006		Riggleman Orchards	-	45.864	121.463	04	11E	05	E	21.1	F	279	D	-	-	-	-	738	P	226	42
KT007		Jeleniewski, Tom	-	45.825	121.360	04	12E	19	D	21.1	F	47	D	-	-	-	-	57	P	18	42
KT008		J. Neils Lumber Co.	-	45.821	121.151	04	13E	23	E	27.0	F	168	D	-	-	-	-	303	N	A	28
KT009S	*	Klickitat Mineral Springs	-	45.823	121.114	04	13E	24	A	29.0	-	-	-	-	-	-	-	-	-	-	17,22,32
KT010		DNR 81 Klickitat	-	45.821	121.130	04	13E	24	E	20.1	B	120	D	51	56	-	71	-	-	-	5,26

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
KT011	*	Gas Ice Corp. 10	1966/03/24	45.821	121.114	04	13E	24	H	27.2	F	90	D	-	167	-	-	341	N	A	22,25,26,28,31,40
KT012	*	Gas Ice Corp. 2	1964/10/21	45.824	121.104	04	14E	19	C	23.0	F	61	D	-	177	-	-	-	-	-	22,25,26,31,40
KT013		Barrett, Charles M.	1982/08/25	45.852	120.777	04	16E	11	D	21.5	-	329	-	-	-	-	-	5678	-	-	40
KT014		Barrett	-	45.852	120.777	04	16E	11	D	20.9	-	187	L	-	48	-	-	-	-	-	26
KT015		Goldendale City 1	-	45.827	120.808	04	16E	16	Q	24.6	B	271	D	-	-	-	-	-	-	0	9,38
KT016		Berk Bros.	-	45.894	120.290	05	20E	27	B	23.1	B	276	D	41	43	-	-	-	-	-	6,22,25,26
KT017		DOE Horse Heaven West	-	45.916	120.191	05	21E	16	L	27.6	B	457	D	49	38	-	78	-	-	-	5,26,37
KT018		Matsen	-	45.894	120.035	05	22E	27	A	28.2	B	321	D	42	48	-	-	-	-	-	6,22,25,26,33
KT019		Matsen, A. M.	-	45.894	120.035	05	22E	27	A	22.2	F	262	D	-	-	-	-	6836	P	22	42
KT020		Matsen, A. M.	-	45.894	120.035	05	22E	27	A	21.1	F	236	D	-	-	-	-	3406	P	17	42
KT021		Rinta, John, 1	1983/07/19	45.883	120.045	05	22E	27	P	24.0	-	248	-	-	-	-	-	9463	-	35	40
KT022		Powers, Tom	-	45.915	119.870	05	23E	13	J	27.2	B	330	D	-	43	-	-	-	-	-	22,25,26,38
KT023		Hiner, Gene	1982/03/31	45.911	119.869	05	23E	13	R	25.0	-	442	-	-	-	-	-	10674	-	39	40
KT024		McBride, Clarence	-	45.893	119.968	05	23E	29	D	25.5	B	267	D	-	51	-	-	8024	N	A	22,25,26,38
KT025		McBride Ranch, 2	1983/07/19	45.893	119.989	05	23E	30	D	24.0	-	257	-	-	-	-	-	17600	-	38	40
KT026S	*	Fish Hatchery Warm Spring	-	46.039	121.179	06	13E	04	H	23.8	-	-	-	-	-	-	-	-	-	-	11
KT027	*	Smith, G.	1970/12/11	46.014	119.905	06	23E	11	N	23.3	F	272	D	-	37	-	-	-	-	A	22,25,26,40,42
KT028		Andrews, Robert	1970/12/11	46.014	119.894	06	23E	11	Q	23.5	F	272	D	-	-	-	-	9462	N	A	9,40
KT029	*	Smith, George	-	46.014	119.894	06	23E	11	Q	21.0	F	204	D	-	44	-	-	-	-	-	22,25,26,31
KT030	*	—	1962/04/30	46.014	119.895	06	23E	11	Q	21.0	-	63	-	-	-	-	-	-	-	-	40
KT031	*	Andrews/Smith	1970/10/22	46.006	119.910	06	23E	15	H	21.0	F	193	L	-	47	-	-	1438	-	0	22,25,26,40
KT032		Andrews	-	46.006	119.910	06	23E	15	H	25.2	S	275	L	-	48	-	-	-	-	-	22,25,26
KT033		DNR Feezell	-	45.999	119.942	06	23E	16	P	22.0	F	290	D	-	-	-	-	10787	P	12	9
KT034		DNR	-	45.999	119.932	06	23E	16	R	22.2	F	290	D	-	-	-	-	7570	P	20	42
KT035		Andrews, Robert	-	45.988	119.911	06	23E	22	J	23.0	B	318	D	-	35	-	-	-	-	-	26,38
KT036		Andrews, Robert	1983/07/19	45.995	119.874	06	23E	24	B	24.5	-	294	-	-	-	-	-	15140	-	44	40
KT037		DNR Mercer N.	-	45.962	119.879	06	23E	36	F	20.8	B	190	D	49	41	-	78	-	-	-	5,26
		LEWIS COUNTY																			
LE001		SU 8	-	46.545	122.847	12	01W	07	A	25.2	B	565	D	33	30	-	36	-	-	-	4,5,22,25,26
LE002		SU 11	-	46.538	122.826	12	01W	08	J	21.3	B	409	D	35	33	-	37	-	-	-	4,5,22,25,26
LE003		SU 12	-	46.538	122.826	12	01W	08	J	25.7	B	578	D	27	31	-	31	-	-	-	4,5,22,25,26
LE004		SU 14	-	46.538	122.836	12	01W	08	L	25.6	B	578	L	34	-	-	36	-	-	-	4,5
LE005		SU 37	-	46.534	122.841	12	01W	08	N	24.7	B	540	D	34	31	-	36	-	-	-	4,5,22,25,26
LE006		SU 4	-	46.535	122.820	12	01W	09	N	28.8	B	760	L	33	-	-	36	-	-	-	4,5
LE007		SU 902	-	46.527	122.826	12	01W	17	H	31.2	B	847	L	33	-	-	36	-	-	-	4,5
LE008		Longview 10	-	46.525	122.833	12	01W	17	-	30.0	-	792	L	26	27	-	-	-	-	-	22,25,26
LE009S		Packwood Hot Spring	-	46.579	121.705	13	09E	32	-	38.0	-	-	-	-	-	-	-	-	-	-	17,22,32
LE010S	*	Ohanapecosh Hot Springs(USGS)	-	46.737	121.561	14	10E	04	C	50.0	-	-	-	-	-	-	-	110	-	-	29
		LINCOLN COUNTY																			
LI001	*	Odessa Oil Test Piezometer A	1972/09/13	47.327	118.913	21	31E	10	M	30.5	-	224	-	-	-	-	-	-	-	71	40
LI002		Basalt Explorer	-	47.326	118.913	21	31E	10	M	65.8	S	1343	L	42	40	38	70	-	-	-	4,5,22,25,26,33,37,38,45
LI003		Schafer, Jerry	-	47.299	118.885	21	31E	23	F	21.0	B	293	D	-	-	35	-	-	-	-	45

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
LI004		Schibel, Don	-	47.303	118.864	21	31E	24	C	20.6	B	194	D	-	-	35	-	-	-	-	45
LI005		Sahible	-	47.287	118.860	21	31E	25	B	28.3	B	195	D	-	84	-	-	-	-	-	22,25,26
LI006		Kissler, Bob	-	47.277	118.960	21	31E	30	R	23.8	B	264	D	-	41	35	-	-	-	-	22,25,26,37,45
LI007		Kissler	-	47.273	118.957	21	31E	32	D	21.1	B	211	D	-	42	-	-	-	-	-	5,6,22,25,26
LI008		Schaffer, Jerry	-	47.301	118.755	21	32E	23	F	24.1	B	299	D	-	41	40	-	-	-	-	22,25,26,37,45
LI009		Fink, Reuben	1983/06/03	47.274	118.840	21	32E	31	C	20.0	-	227	-	-	-	-	-	3785	-	82	40
LI010		Kramer, Robert A.	1983/08/04	47.294	118.539	21	34E	21	K	21.0	-	225	-	-	-	-	-	4164	-	112	40
LI011		Hardung, Joe	-	47.275	118.546	21	34E	33	C	24.9	S	253	L	-	55	-	-	-	-	-	22,25,26,37
LI012		Weizel, LeeRoy	-	47.274	118.511	21	34E	34	A	20.0	F	234	D	-	-	-	-	7229	P	124	44
LI013		Weizel, L. R.	-	47.270	118.511	21	34E	34	H	22.2	F	197	D	-	-	-	-	2650	P	60	44
LI014		Iverson	-	47.329	118.449	21	35E	07	G	20.1	B	128	D	-	65	-	-	-	-	-	6,22,25,26
LI015	*	Sprague City	1983/08/02	47.296	117.985	21	38E	23	L	21.4	F	153	D	-	-	-	-	3217	-	42	7,15,40
LI016		Jantz, Merlin K.	1983/08/05	47.395	118.696	22	33E	17	N	21.5	-	188	-	-	-	-	-	-	-	61	40
LI017		Weishaar	-	47.514	118.787	23	32E	04	J	28.7	B	212	D	-	83	-	-	-	-	-	22,25,26
LI018		Weishaar	-	47.488	118.814	23	32E	17	G	21.2	B	206	D	37	49	-	-	-	-	-	22,25,26
LI019		Zagelow	-	47.499	118.637	23	33E	10	J	21.6	S	232	L	-	46	-	-	-	-	-	22,25,26
LI020		USGS/WDOE Almira	-	47.577	118.933	24	31E	16	E	21.8	B	227	D	48	37	-	-	-	-	-	5,6,22,25,26
LI021		Schmierer, Alvin	-	47.554	118.627	24	33E	23	P	27.0	B	310	D	-	48	-	-	-	-	-	22,25,26,38
LI022		Nealey, Darwin	-	47.538	118.583	24	34E	30	P	21.0	B	231	D	-	43	-	-	-	-	-	26,37
LI023		USGS/WDOE Davenport	-	47.578	118.272	24	36E	16	A	21.9	B	225	D	59	55	-	93	-	-	-	5,26
LI024	*	Wilbur SEC	1983/08/31	47.614	118.754	25	32E	35	P	21.3	F	348	D	-	-	-	-	-	-	79	7,15,40
LI025	*	Davenport City 6	1983/08/10	47.648	118.153	25	37E	21	L	24.0	F	297	D	-	-	-	-	8327	P	67	16,40,44
LI026		Davenport City 5	-	47.648	118.154	25	37E	21	L	24.0	S	227	L	-	57	-	-	-	-	-	22,25,26
LI027		Reardan City	-	47.671	117.880	25	39E	15	D	20.0	S	259	L	28	35	-	-	-	-	-	26,37
LI028		Washington Water Power Co.	-	47.870	118.480	27	34E	01	E	25.8	M	151	D	-	-	-	-	-	-	-	5
LI029		DDH-SF15	-	47.819	118.132	27	37E	22	P	31.7	M	258	D	35	-	-	-	-	-	-	5
LI030		Taylor	-	47.816	118.099	27	37E	26	A	23.8	-	358	D	40	36	-	-	-	-	-	5,26
		OKANOGAN COUNTY																			
OK001		DOE TST3	-	48.151	119.675	31	25E	27	Q	22.7	M	44	D	-	-	-	-	-	-	-	5
OK002		Ayres, Bob	-	48.589	119.567	36	26E	28	K	21.1	F	12	D	-	-	-	-	568	P	7	42
OK003		Gildroy	-	48.680	119.498	37	26E	25	NE4	20.6	M	134	D	-	-	-	-	-	-	-	5
OK004S		Polson Lake	-	48.819	119.451	38	27E	05	J	50.0	-	-	-	-	-	-	-	-	-	-	17,22
OK005		Zissel, Charles	-	48.794	119.256	38	28E	14	H	20.0	F	9	D	-	-	-	-	38	P	2	42
OK006		Zosel, Ralph	-	48.962	119.409	40	27E	15	R	20.0	F	9	D	-	-	-	-	19	P	4	42
OK007S		Hot Lake	-	48.973	119.476	40	27E	18	A	50.0	-	-	-	-	-	-	-	-	-	-	17,22
		PIERCE COUNTY																			
PI001S	*	Longmire Springs	-	46.752	121.813	15	08E	29	R	22.0	-	-	-	-	-	-	-	2	-	-	14
PI002S		Mount Rainier Fumaroles	-	46.855	121.756	16	08E	23	K	72.0	-	-	-	-	-	-	-	-	-	-	17,22
PI003S	*	Spring	-	47.114	122.597	19	02E	19	Q	24.4	-	-	-	-	-	-	-	-	-	-	15
		SKAMANIA COUNTY																			
SK001S	*	Bonneville Hot Springs	-	45.656	121.958	02	07E	16	M	36.3	-	-	-	-	-	-	-	80	-	-	17,18,19,22,32

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
SK002S	*	Rock Creek Hot Springs	-	45.721	121.926	03	07E	27	B	33.5	-	-	-	-	-	-	-	-	-	-	18
SK003		North Bonneville 2	-	45.652	121.960	02	07E	39	E	35.5	B	198	D	143	131	-	190	-	-	-	5,26
SK004		North Bonneville 3	-	45.651	121.958	02	07E	39	K	26.4	B	155	D	91	106	-	120	-	-	-	5,26
SK005		Bonneville drill hole 2	-	45.646	121.955	02	07E	39	Q	28.2	F	-	-	-	-	-	-	-	-	-	18
SK006S		Shiperds Hot Springs	-	45.739	121.805	03	08E	21	C	42.0	-	-	-	-	-	-	-	100	-	-	17,22
SK007		DNR 81-Carson	-	45.735	121.805	03	08E	21	F	27.8	B	113	D	168	166	-	265	-	-	-	5,26
SK008S	*	St. Martin Hot Springs	-	45.728	121.794	03	08E	21	R	49.0	-	-	-	-	-	-	-	-	-	-	14,19,21,29,32
SK009		Green Life 1	-	45.703	121.854	03	08E	31	M	41.0	B	914	D	25	33	-	-	-	-	-	8
SK010S		Collins Hot Springs	-	45.698	121.719	03	09E	31	Q	50.0	-	-	-	-	-	-	-	-	-	-	17,22,32
SK011		Trout Creek Drill Hole	-	45.812	121.954	04	07E	21	P	36.3	B	357	D	89	-	-	141	-	-	-	1,5
SK012S		Mount St. Helens lava dome	-	46.200	122.187	08	05E	09	A	88.0	-	-	-	-	-	-	-	-	-	-	17,22
SK013S		Orr Creek Warm Springs	-	46.344	121.609	10	10E	19	NE4	22.0	-	-	-	-	-	-	-	100	-	-	17,22
		SNOHOMISH COUNTY																			
SN002S	*	Kennedy Hot Springs(USGS)	-	48.119	121.193	30	12E	01	H	38.0	-	-	-	-	-	-	-	-	-	-	29,32
SN003S	*	Gamma Hot Spring	-	48.151	121.062	31	13E	36	D	65.0	-	-	-	-	-	-	-	-	-	-	19,29
SN004S	*	Sulphur Creek Hot Springs	-	48.255	121.180	32	13E	19	C	37.0	-	-	-	-	-	-	-	-	-	-	19,21
		SPOKANE COUNTY																			
SP001		Cheney City 4	-	47.487	117.582	23	41E	13	E	22.2	F	651	D	-	-	-	-	-	-	82	44
SP002		Cheney City 5	-	47.480	117.593	23	41E	14	Q	33.1	B	651	D	-	34	-	-	5488	P	72	22,25,26,38,44
SP003		Cheney City	-	47.481	117.593	23	41E	14	Q	29.1	-	341	L	-	56	-	-	-	-	-	22,25,26
SP004		Anderberg, Gary	-	47.505	117.397	23	43E	08	B	20.0	F	154	D	-	-	-	-	757	P	55	44
SP005	*	US Government	1958/07/22	47.556	117.749	24	40E	22	L	20.5	-	105	-	-	-	-	-	-	-	-	40
SP006	*	Fairchild AFB, 2	1958/07/22	47.595	117.628	24	41E	03	N	20.5	-	123	-	-	-	-	-	3785	-	3	40
SP007	*	US Government	1958/07/22	47.660	117.714	25	40E	14	R	20.0	-	109	-	-	-	-	-	-	-	-	40
SP008	*	US Government	1958/07/22	47.616	117.746	25	40E	34	P	21.0	-	60	-	-	-	-	-	-	-	-	40
SP009	*	US Government	1958/07/23	47.687	117.561	25	41E	01	R	20.0	-	127	-	-	-	-	-	-	-	-	40
SP010	*	US Army, Fort George Wright	1958/07/22	47.680	117.472	25	42E	11	E	20.0	-	18	-	-	-	-	-	5678	-	5	40
SP011	*	Washington Water Power Co.,1-3	1977/10/12	47.669	117.306	25	43E	13	A	21.0	-	34	-	-	-	-	-	2460	-	18	40
SP012	*	US Air Force	1958/07/22	47.732	117.536	26	42E	20	N	20.0	-	49	-	-	-	-	-	-	-	-	40
SP013		Fossen & Gisselburg	-	47.708	117.512	26	42E	33	W2	20.0	F	163	D	-	-	-	-	189	P	128	44
		WALLA WALLA COUNTY																			
WA001		Byerly, Richard	1983/05/16	46.024	118.749	06	32E	01	Q	21.5	-	351	-	-	-	-	-	-	-	-	40
WA002S		Warm Spr. Canyon Warm Spr.	-	46.024	118.772	06	32E	02	Q	22.0	-	-	-	-	-	-	-	-	-	-	32
WA003S		Emmett Lynch warm spring	-	46.020	118.770	06	32E	11	B	22.2	-	-	-	-	-	-	-	189	-	-	30
WA004		Fulgham	-	46.026	118.624	06	33E	01	K	31.8	B	305	D	69	67	-	73	2271	P	14	4,5,22,25,26,44
WA005		McDole, Joe	-	46.024	118.723	06	33E	06	R	25.6	F	398	D	-	-	-	-	1552	P	26	44
WA006		Demaris, Eugene & Leland	-	46.012	118.723	06	33E	07	J	20.0	F	46	D	-	-	-	-	1325	P	7 44	
WA007		Fulgham	-	46.017	118.673	06	33E	10	NW4	31.8	B	305	D	70	67	-	-	-	-	-	23
WA008		Herman, J.	-	46.005	118.697	06	33E	16	D	20.0	F	222	D	-	-	-	-	1287	P	5	44
WA009		Miller	-	46.033	118.520	06	34E	02	B	25.1	-	175	L	-	75	-	-	-	-	-	22,25,26
WA010		Bing/Frost Ranch Ltd.	-	46.026	118.577	06	34E	05	J	25.6	F	366	D	-	-	-	-	5867	P	70	44

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
WA011		Chvatal, Ed.	-	46.033	118.603	06	34E	06	B	36.0	B	484	D	-	48	-	-	-	-	-	22,25,26,33,38
WA012		Chvatal, Ed.	-	46.022	118.613	06	34E	06	N	37.8	F	544	D	-	-	-	-	2650	P	32	44
WA013		—	-	46.018	118.608	06	34E	07	C	40.2	B	407	D	-	64	-	-	-	-	-	6
WA014		Gilbert-Merry	-	46.007	118.608	06	34E	07	P	40.7	B	407	D	78	71	-	-	-	-	-	22,25,26
WA015		Thomas,Sherman/dbaLowden Ranch	1983/08/13	46.008	118.598	06	34E	07	R	45.0	F	506	D	-	-	-	-	3785	P	42	40,44
WA016		Bing/Frost Ranch Ltd.	-	46.018	118.582	06	34E	08	B	40.0	F	366	D	-	-	-	-	4258	P	74	44
WA017		Welch, E. C.	-	46.022	118.369	06	35E	01	R	20.0	F	195	D	-	-	-	-	2971	P	18	44
WA018		Burlingame, E. C.	-	46.022	118.426	06	35E	03	N	20.0	F	416	D	-	-	-	-	38	P	10	30
WA019		Hart, Harley D.	-	46.018	118.453	06	35E	08	A	20.0	F	21	D	-	-	-	-	757	P	3	44
WA020	*	Jaussand, Art	1958/08/01	46.008	118.421	06	35E	10	P	25.0	F	350	D	-	37	-	-	7570	-	50	22,25,26,30,31,40,41
WA021		McAuslan	-	46.015	118.369	06	35E	12	H	21.7	F	214	D	-	42	-	-	757	P	0	22,25,26,30
WA022		Wilson, I. E.	-	46.011	118.380	06	35E	12	L	20.0	F	381	D	-	-	-	-	1703	P	18	44
WA023		Estes or Durand	-	46.006	118.383	06	35E	12	N	24.4	F	180	D	-	56	-	-	1136	P	31	22,25,26,30,31
WA024		Thomas, George	-	46.009	118.372	06	35E	12	R	22.2	F	194	D	-	-	-	-	2271	P	11	44
WA025		Dept. Ecology	-	46.003	118.474	06	35E	18	A	20.3	-	155	L	-	54	-	-	-	-	-	22,25,26
WA026		Dept. Ecology	-	46.004	118.473	06	35E	18	A	36.1	B	396	D	42	61	-	-	-	-	-	22,25,26
WA027	*	WDOE Tst./Obs., Piezometer A	1973/07/12	46.004	118.474	06	35E	18	A	25.5	-	75	-	-	-	-	-	-	-	13	40
WA028		College Place	-	46.004	118.474	06	35E	18	A	26.1	B	399	D	46	35	-	-	-	-	-	26
WA029		—	-	46.004	118.474	06	35E	18	A	21.3	B	399	D	-	46	-	-	-	-	-	6
WA030		Walla Walla	-	46.004	118.474	06	35E	18	A	21.3	-	178	L	-	52	-	-	-	-	-	22,25,26
WA031		Crass, Billy J.	-	46.030	118.323	06	36E	04	E	23.3	F	240	D	-	-	-	-	2725	P	78	44
WA032		Hanlon, Terry D.	-	46.022	118.322	06	36E	04	N	22.2	F	195	D	-	-	-	-	57	P	88	44
WA033		Grieb, Bert	-	46.022	118.322	06	36E	04	N	21.1	F	252	D	-	-	-	-	1904	P	88	44
WA034		Richardson, Ross & Zella L.	-	46.026	118.342	06	36E	05	M	21.4	F	188	D	-	48	-	-	1703	P	15	22,25,26,30,44
WA035		Baker	-	46.022	118.328	06	36E	05	R	27.2	F	554	D	-	36	-	-	5980	P	38	22,25,26,30,44
WA036		Courtney, Jess	-	46.026	118.363	06	36E	06	M	22.0	F	186	D	-	54	-	-	1892	P	2	22,25,26,30
WA037		Brown, Lyle R.	-	46.022	118.363	06	36E	06	N	21.7	F	189	D	-	-	-	-	2975	P	3	44
WA038		Barnett, C. W.	-	46.023	118.348	06	36E	06	R	20.0	F	248	D	-	-	-	-	757	P	57	44
WA039		Border, Lester A.	-	46.018	118.353	06	36E	07	B	20.0	F	168	D	-	-	-	-	757	P	33	44
WA040		Ruzicka or Prusia	-	46.018	118.363	06	36E	07	D	22.2	F	171	D	-	58	-	-	1136	P	4	22,25,26,30
WA041		Bossini, Louis	1982/06/23	46.015	118.363	06	36E	07	E	20.0	-	184	-	-	-	-	-	1514	-	37	40
WA042		Logan, John D.	-	46.011	118.363	06	36E	07	M	20.0	F	299	D	-	-	-	-	2176	P	2	44
WA043		Baker	-	46.011	118.315	06	36E	09	L	22.0	F	352	D	-	28	-	-	4542	P	32	22,25,26,30,31
WA044	*	Baker & Baker	-	46.007	118.315	06	36E	09	P	23.2	F	628	D	-	-	-	-	-	P	35	30,31
WA045		OR WA RR & Nav. Co	-	46.101	118.911	07	31E	10	J	22.8	F	123	D	-	-	-	-	659	P	12	44
WA046		Martin, William C.	-	46.120	118.757	07	32E	01	NW4	20.0	F	34	D	-	-	-	-	76	P	15	44
WA047		Pac. Gas Trans. Co., 1	-	46.054	118.843	07	32E	29	N	26.7	F	195	D	-	-	-	-	57	P	47	44
WA048		Pac. Gas Trans. Co., 2	-	46.054	118.843	07	32E	29	N	21.1	F	145	D	-	-	-	-	170	P	47	44
WA049	*	Byerley Farm, Inc.	1971/09/20	46.039	118.747	07	32E	36	QorR	24.0	F	310	D	-	39	-	-	7570	P	24	22,25,26,40,44
WA050		Taggart	-	46.066	118.623	07	33E	24	Q	23.2	-	434	L	-	26	-	-	-	-	-	22,25,26
WA051		Harpe, William	-	46.059	118.639	07	33E	26	H	24.4	F	335	D	-	-	-	-	3406	P	47	44
WA052		Harpe, William	-	46.052	118.640	07	33E	26	R	23.3	F	284	D	-	-	-	-	1355	P	35	44
WA053		L. W. Weidert Farms, Inc.	-	46.053	118.738	07	33E	30	N	25.6	F	276	D	-	-	-	-	6056	P	81	44

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
WA054		McDole, Joseph and Amalie	-	46.053	118.723	07	33E	30	R	22.8	F	280	D	-	-	-	-	1892	P	51	44
WA055		McDole Farms	-	46.042	118.723	07	33E	31	J	27.8	F	412	D	-	-	-	-	-	-	-	44
WA056		McDole, Joe, 3	-	46.042	118.728	07	33E	31	K	27.7	B	269	D	-	58	-	-	-	-	34	22,25,26,37,44
WA057		Fulgham, Hilda M.	-	46.041	118.644	07	33E	35	K	30.6	F	310	D	-	-	-	-	2839	P	9	44
WA058		Baker, Charles	-	46.051	118.510	07	34E	25	N	20.0	F	336	D	-	-	-	-	1703	P	6	30
WA059		Kelly, Howard J.	-	46.042	118.501	07	34E	36	-	26.7	F	37	D	-	-	-	-	568	P	8	44
WA060		Washington State Penitentiary	-	46.081	118.369	07	35E	13	R	33.3	F	493	D	-	-	-	-	3002	P	125	44
WA061		—	-	46.069	118.406	07	35E	23	M	20.0	B	175	-	-	46	-	-	-	-	-	22,25
WA062		McKinnon, Jack C.	-	46.069	118.406	07	35E	23	M	20.0	F	49	D	-	-	-	-	511	P	7	44
WA063	*	Bonneville Power Admin.	1946/11/21	46.069	118.406	07	35E	23	M	20.0	F	157	D	-	51	-	-	1294	P	18	22,25,26,30,31,40,41
WA064		Hydro Irrigation	-	46.067	118.393	07	35E	23	SE4	20.6	F	174	D	-	-	-	-	3028	P	46	44
WA065		Gluck/BPA	-	46.069	118.385	07	35E	24	M	20.0	B	175	D	-	46	-	-	-	-	-	26
WA066		Arbini, James	-	46.059	118.379	07	35E	25	F	20.0	F	207	D	-	39	-	-	1136	P	5	22,25,26,30
WA067		Columbo	-	46.052	118.379	07	35E	25	P	20.6	F	188	D	-	42	-	-	1325	P	3	22,25,26,30
WA068		Whitman Nat'l. Monument	-	46.044	118.463	07	35E	32	F	25.6	F	230	D	-	-	-	-	291	P	11	44
WA069		Walla Walla College	-	46.044	118.439	07	35E	33	G	21.1	F	232	D	-	-	-	-	3974	P	14	44
WA070		Walla Walla College Farm	-	46.044	118.434	07	35E	33	GorH	22.8	F	305	D	-	-	-	-	5893	P	52	44
WA071	*	Walla Walla College	-	46.044	118.432	07	35E	33	H	24.0	F	217	L	-	55	-	-	-	-	-	22,25,26,31
WA072		Walla Walla College Farm	-	46.041	118.442	07	35E	33	L	21.1	F	306	D	-	-	-	-	4164	P	41	44
WA073		DNR Christian	-	46.040	118.421	07	35E	34	L	24.0	S	219	L	47	55	-	-	-	-	-	22,25,26
WA074		State of Washington	-	46.037	118.426	07	35E	34	N	21.1	F	222	D	-	-	-	-	3047	P	30	44
WA075		Walla Walla College	-	46.048	118.390	07	35E	35	A	20.5	B	310	D	27	27	-	-	-	-	-	5,22,25,26
WA076		Walla Walla College	-	46.048	118.390	07	35E	35	A	20.0	F	183	D	-	-	-	-	-	N	A	30
WA077		Walla Walla College Farm	-	46.048	118.400	07	35E	35	C	20.0	F	245	D	-	-	-	-	1173	P	28	44
WA078		Manuel or Magnoni	-	46.047	118.379	07	35E	36	C	20.6	F	195	D	-	41	-	-	378	P	A	22,25,26,30
WA079	*	College Place	1972/05/24	46.044	118.379	07	35E	36	F	20.5	-	213	-	-	-	-	-	1703	-	11	40
WA080	*	College Place City	1960/05/24	46.044	118.379	07	35E	36	F	20.0	-	216	-	-	-	-	-	2801	-	-	40
WA081		Richards	-	46.043	118.379	07	35E	36	F	21.1	F	186	D	-	48	-	-	-	-	A	22,25,26,30
WA082	*	College Place	-	46.044	118.379	07	35E	36	F	20.4	F	247	D	-	34	-	-	568	P	19	22,25,26,30
WA083	*	College Place	-	46.044	118.379	07	35E	36	F	20.6	F	216	D	-	37	-	-	6813	P	A	22,25,26,30
WA084		Stone Creek Sanitarium	-	46.037	118.372	07	35E	36	R	21.1	F	189	D	-	48	-	-	568	P	16	22,25,26,30
WA085		Foundation FM, 3	1982/06/22	46.106	118.291	07	36E	10	B	20.5	-	284	-	-	-	-	-	-	-	-	40
WA086	*	Walla Walla Comm. Coll.	1994/01/20	46.080	118.275	07	36E	14	P	13.0	F	407	L	-	36	-	-	4542	P	-	22,25,26,37
WA087		Walla Walla Golf Course	-	46.084	118.337	07	36E	17	L	39.1	B	716	D	-	36	-	-	-	-	-	6,22,25,26
WA088		Walla Walla Golf Course	-	46.084	118.337	07	36E	17	L	20.9	S	225	L	35	40	-	56	-	-	-	5,22,25,26
WA089		Blue Mountain Asphalt Co.	-	46.073	118.364	07	36E	19	E	20.0	F	48	D	-	-	-	-	114	P	5	44
WA090		D & K Farms	-	46.073	118.358	07	36E	19	F	30.2	B	471	D	-	38	-	-	-	-	-	6,22,25,26
WA091		DKFF	-	46.073	118.358	07	36E	19	F	20.6	B	250	D	-	-	-	-	-	-	-	5
WA092		General Foods Corp.	-	46.073	118.358	07	36E	19	F	24.4	F	343	D	-	-	-	-	3785	P	18	30
WA093		D & K Frozen Foods, Inc.	-	46.073	118.358	07	36E	19	F	21.7	F	69	D	-	-	-	-	643	P	9	44
WA094		Rodgers Can.	-	46.066	118.348	07	36E	19	R	28.8	F	485	D	-	33	-	-	4164	P	29	22,25,26,30
WA095	*	Rogers Canning	1972/05/24	46.066	118.348	07	36E	19	R	26.5	-	485	-	-	-	-	-	4277	-	29	40
WA096		Whitman College	-	46.073	118.327	07	36E	20	H	22.2	F	366	D	-	27	-	-	2680	P	20	22,25,26,44
WA097	*	Whitman College	1972/05/24	46.073	118.327	07	36E	20	H	23.0	-	366	-	-	-	-	-	2680	-	20	40

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
WA098	*	Walla Walla City 5	1960/07/29	46.051	118.306	07	36E	28	R	23.5	F	332	D	-	48	-	-	6510	-	40	22,25,26,40,41,44
WA099		Walla Walla Country Club	-	46.040	118.348	07	36E	31	J	21.1	F	523	D	-	-	-	-	5678	P	32	30
WA100		Chisholm, J. J.	-	46.037	118.364	07	36E	31	N	20.0	F	183	D	-	-	-	-	1514	P	A	30
WA101		Walla Walla City 7	-	46.048	118.321	07	36E	33	D	30.2	B	425	D	75	40	-	53	-	-	-	4,5,6,22,25,26
WA102		Walla Walla School Dist. 140	-	46.044	118.316	07	36E	33	F	22.2	F	287	D	-	-	-	-	2082	P	40	44
WA103		Smith, Jerry D.	-	46.040	118.306	07	36E	33	J	20.6	F	183	D	-	-	-	-	783	P	39	44
WA104		Peterson, Ross	-	46.177	118.900	08	31E	14	F	24.5	-	336	L	37	37	-	-	-	-	-	22,25,26,37
WA105		Ireland, Ken	1982/08/30	46.155	118.932	08	31E	21	R	22.0	-	38	-	-	-	-	-	114	-	8	40
WA106		McGregor	1970/09/09	46.133	118.912	08	31E	34	H	25.4	F	146	D	-	92	-	-	-	-	-	22,25,26,40
WA107		McGregor Feedlot	-	46.137	118.901	08	31E	35	C	25.6	F	154	D	-	-	-	-	3785	P	46	44
WA108		Gluck, Bill, 2	-	46.153	118.681	08	33E	21	R	31.0	B	237	D	-	-	-	-	-	-	-	37
WA109		Gluck	-	46.155	118.683	08	33E	21	SE4	24.1	B	290	D	38	42	-	60	-	-	-	4,5,22,25,26
WA110		Walla Walla College	-	46.135	118.390	08	35E	35	A	20.5	B	310	L	27	-	-	-	-	-	-	4
WA111		Power	-	46.268	118.753	09	32E	13	C	22.2	B	215	D	35	47	-	55	-	-	-	4,5,26
WA112		Union Pacific RR	-	46.329	118.744	10	32E	24	R	22.2	F	64	D	-	-	-	-	288	P	44	44
WA113		Grote	-	46.426	118.394	11	35E	14	Q	28.4	-	283	L	-	58	-	-	-	-	-	22,25,26
WA114		Western Farm Service	-	46.409	118.446	11	35E	28	D	25.0	F	305	D	-	-	-	-	378	P	237	44
WA115		Anderson, Don	-	46.494	118.264	12	36E	26	H	22.5	-	182	L	-	58	-	-	-	-	-	22,25,26,37
		WHATCOM COUNTY																			
WH001S		Dorr Fumarole Field	-	48.788	121.802	38	08E	17	D	90.0	-	-	-	-	-	-	-	-	-	-	17,22
WH002S		Sherman Crater Fumaroles	-	48.770	121.813	38	08E	19	G	130.0	-	-	-	-	-	-	-	-	-	-	17,22
WH003S	*	Baker Hot Springs	-	48.764	121.670	38	09E	20	M	44.0	-	-	-	-	-	-	-	-	-	-	18,19,21,29
WH004		Baker Hot Springs drill hole	-	48.764	121.670	38	09E	20	M	47.9	F	141	D	200	-	-	-	38	N	A	20
		WHITMAN COUNTY																			
WT001		Moehrle, Bill	-	46.505	117.139	12	45E	23	M	20.0	F	79	D	-	-	-	-	30	P	64	44
WT002		Dubois, L. D.	1983/03/29	46.617	118.149	13	37E	15	A	21.5	-	259	-	-	-	-	-	-	-	91	40
WT003		Peterson, Crump, & Kimball	1983/08/26	46.627	117.976	13	39E	07	E	26.5	-	192	-	-	-	-	-	23	-	152	40
WT004		Roy Davis Estate	-	46.619	117.215	13	44E	12	Q	20.0	F	56	D	-	-	-	-	57	P	24	44
WT005		Pullman City	-	46.733	117.166	14	45E	05	B	20.0	F	50	L	-	160	-	-	-	-	-	22,25,26
WT006	*	Pullman City	-	46.733	117.177	14	45E	05	D	20.0	F	50	D	-	-	-	-	-	-	-	31
WT007		Pullman City	-	46.733	117.177	14	45E	05	D	21.0	F	51	L	-	176	-	-	-	-	-	22,25,26,31
WT008		Steiger, Alan	-	46.761	117.504	15	42E	27	H	20.0	F	95	D	-	-	-	-	231	P	63	44
WT009	*	Pullman City	-	46.737	117.177	15	45E	32	N	20.0	-	70	D	-	-	-	-	-	-	-	31
WT010	*	Colfax City, Clay St. well	-	46.896	117.357	16	43E	11	G	23.5	F	183	L	-	77	-	-	-	-	-	22,25,26,31
WT011		Colfax City 4	1983/08/25	46.874	117.368	16	43E	14	N	21.0	-	229	-	-	-	-	-	2120	-	104	40
WT012		Schlomer, John G.	-	46.957	117.878	17	39E	22	AorB	22.2	F	136	D	-	-	-	-	57	P	40	44
WT013		Storment, Daryl	-	46.936	117.859	17	39E	26	K	22.2	F	117	D	-	-	-	-	34	P	-	44
WT014		Colfax City, E. Glenwood well	-	46.930	117.279	17	44E	32	A	21.0	-	-	-	-	-	-	-	-	-	-	31
WT015		Tekoa City	-	47.224	117.072	20	45E	24?	B?	24.4	F	54	D	-	-	-	-	-	-	-	27
		YAKIMA COUNTY																			
YA001		Sharp, Jack	-	46.082	120.017	07	22E	23	B	23.4	B	300	D	35	38	-	-	-	-	-	22,25,26,33

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m^2)	Flow (l/m)	Flow type	S.W.L. (m)	References
YA002S		Mount Adams Fumaroles	-	46.203	121.493	08	10E	01	Q	50.0	-	-	-	-	-	-	-	-	-	-	17,22
YA003		Mabton	-	46.209	120.000	08	22E	01	G	23.0	B	329	D	36	33	-	-	-	-	-	2,22,25,26
YA004		Flower	-	46.191	120.013	08	22E	11	J	22.0	B	166	D	43	62	-	-	4928	P	-	2,22,25,26,37
YA005		Boast Farms	-	46.169	120.049	08	22E	22	D	20.0	F	266	D	-	-	-	-	-	-	82	42
YA006		Johnson, Ray Y.	-	46.162	120.048	08	22E	22	M	22.2	F	309	D	-	-	-	-	-	-	83	42
YA007		Leyendekker, Arthur	-	46.158	120.048	08	22E	23	N	23.9	F	311	D	-	-	-	-	9462	P	81	42
YA008		Green Acre Farms, Inc.	-	46.301	120.645	09	17E	01	D	27.8	F	572	D	-	-	-	-	6813	P	162	42
YA009		John, Mary	1973/11/27	46.269	120.169	09	21E	15	H	21.0	-	13	-	-	-	-	-	151	-	1	40
YA010		Shinn	-	46.236	120.164	09	21E	26	M	28.5	B	295	D	-	43	52	-	-	-	-	2,6,22,25,26
YA011		Del Monte	1974/05/22	46.232	120.169	09	21E	27	R	22.0	B	35	D	-	286	-	-	-	-	5	2,22,25,40
YA012		—	-	46.279	120.021	09	22E	11	J	20.3	B	166	D	43	43	52	-	-	-	-	2,6,22,25
YA013		Van De Graff Orchards, Inc.	1982/08/19	46.275	120.011	09	22E	12	P	21.0	-	95	-	-	-	-	-	2271	-	6	40
YA014		Ramirez, Christi	-	46.267	120.001	09	22E	13	H	20.0	F	49	D	-	-	-	-	378	P	15	42
YA015		Washington Fruit & Produce	-	46.300	119.880	09	23E	01	B	21.1	F	85	D	-	-	-	-	3535	P	36	42
YA016		Grandview City, well no. 14	-	46.262	119.888	09	23E	13	SW4	22.8	F	291	D	-	-	-	-	7570	P	57	42
YA017		Grandview City, well no. 4	-	46.250	119.917	09	23E	22	J	21.2	B	429	D	-	-	-	-	-	-	-	2
YA018	*	Grandview City, well no. 15	1994/01/19	46.250	119.928	09	23E	22	L	26.0	F	394	D	-	-	-	-	7570	P	49	42
YA019		John Haas, Inc.	-	46.224	119.991	09	23E	31	F	21.1	F	121	D	-	-	-	-	1325	P	11	42
YA020		White Swan Fairgrounds	1989/09/13	46.377	120.719	10	17E	05	Q	20.0	-	59	-	-	-	-	-	-	-	10	40
YA021		—	-	46.359	120.666	10	17E	14	D	22.0	B	35	D	-	-	-	-	-	-	-	2
YA022	*	Showaway, Ida	1974/04/11	46.359	120.666	10	17E	14	D	20.5	B	23	D	-	370	-	-	-	-	3	22,25,40
YA023		Decker, Bert C., 2	1974/06/13	46.337	120.661	10	17E	23	L	20.3	B	213	D	-	39	39	-	6056	-	29	2,22,25,26,40
YA024		Decker, Bert, Jr., (Decker 3)	1989/09/15	46.323	120.651	10	17E	26	J	24.5	F	305	D	-	39	-	-	3478	-	28	2,22,25,26,40
YA025		Decker, Bert C.	1989/09/26	46.319	120.677	10	17E	27	Q	29.0	B	460	D	-	30	39	-	5678	-	60	2,22,25,40
YA026		Decker & Sons (Decker 4)	1989/09/15	46.330	120.698	10	17E	28	B	24.5	B	268	D	-	39	39	-	6813	-	32	2,22,25,26,40
YA027		Napyer, Louis	1989/09/12	46.330	120.703	10	17E	28	C	20.0	-	99	-	-	-	-	-	64	-	63	40
YA028		Shellenberger, Norman, 3	1989/09/14	46.314	120.657	10	17E	35	B	24.5	B	245	D	-	38	39	-	6435	-	75	2,22,25,26,40
YA029		Green Acre Farms, Inc.	1989/08/23	46.305	120.630	10	17E	36	R	23.5	F	297	D	-	-	-	-	-	-	113	40,42
YA030		Darrow	-	46.377	120.592	10	18E	05	Q	20.6	B	202	D	-	37	34	-	-	-	-	2,6,22,25,26
YA031	*	Decker Ranch (Decker 7)	1989/09/26	46.305	120.624	10	18E	31	N	23.8	B	318	D	-	37	39	-	-	-	82	2,22,25,26,40
YA032		Corpus, Laura	1973/11/27	46.359	120.440	10	19E	16	A	20.0	-	18	-	-	-	-	-	38	-	5	40
YA033		Eisenbeis, Chuck	1992/08/04	46.337	120.446	10	19E	21	K	20.5	-	19	-	-	-	-	-	38	-	3	40
YA034		Oneil, Viola	-	46.319	120.488	10	19E	30	Q	20.2	F	254	D	-	-	-	-	-	-	-	10
YA035		Oneal, Karl	1989/07/19	46.319	120.483	10	19E	30	R	23.0	-	254	-	-	-	-	-	160	-	-	40
YA036		Gibson, Joann	-	46.315	120.477	10	19E	32	D	21.1	F	64	D	-	-	-	-	64	P	8	42
YA037	*	Toppenish City 7	1974/09/19	46.381	120.326	10	20E	04	L	23.5	B	312	D	-	34	-	-	8895	-	-	2,22,25,26,40
YA038		Yakima Indian Nation Land Ent.	-	46.381	120.332	10	20E	04	M	20.0	F	19	D	-	-	-	-	1136	P	3	42
YA039		Gamache, Amos	1992/08/05	46.377	120.371	10	20E	06	N	27.0	-	11	-	-	-	-	-	227	-	4	40
YA040	*	Toppenish City 6	1974/09/19	46.373	120.316	10	20E	09	A	20.6	B	256	D	-	27	-	-	-	-	-	2,6,22,25,26,40,41
YA041		Brownlee, Larry	1992/08/04	46.326	120.332	10	20E	28	E	20.5	-	16	-	-	-	-	-	76	-	3	40
YA042		Duim, Garrett	1983/07/15	46.384	120.168	10	21E	03	H	23.0	-	236	-	-	-	-	-	-	-	21	40
YA043		Granger City	1968/04/16	46.341	120.183	10	21E	22	E	21.1	F	77	D	-	-	-	-	3785	N	A	10,42
YA044	*	Phillips, Lena	1974/05/23	46.316	120.195	10	21E	33	B	21.0	-	13	-	-	-	-	-	227	-	2	40
YA045	*	Sunnyside City 4	1970/10/06	46.325	120.011	10	22E	25	F	20.0	B	480	D	-	-	-	-	4542	-	23	2,40

Appendix A. *Descriptive and thermal data for wells and springs (continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
YA046		Sunnyside City 3	1983/07/19	46.325	120.011	10	22E	25	F	21.0	-	354	-	-	-	-	-	1400	-	4	40
YA047		DNR Snipes Mountain	-	46.326	120.121	10	22E	30	E	20.6	F	270	D	-	-	-	-	6245	P	9	42
YA048		Luther, Joe	-	46.326	120.105	10	22E	30	H	22.2	F	91	D	-	-	-	-	568	P	12	42
YA049		*Newhouse, Steve & John*	*1983/07/19*	*46.312*	*120.116*	*10*	*22E*	*31*	F	21.5	-	128	-	-	-	-	-	189	-	14	40
YA050	*	Sunnyside City 7	1994/04/08	46.311	120.016	10	22E	36	E	24.4	F	322	D	-	-	-	-	4164	P	3	40,42
YA051	*	Sunnyside City 6	1994/04/08	46.322	119.998	10	23E	30	M	24.0	F	145	D	-	-	-	-	3406	P	A	-
YA052		Evans, Bill	-	46.315	119.875	10	23E	36	A	26.7	B	401	D	-	37	34	-	-	-	-	2,3,22,25,26,37
YA053		White, John	-	46.312	119.880	10	23E	36	G	23.0	B	284	D	-	39	34	-	3785	P	150	2,22,25,26,42
YA054S		Simcoe Soda Springs	-	46.452	120.958	11	15E	09	P	32.0	-	-	-	-	-	-	-	-	-	-	32
YA055		Pace, W. B.	-	46.406	120.762	11	16E	25	Q	25.4	B	333	D	-	40	34	-	-	-	-	2,22,25,26,33
YA056		Goudy, Steve	1989/08/22	46.395	120.803	11	16E	34	K	22.5	-	137	-	-	-	-	-	45	-	106	40
YA057	*	Gowdy, Albert A.	1982/08/18	46.395	120.803	11	16E	34	K	23.5	B	139	D	-	68	34	-	57	-	105	2,22,25,26,40
YA058	*	Mount Adams Seed	1974/06/13	46.473	120.640	11	17E	01	F	24.2	B	358	D	-	34	34	-	2631	-	34	2,22,25,26,40
YA059		Decker & Sons 6	1989/08/31	46.466	120.661	11	17E	02	LorP	25.5	B	265	D	-	51	34	-	6435	-	29	2,22,25,26,40
YA060	*	Stephenson, C. and H.	1989/09/14	46.468	120.682	11	17E	03	L	25.5	B	301	D	-	44	34	-	4391	-	59	2,22,25,26,40
YA061		Dufault, Maurice	1974/10/01	46.436	120.656	11	17E	14	Q	21.0	-	-	-	-	-	-	-	-	-	-	40
YA062		Stephenson	-	46.442	120.705	11	17E	16	F	31.6	B	302	D	-	62	-	-	-	-	-	2,6,22,25,26
YA063		Stephenson, C. and H.	1989/08/09	46.443	120.693	11	17E	16	H	20.8	B	233	D	-	38	34	-	76	-	4	2,22,25,26,40
YA064		Adams, Dee	1989/09/15	46.432	120.745	11	17E	19	C	21.5	-	154	-	-	-	-	-	49	-	118	40
YA065	*	Siegner, Monte	1974/10/01	46.450	120.582	11	18E	09	N	23.0	B	122	D	-	90	-	-	-	-	-	2,22,25,26,40
YA066		Poirelr, Ray	1974/07/10	46.443	120.588	11	18E	17	H	20.5	-	-	-	-	-	-	-	-	-	-	40
YA067	*	Carlson, Sarah	1974/03/06	46.410	120.535	11	18E	26	L	26.4	B	16	D	-	900	-	-	38	-	4	2,22,25,40
YA068	*	Harrah City	1994/01/19	46.410	120.540	11	18E	26	M	27.5	F	448	D	-	-	-	-	1211	P	7	42
YA069		Rowe, Maurice	1974/07/10	46.407	120.614	11	18E	30	Q	21.5	-	-	-	-	-	-	-	-	-	91	40
YA070		Knight, Rick	1974/07/11	46.396	120.546	11	18E	34	J	22.0	-	-	-	-	-	-	-	-	-	-	40
YA071		Barkes, Ray	1971/03/18	46.392	120.556	11	18E	34	P	20.0	F	156	D	-	-	-	-	-	-	-	10
YA072		CL & Frank	1974/09/30	46.458	120.498	11	19E	07	E	20.5	-	-	-	-	-	-	-	-	-	5	40
YA073		Wapato Irrigation Project	1989/08/25	46.446	120.413	11	19E	14	D	23.0	-	20	-	-	-	-	-	227	-	6	40
YA074	*	Wapato City, well no. 5	1994/01/19	46.439	120.413	11	19E	14	M	21.0	F	305	D	-	-	-	-	5678	P	2	42
YA075		Wapato City	-	46.446	120.419	11	19E	15	A	20.8	B	179	D	-	41	48	-	-	-	-	2,6,22,25,26
YA076		Johnson, F.	1977/09/19	46.467	120.268	11	20E	01	M	28.1	B	457	D	-	38	-	-	-	-	-	2,3,10,22,25,26
YA077		Lynch, B.	1977/06/08	46.464	120.252	11	20E	01	R	21.5	B	351	D	-	27	-	-	-	-	-	2,3,10,22,25,26
YA078		Everts & Walsh, John & Don	1982/06/10	46.471	120.273	11	20E	02	H	23.5	-	206	-	-	-	-	-	132	-	69	40
YA079		Strothers, Kelly	-	46.471	120.294	11	20E	03	H	20.0	F	242	D	-	-	-	-	-	-	111	42
YA080		Young, James	1977/03/22	46.468	120.326	11	20E	04	L	22.2	F	155	D	-	-	-	-	-	-	-	10
YA081		Green, Clayton, & Babcock	-	46.464	120.336	11	20E	05	R	21.1	F	183	D	-	-	-	-	6900	P	53	42
YA082		Peters, Charles A.	1967/03/02	46.475	120.357	11	20E	06	A	22.0	F	190	D	-	49	-	-	-	-	-	10,22,25,26
YA083		Morrison Fruit Co., Inc.	-	46.457	120.304	11	20E	10	F	20.0	F	108	D	-	-	-	-	-	-	46	42
YA084		Narduzzi, Ermanno	-	46.453	120.273	11	20E	11	J	22.2	F	198	D	-	-	-	-	2271	P	27	42
YA085		Rashford, George B.	-	46.453	120.257	11	20E	12	K	22.2	F	248	D	-	-	-	-	1892	P	76	42
YA086		Schmidt Orchards, Inc.	-	46.439	120.268	11	20E	13	M	23.3	F	230	D	-	-	-	-	4731	P	43	42
YA087		Soost Brothers	1977/06/30	46.435	120.252	11	20E	13	R	29.2	S	366	D	-	52	-	-	-	-	-	2,3,10,22,25,26
YA088		Weatherly, B.	-	46.474	120.215	11	21E	05	B	28.5	B	379	D	-	42	40	-	-	-	-	2,22,25,26
YA089		Dahl, T.	-	46.467	120.241	11	21E	06	L	29.2	B	364	D	-	47	40	-	-	-	-	2,3,22,25,26

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
YA090		Valley Farms	-	46.464	120.241	11	21E	06	P	25.6	F	364	D	-	-	-	-	4164	P	98	42
YA091		Dahl, T.	-	46.464	120.236	11	21E	06	Q	29.6	B	393	D	-	45	40	-	4164	P	-	2,3,22,25,26
YA092		Clyde	-	46.460	120.231	11	21E	07	A	33.1	B	510	D	-	41	40	-	-	-	-	2
YA093		Lynch, Bob	-	46.457	120.241	11	21E	07	F	30.6	F	-	-	-	-	-	-	1400	P	116	42
YA094		Roza Investment Co.	1983/07/15	46.457	120.241	11	21E	07	F	27.5	-	494	-	-	-	-	-	1590	-	149	40
YA095		Garretson	-	46.458	120.223	11	21E	08	NW4	33.1	B	510	D	31	41	34	52	-	-	-	2,5,26
YA096		Clyde, Pat	-	46.446	120.200	11	21E	16	C	24.7	B	269	D	-	-	-	-	-	-	-	3
YA097		DNR Ramsler	1979/11/13	46.435	120.200	11	21E	16	P	28.1	S	427	D	41	52	40	65	-	-	-	2,3,5,10,26
YA098		Clyde	-	46.446	120.216	11	21E	17	B	24.8	B	273	D	41	47	-	-	-	-	-	5,26
YA099		Gammie, W./Lloyd Garretson Co.	1980/11/12	46.446	120.226	11	21E	17	D	36.1	F	593	D	-	-	-	-	2574	P	127	10,42
YA100		Schmidt, Dave	-	46.435	120.216	11	21E	17	Q	28.9	F	489	D	-	-	-	-	1287	P	120	42
YA101		Leach, Meier, Olsen	-	46.435	120.231	11	21E	18	R	22.8	F	175	D	-	-	-	-	5678	P	60	42
YA102		Schmidt, Dave	-	46.440	120.239	11	21E	18	-	28.9	F	-	-	-	-	-	-	1310	P	120	42
YA103		J J & G Investment	-	46.431	120.210	11	21E	20	A	25.0	F	242	D	-	-	-	-	530	P	98	42
YA104		Baldwin, John	-	46.431	120.226	11	21E	20	D	20.6	F	313	D	-	-	-	-	-	-	82	42
YA105		Hanrahan, P.	1977/06/20	46.424	120.226	11	21E	20	M	22.2	-	207	D	-	54	40	-	-	-	-	2,3,10,22,25,26
YA106		Ambrose Farms	-	46.432	120.195	11	21E	21	B	27.0	B	279	D	-	53	40	-	-	-	-	2,22,25,26
YA107		—	-	46.424	120.189	11	21E	21	J	20.0	F	184	D	-	-	-	-	1665	P	104	42
YA108		Van Leuven, Miles	-	46.432	120.184	11	21E	22	D	20.0	F	261	D	-	-	-	-	-	-	116	42
YA109		Houghton Farms	-	46.428	120.184	11	21E	22	E	20.0	F	261	D	-	-	-	-	1703	P	116	42
YA110		Sandlin, J.	-	46.428	120.174	11	21E	22	G	24.0	B	304	D	33	40	40	-	-	-	-	2,22,25,26
YA111		Sandlin Farms, Inc., 2	1983/06/09	46.428	120.174	11	21E	22	G	35.2	B	553	D	29	42	40	44	4164	P	132	2,3,5,26,40,42
YA112		Best, Peter C.	-	46.424	120.174	11	21E	22	K	25.6	B	335	D	-	43	40	-	1136	P	121	2,22,25,26,42
YA113		De La Chapelle, Charles	1982/08/21	46.413	120.158	11	21E	26	F	25.5	-	291	-	-	-	-	-	3785	-	114	40
YA114		Gay, H.	-	46.395	120.132	11	21E	36	K	21.5	B	213	D	-	45	40	-	-	-	-	2,3,22,25,26
YA115		Monson, Arvid	1982/08/20	46.421	120.121	11	22E	19	N	21.0	-	257	-	-	-	-	-	49	-	126	40
YA116		—	-	46.421	120.079	11	22E	21	N	22.3	B	207	D	-	46	37	-	-	-	-	2,6,22,25,26
YA117		Evans Fruit	-	46.408	120.026	11	22E	26	K	30.7	B	469	D	-	40	37	-	-	-	191	2,3,26,42
YA118		Spauld R.	-	46.409	120.079	11	22E	28	M	21.5	B	210	D	43	43	-	67	-	-	-	5,26
YA119		Rowe Farms	-	46.406	120.100	11	22E	29	N	29.6	B	340	D	-	53	-	-	-	-	-	22,25,26
YA120		Rowe Farms	-	46.406	120.100	11	22E	29	N	29.6	B	434	D	-	-	37	-	-	-	-	2,3
YA121		De La Chapelle, 2	-	46.416	120.116	11	22E	30	C	29.9	B	324	D	49	57	-	79	5299	P	173	5,26,42
YA122		De La Chapelle, C.	-	46.413	120.110	11	22E	30	G	47.8	B	829	D	-	43	31	-	-	-	-	2,22,25,26
YA123		Shelton, C. L.	1973/06/06	46.539	120.773	12	16E	12	N	25.2	B	269	D	-	53	41	-	3558	P	-	2,3,5,10,22,25,26
YA124		White	-	46.531	120.816	12	16E	15	E	21.5	B	179	D	-	59	-	-	-	-	-	26
YA125		Ridout, Tom	-	46.535	120.859	12	16E	17	D	20.0	F	110	D	-	-	-	-	68	P	28	42
YA126		Cohodas-Lancaster-Frank Co.	-	46.553	120.709	12	17E	04	N	24.4	F	340	D	-	-	-	-	3134	P	106	42
YA127		Palmer, Don	-	46.559	120.714	12	17E	05	H	21.7	F	87	D	-	-	-	-	163	P	59	42
YA128		Catlin, Ida	-	46.556	120.714	12	17E	05	J	20.0	F	113	D	-	-	-	-	76	P	68	42
YA129		Hull Ranches, Inc.	-	46.531	120.667	12	17E	14	E	21.1	F	291	D	-	-	-	-	6056	P	31	42
YA130	*	Wiley, Robert	1972/05/22	46.535	120.693	12	17E	16	A	22.2	B	265	D	-	39	41	-	4921	-	21	2,22,25,26,40
YA131		Valley Roz Orchards, Inc.	1989/08/17	46.509	120.540	12	18E	23	N	26.0	-	418	-	-	-	-	-	-	-	-	40
YA132		Eyle, Alex	1989/08/29	46.505	120.535	12	18E	26	C	24.5	-	130	-	-	-	-	-	-	-	117	40
YA133	*	Hansen Fruit	1974/06/14	46.501	120.551	12	18E	27	G	23.6	B	305	D	-	38	34	-	-	-	-	2,22,25,26,40

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
YA134	*	Hansen Fruit	1974/06/14	46.501	120.546	12	18E	27	H	29.6	B	311	D	-	57	34	-	5450	-	70	2,22,25,26,40
YA135		Keller, Walter	1989/08/30	46.494	120.562	12	18E	27	N	23.5	-	338	-	-	-	-	-	-	-	-	40
YA136		St. Clair, Ray, 2	1965/04/01	46.480	120.610	12	18E	31	R	22.2	B	479	D	-	-	-	-	4164	-	64	2,40
YA137	*	Mount Adams Seed, 2	1974/05/23	46.487	120.588	12	18E	32	H	25.2	B	358	D	-	37	34	-	2631	-	66	2,22,25,26,40
YA138		St. Clair	-	46.484	120.598	12	18E	32	L	27.9	B	379	D	39	40	34	-	-	-	-	2,6,22,25,26
YA139		Nyberg, Herbert	1974/05/23	46.490	120.567	12	18E	33	A	25.6	B	290	D	-	47	34	-	5299	-	64	2,22,25,26,40
YA140		Mount Adams Seed, 3	1970/05/11	46.490	120.572	12	18E	33	B	28.0	B	323	D	-	51	34	-	-	-	-	2,10,22,25,26
YA141	*	Moxee City 1	1994/04/08	46.551	120.382	12	19E	01	Q	31.1	F	396	D	-	45	41	-	2271	P	A	2,22,25,26,40
YA142		East Valley School District	1994/04/08	46.552	120.380	12	19E	01	Q	13.0	F	180	D	-	61	41	-	1041	P	104	2,6,22,25,26,42
YA143		Odom, Matt	1990/03/01	46.537	120.445	12	19E	09	Q	23.3	F	43	D	-	-	-	-	76	P	6	10,42
YA144		Laird, Robert	-	46.537	120.445	12	19E	09	Q	23.3	F	52	D	-	-	-	-	189	P	6	4 2
YA145		Bruwilett?	-	46.537	120.408	12	19E	11	P	26.7	F	362	D	-	-	-	-	3830	P	33	42
YA146		DNR Gangle	-	46.533	120.440	12	19E	16	A	22.0	B	153	D	-	58	-	-	-	-	-	26
YA147		Miocene Petroleum	-	46.533	120.471	12	19E	17	C	33.3	S	546	L	-	39	-	-	-	-	-	18,26
YA148		Olson, Dale	-	46.519	120.444	12	19E	21	B	20.0	F	-	-	-	-	-	-	2233	P	62	42
YA149		Stark West Orchards	1968/10/03	46.508	120.450	12	19E	21	P	20.0	F	110	D	-	-	-	-	2498	P	56	10,42
YA150		Stepniewski	-	46.494	120.418	12	19E	27	R	20.6	-	163	L	42	47	-	-	-	-	-	26
YA151		Deeringhoff, F. E.	-	46.551	120.325	12	20E	04	P	23.3	F	191	D	-	-	-	-	-	-	-	35
YA152		Buwalda and Haines	-	46.561	120.352	12	20E	05	D	20.7	F	194	D	-	-	-	-	962	N	A	35
YA153		Holland No. 2	-	46.554	120.352	12	20E	05	M	23.7	F	209	D	-	-	-	-	595	N	A	35
YA154		Regimbal	-	46.551	120.342	12	20E	05	Q	22.9	F	210	D	-	-	-	-	1852	N	A	35
YA155		Holland 1	-	46.551	120.342	12	20E	05	Q	24.4	F	224	D	-	-	-	-	3398	N	A	35
YA156		Clark 1	-	46.561	120.357	12	20E	06	A	22.9	F	287	D	-	-	-	-	2277	N	A	35
YA157		Peck, J. W.	-	46.556	120.364	12	20E	06	-	23.3	F	252	D	-	-	-	-	-	-	-	27
YA158		Ellens 1	-	46.544	120.357	12	20E	07	H	22.9	F	255	D	-	-	-	-	221	N	A	35
YA159		Dickson	-	46.548	120.337	12	20E	08	A	21.5	F	160	D	-	-	-	-	-	-	-	35
YA160		Gano, James H.	-	46.547	120.347	12	20E	08	C	25.6	F	259	D	-	-	-	-	-	-	-	35
YA161		Longevin 2	-	46.544	120.347	12	20E	08	F	22.6	F	255	D	-	-	-	-	1370	N	A	35
YA162		Longevin 1	-	46.544	120.346	12	20E	08	F	22.3	F	194	D	-	-	-	-	680	N	A	35
YA163		Haines	-	46.541	120.336	12	20E	08	J	22.3	F	275	D	-	-	-	-	1672	N	A	35
YA164		Sauve, J.	-	46.537	120.336	12	20E	08	R	24.0	F	311	D	-	-	-	-	807	N	A	35
YA165		Walters, David	-	46.542	120.344	12	20E	08	-	27.2	F	366	D	-	-	-	-	-	-	-	27
YA166		Bradford	-	46.548	120.326	12	20E	09	C	22.9	F	190	D	-	-	-	-	1536	P	1	35
YA167		Allwardt	-	46.537	120.325	12	20E	09	P	22.3	F	247	D	-	-	-	-	1087	N	A	35
YA168		Allwardt, Mona and Carl	-	46.537	120.325	12	20E	09	P	20.0	F	294	D	-	-	-	-	2650	P	1	42
YA169		Hill, E. S.	-	46.542	120.322	12	20E	09	-	23.3	F	191	D	-	-	-	-	-	-	-	27
YA170		S. Martinez Livestock, Inc.	-	46.537	120.252	12	20E	12	R	30.0	F	824	D	-	-	-	-	-	-	4	42
YA171		Charron, S.	-	46.522	120.258	12	20E	13	Q	27.9	B	376	D	36	42	40	-	-	-	-	2,3,22,25,26
YA172		Roy Farms, Inc.	-	46.533	120.294	12	20E	15	A	25.6	F	640	D	-	-	-	-	-	-	27	42
YA173		—	-	46.533	120.331	12	20E	16	D	21.0	B	154	-	-	58	-	-	-	-	-	22,25
YA174		DNR Elephant Mountain	-	46.526	120.326	12	20E	16	L	29.2	B	418	D	42	44	40	66	-	-	-	2,5,26
YA175		Brulotte, L.	-	46.533	120.362	12	20E	18	B	20.6	F	316	D	-	-	-	-	5678	P	17	42
YA176		Logan	-	46.497	120.310	12	20E	27	M	27.5	B	409	D	48	35	-	-	-	-	-	2,6,22,25,26
YA177		Logan, W.	-	46.493	120.310	12	20E	27	N	30.8	B	396	D	-	46	48	-	-	-	-	2,3,22,25,26,33

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
YA178		Clinger, Jasper	-	46.503	120.336	12	20E	29	AorH	24.4	F	118	D	-	-	-	-	4	P	114	42
YA179		Brooks, Lonnie	1983/07/15	46.486	120.357	12	20E	31	H	27.2	F	354	D	-	-	-	-	946	P	57	40,42
YA180		Estes, M.	-	46.479	120.310	12	20E	34	N	25.9	B	274	D	-	51	48	-	-	-	-	2,3,22,25,26
YA181		Estes, Marvin	1978/03/09	46.479	120.310	12	20E	34	N	33.1	B	430	D	-	49	48	-	-	-	44	2,3,10,22,25,26,42
YA182		DNR Cheyne Rd.	1979/10/19	46.479	120.263	12	20E	36	P	29.0	L	547	D	46	49	-	51	2082	P	-	2,3,5,10,26,42
YA183		DNR	-	46.526	120.200	12	21E	16	L	25.1	B	235	D	46	-	-	65	-	-	-	2,5
YA184		DNR Martinez	-	46.526	120.200	12	21E	16	L	26.7	S	230	L	48	55	-	-	11544	P	25	26,42
YA185		Martinez, D.	-	46.525	120.221	12	21E	17	L	28.3	B	473	D	-	33	-	-	-	-	-	2,3,22,25,26
YA186		S. Martinez Livestock, Inc.	-	46.522	120.221	12	21E	17	P	21.1	F	245	D	-	-	-	-	3936	P	64	42
YA187		Martinez Livestock, Inc., 4	1983/07/14	46.522	120.216	12	21E	17	Q	27.0	-	472	-	-	-	-	-	-	-	5	40
YA188		Martinez, 1	-	46.509	120.234	12	21E	19	SE4	21.7	F	288	D	-	-	-	-	4164	P	64	42
YA189		Martinez, D. T., 1	-	46.518	120.226	12	21E	20	D	24.4	B	315	D	-	39	-	-	-	-	-	2,3,6
YA190		Griswald, P.	-	46.508	120.221	12	21E	20	P	25.2	B	315	D	-	39	40	-	-	-	-	2,6,22,25,26,33
YA191		Martinez, Simon	-	46.511	120.180	12	21E	22	L	21.1	F	202	D	-	-	-	-	8172	P	26	42
YA192		Ekerich, W. M.	-	46.497	120.220	12	21E	29	L	22.2	F	259	D	-	-	-	-	2271	P	122	42
YA193		Marley Orchards	-	46.551	120.022	12	22E	02	R	23.1	-	267	L	-	42	-	-	-	-	-	22,25,26
YA194		Changala, Steve	-	46.521	120.011	12	22E	13	P	30.7	B	518	D	37	40	42	53	7059	P	53	2,5,26,42
YA195		Marley Orch. Black Rock Ranch	-	46.518	120.064	12	22E	21	A	31.1	F	747	D	-	-	-	-	-	-	114	42
YA196		Marley Orchards	1983/07/14	46.508	120.079	12	22E	21	N	23.0	-	436	-	-	-	-	-	-	-	-	40
YA197		Marley Orchards	-	46.507	120.064	12	22E	21	R	22.8	B	270	D	-	-	42	-	5488	P	-	2,3
YA198		Changala, S.	-	46.504	120.090	12	22E	29	B	23.0	B	430	D	-	26	-	-	2650	P	-	2,3,22,25,26,33
YA199		DNR Black Rock 1	-	46.525	119.939	12	23E	16	J	25.6	B	351	D	-	58	42	-	7930	P	136	2,3,26,42
YA200		Black Rock	-	46.525	119.944	12	23E	16	K	25.0	B	225	D	51	-	-	-	-	-	-	5
YA201		—	-	46.522	119.971	12	23E	17	P	20.3	S	206	L	-	40	42	-	-	-	-	2,26
YA202		Pyramid Orchards, 1	1983/07/13	46.601	120.763	13	16E	24	H	27.5	-	448	-	-	-	-	-	2271	-	43	40
YA203		Pyramid Orchards, Inc.	-	46.600	120.771	13	16E	24	-	25.6	F	376	D	-	-	-	-	2332	P	24	42
YA204		Barcott, Mark	-	46.624	120.674	13	17E	11	N	26.7	F	123	D	-	-	-	-	102	P	79	42
YA205		Pyramid Orchards	1983/07/13	46.602	120.758	13	17E	19	E	28.0	-	244	-	-	-	-	-	341	-	107	40
YA206		Clark, Christopher	-	46.602	120.705	13	17E	21	G	20.6	F	107	D	-	-	-	-	140	P	70	42
YA207		Lowary, Kim	-	46.602	120.674	13	17E	23	E	24.4	F	73	D	-	-	-	-	102	P	58	42
YA208		Carrell	-	46.634	120.511	13	18E	12	A	24.8	B	201	D	-	61	-	-	-	-	-	2,6,22,25,26
YA209		Nob Hill Water Co., 3	1983/07/13	46.613	120.621	13	18E	18	K	22.5	F	320	D	-	-	-	-	9932	P	84	40,42
YA210		Yakima County Detention Center	-	46.602	120.621	13	18E	19	G	23.3	F	248	D	-	-	-	-	7040	P	12	42
YA211	*	Yakima Creamery well	1994/01/18	46.598	120.516	13	18E	24	K	27.0	F	513	D	-	43	43	-	-	N	A	2,18,26
YA212		Congdon Orchards	1984/11/08	46.587	120.595	13	18E	29	H	32.8	F	617	D	-	-	-	-	946	N	A	10,42
YA213		Wilson, George	-	46.580	120.600	13	18E	29	Q	26.7	F	386	D	-	-	-	-	1274	N	A	13,35
YA214		Hull Orchards, Inc.	-	46.566	120.632	13	18E	31	N	21.1	F	354	D	-	-	-	-	2324	P	56	42
YA215		Nob Hill Water Assoc.	-	46.575	120.597	13	18E	32	NE4	21.1	F	259	D	-	-	-	-	-	N	A	42
YA216		Yakima City, Kissel Park Well	1991/04/24	46.576	120.547	13	18E	35	D	20.6	F	357	D	-	-	-	-	-	N	A	10,42
YA217		Ostrander, Terry L.	-	46.623	120.463	13	19E	09	N	21.1	F	180	D	-	-	-	-	-	-	105	42
YA218		Yakima Sheep Co.	-	46.623	120.427	13	19E	10	R	20.0	F	104	D	-	-	-	-	-	-	29	42
YA219		Yakima County Dump	-	46.611	120.395	13	19E	13	L	24.4	F	-	-	-	-	-	-	2650	P	101	42
YA220		Terrace Heights	-	46.608	120.390	13	19E	13	Q	25.0	B	251	D	-	47	41	-	-	-	-	2,22,25,26
YA221		Watkins 3	-	46.619	120.405	13	19E	14	A	20.3	B	211	D	27	39	41	39	-	-	-	2,5,26

Appendix A. Descriptive and thermal data for wells and springs *(continued)*

I.D.	*	Site name	Date	Lat. (°N)	Long. (°W)	Twp. N.	Rng.	Sec.	Part. sec.	Temp. (°C)	Temp. type	Depth (m)	Depth type	Gradients (°C/km) A	B	S	Heat flow (mW/m²)	Flow (l/m)	Flow type	S.W.L. (m)	References
YA222		*Hardy, Dorothy*	-	46.619	120.457	13	19E	16	C	20.0	F	146	D	-	-	-	-	1628	P	68	42
YA223		Yakima County, well no. 3	1993/12/13	46.609	120.463	13	19E	16	N	43.3	B	738	D	-	42	-	-	568	N	A	43
YA224		Country Club Dist. Water Co.	-	46.608	120.447	13	19E	16	R	23.9	F	456	D	-	-	-	-	4769	P	31	42
YA225		Cascade Lumber Company (1925)	-	46.614	120.497	13	19E	18	-	21.1	F	764	D	-	-	-	-	568	N?	A?	42
YA226	*	Yakima County (heat pump well)	1994/01/18	46.605	120.505	13	19E	19	D	20.0	F	249	D	-	-	-	-	-	-	12	42
YA227		Yakima Country Club, Inc.	-	46.601	120.437	13	19E	22	F	22.8	F	220	D	-	-	-	-	3596	P	28	42
YA228		Country Club	-	46.594	120.442	13	19E	22	M	20.0	B	82	D	70	91	-	-	-	-	-	2,6,22,25,26
YA229		Rasmussen	-	46.604	120.384	13	19E	24	A	20.0	B	230	D	26	35	41	-	-	-	-	2,22,25,26
YA230		Yakima Sheep Co.	-	46.604	120.389	13	19E	24	B	44.5	B	230	D	-	-	-	-	1514	P	114	2,42
YA231		Sundquist Fruit	-	46.594	120.379	13	20E	19	N	22.1	B	255	D	-	40	41	-	13342	P	80	2,3,22,25,26,42
YA232		Champoux	-	46.601	120.352	13	20E	20	F	23.3	B	215	D	52	52	41	77	-	-	-	2,5,26
YA233		Fay, Gerald	1983/07/13	46.586	120.337	13	20E	28	E	22.5	-	206	-	-	-	-	-	-	-	85	40
YA234		Yergen, R.	-	46.590	120.364	13	20E	30	A	24.2	B	289	D	-	42	41	-	-	-	-	2,3,26
YA235		Clark 4	-	46.568	120.368	13	20E	31	K	22.9	F	293	D	-	-	-	-	335	N	A	35
YA236		Clark 3	-	46.568	120.374	13	20E	31	L	24.2	F	305	D	-	-	-	-	883	N	A	35
YA237		Clark 2	-	46.568	120.373	13	20E	31	L	24.6	F	313	D	-	-	-	-	255	N	A	35
YA238		Coombs	-	46.568	120.331	13	20E	33	L	23.2	B	227	D	39	48	41	-	-	-	-	2,22,25,26
YA239		Coombs, B., 2	-	46.568	120.337	13	20E	33	M	30.2	B	446	D	-	41	41	-	-	-	-	2,3,26
YA240		Larson Fruit	-	46.565	120.336	13	20E	33	N	27.8	F	496	D	-	-	-	-	-	-	45	42
YA241		Smith, Darrell, W.	-	46.564	120.300	13	20E	34	R	21.1	F	184	D	-	-	-	-	341	P	92	42
YA242		Martinez	-	46.572	120.173	13	21E	34	H	21.2	B	290	D	33	40	-	52	-	-	-	5,26
YA243		Martinez, D. T., 2	-	46.572	120.173	13	21E	34	H	23.8	B	313	D	-	41	-	-	-	-	-	2,3,6,22,25,26
YA244		Changala, S., 2	-	46.619	120.009	13	22E	13	B	30.7	B	517	D	-	-	-	-	-	-	-	2
YA245		DNR 81 Tieton	-	46.674	121.029	14	14E	25	E	24.2	B	153	D	93	92	-	87	-	-	-	5,26
YA246		Rowe Farms, Inc.	-	46.697	120.642	14	17E	13	Q	20.6	F	207	D	-	-	-	-	-	-	78	42
YA247		Muzzall, Steve	-	46.689	120.648	14	17E	24	F	23.3	F	75	D	-	-	-	-	57	P	64	42
YA248		Fisher, Harland	-	46.696	120.537	14	18E	14	Q	20.0	F	111	D	-	-	-	-	76	P	36	42
YA249		French, Bruce	1983/07/12	46.700	120.564	14	18E	15	L	20.5	-	235	-	-	-	-	-	95	-	126	40
YA250		Bauman, Ed.	-	46.696	120.564	14	18E	15	P	21.1	F	75	D	-	-	-	-	163	P	19	42
YA251		Zirkle, W. H.	-	46.689	120.601	14	18E	20	G	29.5	B	325	D	-	52	-	-	-	-	-	2,3,22,25,26,37
YA252		*Strawn Nursing*	1982/06/09	46.660	120.611	14	18E	32	E	20.5	-	24	-	-	-	-	-	341	-	7	40
YA253		Eberle, Robert	-	46.653	120.605	14	18E	32	Q	22.2	F	17	D	-	-	-	-	114	P	1	42
YA254		WA State Hwy. 539	1982/08/17	46.714	120.415	14	19E	11	L	20.0	-	190	-	-	-	-	-	144	-	116	40
YA255		Roche Fruit Company	-	46.695	120.462	14	19E	16	N	23.2	B	268	D	-	46	-	-	-	-	-	2,3,22,25,26
YA256		Roche Fruit Co.	-	46.695	120.478	14	19E	17	P	27.8	F	460	D	-	-	-	-	4164	N	A	42
YA257		—	-	46.688	120.468	14	19E	20	H	21.7	F	123	D	-	-	-	-	2506	P	-	42
YA258	*	US Army, Yakima Firing Cen., 1	1955/10/05	46.677	120.452	14	19E	28	B	21.0	B	183	D	-	54	-	-	-	-	4	2,22,25,26,40,41
YA259		—	-	46.755	120.637	15	17E	25	R	29.2	B	598	-	-	29	-	-	-	-	-	34
YA260		DNR Wenas	-	46.751	120.638	15	17E	36	A	30.1	B	598	D	34	33	30	-	-	-	-	2,26

Appendix B. Chemical data for thermal wells and springs

NOTES:

1. See the notes in Appendix A for explanations of I.D. and partial sections.
2. Lower-case letters at the ends of I.D.s signify different analyses for the same well or spring system.
3. **Date** is the date when the water sample was collected for chemical analysis.
4. nd, not detected; na, not analyzed.
5. **Conduct.**, conductivity.
6. **TDS**, total dissolved solids, measured by evaporating a sample to dryness.
7. **Charge balance** is an indication of the quality and (or) completeness of a chemical analysis. Analyses with charge balances more than 10 per cent greater than or less than 1.00 have been excluded from this table. Charge balances were calculated using a worksheet from Kindle (1991, p. 113) with a corrected conversion factor for HCO_3 supplied by Mike Adams, University of Utah Research Institute (oral commun., August 10, 1993). Aqueous solutions are electrically neutral, so chemical analyses that are reasonably complete and of good quality should reflect that neutrality by yielding charge balances near 1.00. Charge balance is the ratio of the sums of the negative (anion) and positive (cation) ionic charges, quantified as milli-equivalents per liter, detected in the fluid (Kindle, 1991, p. 109):

$$\text{Charge balance} = \frac{\text{Sum of anion concentrations (meq/L)}}{\text{Sum of cation concentrations (meq/L)}}$$

The conversion factors to convert concentrations in milligrams per liter to milli-equivalents per liter are listed below. For dilute solutions (below about 7,000 mg/l) milligrams per liter and parts per million are approximately equal and may be used interchangeably (Hem, 1985, p. 55).

Anion	Factor	Cation	Factor
HCO_3	0.0167	Ca	0.0499
CO_3	0.0333	Fe	0.0358
SO_4	0.0208	K	0.0256
F	0.0526	Li	0.144
NO_3	0.0161	Mg	0.0823
Cl	0.0282	Na	0.0435

8. **Mass balance** is also an indication of quality and/or completeness of an analysis. Mass balance is the ratio of total dissolved solids, determined by evaporating a water sample to dryness, to the sum of individually analyzed chemical species (Kindle, 1991, p. 109):

$$\text{Mass balance} = \frac{\text{Total dissolved solids (mg/L)}}{\text{Sum of individually analyzed species (mg/L)}}$$

Mass balances were calculated using a worksheet from Kindle (1991, p. 113). A correction factor of 0.4917 was applied to the concentration of HCO_3 because it is partly volatile (Mike Adams, University of Utah Research Institute, oral commun., August 10, 1993). Mass balances should, ideally, approach values of 1.00 for high-quality, complete analyses. When they are significantly greater than 1.00 it may be because SiO_2 (which is non-ionic in solution and doesn't affect the charge balance calculation) is not reported. When SiO_2 is reported, departures from 1.00 must be caused by failure to report some significant chemical species and/or analytical inaccuracy. If the charge balance is within 10 per cent of 1.00 and SiO_2 is reported, then departures from 1.00 of the mass balance must be caused by offsetting anion and cation analytical errors, incomplete analyses, or inaccurate SiO_2 or TDS measurements. When no TDS is reported, the mass balance is listed as zero in the table. Mass balance was not used as a criterion for excluding analyses from this table.

9. **References:** Reference numbers correspond to the numbered references in the References Cited section.
10. Samples dated 1994 were collected for this study and analyzed by the University of Utah Research Institute, Earth Science Laboratory.

Appendix B. Chemical data for thermal wells and springs *(continued)*

I.D.	Site name	Date	Twp N.	Rge.	Sec.	Part. sec.	pH	Conduct. umhos/cm	TDS ppm	Na ppm	K ppm	Ca ppm	Mg ppm	Fe ppm	Al ppm	SiO_2 ppm	B ppm	Li ppm	HCO_3 ppm	SO_4 ppm	Cl ppm	F ppm	H_2S ppm	CO_3 ppm	NO_3 ppm	Charge ballance	Mass balance	References
	ADAMS COUNTY																											
AD001	CMSP&P RR	1960/10/18	15	28E	08	E	7.9	416	292	34	10	30	14.0	0.6	-	65	-	-	196	41.0	10.0	0.6	-	0	0.7	1.01	0.97	41
AD002	US Bureau of Reclamation	1971/10/06	15	28E	15	D	7.7	-	316	54	29	10	4.7	-	-	68	0.07	0.34	180	49.0	13.0	0.8	-	-	-	1.10	1.00	40
AD005	Othello City 2	1955/08/02	15	29E	03	C	8.4	-	279	77	13	4	1.8	-	-	54	0.05	-	170	23.0	16.0	-	-	-	-	0.93	1.02	40
AD006	Othello City 4	1970/10/27	15	29E	03	J	8.2	-	288	70	13	8	4.8	-	-	56	0.06	0.02	180	30.0	14.0	1.8	-	-	-	0.99	1.01	40
AD008	Othello City 6	1994/04/07	15	29E	04	A	8.9	455	350	90	9	6	3.8	-	-	86	-	-	161	32.0	20.0	4.2	-	17	-	0.99	1.01	—
AD009	Othello City 1	1942/04/27	15	29E	04	A	-	397	287	78	12	4	3.5	0.0	-	52	-	-	183	28.0	15.0	2.6	-	0	0.1	1.01	1.01	41
AD023	Phillips, Robert, 4	1983/05/20	15	32E	07	J	8.3	348	-	57	7	9	4.9	0.0	-	66	-	-	172	18.0	9.8	1.8	-	0	0.2	1.03	0.00	16
AD036	Othello City 3	1961/05/04	16	29E	34	R	8.6	393	294	81	12	3	0.8	0.0	-	62	-	-	170	27.0	14.0	2.8	-	6	0.0	1.02	1.01	41
AD089	Jungblom Ranch	1983/05/19	18	31E	33	D	9.3	400	-	89	7	2	0.1	0.1	-	110	-	-	172	12.0	13.0	4.1	-	22	0.1	1.07	0.00	16
AD100	Warden Hutterian Brethern, 7	1983/05/25	19	33E	07	R	8.8	310	-	62	8	4	1.7	0.0	-	66	-	-	172	7.8	6.8	2.6	-	5	0.1	1.08	0.00	16
	ASOTIN COUNTY																											
AS001a	Wash. Water Power Co., 2	1959/10/28	10	46E	05	Q	8.4	-	202	42	10	7	0.2	-	-	65	-	-	110	8.9	7.8	1.1	-	-	-	0.95	1.03	40
AS001b	Wash. Water Power Co., 2	1959/10/28	10	46E	05	Q	8.4	248	199	42	10	7	0.2	0.0	-	65	-	-	113	8.9	7.8	1.1	-	5	0.1	1.04	0.98	41
AS008a	Wash. Water Power Co., 5	1962/10/30	11	46E	30	Q	8.2	-	241	49	11	11	1.0	-	-	66	-	-	130	25.0	12.0	0.9	-	-	-	1.01	1.00	40
AS008b	Wash. Water Power Co., 5	1962/10/30	11	46E	30	Q	8.3	303	-	49	11	11	1.0	0.0	0.20	66	-	-	128	25.0	12.0	0.9	-	2	0.0	1.02	0.00	31
	BENTON COUNTY																											
BE001	S P & S Ry	1966/07/18	04	24E	03	B	8.0	460	306	92	7	9	0.7	1.0	-	48	-	-	225	0.0	34.0	1.6	-	0	0.1	1.02	1.01	31
BE005	US Army Corps of Engineers	1971/09/24	05	28E	06	R	8.2	-	355	98	18	7	1.9	0.0	0.00	60	0.10	0.27	210	35.0	32.0	1.7	-	-	-	0.99	0.99	40
BE015a	WDOE Tst./Obs., Piezometer C	1972/08/03	07	25E	36	N	8.2	-	317	88	14	8	1.4	-	0.01	61	-	-	220	18.0	17.0	1.1	-	-	-	0.98	1.00	40
BE015b	WDOE Tst./Obs., Piezometer C	1972/08/04	07	25E	36	N	8.2	-	321	92	14	5	1.4	-	0.01	61	-	-	230	18.0	18.0	1.2	-	-	-	1.02	0.99	40
BE015c	WDOE Tst./Obs., Piezometer C	1972/10/05	07	25E	36	N	8.2	-	298	81	14	6	1.7	-	0.01	52	-	-	210	24.0	16.0	1.1	-	-	-	1.05	1.00	40
BE022	Prosser City 5	1994/01/19	08	24E	01	K	6.8	505	332	107	13	2	nd	nd	nd	73	0.25	nd	264	nd	13.0	2.3	na	16	na	1.07	0.93	—
BE031	Mott, Studer	1970/11/17	08	29E	22	A	7.3	-	922	58	17	100	72.0	-	-	53	0.03	0.03	180	510.0	16.0	0.4	-	-	-	1.01	1.01	40
BE039	WSU, IAREC, well 2	1994/01/19	09	25E	19	B	6.2	315	222	29	9	21	6.9	nd	nd	43	0.05	nd	162	18.0	7.2	0.6	na	nd	na	1.06	1.03	—
BE044	Christen	1970/10/12	09	26E	27	K	7.8	-	286	32	9	30	12.0	-	-	59	0.16	0.02	160	54.0	12.0	0.4	-	-	-	1.01	1.00	40
BE068	US Government	1970/11/19	11	26E	34	R	8.8	-	394	120	15	1	0.0	-	-	75	0.49	0.02	150	0.0	81.0	8.5	-	-	-	0.93	1.05	40
BE074	Roberts Bros.	1970/09/11	12	24E	20	N	8.0	-	202	21	8	18	11.0	-	-	56	0.02	0.02	170	0.2	3.8	0.6	-	-	-	1.02	1.00	40
BE076	US Government	1977/04/27	12	26E	04	N	7.7	-	262	17	5	43	15.0	0.0	0.10	50	0.02	0.01	170	39.0	8.3	0.4	-	-	-	0.92	1.00	40
BE078	US Government	1976/04/08	12	26E	07	Q	7.7	-	307	28	7	51	16.0	0.0	0.01	39	0.02	0.01	240	30.0	16.0	0.4	-	-	-	0.97	1.01	40
BE079	US Government	1979/04/19	12	26E	08	P	7.9	-	254	23	6	40	11.0	-	-	43	-	-	180	28.0	14.0	0.4	-	-	-	0.99	1.00	40
BE080	AEC	1979/04/17	12	26E	09	L	7.8	-	255	21	6	40	13.0	-	-	47	-	-	180	32.0	7.7	0.4	-	-	-	0.95	1.00	40
BE081	US Government	1976/04/08	12	26E	12	H	8.0	-	270	41	8	25	7.9	0.0	0.01	48	0.03	0.02	180	45.0	3.6	0.6	-	-	-	1.04	1.01	40
BE083	US Government	1979/04/17	12	26E	13	H	7.9	-	272	31	6	35	12.0	-	-	43	-	-	140	59.0	16.0	0.6	-	-	-	0.95	1.00	40
BE084	US Government	1978/04/20	12	26E	14	D	7.8	-	286	21	6	50	15.0	-	-	40	-	-	200	47.0	8.2	0.5	-	-	-	0.95	1.00	40
BE085a	US Government	1976/04/09	12	26E	15	C	7.8	-	276	25	6	41	12.0	0.0	0.01	40	0.02	0.01	210	41.0	7.3	0.4	-	-	-	1.07	1.00	40
BE085b	US Government	1977/04/28	12	26E	15	C	7.7	-	280	24	6	46	14.0	0.0	0.10	44	0.02	0.01	210	34.0	7.7	0.5	-	-	-	0.96	1.00	40

Appendix B. Chemical data for thermal wells and springs *(continued)*

I.D.	Site name	Date	Twp N.	Rge.	Sec.	Part. sec.	pH	Conduct. umhos/cm	TDS ppm	Na ppm	K ppm	Ca ppm	Mg ppm	Fe ppm	Al ppm	SiO_2 ppm	B ppm	Li ppm	HCO_3 ppm	SO_4 ppm	Cl ppm	F ppm	H_2S ppm	CO_3 ppm	NO_3 ppm	Charge balance	Mass balance	References
BE085c	US Government	1978/04/20	12	26E	15	C	7.8	-	278	24	6	47	14.0	-	-	42	-	-	210	33.0	7.8	0.5	-	-	-	0.95	1.00	40
BE085d	US Government	1979/04/20	12	26E	15	C	7.8	-	278	25	6	41	12.0	-	-	46	-	-	220	32.0	7.6	0.5	-	-	-	1.07	1.00	40
BE086	US Government	1979/04/20	12	26E	15	J	8.0	-	259	21	5	38	12.0	-	-	45	-	-	200	33.0	6.3	0.4	-	-	-	1.08	1.00	40
BE087	US Government	1976/04/08	12	26E	18	E	7.8	-	203	16	4	28	12.0	0.1	0.01	30	0.02	0.01	140	27.0	16.0	0.4	-	-	-	1.05	1.00	40
BE088	US Government	1979/04/19	12	26E	18	G	7.8	-	220	19	4	32	9.8	-	-	45	-	-	150	24.0	12.0	0.5	-	-	-	1.01	1.00	40
BE093	AEC	1979/04/16	12	27E	18	C	7.9	-	256	31	7	32	11.0	-	-	45	-	-	140	50.0	11.0	0.6	-	-	-	0.92	1.00	40
BE096a	US Government	1951/11/30	13	24E	25	E	7.8	-	233	27	9	19	12.0	-	-	65	-	-	190	1.8	5.8	0.5	-	-	-	1.02	1.00	40
BE096b	US Government	1951/11/30	13	24E	25	E	7.8	291	215	27	9	19	12.0	0.0	-	65	-	-	189	1.8	5.8	0.5	-	0	0.1	1.02	0.92	41
BE096c	US Government	1970/08/27	13	24E	25	E	8.0	-	212	26	7	18	11.0	-	-	56	0.09	0.02	180	0.2	4.4	0.7	-	-	-	1.01	1.00	40
BE098	US Govt./Meeker	1951/12/01	13	24E	26	G	7.8	292	218	27	7	20	12.0	0.1	-	60	-	-	193	1.5	5.5	0.5	-	0	0.0	1.03	0.96	41
BE099	—	1951/12/01	13	24E	26	G	7.8	-	228	27	7	20	12.0	-	-	60	-	-	190	1.5	5.5	0.5	-	-	-	1.02	1.01	40
BE100a	US Government	1951/11/29	13	24E	36	D	7.7	277	213	29	7	18	11.0	0.0	-	64	-	-	184	1.8	5.4	0.6	-	0	0.1	1.02	0.94	41
BE100b	US Government	1951/11/29	13	24E	36	D	7.7	-	227	29	7	18	11.0	-	-	64	-	-	180	1.8	5.4	0.6	-	-	-	1.00	1.01	40
BE101	US Government	1953/09/21	13	25E	01	N	7.6	296	216	22	11	19	11.0	0.1	-	39	-	-	143	23.0	8.0	0.4	-	0	0.0	1.01	1.06	31
BE102	US Government	1979/04/18	13	25E	03	Q	7.5	-	196	9	5	33	7.5	-	-	37	-	-	120	42.0	3.9	0.2	-	-	-	1.08	1.00	40
BE103	Hanford, 199-B4-4	1977/04/27	13	25E	11	H	7.6	-	218	10	5	43	5.9	0.0	0.10	46	0.02	0.01	120	42.0	6.6	0.2	-	-	-	0.96	1.00	40
BE106a	US Govt./McGee, Chester	1951/12/01	13	25E	30	G	7.8	-	224	30	10	17	9.4	-	-	62	0.05	-	180	1.6	4.8	0.6	-	-	-	1.01	1.00	40
BE106b	US Govt./McGee, Chester	1953/09/02	13	25E	30	G	7.7	289	216	30	6	18	10.0	0.1	-	64	-	-	180	2.1	5.2	0.7	-	0	0.2	1.01	0.96	41
BE106c	US Govt./McGee, Chester	1953/09/02	13	25E	30	G	7.7	-	225	30	6	18	10.0	-	-	64	-	-	180	2.1	5.2	0.7	-	-	-	1.01	1.00	40
BE106d	US Govt./McGee, Chester	1954/10/28	13	25E	30	G	7.4	-	226	30	8	17	9.4	-	-	67	-	-	180	2.1	5.1	0.6	-	-	-	1.03	0.99	40
BE106e	US Govt./McGee, Chester	1956/10/24	13	25E	30	G	8.0	-	220	30	8	17	9.3	-	-	62	-	-	180	0.4	4.8	0.7	-	-	-	1.02	1.00	40
BE106f	US Govt./McGee, Chester	1970/08/27	13	25E	30	G	8.1	-	211	30	9	16.	8.9	-	-	56	0.11	0.02	170	0.0	4.4	0.7	-	-	-	0.98	1.01	40
BE106g	US Govt./McGee, Chester	1970/09/08	13	25E	30	G	8.1	-	211	30	8	16	8.8	-	-	57	0.07	0.02	170	0.0	4.5	0.7	-	-	-	0.99	1.01	40
BE106h	US Govt./McGee, Chester	1977/04/27	13	25E	30	G	8.0	-	209	29	8	17	9.2	0.1	0.10	55	0.02	0.02	170	1.4	4.5	0.8	-	-	-	0.99	1.00	40
BE110	US Government	1979/04/17	13	26E	31	R	8.0	-	260	14	4	41	17.0	-	-	43	-	-	120	62.0	20.0	0.4	-	-	-	0.93	1.00	40
BE113a	US Government	1969/05/10	13	26E	35	H	8.5	-	256	79	8	2	0.3	-	-	53	0.06	-	210	0.4	3.9	1.0	-	-	-	0.97	1.02	40
BE113b	US Government	1969/07/14	13	26E	35	H	8.9	-	401	130	3	0	0.0	-	-	67	0.38	-	160	21.0	68.0	11.0	-	-	-	0.98	1.06	40
BE118	US Government	1979/04/18	14	26E	23	D	7.7	-	220	12	4	39	8.4	-	-	40	-	-	110	46.0	16.0	0.2	-	-	-	1.00	1.00	40
BE120	Hanford 199-K-19	1979/04/18	14	26E	32	L	8.1	-	145	3	2	34	4.3	-	-	14	-	-	87	42.0	2.6	0.2	-	-	-	1.07	1.00	40
BE123	US Government	1979/04/17	14	27E	33	G	7.8	-	147	4	3	34	4.5	-	-	26	-	-	120	14.0	2.6	0.1	-	-	-	1.02	1.00	40
	CLALLAM COUNTY																											
CL001Sa	Olympic Hot Springs	-	29	08W	27	K	9.5	-	244	72	1	1	-	-	-	66	0.80	-	175	5.0	11.0	1.2	14.0	-	-	1.06	0.95	32
CL001Sb	Olympic Hot Springs	-	29	08W	27	K	9.5	-	-	72	1	1	LD	-	-	66	0.82	0.04	175	5.0	11.0	1.2	-	-	-	1.06	0.00	19
CL002Sa	Sol Duc Hot Springs(1)	-	29	09W	32	C	7.9	380	-	75	2	1	0.0	-	-	80	1.30	0.10	137	34.0	20.0	1.0	-	-	-	1.06	0.00	21
CL002Sb	Sol Duc Hot Springs(2)	-	29	09W	32	C	8.4	360	-	74	3	1	0.0	-	-	-	1.30	0.10	129	35.0	18.0	1.0	-	-	-	1.03	0.00	21
CL002Sc	Sol Duc Hot Springs	-	29	09W	32	C	9.5	-	-	80	1	1	-	0.0	-	60	1.40	0.05	181	7.0	21.0	1.7	-	-	-	1.08	0.00	19
CL002Sd	Sol Duc Hot Springs	-	29	09W	32	C	9.5	-	262	80	1	1	-	-	-	60	1.40	-	181	7.0	21.0	1.7	10.0	-	-	1.09	0.96	32
	COLUMBIA COUNTY																											
CO003a	Ferrel, Robert	1954/08/02	13	38E	26	E	7.5	-	260	9	3	23	9.6	0.1	0.02	-	0.03	-	122	11.0	10.6	-	-	-	-	1.07	2.07	31
CO003b	Ferrel, Robert	1961/01/27	13	38E	26	E	7.6	-	189	9	6	24	8.8	-	-	67	-	-	140	2.8	2.0	0.5	-	-	-	1.00	1.00	40
CO003c	Ferrel, Robert	1961/01/27	13	38E	26	E	7.6	227	194	9	6	24	8.8	0.0	-	67	-	-	140	2.8	2.0	0.5	-	-	-	1.00	1.03	31,41

Appendix B. Chemical data for thermal wells and springs *(continued)*

I.D.	Site name	Date	Twp N.	Rge.	Sec.	Part. sec.	pH	Conduct. umhos/cm	TDS ppm	Na ppm	K ppm	Ca ppm	Mg ppm	Fe ppm	Al ppm	SiO_2 ppm	B ppm	Li ppm	HCO_3 ppm	SO_4 ppm	Cl ppm	F ppm	H_2S ppm	CO_3 ppm	NO_3 ppm	Charge ballance	Mass balance	References
	FRANKLIN COUNTY																											
FR002	Pasco Navy Base/Port of Pasco	1970/08/28	09	30E	18	J	8.6	-	346	120	11	2	0.5	-	-	54	0.10	0.02	280	0.0	15.0	1.8	-	-	-	0.92	1.01	40
FR010	West 15 Domestic Water, Inc.	1994/01/20	11	29E	05	R	6.5	510	320	95	12	2	nd	0.1	nd	47	0.24	nd	154	19.0	46.0	4.8	na	6	na	1.04	1.04	—
FR026	US Bureau of Reclamation	1953/01/01	12	29E	28	F	8.0	-	173	46	6	9	4.6	-	-	-	-	-	120	35.0	11.0	1.0	-	-	-	1.03	1.00	40
FR031	US Bureau of Reclamation	1970/11/10	13	28E	13	N	8.6	-	288	78	17	1	0.4	-	-	67	0.12	0.02	180	19.0	14.0	2.2	-	-	-	1.00	1.00	40
FR043a	US Govt./Othello AFB	1955/09/29	14	29E	09	A	8.1	-	264	44	8	20	9.9	-	-	55	-	-	190	24.0	11.0	0.9	-	-	-	1.03	0.99	40
FR043b	US Govt./Othello AFB	1956/09/13	14	29E	09	A	8.1	-	269	44	8	20	10.0	-	-	56	-	-	190	25.0	13.0	1.0	-	-	-	1.05	1.00	40
FR043c	US Govt./Othello AFB	1960/10/19	14	29E	09	A	8.0	-	270	43	8	21	11.0	-	-	56	-	-	180	29.0	10.0	1.0	-	-	-	0.98	1.01	40
FR043d	US Govt./Othello AFB	1960/10/19	14	29E	09	A	8.0	411	282	43	8	21	11.0	0.0	-	56	-	-	185	29.0	10.0	1.0	-	-	-	1.00	1.04	41
FR043e	US Govt./Othello AFB	1962/10/09	14	29E	09	A	7.9	-	269	45	8	20	10.0	-	-	57	-	-	190	24.0	11.0	1.0	-	-	-	1.02	1.00	40
FR043f	US Govt./Othello AFB	1964/04/29	14	29E	09	A	7.8	-	280	44	8	22	11.0	-	-	57	-	-	180	33.0	14.0	1.0	-	-	-	1.00	1.00	40
FR043g	US Govt./Othello AFB	1965/01/26	14	29E	09	A	7.9	-	275	43	8	21	12.0	-	-	55	-	-	190	31.0	13.0	1.0	-	-	-	1.03	0.99	40
FR043h	US Govt./Othello AFB	1967/02/13	14	29E	09	A	8.1	-	243	44	8	20	11.0	-	-	28	-	-	180	28.0	14.0	1.0	-	-	-	1.01	1.00	40
FR052	Connell City 4	1970/09/24	14	31E	36	J	8.8	-	273	72	9	3	0.3	-	-	70	0.07	0.02	140	27.0	11.0	1.7	-	-	-	0.93	1.04	40
	GARFIELD COUNTY																											
GA002a	Pomeroy City 4	1959/10/28	12	42E	31	L	8.0	-	157	10	6	16	2.3	-	-	74	-	-	90	3.1	1.8	0.4	-	-	-	1.05	1.00	40
GA002b	Pomeroy City 4	1959/10/28	12	42E	31	L	8.0	162	154	10	6	16	2.3	0.0	-	74	-	-	90	3.1	1.8	0.4	-	-	-	1.05	0.98	31,41
	GRANT COUNTY																											
GR007a	US Army/AEC Hanford 90	1952/08/07	14	25E	01	D	7.9	-	270	47	19	12	4.5	-	-	75	-	-	160	25.0	9.7	0.4	-	-	-	1.00	1.00	40
GR007b	US Army/AEC Hanford 90	1952/08/07	14	25E	01	D	7.9	330	265	47	19	12	4.5	0.2	-	75	-	-	157	25.0	9.7	0.4	-	-	-	0.98	0.98	31,41
GR007c	US Army/AEC Hanford 90	1954/10/28	14	25E	01	D	7.7	-	230	20	12	24	9.3	-	-	61	-	-	140	27.0	6.2	0.5	-	-	-	0.99	1.01	40
GR007d	US Army/AEC Hanford 90	1970/09/17	14	25E	01	D	8.1	-	215	17	11	24	8.6	-	-	56	0.03	0.02	140	24.0	5.0	0.4	-	-	-	1.02	1.00	40
GR007e	US Army/AEC Hanford 90	1971/10/08	14	25E	01	D	7.8	-	238	17	17	24	8.5	-	-	64	0.00	0.11	140	31.0	5.4	0.4	-	-	-	1.02	1.01	40
GR011a	US Govt./AEC Hanford 6	1954/10/28	14	25E	21	B	7.6	313	250	21	7	28	11.0	0.1	-	69	-	-	156	25.0	7.4	0.3	-	-	-	0.99	1.02	41
GR011b	US Govt./AEC Hanford 6	1954/10/28	14	25E	21	B	7.6	-	245	21	7	28	11.0	-	-	69	-	-	160	25.0	7.4	0.3	-	-	-	1.01	0.99	40
GR011c	US Govt./AEC Hanford 6	1958/01/07	14	25E	21	B	7.8	-	173	21	6	30	9.6	-	-	-	-	-	150	23.0	7.0	0.3	-	-	-	0.95	1.01	40
GR013a	US Army	1959/10/28	14	27E	24	C	8.0	457	322	80	26	7	0.4	-	-	63	-	-	216	29.0	12.0	1.2	-	-	-	1.02	0.99	31,41
GR013b	US Army	1959/10/28	14	27E	24	C	8.0	-	325	80	26	7	0.4	-	-	63	-	-	220	29.0	12.0	1.2	-	-	-	1.03	0.99	40
GR014	Wahluke School	1994/01/20	15	23E	35	R	5.9	220	142	6	3	23	8.2	0.1	nd	50	nd	nd	105	15.0	4.8	0.3	na	nd	na	1.01	0.87	—
GR019a	AEC Hanford 7	1958/01/07	15	27E	34	L	7.8	330	262	40	18	13	6.0	0.1	-	-	-	-	152	26.0	8.2	0.4	-	-	-	1.00	1.41	31,41
GR019b	AEC Hanford 7	1958/01/07	15	27E	34	L	7.8	-	186	40	18	13	6.0	-	-	-	-	-	150	26.0	8.2	0.4	-	-	-	0.99	1.00	40
GR025a	US Air Force	1959/11/17	16	24E	01	G	7.7	-	384	45	10	38	24.0	-	-	57	-	-	250	68.0	19.0	0.7	-	-	-	1.01	1.00	40
GR025b	US Air Force	1959/12/12	16	24E	01	G	7.9	-	383	45	10	40	24.0	-	-	50	-	-	250	70.0	18.0	0.8	-	-	-	1.00	1.01	40
GR025c	US Air Force	1960/01/24	16	24E	01	G	7.9	-	383	45	10	40	24.0	-	-	51	-	-	250	69.0	19.0	0.6	-	-	-	1.00	1.00	40
GR025d	US Air Force	1963/03/28	16	24E	01	G	7.9	-	397	49	11	40	24.0	-	-	48	-	-	250	82.0	20.0	0.6	-	-	-	1.01	1.00	40
GR023	US Government	1960/01/24	16	24E	01	G	7.9	566	384	45	10	40	24.0	0.3	-	51	-	-	252	69.0	19.0	0.6	-	-	-	1.00	1.00	31,41
GR024a	US Air Force	1959/11/17	16	24E	01	G	7.7	575	380	45	10	38	24.0	0.2	-	57	-	-	250	68.0	19.0	0.7	-	-	-	1.01	0.99	31,41
GR024b	US Air Force	1959/12/12	16	24E	01	G	7.9	581	366	45	10	40	24.0	0.2	-	50	-	-	254	70.0	18.0	0.8	-	-	-	1.01	0.96	31,41
GR032a	US Government	1960/01/24	17	30E	33	K	8.4	317	270	57	10	9	1.9	0.5	-	79	-	-	161	15.0	6.5	1.3	-	-	-	0.98	1.04	31,41
GR032b	US Government	1960/01/24	17	30E	33	K	8.4	-	263	57	10	9	1.9	-	-	79	-	-	160	15.0	6.5	1.3	-	-	-	0.98	1.02	40

Appendix B. Chemical data for thermal wells and springs *(continued)*

I.D.	Site name	Date	Twp N.	Rge.	Sec.	Part. sec.	pH	Conduct. umhos/cm	TDS ppm	Na ppm	K ppm	Ca ppm	Mg ppm	Fe ppm	Al ppm	SiO_2 ppm	B ppm	Li ppm	HCO_3 ppm	SO_4 ppm	Cl ppm	F ppm	H_2S ppm	CO_3 ppm	NO_3 ppm	Charge ballance	Mass balance	References
GR033a	US Army Corps of Engineers	1959/10/28	17	30E	33	K	8.4	321	264	57	10	8	2.1	0.2	-	78	-	-	162	15.0	7.2	1.2	-	-	-	0.99	1.02	31,41
GR033b	US Army Corps of Engineers	1959/10/28	17	30E	33	K	8.4	-	262	57	10	8	2.1	-	-	78	-	-	160	15.0	7.2	1.2	-	-	-	0.98	1.02	40
GR033c	US Army Corps of Engineers	1962/10/30	17	30E	33	K	8.2	-	263	59	10	9	2.0	0.0	-	76	-	-	170	14.0	8.0	1.2	-	-	-	1.00	1.00	40
GR038	WDOE Tst./Obs., Backfilled	1978/02/17	18	25E	15	E	7.0	-	262	50	7	16	6.7	-	-	67	-	-	160	25.0	11.0	1.2	-	-	-	0.97	1.00	40
GR056	Moses Lake City 14	1994/04/07	19	28E	15	A	7.0	370	303	81	10	1	0.9	0.1	-	80	-	0.04	164	6.6	19.0	3.7	-	12	-	1.02	1.03	—
GR058	Moses Lake City 7	1960/05/16	19	28E	23	D	8.4	-	-	56	-	-	-	-	-	-	-	-	160	-	-	-	-	-	-	1.10	0.00	40
GR060	Moses Lake City 10	1994/04/07	19	28E	27	C	7.5	412	317	87	12	3	1.3	-	-	51	-	0.05	180	33.0	20.0	1.2	-	2	-	1.00	1.06	—
GR063	Moses Lake City 4	1994/04/07	19	28E	28	Q	7.0	493	360	92	16	11	5.2	0.0	0.66	56	0.24	0.06	219	41.0	24.0	1.2	-	-	-	0.97	1.01	—
GR081	Quincy City 1	1955/08/03	20	24E	07	R	7.5	-	243	25	4	32	10.0	-	-	50	-	-	150	29.0	17.0	-	-	-	-	0.99	1.01	40
GR082	Wenatchee Apple Land Co.	-	20	24E	09	E	-	-	272	19	4	37	15.0	0.0	-	42	-	-	156	37.0	17.0	0.4	-	-	-	0.97	1.10	39
GR085a	Moses Lake City 21	1951/03/30	20	28E	32	HorJ	8.0	-	238	35	12	17	8.6	-	-	49	-	-	160	25.0	8.9	0.6	-	-	-	1.03	1.01	40
GR085b	Moses Lake City 21	1951/03/30	20	28E	32	HorJ	8.0	315	222	35	12	17	8.6	0.0	-	49	-	-	156	25.0	8.9	0.6	-	-	-	1.01	0.95	41
GR098	Ephrata City	1955/07/22	21	26E	08	M	7.9	-	193	22	3	16	13.0	-	-	46	-	-	150	12.0	7.0	-	-	-	-	1.02	1.00	40
GR100	Ephrata City 5	1955/07/22	21	26E	08	N	7.6	-	168	12	2	19	12.0	-	-	46	-	-	130	6.0	7.0	-	-	-	-	0.99	1.00	40
GR104	Ephrata City 2	1955/07/22	21	26E	16	B	-	-	187	14	5	17	14.0	-	-	50	0.01	-	150	6.0	7.0	-	-	-	-	1.03	1.00	40
GR105	Ephrata City	1955/07/22	21	26E	21	E	8.1	-	191	12	4	17	12.0	-	-	64	0.01	-	130	8.0	7.0	-	-	-	-	1.03	1.02	40
GR109	Schell, Harvey	1982/09/08	21	30E	23	J	8.6	372	-	55	11	16	2.4	0.0	-	68	-	-	130	35.0	20.0	0.9	-	3	0.1	0.98	0.00	7,16
GR111	Soap Lake city	1955/07/22	22	27E	19	N	7.9	-	218	24	5	17	12.0	-	-	58	0.01	-	150	18.0	8.0	-	-	-	-	1.03	1.01	40
	KING COUNTY																											
KI001Sa	Lester Hot Springs(F-1)	-	20	10E	21	M	-	-	-	112	3	8	0.2	-	-	66	-	0.33	-	-	200.0	-	-	-	-	1.04	0.00	21,24
KI001Sb	Lester Hot Springs	-	20	10E	21	M	9.2	-	339	105	2	5	0.0	-	-	61	-	-	61	19.0	115.0	1.6	5.7	-	-	0.97	0.98	32
KI003S	Goldmeyer Hot Springs	-	23	11E	14	B	8.5	-	391	125	3	6	0.0	-	-	56	-	-	61	40.0	130.0	0.9	0.6	-	-	0.95	1.00	32
KI004Sa	Scenic Hot Springs	-	26	13E	28	Q	9.1	-	168	49	1	2	0.0	-	-	44	-	-	75	13.0	22.0	0.7	1.3	-	-	0.97	0.99	32
KI004Sb	Scenic Hot Springs(C-1)	-	26	13E	28	Q	9.3	140	-	32	1	2	-	-	-	37	-	-	44	13.0	14.0	0.6	-	-	-	0.95	0.00	18,24
	KITTITAS COUNTY																											
KS007	USGS/WDOE Umtanum	1978/03/02	16	19E	28	C	8.5	-	157	22	3	14	5.2	-	-	48	-	-	120	1.9	3.3	0.6	-	-	-	1.01	1.00	40
KS011	Ellensburg City Mt. Stuart well	1994/04/07	18	18E	35	E	7.1	185	146	31	2	9	1.3	0.0	-	48	0.07	-	116	1.6	5.0	0.4	-	-	-	1.08	0.93	—
	KLICKITAT COUNTY																											
KT009Sa	Klickitat Mineral Springs	-	04	13E	24	A	5.9	-	-	64	10	120	100.0	-	-	140	-	-	1070	-	4.2	0.3	-	-	-	1.04	0.00	24
KT009Sb	Klickitat Mineral Springs	-	04	13E	24	A	6.1	-	637	34	4	38	38.0	-	-	103	-	-	415	-	4.0	0.8	-	-	-	1.07	1.49	32
KT011a	Gas-Ice Corp. 10	1964/10/21	04	13E	24	H	6.6	1410	964	63	10	120	106.0	11.0	-	121	0.11	-	1060	3.4	3.5	0.4	-	-	-	0.99	1.00	31
KT011b	Gas Ice Corp. 10	1964/10/21	04	13E	24	H	6.6	-	953	63	10	120	110.0	-	-	120	0.11	-	1060	3.4	3.5	0.4	-	-	-	0.99	1.00	40
KT012a	Gas Ice Corp. 2	1964/10/21	04	14E	19	C	6.4	-	319	30	4	27	25.0	-	-	89	0.03	-	280	0.0	3.2	1.1	-	-	-	1.00	1.01	40
KT012b	Gas-Ice Corp. 2	1964/10/21	04	14E	19	C	6.4	429	325	30	4	27	25.0	2.8	-	89	0.03	-	284	-	3.2	1.1	-	-	0.2	0.99	1.01	31

Appendix B. Chemical data for thermal wells and springs *(continued)*

I.D.	Site name	Date	Twp N.	Rge.	Sec.	Part. sec.	pH	Conduct. umhos/cm	TDS ppm	Na ppm	K ppm	Ca ppm	Mg ppm	Fe ppm	Al ppm	SiO_2 ppm	B ppm	Li ppm	HCO_3 ppm	SO_4 ppm	Cl ppm	F ppm	H_2S ppm	CO_3 ppm	NO_3 ppm	Charge balance	Mass balance	References
KT026S	Fish Hatchery Warm Spring	-	06	13E	04	H	-	-	-	160	16	110	95.0	2.2	-	-	-	-	1130	2.6	49.0	0.4	-	-	-	0.98	0.00	24
KT027a	Smith, G.	1970/10/21	06	23E	11	N	8.1	-	255	64	15	6	2.4	-	-	56	0.13	0.02	210	0.2	9.1	1.0	-	-	-	1.04	0.99	40
KT027b	Smith, G.	1970/12/11	06	23E	11	N	8.1	-	252	64	15	6	2.7	-	-	52	0.01	0.04	210	0.0	9.2	1.0	-	-	-	1.03	0.99	40
KT029	Smith, George	1962/04/30	06	23E	11	Q	8.1	344	-	55	11	12	4.1	0.0	-	57	-	-	195	2.2	9.8	1.0	-	-	0.6	1.01	0.00	31
KT030	—	1962/04/30	06	23E	11	Q	8.1	-	248	55	11	12	4.1	-	-	57	-	-	200	2.2	9.8	1.0	-	-	-	1.03	0.99	40
KT031	Andrews/Smith	1970/10/22	06	23E	15	H	7.9	-	254	64	13	7	2.7	-	-	57	0.07	0.02	210	0.2	8.6	1.0	-	-	-	1.03	0.99	40
	LEWIS COUNTY																											
LE010S	Ohanapecosh Hot Springs(USGS)	-	14	10E	04	C	6.8	-	-	920	52	60	4.9	0.0	-	100	12.00	2.90	1060	170.0	880.0	5.2	-	-	-	1.03	0.00	24
	LINCOLN COUNTY																											
LI001	Odessa Oil Test Piezometer A	1972/08/08	21	31E	10	M	8.2	-	356	100	7	8	2.6	-	-	87	-	-	210	19.0	16.0	13.0	-	-	-	0.99	1.00	40
LI015	Sprague City	1982/07/21	21	38E	23	L	8.4	248	-	34	5	15	3.6	0.0	-	63	-	-	145	5.0	3.0	0.9	-	3	0.2	1.04	0.00	7,16
LI024	Wilbur SEC	1982/09/09	25	32E	35	P	8.2	270	-	39	5	12	5.3	0.0	-	57	-	-	151	7.0	4.6	0.8	-	-	0.1	0.99	0.00	7,16
LI025	Davenport City 6	1982/07/21	25	37E	21	L	8.2	288	-	40	5	15	5.8	0.0	-	50	-	-	174	11.0	4.3	0.9	-	-	0.1	1.07	0.00	7,16
	PIERCE COUNTY																											
PI001S	Longmire Springs	-	15	08E	29	R	7.4	-	-	487	41	492	-	-	-	-	-	-	-	-	1657.0	-	-	-	-	1.00	0.00	14
PI003S	Spring	-	19	02E	19	Q	6.8	95	57	5	1	9	2.9	0.0	-	10	-	-	44	5.4	3.0	-	-	-	0.4	1.00	0.98	15
	SKAMANIA COUNTY																											
SK001Sa	Bonneville Hot Springs(A-3)	-	02	07E	16	M	9.9	790	-	134	1	30	-	-	-	50	-	-	-	72.0	187.0	0.6	-	-	-	0.93	0.00	18,24
SK001Sb	Bonneville Hot Springs	-	02	07E	16	M	9.5	-	505	145	1	31	0.0	-	-	46	2.00	-	39	80.0	180.0	0.7	0.5	-	-	0.94	1.00	32
SK002S	Rock Creek Hot Springs(A-1)	-	03	07E	27	B	9.7	400	-	80	0	12	-	-	-	41	-	-	31	40.0	85.0	0.7	-	-	-	0.93	0.00	18,24
SK008Sa	St. Martin Hot Springs	-	03	08E	21	R	7.0	-	-	291	6	104	-	-	-	20	-	-	-	-	636.0	-	-	-	-	1.00	0.00	14
SK008Sb	St. Martin Hot Springs	-	03	08E	21	R	8.5	-	1210	360	6	76	0.3	-	-	48	2.90	-	19	16.0	690.0	0.7	-	-	-	1.03	1.00	32
SK008Sc	St. Martin Hot Springs(A-1)	-	03	08E	21	R	-	2350	-	360	6	73	0.5	-	-	57	-	0.30	-	-	756.0	-	-	-	-	1.09	0.00	21,24
	SNOHOMISH COUNTY																											
SN001Sa	Garland Min. Sprs(Main)(GLA-1)	-	28	11E	25	C	6.9	17000	-	2640	188	318	90.0	1.0	-	107	24.40	8.10	2050	170.0	4250.0	1.3	-	-	-	1.09	0.00	19
SN001Sb	Garland Mineral Springs	-	28	11E	25	C	6.5	-	-	2500	200	390	87.0	5.4	-	105	64.00	9.40	2600	160.0	3600.0	1.6	-	-	-	1.04	0.00	24
SN001Sc	Garland Mineral Springs	-	28	11E	25	C	6.5	-	8380	2500	200	390	87.0	-	-	105	64.00	-	2600	160.0	3600.0	1.6	-	-	-	1.06	1.00	32
SN002S	Kennedy Hot Springs(USGS)	-	30	12E	01	H	6.3	-	2600	670	72	190	48.0	-	-	175	7.50	-	1660	2.0	625.0	1.2	-	-	-	1.02	1.00	32
SN003S	Gamma Hot Spring	-	31	13E	36	D	6.1	-	-	510	80	71	2.8	-	-	141	9.00	2.80	398	30.0	755.0	1.4	-	-	-	1.01	0.00	19
SN004Sa	Sulphur Creek Hot Springs	-	32	13E	19	C	9.4	-	-	100	2	1	-	-	-	76	0.55	0.14	154	21.0	51.0	3.9	-	-	-	1.04	0.00	19
SN004Sb	Sulphur Creek Hot Springs(A-1)	-	32	13E	19	C	7.6	480	-	102	3	2	0.0	-	-	100	0.60	0.10	102	60.0	54.0	3.0	-	-	-	1.01	0.00	21

Appendix B. Chemical data for thermal wells and springs *(continued)*

I.D.	Site name	Date	Twp N.	Rge.	Sec.	Part. sec.	pH	Conduct. umhos/cm	TDS ppm	Na ppm	K ppm	Ca ppm	Mg ppm	Fe ppm	Al ppm	SiO_2 ppm	B ppm	Li ppm	HCO_3 ppm	SO_4 ppm	Cl ppm	F ppm	H_2S ppm	CO_3 ppm	NO_3 ppm	Charge balance	Mass balance	References
	SPOKANE COUNTY																											
SP005	US Government	1958/07/22	24	40E	22	L	7.6	-	201	14	3	30	10.0	-	-	45	-	-	150	21.0	3.8	0.3	-	-	-	1.02	1.00	40
SP006	Fairchild AFB, 2	1958/07/22	24	41E	03	N	7.8	-	166	13	2	21	8.6	-	-	47	-	-	130	10.0	1.8	0.4	-	-	-	1.03	0.99	40
SP007	US Government	1958/07/22	25	40E	14	R	7.5	-	171	14	2	20	12.0	-	-	42	-	-	140	8.1	5.2	0.7	-	-	-	1.02	0.99	40
SP008	US Government	1958/07/22	25	40E	34	P	7.2	-	192	16	2	32	7.8	-	-	49	-	-	150	5.2	4.5	0.4	-	-	-	0.93	1.01	40
SP009	US Government	1958/07/23	25	41E	01	R	7.2	-	192	11	2	28	13.0	-	-	47	-	-	170	6.4	2.5	0.3	-	-	-	1.02	0.99	40
SP010	US Army, Fort George Wright	1958/07/22	25	42E	11	E	7.5	-	121	2	1	28	7.8	-	-	13	-	-	110	11.0	3.8	0.3	-	-	-	1.01	1.00	40
SP011	Washington Water Power Co., 1-3	1977/10/03	25	43E	13	A	7.8	-	138	2	2	32	14.0	0.0	-	-	-	-	150	12.0	1.7	0.1	-	-	-	0.97	1.00	40
SP012	US Air Force	1958/07/22	26	42E	20	N	7.8	-	162	4	2	36	12.0	-	-	17	-	-	150	14.0	3.2	0.1	-	-	-	0.96	1.00	40
	WALLA WALLA COUNTY																											
WA020a	Jaussand, Art	1958/08/01	06	35E	10	P	8.2	226	186	32	9	12	1.7	0.0	-	72	-	-	126	3.2	6.5	0.7	-	-	-	1.02	0.94	31,41
WA020b	Jaussand, Art	1958/08/01	06	35E	10	P	8.2	-	199	32	9	12	1.7	-	-	72	-	-	130	3.2	6.5	0.7	-	-	-	1.05	0.99	40
WA027a	WDOE Tst./Obs., Piezometer A	1973/03/07	06	35E	18	A	8.3	-	229	43	10	6	0.6	-	-	89	-	-	140	4.1	5.2	1.2	-	-	-	1.06	1.01	40
WA027b	WDOE Tst./Obs., Piezometer A	1973/07/12	06	35E	18	A	8.7	-	228	40	8	7	1.1	-	-	93	-	-	120	3.6	4.2	1.1	-	-	-	0.95	1.05	40
WA044	Baker & Baker	1946/11/29	06	36E	09	P	-	186	161	8	3	16	9.8	0.1	-	60	-	-	108	5.7	3.8	0.6	-	-	0.4	1.02	1.00	30
WA049	Byerley Farm, Inc.	1971/09/20	07	32E	36	Q	7.9	-	260	48	16	10	2.9	-	-	80	0.78	0.25	160	3.8	20.0	1.3	-	-	-	1.04	0.99	40
WA063	Bonneville Power Admin.	1946/11/21	07	35E	23	M	-	214	177	31	8	11	2.1	0.0	-	55	-	-	125	3.8	3.6	0.6	-	-	0.1	1.01	1.00	30
WA071	Walla Walla College	1954/08/04	07	35E	33	H	7.6	-	-	17	4	15	5.6	0.1	0.07	-	0.14	-	116	3.8	1.6	-	-	-	-	1.00	0.00	31
WA079	College Place	1970/10/23	07	35E	36	F	8.2	-	190	22	5	19	5.1	-	-	62	-	0.02	130	5.6	3.9	0.5	-	-	-	0.98	1.01	40
WA080	College Place City	1959/10/22	07	35E	36	F	8.2	-	194	21	5	20	5.5	-	-	65	-	-	140	5.4	4.2	0.5	-	-	-	1.04	0.99	40
WA082	College Place	1952/04/20	07	35E	36	F	8.1	233	195	22	6	20	5.8	0.0	-	65	-	-	141	5.8	4.2	0.6	-	-	0.1	1.02	0.98	30
WA083	College Place	1959/10/22	07	35E	36	F	8.2	229	200	21	5	20	5.5	0.0	-	65	-	-	136	5.4	4.2	0.5	-	-	-	1.01	1.03	30,41
WA086	Walla Walla Comm. Coll.	1994/01/20	07	36E	14	P	5.7	165	120	6	2	14	7.0	nd	nd	46	0.11	nd	90	3.2	4.2	0.4	na	nd	na	1.07	0.94	—
WA095	Rogers Canning	1970/10/21	07	36E	19	R	8.1	-	177	23	6	13	3.6	-	-	68	-	0.02	120	3.6	2.8	0.8	-	-	-	1.05	0.99	40
WA097	Whitman College	1970/10/22	07	36E	20	H	8.0	-	192	25	6	17	5.5	-	-	61	-	0.02	140	6.6	1.9	0.9	-	-	-	1.01	1.00	40
WA098a	Walla Walla City 5	1960/07/29	07	36E	28	R	8.2	245	193	29	6	16	5.3	0.1	-	62	-	-	148	5.0	3.0	1.0	-	-	-	1.03	0.97	41
WA098b	Walla Walla City 5	1960/07/29	07	36E	28	R	8.2	-	200	29	6	16	5.3	-	-	62	-	-	150	5.0	3.0	1.0	-	-	-	1.04	1.00	40
	WHATCOM COUNTY																											
WH003Sa	Baker Hot Springs(A-1)	-	38	09E	20	M	7.9	820	-	179	12	6	0.2	-	-	125	3.10	0.40	157	95.0	109.0	3.0	-	-	-	0.93	0.00	21,24
WH003Sb	Baker Hot Springs(Main)(BKA-2)	-	38	09E	20	M	8.3	730	-	146	8	5	-	-	-	105	0.91	0.30	106	95.0	111.0	3.0	-	-	-	1.02	0.00	19
WH003Sc	Baker Hot Springs(B-1)	-	38	09E	20	M	8.0	780	-	154	11	6	0.3	-	-	90	2.70	0.30	124	90.0	99.0	3.0	-	-	-	0.94	0.00	21,24
WH003Sd	Baker Hot Springs	-	38	09E	20	M	8.6	-	-	170	10	6	0.2	-	-	103	2.70	0.36	165	87.0	110.0	3.2	-	-	-	0.98	0.00	19
	WHITMAN COUNTY																											
WT006	Pullman City	1955/06/22	14	45E	05	D	7.8	-	226	14	4	20	15.2	0.1	0.06	-	0.56	-	178	3.4	6.7	-	-	-	-	1.10	1.50	31
WT009	Pullman City	1955/06/22	15	45E	32	N	7.5	-	206	18	4	20	15.7	0.0	-	-	0.01	-	184	2.3	6.7	-	-	-	-	1.05	1.32	31
WT010a	Colfax City Clay St. well	1955/08/18	16	43E	11	G	7.7	-	209	21	2	19	13.5	0.1	0.02	-	0.02	-	172	5.4	3.5	-	-	-	-	1.02	1.40	31
WT010b	Colfax City Clay St. well	1958/06/20	16	43E	11	G	7.4	280	204	22	2	25	9.0	0.1	0.03	-	-	-	185	3.8	4.6	-	-	-	-	1.10	1.29	31

Appendix B. Chemical data for thermal wells and springs *(continued)*

I.D.	Site name	Date	Twp N.	Rge.	Sec.	Part. sec.	pH	Conduct. umhos/cm	TDS ppm	Na ppm	K ppm	Ca ppm	Mg ppm	Fe ppm	Al ppm	SiO_2 ppm	B ppm	Li ppm	HCO_3 ppm	SO_4 ppm	Cl ppm	F ppm	H_2S ppm	CO_3 ppm	NO_3 ppm	Charge ballance	Mass balance	References
	YAKIMA COUNTY																											
YA018	Grandview City, well no. 15	1994/01/19	09	23E	22	L	7.0	415	310	90	10	0	nd	0.0	nd	84	0.27	nd	166	nd	23.0	4.1	na	19	na	1.02	0.99	—
YA022	Showaway, Ida	1974/04/11	10	17E	14	D	-	-	202	19	5	34	16.0	1.5	-	-	-	-	210	4.9	18.0	1.3	-	-	-	1.04	1.00	40
YA031	Decker Ranch (Decker 7)	1974/05/20	10	18E	31	N	-	-	182	31	5	19	14.0	0.1	-	-	-	-	220	1.6	3.3	0.7	-	-	-	1.07	0.99	40
YA037	Toppenish City 7	1974/09/19	10	20E	04	L	-	-	116	24	5	14	4.2	0.1	-	-	-	-	130	0.7	2.6	0.6	-	-	-	1.03	1.01	40
YA040a	Toppenish City 6	1959/10/19	10	20E	09	A	7.8	-	160	19	4	13	2.2	0.1	-	68	-	-	100	0.3	1.0	0.6	-	-	-	0.98	1.02	40
YA040b	Toppenish City 6	1959/10/19	10	20E	09	A	7.8	171	158	19	4	13	2.2	0.1	-	68	-	-	105	0.3	1.0	0.6	-	-	-	1.03	0.99	41
YA040c	Toppenish City 6	1971/02/03	10	20E	09	A	8.0	-	162	20	4	12	3.5	-	-	68	-	0.02	110	0.0	2.0	0.5	-	-	-	1.04	0.99	40
YA044	Phillips, Lena	1974/05/23	10	21E	33	B	-	-	200	25	4	31	13.0	0.3	-	-	-	-	210	17.0	7.7	0.2	-	-	-	1.07	0.99	40
YA045	Sunnyside City 4	1970/10/06	10	22E	25	F	7.6	-	223	16	7	29	9.7	-	-	62	0.02	0.02	160	16.0	4.8	0.5	-	-	-	1.01	1.00	40
YA050	Sunnyside City 7	1994/04/08	10	22E	36	E	6.5	290	220	21	9	24	10.7	0.1	-	69	-	-	183	-	10.0	0.4	-	-	-	1.05	0.94	—
YA051	Sunnyside City 6	1994/04/08	10	23E	30	M	5.9	322	256	15	7	31	14.5	0.1	-	61	-	-	161	30.00	12.0	0.4	-	-	-	1.03	1.02	—
YA057	Gowdy, Albert A.	1974/06/14	11	16E	34	K	-	-	201	30	5	23	16.0	2.2	-	-	-	-	210	18.0	2.8	0.5	-	-	-	1.00	1.00	40
YA058	Mount Adams Seed	1974/06/13	11	17E	01	F	-	-	-	24	4	18	5.9	0.1	-	-	-	-	140	1.0	5.0	0.7	-	-	-	1.00	0.00	40
YA060	Stephenson, C. and H.	1974/05/21	11	17E	03	L	-	-	145	27	4	16	8.8	0.1	-	-	-	-	170	1.4	4.4	0.8	-	-	-	1.08	0.99	40
YA065	Siegner, Monte	1974/10/01	11	18E	09	N	-	-	142	25	4	20	7.4	0.1	-	-	-	-	160	0.8	4.5	0.7	-	-	-	1.02	1.00	40
YA067	Carlson, Sarah	1974/03/06	11	18E	26	L	-	-	160	21	5	24	10.0	0.4	-	-	-	-	130	22.0	11.0	0.2	-	-	-	0.96	1.02	40
YA068	Harrah City	1994/01/19	11	18E	26	M	6.8	325	218	35	7	19	10.9	0.2	nd	95	0.14	nd	199	nd	6.0	1.1	na	nd	na	0.99	0.80	—
YA074	Wapato City, well no. 5	1994/01/19	11	19E	14	M	5.7	190	158	20	4	12	4.2	0.1	nd	79	0.14	nd	112	na	3.6	0.5	na	nd	na	1.04	0.89	—
YA130	Wiley, Robert	1971/09/23	12	17E	16	A	7.8	-	178	24	4	11	3.4	-	-	71	-	0.03	120	0.0	2.2	0.8	-	-	-	1.06	1.01	40
YA133	Hansen Fruit	1974/06/14	12	18E	27	G	-	-	157	22	4	20	14.0	0.1	-	-	-	-	180	1.5	6.3	0.7	-	-	-	1.01	1.00	40
YA134	Hansen Fruit	1974/06/14	12	18E	27	H	-	-	168	35	5	19	6.8	0.1	-	-	-	-	170	4.1	11.0	1.2	-	-	-	1.04	1.01	40
YA137	Mount Adams Seed, 2	1974/05/23	12	18E	32	H	-	-	136	25	4	19	6.4	0.1	-	-	-	-	140	0.8	10.0	0.7	-	-	-	1.00	1.01	40
YA141a	Moxee City, 1	1962/11/02	12	19E	01	Q	8.4	-	180	56	3	5	0.9	-	-	30	0.01	-	160	0.0	4.5	1.7	-	-	-	1.02	1.00	40
YA141b	Moxee City, 1	1994/04/08	12	19E	01	Q	6.5	260	230	57	3	5	1.0	0.1	-	36	-	-	168	-	7.1	1.4	-	-	-	1.07	1.19	—
YA211a	Yakima Creamery well	1994/01/18	13	18E	24	K	6.6	235	126	49	nd	2	nd	0.1	nd	nd	nd	nd	117	nd	5.4	1.3	na	7	na	1.06	1.03	—
YA211a	Yakima Creamery well, rerun	1994/01/18	13	18E	24	K	6.6	235	126	50	1	1	1.0	nd	nd	20	nd	nd	117	nd	5.4	1.3	na	7	na	1.01	0.87	—
YA211b	Yakima Creamery well	1994/04/08	13	18E	24	K	6.6	210	148	50	nd	2	0.7	nd	nd	31	0.19	nd	129	nd	5.7	1.1	na	3	na	1.07	0.94	—
YA211c	Yakima Creamery well	1994/01/18	13	18E	24	K	6.6	210	146	52	nd	2	0.4	nd	nd	18	0.30	nd	124	nd	6.1	1.1	na	4	na	1.03	1.01	—
YA226	Yakima County (heat pump well)	1994/01/18	13	19E	19	D	7.0	155	92	19	3	11	0.3	nd	nd	40	0.35	nd	75	5.4	4.8	0.4	na	3	na	1.08	0.74	—
YA258a	US Army, Yakima Firing Cen., 1	1951/04/20	14	19E	28	B	8.0	-	187	19	6	15	11.0	-	-	56	-	-	150	0.7	4.1	0.5	-	-	-	1.01	1.00	40
YA258b	US Army, Yakima Firing Cen., 1	1951/04/20	14	19E	28	B	8.0	235	179	19	6	15	11.0	0.0	-	56	-	-	151	0.7	4.1	0.5	-	-	-	1.01	0.96	31
YA258c	US Army, Yakima Firing Cen., 1	1953/09/29	14	19E	28	B	7.8	-	187	19	4	16	11.0	-	-	59	-	-	150	0.7	3.8	0.5	-	-	-	1.01	1.00	40
YA258d	US Army, Yakima Firing Cen., 1	1953/09/29	14	19E	28	B	7.8	244	176	19	4	16	11.0	0.2	-	59	-	-	149	0.7	3.8	0.5	-	-	-	1.00	0.94	31,41
YA258e	US Army, Yakima Firing Cen., 1	1955/10/05	14	19E	28	B	8.1	-	175	19	4	16	9.4	-	-	50	-	-	150	0.2	3.5	0.5	-	-	-	1.05	0.99	40
YA258f	US Army, Yakima Firing Cen., 1	1959/03/30	14	19E	28	B	7.8	-	177	18	4	17	11.0	-	-	51	-	-	150	0.5	3.5	0.6	-	-	-	1.00	0.99	40

Appendix B. Chemical data for thermal wells and springs *(continued)*

I.D.	Site name	Date	Twp N.	Rge.	Sec.	Part. sec.	pH	Conduct. umhos/cm	TDS ppm	Na ppm	K ppm	Ca ppm	Mg ppm	Fe ppm	Al ppm	SiO_2 ppm	B ppm	Li ppm	HCO_3 ppm	SO_4 ppm	Cl ppm	F ppm	H_2S ppm	CO_3 ppm	NO_3 ppm	Charge balance	Mass balance	References
YA258g	US Army, Yakima Firing Cen., 1	1960/09/14	14	19E	28	B	7.9	220	174	19	4	15	11.0	0.0	-	52	-	-	147	0.8	4.0	0.6	-	-	0.2	1.02	0.97	31
YA258h	US Army, Yakima Firing Cen., 1	1960/09/14	14	19E	28	B	7.9	-	178	19	4	15	11.0	-	-	52	-	-	150	0.8	4.0	0.6	-	-	-	1.04	0.99	40
YA258i	US Army, Yakima Firing Cen., 1	1967/02/28	14	19E	28	B	8.1	-	183	20	4	16	10.0	-	-	56	-	-	150	0.4	4.0	0.6	-	-	-	1.03	0.99	40

Appendix C. Convectively Heated(?) Wells

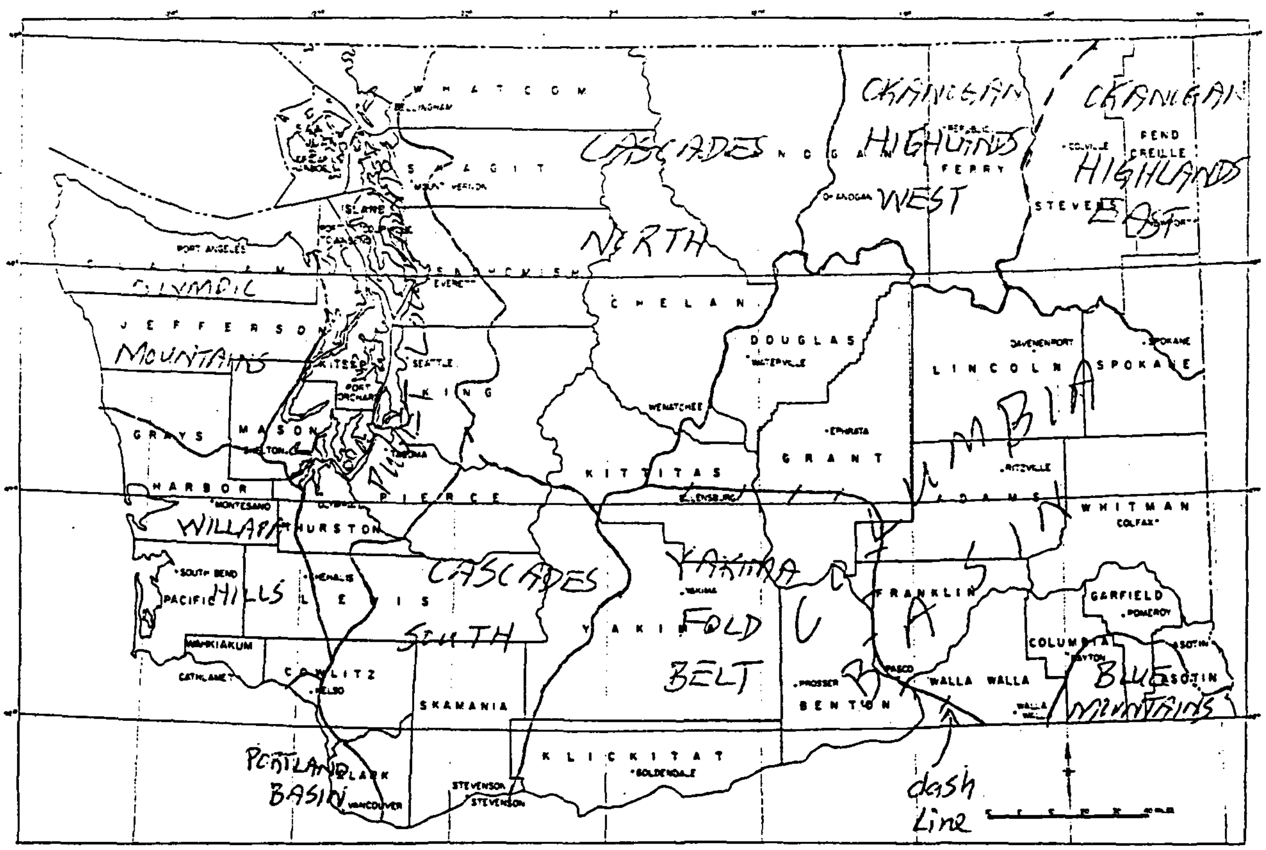
This table lists the wells, statewide, that are too warm to have been heated by conductive gradients. Wells listed are too warm to have been heated conductively in a range of temperature gradients between 30 and 50°C/km. The formula, T = 15°C + (0.05°C/m)(depth in meters), calculates the Predicted Temperature of each well in the table, assuming that the well was heated conductively in a gradient of 50°C/km, with a mean annual surface temperature of 15°C. This is a reasonable maximum temperature for conductively heated wells in the Columbia Basin. Warmer wells, may be heated convectively, that is, by the movement of warmer waters into the well from below. Other explanations, such as errors in the data, local heat sources, and artificial recharge are possible.

I.D.	Predicted temp. °C	Measured temp. °C	Depth (m)
AD010	18.7	20.0	75
AD011	18.9	20.0	77
AD030	18.4	25.0	69
AD037	26.0	26.1	220
AD039	24.6	26.2	192
AD107	20.1	20.8	102
AS003	19.0	20.0	79
BE003	18.7	20.0	75
BE023	17.9	27.8	59
BE024	21.3	24.0	125
BE027	17.4	22.5	47
BE030	16.4	21.0	28
BE032	18.4	21.1	69
BE033	18.4	21.1	69
BE040	15.9	20.0	18
BE048	19.7	23.3	94
BE055	28.7	29.8	273
BE064	15.8	20.5	15
BE076	20.9	21.4	117
BE078	20.0	20.4	99
BE079	19.9	21.2	98
BE080	20.7	22.0	113
BE083	16.9	20.0	38
BE084	20.9	21.1	117
BE086	19.9	21.0	98
BE088	19.3	21.0	85
BE092	18.3	20.5	65
BE093	17.5	21.5	51
BE102	15.8	21.0	16
BE103	16.6	39.1	32
BE108	62.3	62.8	945
BE110	19.9	20.0	98
BE117	16.2	32.5	24
BE118	16.4	24.0	28
BE119	16.2	20.7	24
BE120	15.8	22.0	16
BE121	15.8	22.5	17
BE123	16.0	20.5	20
CK001	18.9	22.0	77
CK002	19.5	24.1	90
CO003	18.7	20.0	74
CO004	20.8	23.3	116
CO005	20.8	23.9	116
DO003	19.1	20.0	83
FR004	16.8	20.5	37
FR005	23.4	24.6	168
FR008	19.6	23.0	91
FR011	16.0	23.0	20
FR015	20.7	21.1	113
FR020	15.8	22.5	15
FR022	18.6	20.0	72
FR023	20.6	21.1	112
FR024	22.3	23.0	146
FR042	15.3	21.5	6
FR045	24.1	26.7	182
FR053	27.1	27.2	242
FR054	24.4	25.6	187
FR060	29.3	29.5	287
GA003	17.4	20.0	47
GR006	21.3	22.5	125
GR008	18.4	25.6	68
GR010	23.6	27.8	172
GR021	20.4	20.6	108
GR022	17.6	21.5	53
GR031	27.7	27.8	253
GR034	17.7	20.0	54
GR045	16.0	21.0	20
GR070	19.9	20.5	98
GR073	24.5	28.8	191
GR083	18.2	20.0	64
GR092	31.9	34.9	337
GR093	24.1	28.6	181
GR096	19.3	20.0	86
GR100	21.9	28.0	137
GR104	19.0	29.0	79
GR105	24.4	25.5	188
GR111	22.1	27.0	142
GR116	24.5	29.2	189
GR118	18.6	24.4	72
GY001	18.6	20.5	71
KI002	18.6	21.5	72
KS001	24.2	24.3	184
KS005	16.1	20.0	21
KS008	21.9	22.8	137
KS010	18.1	26.0	61
KS012	28.1	28.4	262
KT001	19.4	20.5	88
KT002	20.2	21.4	104
KT007	17.4	21.1	47
KT008	23.4	27.0	168
KT011	19.5	27.2	90
KT012	18.1	23.0	61
KT030	18.2	21.0	63
LI001	26.2	30.5	224
LI005	24.7	28.3	195
LI017	25.6	28.7	212
LI028	22.6	25.8	151
LI029	27.9	31.7	258
OK001	17.2	22.7	44
OK002	15.6	21.1	12
OK005	15.5	20.0	9
OK006	15.5	20.0	9
SK003	24.9	35.5	198
SK004	22.8	26.4	155
SK007	20.7	27.8	113
SK011	32.9	36.3	357
SP005	20.3	20.5	105
SP008	18.0	21.0	60
SP010	15.9	20.0	18
SP011	16.7	21.0	34
SP012	17.4	20.0	49
WA004	30.3	31.8	305
WA006	17.3	20.0	46
WA007	30.3	31.8	305
WA009	23.8	25.1	175
WA013	35.4	40.2	407
WA014	35.4	40.7	407
WA015	40.3	45.0	506
WA016	33.3	40.0	366
WA019	16.1	20.0	21
WA023	24.0	24.4	180
WA026	34.8	36.1	396
WA027	18.8	25.5	75
WA045	21.2	22.8	123
WA046	16.7	20.0	34
WA047	24.7	26.7	195
WA057	30.5	30.6	310
WA059	16.8	26.7	37
WA062	17.4	20.0	49
WA089	17.4	20.0	48
WA093	18.4	21.7	69
WA105	16.9	22.0	38
WA106	22.3	25.4	146
WA107	22.7	25.6	154
WA108	26.9	31.0	237
WA112	18.2	22.2	64
WH004	22.0	47.9	141
WT001	19.0	20.0	79
WT003	24.6	26.5	192
WT004	17.8	20.0	56
WT005	17.5	20.0	50
WT006	17.5	20.0	50
WT007	17.6	21.0	51
WT008	19.7	20.0	95
WT009	18.5	20.0	70
WT012	21.8	22.2	136
WT013	20.9	22.2	117
WT015	17.7	24.4	54
YA009	15.6	21.0	13
YA011	16.8	22.0	35
YA013	19.7	21.0	95
YA014	17.4	20.0	49
YA015	19.3	21.1	85
YA020	17.9	20.0	59
YA021	16.8	22.0	35
YA022	16.2	20.5	23
YA032	15.9	20.0	18
YA033	15.9	20.5	19
YA036	18.2	21.1	64

I.D.	Predicted temp. °C	Measured temp. °C	Depth (m)
YA038	15.9	20.0	19
YA039	15.6	27.0	11
YA041	15.8	20.5	16
YA043	18.8	21.1	77
YA044	15.6	21.0	13
YA048	19.6	22.2	91
YA049	21.4	21.5	128
YA051	22.3	24.0	145
YA056	21.9	22.5	137
YA057	22.0	23.5	139
YA062	30.1	31.6	302
YA065	21.1	23.0	122
YA067	15.8	26.4	16
YA073	16.0	23.0	20
YA127	19.3	21.7	87
YA132	21.5	24.5	130
YA143	17.1	23.3	43
YA144	17.6	23.3	52
YA178	20.9	24.4	118
YA184	26.5	26.7	230
YA204	21.2	26.7	123
YA205	27.2	28.0	244
YA206	20.3	20.6	107
YA207	18.7	24.4	73
YA228	19.1	20.0	82
YA230	26.5	44.5	230
YA245	22.7	24.2	153
YA247	18.7	23.3	75
YA250	18.7	21.1	75
YA252	16.2	20.5	24
YA253	15.8	22.2	17
YA257	21.2	21.7	123

Figure 1.

I think the volcanics ... need to be ...



maybe add a pattern for the ...

Figure 2.

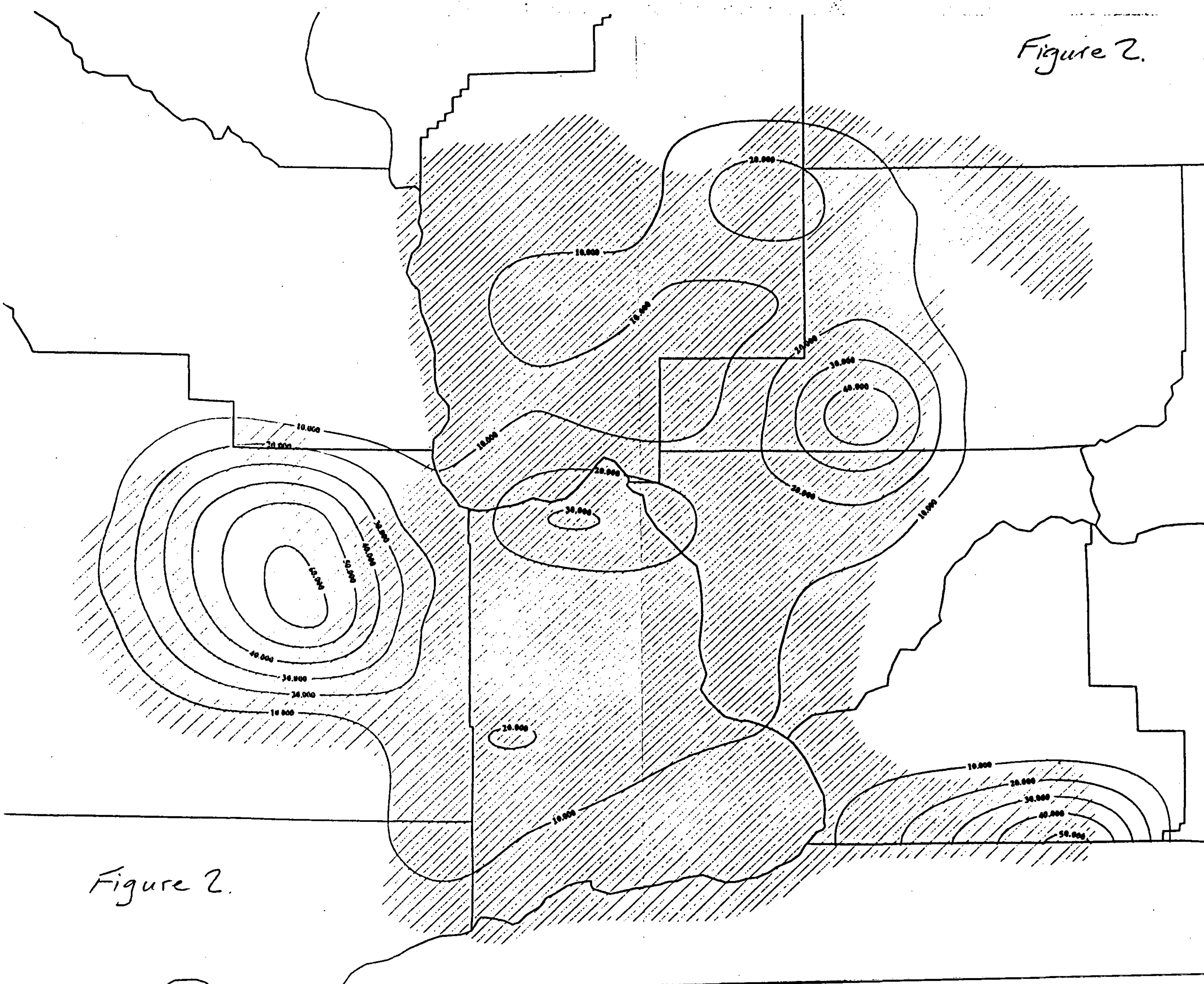
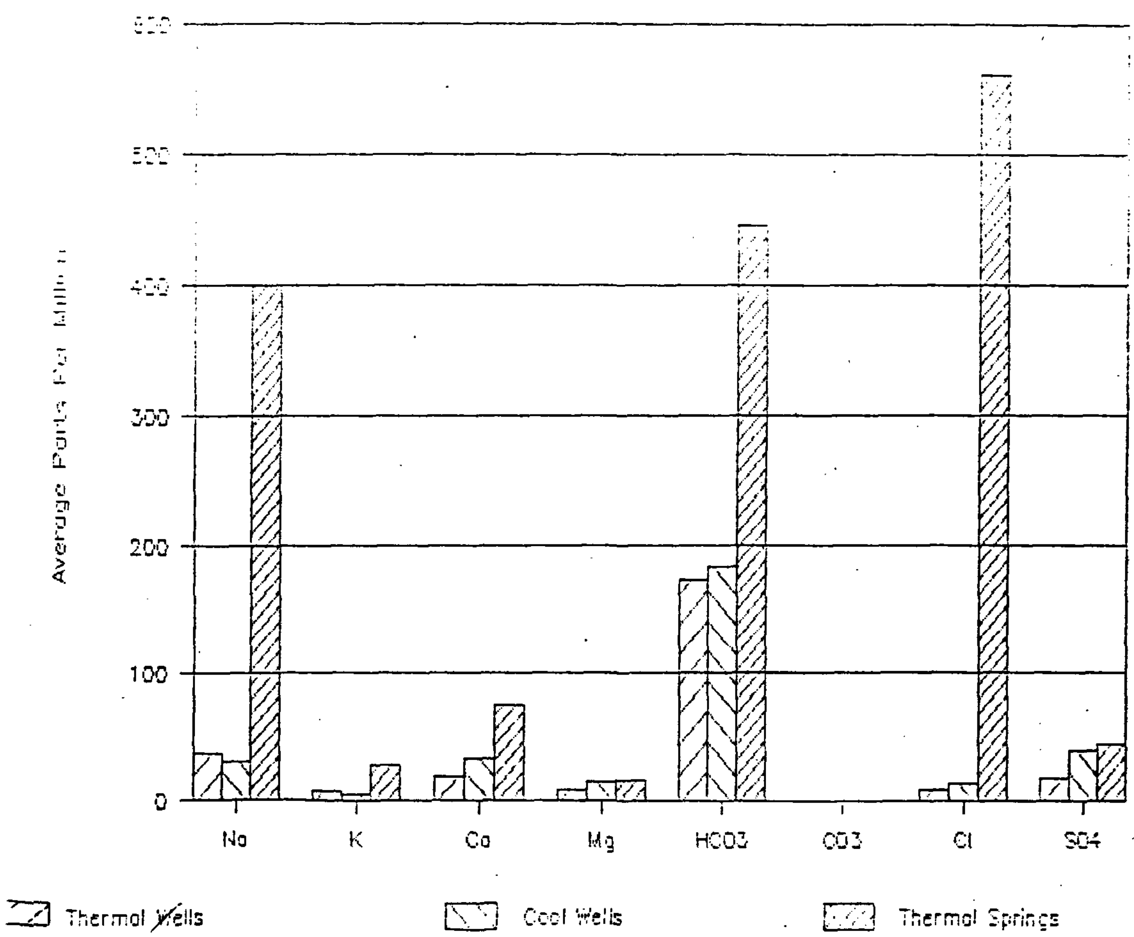
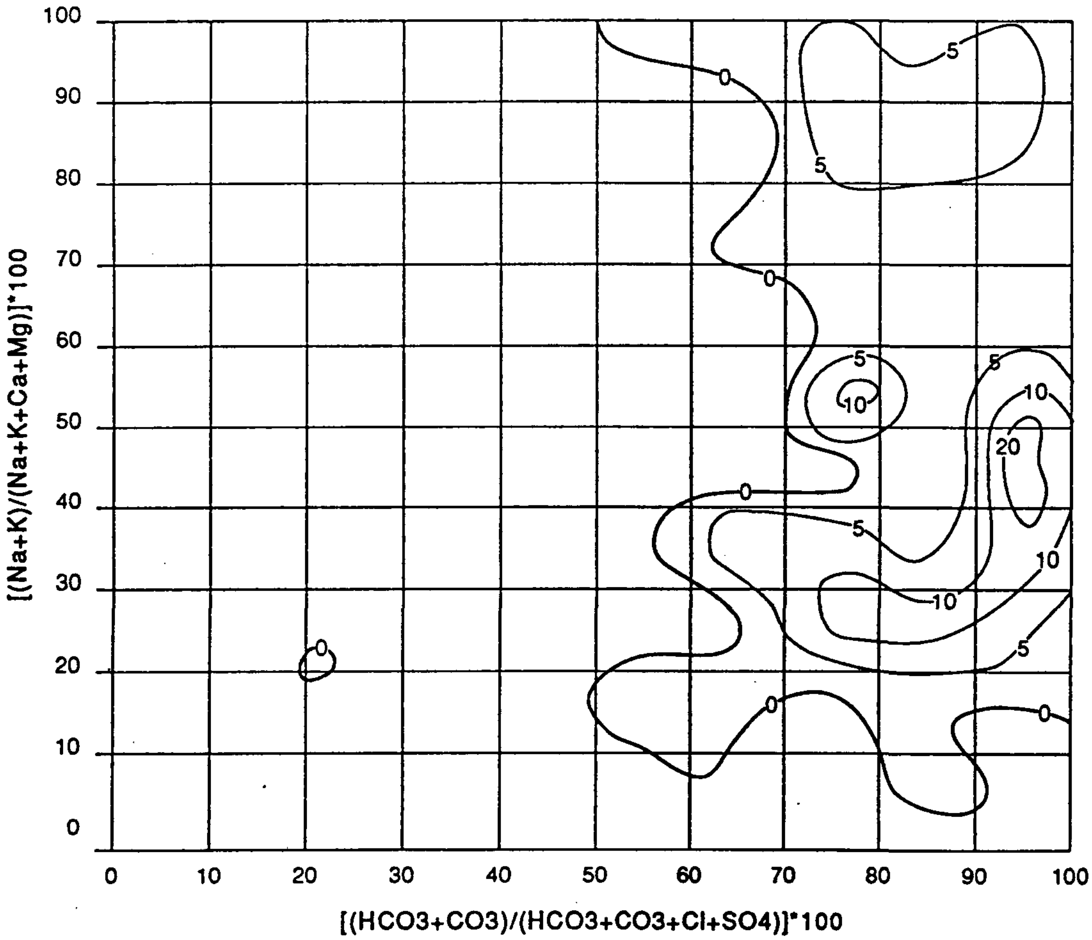


Figure 2.



Average Parts Per Million
600
500
400
300
200
100
0
Na
K
Ca
Mg
HCO3
CO3
Cl
SO4
Thermal Wells
Cool Wells
Thermal Springs

Figure 3.



100
90
80
70
60
50
40
30
20
10
0
[(Na+K)/(Na+K+Ca+Mg)]*100
0
10
20
30
40
50
60
70
80
90
100
[(HCO3+CO3)/(HCO3+CO3+Cl+SO4)]*100
0
5
10
20

Figure 4a.

Figure 4b

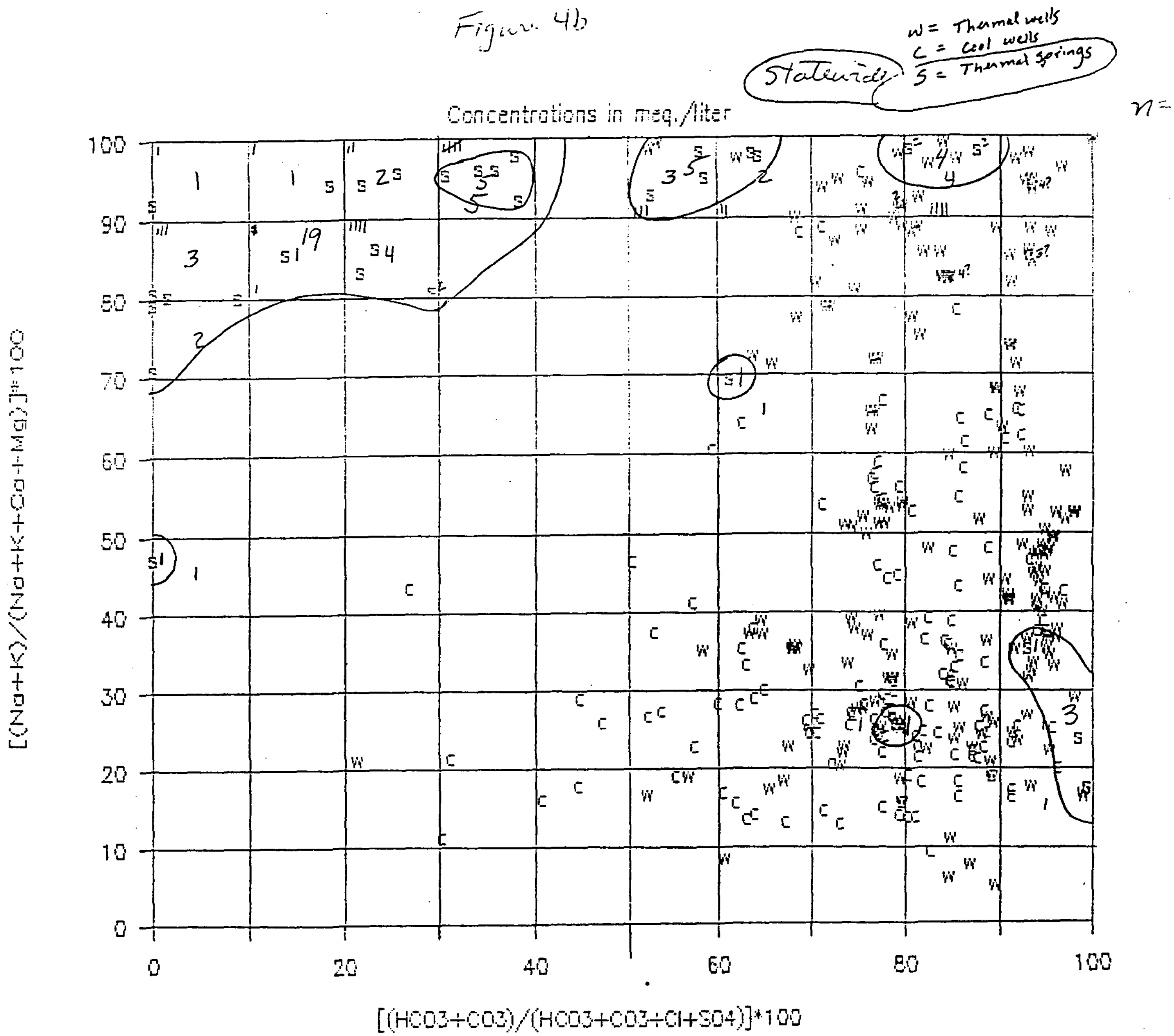


Figure 4b.

Figure. 4c.

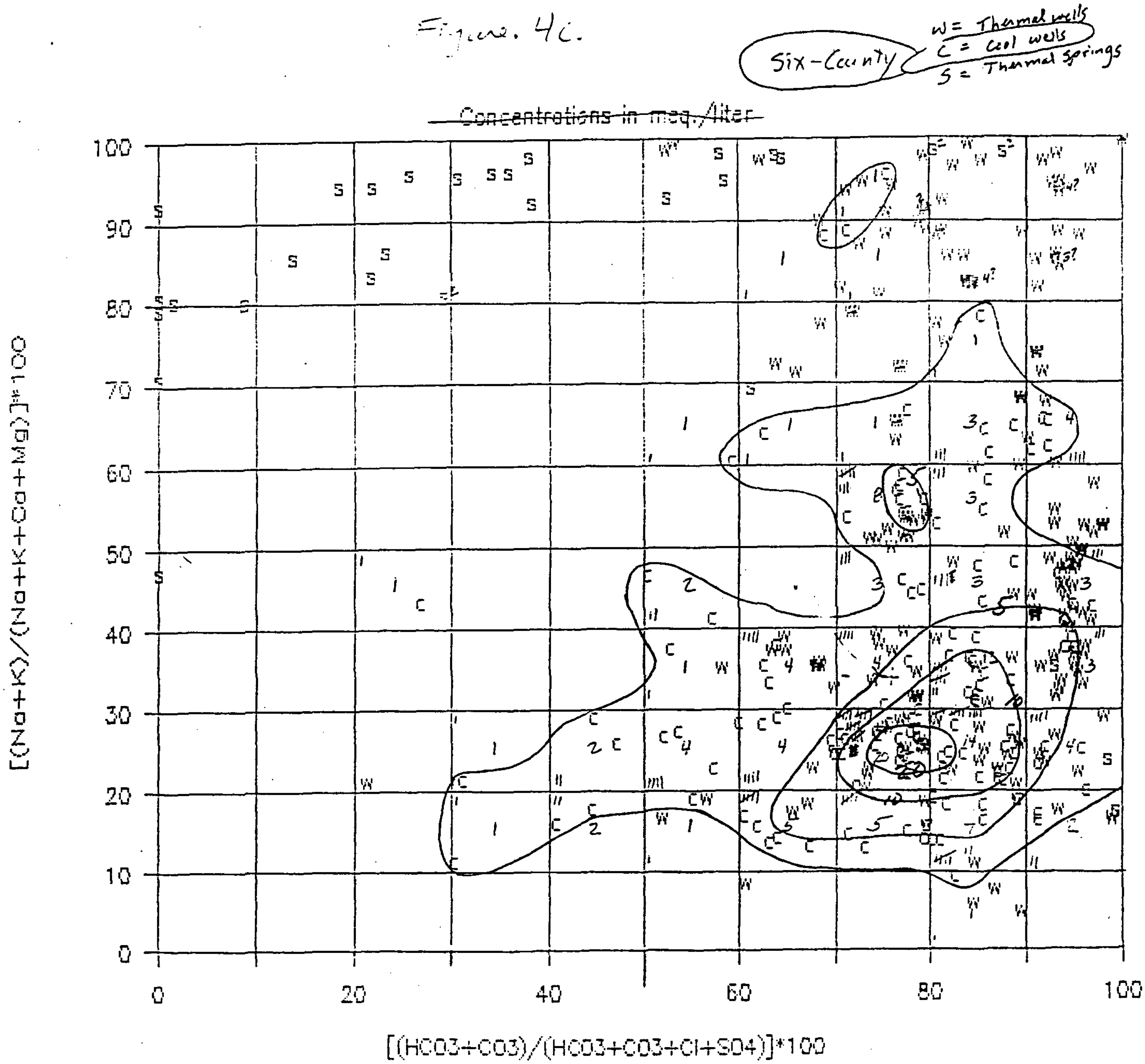


Figure 4c.

SERIES		GROUP	FORMATION	MEMBER	ISOTOPIC AGE (Ma)	MAGNETIC POLARITY
MIOCENE	upper	COLUMBIA RIVER BASALT GROUP	SADDLE MOUNTAINS BASALT	LOWER MONUMENTAL MEMBER	6	N
				ICE HARBOR MEMBER	8.5	
				basalt of Goose Island		N
				basalt of Martindale		R
				basalt of Basin City		N
				BUFORD MEMBER		
	middle			ELEPHANT MOUNTAIN MEMBER	10.5	N,T
				POMONA MEMBER	12	R
				ESQUATZEL MEMBER		N
				WEISSENFELS RIDGE MEMBER		
				basalt of Slippery Creek		N
				basalt of Tenmile Creek		N
				basalt of Lewiston Orchards		N
				basalt of Cloverland		N
				ASOTIN MEMBER	13	
				basalt of Huntzinger		N
				WILBUR CREEK MEMBER		
				basalt of Lapwai		N
				basalt of Wahluke		N
				UMATILLA MEMBER		
				basalt of Sillusi		N
				basalt of Umatilla		N
			WANAPUM BASALT	PRIEST RAPIDS MEMBER	14.5	
				basalt of Lolo		R
				basalt of Rosalia		R
				ROZA MEMBER		T,R
				FRENCHMAN SPRINGS MEMBER		
				basalt of Lyons Ferry		N
				basalt of Sentinel Gap		N
				basalt of Sand Hollow	15.3	N
				basalt of Silver Falls		N,E
				basalt of Ginkgo		E
				basalt of Palouse Falls		E
				ECKLER MOUNTAIN MEMBER		
				basalt of Shumaker Creek		N
				basalt of Dodge		N
				basalt of Robinette Mountain		N
			GRANDE RONDE BASALT (PRINEVILLE BASALT)	Sentinel Bluffs unit	15.6	N_2
				Slack Canyon unit		
				Fields Spring unit		
				Winter Water unit		
				Umtanum unit		
				Ortley unit		
				Armstrong Canyon unit		
				Meyer Ridge unit		R_2
				Grouse Creek unit		
				Wapshilla Ridge unit		
				Mt. Horrible unit		
			GRANDE RONDE BASALT (PICTURE GORGE BASALT)	China Creek unit		N_1
				Downey Gulch unit		
				Center Creek unit		R_1
				Rogersburg unit		
				Teepee Butte unit		
				Buckhorn Springs unit	16.9	
	lower		IMNAHA BASALT	See Hooper and others (1984) for Imnaha units	17.0	R_1
						T
						N_0
					17.3	R_0

Figure 5

14.95	2.20	12.05	6.88	3.41	1.49	2.70	0.35
14.96	2.20	12.47	6.86	3.44	1.54	2.41	0.33
14.75	2.19	12.24	6.93	3.53	1.80	2.44	0.34
14.81	2.28	12.35	7.10	3.61	1.69	2.40	0.35
14.80	2.17	12.73	6.93	3.61	1.70	2.16	0.33
14.59	2.26	12.56	7.16	3.64	1.68	2.29	0.34
14.56	2.13	12.76	7.02	3.15	1.94	2.24	0.35
		FIELD SPRINGS UNIT					
16.06	1.31	9.45	9.15	5.75	0.70	2.71	0.28
15.74	1.30	9.86	9.70	6.00	0.49	2.46	0.27
15.90	1.29	9.22	9.86	6.28	0.45	2.51	0.26
		TEEPEE BUTTE - LOW-TiO_2 UNIT					
4.96	2.02	11.77	8.93	5.21	1.06	2.54	0.27
5.31	1.87	11.47	9.32	4.97	0.95	2.43	0.26
5.18	1.90	11.71	9.60	5.25	0.91	2.58	0.27
5.49	1.82	10.49	9.36	5.89	0.57	2.79	0.25

ɜO

date of 17.0 ± 0.2 Ma
low the GRB–Imnaha
lts (17.5 ± 0.3 Ma,
Ve have also obtained
R_1 GRB flow that we
e data suggest that the
om 17.0 to 15.6 Ma.

:e of all CRBG forma-
extent, covering more
n²) of the total area of
:es for GRB lie in the
Plateau, a number of
were able to cross the
nd Washington coast
Neim, 1985; Pfaff and
for the four MSUs
nd northern extent of
imarily to the tremen-
pre-existing topogra-

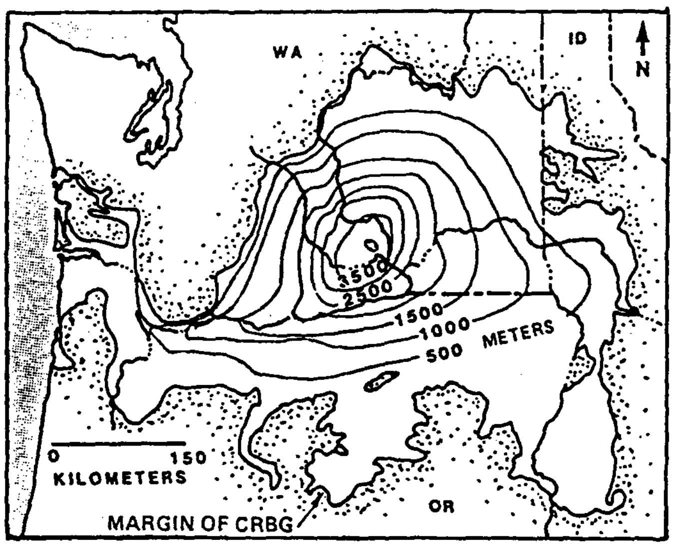


Figure 3. Generalized isopach map of the Grande Ronde Basalt. Data points shown on Figure 2.

Figure 6.
From Reidel and others, 1989

~~explain better - complete caption~~
~~explain contours~~

Figure 7

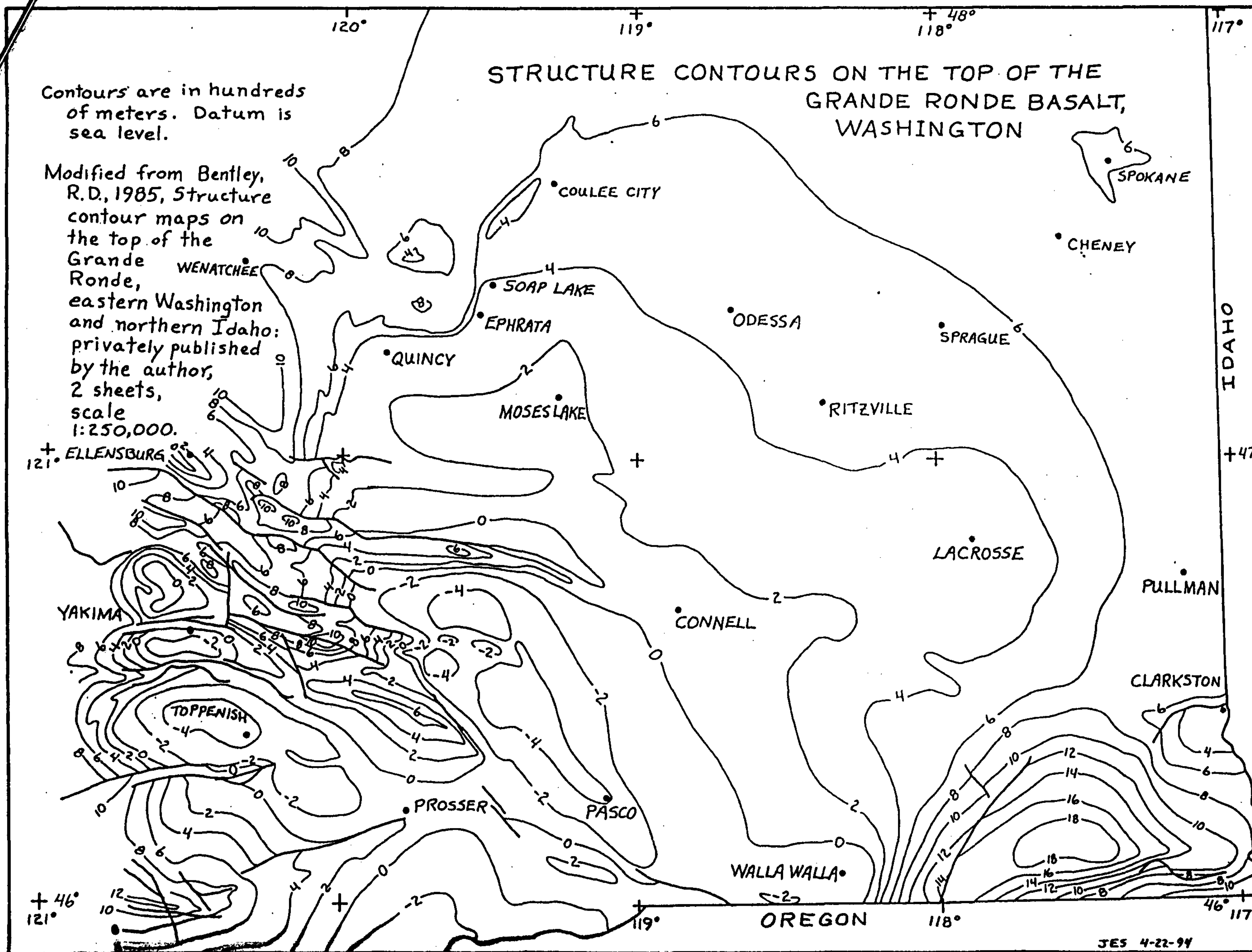


Figure 7

Figure 8

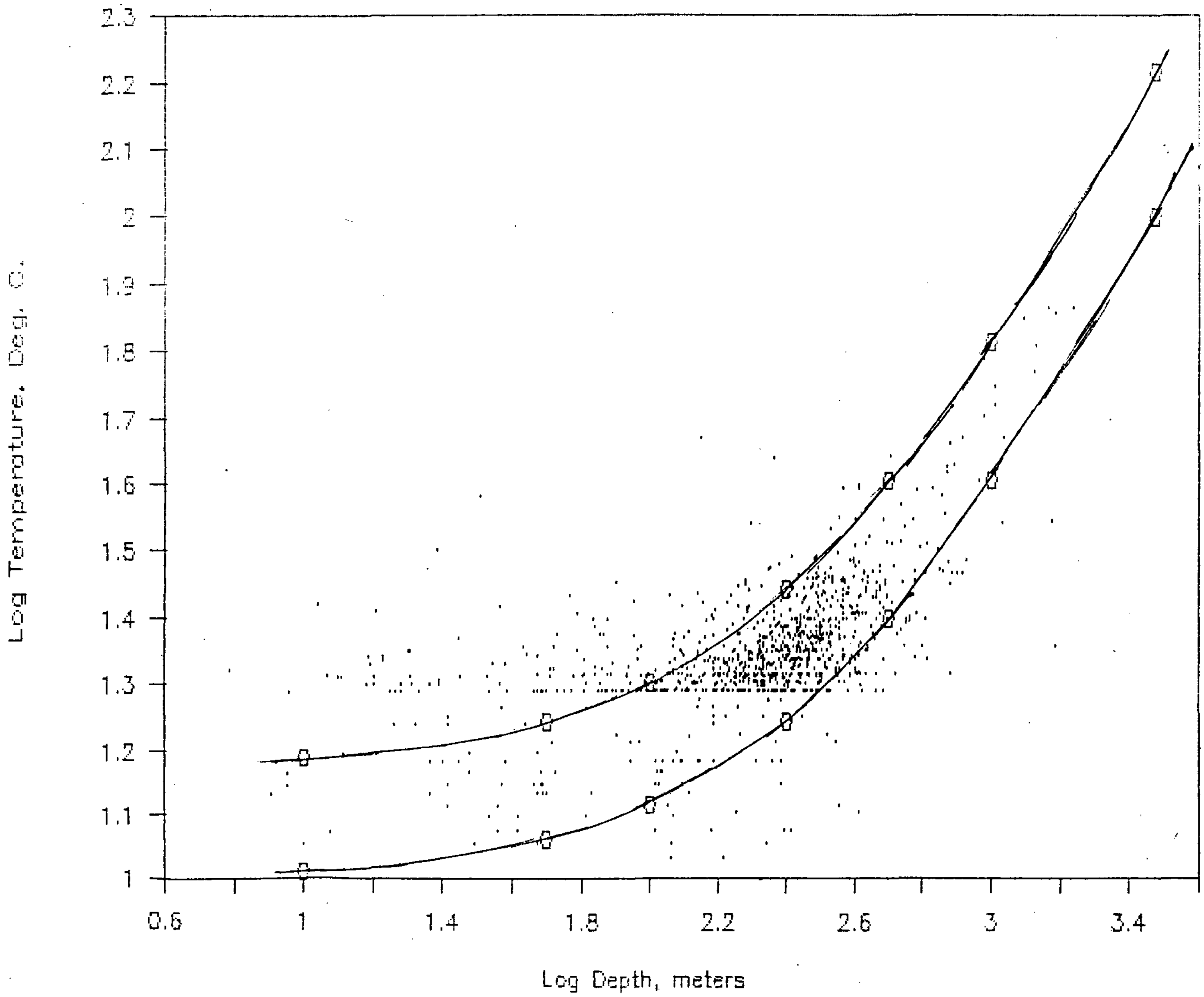


Figure 8.

Table 2. GEOCHEMICAL DATA

I.D.	SITE NAME	pH	CONDUCT. umhos/cm	T.D.S. ppm	Na ppm	K ppm	Ca ppm	Mg ppm	Fe ppm	Al ppm	SiO2 ppm	B ppm	Li ppm	HCO3 ppm	SO4 ppm	Cl ppm	F ppm	H2S ppm	CO2 ppm	GEOTHERMOMETERS Si-Qtz	Na-K-Ca	REF.	I.D.
00380	Baker Hot Springs	-	820	492	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	139	162	3,4,12	00380
00761	Baker Hot Springs	8.56	-	-	170	9.6	5.5	0.18	LD	-	103	2.7	0.36	165	87	110	3.2	-	-	138.9	162.1	17	00761
00748	Baker Hot Springs (BKC-2)	6.8	220	-	37	2.9	5.8	LD	LD	-	32	0.36	8.9	32	-	41	0.34	-	-	82.1	152.8	17	00748
00410	Baker Hot Springs(BKA-1)	7.93	820	-	179	11.8	5.8	0.2	-	-	125	3.1	0.4	157	95	109	3	-	-	150	170	5,12	00410
00545	Baker Hot Springs(BKA-1)	7.93	820	-	179	11.8	5.8	0.2	-	-	125	-	0.4	157	95	109	3	-	-	-	-	9,12	00545
00411	Baker Hot Springs(BKB-1)	7.96	780	-	154	10.5	5.9	0.3	-	-	90	2.7	0.3	124	90	99	3	-	-	132	169	5,12	00411
00546	Baker Hot Springs(BKB-1)	7.96	780	-	154	10.5	5.9	0.3	-	-	90	-	0.3	124	90	99	3	-	-	-	-	9,12	00546
00747	Baker Hot Springs(Main)(BKA-2)	8.3	730	-	146	8.4	5.2	LD	LD	-	105	0.91	0.3	106	95	111	3	-	-	140	161	17	00747
00526a	Bonneville Drill Hole2(BVDH-1)	11.6	2800	-	162	2.6	197	LD	LD	-	26	-	LD	8	92	238	0.4	-	-	74	85	9,12	00526a
00526b	Bonneville Drill Hole2(BVDH-2)	10.9	1150	-	155	1.2	62	LD	LD	-	38	-	LD	-	91	238	0.6	-	-	85	68	9,12	00526b
00757	Bonneville Hot Spring	9.54	-	-	145	0.9	31	0.03	-	-	46	2	-	39	80	180	0.66	-	-	98	63.6	17	00757
00390	Bonneville Hot Springs(BVA-2)	8.2	805	TDS C. -	160	1	31	0.5	-	-	50	-	1	-	8	196	-	-	-	102	65	5,12	00390
00368	Bonneville Hot Springs(BVA-3)	9.9	800	475 480	134	1	30	LD	LD	-	50	-	LD	-	72	187	0.6	-	-	102	69	3,4,9,12	00368
00391	Bonneville Hot Springs(BVB-2)	-	790	-	146	-	28	0.5	-	-	50	-	-	-	78	-	-	-	-	102	-	5,12	00391
00663	Bonneville Hot Springs(USGS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	98	64	12	00663
00369	Collins Hot Springs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00369
00381	Dorr Fumarole Field	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00381
00664	Ephrata Well(EPW-1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	114	178	12	00664
00360	Fish Hatchery Warm Spring	-	1660	996	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	165	3,4,12	00360
00665	Fish Hatchery Warm Spring	-	-	-	160	16	110	95	2.2	-	-	-	-	1130	2.6	49	0.4	-	-	-	-	12	00665
00758	Gamma Hot Spring	6.13	-	-	510	80	71	2.8	-	-	141	9	2.8	398	30	755	1.4	-	-	157.3	216	17	00758
00375	Gamma Hot Springs	-	2800	1680	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	157	216	3,4,12	00375
00759	Garland Mineral Spring	6.46	-	-	2500	200	390	87	5.4	-	105	64	9.4	2600	160	3600	1.6	-	-	139.9	190.5	17	00759
00750	Garland Mineral Springs(GLB-1)	7	16000	-	2360	162	300	86	15	-	103	21.9	LD	-	160	3800	1.3	-	-	138.9	183.3	17	00750
00376	Garland Mineral Springs(USGS)	6.46	-	-	2500	200	390	87	5.4	-	105	64	9.4	2600	-	3600	1.6	-	-	140	191	3,4,12	00376
00749	Garland Min. Sprs(Main)(GLA-1)	6.9	17000	-	2640	188	318	90	1	-	107	24.4	8.1	2050	170	4250	1.3	-	-	141	186.9	17	00749
00357	Goldmeyer Hot Springs	-	-	138	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	107	118	3,4,12	00357
00753	Goldmeyer Hot Springs	8.48	-	-	125	3	6.3	0.04	-	-	56	LD	-	61	40	130	0.88	-	-	107.2	118.1	17	00753
00527	Goldmeyer Hot Springs(GMA-1)	8.8	600	-	122	3	6.2	LD	LD	-	61	-	0.2	-	46	140	0.8	-	-	111	119	9,12	00527
00528	Goldmeyer Hot Springs(GMC-1)	8.8	630	-	119	2.8	6.3	LD	LD	-	62	-	0.2	-	41	137	0.9	-	-	112	117	9,12	00528
00529	Goldmeyer Hot Springs(GMD-1)	8.8	580	-	117	2.7	6.9	LD	LD	-	59	-	0.2	-	42	132	0.8	-	-	110	115	9,12	00529
00356	Green River Soda Springs	-	-	5800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00356
00364	Hot Lake	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00364
00377	Kennedy Hot Springs	-	3400	2040	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00377
00413	Kennedy Hot Springs(C-1)	8.3	700	-	-	-	-	-	-	-	-	-	-	291	2	-	1	-	-	-	-	5	00413
00412	Kennedy Hot Springs(KNB-1)	-	-	-	728	128	184	60	-	-	180	9.5	4.4	-	-	622	-	-	-	173	220	5,12	00412
00414	Kennedy Hot Springs(KND-1)	8.17	3200	-	741	132	187	62	-	-	180	9.7	4.8	1143	2	626	1	-	-	173	222	5,12	00414
00662	Kennedy Hot Springs(USGS)	6.27	-	-	670	72	190	48	3	-	175	7.5	3.5	1660	-	625	1.2	-	-	171	189	12	00662
00530	Klickitat Mineral Sprs.(KLA-1)	6.3	540	-	40	4.6	40	48	5.4	-	110	-	0.1	340	5	4.1	0.9	-	-	143	157	9,12	00530
00531	Klickitat Mineral Sprs.(KLB-1)	6.2	1500	-	68	10.4	118	115	13	-	150	-	0.1	860	9	4.6	0.4	-	-	162	171	9,12	00531
00532	Klickitat Mineral Sprs.(KLC-1)	6.2	1200	TDSc -	62	9.5	99	100	12	-	147	-	0.2	-	9	4.7	0.3	-	-	160	171	9,12	00532
00361	Klickitat Mineral Sprs.(USGS)	5.89	-	1517 900	64	10	120	100	-	-	140	LD	-	1070	-	4.2	0.34	-	-	-	-	3,4,12	00361
00358	Lester Hot Springs	-	520	312	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00358
00754	Lester Hot Springs	9.19	-	-	105	2	5.3	0.03	-	-	61	LD	-	61	19	115	1.6	-	-	111.3	107.9	17	00754
00392	Lester Hot Springs(LSA-1)	7.6	520	-	104	3	7	0.1	-	-	67	-	0.35	-	30	215	-	-	-	116	123	5,12	00392
00393	Lester Hot Springs(LSE-1)	-	500	-	98	2	12	0.1	-	-	67	-	0.33	-	-	200	-	-	-	116	104	5,12	00393
00394	Lester Hot Springs(LSF-1)	-	500	-	112	3	8	0.2	-	-	66	-	0.33	-	-	200	-	-	-	116	119	5,12	00394
00366	Longmire Mineral Springs	-	6500	3900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00366
00395	Longmire Mineral Sprs.(LMA-1)	6	5400	-	508	43	460	150	-	-	112	-	1.9	-	40	876	-	-	-	144	164	5,12	00395

File Name = GEOTHDB2.WK1 Last updated April 30, 1993, by J.E.S.

I.D.	SITE NAME	pH	CONDUCT. umhos/cm	T.D.S. ppm	Na ppm	K ppm	Ca ppm	Mg ppm	Fe ppm	Al ppm	SiO2 ppm	B ppm	Li ppm	HCO3 ppm	SO4 ppm	Cl ppm	F ppm	H2S ppm	CO2 ppm	GEOTHERMOMETERS Si-Qtz	Na-K-Ca	REF.	I.D.
00396	Longmire Mineral Sprs.(LMC-1)	6.2	6550	-	645	51	582	-	-	-	141	-	2.4	-	-	1204	-	-	-	157	170	5,12	00396
00397	Longmire Mineral Sprs.(LMG-1)	-	-	-	555	43	500	-	-	-	102	-	2.1	-	-	946	-	-	-	138	161	5,12	00397
00153	Miocene Petroleum Well (MPW-1)	9.3	555	-	123	17.5	2.8	LD	LD	-	120	-	LD	101	2	88	21	-	-	148	214	9,12	00153
00383	Mount Adams Fumaroles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00383
00367	Mount Rainier Fumaroles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00367
00370	Mount St. Helens Fumaroles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00370
00362	Ohanapecosh Hot Springs	-	4650	2790	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00362
00398	Ohanapecosh Hot Springs(OHA-1)	-	4400	-	895	47	68	5.1	-	-	106	-	2.81	-	175	1010	-	-	-	141	165	5,12	00398
00399	Ohanapecosh Hot Springs(OHB-1)	-	4500	-	889	47	65	4.9	-	-	107	-	2.83	-	-	1000	-	-	-	141	166	5,12	00399
00400	Ohanapecosh Hot Springs(OHC-1)	-	-	-	825	44	64	4.9	-	-	108	-	2.82	-	-	987	-	-	-	142	165	5,12	00400
00401	Ohanapecosh Hot Springs(OHD-1)	-	4650	-	895	50	64	4.9	-	-	107	-	2.82	-	165	1030	-	-	-	141	169	5,12	00401
00402	Ohanapecosh Hot Springs(OHG-1)	-	-	-	895	48	58	4.7	-	-	106	-	2.8	-	175	1050	-	-	-	141	168	5,12	00402
00403	Ohanapecosh Hot Springs(OHH-1)	-	-	-	870	46	69	5.5	-	-	98	-	2.75	-	-	978	-	-	-	136	165	5,12	00403
00663	Ohanapecosh Hot Springs(USGS)	6.8	-	-	920	52	60	4.9	0.04	-	100	12	2.9	1060	-	880	5.2	-	-	137	171	12	00663
00354	Olympic Hot Springs	-	320	192	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00354
00751	Olympic Hot Springs	9.5	-	-	72	1.1	0.9	LD	LD	-	66	0.82	0.04	175	5	11	1.2	-	-	115.2	105.9	17	00751
00415	Olympic Hot Springs(M-1)	8.95	320	-	60	-	1.2	0.01	-	-	80	0.8	0.03	85	37	10	1	-	-	-	-	5	00415
00420	Olympic Hot Springs(OLA-1)	-	320	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	125	-	5	00420
00416	Olympic Hot Springs(OLB-1)	-	-	-	62	2.4	1	0.01	-	-	-	0.8	0.03	-	-	10	-	-	-	-	142	5	00416
00371	Orr Creek Warm Springs	-	180	108	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00371
00404	Orr Creek Warm Springs(OCA-1)	-	175	-	29	9	3	0.1	-	-	29	-	0.01	-	1	28	-	-	-	78	231	5,12	00404
00363	Packwood Hot Spring	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00363
00365	Poison Lake	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00365
00372	Rock Creek Hot Springs	-	-	240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00372
00533	Rock Creek Hot Springs(RCA-1)	9.7	400	-	80	0.1	11.5	LD	LD	-	41	-	LD	31	40	85	0.7	-	-	93	21	9,12	00533
00534	Rock Creek Hot Springs(RCA-2)	9.3	400	-	-	0.1	11.5	LD	LD	-	-	-	LD	35	40	85	0.7	-	-	93	-	9,12	00534
00359	Scenic Hot Springs	-	2350	1410	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00359
00755	Scenic Hot Springs	9.14	-	-	49	0.64	2.1	0.02	-	-	44	LD	-	75	13	22	0.72	-	-	95.9	90.4	17	00755
00536	Scenic Hot Springs(SEA-1)	9.3	180	-	40	0.5	2.3	LD	LD	-	41	-	LD	43	14	18	0.7	-	-	93	86	9,12	00536
00537	Scenic Hot Springs(SEA-2)	-	-	-	51	0.7	2.1	LD	LD	-	49	-	LD	-	18	23	0.8	-	-	101	93	9,12	00537
00535	Scenic Hot Springs(SEA-GT)	9.6	220	-	50	0.4	2.2	LD	LD	-	48	-	LD	-	14	24	0.9	-	-	-	-	9,12	00535
00538	Scenic Hot Springs(SEB-1)	9.4	200	-	46	0.5	1.9	LD	LD	-	46	-	LD	43	16	21	0.8	-	-	98	84	9,12	00538
00539	Scenic Hot Springs(SEC-1)	9.3	140	-	32	0.5	2.1	LD	LD	-	37	-	LD	44	13	14	0.6	-	-	88	92	9,12	00539
00540	Scenic Hot Springs(SED-1)	9.3	170	-	35	0.5	3.5	0.1	LD	-	38	-	LD	44	13	16	0.6	-	-	89	87	9,12	00540
00541	Scenic Hot Springs(SED-2)	-	-	-	40	1	3.5	0.1	LD	-	40	-	LD	-	15	18	0.6	-	-	92	109	9,12	00541
00382	Sherman Crater Fumaroles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00382
00373	Shiperds Hot Springs	-	-	135	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00373
00543	Shiperds Hot Springs(SPA-1)	8.5	220	-	43	LD	4.2	0.1	LD	-	47	-	LD	30	12	38	0.4	-	-	99	53	9,12	00543
00384	Simcoe Soda Springs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00384
00355	Sol Duc Hot Springs	-	350	210	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00355
00752	Sol Duc Hot Springs	9.46	-	-	80	1	0.8	LD	0.04	-	60	1.4	0.05	181	7	21	1.7	-	-	110.5	100.5	17	00752
00417	Sol Duc Hot Springs(1)	7.93	380	-	75	2.2	1.3	0.01	-	-	80	1.3	0.1	137	34	20	1	-	-	-	-	5	00417
00418	Sol Duc Hot Springs(2)	8.43	360	-	74	2.6	1.1	0.01	-	-	-	1.3	0.1	129	35	18	1	-	-	-	-	5	00418
00406	Sol Duc Hot Springs(SDA-1)	9.2	355	-	81	1	3	0.1	-	-	64	-	0.1	-	-	20	-	-	-	114	93	5,12	00406
00407	Sol Duc Hot Springs(SDB-1)	9.2	342	-	75	1	1	0.1	-	-	65	-	0.1	-	-	18	-	-	-	114	99	5,12	00407
00408	Sol Duc Hot Springs(SDC-1)	9.2	345	-	79	1	1	0.1	-	-	64	-	0.1	-	-	19	-	-	-	114	98	5,12	00408
00409	Sol Duc Hot Springs(SDD-1)	9.2	305	-	75	1	2	0.1	-	-	58	-	0.1	-	-	18	-	-	-	109	97	5,12	00409
00374	St. Martin Hot Springs	-	-	1410	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

GEOTHERMAL RESOURCES DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON -- GEOCHEMICAL DATA.

File Name = GEOTHDB2.WK1 Last updated April 30, 1993, by J.E.S.

I.D.	SITE NAME	pH	CONDUCT. umhos/cm	T.D.S. ppm	Na ppm	K ppm	Ca ppm	Mg ppm	Fe ppm	Al ppm	SiO2 ppm	B ppm	Li ppm	HCO3 ppm	SO4 ppm	Cl ppm	F ppm	H2S ppm	CO2 ppm	GEOTHERMOMETERS Si-Qtz	Na-K-Ca	REF.	I.D.
00542	St. Martin Hot Springs(SMA-2)	8.5	2200	-	325	5.2	68	0.4	LD	-	51	-	0.4	22	16	680	0.6	-	-	103	100	9,12	00542
00756	St. Martin's Hot Spring	8.54	-	-	360	6.4	76	0.3	LD	-	48	2.9	0.28	19	16	690	0.74	-	-	99.9	104	17	00756
00378	Sulphur Creek Hot Springs	-	500	300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00378
00419	Sulphur Creek Hot Sprs.(SFA-1)	7.62	480	-	102	2.8	1.6	0.01	-	-	100	0.6	0.1	102	60	54	3	-	-	137	131	5	00419
00760	Sulphur Hot Springs	9.35	-	-	100	1.9	1.2	LD	LD	-	76	0.55	0.14	154	21	51	3.9	-	-	122.4	116.8	17	00760
00379	Warm Spr. Canyon Warm Spr.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,4	00379
00544	Yakima Creamery Well(YKW-1)	-	215	-	52	0.5	1.8	LD	LD	-	23	-	LD	-	2	4.5	1.2	-	-	69	82	9,12	00544

NOTES:

T.D.S.: Total dissolved solids.

REFERENCES:

1. Korosec, M. A.; Kaler, K. L., 1980, Well temperature information and locations in the State of Washington: Washington Division of Geology and Earth Resources Open File Report 80-7, 89 p. [unpaginated], 2 pl., scale 1:500,000.
2. Blackwell, D. D., 1980, Heat flow and geothermal gradient measurements in Washington to 1979 and temperature-depth data collected during 1979: Washington Division of Geology and Earth Resources Open File Report 80-9, 524 p. [unpaginated].
3. Korosec, M. A., 1980, Table of thermal and mineral spring locations in Washington: Washington Division of Geology and Earth Resources Open File Report 80-11, 6 p.
4. Korosec, M. A., and Others, 1981, Geothermal resources of Washington: Washington Division of Geology and Earth Resources Geologic Map GM-25, 1 sheet, scale 1:500,000.
5. Korosec, M. A.; and Others, 1980, The 1979-1980 geothermal resource assessment program in Washington: Washington Division of Geology and Earth Resources Open File Report 81-3, 267 p., 1 map, scale 1:24,000.
6. Schuster, J. E., 1981, Geothermal energy potential of the Yakima valley area, Washington. In Bloomquist, R. G., editor, Proceedings of the Geothermal Symposium--Low temperature utilization, heat pump applications, district heating, September 24, 1980: Washington State Energy Office WAOENG 81-05, p. XI 1 - XI 10.
7. Korosec, M. A., and others, 1982, The low temperature geothermal resources of eastern Washington: Washington Division of Geology and Earth Resources Open File Report 82-1, 20 p., 2 figs., 1 table.
8. Korosec, M. A.; Phillips, W. M., 1982, WELLTHERM: Temperature, depth, and geothermal gradient data for wells in Washington State: Washington Division of Geology and Earth Resources Open File Report 82-2, 3 p., 74-p. table.
9. Korosec, M. A., 1982, Table of chemical analyses for thermal and mineral spring and well waters collected in 1980 and 1981: Washington Division of Geology and Earth Resources Open File

File Name = GEOTHDB2.WK1 Last updated April 30, 1993, by J.E.S.

I.D.	SITE NAME	pH	CONDUCT. umhos/cm	T.D.S. ppm	Na ppm	K ppm	Ca ppm	Mg ppm	Fe ppm	Al ppm	SiO2 ppm	B ppm	Li ppm	HCO3 ppm	SO4 ppm	Cl ppm	F ppm	H2S ppm	CO2 ppm	GEOTHERMOMETERS Si-Qtz	Na-K-Ca	REF.	I.D.

10. Biggane, J. H., 1982, The low-temperature geothermal resource and stratigraphy of portions of Yakima County, Washington: Washington Division of Geology and Earth Resources Open File Report 82-6, 128 p., 58 figs., 4 pl., 11 tables, appendix.

11. Biggane, J. H., 1983, Geophysical logs from water wells in the Yakima area, Washington: Washington Division of Geology and Earth Resources Open File Report 83-2, 50 p.

12. Korosec, M. A., and others, 1983, The 1980-1982 geothermal resource assessment program in Washington; with chapters on thermal springs, gravity investigations, heat-flow drilling, low-temperature resources in eastern Washington, geology the the south Cascades and White Pass areas, and targets for geothermal resource exploration: Washington Division of Geology and Earth Resources Open File Report 83-7, 299 p.

13. Widness, Scott, 1983, Low temperature geothermal resource evaluation of the Moses Lake-Ritzville-Connell area, Washington: Washington Division of Geology and Earth Resources Open File Report 83-11. 27 p.

14. Korosec, M. A., 1983, The 1983 temperature gradient and heat flow drilling project for the State of Washington: Washington Division of Geology and Earth Resources Open File Report 83-12, 11 p.

15. Stoffel, K. L.; Widness, Scott, 1983, Geophysical logs of selected wells in eastern Washington: Washington Division of Geology and Earth Resources Open File Report 83-14, 81 p.

16. Stoffel, K. L.; Widness, Scott, 1983, Fluid-temperature logs for selected wells in eastern Washington: Washington Division of Geology and Earth Resources Open File Report 83-15, 351 p.

17. Korosec, M. A., 1983, Chemical analyses for thermal and mineral springs examined in 1982-1983: Washington Division of Geology and Earth Resources Open File Report 84-1, 8 p.

18. Blackwell, D. D., and others, 1985, Heat flow and geothermal studies in the State of Washington: Washington Division of Geology and Earth Resources Open File Report 85-6, 77 p.

19. Barnett, D. B., 1986, The 1985 geothermal gradient drilling project for the State of Washington: Washington Division of Geology and Earth Resources Open File Report 86-2, 34 p.

20. Washington State Department of Ecology Water Well Reports, Central Regional Office, Yakima, Washington, April 12 and 13, 1993. (Water well reports for 12,000-15,000 wells were reviewed by J. E. Schuster and J. D. Dragovich of the Washington Division of Geology and Earth Resources. 145 records for wells at or above 20 degrees C. were found, copied, and placed in the Division's files.)

GEOTHERMAL RESOURCES DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON -- DESCRIPTIVE AND THERMAL DATA.
File Name = GEOTHDB1.WK1 Last Updated April 30, 1993, by J.E.S.

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.D
00001	CMSTP&P RR	W	Adams	-	-	SW,NW	08	15	28E	20.0	B	126.0	D	63.0	B	-	-	-	-	1,4,8	00001
00002	USBR	-	Adams	-	-	NW,NW	15	15	28E	24.2	B	264.0	D	46.0	B	-	-	-	-	1,4,8	00002
00308	DH 4	-	Adams	-	-	NE,SW	30	15	28E	53.5	S	924.0	L	45.0	B	-	-	-	-	1,4,8	00308
00653	DH 4	-	Adams	-	-	-	30	15	28E	53.5	B	924.1	D	31.1	S	-	-	-	-	10	00653
00003	ECBID	W	Adams	-	-	SE,SW	35	15	28E	24.4	B	253.0	D	49.0	B	-	-	-	-	1,4,8,12	00003
00005	Othello City 4	W	Adams	-	-	NE,SE	03	15	29E	20.8	F	276.0	D	32.0	B	-	-	-	-	1,4,8	00005
00674	Othello City 5	W	Adams	-	-	SE,SW	03	15	29E	29.4	B	298.4	D	65.3	S	-	-	-	-	13,15,16	00674
00004	Othello City 2	W	Adams	-	-	NE,NW	03	15	29E	22.8	F	212.0	D	51.0	B	-	-	-	-	1,4,8	00004
00006	Othello City 5	W	Adams	-	-	SE,SW	03	15	29E	29.0	B	297.8	D	57.0	B	-	-	-	-	1,4,8,12	00006
00007	Othello City 6	W	Adams	-	-	NE,NE	04	15	29E	25.2	B	365.1	D	36.0	B	-	-	-	-	1,4,8	00007
00437	Othello City 1	W	Adams	-	-	NE,NE	04	15	29E	20.0	B	171.0	D	47.0	B	-	-	-	-	1,4,8	00437
00675	Othello City 6	W	Adams	-	-	NE,NE	04	15	29E	24.7	B	367.3	D	-	-	-	-	-	-	13,15,16	00675
00008	McKay	W	Adams	-	-	NE,SW	05	15	31E	26.4	B	403.5	D	36.0	B	-	-	-	-	1,4,8	00008
00676	McKay, Ed.	W	Adams	-	-	NE,SW	05	15	31E	26.8	B	404.4	D	49.1	S	-	-	-	-	13,15,16	00676
00009a	Lyle Bros 3	W	Adams	-	-	SW,NW	11	15	31E	20.5	B	214.0	D	32.2	A	-	-	-	-	1,4,8	00009a
00009b	Lyle Bros 3	W	Adams	-	-	SW,NW	11	15	31E	20.5	B	214.0	D	40.0	B	-	-	-	-	1,4,8	00009b
00786	-	W	Adams	-	-	SW,NW	11	15	31E	20.0	B	212.2	D	34.4	B	-	-	-	-	18	00786
00677	Lyle Bros.	W	Adams	-	-	SW,NW	11	15	31E	20.1	B	213.3	D	-	-	-	-	-	-	13	00677
00678	Johnson, Arthur	W	Adams	-	-	NE,NE	19	15	31E	27.6	B	341.7	D	49.1	S	-	-	-	-	13,15,16	00678
00010	Johnson	W	Adams	-	-	NE,NE	19	15	31E	25.5	B	338.6	D	40.0	B	-	-	-	-	1,4,8	00010
00679	Kummer, Clarence, No.4	W	Adams	-	-	NW,SW	32	15	31E	26.0	B	364.5	D	47.9	S	-	-	-	-	13,16	00679
00427b	Tomkin	W	Adams	-	-	NE,NE	02	15	32E	25.0	B	252.0	D	52.0	B	-	-	-	-	12	00427b
00680	Damon, Don	W	Adams	-	-	NW,NE	04	15	32E	21.9	B	266.2	D	49.1	S	-	-	-	-	13,16	00680
00011	Damon	W	Adams	-	-	NW,NE	04	15	32E	21.8	B	266.4	-	43.0	B	-	-	-	-	1,4,8	00011
00681	Stelger	W	Adams	-	-	SE,NW	16	15	32E	20.0	B	179.8	D	49.1	S	-	-	-	-	13	00681
00438	Stelger	W	Adams	-	-	SE,NW	16	15	32E	20.0	S	180.0	L	44.0	B	-	-	-	-	1,4,8	00438
00682	Hart, Cyril	W	Adams	-	-	SW,NE	35	15	32E	22.9	B	307.8	D	49.1	S	-	-	-	-	13,16	00682
00012	Hart	W	Adams	-	-	SW,NW	35	15	32E	27.6	B	309.7	D	50.0	B	-	-	-	-	1,4,7,8,12	00012
00683	Tompkins, Robert	W	Adams	-	-	NE,NE	02	15	33E	24.9	B	252.1	D	-	-	-	-	-	-	13,16	00683
00427a	Tompkin	W	Adams	-	-	NE,NE	02	15	33E	25.0	B	252.0	D	52.0	B	-	-	-	-	7,8	00427a
00013	-	W	Adams	-	-	NE,NE	02	15	33E	25.0	B	68.9	-	189.0	B	-	-	-	-	1,4	00013
00014	Watson	W	Adams	-	-	SE,SE	27	15	34E	20.9	S	177.0	L	50.0	B	-	-	-	-	1,4,8	00014
00684	Blauert, Fred.	W	Adams	-	-	SE,NW	34	15	36E	25.3	B	213.0	D	-	-	-	-	-	-	13,15,16	00684
00015	Blauert	W	Adams	-	-	SE,NW	34	15	36E	25.4	-	211.5	L	63.0	B	-	-	-	-	1,4,7,8,12	00015
00439	Othello City 3	W	Adams	-	-	SW,SE	34	16	29E	24.8	S	261.0	L	49.0	B	-	-	-	-	1,4,8	00439
00016	Othello City 3	W	Adams	-	-	SE,SE	34	16	29E	23.0	B	275.0	D	40.0	B	-	-	-	-	1,4,8	00016
00685	Othello City 3	W	Adams	-	-	SE,SE	34	16	29E	25.0	B	260.0	D	65.3	S	-	-	-	-	13,16	00685
00017a	Kliphardt	W	Adams	-	-	NW,NW	24	16	30E	25.9	B	219.4	D	64.8	A	-	-	-	-	1,4,7,8,12	00017a
00686	Kliphardt, G. W.	W	Adams	-	-	NW,NW	24	16	30E	26.1	B	219.8	D	65.3	S	-	-	-	-	13,16	00686
00017b	Kliphardt	W	Adams	-	-	NW,NW	24	16	30E	25.9	B	219.4	D	63.0	B	-	-	-	-	1,4,7,8,12	00017b
00018a	Kliphardt	W	Adams	-	-	NE,NE	26	16	30E	26.2	-	192.0	L	34.0	A	-	-	-	-	1,4,8	00018a
00018b	Kliphardt	W	Adams	-	-	NE,NE	26	16	30E	26.2	-	192.0	L	74.0	B	-	-	-	-	1,4,8	00018b
00787	-	W	Adams	-	-	NE,NE	26	16	30E	26.2	B	192.0	D	72.4	B	-	-	-	-	18	00787
00019b	Andrews 2	W	Adams	-	-	NE,SE	27	16	30E	25.2	-	207.0	L	64.0	B	-	-	-	-	1,4,7,8,12	00019b
00019a	Andrews 2	W	Adams	-	-	NE,SE	27	16	30E	25.2	-	207.0	L	91.0	A	-	-	-	-	1,4,7,8	00019a
00788	-	W	Adams	-	-	NE,SE	27	16	30E	25.2	B	207.3	D	60.4	B	-	-	-	-	18	00788
00020	DNR Damon	W	Adams	-	-	NW,SE	36	16	30E	20.3	B	208.8	D	40.0	B	-	-	-	-	1,4,8	00020
00687	DNR Damon No. 2	W	Adams	-	-	NW,SE	36	16	30E	20.6	B	184.1	D	65.3	S	-	-	-	-	[illegible]	[illegible]

~~File Name = GEOTHDB1.WK1 Last Updated April 30, 1993, by J.B.S.~~

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.D.
00688	Damon, Mike	W	Adams	-	-	NW,SE	36	16	30E	20.2	B	209.7	D	-	-	-	-	-	-	13,16	00688
00689	DNR Damon	W	Adams	-	-	NW,SE	36	16	30E	24.7	B	241.4	D	65.3	S	-	-	-	-	13,16	00689
00690	DNR Damon	W	Adams	-	-	NW,SE	36	16	30E	20.1	B	210.6	D	-	-	-	-	-	-	13	00690
00022	Lyle	W	Adams	-	-	NW,NE	15	16	31E	22.7	S	200.5	L	53.0	B	-	-	-	-	1,4,8	00022
00428a	Wholman	W	Adams	-	-	NW,NW	15	16	31E	26.2	-	230.0	L	57.4	A	-	-	-	-	7,8	00428
00691	Wholman	W	Adams	-	-	-	15	16	31E	26.2	B	229.8	D	31.9	S	-	-	-	-	13	00691
00693	Lyle, Rex (South)	W	Adams	-	-	SW,SE	15	16	31E	27.5	B	409.9	D	31.9	S	-	-	-	-	13,15,16	00693
00023	Lyle (south)	W	Adams	-	-	SW,SE	15	16	31E	26.9	B	408.7	D	37.0	B	-	-	-	-	1,4,8	00023
00692	Lyle, Rex	W	Adams	-	-	NW,NE	15	16	31E	22.6	B	200.5	D	31.9	S	-	-	-	-	13,16	00692
00440	Lyle	W	Adams	-	-	NW,NE	15	16	31E	24.1	B	315.8	D	38.0	B	-	-	-	-	1,4,8	00440
00428b	Wholman	W	Adams	-	-	NW,NW	15	16	31E	26.2	-	230.0	L	57.0	B	-	-	-	-	7,8,12	00428
00694	Phillips, D. E., 12	W	Adams	-	-	NW,NW	11	16	32E	28.2	B	321.0	D	31.9	S	-	-	-	-	13	00694
00024	Phillips 12	W	Adams	-	-	NW,NW	11	16	32E	28.2	B	310.0	D	51.0	B	-	-	-	-	1,4,8,16	00024
00441	Phillips, D. E., 11	W	Adams	-	-	NW,NW	14	16	32E	20.0	S	313.9	L	25.0	B	-	-	-	-	1,4,8,16	00441
00695	Phillips, B., house well	W	Adams	-	-	NE,NW	14	16	32E	21.1	B	154.5	D	31.9	S	-	-	-	-	13,16	00695
00696	Phillips, D. E., 11	W	Adams	-	-	NW,NW	14	16	32E	20.0	B	312.7	D	-	-	-	-	-	-	13	00696
00025	Phillips	W	Adams	-	-	NE,NW	14	16	32E	20.7	S	155.1	L	56.0	B	-	-	-	-	1,4,8	00025
00697	Phillips, D. E., 17	W	Adams	-	-	NW,NW	15	16	32E	34.0	B	439.5	D	31.9	S	-	-	-	-	13,15,16	00697
00026	Phillips 17	W	Adams	-	-	NW,NW	15	16	32E	33.4	B	437.1	D	49.0	B	-	-	-	-	1,4,7,8,12	00026
00027	Phillips	W	Adams	-	-	SW,SW	20	16	32E	22.8	S	214.3	L	50.0	B	-	-	-	-	1,4,8	00027
00028	Phillips	W	Adams	-	-	SW,SW	20	16	32E	29.2	S	372.1	L	46.0	B	-	-	-	-	1,4,8	00028
00698	Phillips, R. V.	W	Adams	-	-	SW,SW	20	16	32E	28.8	B	372.1	D	31.9	S	-	-	-	-	13,16	00698
00699	Phillips, D. E., 10	W	Adams	-	-	SW,NE	21	16	32E	26.9	B	282.5	D	31.9	S	-	-	-	-	13,16	00699
00029	Phillips 10	W	Adams	-	-	SW,NW	21	16	32E	27.4	S	158.8	L	97.0	B	-	-	-	-	1,4,8	00029
00030	Phillips 2	W	Adams	-	-	NW,NW	25	16	32E	28.7	B	431.6	D	40.0	B	-	-	-	-	1,4,8	00030
00654	-	W	Adams	-	-	SW,SW	25	16	32E	30.4	B	709.2	D	-	-	-	-	-	-	10	00654
00701	Phillips, D. E., 16	W	Adams	-	-	SW,SW	25	16	32E	31.4	B	381.9	D	31.9	S	-	-	-	-	13,15,16	00701
00700	Phillips, D. E., 2	W	Adams	-	-	NW,NW	25	16	32E	29.1	B	431.3	D	31.9	S	-	-	-	-	13,16	00700
00031	-	W	Adams	-	-	SW,SW	25	16	32E	30.4	B	709.2	-	26.0	B	-	-	-	-	1,4	00031
00429	Phillips 16	W	Adams	-	-	SW,SW	25	16	32E	31.0	B	380.0	D	50.0	B	-	-	-	-	7,8,12	00429
00032a	Phillips 7	W	Adams	-	-	SW,NW	34	16	32E	43.4	B	771.0	D	69.5	A	-	-	-	-	1,4,8	00032a
00702a	Phillips, D. E., C-34	W	Adams	-	-	SW,NW	34	16	32E	41.4	B	772.6	D	38.1	S	-	-	-	-	13,15,16	00702a
00032b	Phillips 7	W	Adams	-	-	SW,NW	34	16	32E	43.4	B	771.0	D	41.0	B	-	-	-	-	1,4,8	00032b
00702b	Phillips A	W	Adams	-	-	SW,NW	34	16	32E	24.0	S	370.0	L	-	-	-	-	-	-	13	00702b
00655	-	W	Adams	-	-	SW,NW	34	16	32E	43.4	B	772.9	D	31.1	S	-	-	-	-	10	00655
00034	Phillips 9	W	Adams	-	-	NW,NW	35	16	32E	24.0	S	192.0	L	63.0	B	-	-	-	-	1,4,8	00034
00703	Phillips, D. E., 9	W	Adams	-	-	NW,NW	35	16	32E	24.2	B	272.2	D	31.9	S	-	-	-	-	13,16	00703
00033	Phillips 9	W	Adams	-	-	NW,NW	35	16	32E	24.0	B	270.6	D	44.0	B	-	-	-	-	1,4,8	00033
00704	Baumann Farms	W	Adams	-	-	SW,SE	31	16	35E	22.4	B	599.5	D	-	-	-	-	-	-	13,15,16	00704
00705	Bauman, Richard	W	Adams	-	-	SW,SW	32	16	35E	21.0	B	214.0	D	-	-	-	-	-	-	13	00705
00706	Phillips, D. E., C-12	W	Adams	-	-	NW,NW	12	17	31E	27.5	B	591.9	D	26.8	S	-	-	-	-	13,15,16	00706
00036	Phillips C-12	W	Adams	-	-	NW,NW	12	17	31E	27.8	B	590.4	D	27.0	B	-	-	-	-	1,4,8	00036
00037	-	W	Adams	-	-	SE,SW	12	17	32E	21.0	B	227.0	-	40.0	B	-	-	-	-	1,4	00037
00789	-	W	Adams	-	-	SE,SW	12	17	32E	21.0	B	225.6	D	40.3	B	-	-	-	-	18	00789
00430	DNR	W	Adams	-	-	NW,SW	14	17	32E	23.2	-	189.0	L	54.0	B	-	-	-	-	7,8,12	00430
~~00707~~	~~DNR CRB~~	~~W~~	~~Adams~~	-	-	~~-~~	~~14~~	~~17~~	~~32E~~	~~23.2~~	~~B~~	~~188.7~~	~~D~~	~~-~~	~~-~~	-	~~-~~	~~-~~	~~-~~	~~13~~	~~00707~~
00442	City of Lind	W	Adams	-	-	SE,SW	12	17	33E	21.0	B	226.0	D	40.0	B	-	-	-	-	8	00442
00038	Benge	W	Adams	-	-	NW,NW	27	17	37E	21.9	-	167.9	L	59.0	B	-	-	-	-	1,4,8,15	00038

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.D.
00804	-	W	Adams	-	-	NE,NW	18	18	31E	21.8	B	240.2	D	37.3	B	-	-	-	-	18	00804
00443	Hutterites	W	Adams	-	-	NE,NW	18	18	31E	21.8	B	238.0	D	41.0	B	-	-	-	-	8	00443
00656	-	W	Adams	-	-	NW,NW	33	18	31E	30.0	B	771.0	D	-	-	-	-	-	-	10	00656
00444	Phillips C-33	W	Adams	-	-	NW,NW	33	18	31E	30.0	B	727.0	D	25.0	B	-	-	-	-	8	00444
00709	Phillips, D. E., C-33	W	Adams	-	-	NW,NW	33	18	31E	30.2	B	727.5	D	26.8	S	-	-	-	-	13,15,16	00709
00710	Hutterian Bretheren	W	Adams	-	-	SE,SW	07	18	32E	21.7	B	239.9	D	26.8	S	-	-	-	-	13	00710
00720	Kagele, Norman	W	Adams	-	-	SW,NE	24	19	31E	20.0	B	164.6	D	-	-	-	-	-	-	13,16	00720
00041	Kagele	W	Adams	-	-	SW,NE	24	19	31E	20.1	S	164.6	L	49.0	B	-	-	-	-	1,4,7,8,12	00041
00721	S & K Farms	W	Adams	-	-	NW,SE	24	19	32E	20.8	B	242.9	D	40.1	S	-	-	-	-	13,16	00721
00043	J. & M. Farms	W	Adams	-	-	SW,SW	24	19	32E	31.5	B	680.3	D	30.0	B	-	-	-	-	1,4,8	00043
00722	J & M Farms	W	Adams	-	-	SW,SW	24	19	32E	32.5	B	694.9	D	-	-	-	-	-	-	13,15,16	00722
00042	S K Farms	W	Adams	-	-	NW,SE	24	19	32E	20.6	B	243.2	D	35.0	B	-	-	-	-	1,4,8	00042
00657	-	W	Adams	-	-	-	24	19	32E	31.5	B	680.3	D	-	-	-	-	-	-	10	00657
00723	Kagele, Norman	W	Adams	-	-	SW,SW	30	19	32E	21.1	B	165.2	D	40.1	S	-	-	-	-	13	00723
00725	Hoefel, Paul, No. 2	W	Adams	-	-	SW,SE	08	19	33E	42.3	B	745.2	D	38.1	S	-	-	-	-	13,15,16	00725
00044	Hoefel	W	Adams	-	-	SW,SE	08	19	33E	20.3	B	229.8	D	36.0	B	-	-	-	-	1,4,8	00044
00045	Hoefel	W	Adams	-	-	SW,SE	08	19	33E	41.0	B	741.5	D	39.0	B	-	-	-	-	1,4,8	00045
00724	Hoefel, Paul	W	Adams	-	-	SW,SE	08	19	33E	20.7	B	231.3	D	40.1	S	-	-	-	-	13,16	00724
00658	-	W	Adams	-	-	SW,SE	08	19	33E	41.0	B	741.8	D	31.1	S	-	-	-	-	10	00658
00445	Kagele	W	Adams	-	-	NW,NE	20	19	34E	22.5	B	341.4	D	34.0	B	-	-	-	-	1,4,8	00445
00046	Gering, Gale	W	Adams	-	-	NW,SE	09	19	36E	21.1	B	229.2	D	41.0	B	-	-	-	-	1,4,8,15,16	00046
00047	Heineman, Don, No. 2	W	Adams	-	-	SW,SW	34	19	36E	20.8	B	102.4	D	96.0	B	-	-	-	-	1,4,8,16	00047
00048b	-	W	Adams	-	-	SE,NW	13	19	38E	21.1	-	201.2	L	55.0	B	-	-	-	-	1,4,8	00048b
00048a	-	W	Adams	-	-	SE,NW	13	19	38E	21.1	-	201.2	L	82.8	A	-	-	-	-	1,4,8	00048a
00049	Weber	W	Adams	-	-	SW,SE	02	20	34E	20.9	B	197.2	D	50.0	B	-	-	-	-	1,4,7,8,12	00049
00735	Weber, John	W	Adams	-	-	SW,SE	02	20	34E	21.0	B	201.5	D	-	-	-	-	-	-	13,16	00735
00050b	Hardung	W	Adams	-	-	NW,NW	17	20	35E	20.9	S	231.6	L	43.0	B	-	-	-	-	1,4,8	00050b
00795	-	W	Adams	-	-	NW,NW	17	20	35E	20.9	B	231.7	D	39.4	B	-	-	-	-	18	00795
00050a	Hardung	W	Adams	-	-	NW,NW	17	20	35E	20.9	S	231.6	L	90.0	A	-	-	-	-	1,4,8	00050a
00051	Ahern, Cliff	W	Adams	-	-	NW,NW	24	20	35E	20.5	B	156.7	D	61.0	B	-	-	-	-	1,4,7,8,12,16	00051
00053	WWP 5	W	Asotin	-	-	SW,SE	30	11	46E	23.3	B	406.0	D	28.0	B	-	-	-	-	1,4,8	00053
00054a	WWP	W	Asotin	-	-	SW,NW	32	11	46E	26.2	B	405.0	D	35.0	B	-	-	-	-	1,4,8,15	00054a
00054b	WWP	W	Asotin	-	-	SW,NW	32	11	46E	26.2	B	405.0	D	38.9	A	-	-	-	-	1,4,8,15	00054b
00055	-	W	Asotin	-	-	-	32	11	46E	23.4	B	387.7	-	29.0	B	-	-	-	-	1,4	00055
00056	Sperry	W	Benton	-	-	NW,NE	03	04	24E	20.6	F	121.0	D	71.0	B	-	-	-	-	1,4,7,8,12	00056
00814	Sandpiper Land Co.	W	Benton	-	-	SW,SW	29	05	25E	20.0	F	74.7	D	-	-	-	144	P	21.9	20	00814
00813	Sandpiper Land Co.	W	Benton	-	-	SW,NE	29	05	25E	20.0	F	106.7	D	-	-	-	378	P	52.4	20	00813
00057	Paterson	W	Benton	-	-	NW,NW	05	05	26E	26.3	B	304.8	D	47.0	B	-	-	-	-	1,4,7,8,12	00057
00815	Powers, G. Tom	W	Benton	-	-	NW,NW	05	05	26E	23.3	F	305.4	D	-	-	-	5787	P	82.6	20	00815
00058	Engineers	W	Benton	-	-	SE,SE	06	05	28E	21.5	F	170.0	D	56.0	B	-	-	-	-	1,4,7,8,12	00058
00059	Columbia R.	W	Benton	-	-	SE,NE	22	06	24E	22.5	B	195.0	D	54.0	B	-	-	-	-	1,4,7,8,12	00059
00800	-	W	Benton	-	-	SE,NE	22	06	24E	22.5	B	195.1	D	43.5	B	-	-	-	-	18	00800
00818	Epstein	W	Benton	-	-	SW,NW	15	06	26E	23.9	F	292.6	D	-	-	-	14383	P	110.0	20	00818
00060	Craig	W	Benton	-	-	NW,SW	15	06	26E	24.2	-	209.7	L	58.0	B	-	-	-	-	1,4,7,8,12	00060
00764	-	W	Benton	-	-	SW,SE	12	06	30E	21.1	B	298.7	D	28.8	B	-	-	-	-	18	00764
00061b	Blair	W	Benton	-	-	SW,SE	12	06	30E	21.1	B	305.0	D	31.0	B	-	-	-	-	1,4,8	00061b
00061a	Blair	W	Benton	-	-	SW,SE	12	06	30E	21.1	B	305.0	D	31.0	A	-	-	-	-	1,4,8	00061a
00062	Irrigro	W	Benton	-	-	SW,SW	19	06	30E	20.5	S	176.8	L	48.0	B	-	-	-	-	1,4,8,16	00062
00819	HundredCirclesFarm,IrrigroDiv	W	Benton	-	-	NW,NW	19	06	30E	23.3	F	248.1	D	-	-	-	378	P	193.2	20	00819

GEOTHERMAL RESOURCES DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
~~STATE OF WASHINGTON -- DESCRIPTIVE AND THERMAL DATA.~~

File Name = GEOTHDB1.WK1 Last Updated April 30, 1993, by J.E.S.

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.D
00063	Horrigan Farms	W	Benton	-	-	NW,NW	08	07	24E	23.4	B	337.7	D	36.0	B	-	-	-	-	1,4,8,15	00063
00820	Horrigon Farms, Inc.	W	Benton	-	-	NW,NE	26	07	24E	20.0	F	162.2	D	-	-	-	757	P	89.9	20	00820
00065	DOE Paterson	W	Benton	-	-	SW,SW	36	07	25E	30.3	B	221.6	D	83.0	B	-	-	-	-	1,4,7,8,12	00065
00066	DNR Baker	W	Benton	-	-	SE,SW	36	07	25E	21.8	B	262.0	D	38.0	B	-	-	-	-	1,4,8	00066
00064	DOE Paterson	W	Benton	-	-	SW,SW	36	07	25E	22.5	B	253.9	D	41.0	B	-	-	-	-	1,4,8	00064
00067	Moon	W	Benton	-	-	NW,NE	05	07	26E	22.1	S	148.1	L	68.0	B	-	-	-	-	1,4,8	00067
00346	DOE Horse Heaven	W	Benton	-	-	NE,NE	36	07	27E	29.4	B	368.5	D	39.0	B	-	-	-	-	8,15	00346
00068	Prosser City 5	W	Benton	-	-	NE,SE	01	08	24E	25.2	B	378.5	D	34.0	B	-	-	-	-	1,4,8	00068
00824	Prosser City	W	Benton	-	-	NE,SE	01	08	24E	23.3	F	385.3	D	-	-	-	9273	P	22.9	20	00824
00770	-	W	Benton	-	-	NE,SE	01	08	24E	23.6	B	381.9	D	26.4	B	-	-	-	-	18	00770
00549	Prosser City	W	Benton	-	-	NE,SE	01	08	24E	25.2	B	391.0	D	-	-	-	-	-	-	10	00549
00825	Bleyhl, Carl	W	Benton	-	-	SE,NE	08	08	24E	27.8	F	58.5	D	-	-	-	727	P	0.0	20	00825
00826	DNR	W	Benton	-	-	NW,NE	36	08	25E	20.0	F	408.4	D	-	-	-	-	-	224.9	20	00826
00446	DNR Gould	W	Benton	-	-	NW,NE	36	08	25E	25.9	S	364.0	L	38.0	B	-	-	-	-	8	00446
00069	Mott	W	Benton	-	-	NE,NE	22	08	29E	23.0	F	244.0	D	45.0	B	-	-	-	-	1,4,8	00069
00828	Noel, Jim	W	Benton	-	-	SW,SW	22	08	30E	21.1	F	68.6	D	-	-	-	-	N	A	20	00828
00827	Burk, Vern	W	Benton	-	-	NW,SW	22	08	30E	21.1	F	68.6	D	-	-	-	492	N	A	20	00827
00835	Salvinia Farms/Harper Farms	W	Benton	-	-	NW,NW	21	09	24E	21.7	F	241.4	D	-	-	-	4542	P	98.4	20	00835
00070	Prosser Exp.	W	Benton	-	-	NW,NE	06	09	25E	27.8	B	364.2	D	43.0	B	-	-	-	-	1,4,8,15	00070
00836	DOE/WSU	W	Benton	-	-	NW,SE	06	09	25E	25.6	F	365.8	D	-	-	-	5678	P	162.4	20	00836
00554	Prosser Experiment Station	W	Benton	-	-	NW,NE	06	09	25E	24.9	B	364.8	D	34.1	S	-	-	-	-	10	00554
00837	Goroch, Chester	W	Benton	-	-	NE,SE	07	09	25E	21.1	F	214.9	D	-	-	-	2650	P	126.5	20	00837
00838	Gammie,William/Whitstran Ranch	W	Benton	-	-	SE,NE	09	09	25E	20.0	F	457.2	D	-	-	-	-	-	138.4	20	00838
00839	Olsen Bros.	W	Benton	-	-	N2,NW	14	09	25E	20.0	F	141.7	D	-	-	-	2460	P	15.2	20	00839
00840	Clark, Roy	W	Benton	-	-	NE,SE	23	09	25E	20.0	F	18.3	D	-	-	-	114	P	7.6	20	00840
00841	Ball, Vern	W	Benton	-	-	NE,NE	33	09	25E	20.0	F	217.9	D	-	-	-	-	N	A	20	00841
00842	Valley View Orchards	W	Benton	-	-	SW,SW	06	09	26E	22.8	F	-	-	-	-	-	1961	P	156.7	20	00842
00843	Bauder, Milo	W	Benton	-	-	NE,NE	20	09	26E	23.3	F	209.4	D	-	-	-	7684	P	21.3	20	00843
00071	Christen	W	Benton	-	-	NW,SE	27	09	26E	21.5	B	204.0	D	47.0	B	-	-	-	-	1,4,8	00071
00844	Edmunds, Gary	W	Benton	-	-	SE,NW	02	09	27E	20.0	F	129.5	D	-	-	-	-	-	42.7	20	00844
00845	Peterson, Jean	W	Benton	-	-	SW,NW	02	09	27E	20.0	F	123.4	D	-	-	-	1041	P	54.9	20	00845
00447	DNR Benton-40	W	Benton	-	-	NW,NW	16	09	27E	23.3	-	94.0	L	122.0	B	-	-	-	-	8	00447
00448	DNR Kid-3	W	Benton	-	-	NE,SW	23	09	27E	29.1	-	370.0	L	46.0	B	-	-	-	-	8	00448
00449	DNR 79-07	W	Benton	-	-	NW,SW	25	09	27E	23.8	B	322.2	D	30.0	B	-	-	-	-	8,15	00449
00846	Davin Land & Livestock, Inc.	W	Benton	-	-	NW,NE	17	09	28E	26.7	F	336.8	D	-	-	-	10182	P	51.5	20	00846
00072	Bauder	W	Benton	-	-	SE,NE	34	09	28E	21.1	-	271.3	L	34.0	B	-	-	-	-	1,4,8	00072
00847	The Quadrant Corporation	W	Benton	-	-	SE,SW	36	09	28E	28.3	F	368.2	D	-	-	-	4542	P	26.8	20	00847
00435	DNR Anderson	W	Benton	-	-	SE,NW	36	10	24E	29.8	S	273.0	L	65.0	B	-	-	-	-	7,8,12	00435
00775	-	W	Benton	-	-	SW,NW	25	10	25E	20.6	B	184.1	D	45.0	B	-	-	-	-	18	00775
00073b	Nakamura	W	Benton	-	-	SW,NW	25	10	25E	20.6	B	184.0	D	47.0	B	-	-	-	-	1,4,7,8,12	00073b
00073a	Nakamura	W	Benton	-	-	SW,NW	25	10	25E	20.6	B	184.0	D	36.0	A	-	-	-	-	1,4,7,8	00073a
00074	J. & R. Orchard	W	Benton	-	-	SW,SW	33	10	25E	21.8	-	275.5	L	36.0	B	-	-	-	-	1,4,8	00074
00568	J. & R. Orchards	W	Benton	-	-	SW,SW	33	10	25E	20.8	B	275.5	D	34.1	S	-	-	-	-	10	00568
00856	Inland Desert Fruit Company	W	Benton	-	-	SE,NW	33	10	26E	24.4	F	254.5	D	-	-	-	2366	P	125.6	20	00856
00857	Champion Orchards	W	Benton	-	-	NW,NW	33	10	26E	22.8	F	255.4	D	-	-	-	1741	P	137.2	20	00857
00450	Hanford S6E4C	-	Benton	-	-	NE,NE	28	10	27E	20.9	-	140.0	L	46.0	B	-	-	-	-	8	00450
00075a	DH 3	-	Benton	-	-	SW,NE	14	10	28E	47.8	B	1079.9	D	34.6	A	-	-	-	-	1,4,8	00075a
00075b	DH 3	-																			

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.D
00451b	Hanford S-30	-	Benton	-	-	NW,NE	14	10	28E	39.7	S	605.0	L	42.0	B	-	-	-	-	8	00451
00347	DH 3	-	Benton	46-21.1	119-16.2	SW,NE	14	10	28E	47.8	B	1079.9	L	34.6	A	47	-	-	-	2	00347
00569	-	-	Benton	-	-	-	14	10	28E	47.8	B	1079.9	D	-	-	-	-	-	-	10	00569
00600	Rattlesnake Hills 1	O	Benton	-	-	-	15	11	24E	96.3	S	2500.0	L	31.1	S	-	-	-	-	10	00600
00076a	Rattlesnake 1	O	Benton	-	-	NE	15	11	24E	128.0	S	2880.0	L	40.0	B	-	-	-	-	1,4,8	00076a
00345	Rattlesnake 1	O	Benton	46-26.0	119-47.0	NE	15	11	24E	96.3	S	2500.0	L	37.1	A	58	-	-	-	2,8	00345
00599	Rattlesnake Hills 1	O	Benton	-	-	-	15	11	24E	110.0	B	2889.4	D	31.1	S	-	-	-	-	10	00599
00076b	Rattlesnake 1	O	Benton	-	-	NE	15	11	24E	96.3	S	2500.0	L	34.0	B	-	-	-	-	1,4,8	00076b
00077	US Govt.	-	Benton	-	-	SE,SE	34	11	26E	24.0	F	305.0	D	39.0	B	-	-	-	-	1,4,8	00077
00452b	Hanford 2-E14	-	Benton	-	-	NW,NW	23	11	28E	26.2	B	288.0	D	42.0	B	-	-	-	-	8	00452b
00452a	Hanford 2-E14	-	Benton	-	-	NW,NW	23	11	28E	26.2	B	288.0	D	39.0	A	-	-	-	-	8	00452a
00908	Berk, Delbert	W	Benton	-	-	NW,NE	03	12	24E	22.2	F	386.8	D	-	-	-	13414	P	10.1	20	00908
00453	Tramel	W	Benton	-	-	NE,NE	05	12	24E	20.4	B	254.0	D	33.0	B	-	-	-	-	8	00453
00627	Tramel, J. D.	W	Benton	-	-	NE,NE	05	12	24E	23.0	B	254.2	D	-	-	-	-	-	-	10,16	00627
00454	Tramel	W	Benton	-	-	NE,NE	05	12	24E	23.0	-	254.0	L	43.0	B	-	-	-	-	8	00454
00909	Tramel, J. D.	W	Benton	-	-	E2,E2	09	12	24E	22.2	F	310.3	D	-	-	-	13475	P	107.0	20	00909
00078	Roberts Bros.	W	Benton	-	-	SW,SW	20	12	24E	26.0	F	366.0	D	38.0	B	-	-	-	-	1,4,8	00078
00079	US Govt.	-	Benton	-	-	SW,SW	04	12	26E	21.4	F	117.0	D	80.0	B	-	-	-	-	1,4,8	00079
00081	US Govt.	-	Benton	-	-	SW,SE	07	12	26E	20.4	F	99.0	D	85.0	B	-	-	-	-	1,4,8	00081
00080	US Govt.	-	Benton	-	-	NW,NE	07	12	26E	20.7	F	126.0	D	69.0	B	-	-	-	-	1,4,8	00080
00082	US Govt.	-	Benton	-	-	SE,SW	08	12	26E	21.2	F	98.0	D	94.0	B	-	-	-	-	1,4,8	00082
00083	US Govt.	-	Benton	-	-	SE,NE	12	12	26E	21.0	F	158.0	D	57.0	B	-	-	-	-	1,4,8	00083
00084	US Govt.	-	Benton	-	-	NW,NW	14	12	26E	21.1	F	117.0	D	78.0	B	-	-	-	-	1,4,8	00084
00085	US Govt.	-	Benton	-	-	NE,NW	15	12	26E	21.7	F	134.0	D	74.0	B	-	-	-	-	1,4,8	00085
00087	US Govt.	-	Benton	-	-	SW,NE	18	12	26E	20.8	F	85.0	D	103.0	B	-	-	-	-	1,4,8	00087
00086	US Govt.	-	Benton	-	-	SW,NW	18	12	26E	20.5	F	177.0	D	48.0	B	-	-	-	-	1,4,8	00086
00910	Maple Leaf Farms, Inc.	W	Benton	-	-	SW,NE	29	12	26E	24.4	F	253.0	D	-	-	-	1703	P	51.8	20	00910
00088	US Govt.	-	Benton	-	-	NW,SW	16	12	27E	20.5	F	65.0	L	131.0	B	-	-	-	-	1,4,8	00088
00089	US Govt.	-	Benton	-	-	SW,NW	25	13	24E	24.2	F	237.0	D	51.0	B	-	-	-	-	1,4,8	00089
00090	Meeker	W	Benton	-	-	SW,NE	26	13	24E	20.0	F	215.0	L	43.0	B	-	-	-	-	1,4,8	00090
00091	US Govt.	-	Benton	-	-	NW,NW	36	13	24E	24.0	F	333.0	D	36.0	B	-	-	-	-	1,4,8	00091
00092	US Govt.	-	Benton	-	-	SW,SW	01	13	25E	23.0	F	241.0	D	46.0	B	-	-	-	-	1,4,8	00092
00093	-	W	Benton	-	-	SE,NE	11	13	25E	39.1	F	32.0	L	847.0	B	-	-	-	-	1,4,8	00093
00094	McGee	W	Benton	-	-	SW,NE	30	13	25E	26.8	F	338.0	D	44.0	B	-	-	-	-	1,4,8	00094
00337	DH 1	-	Benton	46-35.0	119-31.0	-	25	13	26E	21.9	B	182.9	L	37.2	A	64	-	-	-	2	00337
00095a	-	W	Benton	-	-	-	25	13	26E	21.9	B	183.0	-	37.2	A	-	-	-	-	1,4	00095a
00095b	-	W	Benton	-	-	-	25	13	26E	21.9	B	183.0	-	54.0	B	-	-	-	-	1,4	00095b
00457	ARH DC 1	-	Benton	-	-	NE,NE	35	13	26E	70.0	B	1725.0	D	34.0	B	-	-	-	-	8	00457
00456	ARH DC 1	-	Benton	-	-	NW,SE	35	13	26E	75.0	S	1692.0	L	37.0	B	-	-	-	-	8	00456
00455a	DDH 1	-	Benton	-	-	NE,NE	35	13	26E	21.9	S	183.0	L	37.2	A	-	-	-	-	8	00455a
00643	ARH DC 1	-	Benton	-	-	NE,NE	35	13	26E	75.0	B	1691.6	D	31.1	S	-	-	-	-	10	00643
00455b	DDH 1	-	Benton	-	-	NE,NE	35	13	26E	21.9	S	183.0	L	38.0	B	-	-	-	-	8	00455b
00644	DC 6	-	Benton	-	-	SW,NE	26	13	27E	60.2	B	1323.7	D	31.1	S	-	-	-	-	10	00644
00458	Hanford DC-6	-	Benton	-	-	SW,NE	26	13	27E	60.2	B	1322.0	D	37.0	B	-	-	-	-	8	00458
00097	-	W	Benton	-	-	NW,SW	14	14	26E	32.5	F	24.0	L	854.0	B	-	-	-	-	1,4,8	00097
00098	-	W	Benton	-	-	SW,NE	28	14	26E	20.7	F	24.0	L	363.0	B	-	-	-	-	1,4,8	00098
00099a	NORCO 1	O	Chelan	-	-	NW,SW	26	22	20E	35.7	S	900.0	L	26.8	A	-	-	-	-	1,4,8	00099a
00334	NORCO 1	O	Chelan	47-22.1	120-18.0	NW,SW	26	22	20E	35.7	B	900.0	L	28.4	A	62	-	-	-	2	00334
00099b	NORCO 1	O	Chelan	-	-	NW,SW	26	22	20E	35.7	S	900.0	L	27.0	B	-	-	-	-	1,4,8	00099b

GEOTHERMAL RESOURCES DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON -- DESCRIPTIVE AND THERMAL DATA.
File Name = GEOTHDB1.WK1 Last Updated April 30, 1993, by J.E.S.

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.D.
00415	Olympic Hot Springs(M-1)	S	Clallam	-	-	NW	28	29	08W	-	-	-	-	-	-	-	-	-	-	5	00415
00416	Olympic Hot Springs(B-1)	S	Clallam	-	-	NW	28	29	08W	48.0	F	-	-	-	-	-	-	-	-	5	00416
00354	Olympic Hot Springs	S	Clallam	-	-	NW	28	29	08W	48.0	F	-	-	-	-	-	500	N	-	3,4	00354
00751	Olympic Hot Springs	S	Clallam	-	-	NW	28	29	08W	48.5	F	-	-	-	-	-	-	-	-	17	00751
00420	Olympic Hot Springs(A)	S	Clallam	-	-	NW	28	29	08W	48.0	F	-	-	-	-	-	-	-	-	5	00420
00409	Sol Duc Hot Springs(D-1)	S	Clallam	-	-	NW	32	29	09W	46.0	F	-	-	-	-	-	76	N	-	5	00409
00408	Sol Duc Hot Springs(C-1)	S	Clallam	-	-	NW	32	29	09W	40.0	F	-	-	-	-	-	8	N	-	5	00408
00752	Sol Duc Hot Springs	S	Clallam	-	-	NW	32	29	09W	51.0	F	-	-	-	-	-	-	-	-	17	00752
00418	Sol Duc Hot Springs(2)	S	Clallam	-	-	NW	32	29	09W	-	-	-	-	-	-	-	-	-	-	5	00418
00417	Sol Duc Hot Springs(1)	S	Clallam	-	-	NW	32	29	09W	-	-	-	-	-	-	-	-	-	-	5	00417
00407	Sol Duc Hot Springs(B-1)	S	Clallam	-	-	NW	32	29	09W	50.0	F	-	-	-	-	-	151	N	-	5	00407
00406	Sol Duc Hot Springs(A-1)	S	Clallam	-	-	NW	32	29	09W	34.0	F	-	-	-	-	-	114	N	-	5	00406
00355	Sol Duc Hot Springs	S	Clallam	-	-	NW	32	29	09W	50.0	F	-	-	-	-	-	560	N	-	3,4	00355
00100	Ferrell, L.	W	Columbia	-	-	SW,NW	01	12	38E	22.0	-	241.1	L	41.0	B	-	-	-	-	1,4,8,16	00100
00101	-	W	Columbia	-	-	SW,NW	26	13	38E	20.0	F	74.0	L	108.0	B	-	-	-	-	1,4,8	00101
00356	Green River Soda Springs	S	Cowlitz	-	-	NE	02	10	04E	25.0	M	-	-	-	-	-	-	-	-	3,4	00356
00459b	Welch	W	Douglas	-	-	NW,NE	12	20	22E	22.0	B	229.0	D	33.0	B	-	-	-	-	8	00459b
00459a	Welch	W	Douglas	-	-	NW,NE	12	20	22E	22.0	B	229.0	D	31.5	A	-	-	-	-	8	00459a
00947	Fleming & Evenhus	W	Douglas	-	-	SW,NW	19	22	22E	20.0	F	82.9	D	-	-	-	8	P	71.6	20	00947
00946	Welch, Dean	W	Douglas	-	-	SW,NW	19	22	22E	22.8	F	225.9	D	-	-	-	6832	P	176.2	20	00946
00745	Sagebrush Flats	W	Douglas	-	-	NE,SW	27	23	25E	33.0	B	396.2	D	-	-	-	-	-	-	16	00745
00102	Pixlee	W	Douglas	-	-	NW,NW	20	23	26E	27.8	S	244.4	L	69.0	B	-	-	-	-	1,4,8	00102
00103	Pixlee	W	Douglas	-	-	NW,NW	20	23	26E	29.3	S	362.7	L	50.0	B	-	-	-	-	1,4,7,8,12	00103
00948	Isaak, John	W	Douglas	-	-	NE,NW	26	27	28E	20.0	F	246.9	D	-	-	-	-	P	157.6	20	00948
00104	Pasco	W	Franklin	-	-	SE,NE	18	09	30E	21.0	F	315.0	D	29.0	B	-	-	-	-	1,4,8	00104
00105a	Nakamura	W	Franklin	-	-	SW,NW	07	09	31E	24.6	-	167.7	L	33.4	A	-	-	-	-	1,4,8	00105a
00105b	Nakamura	W	Franklin	-	-	SW,NW	07	09	31E	24.6	-	167.7	L	75.0	B	-	-	-	-	1,4,8,16	00105b
00106	Nakamura, H.	W	Franklin	-	-	SE,NE	21	11	31E	24.8	B	356.0	D	34.0	B	-	-	-	-	1,4,8,15	00106
00436	Rowe Farms	W	Franklin	-	-	SW,SW	29	11	32E	29.6	B	333.0	D	53.0	B	-	-	-	-	7,12	00436
00107	USBR	-	Franklin	-	-	SE,NW	28	12	29E	20.0	F	213.0	D	38.0	B	-	-	-	-	1,4,8	00107
00108	USBR	-	Franklin	-	-	SW,SW	13	13	28E	27.6	F	341.0	D	46.0	B	-	-	-	-	1,4,8	00108
00460b	Bailie	W	Franklin	-	-	NW,SE	13	13	29E	22.6	B	210.0	D	43.0	B	-	-	-	-	8	00460b
00460a	Bailie	W	Franklin	-	-	NW,SE	13	13	29E	22.6	B	210.0	D	40.0	A	-	-	-	-	8	00460a
00109a	Cockrans	W	Franklin	-	-	NW,SW	30	13	34E	32.2	B	355.1	D	56.4	A	-	-	-	-	1,4,7,8,12	00109a
00109b	Cockrans	W	Franklin	-	-	NW,SW	30	13	34E	32.2	B	355.1	D	57.0	B	-	-	-	-	1,4,7,8,12	00109b
00111a	Othello A.F.B.	W	Franklin	-	-	NE,NE	09	14	29E	22.2	S	215.0	L	57.6	A	-	-	-	-	1,4,8	00111a
00111b	Othello A.F.B.	W	Franklin	-	-	NE,NE	09	14	29E	22.2	S	215.0	L	47.0	B	-	-	-	-	1,4,8	00111b
00110	US Govt.	-	Franklin	-	-	NE,NE	09	14	29E	22.3	F	263.0	D	39.0	B	-	-	-	-	1,4,8	00110
00784	-	W	Franklin	-	-	NE,NE	09	14	29E	22.2	B	213.4	D	43.9	B	-	-	-	-	18	00784
00666	Rathbun, Corrin	W	Franklin	-	-	NW,SW	08	14	31E	43.1	B	758.0	D	38.1	S	-	-	-	-	13,15,16	00666
00648	Rathbun, C.	W	Franklin	-	-	NW,SW	08	14	31E	46.8	B	758.0	D	31.1	S	-	-	-	-	10	00648
00461	Rathbun	W	Franklin	-	-	NW,SW	08	14	31E	46.8	-	758.0	L	46.0	B	-	-	-	-	8	00461
00112	Rathbun	W	Franklin	-	-	NE,SE	09	14	31E	21.2	-	330.1	L	28.0	B	-	-	-	-	1,4,8	00112
00667	Rathbun, Corrin, 3	W	Franklin	-	-	NE,SE	09	14	31E	22.2	B	332.2	D	47.9	S	-	-	-	-	13,15,16	00667
00668	Kummer Farms	W	Franklin	-	-	NE,NW	15	14	31E	20.3	B	413.3	D	-	-	-	-	-	-	13,15,16	00668
00669	Andrews, Clyde	W	Franklin	-	-	NE,SE	27	14	31E	25.2	B	207.3	D	49.9	S	-	-	-	-	13	00669

GEOTHERMAL RESOURCES DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON -- DESCRIPTIVE AND THERMAL DATA.
File Name = GEOTHDB1.WK1 Last Updated April 30, 1993, by J.E.S.

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.D
00114b	Hart	W	Franklin	-	-	SE,SW	02	14	32E	27.2	S	242.3	L	63.0	B	-	-	-	-	1,4,7,8,12	00114
00115	Hart	W	Franklin	-	-	SW,NW	13	14	32E	25.6	-	187.1	L	73.0	B	-	-	-	-	1,4,7,8,12	00115
00671	Hart, Dick	W	Franklin	-	-	SW,NW	13	14	32E	23.7	B	232.2	D	49.9	S	-	-	-	-	13,16	00671
00116b	Connell 6	W	Franklin	-	-	NW,NW	31	14	32E	29.4	B	303.0	D	57.0	B	-	-	-	-	1,4,7,8,12	00116
00116a	Connell 6	W	Franklin	-	-	NW,NW	31	14	32E	28.5	B	305.0	D	38.0	A	-	-	-	-	1,4,7,8	00116
00672	Connell City No. 6	W	Franklin	-	-	NW,NW	31	14	32E	29.0	B	302.3	D	49.9	S	-	-	-	-	13,16	00672
00673	Heider, Walter	W	Franklin	-	-	SW,SW	21	14	33E	28.2	B	351.1	D	49.9	S	-	-	-	-	13,15,16	00673
00117	Heider	W	Franklin	-	-	SW,SW	21	14	33E	27.3	-	349.3	L	44.0	B	-	-	-	-	1,4,8	00117
00118	Gillis	W	Franklin	-	-	SW,SW	19	14	36E	23.0	S	262.7	L	42.0	B	-	-	-	-	1,4,8	00118
00119	Pomeroy	W	Garfield	-	-	NE,SW	31	12	42E	23.0	F	304.0	D	36.0	B	-	-	-	-	1,4,8	00119
00120	US Army	-	Grant	-	-	NW,NW	01	14	25E	27.5	F	285.0	D	54.0	B	-	-	-	-	1,4,8	00120
00462	Hanford 93-93	-	Grant	-	-	NW,NW	01	14	25E	25.6	F	68.0	L	43.0	B	-	-	-	-	8	00462
00121	US Govt.	-	Grant	-	-	NW,NE	21	14	25E	22.0	F	159.0	D	63.0	B	-	-	-	-	1,4,8	00121
00122	US Army	-	Grant	-	-	NE,NW	24	14	27E	30.0	F	425.0	D	42.0	B	-	-	-	-	1,4,8	00122
00463	DH 5	-	Grant	-	-	SE,SW	25	15	24E	74.0	B	1524.0	D	41.0	B	-	-	-	-	8	00463
00652	DH 5	-	Grant	-	-	-	28	15	24E	74.0	B	1534.3	D	31.1	S	-	-	-	-	10	00652
00123	AEC	-	Grant	-	-	NE,SW	34	15	27E	21.5	F	194.0	D	49.0	B	-	-	-	-	1,4,8	00123
00124	US Govt.	-	Grant	-	-	SW,NE	01	16	24E	23.5	F	244.0	D	47.0	B	-	-	-	-	1,4,8	00124
00125	USAF	-	Grant	-	-	SW,NE	01	16	24E	24.5	F	279.0	D	45.0	B	-	-	-	-	1,4,8	00125
00126	Metro Mortgage	W	Grant	-	-	SE,NW	01	17	25E	25.3	B	239.0	D	56.0	B	-	-	-	-	1,4,8,16	00126
00127	USBR	-	Grant	-	-	NW,NW	31	17	27E	20.8	F	247.0	D	36.0	B	-	-	-	-	1,4,8	00127
00128	-	W	Grant	-	-	SW,NE	01	17	30E	23.0	F	299.0	D	37.0	B	-	-	-	-	1,4,8	00128
00130	US Army	-	Grant	-	-	NW,SE	33	17	30E	23.5	F	222.0	L	52.0	B	-	-	-	-	1,4,8	00130
00129	US Army	-	Grant	-	-	NW,SE	33	17	30E	22.2	F	306.0	D	33.0	B	-	-	-	-	1,4,8	00129
00131	Washington	W	Grant	-	-	SW,NW	15	18	25E	25.6	F	297.0	D	46.0	B	-	-	-	-	1,4,8	00131
00133b	DOE George	W	Grant	-	-	SW,NW	15	18	25E	29.3	-	488.0	L	35.0	B	-	-	-	-	1,4,8,15	00133b
00132	Quincy	W	Grant	-	-	SW,NW	15	18	25E	22.4	S	270.3	L	39.0	B	-	-	-	-	1,4,8	00132
00133a	DOE George	W	Grant	-	-	SW,NW	15	18	25E	29.3	-	488.0	L	35.2	A	-	-	-	-	1,4,8	00133a
00134	Metro Mortgage 11A	W	Grant	-	-	NE,SE	23	18	25E	21.2	-	190.2	L	48.0	B	-	-	-	-	1,4,8	00134
00790	-	W	Grant	-	-	SW,SW	27	18	25E	21.2	B	228.0	D	35.5	B	-	-	-	-	18	00790
00135	Farm Man	W	Grant	-	-	SW,SW	27	18	25E	21.2	-	228.0	L	40.0	B	-	-	-	-	1,4,8	00135
00136	Bradshaw	W	Grant	-	-	NW,NE	28	18	25E	22.4	B	211.5	D	49.0	B	-	-	-	-	1,4,8	00136
00464a	Metro Mortgage	W	Grant	-	-	SE,NW	31	18	26E	20.4	B	216.0	D	39.0	B	-	-	-	-	8	00464a
00137a	Metro Mortgage 20	W	Grant	-	-	NW,SE	31	18	26E	22.5	B	214.6	D	40.0	A	-	-	-	-	1,4,8	00137a
00791	-	W	Grant	-	-	SE,NW	31	18	26E	20.4	B	215.8	D	49.1	B	-	-	-	-	18	00791
00464b	Metro Mortgage	W	Grant	-	-	SE,NW	31	18	26E	20.4	B	216.0	D	46.0	A	-	-	-	-	8	00464b
00137b	Metro Mortgage 20	W	Grant	-	-	NW,SE	31	18	26E	22.5	B	214.6	D	49.0	B	-	-	-	-	1,4,8	00137b
00465a	Shinn	W	Grant	-	-	SW	35	18	26E	23.2	B	165.0	D	51.8	A	-	-	-	-	8	00465a
00465b	Shinn	W	Grant	-	-	SW	35	18	26E	23.2	B	165.0	D	68.0	B	-	-	-	-	8	00465b
00708	American Potato No. 2	W	Grant	-	-	SW,SE	06	18	29E	21.7	B	204.8	D	45.0	S	-	-	-	-	13,15,16	00708
00138	Am. Pot. Co.	W	Grant	-	-	SW,SE	06	18	29E	21.5	B	205.0	D	47.0	B	-	-	-	-	1,4,7,8,12	00138
00139	Lauzier, Paul	W	Grant	-	-	NW,NW	31	19	27E	25.0	-	233.2	L	56.0	B	-	-	-	-	1,4,7,8,12,16	00139
00466	Moses Lake City 28	W	Grant	-	-	NE,SW	04	19	28E	20.9	F	227.0	D	37.0	B	-	-	-	-	8	00466
00140	Moses Lake City 3	W	Grant	-	-	SW,SE	15	19	28E	22.2	F	277.0	D	37.0	B	-	-	-	-	1,4,8	00140
00141	Moses Lake City 7	W	Grant	-	-	NW,NW	23	19	28E	23.7	B	280.4	D	42.0	B	-	-	-	-	1,4,8	00141
00711	Moses Lake City No. 7	W	Grant	-	-	NW,NW	23	19	28E	23.8	B	282.2	D	45.0	S	-	-	-	-	13,16	00711
00142	Moses Lake City 7	W	Grant	-	-	NW,NW	23	19	28E	20.6	F	292.0	D	30.0	B	-	-	-	-	1,4,8	00142

GEOTHERMAL RESOURCES DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON -- DESCRIPTIVE AND THERMAL DATA.
File Name = GEOTHDB1.WK1 Last Updated April 30, 1993, by J.E.S.

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.D.
00792	-	W	Grant	-	-	NW,SE	28	19	28E	22.6	B	292.6	D	32.2	B	-	-	-	-	18	00792
00712	Moses Lake City No. 31	W	Grant	-	-	NW,SW	29	19	28E	20.6	B	140.2	D	-	-	-	-	-	-	13,16	00712
00468	Moses Lake City 31	W	Grant	-	-	NW,SW	29	19	28E	20.0	-	137.2	L	58.0	B	-	-	-	-	8	00468
00144	Fode 1	W	Grant	-	-	SE,NW	03	19	29E	25.4	B	321.2	D	42.0	B	-	-	-	-	1,4,8	00144
00713	Fode, Roy, No. 2	W	Grant	-	-	SE,NW	03	19	29E	29.0	B	322.2	D	45.0	S	-	-	-	-	13,16	00713
00145	Shinn 2	W	Grant	-	-	SE,NE	04	19	29E	25.0	B	280.4	D	46.0	B	-	-	-	-	1,4,7,8,12	00145
00714	Shinn, Frank, No. 2	W	Grant	-	-	SE,NE	04	19	29E	25.7	B	280.7	D	45.0	S	-	-	-	-	13,16	00714
00146	Abrams	W	Grant	-	-	NE,SE	09	19	29E	20.5	S	97.5	L	88.0	B	-	-	-	-	1,4,8	00146
00469	Jett-Aero 2	W	Grant	-	-	NE,SE	14	19	29E	21.5	-	217.3	L	44.0	B	-	-	-	-	8	00469
00715	Jett-Aero No. 2	W	Grant	-	-	NE,SE	14	19	29E	21.5	B	218.2	D	45.0	S	-	-	-	-	13,16	00715
00716	Masto Farms	W	Grant	-	-	NE,NE	15	19	29E	21.1	B	288.6	D	45.0	S	-	-	-	-	13,15,16	00716
00147	Carnation	W	Grant	-	-	SW,SW	16	19	29E	28.8	B	190.5	D	88.0	B	-	-	-	-	1,4,7,8,12	00147
00148	Potato 2	W	Grant	-	-	SE,NW	13	19	30E	20.2	B	201.0	D	41.0	B	-	-	-	-	1,4,8	00148
00717	American Potato	W	Grant	-	-	SE,NW	13	19	30E	20.6	B	202.1	D	-	-	-	-	-	-	13	00717
00793	-	W	Grant	-	-	SE,NW	13	19	30E	20.2	B	201.2	D	38.1	B	-	-	-	-	18	00793
00149	Schmidt	W	Grant	-	-	NW,SW	17	19	30E	21.8	B	220.6	D	44.0	B	-	-	-	-	1,4,8	00149
00718	Schmidt, Reuben	W	Grant	-	-	NW,SW	17	19	30E	21.9	B	224.6	D	45.0	S	-	-	-	-	13,16	00718
00150	Abram 1	W	Grant	-	-	NW,NW	20	19	30E	25.8	B	310.9	D	44.0	B	-	-	-	-	1,4,8	00150
00719	Jett-Aero No. 1	W	Grant	-	-	NW,NW	20	19	30E	25.8	B	311.8	D	45.0	S	-	-	-	-	13,16	00719
00151	Quincy City 1	W	Grant	-	-	SE,SE	07	20	24E	21.0	F	131.0	D	69.0	B	-	-	-	-	1,4,8	00151
00152	Cole	W	Grant	-	-	SE,NE	07	20	29E	24.0	S	213.3	L	56.0	B	-	-	-	-	1,4,8	00152
00726	Cole, E. B.	W	Grant	-	-	SE,NE	07	20	29E	21.0	B	214.9	D	45.0	S	-	-	-	-	13,15,16	00726
00470	Reinke	W	Grant	-	-	NE,NW	25	20	29E	25.0	S	404.1	L	32.0	B	-	-	-	-	1,4,8	00470
00727	Reinke Farms	W	Grant	-	-	NE,NW	25	20	29E	26.3	B	405.7	D	45.0	S	-	-	-	-	13,15,16	00727
00728	Powers, Tom	W	Grant	-	-	NE,NE	35	20	29E	26.6	B	292.6	D	45.0	S	-	-	-	-	13,16	00728
00154	Powers	W	Grant	-	-	NE,NE	35	20	29E	25.0	-	292.6	L	40.0	B	-	-	-	-	1,4,8	00154
00155a	Claassen	W	Grant	-	-	SE,NW	21	20	30E	26.4	S	322.7	L	53.7	A	-	-	-	-	1,4,8	00155a
00471	Claassen	W	Grant	-	-	SE,NW	21	20	30E	25.0	S	323.0	L	40.0	B	-	-	-	-	8	00471
00794	-	W	Grant	-	-	SE,NW	21	20	30E	25.0	B	322.8	D	39.0	B	-	-	-	-	18	00794
00729b	Claassen, Clint	W	Grant	-	-	SW,NE	21	20	30E	28.7	B	469.7	D	35.0	S	-	-	-	-	13,15,16	00729b
00155b	Claassen	W	Grant	-	-	SE,NW	21	20	30E	26.4	S	322.7	L	45.0	B	-	-	-	-	1,4,8	00155b
00157	Claassen	W	Grant	-	-	SW,NE	21	20	30E	28.0	-	466.3	L	34.0	B	-	-	-	-	1,4,8	00157
00729a	Claassen, Clint	W	Grant	-	-	SW,NE	21	20	30E	25.3	S	322.8	L	-	-	-	-	-	-	13	00729a
00156	Claassen	W	Grant	-	-	SW,NE	21	20	30E	22.0	-	351.7	L	28.0	B	-	-	-	-	1,4,8	00156
00731a	Franz, Herb	W	Grant	-	-	SW,NE	23	20	30E	34.9	B	337.1	D	-	-	-	-	-	-	13	00731a
00731b	Franz, Herb, No. 1	W	Grant	-	-	SW,NE	23	20	30E	26.6	B	335.9	D	35.0	S	-	-	-	-	13,16	00731b
00159b	Franz	W	Grant	-	-	SW,NW	23	20	30E	34.8	B	337.0	D	68.0	B	-	-	-	-	1,4,7,8,12	00159b
00159a	Franz	W	Grant	-	-	SW,NW	23	20	30E	34.8	B	337.0	D	101.0	A	-	-	-	-	1,4,7,8	00159a
00472	Franz	W	Grant	-	-	SW,NW	23	20	30E	26.8	B	336.0	D	44.0	B	-	-	-	-	1,4,7,8	00472
00730	Franz, Herb, No. 2	W	Grant	-	-	NE,NE	23	20	30E	21.9	B	218.5	D	35.0	S	-	-	-	-	13,16	00730
00158	Franz 2	W	Grant	-	-	NE,NE	23	20	30E	21.5	S	219.4	L	43.0	B	-	-	-	-	1,4,8	00158
00161	Jantz	W	Grant	-	-	SE,SE	28	20	30E	28.5	B	181.0	D	91.0	B	-	-	-	-	1,4,7,8,12	00161
00160	Stuckey	W	Grant	-	-	SE,SE	28	20	30E	20.4	S	178.3	L	47.0	B	-	-	-	-	1,4,8	00160
00732	Jantz, Joe	W	Grant	-	-	SE,SE	28	20	30E	28.6	B	181.3	D	-	-	-	-	-	-	13	00732
00733	Stucky, J. Jantz	W	Grant	-	-	SE,SE	28	20	30E	20.3	B	178.3	D	35.0	S	-	-	-	-	13,16	00733

GEOTHERMAL RESOURCES DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON -- DESCRIPTIVE AND THERMAL DATA.

File Name = GEOTHDB1.WK1 Last Updated April 30, 1993, by J.E.S.

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.D
00165	Ephrata	W	Grant	-	-	SW,NW	21	21	26E	25.5	F	188.0	D	72.0	B	-	-	-	-	1,4,8	00165
00166	-	W	Grant	-	-	NW,SW	10	21	30E	30.0	B	640.0	-	28.0	B	-	-	-	-	1,4	00166
00167	Schell	W	Grant	-	-	SW,NE	26	21	30E	20.7	B	170.7	D	51.0	B	-	-	-	-	1,4,7,8,12	00167
00736	Schell, Harvey	W	Grant	-	-	SW,NE	26	21	30E	21.4	B	171.0	D	35.0	S	-	-	-	-	13	00736
00796	-	W	Grant	-	-	SW,NE	26	21	30E	21.3	B	170.7	D	53.6	B	-	-	-	-	18	00796
00168	Soap Lake	W	Grant	-	-	SW,SW	19	22	27E	27.0	F	142.0	D	106.0	B	-	-	-	-	1,4,7,8,12	00168
00169a	King, Bud	W	Grant	-	-	SW,NE	26	22	30E	23.5	S	239.9	L	34.7	A	-	-	-	-	1,4	00169a
00474b	King, Bud	W	Grant	-	-	SW,NE	26	22	30E	25.0	B	475.5	D	29.0	B	-	-	-	-	8,15	00474b
00169b	King, Bud	W	Grant	-	-	SW,NE	26	22	30E	23.5	S	239.9	L	52.0	B	-	-	-	-	1,4,8	00169b
00474a	King, Bud	W	Grant	-	-	SW,NE	26	22	30E	25.0	B	475.5	D	25.8	A	-	-	-	-	8,15	00474a
00170	Schafer, Jerry	W	Grant	-	-	SW,NW	27	23	28E	22.8	-	195.7	L	60.0	B	-	-	-	-	1,4,7,8,12,15	00170
00171	-	W	Grant	-	-	NE,SW	24	25	28E	29.2	B	189.0	-	91.0	B	-	-	-	-	1,4	00171
00172	Dormaier	W	Grant	-	-	NW,NE	25	25	28E	23.0	B	177.0	D	67.0	B	-	-	-	-	1,4,7,8,12	00172
00799	-	W	Grant	-	-	NW,NE	25	25	28E	23.0	B	177.4	D	62.1	B	-	-	-	-	18	00799
00336	VO-MO 1	H	Grays Harbor	47-14.3	124-11.5	-	08	20	12W	35.6	B	1066.8	L	27.4	A	36	-	-	-	2	00336
00754	Lester Hot Springs	S	King	-	-	-	21	20	10E	46.5	F	-	-	-	-	-	-	-	-	17	00754
00392	Lester Hot Springs(A-1)	S	King	-	-	-	21	20	10E	48.4	F	-	-	-	-	-	76	N	-	5	00392
00394	Lester Hot Springs(F-1)	S	King	-	-	-	21	20	10E	45.0	F	-	-	-	-	-	19	N	-	5	00394
00393	Lester Hot Springs(E-1)	S	King	-	-	-	21	20	10E	45.0	F	-	-	-	-	-	38	N	-	5	00393
00358	Lester Hot Springs	S	King	-	-	-	21	20	10E	49.0	F	-	-	-	-	-	200	N	-	3,4	00358
00527	Goldmeyer Hot Springs(A-1)	S	King	-	-	NW	14	23	11E	47.5	F	-	-	-	-	-	-	-	-	9	00527
00528	Goldmeyer Hot Springs(C-1)	S	King	-	-	NW	14	23	11E	49.6	F	-	-	-	-	-	-	-	-	9	00528
00529	Goldmeyer Hot Springs(D-1)	S	King	-	-	NW	14	23	11E	45.3	F	-	-	-	-	-	-	-	-	9	00529
00753	Goldmeyer Hot Springs	S	King	-	-	NW	14	23	11E	50.0	F	-	-	-	-	-	-	-	-	17	00753
00357	Goldmeyer Hot Springs	S	King	-	-	NW	14	23	11E	53.0	F	-	-	-	-	-	350	N	-	3,4	00357
00536	Scenic Hot Springs(A-1)	S	King	-	-	SE	28	26	13E	39.2	F	-	-	-	-	-	-	-	-	9	00536
00755	Scenic Hot Springs	S	King	-	-	SE	28	26	13E	47.0	F	-	-	-	-	-	-	-	-	17	00755
00537	Scenic Hot Springs(A-2)	S	King	-	-	SE	28	26	13E	46.5	F	-	-	-	-	-	-	-	-	9	00537
00540	Scenic Hot Springs(D-1)	S	King	-	-	SE	28	26	13E	31.0	F	-	-	-	-	-	-	-	-	9	00540
00539	Scenic Hot Springs(C-1)	S	King	-	-	SE	28	26	13E	28.2	F	-	-	-	-	-	-	-	-	9	00539
00538	Scenic Hot Springs(B-1)	S	King	-	-	SE	28	26	13E	42.4	F	-	-	-	-	-	-	-	-	9	00538
00541	Scenic Hot Springs(D-2)	S	King	-	-	SE	28	26	13E	32.7	F	-	-	-	-	-	-	-	-	9	00541
00535	Scenic Hot Springs(A-GT)	S	King	-	-	SE	28	26	13E	47.0	F	-	-	-	-	-	-	-	-	9	00535
00359	Scenic Hot Springs	S	King	-	-	NE	32	26	13E	50.0	F	-	-	-	-	-	110	N	-	3,4	00359
	Burbank Creek Test Well	W	Kittitas	-	-	NE,SW	22	15	19E	23.0	F	183.5	D	-	-	-	6056	N	A	20	00942
00941	Larson Fruit Co.	W	Kittitas	-	-	SE,SE	22	15	19E	20.0	F	126.5	D	-	-	-	-	N?	A?	20	00941
00424	Larson Fruit	W	Kittitas	-	-	SE,SW	22	15	19E	31.5	-	393.0	L	50.0	B	-	-	-	-	7,8,12	00424
00650	USGS Burbank Creek	-	Kittitas	-	-	NE,SW	22	15	19E	24.3	B	121.9	D	-	-	-	-	-	-	10	00650
00173	USGS Burbank	-	Kittitas	-	-	NE,SW	22	15	19E	23.4	F	183.0	D	62.0	B	-	-	-	-	1,4,7,8,12	00173
00174	USGS Burbank	-	Kittitas	-	-	NE,SW	22	15	19E	23.4	S	121.9	L	93.0	B	-	-	-	-	1,4,8	00174
00651	Larson Fruit	W	Kittitas	-	-	SE,SW	22	15	19E	31.5	B	392.9	D	-	-	-	-	-	-	10,15	00651
00943	Nash, Chet	W	Kittitas	-	-	SE,NE	35	15	19E	20.0	F	21.3	D	-	-	-	163	P	14.0	20	00943
00476b	Bollinger	W	Kittitas	-	-	NW,SE	12	16	19E	20.0	B	333.0	D	48.4	A	-	-	-	-	8	00476b
00476a	Bollinger	W	Kittitas	-	-	NW,SE	12	16	19E	20.0	B	333.0	D	32.0	B	-	-	-	-	8	00476a
00475b	Badger	W	Kittitas	-	-	NW,SE	12	16	19E	20.0	-	333.0	L	33.0	B	-	-	-	-	8	00475b
00475a	Badger	W	Kittitas	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

GEOTHERMAL RESOURCES DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON -- DESCRIPTIVE AND THERMAL DATA.
File Name = GEOTHDB1.WK1 Last Updated April 30, 1993, by J.E.S.

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.D.
00176	Ellensburg City	W	Kittitas	-	-	SW,NW	35	18	18E	20.8	-	272.4	L	32.0	B	-	-	-	-	1,4,8,15	00176
00803	-	W	Kittitas	-	-	NW,NE	36	18	18E	28.4	B	262.2	D	61.3	B	-	-	-	-	18	00803
00177	Central Washington University	W	Kittitas	-	-	NW,NE	36	18	18E	28.4	S	262.2	L	63.0	B	-	-	-	-	1,4,8	00177
00945	Clerf, Howard	W	Kittitas	-	-	SW,E2	27	18	20E	20.0	F	141.7	D	-	-	-	7570	N	A	20	00945
00807	Corps of Engineers	W	Klickitat	-	-	NE,NW	28	03	17E	22.2	F	238.0	D	-	-	-	2271	P	27.6	20	00807
00808	Riggleman Orchards	W	Klickitat	-	-	SW,NW	05	04	11E	21.1	F	278.9	D	-	-	-	738	P	225.6	20	00808
00809	Jeleniewski, Tom	W	Klickitat	-	-	NW,NW	19	04	12E	21.1	F	47.2	D	-	-	-	57	P	17.7	20	00809
00361	Klickitat Mineral Springs	S	Klickitat	-	-	-	24	04	13E	29.0	M	-	-	-	-	-	-	-	-	3,4	00361
00478a	DNR 81 Klickitat	W	Klickitat	45-49.40	121-07.72	SW,NW	24	04	13E	20.1	B	119.8	D	51.0	A	71	-	-	-	8,12	00478
00530	Klickitat Mineral Springs(A-1)	S	Klickitat	-	-	-	24	04	13E	22.3	F	-	-	-	-	-	-	-	-	9	00530
00178	Gas Ice Corp.	W	Klickitat	-	-	SE,NE	24	04	13E	27.2	F	90.0	L	167.0	B	-	-	-	-	1,4,8	00178
00532	Klickitat Mineral Springs(C-1)	S	Klickitat	-	-	-	24	04	13E	29.1	F	-	-	-	-	-	-	-	-	9	00532
00531	Klickitat Mineral Springs(B-1)	S	Klickitat	-	-	-	24	04	13E	26.2	F	-	-	-	-	-	-	-	-	9	00531
00478b	DNR 81 Klickitat	W	Klickitat	45-49.40	121-07.72	SW,NW	24	04	13E	20.1	B	119.8	D	56.0	B	-	-	-	-	8	00478
00179	Gas Ice Corp.	W	Klickitat	-	-	NE,NW	19	04	14E	22.8	F	61.0	D	177.0	B	-	-	-	-	1,4,8	00179
00479	Barrett	W	Klickitat	-	-	NW,NW	11	04	16E	20.9	-	187.4	L	48.0	B	-	-	-	-	8	00479
00744	Goldendale City No. 1	W	Klickitat	-	-	SW,SE	16	04	16E	24.6	B	271.0	D	-	-	-	-	-	-	15	00744
00180b	Berk Bros.	W	Klickitat	-	-	NW,NE	27	05	20E	22.8	B	276.0	D	40.0	B	-	-	-	-	1,4,8	00180
00181	Berk	W	Klickitat	-	-	NW,NE	27	05	20E	23.1	B	271.6	D	41.0	B	-	-	-	-	1,4,8	00181
00762	-	W	Klickitat	-	-	NW,NE	27	05	20E	22.8	B	274.3	D	42.9	B	-	-	-	-	18	00762
00180a	Berk Bros.	W	Klickitat	-	-	NW,NE	27	05	20E	22.8	B	276.0	D	41.0	A	-	-	-	-	1,4,8	00180
00480	DOE Horse Heaven West	W	Klickitat	-	-	NE,SW	16	05	21E	27.6	B	457.0	D	38.0	B	-	-	-	-	8,16	00480
00763	-	W	Klickitat	-	-	NE,NE	27	05	22E	28.2	B	321.3	D	47.6	B	-	-	-	-	18	00763
00811	Matsen, A. M.	W	Klickitat	-	-	NE,NE	27	05	22E	22.2	F	262.1	D	-	-	-	6836	P	21.9	20	00811
00182a	Matsen	W	Klickitat	-	-	NE,NE	27	05	22E	28.2	-	320.0	L	42.0	A	-	-	-	-	1,4,7,8	00182
00810	Matsen, A. M.	W	Klickitat	-	-	NE,NE	27	05	22E	21.1	F	236.2	D	-	-	-	3406	P	16.5	20	00810
00182b	Matsen	W	Klickitat	-	-	NE,NE	27	05	22E	28.2	-	320.0	L	50.0	B	-	-	-	-	1,4,7,8,12	00182
00183	Powers, Tom	W	Klickitat	-	-	NE,SE	13	05	23E	27.2	B	330.1	D	43.0	B	-	-	-	-	1,4,7,8,12,15	00183
00184	-	W	Klickitat	-	-	NW,NW	29	05	23E	25.5	B	61.0	-	221.0	B	-	-	-	-	1,4	00184
00434	McBride, C.	W	Klickitat	-	-	NW,NW	29	05	23E	25.5	B	265.5	D	51.0	B	-	-	-	-	7,8,12,15	00434
00812	McBride, Clarence	W	Klickitat	-	-	NW,NW	29	05	23E	22.2	F	266.7	D	-	-	-	8024	N	A	20	00812
00665	Fish Hatchery Warm Spring	S	Klickitat	-	-	SE,NE	04	06	13E	23.8	F	-	-	-	-	-	-	-	-	12	00665
00360	Fish Hatchery Warm Spring	S	Klickitat	-	-	SE,NE	04	06	13E	24.0	F	-	-	-	-	-	15	N	-	3,4	00360
00816	Smith, G.	W	Klickitat	-	-	SW,SW	11	06	23E	23.3	F	271.9	D	-	-	-	-	-	A	20	00816
00185	Smith	W	Klickitat	-	-	SE,SW	11	06	23E	22.0	F	272.0	D	37.0	B	-	-	-	-	1,4,8	00185
00186	Smith	W	Klickitat	-	-	SW,SE	11	06	23E	21.0	F	204.0	D	44.0	B	-	-	-	-	1,4,8	00186
00188	Andrews	W	Klickitat	-	-	SE,NE	15	06	23E	21.0	F	193.0	L	47.0	B	-	-	-	-	1,4,8	00188
00187	Andrews	W	Klickitat	-	-	SE,NE	15	06	23E	25.2	S	275.0	L	48.0	B	-	-	-	-	1,4,7,8,12	00187
00817	DNR	W	Klickitat	-	-	SE,SE	16	06	23E	22.2	F	290.2	D	-	-	-	7570	P	20.1	20	00817
00189	Andrews, Robert	W	Klickitat	-	-	NE,SE	22	06	23E	23.0	B	317.9	D	35.0	B	-	-	-	-	8,15	00189
00481b	DNR Mercer N.	W	Klickitat	-	-	SE,NW	36	06	23E	20.8	-	190.0	L	48.9	A	-	-	-	-	8	00481b
00481a	DNR Mercer N.	W	Klickitat	-	-	SE,NW	36	06	23E	20.8	-	190.0	L	41.0	B	-	-	-	-	8	00481a
00338	RDH SU8	-	Lewis	46-32.7	122-50.8	NE,NE	07	12	01W	25.2	-	565.0	L	33.2	A	-	-	-	-	2,8	00338
00190b	SU 8	-	Lewis	-	-	NE,NE	07	12	01W	25.2	-	565.0	L	30.0	B	-	-	-	-	1,4,8	00190b

GEOTHERMAL RESOURCES DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON -- DESCRIPTIVE AND THERMAL DATA.
File Name = GEOTHDBI.WK1 ~~Last Updated April 30, 1993, by J.E.S.~~

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.
00192b	SU 11	-	Lewis	-	-	NE,SE	08	12	01W	21.3	-	409.0	L	33.0	B	-	-	-	-	1,4,8	0019
00192a	SU 11	-	Lewis	-	-	NE,SE	08	12	01W	21.3	-	409.0	L	34.6	A	-	-	-	-	1,4,8	0019
00191b	SU 37	-	Lewis	-	-	SW,SW	08	12	01W	24.7	-	540.0	L	30.8	B	-	-	-	-	1,4,8	0019
00385b	SU 12	-	Lewis	-	-	NE,SE	08	12	01W	25.7	-	578.0	L	31.0	B	-	-	-	-	1,4,8	0038
00340	RDH SU37	-	Lewis	46-31.9	122-50.5	SW,SW	08	12	01W	24.7	B	540.0	L	33.5	A	-	-	-	-	2	0034
00343	SU 4	-	Lewis	46-32.0	122-48.7	SW,SW	09	12	01W	28.8	B	760.0	L	32.8	A	36	-	-	-	2	0034
00193a	Longview City 10	W	Lewis	-	-	-	17	12	01W	30.0	-	792.0	L	26.0	A	-	-	-	-	1,4,8	0019
00193b	Longview City 10	W	Lewis	-	-	-	17	12	01W	30.0	-	792.0	L	27.0	B	-	-	-	-	1,4,8	0019
00344	SU 902	-	Lewis	46-31.6	122-50.1	SE,NE	17	12	01W	31.2	B	847.0	L	32.7	A	-	-	-	-	2	0034
00363	Packwood Hot Spring	S	Lewis	-	-	-	32	13	09E	38.0	F	-	-	-	-	-	-	-	-	3,4	0036
00402	Ohanapecosh Hot Springs(G-1)	S	Lewis	-	-	NW	04	14	10E	47.8	F	-	-	-	-	-	30	N	-	5	0040
00401	Ohanapecosh Hot Springs(D-1)	S	Lewis	-	-	NW	04	14	10E	50.1	F	-	-	-	-	-	76	N	-	5	0040
00400	Ohanapecosh Hot Springs(C-1)	S	Lewis	-	-	NW	04	14	10E	43.6	F	-	-	-	-	-	11	N	-	5	0040
00362	Ohanapecosh Hot Springs	S	Lewis	-	-	NW	04	14	10E	50.0	M	-	-	-	-	-	110	N	-	3,4	0036
00398	Ohanapecosh Hot Springs(A-1)	S	Lewis	-	-	NW	04	14	10E	39.5	F	-	-	-	-	-	38	N	-	5	0039
00403	Ohanapecosh Hot Springs(H-1)	S	Lewis	-	-	NW	04	14	10E	30.6	F	-	-	-	-	-	-	-	-	5	0040
00399	Ohanapecosh Hot Springs(B-1)	S	Lewis	-	-	NW	04	14	10E	45.0	F	-	-	-	-	-	23	N	-	5	0039
00195	Basalt Explorer (Schell)	W	Lincoln	-	-	NW,SW	10	21	31E	30.4	F	229.0	L	80.0	B	-	-	-	-	1,4,8	0019
00737a	Basalt Explorer	W	Lincoln	-	-	NW,SW	10	21	31E	64.5	B	1340.1	D	38.1	S	-	-	-	-	13,15,16	0073
00482b	Basalt Explorer	O	Lincoln	-	-	NW,SW	10	21	31E	64.0	S	1335.0	L	34.0	A	-	-	-	-	8	0048
00659	-	W	Lincoln	-	-	-	10	21	31E	65.8	B	1342.5	D	31.1	S	-	-	-	-	10	0065
00737b	Basalt Explorer	W	Lincoln	-	-	NW,SW	10	21	31E	57.5	S	1249.7	L	-	-	-	-	-	-	13	0073
00335b	Basalt Explorer	O	Lincoln	-	-	NW,SW	10	21	31E	57.5	S	1249.0	L	37.0	B	-	-	-	-	8	0033
00483	Basalt Explorer DOE	-	Lincoln	-	-	NW,SW	10	21	31E	28.9	S	462.0	L	36.0	B	-	-	-	-	8	0048
00482a	Basalt Explorer	O	Lincoln	-	-	NW,SW	10	21	31E	64.0	S	1335.0	L	39.0	B	-	-	-	-	8	0048
00194a	Basalt Explorer	O	Lincoln	-	-	NW,SW	10	21	31E	65.8	S	1343.0	L	40.0	A	-	-	-	-	1,4,8	0019
00335a	Basalt Explorer	O	Lincoln	47-20.0	118-55.0	NW,SW	10	21	31E	57.5	S	1249.0	L	42.0	A	70	-	-	-	2,8	0033
00194b	Basalt Explorer	O	Lincoln	-	-	NW,SW	10	21	31E	65.8	S	1343.0	L	40.0	B	-	-	-	-	1,4,8	0019
00738	Schafer, Jerry	W	Lincoln	-	-	SE,NW	23	21	31E	21.0	B	292.9	D	35.0	S	-	-	-	-	13	0073
00739	Schibel, Don	W	Lincoln	-	-	NE,NW	24	21	31E	20.6	B	193.8	D	35.0	S	-	-	-	-	13	0073
00196	Sahible	W	Lincoln	-	-	NW,NE	25	21	31E	28.3	B	194.8	D	84.0	B	-	-	-	-	1,4,7,8,12	0019
00740	Kissler, Bob	W	Lincoln	-	-	SE,SE	30	21	31E	23.8	B	263.3	D	35.0	S	-	-	-	-	13,16	0074
00197	Kissler	W	Lincoln	-	-	SE,SE	30	21	31E	22.8	B	263.6	D	41.0	B	-	-	-	-	1,4,8	0019
00797	-	W	Lincoln	-	-	NW,NW	32	21	31E	21.0	B	211.0	D	41.7	B	-	-	-	-	18	0079
00198	Kissler	W	Lincoln	-	-	NW,NW	32	21	31E	21.1	B	211.0	D	43.0	B	-	-	-	-	1,4,8	0019
00484	Schafer	W	Lincoln	-	-	SE,NW	23	21	32E	24.1	S	297.2	L	41.0	B	-	-	-	-	8	0048
00741	Schaffer, Jerry	W	Lincoln	-	-	SE,NW	23	21	32E	23.8	B	297.2	D	40.1	S	-	-	-	-	13,16	0074
00199	Schafer	W	Lincoln	-	-	SE,NW	23	21	32E	22.0	S	298.7	L	34.0	B	-	-	-	-	1,4,8	0019
00200	Hardung, Joe	W	Lincoln	-	-	NE,NW	33	21	34E	24.9	S	252.7	L	55.0	B	-	-	-	-	1,4,7,8,12,16	0020
00805	-	W	Lincoln	-	-	SW,NE	07	21	35E	20.1	B	128.0	D	64.8	B	-	-	-	-	18	0080
00201	Iverson	W	Lincoln	-	-	SW,NE	07	21	35E	20.1	S	128.0	L	71.0	B	-	-	-	-	1,4,8	0020
00202	Weishaar	W	Lincoln	-	-	NE,SE	04	23	32E	28.7	B	211.8	D	83.0	B	-	-	-	-	1,4,7,8,12	0020
00203a	Weishaar	W	Lincoln	-	-	SW,NE	17	23	32E	21.2	B	206.3	D	36.5	A	-	-	-	-	1,4,7,8	0020
00203b	Weishaar	W	Lincoln	-	-	SW,NE	17	23	32E	21.2	B	206.3	D	49.0	B	-	-	-	-	1,4,7,8,12	0020
00204	Zagelow	W	Lincoln	-	-	NE,SE	10	23	33E	21.6	S	231.6	L	46.0	B	-	-	-	-	1,4,8	0020
00798	-	W	Lincoln	-	-	SW,NW	16	24	31E	20.1	B	227.1	D	36.5	B	-	-	-	-	18	0079
00486	USGS Almira	-	Lincoln	-	-	SW,NW	16	24	31E	20.0	B	226.0	D	40.0	B	-	-	-	-	8	0048
00485	USGS Almira	-	Lincoln	-	-	SW,NW	16	24	31E	20.1	B	227.0	D	40.0	B	-	-	-	-	8	0048

GEOTHERMAL RESOURCES DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON -- DESCRIPTIVE AND THERMAL DATA.
File Name = GEOTHDB1.WK1 Last Updated April 30, 1993, by J.E.S.

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.
00205b	DOE Almira	-	Lincoln	-	-	SW,NW	16	24	31E	21.8	B	227.0	D	48.4	A	-	-	-	-	1,4,7,8,12	0020
00206	Schmierer, Alvin	W	Lincoln	-	-	SE,SW	23	24	33E	27.0	B	310.0	D	48.0	B	-	-	-	-	1,4,7,8,12,15	0020
00487	Nealey, Darwin	W	Lincoln	-	-	SE,SW	30	24	34E	21.0	B	231.3	D	43.0	B	-	-	-	-	8,16	0048
00431a	USGS Davenport	-	Lincoln	-	-	NE,NE	16	24	36E	21.3	B	221.0	D	55.0	A	-	-	-	-	7,8,12	0043
00431b	USGS Davenport	-	Lincoln	-	-	NE,NE	16	24	36E	21.3	B	221.0	D	51.0	B	-	-	-	-	7,8,12	0043
00432a	DOE Davenport	-	Lincoln	-	-	NE,NE	16	24	36E	21.9	B	225.0	D	76.0	A	-	-	-	-	7,8,12	0043
00432b	DOE Davenport	-	Lincoln	-	-	NE,NE	16	24	36E	21.9	B	225.0	D	55.0	B	-	-	-	-	7,8,12	0043
00207	Davenport 5	W	Lincoln	-	-	NE,SW	21	25	37E	24.0	S	226.5	L	57.0	B	-	-	-	-	1,4,7,8,12	0020
00433	Davenport 5	W	Lincoln	-	-	NE,SW	21	25	37E	20.0	B	149.3	D	60.0	B	-	-	-	-	7,8,12	0043
00489a	Reardan City	W	Lincoln	-	-	NW,NW	15	25	39E	20.0	S	259.4	L	35.0	B	-	-	-	-	8,16	0048
00489b	Reardan City	W	Lincoln	-	-	NW,NW	15	25	39E	20.0	S	259.4	L	28.3	A	-	-	-	-	8	0048
00490b	Taylor	W	Lincoln	-	-	NE,NE	26	27	37E	23.8	-	358.0	L	36.0	B	-	-	-	-	8	0049
00490a	Taylor	W	Lincoln	-	-	NE,NE	26	27	37E	23.8	-	358.0	L	40.4	A	-	-	-	-	8	0049
00949	Ayres, Bob	W	Okanogan	-	-	NW,SE	28	36	26E	21.1	F	11.6	D	-	-	-	568	P	6.7	20	0094
00950	Zissel, Charles	W	Okanogan	-	-	SE,NE	14	38	28E	20.0	F	9.1	D	-	-	-	38	P	2.4	20	0095
00365	Poison Lake	-	Okanogan	-	-	SE	05	39	27E	50.0	M	-	-	-	-	-	-	-	-	3,4	0036
00951	Zosel, Ralph	W	Okanogan	-	-	SE,SE	15	40	27E	20.0	F	9.1	D	-	-	-	19	P	3.7	20	0095
00364	Hot Lake	-	Okanogan	-	-	NE	18	40	27E	50.0	M	-	-	-	-	-	-	-	-	3,4	0036
00395	Longmire Mineral Springs(A-1)	S	Pierce	-	-	SE	29	15	08E	22.0	F	-	-	-	-	-	-	-	-	5	0039
00366	Longmire Mineral Springs	S	Pierce	-	-	SE	29	15	08E	25.0	F	-	-	-	-	-	250	-	-	3,4	0036
00396	Longmire Mineral Springs(C-1)	S	Pierce	-	-	SE	29	15	08E	25.1	F	-	-	-	-	-	-	-	-	5	0039
00397	Longmire Mineral Springs(G-1)	S	Pierce	-	-	SE	29	15	08E	24.0	F	-	-	-	-	-	-	-	-	5	0039
00367	Mount Rainier Fumaroles	-	Pierce	-	-	-	23	16	08E	72.0	M	-	-	-	-	-	-	-	-	3,4	0036
00368	Bonneville Hot Springs(A-3)	W	Skamania	-	-	SW	16	02	07E	36.3	F	-	-	-	-	-	80	P	-	3,4,9	0036
00663	Bonneville Hot Springs(USGS)	W	Skamania	-	-	SW	16	02	07E	36.0	F	-	-	-	-	-	-	-	-	12	0066
00757	Bonneville Hot Springs	W	Skamania	-	-	SW	16	02	07E	36.0	F	-	-	-	-	-	-	-	-	17	0075
00391	Bonneville Hot Springs(B-2)	W	Skamania	-	-	SW	16	02	07E	29.2	F	-	-	-	-	-	-	-	-	5	00391
00390	Bonneville Hot Springs(A-2)	W	Skamania	-	-	SW	16	02	07E	36.2	F	7.6	-	-	-	-	75	N	-	5	0039
00526a	Bonneville Drill Hole 2(DH-1)	W	Skamania	-	-	SW,SE	39	02	07E	27.7	F	-	-	-	-	-	-	-	-	9	0052
00491b	North Bonneville 3	H	Skamania	45-39.15	121-57.61	-	39	02	07E	26.5	B	153.0	D	106.0	B	-	-	-	-	8,12	00491
00526b	Bonneville Drill Hole 2(DH-2)	W	Skamania	-	-	SW,SE	39	02	07E	28.2	F	-	-	-	-	-	-	-	-	9	0052
00494b	North Bonneville 3	H	Skamania	-	-	NW,SE	39	02	07E	26.4	B	155.0	D	90.0	A	-	-	-	-	8	00494
00492a	North Bonneville 2	H	Skamania	-	-	SW,NW	39	02	07E	35.5	B	195.0	D	131.0	B	-	-	-	-	8	00492
00493a	North Bonneville 2	H	Skamania	45-38.92	121-57.24	SW,NW	39	02	07E	35.5	B	198.0	D	101.0	A	-	-	-	-	8,12	00493
00492b	North Bonneville 2	H	Skamania	45-38.92	121-57.24	SW,NW	39	02	07E	35.5	B	195.0	D	93.4	A	-	-	-	-	8,12	00492
00491a	North Bonneville 3	H	Skamania	45-39.15	121-57.61	-	39	02	07E	26.5	B	153.0	D	80.1	A	-	-	-	-	8,12	00491
00493b	North Bonneville 2	H	Skamania	45-38.92	121-57.24	SW,NW	39	02	07E	35.5	B	198.0	D	126.0	B	-	-	-	-	8,12	00493
00494a	North Bonneville 3	H	Skamania	45-39.15	121-57.61	-	39	02	07E	26.4	B	155.0	D	99.0	B	-	-	-	-	8,12	00494
00372	Rock Creek Hot Springs	S	Skamania	-	-	NE	27	03	07E	34.0	F	-	-	-	-	-	-	-	-	3,4	00372
00534	Rock Creek Hot Springs(A-2)	S	Skamania	-	-	NE	27	03	07E	33.4	F	-	-	-	-	-	-	-	-	9	00534
00533	Rock Creek Hot Springs(A-1)	S	Skamania	-	-	NW,NE	27	03	07E	33.5	F	-	-	-	-	-	-	-	-	9	00533
00405	St. Martin Hot Springs(A-1)	S	Skamania	-	-	SE	21	03	08E	32.0	F	-	-	-	-	-	-	-	-	5	00405
00374	St. Martin Hot Springs	S	Skamania	-	-	SE	21	03	08E	53.0	F	-	-	-	-	-	-	-	-	3,4	00374
00542	St. Martin Hot Springs(A-2)	S	Skamania	-	-	SE,SE	21	03	08E	50.0	F	-	-	-	-	-	-	-	-	9	00542
00756	St. Martin Hot Spring	S	Skamania	-	-	SE,SE	21	03	08E	48.0	F	-	-	-	-	-	-	-	-	17	00756
00495b	DNR 81-Carson	H	Skamania	45-44.07	121-48.24	SE,NW	21	03	08E	27.8	B	113.2	D	166.0	B	-	-	-	-	8	00495
00373	Shiperds Hot Springs	S	Skamania	-	-	SE	21	03	08E	42.0	F	-	-	-	-	-	100	N	-	3,4	00373
00495a	DNR 81-Carson	H	Skamania	45-44.07	121-48.24	SE,NW	21	03	08E	27.8	B	113.2	D	368.8	A	590	-	-	-	8,12	00495

GEOTHERMAL RESOURCES DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON -- DESCRIPTIVE AND THERMAL DATA.

File Name = GEOTHDB1.WK1 Last Updated April 30, 1993, by J.E.S.

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.
00369	Collins Hot Springs	S	Skamania	-	-	SW	31	03	09E	50.0	M	-	-	-	-	-	-	-	-	3,4	0036
00806	Trout Creek Drill Hole	H	Skamania	-	-	SE,SW	21	04	07E	36.3	B	357.0	D	87.0	A	-	-	-	-	19	0080
00370	Mount St. Helens Fumaroles	-	Skamania	-	-	-	04	08	05E	88.0	-	-	-	-	-	-	-	-	-	3,4	0037
00371	Orr Creek Warm Springs	S	Skamania	-	-	NE	19	10	10E	22.0	F	-	-	-	-	-	100	-	-	3,4	0037
00404	Orr Creek Warm Springs(A-1)	S	Skamania	-	-	NE	19	10	10E	21.7	F	-	-	-	-	-	114	N	-	5	0040
00376	Garland Mineral Springs	S	Snohomish	-	-	NW	25	28	11E	29.0	F	-	-	-	-	-	100	N	-	3,4	0037
00759	Garland Mineral Spring	S	Snohomish	-	-	NW	25	28	11E	29.0	F	-	-	-	-	-	-	-	-	17	0075
00750	Garland Mineral Springs(GLB-1)	S	Snohomish	-	-	NW	25	28	11E	25.3	F	-	-	-	-	-	-	-	-	17	0075
00749	Garland Min. Sprs(Main)(GLA-1)	S	Snohomish	-	-	NW	25	28	11E	28.0	F	-	-	-	-	-	-	-	-	17	0074
00414	Kennedy Hot Springs(D-1)	S	Snohomish	-	-	NE	01	30	12E	38.0	F	-	-	-	-	-	-	-	-	5	0041
00412	Kennedy Hot Springs(B-1)	S	Snohomish	-	-	NE	01	30	12E	35.0	F	-	-	-	-	-	-	-	-	5	0041
00662	Kennedy Hot Springs(USGS)	S	Snohomish	-	-	NE	01	30	12E	38.0	F	-	-	-	-	-	-	-	-	12	0066
00413	Kennedy Hot Springs(C-1)	S	Snohomish	-	-	NE	01	30	12E	-	-	-	-	-	-	-	-	-	-	5	0041
00377	Kennedy Hot Springs	S	Snohomish	-	-	NE	01	30	12E	38.0	F	-	-	-	-	-	60	N	-	3,4	0037
00375	Gamma Hot Springs	S	Snohomish	-	-	SE	24	31	13E	60.0	F	-	-	-	-	-	15	N	-	3,4	0037
00758	Gamma Hot Spring	S	Snohomish	-	-	SE	24	31	13E	65.0	F	-	-	-	-	-	-	-	-	17	0075
00378	Sulphur Creek Hot Springs	S	Snohomish	-	-	NE	19	32	13E	37.0	F	-	-	-	-	-	10	N	-	3,4	0037
00760	Sulphur Creek Hot Springs	S	Snohomish	-	-	NE	19	32	13E	37.0	F	-	-	-	-	-	-	-	-	17	0076
00419	Sulphur Creek Hot Springs(A-1)	S	Snohomish	-	-	NE	19	32	13E	37.0	F	-	-	-	-	-	-	-	-	5	0041
00208	Cheney City	W	Spokane	-	-	SW,SE	14	23	41E	29.1	-	341.4	L	56.0	B	-	-	-	-	1,4,8	0020
00209	Cheney City 5	W	Spokane	-	-	SW,SE	14	23	41E	33.1	B	650.7	D	34.0	B	-	-	-	-	1,4,8,15	0020
00379	Warm Spr. Canyon Warm Spr.	S	Walla Walla	-	-	SE	02	06	32E	22.0	F	-	-	-	-	-	-	-	-	3,4	0037
00210a	Fulgham	W	Walla Walla	-	-	NW,SE	01	06	33E	31.8	B	305.0	D	69.6	A	-	-	-	-	1,4,8	0021
00210b	Fulgham	W	Walla Walla	-	-	NW,SE	01	06	33E	31.8	B	305.0	D	67.0	B	-	-	-	-	1,4,8	0021
00353	BRNAM WW	W	Walla Walla	46-01.5	118-37.3	NW,SE	01	06	33E	31.8	B	305.0	L	69.7	A	73	-	-	-	2	00353
00426a	Fulgham	W	Walla Walla	-	-	NW	10	06	33E	31.8	B	305.0	D	69.6	A	-	-	-	-	7,12	00426
00426b	Fulgham	W	Walla Walla	-	-	NW	10	06	33E	31.8	B	305.0	D	67.0	B	-	-	-	-	7,12	00426
00211	Miller	W	Walla Walla	-	-	NW,NE	02	06	34E	25.1	-	175.3	L	75.0	B	-	-	-	-	1,4,7,8,12	00211
00212	Chuatal, E.	W	Walla Walla	-	-	NW,NE	06	06	34E	36.0	B	484.0	D	48.0	B	-	-	-	-	1,4,7,8,12,15	00212
00496a	Gilbert-Merry	W	Walla Walla	-	-	SE,SW	07	06	34E	40.1	B	407.2	D	77.0	A	-	-	-	-	8	00496
00765	-	W	Walla Walla	-	-	NE,NW	07	06	34E	40.2	B	407.2	D	64.2	B	-	-	-	-	18	00765
00213a	Gilbert-Merry	W	Walla Walla	-	-	SE,SW	07	06	34E	40.7	B	407.2	D	77.8	A	-	-	-	-	1,4,7,8,12	00213
00213b	Gilbert-Merry	W	Walla Walla	-	-	SE,SW	07	06	34E	40.7	B	407.2	D	71.0	B	-	-	-	-	1,4,7,8,12	00213
00496b	Gilbert-Merry	W	Walla Walla	-	-	SE,SW	07	06	34E	40.1	B	407.2	D	69.0	B	-	-	-	-	8	00496
00215	Jaussand	W	Walla Walla	-	-	SE,SW	10	06	35E	25.0	F	350.0	D	37.0	B	-	-	-	-	1,4,8	00215
00217	Estes	W	Walla Walla	-	-	SW,SW	12	06	35E	22.0	F	180.0	D	56.0	B	-	-	-	-	1,4,8	00217
00216	McAuslan	W	Walla Walla	-	-	SE,NE	12	06	35E	21.0	F	214.0	L	42.0	B	-	-	-	-	1,4,8	00216
00220a	Dept. Ecology	-	Walla Walla	-	-	NE,NE	18	06	35E	36.1	B	396.2	D	41.8	A	-	-	-	-	1,4,7,8	00220
00497b	College Place	W	Walla Walla	-	-	NE,NE	18	06	35E	26.1	B	399.0	D	46.2	A	-	-	-	-	8	00497
00218	Dept. Ecology	-	Walla Walla	-	-	NE,NE	18	06	35E	20.3	-	154.8	L	54.0	B	-	-	-	-	1,4,8	00218
00497a	College Place	W	Walla Walla	-	-	NE,NE	18	06	35E	26.1	B	399.0	D	35.0	B	-	-	-	-	8	00497
00220b	Dept. Ecology	-	Walla Walla	-	-	NE,NE	18	06	35E	36.1	B	396.2	D	61.0	B	-	-	-	-	1,4,7,8,12	00220
00766	-	W	Walla Walla	-	-	NE,NE	18	06	35E	21.3	B	398.7	D	46.2	B	-	-	-	-	18	00766
00219	Walla Walla	W	Walla Walla	-	-	NE,NE	18	06	35E	21.3	-	177.7	L	52.0	B	-	-	-	-	1,4,8	00219
00222	Baker	W	Walla Walla	-	-	SE,SE	05	06	36E	27.0	F	554.0	D	36.0	B	-	-	-	-	1,4,8	00222
00221	Richardson	W	Walla Walla	-	-	NW,SW	05	06	36E	21.0	F	188.0	D	48.0	B	-	-	-	-	1,4,8	00221
00223	Courtney	W	Walla Walla	-	-	NW,SW	06	06	36E	22.0	F	186.0	D	54.0	B	-	-	-	-	1,4,8	00223
00224	Ruzicka	W	Walla Walla	-	-	NW,NW	07	06	36E	22.0	F	171.0	D	58.0	B	-	-	-	-	1.4.8	00224

GEOTHERMAL RESOURCES DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON -- DESCRIPTIVE AND THERMAL DATA.

File Name = GEOTHDB1.WK1 Last Updated ~~April 30, 1993, by J.E.S.~~

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.D.
00227	Byerly	W	Walla Walla	-	-	SW,SE	36	07	32E	24.0	F	310.0	D	39.0	B	-	-	-	-	1,4,8	00227
00386b	Taggart	W	Walla Walla	-	-	SW,SE	24	07	33E	23.2	-	433.7	L	26.0	B	-	-	-	-	1,4,8	00386
00228	McDole, Jim, No. 3	W	Walla Walla	-	-	NW,SE	31	07	33E	27.7	B	268.8	D	58.0	B	-	-	-	-	1,4,7,8,12,16	00228
00231	-	W	Walla Walla	-	-	NW,SW	23	07	35E	20.0	B	175.0	-	46.0	B	-	-	-	-	1,4	00231
00230	B.P.A.	W	Walla Walla	-	-	NW,SW	23	07	35E	20.0	F	157.0	D	51.0	B	-	-	-	-	1,4,8	00230
00498	Gluck/B.P.A.	W	Walla Walla	-	-	NW,SW	24	07	35E	20.0	B	175.0	D	46.0	B	-	-	-	-	8	00498
00232	Arbini	W	Walla Walla	-	-	SE,NW	25	07	35E	20.0	F	207.0	D	39.0	B	-	-	-	-	1,4,8	00232
00233	Columbo	W	Walla Walla	-	-	SE,SW	25	07	35E	20.0	F	188.0	D	42.0	B	-	-	-	-	1,4,8	00233
00234	Walla Walla College	W	Walla Walla	-	-	SE,NE	33	07	35E	24.0	F	217.0	L	55.0	B	-	-	-	-	1,4,8	00234
00235a	DNR Christian	W	Walla Walla	-	-	NE,SW	34	07	35E	24.0	S	219.4	L	47.4	A	-	-	-	-	1,4,8	00235
00235b	DNR Christian	W	Walla Walla	-	-	NE,SW	34	07	35E	24.0	S	219.4	L	55.0	B	-	-	-	-	1,4,8	00235
00387a	Walla Walla College	W	Walla Walla	-	-	NE,NE	35	07	35E	20.5	B	310.0	D	27.4	A	-	-	-	-	1,4,8	00387
00236	Walla Walla College	W	Walla Walla	-	-	NE,NE	35	07	35E	20.0	F	183.0	L	44.0	B	-	-	-	-	1,4,8	00236
00387b	Walla Walla College	W	Walla Walla	-	-	NE,NE	35	07	35E	20.5	B	310.0	D	27.0	B	-	-	-	-	1,4,8	00387
00237	Manuel	W	Walla Walla	-	-	NE,NW	36	07	35E	20.0	F	195.0	D	41.0	B	-	-	-	-	1,4,8	00237
00239	Richards	W	Walla Walla	-	-	SE,NW	36	07	35E	21.0	F	186.0	D	48.0	B	-	-	-	-	1,4,8	00239
00240	College Place	W	Walla Walla	-	-	SE,NW	36	07	35E	20.0	F	216.0	D	37.0	B	-	-	-	-	1,4,8	00240
00241	Stone Creek	W	Walla Walla	-	-	SE,SE	36	07	35E	21.0	F	189.0	L	48.0	B	-	-	-	-	1,4,8	00241
00238	College Place	W	Walla Walla	-	-	SE,NW	36	07	35E	20.4	F	247.0	D	34.0	B	-	-	-	-	1,4,8	00238
00242	Walla Walla Comm. Coll.	W	Walla Walla	-	-	SE,SW	14	07	36E	26.5	-	406.9	L	36.0	B	-	-	-	-	1,4,8,16	00242
00351a	Walla Walla Golf Course	W	Walla Walla	46-05.4	118-20.3	NE,SW	17	07	36E	20.9	S	225.0	L	35.4	A	56	-	-	-	1,4,8	00351
00767	-	W	Walla Walla	-	-	NE,SW	17	07	36E	39.1	B	713.2	D	36.4	B	-	-	-	-	18	00767
00351b	Walla Walla Golf Course	W	Walla Walla	-	-	NE,SW	17	07	36E	20.9	S	225.0	L	40.0	B	-	-	-	-	8	00351
00499	Walla Walla Golf Course	W	Walla Walla	-	-	NE,SW	17	07	36E	39.1	S	716.0	L	38.0	B	-	-	-	-	8	00499
00243	-	W	Walla Walla	-	-	NE,SW	17	07	36E	39.1	B	716.0	-	38.0	B	-	-	-	-	1,4	00243
00500	Birdseye	W	Walla Walla	-	-	SE,NW	19	07	36E	31.1	B	462.1	D	41.0	B	-	-	-	-	8	00500
00501	D & K Farms	W	Walla Walla	-	-	SE,NW	19	07	36E	20.3	S	247.0	L	34.0	B	-	-	-	-	8	00501
00245	Rodgers Can.	W	Walla Walla	-	-	SE,SE	19	07	36E	28.8	F	485.0	D	33.0	B	-	-	-	-	1,4,8	00245
00244	-	W	Walla Walla	-	-	SE,NW	19	07	36E	30.2	B	468.8	-	39.0	B	-	-	-	-	1,4	00244
00768	-	W	Walla Walla	-	-	SE,NW	19	07	36E	31.1	B	470.6	D	37.8	B	-	-	-	-	18	00768
00246	Whitman College	W	Walla Walla	-	-	SW,NE	20	07	36E	22.0	F	366.0	D	27.0	B	-	-	-	-	1,4,8	00246
00247	Walla Walla City 5	W	Walla Walla	-	-	SE,SE	28	07	36E	23.5	F	276.0	D	48.0	B	-	-	-	-	1,4,8	00247
00352a	Walla Walla City 7	W	Walla Walla	-	-	NW,NW	33	07	36E	30.2	B	424.0	D	43.0	B	-	-	-	-	8	00352a
00250a	Walla Walla City 7	W	Walla Walla	46-02.9	118-19.3	NW,NW	33	07	36E	28.6	B	425.0	D	74.7	A	53	-	-	-	2,8	00250a
00352b	Walla Walla City 7	W	Walla Walla	-	-	NW,NW	33	07	36E	30.2	B	424.0	D	36.0	A	-	-	-	-	8	00352b
00249	Walla Walla City 7	W	Walla Walla	-	-	NW,NW	33	07	36E	25.9	S	185.9	L	75.0	B	-	-	-	-	1,4,8	00249
00250b	Walla Walla City 7	W	Walla Walla	-	-	NW,NW	33	07	36E	28.6	B	425.0	D	39.0	B	-	-	-	-	1,4,8	00250b
00769	-	W	Walla Walla	-	-	NW,NW	33	07	36E	30.2	B	424.0	D	39.9	B	-	-	-	-	18	00769
00251b	Peterson, Ross	W	Walla Walla	-	-	SE,NW	14	08	31E	24.5	-	335.9	L	37.0	B	-	-	-	-	1,4,8,16	00251b
00251a	Peterson	W	Walla Walla	-	-	SE,NW	14	08	31E	24.5	-	335.9	L	36.5	A	-	-	-	-	1,4,8	00251a
00252	McGregor	W	Walla Walla	-	-	SE,NE	34	08	31E	25.4	F	146.0	D	92.0	B	-	-	-	-	1,4,8	00252
00746	Gluck, Bill, No. 2	W	Walla Walla	-	-	SE,SE	21	08	33E	31.0	B	237.1	D	-	-	-	-	-	-	16	00746
00349	GLUCK WW	W	Walla Walla	46-09.3	118-41.0	SE	21	08	33E	23.7	-	285.0	L	37.7	A	60	-	-	-	2	00349
00253b	Gluck	W	Walla Walla	-	-	SE	21	08	33E	24.1	-	290.0	L	42.0	B	-	-	-	-	1,4,8	00253b
00253a	Gluck	W	Walla Walla	-	-	SE	21	08	33E	24.1	-	290.0	L	37.7	A	-	-	-	-	1,4,8	00253a
00350	WWCOLL WW	W	Walla Walla	46-02.9	118-22.3	NE,NE	35	08	35E	20.5	B	310.0	L	27.4	A	-	-	-	-	2	00350
00348	Power	W	Walla Walla	46-16.0	118-45.2	NE,NW	13	09	32E	22.2	-	215.0	L	34.8	A	55	-	-	-	2,8	00348
00254	Power	W	Walla Walla	-	-	NE,NW	13	09	32E	22.2	-	215.0	L	47.0	B	-	[illegible]	[illegible]	[illegible]	1,4,8	00254

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.
00256	Anderson, Don	W	Walla Walla	-	-	SE,NE	26	12	36E	22.5	-	182.3	L	58.0	B	-	-	-	-	1,4,8,16	0025
00381	Dorr Fumarole Field	-	Whatcom	-	-	NW,NW	17	38	08E	90.0	-	-	-	-	-	-	-	-	-	3,4	0038
00382	Sherman Crater Fumaroles	-	Whatcom	-	-	SW,NE	19	38	08E	130.0	M	-	-	-	-	-	-	-	-	3,4	0038
00742	Baker Hot Springs Drill Hole	H	Whatcom	-	-	NW,SW	20	38	08E	47.9	B	140.5	D	200.0	A	-	-	-	-	14	0074
00380	Baker Hot Springs	S	Whatcom	-	-	SW	20	38	09E	42.0	F	-	-	-	-	-	26	N	-	3,4	0038
00410	Baker Hot Springs(A-1)	S	Whatcom	-	-	SW	20	38	09E	42.0	F	-	-	-	-	-	-	-	-	5	0041
00747	Baker Hot Springs(Main)(BKA-2)	S	Whatcom	-	-	SW	20	38	09E	38.3	F	-	-	-	-	-	-	-	-	17	0074
00748	Baker Hot Springs (BKC-2)	S	Whatcom	-	-	SW	20	38	09E	24.0	F	-	-	-	-	-	-	-	-	17	0074
00545	Baker Hot Springs(A-1)	S	Whatcom	-	-	SW	20	38	09E	42.0	F	-	-	-	-	-	-	-	-	9	0054
00411	Baker Hot Springs(B-1)	S	Whatcom	-	-	SW	20	38	09E	-	-	-	-	-	-	-	-	-	-	5	0041
00761	Baker Hot Springs	S	Whatcom	-	-	SW	20	38	09E	44.0	F	-	-	-	-	-	-	-	-	17	0076
00546	Baker Hot Springs(B-1)	S	Whatcom	-	-	SW	20	38	09E	40.0	F	-	-	-	-	-	-	-	-	9	0054
00258	Pullman	W	Whitman	-	-	NW,NW	05	14	45E	21.0	F	51.0	L	176.0	B	-	-	-	-	1,4,8	0025
00257	Pullman	W	Whitman	-	-	NW,NE	05	14	45E	20.0	F	50.0	L	160.0	B	-	-	-	-	1,4,8	0025
00259	Colfax City	W	Whitman	-	-	SW,NE	11	16	43E	23.5	F	183.0	L	77.0	B	-	-	-	-	1,4,8	0025
00260a	Sharp	W	Yakima	-	-	NW,NE	23	07	22E	23.4	B	299.9	D	34.9	A	-	-	-	-	1,4,6,8	0026
00260b	Sharp	W	Yakima	-	-	NW,NE	23	07	22E	23.4	B	299.9	D	38.0	B	-	-	-	-	1,4,6,8	0026
00383	Mount Adams Fumaroles	-	Yakima	-	-	-	01	08	10E	50.0	-	-	-	-	-	-	-	-	-	3,4	0038
00261b	Mabton	W	Yakima	-	-	SW,NE	01	08	22E	23.0	S	329.0	L	33.0	B	-	-	-	-	1,4,6,8	0026
00547	-	W	Yakima	-	-	SW,NE	01	08	22E	23.0	B	329.0	D	-	-	-	-	-	-	10	0054
00261a	Mabton	W	Yakima	-	-	SW,NE	01	08	22E	23.0	S	329.0	L	36.0	A	-	-	-	-	1,4,6,8	0026
00502a	Flower	W	Yakima	-	-	NE,SE	11	08	22E	20.3	B	166.0	D	43.1	A	-	-	-	-	8	0050
00548	Flower, Bill	W	Yakima	-	-	NE,SE	11	08	22E	21.9	B	161.5	D	52.2	S	-	4928	P	-	10,16	0054
00502b	Flower	W	Yakima	-	-	NE,SE	11	08	22E	20.3	B	166.0	D	50.0	B	-	-	-	-	8	0050
00262	Flower	W	Yakima	-	-	NE,SE	11	08	22E	22.0	B	161.5	D	62.0	B	-	-	-	-	1,4,6,7,8,12	0026
00822	Boast Farms	W	Yakima	-	-	NW,NW	22	08	22E	20.0	F	266.1	D	-	-	-	-	-	82.3	20	00822
00821	Johnson, Ray Y.	W	Yakima	-	-	NW,SW	22	08	22E	22.2	F	309.4	D	-	-	-	-	-	82.6	20	00821
00823	Leyendekker, Arthur	W	Yakima	-	-	SW,SW	23	08	22E	23.9	F	310.9	D	-	-	-	9462	P	81.1	20	00823
00829	Green Acre Farms, Inc.	W	Yakima	-	-	NW,NW	01	09	17E	27.8	F	571.5	D	-	-	-	6813	P	161.5	20	00829
00771	-	W	Yakima	-	-	NW,SW	26	09	21E	26.5	B	294.4	D	43.3	B	-	-	-	-	18	00771
00550	-	W	Yakima	-	-	NE,SW	26	09	21E	28.0	B	295.0	D	52.2	S	-	-	-	-	10	00550
00263	Shinn	W	Yakima	-	-	NW,SW	26	09	21E	28.5	B	295.0	D	56.0	B	-	-	-	-	1,4,6,7,8,12	00263
00551	-	W	Yakima	-	-	SE,SE	27	09	21E	22.0	B	35.0	D	-	-	-	-	-	-	10	00551
00264	-	W	Yakima	-	-	SE,SE	27	09	21E	22.0	B	35.0	-	286.0	B	-	-	-	-	1,4,6	00264
00552	-	W	Yakima	-	-	SE,NE	11	09	22E	20.3	B	166.0	D	52.2	S	-	-	-	-	10	00552
00265b	-	W	Yakima	-	-	NE,SE	11	09	22E	20.3	B	166.0	-	50.0	B	-	-	-	-	1,4,6	00265
00772	-	W	Yakima	-	-	NE,SE	11	09	22E	20.3	B	165.8	D	43.1	B	-	-	-	-	18	00772
00265a	-	W	Yakima	-	-	NE,SE	11	09	22E	20.3	B	166.0	-	43.1	A	-	-	-	-	1,4,6	00265
00830	Ramirez, Christi	W	Yakima	-	-	SE,NE	13	09	22E	20.0	F	48.8	D	-	-	-	378	P	15.2	20	00830
00831	Washington Fruit & Produce	W	Yakima	-	-	NW,NE	01	09	23E	21.1	F	85.0	D	-	-	-	3535	P	36.0	20	00831
00832	Grandview City	W	Yakima	-	-	SW	13	09	23E	22.8	F	290.8	D	-	-	-	7570	P	57.0	20	00832
00553	Grandview City	W	Yakima	-	-	NE,SE	22	09	23E	21.2	B	429.4	D	-	-	-	-	-	-	10	00553
00833	Grandview City	W	Yakima	-	-	NE,SW	22	09	23E	26.1	F	394.4	D	-	-	-	9640	P	48.5	20	00833
00834	John Haas, Inc.	W	Yakima	-	-	SE,NW	31	09	23E	21.1	F	121.3	D	-	-	-	1325	P	10.7	20	00834
00266	-	W	Yakima	-	-	NW,NW	14	10	17E	20.5	B	23.0	-	370.0	B	-	-	-	-	1,4,6	00266
00555	-	W	Yakima	-	-	NW,NW	14	10	17E	22.0	B	35.0	D	-	-	-	-	-	-	10	00555
00556	-	W	Yakima	-	-	NE,SW	23	10	17E	20.3	B	213.0	D	38.7	S	-	-	-	-	10	00556
00267	Decker 2	W	Yakima	-	-	NE,SW	23	10	17E	20.3	F	213.0	D	39.0	B	-	-	-	-	1,4,6,8	00267

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.D.
00268	Decker 3	W	Yakima	-	-	SE,SE	26	10	17E	23.8	F	305.0	D	39.0	B	-	-	-	-	1,4,6,8	00268
00558	-	W	Yakima	-	-	SW,SE	27	10	17E	26.0	B	460.0	D	38.7	S	-	-	-	-	10	00558
00269	-	W	Yakima	-	-	SW,SE	27	10	17E	26.0	B	460.0	-	30.0	B	-	-	-	-	1,4,6	00269
00559	-	W	Yakima	-	-	NW,NE	28	10	17E	22.4	B	268.0	D	38.7	S	-	-	-	-	10	00559
00270	Decker 4	W	Yakima	-	-	NW,NE	28	10	17E	22.4	F	268.0	D	39.0	B	-	-	-	-	1,4,6,8	00270
00271	Shellenberg 3	W	Yakima	-	-	NW,NE	35	10	17E	21.2	F	245.0	D	38.0	B	-	-	-	-	1,4,6,8	00271
00560	-	W	Yakima	-	-	NW,NE	35	10	17E	21.2	B	245.0	D	38.7	S	-	-	-	-	10	00560
00848	Green Acre Farms, Inc.	W	Yakima	-	-	SE,SE	36	10	17E	22.2	F	297.2	D	-	-	-	-	-	113.1	20	00848
00272	Darrow	W	Yakima	-	-	SW,SE	05	10	18E	20.6	-	196.0	L	44.0	B	-	-	-	-	1,4,6,8	00272
00561	-	W	Yakima	-	-	SW,SE	05	10	18E	20.6	B	202.0	D	33.7	S	-	-	-	-	10	00561
00773	-	W	Yakima	-	-	SW,SE	05	10	18E	20.6	B	195.1	D	36.5	B	-	-	-	-	18	00773
00273	Decker 7	W	Yakima	-	-	SW,SW	31	10	18E	23.8	F	318.0	D	37.0	B	-	-	-	-	1,4,6,8	00273
00562	-	W	Yakima	-	-	SW,SW	31	10	18E	23.8	B	318.0	D	38.7	S	-	-	-	-	10	00562
00849	Gibson, Joann	W	Yakima	-	-	NW,NW	32	10	19E	21.1	F	64.0	D	-	-	-	64	P	8.2	20	00849
00274	Toppenish City 7	W	Yakima	-	-	NE,SW	04	10	20E	22.6	F	312.0	D	34.0	B	-	-	-	-	1,4,6,8	00274
00563	-	W	Yakima	-	-	NE,SW	04	10	20E	22.6	B	312.0	D	-	-	-	-	-	-	10	00563
00850	Yakima Indian Nation Land Ent.	W	Yakima	-	-	NW,SW	04	10	20E	20.0	F	18.9	D	-	-	-	1136	P	3.4	20	00850
00564	-	W	Yakima	-	-	NE,NE	09	10	20E	20.5	B	256.0	D	-	-	-	-	-	-	10	00564
00275	Toppenish City 6	W	Yakima	-	-	NE,NE	09	10	20E	20.5	B	256.0	D	33.0	B	-	-	-	-	1,4,6,8	00275
00774	-	W	Yakima	-	-	NE,NE	09	10	20E	20.5	B	256.0	D	26.6	B	-	-	-	-	18	00774
00851	Granger City	W	Yakima	-	-	SW,NW	22	10	21E	21.1	F	76.8	D	-	-	-	3785	N	A	20	00851
00565	-	W	Yakima	-	-	SE,NW	25	10	22E	20.0	B	480.0	D	-	-	-	-	-	-	10	00565
00852	Luther, Joe	W	Yakima	-	-	SE,NE	30	10	22E	22.2	F	91.4	D	-	-	-	568	P	11.9	20	00852
00853	DNR Snipes Mountain	W	Yakima	-	-	SW,NW	30	10	22E	20.6	F	269.7	D	-	-	-	6245	P	9.0	20	00853
00854	Sunnyside Port District	W	Yakima	-	-	SW,NW	36	10	22E	23.9	F	322.2	D	-	-	-	1892	N	A	20	00854
00277	Evans	W	Yakima	-	-	NE,NE	36	10	23E	22.9	S	352.9	L	31.0	B	-	-	-	-	1,4,6,8	00277
00566	Evans, B.	W	Yakima	-	-	NE,NE	36	10	23E	25.6	B	401.1	D	34.1	S	-	-	-	-	10,11	00566
00855	White, John	W	Yakima	-	-	SW,NE	36	10	23E	21.1	F	281.3	D	-	-	-	3785	P	150.3	20	00855
00278	Evans, Bill	W	Yakima	-	-	NE,NE	36	10	23E	26.7	B	400.8	D	37.0	B	-	-	-	-	1,4,6,8,16	00278
00567	White, J.	W	Yakima	-	-	SW,NE	36	10	23E	22.8	B	282.8	D	34.1	S	-	-	-	-	10	00567
00279	White	W	Yakima	-	-	SW,NE	36	10	23E	23.0	-	284.1	L	39.0	B	-	-	-	-	1,4,6,8	00279
00384	Simcoe Soda Springs	S	Yakima	-	-	SW	09	11	15E	20.0	F	-	-	-	-	-	-	-	-	3,4	00384
00570	Pace, W. B.	W	Yakima	-	-	SW,SE	25	11	16E	25.0	B	332.5	D	33.7	S	-	-	-	-	10	00570
00280	Pace	W	Yakima	-	-	SE,SW	25	11	16E	25.4	B	332.5	D	40.0	B	-	-	-	-	1,4,6,8	00280
00571	Gowdy	W	Yakima	-	-	NW,SE	34	11	16E	21.4	B	139.0	D	33.7	S	-	-	-	-	10,12	00571
00281	Gowdy	W	Yakima	-	-	NW,SE	34	11	16E	21.4	F	139.0	D	68.0	B	-	-	-	-	1,4,6,7,8	00281
00572	-	W	Yakima	-	-	SE,NW	01	11	17E	24.2	B	358.0	D	33.7	S	-	-	-	-	10	00572
00282	Mount Adams Seed	W	Yakima	-	-	SE,NW	01	11	17E	24.2	F	358.0	D	34.0	B	-	-	-	-	1,4,6,8	00282
00573	Dekker	W	Yakima	-	-	NE,SW	02	11	17E	25.5	B	265.0	D	33.7	S	-	-	-	-	10	00573
00283	Dekker	W	Yakima	-	-	NE,SW	02	11	17E	25.5	F	265.0	D	51.0	B	-	-	-	-	1,4,6,7,8,12	00283
00284	Stephenson	W	Yakima	-	-	NE,SW	03	11	17E	25.2	F	301.0	D	44.0	B	-	-	-	-	1,4,6,8	00284
00574	-	W	Yakima	-	-	NE,SW	03	11	17E	25.2	B	301.0	D	33.7	S	-	-	-	-	10	00574
00576	-	W	Yakima	-	-	SE,NE	16	11	17E	20.8	B	233.0	D	33.7	S	-	-	-	-	10	00576
00776	-	W	Yakima	-	-	SE,NW	16	11	17E	31.6	B	301.8	D	62.3	B	-	-	-	-	18	00776
00286	Stephenson	W	Yakima	-	-	SE,NE	16	11	17E	20.8	F	233.0	D	38.0	B	-	-	-	-	1,4,6,8	00286
00285	Stephenson	W	Yakima	-	-	SW,NW	16	11	17E	31.6	B	302.0	D	65.0	B	-	-	-	-	1,4,6,7,8,12	00285
00575	Stephenson	W	Yakima	-	-	SW,NW	16	11	17E	31.6	B	302.0	D	-	-	-	-	-	-	10	00575
00287	Siegner	W	Yakima	-	-	SW,SW	09	11	18E	23.0	F	122.0	D	90.0	B	-	-	-	-	1,4,6,7,8,12	00287
00577	Siegner	W	Yakima	-	-	SW,SW	09	11	18E	23.0	B	122.0	D	-	-	-	-	-	-	10	00577

GEOTHERMAL RESOURCES DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON -- DESCRIPTIVE AND THERMAL DATA.

File Name = GEOTHDB1.WK1   Last Updated April 30, 1993, by J.E.S.

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.
00578	-	W	Yakima	-	-	NE,SW	26	11	18E	26.4	B	16.0	D	-	-	-	-	-	-	10	0057
00288	-	W	Yakima	-	-	NE,SW	26	11	18E	26.4	B	16.0	-	900.0	B	-	-	-	-	1,4,6	0028
00858	Harrah City	W	Yakima	-	-	NW,SW	26	11	18E	32.8	F	448.4	D	-	-	-	189	N	A	20	0085
00859	Wapato City	W	Yakima	-	-	NW,SW	14	11	19E	22.2	F	305.1	D	-	-	-	5678	P	2.1	20	0085
00579	-	W	Yakima	-	-	NE,NE	15	11	19E	20.8	B	179.2	D	48.3	S	-	-	-	-	10	0057
00289	Wapato	W	Yakima	-	-	NE,NE	15	11	19E	20.8	S	179.2	L	49.0	B	-	-	-	-	1,4,6,8	0028
00777	-	W	Yakima	-	-	NE,NE	15	11	19E	20.8	B	179.2	D	40.6	B	-	-	-	-	18	0077
00580	Johnson, F.	W	Yakima	-	-	NW,SW	01	11	20E	27.5	B	457.2	D	-	-	-	-	-	-	10,11	0058
00290	Johnson	W	Yakima	-	-	NW,SW	01	11	20E	28.1	B	427.1	D	38.0	B	-	-	-	-	1,4,6,8	0029
00291	Lynch	W	Yakima	-	-	SE,SE	01	11	20E	21.5	-	350.8	L	27.0	B	-	-	-	-	1,4,6,8	0029
00581	Lynch, B.	W	Yakima	-	-	SE,SE	01	11	20E	20.8	B	350.8	D	-	-	-	-	-	-	10,11	0058
00860	Strothers, Kelly	W	Yakima	-	-	SE,NE	03	11	20E	20.0	F	242.3	D	-	-	-	-	-	111.2	20	0086
00861	Green, Clayton, & Babcock	W	Yakima	-	-	SE,SE	05	11	20E	21.1	F	182.9	D	-	-	-	6900	P	53.0	20	0086
00292	Peters	W	Yakima	-	-	NE,NE	06	11	20E	20.2	-	166.1	L	49.0	B	-	-	-	-	1,4,6,7,8,12	0029
00862	Morrison Fruit Co., Inc.	W	Yakima	-	-	SE,NW	10	11	20E	20.0	F	108.2	D	-	-	-	-	-	45.7	20	0086
00863	Narduzzi, Ermanno	W	Yakima	-	-	NE,SE	11	11	20E	22.2	F	198.1	D	-	-	-	2271	P	27.4	20	0086
00864	Rashford, George B.	W	Yakima	-	-	NW,SE	12	11	20E	22.2	F	248.4	D	-	-	-	1892	P	76.2	20	0086
00865	Rashford, George B.	W	Yakima	-	-	NW,SE	12	11	20E	22.2	F	176.8	D	-	-	-	1892	P	95.4	20	0086
00293	Soost	W	Yakima	-	-	SE,SE	13	11	20E	29.2	S	328.6	L	52.0	B	-	-	-	-	1,4,6,7,8,12	0029
00866	Schmidt Orchards, Inc.	W	Yakima	-	-	NW,SW	13	11	20E	23.3	F	230.4	D	-	-	-	4731	P	42.7	20	0086
00582	Soost Brothers	W	Yakima	-	-	SE,SE	13	11	20E	28.4	S	333.7	L	-	-	-	-	-	-	10,11	0058
00583	Weatherly, B.	W	Yakima	-	-	NW,NE	05	11	21E	28.5	B	378.8	D	40.3	S	-	-	-	-	10	0058
00294	Weatherly	W	Yakima	-	-	NW,NE	05	11	21E	27.8	-	378.8	L	42.0	B	-	-	-	-	1,4,6,8	0029
00296	Dahl	W	Yakima	-	-	SW,SE	06	11	21E	29.6	-	392.0	L	45.0	B	-	-	-	-	1,4,6,8	0029
00295	Dahl	W	Yakima	-	-	NE,SW	06	11	21E	29.2	-	364.2	L	47.0	B	-	-	-	-	1,4,6,7,8,12	0029
00867	Valley Farms	W	Yakima	-	-	SE,SW	06	11	21E	25.6	F	364.2	D	-	-	-	4164	P	98.1	20	0086
00585	Dahl, T.	W	Yakima	-	-	SW,SE	06	11	21E	28.9	B	392.6	D	40.3	S	-	4164	P	-	10,11	0058
00584	Dahl, T.	W	Yakima	-	-	NE,SW	06	11	21E	27.7	B	364.2	D	40.3	S	-	-	-	-	10,11	0058
00035	-	W	Yakima	-	-	NE,NE	07	11	21E	33.1	B	510.0	-	41.0	B	-	-	-	-	6	0003
00868	Lynch, Bob	W	Yakima	-	-	SE,NW	07	11	21E	30.6	F	-	-	-	-	-	1400	P	116.4	20	0086
00586	Clyde	W	Yakima	-	-	NE,NE	07	11	21E	33.0	B	510.0	D	40.3	S	-	-	-	-	10	0058
00661	DNR Ramsier	W	Yakima	-	-	SE,SW	16	11	21E	26.1	S	380.4	L	-	-	-	-	-	-	11	0066
00040a	DNR Ramsier	W	Yakima	-	-	SW,SW	16	11	21E	25.7	S	260.0	L	52.0	B	-	-	-	-	6,8	0004
00503	DNR Ramsier	W	Yakima	-	-	SE,SW	16	11	21E	27.5	S	380.0	L	41.0	B	-	-	-	-	8	0050
00587	DNR Ramsier	W	Yakima	-	-	SE,SW	16	11	21E	28.1	S	380.4	L	40.3	S	-	-	-	-	10	0058
00040b	-	W	Yakima	-	-	SW,SW	16	11	21E	25.7	B	260.0	-	53.0	B	-	-	-	-	6	0004
00660	Clyde, Pat	W	Yakima	-	-	NE,NW	16	11	21E	24.7	B	269.4	D	-	-	-	-	-	-	11	0066
00504a	Garretson	W	Yakima	-	-	NE,NE	17	11	21E	33.1	S	510.0	L	33.0	A	-	-	-	-	8	0050
00052	Clyde	W	Yakima	-	-	NW,NE	17	11	21E	24.8	-	273.0	L	47.0	B	-	-	-	-	6,8	0005
00869	Schmidt, Dave	W	Yakima	-	-	SW,SE	17	11	21E	28.9	F	489.2	D	-	-	-	1287	P	120.1	20	0086
00588	Garretson	W	Yakima	-	-	NE,NE	17	11	21E	24.8	B	273.0	D	40.3	S	-	-	-	-	10	0058
00504b	Garretson	W	Yakima	-	-	NE,NE	17	11	21E	33.1	S	510.0	L	41.0	B	-	-	-	-	8	0050
00870	Gammie, W./Lloyd Garretson Co.	W	Yakima	-	-	NW,NW	17	11	21E	36.1	F	592.8	D	-	-	-	2574	P	126.5	20	0087
00872	Leach, Meier, Olsen	W	Yakima	-	-	SE,SE	18	11	21E	22.8	F	175.3	D	-	-	-	5678	P	60.4	20	0087
00871	Schmidt, Dave	W	Yakima	-	-	-	18	11	21E	28.9	F	-	-	-	-	-	1310	P	120.1	20	0087
00589	Hanrahan, P.	W	Yakima	-	-	NW,SW	20	11	21E	20.8	B	190.5	D	40.3	S	-	-	-	-	10,11	0058
00297	Hanrahan	W	Yakima	-	-	NW,SW	20	11	21E	22.2	S	190.5	L	54.0	B	-	-	-	-	1,4,6,7,8,12	0029
00873	Baldwin, John	W	Yakima	-	-	NW,NW	20	11	21E	20.6	F	312.7	D	-	-	-	-	-	81.8	20	0087

GEOTHERMAL RESOURCES DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON -- DESCRIPTIVE AND THERMAL DATA.
File Name = GEOTHDB1.WK1 Last Updated April 30, 1993, by J.E.S.

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.D
00875	-	W	Yakima	-	-	NE,SE	21	11	21E	20.0	F	184.4	D	-	-	-	1665	P	104.2	20	00875
00298	Ambrose Farms	W	Yakima	-	-	NW,NE	21	11	21E	27.0	B	279.2	D	53.0	B	-	-	-	-	1,4,6,7,8,12	00298
00590	Ambrose, A.	W	Yakima	-	-	NW,NE	21	11	21E	26.4	B	279.2	D	40.3	S	-	-	-	-	10	00590
00096a	Sandlin	W	Yakima	-	-	SW,NE	22	11	21E	33.4	-	551.0	L	28.8	A	-	-	-	-	6,8	00096
00096b	Sandlin	W	Yakima	-	-	SW,NE	22	11	21E	33.4	-	551.0	L	39.0	B	-	-	-	-	6,8	00096
00876	Houghton Farms	W	Yakima	-	-	SW,NW	22	11	21E	20.0	F	260.6	D	-	-	-	1703	P	115.8	20	00876
00593	Best, P.	W	Yakima	-	-	NW,SE	22	11	21E	24.6	B	319.4	D	40.3	S	-	-	-	-	10	00593
00878	Sandlin Farms, Inc.	W	Yakima	-	-	SW,NE	22	11	21E	28.6	F	551.1	D	-	-	-	4164	P	132.2	20	00878
00388b	Best	W	Yakima	-	-	NW,SE	22	11	21E	25.6	B	319.4	D	43.0	B	-	-	-	-	1,4,6,8	00388
00592	Sandlin, J., 2	W	Yakima	-	-	SW,NE	22	11	21E	34.9	B	553.2	D	40.3	S	-	-	-	-	10,11	00592
00299b	Sandlin	W	Yakima	-	-	SW,NE	22	11	21E	24.0	S	299.3	L	40.0	B	-	-	-	-	1,4,6,8	00299b
00879	Best, Peter C.	W	Yakima	-	-	NW,SE	22	11	21E	20.0	F	335.3	D	-	-	-	1136	P	120.7	20	00879
00299a	Sandlin	W	Yakima	-	-	SW,NE	22	11	21E	24.0	S	299.3	L	33.2	A	-	-	-	-	1,4,6,8	00299a
00877	Van Leuven, Miles	W	Yakima	-	-	NW,NW	22	11	21E	20.0	F	260.6	D	-	-	-	-	-	115.8	20	00877
00591	Sandlin, J.	W	Yakima	-	-	SW,NE	22	11	21E	23.0	B	303.9	D	40.3	S	-	-	-	-	10	00591
00505	Sandlin 2	W	Yakima	-	-	SW,NE	22	11	21E	35.2	-	553.0	L	42.0	B	-	-	-	-	8	00505
00594	Gay, H.	W	Yakima	-	-	NW,SE	36	11	21E	21.3	B	213.3	D	40.3	S	-	-	-	-	10,11	00594
00300	Gay	W	Yakima	-	-	NW,SE	36	11	21E	21.5	-	213.3	L	45.0	B	-	-	-	-	1,4,6,8	00300
00801	-	W	Yakima	-	-	SW,SW	21	11	22E	22.3	B	207.3	D	46.2	B	-	-	-	-	18	00801
00301	-	W	Yakima	-	-	SW,SW	21	11	22E	22.3	-	207.0	L	50.0	B	-	-	-	-	1,4,6,8	00301
00595	-	W	Yakima	-	-	SW,SW	21	11	22E	22.3	B	207.0	D	36.5	S	-	-	-	-	10	00595
00506	Evans	W	Yakima	-	-	SE,SE	26	11	22E	30.7	-	466.0	L	40.0	B	-	-	-	-	8	00506
00880	Evans Fruit	W	Yakima	-	-	NW,SE	26	11	22E	26.7	F	468.8	D	-	-	-	-	-	190.5	20	00880
00596	Evans, B.	W	Yakima	-	-	SE,SE	26	11	22E	30.7	B	466.3	D	36.5	S	-	-	-	-	10,11	00596
00507b	Spauld R.	W	Yakima	-	-	NW,SW	28	11	22E	21.5	-	210.0	L	43.0	B	-	-	-	-	8	00507b
00507a	Spauld R.	W	Yakima	-	-	NW,SW	28	11	22E	21.5	-	210.0	L	42.0	A	-	-	-	-	8	00507a
00302	-	W	Yakima	-	-	SW,SW	29	11	22E	21.6	B	340.4	-	28.0	B	-	-	-	-	1,4,6	00302
00597	Rowe Farms	W	Yakima	-	-	SW,SW	29	11	22E	29.6	B	434.3	D	36.5	S	-	-	-	-	10,11	00597
00508	Rowe Farms	W	Yakima	-	-	SW,SW	29	11	22E	29.6	B	332.5	D	53.0	B	-	-	-	-	8	00508
00509b	De LaChapelle	W	Yakima	-	-	NE,NW	30	11	22E	29.9	S	324.0	L	57.0	B	-	-	-	-	8	00509b
00303	Chapelle	W	Yakima	-	-	SW,NE	30	11	22E	20.3	-	206.3	L	40.0	B	-	-	-	-	1,4,6,8	00303
00881	De La Chapelle, No. 2	W	Yakima	-	-	NE,NW	30	11	22E	28.3	F	-	-	-	-	-	5299	P	173.4	20	00881
00598	De La Chapelle, C.	W	Yakima	-	-	SW,NE	30	11	22E	47.8	B	829.0	D	31.1	S	-	-	-	-	10	00598
00510	De LaChapelle	W	Yakima	-	-	SW,NE	30	11	22E	47.8	B	827.0	D	43.0	B	-	-	-	-	8	00510
00509a	De LaChapelle	W	Yakima	-	-	NE,NW	30	11	22E	29.9	S	324.0	L	42.0	A	-	-	-	-	8	00509a
00601	Shelton, C. L.	W	Yakima	-	-	SW,SW	12	12	16E	24.4	B	268.8	D	40.7	S	-	3558	P	-	10,11	00601
00304	Shelton	W	Yakima	-	-	SW,SW	12	12	16E	25.2	-	268.2	L	53.0	B	-	-	-	-	1,4,6,7,8,12	00304
00425	White	W	Yakima	-	-	SW,NW	15	12	16E	21.5	B	179.0	D	59.0	B	-	-	-	-	7,8,12	00425
00882	Ridout, Tom	W	Yakima	-	-	NW,NW	17	12	16E	20.0	F	109.7	D	-	-	-	68	P	28.0	20	00882
00883	Cohodas-Lancaster-Frank Co.	W	Yakima	-	-	SW,SW	04	12	17E	24.4	F	340.2	D	-	-	-	3134	P	106.1	20	00883
00884	Palmer, Don	W	Yakima	-	-	SE,NE	05	12	17E	21.7	F	86.9	D	-	-	-	163	P	59.4	20	00884
00885	Catlin, Ida	W	Yakima	-	-	NE,SE	05	12	17E	20.0	F	112.8	D	-	-	-	76	P	68.3	20	00885
00886	Hull Ranches, Inc.	W	Yakima	-	-	SW,NW	14	12	17E	21.1	F	290.8	D	-	-	-	6056	P	31.1	20	00886
00305	Wiley	W	Yakima	-	-	NE,NE	16	12	17E	22.2	F	265.0	D	39.0	B	-	-	-	-	1,4,6,8	00305
00602	-	W	Yakima	-	-	NE,NE	16	12	17E	22.2	B	265.0	D	40.7	S	-	-	-	-	10	00602
00307	Hansen Fruit	W	Yakima	-	-	SE,NE	27	12	18E	29.6	F	311.0	D	57.0	B	-	-	-	-	1,4,6,7,8,12	00307
00604	Hansen Fruit	W	Yakima	-	-	SE,NE	27	12	18E	29.6	B	311.0	D	33.7	S	-	-	-	-	10	00604

GEOTHERMAL RESOURCES DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON -- DESCRIPTIVE AND THERMAL DATA.
File Name = GEOTHDB1.WK1 Last Updated April 30, 1993, by J.E.S.

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.
00605	-	W	Yakima	-	-	SE,SE	31	12	18E	22.2	B	479.0	D	-	-	-	-	-	-	10	0060
00310b	St. Clair	W	Yakima	-	-	NE,SW	32	12	18E	27.9	S	379.0	L	42.0	B	-	-	-	-	1,4,6,8	0031
00606	-	W	Yakima	-	-	SE,NE	32	12	18E	25.2	B	358.0	D	33.7	S	-	-	-	-	10	0060
00310a	St. Clair	W	Yakima	-	-	NE,SW	32	12	18E	27.9	S	379.0	L	39.0	A	-	-	-	-	1,4,6,8	0031
00607	-	W	Yakima	-	-	NE,SW	32	12	18E	27.9	B	379.0	D	33.7	S	-	-	-	-	10	0060
00778	-	W	Yakima	-	-	NE,SW	32	12	18E	27.9	B	379.2	D	39.5	B	-	-	-	-	18	0077
00309	Mount Adams Seed	W	Yakima	-	-	SE,NE	32	12	18E	25.2	F	358.0	D	37.0	B	-	-	-	-	1,4,6,8	0030
00312	Mount Adams 3	W	Yakima	-	-	NW,NE	33	12	18E	28.0	-	312.7	L	51.0	B	-	-	-	-	1,4,6,8	0031
00311	Nyberg	W	Yakima	-	-	NE,NE	33	12	18E	25.6	F	290.0	D	47.0	B	-	-	-	-	1,4,6,8	0031
00609	Mount Adams Feed, No. 3	W	Yakima	-	-	NW,NE	33	12	18E	28.0	B	323.1	D	33.7	S	-	-	-	-	10	0060
00608	-	W	Yakima	-	-	NE,NE	33	12	18E	25.6	B	290.0	D	33.7	S	-	-	-	-	10	0060
00313	Moxee	W	Yakima	-	-	SW,SE	01	12	19E	30.0	F	404.0	D	45.0	B	-	-	-	-	1,4,6,8	0031
00610	-	W	Yakima	-	-	SW,SE	01	12	19E	30.0	B	404.0	D	40.5	S	-	-	-	-	10	0061
00888	Laird, Robert	W	Yakima	-	-	SW,SE	09	12	19E	23.3	F	52.4	D	-	-	-	189	P	6.1	20	0088
00887	Odom, Matt	W	Yakima	-	-	SW,SE	09	12	19E	23.3	F	42.7	D	-	-	-	76	P	6.4	20	0088
00889	Bruwllett?	W	Yakima	-	-	SE,SW	11	12	19E	26.7	F	361.5	D	-	-	-	3830	P	32.6	20	0088
00422	DNR Gangle	W	Yakima	-	-	NE,NE	16	12	19E	22.0	B	153.0	D	58.0	B	-	-	-	-	7,8,12	00422
00153	Miocene Petroleum (MPW-1)	O	Yakima	-	-	NE,NW	17	12	19E	33.3	S	546.0	L	39.0	B	-	-	-	-	6,8	00153
00891	Olson, Dale	W	Yakima	-	-	NW,NE	21	12	19E	20.0	F	-	-	-	-	-	2233	P	61.9	20	00891
00890	Stark West Orchards	W	Yakima	-	-	SE,SW	21	12	19E	20.0	F	109.7	D	-	-	-	2498	P	55.8	20	00890
00511a	Stepniewski	W	Yakima	-	-	SE,SE	27	12	19E	20.6	-	163.0	L	42.3	A	-	-	-	-	8	00511
00511b	Stepniewski	W	Yakima	-	-	SE,SE	27	12	19E	20.6	-	163.0	L	47.0	B	-	-	-	-	8	00511
00892	Allwardt, Mona and Carl	W	Yakima	-	-	SE,SW	09	12	20E	20.0	F	294.1	D	-	-	-	2650	P	0.6	20	00892
00893	S. Martinez Livestock, Inc.	W	Yakima	-	-	SE,SE	12	12	20E	30.0	F	823.9	D	-	-	-	-	-	4.3	20	00893
00314a	Charron	W	Yakima	-	-	SW,SE	13	12	20E	27.9	-	374.9	L	35.9	A	-	-	-	-	1,4,6,8	00314
00611	Charron, S.	W	Yakima	-	-	SE,SE	13	12	20E	27.6	B	376.4	D	39.8	S	-	-	-	-	10,11	00611
00314b	Charron	W	Yakima	-	-	SW,SE	13	12	20E	27.9	-	374.9	L	42.0	B	-	-	-	-	1,4,6,8	00314
00894	Roy Farms, Inc.	W	Yakima	-	-	NE,NE	15	12	20E	25.6	F	640.1	D	-	-	-	-	-	26.5	20	00894
00612	DNR Elephant Mountain	W	Yakima	-	-	SE,NE	16	12	20E	29.2	B	415.0	D	39.8	S	-	-	-	-	10	00612
00423b	DNR Elephant	W	Yakima	-	-	NE,SW	16	12	20E	29.2	B	418.0	D	41.0	A	-	-	-	-	7,8	00423
00423a	DNR Elephant	W	Yakima	-	-	NE,SW	16	12	20E	29.2	B	418.0	D	44.0	B	-	-	-	-	7,8,12	00423
00315	-	W	Yakima	-	-	NW,NW	16	12	20E	21.0	B	153.9	-	58.0	B	-	-	-	-	1,4,6	00315
00895	Brulotte, L.	W	Yakima	-	-	NW,NE	18	12	20E	20.6	F	315.5	D	-	-	-	5678	P	17.1	20	00895
00779	-	W	Yakima	-	-	NW,SW	27	12	20E	26.8	B	397.2	D	35.4	B	-	-	-	-	18	00779
00317b	Logan	W	Yakima	-	-	NW,SW	27	12	20E	27.5	-	409.0	L	38.0	B	-	-	-	-	1,4,6,8	00317
00613	Logan, W.	W	Yakima	-	-	SW,SW	27	12	20E	30.8	B	396.2	D	48.3	S	-	-	-	-	10,11	00613
00317a	Logan	W	Yakima	-	-	NW,SW	27	12	20E	27.5	-	409.0	L	48.0	A	-	-	-	-	1,4,6,8	00317
00316	Logan	W	Yakima	-	-	SW,SW	27	12	20E	30.4	-	396.2	L	46.0	B	-	-	-	-	1,4,6,7,8,12	00316
00614	-	W	Yakima	-	-	NW,SW	27	12	20E	27.5	B	409.0	D	-	-	-	-	-	-	10	00614
00896	Clinger, Jasper	W	Yakima	-	-	E2,NE	29	12	20E	24.4	F	117.7	D	-	-	-	4	P	113.7	20	00896
00897	Brooks, Lonnie	W	Yakima	-	-	-	31	12	20E	27.2	F	-	-	-	-	-	1518	P	57.3	20	00897
00318	Estes	W	Yakima	-	-	SW,SW	34	12	20E	25.9	-	274.0	L	51.0	B	-	-	-	-	1,4,6,8	00318
00616	Estes, M.	W	Yakima	-	-	SW,SW	34	12	20E	32.3	B	429.7	D	48.3	S	-	-	-	-	10,11	00616
00319	Estes	W	Yakima	-	-	SW,SW	34	12	20E	33.1	-	429.0	L	49.0	B	-	-	-	-	1,4,6,7,8,12	00319
00615	Estes, M.	W	Yakima	-	-	SW,SW	34	12	20E	24.8	B	274.0	D	48.3	S	-	-	-	-	10,11	00615
00898	Estes, Marvin	W	Yakima	-	-	SW,SW	34	12	20E	27.2	F	429.8	D	-	-	-	-	-	43.9	20	00898
00899	DNR	W	Yakima	-	-	SE,SW	36	12	20E	27.8	F	413.0	D	-	-	-	2082	P	-	20	00899
00617	DNR Cheyne Road	W	Yakima	-	-	SE,SW	36	12	20E	25.6	B	407.8	D	-	-	-	2082	P	-	10,11	00617

GEOTHERMAL RESOURCES DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON -- DESCRIPTIVE AND THERMAL DATA.

File Name = GEOTHDB1.WK1 Last Updated April 30, 1993, by J.E.S.

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.D
00162b	DNR Cheyne Rd.	W	Yakima	-	-	SE,SW	36	12	20E	29.3	-	350.0	L	49.0	B	-	-	-	-	6,8	00162
00164b	DNR Martinez	W	Yakima	-	-	NE,SW	16	12	21E	24.3	S	230.0	L	48.0	A	-	-	-	-	8	00164
00512	DNR	W	Yakima	-	-	NE,SW	16	12	21E	25.1	S	235.0	L	55.0	B	-	-	-	-	6,7,8,12	00512
00618	DNR	W	Yakima	-	-	SE,SE	16	12	21E	25.1	B	235.0	D	-	-	-	-	-	-	10	00618
00164a	DNR Martinez	W	Yakima	-	-	NE,SW	16	12	21E	24.3	S	230.0	L	49.0	B	-	-	-	-	6,7,8	00164a
00900	DNR	W	Yakima	-	-	NE,SW	16	12	21E	26.7	F	423.7	D	-	-	-	11544	P	25.3	20	00900
00320	Martinez	W	Yakima	-	-	NE,SW	17	12	21E	27.8	B	472.7	D	33.0	B	-	-	-	-	1,4,6,8	00320
00901	S. Martinez Livestock, Inc.	W	Yakima	-	-	SE,SW	17	12	21E	21.1	F	244.8	D	-	-	-	3936	P	64.0	20	00901
00619	Martinez, D.	W	Yakima	-	-	NE,SW	17	12	21E	28.3	B	472.7	D	-	-	-	-	-	-	10,11	00619
00902	Martinez, No. 1	W	Yakima	-	-	SE	19	12	21E	21.7	F	288.3	D	-	-	-	4164	P	64.0	20	00902
00621	Griswald, P.	W	Yakima	-	-	SE,SW	20	12	21E	25.2	B	314.5	D	39.8	S	-	-	-	-	10	00621
00780	-	W	Yakima	-	-	SE,SW	20	12	21E	24.4	B	315.2	D	38.7	B	-	-	-	-	18	00780
00321	Griswald	W	Yakima	-	-	SE,SW	20	12	21E	25.0	B	313.6	D	42.0	B	-	-	-	-	1,4,6,8	00321
00785	-	W	Yakima	-	-	NW,NW	20	12	21E	24.4	B	315.2	D	38.7	B	-	-	-	-	18	00785
00620	Martinez, D. T., No. 1	W	Yakima	-	-	NW,NW	20	12	21E	21.4	S	143.9	L	-	-	-	-	-	-	10,11	00620
00903	Martinez, Simon	W	Yakima	-	-	NE,SW	22	12	21E	21.1	F	201.8	D	-	-	-	8172	P	26.2	20	00903
00904	Ekerich, W. M.	W	Yakima	-	-	NE,SW	29	12	21E	22.2	F	259.1	D	-	-	-	2271	P	121.6	20	00904
00322	Marley Orchards	W	Yakima	-	-	SE,SE	02	12	22E	23.1	-	267.0	L	42.0	B	-	-	-	-	1,4,6,8	00322
00905	Changala, Steve	W	Yakima	-	-	-	13	12	22E	20.0	F	518.2	D	-	-	-	7059	P	52.9	20	00905
00514b	Changala	W	Yakima	-	-	SE,SW	13	12	22E	29.5	S	450.0	L	38.0	B	-	-	-	-	8	00514b
00514a	Changala	W	Yakima	-	-	SE,SW	13	12	22E	29.5	S	450.0	L	37.0	A	-	-	-	-	8	00514a
00622	Changala	W	Yakima	-	-	-	13	12	22E	29.5	S	460.0	L	42.3	S	-	-	-	-	10	00622
00515	Changala	W	Yakima	-	-	SE,SW	13	12	22E	30.7	B	517.0	D	36.0	B	-	-	-	-	8	00515
00214b	Changala	W	Yakima	-	-	SE,SW	13	12	22E	20.3	S	206.0	L	40.0	B	-	-	-	-	6,8	00214b
00214a	Changala	W	Yakima	-	-	SE,SW	13	12	22E	20.3	S	206.0	L	33.0	A	-	-	-	-	6,8	00214a
00906	Marley Orch. Black Rock Ranch	W	Yakima	-	-	NE,NE	21	12	22E	31.1	F	747.4	D	-	-	-	-	-	114.0	20	00906
00623	Marley Orchards	W	Yakima	-	-	SE,SE	21	12	22E	22.8	B	270.0	D	42.3	S	-	5488	P	-	10,11	00623
00624	Changala, S.	W	Yakima	-	-	NW,NE	29	12	22E	23.0	B	430.1	D	-	-	-	2650	P	-	10,11	00624
00323	Changala	W	Yakima	-	-	NW,NE	29	12	22E	23.0	-	430.1	L	26.0	B	-	-	-	-	1,4,6,8	00323
00226	DNR Black Rock 1	W	Yakima	-	-	NW,SE	16	12	23E	25.0	S	225.0	L	58.0	B	-	-	-	-	6,8	00226
00625	DNR Blackrock No.1	W	Yakima	-	-	NE,SE	16	12	23E	25.6	B	350.8	D	42.3	S	-	-	-	-	10,11	00625
00907	Black Rock Well No. 1	W	Yakima	-	-	NE,SE	16	12	23E	23.3	F	349.0	D	-	-	-	7930	P	136.2	20	00907
00516	DNR Black Rock 1	W	Yakima	-	-	NE,SE	16	12	23E	25.5	B	350.0	D	39.0	B	-	-	-	-	8	00516
00626	-	W	Yakima	-	-	SE,SW	17	12	23E	20.3	S	206.0	L	42.3	S	-	-	-	-	10	00626
00517	-	W	Yakima	-	-	SE,SW	17	12	23E	20.3	-	206.0	L	40.0	B	-	-	-	-	8	00517
00911	Pyramid Orchards, Inc.	W	Yakima	-	-	-	24	13	16E	25.6	F	376.4	D	-	-	-	2332	P	23.9	20	00911
00912	Barcott, Mark	W	Yakima	-	-	SW,SW	11	13	17E	26.7	F	123.4	D	-	-	-	102	P	78.6	20	00912
00913	Clark, Christopher	W	Yakima	-	-	SW,NE	21	13	17E	20.6	F	106.7	D	-	-	-	140	P	70.1	20	00913
00914	Lowary, Kim	W	Yakima	-	-	SW,NW	23	13	17E	24.4	F	73.2	D	-	-	-	102	P	57.9	20	00914
00324	Carrell	W	Yakima	-	-	NE,NE	12	13	18E	24.8	B	201.0	D	59.0	B	-	-	-	-	1,4,6,7,8	00324
00628	Carrell	W	Yakima	-	-	NE,NE	12	13	18E	24.8	B	201.0	D	59.0	B	-	-	-	-	10,12	00628
00802	-	W	Yakima	-	-	NE,NE	12	13	18E	24.8	B	200.6	D	60.7	B	-	-	-	-	18	00802
00915	Nob Hill Water Co.	W	Yakima	-	-	NW,SE	18	13	18E	21.1	F	320.3	D	-	-	-	9932	P	84.4	20	00915
00916	Yakima County Detention Center	W	Yakima	-	-	SW,NE	19	13	18E	23.3	F	248.4	D	-	-	-	7040	P	12.2	20	00916
00629	Yakima Creamery well	W	Yakima	-	-	-	24	13	18E	33.9	B	513.0	D	43.4	S	-	-	-	-	10,12	00629
00229	Yakima Creamery well	W	Yakima	-	-	SE	24	13	18E	33.9	-	513.0	L	43.0	B	-	-	-	-	6,7,8	00229
00544	Yakima Creamery well (YKW-1)	W	Yakima	-	-	-	24	13	18E	28.3	-	-	-	-	-	-	-	-	-	9	00544
00917	Congdon Orchards	W	Yakima	-	-	SE,NE	29	13	18E	32.8	F	617.2	D	-	-	-	946	[illegible]	[illegible]	20	00917

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.D
00919	Nob Hill Water Assoc.	W	Yakima	-	-	NE	32	13	18E	21.1	F	259.1	D	-	-	-	-	N	A	20	00919
00920	Yakima City	W	Yakima	-	-	NW,NW	35	13	18E	20.6	F	356.9	D	-	-	-	-	N	A	20	00920
00921	Ostrander, Terry L.	W	Yakima	-	-	SW,SW	09	13	19E	21.1	F	179.8	D	-	-	-	-	-	105.2	20	00921
00922	Yakima Sheep Co.	W	Yakima	-	-	SE,SE	10	13	19E	20.0	F	103.6	D	-	-	-	-	-	29.3	20	00922
00630	Terrace Heights	W	Yakima	-	-	SW,SE	13	13	19E	25.0	B	251.1	D	40.5	S	-	-	-	-	10	00630
00325	Terrace Hts.	W	Yakima	-	-	SW,SE	13	13	19E	24.8	-	250.8	L	47.0	B	-	-	-	-	1,4,6,7,8,12	00325
00631	Watkins	W	Yakima	-	-	NE,NE	14	13	19E	20.3	B	210.5	D	40.5	S	-	-	-	-	10	00631
00923	Yakima County Dump	W	Yakima	-	-	-	14	13	19E	24.4	F	-	-	-	-	-	2650	P	100.6	20	00923
00248b	Watkins 3	W	Yakima	-	-	NE,NE	14	13	19E	20.3	B	211.0	D	98.0	A	-	-	-	-	6,8	00248b
00248a	Watkins 3	W	Yakima	-	-	NE,NE	14	13	19E	20.3	B	211.0	D	39.0	B	-	-	-	-	6,8	00248a
00925	Hardy, Dorothy	W	Yakima	-	-	NE,NW	16	13	19E	20.0	F	145.7	D	-	-	-	1628	P	68.3	20	00925
00924	Country Club Dist. Water Co.	W	Yakima	-	-	SE,SE	16	13	19E	23.9	F	455.7	D	-	-	-	4769	P	30.5	20	00924
00926	Cascade Lumber Company (1925)	W	Yakima	-	-	-	18	13	19E	21.1	F	763.5	D	-	-	-	568	N?	A?	20	00926
00927	Yakima County (heat pump well)	W	Yakima	-	-	NW,NW	19	13	19E	23.3	F	249.0	D	-	-	-	-	-	12.2	20	00927
00781	-	W	Yakima	-	-	NW,SW	22	13	19E	20.0	B	79.3	D	90.6	B	-	-	-	-	18	00781
00326a	Country Club	W	Yakima	-	-	NW,SW	22	13	19E	20.0	S	82.0	L	70.0	A	-	-	-	-	1,4,6,8	00326a
00928	Yakima Country Club, Inc.	W	Yakima	-	-	SE,NW	22	13	19E	22.8	F	219.5	D	-	-	-	3596	P	28.3	20	00928
00326b	Country Club	W	Yakima	-	-	NW,SW	22	13	19E	20.0	S	82.0	L	85.0	B	-	-	-	-	1,4,6,8	00326b
00632	-	W	Yakima	-	-	NW,SW	22	13	19E	20.0	B	82.0	D	-	-	-	-	-	-	10	00632
00634	-	W	Yakima	-	-	NE,NE	24	13	19E	20.0	B	230.0	D	40.5	S	-	-	-	-	10	00634
00327a	Rasmussen	W	Yakima	-	-	NE,NE	24	13	19E	20.0	B	230.0	D	26.4	A	-	-	-	-	1,4,8	00327a
00929	Yakima Sheep Co.	W	Yakima	-	-	NW,NE	24	13	19E	21.0	F	230.4	D	-	-	-	1514	P	114.0	20	00929
00633	-	W	Yakima	-	-	NW,NE	24	13	19E	44.5	B	230.0	D	-	-	-	-	-	-	10	00633
00327b	Rasmussen	W	Yakima	-	-	NE,NE	24	13	19E	20.0	B	230.0	D	35.0	B	-	-	-	-	1,4,8	00327b
00930	Sundquist Fruit & Cold Storage	W	Yakima	-	-	SW,SW	19	13	20E	21.7	F	254.5	D	-	-	-	13342	P	79.9	20	00930
00635	Sundquist Fruit	W	Yakima	-	-	SW,SW	19	13	20E	21.2	B	253.3	D	40.5	S	-	-	-	-	10,11	00635
00389b	Sundquist	W	Yakima	-	-	SW,SW	19	13	20E	22.1	B	253.3	D	40.0	B	-	-	-	-	1,4,6,8	00389b
00636	Champoux	W	Yakima	-	-	SE,NW	20	13	20E	23.3	B	215.0	D	40.5	S	-	-	-	-	10	00636
00276	Champoux	W	Yakima	-	-	SE,NW	20	13	20E	23.3	B	215.0	D	52.0	B	-	-	-	-	6,7,8,12	00276
00931	Moxee School District No. 90	W	Yakima	-	-	NW,NW	29	13	20E	22.8	F	179.8	D	-	-	-	1041	P	103.6	20	00931
00782	-	W	Yakima	-	-	NW,NW	29	13	20E	22.7	B	175.9	D	60.6	B	-	-	-	-	18	00782
00328	Moxee School	W	Yakima	-	-	NW,NW	29	13	20E	22.7	B	176.0	D	55.0	B	-	-	-	-	1,4,6,8	00328
00637	-	W	Yakima	-	-	NW,NW	29	13	20E	22.7	B	176.0	D	40.5	S	-	-	-	-	10	00637
00638	Yergen, R.	W	Yakima	-	-	NE,NE	30	13	20E	24.2	B	289.2	D	40.5	S	-	-	-	-	10,11	00638
00518	-	W	Yakima	-	-	NE,NE	30	13	20E	24.2	-	289.0	L	42.0	B	-	-	-	-	8	00518
00639	Coombs, B.	W	Yakima	-	-	NE,SW	33	13	20E	23.2	B	227.1	D	40.5	S	-	-	-	-	10	00639
00640	Coombs, B., No. 2	W	Yakima	-	-	NW,SW	33	13	20E	30.0	B	446.2	D	40.5	S	-	-	-	-	10,11	00640
00329a	Coombs	W	Yakima	-	-	NE,SW	33	13	20E	23.2	-	227.1	L	39.3	A	-	-	-	-	1,4,6,7,8	00329a
00329b	Coombs	W	Yakima	-	-	NE,SW	33	13	20E	23.2	-	227.1	L	48.0	B	-	-	-	-	1,4,6,7,8,12	00329b
00519	Coombs 2	W	Yakima	-	-	NW,SW	33	13	20E	30.2	-	446.0	L	41.0	B	-	-	-	-	8	00519
00932	Larson Fruit	W	Yakima	-	-	SW,SW	33	13	20E	27.8	F	496.2	D	-	-	-	-	-	44.5	20	00932
00933	Smith, Darrell, W.	W	Yakima	-	-	SE,SE	34	13	20E	21.1	F	184.1	D	-	-	-	341	P	92.0	20	00933
00520	Martinez	W	Yakima	-	-	SE,NE	34	13	21E	21.8	B	310.9	D	32.0	B	-	-	-	-	1,4,6,8	00520
00521b	Martinez	W	Yakima	-	-	SE,NE	34	13	21E	22.0	B	290.0	D	40.0	A	-	-	-	-	8	00521b
00641	Martinez, D. T., No. 2	W	Yakima	-	-	SE,NE	34	13	21E	21.2	B	310.9	D	-	-	-	-	-	-	10,11	00641
~~00330~~	~~Martinez~~	~~W~~	~~Yakima~~	-	-	~~SE,NE~~	~~34~~	~~13~~	~~21E~~	~~23.8~~	~~B~~	~~313.0~~	~~D~~	~~37.0~~	~~B~~	-	-	-	-	~~8~~	~~00330~~
00783	-	W	Yakima	-	-	SE,NE	34	13	21E	23.8	B	310.9	D	40.5	B	-	-	-	-	18	00783
00521a	Martinez	W	Yakima	-	-	SE,NE	34	13	21E	22.0	B	290.0	D	35.1	A	-	-	-	-	8	00521a

GEOTHERMAL RESOURCES DATA BASE, LOW AND MODERATE TEMPERATURE RESOURCES,
STATE OF WASHINGTON -- DESCRIPTIVE AND THERMAL DATA.

File Name = GEOTHDB1.WK1   Last Updated April 30, 1993, by J.E.S.

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.D
00642	Changala, S., No. 2	W	Yakima	-	-	NW,NE	13	13	22E	30.7	B	516.9	D	-	-	-	-	-	-	10	0064
00523b	DNR 81 Tieton	H	Yakima	46-40.44	121-01.70	SW,NW	25	14	14E	24.2	B	152.0	D	92.0	B	-	-	-	-	8	0052
00523a	DNR 81 Tieton	H	Yakima	46-40.44	121-01.70	SW,NW	25	14	14E	24.2	B	152.0	D	92.6	A	87	-	-	-	8,12	0052
00934	Rowe Farms, Inc.	W	Yakima	-	-	SW,SE	13	14	17E	20.6	F	207.3	D	-	-	-	-	-	78.0	20	0093
00935	Muzzall, Steve	W	Yakima	-	-	SE,NW	24	14	17E	23.3	F	74.7	D	-	-	-	57	P	64.3	20	0093
00936	Fisher, Harland	W	Yakima	-	-	SW,SE	14	14	18E	20.0	F	111.3	D	-	-	-	76	P	36.3	20	0093
00937	Bauman, Ed.	W	Yakima	-	-	SE,SW	15	14	18E	21.1	F	74.7	D	-	-	-	163	P	18.9	20	0093
00645	Zirkle, W. H.	W	Yakima	-	-	SW,NE	20	14	18E	29.5	B	324.6	D	-	-	-	-	-	-	10,11,16	00645
00331	Zirkle	W	Yakima	-	-	SW,NE	20	14	18E	29.0	B	324.0	D	52.0	B	-	-	-	-	1,4,6,7,8,12	00331
00938	Eberle, Robert	W	Yakima	-	-	SW,SE	32	14	18E	22.2	F	16.8	D	-	-	-	114	P	1.2	20	00938
00646	Roche Fruit Company	W	Yakima	-	-	SW,SW	16	14	19E	22.5	B	268.2	D	-	-	-	-	-	-	10,11	00646
00332	Roche	W	Yakima	-	-	SW,SW	16	14	19E	23.2	B	267.3	D	46.0	B	-	-	-	-	1,4,6,7,8,12	00332
00939	Roche Fruit Co.	W	Yakima	-	-	SE,SW	17	14	19E	27.8	F	459.6	D	-	-	-	4164	N	A	20	00939
00940	-	W	Yakima	-	-	SE,NE	20	14	19E	21.7	F	123.1	D	-	-	-	2506	P	-	20	00940
00647	-	W	Yakima	-	-	NW,NE	28	14	19E	21.0	B	183.0	D	-	-	-	-	-	-	10	00647
00333	US Govt.	W	Yakima	-	-	NW,NE	28	14	19E	21.0	F	183.0	D	54.0	B	-	-	-	-	1,4,6,8	00333
00421	-	W	Yakima	-	-	SE,SE	25	15	17E	29.2	B	598.0	-	29.0	B	-	-	-	-	6	00421
00524b	DNR Wenas	W	Yakima	-	-	NE,NE	36	15	17E	29.2	B	598.0	D	33.5	A	-	-	-	-	8	00524
00525a	DNR Wenas	W	Yakima	-	-	NE,NE	36	15	17E	30.1	B	595.0	D	33.3	A	-	-	-	-	8	00525
00649	DNR Wenas	W	Yakima	-	-	NE,NE	36	15	17E	29.2	B	598.0	D	29.8	S	-	-	-	-	10	00649
00524a	DNR Wenas	W	Yakima	-	-	NE,NE	36	15	17E	29.2	B	598.0	D	31.0	B	-	-	-	-	8	00524
00525b	DNR Wenas	W	Yakima	-	-	NE,NE	36	15	17E	30.1	B	595.0	D	33.0	B	-	-	-	-	8	00525

NOTES:

SITE TYPE: S = spring; W = water well; H = heat-flow/temperature-gradient well; O = oil and gas test well; - = other or unknown.
PARTIAL SECTION: Written as quarter-section of quarter-section. Example: NW,NE is the northwest quarter of the northeast quarter of the section.
TEMPERATURE TYPE: B = bottom-hole temperature or near-bottom-hole temperature; F = flowing temperature; M = maximum temperature; S = temperature measured short of well bottom, and - = other or unknown.
DEPTH TYPE: D = drilled depth or near drilled depth; L = logged depth; - = other or unknown.
GRADIENT TYPE: A = gradient estimated from linear segment of well log; B = gradient estimated from a bottom-hole temperature or the deepest logged temperature and an estimated or calculated mean annual surface temperature; S = statistically determined gradient.
FLOW TYPE: N = natural; P = pumped, bailed, or air-driven; - = other, no flow, or unknown.
S.W.L.: Static water level, meters from surface. A = artesian.

REFERENCES:

1. Korosec, M. A.; Kaler, K. L., 1980, Well temperature information and locations in the State of Washington: Washington Division of Geology and Earth Resources Open File Report 80-7, 89 p. [unpaginated], 2 pl., scale 1:500,000.

I.D.	SITE NAME	SITE TYPE	COUNTY	LAT. N.	LONG. W.	PART. SEC.	SEC.	TWP. N.	RNG.	TEMP. deg C	TEMP. TYPE	DEPTH m	DEPTH TYPE	GRADIENT deg.C/km	GRAD. TYPE	HEAT FLOW mW/sq.m	FLOW l/m	FLOW TYPE	S.W.L. m	REF.	I.D.

measurements in Washington to 1979 and temperature-depth data collected during 1979: Washington Division of Geology and Earth Resources Open File Report 80-9, 524 p. [unpaginated].

3. Korosec, M. A., 1980, Table of thermal and mineral spring locations in Washington: Washington Division of Geology and Earth Resources Open File Report 80-11, 6 p.
4. Korosec, M. A., and Others, 1981, Geothermal resources of Washington: Washington Division of Geology and Earth Resources Geologic Map GM-25, 1 sheet, scale 1:500,000.
5. Korosec, M. A.; and Others, 1980, The 1979-1980 geothermal resource assessment program in Washington: Washington Division of Geology and Earth Resources Open File Report 81-3, 267 p., 1 map, scale 1:24,000.
6. Schuster, J. E., 1981, Geothermal energy potential of the Yakima valley area, Washington. In Bloomquist, R. G., editor, Proceedings of the Geothermal Symposium--Low temperature utilization, heat pump applications, district heating, September 24, 1980: Washington State Energy Office WAOENG 81-05, p. XI 1 - XI 10.
7. Korosec, M. A., and others, 1982, The low temperature geothermal resources of eastern Washington: Washington Division of Geology and Earth Resources Open File Report 82-1, 20 p., 2 figs., 1 table.
8. Korosec, M. A.; Phillips, W. M., 1982, WELLTHERM: Temperature, depth, and geothermal gradient data for wells in Washington State: Washington Division of Geology and Earth Resources Open File Report 82-2, 3 p., 74-p. table.
9. Korosec, M. A., 1982, Table of chemical analyses for thermal and mineral spring and well waters collected in 1980 and 1981: Washington Division of Geology and Earth Resources Open File Report 82-3, 5 p.
10. Biggane, J. H., 1982, The low-temperature geothermal resource and stratigraphy of portions of Yakima County, Washington: Washington Division of Geology and Earth Resources Open File Report 82-6, 128 p., 58 figs., 4 pl., 11 tables, appendix.
11. Biggane, J. H., 1983, Geophysical logs from water wells in the Yakima area, Washington: Washington Division of Geology and Earth Resources Open File Report 83-2, 50 p.
12. Korosec, M. A., and others, 1983, The 1980-1982 geothermal resource assessment program in Washington; with chapters on thermal springs, gravity investigations, heat-flow drilling, low-temperature resources in eastern Washington, geology the the south Cascades and White Pass areas, and targets for geothermal resource exploration: Washington Division of Geology and Earth Resources Open File Report 83-7, 299 p.
13. Widness, Scott, 1983, Low temperature geothermal resource evaluation of the Moses Lake-Ritzville-Connell area, Washington: Washington Division of Geology and Earth Resources Open File Report 83-11, 27 p.

14. Korosec, M. A., 1983, The 1983 temperature gradient and heat flow drilling project for the State of Washington: Washington Division of Geology and Earth Resources Open File Report 83-12, 11 p.
15. Stoffel, K. L.; Widness, Scott, 1983, Geophysical logs of selected wells in eastern Washington: Washington Division of Geology and Earth Resources Open File Report 83-14, 81 p.
16. Stoffel, K. L.; Widness, Scott, 1983, Fluid-temperature logs for selected wells in eastern Washington: Washington Division of Geology and Earth Resources Open File Report 83-15, 351 p.
17. Korosec, M. A., 1983, Chemical analyses for thermal and mineral springs examined in 1982-1983: Washington Division of Geology and Earth Resources Open File Report 84-1, 8 p.
18. Blackwell, D. D., and others, 1985, Heat flow and geothermal studies in the State of Washington: Washington Division of Geology and Earth Resources Open File Report 85-6, 77 p.
19. Barnett, D. B., 1986, The 1985 geothermal gradient drilling project for the State of Washington: Washington Division of Geology and Earth Resources Open File Report 86-2, 34 p.
20. Washington State Department of Ecology Water Well Reports, Central Regional Office, Yakima, Washington, April 12 and 13, 1993. (Water well reports for 12,000-15,000 wells were reviewed by J. E. Schuster and J. D. Dragovich of the Washington Division of Geology and Earth Resources. 145 records for wells at or above 20 degrees C. were found, copied, and placed in the Division's files.)