Potential Use Of Geothermal Resources In The Snake River Basin: An Environmental Overview

VOLUME II — ANNOTATED BIBLIOGRAPHY

Susan G. Spencer
Brent F. Russell
Jacquelyn F. Sullivan
Editors

September 1979

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POTENTIAL USE OF GEOTHERMAL RESOURCES IN THE SNAKE RIVER BASIN: AN ENVIRONMENTAL OVERVIEW

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EG&G Idaho, Inc.
Idaho Falls, Idaho 83401

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INTRODUCTION

EG&G Idaho, Inc., has completed an environmental analysis of seven known geothermal resource areas (KGRAs) as part of a comprehensive preplanning environmental program related to the KGRAs in the Snake River Basin. EG&G Idaho, Inc., is performing this preplanning environmental program under the auspices of the Office of Health and Environmental Research of the U.S. Department of Energy (DOE). KGRAs included under this program (see Figure 1) are Vulcan Hot Springs, Crane Creek, Castle Creek, Bruneau, Mountain Home, Raft River, Island Park, and Yellowstone.

The ultimate goal of the preplanning environmental program is to reduce the delays in geothermal development while minimizing environmental impacts by (a) assessing the existing environmental baseline data for the KGRAs, (b) evaluating those data for adequacy and applicability, and (c) developing a plan for supplementing the existing data to achieve a sound environmental data base prior to geothermal development.

This volume is a partially annotated bibliography of reference materials pertaining to the seven KGRAs. The bibliography is divided into sections by program element. Cross-referencing is available for those references which are applicable to specific KGRAs.

TERRESTRIAL ECOLOGY


Figure 1. Locations of KGRAs in the Snake River Basin.


S. F. Baird, Birds In: Reports of explorations and surveys to ascertain the most practicable and economic route for a railroad from the Mississippi River to the Pacific Ocean. Vol. 9: (1858).


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Key
1. Vulcan Hot Springs KGRA
2. Crane Creek KGRA
3. Castle Creek KGRA
4. Bruneau KGRA
5. Mountain Home KGRA
6. Raft River KGRA
7. Island Park/Yellowstone KGRAs.


W. Brewster, "Descriptions of a New Warbler and a New Song Sparrow," Auk 13 (1896) pp 44-47.


Baseline algal floristic data for the Raft River adjacent to the geothermal study site, and interpretation of species fragility and tolerance for water quality indication:


A precursory general discussion of most prevalent species, possible impact, and future research emphasis.


Results of a one-day (Feb. 13, 1977) fish survey using electro fishing gear. Includes population estimates.


Development in the Raft River Valley, Idaho. Preliminary baseline environmental data primarily concerning two vertebrate classes — Mammalia and Aves.


C. L. Hayward, "Important Heron Rookeries in Southeastern Idaho," *Auk* 51 (1934) pp 39-41.


G. E. Hudson, "Black-billed Cuckoo (Coccyzus erythropthalmus) at Gray's Lake, Bonneville County, Idaho," *Murrelet* 33 (1952) p 44.


V. E. Jones, “White-fronted Goose in Idaho,” Condor 45 (1943) p 120.


A presentation of field data and interpretations on terrestrial ecology of the Basin. Baseline descriptions of biotic communities, geothermal impact assessment, and community models for future monitoring are presented.


An extrapolation of data from Curlew Valley (Knowlton), and the National Reactor Testing Station (Allred); 48 km and 1440 km distant, respectively. A list of species comprises the bulk of the report.


E. A. Mearns, “A study of the Sparrow Hawks (Subgenus *Tinnunculus*) of America, With Special Reference to the Continental Species (*Falco sparverius*, Linn.),” *Auk* 9 (1892) pp 252-270.


A. C. Olson, "Starlings in Northern Idaho," *Condor* 45 (1943) p 197.


Summarizes monitoring and research efforts conducted in 1978 to characterize impacts due to geothermal development.


R. L. Speth, L. D. Weber, and O. D. Simpson, Trace Element-Neutron Activation Analysis Results (from water and soil, from hot water wells, soil from agricultural and desert areas, desert vegetation, alfalfa, mice, lizards, rabbits, birds, and ants).

Indicates some trace element accumulation in desert plants and aquatic organisms.


V. M. Tanner, "A Study of the Variation of the Dorsal Scale Rows of Charina bottae (Blainville)," *Copeia* (2) (1933) pp 81-84.


L. E. Trout and J. L. Thiessen, "Food Habits and Conditions of Mule Deer in Owyhee County," *Conf. of Western Assoc. of State Game and Fish Commissioners, 48th Annual Proc.*, Reno, Nevada.


This report includes baseline information on air quality and vegetation.


This report deals with chronic fluoride toxicosis in domestic animals at Raft River, soils analysis, and water quality.


H. M. Webster, Jr., "Notes From Idaho," Auk 63 (1946).

A. Wetmore, Migration Records From Wild Ducks and Other Birds Banded in the Salt Lake Valley, Utah, USDA Bull. 1145 (1923).

A. Wetmore, "Geographic Variation in the American Redstart (Setophaga ruticilla)," J. Wash. Acad. Sci. 39 (1949) pp 137-139.


This report deals primarily with a study of the sensitivity of ferruginous hawks and the degree of impact to the hawks by geothermal development.

T. E. Wilcox, "Introduced Game Birds in Oregon and Idaho," Auk 2 (1885).


L. E. Wyman, "Bobolink Again Noted in Idaho," *Condor* 13 (1911).


L. E. Wyman, "Occurrence of the Red Crossbill (Loxia curvirostra minor) in Southern Idaho," *Condor* 13 (1911).


L. E. Wyman, "White-throated Sparrow in Idaho," *Auk* 29 (1912).


**AQUATIC ECOLOGY**


Bureau of Land Management, *Environmental Analysis Record, Geothermal Leasing for Crane Creek KGRA and Adjacent Areas*, (no date).
Bureau of Land Management, Environmental Analysis Record, Geothermal Leasing and Development on Potential Areas within the Boise District — Bruneau, Grandview and Bennett Mountain, (no date).


Baseline algal floristic data for the Raft River adjacent to the geothermal study site, and interpretation of species fragility and tolerance for water quality indication.


W. S. Platts, *Geomorphic and Aquatic Conditions Influencing Salmonids and Stream Classification*, U.S. Forest Service (June 1974).


Summarizes results from sampling of four collecting sites along the Raft River for aquatic invertebrates. Density (number per square foot) of organisms was computed, as well as their trace element composition by neutron activation analysis.


Indicates some trace element accumulation in desert plants and aquatic organisms.

D. Stefan, *Unpublished Field Notes for Castle Creek, Catherine Creek and Brown’s Creek* (1976-1978).


USEPA, *Water Quality Assessment, Middle Snake River Basin,* Surveillance and Analysis Division (no date).


**HERITAGE RESOURCES**


This site has provided a basic cultural chronology for the Owyhee area of the northern Great Basin, including both southeastern Oregon and southwestern Idaho, and is a model of possible resources within the selected Idaho KGRAs in that region.


Two sites in southern Owyhee County have been interpreted to be prehistoric or protohistoric bison jumps, again serving as a model for potential cultural resources within the selected KGRAs in that general region.

This unpublished dissertation delineates the paleontologically significant formations of part of the Castle Creek KGRA, and lists localities where fossils have been collected.


This report does not pertain to any specific KGRA, but only mentions that Indians occupied the Owyhee County area.


The Dean site on Brown's Bench in the Upper Salmon Falls drainage has 8000-10,000 years of occupation represented within its sediments and again is a model of potential cultural resources within the Bruneau and Castle Creek KGRAs especially.


This book is an excellent introduction to general Idaho historical research. It summarizes significant events in Idaho history but does not give data specific to the KGRAs. It does provide good bibliographic references.


This description of fossil fauna in the Hagerman area is relevant to evaluation of the paleontological resources of the Bruneau and Castle Creek KGRAs.


Blyth puts the Paiute Salmon Eaters on the lower Malheur River with spring and summer camps on both sides of the Snake River about at the mouth of the Malheur as of 1840-50; mixed Paiute-Shoshoni groups wintered near the Boise River. "People Eaters" were in the hills above the Boise River, either to the north or south; if north, this has implications for evaluating the cultural resource potential of the Crane Creek KGRA.


This geologic base map was just revised recently and has been published before its companion explanatory volume (Idaho Bureau of Mines and Geology Information Circular 31) is available. It does have a full legend explaining the mapping units and labels, but unfortunately was poorly printed so that the underlain cultural and geographic features (rivers, lakes, towns, county lines) are nearly invisible making the map difficult to use.
This site is on the north side of the Snake River, north of the Bruneau KGRA and east of the Castle Creek KGRA; it is one of the few excavated sites in that area and is evidence of the excellent preservation of archaeological materials from the early historic period there.


These companion papers document the known record of prehistoric pictograph and petroglyph sites in Idaho, none of which is from the selected KGRAs. Several rock art sites are noted just north of the Mountain Home KGRA, and such resources should be expected in areas such as the Castle Creek KGRA especially.

A. W. Bowers, *Archaeological Excavations in the Spangler Reservoir and Surveys in Washington County, Idaho*, Ms, Interagency Archaeological Services-San Francisco (HCRS, USDI) and the Archive of Pacific Northwest Archaeology, University of Idaho, Moscow (1967).

This 107 page (with illustrations, 4 large maps) manuscript is a report to the National Park Service and the National Science Foundation of the 1964-1965 survey and test excavations of sites in the Spangler (Mann Creek) Reservoir in the Weiser River drainage and in Washington County in general. It unfortunately has rarely been available and is rarely cited, but does contain a valuable overview of archaeological resources in the area of the Crane Creek KGRA.


This is an earlier report on the Brown's Bench Dean site in the Upper Salmon Falls drainage east of the Bruneau and Castle Creek KGRAs, and provides basic data for developing a model of expected cultural resources within those KGRAs.


Brimlow's map of the campaign documents the military movement through the Weiser valley, but there is no specific discussion of the Crane Creek KGRA.


This report of the military campaign against "small renegade bands of Bannocks, Shoshones (Sheepeaters) and Weisers" includes a map that indicates that Captain Bernard's regiment camped in the Vulcan KGRA on 21 July 1879.


The Midvale basalt quarry is ca. 15 km north of the Crane Creek KGRA and provides a useful model of the prehistoric sites to be expected in the general area.


This volume is now out-of-print and the 3rd edition by the same title is limited to a discussion of southeastern Idaho rather than the entire state. Though dated, the 1968 edition of Butler's synthesis is still the most useful introduction to the archaeology of the state and to southwestern Idaho.


This synthesis of information relating to Nez Perce territorial claims was compiled for presentation to the Indian Claims Commission, who essentially accepted its findings as fact. Thus, the Crane Creek KGRA is included within the southern boundaries of Nez Perce territory, being a marginal area shared with the Shoshoni. Vulcan KGRA is not within this area, but is assigned to the Shoshoni.


This 96 page (with illustrations) technical report of Idaho State University's survey of the Mount Bennett Hills Planning Unit was submitted to the Bureau of Land Management and is difficult to find; its sample survey does include a small portion of the Mountain Home KGRA. No sites were found within those sampled areas of the KGRA, but the report does provide a model of prehistoric site distributions within the general Mt. Bennett Hills area.

M. O. Cross, A report, in the form of a journal, to the Quartermaster General, of the march of the regiment of mounted riflemen to Oregon, from May 10 to October 5, 1849. In "Report of the Quartermaster General," pp 128-321. 31st Congress, 2nd Session, Senate Executive Documents No. 1, Pt. 2, No. 3 (Serial No. 587) (1850).

Osborne's regiment traversed the Castle Creek KGRA, and also camped on the Bruneau River just downstream from the Bruneau KGRA. However, he has no specific comments about inhabitants or characteristics of those areas.

This report of the population of Fort Hall Indian Reservation includes comments about the Bruneau, Boise, and Western Shoshoni then resident at Fort Hall. However, it includes no comments about their original non-reservation territory or settlement pattern.


This original description of the Midvale archaeological site complex, which is focused approximately 15 km north of the Crane Creek KGRA, is the basic discussion of the potential age of those cultural deposits. Again, it serves as a model of potential archaeological resources within the KGRA.


Though this report is on sites in eastern Idaho, well outside any of the KGRAs, it does include a radiocarbon determination of the age of Folsom projectile points in Idaho; it thus provides comparative information for evaluation of resources around the Crane Creek KGRA in particular.


This original survey of Idaho pictographs and petroglyphs does not include any of the selected Idaho KGRAs, but is an excellent overview of the varieties and locations of materials that might be expected to be found in central and southern Idaho especially.

T. J. Farnham, Travels in the Great Western Prairies, the Anahuac and the Rocky Mountains, and in the Oregon Territory, New York: Greeley and McElrath, Tribune Buildings, 1843.

This 1838 journal reports Shoshoni living along the Snake River but does not specifically locate them within any of the selected KGRAs.


This report gives locations of early Idaho ferries and notes the presence of the Grandview Ferry across the Snake River (within the Castle Creek KGRA).


This hard-to-find thesis uses the 7000 years of cultural sequence at the Sheepeater Battleground site north of Stanley as a basis for outlining the prehistoric settlement patterns in the area, and is a first model for the Vulcan KGRA resources as well.


Gazin’s early description of the Hagerman Fossil Beds found along the Snake River valley in south central Idaho, is a basic reference for predicting the occurrence of similar materials in the Castle Creek and Bruneau KGRAs.


This site is well east of the selected Idaho KGRAs, near Twin Falls along the Snake River, and is evidence of occupation of the canyon between approximately AD 700-1200.


These sites appear to date approximately 4000-2500 years ago but while relatively close to each other seem to have different cultural components. The sites are downriver along the Snake from the Castle Creek KGRA, and while small also serve as models of the cultural variation that might be expected within the Castle Creek area.


This unpublished thesis contains geological descriptions pertinent to understanding the significance of paleontological materials in the Bruneau KGRA.


Harris places the White Knife Shoshoni on the Bruneau occasionally, perhaps for anadromous salmon fishing in the lower reaches.


Again, Harris comments on the White Knife Shoshoni exploitation of the upper Bruneau canyon.


This report of fossil voles from the Glenns Ferry Formation exposures near Twin Falls is relevant to evaluation of the paleontological resources of the Bruneau and Castle Creek KGRAs.


Hoebel puts the Row of Willows Shoshoni on Willow Creek in the Weiser drainage and notes that they are the western most group of Shoshoni; he locates the Big Salmon Eaters or "Those Who Do Not Roam" in the Snake River canyon from the mouth of the Bruneau to the mouth of the Boise. These comments are relevant to the evaluation of potential cultural resources in the Bruneau, Castle Creek, and Crane Creek KGRAs.


This documentation of the various Shoshoni tribal entities' claim against the Federal government for redress of territorial losses includes the general area of all the selected KGRAs discussed in this report. The conclusion of the Indian Claims Commission was that this region was not used exclusively by any single Shoshoni or other tribal group, and that instead there was constant sharing of territory and resources there aboriginally.


This report records 125 Shoshoni camped at the mouth of the Bruneau and settlers on both Castle and Sinker Creeks.


This brief and popular description of the Oregon Trail and its route is a handy introduction to the topic.


This brief summary of the historic Euroamerican exploitation of the Sawtooth Mountains is relevant to evaluating the potential cultural resources of the Vulcan KGRA.


This brief reference summarizes the identities of the various Shoshoni and Northern Paiute groups in Idaho in the late 1800s, and is relevant to understanding the ethnography of all five KGRAs.


The Commission decided that the area of the Vulcan KGRA was the western boundary of Lemhi Shoshoni territory, and that the Crane Creek, Castle Creek, Bruneau, and Mountain Home vicinities were all used by both Northern Paiute and Shoshoni and hence the exclusive territory of no single group. However, Merle Wells and Sven Liljebl place the Sheep-eater Shoshoni at Vulcan, the Bruneau Shoshoni at Castle Creek and Bruneau, and the Boise Shoshoni at Mountain Home and Crane Creek (with perhaps some mixed bands of Northern Shoshoni and Paiutes in the latter area.)


Bonneville in 1835 recorded Bannocks along the Boise and Payette Rivers, but makes no comments about populations specific to the selected KGRAs.

Irving documents the presence of William Price Hunt of the Pacific Fur Company near Weiser in 1811.


Fremont recorded several Indian camps along the Boise River, but has no comments about them within a specific selected KGRA.


This brief summary of the Kelton road, which crossed the corner of the Mountain Home KGRA, is one of the few available descriptions of the road.


The Reservoir would extend from Walter's Ferry to Grandview on the Snake River, including the riverine portion of the Castle Creek KGRA. The manuscript is available only on a "need to know" basis and includes many prehistoric and historic site locations along the Snake River.


Fossil fish localities on the Oregon-Idaho border yield information relevant to evaluating the paleontological resources of the Castle Creek KGRA.


This reports that many Indians live along the Snake River (including the general area of the Castle Creek KGRA), but gives no specific locational data.


This overview, prepared as part of the Idaho State Historic Preservation Plan, is a summary of current knowledge of the cultural resources of this central Idaho region and is a model of expected resources in the Vulcan KGRA.


In 1832 John Work of the Hudson Bay Company Snake Brigade camped on the tributaries of the Weiser River, south of the Crane Creek KGRA, and described the Shoshoni who were also camped in that area. His brigade also travelled north and east into the Stanley Basin area.

This brief statement is relevant to the ethnography of the Crane Creek and Mountain Home KGRAs, and peripherally to the Castle Creek KGRA.


This mimeographed paper, available in the Office of the Idaho State Archaeologist, is a general statement of Native American populations within Idaho but does not contain data specifically relevant to the selected KGRAs.


Liljeblad places the Shoshoni throughout southern Idaho as early as 8500 years ago (see Swanson 1972), but has no data specifically relevant to the selected KGRAs.


Both these papers are relevant to evaluating the paleontological resources of the Bruneau and Castle Creek KGRAs.


This rockshelter is located in the headwaters of the Bruneau River and records at least 7000-8000 years of human exploitation of that area.


This report only generally mentions that Indians occupied the Owyhee County area and does not provide data specific to the KGRAs.


This is the basic statement of stratigraphy in the western Snake River Plain, and is relevant to evaluations of the paleontological resources of the Mountain Home, Bruneau, and Castle Creek KGRAs.


This basic outline of the stratigraphy of the area places the paleontological resources within a temporal framework and serves as a model for evaluating their potential within the selected KGRAs.

This report is again on a site in eastern Idaho well outside the KGRAs, but does include a radiocarbon determination of the age of Folsom projectile points in Idaho; it thus provides comparative information for evaluation of resources around the Crane Creek KGRA in particular.


A discussion of an archaeological survey of the area, indicating seven sites of interest to be further investigated.


Godfrey conducted an extensive survey of the Bruneau Canyon, locating over 200 archaeological sites; his notes and collections have been lost and hence are not available for evaluation of the Bruneau KGRA resources.


This directory provides useful comments on the late nineteenth century inhabitants, communities, and now historic structures of the Castle Creek and Brunean KGRAs.


Pavesic has used the cultural sequence in the Hells Canyon Creek site and other nearby remains to establish a chronology for the Hells Canyon area that has relevance to the archaeology of the Crane Creek KGRA in particular.


Pavesic disagrees with Swanson's (1965, 1974) concepts of an invasion of Plateau people into a Desert Culture area at AD 1300, but thinks that the architectural and artifact characteristics of the western Snake River Plain can be explained within a regional cultural model.

Archaeological Overview of the Middle Fork of the Salmon River Corridor, Idaho Primitive Area, Boise State University Archaeological Report No. 3 (1978).

This overview of the Middle Fork Salmon canyon provides a basis for evaluating the heritage resource potential of the Vulcan KGRA.


This intensive survey was conducted in the Bruneau Canyon from the Nevada border to just south of the Bruneau KGRA, and its identification of intensive and extensive use of the canyon bottoms has relevance for evaluating the cultural resource potential in the KGRA. The 26 page manuscript is available from the Boise District Office on a "need to know" basis.


Both of these reports are of materials to the southwest of the Bruneau and Castle Creek KGRAs, in the Owyhee Uplands, and serve as a model of the expected prehistoric settlement systems in that general region.


These two reports note that various Shoshoni and Bannock camps were located along the Boise River, and that those people moved to Ft. Hall, but include no specific comments relevant to the selected KGRAs.


This short article has comments on the history of the Hot Springs area and the Bruneau KGRA.


Randolph’s survey is north of the Crane Creek KGRA, but documents a heavy use of the Hells Canyon area that has relevance for understanding the potential resources of the KGRA. Preliminary evidence in Hells Canyon is for intensive and long time use of anadromous fish.


Again, this rockshelter deep in Hells Canyon is peripheral to the Crane Creek KGRA but provides evidence of 8000 years of continuous human exploitation of that region.


This site is north of the Crane Creek KGRA and documents extensive use of local basalts for stone tool production over perhaps 6000 years; the same basalts outcrop to the east of the KGRA.


Fossil localities near the Castle Creek KGRA are described and discussed here.

This summary of recent archaeological reconnaissance in the basin of the Middle Fork Salmon provides comparative information for evaluation of the potential archaeological resources in the Vulcan KGRA.


This manuscript report notes a Shoshoni and Bannock fishing site at the mouth of the Bruneau River, but has no comments specific to the KGRAs.


Steward recorded general ethnographic data for southwestern Idaho and mapped known villages; he does record one winter village that probably falls within the Bruneau KGRA.


Stewart puts the Koa'-agai band of Northern Shoshoni along the Snake River from approximately the mouth of the Bruneau north to the upper Weiser River area, which has implications for evaluating the cultural resource potential of the Bruneau, Castle Creek, and Crane Creek KGRAs.


This report of archaeological reconnaissance focuses on the Salmon Falls drainage to the southeast of the Bruneau and Castle Creek KGRAs, in a canyon and uplands environment similar to that of the study units. Thus, material in this report is relevant to evaluating the potential cultural resources in the KGRAs.


Documentation of use of the valley by trappers, pioneers, and suppliers.


This report of surveys of proposed Snake and Salmon River reservoirs notes a high density of prehistoric sites in the Snake canyon between the mouth of the Bruneau and the Weiser, including the reverine portion of the Castle Creek KGRA. The largest concentration of sites, however, was in the foothills.
While this monograph focuses on the Birch Creek valley, well to the northeast of the selected KGRAs under discussion in this report, one must evaluate the relative significance of the KGRA prehistoric resources within Swanson's cultural model. This Birch Creek paper serves as one of the most basic models for explaining cultural adaptation and development within the northern Great Basin.


This description of surface collections is the basic typology used in southwestern Idaho archaeology ever since, and while it contains few data specific to the KGRAs it is relevant to understanding the general cultural chronology in that region.


This description of the materials recovered during the 1959 archaeological reconnaissance includes some information about the Castle Creek KGRA, but very little. It is useful for understanding the general range of cultural materials found in prehistoric sites in the Castle Creek and Bruneau KGRAs.


Lewis and Clark comment on the presence of Shoshoni villages on the Weiser River, which has implications for evaluating the potential cultural resources of the Crane Creek KGRA.


This multi-volume set of diaries and journals includes several general references to Indian populations in southwestern Idaho. However, because of variations in geographic place names and the absence of maps it is rarely possible to locate specific camps today. They do provide ethnographic and historic data for development of a model of expected cultural resources within several of the selected KGRAs.


This study is well to the southeast of the Bruneau KGRA, but in a topographic setting similar to the Bruneau and Castle Creek KGRAs. It thus serves as another model for evaluation of potential cultural resources within those localities.

This early paper on Shoshonean ware from prehistoric sites in southern Idaho is still a basic statement on the subject, and relevant to evaluation of the prehistoric cultural resources within all the KGRAs (and particularly Castle Creek, since Shoshonean ceramics are known from sites there).


This report of the 1958 Idaho State University reconnaissance of the Snake River Canyon around Guffey identifies several prehistoric archaeological sites that fall within the Castle Creek KGRA; it is available on a "need to know" basis.


This pipeline survey south of the Bruneau KGRA indicates that the area was originally occupied by both Northern Paiute and Shoshoni who used the Owyhee Uplands as a summer hunting ground.


This small rockshelter is northwest of the Castle Creek KGRA, probably was occupied between several times over the past 4000 years, and indicates a continuing reliance on resources during that period.


These records are available from Boise National Forest only on a "need to know" basis, and are basic descriptions of identified architectural properties within the Forest.


Segments of the Oregon Historic Trail through the Castle Creek and Mountain Home KGRAs have been declared to have "high potential" for recreational development.


These records are basic descriptions of identified archaeological and historic architectural properties on District lands, and are exempted from public disclosure by 90 Stat. 1942.


These two sets of land survey and ownership data provide excellent historical records of land use patterns. The plats are the actual survey maps drawn per township, with structures recorded for the most part; the tract books contain land ownership and transfer records.


This description of the Glenns Ferry Formation is basic to an evaluation of the paleontological resource potential in the selected Idaho KGRAs along the Snake River valley.


This complex of sites lies ca. 15 km north of the Crane Creek KGRA, and similar sites are likely to occur within the latter vicinity.

G. Webster, "Dry Creek Rockshelter: Cultural Chronology in the Western Snake River Region in Idaho," *Tebiwa, Miscellaneous Papers of the Idaho State University Museum of Natural History No. 15* (1975).

The Foothills Rockshelter, just northwest of Boise, has a full 4000-3000 year sequence of cultural materials and serves as a model for understanding human settlements along the northern foothills edge of the Snake River plain.


Ogden probably passed through the Castle Creek and perhaps Bruneau KGRAs during 1928, though he makes little specific comment about those localities.


This basic description of paleontological materials includes information relevant to evaluation of heritage resources in both the Castle Creek and Bruneau KGRAs.

F. G. Young, Editor, "The Correspondence and Journals of Captain Nathaniel J. Wyeth, 1831-6," *Sources of the History of Oregon* 1(3-6) (1899).

Wyeth's 1832-33 expedition across southern Idaho passed through the Castle Creek KGRA, but it is not possible to find specific campsite locations today on the basis of his descriptions.

**SOCIOECONOMICS AND DEMOGRAPHY**


Idaho Department of Employment, Personal communication from Mr. David Porter, Boise, Idaho, November 1, 1978.


**GEOLOGY**


Geology of small area south-southwest of Crane Creek KGRA (BSU Library).


Original descriptions of Idaho Group sediments and surficial geology in Castle Creek Area.


An evaluation of data is presented here indicating crossplots of transit time, porosity, and density versus depth which are most useful in determining producing zones.


The Raft River, Boise, and Cascade geothermal areas are discussed in this publication. A generalized description of the Raft River system includes surface and borehole geophysical interpretations.


Ninety-eight radiometric dates presented for Snake River Plain documenting eastward transgression of Snake River Plain volcanism. Problems of correlations and ages of some map units discussed.


Oligocene collapse of Eocene north-south highland axis across present Snake River Plain. Defines Snake River Plain as a tensional rift. Paleobotanical maps.

C. Axelsen, *Pennsylvanian Stratigraphy in South-Central Idaho and Adjacent Area*, Oregon State University, M.S. Thesis.


Weiser River as an antecedent stream across recent fault blocks but originating on the homoclinal slope of earlier rotated fault blocks.


Regional gravity data.


Seismic refraction profiles indicate basaltic crust under Snake River Plain that thins eastward. The presence of "granitic" crust under eastern Snake River Plain has not been established.


Regional heat flow values presented.

Brief description of sedimentary deposits along south side Snake River. Names the Poison Creek Formation.


Description of Payette Formation sediments and geologic age assigned by fossil data.


Discussion of Cougar Point Welded Tuff (Late Miocene age) probably equivalent to part of Idavada Volcanics. Relation to source dikes discussed.


K. L. Cook, "Regional Gravity Survey in Northern Utah (abs.)" Geophysics, 23 p 400.


Classified fossil fish collected from sediments near Castle Creek as Pliocene in age. Apparently Cope's Idaho Formation also included Pleistocene deposits. This bibliographic citing is not readily available.


Review of Payette Formation and Idaho Formation stratigraphy in eastern Oregon — western Idaho and problems of relationships between the two.


This report presents the basic data from the core holes that had been collected to September 1975, and includes lithologic and geophysical logs, chemical analysis of water, and laboratory analysis of cores.


Description of Idaho Group sediments in areas east of Bruneau KGRA.


ERTS lineament study — showed strong correlation of geothermal sites with linear trends.


Discussion of fluidal ash flow tuffs in Owyhee Mountains, southwestern Idaho and their petrogenetic significance.


Uncolored preliminary geologic map 1:250,000 complete description of map units — some reference to older/other formational terminology — no other text.


On north side of river, basalts interbedded with fluvial sediments; basalt flows are 10-50 feet thick, dense and fine-grained at the base, coarse-grained in the middle, and fractured at the top. On the south side the flows are fewer in number and interfingered with many sediments.

D. E. French, Geology and Mineralization of the Southeastern Part of the Black Pine Mountains, Cassia County, Idaho, Utah State University, M.S. Thesis.

Canyons in Snake River Plain basalts filled by younger basalt.


Regional tectonic model.


Regional tectonic setting and possible tectonic cause of Snake River Plain.


Fairly complete summary of general geology of Snake River Plain.


Western Snake River Plain is a graben filled with Pliocene and Pleistocene sedimentary and volcanic rocks to a depth of at least 3000 feet below the present surface of the Plain. Three northwest gravity anomalies parallel to major graben boundary faults.


Crustal structure of western Snake River Plain.


Crustal structure of western Snake River Plain.

Crustal structure of western Snake River Plain.


Geology north side of Mount Bennett Hills, north of Mountain Home KGRA.


Brief geologic reference.


Discussion of relative correlation of Cenozoic sediments of western Snake River Plain and northwestern corner of the Plain.


General descriptions of various igneous and volcanic provinces and petrographic data on rocks in these provinces.


Discussions of the origin of the Snake River Plain.


Described stratigraphy of silicic volcanic rocks in southeastern part of Owyhee Mountains. Stratigraphic nomenclature superseded by that of Ekren, McIntyre, Bennett, 1978.


Petrography and chemical analyses of basalts of western Snake River Plain, including McKinney Basalt. Petrogenetic model for evolution of basalts presented.


Petrochemistry and genetic model for Snake River Plain basalts.


Petrochemical data — mainly isotopic — of Snake River Plain lavas — upper mantle source area for magmas.


Generalized geologic map but good lithologic descriptions of surficial rocks. Discussion of faults with subsurface control on some faults.


Regional gravity data presented.

Prominent gravity anomaly in western Snake River Plain — Cenozoic volcanic plus sedimentary rocks at least 7 km thick.


Eastward transgression of silicic volcanism and related geothermal potential in relationship to this volcanism.


Correlation of volcanic marker beds in fossiliferous lake and stream deposits along 50 miles of Snake River. Stratigraphic columns of Glenns Ferry Fm.: structural contour map of part of Glenns Ferry Fm. in King Hill area.


Most detailed geologic map covering Mountain Home KGRA.


Descriptions of McKinney and Wendell Grade Basalts and relationship to Late Pleistocene history of Snake River.


General description of stratigraphy identification of tectonic/physiographic provinces; eastern and western Snake River Plain. Two structural parts to Plain; northwest trending graben in west, downwarp in the east, with geologic and gravity map.


Best geologic mapping available that correlates units from Mountain Home area to Castle Creek area.


Classification of stratigraphy into unnamed Miocene rocks, Idavada Volcanics, Idaho Group, and Snake River Group. Further subdivision of these four main groups of rocks; thicknesses (general) given. Stratigraphy given in figures. Cross sections through Boise, Mountain Home, and King Hill.

Geophysical-geological evidence for western Snake River Plain boundary faults given. At least 9000 ft of displacement indicated.


12 K-Ar dates over entire area of batholith, primary age 125 m.y. — most recent thermal event occurred in the upper Eocene, i.e., probably addition of Tertiary plutonic rocks.


Most detailed geology of Weiser — Crane Creek KGRA areas — with text. Discusses problems of stratigraphic correlations.


Descriptions of geologic units west-southwest of Castle Creek KGRA.


Fish fossils in sediments of southwestern Idaho.


Physiographic subdivisions of western Snake River Plain. Brief summary geologic descriptions with generalized maps (approx. scale — 8 miles to the inch). Details of hydrology of Snake River Plain. Summary lithologic descriptions of water-bearing formations of western Snake River Plain. Abundant hydrologic data.


A descriptive analysis of hydrology of the Basin in response to concern over overpumping of groundwater for irrigation. Geographical background information is included.


Pliocene & Quaternary faulting and folding adjacent to western Idaho.


Generalized geology of western Idaho border including Crane Creek KGRA. 50-3000 ft displacement on faults — generally normal faults dip 60-85° with a few high angle reverse faults.


General assessment of geothermal areas in Idaho.


Crustal structure of western Snake River Plain.

Bibliographies of studies concerning the Snake River Plain including geology and groundwater bibliographies.


General description of surface geology. General hydrologic review with geologic map (superseded by later mapping).


Stratigraphic correlation of ash beds in area near Hagerman, Idaho.


Problems of tectonic models of Snake River Plain discussed. Lack of subsurface geometric controls does not allow choice of one specific model.


General geologic descriptions. General lithologies of aquifers. Some small scale regional hydrology maps.

Surficial geology of region encompassing Castle Creek-Bruneau KGRAs summarized. Subsurface data from water wells in the region Hydrology discussed.


Fairly good summary of geologic data including subsurface well data. Generalized geologic map of area west of Mountain Home KGRA.


Idealized hydrologic sections showing general relation of geologic units to inferred ground water movement.


Summary of geologic history of Idaho.

Detailed geologic descriptions of mercury mining area east of Weiser, south of Crane Creek KGRA. Geologic map 1 in. = 400 ft.


Lists locations of surface geothermal waters.


Summary of geologic history and tectonic development of Idaho.


Miocene Columbia River Basalt — tilted 15-30°W Early-Middle Pleistocene lacustrine deposits tilted 20° as result of block faulting.


Very general reconnaissance geologic map of area including Vulcan KGRA. No faults indicated. Model analysis of granitic rocks in area.


General stratigraphic descriptions from areas west of Weiser. Small scale geologic map — as far east as Weiser River (west of Crane Creek KGRA. Map superseded by McIntyre 1973).


Questions thickness of basalts in western Snake River Plains graben.


Many lakes in Payette time-lake sediments interbedded with basalts — pre-Snake River Plain Subsidence.


Questions Miocene age of Kirkhaus Payette Formation from type location near Weiser based on one fossil.


Petrochemical data on western Snake River Plain lavas.


Petrochemical-petrographic data on Snake River Plain lavas.


Petrochemical-petrographic data on Snake River Plain lavas.


Postulated horizontal displacement along Snake River in Glenns Ferry-King Hill and Shoshone Falls areas.


Extension of Sierra Nevada batholith to connect with Idaho batholith — 50 miles lateral displacement between two batholiths since Oligocene time. Gravity-seismic layer interpreted in terms of surface geology indicate granite underlying western Snake River Plain.


Petrochemistry and isotope data supplied for Snake River Plain basalts. Genetic model for basaltic volcanism addressed.


Descriptions of rock types presented in this area along with lithologic logs of wells in the area. Depth of these logs does not exceed 1000 feet.


General geologic history.

Assesses standard groundwater parameters of the basin, updating data of Nace (1961), with minor discrepancies.


General geologic setting and description of sedimentary rocks.


Location listings of thermal water occurrences and temperature data.


Paleogeologic data of Cenozoic of southwestern Idaho including geologic evolution, model, and tectonics of Snake River Plain.


Discusses paleogeology of western Snake River Plain and untested oil and gas exploration targets.


Cenozoic paleogeography model discussed along with Cenozoic volcanism.


Good description of tectonic setting and general stratigraphy of Snake River Plain. Describes model for rifting. Deep hole data for Mountain Home KGRA and other parts of Snake River Plain.


Cenozoic paleogeology of southwestern Idaho briefly discussed — Cenozoic rifting model outlined — areas of geothermal potential outlined.


A comprehensive geologic overview with geothermal emphasis is presented here.


Hydrothermal alteration along bedrock faults. Fault related hot springs. Microseismic activity in Cascade area discussed.


Fault map at 1:62,500 of Cascade area. Microseismic data suggest E-W trending faults are the more active in the Cascade region.


Active fault map (1:500,000 scale) with text. Principally compilation of published data and unpublished U.S. Geological Survey mapping data.


Primarily restatement of 1973 data.


Regional geothermal occurrences in Idaho, temperature and chemical measurements from surface waters. Very limited geologic data of geothermal areas.


Descriptions of lithologies in Mountain Home area. Geophysical logs of water wells; estimate of depth to basement in Mountain Home area. Groundwater data.


General geologic descriptions of surficial rocks with some well data and hydrogeologic model.

Generalized geologic map (1:250,000). Some well data south-southwest of Crane Creek KGRA model for source of geothermal water discussed.


General stratigraphy described along with inferred Cenozoic tectonics. Descriptive lithologic log of 3808 foot deep drill hole located approximately 19 km south of the Mountain Home KGRA. Drill hole bottomed in thick basalt flow.


Presents resistivity maps and graphs plotting resistivity (in ohmmeters) versus Darzarrouk depth in metres.


Results from a geo-electrical survey of the resource area, indicating the method is useful for predicting depth to hydrothermally altered sediments.


Depth to pre-Tertiary basement sediments (possibly) in eastern Snake River Plain.

GEOTHERMAL


An evaluation of data is presented here indicating crossplots of transit time, porosity, and density versus depth which are more useful in determining producing zones.


Regional heat flow values are presented.


ERTS lineament study showed strong correlation of geothermal sites with linear trends.


General assessment of geothermal areas in Idaho.


Location listings of thermal water occurrences and temperature data.


A comprehensive geologic overview with geothermal emphasis is presented here.


Hydrothermal alteration along bedrock faults. Fault related hot springs. Microseismic activity in Cascade area discussed.


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Results from a geo-electrical survey of the resource area, indicating the method is useful for predicting depth to hydrothermally altered sediments.

**SOILS**


This survey was the basic source of information on soil and landtype characteristics with the Vulcan KGRA. It is available on open file in the Boise National Forest Supervisor’s Office in Boise.


This report contains information on soil characteristics such as texture, depth of profile, permeability, salinity/alkalinity, irrigability class, land types, parent materials, and natural plant communities. The mapping units are soil associations and individual soil boundaries have not been drawn. This type of soil survey is one of a general nature designed to obtain maximum information about soils important to determining irrigability and for broad land use planning.

Soil Conservation Service detailed soil surveys mapped on aerial photographs (1:20,000) on open file in county SCS offices. Soil descriptions and interpretive tables are provided by SCS central office in Boise, 304 N. 8th St.

**Mountain Home KGRA.** Soil survey covers Section 1, T4S, R8E and Sections 6 and 7, T4S, R9E. Legend is in Elmore County Handbook. Elmore County SCS Office, Mountain Home, Idaho.

**Bruneau KGRA.** Soil survey covers portions of Sections 15, 23, and 26, T7S, R6E. Legend is in Owyhee County Handbook. Owyhee County SCS office, Grandview, Idaho.
Castle Creek KGRA. Soil surveys include portions of 11 sections in Owyhee County (T3, 4, 5S, R1E), legend is in Grandview office; and Sections 23, 24, 25, 26, 35, and 36 in Ada County, legend in Meridian, Idaho.

Crane Creek KGRA. Soil survey covers portions of Sections 17 and 18, T11N, R3W and Section 12, T11N, R4W. Legend is in Washington County SCS office in Weiser, Idaho.

Soils are classified to series and phase. This is the most detailed type of soil survey and is adequate for all activities involving soil uses and impacts which would accompany geothermal development. Soil chemistry data is lacking except for pH, alkalinity, and salinity.

Soil Conservation Service land use maps, April, 1973 series. Blue line maps at the scale of 1:126,720 (1/2 inch:mile). Provided by SCS central office in Boise, Room 345, 304 N. 8th St.

Mountain Home KGRA. Elmore County, sheets 1 and 2.

Bruneau KGRA. Owyhee County, sheet 6.

Castle Creek KGRA. Owyhee County, sheets 1 and 3.

Crane Creek KGRA. Washington County, sheet 1.

The following land uses are denoted: surface and sprinkler irrigated cropland, nonirrigated cropland, rangeland, forest and woodland, water and wetland, recreation — nonurban land, and urban and built-up land. Up-to-date land use maps (agriculture oriented) are maintained by each SCS county field office.


U.S. Bureau of Land Management land capability class surveys mapped on 7-1/2 minute (1:24,000) USGS topographic maps. Prepared by Boise District Office of BLM, 5th and Bannock, Boise, Idaho for Owyhee County (Bruneau and Castle Creek KGRAs).

These maps constitute reconnaissance soil surveys designed to determine land capability class primarily for irrigability. Class is denoted by a system of symbols which summarize or code information on soil texture, depth, drainage, alkalinity/salinity, slope, parent materials, and limitations. These data are adequate only for determining suitability of the land unit for irrigation and for broad land use planning.

U.S. Bureau of Land Management soil association map for Crane Creek KGRA prepared by Boise District, BLM to provide baseline information for Environmental Analysis Report, 1976.

Broad soil associations were delineated on a 1:24,000 USGS topographic map based on similarities in soil depth, texture, and land slope. Areas of erosion hazard are shown. This survey is adequate only for broad land use planning.


This is the working document soil and landtype characteristics within the KGRA. Landtype descriptions include subsections on: location, management zone, extent, topography, geomorphic features, bedrock characteristics, vegetation, soils, management qualities, and management evaluation. The soils subsection gives abbreviated information on texture, composition, and depth
and refers to the soil by number. These soil numbers are contained in a table giving classification of the soil and more detailed information on texture, composition, and depth.

This document is available on open file in the Boise National Forest Supervisor's Office in Boise or the Cascade Ranger District Office in Cascade.


Very general information on all aspects of the South Fork Planning Unit. General statements on soils but no specific information on the Vulcan KGRA. Copies available upon request at Boise and Payette National Forest Supervisors' Offices (Boise and McCall) and at the Cascade Ranger District Office.


This EAR attempts to address all aspects of the environment as they would be affected by geothermal development. A landtype map is included but the reader is referred to the Soil Hydrological Reconnaissance report for additional information on soils and landtypes.


**HYDROLOGY AND WATER QUALITY**


Average precipitation in the Owyhee Mountains of southwestern Idaho ranges from 8 inches in the lower part of the Owyhee Mountains to 28 inches at the highest elevation. Total annual precipitation increases about 4 inches for each 1000-foot increase in elevation. Since high intensity rainfall is strongly localized, there is a high probability that it will not be sampled by a single randomly placed gage. The study reinforced previous observations that rain gage densities of 1 or 2 per 100 square miles are not adequate to determine probability of infrequent high intensity rains within reasonable time.


This report presents the basic data from the core holes that had been collected to September 1975, and includes lithologic and geophysical logs, chemical analysis of water, and laboratory analysis of cores.


The Raft River Basin in south-central Idaho and the Reynolds Creek experimental watershed in southwest Idaho were studied to determine precipitation distribution in an attempt to develop better isohyetal maps for semiarid mountain valleys. Two methods were used to determine precipitation distribution. The computer isohyetal method worked well, but should be used only where a dense gage network is available. The Thiessen method was preferred in areas where gages are spread out.

Through adaptation of the National Weather Service River Forecast System (NWSRFS) Snow Accumulation and Ablation model, this study estimates the frequency of water available for runoff (WAR) from snowmelt and precipitation over the agricultural areas of Idaho's Snake River Basin. The report outlines the adaptation, testing, and use of the NWSRFS model, presents maps of 4- and 15-day WAR values at return periods of 2 and 100 years, and discusses seasonal variation of WAR and differences between WAR-frequency and precipitation-frequency values.


A dense precipitation gage network is an integral part of the hydrologic studies in the Reynolds Creek experimental watershed located in southwestern Idaho. Overall, the study is to gain a better understanding of the role of the land and the influences of vegetation, climate, and land management on the movement of water and sediment. Accurate point measurements of precipitation at sufficient sites to determine the temporal and spatial variations in precipitation are needed to develop a predictive hydrologic model.


The Bruneau-Grandview area is arid and irrigation is essential for stable agricultural development. Nearly all usable indigenous surface water in the area is appropriated, including flow from the Bruneau River, which is used for power generation at the C. J. Strike Dam. Sedimentary and igneous rocks underlie the area which contain economically important artesian aquifers. The chemical quality of the water is unsuitable for irrigation and domestic use due to moderate levels of dissolved solids, high percent sodium, and excessive concentrations of fluoride.


A descriptive analysis of hydrology of the Basin in response to concern over overpumping of ground water for irrigation. Geographical background information is included.


This is a brief abstract and summary of studies conducted in cooperation with the U.S. Bureau of Reclamation concerning ground water aspects of the alternative plan for irrigation of the Mountain Home Project. This mentions what has become known in the Sloan Plan for using ground water in Boise Valley and diverting some waters by exchange on to the Mountain Home desert.


Climatological Data is published monthly by NOAA and reports daily temperature, daily precipitation, and snowfall data. The monthly reports are summarized in annual data summaries.

The study concentrates on a consideration of the geologic factors in the evaluation of Idaho's geothermal potential, and on the assessment of the principal commercial uses of hot waters in the state. The investigation covered geochemical sampling of five of the most promising geothermal areas known, plus two additional that seemed to warrant further study, with location, temperature, and chemical data tabulated. Greater potential is seen in the use of such hot water for home heating and commercial greenhouse agriculture.


The report is based on two months of field work in 1922 which was conducted to determine potential of developing additional ground water for use in irrigation. The report is very general and serves as a reconnaissance study of the region.


Ground water in the Mountain Home region is used as a primary source of domestic and irrigation supplies over most of the area. The Glens Ferry Formation, a thick intertonguing deposit of lake and stream sediments, and the Bruneau Formation, sediment and basalts, comprise the primary aquifers in the region. The Bruneau Formation in the western portion of the study area yields large quantities of water to wells at pumping lifts at 390 feet. The Glens Ferry Formation in the eastern portion of the study area yields only small quantities of water to wells with discharges of 20 to 100 gpm common. Hot artesian flowing wells have been developed near the Mt. Bennett Hills east of Mountain Home.


Ground water is utilized as the primary source for domestic and irrigation supplies in northern Owyhee County. Four geologic formations are most important as aquifers in the nearby area: Tertiary Silicic Volcanics, Poison Creek Formation, Banbury Basalt, and Glens Ferry Formation. The study area has been divided into seven hydrologic subareas. Each subarea is discussed in detail with respect to current ground water utilization and development. The quality of the ground water in much of the study area is only fair for irrigation and domestic use because of a salinity hazard and excessive fluoride concentrations.

Hot ground water may be found in many parts of Idaho. The history and present use of the resource provides useful insight into the utilization of thermal effluents. Water from 32 to 85°C is piped into greenhouses for heat dissipation and then used for irrigation and water ranging from 29 to 38°C is piped through hot water lines and heaters in homes for residential heating. Hot water is applied directly or after cooling in a pond to hay and grain crops which lengthens the growing season providing the farmers with an extra cutting of hay.


Channel-width measurements were used to estimate annual peaks with a recurrence interval of 10 years at 79 sites in Owyhee County, Idaho, and adjacent areas. These discharges and those from 33 gaging stations are plotted on a map of the area. The map is provided to allow a user to interpolate between sites or otherwise transfer the data to a site of interest.


The first comprehensive inventory and evaluation of thermal ground water in the state of Idaho since 1925 shows that such water can be expected in wells and springs almost anywhere along the margins of the Snake River Plain or in valleys south of the Plain. Although no steam has been observed, water in a few wells is boiling, and temperatures of many springs are only slightly lower. Sodium and bicarbonate are the dominant ions in most waters, although a few highly mineralized springs are the sodium-chloride type.


This is a report of Russell's reconnaissance surveys of artesian well situations in Idaho and Oregon. Flowing wells reported on included those near Hot Spring, the Whitson Ranch on the east side of the Bruneau River Valley, those in Little Valley 9 miles west of Bruneau, a well near Guffey in a small valley cut by Dry Creek, and wells near Barnard Ferry 7 to 9 miles northwest of Guffey.


The Vulcan Hot Springs KGRA is a potential site for power generation with geothermal energy. Insect communities in Vulcan Hot Springs (VHS) and the South Fork Salmon River (SFSR) above and below its confluence with the thermal flow were investigated.


Results of a survey for dental fluorosis in the valley indicating almost half of those surveyed had some type of dental anomalies possibly associated with drinking water of the area.

The development of Idaho's ground-water resources has expanded at a very rapid rate in recent years which has been accompanied by a decline of local and, in some cases, ground-water levels. The ground-water-level data presented in this report were collected to provide the basic data needed by agencies and individuals interested in developing, managing, and administering the ground-water resources in Idaho. A statewide network of observation wells, established by the U.S.G.S. in cooperation with the Idaho Department of Water Resources, serves to monitor the seasonal and long-term water-level changes occurring in the many aquifers of Idaho.


Systematic depth-to-water measurements were begun about 1912 in Idaho by the U.S. Reclamation Service in connection with drainage problems on the Boise and Minidoka projects. A comprehensive investigation of the ground-water conditions of the Snake River Plain and Tributary drainage basins in southern Idaho was begun in 1928 by the Geological Survey in cooperation with the Idaho Department of Reclamation and the Idaho Bureau of Mines and Geology. The observation-well network changes continually, as wells are added and deleted occasionally for various regions. This report contains all data for discontinued observation wells from 1915-1972 and should make the information more useful to investigators, planners, developers, and administrators.


Summarizes monitoring and research efforts conducted in 1978 to characterize impacts due to geothermal development.


G. R. Stephenson and R. A. Freeze, "Mathematical Simulation of Sub-Surface Flow Contributions to Snowmelt Runoff, Reynolds Creek Water-shed, Idaho" *Water Resources Research, 10*

A mathematical model of subsurface flow complements a field study of snowmelt runoff in a small upstream source area in the Reynolds Creek experimental watershed near Boise, Idaho. The mathematical model provides a two-dimensional transient saturated-unsaturated analysis of the subsurface flow at the fluid site which is a valuable aid to generate a unified interpretation of the field measurements.


This report is a compilation of information on consumptive use and irrigation requirements for various agricultural crops grown in Idaho. Over 80 separate stations where climatological data are collected have data reported on consumptive use per acre and consumptive irrigation requirements.
A method is described for estimating peak discharges at 10-, 25-, and 50-year recurrence intervals for most small streams in Idaho. Reliable estimates can be obtained using this method, but there are significant limitations and variations which should be considered.


This is an extensive review report of the water and land resources of the Columbia River and its tributaries. The report contains extensive information on hydrology and land resources. Of particular value are detailed isohyetal maps of normal annual precipitation which is in greater detail than most other previous studies. Stream profiles are included that would be of use in detailed hydrologic studies.


This volume is one of a series of reports presenting monthly and yearly summaries of stream flow and reservoir data collected by the Geological Survey. Included with these data are some records furnished by other federal, state, and private agencies.

University of Idaho, Preliminary Inventory of the Water Resources of Idaho (1968).

Historical records, as well as current conditions, are utilized to identify the sources of water, the magnitude of yields and flows, the dependability of the supply, the character of the water, and the extent of water use. The report is organized into chapters on climatology (atmospheric water resources), surface water, ground water, water use and water control, and water rights. An atlas is included which delineates climatological and surface water supply information, availability of ground water to wells, presently irrigated land, locations of decreed water rights, and other hydrologic and water use information.


This report deals with chronic fluoride toxicosis in domestic animals at Raft River, soils analysis, and water quality.


Much arable land in the Raft River Basin, Idaho lacks water irrigation, and the potentially irrigable acreage far exceeds the amount that could be irrigated with the basin's 140,000 acre-feet estimated annual water yield. Pumping more ground water is possible only if large additional ground-water storage depletion can be tolerated. Transmissivity of the composite aquifer is estimated to vary from about 10,000 gpd/ft to more than 45,000 gpd/ft. The depletion of ground-water storage during the years 1952 to 1965 was approximately 410,000 acre-feet, by the end of 1966 it was nearly 515,000 acre-feet.

The U.S. Geological Survey has outlined two known geothermal resource areas (KGRAs) in Idaho. One of these is on the State's eastern border next to Yellowstone Park and the other is near the south-central border along the Raft River. Another reconnaissance has outlined 5 areas in addition to the two KGRAs of the USGS, which show indications of probable geothermal potential. Surface conditions in the 7 favorable areas indicate that most of the areas are of the hot water type system rather than the vapor dominated type.


Development of ground-water resources has caused water-level declines in several locations. The greatest declines are south of Mountain Home, where water levels dropped more than 20 feet in the last 9 years. Recharge to the ground-water system is from the Boise River drainage basin, precipitation on the plateau and adjacent mountains, and leakage from irrigation structures. The chemical composition of the ground water generally reflects water characteristics in the area of the source or recharge and is considered good. Additional large-scale ground-water development will probably result in economically prohibitive pumping lifts, which also would consume excessive amounts of energy.


The principal use of water in the basin are in the basalt of the Columbia River Basalt Group and the overlying Tertiary and Quaternary sedimentary rocks. Reported well yields in basin range from 1 to 1,835 gallons per minute (0.063 to 122 liters per second). Ground water in the basin is generally of good chemical quality, with dissolved solids concentrations usually less than 200 milligrams per liter. Surface waters of the basin are also considered to be of good chemical quality.


**AIR QUALITY**


EPA requirements, emissions inventory, mitigations, monitoring system in Idaho.


Extensive report dealing with many aspects of $SO_x$ and $NO_x$, including environmental impacts on soil, forest, and fisheries. Notes on social and real costs of emissions. Discusses some problems associated with geothermal and related projects.

Indicates the relationship of SO$_2$ with population centers as compared to rural areas. Discusses diffusion rates.


Discusses gas measurement through indirect monitoring practices.


General statement covering aspects of power generation. Excellent bibliography on state-of-the-art, emission control.


One chapter devoted to air quality. Indicates federal laws and interpretation as they relate to air quality.


Reported on five stations in Idaho. Identified sources, levels, and diffusion of particulates.

*Geothermal Abstracts, Part B* (University of Idaho Library)

Published six times a year. Has section on reports and papers dealing with air quality.


Reviews the emissions problems associated with the Geysers Geothermal Project, California. Discusses noise, air pollution, mitigation.


Discusses probability of quasi-stationary anticyclones. Southern Idaho has high probability of air stagnation.


Outlines alteration of SO$_2$ to H$_2$SO$_4$ in fog.

Indicates presence and distribution of gases as they are associated with energy production and population centers.


Discusses the presence of aerosols in onshore air. Can be used to measure any increase.


Large accumulation of meteorological data including upper air conditions. Data can be used to calculate stagnation possibilities.


Source for literature on air quality.


Discusses applied techniques for microclimatology and climate change associated with industrial and population centers.


A survey of literature dealing with climate change, microclimates.


Discusses microclimate and changes that occur when pollutants are concentrated.


Snake River Regional Studies Center, Donna Parsons, Director, College of Idaho, Caldwell, Idaho 83605.

Depository for papers written on subjects dealing with southern Idaho. Some papers on air quality.


Discusses mixing and ventilation in mountain canyons. Information could apply to central Idaho.

Discusses mixing and ventilation in mountain canyons.


The most comprehensive document to date outlining air quality. Data are limited to problem areas.


- Monitor, collect, publish air quality data for the State of Idaho.


- Comprehensive statement of all laws in Idaho relating to air quality. Includes aerosols, emissions, odor, etc.

State of Idaho Department of Budget, Policy, Planning and Coordination, State Clearing House, 700 West State St., Boise, Idaho.

- Depository for all environmental impact statements of interest or pertaining to Idaho.


- A report providing information as to where information can be found. The reader may select specific topics.


- Provides papers and information on meteorology, climate, atmospheric physics.


- Provides emissions inventory for Boise area including Elmore Country.


- Identifies problems, indicates lack of data to establish baseline studies. Provides good model.


- Establishes guidelines for developing: (a) air quality standards, (b) air quality control regions, (c) control techniques, (d) defines air quality standards, (e) air quality implementation, (f) standards of performance for new stationary sources.
U.S. Environmental Protection Agency, Division of Air Quality, 422 Washington St., Boise, Idaho 83702.

Coordinate and monitor problems dealing with EPA directives.


Identifies SOx as a major source of irritant in the atmosphere, how to deal with it, compliance with the Clean Air Act-1970, status of technology.


Discusses air quality in Idaho. Indicates centers of emissions and types of pollutants.


Provides dispersal forecast for pollutants. Accumulate meteorological data.


Provides summary of climatological data for Idaho stations.

SEISMICITY


Presents interpreted seismic velocities correlating to structure, stratigraphy, and geothermal environment of the area.


Analysis of criteria for evaluating seismicity and the importance of such evaluations.


Map of the geology of the State of Idaho.

Study of faulting near Boise, Idaho with regard to seismic risk.


Compilation of seismic monitoring data from INEL network.


Review of induced seismicity from Rocky Mountain Arsenal well.


Compilation of all data associated with induced seismicity of the Rocky Mountain Arsenal well.


Computer file of earthquake epicenters for U.S.


The results of a series of microearthquake surveys from the Western Snake River Plain and Stanley areas.


The regional stress field as derived from microseismic data, discussion of the tectonic setting of the area.


A discussion of the intermountain Seismic Belt and its structural setting and controls.

R. B. Smith, Personal communication.

Discussions on the results of microseismic surveys from Stanley, Idaho eastward.


Discussion of the regional controls on seismic activity, and the effects of high heat flow.


Analysis of the seismic data for southwestern Idaho and eastern Oregon for the period 1975-1976 and its relationship to historical seismicity.


Geology, geochemistry, and microseismicity of the Cascade geothermal system.


Map and description of active faults in Idaho.

S. H. Wood, Personal communica
ti

Mapping of the geology of the Snake River Plain: Canyon and Ada Counties, in progress.

SUBSIDENCE


Description of geothermal system types of Idaho, and the nature of the rocks found in these areas.


Not available; synopsis indicates that it discusses criteria for subsidence, and proposes some mathematical models.


Map of the geology of the State of Idaho showing known faulting and hot springs.

The Department maintains data on water wells drilled and on various irrigation projects and areas. Publishes reports on water resources. Also has geothermal studies underway that may provide extensive bits of information.


An excellent preliminary report on the subsidence problems in a geologic terrain similar to some of the KGRAs under investigation.


Discussion of the general physical parameters controlling subsidence, and specific comments on the Arvin-Maricopa area, CA. Also good discussion of hydropcompaction.


Description of northern boundary fault of the Snake River Plain, and discussion of general geology.

National Geodetic Survey, Continuous Updated, Maps of First Order Level Lines, Rockville, Maryland (also available from U.S.G.S., Menlo Park, CA).

First order level data of the United States. Available on maps of entire states. More detail can be gathered by checking maps that are expansions of the state maps. Maps are updated every third year.


Excellent discussion of the problems of subsidence, the controls, and possible cures.


Establishes models for geothermal reservoirs. Some computer synthesis. Appears to be very good at analyzing reservoir size and recharge.


Analysis of subsidence problems in New Zealand. Addresses effects of subsidence on pipelines and plants. Not very definite on geological controls.


Source of extensive work on water resources in Idaho. Repository for U.S.G.S. work in southern Idaho.

Evaluation of sources and controls of the ground-water resources. Gives some excellent data that may be valuable in assessing geothermal.


Excellent assessment of the geological data available on the Bruneau-Grandview area, also includes Castle Creek. Discusses potential recharge and structural controls on the geothermal system.


Analysis of the geology and geophysical data available on the Weiser and Crane Creek areas. Excellent data source.


Analysis of subsidence associated with relatively deep production. Applicable to deep geothermal wells.
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