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CRANE CREEK KNOWN GEOTHERMAL RESOURCE AREA:
AN ENVIRONMENTAL ANALYSIS

Susan G. Spencer
Brent F. Russell
Editors

MASTER**U.S. Department of Energy**

Idaho Operations Office • Idaho National Engineering Laboratory

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An Environmental Analysis

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

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Crane Creek KGRA

ABSTRACT

The Crane Creek known geothermal resource area (KGRA) is located in Washington County, in southwestern Idaho. Estimated hydrothermal resource temperatures for the region are 166°C (Na-K-Ca) and 176°C (quartz). The KGRA is situated along the west side of the north-south trending western Idaho Fault Zone. Historic seismicity data for the region identify earthquake activity within 50 km. The hot springs surface along the margin of a siliceous sinter terrace or in adjacent sediments. Approximately 75% of the KGRA is underlain by shallow, stony soils on steep slopes indicating topographic and drainage limitations to geothermal development. Species of concern include sage grouse, antelope, and mule deer. There is a high probability of finding significant pre-historic cultural resources within the proposed area of development.

INTRODUCTION

EG&G Idaho, Inc., has completed an environmental analysis for the Crane Creek Hot Springs KGRA as part of a comprehensive preplanning environmental program related to the KGRAs in the Snake River Basin of Idaho. EG&G Idaho, Inc., is performing the 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 Crane Creek Hot Springs KGRA is the subject of this report.

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.

Figure 1. Regional setting.

Results from the environmental program thus far include a summary of the environmental concerns related to geothermal development in each of the KGRAs¹, an annotated bibliography of reference materials, detailed reports on the various program elements for each of the KGRAs, a program plan identifying future research needs, and a comprehensive data file. These will serve: (a) as planning tools for state and federal energy, environmental, and land management agencies, (b) as reference documents for developers to shorten and simplify project environmental evaluations, and (c) to identify the significant environmental concerns for each KGRA so that mitigation measures can be incorporated early in the development process.

This report includes available environmental information for the Crane Creek Hot Springs KGRA. The information presented is a compilation of the most recent data available for analyzing the physical environment, biological environment, and human environment for this area. The sources providing the data are identified alongside the subject titles throughout the report. Current commitments and environmental concerns that might affect geothermal development in the region are discussed. Other reports in this series as well as the technical reports which form the basis of this overview are listed in Appendix A and are available from Information Processing in the Information Division at EG&G Idaho, Inc., P.O. Box 1625, Idaho Falls, Idaho 83401.

EVALUATION OF THE ENVIRONMENT

The Crane Creek KGRA is located in Washington County along Crane Creek, which flows west through a steep, narrow canyon and enters the broad Weiser River Valley (Figures 2 through 6). Of the 1757 ha included in the KGRA, 1311 are controlled by the Bureau of Land Management. The remaining lands are privately-owned. Ninety-two percent of the KGRA is utilized as rangeland, while 8% is irrigated cropland.

Figure 2. Crane Creek KGRA.

Figure 3. Topographical map of Crane Creek KGRA.

Figure 4. LANDSAT photograph of Crane Creek.

Figure 5. Crane Creek KGRA.

Figure 6. Crane Creek Hot Springs.

Estimated resource temperatures from the Crane Creek Hot Springs are 166°C (Na-K-Ca) and 176°C (quartz).² Sinter deposits indicate temperatures exceeding 180°C at depth. On the basis of the estimated reservoir temperatures, the Crane Creek resource is one of the two hottest resources in Idaho. The Idaho Department of Water Resources has classified the area as a designated geothermal resource area, therefore, any drilling in excess of 900 m requires a geothermal drilling permit from the State. The hot springs are located on the east side of a fault zone and may be controlled by a deep-seated basement fault. The springs surface along the margin of a siliceous sinter terrace or in adjacent sediments. A chemical analysis of the geothermal fluids is shown in Table 1.

Physical Environment

The evaluation of the physical environment of the Crane Creek KGRA includes climate and meteorology, air quality, geology, subsidence, seismicity, and water resources; these are discussed in detail in the following subsections.

Climate and Meteorology (M. Delisio, GeoTechniques)

No primary meteorological data exist for the Crane Creek KGRA. Data on climate and meteorology included in this report are extrapolated from several sources^{3,4,5,6} and are provided as an estimate of existing conditions (Table 2). The average annual temperature at Weiser, the nearest weather station, is 10.7°C. The average rainfall at Weiser is 533 mm and the mean annual snowfall is 610 mm.

The area is in the zone of prevailing westerlies and polar easterlies wind systems; the contact of the two form fronts and generate the clouds and associated weather activity that occur. Most of the cool air consequent with frontal activity is maritime polar air from the Pacific Ocean while some is the result of continental polar air from interior Canada.

TABLE 1. ANALYSIS OF WATER CHEMISTRY - CRANE CREEK HOT SPRINGS
 11N-3W-7BDB1S
 (in mg/l unless otherwise noted)

Surface temperature	92
(°C)	
Discharge (l/s)	0.3
B	0.0
Ca	29
K	18
Mg	0.5
Na	280
NH ₃	10
SiO ₂	180
Cl ⁻	200
CO ₃	0.0
P ⁻	3.2
HCO ⁻	201
NO ₃	0.01
SO ₄	250
Specific conductance	250
(mhos/cm)	1629
pH	7.8
Total dissolved solids	1059

TABLE 2. SUMMARY OF CLIMATIC CONDITIONS

Temperature (°C)

107

Precipitation (mm)

total annual 1143

Wind

(no surface data available)
850 mb level airflow

Spring - W
Summer - W to NW
Autumn - SW
Winter - S to SW

Stagnation (%)

Summer: Night-time windspeed 11 km/h or less - 60%
Inversion based 150 m or less above ground - 37%

Autumn: Night-time windspeed 11 km/h or less - 50%
Inversion based 150 m or less above ground - 53%

Damaging storms occur infrequently; most are associated with thunderstorms or a fast moving cold front. Hail damage occurs less than 1% of the time in any month.

Air Quality (E. Bentley, GeoTechniques)

Air quality data are extrapolated from that collected at Weiser by the Environmental Protection Agency and the Idaho Department of Health and Welfare. Crane Creek KGRA is isolated from the major population center at Weiser by a distance of 48 km. Air circulation from Weiser tends to be southeasterly and away from the KGRA; therefore, conditions in Washington County are not represented by conditions in Weiser. Overall, the county exceeds primary standards for particulate matter. Two sources of pollutants have been identified in the county; both are located in Weiser. Petty Redimix and Weiser Feed and Storage generate 2032 kg and 4064 kg, respectively, per year. No data are available for sulfur dioxide, nitrous oxides, hydrocarbons, or carbon monoxide.

The Crane Creek geothermal site encompasses a deep canyon that is geographically isolated from any major population centers; therefore, the impact on air quality in these areas by geothermal development will be minimized. Due to the physical geography of the area, gravity winds are a problem in the fall and spring of the year. During the evening hours, down-canyon movement of cool air can be expected and fog generated at the geothermal site could be carried as far west as the city of Weiser. Any plans for geothermal development in this area should consider this problem.

Geology (R. Hardyman, GeoTechniques)

The Crane Creek KGRA is located along the west side of the north-south trending, Western Idaho Fault Zone that in part separates the Idaho Batholith to the east from the Payette Basin to the west. Cretaceous Idaho Batholith rocks are exposed approximately 20 km east

of the KGRA. Older Mesozoic and Paleozoic metavolcanic and metasedimentary rocks are exposed approximately 11 km northwest of the KGRA. These rocks and perhaps Cretaceous Idaho Batholith rocks are believed to form the basement complex under the Crane Creek KGRA.

The surficial geology in the Crane Creek KGRA consists of rocks ranging in age from Miocene to Holocene. Most of the exposed bedrock in the KGRA consists of basalt to latite lava flow rock or volcanoclastic sedimentary and arkosic sandstones of Miocene age. The sedimentary rocks overlie the lavas in angular unconformity. The existence of sedimentary rocks of Pleistocene age has not been confirmed in the Crane Creek KGRA area. The youngest deposits in the area consist of landslide debris (minor) and surficial alluvium deposits of the Holocene age.

The oldest rocks in the Crane Creek KGRA are lava flow rock and interbedded volcanoclastic sedimentary rocks of Miocene age. Lava flows consist primarily of nonporphyritic fine-grained or ophitic olivine-bearing basalts. Some nonporphyritic flows of andesite or latite composition are also locally present in the sequence. Lava flows are generally 15 m or less in thickness and are commonly separated by thin layers of basaltic clinker material, fine-grained basaltic ash, rarely silicic vitric tuff, or pumice lapilli tuff. The exact stratigraphic relationship of these lavas to Columbia Plateau Basalts, mapped regionally to the west and northwest of the Weiser area, is uncertain. The aggregate thickness of the lava flows in the KGRA may be as much as 300 m.⁷

Younger Miocene sedimentary rocks unconformably overlie the basalt flows in and to the west of the KGRA. Fine-grained volcanoclastic rocks and coarse-grained arkosic sandstone are the dominant lithologies in these sediments. Locally, thin beds of flood-plain deposits rich in plant debris and thin lignite layers are present. Most of the sandstone exposed in the KGRA is silica-cemented and the rocks crop out in ledge-forming layers. A cobble conglomerate con-

taining porphyritic, plagioclase-bearing igneous rock of unknown provenance occurs north of Crane Creek. Minor thin beds of tuff (commonly altered to clay) and well-sorted lacustrine silts occur in the sedimentary section. The sedimentary section may be as much as 200 m thick in areas south of the KGRA. Combined thickness of the rocks in the KGRA is uncertain.

The basalt flows in the KGRA and vicinity generally dip 5 to 15° to the east-northeast. Locally, south of the KGRA, the lavas are tilted to 20° to the southwest by rotation on normal faults that are downthrown to the northeast. Dips of the overlying sedimentary rocks are variable but dips to the north-northeast are common. Locally, small shallow folds are present in these sediments west of the KGRA (west of Mann Creek). Some of the variable dips in these sediments may be due to vertical readjustments on buried faults in the underlying basalts.

The dominant structures in the Crane Creek KGRA are a series of north-northwest trending high-angle (apparently) faults that form a narrow structural zone that trends across lower Crane Creek and parallel to the Weiser River in the KGRA. Apparent displacement on these faults is commonly down-to-the-east but some down-to-the-west displacements are present. The amount of vertical separation across these faults is uncertain due to the lack of stratigraphic correlation of lava flows across the various faults.

The northwest-trending fault zone crossing the lower Crane Creek area is approximately 5 km wide. This fault zone coincides with a steep gravity gradient that is suggestive of a major structure in basement rocks at depth.⁷ Hot springs along Crane Creek are located on the east side of the fault zone and may be related to hot water rising along a deep-seated basement fault and into younger faults in the overlying lavas. The overlying sandstones are fractured and

displaced by minor faults. Small faults in the sediments may have resulted from continued movement on older faults in the underlying lavas or from subsidence related to hot spring activity. The hot springs in the Crane Creek area are located along the margin of a siliceous sinter terrace or in adjacent sediments veneering part of a sinter apron.⁸

An erosional surface was cut into pre-Tertiary metavolcanic-metasedimentary and perhaps granitic batholith rocks in the Crane Creek area in early Tertiary time. This surface was subsequently buried by a series of Miocene lavas of basaltic to latitic composition that are apparently stratigraphically correlative with Columbia Plateau Basalts further to the west. The basaltic rocks may conceal a major structural discontinuity in the pre-Tertiary basement rocks. Post-Miocene faulting of the lava sequence generally predated deposition of the overlying unconformable continental sedimentary rocks. Faulting may, in part, have been contemporaneous with deposition of the older part of these sediments, but fault activity was apparently subdued during deposition of most of the sedimentary rocks. These sedimentary rocks and related faults are apparently unrelated to subsidence of the Western Snake River Plain.

Subsidence (J. Applegate, GeoTechniques)

Subsidence of the ground surface associated with the production of fluids (petroleum and water) has been documented in many areas of the world. A significant number of these areas are in the American West and include Houston, Texas; portions of southern Arizona; Las Vegas, Nevada; the Wilmington and Inglewood oil fields of southern California; the San Joaquin Valley of California; the South Bay area near San Jose, California; and the Raft River Valley of Idaho. Generalized criteria can be established from assessing these areas where subsidence has occurred. The areas of subsidence generally occur where there are youthful, relatively-unconsolidated sedimentary rocks

of Cenozoic age.⁹ These rocks are of lacustrine and/or alluvial origin and include interbedded coarse-grained and fine-grained rocks. The permeable sands and/or gravel aquifers have low compressibility and are interbedded with clayey aquitards of low permeability, high compressibility, and variable thickness. The withdrawal of fluids causes a decrease in the hydrostatic head of the aquifers and in turn causes a transfer of additional load to the matrix (grain-to-grain load). The effect results in small amounts of generally elastic compaction in the coarse-grained aquifer and much larger amounts of inelastic compaction in the fine-grained aquitard. In the aquitard, the increase in effective stress results in a dewatering of the clays.¹⁰ Montmorillonite is the common clay mineral in many of the previously cases of subsidence⁹ and has the ability to lose large volumes of water.

Withdrawal of fluids appears to be the most likely subsidence mechanism in the KGRAs under study. However, two other potential mechanisms that should be assessed are hydrocompaction and tectonic-related subsidence.

Hydrocompaction is subsidence due to the collapse of the soil structure of certain moisture-deficient deposits when these deposits lose their dry strength due to wetting.¹¹ Hydrocompaction is a one-time process where excess moisture penetrates below the root zone into moisture deficient material. The process may continue to intensify as the water percolates downward and deeper deposits become wetted.

Tectonic subsidence is subsidence, or uplift, that is related to active tectonic processes within the earth such as movement along faults, aseismic movement, or emplacement of igneous bodies. As with subsidence related to fluid withdrawal, tectonic subsidence is best observed with repeated leveling; however, these data are extremely limited. There is some documentation of tectonic movements of 0.067 m in the Raft River Valley, Idaho.¹²

Groundwater production in the Crane Creek KGRA is generally from Quaternary alluvium and sandy units in the Idaho Group. From a cursory examination, the groundwater production does not appear to be as high in volume as other areas associated with the Snake River Plain. A factor of interest may be the source of the thermal water at depth. Does the water represent meteoric water that has fallen on the uplands to the north and circulated downward to reasonable depths to be heated or does it represent significantly older water that is upwelling from units deep within the Snake River downwarp. This question would be important in assessing the recharge and water level problems with deep and extensive geothermal production. The shallow Idaho Group rocks appear to be candidates for subsidence and, hence, prompt a careful assessment of the potential subsidence.

Seismicity (J. Applegate, GeoTechniques)

Seismicity studies to determine levels of micro-earthquake activity have been one of the principal exploration tools to define areas of geothermal activity. Many geothermal areas have been found to have large numbers of small earthquakes. The microseismic events have been postulated to be a function of the youthful geologic activities (volcanism and/or faulting) that are associated with geothermal areas. Thus, it is more common than not to find significant seismic activity in close proximity to geothermal systems. However, in this review, the objective is to evaluate the problems associated with seismic activity pertaining to development.

All of the KGRAs in southwest Idaho are in seismic zone II. However, the data base upon which this recommendation was made was somewhat limited. The major problem in the evaluation of seismic risk is that the instrumental seismic data set represents only a limited time period. In the last few years several additional seismic net-

works have been installed in the State. However, the only two that provide substantial data for this study are the networks surrounding the Idaho National Engineering Laboratory (INEL) and a three-station array in the vicinity of Boise, operated by Boise State University (BSU).

With the limited seismic instrumental data base, other forms of data need to be assessed. The importance of assessing the geological criteria for evaluating seismicity has been emphasized very strongly by Allen.¹³ These data include indicated active faults (in areas where adequate investigations have been undertaken), evaluation of maps, lineaments, LANDSAT imagery, U-2 photos, and geophysical data including seismic reflection, gravity, and aeromagnetism. These data sets are, of course, not as directly indicative of active seismic zones, but do allow one to more clearly assess potential hazards.

In the portion of southwestern Idaho where the geothermal areas are located, there has been an operating seismograph network since 1975. This network recorded over 800 earthquakes during the period 1976-77.¹⁴ Other available instrumental data come from the INEL network (operating since 1971) and from the National Oceanic Atmospheric Administration (NOAA) computer files on earthquake activity for 1880-1975. Numerous workers have published geological reports on areas in southwestern Idaho. The most applicable report and map for this project was a map of active faults in Idaho compiled by Witkind.⁷

These data sets may be sufficient to evaluate the general seismicity of the area, but the limited time span for instrumental data and the small number of observation points does not make the data set applicable for detailed analysis of site specific areas. Geologic studies are generally limited in detail and spatial extent to the point that it is quite possible that all of the active faults have not been mapped.

The Crane Creek KGRA is located in the northern boundary fault zone of the Snake River Plain.⁷ Witkind's map indicates a number of faults which transect the Crane Creek KGRA.⁷ These faults are believed to have last been active in the Late Cenozoic.

The historical seismicity map (Figure 7) shows earthquake activity within 50 km. However, the 1976 to 1977 data (Figure 8) delineate significant seismic activity slightly to the east and north of the area (within approximately 20 km). Of these events, one was a magnitude 4.5 in November 1977. A large number of aftershocks were associated with this master event.

No detailed microseismic monitoring studies are available in the immediate area. Proprietary studies exist but these sources are not available. A short term (8-day) study to evaluate seismicity associated with the Cascade geothermal system in the Cascade area¹⁵ may shed some light on the activity. The activity was of a swarm nature with essentially no activity recorded during the first seven days and approximately 25 events the last day. The events appeared to be related to an east-west trending structure near the site of the Cascade Dam. Any possible activity at the Crane Creek area could also be of a swarm nature.

The lack of documented seismic activity in the immediate area can not be considered evidence of an aseismic area, but may be indicative of the limited data base. In terms of seismic risk, the 1976 to 1977 activity must be considered as posing significant hazard to proposed development at Crane Creek. Studies by Woodward-Lundgren and Associates (now Woodward-Clyde)¹⁶ and others¹⁷ indicate that there are geologic features in the area (the Cascade-Sweet zone) of the seismic activity that appear to be youthful when viewed from the air. The possible activity in this area prompted Woodward-Lundgren to

Figure 7. Historical seismicity from U.S. Coast and Geodetic Survey (NOAA) 1880 - 1975. KGRAs are noted on map: MH - Mountain Home, B - Bruneau, CC - Castle Creek, CRC - Crane Creek, and V - Vulcan.

Figure 8. Seismicity for 1976 - 1977 from B.S.U. network. KGRAs are noted on the map: MH - Mountain Home, B - Bruneau, CC - Castle Creek, CRC - Crane Creek, and V - Vulcan.¹⁴

use the lineament as observed from the air (also can be observed on LANDSAT imagery) as the source of the earthquakes which could potentially cause the most damage in the Boise area. These features could generate a magnitude 7.5 earthquake which might produce accelerations in the Crane Creek area in excess of 25% G.

The data available at the present time are insufficient to assess ground rupture or strong shaking resulting from an earthquake immediately within or adjacent to the Crane Creek KGRA. However, there are sufficient data to indicate that potential earthquake sources do exist in the area. These potential earthquake generators warrant detailed geological and seismic studies.

Water Resources

Hydrology. The primary stream in the KGRA is Crane Creek, which is a tributary to the Weiser River. The drainage area, at the gaging station near the mouth of Crane Creek, is 74 563 ha. The significant tributaries to Crane Creek are North Crane Creek, South Crane Creek, and Hog Creek. North and South Crane Creeks flow to the north and meet Hog Creek at Crane Creek Reservoir. Crane Creek flows west from Crane Creek Reservoir and meets the Weiser River near Weiser, Idaho. Figure 9 is a general drainage basin map of the area.

The topography of the Crane Creek drainage basin is broken into the flat lands east of Hog Creek, the valleys that are drained by North and South Crane Creeks, and the steep-walled canyon below Crane Creek Reservoir, that opens up into flat land at the mouth of Crane Creek. Elevations in the drainage basin vary from 1580 m at the headwaters to 680 m near the mouth of Crane Creek. The KGRA is situated mostly in the canyon below the reservoir and includes a small portion of the flat lands near the mouth of Crane Creek. The agricultural activity on the land near the KGRA consists of cattle grazing and growing forage crops.

Figure 9. Crane Creek Basin and Crane Creek KGRA.

The data base for the hydrology of the drainage basin consists of two streamflow measurement records for Crane Creek, rainfall and snowfall records near the drainage basin, and an assessment of the groundwater resources. Table 3 gives information concerning the hydrologic records that form the data base for the Crane Creek drainage basin. The two Crane Creek gaging stations are no longer active; one gage was located at the mouth of Crane Creek, and the other gage was located just below the dam at Crane Creek Reservoir. Figures 10 and 11 show the monthly distribution of runoff for the two streamflow records. Data are also available concerning the flow characteristics of Crane Creek in the Idaho Department of Water Resources Water Information Bulletin Number 44.

The rainfall and snowfall data consist of records at three gaging stations: Weiser, Cambridge, and Ola. Figure 9, the general map of the basin, gives an isohyetal map of the Crane Creek drainage basin that was prepared from maps developed by the U.S. Army Corps of Engineers for a study of the Columbia River Basin.

The Idaho Department of Water Resources conducted a study of the groundwater resources of the Crane Creek drainage basin as part of its evaluation of the water resources of the Weiser River Basin. The data that were collected during the study were reported in Water Information Bulletin Number 44. Figure 12 is a contour map of groundwater levels in the Crane Creek drainage basin. Measurements were made at several wells in the drainage basin, but there are no long-term observation well records available for the Crane Creek drainage basin.

Water Quality. The surface water quality data base for the Crane Creek drainage basin consists of data found in Water Information Bulletin Number 44 and STORET records obtained from the U.S. Environmental Protection Agency offices in Seattle, Washington. Table 4 presents some of the STORET data for Crane Creek.

TABLE 3. HYDROLOGIC RECORDS FOR THE CRANE CREEK DRAINAGE BASIN

Station	Type of Record	Latitude	Longitude	Period of Records	Length (months)	Annual Average
Weiser 2 SE	Rainfall	44° 14'	116° 57'	07/1948 - 05/1963	179	280 mm
				08/1963 - 09/1963	2	
				11/1963 - 12/1976	158	
Cambridge	Snowfall	44° 34'	116° 41'	11/1948 - 12/1976	116	550 mm
				01/1931 - 12/1958	336	
				02/1959 - 12/1976	215	
01a 4 S	Rainfall	44° 08'	116° 17'	01/1931 - 12/1976	343	1,430 mm
				08/1951 - 12/1977	317	
				12/1951 - 12/1976	123	
Crane Creek near Midvale	Streamflow	44° 21' 05"		11/1910 - 09/1911	11	65,978,500 m ³
				01/1912 - 09/1915	45	
				01/1916 - 04/1916	4	
				05/1924 - 09/1969	545	
Crane Creek at mouth near Weiser	Streamflow	44° 17' 28"	116° 46' 48"	04/1921 - 11/1973	632	74,690,700 m ³

a. Source for these records is HISARS Records, University of Idaho.

Figure 10. Characteristic monthly runoff at the mouth of Crane Creek near Weiser (source: HISARS Record, University of Idaho).

Figure 11. Characteristic monthly runoff of Crane Creek below reservoir near Midvale.

Figure 12. Groundwater contour map.

TABLE 4. CRANE CREEK WATER QUALITY DATA

Parameter Measured	Crane Creek 26 km above Weiser	Crane Creek at mouth near Weiser
Water Temperature (°C)	14	12
Streamflow (m ³ /s)	3.03	5.66
Conductivity (µmhos)	153.8	124.8
Dissolved solids (mg/l)	188.0	--
Dissolved oxygen (mg/l)	9.7	--
Silicon (µg/l)	11.0	--
Suspended sediment (kg/d)	--	48 484

The groundwater quality data that are available for the Crane Creek Basin are contained in Water Information Bulletin Number 44. Table 5 gives the data for six wells inside the Crane Creek Basin, and Table 6 shows data from the same six wells. The geothermal water quality data are shown in Table 1.

Water Rights. The water rights that are currently held inside the KGRA consist of two licensed surface diversions and a permit well. Figure 13 shows the locations of the diversions, and Table 7 gives information concerning the water rights.

The Crane Creek KGRA demonstrates the best water quality of all the Snake River Plain KGRAs. Most streams and groundwater wells have data available through the STORET program of EPA. These measurements need to be continued and a more intensive program that gives better special representation should be initiated.

There are not many recorded water rights and few decreed water rights so adjudication of all water rights is a definite need. This area of irrigation water rights is administered under State Water-master District 67.

Soils (N. Savage, Idaho Water Resources Research Institute/U of I)

The Crane Creek KGRA contains both public domain lands administered by the Bureau of Land Management and privately-owned lands. The Washington County Soil Conservation Service (SCS) has completed a detailed soil survey on 89 ha of private lands as indicated in Figure 14. Of these, 16 ha are irrigated, 12 ha are dry cropland, and the remainder are rangeland.

The soils have been mapped on aerial photographs (1:20,000) and are available on open file at the Weiser office, Washington County SCS. The SCS central office in Boise has on file detailed descriptions of each soil series which include the following data:

TABLE 5. CRANE CREEK GROUNDWATER QUALITY DATA^a

Well	Conductance (μ mho)	Concentration (meg/l)					
		Cl ⁻	CO ₃	SO ₄	Na ⁺ + K ⁺	Mg ⁺⁺	Ca ⁺⁺
11 N 2W 16 AAC1	440	0	4.1	0.3	1.5	1.89	1.8
11 N 4W 12 CDC1	248	0.1	2.2	0.3	0.7	0.7	0.9
12 N 3W 1 CDD1	333	0.1	3.5	0.2	0.7	1.4	1.4
12 N 2W 14 DAC1	171	0.1	1.4	0.3	0.6	0.4	0.6
13 N 2W 21 DCD2	700	0.4	0.9	4.7	1.0	2.1	3.2
13 N 1W 21 CDC1	193	0.1	1.6	0.2	0.7	0.5	0.7

a. Source: IDWR - WIB Number 44.

TABLE 6. BASIC DATA TABLE OF CHEMICAL ANALYSES OF WATER FROM
SELECTED WELLS AND SPRINGS IN THE WEISER RIVER BASIN

	Well 13N-2W-21DCD2	Well 13N-1W-21CDC1	Well 12N-3W-1CDD1	Well 12N-2W-14-DAC1	Well 11N-4W-12CCB1	Well 11N-2W-16AAC1
Discharge (l/s)	0.6	0.8	0.8	1.0	—	140
Ca	66	13	30	12	20	31
K	4.5	6.7	9	5.4	8.4	13
Mg	26	6	18	4	8.2	19
Na	23	12	16	12	13	26
SiO ₂	75	57	41	66	48	81
Cl ⁻						
F ⁻						
HCO ₃ ⁻	59	122	232	98	119	283
SO ₄ ⁼	230	4	5.8	8.2	8.4	11
Conductivity (μmhos)	700	193	333	171	203	440
Total Dissolved Solids	499	161	236	160	181	323
pH	6.3	8.0	7.0	7.3	7.0	8.0

Figure 13. Known water rights in the Crane Creek KGRA.

TABLE 7. WATER RIGHTS INFORMATION FOR THE CRANE CREEK KGRA AREA

<u>File Number</u>	<u>Quantity (cfs)</u>	<u>Priority Date</u>
67-2019	0.2	03/14/07
67-2063	1.4	10/11/11
67-7064	0.03	

a. Source: Files of IDWR.

CRANE CREEK KGRA

Figure 14. Location of Soil Conservation Service soil survey (Washington County).

1. Soil taxonomic class
2. Typical soil profile:
 - Depth
 - Color
 - Texture
 - Composition
 - pH
3. Range in characteristics:
 - Mean annual soil temperature
 - Mean summer soil temperature
 - Relative moisture content
 - Depth to bedrock
 - Organic content
 - Structure
4. Geographic setting:
 - Elevation
 - Slope
 - Parent materials
 - Climate
5. Drainage:
 - Permeability (in./hr)
 - Available water capacity (in./in.)
 - Soil reaction (pH)
 - Salinity
6. Use and vegetation potentials:
 - Sanitary facilities
 - Community development
 - Source materials
 - Water management
 - Wildlife habitat
 - Native vegetation
 - Crop use and potential

In 1976, the Boise District, Bureau of Land Management completed an environmental assessment of the Crane Creek KGRA. Figure 15 shows a reconnaissance soil association map of the KGRA and adjacent lands from this assessment. The map legend describes the soil types and general land uses within the area. Soil data include general information on composition, depth, parent materials, landtypes, and slope gradient.

Approximately 75% of the Crane Creek KGRA is underlain by shallow, stony soils on steep slopes indicating both topographic and drainage limitations to geothermal development. Developed farmlands comprise most of the flat bottomlands and dissected terrace lands representing possible land use conflicts with geothermal development.

The Washington County SCS will complete a detailed soil survey of the county by 1983. The remaining private lands within the Crane Creek KGRA may be mapped during the summer of 1979. Soils on specific sites chosen for geothermal development should be mapped at the level of detail prescribed by the SCS.

Biological Environment

The biological environment of Crane Creek KGRA is discussed in detail in the following sections: Terrestrial and Aquatic Ecology.

Terrestrial Ecology (T. L. Johnson and C. D. Jorgensen, BYU)

The assessment of the terrestrial ecology for the Crane Creek KGRA examined the habitats associated with the region. The potential impact of possible geothermal development was assessed with regard to habitats found in the KGRA and their relative abundance within the region.

Figure 15. Areas in Crane Creek KGRA of high environment sensitivity due to erosion hazards (BLM soil survey, 1976) (legend follows).

Legend for Figure 15

Soils

There are six soil associations found in the area. They consist of the following types:

- A. Very shallow (0 to 25 cm) and shallow (25 to 50 cm) very stony loams to clays overlying basalt bedrock. Slopes range generally from 0 to 30%.
- B. Very shallow and shallow, very stony loams and clay loams overlying basalt with numerous outcroppings of bedrock. Slopes are generally more than 30%.
- C. Shallow to deep loams to clays (may or may not be stony) developed on dissected terraces and hills overlying basalt bedrock. Slopes generally range from 10 to 30%.
- D. These are moderately deep to deep well drained to poorly drained, nearly level to moderately sloping soils on stream bottoms and terraces. Slopes generally less than 15%.
- E. These are moderately deep loamy soils developing on dissected terraces and hills overlying basalt bedrock. Slopes range from 10 to 30%.
- F. These are generally deep, loam and silt loam soils that are developed on dissected terraces and hills overlying basalt bedrock. Slopes range from about 15 to 50%.

Areas of high soil erosion hazard are shown in Figure 15. Shaded portions of the map indicate areas of high environmental sensitivity due to soil composition and erosion factors.

Flora. The Crane Creek KGRA is located in the Tall Sagebrush vegetative habitat (Figure 16), but differs somewhat from Tall Sagebrush in the other Snake River Plain KGRAs. The variation provides more diversity in habitats as well as making riparian or wash-type communities more important.

Threatened and endangered plant species are illustrated with respect to their proximity to the KGRA in Figure 17. Records of these plant species were usually from museum collections only, not from extensive studies. Data for the proposed threatened and endangered plant species were taken directly from Henderson et al.¹⁸ Their study not only recommends a status based on the existing state of knowledge, but makes some recommendations of change in status. Only those whose status appears critical because of a lack of information or extremely limited distributions are discussed beyond merely illustrating their status. Specific efforts have not been made to establish their status; the data are almost incidental and need much more validation to be conclusive.

Fauna. Species of vertebrates were compiled for Crane Creek, based largely on their reported association with habitats included in the area. These data were collected from numerous sources. Since none of the data were specifically concerned with geothermal development, they represent the best estimate of what might be expected. Specific onsite research would be required to validate species present and relative numbers; but in the absence of such data, these listings represent the best summary of what is included in the resources available. The listings (Tables 8 through 11) are as comprehensive as possible, with reported species being deleted only if there is reason for doing so.

Most of the information included in Tables 8 through 11 was available from a limited number of resources.

Figure 16. Relative extent of the Tall Sagebrush vegetation habitat (shaded area) within the Crane Creek KGRA and its associated non-competitive lease application area (Stippled area).

Figure 17. Recorded distributions of threatened and endangered plant species in Washington County. Note: This figure is followed by six pages of specific information concerning these species. Species included are: *Eriogonum thymoides*, *Primula cusickiana*, *Haplopappus radiatus*, *Trifolium plumosum amplifolium*.

ASTERACEAE (Compositae)

Haplopappus radiatus

Location: Idaho: Washington County; Oregon: Baker, Malheur and Wallowa counties "South end of Snake River Canyon in Oregon and Idaho".

Land Ownership: Judging from locations and general description mostly private but some BLM is likely and U.S.F.S. (Payette N.F.) possible.

Vegetation Type: Grasslands or sagebrush/grass communities.

Habitat: Undetermined, much may have been inundated by Snake River reservoirs.

Hazards: Unknown.

Herbarium Data: Number of sites by county: Idaho -- Washington - 1; Oregon--Baker - 1, Malheur - 1, Wallowa - 1 (reported).

Number of collections in herbaria searched:
BOIS - 0, BS - 0, CIC - 1, ID - 1, IDF - 0,
IDS - 0, WS - 1.

Remarks: The WS and ID material was filed under II. carthamoides var. maximus and H. radiatis; thus herbaria could be missing this taxon when asked to search for H. radiatus. Certainly very uncommon in Idaho, although the type collection was probably made right across the state line (Snake River) in Oregon.

Recommendation: Retain as endangered.

References: Lee (1968) does not recognize this taxon.

Compiler: Johnson.

FABACEAE (Legaminosae)

Trifolium plumosum Dougl.
Var. amplifolium

Location: Idaho: Idaho, Nez Perce, Lewis, Clearwater, and Washington counties; Idaho endemic variety.

Land Ownership: Uncertain, private, primarily, one collection from U.S.F.S. (Clearwater N.F.), and several periphera to U.S.F.S. (Nez Perce and Payette N.F.) possibly Idaho Department of Lands.

Vegetation Type: In middle elevation grasslands (600 to 1200 m) and in open Pinus ponderosa forests.

Habitat: "low places in meadow areas," "dry grassy flat," "dry, open slopes," "open forest with Pinus ponderosa and Symphoricarpos" "Festuca/Agropyron ... zone".

Hazards: Undetermined, but most of the sites are in areas with a long history of grazing.

Herbarium Data: Number of sites by county: Idaho -- Clearwater - 1, Idaho - 3, Lewis - 2, Nez Perce - 4, Washington - 1.

Number of collections in herbaria searched:
BOIS - 0, BS - 0, CIC - 0, ID - 4, IDF - 0,
IDS - 0, RENO - 5, UTC - 2, WS - 7. (From the
above, seven separate collections are from a
single area along U.S. 95 in Idaho County).

Remarks:

Much more widespread than indicated in Hitchcock
et al (1961) or Hitchcock & Cronquist (1973).

Recommendation:

While not common, the extent of the population
seems to indicate that removal from threatened
status would be possible with either a more
extensive herbarium search and/or a small amount
of field work, particularly to note the impact of
grazing. For now. Retain as threatened.

Compiler:

Johnson.

POLYGONACEAE

Eriogonum thymoides

Location:

Idaho: Blaine, Camas, possibly Elmore, Gooding,
Lincoln, and Washington counties;
Oregon: Union County;
Washington: Chelan, King, and Kittitas counties.

Land Ownership:

BLM, private and possible Idaho Department of
Lands.

Vegetation Type:

Sagebrush/grass.

Habitat:

Thin rocky soil.

Hazards: Collected by "bonsai gardeners", range improvement programs.

Herbarium Data: Number of sites by county: Idaho -- Blaine - 2, Camas - 1, Washington - 2. Number of collections in herbaria searched: BOIS - 0, CIC - 2, ID - 3, IDF - 4, IDS - 2, WS - 0.

Remarks: This plant is common in the Bennett Hills area and has a wide distribution from there to Chelan County, Washington. It is rare in the Washington County area and may be locally jeopardized, especially near highways where it is apparently collected for "bonsai" arrangements.

Recommendation: Remove from threatened list.

Compiler: Packard.

PRIMULACEAE

Primula cusickiana

Location: Idaho: Ada, Adams, Blaine, Boise, Camas, Custer, Elmore, Gem, Gooding, Idaho, Owyhee, Valley, and Washington counties;
Oregon: Wallowa county.

Land Ownership: BLM U.S.F.S. (Boise, Payette, and Sawtooth N.F.), probably private and Idaho Department of Lands.

Vegetation Type: Mostly in grass meadows or sagebrush/grass.

Habitat:

The more northern population grows in mountain meadows in heavy clay soil. The southern populations grow in thin, rocky soil on steep slopes of eroded lake terraces and in seeps or where it is wet in spring.

Hazards:

Many populations are subject to grazing; many more have been destroyed by agriculture and housing developments. This plant is attractive and tempting to transfer to the garden but transplants very poorly.

Herbarium Data:

Number of sites by county: Idaho -- Ada - 9, many since destroyed, Adams - 2, Blaine - 1, Boise - 5, Camas - 4, Custer - 3, Elmore - 7, Gem - 1, Gooding - 2, Idaho - 2, Owyhee - 1, Washington - 2.

Number of collections in herbaria searched:
BOIS - 3, BS - 5, CIC - 18, ID - 15, IDF - 2,
INT - 9, WS - 3, WTU - 2.

Remarks:

Dr. Marion Ownbey once said (pers. comm.) that probably three species of Primula are represented. The Hill City population being one undescribed species, the Boise area population being the now unrecognized P. wilcoxiana, and the more northern population being the typic P. cusickiana. The difference in habitat preference indicates that this might be true. If, as "Ownbey indicated, this is actually three species, then the Hill City population is truly endangered and the Boise P. wilcoxiana is possibly threatened. The P. cusickiana of the Wallowa Mountains and west-central Idaho is neither endangered nor threatened.

Recommendation:

Retain on endangered list until the taxonomy of these populations has been clarified. Then remove or reduce in status any segment of the complex that does not warrant protection.

References:

Eidemiller 1976
Holmgren and Holmgren 1974
Williams 1936.

Compiler:

Packard.

TABLE 8. RELATIVE ABUNDANCE AND HABITAT LISTINGS FOR AMPHIBIANS IN THE CRANE CREEK KGRA

Species		Relative Abundance ^a				Habitat Types ^b		
Common Name	Scientific Name	Sp	Su	Fa	Wi	1	2	3
Tiger Salamander	<u>Ambystoma tigrinum</u>	L	L	L	L			X
Long-toed Salamander	<u>Ambystoma macrodactylum</u>	L	L	L	L			X
Great Basin Spadefoot	<u>Scaphiopus intermontanus</u>	L	L	L	L			X
Western Toad	<u>Bufo boreas</u>	M	M	M	M		X	X
Woodhouse's Toad	<u>Bufo woodhousei</u>	P	-	-	-			X
Chorus Frog	<u>Pseudacris triseriata</u>	L	L	L	L			X
Pacific Treefrog	<u>Hyla regilla</u>	L	L	L	L			X
Spotted Frog	<u>Rana pretiosa</u>	L	L	L	L			X
Bullfrog	<u>Rana catesbeiana</u>	M	M	M	M			X

^aKey to Relative Abundance: H=High, M=Medium, L=Low, A=Absent, P=Population level unknown, U=Presence unknown.

^bKey to Habitat Types: 1=Sagebrush, 2=Non-irrigated Farm, 3=Stream Side.

TABLE 9. RELATIVE ABUNDANCE AND HABITAT LISTINGS FOR REPTILES IN THE CRANE CREEK KGRA

Species		Relative Abundance ^a				Habitat Types ^b		
Common Name	Scientific Name	Sp	Su	Fa	Wi	1	2	3
Western Fence Lizard	<u>Sceloporus occidentalis</u>	L	L	L	L	X	X	
Sagebrush Lizard	<u>Sceloporus graciosus</u>	L	L	L	L	X	X	
Western Skink	<u>Eumeces skiltonianus</u>	L	L	L	L		X	
Racer	<u>Coluber constrictor</u>	L	L	L	L		X	X
Gopher Snake	<u>Pituophis melanoleucus</u>	L	L	L	L		X	X
Common Garter Snake	<u>Thamnophis sirtalis</u>	L	L	L	L	X	X	X
Western Garter Snake	<u>Thamnophis elegans</u>	L	L	L	L		X	X
Western Ground Snake	<u>Sonora semiannulata</u>	L	L	L	P	X		
Western Rattlesnake	<u>Crotalus viridis</u>	M	M	M	M	X	X	X

^aKey to Relative Abundance: H=High, M=Medium, L=Low, A=Absent, P=Population level unknown, U=Presence unknown.

^bKey to Habitat Types: 1=Sagebrush, 2=Non-irrigated Farm, 3=Stream Side.

TABLE 10. RELATIVE ABUNDANCE AND HABITAT LISTINGS FOR BIRDS IN THE CRANE CREEK KGRA

Species		Relative Abundance ^a				Habitat Types ^b		
Common Name	Scientific Name	Sp	Su	Fa	Wi	1	2	3
Western Grebe	<u>Aechmophorus occidentalis</u>	H	M	H	L			X
Horned Grebe	<u>Podiceps auritus</u>	U	U	U	U			
Eared Grebe	<u>Podiceps caspicus</u>	M	M	M	P			X
Pied-billed Grebe	<u>Podilymbus podiceps</u>	M	M	M	P			X
Whistling Swan	<u>Olor columbianus</u>	L	P	L	P			X
Canada Goose	<u>Branta canadensis</u>	H	H	H	H		X	X
Snow Goose	<u>Chen hyperborea</u>	U	U	U	U			
Mallard	<u>Anas platyrhynchos</u>	H	H	H	M	X	X	X
Pintail	<u>Anas acuta</u>	H	M	H	L			X
Gadwall	<u>Anas strepera</u>	M	L	M	P			X
Wigeon	<u>Anas americana</u>	H	H	H	L			X
Northern Shoveler	<u>Anas clypeata</u>	L	L	L	P			X
Blue-winged Teal	<u>Anas discors</u>	M	M	M	L			X
Cinnamon Teal	<u>Anas cyanoptera</u>	M	M	M	P			X
Green-winged Teal	<u>Anas crecca</u>	H	H	H	L		X	X
Wood Duck	<u>Aix sponsa</u>	H	H	H	L			X
Redhead	<u>Aythya americana</u>	L	L	L	P			X
Canvasback	<u>Aythya valisineria</u>	P	P	P	P			
Ring-necked Duck	<u>Aythya collaris</u>	P	P	P	P			
Greater Scaup	<u>Aythya marila</u>	M	P	M	L			X
Lesser Scaup	<u>Aythya affinis</u>	M	P	H	P			X
Common Goldeneye	<u>Bucephala clangula</u>	H	H	H	M			X
Barrow's Goldeneye	<u>Bucephala islandica</u>	M	L	M	L			X
Bufflehead	<u>Bucephala albeola</u>	H	L	H	L			X
Ruddy Duck	<u>Oxyura jamaicensis</u>	H	M	H	L			X

TABLE 10. (continued)

Species		Relative Abundance ^a				Habitat Types ^b		
Common Name	Scientific Name	Sp	Su	Fa	Wi	1	2	3
Common Merganser	<u>Mergus merganser</u>	H	H	H	H			X
Red-breasted Merganser	<u>Mergus serrator</u>	M	M	M	M			X
Hooded Merganser	<u>Lophodytes cucullatus</u>	L	L	L	P			X
Turkey vulture	<u>Cathartes aura</u>	L	L	L	P	X	X	
Goshawk	<u>Accipiter gentilis</u>	P	P	P	L	X		
Cooper's Hawk	<u>Accipiter cooperii</u>	L	L	L	L	X	X	
Sharp-shinned Hawk	<u>Accipiter striatus</u>	L	L	L	L	X	X	
Marsh Hawk	<u>Circus cyaneus</u>	H	H	M	L	X	X	X
Rough-legged Hawk	<u>Buteo lagopus</u>	M	M	M	H	X	X	X
Red-tailed Hawk	<u>Buteo jamaicensis</u>	M	M	M	H	X	X	X
Ferruginous Hawk	<u>Buteo regalis</u>	L	L	L	L			X
Swainson's Hawk	<u>Buteo swainsoni</u>	M	M	M	M	X	X	X
Golden Eagle	<u>Aquila chrysaetos</u>	H	H	H	H	X	X	X
Bald Eagle	<u>Haliaeetus leucocephalus</u>	M	L	L	H	X	X	X
Osprey	<u>Pandion haliaetus</u>	L	L	L	P			X
Prairie Falcon	<u>Falco mexicanus</u>	M	M	M	M	X	X	
Merlin	<u>Falco columbarius</u>	U	U	U	U			
American Kestrel	<u>Falco sparverius</u>	H	H	H	M	X	X	X
Blue Grouse	<u>Dendragapus obscurus</u>	H	H	H	H	X	X	X
Ruffed Grouse	<u>Bonasa umbellus</u>	M	M	M	M	X		X
Sharped-tailed Grouse	<u>Pedioecetes phasianellus</u>	L	L	L	L	X	X	
Sage Grouse	<u>Centrocercus urophasianus</u>	M	M	M	M	X	X	X
California Quail	<u>Lophortyx californicus</u>	H	H	H	H	X	X	X
Ringed-necked Pheasant	<u>Phasianus colchicus</u>	H	H	H	H	X	X	X
Chukar	<u>Alectoris chukar</u>	H	H	H	H	X	X	X

TABLE 10. (continued)

Species		Relative Abundance ^a				Habitat Types ^b		
Common Name	Scientific Name	Sp	Su	Fa	Wi	1	2	3
Gray Partridge	<u>Perdix perdix</u>	H	H	H	H	X	X	X
Great Blue Heron	<u>Ardea herodias</u>	H	H	H	L	X		X
Common Egret	<u>Casmerodius albus</u>	U	U	U	U			
Snowy Egret	<u>Leucophoyx thula</u>	L	L	L	P			X
Black-crowned Night Heron	<u>Nycticorax nycticorax</u>	L	L	L	P			X
American Bittern	<u>Botaurus lentiginosus</u>	M	M	M	P			X
White-faced Ibis	<u>Plegadis chihi</u>	P	P	P	P			
Virginia Rail	<u>Rallus limicola</u>	P	P	P	P			
Sora	<u>Porzana carolina</u>	U	U	U	U			
American Coot	<u>Fulica americana</u>	P	P	P	P			
American Avocet	<u>Recurvirostra americana</u>	H	H	H	P			X
Semipalmated Plover	<u>Charadrius semipalmatus</u>	U	U	U	U			
Killdeer	<u>Charadrius vociferus</u>	H	H	H	L		X	X
Common Snipe	<u>Capella gallinago</u>	P	P	P	P			
Long-billed Curlew	<u>Numenius americanus</u>	L	L	L	L	X	X	
Solitary Sandpiper	<u>Tringa solitaria</u>	P	P	P	P			
Spotted Sandpiper	<u>Acitis macularia</u>	P	P	P	P			
Willet	<u>Catoptrophorus semipalmatus</u>	H	H	H	P			X
Greater Yellowlegs	<u>Totanus melanoleucus</u>	P	P	P	P			
Lesser Yellowlegs	<u>Totanus flavipes</u>	P	P	P	P			
Long-billed Dowitcher	<u>Limnodromus scolopaceus</u>	U	U	U	U			
Short-billed Dowitcher	<u>Limnodromus griseus</u>	M	M	M	P			X
Pectoral Sandpiper	<u>Erolia melanotos</u>	P	P	P	P			
Sanderling	<u>Crocethia alba</u>	U	U	U	U			
Baird's Sandpiper	<u>Erolia bairdii</u>	U	U	U	U			

TABLE 10. (continued)

Species		Relative Abundance ^a				Habitat Types ^b		
Common Name	Scientific Name	Sp	Su	Fa	Wi	1	2	3
Least Sandpiper	<u>Erolia minutilla</u>	U	U	U	U			
Western Sandpiper	<u>Ereunetes mauri</u>	U	U	U	U			
Wilson's Phalarope	<u>Steganopus tricolor</u>	P	P	P	P			
Northern Phalarope	<u>Lobipes lobatus</u>	U	U	U	U			
Common Snipe	<u>Capella gallinago</u>	P	P	P	P			
California Gull	<u>Larus californicus</u>	H	H	H	L		X	X
Ring-billed Gull	<u>Larus delawarensis</u>	H	H	H	L		X	X
Franklin's Gull	<u>Larus pipixcan</u>	U	U	U	U			
Forster's Tern	<u>Sterna forsteri</u>	U	U	U	U			
Black Tern	<u>Chlidonias niger</u>	U	U	U	U			
Mourning Dove	<u>Zenaidura macroura</u>	H	H	H	H	X	X	X
Yellow-billed Cuckoo	<u>Coccyzus americanus</u>	U	U	U	U			
Black-billed Cuckoo	<u>Coccyzus erythrophthalmus</u>	U	U	U	U			
Great Horned Owl	<u>Bubo virginianus</u>	M	M	M	M	X	X	X
Snowy Owl	<u>Nyctea scandiaca</u>	P	P	P	L		X	
Short-eared Owl	<u>Asio flammeus</u>	L	L	L	P	X		
Long-eared Owl	<u>Asio otus</u>	L	L	L	P	X		
Burrowing Owl	<u>Speotyto cunicularia</u>	L	L	L	L	X	X	X
Saw-whet Owl	<u>Aegolius acadicus</u>	U	U	U	U			
Poor Will	<u>Phalaenoptilus nuttallii</u>	L	L	L	P		X	
Common Nighthawk	<u>Chordeiles minor</u>	H	H	M	P	X	X	X
Black-chinned Hummingbird	<u>Archilochus alexandri</u>	U	U	U	U			
Broad-tailed Hummingbird	<u>Selasphorus platycercus</u>	U	U	U	U			
Rufous Hummingbird	<u>Selasphorus rufus</u>	U	U	U	U			
Belted Kingfisher	<u>Megasceryle alcyon</u>	H	H	H	M			X

TABLE 10. (continued)

Species		Relative Abundance ^a				Habitat Types ^b		
Common Name	Scientific Name	Sp	Su	Fa	Wi	1	2	3
Common Flicker	<u>Colaptes auratus</u>	M	M	M	L	X		X
Lewis' Woodpecker	<u>Asyndesmus lewis</u>	U	U	U	U			
Hairy Woodpecker	<u>Dendrocopos villosus</u>	U	U	U	U			
Downy Woodpecker	<u>Dendrocopos pubescens</u>	P	P	P	P			
Eastern Kingbird	<u>Tyrannus tyrannus</u>	M	M	L	L		X	X
Western Kingbird	<u>Tyrannus verticalis</u>	M	M	L	L		X	X
Ash-throated Flycatcher	<u>Myiarchus cinerascens</u>	U	U	U	U			
Say's Phoebe	<u>Sayornis saya</u>	P	P	P	P			
Traill's Flycatcher	<u>Empidonax traillii</u>	P	P	P	P			
Hammond's Flycatcher	<u>Empidonax hammondi</u>	U	U	U	U			
Dusky Flycatcher	<u>Empidonax oberholseri</u>	U	U	U	U			
Western Wood Pewee	<u>Contopus sordidulus</u>	U	U	U	U			
Olive-sided Flycatcher	<u>Nuttallornis borealis</u>	P	P	P	P			
Horned Lark	<u>Eremophila alpestris</u>	M	M	M	M		X	
Barn Swallow	<u>Hirundo rustica</u>	L	L	L	P		X	
Cliff Swallow	<u>Petrochelidon pyrrhonota</u>	H	H	H	P		X	X
Violet-green Swallow	<u>Tachycineta thalassina</u>	L	L	L	P		X	
Tree Swallow	<u>Iridoprocne bicolor</u>	L	L	L	P			X
Bank Swallow	<u>Riparia riparia</u>	L	L	L	P		X	
Rough-winged Swallow	<u>Stelgidopteryx ruficollis</u>	L	L	L	P		X	
Steller's Jay	<u>Cyanocitta stelleri</u>	L	L	L	L	X		
Gray Jay	<u>Perisoreus canadensis</u>	U	U	U	U			
Black-billed Magpie	<u>Pica pica</u>	H	H	H	H	X	X	X
Common Raven	<u>Corvus corax</u>	M	M	M	M	X	X	
Common Crow	<u>Corvus brachyrhynchos</u>	M	M	M	L		X	X

TABLE 10. (continued)

Species		Relative Abundance ^a				Habitat Types ^b		
Common Name	Scientific Name	Sp	Su	Fa	Wi	1	2	3
Black-capped Chickadee	<u>Parus atricapillus</u>	U	U	U	U			
Dipper	<u>Cinclus mexicanus</u>	M	M	M	L			X
White-breasted Nuthatch	<u>Sitta carolinensis</u>	U	U	U	U			
Brown Creeper	<u>Certhia familiaris</u>	P	P	P	P			
House Wren	<u>Troglodytes aedon</u>	L	L	L	L		X	X
Long-billed Marsh Wren	<u>Telmatodytes palustris</u>	P	P	P	P			
Canyon Wren	<u>Catherpes mexicanus</u>	P	P	P	P			
Gray Catbird	<u>Dumetella carolinensis</u>	L	L	L	P			X
Sage Thrasher	<u>Oreoscoptes montanus</u>	L	L	L	P	X	X	X
Robin	<u>Turdus migratorius</u>	H	H	H	L	X	X	X
Hermit Thrush	<u>Hylocichla guttata</u>	L	L	L	P			X
Swainson's Thrush	<u>Hylocichla ustulata</u>	L	L	L	P			X
Veery	<u>Hylocichla fuscescens</u>	U	U	U	U			
Mountain Bluebird	<u>Sialia currucoides</u>	L	L	H	P	X		
Townsend's Solitaire	<u>Myadestes townsendi</u>	U	U	U	U			
Golden-crowned Kinglet	<u>Regulus satrapa</u>	U	U	U	U			
Ruby-crowned Kinglet	<u>Regulus calendula</u>	U	U	U	U			
Water Pipit	<u>Anthus spinoletta</u>	U	U	U	U			
Bohemian Waxwing	<u>Bombycilla garrula</u>	L	P	L	L			X
Cedar Waxwing	<u>Bombycilla cedrorum</u>	L	P	L	L			X
Northern Shrike	<u>Lanius excubitor</u>	M	L	L	L		X	
Loggerhead Shrike	<u>Lanius ludovicianus</u>	M	L	L	L		X	X
Starling	<u>Sturnus vulgaris</u>	H	H	H	H	X	X	X
Red-eyed Vireo	<u>Vireo olivaceus</u>	U	U	U	U			
Warbling Vireo	<u>Vireo gilvus</u>	L	L	L	P			X

TABLE 10. (continued)

Species		Relative Abundance ^a				Habitat Types ^b		
Common Name	Scientific Name	Sp	Su	Fa	Wi	1	2	3
Orange-crowned Warbler	<u>Vermivora celata</u>	P	P	P	P			
Nashville Warbler	<u>Vermivora ruficapilla</u>	U	U	U	U			
Yellow Warbler	<u>Dendroica petechia</u>	L	L	L	P			X
Yellow-rumped Warbler	<u>Dendroica coronata</u>	U	U	U	U			
Townsend's Warbler	<u>Dendroica townsendi</u>	U	U	U	U			
MacGillivray's Warbler	<u>Oporornis tolmiei</u>	U	U	U	U			
Common Yellowthroat	<u>Geothlypis trichas</u>	L	L	L	P			X
Wilson's Warbler	<u>Wilsonia pusilla</u>	U	U	U	U			
Yellow-breasted Chat	<u>Icteria virens</u>	U	U	U	U			
House Sparrow	<u>Passer domesticus</u>	M	M	M	M	X	X	
Western Meadowlark	<u>Sturnella neglecta</u>	H	H	H	M	X	X	
Yellow-headed Blackbird	<u>Xanthocephalus</u> <u>xanthocephalus</u>	M	M	M	P		X	X
Red-winged Blackbird	<u>Agelaius phoeniceus</u>	H	H	H	L		X	X
Northern Oriole	<u>Icterus galbula</u>	U	U	U	U			
Brewer's Blackbird	<u>Euphagus cyanocephalus</u>	M	M	M	P		X	X
Common Grackle	<u>Quiscalus quiscula</u>	L	L	L	P			X
Brown-headed Cowbird	<u>Molothrus ater</u>	L	L	L	P			X
Western Tanager	<u>Piranga ludoviciana</u>	L	L	L	P		X	X
Black-headed Grosbeak	<u>Phaeucticus melanocephalus</u>	L	L	L	P			X
Lazuli Bunting	<u>Passerina amoena</u>	L	L	L	P		X	X
Evening Grosbeak	<u>Hesperiphona vespertina</u>	U	U	U	U			
Cassin's Finch	<u>Carpodacus cassinii</u>	L	L	L	P			X
House Finch	<u>Carpodacus mexicanus</u>	M	M	L	P		X	X
Gray-crowned Rosy Finch	<u>Leucosticte tephrocotis</u>	P	P	P	P			
Black Rosy Finch	<u>Leucosticte atrata</u>	U	U	U	U			

TABLE 10. (continued)

Species		Relative Abundance ^a				Habitat Types ^b		
Common Name	Scientific Name	Sp	Su	Fa	Wi	1	2	3
American Goldfinch	<u>Spinus tristis</u>	L	L	L	P		X	X
Green-tailed Towhee	<u>Chlorura chlorura</u>	U	U	U	U			
Rufous-sided Towhee	<u>Pipilo erythrophthalmus</u>	L	L	L	P			X
Savannah Sparrow	<u>Passerculus sandwichensis</u>	L	L	L	P		X	
Grasshopper Sparrow	<u>Ammodramus savannarum</u>	L	L	L	P			
Vesper Sparrow	<u>Pooecetes gramineus</u>	P	P	P	P			
Lark Sparrow	<u>Chondestes grammacus</u>	L	L	L	P			
Black-throated Sparrow	<u>Amphispiza bilineata</u>	P	P	P	P			
Sage Sparrow	<u>Amphispiza belli</u>	P	P	P	P	X		
Dark-eyed Junco	<u>Junco hyemalis</u>	H	H	H	M	X	X	X
Tree Sparrow	<u>Spizella arborea</u>	U	U	U	U			
Chipping Sparrow	<u>Spizella passerina</u>	L	L	L	P			X
Brewer's Sparrow	<u>Spizella breweri</u>	L	L	L	P			
White-crowned Sparrow	<u>Zonotrichia leucophrys</u>	L	L	L	L		X	X
Fox Sparrow	<u>Passerella iliaca</u>	U	U	U	U			
Lincoln's Sparrow	<u>Melospiza lincolni</u>	U	U	U	U			
Song Sparrow	<u>Melospiza melodia</u>	L	L	L	P			X
Snow Bunting	<u>Plectrophenax nivalis</u>	A	A	A	P			

^aKey to Relative Abundance: H=High, M=Medium, L=Low, A=Absent, P=Population level unknown, U=Presence unknown.

^bKey to Habitat Types: 1=Sagebrush, 2=Non-irrigated Farm, 3=Stream Side.

TABLE 11. RELATIVE ABUNDANCE AND HABITAT LISTINGS FOR MAMMALS IN THE CRANE CREEK KGRA

Species		Relative Abundance ^a				Habitat Types ^b		
Common Name	Scientific Name	Sp	Su	Fa	Wl	1	2	3
Shrews		M	M	M	M	X	X	X
Vagrant Shrew	<u>Sorex vagrans</u>							
Masked Shrew	<u>Sorex cinereus</u>							
Merriam Shrew	<u>Sorex merriami</u>							
Dusky Shrew	<u>Sorex obscurus</u>							
Bats		M	M	M	M	X	X	X
Little Brown Myotis	<u>Myotis lucifugus</u>							
Fringed Myotis	<u>Myotis thysanodes</u>							
California myotis	<u>Myotis californicus</u>							
Yuma Myotis	<u>Myotis yumanensis</u>							
Long-legged Myotis	<u>Myotis volans</u>							
Western Pipistrel	<u>Pipistrellus hesperus</u>							
Spotted Bat	<u>Euderma maculata</u>							
Western Big-eared Bat	<u>Plecotus townsendii</u>							
Pallid Bat	<u>Antrozous pallidus</u>							
Raccoon	<u>Procyon lotor</u>	H	H	H	H	X	X	X
Weasel		H	H	H	H	X	X	X
Shorttail Weasel	<u>Mustela erminea</u>							
Longtail Weasel	<u>Mustela frenata</u>							
Mink	<u>Mustela vison</u>	H	H	H	H			X
River Otter	<u>Lutra canadensis</u>	U	U	U	U			
Badger	<u>Taxidea taxus</u>	M	M	M	M	X	X	X
Spotted Skunk	<u>Spilogale putorius</u>	M	M	M	M	X	X	X
Striped Skunk	<u>Mephitis mephitis</u>	H	H	H	H	X	X	X
Coyote	<u>Canis latrans</u>	H	H	H	H	X	X	X
Red Fox	<u>Vulpes fulva</u>	H	H	H	H	X	X	X
Bobcat	<u>Lynx rufus</u>	M	M	M	M	X	X	X
Yellowbelly Marmot	<u>Marmota flaviventris</u>	M	M	M	M	X	X	X

TABLE 11. (continued)

Species		Relative Abundance ^a				Habitat Types ^b		
Common Name	Scientific Name	Sp	Su	Fa	W1	1	2	3
Townsend Ground Squirrel	<u>Spermophilus townsendi</u>	L	L	L	L		X	
Idaho Ground Squirrel	<u>Spermophilus brunneus</u>	P	P	P	P			X
Columbia Ground Squirrel	<u>Spermophilus columbianus</u>	M	M	M	M	X	X	X
Least Chipmunk	<u>Eutamias minimus</u>	H	H	H	H	X	X	X
Fox Squirrel	<u>Sciurus niger</u>	H	H	H	H			X
Northern Pocket Gopher	<u>Thomomys talpoides</u>	M	M	M	M	X	X	X
Townsend Pocket Gopher	<u>Thomomys townsendi</u>	P	P	P	P			X
Great Basin Pocket Mouse	<u>Perognathus parvus</u>	P	P	P	P	X		
Beaver	<u>Castor canadensis</u>	H	H	H	H	X		X
Western Harvest Mouse	<u>Reithrodontomys megalotis</u>	M	M	M	M		X	X
Deer Mouse	<u>Peromyscus maniculatus</u>	H	H	H	H	X	X	X
Northern Grasshopper Mouse	<u>Onychomys leucogaster</u>	L	L	L	L	X		
Bushytail Woodrat	<u>Neotoma cinerea</u>	L	L	L	L	X	X	X
Mountain Vole	<u>Microtus montanus</u>	L	L	L	L			X
Longtail Vole	<u>Microtus longicaudus</u>	P	P	P	P			X
Richardson Vole	<u>Microtus richardsoni</u>	U	U	U	U			
Muskrat	<u>Ondatra zibethica</u>	H	H	H	H			X
Western Jumping Mouse	<u>Zapus princeps</u>	L	L	L	L	X		X
Porcupine	<u>Erethizon dorsatum</u>	M	M	M	M	X	X	X
Whitetail Jackrabbit	<u>Lepus townsendi</u>	M	M	M	M	X	X	
Blacktail Jackrabbit	<u>Lepus californicus</u>	H	H	H	H	X	X	
Mountain Cottontail	<u>Sylvilagus nuttalli</u>	M	M	M	M	X	X	X
Pygmy Rabbit	<u>Sylvilagus idahoensis</u>	L	L	L	L		X	X
Mule Deer	<u>Odocoileus hemionus</u>	H	H	H	H	X	X	X
Pronghorn Antelope	<u>Antilocapra americana</u>	M	M	M	M	X	X	

^aKey to Relative Abundance: H=High, M=Medium, L=Low, A=Absent, P=Population level unknown, U=Presence unknown.

^bKey to Habitat Types: 1=Sagebrush, 2=Non-irrigated Farm, 3=Stream Side.

These data sources are summarized as follows for:

1. Amphibians and reptiles, References 19, 20, 21, 22, and 23.
2. Birds, References 19, 22, 23, 24, 25, and 26.
3. Mammals, References 19, 22, 23, 27, and 28.

Tables 8 through 11 represent a convenient compilation of the information obtained. Since numerous techniques were used (sometimes little more than guessing about distribution) to gather these data, it seemed better to simply assign their numbers to some "relative abundance" category. This was the best way to avoid encouraging conclusions of the reader that could not be supported with data. Where blanks occur in Tables 8 through 11, data were either unavailable or were too questionable.

Species of special concern (key species) presented in Table 12, have been classified according to whether they are considered game species, furbearer or of extended concern because of restricted range, specific habitat requirements, population numbers so low that they may be easily eliminated from Idaho, and/or whether they are threatened or endangered. Because these species have received more consideration in past work and more data are available, Table 12 should be considered rather accurate.

Distributions of some species of concern, listed in Table 12, are plotted in Figures 18 through 26, demonstrating their proximities to the KGRAs. Species not included in these figures were either ubiquitous or their distributions were unknown, such as would be expected for many of the nongame and migratory species. Data included were taken from "Idaho Environmental Overview"²⁹ and adopted for the county maps. The data accuracy must be accepted cautiously. Local habitat variation not included in the overall diagrams will create many exceptions to what is illustrated, providing sufficient research is done.

TABLE 12. SPECIAL CONCERN SPECIES OF THE KGRA

Species		KGRA Areas ^a				Special Concern Category		
Common Name	Scientific Name	B	M	C	V	Game	Furbearer	Extended Concern ^b
Mammals:								
Black Bear	<u>Ursus americanus</u>		/ ^c		X	X		
Raccoon	<u>Procyon lotor</u>	X	X	X	X		X	
Marten	<u>Martes americana</u>				X		X	
Fisher	<u>Martes pennanti</u>				/ ^c			X
Mink	<u>Mustela vison</u>	X	X	X	X		X	
Wolverine	<u>Gulo luscus</u>				/ ^c			X
Gray Wolf	<u>Canis lupus</u>				/ ^c			XE
Red Fox	<u>Vulpes fulva</u>	X	X	X	X		X	
Kit Fox	<u>Vulpes macrotis</u>	/ ^c						X
Mountain Lion	<u>Felis concolor</u>		X		X	X		
Canada Lynx	<u>Lynx canadensis</u>				X		X	X
Bobcat	<u>Lynx rufus</u>	X	X	X	X		X	X
Idaho Ground Squirrel	<u>Spermophilus brunneus</u>			X				X
Beaver	<u>Castor canadensis</u>	X	X	X	X		X	
Muskrat	<u>Ondatra zibethica</u>	X	X	X	X		X	
Mountain Cottontail	<u>Sylvilagus nuttalli</u>	X	X	X	X	X		
Pygmy Rabbit	<u>Sylvilagus idahoensis</u>	X	X	X		X		
Elk	<u>Cervus canadensis</u>	/ ^c	X		X	X		
Mule Deer	<u>Odocoileus hemionus</u>	X	X	X	X	X		
Whitetail Deer	<u>Odocoileus virginianus</u>				/ ^c	X		
Moose	<u>Alces alces</u>				/ ^c	X		
Pronghorn Antelope	<u>Antilocapra americana</u>	X	X	X		X		
Mountain Goat	<u>Oreamnos americanus</u>				/ ^c	X		
Bighorn Sheep	<u>Ovis canadensis</u>	X				X		

TABLE 12. (continued)

Species		KGRA Areas ^a				Special Concern Category		
Common Name	Scientific Name	B	M	C	V	Game	Furbearer	Extended Concern ^b
Birds:								
Canada Goose	<u>Branta canadensis</u>	X	X	X	X	X		
Snow Goose	<u>Chen hyperborea</u>	/c	/c	/c		X		
Ross' Goose	<u>Chen rossii</u>		/c			X		
Mallard	<u>Anas platyrhynchos</u>	X	X	X	X	X		
Pintail	<u>Anas acuta</u>	X	X	X	/c	X		
Gadwall	<u>Anas strepera</u>	X	X	X	/c	X		
Wigeon	<u>Anas americana</u>	X	X	X	/c	X		
Northern Shoveler	<u>Anas clypeata</u>	X	X	X	/c	X		
Blue-winged Teal	<u>Anas discors</u>	X	X	X	/c	X		
Cinnamon Teal	<u>Anas cyanoptera</u>	X	X	X	/c	X		
Green-winged Teal	<u>Anas crecca</u>	X	X	X	X	X		
Wood Duck	<u>Aix sponsa</u>	X	X	X	/c	X		
Redhead	<u>Aythya americana</u>	X	X	X	/c	X		
Canvasback	<u>Aythya valisineria</u>	X	X	X	/c	X		
Ring-necked Duck	<u>Aythya collaris</u>	X	X	X	/c	X		
Greater Scaup	<u>Aythya marila</u>	X	X	X	/c	X		
Lesser Scaup	<u>Aythya affinis</u>	X	X	X	/c	X		
Common Goldeneye	<u>Bucephala clangula</u>	X	X	X	/c	X		
Barrow's Goldeneye	<u>Bucephala islandica</u>		X	X	/c	X		
Bufflehead	<u>Bucephala albeola</u>	X	X	X	/c	X		
Ruddy Duck	<u>Oxyura jamaicensis</u>	X	X	X	/c	X		
Common Merganser	<u>Mergus merganser</u>	X	X	X	/c	X		
Red-breasted Merganser	<u>Mergus serrator</u>		X	X		X		
Hooded Merganser	<u>Lophodytes cucullatus</u>	X	X	X	/c	X		
Ferruginous Hawk	<u>Buteo regalis</u>	X	X	X	X			X

TABLE 12. (continued)

Species		KGRA Areas ^a				Special Concern Category		
Common Name	Scientific Name	B	M	C	V	Game	Furbearer	Extended Concern ^b
Bald Eagle	<u>Haliaeetus leucocephalus</u>	X	X	X	X			E
Prairie Falcon	<u>Falco mexicanus</u>	X	X	X				X
Peregrine Falcon	<u>Falco peregrinus</u>	X	X		X			XE
Wild Turkey	<u>Meleagris gallopavo</u>		/ ^c			X		
Blue Grouse	<u>Dendragapus obscurus</u>	X	X	X	X	X		
Spruce Grouse	<u>Canachites canadensis</u>	X	X		X	X		
Ruffed Grouse	<u>Bonasa umbellus</u>		X	X	X	X		
Sharp-tailed Grouse	<u>Pedioecetes phasianellus</u>			X		X		X
Sage Grouse	<u>Centrocercus urophasianus</u>	X	X	X		X		
Bobwhite	<u>Colinus virginianus</u>	X				X		X
California Quail	<u>Lophortyx californicus</u>	X	X	X		X		X
Mountain Quail	<u>Oreortyx pictus</u>		X			X		
Ring-necked Pheasant	<u>Phasianus colchicus</u>	X	X	X		X		
Chukar	<u>Alectoris chukar</u>	X	X	X	X	X		
Gray Partridge	<u>Perdix perdix</u>	X	X	X		X		
American Coot	<u>Fulica americana</u>	/ ^c	/ ^c	X		X		
Common Snipe	<u>Capella gallinago</u>	/ ^c	/ ^c	X	/ ^c	X		
Mourning Dove	<u>Zenaidura macroura</u>	X	X	X	X	X		
Reptiles:								
Ringneck Snake	<u>Diadophis punctatus</u>	X						X
Long-nosed Snake	<u>Rhinocheilus lecontei</u>	X	X					X
Western Ground Snake	<u>Sonora semiannulata</u>	X	X	X				X
Night Snake	<u>Hypsiglena torquata</u>	X	X					X

^aKGRA Areas: B=Castle Creek-Bruneau, M=Mountain Home, C=Crane Creek, V=Vulcan.

^bSpecial Concern: "X"-Classified by the Idaho State Fish and Game as species whose restricted range, specific habitat requirements and/or population numbers make them vulnerable to elimination from the state.

"E"-Indicates species that are federally protected as "Endangered Species", according to the Endangered Species Act (Revised List; August, 1978).

^cReported range of species is within close proximity of the non-competitive application areas.

Figure 18. Distribution of Mule Deer (*Odocoileus hemionus*) wintering habitat within Washington County, Idaho, generally illustrating its proximity to the Crane Creek KGRA.

Figure 19. Distribution of Elk (*Cervus Canadensis*) habitat within Washington County, Idaho, generally illustrating its proximity to the Crane Creek KGRA.

Figure 20. Distributions of Black Bear (*Ursus americanus*) habitat (cross-hatched) and Pronghorn (*Antilocarpa americana*) habitat (horizontal lines) within Washington County, Idaho, generally illustrating its proximities to the Crane Creek KGRA.

Figure 21. Distributions of California Quail (*Lophortyx californicus*) habitat (cross-hatched) and Mountain Lion (*Felis concolor*) habitat (horizontal lines) within Washington County, Idaho, generally illustrating their proximities to the Crane Creek KGRA.

Figure 22. Distribution of Chukar (*Alectoris chukar*) habitat within Washington County, Idaho, generally illustrating its proximity to the Crane Creek KGRA.

Figure 23. Distribution of Sage Grouse (*Centrocercus urophasianus*) habitat (cross-hatched) and its known strutting grounds (stippled) within Washington County, Idaho, generally illustrating their proximities to the Crane Creek KGRA.

Figure 24. Distributions of Bald Eagle (*Haliaeetus leucocoephalus*) wintering habitat (double lines), Wild Turkey (*Meleagris gallopavo*) habitat (cross-hatched) and waterfowl reproduction habitat (horizontal lines) within Washington County, Idaho.

Figure 25. Distributions of White-faced Ibis (Plegadis chihi) habitat (horizontal lines), Sharp-tailed Grouse (Pedioecetes phasianellus) habitat (cross-hatched) and Prairie Falcon (Falco mexicanus) habitat (vertical lines) within Washington County, Idaho, generally illustrating their proximities to the Crane Creek KGRA.

Figure 26. Distribution of Idaho Ground Squirrel (*Spermophilus brunneus*) within Washington County, Idaho, generally illustrating its proximity to the Crane Creek KGRA.

Mule Deer use much of the KGRA as winter range (Figure 18). An assessment of this winter range, critical to deer herd maintenance, needs to be made to determine how big of an impact the development at the KGRA will have for Mule Deer wintering habitat.

The KGRA and most all of its non-competitive lease application area is included within Pronghorn habitat. Geothermal resource development should not interfere with Pronghorn growth and reproduction unless its presence interferes with migration to and from water.

A Sage Grouse strutting ground area is located near the KGRA. These strutting grounds are historically established and maintained year after year, and their preservation is essential to the reproductive success of the species. Eliminating or disturbing strutting grounds could have far reaching impacts on the population size, since birds do not often change to other strutting grounds. Additional work needs to be initiated to determine the location of the strutting grounds with respect to the KGRA, how many birds visit and breed at these grounds, what impact geothermal development will likely have on strutting success, what impact reduced strutting success at the grounds will have on the population, and the artificial establishment of new strutting grounds using captive-reared and released birds.

This KGRA has more migrating waterfowl flying over it than any of the other cold desert KGRAs (Table 13). This area does not serve as a resting area for migrating birds; therefore, no special attention to migrating waterfowl is required. Waterfowl reproduction occurs within the KGRA and these breeding areas need special consideration to insure their preservation.

The White-faced Ibis has breeding grounds included within the KGRA. No data delineating the number of Ibis present are available, and the uncertainty of this species creates a problem of gathering data before geothermal development is initiated.

TABLE 13. ESTIMATED PERCENTAGE OF MIGRATING DUCKS, GEESE AND SWANS THAT FLY OVER THE KGRAS ANNUALLY

Species	Percent Over KGRA's ^a					Total Migrating Birds (thousands)
	Castle Creek	Bruneau	Mountain Home	Crane Creek	Vulcan	
Whistling Swan	--	--	--	--	--	102 - 233
Lesser Snow Goose (Fall)	1 - 2	1 - 2	1 - 2	14 - 11	14 - 11	735 - 2,240
Lesser Snow Goose (Spring)	2 - 2	2 - 2	2 - 2	39 - 41	39 - 41	651 - 2,210
Canada Goose (Small races)	--	--	--	--	--	646 - 1,200
Canada Goose (Large races)	3 - 2	3 - 2	3 - 2	3 - 2	3 - 2	1,558 - 1,718
American Wigeon	17 - 16	17 - 16	17 - 16	17 - 16	17 - 16	2,419 - 4,950
Gadwall	3 - 2	3 - 2	3 - 2	3 - 2	3 - 2	778 - 3,010
Green-Winged Teal	--	--	--	4 - 2	4 - 2	3,176 - 12,870
Blue-Winged Teal	--	--	--	1 - 1	1 - 1	4,442 - 8,330
Mallard	12 - 11	12 - 11	12 - 11	12 - 11	12 - 11	12,078 - 26,850
Pintail	--	--	--	23 - 20	23 - 20	8,520 - 17,500
Shoveler	3 - 4	3 - 4	3 - 4	9 - 9	9 - 9	1,116 - 2,560
Canvasback	--	--	--	--	--	468 - 1,002
Redhead	5 - 6	5 - 6	5 - 6	--	5 - 6	548 - 1,290
Lesser Scaup	--	--	--	--	--	1,724 - 3,960
Bufflehead	--	--	--	--	--	240 - 574
Ruddy Duck	13 - 13	13 - 13	--	--	--	230 - 474

^aWhere a dash is entered in the table implies that major flights over the KGRA are not expected, although the species is likely to be present in small, perhaps incidental numbers.

An unresolved problem is the population and taxonomic status of the Idaho Ground Squirrel. The squirrel presumably has a wide range; but until the taxonomic status is made clear, its population and distribution data will remain questionable.

Aquatic Ecology (K. McCarthy, EG&G Idaho)

Crane Creek is a major tributary of the Weiser River. The boundary of the KGRA is within 2 km of the confluence of the creek with the Weiser River. Aquatic data are available for the Weiser River Basin. The aquatic organisms discussed here represent the types present in the surrounding area that could be impacted by geothermal development and can be interpolated to exist within the boundaries of the study area.

Electroshocking surveys on the Weiser River conducted in 1974 and 1975 indicated 21 species of fish present. Figure 27 shows the percentage composition for total fish in the river. Benthic macroinvertebrates samples with a Surber sampler are shown in Table 14. Water depth at each sample site was less than 30.5 cm.³⁰

Aquatic macrophytes that reached "nuisance" levels in the Weiser River and adjacent sloughs and ponds were milfoil (Myriophyllum sp.), buttercup (Ranunculus reptans, Ranunculus trichophyllus, Callitriche heterophylla), American pondweed (Potamogeton americanus), and coontail (Ceratophyllum demerson). All sites of abundant macrophytes were in areas with some disturbance such as irrigation or heavy grazing. The only sites of moving water nuisance levels were those containing the Potamogetons.

Total coliform bacteria counts at two stations below the Crane Creek confluence on the Weiser River have revealed values of 3600 and 1250 immediate coliform per 100 ml, respectively.³¹ Standards set by the Environmental Protection Agency recommend a 1 count/100 ml maximum value for drinking water, while recommended values for secondary contact recreational use are 1000 counts/100 ml.³²

Figure 27. Percentage composition for total fish, game fish, and nongame fish in the electrofishing sample; Weiser River (Starkey downstream to the mouth at the Snake River), August 27 to September 10, 1974.³⁰

TABLE 14. WEISER RIVER BENTHOSA^a

Organism	Location			
	Above Weiser	Below Cambridge	Starkey	Little Weiser River
Ephemeroptera (mayflies)				
Baetidae	4.0	16.0	2.8	4.2
Heptagenidae	7.8	24.0	22.0	1.3
Ephemeridae	1.4		0.4	
Trichoptera (caddisflies)				
Hydropsychidae	10.4	145.8	21.8	85.0
Limnephilidae	15.0		45.6	
Rhyacophilidae	1.0	1.3	6.8	
Brachycentridae		0.2		
Plecoptera (stoneflies)				
Pteronarcidae			0.4	
Perlidae	1.6	2.4	2.6	
Diptera				
Chironomidae (midges)	32.2	6.6	8.4	83.3
Simuliidae (blackflies)				2.0
Tipulidae		0.6	1.2	9.3
Rhagionidae	0.4	0.4	0.4	
Tabanidae			0.2	
Lepidoptera (moth)				
Pupalidae		3.8		
Coleoptera (Beetles)				
Elmidae	6.4	3.6	15.2	15.0
Dytiscidae			0.2	
Psephenidae	0.2	2.6	0.2	0.7
Odonata				
Gomphidae (dragonfly)				0.3
Coenagrionidae (damselfly)				0.3
Mollusca	0.6			2.3
Nematoda (round worms)	1.8	0.2	0.6	
Hirudinea (leeches)	<u>12.4</u>	<u>0.2</u>	<u> </u>	<u> </u>
August number of insects/ sample	95.2	207.8	128.8	203.7

Human Environment

The sections Demography, Socioeconomics, and Heritage Resources provide a detailed discussion of human environment of the Crane Creek KGRA.

Demography (C. Lewis, Lewis & Associates)

The socioeconomic and demographic impacts of any significant geothermal resource development at the Crane Creek KGRA will be primarily in Washington County. Most of the socioeconomic data are reported on a county basis. In some cases, there may be a need for data for the area immediately surrounding the KGRA. In other cases, the county data will suffice.

Table 15 summarizes population data for Washington County and the three principal population centers: Cambridge, Midvale, and Weiser. Between 1970 and 1976, population in the county grew 11.5%. The components of population change, also reported in that table, show positive net migration of 500. Population growth, especially when accompanied with net immigration, is one indication of a healthy socioeconomic climate. Summary characteristics of the population from the 1970 Census are reported in Table 16. Racially, it is a homogeneous population with Caucasians accounting for almost 98% of total population. The data on educational attainment and percentage of 16- and 17-year-olds in school are about average.

Forecasts of population, employment by industry, labor force, and school enrollment are reported in Table 17. These data are current, having been developed in July 1978, and provide a more than adequate level of detail for environmental impact assessment. The projections are made through the year 2000 and provide a solid basis for the "no development" alternative. Such data are essential in an environmental

TABLE 15. POPULATION CHANGE, 1970-1976^a
AREA: WASHINGTON COUNTY

County (Cities)	Population		% Change 1970-1976 (1975) ^a
	1970	1976 (1975) ^a	
Washington County	7,633	8,500	11.5
(Cambridge)	383	442	15.4
(Midvale)	176	409	132.4
(Weiser)	4,108	4,538	10.4

Components of Population Change, 1970-1976

Area	Population Change	Births	Deaths	Net Migration
Washington County	800	900	600	500

^aCity data is for 1975.

Source: U. S. Bureau of the Census, 1977. Idaho Department of Health and Welfare, 1977. Idaho Division of Budget, Policy Planning, and Coordination, 1978.

TABLE 16. SUMMARY CHARACTERISTICS OF THE POPULATION, 1970
AREA: WASHINGTON COUNTY

Characteristics	Number	Percent
Population: White	7,452	97.6
Black	3	a
Other	178	2.3

	<u>Male</u>	<u>Female</u>
	<u>%</u>	<u>%</u>
Median school years completed	10.9	12.0
Percent high school graduates	42.7	50.1
16-17 year-olds in school	86.0	
Percent of population foreign born	2.7	

^aLess than 0.05 percent.

Source: U. S. Bureau of the Census, 1972a.

TABLE 17. POPULATION AND EMPLOYMENT FORECAST, 1978,
WASHINGTON COUNTY

EMPLOYMENT SUMMARY							
	1972	1975	1980	1985	1990	1995	2000
AGRICULTURE	785	705	634	600	551	518	479
MINING	8	8	10	12	14	17	19
CONSTRUCTION	64	88	106	117	130	146	165
FOOD AND KINDRED	30	32	34	36	38	41	44
WOOD PRODUCTS	291	243	326	421	449	681	348
OTHER MANUFACTURING	19	16	42	61	85	114	130
TRANS. COMM. AND UTILS	81	97	98	98	99	100	101
WHOLE AND RETAIL TRADE	626	794	886	960	1007	1078	1163
FINANCE, INS. REAL ESTATE	67	71	75	78	82	85	89
SERVICES AND MISC.	419	215	267	303	345	392	447
STATE AND LOCAL GOVT.	465	501	539	583	627	675	730
FEDERAL GOVERNMENT	51	53	51	53	54	54	54
TOTAL	2925	2820	3093	3306	3587	3902	4295

FORECAST SUMMARY							
	1970	1975	1980	1985	1990	1995	2000
TOTAL POPULATION	7630	7400	8330	9040	9900	10633	11463
TOTAL EMPLOYMENT *	2920	2820	3090	3300	3580	3900	4290
LABOR FORCE **	3010	2860	3170	3390	3670	3930	4380
TOTAL SCHOOL ENROLLMENT	1930	1750	1910	2230	2770	3070	3230
NURSERY	20	30	40	50	50	50	60
KINDERGARTEN	60	80	140	170	230	200	210
ELEMENTARY	1220	930	1070	1440	1730	1860	1880
HIGH SCHOOL	330	650	590	490	710	380	490
COLLEGE	30	40	60	60	50	60	70
HOUSEHOLD HEADS	2580	2400	2570	2640	2820	2920	3120

* EMPLOYMENT BASE YEAR = 1972
 ** LABOR FORCE BASE YEAR = 1970
 ** LABOR FORCE IS DEPENDENT UPON UNEMPLOYMENT RATE AND
 THE AVERAGE NUMBER OF JOBS HELD BY EACH WORKER

COMPONENTS OF POPULATION GROWTH SUMMARY						
	1970-1975	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000
TOTAL CHANGE	-229	933	750	820	732	825
NATURAL INCREASE	244	414	599	633	691	860
BIRTHS	801	962	1149	1172	1227	1392
DEATHS	557	548	550	539	536	532
MIGRATION	-483	534	151	187	41	-35
EMPLOYMENT	-483	534	151	187	41	-35
RETIREMENT	0	0	0	0	0	0

Source: Idaho Dept. of Water Resources and Center for Research,
Grants, and Contracts, Boise State Univ., July, 1978.

assessment to meet two objectives: (a) to describe the future socioeconomic environment in the absence of any significant resource development and (b) to provide a baseline or standard against which impacts of development can be compared. The projections show steady population and employment growth through the next 20 years. Projected net migration is positive until the period 1995 to 2000.

Summary data on school enrollment and number of teachers in the three school districts in Washington County are reported in Table 18. Weiser accounts for the largest share of total enrollment and reports a student/teacher ratio of 22.1, compared to <15 in the other two districts. The population impacts on the local school systems are expected to be concentrated in the Weiser and Midvale areas. The names, grades, and enrollment of all elementary, junior high, and senior high schools in those places are reported in Table 19.

Crime frequencies and rates per 100,000 population for the county are reported in Table 20. These data are not surprising as they reflect conditions in most low-population areas in the intermountain west. The rather steady increase in the crime rate from 1971 through 1976 reflects a national trend. Since 1973, the rate of increase in the crime rate has been relatively low; and, as a general statement, crime does not appear to be anymore a problem here than in most places. For the Southwest Idaho region, only in Ada County, and especially in Boise, does the crime rate appear to be a serious problem.

The conventional wisdom in socioeconomic impact analysis suggests that rapid economic growth is almost always associated with a significant increase in crime rates. A review of several impacted communities suggests that the experience is varied. Some places have experienced what could be considered a crime epidemic. Other places have seen no measurable change. Given the magnitude and type of development expected in this KGRA, the crime rate is not expected to increase.

TABLE 18. SUMMARY EDUCATION DATA AREA: WASHINGTON COUNTY

District	Enrollment			Change From 1976-1977	Teachers	Student/ Teacher Ratio
	Elementary ^a	Secondary ^b	Total			
431 - Weiser	837	731	1,568	+29	71	22.1
432 - Cambridge	118	143	261	-6	18	14.5
433 - Midvale	<u>66</u>	<u>92</u>	<u>158</u>	<u>-15</u>	<u>14</u>	<u>11.3</u>
Total	1,021	966	1,987	+8	103	19.3

^aGrades K-6.

^bGrades 7-12.

Source: Idaho Department of Education, 1977 and 1978.

TABLE 19. NAME, ENROLLMENT, AND LOCATION OF SCHOOLS NEAR KGRA, 1977-1978
 AREA: CRANE CREEK KGRA (WASHINGTON COUNTY)

City	School	Grades	Enrollment
Weiser	Weiser Senior High School	9-12	501
Weiser	Weiser Junior High School	7-8	222
Weiser	Park Intermediate School	4-6	349
Weiser	Pioneer Primary School	K-6	472
Midvale	Midvale Junior-Senior High School	7-12	141
Midvale	Cambridge Elementary School	1-6	109

Source: Fennell, 1977.

TABLE 20. CRIME FREQUENCIES AND RATES PER 100,000 POPULATION, 1971-1976
AREA: WASHINGTON COUNTY

	1971	1972	1973	1974	1975	1976
Part I Crimes (Rate)	182 (2,213.3)	191 (2,329.3)	246 (2,925.8)	246 (2,952.8)	254 (2,978.4)	259 (2,986.3)
Murder	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)
Rape	0 (-)	1 (12.2)	1 (11.9)	0 (-)	0 (-)	0 (-)
Robbery	0 (-)	1 (12.2)	0 (-)	3 (36.0)	3 (35.2)	3 (34.6)
Aggravated assault	0 (-)	3 (36.6)	8 (95.1)	9 (108.0)	6 (70.4)	10 (115.3)
Burglary	18 (218.9)	28 (341.5)	41 (487.6)	49 (588.2)	43 (504.2)	52 (599.6)
Larceny	156 (1,897.1)	155 (1,890.2)	189 (2,247.9)	179 (2,148.6)	191 (2,239.7)	185 (2,133.1)
Motor vehicle theft	8 (97.3)	3 (36.6)	7 (83.3)	6 (72.0)	11 (129.0)	9 (103.8)

Source: Idaho Law Enforcement Planning Commission, 1978.

Health care capability is another area for concern since many low-population areas provide only limited medical facilities and personnel. Washington County has only four doctors, implying a population per physician ratio of 2100, and one hospital with 30 acute care beds. Ambulance services are available. Any significant economic growth, regardless of the source, may strain the ability of the county health care resources to service an expanded population.

In general, the demographic data must be regarded as at least adequate for environmental studies. The population data, both for the county and for principal population centers, are relatively current. The data on characteristics of the population are outdated, having been collected in 1970, but probably are not of sufficient importance to warrant spending additional resources to provide an updated data set.

The projections of population, labor force, and employment must be regarded as excellent. They are current and provide the type of details that are needed for environmental studies.

Additional data in the education and health care areas would be useful. Especially important would be capacity data for schools in the area. Enrollment and number of teachers have been reported; but capacity data are not available from secondary sources. Some idea of the location and ability of the four physicians in the county to service the population would be of value.

Socioeconomics (C. Lewis, Lewis & Associates)

Summary data on labor force, unemployment, and employment in Washington County for the period 1974 through 1977 are reported in Table 21.

TABLE 21. LABOR FORCE, UNEMPLOYMENT, UNEMPLOYMENT RATE, AND EMPLOYMENT,
1974-1977 AREA: WASHINGTON COUNTY

Year	Labor Force	Unemployment	Unemployment Rate	Employment
1974	3,309	272	8.2	3,037
1975	3,222	339	10.5	2,883
1976	3,338	288	8.6	3,050
1977	3,514	290	8.3	3,224

Source: Idaho Department of Employment Security, 1977, 1978a, and 1978b.

The unemployment rate has consistently been in excess of 8%, suggesting a lack of strength in the employment market. For 1977, an average 290 workers were unemployed, indicating the labor pool is available to a potential new industrial development. Some of that employment is seasonal and does not reflect the availability of workers to move into other industry. However, development requiring an additional 100 to 200 workers would not strain the ability of the local labor market to meet the demand.

Detailed employment data for 1971 through 1976 are reported in Table 22, and an analysis of the employment data is included in Table 23. Of particular interest are the location quotients, which indicate the relative specialization of industry compared to both the nation and the state. A location quotient in excess of unity implies the county has more than a proportionate share of employment in that sector. Relative to the nation, agriculture, wholesale trade, and state and local government are the relatively important sectors. While employment growth has not been great, it has been steady. Since 1971, there has been only one year where total employment declined (1975).

The ability of the local economy to supply residents with goods and services is an area of concern. Summary data on retail trade and selected services activity for 1972 are reported in Tables 24 and 25. Data are shown for Washington County, Weiser, and the rest of county area. Most of the retail and virtually all of the services activity are concentrated in Weiser, with only limited numbers of establishments outside the city.

Detailed data on personal income by major source and a set of summary analytics are reported in Tables 26 and 27. These data are provided from the Regional Economics Information System developed and managed by the Bureau of Economic Analysis of the U.S. Department of Commerce (1978).

TABLE 22. EMPLOYMENT BY TYPE AND BROAD INDUSTRIAL SOURCES, 1971-1976
(FULL- AND PART-TIME), WASHINGTON COUNTY

ITEM	1971 1/	1972 1/	1973 1/	1974 1/	1975 2/	1976 2/
EMPLOYMENT BY PLACE OF WORK						
TOTAL EMPLOYMENT 3/	3,063	3,130	3,160	3,224	3,135	3,355
NUMBER OF PROPRIETORS	933	930	911	913	908	906
FARM PROPRIETORS	620	611	605	599	595	590
NONFARM PROPRIETORS	313	319	306	314	313	316
TOTAL WAGE AND SALARY EMPLOYMENT	2,130	2,200	2,249	2,311	2,227	2,449
FARM	268	254	241	251	251	335
NON-FARM	1,862	1,946	2,008	2,060	1,976	2,114
PRIVATE	1,236	1,334	1,367	1,432	1,330	1,463
AG. SERV., FOR., FISH., AND OTHER 4/	(U)	53	60	(U)	32	33
MINING	(U)	7	8	(U)	7	20
CONSTRUCTION	79	86	98	110	97	97
MANUFACTURING	371	461	399	394	341	387
NON-DURABLE GOODS	54	56	60	59	64	66
DURABLE GOODS	317	405	339	335	277	321
TRANSPORTATION AND PUBLIC UTILITIES	58	58	57	62	66	66
WHOLESALE TRADE	17	34	86	110	134	180
RETAIL TRADE	384	413	430	462	425	452
FINANCE, INSURANCE, AND REAL ESTATE	47	49	48	50	59	55
SERVICES	222	173	181	177	169	173
GOVERNMENT AND GOVERNMENT ENTERPRISES	626	612	641	628	646	651
FEDERAL, CIVILIAN	53	51	54	53	65	53
FEDERAL, MILITARY	85	81	73	75	72	69
STATE AND LOCAL	488	480	514	500	509	529

1/ ESTIMATES BASED ON 67 SIC.

2/ ESTIMATES BASED ON 72 SIC.

3/ CONSISTS OF WAGE AND SALARY JOBS PLUS NUMBER OF PROPRIETORS.

4/ INCLUDES NUMBER OF JOBS HELD BY U.S. RESIDENTS WORKING FOR INTERNATIONAL ORGANIZATIONS.

PRIMARY SOURCE FOR PRIVATE NON-FARM EMPLOYMENT: ES-202 COVERED WAGES - IDAHO DEPT. OF EMPLOYMENT

(U) NOT SHOWN TO AVOID DISCLOSURE OF CONFIDENTIAL DATA. DATA ARE INCLUDED IN TOTALS.

Source: Regional Economics Information System, Bureau of Economic Analysis, August, 1978.

TABLE 23. EMPLOYMENT BY TYPE AND BROAD INDUSTRIAL SOURCES, 1971-1976 (FULL- AND PART-TIME -- SUMMARY ANALYTICS), WASHINGTON COUNTY

ITEM	PERCENT	PERCENT	% TOTAL	PERCENT CHANGE		LOCATION QUOTIENT	
	OF U.S. 1976	OF STATE 1976	W+S EMPL 1976	76/71	76/75	U.S. 1976	STATE 1976

EMPLOYMENT BY PLACE OF WORK							

INITIAL EMPLOYMENT 1/	.0035	.87		10	7		
NUMBER OF PROPRIETORS	.0103	1.59		-3	0		
FARM PROPRIETORS	.0207	2.11		-5	-1		
NONFARM PROPRIETORS	.0053	1.09		1	1		

TOTAL WAGE AND SALARY EMPLOYMENT	.0029	.75		15	10		
FARM	.0240	1.40	13.68	25	33	8.4221	1.8696
NON-FARM	.0025	.70	86.32	14	7	.8775	.9314
PRIVATE	.0022	.64	59.74	18	10	.7681	.8635
AG. SERV., FCR., FISH., AND OTHER 2/	.0088	1.37	1.35	(D)	3	3.0779	1.8363
MINING	.0026	.60	.82	(D)	186	.9004	.8006
CONSTRUCTION	.0027	.57	3.96	23	0	.9405	.7580
MANUFACTURING	.0020	.74	15.80	4	13	.7128	.9962
NON-DURABLE GOODS	.0008	.26	2.69	22	3	.2915	.3684
DURABLE GOODS	.0029	1.14	13.11	1	16	1.0141	1.5336
TRANSPORTATION AND PUBLIC UTILITIES	.0014	.40	2.69	14	0	.5066	.5321
WHOLESALE TRADE	.0039	.90	7.35	959	34	1.3813	1.2084
RETAIL TRADE	.0034	.86	18.46	18	6	1.1927	1.1531
FINANCE, INSURANCE, AND REAL ESTATE	.0013	.44	2.25	17	-7	.4428	.5898
SERVICES	.0011	.34	7.06	-22	2	.3745	.4594
GOVERNMENT AND GOVERNMENT ENTERPRISES	.0037	.84	26.58	4	1	1.2906	1.1309
FEDERAL, CIVILIAN	.0018	.48	2.16	0	-18	.6463	.6368
FEDERAL, MILITARY	.0028	.57	2.82	-19	-4	.9698	.7634
STATE AND LOCAL	.0043	.98	21.60	8	4	1.5059	1.3159

1/ CONSISTS OF WAGE AND SALARY JOBS PLUS NUMBER OF PROPRIETORS.

2/ INCLUDES NUMBER OF JOBS HELD BY U.S. RESIDENTS WORKING FOR INTERNATIONAL ORGANIZATIONS.

PRIMARY SOURCE FOR PRIVATE NON-FARM WAGE AND SALARY EMPLOYMENT: IDAHO DEPT. OF EMPLOYMENT

(D) NOT SHOWN TO AVOID DISCLOSURE OF CONFIDENTIAL INFORMATION. DATA ARE INCLUDED IN TOTALS.

Source: Regional Economics Information System, Bureau of Economic Analysis, August, 1978.

TABLE 24. SUMMARY SELECTED SERVICES DATA, 1972
AREA: WASHINGTON COUNTY

		Washington County	Weiser	Rest of County		
All establishments:	Number	78	63	15		
	Receipts (000)	\$1,313	\$1,098	\$215		
Establishments with payroll:	Number	27	24	3		
	Receipts (000)	847	(D)	(D)		
	Payroll (000)	153	(D)	(D)		
	Employees	58	(D)	(D)		
<hr/>						
	<u>Washington County</u>		<u>Weiser</u>		<u>Rest of County</u>	
Service	Number	Receipts	Number	Receipts	Number	Receipts
<hr/>						
Hotels, motels, etc.	3	\$118	3	\$118	--	--
Automotive repair	12	249	8	166	4	\$83
Miscellaneous repair	11	181	10	(D)	1	(D)
Amusement and recreation	12	149	8	(D)	4	(D)
Legal services	6	168	6	168	--	--

(D) -- not reported to avoid disclosure of individual firm data.

Source: U. S. Department of Commerce, 1976f.

TABLE 25. SUMMARY RETAIL TRADE DATA, 1972
AREA: WASHINGTON COUNTY

	Washington County	Weiser	Rest of County
All establishments: Number	119	82	37
Sales (000)	\$14,086	\$12,361	\$1,725
Establishments with payroll: Number	74	57	17
Sales (000)	\$12,999	\$11,649	\$1,350
Payroll (000)	1,359	1,215	144
Employees	313	257	56
Number of establishments:			
Building materials, hardware, etc.	5	4	1
General merchandise	3	2	1
Food stores	15	10	5
Automotive dealers	10	9	1
Service stations	13	9	4
Apparel and accessory stores	5	5	--
Furniture and home furnishings	5	3	2
Eating and drinking places	30	16	14
Drug stores	4	3	1
Miscellaneous	29	21	8

Source: U. S. Department of Commerce, 1976c.

TABLE 26. PERSONAL INCOME BY MAJOR SOURCES, 1971-1976 (Thousands of Dollars), WASHINGTON COUNTY

ITEM	1971 1/	1972 1/	1973 1/	1974 1/	1975 2/	1976 2/
TOTAL LABOR AND PROPRIETORS INCOME BY PLACE OF WORK 3/						
BY TYPE						
WAGE AND SALARY DISBURSEMENTS	10,593	12,511	12,984	14,481	15,119	17,716
OTHER LABOR INCOME	774	976	934	1,067	1,062	1,349
PROPRIETORS INCOME 4/	5,749	6,817	9,562	9,563	5,449	6,374
FARM	3,772	4,428	7,109	6,902	2,500	3,144
NON-FARM 4/	1,977	2,389	2,453	2,661	2,949	3,185
BY INDUSTRY						
FARM	4,968	5,753	8,543	8,637	4,348	5,607
NON-FARM	12,148	14,551	14,937	16,474	17,262	19,840
PRIVATE	9,638	11,861	12,077	13,344	13,650	15,742
AG.SERV., FOR., FISH., AND OTHER 5/	(D)	244	283	(D)	301	287
MINING	(D)	64	79	(D)	112	361
CONSTRUCTION	723	953	1,092	1,269	1,247	1,435
MANUFACTURING	3,632	4,803	4,095	4,599	4,044	4,916
NON-DURABLE GOODS	333	363	422	479	566	786
DURABLE GOODS	3,299	4,440	3,673	4,120	3,458	4,130
TRANSPORTATION AND PUBLIC UTILITIES	564	641	692	759	852	935
WHOLESALE TRADE	173	333	518	630	863	1,106
RETAIL TRADE	2,262	2,547	2,892	3,109	3,232	3,543
FINANCE, INSURANCE, AND REAL ESTATE	435	495	530	531	652	652
SERVICES	1,638	1,781	1,896	2,040	2,277	2,507
GOVERNMENT AND GOVERNMENT ENTERPRISES	2,510	2,690	2,860	3,130	3,632	4,098
FEDERAL, CIVILIAN	423	448	499	576	642	722
FEDERAL, MILITARY	130	146	148	152	162	174
STATE AND LOCAL	1,957	2,096	2,213	2,402	2,828	3,202
DERIVATION OF PERSONAL INCOME BY PLACE OF RESIDENCE						
TOTAL LABOR AND PROPRIETORS INCOME BY PLACE OF WORK	17,116	20,304	23,480	25,111	21,630	25,447
LESS: PERSONAL CONTRIBUTIONS FOR SOCIAL INSURANCE BY PLACE OF WORK	662	808	861	1,083	1,135	1,265
NET LABOR AND PROPRIETORS INCOME BY PLACE OF WORK	16,454	19,496	22,619	24,028	20,495	24,182
PLUS: RESIDENCE ADJUSTMENT	613	694	899	959	1,853	2,231
NET LABOR AND PROPRIETORS INCOME BY PLACE OF RESIDENCE	17,067	20,190	23,518	24,987	22,348	26,413
PLUS: DIVIDENDS, INTEREST, AND RENT 7/	3,828	4,416	5,055	6,209	6,654	7,411
PLUS: TRANSFER PAYMENT	3,828	4,229	4,710	5,791	6,983	7,610
PERSONAL INCOME BY PLACE OF RESIDENCE	24,723	28,835	33,383	36,987	35,985	41,434
PER CAPITA PERSONAL INCOME (DOLLARS)	3,096	3,472	4,086	4,511	4,367	4,870
TOTAL POPULATION (THOUSANDS)	8.0	8.3	8.2	8.2	8.2	8.5

1/ ESTIMATES BASED ON 1967 SIC.

2/ ESTIMATES BASED ON 1972 SIC.

3/ CONSISTS OF WAGE AND SALARY DISBURSEMENTS, OTHER LABOR INCOME, AND PROPRIETORS' INCOME.

4/ PRIMARY SOURCE FOR PRIVATE NON-FARM WAGES: ES-202 COVERED WAGES - IDAHO DEPARTMENT OF EMPLOYMENT

5/ INCLUDES THE CAPITAL CONSUMPTION ADJUSTMENT FOR NON-FARM PROPRIETORS.

6/ INCLUDES WAGE AND SALARIES OF U.S. RESIDENTS WORKING FOR INTERNATIONAL ORGANIZATIONS.

7/ INCLUDES THE CAPITAL CONSUMPTION ADJUSTMENT FOR RENTAL INCOME OF PERSONS.

(D) NOT SHOWN TO AVOID DISCLOSURE OF CONFIDENTIAL INFORMATION, DATA ARE INCLUDED IN TOTALS.

Source: Regional Economics Information System, Bureau of Economic Analysis, July, 1978.

TABLE 27. PERSONAL INCOME BY MAJOR SOURCES, 1971-1976 (SUMMARY ANALYTICS), WASHINGTON COUNTY

ITEM	PERCENT OF U.S.	PERCENT OF STATE	% TOTAL EARNINGS	PERCENT CHANGE 76/71 76/75		LOCATION QUOTIENT U.S. STATE
TOTAL LABOR AND PROPRIETORS INCOME BY PLACE OF WORK 3/						
BY TYPE						
WAGE AND SALARY DISBURSEMENTS	.0020	.61		67	17	
OTHER LABOR INCOME	.0018	.58		74	25	
PROPRIETORS INCOME 4/	.0073	1.26		11	17	
FARM	.0176	1.70		-15	28	
NON-FARM 4/	.0046	1.00		61	9	
BY INDUSTRY						
FARM	.0224	1.63	22.03	13	29	9.2262 2.3490
NON-FARM	.0019	.60	77.97	63	15	.7987 .8604
PRIVATE	.0019	.60	61.86	63	15	.7748 .8563
AG.SERV.,FOR.,FISH.,AND OTHER 5/	.0077	1.48	1.13	(D)	-5	3.1476 2.1267
MINING	.0024	.70	1.42	(D)	222	.9708 1.0011
CONSTRUCTION	.0024	.47	5.64	98	11	.9825 .6730
MANUFACTURING	.0018	.73	19.32	35	22	.7456 1.0533
NON-DURABLE GOODS	.0008	.29	3.09	136	34	.3234 .4118
DURABLE GOODS	.0024	1.04	16.23	25	19	.9920 1.4973
TRANSPORTATION AND PUBLIC UTILITIES	.0012	.36	3.67	66	10	.4918 .5127
WHOLESALE TRADE	.0016	.45	4.35	539	25	.6477 .6515
RETAIL TRADE	.0032	.83	13.92	57	10	1.3275 1.1983
FINANCE,INSURANCE, AND REAL ESTATE	.0012	.45	2.56	50	0	.4863 .6536
SERVICES	.0015	.48	9.85	53	10	.5994 .6938
GOVERNMENT AND GOVERNMENT ENTERPRISES	.0022	.61	16.10	63	13	.9064 .8764
FEDERAL, CIVILIAN	.0016	.40	2.84	71	12	.6599 .5792
FEDERAL, MILITARY	.0009	.24	.68	34	7	.3882 .3457
STATE AND LOCAL	.0026	.76	12.58	64	13	1.0750 1.0943
DERIVATION OF PERSONAL INCOME BY PLACE OF RESIDENCE						
TOTAL LABOR AND PROPRIETORS INCOME BY PLACE OF WORK						
	.0024	.70		49	18	
LESS: PERSONAL CONTRIBUTIONS FOR SOCIAL INSURANCE BY PLACE OF WORK						
	.0023	.64		91	11	
NET LABOR AND PROPRIETORS INCOME BY PLACE OF WORK						
	.0024	.70		47	18	
NET LABOR AND PROPRIETORS INCOME BY PLACE OF RESIDENCE						
	.0027	.76		55	18	
PLUS: DIVIDENDS, INTEREST, AND RENT 7/						
	.0039	1.27		94	11	
PLUS: TRANSFER PAYMENTS						
	.0039	1.24		99	9	
PERSONAL INCOME BY PLACE OF RESIDENCE						
	.0030	.88		68	15	

3/ CONSISTS OF WAGE AND SALARY DISBURSEMENTS, OTHER LABOR INCOME, AND PROPRIETORS' INCOME.
PRIMARY SOURCE FOR PRIVATE NON-FARM WAGES: ES-202 COVERED WAGES -IDAMO DEPARTMENT OF EMPLOYMENT

4/ INCLUDES THE CAPITAL CONSUMPTION ADJUSTMENT FOR NON-FARM PROPRIETORS.

5/ INCLUDES WAGE AND SALARIES OF U.S. RESIDENTS WORKING FOR INTERNATIONAL ORGANIZATIONS.

7/ INCLUDES THE CAPITAL CONSUMPTION ADJUSTMENT FOR RENTAL INCOME OF PERSONS.

(D) NOT SHOWN TO AVOID DISCLOSURE OF CONFIDENTIAL INFORMATION. DATA ARE INCLUDED IN TOTALS.

Source: Regional Economics Information System, Bureau of Economic Analysis, July, 1978.

Data on agriculture are especially important because that sector may be significantly impacted by geothermal resource development. Summary agricultural data from the 1974 Census of Agriculture are reported in Table 28. Agriculture is especially important in Washington County, accounting for about 22% of total industrial earnings in industry. Average farm size is in excess of 400 ha, and more than one half of the county land area is in farms. Irrigated agriculture is relatively unimportant in size, as it accounts for only 6.6% of all farmland; but because geothermal development may impact on the quantity and quality of water available from wells, this area can be especially important.

Related to the agricultural question is the whole area of land use; data are reported in Table 29. As shown, urban use accounts for less than 1% of total land area, with agricultural and rangeland accounting for almost 80%, and 55.9% of county land area is privately-owned. This is quite different than many parts of the intermountain west where the federal government owns the majority of the land area.

A summary of the availability of land-use control mechanisms is also reported in Table 29. Washington County has a planning and zoning commission and subdivision ordinance but has no county comprehensive plan or zoning ordinance at this time.

Summary data on assessed value and property tax charges for 1977 are reported in Table 30. Assessed value of property in the county per capita is \$3,131, with property tax charges averaging \$148. On real and personal property only, per capita taxes are \$166. Selected measures of uniformity in assessment ratios are also provided in Table 30. The relatively large coefficient of variation suggests some disparity in assessment ratios among properties and the possible existence of some equity problems in property taxation.

TABLE 28. GENERAL AGRICULTURAL DATA, 1974 AREA: WASHINGTON COUNTY

Number of farms	503
Land in farms (acres)	518,735
Average farm size (acres)	1,031
County land area (acres)	935,936
Percent in farms	55.4%
Value of land and buildings	
Total (000)	\$75,603
Per farm	\$150,304
Per acre	\$146
Cropland (acres)	101,591
Percent of all land	10.9%
Percent of all farmland	19.6%
Irrigated land (acres)	34,275
Percent of all land	3.7%
Percent of all farmland	6.6%
Quantity of irrigation water applied (ac ft)	90,356
Per acre (ac ft)	2.7
Value of agricultural products sold--total (000)	\$16,924
Average per farm	\$33,647

Source: U. S. Bureau of the Census, 1977.

TABLE 29. SUMMARY DATA ON LAND USE, LAND OWNERSHIP, AND
LAND-USE CONTROL MECHANISMS, 1976-1977
AREA: WASHINGTON COUNTY

	Acres	% of Total
Land Use--1976:		
Urban	3,500	0.4
Agricultural	134,000	13.8
Rangeland	706,100	74.6
Other	104,900	11.2
Land Ownership--1977:		
Federal government	345,946	37.0
State government	63,254	6.8
Private	523,621	55.9
Local government	3,115	0.3
Land-Use Control Mechanisms:		
Planning and Zoning Commission	Yes	
County Comprehensive Plan	No	
Subdivision Ordinance	Yes	
Zoning Ordinance	No	

Source: Idaho Division of Budget, Policy Planning, and Coordination, 1978

TABLE 30. SUMMARY DATA ON ASSESSED VALUE AND PROPERTY
TAX CHARGES, 1977
AREA: WASHINGTON COUNTY

Assessed value of all property--total (000)	\$26,610
Per capita	\$3,131
All property tax charges--total (000)	\$2,261
Per capita	\$266
Property tax charges-real and personal property-- total (000)	\$1,408
Per capita	\$166
Measures of uniformity in assessment ratios:	
Weighted assessment ratio	14.76
Regression index	0.97
Coefficient of variation	36.21

Source: Idaho State Tax Commission, 1977a.

With few exceptions, the socioeconomic data are more than adequate for environmental assessment studies. The housing data are an exception.

The 1970 data may provide a guide for additional data collection but are of no value in assessing quality, availability, or cost of housing. The land-use data do not provide details for land use in the immediate vicinity of the KGRA, nor the agricultural sector in that immediate vicinity. The retail trade and selected services data are six years old and are somewhat outdated. The private sector is expected to provide goods and services when the demand exists; and it is not clear if there is much of a role to be played by the public sector through the planning process.

Heritage Resources (R. Knudson, M. Pfaff, Idaho Water Resources Research Institute)

Paleontological Resources. In the Weiser area³³ Upper Miocene floral remains have been found in the Payette Formation, a set of sedimentary interbeds of white tuffaceous sand that are intercolated between members of the Miocene plateau basalts. This later Tertiary vegetation is unique within the plateau. These Payette flora have not been specifically identified within the Crane Creek KGRA, but the Tertiary vegetation is within the general area of the florally rich Payette Formation. Bond and others³⁴ map the border between the Miocene igneous extrusive basalts and the contemporary sedimentary formations across the KGRA. Paleontological field reconnaissance of this area is needed before further plans can be developed.

Prehistoric Resources. There has been no professional archaeological reconnaissance conducted within the Crane Creek KGRA to date. Surveys within the general Weiser River valley within the last three decades include an early reconnaissance of selected proposed reservoir areas by the Columbia River Project, River Basin Surveys, Smithsonian Institution in the late 1940s³⁵, and of proposed highway projects by

Idaho State University in the early 1960s^{36,37}. In 1964 to 1965, Alfred Bowers of the University of Idaho conducted extensive surveys across Washington County as well as test excavations in the area of Mann Creek Reservoir west of the Crane Creek KGRA.³⁵ Further excavations and analysis of the Midvale Complex^{36,37,38}, of the Mesa Hill site³⁹, and within Hells Canyon^{40,41,42} to the north and northwest of the Crane Creek provide a framework for evaluation of the potential prehistoric archaeological resources for the Crane Creek KGRA.

Bowers³⁵ report of his reconnaissance of Washington County is brief, with terse site reports that essentially provide site locational data. He does record the recovery of a mid-section of a Folsom projectile point at a mapped location near Ant Butte, California, 10 km east of the Crane Creek KGRA and just south of the Crane Creek Reservoir.³⁵ Folsom points in eastern Idaho are found in archaeological contexts that are dated at approximately 10,900 years ago.⁴³ The Ant Butte isolated find does not constitute a significant archaeological site and could have been dropped in the area by later inhabitants; the point is an indication that considerable time depth could be expected of the cultural resources in the Crane Creek area.

Bowers had little way of establishing good temporal controls on the materials he found during his 1964 and 1965 surveys in Washington County, though he did note considerable artifactual variation among the assemblages of his 116 recorded sites. He did test excavate one site within the proposed Mann Creek Reservoir take-line, the Spangler site (10-WN-30), and was able to date a significant cultural component there at 600 years ago³⁵ with additional cultural materials in place well below the dated level. The Spangler site and three other prehistoric sites near it are located in a topographic setting very

similar to that of the Crane Creek KGRA -- and alluvial valley that is tributary to the main Weiser River valley, near the valley wall created by erosion of the Miocene basalts, in the vicinity of good springs and a permanent stream. Thus, materials similar to those at Spangler could be remnant in the Crane Creek area.

Bowers also noted the presence of an unusual set of artifacts spread across Washington County,³⁵ well-made bifaces and flake tools of fine-grained basalt. These materials had first been noted in the Midvale area about 15 km up the Weiser Valley from the Crane Creek KGRA and have been well described as a distinct prehistoric technical industry.³⁸ Unfortunately, these materials have never been dated, and the artifact assemblages associated with the Midvale Complex frequently do not include temporally diagnostic projectile points. Dort³⁶ in his analysis of the Midvale sites' geology noted that the archaeological materials were deposited within a thin soil that could not be reliably dated and that was draped over a much older landform; the sites are usually associated with outcrops of fine-grained basalt and hence are not deeply buried if at all. Warren, Wilkinson, and Pavesic³⁷ in their original analysis of the Midvale materials assigned a date of 4500 to 2000 years ago on the basis of the associated projectile points at 10-WN-4, the Midvale site, but that site yielded little stratigraphy to verify the assignment. Bucy³⁸ has not questioned this determination. On the other hand, Reubelmann in his analysis of the Mesa Hill site, another fine-grained basalt quarry and workshop in the Weiser Valley upriver from the Midvale sites and approximately 30 to 35 km north of the Crane Creek KGRA, assigns this industry to the Cascade period at 7000 to 4000 years ago.³⁹ This assignment is quite probable, since it reflects a general correlation of basalt technology and Cascade settlements in the southern Plateau. Coming back to Crane Creek, Bowers noted the presence of this basalt

assemblage at a series of prehistoric sites east and south of Crane Creek Reservoir, just east of the Crane Creek KGRA.³⁵ When one reviews all the available data on the known prehistoric cultural resources in the Crane Creek KGRA vicinity, one must assume that there is a high probability of the KGRA having archaeological materials with considerable time depth, perhaps including the Midvale Complex materials, and reflecting a settlement pattern similar to that of the Spangler locality.

Ethnographically, the lower Weiser valley was a focus of cultural exploitation and interaction, which could be reflected in the Crane Creek KGRA resources. As with the Vulcan area, both the Nez Perce and the Shoshoni moved through the Weiser Valley. Verne Ray recorded Nez Perce temporary fishing and hunting camps at the confluence of the Little and main Weiser Rivers, the west end of modern Crane Creek Reservoir, and the confluence of the Weiser and Snake Rivers (ca. 30 km north, 10 km east, and 15 km west of the Crane Creek KGRA, respectively). This record is again referenced by Schwede,⁴⁴ and Marshall⁴⁵ includes the Crane Creek KGRA within his map of ethnographic Nez Perce territory. The Indian Claims Commission⁴⁶ accepted Ray's information as fact but drew their boundary of exclusive Nez Perce territory well to the north of Crane Creek. The Commission⁴⁶ did note that one of the principal root digging grounds exploited by the Nez Perce was north and east of Weiser, perhaps in the area now inundated by the Crane Creek Reservoir, and that antelope abounded in this same area and further east and northeast. Chalfant⁴⁷ noted that the Nez Perce traditionally in the spring with the Shoshoni in the Weiser River Valley near modern Council before travelling to Wyoming to hunt buffalo. His map⁴⁷ of the Wyoming trail notes a route passing through the upper Crane Creek Valley approximately 20 to 25 km east of the Crane Creek KGRA. Chalfant⁴⁷

commented that the Nez Perce obtained "black flint" from a small stream emptying into the Snake from the east, north of Weiser. Thus, the Nez Perce within the last two hundred years were exploiting the lower Weiser Valley for stone materials, plant and animal foods, and social and economic interaction, and quite likely the exploitation included the springs of the Crane Creek KGRA.

The lower Weiser Valley was also popular with the Shoshoni. Steward⁴⁸ reported that the Shoshoni were exploiting the anadromous fish, root crops, and mild winters in that area, and Murphy and Murphy⁴⁹ also note the presence of a Shoshoni camp site near the mouth of Crane Creek, within 1 to 2 km of the Crane Creek KGRA. Nearly all the trappers and traders who travelled along the western Snake River Plain in the early nineteenth century (Figures 28 and 29) comment about finding "Snakes" (Shoshoni) near the confluence of the Weiser and Snake Rivers, and some such as John Work⁵⁰ and Wilson Price Hunt⁵¹ comment on the numerous Shoshoni camps along the Weiser. Hunt⁵¹ on November 28, 1811, encountered "some huts of Chochonis (Shoshoni)" on what appears to be the headwaters of Mann Creek, perhaps 15 km northwest of the Crane Creek KGRA, an indication that even in winter people were scattered over all elevations of the Weiser Valley.

Reviewing the present archaeological, ethnographic, and ethno-historic data relative to the Crane Creek KGRA, there is a high probability of finding significant prehistoric cultural resources within the proposed area of development. Materials dating throughout the Late Pleistocene and Holocene could be found there, and the Midvale Complex could well be represented in that locality. Considering Chalfant's⁴⁷ comment that Nez Perce exploitation of the lower Weiser Valley is relatively recent, a function of their aggressive strength with their adoption of horses, one would expect a more typical Shoshoni settlement pattern including winter villages to be represented in any KGRA prehistoric resources. An intensive professional archaeological reconnaissance of the KGRA is a first planning requirement.

Figure 28. Stuart's and Hunt's routes across southern Idaho (Rollins 1935:2).

Figure 29. John Work's route across central Idaho.⁵⁰

Historic Resources. Few specific comments about the Crane Creek KGRA are present in the literature, though several traders were in the general Weiser Valley or its mouth in the early nineteenth century.^{52,53,54,55,56,57,58} John Work and his Hudson Bay Company Snake Brigade may even have passed directly through the KGRA.⁵⁰ Apparently, none of them settled there, and no major trading posts were established. The Oregon Trail passed well south of the Weiser Valley,⁵⁹ and it was not until the Boise Basin mines opened in the 1860s that major Euroamerican traffic began to funnel past the Weiser area. Olds Ferry⁶⁰ was constructed in 1860 or 1861 approximately 20 km west of modern Weiser and ran across the Snake River from the Idaho side; it continued to operate until 1920 and brought many people to the Weiser area. The Abernathy trading post was built at the ferry site in 1862, and again attracted Euroamericans to the area. The first land surveys⁶¹ indicate that a house had been constructed within the Crane Creek KGRA by 1870, that there was a school there by 1901, and land titles were finally issued beginning in 1906. Settlement of the lower Weiser Valley certainly was becoming well established by time the Bannock War campaigners travelled through there in 1878,⁶² and this was supported by construction of the Pacific and Idaho Northern Railroad from Weiser to New Meadows in 1899 to 1902. This railroad passed within 2 to 3 km west of the Crane Creek KGRA. As with the prehistory of the area, the historic archaeological and architectural resource potential within the KGRA is great and the area merits professional field reconnaissance before further development planning is carried out.

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APPENDIX A

**SNAKE RIVER BASIN OVERVIEW REPORTS
AND SUPPORTING DOCUMENTS**

The reports, prepared as part of the Snake River Basin environmental program, are listed. Copies of these reports are available from the Information Processing of the Information Division at EG&G Idaho, Inc., Box 1625, Idaho Falls, Idaho 83401.

- EGG-2001 "Potential Use of Geothermal Resources in the Snake River Basin: An Environmental Overview,"
S. G. Spencer, B. F. Russell, and J. S. Sullivan,
editors.
- EGG-GTH-5001 "Vulcan Hot Springs KGRA: An Environmental Analysis,"
S. G. Spencer and B. F. Russell, editors.
- EGG-GTH-5002 "Crane Creek KGRA: An Environmental Analysis,"
S. G. Spencer and B. F. Russell, editors.
- EGG-GTH-5003 "Castle Creek KGRA: An Environmental Analysis,"
S. G. Spencer and B. F. Russell, editors.
- EGG-GTH-5004 "Bruneau KGRA: An Environmental Analysis,"
S. G. Spencer and B. F. Russell, editors.
- EGG-GTH-5005 "Mountain Home KGRA: An Environmental Analysis,"
S. G. Spencer and B. F. Russell, editors.
- EGG-GTH-5006 "Raft River KGRA: An Environmental Analysis,"
S. G. Spencer and B. F. Russell, editors.
- EGG-GTH-5007 "Geothermal Development in Southwest Idaho: The Socioeconomic Data Base," W. C. Lewis, Lewis & Associates.
- PG-G-79-001 "KGRA Comprehensive Completion Report: Seismicity,"
J. K. Applegate, GeoTechniques.

- PG-G-79-002 "KGRA Comprehensive Completion Report: Subsidence,"
J. K. Applegate, GeoTechniques.
- PG-G-79-003 "Snake River Basin KGRA Environmental Report: Soils,"
N. Savage, Idaho Water Resources Research Institute.
- PG-G-79-004 "KGRA Comprehensive Completion Report: Air Quality,"
E. Bentley, GeoTechniques.
- PG-G-79-005 "KGRA Comprehensive Completion Report: Meteorology,"
M. Delisio, GeoTechniques.
- PG-G-79-006 "Heritage Resources and Known Geothermal Resource Areas
in Idaho: A Preliminary Review," R. Knudson and
M. Pfaff, Idaho Water Resources Research Institute.
- PG-G-79-007 "Assessment of Hydrology and Water Quality Data of the
KGRAs of the Snake River Basin," C. L. Miller and C. C.
Warnick, Idaho Water Resources Research Institute.
- PG-G-79-008 "KGRA Comprehensive Completion Report: Geology,"
R. Hardyman, GeoTechniques.
- PG-G-79-010 "Aquatics of Five Snake River Basin KGRAs,"
K. P. McCarthy and J. F. Sullivan, EG&G Idaho, Inc.
- PG-G-79-011 "A Summary of the Assessments of Geothermal Resource
Use Limitations of Bruneau, Castle Creek, Crane Creek,
Mountain Home, and Vulcan Hot Springs KGRAs," B. Moore,
N. Savage, J. S. Gladwell, and C. C. Warnick, Idaho
Water Resources Research Institute.