**SMALL SCALE
HYDRO POTENTIAL
IN NEVADA**

Nevada Department of Energy

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Small-Scale Hydroelectric-Power Potential in Nevada:
A Preliminary Reconnaissance Survey

by

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INTRODUCTION

In the past, the concepts of "economy of scale" and the pervasive "benefit/cost" ratio largely controlled decisions on hydroelectric development in the West. Coupled with low cost gas, oil and coal these concepts resulted in construction of a great many dams and reservoirs without hydroelectric generation facilities. The 1973 OPEC oil embargo and resultant quadrupling of oil prices reawakened interest in hydroelectric power generation, particularly low-head generation in the ten to thirty megawatt (MW) range. These smaller plants can have both energy and capacity value. This renewed interest was reflected by a U.S. Department of Energy (DOE) initiative to inventory low-head hydro sites throughout the country. Many utilities also began to look seriously at the economics of developing low-head hydroelectric plants.

Continuing escalation of oil prices since 1973, to about \$40.00 per barrel currently, coupled with stringent air pollution regulations related to burning coal, have caused two effects. First it has served to increase the economic viability of small hydroelectric plants and second it has reduced the lower feasible size. The DOE has begun a more active program to promote development and further has shifted the focus from "low-head" hydroelectric, to "small-scale" hydroelectric.

Recent congressional legislation has recognized the importance of small-scale hydroelectric and the attendant

* ED. NOTE

financial handicaps which are to be ameliorated through federal assistance. Title IV of Public Law 95-617, entitled "Small Hydroelectric Power Projects of the Public Utility Regulatory Policies Act of 1978", authorized a program to encourage the development of small hydroelectric power projects at the site of existing dams which are not being used to generate electric power.

Title IV also authorized direct loans through U.S. DOE for up to 90 percent of the costs for performing feasibility studies and for obtaining licenses and permits for small hydroelectric projects. Title IV also includes authority for simplified Federal Energy Regulatory Commission (FERC) licensing and for loans for construction costs.

Up to 90 percent of a feasibility study, not to exceed \$50,000, may be loaned at 7-1/8 percent (currently) for a period not to exceed 10 years. Loans will be forgiven for those projects which prove not to be feasible. This loan program is available for projects having hydraulic heads derived from dams constructed by April 20, 1977. The small-scale hydroelectric projects must have a capacity of at least 100KW but not greater than 15,000KW and can be located at a potential head downstream from a dam or as the direct result of a canal drop.

Congressional desire to foster hydroelectric development is further demonstrated by tax legislation.¹ Public Law 96-

¹Small Hydro Bulletin, Division of Hydroelectric Resources Development, U.S. Dept. of Energy, Idaho National Engineering Laboratory, June, 1980.

*As of June 30, 1981. These federal financial assistance programs have been suspended, eliminating any involvement of the federal government in this area.

223, "The Crude Oil Windfall Profits Tax Act of 1980," Title II, Part II, entitled "Business Energy Investment Credits," allows an 11 percent business energy credit for investments in qualifying hydroelectric property. This credit is in addition to the long-standing 10 percent investment tax credit. This new 11 percent credit is available at sites having an existing generating capacity as well as where none currently exists. It is available for existing dams, which were completed before October 18, 1979, and at new or existing natural or manmade water flows (such as rivers, conduits, or irrigation ditches) which are not at the site of the dam. This credit is available to all taxpayers.

The federal government and state governments have extensive regulations under which licensing and operation of hydroelectric facilities can take place. These regulations are primarily intended to protect public safety and welfare. Federal regulatory authority over small-scale hydroelectric facilities stems from the Federal Power Act of 1920 and lies primarily within the FERC which is involved in the regulation of dams used for electric power generation. FERC has authority over four types of hydroelectric development:

1. Projects located on navigable waterways;
2. Projects affecting interstate commerce;
3. Projects which use federal lands; and
4. Projects which use surplus water or water power from a federal dam.

These categories cover most potential hydroelectric projects.

When considering a particular site and project it is necessary to determine if FERC has control over the project by either seeking an informal opinion or filing a declaration of intent with the Commission. Of significance to any potential developer is the initial step in the procedure, that of application for a Preliminary Permit. The Preliminary Permit is necessary for a potential developer to secure a legal prior right to develop a particular site if the site is on non-private property. This permit is designed to allow an investor an opportunity to recoup his investments for site appraisals and license applications if the proposed project is developed. The Preliminary Permit procedure gives preference to public entities when two or more parties are competing for the same site.

The overall feasibility of a small-scale hydroelectric project depends upon a multitude of concerns. These can be broken into two distinct areas: 1) engineering and technical problems, and 2) legal and institutional issues.

In general the technical appraisal must address each of the following items specifically.

- A. Physical structures (dam, conduits, spillways, canals, etc.)
 - 1. Physical composition
 - 2. General configuration and dimensions

- B. Reservoirs
 - 1. Elevation, storage, and surface area relationships
 - 2. Current uses of reservoir and shoreline
 - 3. Estimate of storage capability to accommodate peak and reduced power requirements
- C. Electric transmission
 - 1. Age, ownership, and voltage of system to be connected
 - 2. Distance to connection
- D. Electrical generation preliminary estimates
 - 1. Potential capacity (hydraulic)
 - 2. Installed capacity (proposed)
 - 3. Average annual energy generation
 - 4. Most Likely customers
- E. Estimated value or sales price of hydroelectric energy
- F. Stream characteristics
 - 1. Flow-duration estimates
 - 2. Water rights and usages downstream
- G. Site characteristics
 - 1. Geology
 - 2. Seismic

The major legal and institutional concerns that must be addressed include the following.

- A. Water Law: Does the developer have the right to the use of the water?

1. Nevada water law - appropriation doctrine
- B. Licenses: Does the small-scale hydroelectric facility need a license and who issues it?
 1. Federal Energy Regulatory Commission
 2. State licensing agencies
- C. Environmental Regulation: What is to be protected?
 1. National environmental policy
 2. Water quality
 3. Fish and endangered species
 4. Historic, natural and scenic places
- D. Power Marketing: How does the output get sold at a fair price?
 1. State and federal public utility regulation

SURVEY OBJECTIVES

This preliminary reconnaissance survey is intended to:

1) develop a first estimate as to the potential number, location and characteristics of small-scale hydroelectric sites: 2) provide a compilation of various Federal and state laws and regulations that affect small-scale hydroelectric development and 3) provide information on sources of small-scale hydroelectric generation hardware and consultants/contractors who do small scale hydroelectric work. The entire survey has been conducted in the office working with various available data bases. Since no field work was actually done, some sites have been listed that are not feasible and some sites which are feasible may not have

been listed. Users of this survey are encouraged to notify the Nevada Department of Energy of both errors of commission and omission.

BACKGROUND AND SCOPE

Small scale hydroelectric power plants are defined in the Public Utilities Regulatory Policy of 1978 (PURPA) as generating facilities with a capacity between 100 and 15,000 kilowatts (KW). However, for this Nevada survey the lower limit was extended to 50KW, which is often referred to as the "micro-scale" range.

Production of hydroelectric energy involves the conversion of the kinetic energy of flowing water first to mechanical energy in a rotating turbine or wheel and then to electrical energy in the generator. The amount of energy that can be extracted from the water is a function of flow-rate, Q , the distance through which it falls, or head, H , and the plant efficiency, e :

$$KW \propto QHe$$

Thus the same energy can be generated either with a high head and low flow, or low head and high flow. "Low head" and "high head" are common terms in the hydroelectric field, with the demarcation generally defined as 20 meters, or about 66 feet. For a head of 66 feet and an 80 percent efficiency a flow of about 12 cubic feet per second (cfs) is required to generate 50KW. Almost every significant stream or canyon in Nevada is capable of yielding flood flows with discharge in excess of this amount, but few are capable of sustaining

such a flow for even 50 percent of the time. Thus Nevada's climate and hydrology fairly well restrict small-scale hydroelectric facilities to the high head-low volume variety. For a head of 660 feet ($\eta=80\%$) a flow of only 1.2 cfs is required to generate 50KW, and many streams in Nevada are capable of sustained flows of this magnitude. Thus this survey focuses on potential high-head low-flow generating sites.

The power potential of a site is determined by the number of KW that can be generated, or the capacity. The feasibility of a site depends, among other things, on the energy that can be generated. The energy potential is equal to the product of the capacity (KW) and the number of hours that the facility is in operation, and is expressed as kilowatt-hours (KWH) or megawatt hours (1MWH=1000KWH). Many sites may have a potential capacity of several hundred KW, but if that capacity can be used for only a few hours or days per year, the site has little real practical value. Thus to be feasible a site must have a potential capacity equal or greater than 50KW and be capable of sustaining that flow for a relatively high percentage of the time. Any site with an associated reservoir has greater potential feasibility than one without a reservoir because of the ability to store water during high runoff periods for later release.

Fifty KW of power is not very significant in terms of Nevada's total commercial generating capacity when one considers, for example, that Sierra Pacific Power Company's new Valmy No. 1 plant will generate 250,000KW. However, the power

may not be trivial. Peak power consumption in the major urban areas of the state generally averages less than about 5KW per residence. This figure applies to homes with most "modern" conveniences, i.e. electric range, electric hot water, electric refrigerator, air conditioner, etc. In much of the more rural areas the peak power demand is considerably less, and probably averages no more than about 3KW per residence. Many of the more isolated ranching and mining operations, and small communities that do not have electric utility service often rely upon deisel-electric generators and in these instances peak load may be even lower. Thus in the rural areas even a 50KW hydroelectric facility could serve 15 to 20 residences provided the peak demand remained low. If restrictions were placed on allowable electrical appliances the service population could be further extended.

Small-scale hydroelectric facilities may find greatest application in the state's rural areas where electricity is currently unavailable, or where the cost of increasing the supply from distant production points is very high. However, under the proper circumstances, small facilities may be feasible where they can be easily connected to the major utility distribution networks.

If, when, and where additional small hydroelectric plants are built in Nevada will be largely dictated by economics. While the "fuel" for a hydroelectric plant is free, the capital

construction cost is fairly high on a per KW installed basis. For very small capacities (50-150KW), the study, design and construction costs are essentially independent of the capacity, such that it costs nearly as much to build a 50KW facility as it does to build a 150KW facility. Construction costs in 1979 were nearly \$2000/KW for plants in the 500 to 2000KW range. Standardized designs and "off-the-shelf" hardware should significantly reduce the costs for smaller plants.

INSTITUTIONAL, LEGAL AND FINANCING ISSUES

Institutional and Legal: General

The institutional and legal problems that face a potential developer of a small-scale hydroelectric facility in Nevada can be confusing and complex. This chapter has been organized to identify these issues both at the federal and state levels.

Federal Regulation

Federal regulation of small-scale hydroelectric development is primarily performed by the Federal Energy Regulatory Commission (FERC). In general, the following FERC regulation would apply to any development on the Carson, Humboldt, Walker, Truckee or Colorado rivers or to developments that occupy in whole or in part on lands owned by the federal government or that use surplus water or water power from a government dam. Developments on the small rivers and streams probably will not be required to comply with these regulations, however, even in this case, FERC may require a filing. Therefore, all potential developers should contact FERC prior to developing a final project plan. All power projects within this jurisdiction are required to be licensed by the FERC. The licensing process is complex and detailed, requiring input from many agencies. The FERC has been authorized to determine if a project complies with state and federal laws. A FERC license usually will not be granted unless all permits and licenses required under state

and local laws have been obtained by a developer. The FERC must also insure compliance with 11 federal laws.

The licensing process entails an examination of the uses and impacts of a potential project. Detailed information regarding the project's plans, location, site topography, environmental impact and other aspects must be supplied by the developer.

Agencies may participate in the process through their permitting decisions, intervention in the regulatory proceedings, and objection to a license decision. This procedure often requires several years to complete. Even after the FERC has made a final ruling, this decision may be challenged in the courts.

The FERC has recently simplified the licensing procedure for certain types of projects. One simplified procedure applies to sites of 1.5MW or less. Under this process, the amount of information and the complexity of detail are reduced. Using this simplified procedure, the FERC recently granted a license within 18 months of receiving the application.

A second simplified process applies to sites at existing dams. This process also requires less detail and is procedurally simpler. It has been estimated that a license could be issued within 12 months using this process. Thus, the FERC has taken major steps to reduce the federal regulatory burden on small-scale hydroelectric development.

There are certain advantages to a developer in obtaining a FERC license. First, it gives the developer an absolute right to develop that particular site. Second, the power of federal eminent domain is made available to that developer. Third, the FERC has a comprehensive program of dam safety and inspections.

Through the FERC licensing process, various federal statutes are enforced. If a potential developer does not comply with certain aspects of federal legislation, a FERC license will be denied. The important federal statutes affecting small-scale hydroelectric facilities are as follows:

- ° The Federal Water Pollution Control Act Amendments of 1972 (FWPCA) require approval from the Environmental Protection Agency (EPA) and the U.S. Corps of Engineers for all projects. Pursuant to Section 401, the EPA has delegated its responsibility for water quality criteria to state regulatory agencies. Section 404 requires the Corps to issue a permit for any activity which will dredge or fill a river bed, as when a dam is substantially altered.
- ° The National Environmental Policy Act (NEPA) requires environmental impact assessments or statements for many hydroelectric developments.
- ° The Fish and Wildlife Coordination Act (FWCA) requires the FERC to consult with federal and state

game agencies. It is quite possible that fish ladders or other mitigating measures will be required to comply with this act.

- ° The Endangered Species Act requires the FERC to coordinate with the Department of Interior to ensure that development will not interfere with or destroy any endangered species or its habitat.
- ° The Historic Preservation Act requires the FERC to consult with the Advisory Council on Historic Preservation and the state historic preservation office to ensure that historic and cultural areas are not destroyed.
- ° The Wilderness Act and Wild and Scenic Rivers Act would probably prohibit any development in an area which has been designated as wilderness or a wild and scenic river area.

Several other federal laws may also influence the FERC licensing determination. These laws include the Clean Water Act of 1977, the National Trails System Act and the Federal Land Policy and Management Act of 1976.

This federal regulatory system must interact with the state and local regulatory system. The degree of cooperation and coordination in this dual licensing system can have an important impact on the feasibility of development. States can help improve this coordination.

Questions concerning this licensing process should be directed to the San Francisco Regional Office of the Federal

Energy Regulatory Commission as the procedure is a dynamic,
ever changing process.

Chief
Hydropower Licensing Branch
Federal Energy Regulatory Comm.
San Francisco Regional Office
333 Market Street, 6th Floor
San Francisco, CA 94105

(415) 764-7137

State Regulation

State regulation of small-scale hydroelectric development can be divided into two categories, state jurisdiction over environmental control and over public utilities.

In Nevada, concerns over permitting issues related to small-scale hydroelectric development reside with the State Water Engineer's Office. Questions regarding water ownership and water law in general should be directed to the State Water Engineer as well as questions regarding the various permits that may be required to develop such a facility.

Individuals considering the development of a small-scale hydroelectric facility should contact the State Engineer's Office as early in the planning process as possible to become aware of regulations regarding diversions, dam construction, dam alteration, reservoir development and other environmental concerns, in addition to estimates of the time to acquire these licenses and permits. Inquiries should be directed to:

State Water Engineer
Department of Conservation
and Natural Resources
Division of Water Resources
201 S. Fall Street
Carson City, NV 89710
(702) 885-4380

The Nevada Department of Wildlife has many concerns regarding the development of small-scale hydroelectric facilities on Nevada's rivers and streams. Obviously, these concerns relate to the potential impact that such a facility could have on the wildlife that may inhabit these rivers and streams. One major area of concern is the impact on the disruption of instream flows related to aquatic habitat and wildlife using the river or stream in its current condition. Modification of a river or stream to accommodate a small hydroelectric facility may require the acquisition of a Habitat Alteration Permit. As with the other agencies and departments listed in this section, contact with the Nevada Department of Wildlife is advisable at the beginning of the planning process to become aware of possible requirements and permits.

Chief
Habitat Section
Nevada Department of Wildlife
1100 Valley Road
P.O. Box 10678
Reno, Nevada 89520
(702) 784-6214

The Division of Environmental Protection (DEP) is also involved in a regulation of various aspects of small hydroelectric development. Specifically any development which involves the construction of a dam is subject to review

by DEP. Construction procedures, land disturbances, erosion control and general project management practices are areas that the Division would analyze. Therefore, developers who are planning to construct a dam should contact the Division early in the planning process:

Environmental Specialist
Department of Conservation and
Natural Resources
Division of Environmental Protection
201 S. Fall Street
Carson City, Nevada 89710
(702) 885-4670

Finally, the Division of State Lands should be contacted if the proposed development, in whole or in part, involves state lands either directly or by a river or stream passing through state owned land. Again, early contact is urged to avoid any unexpected problems later on.

Land Agent
Department of Conservation and
Natural Resources
Division of State Lands
201 S. Fall Street
Carson City, Nevada 89710
(702) 885-4363

Utility Regulation

Various aspects of the development and operation of small-scale hydroelectric facilities may be subject to regulation by the Public Service Commission of Nevada (PSC). The PCS's regulatory authority includes the issuance of construction permits for electric generation facilities that are constructed in Nevada, the certification of companies that supply electrical energy to the public, the

establishment of utility interconnection requirements and establishing rates.

Any person who is contemplating the construction or operation of a small-scale hydroelectric facility should contact the PSC to determine to what extent their project will be subject to regulation. Furthermore, the PSC has recently issued regulations, in compliance with the Public Utilities Regulatory Policy Act of 1978 (PURPA), which require utilities to purchase energy produced by small-scale hydroelectric facilities, as well as other small power producers. If interconnection with a utility system selling energy to a public utility or using a public utility where energy supplied by such a facility is considered, contact with both the utility and the PSC should be initiated at the earliest possible date to insure that there is a clear understanding of all regulations and requirements. The PSC can be contacted by writing or calling:

Public Service Commission of Nevada
505 E. King Street, 3rd Floor
Carson City, NV 89710
(702) 885-4180

Incentives

The most recent federal legislation directly affecting small-scale hydroelectric power marketing is PURPA. As mentioned previously, PURPA authorizes the Federal Energy Regulatory Commission to establish incentives for certain small-scale hydroelectric sites. In Nevada, major electric

utilities are currently required to purchase power generated by "qualified small power producers" and submit plans to the Public Service Commission regarding equipment requirements and the rates at which this power will be purchased.

A qualifying small power producer is defined as the owner or operator of a facility which (1) uses renewable resources as the primary energy source, (2) has power production capacity of 80 megawatts or less, and (3) is owned by a person not primarily engaged in the generation or sale of electric power except from the small power facility itself. Only some small-scale hydroelectric sites fit the above requirements, and only these sites are eligible for the PURPA incentives.

Title II of PURPA attempts to minimize institutional barriers for qualifying small power producers with three major incentives. First, electric utilities are required to physically connect (interconnect) with a qualifying small-scale hydroelectric facility. Second, an electric utility is required to purchase the power output of a qualifying small-scale hydroelectric facility at rates that do not exceed the "avoided cost" for the utility, that is the utility's energy costs savings and any demand cost savings. Also, the utility must sell back-up power to a qualifying small-scale hydroelectric facility at rates which are just, reasonable and non-discriminatory.

Finally, FERC is given authority to exempt qualifying small-scale hydroelectric projects of less than 30 megawatts from all or part of the provisions of the Public Utility Holding Company Act, from state laws and regulations respecting the rates, financial or organizational activities of electric utilities, and certain parts of the Federal Power Act.

For further information regarding PURPA and how it is implemented in Nevada, contact the Nevada Public Service Commission and your electric utility.

Tax Incentives

The primary federal tax impacting small-scale hydroelectric is the corporate income tax. Congress, in the Windfall Profits Tax, recently changed the tax code to foster small-scale hydroelectric development.

First, businesses have traditionally received a 10 percent investment tax credit in order to promote investment in modern, more efficient equipment and plants. The Energy Tax Act of 1978 added an additional 10 percent credit for investment in alternative energy sources. Hydroelectric power was not included under the definition of alternative energy sources. The Windfall Profits legislation now gives hydroelectric an additional 11 percent credit to make it competitive with other alternative energy sources.

Second, many small-scale hydroelectric dams are required by state or federal environmental laws and regulations to have fish ladders. These ladders can add substantially to

the cost of retrofitting an existing dam. Although the ladders are mandated by law, their construction costs were not eligible for the 1978 investment tax credit. Under the Windfall Profits Tax, fish ladders are eligible for both the standard and alternate energy resource investment tax credits.

Third, many potential small-scale hydroelectric sites are owned by municipalities. Retrofitting of these sites may be accomplished through the issuance of tax-free municipal bonds. The tax status of municipal bonds issued for this purpose was not clearly defined in federal tax regulations. Changes by the Windfall Profits bill do not insure tax-free status for all bonds issued for projects at existing dams owned by municipalities on October 18, 1979, up to a 25 megawatt limit. A sliding scale of tax exempt status is available for sites of 25 megawatts to 125 megawatts.

For further information contact your local Internal Revenue Service Office or an experienced tax consultant.

Financing

Small-scale hydroelectric development is a capital intensive undertaking requiring substantial funds for development of the project. Private developers can include entrepreneurs, small industries and investor-owned utilities. Public developers may include municipalities, irrigation districts and electric cooperatives.

Financing of small-scale hydroelectric facilities suffers from several disadvantages relative to investment in

thermal power plants. Hydroelectric facilities usually are more expensive to construct, entailing greater initial investment. Small-scale hydroelectric development is relatively new, and is perceived as having greater risk. Also, the repayment schedule is rather long. For these reasons, financing is a crucial concern.

The marketing contract is critical in financing a small-scale hydroelectric facility, due to the relation between project revenues and debt service. Two questions associated with financing are:

- ° Is a developer capable of bearing the cost for feasibility studies? (Feasibility funds may be completely lost if the project is determined infeasible.)
- ° Is an investment in small-scale hydroelectric competitive relative to investments in other areas? (This question will be very sensitive to the cost of financing and the terms of the power marketing contract.)

There are several different ways that financing may be accomplished. Private developers may sell bonds, notes, warrants and stock, all of which will probably be subject to state and federal control.

Public entities may finance a facility using general obligation bonds or revenue bonds. General obligation bonds are secured by the taxing power of the political entity.

Revenue bonds are not secured by taxing power, but rather by the revenue earned from the sale of project power.

There are four basic types of financing required to put together a small-scale hydroelectric facility financing package: front-end money, construction loan, short-term money and long-term loan. Combinations of these financing types, along with any available medium-term financing, will make up the financing package. Table 1 indicates the types of financing required, sources for the funds and typical terms.

The front-end money pays for such items as site acquisition, feasibility studies, power marketing, construction fees and licenses, and legal and accounting fees. The construction loan is used to pay contractors during construction, the long-term loan amortizes the construction loan over time, and the short-term money or equity is the "down payment" for the long-term debt.

Historically, financial assistance has been available to developers to conduct feasibility studies of potential sites as well as loans for the construction of small scale hydroelectric facilities from both the U.S. Department of Energy and the Farmers Home Administration. However, as of June 30, 1981, these federal financial assistance programs have been suspended eliminating any involvement of the federal government in this area.

Table 1

Types of Financing	Types of Financing	
	Source	Typical Terms
Front-end money	Government grants	Nonreimbursable or forgiveable if project infeasible.
	Equity of developer	Often not possible or undesirable to developer
	Commercial banks	Interest at 125 percent of prime rate
Construction loan	Commercial banks	Interest at 125 percent of prime rate--must provide personal guarantee
	Short-term notes as warrants	Issued by local governments for construction financing, completely secured
Long-term funding	Manufacturers	Similar terms to commercial banks
	Insurance companies or savings banks	Power marketing contract must guarantee good cash flow to service debt
	Bonds	General obligation or revenue bonds issued by local government entity or a bonding authority.
Short-term money or equity	Commercial banks	Five to ten years duration, interest tied to the prime rate
Medium-term financing	Leasing companies or financial subsidiary of equipment (turbine) manufacturers	Interest rates and availability highly variable according to money market conditions and desire of manufacturers to market equipment

CONDUCT OF THE SITE SURVEY

Since this site survey was an office study only, all conclusions are based entirely on published or otherwise available data sources and relationships derived from those data.

Hydrologically, Nevada is divided into 245 hydrographic basins and sub-basins, each of which represents either a separate valley or a major segment of a larger basin, such as the Humboldt River Basin. Each of these hydrographic basins was examined individually, but identified sites are aggregated on the basis of counties.

Data Sources

Data used in the survey can be grouped in two major categories: 1) primary--or those data used to identify potential sites and 2) supplementary--or those data used to evaluate sites in terms of cultural, environmental, or institutional aspects.

Primary data sources used include:

1. Topographic and Related Maps
 - a) USGS 7-1/2' quadrangles; 1:24,000 scale
 - b) USGS 15' quadrangles; 1:62,500 scale
 - c) Army Map Service Sheets; 1:250,000 scale
 - d) U.S. Bureau of Land Management Range Maps;
1:126,720
 - e) State of Nevada Hydrographic Area Map; 1:
500,000 scale

- f) Hydrologic maps from various reports (see 2.b and 2.c below); various scales

2. Hydrologic and Related Reports

- a) "Nevada Streamflow Characteristics"; 1978, Nevada Department of Conservation and Natural Resources, Division of Water Resources; Water Resources-Information Series Report No. 28
- b) "Nevada Water Resources Reconnaissance Series Reports", No.s 1 through 58, Nevada Department of Conservation and Natural Resources, Division of Resources
- c) "Nevada Water Resources Bulletins", Nos. 1 through 41, Nevada Department of Conservation and Natural Resources, Division of Water Resources
- d) U.S Geological Survey Water Supply Papers, various.
- e) "Water for Nevada", Vol. 3, Nevada Department of Conservation and Natural Resources, Division of Water Resources
- f) Water and Power Resource Service, 1980, "Western States Inventory of Hydroelectric Sites, Vols. I and II," prepared by Tudor Engineering Co., San Francisco, California.
- g) Water and Power Resource Service, 1980,

"Small Hydroelectric Development at Existing Facilities."

- h) U.S. Corps of Engineers, National Hydropower Inventory Computer Listings.

Supplementary data sources used include:

1. Land Status Map of Nevada, 1972; 1:500,000 scale
2. Map of Nevada Public Utility Service Areas
3. Communities and Roads--various topographic and road maps
4. Stream Evaluation Map of Nevada, 1978, U.S. Fish and Wildlife Service; 1:500,000 scale.
5. Unpublished water rights compilations for the Nevada MX Region, Water Resources Center, DRI.
6. Water use--water rights compilations and Water Resource Reconnaissance Reports.
7. Map of Transmission and Transportation Facilities in Nevada, 2nd ed., 1970, Nevada Bureau of Mines and Geology; 1:750,000 scale.

Hydrologic Data

A serious difficulty encountered in this survey, and to possible development of small-scale hydroelectric facilities in Nevada, is the lack of hydrologic data needed to evaluate a site or to design a plant. Most streams in Nevada do not have streamflow recorders installed, though some have short periods of recorded flows or spot measurements. There are 226 sites in Nevada where the streamflow is not completely regulated and which have approximately five or more years of record(s).

These records are of two types, continuous records (136) and annual peak flows (90). Of the continuous records many are for little more than five years and/or are intermittent in nature. Generally, unless there is strong correlation with near-by long-term records, 25 to 30 years of streamflow data are considered necessary to develop reliable streamflow characteristics (e.g. means and flow durations) and even then, extreme events (floods and droughts) may not be well represented. The USGS currently maintains gaging stations at 128 sites on Nevada streams with 37 of those sites actually in other states (33 in California; 2 in Idaho; 1 in Oregon; 1 in Arizona)(Water Resources Data for Nevada, WY79). This gage density represents approximately 1 station in Nevada for every 1,200 square miles, but for most of the state the density is even lighter. Of the 91 stations actually in Nevada, 65 are located in the Walker (8), Carson (12), Humboldt (21) and Truckee River (24)basins. Thus approximately two-thirds of the state is represented by about 30 percent of the gaging stations, for a density of about 1 gage per 2,800 square miles. Looked at from a slightly different perspective, there are well in excess of 500 separate water courses or major tributaries that provide fish habitat (thence perennial streamflow?). The current gaging sites represent only about 60 separate streams or approximately 10 percent of the total streams.

A listing of current Nevada stream gaging sites is included in Appendix A together with a listing of all sites that are not completely regulated and which have five or more years of either continuous or high flow measurements.

The manner in which lack of "hard" hydrologic data was dealt with is discussed under the section dealing with survey methodologies.

Previous and On-going Studies

There is one on-going study and three recently completed studies of hydroelectric power development potential within Nevada. The completed studies were all restricted to low-head sites and/or sites with existing dams. These latter study reports were reviewed in this survey and their results have been included. These studies are identified below and a short description of each is given.

1. Ott Water Engineers, Inc., "Brief Reconnaissance Studies of Small-Scale Hydroelectric Sites in Nevada".

Under contract to the U.S. Department of Energy, (Contract No. DE-AC07-81 ID 12249) Ott Water Engineers have been performing a series of brief reconnaissance studies of specific sites in both Nevada and California. Sites are selected on the basis of owner requests made to DOE for assistance in site evaluation. Each brief reconnaissance involves a site visit and analysis of hydrologic and topographic data to develop a preliminary feasibility determination. These determinations include both economic and technical considerations. Brief commentary is also made on environmental, institutional and safety aspects of the proposed developments.

The Ott studies in Nevada were begun in late October 1980 and continued through the course of the present study. However, results of Ott's work were not available until the final writing of this report. In all, Ott has examined at least 22 Nevada sites. These sites and their correlation with results of this state-wide survey are included in the Summary Analysis section of this report.

2. "Nevada Listing--U.S. Corps of Engineers National Hydropower Study."

The entire Western states listing is incorporated in the fourth report discussed below.

3. "Report on Assessment of Small Hydroelectric Development at Existing Facilities," 1980, U.S. Water and Power Resources Service.

This study evaluated 159 potential small scale hydroelectric developments at existing U.S. Water and Power Resources Service (WPRS) projects in the 17 western states. A basic assumption was that existing reservoir operations and flow regimes would not be changed with development. The evaluation process included both economic and environmental considerations. The analysis included effects of escalating fossil fuel costs and compared one- and two-turbine-generator-unit plants. The 159 sites were screened down to 62 sites which appeared economically attractive. Final screening based on economic, environmental, social and acceptability factors resulted in identification of 37 sites that appear viable at this time. Of the 159 sites only two are in Nevada, but both

are in the final 37. These two sites are Lahontan Dam where it was concluded that 1840KW should be added, and Rye Patch Dam where it was concluded 1247KW should be installed.

4. "Western States Inventory of Low-Head Hydroelectric Sites", 1980, U.S. Water and Power Resources Service, by Tudor Engineering Company Company, Vols. 1 and 2.

This two-volume report represents the second phase of a three-phase study. In the first phase the contractor screened the National Listing of the Corps of Engineers National Hydropower Study eliminating all sites but those in the 17 western states with heads less than 66 feet (20m) at existing dams. All undeveloped sites with heads greater than 66 feet were first eliminated from the list and then re-entered with heads of 66 feet. Finally the contractor eliminated all potential sites with a capacity less than 1000KW.

In the second phase the contractor assembled a state-by-state environmental data base and screened all the sites identified in phase I to identify sites with known environmental and social constraints. The third phase was not scheduled for completion until October 1981, but was supposed to add 500 new low-head sites with potential capacities exceeding 1000KW.

The phase two report identifies 27 potential sites in Nevada with a total capacity of 68 MW. Twenty-five of these have capacities between 1000 and 5000KW and the remaining two have capacities between 5000 and 10,000KW. Twelve of the sites are at existing dams or canal drops; 7 are at previously

identified but undeveloped sites, and 6 new undeveloped sites. Both Lahontan and Rye Patch are included in the 27 sites.

All Nevada sites in the latter three studies are included in the summary analysis and conclusions of this survey.

SITE SURVEY METHODOLOGY

A basic premise in identifying potential hydroelectric generation sites in this survey was that there first had to be water. To do this from the office, three indicators were used; topographic maps; hydrologic reports; and personal knowledge. The survey process was organized on the basis of recognized hydrographic basins and proceeded basically as follows.

A. Site Identification

1. Topographic maps for the basin were assembled and each major canyon or drainage was examined for evidence of water. Criteria used included
 - a) subjective assessment of drainage area and relief;
 - b) mapped springs;
 - c) stream courses mapped in blue ink;
 - d) drainage names (names such as Water Canyon and Thousand Springs Creek were dead giveaways); and
 - e) existence of large ranches.
2. Hydrologic reports were assembled and reviewed for any streamflow measurements, discussions of surface water use, floods, water rights, etc.;

3. Drainage topography was examined to estimate maximum available head in the shortest distance with likely adequate flow. As a general guide, drainages with less than 200 feet of head were not considered unless there was obviously a substantial flow. Also drainages where more than about 5 miles are needed to develop the necessary head were not considered.

B. Site Analysis

4. Approximate stream drainage areas were estimated using a grid overlay. Accurate measurements by planimeter were not made because of the large number of sites involved.
5. Possible water uses (such as ranches or towns downstream), the presence of lakes, reservoirs or other upstream regulating structures, and access roads along stream reaches were noted from the topographic maps.
6. Land ownership status adjacent to the sites was determined from the "Land Status Map of Nevada" and noted as being private, public, defense, forest, reservation, etc. Individual private owners were not determined.
7. Average annual flow values for the streams were obtained from the literature where available. For streams without flow measurements an estimating technique was developed as discussed in a later section.

8. Cultural data for each site were estimated from various maps and include such factors as distances to nearest roads, towns, ranches, powerlines, etc.
9. Environmental data, fisheries only, were gathered from the 1978 Nevada Stream Evaluation Map.
10. Water rights information was summarized from existing available compilations on the central region of the state.

C. Site Evaluation

11. Regional flow duration curves were developed relating drainage area and estimated average annual flow to flows that are exceeded 25, 30, 50, 80 and 90 percent of the time.
12. Capacity (KW) and annual energy production (MWH) were calculated at each site for 25 or 30, and 50 and 90 percent exceedence flow values.
13. Various statistical summaries were made of all site data and sites were ranked.

Ungaged Streamflow and Flow Duration Estimates

Recognizing that different hydrologic and climatologic conditions exist across the state, two regions were defined for analyzing streamflows. A "Central Region" was defined as including the Great Basin, Humboldt River Basin, Black Rock Desert, Snake River Basin and the Owyhee River Basin. An "East-Slope Sierra Region" was defined as including the Walker, Carson and Truckee River basins.

Using published streamflow records for those drainages with little or no regulation and small area, two sets of curves were plotted for each region: Flow (Percent of time exceeded) versus drainage area and Flow (Percent of time exceeded) versus Average Annual Flow. These curves are shown in Figures 1, 2, 3 and 4. The flow durations used were those flows that are exceeded 90, 80, 50 and 30 percent of the time. The 25 percent value was also plotted for the Central Region.

Linear regression techniques were used to fit lines of best fit through the data points. Correlation coefficients (r) and coefficients of determination (r^2) were computed and are shown on the figures. These coefficients indicate a reasonably good statistical fit of the lines to the data. Theoretically, the lines should pass through the origin (0,0), and most come fairly close that point. However, the 25 percent exceedence line in Figure 1 was forced through the origin, since the computed line showed an unacceptable departure.

These curves were then used to estimate the average annual flow and flow duration values for those drainages for which no streamflow records exist. The area of the ungaged drainages were approximated from the topographic maps using a grid overlay. The area was used to enter the Flow vs. Area curves (Figures 1 and 3) to obtain either the 25 or 30 percent flow duration value (25 percent was used for the Central Region and 30 percent for the East-Slope Sierra Region). These values were chosen because they most closely approximate the respective average annual flows. The 25/30 percent flow values were

Figure 1. Drainage Area vs. Flow and Frequency - Walker, Carson and Truckee Basins.

Figure 2. Drainage Area vs. Flow and Frequency - Great Basin, Humboldt, Black Rock, Snake and Owyhee Basins.

Figure 3. Average Annual Flow vs. Flow and Frequency - Walker, Carson and Truckee Basins.

Figure 4. Average Annual Flow vs. Flow and Frequency - Great Basin, Humboldt, Black Rock, Snake and Owyhee Basins.

in turn used to enter the second set of curves (Figures 2 and 4) to obtain an estimate of the average annual flow.

SITE EVALUATION

A total of 170 potential small-scale hydroelectric sites were identified from the topographic maps. Of these, 26 were dropped from further consideration when it was determined there was probably inadequate flow to produce the 50KW minimum capacity criteria. The 50KW was calculated on the basis of average annual flow. Of the remaining 144 sites identified and evaluated in this survey none appear to have been included in previous studies (i.e. Tudor, USBR, CoE) though seven sites are in the same drainages or on the same streams at different locations. Also, of the 144 sites evaluated it appears that 11 may be coincident with, or close to, sites evaluated by Ott Water Engineers during the course of this survey. Thus basically all 144 sites in this survey are new sites. Correlation with related sites of the other studies is presented in the summary analysis section of this report.

All 144 sites were assigned serial numbers and the data organized into a series of tables as presented in Appendix B. The information tabulated includes:

1. County
2. Hydrographic Basin Number
3. Drainage Name and Location
4. Land Ownership Status
5. Type Water Use
6. Average Annual Flow
7. Elevation Drop (head)
8. Length of Power Reach ("penstock" length)

9. Map and Literature References
10. Distances to Nearest: Paved Road; Residence;
Community
11. Water Rights
12. Stream Evaluation (fishery value class)

Because of statistical reliability the sites based on derived average annual flows were tabulated and considered separately from those where streamflow records are available. The survey resulted in 65 sites with flow records and 79 based on derived flows.

For major streams, such as the Humboldt River and some of its major tributaries only one representative site was included. The Truckee River was not examined because of existing hydropower developments, but numerous additional sites may exist in both California and Nevada. Some of the Truckee sites involve drops from existing canals that would be feasible only with a major change in downstream water use and water rights.

Available flow is one of the critical components determining technical site feasibility. Preliminary evaluation (weeding out), was done on the basis of estimated average annual flow. The mean of average annual flows for all sites is 23 cfs (40.5 cfs for measured flows and 8.5 cfs for derived flows). However, as can be seen in Figure 5 the mean is skewed by a few high flows, since 71 percent of the flows are less than 12 cfs. Thus for at least 71 percent of the sites the available head must be greater than about 60 feet to produce

Figure 5. Frequency Histogram of number of sites according to estimated average annual flow.

the 50KW cut-off and for 46 percent of the sites it must be greater than about 125 feet.

Potential gross head at the identified sites ranges from a minimum of about 20 feet up to a maximum of 1,200 ft. Average gross head for all 144 sites is 482 feet. However, for sites with measured flows the average gross head is 376 feet compared to 573 feet for sites with derived flows. The frequency distribution of available gross heads is shown in Figure 6, where it can be seen that 70 sites (49%) have heads between 400 and 700 feet.

An important factor in the economic viability of potential sites is the distance water must be transported in a canal or pipe to the turbine penstock to develop the available head. The cost of a penstock will basically be a function of its length and diameter and the pressure head. For this survey it was assumed that all sites would be developed with a penstock from point of stream diversion to point of generation. No site was considered viable for penstock lengths greater than 5 miles. The alternative to using low gradient ditches or canals to minimize penstock length was not examined. Of the 144 sites, 110 would have penstocks less than 2.5 miles long. The average length for all sites is about 1.9 miles. Figure 7 is a frequency plot of penstock lengths for all identified sites.

A fourth factor which is important to both the technical and economic viability of a site is the total energy expected to be generated. Average annual energy production was examined for those flows at each site that are exceeded 25 or 30 and 50

Figure 6. Frequency Histogram of number of sites according to Maximum Gross Head.

Figure 7. Frequency Histogram of number of sites according to Penstock Length.

and 90 percent of the time. The 90 percent value represents an approximation of the firm capacity of the site. The 25/30 percent value represents about the upper limit of installed capacity for sites that could be used to help meet peak power loads and produce significant fossil fuel saving electrical energy. Figure 8a, b and c show the frequency distributions of sites for the chosen flow exceedence values. It was not possible to determine flows for all sites for all three durations and thus the number of sites varies in Figure 8. However, as can be seen in Figure 8, as the percentage of time a given flow is exceeded increases, the number of sites with greater than 50KW capacity decreases dramatically. For example the number of sites producing between 100 and 150KW decreases from 27 to 12 to 4 as the duration increases from 25/30 to 50 to 90 percent. Simultaneously the number of sites producing less than 50KW increases from 10 to 55 to 89.

Within limits a plant designed for a specific flow will yield greater or lesser capacity as the flow increases or decreases from the design flow. Additionally at a given site, multiple penstocks and turbines could be installed to operate at peak efficiency over a range of flows thus maximizing the power and energy extracted from that site.

Duration enhancement through flow regulation by upstream reservoirs was not examined. However, at least 21 of the sites have upstream reservoirs that might improve their potential.

Three uses of generated power were considered: general public through an existing powerline; direct to a small

NUMBER OF SITES AT GIVEN FLOW EXCEEDENCE

Figure 8. Frequency Histogram of Number of Sites According to Generating Capacity.

community; and direct to an individual. The "uses" were indirectly considered using distance to the nearest of each class as a surrogate measure of the ease (cost) with which service might be accomplished. Straight line distances to each "use" are highly variable, ranging from essentially zero to over 43 miles. The greater the distance to a user the less attractive a site becomes because of the cost of transmission line construction. However, each site must be evaluated separately to allow consideration of the cost of alternative sources of power, which was not done in this survey.

Water rights were examined for some sites only to the extent of determining whether the streams have been adjudicated, the total water involved and how it is used. Water rights are a critical consideration at every site because regardless of whether the site is technically and economically feasible, development could be precluded by a complex water allocation scheme or an existing rightholder. Only 29 sites were examined for water rights and of these, rights were indicated at 14 sites totaling 395 cfs. All types of water use are indicated.

The last factor considered is possible environmental conflict for water at the potential sites as represented by fishery resource evaluations. The 1978 "Stream Evaluation Map - State of Nevada" was used for this purpose. That map establishes five "Value Classes" from I - V with following class definitions:

- I. Highest-valued fishery resource
- II. High-priority fishery resource
- III. Substantial fishery resource
- IV. Limited fishery resource
- V. Unsurveyed stream reach

All other streams (those not rated) are indicated to have no fishery resource. Criteria for value classes are given in Appendix C.

Of the 144 sites identified, 32 had "no fishery resource". The distribution of number of sites for each value class is shown in Figure 9. For some sites, stream reaches had different value classes. Figure 9 shows those sites in the higher value classes (lower numbers). At approximately half the sites fisheries may present an impediment to power development, though mitigating measures through design and/or operation could allow compatible co-existence.

Figure 9. Frequency Histogram of Number of Sites According to Stream Fishery Resource Value Class.

SUMMARY ANALYSIS

Technical Considerations

Potential power capacity and producible energy were examined for each of the 144 sites. As indicated, capacity was calculated for the 25/30, 50 and 90 percent exceedence flow values. The KW_{90} estimates a site's firm capacity, but not the design capacity (P_c). Realistically plants would be designed for either the 25/30 or 50 percent exceedence flow. However, a single turbine plant designed for $KW_{25/30}$ might not provide the KW_{90} firm power, since in general the minimum flow for generation is about 30 percent of the maximum flow. If a fixed blade turbine is used the minimum generating flow can be as high as 50 percent of the maximum.

Energy produced by a plant is equal to the average generating flow through the plant, Q , times the net available head, H , converted to KWH. In order to truly estimate Q , a full flow duration curve is required. The average generating flow would be calculated as the shaded portion in the sketch below.

However, since full duration curves are not available for the majority of sites identified, it was necessary to make an approximation of average annual energy producible. This was done by using the flow values estimated from the regional data ($Q_{25/30}$, Q_{50} and Q_{90}). Two sets of flows were considered as follows:

Maximum Flow	Minimum Flow
$Q_{25/30}$	Q_{50}
Q_{50}	Q_{90}

The first set of flows would maximize peak power and annual average energy while the second set generally maximizes "firm" power and the percent of time the plant would generate electricity, or plant factor (PF).

The two annual average generating flows (Q_1 and Q_2) were estimated as shown in the following sketch:

$$Q_1 = 0.25A + 0.25(A+B)/2 \text{ for } Q_{25}$$

or,

$$Q_1 = 0.30A + 0.2(A+B)/2 \text{ for } Q_{30}$$

$$Q_2 = 0.5B + 0.40(B+C)/2 \text{ for } Q_{50}$$

where $A = Q_{25}/30 = 25$ or 30% Exceedence Flow,

$B = Q_{50} = 50\%$ Exceedence Flow, and

$C = Q_{90} = 90\%$ Exceedence Flow

The average annual producible energy is then calculated as

$$KWH = (0.0847 Q_{He})(8760)$$

$$= 742 Q_{He}$$

$$= 445 Q_H \text{ for } e = 60\%$$

The plant factor is given by the following equation:

$$PF = \frac{KWH}{P_c \times 8760}$$

where P_c = design capacity, i.e. $KW_{25/30}$ or KW_{50}

In all the analyses, an overall conversion efficiency, e , of 60 percent was used. This figure is conservative since, typically, hydroelectric plants operate at an efficiency of 80 percent or better. The lower percentage was used to compensate for the fact that gross head was not reduced by frictional losses in the penstocks when capacity was calculated.

Potential power and energy calculated for each of the sites are given in Tables B.1 together with the associated head and the three exceedence flows. Column 16 of Tables B.1 lists an estimate of "firm" power. This, however, is not truly firm power because it is based on the 90 percent exceedence flow and thus would be available only 90 percent of the time.

Table 2 summarizes the means and extremes for power and energy potential production at both the "measured" flow and "derived" flow sites.

For various reasons it was not possible to calculate power and energy at all sites for both development alternatives. The means and totals of Table 2 are based on the number of sites in each category with data. The extremes are based on all sites with complete data.

Development Priority

Developability of the identified sites has been considered in a very simplistic and tentative fashion. The measured flow and estimated flow sites are considered separately. All sites in each category are ranked according to potential energy production under the first development alternative, i.e. for the 25/30 percent exceedence flows. "Developability" is then expressed in terms high, moderate, or low "interest level" for more detailed examination.

The following criteria are used:

Table 2

Mean and Extreme Power and Energy at Measured
and Derived Flow Sites for Two Development Alternatives

	Alternative No. 1			Alternative No. 2		
	Capacity	Energy	Site	Capacity	Energy	Site
	KW	MWH	No.	KW	MWH	No.
A. Measured Flows						
Maximum	811	3,072	59	262	1,822	59
Minimum	49	196	26	15	105	14
Total	13,317	46,533	--	4,058	27,646	--
Average	215	831	--	74	503	--
B. Derived Flows						
Maximum	1,372	5,262	110	518	3,553	110
Minimum	41	162	112	24	166	82
Total	15,059	49,158	--	4,826	32,562	--
Average	209	806	--	82	592	--
C. Overall						
Maximum	1,372	5,262	110	518	3,553	110
Minimum	41	162	112	15	105	14
Total	28,376	95,691	--	8,884	60,208	--
Average	212	818	--	78	547	--

Development "Interest Level"Criteria

High	>1000 MWH
Moderate	500 to 1000 MWH
Low	<500 MWH

Sites for which data are missing are not ranked, but are included with a subjective indication of development interest. The rankings for all sites are given in Tables 3a and 3b. True development potential can only be assessed by a more detailed examination of each site. Tables 3a and 3b include site data that should provide a feel for the problems and/or opportunities that might exist, e.g. fishery value class, etc.

Economic Considerations

Because of budgetary and time constraints on this survey it was not feasible to prepare economic analysis for the identified sites. Simplified preliminary analyses can be developed for benefits on the basis of estimated annual energy production (KWh) and for development costs on the basis of site characteristics using "rules of thumb" developed by the U.S. DOE. This type of preliminary economic analysis has been prepared for the sites evaluated by Ott Water Engineers under their DOE contract. Examples of these analyses and the procedural steps to develop them are presented in Appendix F. Site familiarity is essential to producing reasonable construction component estimates (e.g.

TABLE 3a

Potential Small-Scale Hydroelectric Sites -
Measured Flow Sites

Rank	Map Number	Stream Name	County	Interest Level	Gross Head, ft H	Development Alternative No. 1				Development Alternative No. 2				"Firm" Power KW (15)	Fish Value Class (16)
						Instl'd Cap. KW ₁	Ave. Gen. Flow, cfs Q ₁	Ave. Annual Energy Prod. MWH ₁	Plant Factor PF ₁	Instl'd Cap. KW ₂	Ave. Gen. Flow, cfs Q ₂	Ave. Annual Energy Prod. MWH ₂	Plant Factor PF ₂		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
1	59*	Franktown Creek	Washoe	H	1200	811	5.8	3,072	0.43	262	3.4	1,822	0.79	122	II
2	27	Maggie Creek	Elko	H	40	710	143.5	2,538	0.41	188	71.6	1,274	0.77	69	--
3	11	Bruneau River	Elko	H	100	617	49.7	2,211	0.41	167	25.4	1,132	0.78	63	I
4	50*	Walker River	Lyon	H	40	504	110.1	1,961	0.44	222	85.1	1,515	0.78	89	IV
5	8*	Desert Creek	Douglas	H	560	427	6.5	1,625	0.43	148	4.	1,007	0.78	57	I, III
6	60*	Third Creek	Washoe	H	1000	422	3.6	1,580	0.43	117	1.7	770	0.75	30	I
7	2	Virgin River	Clark	H	40	430	86.3	1,537	0.41	115	43.6	777	0.77	42	II
8	21	Talbot Creek	Elko	H	800	382	3.9	1,402	0.42	134	2.7	944	0.80	69	I
9	3	Las Vegas Wash	Clark	H	120	381	25.6	1,367	0.41	105	13.4	715	0.78	41	--
10	16	East Fork Boulder Creek	Elko	H	500	343	5.6	1,247	0.41	109	3.4	759	0.79	51	I
11	28	Overland Creek	Elko	H	600	323	4.4	1,182	0.42	110	2.9	769	0.80	55	I
12	31*	Perry-Aiken Creek	Emeralda	H	800	313	3.3	1,168	0.43	81	1.5	534	0.75	20	III
13	12	Jarbridge River	Elko	H	100	305	24.6	1,094	0.41	84	12.9	572	0.78	33	II
14	18	Secret Creek	Elko	H	400	301	6.1	1,093	0.41	96	3.7	661	0.79	43	I
15	17	West Fork Boulder Creek	Elko	H	400	301	6.1	1,091	0.41	94	3.6	648	0.79	43	I
16	58*	Galena Creek	Washoe	H	600	284	4.	1,063	0.43	79	1.8	483	0.79	30	II, III
17	1	Muddy River	Clark	H	120	284	19.1	1,018	0.41	79	10.1	542	0.78	32	I
18	10	Owyhee River	Elko	M	50	278	44.7	996	0.41	75	23.	511	0.78	28	III
19	13	Salmon Falls Creek	Elko	M	40	270	54.2	965	0.41	73	27.7	493	0.78	27	II
20	24	Rabbit Creek	Elko	M	440	250	4.7	915	0.42	83	2.9	574	0.79	38	I
21	23	Thorpe Creek	Elko	M	400	244	5.	890	0.42	81	3.2	566	0.80	39	I
22	29	Franklin River	Elko	M	400	230	4.7	839	0.42	77	3.0	541	0.80	39	I
23	47	Kington Creek	Lander	M	560	225	3.3	826	0.42	80	2.3	563	0.81	43	II
24	55*	Whites Creek	Washoe	M	600	213	3.	788	0.42	46	1.3	334	0.83	30	III
25	4*	Clear Creek	Douglas	M	600	198	2.8	748	0.43	61	1.5	400	0.75	15	II
26	19	Ackler Creek	Elko	M	400	203	4.2	743	0.42	69	2.9	520	0.86	55	I
27	22	Humboldt River	Elko	M	20	200	80.4	715	0.41	53	40.5	361	0.77	20	II
28	44	Indian Creek	Humboldt	M	400	183	3.8	672	0.42	65	2.6	459	0.81	35	III

TABLE 3a (Continued)

Rank	Map Number	Stream Name	County	Interest Level	Gross Head, ft H	Development Alternative No. 1				Development Alternative No. 2				"Firm" Power KW (15)	Fish Value Class (16)
						Instl'd Cap. KW ₁	Ave. Gen. Flow, cfs Q ₁	Ave. Annual Energy Prod. MWH ₁	Plant Factor PF ₁	Instl'd Cap. KW ₂	Ave. Gen. Flow, cfs Q ₂	Ave. Annual Energy Prod. MWH ₂	Plant Factor PF ₂		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
29	30*	Chiatovich Creek	Esmeralda	H	400	177	3.7	661	0.43	47	1.73	308	0.75	12	II
30	52	South Twin River	Nye	H	600	162	2.3	608	0.43	70	1.9	505	0.82	43	II
31	33*	Indian Creek	Esmeralda	H	800	167	1.7	602	0.41	20	0.37	132	0.74	4	III
32	65	Baker Creek	White Pine	H	400	161	3.3	592	0.42	59	2.4	418	0.81	33	--
33	32*	Leidy Creek	Esmeralda	H	800	163	1.7	588	0.41	20	0.37	132	0.74	4	II
34	56*	Thomas Creek	Washoe	H	800	142	1.4	502	0.40	4	0.1	26	0.72	1	II, I
35	46	Rock Creek	Lander	L	80	137	13.8	493	0.41	39	7.5	268	0.78	16	--
36	39	E. Quinn River	Humboldt	L	100	136	11.0	489	0.41	40	6.1	272	0.78	17	II
37	64	Lehman Creek	White Pine	L	600	128	1.8	487	0.43	61	1.6	438	0.82	37	--
38	5*	Duggett Creek	Douglas	H	600	131	1.8	473	0.41	15	0.37	99	0.74	3	III
39	15	Herder Creek	Elko	L	400	126	2.6	470	0.43	51	2.	362	0.81	28	II
40	42	Martin Creek	Humboldt	L	80	126	12.8	455	0.41	37	7.1	251	0.78	15	II
41	62	Cleve Creek	White Pine	L	480	115	2.	433	0.43	51	1.7	370	0.82	32	I
42	9	Jack Creek	Elko	L	80	120	12.1	432	0.41	35	6.8	241	0.79	15	II
43	48	Meadow Valley Wash	Lincoln	L	230	117	4.2	428	0.42	40	2.7	281	0.81	21	II
44	49*	East Walker River	Lyon	L	40	108	23.4	417	0.44	45	17.2	306	0.78	18	III
45	6*	Bryant Creek	Douglas	L	240	104	3.6	388	0.43	28	1.8	189	0.77	10	--
46	61	Sceptoe Creek	White Pine	L	320	102	2.7	381	0.43	41	2.0	289	0.81	23	I
47	43	Big Cottonwood Cr.	Humboldt	L	320	102	2.7	378	0.42	37	1.9	269	0.82	23	II

TABLE 3a (Continued)

Rank	Map Number	Stream Name	County	Interest Level	Gross Head, ft	Inst'l'd Cap. KW ₁	Development Ave. Gen. Flow, cfs	Alternative No. 1 Ave. Annual Energy Prod. MWH ₁	Plant Factor PF ₁	Inst'l'd Cap. KW ₂	Development Ave. Gen. Flow, cfs	Alternative No. 2 Ave. Annual Energy Prod. MWH ₂	Plant Factor PF ₂	"Firm" Power KW	Fish Value Class
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
48	35	Leonard Creek	Humboldt	L	400	96	2.0	356	0.43	39	1.6	283	0.84	26	II
49	41	Lit. Humboldt Rv.	Humboldt	L	80	95	9.6	341	0.41	28	5.4	191	0.79	12	I
50	51	Reese River	Nye	L	160	89	4.6	324	0.42	30	3.	212	0.80	15	I,II
51	53	Currant Creek	Nye	L	400	81	1.7	309	0.43	39	1.6	280	0.83	24	--
52	45	Pole Creek	Humboldt	L	400	73	1.6	280	0.44	37	1.5	267	0.83	24	III
53	34	Pine Creek	Eureka	L	120	77	5.2	279	0.41	24	3.2	171	0.80	12	--
54	54*	Steamboat Creek	Washoe	L	100	69	5.9	261	0.43	22	3.4	152	0.79	10	III
55	63	Spring Creek	White Pine	L	300	64	1.8	244	0.43	30	1.6	219	0.82	18	--
56	40	McDermitt Creek	Humboldt	L	40	62	12.6	224	0.41	18	6.9	123	0.78	8	III
57	36	Kings River	Humboldt	L	320	54	1.5	207	0.44	28	1.4	201	0.83	18	II
58	14	Marys River	Elko	L	20	56	22.6	201	0.41	15	11.8	105	0.78	6	I
59	26	Susie Creek	Elko	L	240	49	1.8	196	0.46	33	2.1	225	0.78	13	--
60	37	Log Cabin Creek	Humboldt	M	560	43	0.73	181	0.48	37	1.1	277	0.85	28	III
61	38	Granite Creek	Humboldt	L	500	28	0.54	120	0.49	25	0.88	196	0.88	23	IV
	7*	West Walker River	Douglas	H	**	-	77.5	-	-	-	59.7	-	-	-	I,II
	20	North Fork Humboldt River	Elko	H	**	-	27.0	-	-	-	14.3	-	-	-	IV
	25	South Fork Humboldt River	Elko	H	**	-	49.2	-	-	-	25.1	-	-	-	I,III,I

Column Notes: (1) Rank order based on average annual energy production for alternative No. 1 - see col. No. 9
 (2) See plate in pocket
 (3),(4) from maps
 (5) HP1000 MWH; M: 500 to 1000 MWH; L < 500 MWH
 (6) from topographic map
 (7),(11) KW = 0.0847 QHe
 (8),(12) estimated from exceedence flows
 (9),(13) MWH = 0.445 QH
 (10),(14) PF = KW/(P_c x 8760)
 (15) Based on 90 percent exceedence flow
 (16) From "Stream Evaluation Map of Nevada, 1978"

* used 30% exceedence flows; all others used 25%

** multiple sites available

TABLE 3b

Potential Small-Scale Hydroelectric Sites -
Derived Flow Sites

Rank	Map Number	Stream Name	County	Interest Level	Gross Head, ft	Instl'd Cap. KW ₁	Development Ave. Gen. Flow, cfs	Alternative No. 1 Ave. Annual Energy Prod. MWH ₁	Plant Factor PF ₁	Instl'd Cap. KW ₂	Development Ave. Gen. Flow, cfs	Alternative No. 2 Ave. Annual Energy Prod. MWH ₂	Plant Factor PF ₂	"Firm" Power KW	Fish Value Class
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
1	110*	Cottonwood Cr.	Mineral	H	1200	1,372	9.9	5,262	0.44	518	6.7	3,553	0.78	213	-
2	144	White River	White Pine	H	400	1,057	21.3	3,791	0.41	291	11.2	1,986	0.78	116	IV
3	108*	Bodie Creek	Mineral	H	400	854	18.5	3,285	0.44	335	13.	2,306	0.78	142	III
4	69*	Pine Nut Cr.	Douglas	H	500	839	14.5	3,216	0.44	318	10.	2,215	0.80	152	-
5	106*	Dalzell Canyon Cr.	Lyon	H	400	793	16.9	3,000	0.43	254	10.1	1,790	0.80	132	-
6	111*	Cat Creek	Mineral	H	800	630	6.7	2,397	0.43	215	4.2	1,485	0.79	94	-
7	109*	Rough Creek	Mineral	H	240	470	16.9	1,806	0.44	183	11.8	1,261	0.79	79	IV
8	135*	Bronco Creek	Washoe	H	600	427	6.1	1,621	0.43	143	3.7	986	0.79	61	II
9	136*	Deep Canyon	Washoe	H	1200	427	3.8	1,587	0.42	104	1.3	668	0.74	18	V
10	107*	Sweetwater Canyon	Lyon	H	800	394	4.2	1,489	0.43	122	2.3	819	0.77	41	II
11	131*	Ophir Creek	Washoe	H	600	335	4.7	1,263	0.43	101	2.5	670	0.76	30	II
12	141	Silver Creek	White Pine	H	600	311	4.3	1,135	0.42	104	2.7	732	0.81	55	I
13	137*	(no name)	Washoe	H	1000	305	2.5	1,113	0.42	51	0.8	356	0.80	25	-
14	84*	Rock Creek	Esmeralda	H	800	285	3.	1,051	0.42	61	1.3	445	0.83	41	III
15	93	Battle Creek	Humboldt	H	600	262	3.6	965	0.42	95	2.5	670	0.81	52	IV
16	75	E. P. Jarbidge R.	Elko	H	350	260	6.1	945	0.42	84	3.7	578	0.79	37	I
17	125*	Ash Canyon Creek	Ormsby	H	800	244	2.5	890	0.42	41	0.8	285	0.80	20	I
18	139	Kalamazoo Creek	White Pine	H	800	211	2.2	797	0.43	94	1.9	666	0.81	53	I
19	66*	Logan House Cr.	Douglas	H	1000	203	1.7	735	0.41	25	0.37	165	0.74	5	-
20	73	Buck Creek	Elko	H	450	197	3.6	724	0.42	71	2.5	503	0.81	39	I
21	134*	W. P. Grey Cr.	Washoe	H	400	189	4.	703	0.42	47	1.8	312	0.76	14	II
22	142	Big Wash Creek	White Pine	H	400	185	3.8	681	0.42	67	2.7	472	0.80	35	II

TABLE 3b (Continued)

Rank	Map Number	Stream Name	County	Interest Level	Gross Head, ft	Instl'd Cap. KW ₁	Development Ave. Gen. Flow, cfs	Alternative No. 1 Ave. Annual Energy Prod. MWH ₁	Plant Factor PF ₁	Instl'd Cap. KW ₂	Development Ave. Gen. Flow, cfs	Alternative No. 2 Ave. Annual Energy Prod. MWH ₂	Plant Factor PF ₂	"Firm" Power KW	Fish Value Class
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
23	94	Bilk Creek	Humboldt	M	400	185	3.8	679	0.42	65	2.6	459	0.81	35	II
24	143	Snake Creek	White Pine	M	450	165	3.	609	0.42	62	2.2	431	0.80	30	I
25	68*	Hott Canyon Creek	Douglas	M	800	163	1.7	588	0.42	20	0.37	132	0.74	4	-
26	70	Bull Run Creek	Elko	M	200	160	6.5	579	0.41	50	3.9	345	0.79	22	II
27	83*	Morris Creek	Esmeralda	M	800	142	1.5	516	0.41	20	0.4	139	0.78	8	-
28	119	N. Twin River	Nye	M	800	134	1.5	516	0.44	69	1.4	509	0.84	49	-
29	95	Big Creek	Humboldt	L	640	130	1.8	499	0.44	65	1.7	473	0.83	42	III
30	105	Steiner Creek	Lander	L	800	110	1.2	432	0.45	65	1.3	477	0.84	45	III
31	117	Broad Creek	Nye	L	1200	104	0.8	427	0.47	79	1.1	593	0.85	61	III
32	77	Bishop Creek	Elko	L	200	113	4.6	413	0.42	39	3.	271	0.80	19	-
33	133*	Incline Creek	Washoe	L	280	110	3.3	409	0.43	28	1.5	187	0.75	7	I
34	79	Smith Creek	Elko	L	440	107	2.1	406	0.43	49	1.8	353	0.82	29	I
35	124	Sixmile Creek	Nye	L	400	106	2.2	398	0.43	47	1.9	333	0.81	26	III
36	100	Mullinix Creek	Humboldt	L	320	106	2.8	394	0.43	42	2.1	302	0.82	24	-
37	71	Coon Creek	Elko	L	500	102	1.7	387	0.43	48	1.6	349	0.83	30	I
38	122	Danville Creek	Nye	L	700	96	1.2	378	0.45	57	1.3	418	0.84	39	IV
39	76	Canyon Creek	Elko	L	200	102	4.2	371	0.42	34	2.7	238	0.81	18	I
40	115	Pablo Canyon Cr.	Nye	L	600	95	1.4	367	0.44	52	1.4	382	0.84	37	IV
41	80	Dixie Creek	Elko	L	80	99	10.1	358	0.41	29	5.7	202	0.79	13	-
42	102	Birch Creek	Lander	L	400	94	2.	354	0.43	43	1.7	308	0.82	26	I
43	129	Edwards Creek	Perishing	L	400	94	2.	354	0.43	43	1.7	308	0.82	26	-
44	74	Dave Creek	Elko	L	500	91	1.6	351	0.44	46	1.5	334	0.83	30	-
45	140	Piermont Creek	White Pine	L	800	85	0.95	338	0.45	53	1.1	395	0.85	41	I
46	123	Clear Creek	Nye	L	700	82	1.1	327	0.46	53	1.3	396	0.85	39	III
47	114	Jett Canyon Creek	Nye	L	600	82	1.2	324	0.45	49	1.3	358	0.84	34	III
48	120	Last Chance Creek	Nye	L	900	78	0.8	321	0.47	59	1.1	445	0.85	46	II
49	121	Ophir Creek	Nye	L	900	78	0.8	321	0.47	59	1.1	445	0.85	46	II
50	104	Callaghan Creek	Lander	L	440	83	1.6	316	0.44	40	1.5	294	0.83	27	II
51	128	Buena Vista Creek	Perishing	L	600	79	1.2	311	0.45	46	1.3	339	0.85	34	-
52	138	Big Indian Cr.	White Pine	L	600	79	1.2	311	0.45	46	1.3	339	0.85	34	II

TABLE 3b (Continued)

Rank	Map Number	Stream Name	County	Interest Level	Gross Head, ft H	Inst'l'd Cap. KW ₁	Development Ave. Gen. Flow, cfs Q ₁	Alternative No. 1 Ave. Annual Energy Prod. MWH ₁	Plant Factor PF ₁	Inst'l'd Cap. KW ₂	Development Ave. Gen. Flow, cfs Q ₂	Alternative No. 2 Ave. Annual Energy Prod. MWH ₂	Plant Factor PF ₂	"Firm" Power KW	Fish Value Class
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
53	86	Little Alder Cr.	Humboldt	L	650	76	1.05	304	0.46	50	1.25	362	0.83	33	II
54	85	Wilder Creek	Humboldt	L	400	75	1.6	287	0.44	37	1.5	267	0.83	24	IV,V
55	89	Colman Creek	Humboldt	M	800	69	1.7	604	-	-	-	-	-	-	-
56	116	Barker Creek	Nye	M	800	69	1.7	604	-	-	-	-	-	-	II
57	118	Cove Canyon	Nye	M	1200	67	1.1	587	-	-	-	-	-	-	III
58	82	Thousand Spr. Cr.	Elko	L	100	76	6.2	277	0.41	24	3.7	166	0.79	11	-
59	96	Rebel Creek	Humboldt	L	400	67	1.5	258	0.44	35	1.4	255	0.84	24	III
60	87	Alder Creek	Humboldt	L	400	67	1.5	258	0.44	35	1.4	255	0.84	24	-
61	92	Summer Camp Cr.	Humboldt	L	400	67	1.5	258	0.44	35	1.4	251	0.83	22	I
62	78	Stephen's Creek	Elko	L	400	65	1.4	252	0.44	35	1.4	251	0.83	22	I,II
63	90	Sluagullion Creek	Humboldt	L	400	63	1.4	245	0.44	35	1.4	255	0.84	24	V
64	101	Big Creek	Lander	L	400	63	1.4	245	0.44	35	1.4	255	0.84	24	II
65	72	Copper Cr.	Elko	L	500	58	1.1	234	0.46	38	1.3	283	0.85	28	II
66	88	Knott Creek	Humboldt	L	400	55	1.2	216	0.45	33	1.3	239	0.84	22	III
67	97	Singas (Colony) Cr.	Humboldt	L	600	52	0.8	214	0.47	40	1.1	296	0.85	30	II
68	91	Soldier Cr. (80)	Humboldt	L	400	53	1.2	207	0.45	30	1.3	226	0.85	22	-
69	98	Wash O'Neal Cr.	Humboldt	L	400	53	1.2	207	0.45	30	1.3	226	0.85	22	V
70	113	Peavine Canyon Cr.	Nye	L	400	53	1.2	207	0.45	30	1.3	226	0.85	22	II
71	99	Abel/Stone Ho. Cr.	Humboldt	L	360	49	1.2	194	0.45	29	1.3	215	0.84	20	III
72	103	Bowman Creek	Lander	L	800	45	0.54	191	0.49	41	0.89	313	0.88	37	-
73	81	Myers Creek	Elko	L	600	43	0.68	180	0.48	37	1.04	278	0.87	30	II
74	126	Indian Creek	Perching	L	600	43	0.68	180	0.48	37	1.04	278	0.87	30	IV
75	127	Cottonwood Creek	Perching	L	600	43	0.68	180	0.48	37	1.04	278	0.87	30	IV
76	112	Clear Creek	Nye	L	300	41	1.2	162	0.45	24	1.3	179	0.84	17	-
77	130	(no name)	Washoe	L	340	29	0.8	121	0.47	22	1.1	168	0.85	17	-
	132*	Marlette Creek	Washoe	M	1200	-	-	-	-	-	-	-	-	-	-

Column Notes: (1) Rank order based on average annual energy production for alternative No. 1 - see col. No. 9

(2) See plate in pocket

(3),(4) from maps

(5) H>1000 MWH; M: 500 to 1000 MWH; L < 500 MWH

(6) from topographic map

(7),(11) KW = 0.0847 QH_e

(8),(12) estimated from exceedence flows

(9),(13) MWH = 0.445 QH

(10),(14) PF = KW/(P_c × 8760)

(15) Based on 90 percent exceedence flow

(16) From "Stream Evaluation Map of Nevada, 1978"

used 30% exceedence flow; all others used 25%

nature of diversion structure, length of conveyance ditch, length of penstock, length of powerlines, construction problems). Users of this small scale hydroelectric survey should be able to develop their own preliminary economic analyses by following the procedures outlined in Appendix F using the data provided here supplemented with the necessary actual physical characteristics for the specific site of interest.

Correlation With Other Studies

Potential low-head hydroelectric sites identified in previous studies are shown in Table 4. All of those sites have a capacity in excess of 1,000 KW, which was one of the selection criteria. Small-scale hydroelectric sites, in Nevada examined by Ott Water Engineers during the course of this survey are listed in Table 5.

As indicated earlier the 144 potential sites listed in this study are essentially new sites. Some are located on the same streams as sites identified in the "lowhead hydroelectric surveys", Table 4, (Tudor/USBR) but are at different locations. Also it appears that as many as eleven of the potential sites may have been evaluated by Ott Water Engineers. Table 6 lists the sites included in both the Ott studies and this survey.

Also, during the writing of this survey report, it was discovered that one of the sites identified from the topographic maps (No. 32, Leidy Creek) has had an operating

TABLE 4
Nevada Low-Head Hydroelectric Sites
from Previous Studies⁽⁵⁾

PROJECT NAME	ID NO. PROJECT TYPE (1)(2)	RIVER	LATITUDE LONGITUDE (D M.M)	DRAIN AREA (SQ MI)	AV ANN INFLOW (CFS)	POWER HEAD (FT)	ENVIRN STATUS (4)	PLANT FACTOR	CAPACITY (MW)	AV ANN ENERGY (GWH)

COUNTY NAME=CHURCHILL			FERC POWER SUPPLY AREA=46			FERC REGIONAL OFFICE CODE=SF				
CARSON RIVER DIVERSI CN	NV10120 IED	CARSON RIVER	39 29.7 118 59.6	1803	500	14.0	PC	.22	2.2	4.3
STILLWATER POINT RES ERVOIR	NV10133 IED	STILLWATER CANAL	39 31.9 118 28.8	2000	123	25.5	SC	.19	1.1	1.9

COUNTY NAME=DOUGLAS			FERC POWER SUPPLY AREA=46			FERC REGIONAL OFFICE CODE=SF				
KATASHEANU RESERVOIR	NV00015 IUH	EAST FORK CARSON RIV	38 50.0 119 42.0	344	511	66.0	PC	.24	7.7	16.5
HOYE CANYON RESERVOIR	NV00020 IUL	WALKER RIVER	38 42.5 119 36.0	533	564	55.4	PC	.47	3.4	14.0
TOPAZ RESERVOIR	NV00093 IED	WALKER RIVER (OFF	38 41.6 119 30.9	500	235	23.0	PC	.24	4.0	8.3
REDHEAD DAM	NV20004 NUP	E F CARSON R	38 48.2 119 41.9	350	370	66.0	PC	.47	2.7	11.1

COUNTY NAME=ELKO			FERC POWER SUPPLY AREA=41			FERC REGIONAL OFFICE CODE=SF				
PAISVILLE	NV00001 IUH	EAST FORK OWYHEE RIV	41 48.0 115 57.3	332	105	66.0	PC	.20	1.6	2.9
SKULL CREEK	NV00002 IUH	OWYHEE RIVER	41 55.0 115 4.0	458	140	66.0	PC	.21	3.4	6.4
VISTA RESERVOIR	NV00004 IUL	MARYS RIVER	41 19.8 115 15.0	373	55	50.3	PC	.18	1.2	2.0
HYLTON RESERVOIR	NV00016 IUH	SOUTH FORK HUMBOLODT	40 40.0 115 47.0	1150	111	66.0	PC	.19	2.9	4.9
DEVILS GATE RESERVOIR	NV00017 IUH	NORTH FORK HUMBOLODT	41 11.0 115 30.0	878	74	66.0	PC	.20	1.9	3.3

TABLE 4 (Continued)

PROJECT NAME	ID NO. PROJECT TYPE	RIVER	LATITUDE LONGITUDE (D M.M)	DRAIN AREA (SQ MI)	AV ANN INFLOW (CFS)	POWER HEAD (FT)	ENVIRN STATUS (4)	PLANT FACTOR	CAPACITY (MW)	AV ANN FNEPGY (GWH)

COUNTY NAME=ELKO		FERC POWER SUPPLY AREA=41			FERC REGIONAL OFFICE CODE=SF					

BISHOP CREEK RESERVOIR	NVJ0053	BISHOP CREEK	41 15.3	68	118	40.7		.19	1.8	3.0
IR	IED		114 54.9							

DAKE RESERVOIR	NV03109	THOUSAND SPRING CREE	41 21.8	1421	137	28.1		.23	1.3	2.6
	IED		114 5.0							

21 MILE RESERVOIR	NV00110	THOUSAND SPRINGS CRE	41 31.8	801	77	42.5		.23	1.1	2.2
	IED		114 21.8							

COUNTY NAME=LYCN		FERC POWER SUPPLY AREA=46			FERC REGIONAL OFFICE CODE=SF					

EUREKA RESERVOIR	NV00019	CARSON RIVER	39 12.0	876	395	66.0	PC	.52	6.0	27.6
	IUH		119 38.0			200.0				

HUDSON	NV20006	WEST WALKER R	38 48.7	966	190	66.0	PC	.50	1.4	6.3
	NUP		119 12.8							

26 FOOT DROP POWER PLANT	NV80000	V CANAL (CARSON RIVE	39 29.0	2000	100	26.0		.43	1.6	6.0
	IED		118 53.5							

COUNTY NAME=MINERAL		FERC POWER SUPPLY AREA=46			FERC REGIONAL OFFICE CODE=SF					

WEBER RESERVOIR	NV10132	WALKER RIVER	39 2.7	2700	158	28.9	PC	.19	1.7	2.9
	IED		118 51.6							

COUNTY NAME=OPMSBY		FERC POWER SUPPLY AREA=46			FERC REGIONAL OFFICE CODE=SF					

PIGSINLOVE DAM	NV20003	E F CARSON R	39 10.9	1000	498	66.0	PC	.47	3.5	14.3
	NUP		119 39.7							

COUNTY NAME=PERSHING		FERC POWER SUPPLY AREA=46			FERC REGIONAL OFFICE CODE=SF					

LOWER PITT TAYLOR RESERVOIR	NV00063	HUMBOLDT RIVER	40 36.3	15700	207	22.1	PC	.22	1.5	3.0
	IED		118 18.0							

TABLE 4 (Continued)

PROJECT NAME	ID NO. PROJECT TYPE (1)(2)	RIVER	LATITUDE LONGITUDE (D M M)	DRAIN AREA (SQ MI)	AV ANN INFLOW (CFS)	POWER HEAD (FT)	ENVIRN STATUS (4)	PLANT FACTOR	CAPACITY (MW)	AV ANN ENERGY (GWH)
COUNTY NAME=PERSHING			FERC POWER SUPPLY AREA=46			FERC REGIONAL OFFICE CODE=SF				
RYE PATCH RESERVOIR	NV10124 IED	HUMBOLDT RIVER	40 28.2 119 18.0	13700	167	66.0	SC	.22	3.9	7.7
COUNTY NAME=STOREY			FERC POWER SUPPLY AREA=46			FERC REGIONAL OFFICE CODE=SF				
DERBY DAM	NV10121 IED	TRUCKEE RIVER	39 35.2 119 26.8	1700	800	15.0	PC	.16	2.3	3.2
COUNTY NAME=WASHOE			FERC POWER SUPPLY AREA=46			FERC REGIONAL OFFICE CODE=SF				
UPPER WALL CREEK RES ERVOIR	NV00023 IED	WALL CREEK	41 9.9 119 49.0	243	78	46.8		.27	1.1	2.5
LANTON DAM	NV20031 NUP	TRUCKEE RIVER	39 30.7 119 54.7	1020	601	66.0	MC	.54	4.1	19.2
VERDI DAM	NV20002 NUP	TRUCKEE RIVER	39 29.6 119 59.6	1000	590	66.0	MC	.54	4.0	18.9
PEKOE DAM	NV20005 NUP	TRUCKEE RIVER	39 46.1 119 20.2	1810	447	66.0	PC	.47	2.0	8.2
COUNTY NAME=WHITE PINE			FERC POWER SUPPLY AREA=47			FERC REGIONAL OFFICE CODE=SF				
KEYSTONE RESERVOIR	NV00023 IUL	GLEASON CREEK	39 18.0 114 58.5	55	95	34.0		.19	1.2	2.0
STATE NV TOTAL SITES= 27										

- (1) ID NO.-- UPPER FIGURE IS PROJECT IDENTIFICATION NUMBER, LOWER FIGURE IS PROJECT TYPE. SEE (2) BELOW.
 (2) PROJECT TYPE-- NED = NEW SITE, EXISTING DAM. NCD = NEW SITE, CANAL DROP. NUP = NEW SITE, UNDEVELOPED PROJECT.
 IED = IDENTIFIED EXISTING DAM. IUD = IDENTIFIED UNDEVELOPED PROJECT WITH ORIGINAL HEAD GREATER THAN 66 FT.
 IUL = IDENTIFIED UNDEVELOPED PROJECT WITH ORIGINAL HEAD LESS THAN 66 FT.
 (3) POWER HEAD-- UPPER FIGURE IS NET POWER HEAD FOR LOW HEAD INVENTORY LISTING. A LOWER FIGURE, IF GIVEN, INDICATES THE ORIGINAL HEAD AT A PREVIOUSLY IDENTIFIED SITE.
 (4) ENVIRONMENTAL STATUS-- MC = MAJOR CONSTRAINTS. SC = SERIOUS CONSTRAINTS. PC = POTENTIALLY SERIOUS CONSTRAINTS.
 BLANK = NO LISTED CONSTRAINTS.

(5) Source: "Western States Inventory of Low-Head Hydroelectric Sites", U.S. Water and Power Resources Service, Denver, Co. Vol. 1 App. A., 1980 (prepared by Tudor Engineering Co.)

TABLE 5
Ott Water Engineers Small-Scale Hydroelectric
Reconnaissance Studies for Nevada Sites

<u>Site Name</u>	<u>Location</u>	<u>County</u>	<u>Owner</u>	<u>Date Assigned</u>	<u>Recon Date</u>	<u>Recon Report</u>	<u>Remarks</u>
Lapon Canyon Cr.	Yerington, NV	Lyon	Monarch Mining Co.	10/27/80	12/11/80	1/21/81	Final
Soroni Canal at Hoyo Canyon	Smith Valley, NV	Lyon	Walker River Irrigation District	10/27/80	12/11/80	1/23/81	Final
Irrigation Res.	Smith Valley, NV	Lyon	Six N Ranch	10/27/80	12/11/80	Not required	Not feasible
Young, Brennan Rabbit, Big Spring Creeks	Pleasant Valley LaMoille, NV	Elko	Rave Estate Lee Livestock Co.	2/23/81	2/24/81	5/6/81	Final
Snell Creek	LaMoille, NV	Elko	William O. Hollison Wild Meadows Ranch	2/23/81	2/24/81	5/15/81	Final
Galena Creek	290 Galena Pines, Reno, NV 89511	Washoe	Tim Holt	2/23/81	April '81	4/20/81	Final
North & South Twin Rivers	Round Mountain, NV	Nye	Evan Zimmerman	3/10/81	?	?	Budget Limitation
Unknown	Jiggs Bar, Elko, NV	Elko	Tom Poulsen	3/10/81	4/9/81	Not required	Not feasible
Cave Lake State Recreation Area	P.O. Box 761 Ely, NV 89301	White Pine	State of Nevada		4/9/81	?	Budget Limitation
Pine Creek	Pine Valley Carlin, NV	Eureka	Dean Stitzel Palisade Ranch	"	2/17/81	5/18/81	Final
Troat Creek Spr.	Metropolis Wells, NV	Elko	Herbert & Ernest Uhlig, Uhlig Ranch	"	2/17/81	5/5/81	Final
Ralph Creek	Clover Vly/Wells NV 89835	Elko	Robert Wright, Sr.	"	2/18/81	5/5/81	Final
Wines Creek	Ruby Valley Wells, NV	Elko	Calvin Wines	"	2/18/81	4/17/81	Final
Career, Getmi, Springs Creeks	Ruby Valley Wells, NV	Elko	Guy Weatherby	"	2/18/81	4/20/81	Final

TABLE 5 (Continued)

<u>Site Name</u>	<u>Location</u>	<u>County</u>	<u>Owner</u>	<u>Date Assigned</u>	<u>Recon Date</u>	<u>Recon Report</u>	<u>Remarks</u>
Withington and Robinson Creeks	Ruby Valley Wells, NV	Elko	David Neff	12/19/80	2/18/81	4/20/81	Final
Unknown	Starr Valley Wells, NV	Elko	Fred Howell	"	2/18/81	4/28/81	Final
Ackler Creek	Starr Valley Wells, NV	Elko	Robert Morrow, Mountain View Guest Ranch	"	2/19/81	Need land ownership	Budget Limitation
Gardner/Hankins Creek	South Ruby Valley, Wells, NV	Elko	Cliff Gardner	"	4/9/81	5/4/81	Final
Salmon Falls Cr.	Contact, NV	Elko	Steve Boies	"	4/8/81	5/19/81	Final
Unknown	Starr Valley, Wells, NV	Elko	William Rodriguez	"	No access until June		Budget Limitation
Salmon Falls Cr.	Twin Meadows Wells, NV	Elko	Dirk Agee	"	4/8/81	5/8/81	Final
Chatovich Creek	Fish Lake Valley, NV	Esmeralde	James Carter	"	?	?	Budget Limitation

TABLE 6
Correlation of Ott Water Engineer Sites With
Potential Sites Identified in this Survey

Ott			This Survey	
Site Name	Location	County	Site No.	Stream
Young, Brennan Rabbit & Big Springs Creeks	Pleasant Vly	Elko	24	Rabbit Creek
North and South Twin Rivers	Big Smokey Valley	Nye	52 119	So. Twin River No. Twin River
89 Pine Creek	Pine Valley	Eureka	34	Pine Creek
Unknown	Star Valley	Elko	15,16	all are in Starr Valley
Ackler Creek	Starr Valley	Elko	19	Ackler Creek
Salmon Falls Creek	Contact	Elko	13	Salmon Falls Creek
Unknown	Starr Valley	Elko	15,16,17,18	all are in Starr Valley
Salmon Falls Creek	Twin Meadows	Elko	13	Salmon Falls Creek
Chiatovich Creek	Fish Lake Valley	Esmeralda	30	Chiatovich Creek
Galena Creek	Truckee Meadows	Washoe	58	Galena Creek

small scale hydroelectric plant since 1941. The estimated and actual head capacity and energy production at this site are respectively; head-800 est. v. 1,290 act.; capacity - 163 KW est. v. 200 KW act.; production - 1,428 MWH est. v. 1,900 MWH act. (in 1965). Thus this survey's estimates at Leidy Creek were conservative when compared to what had actually been installed. It is believed that, at least for the measured flow sites, all capacity and production estimates in this survey are on the conservative side. There is much greater uncertainty for the derived flow sites.

APPENDIX A

Nevada Streamflow Measurement Sites

SOURCE: "Nevada Streamflow Characteristics", State of Nevada, Department of Conservation and Natural Resources, and "Water Resources Data for Nevada", United States Geological Survey.

TABLE A-1
Streamflow Stations, in Downstream Order,
and Period of Record

Recorded mean daily values Peak flow data only

STATION NO.	STATION NAME	PAGE	1890	1895	1900	1905	1910	1915	1920	1925	1930	1935	1940	1945	1950	1955	1960	1965	1970	1975	1980
Period of record (water years)																					
COLORADO RIVER BASIN																					
Colorado River:																					
VIRGIN RIVER BASIN																					
09415000	Virgin River at Littlefield, AZ	11																			
09415100	Puleigher Wash near Mesquite	15																			
	White River (head of Muddy River):																				
09415560	White River tributary near Sunnyside	14																			
09416000	Muddy River near Moapa	17																			
09417500	Meadow Valley Wash at Eagle Canyon near Ordain	20																			
	Patterson Wash:																				
09418100	Patterson Wash tributary near Pioche	22																			
09418150	Caseltown Wash near Panaca	23																			
09418450	Meadow Valley Wash tributary near Caliente	24																			
09418500	Meadow Valley Wash near Caliente	25																			
09418990	Weiser Wash near Glendale	28																			
09419000	Muddy River near Glendale	29																			
LAS VEGAS VALLEY																					
Las Vegas Wash:																					
09419610	Las Vegas Wash near Charleston Park	32																			
09419620	Mormon Wells Wash near Las Vegas	35																			
09419623	Deer Creek near Charleston Park	36																			
	Kyle Canyon:																				
09419630	Telephone Canyon near Charleston Park	37																			
09419640	Kyle Canyon near Charleston Park	38																			
09419647	Las Vegas Wash tributary near North Las Vegas	39																			
09419650	Las Vegas Wash at North Las Vegas	40																			
09419660	Las Vegas Wash tributary near Nellis Air Force Base	43																			
09419663	Las Vegas Wash tributary south of Nellis Air Force Base	44																			
09419670	Red Rock Wash near Blue Diamond	45																			
09419675	Fleming Wash at Las Vegas	46																			
09419677	Fleming Wash at Maryland Parkway at Las Vegas	47																			
09419678	Fleming Wash near mouth at Las Vegas	49																			
09419680	Cottonwood Valley near Blue Diamond	50																			
09419690	Duck Creek at Whitney	51																			
09419697	Las Vegas Wash tributary near Henderson	52																			
09419700	Las Vegas Wash near Henderson	53																			
09419800	Las Vegas Wash near Boulder City	56																			
PIUTE VALLEY																					
Piute Wash:																					
09423300	Piute Wash tributary at Searchlight	58																			
THE GREAT BASIN																					
GREAT SALT LAKE BASIN																					
GREAT SALT LAKE DESERT																					
10172902	Dead Cedar Wash near Wendover, UT	59																			
10172909	Thousand Springs Creek:																				
	Burnt Creek near Shores	60																			
10172913	Loray Wash:																				
	Loray Wash tributary near Cobee	61																			
ESCALANTE VALLEY																					
10242460	Escalante Valley tributary near Panaca	62																			
SNAKE VALLEY																					
10243260	Baker Creek at narrows, near Baker	63																			
10243260	Lehman Creek near Baker	65																			
SPRING VALLEY																					
10243700	Cleve Creek near Ely	67																			
ANTHLOPE VALLEY (NORTHERN PART)																					
10243950	Hillside Canyon tributary near Currie	69																			
CLOVER AND INDEPENDENCE VALLEYS																					
10244260	Clover Valley tributary near Arthur	70																			
DIXIE VALLEY BASIN																					
10244360	Dixie Valley tributary near Eastgate	71																			
RAWHIDE FLATS																					
10244460	Rawhide Flat tributary near Schurz	72																			
GABBS VALLEY																					
10244480	Gabbs Valley tributary near Gabbs	73																			
RUBY VALLEY																					
10244720	Franklin River near Arthur	74																			
10244745	Overland Creek near Ruby Valley	76																			
STEPTOE VALLEY BASIN																					
10244930	Steptoe Creek near Ely	78																			
	Melton Creek:																				
10245080	Melton Creek tributary near Currie	80																			
DRY LAKE VALLEY																					
10245270	Dry Lake Valley tributary near Caliente	81																			
JAMES VALLEY																					
	Illipah Creek:																				
10245450	Illipah Creek tributary near Hamilton	82																			
Period of record (water years)																					

TABLE A-1 (Cont.)

Recorded mean daily values

Peak flow data only

STATION NO.	STATION NAME	PAGE	Period of record (water years)																			
THE GREAT BASIN--Continued			1890	1895	1900	1905	1910	1915	1920	1925	1930	1935	1940	1945	1950	1955	1960	1965	1970	1975	1980	
REMARK VALLEY																						
10245800	Remark Valley tributary near Hamilton	83, 64																				
MONITOR AND DIAMOND VALLEYS BASIN																						
10245950	Bean Flat tributary near Austin	85																				
Garden Pass Creek:																						
10246000	Garden Pass Creek tributary near Eureka	86																				
10246010	Garden Pass Creek near Eureka	87																				
ROY CREEK AND RAILROAD (NORTHERN PART) VALLEYS																						
Current Creek:																						
10246845	Current Creek tributary near Current	88																				
10246846	Little Current Creek near Current	89																				
10246847	Current Creek below Little Current Creek near Current	91																				
PUMPER (SAND SPRING) VALLEY																						
10247860	Pumper Valley tributary near Temple	91																				
INDIAN SPRINGS VALLEY																						
10248490	Indian Springs Valley tributary near Indian Springs	94																				
ELDORADO VALLEY																						
10248510	Eldorado Valley tributary near Nelson	95																				
STONEMALL AND SARCOBATUS FLATS BASIN																						
10249050	Sarcobatus Flat tributary near Springdale	97																				
STONE CASH AND RALSTON VALLEYS																						
10249135	San Antonio Wash tributary near Tonopah	98																				
10249180	Sealebury Wash near Tonopah	99																				
BIG SMOKEY VALLEY (NORTHERN PART)																						
10249280	Eligaton Creek below Cougar Canyon near Austin	100																				
10249300	South Twin River near Round Mountain	102																				
SMITH CREEK VALLEY																						
Campbell Creek:																						
10249411	Campbell Creek tributary near Eastgate	104																				
10249417	Smith Creek Valley tributary near Austin	106																				
LOWE AND BIG SMOKEY (TONOPAH PLATE) VALLEYS																						
10249480	Big Smoky Valley tributary near Blair Junction	107																				
FISH LAKE VALLEY AND COLUMBUS SALT MARSH																						
Falmetto Wash:																						
10249850	Falmetto Wash tributary near Lida	108																				
10249855	Falmetto Wash tributary near Oasis	109																				
10249900	Chiatovich Creek near Dyer	110																				
DE-YE VALLEY																						
10251270	Emergosa River tributary near Mercury	112																				
10251271	Emergosa River tributary No. 1 near Johnnie	113																				
10251272	Emergosa River tributary No. 2 near Johnnie	114																				
FAIRBANK VALLEY																						
10251980	Lovell Wash near Blue Diamond	115																				
WALKER LAKE BASIN																						
10289000	Virginia Creek (head of Walker River) near Bridgeport, CA	117																				
10289500	Green Creek near Bridgeport, CA	120																				
10290000	Summers Creek near Bridgeport, CA	123																				
10291500	Buckeye Creek near Bridgeport, CA	125																				
10292000	Bounger Creek near Bridgeport, CA	128																				
East Walker River (continuation of Virginia Creek):																						
10292500	Bridgeport Reservoir tributary near Bridgeport, CA	131																				
10293500	East Walker River above Strosser Ditch near Mason	132																				
10293500	West Walker River at Leavitt Meadows, near Coleville, CA	135																				
10295500	Little Walker River near Bridgeport, CA	136																				
10296000	West Walker River below Little Walker River near Coleville, CA	141																				
10296500	West Walker River near Coleville, CA	145																				
Slinkard Creek:																						
10296800	Slinkard Creek tributary near Topaz, CA	149																				
10297500	West Walker River at Boye Bridge near Wellington	150																				
10299100	Desert Creek near Wellington	153																				
10300000	West Walker River near Hudson	155																				
10301000	Walker River at Mason	159																				
10301500	Walker River near Wabuska	160																				
10302000	Walker River at Schurz	164																				
10302010	Reese River Canyon near Schurz	167																				
MUNDOLTY-CARSON SINK BASIN																						
CARSON RIVER BASIN																						
10302500	East Fork Carson River above Soda Springs ranger station, near Markleeville, CA	169																				
10303000	Silver King Creek near Coleville, CA	171																				
10304000	Wolf Creek near Markleeville, CA	173																				
10304500	Silver Creek below Pennsylvania Creek near Markleeville, CA	175																				
10306000	Hot Springs Creek near Markleeville, CA	176																				
10307000	Pleasant Valley Creek above Raymond Canyon Creek near Markleeville, CA	180																				
10308100	Millberry Creek at Markleeville, CA	182																				

Period of record (water years)

Period of record (water years)

TABLE A-1 (Cont.)

Recorded mean daily values

Peak flow data only

STATION NO.	STATION NAME	PAGE	Period of record (water years)																			
			1890	1895	1900	1905	1910	1915	1920	1925	1930	1935	1940	1945	1950	1955	1960	1965	1970	1975	1980	
THE GREAT BASIN--Continued																						
HUMBOLDT-CARSON RIVER BASIN--Continued																						
CARSON RIVER BASIN--Continued																						
10308200	East Fork Carson River below Markleeville Creek near Markleeville, CA	183																				
10308800	Bryant Creek near Gardnerville	186																				
10309000	East Fork Carson River near Gardnerville	188																				
10309500	West Fork Carson River above Woodfords, CA	192																				
10310000	West Fork Carson River at Woodfords, CA	194																				
10315000	Daggett Creek near Ganoe	198																				
10310500	Clear Creek near Carson City	200																				
10311000	Carson River near Carson City	203																				
10311450	Brunswick Canyon near New Empire	206																				
10311500	Carson River near Empire	207																				
10312000	Carson River near Fort Churchill	210																				
HUMBOLDT RIVER BASIN																						
Humboldt River:																						
10312750	Willow Creek near Wells	214																				
10313000	Starr Creek near Death	215																				
10315000	Marys River near Death	217																				
10315500	Marys River above Hot Springs Creek near Death	220																				
10315800	Humboldt River tributary near Halleck	223																				
Secret Creek:																						
10315950	Secret Creek tributary near Arthur	224																				
10316000	Secret Creek near Halleck	225																				
10316500	Lamolle Creek near Lamolle	227																				
10317000	Lamolle Creek near Halleck	231																				
10317400	North Fork Humboldt River near North Fork	232																				
10317430	Jim Creek near Tuscarora	234																				
10317500	North Fork Humboldt River at Devils Gate near Halleck	235																				
10318000	North Fork Humboldt River near Halleck	239																				
10318500	Humboldt River near Elko	241																				
10319000	South Fork Humboldt River near Lee	245																				
Huntington Creek:																						
Willow Creek:																						
10319470	Willow Creek tributary near Jiggs	247																				
10319500	Huntington Creek near Lee	248																				
10320000	South Fork Humboldt River above Dixie Creek, near Elko	251																				
10320500	South Fork Humboldt River near Elko	254																				
10321000	Humboldt River near Carlin	258																				
10322000	Maggie Creek near Carlin	261																				
10322500	Humboldt River at Palisade	263																				
Pine Creek:																						
10322980	Cole Creek near Palisade	268																				
10323000	Pine Creek near Palisade	269																				
10323200	Rob Creek near Beowawe	272																				
10323500	Humboldt River near Argenta	273																				
Rock Creek:																						
10323870	Willow Creek above Willow Creek Reservoir, near Tuscarora	276																				
10324500	Rock Creek near Battle Mountain	277																				
10325000	Humboldt River at Battle Mountain	281																				
10325500	Reese River near Ione	285																				
10326400	Reese River tributary near Austin	288																				
10326650	Silver Creek near Austin	289																				
10326700	Reese River near Austin	290																				
10326850	Reese River tributary near Battle Mountain	292																				
10327000	Humboldt River near Valay	293																				
10327500	Humboldt River at Comus	295																				
10328000	Pole Creek near Golconda	299																				
10328240	Humboldt River tributary near Bliss	301																				
10328500	Little Humboldt River below Chimney Dam near Paradise Valley	302																				
10329000	Little Humboldt River near Paradise Valley	304																				
10329500	Martin Creek near Paradise Valley	308																				
10330000	Cottonwood Creek near Paradise Valley	312																				
10330300	Mullins Creek near Paradise Valley	314																				
10330500	Cottonwood Creek at Paradise Valley	315																				
10331500	Humboldt River near Rose Creek	317																				
10332200	Raspberry Creek near Hill City	320																				
10333000	Humboldt River near Islay	321																				
10335000	Humboldt River near Eye Patch	325																				
10336000	Humboldt River near Lovelock	328																				
Toulon drain:																						
10336030	Toulon drain tributary near Lovelock	331																				
Humboldt Slough:																						
10336080	Humboldt Slough tributary near Bradys Hot Springs	332																				

TABLE A-1 (Cont.)

Period of record (water years)

TABLE A-1 (Cont.)

		Recorded mean daily values		Peak flow data only																		
STATION NO.	STATION NAME	PAGE	Period of record (water years)																			
THE GREAT BASIN--Continued			1890	1895	1900	1905	1910	1915	1920	1925	1930	1935	1940	1945	1950	1955	1960	1965	1970	1975	1980	
OUTRICK RIVER BASIN																						
13174500	Owyhee River near Gold Creek	455																				
13175000	Owyhee River at Mountain City	457																				
13175500	Owyhee River near Owyhee	460																				
13175900	Lead Creek near Owyhee	462																				
13176000	Owyhee River above China Diversion Dam, near Owyhee	453																				
South Fork Owyhee River:																						
13176400	Taylor Canyon tributary near Tucacora	456																				
Harrington Creek:																						
13176900	Jack Creek below Schoonover Creek, near Tucacora	447																				
13177000	Jack Creek near Tucacora	449																				
13177200	South Fork Owyhee River at Spanish Ranch near Tucacora	471																				
13177800	South Fork Owyhee River near Whiterock	473																				

TABLE A-2
GAGING STATIONS, IN DOWNSTREAM ORDER,
FOR WHICH RECORDS ARE PUBLISHED

[Letter after station name designates type of data: (d) discharge, (e) elevation or contents, (c) chemical, (b) biological and micro-biological, (t) water temperature, (s) sediment; (x) supplemental water-quality data listed separately beginning on p. 344]

COLORADO RIVER BASIN

Colorado River:

VIRGIN RIVER BASIN

Virgin River at Littlefield, AZ (dcbts)

Virgin River above Halfway Wash near Riverside (dcbts)

White River (head of Muddy River):

Muddy River Power Diversion near Moapa (d)

Muddy River near Moapa (dx)

Meadow Valley Wash at:

Clover Creek:

Mathews Canyon Wash near Caliente (d)

Pine Canyon Wash near Caliente (d)

Meadow Valley Wash near Caliente (dx)

Muddy River near Glendale (dx)

Muddy River above Lake Mead near Overton (dcbts)

LAS VEGAS VALLEY

Lee Canyon near Charleston Park (d)

Las Vegas Wash near Henderson (dcts)

Las Vegas Wasteway near East Las Vegas (d)

Las Vegas Wash near Boulder City (dcts)

Lake Mead at Hoover Dam, AZ-NV (ect)

Colorado River below Hoover Dam, AZ-NV (dcbts)

Lake Mojave at Davis Dam, AZ-NV (e)

Colorado River below Davis Dam, AZ-NV (dct)

THE GREAT BASIN

SPRING VALLEY

Cleve Creek near Ely (d)

RUBY VALLEY

Franklin River near Arthur (dx)

Overland Creek near Ruby Valley (dx)

STEPTOE VALLEY BASIN

Steptoe Creek near Ely (dcbts)

LITTLE SMOKY (NORTHERN PART) AND NEWARK VALLEYS

Newark Valley tributary near Hamilton (d)

MONITOR VALLEY

Pine Canyon Creek near Belmont (dx)

Mosquito Creek near Belmont (dx)

Stoneberger Creek near Austin (d)

HOT CREEK AND RAILROAD (NORTHERN PART) VALLEYS

Little Currant Creek near Currant (dx)

STONE CABIN VALLEY

Willow Creek near Warm Springs (d)

TABLE A-2 (Cont.)
GAGING STATIONS IN DOWNSTREAM ORDER

THE GREAT BASIN--Continued

GRASS VALLEY

McClusky Creek near Austin (d)

BIG SMOKY VALLEY (NORTHERN PART)

Kingston Creek below Cougar Canyon near Austin (dx)

South Twin River near Round Mountain (dcbts)

SMITH CREEK VALLEY

Campbell Creek:

Campbell Creek tributary near Eastgate (d)

FISH LAKE VALLEY AND COLUMBUS SALT MARSH

Chiatovich Creek near Dyer (dcbts)

PAHRUMP VALLEY

Peak Springs Canyon Creek near Charleston Peak (d)

WALKER LAKE BASIN

Walker Lake near Hawthorne (e)

Virginia Creek (head of Walker River):

Upper Twin Lake near Bridgeport, CA (e)

Lower Twin Lake near Bridgeport, CA (e)

Buckeye Creek near Bridgeport, CA (dx)

East Walker River (continuation of Virginia Creek):

Bridgeport Reservoir near Bridgeport, CA (e)

East Walker River near Bridgeport, CA (dct)

East Walker River below Sweetwater Creek, near

Bridgeport, CA (d)

East Walker River above Strosnider ditch, near Mason (dx) . .

Little Walker River near Bridgeport, CA (dx)

West Walker River below L. Walker R., near Coleville,

CA (dct)

West Walker River near Coleville, CA (dx)

Topaz Lake near Topaz, CA (e)

West Walker River at Hoyer bridge, near Wellington (dx) . . .

West Walker River near Hudson (dx)

Walker River near Mason (dx)

Walker River near Wabuska (dcbts)

Walker River above Weber Reservoir near Schurz (dct)

Walker River at diversions above Schurz (dct)

HUMBOLDT-CARSON SINK BASIN

CARSON RIVER BASIN

East Fork Carson River:

East Fork Carson River below Markleeville Creek, near

Markleeville, CA (dx)

Bryant Creek near Gardnerville (d)

East Fork Carson River near Gardnerville (dts)

East Fork Carson River at Minden (dx)

West Fork Carson River at Woodfords, CA (dct)

Daggett Creek near Genoa (d)

Carson River at Genoa (dx)

TABLE A-2 (Cont.)
GAGING STATIONS IN DOWNSTREAM ORDER

THE GREAT BASIN--Continued

HUMBOLDT-CARSON SINK BASIN--Continued

CARSON RIVER BASIN--Continued

Carson River near Carson City (dt)
 Kings Canyon Creek near Carson City (dx)
 Ash Canyon Creek near Carson City (dx)
 Carson River at Deer Run Road near Carson City (d)
 Carson River near Fort Churchill (dcbts)
 Lahontan Reservoir near Fallon (e)
 Carson River below Lahontan Reservoir, near Fallon (dct) . . .
 Outfall from Newlands Project into Stillwater National
 Wildlife Refuge, near Fallon (dx)
 Carson River below Fallon (d)

HUMBOLDT RIVER BASIN

East Fork Humboldt River:

Marys River above Hot Springs Creek, near Deeth (dx)
 Lamoille Creek near Lamoille (dx)
 North Fork Humboldt River near North Fork (dx)
 North Fork Humboldt River at Devils Gate, near Halleck (dx).
 Humboldt River near Elko (dx)
 South Fork Humboldt River above Dixie Creek, near Elko (dx).
 Humboldt River near Carlin (dcbts)
 Humboldt River at Palisade (dx)
 Humboldt River near Argenta (dx)
 Rock Creek near Battle Mountain (dx)
 Humboldt River at Battle Mountain (dx)
 Reese River near Ione (d)
 Fish Creek near Battle Mountain (dx)
 Humboldt River at Comus (dx)

Little Humboldt River:

North Fork Little Humboldt River (head of Little Humboldt
 River) near Paradise Valley (dx)
 South Fork Little Humboldt River near Paradise
 Valley (dx)
 Little Humboldt River below Chimney Dam site near Paradise
 Valley (d)
 Little Humboldt River near Paradise Valley (dx)
 Martin Creek near Paradise Valley (d)
 Humboldt River near Imlay (dts)
 Rye Patch Reservoir near Rye Patch (e)
 Humboldt River near Rye Patch (dcbts)

PYRAMID AND WINNEMUCCA LAKES BASIN

Pyramid Lake near Nixon (e)

Truckee River:

Upper Truckee River near Meyers, CA (d)
 Fallen Leaf Lake near Camp Richardson, CA (e)

TABLE A-2 (Cont.)
GAGING STATIONS IN DOWNSTREAM ORDER

THE GREAT BASIN--Continued

PYRAMID AND WINNEMUCCA LAKES BASIN--Continued

Truckee River--Continued

Taylor Creek near Camp Richardson, CA (d)	.....
Blackwood Creek near Tahoe City, CA (d)	.....
Ward Creek at Highway 89, near Tahoe Pines, CA (d)	.....
Third Creek near Crystal Bay (dct)	.....
Marlette Lake near Carson City (e)	.....
Marlette Creek near Carson City (dx)	.....
Trout Creek near Tahoe Valley, CA (d)	.....
Lake Tahoe at Tahoe City, CA (ect)	.....
Truckee River at Tahoe City, CA (dct)	.....
Truckee River near Truckee (dt)	.....
Donner Creek at Donner Lake, near Truckee, CA (d)	.....
Martis Creek at Highway 267, near Truckee, CA (cts)	.....
Martis Creek Lake near Truckee, CA (ect)	.....
Martis Creek near Truckee, CA (dcts)	.....
Prosser Creek:	
Prosser Creek Reservoir near Truckee, CA (e)	.....
Prosser Creek below Prosser Creek Dam near Truckee, CA (d)	..
Little Truckee River:	
Independence Creek near Truckee, CA (d)	.....
Sagehen Creek near Truckee, CA (d)	.....
Stampede Reservoir near Boca, Truckee, CA (e)	.....
Little Truckee River above Boca Reservoir, near Truckee, CA (d)	.....
Boca Reservoir near Truckee, CA (e)	.....
Little Truckee River below Boca Dam, near Truckee, CA (d)	..
Truckee River at Farad, CA (dcbt)	.....
Hunter Creek near Reno (d)	.....
Truckee River at Reno (dx)	.....
Truckee River near Sparks (dx)	.....
Franktown Creek (head of Steamboat Creek) near Carson City (dx)	.....
Steamboat Creek:	
Washoe Lake near Carson City (e)	.....
Little Washoe Lake near Steamboat (e)	.....
Galena Creek near Steamboat (dx)	.....
Steamboat Creek at Steamboat (dx)	.....
Truckee River at Vista (dx)	.....
Truckee River at Lockwood (cbt)	.....
Truckee River above Tracy (t)	.....
Truckee River below Tracy (dt)	.....
Truckee River right bank below Tracy (t)	.....
Truckee River at Clark (t)	.....
Truckee Canal near Wadsworth (d)	.....
Fernley A Drain near Fernley (d)	.....
Truckee Canal near Hazen (d)	.....

TABLE A-2 (Cont.)
GAGING STATIONS IN DOWNSTREAM ORDER

THE GREAT BASIN--Continued

PYRAMID AND WINNEMUCCA LAKES BASIN --Continued

Truckee River--Continued

Truckee River below Derby Dam, near Wadsworth (d)
Truckee River at Wadsworth (dct)
Truckee River near Nixon (dcbs)

BLACK ROCK DESERT BASIN

Quinn River:

McDermitt Creek near McDermitt (dx)
East Fork Quinn River near McDermitt (dx)
Quinn River near McDermitt (dcbs)
King's River near Orovada (dx)
Quinn River near Denio (d)
Leonard Creek near Denio (dx)

HUALAPAI FLAT

South Willow Creek near Gerlach (d)

SNAKE RIVER BASIN

GOOSE CREEK BASIN

Goose Creek above Trapper Creek, near Oakley, ID (dct)

SALMON FALLS CREEK BASIN

Salmon Falls Creek near San Jacinto (dct)
Salmon River Canal Co. Reservoir near Rogerson, ID (e)

BRUNEAU RIVER BASIN

Bruneau River:

Bruneau River at Rowland (dx)

OWYHEE RIVER BASIN

Wild Horse Reservoir near Gold Creek (e)
Owyhee River near Gold Creek (d)
Owyhee River above China diversion dam, near Owyhee (dx)
South Fork Owyhee River near Whiterock (dx)
Owyhee River near Rome, OR (d)

APPENDIX B

Small-Scale Hydroelectric Power Site Data

TABLE B.1-a

Site Exceedence Flows and Development
Alternatives-Measured-flow Sites

County	Map Number	Stream Name	Gross Head, ft H (4)	Exceedence Flows, cfs			Instl'd Cap. KW ₁ (8)	Development Alternative No. 1			Instl'd Cap. KW ₂ (12)	Development Alternative No. 2			"Firm" Power KW (16)
				Q _{25/30} (5)	Q ₅₀ (6)	Q ₉₀ (7)		Ave. Gen. Flow, cfs Q ₁ (9)	Ave. Annual Energy Prod. MWH ₁ (10)	Plant Factor PF ₁ (11)		Ave. Gen. Flow, cfs Q ₂ (13)	Ave. Annual Energy Prod. MWH ₂ (14)	Plant Factor PF ₂ (15)	
Clark	1	Muddy River	120	46.5	13.	5.2	284	19.1	1,018	0.41	79	10.1	542	0.78	32
	2	Virgin River	40	211.4	56.4	20.8	430	86.3	1,537	0.41	115	43.6	777	0.77	42
	3	Las Vegas Wash	120	62.5	17.2	6.7	381	25.6	1,367	0.41	105	13.4	715	0.78	41
Douglas	4	Clear Creek	600	6.5*	2.0	0.5	198	2.8	748	0.43	61	1.5	400	0.75	15
	5	Daggett Creek	600	4.3*	0.5	0.1	131	1.8	473	0.41	15	0.37	99	0.74	3
	6	Bryant Creek	240	8.5*	2.3	0.8	104	3.6	388	0.43	28	1.8	189	0.77	10
	7	West Walker River	**	174.6*	76.6	30.2	-	77.5	-	-	-	59.7	-	-	-
Elko	8	Desert Creek	560	15.0*	5.2	2.0	427	6.5	1,625	0.43	148	4.	1,007	0.78	57
	9	Jack Creek	80	29.5	8.6	3.7	120	12.1	432	0.41	35	6.8	241	0.79	15
	10	Owyhee River	50	109.4	29.6	11.2	278	44.7	996	0.41	75	23.	511	0.78	28
	11	Bruneau River	100	121.5	32.8	12.3	617	49.7	2,211	0.41	167	25.4	1,132	0.78	63
	12	Jarbridge River	100	60.	16.5	6.5	305	24.6	1,094	0.41	84	12.9	572	0.78	33
	13	Salmon Falls Creek	40	132.6	35.7	13.4	270	54.2	965	0.41	73	27.7	493	0.78	27
	14	Marys River	20	55.1	15.2	6.0	56	22.6	201	0.41	15	11.8	105	0.78	6
	15	Horder Creek	400	6.2	2.5	1.4	126	2.6	470	0.43	51	2.	362	0.81	28
	16	East Fork Boulder Creek	500	13.5	4.3	2.0	343	5.6	1,247	0.41	109	3.4	759	0.79	51
	17	West Fork Boulder Creek	400	14.8	4.6	2.1	301	6.1	1,091	0.41	94	3.6	648	0.79	43
	18	Secret Creek	400	14.8	4.7	2.1	301	6.1	1,093	0.41	96	3.7	661	0.79	43
	19	Ackler Creek	400	10.0	3.4	2.7	203	4.2	743	0.42	69	2.9	520	0.86	55
	20	North Fork Humboldt River	**	66.0	18.1	8.0	-	27.0	-	-	-	14.3	-	-	-
	21	Talbot Creek	800	9.4	3.3	1.7	382	3.9	1,402	0.42	134	2.7	944	0.80	69
	22	Humboldt River	20	196.8	52.4	19.3	200	80.4	715	0.41	53	40.5	361	0.77	20
	23	Thorpe Creek	400	12.0	4.0	1.9	244	5.	890	0.42	81	3.2	566	0.80	39
	24	Rabbit Creek	440	11.2	3.7	1.7	250	4.7	913	0.42	83	2.9	574	0.79	38
	25	South Fork Humboldt River	**	120.5	32.4	12.2	-	49.2	-	-	-	25.1	-	-	-
	26	Susie Creek	240	4.0	2.7	1.1	49	1.8	196	0.46	33	2.1	225	0.78	13

TABLE B.1-a (Continued)

County	Map Number	Stream Name	Gross Head, ft H (4)	Exceedence Flows, cfs			Instl'd Cap. KW ₁	Development Alternative No. 1		Plant Factor PF ₁	Instl'd Cap. KW ₂	Development Alternative No. 2		Plant Factor PF ₂	"Firm" Power KW (16)
				Q _{25/30}	Q ₅₀	Q ₉₀		Ave. Gen. Flow, cfs Q ₁	Ave. Annual Energy Prod. MWh ₁			Ave. Gen. Flow, cfs Q ₂	Ave. Annual Energy Prod. MWh ₂		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Esmeralda	27	Maggie Creek	40	349.2	92.6	33.7	710	143.5	2,538	0.41	188	71.6	1,274	0.77	69
	28	Overland Creek	600	10.6	3.6	1.8	323	4.4	1,182	0.42	110	2.9	769	0.80	55
	29	Franklin River	400	11.3	3.8	1.9	230	4.7	839	0.42	77	3.0	561	0.80	39
	30	Chiatovich Creek	400	8.7*	2.3	0.6	177	3.7	661	0.43	47	1.73	308	0.75	12
	31	Perry-Aiken Creek	800	7.7*	2.0	0.5	313	3.3	1,168	0.43	81	1.5	534	0.75	20
	32	Leidy Creek	800	4.0*	0.5	0.1	163	1.7	588	0.41	20	0.37	132	0.74	4
	33	Indian Creek	800	4.1*	0.5	0.1	167	1.7	602	0.41	20	0.37	132	0.74	4
Humboldt	34	Pine Creek	120	12.6	4.0	2.0	77	5.2	279	0.41	24	3.2	171	0.80	12
	35	Leonard Creek	400	4.7	1.9	1.3	96	2.0	356	0.43	39	1.6	283	0.84	26
	36	Kings River	320	3.3	1.7	1.1	54	1.5	207	0.44	28	1.4	201	0.83	18
	37	Log Cabin Creek	560	1.5	1.3	1.0	43	0.73	181	0.48	37	1.1	277	0.85	28
	38	Granite Creek	500	1.1	1.0	0.9	29	0.54	120	0.49	25	0.88	196	0.88	23
	39	East Quinn River	100	26.7	7.8	3.3	136	11.	489	0.41	40	6.1	272	0.78	17
	40	McDermitt Creek	40	30.6	8.8	3.7	62	12.6	224	0.41	18	6.9	123	0.78	8
Humboldt	41	Lit. Humboldt Rv.	80	23.3	6.8	3.0	95	9.6	341	0.41	28	5.4	191	0.79	12
	42	Martin Creek	80	31.1	9.0	3.8	126	12.8	455	0.41	37	7.1	251	0.78	15
	43	Big Cottonwood Cr.	320	6.3	2.3	1.4	102	2.7	378	0.42	37	1.9	269	0.82	23
	44	Indian Creek	400	9.0	3.2	1.7	183	3.8	672	0.42	65	2.6	459	0.81	35
	45	Pole Creek	400	3.6	1.8	1.2	73	1.6	280	0.44	37	1.5	267	0.83	24
Lander	46	Rock Creek	80	33.7	9.6	4.0	137	13.8	493	0.41	39	7.5	268	0.78	16
	47	Kingston Creek	560	7.9	2.8	1.5	225	3.3	826	0.42	80	2.3	563	0.81	43
Lincoln	48	Meadow Valley Wash	230	10.0	3.4	1.8	117	4.2	428	0.42	40	2.7	281	0.81	21
Lyon	49	East Walker River	40	53.0*	22.0	9.0	108	23.4	417	0.44	45	17.2	306	0.78	18
	50	Walker River	40	248.0*	109.0	44.0	504	110.1	1,961	0.44	222	85.1	1,515	0.78	89
Nye	51	Reese River	160	10.9	3.7	1.9	89	4.6	324	0.42	30	3.	212	0.80	15
	52	South Twin River	600	5.3	2.3	1.4	162	2.3	608	0.43	70	1.9	505	0.82	43
	53	Currant Creek	400	4.0	1.9	1.2	81	1.7	309	0.43	39	1.6	280	0.83	24

TABLE B.1-a (Continued)

County	Map Number	Stream Name	Gross Head, Ft H (4)	Exceedence Flows, cfs			Instl'd Cap. KW ₁	Development Alternative No. 1			Instl'd Cap. KW ₂	Development Alternative No. 2			"Firm" Power KW (16)
				Q _{25/30}	Q ₅₀	Q ₉₀		Ave. Gen. Flow, cfs Q ₁	Ave. Annual Energy Prod. MWH ₁	Plant Factor PF ₁		Ave. Gen. Flow, cfs Q ₂	Ave. Annual Energy Prod. MWH ₂	Plant Factor PF ₂	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Washoe	54	Steamboat Creek	100	13.6*	4.3	2.0	69	5.9	261	0.43	22	3.4	152	0.79	10
	55	Whites Creek	600	7.0*	1.5	1.0	213	3.	788	0.42	46	1.3	334	0.83	30
	56	Thomas Creek	800	3.5*	0.1	0.01	142	1.4	502	0.40	4	0.1	26	0.72	1
	57	Hunter Creek	400	11.0*	4.0	1.1	224	4.8	855	0.44	81	3.	538	0.76	22
	58	Galena Creek	600	9.3*	2.6	1.0	284	4.	1,063	0.43	79	1.8	483	0.79	30
	59	Franktown Creek	1200	13.3*	4.3	2.0	811	5.8	3,072	0.43	262	3.4	1,822	0.79	122
	60	Third Creek	1000	8.3*	2.3	0.6	422	3.6	1,580	0.43	117	1.7	770	0.75	30
White Pine	61	Steptoe Creek	320	6.3	2.5	1.4	102	2.7	381	0.43	41	2.	289	0.81	23
	62	Cleve Creek	480	4.7	2.1	1.3	115	2.	433	0.43	51	1.7	370	0.82	32
	63	Spring Creek	300	4.2	2.0	1.2	64	1.8	244	0.43	30	1.6	219	0.82	18
	64	Lehman Creek	600	4.2	2.0	1.2	128	1.8	487	0.43	61	1.6	438	0.82	37
	65	Baker Creek	400	7.9	2.9	1.6	161	3.3	592	0.42	59	2.4	418	0.81	33

* used 30% exceedence flows; all others used 25%

** multiple sites available

TABLE B.1-b

Site Exceedence Flows and Development
Alternatives-Derived Flow Sites

County	Map Number	Stream Name	Gross Head, ft H	Exceedence Flows, cfs			Instl'd Cap. KW ₁	Development Ave. Gen. Flow, cfs Q ₁	Alternative No. 1 Ave. Annual Energy Prod. MMH ₁	Plant Factor PF ₁	Instl'd Cap. KW ₂	Development Ave. Gen. Flow, cfs Q ₂	Alternative No. 2 Ave. Annual Energy Prod. MMH ₂	Plant Factor PF ₂	"Firm" Power KW (16)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Douglas	66	Logan House Cr.	1000	4.0*	0.5	0.1	203	1.7	735	0.41	25	0.37	165	0.74	5
	67	Lincoln Creek	400	5.6*	1.0	0.2	114	2.3	417	0.42	20	0.7	132	0.74	4
	68	Hott Canyon Cr.	800	4.0*	0.5	0.1	163	1.7	588	0.42	20	0.37	132	0.74	4
	69	Pine Nut Cr.	500	33.0*	12.5	6.0	839	14.5	3,216	0.44	318	10.	2,215	0.80	152
Elko	70	Bull Run Creek	200	15.7	4.9	2.2	160	6.5	579	0.41	50	3.9	345	0.79	22
	71	Coon Creek	500	4.0	1.9	1.2	102	1.7	387	0.43	48	1.6	349	0.83	30
	72	Copper Cr.	500	2.3	1.5	1.1	58	1.1	234	0.46	38	1.3	283	0.85	28
	73	Buck Creek	450	8.6	3.1	1.7	197	3.6	724	0.42	71	2.5	503	0.81	39
	74	Dave Creek	500	3.6	1.8	1.2	91	1.6	351	0.44	46	1.5	334	0.83	30
	75	E. Fork Jarbidge R.	350	14.6	4.7	2.1	260	6.1	945	0.42	84	3.7	578	0.79	37
	76	Canyon Creek	200	10.0	3.3	1.8	102	4.2	371	0.42	34	2.7	238	0.81	18
	77	Bishop Creek	200	11.1	3.8	1.9	113	4.6	413	0.42	39	3.	271	0.80	19
	78	Stephen's Creek	400	3.2	1.7	1.1	65	1.4	252	0.44	35	1.4	251	0.83	22
	79	Smith Creek	440	4.8	2.2	1.3	107	2.1	406	0.43	49	1.8	353	0.82	29
	80	Dixie Creek	80	24.4	7.2	3.1	99	10.1	358	0.41	29	5.7	202	0.79	13
Elko	81	Myers Creek	600	1.4	1.2	1.0	43	0.68	180	0.48	37	1.04	278	0.87	30
	82	Thousand Springs Cr	100	15.0	4.7	2.2	76	6.2	277	0.41	24	3.7	166	0.79	11
	83	Morris Creek	800	3.5*	0.5	0.2	142	1.5	516	0.41	20	0.4	139	0.78	8
Esmeralda	84	Rock Creek	800	7.0*	1.5	1.0	285	3.	1,051	0.42	61	1.3	445	0.83	41
Humboldt	85	Wilder Creek	400	3.7	1.8	1.2	75	1.6	287	0.44	37	1.5	267	0.83	24
	86	Little Alder Cr.	650	2.3	1.5	1.0	76	1.05	304	0.46	50	1.25	362	0.83	33
	87	Alder Creek	400	3.3	1.7	1.2	67	1.5	258	0.44	35	1.4	255	0.84	24
	88	Knott Creek	400	2.7	1.6	1.1	55	1.2	216	0.45	33	1.3	239	0.84	22
	89	Colman Creek	800	1.7	1.3	1.0	69	0.8	285	0.47	53	1.1	395	0.85	41
	90	Slungullion Creek	400	3.1	1.7	1.2	63	1.4	245	0.44	35	1.4	255	0.84	24
	91	Soldier Cr. (SB)	400	2.6	1.5	1.1	53	1.2	207	0.45	30	1.3	226	0.85	22
	92	Summer Camp Cr.	400	3.3	1.7	1.1	67	1.5	258	0.44	35	1.4	251	0.83	22
	93	Battle Creek	600	8.6	3.1	1.7	262	3.6	965	0.42	95	2.5	670	0.81	52

TABLE B.1-b (Continued)

County	Map Number	Stream Name	Gross Head, ft H (4)	Exceedence Flows, cfs			Instl'd Cap. KW ₁	Development Alternative No. 1			Instl'd Cap. KW ₂	Development Alternative No. 2			"Firm" Power KW (16)
				Q _{25/30}	Q ₅₀	Q ₉₀		Ave. Gen. Flow, cfs Q ₁ (9)	Ave. Annual Energy Prod. MMH ₁ (10)	Plant Factor PF ₁ (11)		Ave. Gen. Flow, cfs Q ₂ (13)	Ave. Annual Energy Prod. MMH ₂ (14)	Plant Factor PF ₂ (15)	
Humboldt	94	Black Creek	400	9.1	3.2	1.7	185	3.8	679	0.42	65	2.6	459	0.81	35
	95	Big Creek	640	4.0	2.0	1.3	130	1.8	499	0.44	65	1.7	473	0.83	42
	96	Rebel Creek	400	3.3	1.7	1.2	67	1.5	258	0.44	35	1.4	255	0.84	24
	97	Simas (Colony) Cr.	600	1.7	1.3	1.0	52	0.8	214	0.47	40	1.1	296	0.85	30
	98	Wash O'Neal Cr.	400	2.6	1.5	1.1	53	1.2	207	0.45	30	1.3	226	0.85	22
	99	Abell/Stone House Cr	360	2.7	1.6	1.1	49	1.2	194	0.45	29	1.3	215	0.84	20
	100	Mullinex Creek	320	6.5	2.6	1.5	106	2.8	394	0.43	42	2.1	302	0.82	24
	101	Big Creek	400	3.1	1.7	1.2	63	1.4	245	0.44	35	1.4	255	0.84	24
Lander	102	Birch Creek	400	4.6	2.1	1.3	94	2.	354	0.43	43	1.7	308	0.82	26
	103	Bowman Creek	800	1.1	1.0	0.9	45	0.54	191	0.49	41	0.89	313	0.88	37
	104	Callaghan Creek	440	3.7	1.8	1.2	83	1.6	316	0.44	40	1.5	294	0.83	27
	105	Steiner Creek	800	2.7	1.6	1.1	110	1.2	432	0.45	65	1.3	477	0.84	45
Lyon	106	Dalzell Canyon Cr.	400	39.0*	12.5	6.5	793	16.9	3,000	0.43	254	10.1	1,790	0.80	132
	107	Sweetwater Canyon	800	9.7*	3.0	1.0	394	4.2	1,489	0.43	122	2.3	819	0.77	41
Mineral	108	Bodie Creek	400	42.0*	16.5	7.0	854	18.5	3,285	0.44	335	13.	2,306	0.78	142
	109	Rough Creek	240	38.5*	15.0	6.5	470	16.9	1,806	0.44	183	11.8	1,261	0.79	79
	110	Cottonwood Cr.	1200	22.5*	8.5	3.5	1,372	9.9	5,262	0.44	518	6.7	3,553	0.78	213
Nye	111	Cat Creek	800	15.5*	5.3	2.3	630	6.7	2,397	0.43	215	4.2	1,485	0.79	94
	112	Clear Creek	300	2.7	1.6	1.1	41	1.2	162	0.45	24	1.3	179	0.84	17
	113	Peavine Canyon Cr.	400	2.6	1.5	1.1	53	1.2	207	0.45	30	1.3	226	0.85	22
	114	Jett Canyon Creek	600	2.7	1.6	1.1	82	1.2	324	0.45	49	1.3	358	0.84	34
	115	Pabbo Canyon Creek	600	3.1	1.7	1.2	95	1.4	367	0.44	52	1.4	382	0.84	37
	116	Barber Creek	800	1.7	1.3	1.0	69	0.8	285	0.47	53	1.1	395	0.85	41
	117	Broad Creek	1200	1.7	1.3	1.0	104	0.8	427	0.47	79	1.1	593	0.85	61
	118	Cove Canyon	1200	1.1	0.9	0.5	67	0.53	280	0.48	55	0.73	390	0.81	30
	119	North Twin River	800	3.3	1.7	1.2	134	1.5	516	0.44	69	1.4	509	0.84	49
	120	Last Chance Creek	900	1.7	1.3	1.0	78	0.8	321	0.47	59	1.1	445	0.85	46
	121	Ophir Creek	900	1.7	1.3	1.0	78	0.8	321	0.47	59	1.1	445	0.85	46

TABLE B.1-b (Continued)

County	Map Number	Stream Name	Gross Head, ft H (4)	Exceedence Flows, cfs			Instl'd Cap. KW ₁	Development	Alternative No. 1	Plant Factor PF ₁ (11)	Instl'd Cap. KW ₂	Development	Alternative No. 2	Plant Factor PF ₂ (15)	"Firm" Power KW (16)
				Q _{25/30}	Q ₅₀	Q ₉₀		Ave. Gen. Flow, cfs Q ₁ (9)	Ave. Annual Energy Prod. MW ₁ (10)			Ave. Gen. Flow, cfs Q ₂ (13)	Ave. Annual Energy Prod. MW ₂ (14)		
Nye	122	Danville Creek	700	2.7	1.6	1.1	96	1.2	378	0.45	57	1.3	418	0.84	39
	123	Clear Creek	700	2.3	1.5	1.1	82	1.1	327	0.46	53	1.3	396	0.85	39
	124	Sixmile Creek	400	5.2	2.3	1.3	106	2.2	398	0.43	47	1.9	333	0.81	26
Ormsby	125	Ash Canyon Creek	800	6.0*	1.0	0.5	244	2.5	890	0.42	41	0.8	285	0.80	20
Pershing	126	Indian Creek	600	1.4	1.2	0.9	43	0.68	180	0.48	37	1.04	278	0.87	30
	127	Cottonwood Creek	600	1.4	1.1	1.0	43	0.68	180	0.48	37	1.04	278	0.87	30
	128	Buena Vista Creek	600	2.6	1.5	1.1	79	1.2	311	0.45	46	1.3	339	0.85	34
	129	Edwards Creek	400	4.6	2.1	1.3	94	2.	354	0.43	43	1.7	308	0.82	26
	130	(no name)	340	1.7	1.3	1.0	29	0.8	121	0.47	22	1.1	168	0.85	17
	131	Ophir Creek	600	11.0*	3.3	1.0	335	4.7	1,263	0.43	101	2.5	670	0.76	30
	132	Marlette Creek	1200	-*	-	-	-	-	-	-	-	-	-	-	-
	133	Incline Creek	280	7.7*	2.0	0.5	110	3.3	409	0.43	28	1.5	187	0.75	7
	134	West Fork Grey Cr.	400	9.3*	2.3	0.7	189	4.	703	0.42	47	1.8	312	0.76	14
	135	Bronco Creek	600	14.0*	4.7	2.0	427	6.1	1,621	0.43	143	3.7	986	0.79	61
	136	Deep Canyon	1200	7.0*	1.7	0.3	427	3.	1,587	0.46	104	1.3	668	0.74	18
	137	(no name)	1000	6.0*	1.0	0.5	305	2.5	1,113	0.42	51	0.8	356	0.80	25
White Pine	138	Big Indian Cr.	600	2.6	1.5	1.1	79	1.2	311	0.45	46	1.3	339	0.85	34
	139	Kalamazoo Creek	800	5.2	2.3	1.3	211	2.2	797	0.43	94	1.9	666	0.81	53
	140	Piermont Creek	800	2.1	1.3	1.0	85	0.95	338	0.45	53	1.1	395	0.85	41
	141	Silver Creek	600	10.2	3.4	1.8	311	4.3	1,135	0.42	104	2.7	732	0.81	55
	142	Big Wash Creek	400	9.1	3.3	1.7	185	3.8	681	0.42	67	2.7	472	0.80	35
	143	Snake Creek	450	7.2	2.7	1.3	165	3.	609	0.42	62	2.2	431	0.80	30
	144	White River	400	52.0	14.3	5.7	1,057	21.3	3,791	0.41	291	11.2	1,986	0.78	116

* 30% exceedence flow used; all others 25%.

TABLE B.2-a
Primary Site Data and References -
Measured Flow Sites

COUNTY	BASIN NO.	BASIN NAME	SITE NO.	STREAM NAME (Drainage Name)	DRAINAGE LOCATION	Q _A (cfs)	Δh (ft)	Δl (mi)	CAPACITY (kw)	LAND OWNERSHIP	MAP REFERENCE	LITERATURE REFERENCES
Clark	220	Lower Moapa Valley	1	Muddy River	T15S R67E	46.5	120	2.25	280	Private & Public Domain	15'-Moapa, NV 15'-Overton, NV	GWR-RS #75, p.1,15, 23 STRM. CHAR. p.17-19
	222	Virgin River Valley	2	Virgin River	T15S R69E	210	40	2.25	425	Private, State & Bur. Recl.	15'-Overton, NV	GWR-RS #51, p.27 STRM. CHAR., p.11-14
	212	Las Vegas Valley	3	Las Vegas Wash	T21S R63E	62.5	120	2.0	380	Bur. Rec.	7.5'-Henderson, NV	STRM, CHAR. p. 56-57
Douglas	104	Eagle Valley	4	Clear Cr.	T14N T15N R19E	5.8	600	2.4	180	Private	7.5'-Genoa, NV	WRB #40, App. A-2 GWR-RS #39, p. 18-19 STRM, CHAR., p.200-20
	105	Carson Valley	5	Daggett Cr. (Haines Canyon)	T13N R19E	2.26	600	0.8	70	Private	7.5'-Minden, NV, CA	STRM, CHAR., p.198-19
			6	Bryant Cr.	T11N R21E	8.39	240	1.75	100	Indian Trust	15'-Mt. Siegel, NV, CA	STRM, CHAR., p.186-18
	106	Antelope Valley	7	West Walker Riv. (Hoye Canyon)	T10N R23E	207*	(could not be determined from map)			Private	15'-Desert Cr. Peak, NV, CA	GWR-RS #53, p. 23 STRM, CHAR., p.150-15
	107	Smith Valley	8	Desert Cr.**	T9N R24E	16.3 (4 yr record)	560	2.5	460	Toiyabe National Forest	15'-Desert Cr. Peak, NV CA	STRM, CHAR., p.153-15
Elko	36	Independence Valley	9	Jack Cr.	T42N R52E	29.9	80	1.0	120	Private	15'-Bull Run, NV 15'-Tuscarora, NV	GWR-RS #8, p.8 STRM CHAR, p.467-470
	37	Owyhee River Basin	10	Owyhee River	T45N T46N R53E	109*	50	2.0	280	Duck Valley Indian Reservation	15'-Mountain City, NV 15'-Wild Horse, NV	GWR-RS #48, p. 59 STRM, CHAR., p.455-46

TABLE B.2-a (Continued)

COUNTY	BASIN NO.	BASIN NAME	SITE NO.	STREAM NAME (Drainage Name)	DRAINAGE LOCATION	Q _A (cfs)	Δh (ft)	Δl (mi)	CAPACITY (kw)	LAND OWNERSHIP	MAP REFERENCE	LITERATURE REFERENCES
	38	Bruneau River Area	11	Bruneau River	T46N R56E	121	100	2.5	615	Humboldt National Forest	15'-Rowland, NV	GWR-RS #48, p.47 STRM, CHAR. p.449-450
	39	Jarbridge River Area	12	Jarbridge River	T47N R58E	60.0	100	1.0	300	Private & Public Domain	15'-Jarbridge, NV	GWR-RS #48, p.54 STRM, CHAR. p. 452
	40	Salmon Falls Cr.	13	Salmon Falls Cr.	T46N R64E	132	40	2.0	270	Private	15'-Dela Plain, NV	GWR-RS #48, p.39 STRM, CHAR. p.442-445
	42	Marys River Area	14	Marys River	T39N R59E	55.1	20	2.4	56	Private & Public Domain	7.5'-Hot Springs Cr. NV	WRB #32, p. 83 STRM, CHAR., p.220-222
	43	Starr Valley Area	15	Herder Cr. (Humboldt Range)	T36N R60E	6.8	400	1.25	140	Private	7.5'-Herder Cr., NV	WRB #32, p. 85
			16	East Fork Boulder Cr. (Boulder Cr.)	T36N R60E	13.8	500	1.5	350	Private	7.5'-Tent Mtn., NV	WRB #32, p. 85
			17	West Fork Boulder Cr. (Boulder Cr.)	T35N T36N R60E	15.2	400	1.0	310	Private	7.5'-Tent Mtn, NV	WRB #32, p. 85
			18	Secret Cr.	T34N T35N R59E	15.2	400	0.8	310	Private	7.5'-Soldiers Peak, NV	WRB #32, p. 83 STRM, CHAR., p.224-22
			19	Ackler Cr.	T36N R60E	10.5	400	1.25	210	Private	7.5'-Tent Mtn, NV AMS NK 11-9 (Wells, NV; UT; 1D	WRB #32, p. 85

TABLE B.2-a (Continued)

COUNTY	BASIN NO.	BASIN NAME	SITE NO.	STREAM NAME (Drainage Name)	DRAINAGE LOCATION	Q _A (cfs)	Δh (ft)	Δl (mi)	CAPACITY (kw)	LAND OWNERSHIP	MAP REFERENCE	LITERATURE REFERENCES
	44	North Fork Area	20	North Fork Humboldt River	T38N R57E	66.0	(could not be determined from map)			Private & Public Domain	AMS NK 11-9 (Wells, NV; UT; ID)	WRB #32, p. 83 STRM, CHAR., p.235-23
	45	Lamoille Valley	21	Talbot Cr.	T33N R58E	9.9	800	1.3	400	Private & Humboldt National Forest	15'-Lamoille, NV	WRB #32, p. 83
			22	Humboldt River	T35N R56E	195	20	1.5	200	Private & Public Domain	7.5'-Ryndon, NV	WRB #32, p. 83 STRM, CHAR., p.263-26
			23	Thorpe Cr.	T33N R58E	*** 12.4	400	1.5	250	Private	15'-Lamoille, NV	WRB #32, p. 85
			24	Rabbit Cr. (Seitz Canyon)	T32N R57E	11.7	440	0.9	260	Private & Humboldt National Forest	15'-Lee, NV 15'-Lamoille, NV	WRB #32, p. 85
	46	S. Fork Area	25	S. Fork Humboldt River	T31N R55E	118-127	(Varies)			Private & S. Fork Indian Res.	15'-Dixie Plate, NV 15'-Lee, NV	WRB #37, p. 83 STRM, CHAR., p.251-257
	50	Susie Cr. Area	26	Susie Cr.	T35N T36N R53E	4.5	240	4.0	55	Private	7.5'-Adobe Summit, NV	WRB #32, p. 83
	51	Maggie Cr. Area	27	Maggie Cr.	T33N R52E	346.4	40	1.0	740	Private	7.5'-Schroeder Mtn., NV	WRB #32, p. 83 STRM, CHAR., p.261-26
	176	Ruby Valley	28	Overland Cr.	T29N T30N R58E	11.2	600	2.5	340	Private	7.5'-Franklin Lake N.E., NV AMS NJ 11-3 (Ely, NV; UT)	STRM, CHAR., p.76-79

TABLE B.2-a (Continued)

COUNTY	BASIN NO.	BASIN NAME	SITE NO.	STREAM NAME (Drainage Name)	DRAINAGE LOCATION	QA (cfs)	Δh (ft)	Δl (mi)	CAPACITY (kw)	LAND OWNERSHIP	MAP REFERENCE	LITERATURE REFERENCES
Elko (cont.)	176	Ruby Valley	29	Franklin River	T34N R60E R61E	11.8	400	2.0	240	Private & Humboldt National Forest	7.5'-Humboldt Peak, NV 7.5'-Secret Valley, NV 7.5'-Gordon Cr., NV	STRM, CHAR., p.74-75
Esmeralda	117	Fish Lake Valley	30	Chiatovich Cr.	T1S R34E	8.63	400	1.1	175	Private	15'-Benton, NV-CA 15'-Davis Mtn, NV-CA	GWR-RS #58, p. 24 WRB #40, App. A-Z STRM, CHAR., p.110-11
			31	Perry-Aiken Cr.	T3S R35E	7.4 (10 yr record)	800	2.0	300	Private & Stock Driveway	15'-Mount Barcroft, NV-CA	GWR-RS #58, p. 24
			32	Leidy Cr.	T2S T3S R34E	2.8' (10 yr record)	800	2.0	115	Inyo National Forest & Public Domain	15'-Mount Barcroft, NV-CA	GWR-RS #58, p. 24
			33	Indian Cr.	T2S R34E	3.2 (10 yr record)	800	2.0	130	Private & Public Domain	15'-Davis Mtn, NV-CA	GWR-RS #58, p. 24
Eureka	53	Pine Valley	34	Pine Cr. (Pine Valley)	T31N R51E R52E	13.2	120	3.0	80	Private	15'-Carlin, NV	WRB #32, p. 84 STRM, CHAR., p.269-27
Humboldt	28	Black Rock Desert	35	Leonard Cr.	T42N R28E	5.3	400	2.5	110	Private	15'-Duffer Peak, NV	STRM, CHAR. p.433-434 WRB #40, App. A-Z
	30	Kings River Valley	36	Kings River	T47N R33E	4.1 (6 yr record) ****	320	1.5	65	Private & Public Domain	15'-Trident Peak, NV	STRM, CHAR. p.431-432 WRB #40, App. A-Z WRB #31, p. 24
			37	Log Cabin Cr.	T47N R32E	2.2+	560	1.9	60+	Private & Public Domain	15'-Trident Peak, NV	WRB #31, p. 22,24

TABLE B.2-a (Continued)

COUNTY	BASIN NO.	BASIN NAME	SITE NO.	STREAM NAME (Drainage Name)	DRAINAGE LOCATION	QA (cfs)	Δh (ft)	Δl (mi)	CAPACITY (kw)	LAND OWNERSHIP	MAP REFERENCE	LITERATURE REFERENCES
Humboldt (cont.)	30	Kings River Valley	38	Granite Cr.	T47N R33E	**** 1.8+	500	1.8	50+	Public Domain	15'-Trident Peak, NV	WRB #31, p. 22,24
	34	Little Owyhee River	39	East Quinn River	T47N R39E	27.1	100	0.7	135	Private, Humboldt Nat. Forest, & Fort McDermitt Ind. Res.	15'-McDermitt, NV-OR	STRM, CHAR., p.424-42 WRB #14, p. 27-28
	33	Quinn River Valley	40	McDermitt Cr.	T47N R37E	30.9*	40	1.5	60	Private & Public Domain	15'-McDermitt, NV-OR	STRM, CHAR., p.422-42 WRB #14, p.27-28
	67	Little Humboldt Valley	41	Little Humboldt River	T41N T42E	23.5	80	3.6	95	Private	7.5'-Chimney Res., NV	WRB #32, p. 84 STRM, CHAR., p.304-307
	69	Paradise Valley	42	Martin Cr.	T42N R40E	31.6	80	1.6	130	Private & Public Domain	7.5'-Spring City, NV	WRB #32, p. 84 STRM, CHAR, p. 308-31
			43	Big Cottonwood Cr.	T42N R39E	6.9	320	3.3	110	Private	15'-Hinkey Summit, NV	WRB #32, p. 84
			44	Indian Cr.	T42N T43N R39E	9.5	400	2.5	190	Private, Public Domain & Humboldt Nat. Forest	15'-Hinkey Summit, NV	WRB #10, p. 37
	70	Winnemucca Segment	45	Pole Cr.	T35N R39E	4.36	400	1.5	90	Private & Public Domain	15'-Winnemucca, NV	STRM, CHAR., p.299-30 WRB #32, p. 84
Lander	62	Rock Cr. Valley	46	Rock Cr.**	T34N R48E	33.9	80	4.4	135	Private & Public Domain & Stock Driveway	7.5'-Sheep Cr. Range SW, NV	WRB #32, p. 84 STRM, CHAR, p.277-280
	137	Big Smokey Valley	47	Kingston Cr.	T16N R43E	8.54	560	1.75	240	Toiyabe National Forest	15'-Millet Ranch, NV	STRM, CHAR., p. 100 WRB #41, p. 20 USGS WSP #423, p.74

TABLE B.2-a (Continued)

COUNTY	BASIN NO.	BASIN NAME	SITE NO.	STREAM NAME (Drainage Name)	DRAINAGE LOCATION	QA (cfs)	Δh (ft)	Δl (mi)	CAPACITY (kw)	LAND OWNERSHIP	MAP REFERENCE	LITERATURE REFERENCES
Lincoln	201	Spring Valley	48	Meadow Va. Wash (Meadow Valley)	T2N R69E	10.7*	230	2.0	125	Private & Public Domain & Eagle Va. State Rec. Land	7.5'-Eagle Valley Res., NV 7.5'-Ursine, NV	STRM, CHAR., p. 25 GWR-RS #27, p. 19,19+
Lyon	108	Mason Valley	49	East Walker River	T11N R26E	62	40	2.2	130	Private	15'-Yerington, NV	WRB #38, p. 24 STRM, CHAR., p. 132-1
			50	Walker River	T12N R25E	298	40	5.0	600	Private	15'-Yerington, NV	WRB #38, p. 1 STRM, CHAR., p. 159
Nye	56	Upper Reese River Valley	51	Reese River	T11N T12N R40E	11.4	160	2.0	90	Yomba Indian Res.	7.5'-Bareover, NV	GWR RS #31, p. 19 STRM, CHAR., p. 285-28
	137	Big Smokey Valley	52	South Twin River	T12N R42E	5.95	600	1.8	180	Toiyabe National Forest	7.5'-Arc Dome, NV 7.5'-Carvers, NV	STRM CHAR., p. 102-103 WRB #41, p. 20
	173	Railroad Valley	53	Currant Cr.	T11N R58E	4.7 (5 yr record)	400	2.2	95	Private	15'-Currant Mtn, NV	WRB #12, p. 134,142-1
Washoe	87	Truckee Meadows	54	Steamboat Cr.	T18N R20E	14.5	100	2.5	75	Private	7.5'-Steamboat, NV	STRM, CHAR. p. 402-40 GWR-RS #57, p. 131
			55	Whites Cr.	T18N R19E	6.5 (5 yr record)	600	2.0	200	Private	7.5'-Mt. Rose, NE, NV	STRM CHAR. p. 404-405 WRB #40, App. A-Z GWR-RS #57, p. 24
			56	Thomas Cr.	T18N R19E	2.5 (approx)	800	2.0	100	Private	7.5'-Mt. Rose, NE, NV	WRB #40, App. A-Z GWR-RS #57, p. 24

TABLE B.2-a (Continued)

COUNTY	BASIN NO.	BASIN NAME	SITE NO.	STREAM NAME (Drainage Name)	DRAINAGE LOCATION	Q _A (cfs)	Δh (ft)	Δl (mi)	CAPACITY (kw)	LAND OWNERSHIP	MAP REFERENCE	LITERATURE REFERENCES
Washoe (cont)	87	Truckee Meadows	57	Hunter Cr.	T19N R18E R19E	10.8	400	1.0	220	Private	7.5'-Mt. Rose, NW, NV	STRM, CHAR., p.390-39 WRB #40, App. A-2
	88	Pleasant Valley	58	Galena Cr.	T17N R18E	9.14	600	2.0	280	Private	7.5'-Washoe City, NV	STRM, CHAR, p.398-399 GWR-RS #57, p. 24
	89	Washoe Valley	59	Franktown Cr.	T14N R19E	17.0* (6 yr record)	1200	1.6	850	Private & Nat. Forest	7.5'-Washoe City, NV	STRM CHAR, p.396-397 GWR RS #57, p. 24
	90	Lake Tahoe Basin	60	Third Cr.	T16N T17N R18E	8.14 (4 yr record)	1000	1.2	410	Private	7.5'-Mt. Rose, NV	STRM, CHAR. p.344 GWR RS #57, p. 43
White Pine	179	Steptoe Valley	61	Steptoe Cr.	T15N R64E	7.0*	320	2.5	115	Private & Cave Lake Rec. Area	15'-Connors Pass, NV	STRM CHAR, p. 78-80 GWR RS #42, p.16+, 22
	184	Spring Valley	62	Cleve Cr.	T16N R66E	5.42	480	2.5	130	Humboldt Nat. Forest	15'-Connors Pass, NV	STRM, CHAR, p. 200-20 GWR RS #42, p. 20
	193	Deep Cr. Valley	63	Spring Cr. (Deep Cr. Va.)	T24N R70E	4.9	300	4.5	75	Goshute Ind. Res.	AMS NJ 11-3 (Ely, NV UT)	GWR RS #56, Plate I, p. 13
	195	Snake Valley	64	Lehman Cr.	T13N R69E	4.93	600	2.0	150	Private & Public Domain	AMS NJ 11-3 (Ely, NV UT)	STRM CHAR, p. 65-66
			65	Baker Cr.	T13N R69E	8.52	400	1.0	1.75*	Private	15'-Garrison, NV	STRM, CHAR., p. 63

TABLE B.2-b
Primary Site Data and References -
Derived Flow Sites

CODNTY	BASIN NO.	BASIN NAME	SITE NO.	STREAM NAME (Drainage Name)	DRAINAGE LOCATION	QA (cfs)	Δh (ft)	Δl (mi)	CAPACITY (kw)	LAND OWNERSHIP	MAP REFERENCE	LITERATURE REFERENCES
Douglas	90	Lake Tahoe Basin	66	Logan House Cr.	T14N R19E	3.0	1000	1.1	150	Private	7.5'-Glenbrook, NV	----
			67	Lincoln Cr.	T14N R19E	5.3	400	0.6	105	Private	7.5'-Glenbrook, NV	----
	105	Carson Valley	68	Hott Canyon Cr.	T12N R19E	3.0	800	1.0	120	Private	7.5'-Minden, NV CA	----
			69	Pine Nut Cr.	T12N R21E	39.0	500	2.0	990	Private, Public Domain & Indian Trust Allotment	15'-Mt. Siegel, NV CA	----
Elko	35	South Fork Owyhee	70	Bull Run Cr.	T43N R52E	16.0*	200	1.25	160	Private & Stock Driveway	15'-Bull Run, NV	GWR-RS #48, p.69: 7/13/57 - 22.3 cfs 7/7/66 - 2.42 cfs 7/13/57 - 21.5 cfs 9/27/57 - 3.79 cfs
	38	Bruneau River Area	71	Coca Cr.	T45N R57E	4.7	500	1.75	120	Humboldt National Forest	15'-Rowland, NV	GWR-RS #48, p.47: 9/13/47 - 1.4 cfs 8/14/63 - 3.6 cfs 4/16/66 - 11.0 cfs
			72	Copper Cr. (Copper Mins)	T44N R57E	3.0	500	2.0	75	Private & Humboldt National Forest	15'-Mt. Velma, NV	GWR-RS #48, p. 47: (8 Flow Measurements Range=0.38 cfs (10/8/64) - 20.9 (4/6/66)

TABLE B.2-b (Continued)

COUNTY	BASIN NO.	BASIN NAME	SITE NO.	STREAM NAME (Drainage Name)	DRAINAGE LOCATION	Q _A (cfs)	Δh (ft)	Δl (mi)	CAPACITY (kw)	LAND OWNERSHIP	MAP REFERENCE	LITERATURE REFERENCES
Elko (cont.)	48	Dixie Cr.-Ten-Mile Cr. Area	80	Dixie Cr.	T32N R54E	24.7	80	2.7	100	Public Domain	15'-Dixie Flats, NV	----
	176	Ruby Valley	81	Myers Cr.	T30N R58E R59E	2.1	600	1.0	65	Private, Public Domain & Humboldt National Forest	AMS NJ 11-3 (Ely, NV UT) 7.5'-Franklin Lake, N.E., NV	----
	189	Thousand Springs Valley	82	Thousand Sp. Cr. (Thousand Sp. Valley)	T41N R63E	15	100	3.0	75	Private	7.5'-Wilkins, NV	GWR-RS #47 p. 17,22: 6/19/67 - 0.5 cfs 10/21/66 - 2.8 cfs USGS-WSP #360 Q _A -10.6 cfs for 1913 (Excluding winter months)
Esmeralda	116	Queen Valley	83	Morris Cr.	T15 R32E	2.4	800	1.25	100	Inyo National Forest	15'-Benton, NV-CA	GWR-RS #52, p. 14: 6 Flow Measurements Range=1.13 cfs (7/17/66)-2.31 cfs (8/10/65)
	117	Fish Lake Valley	84	Rock Cr. (Trail Canyon)	T15 R34E	6.4	800	2.0	260	Inyo National Forest & Public Domain	15'-Benton, NV-CA 15'-Davis Mtn., NV-CA	----
Humboldt	1	Pueblo Valley	85	Wilder Cr. (Bilk Cr. Range)	T47N R31E	4.4	400	1.0	90	Private & Public Domain	15'-Trident Peak, NV	----
	2	Continental Lake Valley	86	Little Alder Cr. Wood Canyon	T44N R28E	3.0	650	1.3	100	Private & Public Domain	15'-Idaho Canyon, NV 15'-Duffer Peak, NV	----

TABLE B.2-b (Continued)

COUNTY	BASIN NO.	BASIN NAME	SITE NO.	STREAM NAME (Drainage Name)	DRAINAGE LOCATION	QA (cfs)	Δh (ft)	Δl (mi)	CAPACITY (kw)	LAND OWNERSHIP	MAP REFERENCE	LITERATURE REFERENCES
Humboldt (cont.)	2	Continental Lake Valley	87	Alder Cr.	T44N R28E	4.1*	400	1.0	85	Private & Public Domain	15'-Idaho Canyon, NV 15'-Duffer Peak, NV	----
	3	Gridley Lake Valley	88	Knott Cr.	T43N R27E	3.5*	400	1.0	70	Private & Public Domain	15'-Idaho Canyon, NV	----
	26	Mud Meadow	89	Colman Cr.	T41N R26E	2.4	800	1.25	100	Public Domain	7.5'-Burnt Springs, NV	----
			90	Slungullion Cr.	T40N T41N R25E	3.8	400	2.0	80	Private & Public Domain	7.5'-Red Mountain, NV	----
			91	Soldier Cr. (South Branch)	T41N R26E	3.3	400	1.8	65	Private & Public Domain	7.5'-Red Mountain, NV	----
	27	Summit Lake Valley	92	Summer Camp Cr. (Summer Camp Canyon)	T42N R26E	4.1	400	2.0	85	Private & Public Domain	15'-Idaho Canyon, NV 7.5'-Burnt Springs, NV	----
	28	Black Rock Desert	93	Battle Cr.	T40N R27E	9.2	600	0.5	280	Private & Public Domain	7.5'-Burnt Springs, NV	----
	29	Pine Forest Valley	94	Bilk Cr.	T44N R32E	9.7	400	1.0	195	Public Domain	15'-Quinn River Crossing, NV	CWR-RS #4, p. 4: (creek overflows 2000 AF capacity reservoir during spring runoff)
			95	Big Cr. (Willow Cr.)	T44N R30E	4.7	640	3.0	150	Public Domain	15'-Duffer Peak, NV	----

TABLE B.2-b (Continued)

COUNTY	BASIN NO.	BASIN NAME	SITE NO.	STREAM NAME (Drainage Name)	DRAINAGE LOCATION	Q _A (cfs)	Δh (ft)	Δl (mi)	CAPACITY (kw)	LAND OWNERSHIP	MAP REFERENCE	LITERATURE REFERENCES
Humboldt (cont.)	33	Quinn River Valley	96	Rebel Cr.	T42N R38E	4.1	400	1.2	85	Private, Public & Humboldt National Forest	15'-Hinkey Summit, NV	----
	69	Paradise Valley	97	Singas (Colony) Cr.	T42N R39E	2.4	600	1.6	75	Private & Public Domain	15'-Paradise Valley, NV	WRB #10, p. 32: 6/26/47 Q=3.0 cfs (1947 = dry year-p.37)
			98	Wash O'Neill Cr.	T41N R39E	3.3	400	1.5	65	Private & Public Domain	15'-Paradise Valley, NV	----
			99	Abel/Stone House Cr.	T41N R39E	3.5	360	1.75	65	Private & Public Domain	15'-Paradise Valley, NV	----
			100	Hullinex Cr. (Coleman Cr.)	T42N T43N R39E	7.2	320	3.3	115	Private & Public Domain	15'-Hinkey Summit, NV	----
Lander	56	Upper Reese River Valley	101	Big Cr.	T17N R43E	3.8	400	1.75	75	Private & Pueblo Nat. Forest	15'-Austin, NV	----
	137	Big Smokey Valley	102	Birch Cr.	T16N R44E	5.3	400	2.0	105	Private & Toiyabe National Forest	15'-Austin, NV 15'-Spencer Hot Spring, NV	WRB #41, p.23: Q _A (Estimate) for 1968=1.4 cfs (1968=dry year p.8) USGS WSP #423, p.71 Q _A 2.92cfs for 1913 (excluding winter months)

TABLE B.2-b (Continued)

COUNTY	BASIN NO.	BASIN NAME	SITE NO.	STREAM NAME (Drainage Name)	DRAINAGE LOCATION	Q _A (cfs)	Δh (ft)	Δl (mi)	CAPACITY (kw)	LAND OWNERSHIP	MAP REFERENCE	LITERATURE REFERENCES
Lander (cont.)	137	Big Smokey Valley	103	Bowman Cr.	T15N T16N R43E	*** 1.8+	800	1.5	75+	Toiyabe National Forest	15'-Millet Ranch, NV	WRB #41, p. 23: Q _A (Estimate) for 1968=0.9 cfs (1968=dry year p.8)
	138	Grass Valley	104	Callaghan Cr.	T21N R45E R46E	4.4	440	4.0	100	Private & Stock Driveway	15'-Mount Callaghan, NV	QWR-RS #37, p.8 6/14/65-5 cfs 10/22/65-1.05 cfs (1965=wet year p.7)
			105	Steiner Cr.	T20N R46E	3.5	800	3.5	140	Public Domain	15'-Mount Callaghan, NV	QWR-RS #37, p. 8: 5/14/65-3.4 cfs 10/22/65-0.17 cfs (1965=wet year p.7)
Lyon	107	Smith Valley	106	Dalzell Canyon Cr.	T8S T9S R24E R25E	40.0	400	3.5	810	Toiyabe National Forest	15'-Desert Cr. Peak, NV, CA 15'-Pine Grove Hills, NV	----
	109	East Walker Area	107	Sweetwater Canyon Cr.	T7S R24E	9.8	800	3.3	400	Private	15'-Fales Hot Spring, 15'-Bridgeport, NV-CA	QWR-RS #53, p.18, 22: 9/5/68-0.41 cfs 8/28/68-2.57 cfs
Mineral	109	East Walker Area	108	Bodie Cr.	T5N R27E	39.0	400	1.5	790	Private & Public Domain	15'-Aurora, NV-CA	QWR-RS #53, p. 18,22: 11/10/52-1.24 cfs 11/28/52-0.68 cfs 8/29/68-0.16 cfs
			109	Rough Cr.	T6N R27E	46.0	240	4.0	560	Private & Public Domain	15'-Aurora, NV-CA	QWR-RS #53, p.18,22: 11/10/52-3.5 cfs 11/28/52-2.45 cfs

TABLE B.2-b (Continued)

COUNTY	BASIN NO.	BASIN NAME	SITE NO.	STREAM NAME (Drainage Name)	DRAINAGE LOCATION	Q _A (cfs)	Δh (ft)	Δl (mi)	CAPACITY (kw)	LAND OWNERSHIP	MAP REFERENCE	LITERATURE REFERENCES
Mineral (cont.)	110	Walker Lake Valley	110	Cottonwood Cr.	T9N E28E R29E	25.3	1200	1.9	1540	Dept. of Defense	15'-Mt. Grant, NV	----
			111	Cat Cr.	T8N E29E	17.0	800	2.0	690	Dept. of Defense	15'-Hawthorne, NV	----
Nye	56	Upper Reese River Valley	112	Clear Cr.	T12N E13N R40E R41E	3.5	300	1.7	50	Toiyabe National Forest	7.5'-Toiyabe Peak, NV 7.5'-Corral Wash, NV	----
			137	Big Snokey Valley	T9N R41E	3.3	400	3.0	65	Toiyabe National Forest	7.5'-Tom's Canyon, NV	WRB #41, p.23: Q _A (Estimate) for 1968=2.8 cfs (1968=dry year, p.8) USGS WSP #423, p.77 Flow Measurements- Range from 2-100 cfs.
			114	Jett Canyon Cr.	T10N R42E	3.5	600	1.9	105	Toiyabe National Forest	7.5'-Pablo Canyon Ranch, NV	WRB #41, p.23: Q _A (Estimate) for 1968 =1.6 cfs (1968=dry year, p.8) USGS WSP #423, p.76 4/20/15-18.6 cfs 7/5/15-5.38 cfs

TABLE B.2-b (Continued)

COUNTY	BASIN NO.	BASIN NAME	SITE NO.	STREAM NAME (Drainage Name)	DRAINAGE LOCATION	QA (cfs)	Δh (ft)	Δl (mi)	CAPACITY (kw)	LAND OWNERSHIP	MAP REFERENCE	LITERATURE REFERENCES
Nye (cont.)	137	Big Smokey Valley	115	Pablo Canyon Cr.	T10N R42E	3.8	600	2.0	115	Toiyabe National Forest	7.5'-Pablo Canyon Ranch, NV	WRB #41, p. 23: QA (Estimate) for 1968 = 2.2 cfs (1968=dry year, p.8) USGS WSP #423, p.76: 4/20/15-6.58 cfs 7/6/15-2.65 cfs
			116	Barker Cr.	T11N R42E	2.4	800	2.0	100	Public Domain	7.5'-Carvers, S.E., NV	WRB #41, p. 23: QA (Estimate) for 1968=1.0 cfs (1968=dry year, p.8) USGS WSP #423, p. 78: Flow Measurements- Range=1.5-7.1 cfs
			117	Broad Cr.	T11N R42E	2.4	1200	1.0	145	Toiyabe National Forest	7.5'-Carvers, NV	WRB #41, p. 23: QA (Estimate) for 1968-1.0 cfs (1968=dry year, p.8)
			118	Cove Canyon	T11N R42E	1.8	1200	1.1	110	Toiyabe National Forest	7.5'-Carvers, NV	USGS WSP #423, p. 76: 4/21/15-2.78 cfs 7/4/15-3.43 cfs
			119	North Twin River	T12N R42E	4.1	800	1.5	165	Toiyabe National Forest	7.5'-Toiyabe Peak, NV	WRB #41, p. 23: QA (Estimate) for 1968=3.1 cfs (1968=dry year, p.8)

TABLE B.2-b (Continued)

COUNTY	BASIN NO.	BASIN NAME	SITE NO.	STREAM NAME (Drainage Name)	DRAINAGE LOCATION	Q _A (cfs)	Δh (ft)	Δl (mi)	CAPACITY (kw)	LAND OWNERSHIP	MAP REFERENCE	LITERATURE REFERENCES
Nye (cont.)	137	Big Smokey Valley	120	Last Change Cr.	T12N R42E	2.4	900	1.2	110	Toiyabe National Forest	7.5'-Toiyabe Peak, NV 7.5'-Carvers, NW, NV	USGS WSP #423, p. 75: 7/3/15-1.19 cfs
			121	Ophir Cr.	T13N R42E	2.4	900	1.2	110	Toiyabe National Forest	7.5'-Toiyabe Peak, NV 7.5'-Carvers, NW, NV	WRB #41, p. 23: Q _A (Estimate) for 1968=1.1 cfs (1968=dry year, p.8)
	150	Little Fish Lake Valley	122	Danville Cr. (Danville Canyon)	T11N R48E	3.5	700	2.4	125	Public Domain & Toiyabe National Forest	7.5'-Danville, NV 7.5'-Fish Springs, NV	GWR-RS #38, p. 13 & Table 3: 9/1/65- 1.0 cfs
			123	Clear Cr.	T11N R48E	3.0	700	2.7	105	Private, Public Domain & Toiyabe National Forest	7.5'-Danville, NV 7.5'-Fish Springs, NV	GWR-RS #38, p. 13 & Table 3: 9/1/65- 1.5 cfs.
	156	Hot Creek Valley	124	Sixmile Cr. (So. Sixmile Canyon)	T9N R50E	5.8	400	2.0	120	Public Domain	15'-Morey Peak, NV	
Ormsby	104	Eagle Valley	125	Ash Canyon Cr.	T15N R19E	5.3	800	1.6	215	Private	7.5'-Marlett Lake, NV	GWR-RS #39., p.18-19: 6 flow measurements, range=1.48 cfs (8/25/64)-3.45 cfs (6-19-64)
Pershing	129	Buena Vista Valley	126	Indian Cr.	T29N R34E R3SE	2.1	600	1.7	65	Private & Public Domain	15'-Unionville, NV	
			127	Cottonwood Cr.	T29N R34E R3SE	2.1	600	2.0	65	Private & Public Domain	15'-Unionville, NV	

TABLE B.2-b (Continued)

COUNTY	BASIN NO.	BASIN NAME	SITE NO.	STREAM NAME (Drainage Name)	DRAINAGE LOCATION	Q _A (cfs)	Δh (ft)	Δl (mi)	CAPACITY (kw)	LAND OWNERSHIP	MAP REFERENCE	LITERATURE REFERENCES
Pershing (cont.)	129	Buena Vista Valley	128	Buena Vista Cr.	T3CN R34E R35E	3.3	600	1.9	100	Private	15'-Unionville, NV	----
	133	Edwards Cr. Valley	129	Edwards Cr.	T18N R38E	5.3	400	1.9	105	Private & Public Domain	7.5'-Basque Summit, NV	----
Washoe	11	Coleman Valley	130	(no name) (Flows out of Little Valley Res)	T46N T47N R20E	2.4*	340	1.4	40	Private & Public Domain	7.5'-Little Coleman Canyon, NV 7.5'-Coleman Canyon, NV	----
	89	Washoe Valley	131	Ophir Cr.	T17N R19E	11.5	600	0.9	350	Private & Toiyabe National Forest	7.5'-Washoe City, NV	GWR-RS #57, p. 43: 6 Flow Measurements Range=2.27 cfs (8/24/64)-15.0 cfs (5/11/64)
	90	Lake Tahoe Basin	132	Marlette Cr.	T15N R18E	*	1200	0.7		Private	7.5'-Marlette Lake, NV	----
			133	Incline Cr.	T16N R18E	7.5	280	0.75	105	Private	7.5'-Mt. Rose, NV 7.5'-Marlette Lake, NV	(STRM CHAR. p. 346- 347--See Notes)
	91	Truckee Canyon Segment	134	West Fork Grey Cr.	T17N R18E	8.9	400	0.9	180	Private	7.5'-Mt. Rose, NV	----
			135	Bronco Cr.	T18N R18E	15.0	600	1.0	455	Private	7.5'-Mt. Rose, NW, NV	----
			136	Deep Canyon	T18N R18E	6.5	1200	1.3	395	Private & Toiyabe National Forest	7.5'-Mt. Rose, NW, NV	----

TABLE B.2-b (Continued)

COUNTY	BASIN NO.	BASIN NAME	SITE NO.	STREAM NAME (Drainage Name)	DRAINAGE LOCATION	Q _A (cfs)	Δh (ft)	Δl (mi)	CAPACITY (kw)	LAND OWNERSHIP	MAP REFERENCE	LITERATURE REFERENCES
Washoe (cont.)	91	Truckee Canyon Segment	137	(no name)	T19N R18E Sec.27	5.3	1000	1.1	270	Private	7.5'-Mt. Rose, NV, NV	----
White Pine	179	Steptoe Valley	138	Big Indian Cr.	T21N R64E	3.3	600	2.5	100	Private & Humboldt National Forest	AMS NJ 11-3 (Ely, NV; UT)	----
	184	Spring Valley	139	Kalamazoo Cr.	T20N R66E	5.8	800	2.0	235	Humboldt National Forest & Public Domain	AMS NJ 11-3 (Ely, NV UT)	----
			140	Piermont Cr.	T19N R66E	2.7	800	1.5	110	Private, Public & Humboldt National Forest	15'-Schell Peaks, NV	----
	195	Snake Valley	141	Silver Cr.	T14N T15N R69E	10.5	600	4.0	320	Private	AMS NJ 11-3 (Ely, NV UT)	----
			142	Big Wash Cr.	T12N E70E	9.7	400	2.5	195	Private, Public & Humboldt National Forest	15'-Garrison, NV	----
			143	Snake Cr.	T12N E70E	7.8	450	2.0	180	Private, Public & Humboldt National Forest	15'-Garrison, NV	----
	207	White River Valley	144	White River	T12N T13N R59E R60E	52	400	3.0	1055	Private	15'-Carrant Mtn., NV	WRB #8, p. 15-17 (Q _A =2cfs near Preston, 4 mi down stream)

TABLE B.3-a

Cultural, Environmental and Related
Site Data - Measured Flow Sites

County	Basin Number	Map Number	Approximate Distance in Miles to:			Upstream Control Structure	Utility Service Area	Fishery Value Class	Water Rights (2)
			Nearest Private Land	Nearest Community	Nearest Paved Road (1)				
Clark	220	1	0	1 - Logandale	0 - S.R.12	-	Overton Power District No.5	I	-
	222	2	0	9 - Logandale	9 - S.R.12	-	"	II	-
	212	3	0	4 - Pittman	4 - U.S.95	-	NPC	-	-
Douglas	104	4	0	3 - Stewart	1 - U.S.50	-	SPP	II	-
	105	5	0	3 - Genoa	0 - S.R.57	-	"	III	-
		6	3	10 - Dresslerville	4 - U.S.395	-	"	-	-
	106	7	0	2 - Wellington	1 - S.R.3	Topaz	"	I, II	-
	107	8	2	9 - Wellington	3 - S.R.22	-	"	I, III	-
Elko	36	9	0	14 - Tuscarora	1 - S.R.11	-	IPC	II	-
	37	10	2	0 - Patsville	0 - S.R.11	Wildhorse	"	III	-
	38	11	3	6 - Rowland	18 - S.R.43	-	"	I	-
	39	12	0	14 - Rowland	30 - S.R.43	-	"	II	-
	40	13	0	2 - San Jacinto	1 - U.S.93	-	"	II	-
	42	14	0	12 - Deeth	14 - U.S.40	-	WRE	I	-
	43	15	0	6 - Deeth	6 - U.S.40	-	"	II	-
		16	0	8 - Deeth	7 - S.R.11	-	"	I	-

TABLE B.3-a (Continued)

County	Basin Number	Map Number	Approximate Distance in Miles to:			Upstream Control Structure	Utility Service Area	Fishery Value Class	Water Rights (2)
			Nearest Private Land	Nearest Community	Nearest Paved Road (1)				
Esmeralda		17	0	9 - Deeth	6 - S.R.11	-	"	I	-
		18	0	12 - Halleck	0 - S.R.11	-	"	I	-
		19	0	8 - Deeth	7 - U.S.40	-	"	I	-
	44	20	0	12 - Deeth	12 - S.R.80	-	"	IV	-
	45	21	1	6 - Lamoille	12 - S.R.46	-	CPU	I	-
		22	0	6 - Elburz	0 - U.S.40	-	"	II	-
		23	0	4 - Lamoille	10 - S.R.11	-	"	I	-
		24	0	4 - Lamoille	12 - S.R.46	Seitz Lake	"	I	-
	46	25	4	14 - Jiggs	0 - S.R.46	-	"	I, III, IV	-
	50	26	0	14 - Elko	14 - U.S.40	-	"	-	-
	51	27	0	6 - Carlin	6 - U.S.40	-	"	-	-
	176	28	0	12 - Jiggs	12 - S.R.46	-	WRE	I	-
		29	0	2 - Arthur	0 - S.R.11	-	CPU	I	-
	117	30	3	12 - Dyer	8 - S.R.3A	-	VEA	II	-
		31	0	0 - Dyer	0 - S.R.3A	-	"	III	-
		32	2	4 - Dyer	3 - S.R.3A	-	"	II	-

TABLE B.3-a (Continued)

County	Basin Number	Map Number	Nearest Private Land	Approximate Distance in Miles to:		Upstream Control Structure	Utility Service Area	Fishery Value Class	Water Rights (2)
				Nearest Community	Nearest Paved Road (1)				
Esmeralda	117	33	2	6 - Dyer	6 - S.R.3A	-	"	III	-
Eureka	53	34	0	3 - Palisade	0 - S.R.20	small dam	"	-	-
Humboldt	28	35	4	30 - Denio	14 - S.R.8A	lake	HEL	II	-
	30	36	0	13 - Denio	18 - S.R.8A	-	"	II	-
		37	1	15 - Denio	16 - S.R.8A	-	"	III	-
		38	0	19 - Denio	19 - S.R.8A	-	"	IV	-
	34	39	1	6 - McDermitt	6 - U.S.95	-	"	II	-
	33	40	0	5 - McDermitt	5 - U.S.95	-	"	III	-
	67	41	0	18 - Paradise Vly.	17 - S.R.8B	Chimney Dam & Res	CPU	I	-
	69	42	0	7 - Paradise Vly.	7 - S.R.8B	small dam	"	II	-
		43	0	2 - Paradise Vly.	2 - S.R.8B	-	"	II	-
		44	0	4 - Paradise Vly.	2 - S.R.8B	-	"	III	-
	70	45	0	3 - Golconda	3 - U.S.40	-	SPP	III	-
Lander	62	46	0	11 - Dunphy	12 - U.S.40	-	"	-	-
	137	47	1	20 - Austin	4 - S.R.8A	Groves Lake	"	II	32.01

TABLE B.3-a (Continued)

County	Basin Number	Map Number	Approximate Distance in Miles to:			Upstream Control Structure	Utility Service Area	Fishery Value Class	Water Rights (2)
			Nearest Private Land	Nearest Community	Nearest Paved Road (1)				
Lincoln	201	48	2	2 - Ursine	14 - U.S.93	Eagle Vly Res	Lincoln County Power District #1	II	-
Lyon	108	49	3	14 - Smith	0 - S.R.3C	Bridgeport Res	SPP	III	-
		50	0	6 - Yerington	2 - S.R.3	Bridgeport & Topaz	"	IV	-
Nye	56	51	6	24 - Round Mountain	10 - S.R.91	-	"	I, II	-
	137	52	0	15 - Round Mountain	3 - S.R.8A	-	"	II	96.23
	173	53	0	4 - Currant	0 - U.S.6	-	MWP	-	4.0
Washoe	87	54	0	8 - Washoe City	1 - U.S.395	-	SPP	III	-
		55	0	8 - Washoe City	1 - U.S.395	-	"	III	-
		56	0	8 - Washoe City	2 - U.S.395	-	"	II, III	-
		57	0	2 - Lewton	2 - S.R.80	-	"	II	-
		88	0	4 - Washoe City	3 - U.S.395	Hobart Res.	"	II, III	-
	89	59	0	5 - Washoe City	1 - U.S.395	-	SPP	II	-
	90	60	0	5 - Crystal Bay	0 - S.R.28	-	"	I	-
	White Pine	179	1	8 - East Ely	4 - U.S.6	res.	MWP	I	-
		184	6	15 - East Ely	15 - U.S.93	-	"	I	8.02
County	Basin Number	Map Number	Approximate Distance in Miles to:			Upstream Control Structure	Utility Service Area	Fishery Value Class	Water Rights (2)
			Nearest Private Land	Nearest Community	Nearest Paved Road (1)				
White Pine	193	63	2	16 - Tippet	0 - S.R.2	-	MWP	-	-
	195	64	0	2 - Baker	2 - S.R.74	-	"	-	59.96
		65	0	2 - Baker	2 - S.R.74	-	"	-	28.63

TABLE B.3-b

Cultural, Environmental and Related
Site Data - Derived Flow Sites

County	Basin Number	Map Number	Nearest Private Land	Approximate Distance in Miles to:		Upstream Control Structure	Utility Service Area	Fishery Value Class	Water Rights (2)
				Nearest Community	Nearest Paved Road (1)				
Douglas	90	66	0	1 - Glenbrook	0 - S.R.28	-	SPP	-	-
		67	0	3 - Glenbrook	0 - S.R.28	-	"	-	-
	105	68	0	4 - Minden	1 - S.R.57	-	"	III	-
		69	1	8 - Dresslerville	6 - U.S.395	-	"	-	-
Elko	35	70	1	16 - Patsville	3 - S.R.11A	res-1246 AP	IPP	II	-
	38	71	1	9 - Rowland	18 - S.R.43	-	"	I	-
		72	2	16 - Rowland	14 - S.R.43	-	"	II	-
	39	73	0	14 - Rowland	30 - S.R.11A	-	"	I	-
		74	0	16 - Rowland	31 - S.R.11A	-	"	-	-
	75	0	18 - Rowland	34 - S.R.11A	-	-	"	I	-
		40	76	1	20 - Contact	18 - U.S.93	-	WRE	I
	42	77	1	9 - Wells	6 - U.S.93	Bishop Cr. Res	"	-	-
	43	78	0	6 - Deeth	6 - U.S.40	-	"	I,II	-
	47	79	0	4 - Jiggs	3 - S.R.46	-	"	I	-
	48	80	0	14 - Carlin	8 - S.R.46	-	CPU	-	-
	176	81	0	7 - Ruby Valley	18 - S.R.46	-	WRE	II	-

TABLE B.3-b (Continued)

County	Basin Number	Map Number	Nearest Private Land	Nearest Community	Approximate Distance in Miles to Nearest Paved Road (1)	Upstream Control Structure	Utility Service Area	Stream Value Class	Water Rights (2)
Elko	189	82	0	1 - Wilkins	1 - U.S.93	-	WRE	-	-
Esmeralda	116	83	2	20 - Dyer	4 - U.S.6	-	VEA	-	-
	117	84	2	10 - Dyer	8 - S.B.3A	-	"	III	-
Humboldt	1	85	0	8 - Denio	7 - S.R.8A	-	HEC	IV, V	-
	2	86	1	19 - Denio	11 - S.R.8A	Onion Vly Res	"	III	-
		87	1	18 - Denio	11 - S.R.8A	Li. Onion Res	"	-	-
	3	88	0	32 - Denio	16 - S.R.8A	Knott Cr. Res	"	III	-
	26	89	2	42 - Denio	30 - S.R.8A	-	"	-	-
		90	3	46 - Denio	34 - S.R.8A	-	"	V	-
		91	2	42 - Denio	37 - S.R.8A	-	"	-	-
	27	92	1	38 - Denio	23 - S.R.8A	-	"	I	-
	28	93	2	43 - Denio	28 - S.R.8A	-	"	IV	-
	29	94	2	26 - Denio	8 - S.R.8A	-	"	II	-
		95	1	22 - Denio	6 - S.R.8A	-	"	III	-
	33	96	0	4 - Orovada	2 - U.S.95	-	"	III	-
	69	97	0	4 - Paradise Vly	3 - S.R.8B	-	"	II	-

TABLE B.3-b (Continued)

County	Basin Number	Map Number	Nearest Private Land	Approximate Distance in Miles to:		Upstream Control Structure	Utility Service Area	Fishery Value Class	Water Rights (2)
				Nearest Community	Nearest Paved Road (1)				
Humboldt	69	98	1	5 - Paradise Vly	3 - S.R.8B	-	"	V	-
		99	0	7 - Paradise Vly	2 - S.R.8B	-	"	III	-
		100	0	5 - Paradise Vly	2 - S.R.8B	-	"	-	-
Lander	56	101	2	10 - Austin	4 - S.R.21	-	SPP	II	-
	137	102	1	8 - Austin	3 - S.R.8A	-	"	I	1.03
		103	1	20 - Austin	4 - S.R.8A	-	"	-	-
	138	104	1	13 - Austin	4 - S.R.21	-	"	II	-
		105	5	19 - Austin	4 - S.R.21	-	"	III	-
Lyon	107	106	1	13 - Wellington	0 - S.R.22	-	"	-	-
	109	107	0	20 - Wellington	5 - S.R.22	-	"	II	-
Mineral	109	108	1	21 - Hawthorne	0 - S.R.3C	-	"	III	-
		109	2	20 - Hawthorne	10 - S.R.22	-	"	IV	-
	110	110	4	11 - Thorne	2 - U.S.95	-	"	-	-
		111	0	4 - Hawthorne	1 - U.S.95	-	"	-	-
Nye	56	112	4	9 - Ione	5 - S.R.21	-	"	-	-
	137	113	8	14 - Round Mountain	10 - S.R.8A	-	"	II	5.0

TABLE B.3-b (Continued)

County	Basin Number	Map Number	Nearest Private Land	Approximate Distance in Miles to:		Upstream Control Structure	Utility Service Area	Fishery Value Class	Water Rights (2)
				Nearest Community	Nearest Paved Road (1)				
Nye	137	114	2	8 - Round Mountain	5 - S.R.8A	Irris Dam	"	III	-
		115	2	8 - Round Mountain	5 - S.R.8A	-	"	IV	-
		116	2	7 - Round Mountain	8 - S.R.8A	-	"	II	-
		117	3	9 - Round Mountain	3 - S.R.8A	-	SPP	III	-
		118	3	12 - Round Mountain	3 - S.R.8A	-	"	III	-
		119	4	10 - Round Mountain	4 - S.R.8A	-	"	-	-
		120	5	18 - Round Mountain	4 - S.R.8A	-	"	II	-
		121	1	19 - Round Mountain	3 - S.R.8A	-	"	II	0.15
	150	122	3	30 - Round Mountain	13 - S.R.82	-	"	IV	-
		123	3	31 - Round Mountain	15 - S.R.82	-	"	III	-
		156	8	30 - Warm Springs	11 - U.S.6	-	"	III	-
Ormsby	104	125	0	2 - Carson City	2 - U.S.395	-	"	I	-
		126	0	5 - Union City	5 - S.R.50	-	"	IV	-
		127	0	2 - Union City	2 - S.R.50	-	"	IV	-
		128	0	2 - Union City	2 - S.R.50	-	"	-	-
	133	129	2	11 - Eastgate	11 - U.S.50	-	"	-	-

TABLE B.3-b (Continued)

County	Basin Number	Map Number	Nearest Private Land	Approximate Distance in Miles to:		Upstream Control Structure	Utility Service Area	Fishery Value Class	Water Rights (2)
				Nearest Community	Nearest Paved Road (1)				
Washoe	11	130	0	24 - Vya	1 - S.R.34	Little Vly Res	SPP	-	-
	89	131	0	3 - Washoe City	2 - U.S.395	-	"	II	-
	90	132	0	16 - Carson City	0 - S.R.28	Marlette Lake	"	I	-
		133	0	4 - Crystal Bay	1 - S.R.28	-	"	I	-
	91	134	0	8 - Crystal Bay	6 - S.R.27	-	"	II	-
		135	0	10 - Crystal Bay	6 - S.R.27	-	"	II	-
		136	0	4 - Verdi	4 - I.S.80	-	"	V	-
		137	0	3 - Verdi	1 - I.S.80	-	"	-	-
White Pine	179	138	4	6 - Warm Springs	4 - U.S.93	-	MWP	II	-
		139	3	16 - McGill	11 - U.S.93	-	"	I	27.40
		140	2	14 - McGill	12 - U.S.93	-	"	I	8.64
	195	141	0	9 - Baker	3 - U.S.50	-	"	I	1.73
		142	1	10 - Baker	6 - S.R.73	-	"	II	-
		143	1	7 - Baker	3 - S.R.73	-	"	I	5.0
	207	144	6	16 - Currant	6 - U.S.6	-	"	IV	117.30

(1) Access to most sites is available on dirt roads that range from improved county gravel to unimproved jeep trails.

(2) Water rights were not examined for all sites and at others no rights were indicated in the available summaries. Where rights were indicated they are summed and use codes are given. The following codes are used:

U - water rights were unstudied

NI - water rights studied but none were indicated

P - power

I - irrigation

S - stock

Mi - mining

M - municipal

QM - Quasi-municipal

R - recreation

W - wildlife

APPENDIX C

Fishery Value Class Criteria

SOURCE: State of Nevada, Department of Wildlife

STREAM EVALUATION MAP STATE OF NEVADA

INTRODUCTION:

Increasing demands for water due to predicted development of energy and agricultural resources and attendant municipal/industrial growth may significantly impact existing fishery resources of western streams. Additionally, already stressed fisheries may be further jeopardized by reduced or altered flows and changed water quality.

This stream evaluation map is provided to assist Federal and State agencies and water users in assessing the impact of proposed water development projects on existing fishery resources. The map displays an appraisal of the relative value of streamfishery resources within the state and is based on information and professional opinion available as of fall 1976. It is emphasized that fishery resources will be reevaluated as new information is acquired. Information depicted on the map is essential to identifying highly valued fishery resources, establishing priorities to fill data gaps, and establishing instream flow requirements to maintain existing fisheries or other instream water uses.

This map is one of several similar products of a cooperative effort whose participants included the U.S. Department of the Interior, Office of Biological Services and Division of Ecological Services, Fish and Wildlife Service; State Fish and Wildlife Departments of California, Colorado, Idaho, Montana, Nebraska, Nevada, North Dakota, Oklahoma, South Dakota, Texas, Utah, and Wyoming; and the U.S. Environmental Protection Agency. Funds for preparation and production of these maps were provided by the Federal Inter-agency Energy/Environment Research and Development Program, Office of Energy, Minerals, and Industry, U.S. Environmental Protection Agency.

METHOD

A standard rating system was used by the state fish and wildlife departments conducting the evaluation. Fishery habitat evaluated by the rating system included permanent streams, their tributaries, and those streams protected by or proposed for protection under the Wild and Scenic Rivers Act. Intermittent streams that were deemed necessary for sustenance of a highly valued fishery were also evaluated. Information presented on this map originated from the state fish and wildlife departments and is based on the following evaluation scheme with existing fishery habitat assigned one of five values.

VALUE CLASS	MAP CODE	CLASS DEFINITION
I		Highest-valued fishery resource
II		High-priority fishery resource
III		Substantial fishery resource
IV		Limited fishery resource
V		Unsurveyed stream reach

All other streams have no fishery resource

To determine the appropriate value class, each stream reach was judged on criteria provided below. The final value classification assigned to the habitat was determined by the highest rating given in Criteria 1 through 3. Criterion 4 was used only in a few instances to upgrade or downgrade the overall habitat evaluation when the rating for criteria 1-3 was less than the highest possible.

CRITERIA

- 1. Occurrence of State or Federal endangered species**
- 2. Occurrence of State or Federal threatened species**
- 3. Species of high interest to the State**
- 4. Habitat restoration, reclamation, or mitigation potential**

A value class was determined for each criterion as follows:

1. Status of State or Federal Endangered Species

Value Class I Documented occurrence (legally defined) of any State or Federally chartered endangered species.

Value Class II Probable occurrence or past occurrence of an endangered species based on professional judgment of personnel familiar with the stream reach. It is differentiated from Value Class I by the fact that undocumented reports of the occurrence of an endangered species may be available for the reach.

Value Class III Not applicable - only value classes I, II, and IV were used for Criterion 1.

Value Class IV Absence or no record of any endangered species.

2. Status of State or Federal Threatened Species

Value Class I Documented present occurrence of a State or Federally chartered threatened species.

Value Class II Documented past occurrence and probable continued existence of a threatened species.

Value Class III Possible occurrence of a threatened species (undocumented) including potential restocking of threatened species.

Value Class IV Absence or no record of any threatened species.

3. Species of High Interest

Value Class I Habitat maintaining outstanding populations of species of high interest as defined by the State. Includes self-sustaining "wild" populations that maintain a high yield or represent a unique esthetic, scientific, economic, educational, or recreational value.

Value Class II Habitat that is intensively used in terms of the several requirements of a highly-valued population or required habitat for less highly-valued populations of a species of high interest.

Value Class III Habitat that is occasionally used by a highly-valued population of high interest or an essential habitat for maintaining a relatively low-valued population of a species of high interest. Occasionally-used habitat implies that reduction of that habitat would not seriously impair the continued existence of the population.

Value Class IV Habitat that is not used or is sporadically or unpredictably used by species of high interest.

4. Habitat Restoration, Reclamation, or Mitigation Potential

Value Class I Current technology makes it probable that the area to be restored or reclaimed to at least an equally valued fishery as that existing prior to development. Acceptable compensation options are likely.

Value Class II Moderate potential exists for either restoration of the habitat or reclamation to an equal or higher-valued fishery, or total compensation options can be defined.

Value Class III Low potential for restoration to present species composition and population levels; however, partial compensation options can be defined.

Value Class IV Very low or essentially no potential for restoration or reclamation of the habitat to its present species composition and population levels, no alternate resource could be introduced that would be as highly valued; no acceptable options are available to compensate for the loss of this habitat, at the present time (includes stream reaches that have been designated as habitat for reintroduction of an endangered species by a National Recovery Team or State Rehabilitation Plan).

For the reader interested in detailed documentation of the assigned value classification for Nevada streams, this information can be requested at the following locations:

U.S. Fish and Wildlife Service
Federal Building, Room E-1837
2800 Cottage Way
Sacramento, California 95825

Nevada Department of
Wildlife
Box 10678
Reno, Nevada 89501

APPENDIX D

Architectural, Engineering, Consultant and Construction

Firms that Do Work on Hydropower Facilities

SOURCE: United States Department of Energy, Idaho Operations Office, Idaho Falls, Idaho, with additions by Nevada Department of Energy, May 1981.

HYDROPOWER

Architectural, Engineering, Consultant and Construction Firms

The following are Design Firms, Consultants, and Contractors in the Western States with expressed interest in hydropower development. The list encompasses a spectrum ranging from small consultant firms with minimal hydropower experience to large engineering firms which can totally manage a project from conception through construction. A potential user of the services of any of the firms listed should satisfy himself that the firm has the capability and experience required for the service desired.

Edward A. Abdun-nur
Consulting Engineer
3067 South Dexter Way
Denver, CO 80222
(303) 756-7226

Richard W. Barret
Vice President, Marketing
Aerojet Manufacturing Company
601 S. Placentia Avenue
Fullerton, CA 92634

American Hydroelectric
Development Corporation
100 Park Center Plaza #520
San Jose, CA 95113
(408) 288-5515
Attn: William Jennings

Anderson-Nichols
661 Harbour Way South
Richmond, CA 94804
(415) 237-5490

Appropriate Technologies, Inc.
Attn: George L. Smith
P.O. Box 1016
Idaho Falls, Idaho 83401
(208) 529-1611

Appropriate Technologies, Inc.
Attn: R.E. Palmquist
3131 Fernbrook Lane North
Minneapolis, MN 55441
(612) 559-5511

Auslam & Associates, Inc.
Economic Consultants
Attn: Margaret S. Hall
601 University Avenue
Sacramento, CA 95825

George Balalau
Engineer
Energy Research & Applications
1301 E. El Segundo Blvd
El Segundo, CA 90245

Banner Associates, Inc.
Attn: Joseph C. Lord
P.O. Box 550
309 South Fourth Street
Laramie, WY 82070
(307) 745-7366

Bechtel National, Inc.
Attn: G.D. Coxon,
Business Development Representative
Research Engineering
P.O. Box 3965
San Francisco, CA 94119

R.W. Beck & Associates
Attn: Richard Lofgren
200 Tower Building
Seattle, WA 98101
(206) 773-8891

Boeing Engineering & Construction
P. O. Box 3707
Seattle, WA 98124
(206) 773-8891

Joseph E. Bonadiman
Attn: J.C. Bonadiman
P.O. Box 5852
606 East Mill Street
San Bernardino, CA 92412

Bookman-Edmonston Engineering
Attn: Edmond R. Bates, P.E.
600 Security Building
102 North Brand Blvd.
Glendale, CA 91203
(203) 245-1883

Bovey Engineers, Inc.
Attn: George Wallace
East 808 Sprague Avenue
Spokane, WA 99202
(509) 838-4111

Kurt F. Frank
Principal Engineer
Boyle Engineering Corp.
1501 Quail Street
P.O. Box 3030
Newport Beach, CA 92663

CH2M Hill, Inc.
Attn: R.W. Gillette, Director
of Power Generation
1500 114th Avenue, S.E.
Bellevue, WA 98004

Childs & Associates
Attn: Thomas R. Childs
1317 Commercial
Bellingham, WA 98225
(206) 671-0107

Chilton Engineering
Attn: Sheldon Gordon
160 Hubbard Way
Unit #2
Reno, NV 89502

Doug McClelland
Administrative Branch Manager
Confederated Tribes of Warm Springs
P.O. Box 548
Warm Springs, OR 97761

Davis Constructors & Engineers, Inc.
P.O. Box 4-2360
Anchorage, AK 99509
(907) 344-0571

Desert Research Institute
Water Resources Center
P.O. Box 60220
Reno, NV 89506
(702) 673-7350

Edward F. Dibble
Consulting Engineer
303 Brookside Avenue
Redlands, CA 92373

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EG&G Idaho, Inc.
P.O. Box 1625
Idaho Falls, Idaho 83401

Energy Research & Applications, Inc.
1301 East El Segundo Blvd
El Segundo, CA 90245
(203) 322-9302

Energy Services Consulting
37 Shoal Drive
Daly City, CA 94104
(415) 992-0700

Engineering & Design Associates
Attn: Stanley D. Reed
Senior Principal
6900 Southwest Haines Road
Tigard, OR 97223
(503) 639-8215

Engineering-Science, Inc.
Attn: G.S. Magnuson, Vice President
150 North Santa Anita Avenue
Arcadia, CA 91006
(203) 445-7560

Thomas R. Schneider
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3412 Hillview Avenue
Palo Alto, CA 94303

George Erskine
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P.O. Box 3060
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(707) 443-6258

Fluid Energy Systems
Attn: K.T. Miller
President/Director
2903 Ocean Park Blvd
Santa Monica, CA 90405

Ford, Bacon & Davis Utah, Inc.
Attn: H.G. Slighting
375 Chipeta Way
P.O. Box 8009
Salt Lake City, UT 84108
(801) 583-3773

C.H. Guernsey & Company
Attn: P.P. Pyle,
Assistant Manager
Rocky Mountain Area
7181 Hooker Street
Westminster, CO 80030
(303) 428-5643

Gutherland, Ricketts & Rindahl
Consulting Engineers, Inc.
Attn: D.R. Ricketts, P.E.
2180 South Ivanhoe Street
Denver, CO 80222
(303) 759-0951

Hansa Engineering Corporation
Attn: Kurt A. Scholz, President
500 Sansome Street
San Francisco, CA 94111
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James Hansen & Associates
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(916) 786-5424

Harding-Lawson Associates
P.O. Box 3030
San Rafael, CA 94902
(415) 472-1400

Harrison-Western Corporation
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1208 Quail Street
Denver, CO 80215

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Helicon Corporation
P.O. Box 5501
Boise, Idaho 83705

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P.O. Box 9760
1200 Westlake N.
Seattle, WA 98109

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Suite 1111
421 S.W. 6th Avenue
Portland, OR 97204

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3938 West Point Drive
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P.O. Box 7050, Downtown Station
Portland, ME 04112
(207) 775-5401

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300 Lakeside Drive
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W.A. Wahler & Associates
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Palo Alto, CA 94303
(415) 968-6250

Wilsey & Ham
1035 East Hillsdale Blvd
Foster City, CA 94404
(415) 349-2151

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(415) 956-7070

APPENDIX E

Hydropower Equipment Manufacturers and Hardware Suppliers

SOURCE: United States Department of Energy, Idaho Operations
Office, Idaho Falls, March 1981

HYDROPOWER

EQUIPMENT MANUFACTURERS & HARDWARE SUPPLIERS

A. U.S. FIRMS

ACEC

Attn: Ralph J. Douglass,
North America Coordinator
7308 West Rim Drive
Austin, Tx 78731

Alaska Wind and Water Power
Box G
Chugiak, AK 99566

Allis-Chalmers
Hydro-Turbine Division
East Berlin Road
Box 712
York, PA 17405
(717)-792-3511

American Ligurian Company
Attn: Dr. C.A. Cacciapuoti, Pres.
15 Ralsey Road South
P.O. Box 1005
Stanford, CT 06902

Arbanas Industries
Attn: Vilim Arbanas, Pres.
24 Hill Street
Xenia, OH 45385
(513)-372-1884

Axel Johnson Corporation
Spear Street Tower, Suite 445
1 Market Plaza
San Francisco, CA. 94105
(415)-777-3800

Babcock & Wilcox
Power Generation Group
Attn: R.J. Harris, Marketing Spec.
74 East Robinson Ave.
Barberton, OH 44203

Beckwith Electric Company, Inc.
11811 62nd Street North
Largo, FL. 33543
(813)-535-3408

Boeing Engineering & Construction
P.O. Box 3707
M.S. 8C-12
Seattle, WA. 98124
(206)-773-8891

Bofors-Nohab, Inc.
One World Trade Center
Suite 10225
New York, NY 10048

Border Electric Company
Route 1
Blaine, WA 98230
(206)-332-5545

Brown-Boveri Corporation
North Brunswick, NJ 08902
(201)-932-6000

Canyon Industries
P.O. Box 2543
Bellingham, WA 98225

Carl G. Brimmekamp & Company, Inc.
Attn: C.G. Brimmekamp
460 Summer Street
Stamford, CT 06901
(203)-325-4101

Cascade Patterns
Attn: George R. Maxfield
1309 Glenwood Drive
Mount Vernon, WA 98273
(206)-856-6608

Charles T. Main, Inc.
Southeast Tower, Prudential Center
Boston, MA 02199

Charmilles
EURO-USA Company
779 Barbara Ave.
Solana Beach, CA. 92075
(714)-775-7974

Electric Machinery Manufacturing Co.
Division of Turbodyne Corp.
Attn: David C. Sinclair, Manager
Standard Products Marketing
800 Central Ave.
Minneapolis, MN 55413

English Electric Corporation
500 Executive Boulevard
Elmsford, NY 10523
(914)-592-4810

General Electric Company
Attn: C.A. Neumann,
Hydrogeneration Marketing
One River Road
Schenectady, NY 12345
(518)-385-5444

Hannon Electric Company
Attn: Merrill Mossbarger
1605 Waynesburg Drive, S.E.
Canton, OH 44707
(216)-456-4728

Hydro Research Science
3334 Victor Court
Santa Clara, Ca. 95050

Hydrotool Corporation
2640 Industry Way
Lynwood, CA 90262
(213)-639-4402

Hydro West
Attn: Myles A. Duffy
P.O. Box 765
Alamo, CA 94507
(415)-546-4467

Independent Power Developers
P.O. Box 1467
Noxon, MT 59853
(406)-847-2315

Independent Power Developers
Route 3, Box 285
Sandpoint, Idaho 83864

International Power Machinery Co.
834 Terminal Tower
Cleveland, OH 44113

James Leffel and Company
Springfield, OH 45501
(513)-323-6481

Kvaerner-Brug A/S
c/o Kvaerner-Moss, Inc.
800 Third Avenue
New York, NY 10022
(212)-752-7310

Leroy Somer, Inc.
16 Passaic Ave.
Fairfield, NJ 07006
(201)-227-9277

Leroy-Somer, Inc.
405 W. University Dr.
Arlington Heights, IL 60004 133

Lima Electric Company
Attn: L.R. Thomas
200 East Chapman Road
Box 918
Lima, OH 45802
(419)-227-7327

McKay Water Power, Inc.
Attn: Harry J. McKay
1051 Clinton Street
Buffalo, NY 14206
(716)-854-7522

Meinikheim Machines
Attn: B. Felix Meinikheim
Owner and Manager
P.O. Box 5
Banks, ID 83602
(208)-793-2555

Mill Creek Hydro-Electric Co.
P.O. Box 1035
Healdsburg, CA 95448
(707)-433-2890/2863

Morrison-Knudsen Co., Inc.
One Morrison-Knudsen Plaza
P.O. Box 7808
Boise, Idaho 83729

National Tank & Pipe Company
Attn: Steve McLaughlin, Sales
P.O. Box 7
10037 S.E. Mather Road
Clackamas, OR 97105
(503)-656-1991

Nissho-Iwai
American Corporation
Broadway Plaza, Suite 1900
700 South Flower Street
Los Angeles, CA 90017
(213)-688-0600

Northeast Hydro Company, Inc.
P.O. Box 127 - Clement Road
Hudson, NH 03051

Northern Water Power
P.O. Box 49
Harrisville, NH 03450
(603)-827-3367

Alexis Pastuhov
Box 62
Harvard, MA 01451
(617)-456-8834

Pullman Incorporated
200 South Michigan Ave.
Chicago, IL 60604
(312)-322-7167

Pumps, Pipe and Power
Kingston Village
Austin, NV. 89310

Radiation Management Corporation
Ecological Division
3508 Market Street, Suite 400
Philadelphia, PA 19104

Rand Corporation
1700 Main Street
Santa Monica, CA 90406
(213)-393-0411

Short Stoppers Electric
Route 4, Box 247
Coos Bay, OR 97420
(503)-267-3559

Small Hydroelectric Systems
and Equipment
15220 S.R. 530
Arlington, WA 98223
(206)-435-3148

Sorumsand Verksted A/S
c/o Kvaerner-Moss, Inc.
800 Third Ave.
New York, NY 10022
(212)-752-7310

Sulzer Brothers, Inc.
19 Reactor St.
New York, NY 10006
(212)-425-4560

Sulzer Escher Wyss
200 Park Ave.
New York, NY 10017

Westinghouse Electric Corporation
Attn: J.J. Ruffing
700 Braddock Ave.
East Pittsburgh, PA 15112

APPENDIX F

Procedures and Examples of Preliminary Economic Analyses

Following are two sample economic calculations performed on Franktown Creek and Maggie Creek to illustrate a very rough cost-benefit ratio. These calculations are based upon Development Alternative number 1 for both examples. A blank worksheet has been provided as well as a cost curve to estimate turbine and generator costs under part II.

Using these formulas and cost estimates a rough "first-cut" economic evaluation can easily be performed.

Actual data should be used when and where available. Detailed economic and engineering evaluations should be performed by experienced and qualified professionals prior to any actual development.

Figure F.1 Curves for Estimating Turbine and Generator Cost Based on Installed Capacity and Gross Head.

PRELIMINARY ECONOMIC ANALYSIS

Site: _____

I. PLANT CHARACTERISTICS AND POWER POTENTIAL

Use data provided in Table 3a and 3b.

<u>Item</u>	<u>Value</u>
A.) Gross Head (H) (Column 6)	_____ ft
B.) Average generating flow (Q) using Alternative No. 1 (Column 8)	_____ cfs
C.) Capacity (Column 7)	_____ kw
D.) Average annual energy generated (Column 9 x 1000)	_____ kwh

II. INVESTMENT COST

<u>Item</u>	<u>Cost</u>
Turbine, Generator & Civil	Subtotal \$ _____
(Use Figure F.1 or Cost = $1614[1150\text{MW}^{0.48}H^{-(0.25+0.052\text{MW})}]$)	
(2.0)* x Subtotal	= TOTAL INVESTMENT COST \$ _____

*(Allowance for penstock, switchyard equipment,
tailrace, transmission line, contingencies
and indirects)

III. OPERATING AND MAINTENANCE (O & M) COST

O & M Cost (\$20,000 minimum or 1.5% - 4% of
investment cost) (Used _____%) \$ _____

IV. BENEFIT ESTIMATE

Average annual energy generated from Part I \$ _____
(_____ kwh) x value of energy (_____
\$/kwh). Utility company will provide actual
rates for "buy-back" arrangements.

Note: 1 mill = \$0.001

V. ECONOMICS

Investment Costs (INV) (From Part II)	= \$
First Year Annual Revenue (A_r) (From Part IV)	= \$
Escalation Rate - Revenue (E_r)	= 8%
First Year O & M Cost (A_e) (From Part III)	= \$
Escalation Rate - Expenses (E_e)	= 6%
Economic Life - Years (n)	= 30
Discount Rates (k)	= 8% & 15%
8% for Public Sector	
15% for Individual or Corporation	

Determine the following:

Present Value of Net Revenue (PNR)

Benefit/Cost Ratio (B/C)

$$PNR = \sum_{j=1}^n \frac{A_r (1 + E_r)^j - A_e (1 + E_e)^j}{(1 + k)^j} =$$

$$B/C @ k \text{ of } 8\% = \frac{PNR}{INV} =$$

$$B/C @ k \text{ of } 15\% = \frac{PNR}{INV} =$$

PRELIMINARY ECONOMIC ANALYSIS

Site: No. 40 - Maggie Creek, Elko Co.

I. PLANT CHARACTERISTICS AND POWER POTENTIAL

Use data provided in Table 3a and 3b.

<u>Item</u>	<u>Value</u>	
A.) Gross Head (H) (Column 6)	<u>40</u>	ft
B.) Average generating flow (Q) using Alternative No. 1 (Column 8)	<u>143.5</u>	cfs
C.) Capacity (Column 7)	<u>710</u>	kw
D.) Average annual energy generated (Column 9 x 1000)	<u>2,538,000</u>	kwh

II. INVESTMENT COST

<u>Item</u>	<u>Cost</u>
Turbine, Generator & Civil (Use Figure F.1 or Cost = $1614[1150MW^{0.48}H^{-(0.25+0.052MW)}]$)	Subtotal \$ <u>546,440</u>
(2.0)* x Subtotal	= TOTAL INVESTMENT COST \$ <u>1,092,880</u>

*(Allowance for penstock, switchyard equipment,
tailrace, transmission line, contingencies
and indirects)

III. OPERATING AND MAINTENANCE (O & M) COST

O & M Cost (\$20,000 minimum or 1.5% - 4% of
investment cost) (Used 4%) \$ 43,715

IV. BENEFIT ESTIMATE

Average annual energy generated from Part I \$ 101,520
(2,538,000 kwh) x value of energy (0.04
\$/kwh). Utility company will provide actual
rates for "buy-back" arrangements.

Note: 1 mill = \$0.001

V. ECONOMICS

Investment Costs (INV) (From Part II)	= \$ 546,440
First Year Annual Revenue (A_r) (From Part IV)	= \$ 101,520
Escalation Rate - Revenue (E_r)	= 8%
First Year O & M Cost (A_e) (From Part III)	= \$ 43,715
Escalation Rate - Expenses (E_e)	= 6%
Economic Life - Years (n)	= 30
Discount Rates (k)	= 8% & 15%
8% for Public Sector	
15% for Individual or Corporation	

Determine the following:

Present Value of Net Revenue (PNR)

Benefit/Cost Ration (B/C)

$$PNR = \sum_{j=1}^n \frac{A_r (1 + E_r)^j - A_e (1 + E_e)^j}{(1 + k)^j} =$$

$$B/C @ k \text{ of } 8\% = \frac{PNR}{INV} = \frac{2,065,624}{1,092,880} = 1.89$$

$$B/C @ k \text{ of } 15\% = \frac{PNR}{INV} = \frac{864,388}{1,092,880} = 0.79$$

PRELIMINARY ECONOMIC ANALYSIS

Site: No. 59 - Franktown Creek, Washoe Co.

I. PLANT CHARACTERISTICS AND POWER POTENTIAL

Use data provided in Table 3a and 3b.

<u>Item</u>	<u>Value</u>	
A.) Gross Head (H) (Column 6)	<u>1,200</u>	ft
B.) Average generating flow (Q) using Alternative No. 1 (Column 8)	<u>5.8</u>	cfs
C.) Capacity (Column 7)	<u>811</u>	kw
D.) Average annual energy generated (Column 9 x 1000)	<u>3,072,000</u>	kwh

II. INVESTMENT COST

<u>Item</u>	<u>Cost</u>
Turbine, Generator & Civil	Subtotal \$ <u>211,486</u>
(Use Figure F.1 or Cost = $1614[1150\text{MW}^{0.48} H^{-(0.25+0.052\text{MW})}]$)	
(2.0)* x Subtotal	= TOTAL INVESTMENT COST \$ <u>422,972</u>

*(Allowance for penstock, switchyard equipment,
tailrace, transmission line, contingencies
and indirects)

III. OPERATING AND MAINTENANCE (O & M) COST

O & M Cost (\$20,000 minimum or 1.5% - 4% of investment cost) (Used ____%)	\$ <u>20,000</u>
---	------------------

IV. BENEFIT ESTIMATE

Average annual energy generated from Part I	\$ <u>122,880</u>
(<u>3,072,000</u> kwh) x value of energy (<u>0.04</u> \$/kwh). Utility company will provide actual rates for "buy-back" arrangements. Note: 1 mill = \$0.001	

V. ECONOMICS

Investment Costs (INV) (From Part II)	= \$422,972
First Year Annual Revenue (A_r) (From Part IV)	= \$122,800
Escalation Rate - Revenue (E_r)	= 8%
First Year O & M Cost (A_e) (From Part III)	= \$ 20,000
Escalation Rate - Expenses (E_e)	= 6%
Economic Life - Years (n)	= 30
Discount Rates (k)	= 8% & 15%
8% for Public Sector	
15% for Individual or Corporation	

Determine the following:

Present Value of Net Revenue (PNR)

Benefit/Cost Ratio (B/C)

$$PNR = \sum_{j=1}^n \frac{A_r (1 + E_r)^j - A_e (1 + E_e)^j}{(1 + k)^j} =$$

$$B/C @ k \text{ of } 8\% = \frac{PNR}{INV} = \frac{3,210,896}{422,972} = 7.59$$

$$B/C @ k \text{ of } 15\% = \frac{PNR}{INV} = \frac{1,383,650}{422,972} = 3.27$$