Biological Evaluation of the NPDES General Permit for Hydroelectric Facilities Within the State of Idaho

Permit Number IDG360000

Prepared for:

US Fish and Wildlife Service

and

National Oceanic and Atmospheric Administration – Fisheries

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Executive Summary

The U.S. Environmental Protection Agency (USEPA) conducted a biological evaluation to identify potential impacts to federally listed Endangered or Threatened species that could result from the issuance of the National Pollutant Discharge Elimination System (NPDES) General Permit to hydroelectric facilities operating in the State of Idaho.

The proposed Hydroelectric Facility General Permit (General Permit) authorizes the following types of discharges from hydroelectric facilities into waters of the State of Idaho: equipment cooling water, equipment and floor drain water, equipment backwash strainer water, and specific maintenance waters. The General Permit places effluent limits on the discharges for oil, grease, and pH, monitoring requirements for oil, grease and temperature, and requirements for best management practices. The General Permit does not regulate the river flow through the turbines or over the dam.

The Threatened and Endangered Species of concern identified for this action are:

Endangered Species:	Snake River Sockeye salmon (*Oncorhynchus nerka)* Kootenai River White Sturgeon (*Acipenser transmontanus*) Banbury Springs Lanx (*Lanx sp*.) Bruneau Hot Spring Snail (*Pyrgulopsis brungeuenis*) Snake River Physa Snail (*Physa natricina*) Ute Ladies' Tresses Orchid ((Spiranthes divulvialis) Water Howellia (*Howellia aquatilis*)
Threatened Species:	Snake River Spring/summer Chinook salmon (*O. tshawytscha*) Snake River Fall Chinook salmon (*O. tshawytscha*) Snake River Steelhead (*O. mykiss*) Bull trout (*Salvelinus confluentus*) Bliss Rapids Snail (*Taylorconcha serpenticola*)

The EPA has determined that issuance of the General Permit for hydroelectric facilities is ***not likely to adversely affect*** Snake River Sockeye salmon, Snake River Spring/Summer and Fall Chinook salmon, Snake River Steelhead, and Bull trout, Banbury Springs Lanx, , Snake River Physa Snail, Bliss Rapids Snail and Ute Ladies' Tresses Orchid. The EPA has determined that issuance of the General Permit will have ***no effect*** on Kootenai River White sturgeon, Bruneau Hot Spring Snail, and Water Howellia.

The EPA has also determined that issuance of the General Permit is ***not likely to adversely affect*** the Critical Habitat designated for Bull Trout, Snake River Chinook, Snake River Steelhead, and Snake River Sockeye.

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ACRONYMS

BE – biological evaluation
BMP – Best Management Practices
CWIS – cooling water intake structure
DDT – Dichloro-diphenyl-trichloroethane
DMR – Discharge Monitoring Report
DPS – distinct population segment
EFH – essential fish habitat
ESA – Endangered Species Act
ESU – ecological significance unit
GP – General Permit
HD – hydro-electric dam
HYDRO-ELECTRIC GENERATING FACILITIES– Hydroelectric Generating Facilities
IDEQ – Idaho Department of Environmental Quality
LAA – likely to adversely affect
MGD – million gallons per day
ML – Minimum level
MSA – Magnuson-Stevens Fishery Conservation and Management Act
NCCW – Noncontact cooling water
NE – no effect
NLAA – not likely to adversely affect
NOAA – National Oceanic and Atmospheric Administration
NOI – Notice of Intent
NPDES – National Pollutant Discharge Elimination System
NWEVC – naturally weathered Exxon Valdez crude oil
PAH – polycyclic aromatic hydrocarbons
PCB – Polychlorinated Biphenyls
PCP - pentachlorophenol
SIC – Standard Industrial Classification
T&E – threatened and endangered
TEC – threshold effect concentration
TMDL – Total Maximum Daily Load
TPAH – total polycyclic aromatic hydrocarbons
US EPA – Unites States Environmental Protection Agency
USFWS – United States Fish & Wildlife Service
WAFWA – Western Association of Fish and Wildlife Agencies

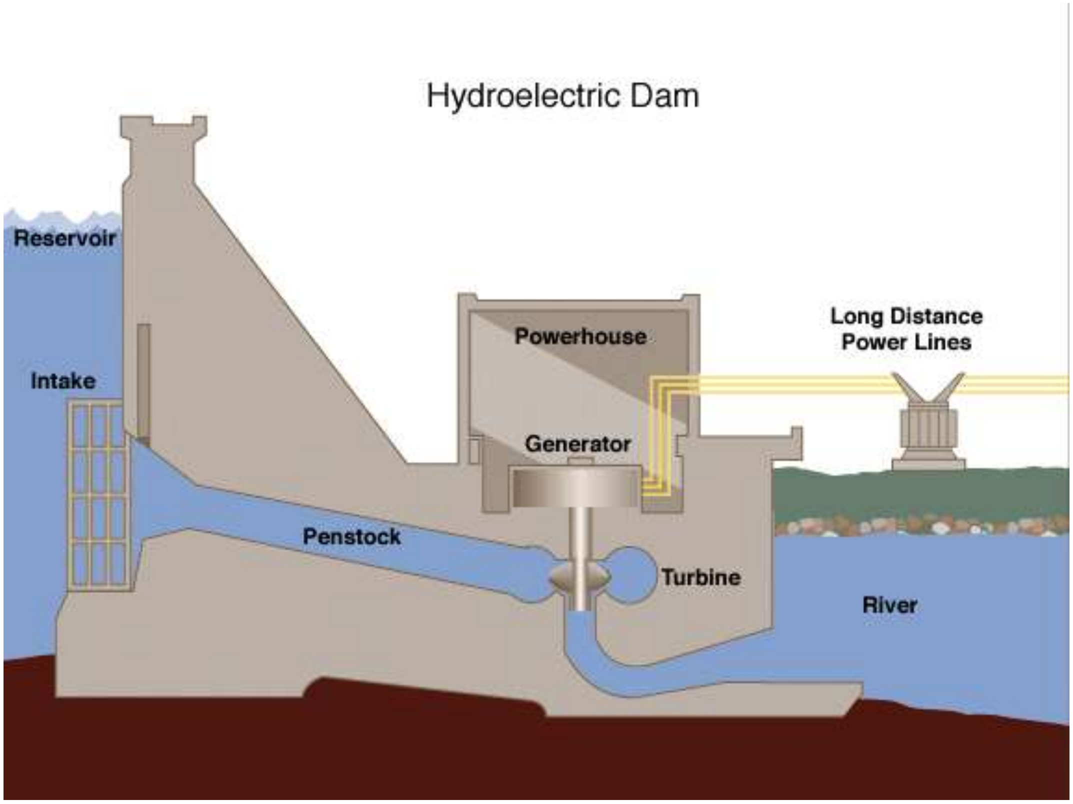
1 Description of the Proposed Action

USEPA, Region 10 is proposing to issue the National Pollutant Discharge Elimination System (NPDES) general permit to establish conditions for the discharge of pollutants from hydroelectric generating facilities to waters of the United States within the boundaries of the State of Idaho. In order to ensure protection of water quality and human health, the Hydroelectric Generating Facilities General Permit (General Permit) establishes effluent limits, monitoring requirements, and other conditions specified in the permit. The General Permit does not regulate the river flow through the turbines or over the dam. This is the first general permit issued by the EPA to hydroelectric facilities in the State of Idaho. The General Permit will authorize discharge from approximately 130 facilities located throughout the State (see Figure 2). Only those facilities who submit a Notice of Intent (NOI) will be authorized to discharge. The permit will be effective for five years. The following section provides a description of the types of hydroelectric generating facilities and the discharges that will be covered by this General Permit.

1.1 Description of Hydroelectric Generating Facilities

A hydroelectric generating facility includes the generating station (station), dam(s), reservoir(s), canal system or tunnel system, and associated equipment and structures used in the generation of hydroelectric power. The typical hydroelectric facility generates electricity through the use of falling or flowing water to drive turbine(s) and generator(s). The flow of water continuously turns the waterwheel turbines which spin the generators producing electricity. (See figure 1). Hydroelectric facilities are classified by the Standard Industrial Classification (SIC) code number 4911 for the electric services industry which is comprised of establishments engaged in electric power generation, transmission, or distribution. While each generating facility is unique in its location, physical layout, and operational pattern, all facilities contain one or more of the discharges mentioned in the discussion below.

Figure 1. General illustration of a hydroelectric Facility



There are approximately 136 known hydro-electric facilities located in the State of Idaho. Table 22 in Appendix B provides a list of facilities identified by the Northwest Power Planning Conservation Council as operating within the State of Idaho. The facilities range in size (average megawatts (MW) produced) from less than 1MW to 340 MWs per year. They discharge to a range of waterbodies from large rivers such as the Snake River, streams and creeks such as Briggs Creek, to canals such as Low Line Canal. Some facilities operate year round, others operate a few times of year. Figure 2 below is a map showing the distribution of hydroelectric facilities across the State.

1.2 Discharges from Hydro-Electric Facilities

Hydroelectric facilities discharge wastewater through outfalls located at the base of the facilities often referred to as the tailrace. The General Permit will cover three types of discharges related to hydroelectric facilities: equipment-related cooling water discharges; equipment and floor drain water operation discharges; and equipment and facility maintenance-related water operation. Large hydroelectric facilities usually have multiple outfalls of each type of discharge, while small facilities have one outfall for all discharge types. See examples of flow diagrams of a small and large hydro-electric facility in Appendix A Figures 3 - 6.

Equipment-Related Cooling Water

Facilities use river water to cool equipment resulting in discharges, of noncontact cooling water and direct cooling water to the river. Noncontact cooling water is "water used for cooling which does not come into direct contact with any raw material, intermediate product, waste product or finished product" as defined in the regulations at 40 CFR 401.11(n). The non-contact cooling water is used in cooling the turbine bearings, guide bearings, air compressor, generators, and at some stations, the power transformers. At the pump storage projects, non-contact cooling water is used in cooling additional equipment which includes the air compressors, air handlers, air conditioner, and rheostats. Direct cooling water is used to directly cool the bearings. A facility may divert certain equipment-related cooling waters to the equipment and floor drain water drainage system.

The pollutants associated with these wastewaters are oil, grease, excess heat, pH, and backwash water from cleaning of river debris and silt from the strainer's screens.

Equipment and Floor Drain Water

The equipment and floor drain water operation primarily represents the internal station drainage from the trench drains, floor drains, and station sumps. All or part of the internal station drainage is collected in the station sumps at some facilities. The equipment and floor drain water operation includes discharges from the following: floor drains, trench drains, oil/water separators, wheel pit drains or sumps, compressor blowdowns, turbine leakage, penstock housing leakage, packing boxes leakage, lower guide bearing drains and other bearing-related discharges (including bearing seal leakage, bearing water seal, and bearing lubrication water). Additional equipment waters are from various pit drains such as the gate stems, turbine access doors, and scroll case access doors. Miscellaneous drainage waters that are collected in a sump, including ground water infiltration, surface water seepage, and tunnel pumpage are also in this category. The station drainage system may include treatment units such as oil/water separators, oil flotation wells, or station sumps with some functioning as oil/water separators. These discharges can be intermittent and seasonal and the outfalls in certain stations can be inaccessible for sampling purposes.

The pollutants associated with these wastewaters are oil, grease, and pH.

Equipment and Facility Maintenance-Related Water

The equipment and facility maintenance-related water operation includes river water pumped from the facility during periods of equipment, station, and facility maintenance. During the equipment maintenance operation, discharges occur from the dewatering of equipment containing river water such as the turbine, penstock, and dewatering sumps. During flood and high water events, the station maintenance operation results in discharges of flood/high waters from flood water pumps and high water sump pumps. During these events, there may be discharges from miscellaneous flood/high water collection devices such as floor drains, siphon hoses, and access manway areas. These maintenance-related discharges are intermittent and can occur seasonally. This facility maintenance operation is the collection of internal dam or headwall drainage and the direct discharge to the receiving water without an oil/water separator installed in the drainage collection system.

The pollutants associated with these wastewaters are oil, grease, and pH.

Facility Maintenance-Related Water during Flood/High Water Events and for Equipment-Related Backwash Strainer Water

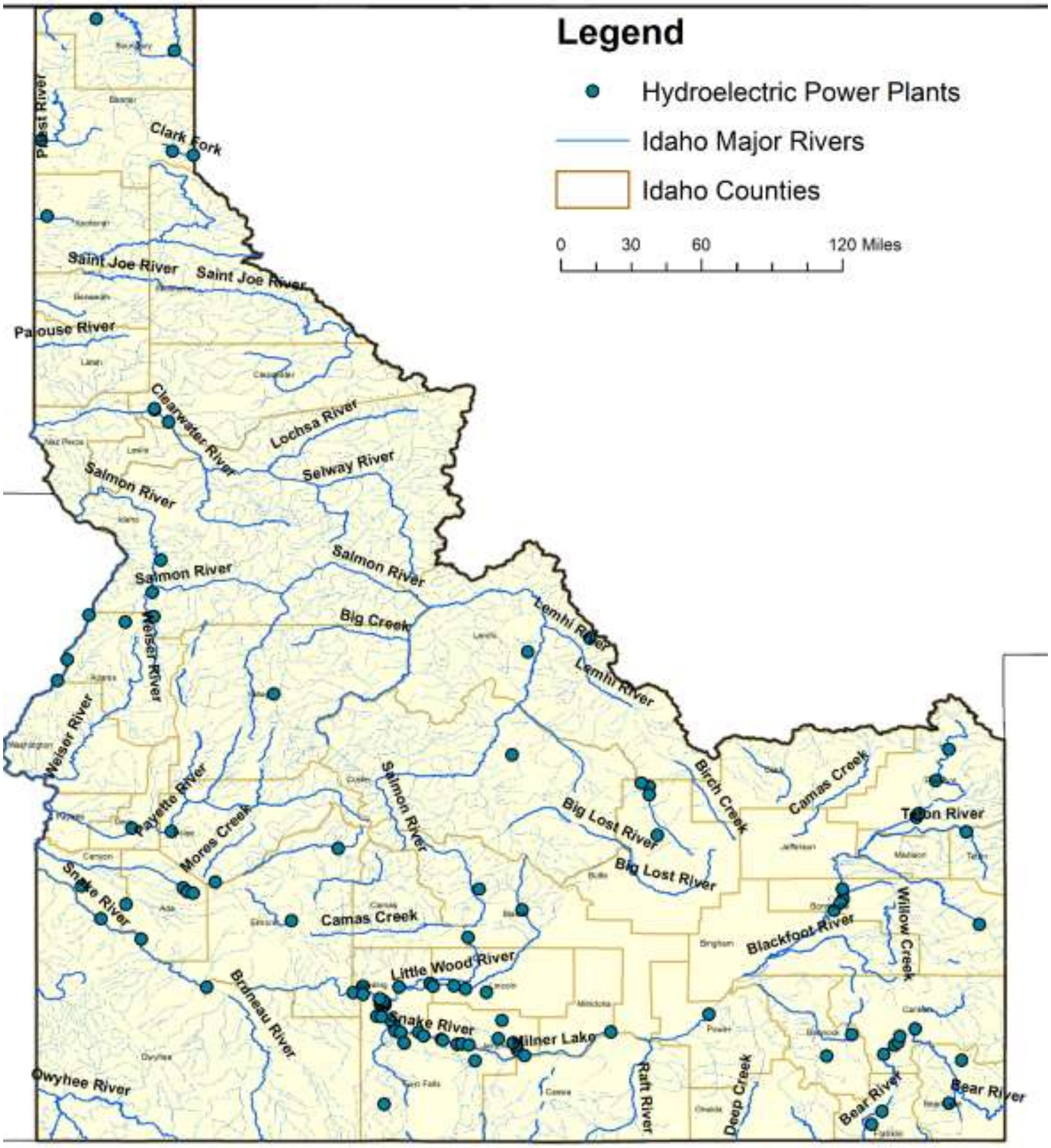
Discharges falling under this category come the need to discharge maintenance water from flood events. The discharged water comes from flood water pumps, high water sump pumps, and miscellaneous flood/high water collection devices. It may also include equipment-related backwash strainer water from the operation on the backwash strainer on the cooling water intake line.

The pollutants associated with these wastewaters are oil, grease, pH, and strainer debris.

Combination of one or more of the Above Listed Discharges

Discharges from this category would be made up of some or all of the discharges described above. The pollutants associated with this category would be a combination of all or some of the following pollutants: excess heat, oil, grease, pH, and or debris.

Figure 2. *Base map of current Hydroelectric Facilities in Idaho Discharging to Waters of the US within the State of Idaho as Identified by Northwest Power Conservation Council website.*



1.3 Scope of General Permit

The proposed hydroelectric generating facility General Permit will cover the discharges from certain outfalls from these facilities, which are described in '1.3.3 below. This General Permit will not cover waters running through, around behind, or over hydroelectric facilities. The General Permit conditions eligibility for coverage, sets discharge limitations and prohibitions, imposes monitoring and reporting requirements, requires development and implementation of Best Management Practices (BMP) Plan, and requirements to minimize impingement and entrainment of aquatic organisms in the cooling water intake structures. The permit will cover discharges of specific wastewaters from all eligible hydro-electric generating facilities in the state of Idaho and will be effective for five years.

The wastewaters regulated by this General Permit are noncontact and direct cooling water, equipment and floor drain water, equipment backwash strainer water, and specific maintenance waters from the hydroelectric facility from hydroelectric generating. Pollutants covered in this permit are: oil and grease, temperature, and pH.

1.3.1 Eligibility Requirements

Any discharger seeking coverage under the General Permit must submit a Notice of Intent (NOI) to the EPA, Idaho Department of Environmental Quality (IDEQ) and, if discharging to tribal waters to the office of the Tribal government. The NOI must include certain information in order to receive authorization to discharge under this NPDES permit. The NOI requirements are spelled out in the General Permit and include the following requirements:

Discharge information.
Line Drawing/Flow Schematic showing water flow through the facility
All Discharge Outfalls.
Chemical Additives.
Supplemental Information.

1.3.2 Hydro-electric Facilities Ineligible for Coverage

A facility with any of the following types of discharges, conditions and locations cannot receive coverage under this permit and must apply for an individual NPDES permit:

- The facility uses or proposes to use one or more cooling water intake structures with a cumulative design intake flow greater than 2 million gallons per day (mgd) and twenty-five percent or more of the water is used exclusively for cooling water purposes.
- A facility that uses toxic pollutants as listed in 40CFR'401.5 in the treatment process.
- A facility that discharges to waters within the reservations of the Nez Perce, Coeur d'Alene, Kootenai, Shoshone Bannock, and the Duck Valley Reservation of the Shoshone-Paiute tribes.
- The Director may require an individual permit based on consideration of a recommendation from the state.

Facilities ineligible for coverage under the General Permit will need to apply for an individual permit.

1.3.3 Authorized Discharges

The General Permit will authorize discharges from facilities for the following outfalls only:

- *Outfalls discharging Equipment Cooling Water* discharge equipment-related cooling water from the following operations: noncontact cooling water and direct cooling water

- *Outfalls discharging Equipment and Floor Drain Water*

  discharge equipment and floor drain water from the following operations: floor drains, trench drains, station sumps, oil/water separators, wheel pit drains or sumps, compressor blowdowns, equipment and seal leakage, lower guide bearing drains and other bearing-related discharges, various pit drains, and miscellaneous infiltration and seepage waters collected in a sump or an oil/water separator

- *Outfalls discharging Maintenance Waters*

  discharge maintenance-related water from sump dewatering

- *Outfalls discharging Facility Maintenance-related Water during Flood/High Water Events and for Equipment-Related Backwash Strainer Water*

  discharge facility maintenance-related water during flood/high water events from flood water pumps, high water sump pumps, and miscellaneous flood/high water collection devices; and to discharge equipment-related backwash strainer water from the operation of the backwash strainer on the cooling water intake line

- *Outfalls discharging a Combination of the following: Cooling water, Equipment and Floor Drain Water, Maintenance-Related Water, Maintenance-related Water During Flood/High Water Events and for Back-Wash Strainer Water.*

1.3.4 Effluent Limits and Monitoring Requirements

A review of the discharges of hydroelectric facilities permitted by other states and information gathered from other sources reveal that the pollutants of concern in the discharges are: pH, oil and grease, and, potentially temperature. There are no industrial processes associated with these facilities that would contribute other pollutants to the wastewater. The General Permit establishes effluent limits for pH and oil and grease and monitoring requirements for temperature. The tables below (Tables 1 – 5) provide the effluent limits for the five authorized discharges. In addition to the numeric effluent limits identified in the tables, the General Permit also includes the following narrative effluent restrictions:

- Solid materials shall be removed from the trash racks or intake screens and disposed of in accordance with in accordance with the Idaho Solid Waste Management Rules at IDAPA 58.01.06.
- The permittee must not discharge hazardous materials in concentrations that pose a threat to public health or impair the beneficial uses of the receiving water.
- The Permittee must not discharge toxic substances in concentrations that impair the beneficial uses of the receiving water.
- The Permittee must not discharge floating, suspended or submerged matter of any kind in concentrations causing nuisance or objectionable conditions or that may impair the beneficial uses of the receiving water. There shall be no visible oil sheen or foam other than in trace amounts.
- The Permittee must not discharge excess nutrients that can cause visible slime growth or other nuisance aquatic growths impairing beneficial uses of the receiving water.
- The Permittee must not discharge polychlorinated biphenyl (PCB) compounds such as those commonly used for transformer fluid.

***Table 1.* *Effluent limitations and monitoring requirements for equipment related cooling water*.**

Parameter	Units	Effluent Limitations	Monitoring Requirements	
		Average Monthly	Sample Frequency	Sample Type
Flow	gpd	--	1/Month	Measurement/Estimate
pH	standard units	6.5 to 9.0	1/Month	Grab
Temperature	7DADM C˚	--	Continuous	Continuous

Table 2.* *Effluent Limitations and Monitoring Requirements for Equipment and Floor Drain Water

Parameter	Units	Effluent Limitations	Monitoring Requirements	
		Average Monthly	Sample Frequency	Sample Type
Flow	gpd	--	1/Month	Measurement/ Estimate
pH	standard units	6.5 to 9.0	1/Month	Grab
Oil and Grease	mg/L	10	1/Month	Grab

Table 3.* *Effluent Limitations and Monitoring Requirements for Maintenance-Related Water

Parameter	Units	Effluent Limitations	Monitoring Requirements	
		Average Monthly	Sample Frequency	Sample Type
Flow	gpd	--	1/Maintenance Event	Measurement/ Estimate
pH	standard units	6.5 to 9.0	1/Maintenance Event	Grab
Oil and Grease	mg/L	10	1/Maintenance Event	Grab

Table 4.* *Effluent Limitations and Monitoring Requirements for Maintenance-Related Water during Flood/High Water Events and for Equipment related Backwash Strainer Water

Parameter	Units	Effluent Limitations	Monitoring Requirements

		Average Monthly	Sample Frequency	Sample Type
Flow	gpd	--	1/Event	Measurement/ Estimate
pH	standard units	6.5 to 9.0	1/Event	Grab
Oil and Grease	mg/L	10	1/Event	Measurement

***Table 5. Effluent Limitations and Monitoring Requirements for any Combination of the Following: Equipment-Related Cooling Water, Equipment and Floor Drain Water, Maintenance-Related Water, Equipment-Related Backwash Strainer Water, and Maintenance-Related Water during Flood/High Water Events*.**

Parameter	Limit and Monitor	Units	Effluent Limitations	Monitoring Requirements	
			Average Monthly	Sample Frequency	Sample Type
Flow	All	gpd	--	1/Quarter	Measurement/ Estimate
pH	All	standard units	6.5 to 9.0	1/Quarter	Grab
Oil and Grease	**1**	mg/L	10	1/Quarter	Grab
Temperature	**2**	°F	Report	Continuous	Continuous
1The effluent limitations and monitoring requirements for Oil and Grease apply to outfalls discharging equipment and floor drain water or facility maintenance-related water. **2**The effluent limitations and monitoring requirements for Temperature apply to outfalls discharging equipment-related cooling water.					

1.3.5 Operating Requirements

In addition to the numeric and narrative effluent limits and requirements to control the pollutants from hydro-electric generating facilities, the General Permit includes a set of specific best management practices to minimize the discharge of oil and grease and reduce the reliance on petroleum based lubricants. The General Permit also includes specific requirements to address the requirements of section 316(b) of the Clean Water Act to minimize the impingement and entrainment of aquatic organisms in the cooling water intake structures.

Best Management Practices Plan

Given that many hydro-electric generating facilities contain numerous sources of oil and grease, the General Permit calls for the development of Best Management Plan (BMP) plans that include practices and products that focus on reducing oil and grease spills, reducing the need for oil and grease, and replacement of petroleum based products with environmentally friendly lubricants. Additionally, the General Permit calls for BMP plans to include monitoring oil and grease usage and reporting of spills/releases. The BMP plans are to include practices that ensure:

- Oil, grease, and hydraulic fluids, from all sources, do not enter the river.
- The quantity and type of all oil products used on-site are monitored and tracked.
- Protective seals on all equipment with oil-to-water interfaces are maintained in good operating order to minimize the leaking of hydraulic oil or other oils
- Reduction in the reliance for lubricants for all facility equipment that come in contact with river water such as spill gate mechanisms, turbine gate mechanisms, etc.
- Substitution Environmentally Acceptable Lubricant (EAL) in all oil to water interfaces, unless technically infeasible. For purposes of requirements related to EALs, technically infeasible means that no EAL products are approved for use in a given application that meet manufacturer specifications for that equipment; products which come pre- lubricated (e.g., wire ropes) have no available alternatives manufactured with EALs; or products meeting a manufacturers specifications are not available.
- Preventative maintenance and cleaning program for turbine and wicket gate parts.
- Regular inspection of fuel hoses, oil drums, oil or fuel transfer valves and fittings, etc to prevent drips or leaks.
- Preventive maintenance program for internal facility drainage water management devices (e.g., cleaning oil/water separators, pits, sumps) that includes inspection and testing to uncover conditions that could cause breakdowns or failures resulting in discharges of pollutants to surface waters, and ensuring appropriate maintenance of such equipment and systems.
- Proper operation of the oil/water separators through inspections at appropriate intervals, regularly scheduled maintenance, and by review of sampling data.

Cooling Water Intake Structure Requirements

Hydro-electric generating facilities with a design intake flow of less than 2 MGD and use less than 25% of their water for cooling water purposes, are required to implement Section 316(b) on a case-by-case basis to minimize the adverse environmental effects of a cooling water intake structure (CWIS), specifically to minimize the entrainment and impingement of aquatic organisms.

The EPA Region 10 drew on several sources to inform the 316(b) requirements in the General Permit. The EPA reviewed relevant requirements from the States of Idaho, Oregon, and Washington as well as from federal wildlife agencies. The fish and wildlife agencies of the three states and the National Marine Fisheries Agency have developed guidelines for fish screen design criteria and are found in Anadromous Salmonid Passage Facility Design, NMFS- Northwest Region, July 2011. http://www.westcoast.fisheries.noaa.gov/publications/hydropower/fish_passage_design_criteria.pdf. These guidelines represent the best information on intake screen design for the Pacific Northwest and the EPA believes facilities using these design standards would lead to reducing the adverse impacts of CWIS.

The General Permit calls for facilities that fall under this category to implement the following Best Technology Available (BTA) requirements to minimize the adverse environmental effects of CWISs:

- Manage the intake operations to minimize injury to resident fish and other aquatic species in the river
- Manage tailrace operations to prevent fish access to the draft tube areas to minimize injury of fish and other aquatic species.
- Cease or reduce the intake of cooling water whenever withdrawal of source water is not necessary, i.e. during equipment testing or maintenance activities;
- Return all observed live impinged fish to the source water to the extent practicable in a manner that maximizes their chance of survival;
- Do not spray impinged fish or invertebrates with chlorinated water;

- Each permittee covered by the General Permit must design, conduct and document an impingement and entrainment monitoring program based on site-specific factors at its facility and report the results to the USEPA;
- Implement measures and practices for minimizing impingement required and/or recommended by Idaho State Department of Fish and Game and USFWS, and NMFS;
- Implement measures and practices for minimizing entrainment required and/or recommended by Idaho Department of Fish and Game, USFWS, NMFS;
- The Permittee must, at all times, properly operate and maintain the CWIS including any existing technologies used to minimize impingement and entrainment and report any significant impingement or entrainment events to U.S. EPA Region 10 within 24 hours;

In addition to the above BTA requirements, the General Permit requires the permittee to prepare a report, providing information on the waterbody that is the source of the cooling water, a biological characterization of the waterbody, and information on the configuration and operation of the CWIS itself. This information is to inform the permit writing authority on whether additional requirements may be necessary in next permit cycle to minimize impingement and entrainment.

Reporting Requirements

The General Permit includes the standard monitoring and reporting requirements required of all facilities with NPDES permit. General monitoring, recording, and reporting requirements include a representative sampling (of routine and non-routine discharges), monitoring procedures, reporting of monitoring results, additional monitoring by the permittee, maintenance and retention of certain records, 24-hour notice of noncompliance reporting, other noncompliance reporting (not falling under the 24-hour requirement), and changes in discharge of toxic substances. These topics are covered in detail in the permit.

2 Threatened and Endangered Species

The complete list of the federally listed, threatened and endangered species that are known or suspected to occur in Idaho State are listed in the Table 6 below. The Table identifies the counties in which the species are found, whether Critical Habitat is designated, and the ESA status. The USEPA R10 identified the species of concern for this Biological Evaluation (BE) based on a screen of the listed species life history. Species dependent on water for all or most of their life histories were identified as species of concern. Table 7 lists the species of concern covered in this BE.

The primary action that is evaluated in this BE is the issuance of a general NPDES permit for wastewater discharges from hydroelectric facilities located in Idaho. To be affected by this action, either directly or indirectly, a species must have at least some portion of their life history occurring within waters where hydroelectric facilities discharge.

All five terrestrial mammals and bird species will not be affected by the hydroelectric general permit. These species do not inhabit the river and streams where the hydroelectric facilities are found and would not be exposed to any possible effects from this action. Therefore, these mammal and bird species are assigned a **NO EFFECT** determination and will not be addressed further in this BE.

Four terrestrial plant species, MacFarlane's Four-o'clock, Spalding's Catchfly, Slickspot Peppergrass, and Whitebark Pine will not be affected by the hydroelectric general permit. These species do not inhabit the river and streams where the hydroelectric facilities are found and would not be exposed to any possible effects from this action. Therefore, these plant species are assigned a **NO EFFECT** determination and will not be addressed further in this BE.

Table 6. ESA Listed and Candidate Species found within the State of Idaho

Species	**Idaho Counties**	**Critical Habitat**	**Status**
Fish			
Bull Trout (Salvelinus confluentus)	Adams, Benewah, Blaine, Boise, Bonner, Boundary, Butte, Camas, Clearwater, Custer, Elmore, Gem, Idaho, Kootenai, Lemhi, Lewis, Nez Perce, Owyhee, Shoshone, Valley, Washington	Yes	Threatened
Snake River Fall and Spring/Summer Chinook Salmon (Oncorhynchus tshawytscha)	Adams, Clearwater (fall run), Custer, Idaho, Latah (fall run), Lemhi, Lewis, Nez Perce, Valley	Yes	Threatened
Snake River Steelhead (Oncorhynchus mykiss)	Adams, Blaine, Clearwater, Custer, Idaho, Latah, Lemhi, Lewis, Nez Perce, Valley.	Yes	Threatened
Kootenai River White Sturgeon (Acipenser transmontanus)	Bonner and Boundary Counties	Yes	Endangered
Snake River Sockeye Salmon (Oncorhynchus nerka).	Ada, Adams, Bannack, Blaine, Bingham, Bonneville, Canyon, Elmore, Gooding, Idaho, Jefferson, Jerome, Madison, Minidoka, Nez Perce, Owyhee, Payette, Washington	Yes	Endangered
Invertebrates			

Banbury Springs Lanx (Lanx sp.)	Gooding County	No	Endangered
Bliss Rapids Snail (Taylorconcha serpenticola)	Elmore, Gooding, Jerome, and Twin Falls counties	No	Threatened
Bruneau Hot Spring Snail (Pyrgulopsis brunaeuensis)	Owyhee county	No	Endangered
Snake River Physa Snail (Physa natricina)	Ada, Canyon, Cassia, Elmore, Gooding, Jerome, Minidoka, Owyhee, Payette, and Twin Falls counties	No	Endangered
Mammals			
Canada Lynx (Lynx Canadensis	Adams, Bear Lake*, Blaine, Boise, Bonner, Bonneville, Boundary, Butte*, Camas, Caribou, Clark, Clearwater, Custer, Elmore, Fremont, Idaho, Jerome *, Kootenai*, Latah, Lemhi, Lewis*, Nez Perce, Oneida*, Power, Shoshone, Teton, Twin Falls*, Valley	Yes	Threatened
Grizzly Bear (Ursus arctos)	Bonner, Boundary, Clark, Fremont, and Teton counties	No	Threatened
Northern Idaho Ground Squirrel (Spermophilus brunneus brunneus)	Valley, Washington, Adams, Gem, and Idaho counties	No	Threatened
Selkirk Mountains Woodland Caribou (Rangifer tarandus caribou)	Bonner and Boundary counties	Yes	Endangered
Birds			
Yellow-billed Cuckoo (Coccyzus americanus	Western U.S. DPS	Yes	Threatened
Plants			
MacFarlane's Four-o'clock (Mirabilis macfarlanei)	Idaho , Lewis, and Nez Perce counties	No	Threatened
Spalding's catchfly (Silene spaldingii)	Adams, Benewah, Clearwater, Idaho, Kootenai, Latah, Lewis, and Nez Perce counties	No	Threatened
Ute Ladies' Tresses (Spiranthes divulvialis)	Bannock, Bingham, Bonneville, Fremont, Jefferson, Madison, and Teton counties	No	Threatened
Water Howelia (Howelia aquatilis)	Benewah, Clearwater, Idaho, Latah, Lewis, and Nez Perce counties	No	Threatened
Slickspot Peppergrass (Lepidium papilliferum)	Ada, Boise, Canyon, Elmore, Gem, Owyhee, Payette , and Twin Falls counties	No	Threatened
	Candidate Species		
Southern Idaho Ground Squirrel (Spermophilus brunneus endemicus)	Adams, Gem, Payette, and Washington counties	No	Candidate
Whitebark Pine (Pinus albicaulis)	Benewah, Bonner, Boundary, Clearwater, Kootenai, Idaho, Latah, Lemhi, Lewis, Nez Perce, Shoshone	No	Candidate

Table 7. Threatened & Endangered Species Assessed in this Biological Evaluation

Species	**Idaho Counties Containing or Bordering Rivers and Hydrologic Units Designated as Critical Habitat**	**Critical Habitat**	Status
Fish			
Bull Trout (Salvelinus confluentus)	Adams, Benewah, Blaine, Boise, Bonner, Boundary, Butte, Camas, Clearwater, Custer, Elmore, Gem, Idaho, Kootenai, Lemhi, Lewis, Nez Perce, Owyhee, Shoshone, Valley, Washington	Yes 75 FR no200 pg. 63898, 10/18/2010,	Threatened 62FR58910 Nov 1, 1999
Snake River Fall and Spring/Summer Chinook Salmon (Oncorhynchus tshawytscha)	Adams, Clearwater (fall run), Custer, Idaho, Latah (fall run), Lemhi, Lewis, Nez Perce, Valley	Yes 10/25/99 64FR57399 50CFR Part 226	Threatened 70 FR37160 June 28, 2005
Snake River Steelhead (Oncorhynchus mykiss)	Adams, Blaine, Clearwater, Custer, Idaho, Latah, Lemhi, Lewis, Nez Perce, Valley.	Yes September 2, 2005 (70FR52630).	Threatened 71 FR 834 Jan.5,2006
Kootenai River White Sturgeon (Acipenser transmontanus)	Bonner and Boundary Counties	Yes 73 FR 39506 July 9, 2008	Endangered 59FR45989 Sept 6, 1994
Snake River Sockeye Salmon (Oncorhynchus nerka).	Idaho, Blaine, Custer, Lemhi, Lewis, Nez Perce,	Yes FR Notice: 70 FR 37160 Date: 6/28/2005	Endangered 58FR68543 Dec 28, 1993 70FR37160 June 28, 2005
Invertebrates			
Banbury Springs Lanx (Lanx sp.)	Gooding County	No	Endangered Dec 12, 1992
Bliss Rapids Snail (Taylorconcha serpenticola)	Elmore, Gooding, Jerome, and Twin Falls counties	No	Threatened 57FR59244 Dec 14, 1992
Bruneau Hot Spring Snail (Pyrgulopsis brunaeuensis)	Owyhee county	No	Endangered 63FR32981 June 17, 1998
Snake River Physa Snail (Physa natricina)	Ada, Canyon, Cassia, Elmore, Gooding, Jerome, Minidoka, Owyhee, Payette, and Twin Falls counties	No	Endangered 57FR59244 Jan 13, 1993
Plants			
Ute Ladies' Tresses (Spiranthes divulvialis)	Bannock, Bingham, Bonneville, Fremont, Jefferson, Madison, and Teton counties	No	Threatened 57FR2048205 Jan 1, 1992
Water Howellia (Howellia aquatilis)	Benewah, Clearwater, Idaho, Latah, Lewis, and Nez Perce counties	No	Threatened 59 FR 35860 July 14, 1994

2.1 Species Status, Life History, and Distribution for Species of Concern

This section provides status and life history information for the species covered in this Biological Evaluation.

2.1.1 Snake River Fall Chinook Salmon

Description

The Chinook salmon (Oncorhynchus tshawytscha) is located in the Snake, Salmon and Clearwater rivers. They prefer streams that are deeper and larger than those used by other Pacific salmon species. Spawning sites have larger gravel and more water flow up through the gravel than the sites used by other Pacific salmon. Chinook salmon are highly migratory.

Juveniles may spend from three months to two years in freshwater streams and rivers before migrating to estuarine areas as smolts and then into the ocean to feed and mature. Chinook salmon remain at sea commonly for 2 to 4 years. Once they have matured at sea, they return to freshwater to breed and die. In Idaho, adults return to the Snake, Salmon and Clearwater rivers. Idaho's Chinook salmon are often loosely separated into three groups - Spring, Summer and Fall, based on their size and ocean life history. Eggs are deposited at a time to ensure that young salmon fry emerge during the following spring when the river or estuary productivity is sufficient for juvenile survival and growth. Chinook feed on terrestrial and aquatic insects, amphipods, and other crustaceans while young, and primarily on other fishes when older. Adults returning to spawn do not eat; they live off their fat reserves (IDFG 2010b).

This ESU was listed as threatened on June 28, 2005. The 11/2/94 Emergency Rule (59 FR 54840), reclassifying Snake River Chinook from threatened to endangered, expired on May 26, 1995.

Distribution

The Snake River Basin drains an area of approximately 280,000 km2 and incorporates a range of vegetative life zones, climatic regions, and geological formations. The Snake River ecological significance unit (ESU) includes the mainstream river and all tributaries, from their confluence with the Columbia River to the Hells Canyon Dam complex. Because genetic analyses indicate that fall-run Chinook salmon in the Snake River are distinct from the spring-summer-run in the Snake River Basin (Waples et al. 1991), Snake River fall-run Chinook salmon are considered separately from the other two forms. They are also considered separately from those assigned to the Upper Columbia River summer- and fall-run ESU because of considerable differences in habitat characteristics and adult ocean distribution, and less definitive, but still significant, genetic differences. There is, however, some concern that recent introgression from Columbia River hatchery strays is causing the Snake River population to lose the qualities that made it distinct for ESA purposes.

Threats to Species

Almost all historical Snake River fall-run Chinook salmon spawning habitat in the Snake River Basin was blocked by the Hells Canyon Dam complex; other habitat blockages have also occurred in Columbia River tributaries. The ESU's range has also been affected by agricultural water withdrawals, grazing, and vegetation management. The continued straying by nonnative hatchery fish into natural production areas is an additional source of risk. Limiting factors and threats to Snake River Fall Chinook include lost access to historic spawning and rearing habitat above the Hells Canyon Dam complex; mainstem Columbia and Snake River hydropower impacts to spawning, rearing, and migration habitat; alteration to freshwater habitat caused by upriver dams and water management (altered river flow and temperature regimes, dissolved oxygen, substrate condition, and riparian vegetation), and hatchery and harvest related effects.

Recovery Plans

Efforts are underway to conserve and enhance natural Chinook salmon populations by improving seaward migration survival, restoring habitat, reducing harvest and modifying hatchery operations to reduce negative effects on wild fish.

Critical Habitat

The critical habitat for the Snake River Fall Chinook salmon was listed on December 28, 1993 (58 FR 68543) and modified on March 9, 1998 (63 FR 11515) to include the Deschutes River (Table).

Critical habitat in the Snake River includes its tributaries in Idaho, Oregon, and Washington (exclusive of the upper Grande Ronde River and the Wallowa River in Oregon, the Clearwater River above its confluence with Lolo Creek in Idaho, and the Salmon River upstream of its confluence with French Creek in Idaho). Excluded are areas above specific dams (see March 9, 1998, 63 FR 11519) or above longstanding, naturally impassable barriers (e.g., natural waterfalls in existence for at least several hundred years).

2.1.2 Snake River Spring and Summer Chinook Salmon

Description

In the Snake River, spring and summer Chinook are both stream-type fish, with juveniles that migrate to sea as yearling smolts. Depending primarily on location within the basin (and not on run type), adults tend to return after either 2 or 3 years in the ocean. Most Snake River spring/summer Chinook salmon enter individual subbasins from May through September. Juvenile Snake River spring/summer Chinook salmon emerge from spawning gravels from February through June (Bjornn and Peery 1992). Typically, after rearing in their nursery streams for about 1 year, smolts begin migrating seaward in the period from April through May (Bugert et al. 1990, as cited in Matthews and Waples 1991; Cannamela 1992, as cited in NMFS 1999b). After reaching the mouth of the Columbia River, spring/summer Chinook salmon probably inhabit near-shore areas before beginning their northeast Pacific Ocean migration. For detailed information on the life history and stock status of Snake River spring/summer Chinook salmon, see Matthews and Waples (1991), NMFS (1995), and 56 FR 29542 (June 27, 1991).

This ESU was listed as threatened on June 28, 2005. The 11/2/94 Emergency Rule (59 FR 54840), reclassifying Snake River Chinook from threatened to endangered, expired on May 26, 1995.

Distribution

Snake River spring-run and/or summer-run Chinook salmon are found in several subbasins of the Snake River (CBFWA 1990). Of these, the Grande Ronde and Salmon Rivers are large, complex systems composed of several smaller tributaries that are further composed of many small streams. In contrast, the Tucannon and Imnaha Rivers are small systems with most salmon production in the main river. In addition to these major subbasins, three small streams, Asotin, Granite, and Sheep Creeks, which enter the Snake River between Lower Granite and Hells Canyon Dams, provide small spawning and rearing areas (CBFWA 1990). Although there are some indications that multiple ESUs may exist within the Snake River Basin, the available data do not clearly demonstrate their existence or define their boundaries.

Threats to Species

Recent trends in redd counts in major tributaries of the Snake River indicate that many subpopulations could be at critically low levels. Subpopulations in the Grande Ronde River, Middle Fork Salmon River, and Upper Salmon River Basins are at particularly high risk. Both demographic and genetic risks would be of concern for such subpopulations, and in some cases, habitat may be so sparsely populated that adults have difficulty finding mates. The National Oceanic and Atmospheric Administration (NOAA)

Fisheries estimates that the median population growth rate (lambda) over a base period from 1980 through 1998 ranges from 0.96 to 0.80, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared with the effectiveness of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000). In 2002, the fish count at Lower Granite Dam was 75,025, more than double the 10-year average. Estimated hatchery Chinook at Lower Granite Dam accounted for a minimum of 69.7 percent of the run. The spring Chinook count in the Snake River was at the all-time low of about 1,500 as recently as 1995, but in 2001 and 2002 both hatchery and wild/natural returns to the Snake River increased (FPC 2003).

Recovery Plans

Efforts are underway to conserve and enhance natural Chinook salmon populations by improving seaward migration survival, restoring habitat, reducing harvest and modifying hatchery operations to reduce negative effects on wild fish.

Critical Habitat

The critical habitat for the Snake River spring/summer Chinook salmon was listed on December 28, 1993, (58 FR 68543). The designated habitat consists of river reaches of the Columbia, Snake, and Salmon Rivers, and all tributaries of the Snake and Salmon Rivers (except the Clearwater River) presently or historically accessible to Snake River spring/summer Chinook salmon (except reaches above impassable natural falls and Hells Canyon Dam).

2.1.3 Snake River Sockeye Salmon

Description

Snake River sockeye population uses the mainstem Salmon River as a migration corridor between freshwater spawning and rearing areas in the Stanley basin of the Sawtooth National Forest and saltwater feeding grounds. This population is distinctive because of its long freshwater migration (approximately 1500km) and high elevation spawning (2000m) relative to other sockeye populations. Both resident and anadromous forms reside in Redfish Lake. Sockeye spawn along the lake's shoals in October and November while, resident sockeye spawn in a tributary of Redfish Lake during August and September (NMFS 1991).

Juveniles rear in a lake for one or two years and smolts out-migrate in spring from April through June. Ocean residency is two to three years. Juvenile and adult migration corridors include the lakes above inlets and outlet creeks, Alturas Lake Creek, Valley Creek between Stanley Lake Creek and the Salmon River, the main fork of the Salmon River, the Snake River, and the Columbia River to the Pacific Ocean (NMFS 1993).

Distribution

The only remaining anadromous sockeye in the Snake River system are found in Redfish Lake, on the Salmon River. The non-anadromous form (kokanee), found in Redfish Lake and elsewhere in the Snake River Basin, is included in the ESU. Snake River sockeye were historically abundant in several lake systems of Idaho and Oregon. However, all populations have been extirpated in the past century, except fish returning to Redfish Lake.

Threats to Species

The ESU was first listed as endangered under the ESA in 1991, the listing was reaffirmed in 2005 (70FR 37160 &37204). Reasons for the decline of this species include high levels of historic harvest, dam construction including hydropower development on the Snake and Columbia Rivers, water diversions and water storage, predation on juvenile salmon in the mainstem river migration corridor, and active eradication of sockeye from Pettit, Stanley, and Yellowbelly Lakes in the 1950s and 1960s (56FR58619; ICBTRT2003). On August 15, 2011, NMFS completed a 5-year review for the Snake River sockeye salmon ESU and concluded that the species should remain listed as endangered (76FR50448).

Limiting factors affecting Snake River sockeye survival include the impacts of the Snake and Columbia hydrosystem on migrating juvenile sockeye; predation on juvenile sockeye in the migration corridor; and poor water quality and high temperature faced by returning adults in portions of the migration corridor in the Salmon River (IDEQ 2011). The natural hydrological regime in the upper mainstem Salmon River Basin has been altered by water withdrawals, which can lead to elevated summer water temperatures. In many years, sockeye adult returns to Lower Granite Dam suffer relatively high losses before reaching the Sawtooth Valley, perhaps due to high migration corridor water temperatures and poor initial fish condition or parasite loads.

Recovery Plans

Restoration of sockeye populations will depend on a combination of efforts, including flushing water over dams during seaward migration periods, improving habitat, increasing survival of juveniles migrating to the ocean and restricting harvest. Idaho's sockeye recovery plan also calls for restoring natural river flows to speed up downstream migration.

Critical Habitat

The critical habitat for the Snake River sockeye salmon was designated on December 28, 1993 (58 FR 68543). The designated habitat in Idaho consists of all mainstem river segments and tributary streams that comprise the Salmon River and Alturas Lake Creek, Valley Creek, and Stanley, Redfish, Yellow Belly, Pettit, and Alturas Lakes (including their inlet and outlet creeks).

2.1.4 Snake River Steelhead

Description

The steelhead (Oncorhynchus mykiss) is found in the Snake, Salmon and Clearwater rivers. Steelhead are capable of surviving in a wide range of temperature conditions, but do best where dissolved oxygen concentration is at least 7 parts per million. In streams, deep low-velocity pools are important wintering habitats. They use areas of gravel or cobble for spawning and females dig redds in a riffle area below a pool. Steelhead are migratory, anadromous, and, in Idaho, are often classified into two groups, A-run and B-run, based on their size and ocean life history. Idaho's A-run steelhead are usually found in the Snake and Salmon rivers. They return from the ocean earlier in the year (usually June through August) and they most often return after spending one year in the ocean. The B-run steelhead most often return to the Clearwater River, but some return to tributaries in the Salmon River. These fish usually spend two years in the ocean, and start their migration to Idaho later in the summer or fall of the year (usually late August or September). Most steelhead require 3 to 5 years to reach sexual maturity and unlike other Pacific salmonids they can spawn more than one time. The young fish live in the stream and migrate to the ocean, usually after two years of rearing in the stream. When they mature and are ready to spawn, steelhead migrate back to the place they were born. Their maximum lifespan is about 11 years. Young steelhead feed primarily on zooplankton. Adults feed on aquatic and terrestrial insects, mollusks, crustaceans, fish eggs, minnows, and other small fishes (including other trout) (IDFG 2010c).

Distribution

This inland steelhead ESU occupies the Snake River Basin of southeast Washington, northeast Oregon, and Idaho. The Snake River flows through terrain that is warmer and drier on an annual basis than the upper Columbia Basin or other drainages to the north. Geologically, the land forms are older and much more eroded than most other steelhead habitat. Collectively, the environmental factors of the Snake River

Basin result in a river that is warmer and more turbid, with higher pH and alkalinity, than is found elsewhere in the range of inland steelhead. In many Snake River tributaries, spawning occurs at a higher elevation (up to 2,000 m) than for steelhead in any other geographic region.

Threats to Species

Limiting factors affecting Snake River steelhead survival include the impacts of the Snake and Columbia hydrosystem on migrating juvenile steelhead; predation on juvenile sockeye in the migration corridor; and poor water quality and high temperature faced by returning adults in portions of the migration corridors; poor water quality of spawning and rearing habitat in tributary streams the Snake River Basin.

Recovery Plans

Efforts are underway to conserve and enhance natural steelhead populations by improving seaward migration survival, restoring habitat, reducing harvest and modifying hatchery operations to reduce negative effects on wild fish.

Critical Habitat

Critical Habitat was designated for the Snake River steelhead ESU on February 16, 2000 (59 FR 7764) and revised on September 2, 2005 (70 FR 52630). This designation encompasses historically accessible reaches of all rivers and tributaries with this ESU's range (excludes areas above Hells Canyon Dam, Dworshak Dam, and Napias Falls on Napias Creek). Critical habitat has been designated in Adams, Blaine, Clearwater, Custer, Idaho, Latah, Lemhi, Lewis, Nez Perce, and Valley counties.

Primary constituent elements (PCEs) for Snake River Spring, Summer, Fall Chinook, Steelhead, and Sockeye

In 1993, NMFS determined that the critical habitat designations for SR fall-run Chinook salmon would focus on the physical and biological features of the habitat that are essential to the conservation of the species. In 2005, in designating critical habitat for SRB Steelhead NMFS focused on certain habitat features called "primary constituent elements" (PCEs) that are essential to support one or more of the life stages of salmon and steelhead. The 2005 designations also analyzed areas that will provide the greatest biological benefits for listed salmon and balance the economic and other costs for areas considered for designation. The species addressed in this document occupy the same geographic areas and have similar life history characteristics and, therefore, require many of the same habitat functions provided by critical habitat. The critical habitat designation lists these critical functions as essential physical and biological features and the critical habitat designation lists these as PCEs; however, they function the same for all listed species. The PCEs are identified for Snake River Spring/Summer and Fall chinook, Snake River sockeye, and Snake River steelhead are listed below in Tables A. and B.

Table A Primary constituent elements (PCEs) of critical habitats designated for SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, and SR sockeye salmon, and corresponding species life history events.

Primary Constituent Elements		**Species Life History Event**
Site	**Site Attribute**	
Spawning and juvenile rearing areas	Access (sockeye) Cover/shelter Food (juvenile rearing) Riparian vegetation Space (Chinook) Spawning gravel	Adult spawning Embryo inclubation Alevin development Fry emergence Fry/parr growth and development Fry/parr smoltification

	Water quality Water temperature (sockeye) Water quantity	Smolt growth and development
Juvenile migration corridors	Cover/shelter Food Riparian vegetation Safe passage Space Substrate Water quality Water quantity Water temperature Water velocity	Fry/parr seaward migration Smolt growth and development Smolt seaward migration
Adult migration corridors	Cover/shelter Riparian vegetation Safe passage Space) Substrate Water quality Water quantity Water temperature Water velocity	Adult sexual maturation Adult "reverse smoltification" Adult upstream migration Kelt (steelhead) seaward migration

Table B. Primary constituent elements (PCEs) of critical habitats designated for Pacific salmon and steelhead species (except SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, and SR sockeye salmon), and corresponding species life history events.

Primary Constituent Elements		**Species Life History Event**
Site Type Site	**Site Attribute**	
Freshwater spawning	Substrate Water quality Water quantity	Adult spawning Embryo incubation Alevin development
Freshwater rearing	Flood plain connectivity Forage Natural cover Water quality Water quantity	Fry emergence Fry/parr growth and development
Freshwater migration	Free of artificial obstructions Natural cover Water quality Water quantity	Adult sexual maturation Adult upstream migration Kelt (steelhead) seaward migration Fry/parr seaward migration

2.1.5 Bull Trout

Description

The bull trout (Salvelinus confluentus) is located throughout Idaho, in all but the eastern section. It can be found in streams, rivers, and lakes and depends on cold, clear water. After hatching, fry rear in low velocity water and find cover in substrate interstices and are associated with cobble and boulders or submerged fine debris. Juveniles prefer to be close to the substrate or some other cover which creates visual isolation. Strong populations require high stream channel complexity. Channel stability, winter high flows, summer low flows, substrate, cover, temperature, and the presence of migratory corridors influence distribution and abundance. Bull trout exhibit two distinct life history forms, resident and migratory. Resident populations generally spend their entire lives in small headwater streams, while migratory bull trout rear in tributary streams for several years before either migrating into large rivers or lakes. They spawn in the fall, primarily September and October. They may spawn every year or in alternate years. Decreasing water temperatures may influence the onset of spawning. Hatching is completed in 100 to 145 days, usually the end of January. Hatchlings emerge from the stream bed approximately in April. Out-migrating bull trout migrate around age 2 to 3 years during the spring or summer. Juvenile bull trout feed on macroinvertebrates, with preference for mayflies and flies, stoneflies, caddisflies, and beetles, while adults are opportunistic fish eaters (Batt 1996).

Distribution

The Columbia River population segment is from the northwestern United States and British Columbia, Canada. This population segment comprises 386 bull trout populations in Idaho, Montana, Oregon, and Washington, with additional populations in British Columbia. The Columbia River population segment includes the entire Columbia River Basin and all its tributaries, excluding the isolated bull trout populations found in the Jarbridge River in Nevada. Bull trout populations within the Columbia River population segment have declined from historic levels and are generally considered to be isolated and remnant.

Threats to Species

Bull trout are vulnerable to many of the same threats that have reduced salmon populations. Because of their need for very cold waters and long incubation time, bull trout are more sensitive to increased water temperatures, poor water quality, and degraded stream habitat than many other salmonids. Further threats to bull trout include hybridization and competition with nonnative brook trout, brown trout, and lake trout; overfishing; poaching; and man-made structures that block migration (USFWS 2002a).

In many areas, continued survival of the species is threatened by a combination of factors rather than one major factor. For example, past and continuing land management activities have degraded stream habitat, especially along larger river systems and streams located in valley bottoms. Degraded conditions have severely reduced or eliminated migratory bull trout as water temperature, stream flow, and other water quality parameters fall below the range of conditions that these fish can tolerate. In many watersheds, remaining bull trout are smaller, resident fish isolated in headwater streams. Brook trout, introduced throughout much of the range of bull trout, easily hybridize with them, producing sterile offspring. Brook trout also reproduce earlier and at a higher rate than bull trout, so bull trout populations are often supplanted by these non-natives. Dams and other in-stream structures also affect bull trout by blocking migration routes, altering water temperatures, and killing fish as they pass through and over dams or are trapped in irrigation and other diversion structures (USFWS 2002a).

Recovery Plans

The goal of the bull trout recovery plans for the Recovery Units are to ensure the long-term persistence of self-sustaining, complex interacting groups of bull trout distributed across the species' range so that the species can be delisted. To recover bull trout in the Recovery Units, the following objectives have been identified:

- Maintain current distribution of bull trout and restore distribution in previously occupied or depressed areas within the recovery unit;
- Maintain stable or increasing trends in bull trout abundance,
- Restore and maintain suitable habitat conditions for all bull trout life stages; and
- Conserve genetic diversity and provide opportunity for genetic exchange (USFWS 2002b).

Critical Habitat

On September 30, 2010, the U.S. Fish and Wildlife Service designated critical habitat for bull trout throughout their U.S. range (75 FR 63898). 8,772 stream miles and 170,218 acres of lakes or reservoirs were designated as critical habitat in Idaho. Critical habitat units in Idaho include the Clark Fork River

Basin, Kootenai River Basin, Coeur d'Alene River Basin, Little Lost River, Salmon River, Southwest Idaho Basins, Jarbridge River, Mainstem Snake River, Clearwater River, Hells Canyon Complex, and Sheep/Granite Creeks.

Primary Constituents Elements (PCE)

The PCE for bull trout have been identified include:

- springs, seeps, groundwater sources, and hyporheic flows to contribute to water quality and quantity and provide thermal refugia;
- minimal migration impediments between the habitats that support the various life history stages;
- abundant food base; complex river, stream, lake, reservoir, aquatic environments and process;
- complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes
- water temperatures ranging from 2 to 15C, with adequate thermal refugia available for temperatures that exceed the upper end of this range;
- Spawning and rearing areas with sufficient amount, size, and composition of substrate with minimal fine sediment;
- Natural hydrograph;
- Sufficient water quality and quantity; and
- Sufficiently low levels of nonnative predatory, interbreeding, or competing species

2.1.6 Kootenai River White Sturgeon

Description

The white sturgeon (Acipenser transmontanus) is landlocked in Idaho and restricted to 168 river miles of the Kootenai River. These 168 river miles are between Kootenai Falls (31 miles below Libby Dam) and Kootenay Lake. In general, white sturgeon requires rocky substrates for spawning and attachment of eggs and have in-water minimum flow, depth, and temperature requirements on at least an intermittent basis during the spawning period from May through the end of June. Although rocky substrates do not seem to be a cue for spawning site selection, they appear to be essential to the viability of eggs and the survival of free embryos. In other areas where white sturgeon is reliably reproducing and recruiting, the river bed at spawning sites typically consists of several miles of gravel, cobble, and boulder substrates that provide shelter and cover during this free embryo hiding phase. Many Kootenai sturgeons spend part of their lives in Kootenay Lake in British Columbia and migrate upstream to spawn in the Kootenai River. The sturgeon has been described as having a unique two-step pre-spawning migration process, migrating first from the lower river and Kootenay Lake during autumn to staging reaches in the Kootenai River, then migrating in spring to the spawning reach near Bonners Ferry, Idaho. White sturgeon spawn in fast-flowing water, and water velocity appears to act as a cue for spawning. Based upon recent studies, Kootenai River white sturgeon spawn during the period of historical peak flows from May through July. Spawning at peak flows with high water velocities disperses and prevents clumping of the adhesive eggs. White sturgeon is generally long-lived, with females living from 34 to 70 years. Some individuals may approach or exceed 100 years of age. White sturgeon in the Kootenai River system and elsewhere are considered opportunistic feeders. They feed on a variety of prey items including clams, snails, aquatic insects, and fish. Sockeye salmon in Kootenay Lake, prior to a dramatic population crash beginning in the mid-1970's, were once considered an important prey item for adult white sturgeon (USFWS 1999).

Distribution

For the species as a whole, white sturgeon are found only in the Pacific drainages of North America from the Aleutian Islands of Alaska to Monterey, California. White sturgeon in the Kootenai River Basin (Kootenai River and Kootenay Lake) are found in Idaho, Montana and British Columbia, Canada. In 1997 the white sturgeon population was estimated at 1,468 adults and only 100 wild juveniles. Most adult fish are older than 25 years in age.

Threats to Species

The free-flowing river habitat for the Kootenai River white sturgeon has been modified and negatively impacted by development in the Kootenai River basin. The natural Kootenai River flows were altered by the construction of the Libby Dam for hydro power in 1974, which also negatively affects successful reproduction and removes some nutrients necessary for biological productivity.

Recovery Plans

The Recovery Plan for the Kootenai River white sturgeon calls for implementing various conservation measures to prevent extinction and allow successful natural reproduction of the species to begin. Actions include increasing Libby Dam water releases during the spring that would enhance Kootenai River flows to encourage natural reproduction. A conservation aquiculture program, operated by the Kootenai Tribe of Idaho, has been developed to rear juvenile white sturgeon yearly over the next ten years for release into the Kootenai River. To date, about 3,000 young sturgeon have been released from eggs hatched in 1992, 1994 and 1995.

Critical Habitat

A revised final designation of critical habitat was published on July 9, 2008 (73 FR 39506) for 18.3 river miles (RM) of the Kootenai River. The area is entirely within Boundary County and begins 31 miles (50 km) downstream from Libby Dam at Bonner's Ferry, extending downstream to river mile 141.4, below Shorty's Island.

Primary Constituent Elements

PCEs for Kootenai River white sturgeon include: (From FR Vol.73, No.132/Wednesday, July 9, 2008)

- A flow regime during May – June spawning season capable of producing depths of 23ft and velocities of 3.3ft/s
- During spawning season of May – June, water temperatures between 47.3 and 53.6 F (8.5 and 12C), with no more than a 3.6F(2.1C) fluctuation as measured at Bonners Ferry;
- Submerged rocky substrates in approximately 5 river miles to provide for natural free embryo redistribution behavior
- A flow regime that limits sediment deposition and maintains appropriate rocky substrate and inter-gravel spaces for sturgeon egg adhesion, incubation, escape cover, and free embryo development.

2.1.7 Banbury Springs Lanx

Description

The Banbury Springs lanx (Lanx sp., undescribed) is a snail that is native to western North America. Its conical, pyramid-shaped shell is red-cinnamon in color, 0.09 to 0.28 inches in length, and only 0.03 to 0.17 inches tall. It is found only in cold, clear, well-oxygenated waters with swift currents. Lanx are found on smooth basalt, boulders or cobble-sized grounds ranging from two to 20 inches deep, but avoid areas with green algae. This species only lives about one year. Older adults die following reproduction in late winter to early spring (USFWS 2006).

Distribution

Today, the Banbury Springs lanx only occurs in the largest and least disturbed spring complexes at Banbury Springs (River mile589), Box Canyon Springs (River mile 588), Thousand Springs (River mile 584) and Briggs Springs (River mile 591).

Threats to Species

Because the limpet is found only at three sites within the Snake River drainage in Idaho, it is extremely vulnerable to habitat changes. The free-flowing, cold water environments required by this species have been threatened by hydroelectric development and operation, water withdrawal and diversions of springs, and water pollution in the aquifer. The primary factors that threaten the existence of the Banbury Springs lanx in its four remaining cold water spring complexes and tributaries of the middle Snake River include the effects from habitat modification, spring flow reduction, reduced groundwater quality, the invasive New Zealand mudsnail, and inadequate regulatory mechanisms. The respiratory requirements and life history attributes of the Banbury Springs lanx make this species susceptible to small fluctuations in water temperature, dissolved oxygen, sediment, or the effects of pollutants. This species appears to prefer deep, cold water spring flows of high quality and stable substrate. Habitat modification has affected this species by reducing the availability of suitable cold water spring habitats. Examples of habitat modification at the four known locations include: hydroelectric development in the Thousand Springs Preserve; aquaculture diversions in Box Canyon and Briggs Springs; and past impoundments of the spring flows at Banbury Springs. Coldwater spring flows from the Snake River aquifer at the four Banbury Springs lanx sites are also declining. As spring flows continue to decline throughout the range of this species, flows appropriated for hydroelectric power generating facilities and cold water spring flows diverted for aquaculture facilities and other uses will continue to compete for and likely reduce the available water for the Banbury Springs lanx. Degraded groundwater quality of the Snake River aquifer from agricultural and aquaculture practices will continue to affect the cold water spring outflows upon which this species exists. The non-native New Zealand mudsnail has invaded the cold water spring flows where the Banbury Springs lanx colonies occur, and occupation of nearby coldwater spring habitat could alter the trophic dynamics of these tributary springs. (From Banbury Springs Lanx (Lanx n sp.) (undescribed) 5-Year Review: Summary and Evaluation. 8/25/06 Carl Myler, Lysne, Steve, and Hooper, Dave.)

Recovery Plans

Monitoring and habitat protection will be necessary to protect this species. A Management Plan for the Banbury Springs lanx complex is currently underway by Idaho Power Company.

Critical Habitat

Critical habitat has not yet been designated but is proposed for the Banbury springs lanx.

2.1.8 Bliss Rapids Snail

Description

The Bliss Rapids snail (Taylorconcha serpenticola) has a 2.0 to 4.0 millimeter-long (0.8 to .16 inch) shell. The shell ranges from pale tan, which is almost colorless, to an amber color. The pale form of this snail is slightly smaller. Most of these mollusks are found on stable rocks in the free-flowing waters of the Middle Snake River, as well as in several cold-water springs in the Hagerman Valley, Idaho. During the daytime, the snail resides on the sides and undersides of the rocks. It migrates to graze on small algae and diatoms on the tops of rocks at night (USFWS 1995).

Distribution

Populations of Bliss Rapids snails are found in a few isolated colonies in the main stem of the Snake River from King Hill (river mile 545) to Banbury Springs (river mile 589) in Idaho. They are found in Thousand Springs, Box Canyon Springs, Briggs Springs and Banbury Springs.

Threats to Species

The final rule that determined threatened status for the Bliss Rapids snail indicated that the free-flowing, cool water environments required by the species were impacted by and are vulnerable to continued adverse habitat modifications and deteriorating water quality from one or more of the following: hydroelectric development, peak-loading effects from existing hydroelectric project operations, water pollution, and inadequate regulatory mechanisms.

Recovery Plans

Water quality and habitat conditions in the mainstream Snake River must be improved to begin to recover the Bliss Rapids snail. Natural reproduction may increase if conservation measures are implemented such as protection of remaining free-flowing habitats from hydro development, prevention of further Snake River diversions, improved water quality and natural flow conditions. ‘The Bliss Rapids snail reaches its highest densities in cold-water springs dominated by cobble substrates and free, or relatively free, of fine sediments, and with good water quality. Protecting these habitats that contain Bliss Rapids snail populations is critical to their survival and recovery. Ensuring that water quality within the Snake River is not degraded is important for sustaining the species’ river-dwelling populations. Since water quality appears to be of crucial importance to the species, protection of the Snake River Plain Aquifer is a priority. The aquifer is the source of water for the springs occupied by the snail and serves a major role in maintaining river water quality within the species’ range.

Critical Habitat

Critical habitat has not yet been designated but is proposed for the Bliss Rapids snail.

2.1.9 Bruneau Hot Spring Snail

Description

Adult Bruneau hot spring snails (Pyrgulopsis bruneauensis) have a small shell that is only .22 inches long. Fresh shells are thin and transparent. Because the shells are clear to white, the pigmentation underneath makes the snail appear black. This freshwater snail occurs in a 5-mile reach of the Bruneau River and the lower one-third of its tributary, Hot Creek, in Owyhee County, Idaho. The snail is native to geothermal springs and seeps with temperatures ranging from 15.7 to 36.9C. It is found in these habitats on the exposed surfaces of various substrates including rocks, sand, gravel, mud, and algal films (USFWS 1995).

Distribution

The snail is native to geothermal springs and seeps with temperatures ranging from 15.7 to 36.9C. It is found in these habitats on the exposed surfaces of various substrates including rocks, sand, gravel, mud, and algal films. This freshwater snail occurs in a 5-mile reach of the Bruneau River and the lower one-third of its tributary, Hot Creek, in Owyhee County, Idaho. No Bruneau hot springs snails have been collected outside thermal plumes of hot springs entering the Bruneau River.

Threats to Species

The principal threat to the spring snail is the reduction and/or elimination of their geothermal spring habitat as a result of agricultural groundwater withdrawals. Grazing livestock also pose a threat to the snail.

Recovery Plans

The focus of the Recovery Plan is to ensure that groundwater and habitat management activities provide for the protection of the geothermal habitat. This includes that water levels in the geothermal aquifer (i.e., springs discharge) have shown an increasing trend over a period of 10 years toward the recovery goal of at least 815 meters (m) (2,674 feet (ft)) above sea level, and the number of geothermal springs and seeps have increased to approximately 165 and are well distributed within the recovery area. And finally, that regulatory measures are adequate to permanently protect groundwater against further reductions

Critical Habitat

Critical habitat has not yet been designated for this species.

2.1.10 Snake River Physa Snail

Description

Adult Snake River physa snails (Physella natricina) are 0.2 to 0.5 inches high and are usually amber to brown in color. Most Physidae are found in standing or slow-moving water, but the Snake River physa snail is a large-river species. This is exceptional because in the entire western United States there are only a few freshwater mollusks that can survive in that type of habitat. These snails live in the undersides of gravel and boulders in the deep, swift rapids of the mainstream Snake River.

Distribution

Snake River physa remains only at a few locations in the Snake River, mostly in the Hagerman and King Hill reaches. Living specimens of the snail have been found on boulders in the deepest accessible parts of the Snake near the margins of rapids, but it is believed that fewer than 50 live Snake River physa have ever been collected in the middle Snake River, and only three have been seen in the last five years.

Threats to Species

Free-flowing, turbulent, and cold water environments required by this species have been altered by reservoir development, river diversions and habitat modification. Also, water quality has deteriorated due to altered natural flow and pollution.

Recovery Plans

Because this species has become so rare, little has been done for it. Specimens that have been inadvertently collected are returned immediately to the wild. Water quality and habitat conditions in the mainstream Snake River must be improved to begin to recover the Snake River physa snail. Natural reproduction may begin to recur if conservation measures are implemented such as protection of remaining free-flowing habitats from hydro development, prevention of further Snake River diversions, improved water quality and greater emphasis on natural flow conditions.

Critical Habitat

Critical habitat has not yet been designated for the Snake River physa snail.

2.1.11 Ute Ladies' Tresses Orchid

Description

Ute ladies'-tresses (Spiranthes diluvialis) is a perennial, terrestrial orchid that generally blooms from late July through August. Ute ladies'-tresses is found in moist soils near springs, lakes or perennial streams at elevations of 1,800 to 7,000 feet. It may also occur in meadows or near riparian woodlands. The orchid was discovered in Idaho in 1996 along the South Fork of the Snake River, downstream of Palisades Dam. The riparian areas where this species is found in Idaho are most concisely characterized as medium to large streams and rivers of moderate gradient (not slow and meandering), generally near the edge of the mountains or somewhat out onto the plains (Fertig et al. 2005).

Distribution

Ute Ladies' Tresses is known to or is believed to occur in Bannock, Bingham, Bonneville, Fremont, Jefferson, Madison, and Teton counties in Idaho. Currently, over 20 small populations of the plant have been identified. They are found on the floodplain habitats along 30 miles of the South Fork Snake River, between Heise and Swan Valley. In Idaho, many of the plants are on federal lands administered by the U.S. Forest Service and Bureau of Land Management. Other populations occur in Utah, Colorado, Wyoming, Washington, Montana, Nevada, and Nebraska.

Threats to Species

Orchid species generally are never common. Natural stream processes that contribute to the orchid's flood-plain habitat have been dramatically modified since settlement of the west. A major threat to the orchid has been result of habitat alteration due to increased demands of water by agriculture and municipal uses, which resulted in dams, reservoirs, and water diversions. Other threats include increased recreational use of riparian areas, changes in grazing patterns and invasion of exotic plant species.

Recovery Plans

Service biologists are working in partnership with other federal agencies, such as the U.S. Forest Service and Bureau of Land Management, to remove threats and conserve habitat for this species on federal land in Idaho. In some areas, plants are being protected while allowing for the development of nearby transportation and recreation projects such as roads, boat ramps, campgrounds and trails.

Critical Habitat

Critical habitat has not yet been designated for this species.

2.1.12 Water Howellia

Description

Water howellia (Howellia aquatilis) is an annual aquatic plant that completes its entire life cycle in one growing season. The plant roots in bottom sediments of low-elevation ponds or sloughs. A critical feature of water howellia habitat is that the ponds dependably dry out, at least in part, by the end of the growing season. Populations are found almost exclusively in ponds with a bottom surface of firm, consolidated clay and organic sediments. Ponds are generally shallow and occupied by emergent and aquatic plants. A dry pond bed is required for seed germination, which begins shortly after the bottom is uncovered and continues until seeds are once again submerged. Water howellia is no longer present in most of its historical range. Most sites containing water howellia are less than 1 acre in size.

Distribution

Water howellia is no longer present in most of its historical range. The largest population is found in Montana, small populations may be found in California and Washington, and only one site is known in Idaho. The single known location in Idaho occurs on the flood plain of the Palouse River in the northern part of the state (Latah County), in three small ponds formed by fluvial processes. Most sites containing water howellia are less than 1 acre in size.

Threats to Species

Water howellia may have difficulty surviving long periods of drought due to its need for water sources. It may also be threatened by disturbances to wetland habitat (such as reduced water levels and/or vegetation), grazing, and exotic plant invasions.

Recovery Plans

Additional surveys and monitoring are being conducted throughout its range to evaluate population levels. Funding has been provided for the development of a management plan for water howellia habitat in Idaho. This species must be protected throughout its remaining range to ensure its preservation. Education in proper land management techniques may help much in species recovery.

Critical Habitat

Critical habitat has not yet been designated for water howellia.

3 Environmental Baseline

3.1 Description of Action Area

Although the action area will cover all of Idaho, the location of current hydro-electric generating facilities that will be covered under the permit is fixed and US EPA does not envision any new dams opening during the effective period of this general permit. Therefore, the action area is defined as the area upstream/downstream of the current hydro-electric facilities. See Table 22 in Appendix B for a list of all known hydroelectric facilities and their locations by river and county.

3.2 Current Status of the Environment

The Idaho Toxics Consultation (2014) documents describe in depth the environmental baseline of the action area, which consists of most of the State of Idaho. Past and ongoing human actions have shape the environmental condition of habitat of the species covered under this BE. Such activity includes but are not limited to dam operation and the resulting creation of reservoirs, disruption of river flows, redistribution and retention of sediments, solar heating, creation of physical and habitat barriers to dispersal; agriculture and urban development resulting in water diversions/ dewater of some riverbeds, sediment runoff, physical alterations to rivers and streams through channeling/diking/ditching, filling of wetlands alterations to rivers and streams

Idaho Department of Environmental Quality has monitored and assessed approximately, 95,344 stream miles in Idaho and approximately 32,000 miles (32%) have been found to fully support beneficial uses, 33,873 (36%) are not supporting beneficial uses and 31% of streams miles are not assessed. The leading cause of impairment in streams and rivers are combined biota/habitat bio-assessments (3,303 miles), temperature (2,925 miles), sedimentation/siltation (2,870 miles), Escherichia coli (E.Coli miles) (1,911 miles). Of the pollutants of concern in the General Permit, no stream miles are listed for pH, 350 stream miles are listed for oil/grease, and 2,925 miles are listed for temperature. (Idaho Department of Environmental Quality. 2017. Idaho's 2014 Integrated Report Boise, ID) http://www.deq.idaho.gov/media/60179654/idaho-2014-integrated-report.pdf The waters listed for oil/grease are found within the Portneuf Basin. The waters listed for temperature are found throughout the State. Tables 8, 9. summarize the status of Idaho's rivers, streams, lakes and reservoirs support of beneficial uses.

Table 8. Status of Idaho Rivers and Streams Support of Beneficial Uses[1]

Status of Idaho River and Streams	
Support Status	Miles
Fully Supporting Beneficial Uses	31,584 or 33%
Not Supporting Beneficial Uses	33,873 or 36%
Stream Miles Not Assessed	29,888 or 31%

1. Idaho Department of Environmental Quality, 2017. Idaho's 2014 Integrated Report Boise, ID: DEQ

Table 9. Status of Idaho Lakes and Reservoirs Support of Beneficial Uses[1]

Status of Idaho Lakes and Reservoirs	
Support Status	Miles

Fully Supporting Beneficial Uses	27,471 (6%)
Not Supporting Beneficial Uses	258,383 (55%)
Stream Miles Not Assessed	182,964 (39%)

[1] The lake and reservoir support status is based on acreage. The percentage (by area) of lakes not supporting beneficial uses is relatively high because of a few large lakes listed in the not supporting category.

Table 10 provides a summary of the waters listed for oil and grease, temperature, and pH and the known hydroelectric facilities that are located on those waters. Note: MP = multiple parameters in addition to the pollutants of concern to this general permit. The Table also provides a status of the TMDL for the given waterbody.

Table 10 Hydro-Electric Facilities Overlap with 303(d) Listed Waters

From Idaho Department of Environmental Quality Draft 2014 Integrated Report				
Hydroelectric Facility Name	Waterbody	Impaired Segment	Listed Parameter (Oil and Grease, Temperature, pH)	TMDL with Wasteload Allocation (WLA)Facilities
Swan Falls	Snake River	Segment ID17050103SW006_07b	Multiple parameters, (MP) & Temperature	No Temperature TMDL
Marsh Valley	Portneuf Marsh Valley Canal	Discharge to Portneuf, Segment ID17040208SK016_05	MP & Oil and Grease, Temperature	No TMDL for segment
Cabinet Gorge	Clark Fork River	Segment ID17010213PN003_08	MP and Temperature	No Temperature. TMDL
Moyie River/ Moyie Springs	Moyie River	Segment ID17010105PN001_05	Temperature	No TMDL
Smith Creek (Smith Falls)	Smith Creek	Segment ID17010104PN005_04	Temperature	TMDL for T but no WLA for facility
Grace	Bear River	Segment ID16010202BR009_06	MP and Temperature	TMDL but not Temperature
Last Chance Canal	Bear River	Segment ID16010202BR009_06	MP and Temperature	TMDL but Not for Temperature
Soda (Soda Point)	Bear River	Segment ID16010202BR009_06	MP and Temperature	TMDL but Not for Temperature
Jim Ford Creek (Ford Hydro LP)	Jim Ford Creek	Segment ID17060306CL035_04	MP and Temperature	TMDL but Not for Temperature

Oneida	Bear River	Segment ID16010202BR006_06	MP and Temperature	TMDL but Not for Temperature
Koyle Ranch 1	Big Wood River.	Discharge to Little Wood, Segment ID17040221SK001_05b	MP and Temperature	TMDL but NOT for Temperature
Geo-Bon No. 2 (Notch Butte)	Little Wood River	Segment ID17040221SK001_05a	MP and Temperature	TMDL but NOT for Temperature
C.J. Strike	Snake River	Segment ID17050103SW006_07	Temperature	No TMDL for Temperature
Lateral No. 10	Lateral No. 10 Canal	Discharge to Salmon Falls Creek, Segment ID17040213SK001_06	MP and Temperature	TMDL but NOT for Temperature
Little Mac (Cedar Draw)	Cedar Draw	Segment ID17040212SK012_03	MP and Temperature	TMDL but NOT for Temperature
Milner Dam	Snake River	Segment ID17040212SK020_07	MP and Temperature	TMDL but NOT for Temperature
Brownlee	Snake River.	Segment ID17050201SW003_08	MP and Temperature	TMDL for temperature but no WLA for Brownlee

Actions that form the environmental baseline for this consultation include but are not limited to: dam operation and the resulting impacts to the environment (creation of reservoirs, disruption of river flows, redistribution and retention of sediments, solar heating, reduced DO, creation of physical and habitat barriers to dispersal; diversion and nutrient loading of spring and river waters; complete dewatering of some riverbed areas; and degradation of water quality due to point and non-point sources of pollutants or nutrient enrichment

Beyond water quality concerns, a broad range of stressors to both the listed species and their critical habitat are present within the region. Urban development, the flow alteration of dams (including the hydroelectric facilities), agricultural grazing and runoff, and poor forestry practices are all harmful (USFWS 2015). Other activities which can often have cumulative negative effects include runoff from agricultural, commercial, and residential sources, contaminant spills or leaks, introduced pathogens or nonnative species, and hybridization with said species. Aquatic habitat of listed species and critical habitat will become further limited by the ongoing stressors listed above, and although detailed stressor information is limited for many of the listed species, the information that is available concludes that the white sturgeon, and over ¾ of the core area populations of bull trout risk extirpation (USFWS 2015). Ground water depletion and pollution, and the decline in the quality of spring habitats are of particular concern to listed snails and other spring-dependent life. Due to the lack of protection from anthropogenic (and even natural) impacts, and that water quality degradation is increasing in severity, the situation for these invertebrates becomes that much more desperate (USFWS 2015). Poor land use practices in agriculture, resident, and commercial applications will continue to be a major problem with the growing population, and water quality will continue to degrade. Figure 18 Appendix A illustrates the various land uses in Idaho showing the distribution of agriculture and urban development.

Recovery plans for the listed species do have the potential to ensure their conservation, and include improvements like riparian buffer and fish habitat restoration. It is important to note however, that increasing human activity in the region is likely to outweigh this. Current land use/land cover in Idaho is predominantly agriculture and forested land, but urban/suburban areas are on the rise (Figure 18 Appendix A). Present research concludes that sediment, nutrient, and chemical pollution input will continue to increase; the stressors to listed species inhabiting Idaho's waters will most likely increase during the life of the proposed actions (USFWS 2015).

Another stressor, climate change, is a bit less tangible, but will continue to have negative effects on the listed species and critical habitats. Warming temperatures are causing an earlier spring runoff, occurring 1-3 weeks earlier compared to the early 20th century. Coupled with a decreasing amount of precipitation, and therefore a smaller snowpack, these events have caused a change in flow within the Snake River watershed. Climate change is also forecasted to bring significantly less rainfall to the region, and moderate and extreme droughts could occur in the future. This brings with it a myriad of other stressors, including wildfires, which in addition to direct damage to listed species, could drastically change the critical habitat(s) as well (USFWS 2015).

4 Exposure Assessment

The initial assessment of exposure consisted of mapping the location of known current hydro-electric facilities and determining whether any threatened and endangered species are known to occur in areas or have critical habitat in areas the dams may impact (see Appendix A Figures 7-17). If no overlap or presence of critical habitat is found, then a "No Effect" determination is made. If there is overlap, then the analysis proceeds to determine the effect the effluent limitations and requirements proposed by the General Permit have on the species of concern.

4.1 Plants

Ute Ladies Tresses Orchid range overlaps with locations of hydroelectric facilities (see Appendix A Figure 16). Therefore, this plant will be further evaluated in the BE.

Water Howellia are found in a single location on the flood plain of the Palouse River in the northern part of the state (Latah County), in three small ponds. Appendix A Figure 17 shows where Water Howellia are found within the State of Idaho. Based on the list of know hydro-electric facilities within the State of Idaho there are no hydroelectric facilities that overlap with locations where Water Howellia are found. Therefore, the EPA has determined there will be **NO EFFECT** from the issuance of this General Permit.

4.2 Fish

The ranges of Bull Trout, Kootenai River White Sturgeon, Snake River Sockeye, Snake River Spring, Summer, and Fall Chinook and Snake River Steelhead Salmon in relationship to hydro-electric facilities are shown in Appendix A Figures 7 - 11. Bull trout, Snake River Sockeye, Spring/Summer and Fall Chinook, and Snake River steelhead are found in rivers and streams where hydroelectric facilities are located. Therefore, these fish species will be further evaluated in the BE.

The Kootenai River sturgeon occurs solely in the Kootenai River and there are no known hydroelectric facilities located on the Kootenai River within the boundaries of the State of Idaho. One hydroelectric facility is located on the portion of Kootenai River that is within the State of Montana, however the General Permit does not apply to facilities in Montana. Because Kootenai River White sturgeon habitat does not overlap with hydroelectric facility within the State of Idaho, the EPA has determined there will be **NO EFFECT** from the issuance of this General Permit on the Kootenai River White sturgeon.

4.3 Invertebrates

Appendix A Figures 12 – 15 show the ranges of the Banbury Springs Lanx, Bruneau Hot Springs snail, Bliss Rapids snail, and Snake River Physa snail in relationship to the location of hydro-electric facilities. Hydro-electric generating facilities in Southwest Idaho overlap with the ranges of the Banbury Springs Lanx, Bliss Rapids snail, and Snake River Physa snail. Therefore, these snails will be further evaluated in the BE.

The Bruneau Hot Springs snail is found in small stretch of the Bruneau River. There are no hydroelectric facilities located near where these snails are found. Therefore, the EPA has determined there will be **NO EFFECT** from the issuance of this General Permit.

5 Analysis of Effects

The ESA Section 7 implementing regulations (50 CFR 402.02) define "effects of the action" as: The direct and indirect effects of an action on the species or critical habitat together with the effects of other activities which are interrelated or interdependent with that action, that will be added to the environmental baseline. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur (50 CFR 402.02).

This BE concentrates on the protective measures afforded by the proposed permit. It is important to understand that the permit does not authorize noncompliance. Although it is possible that there may be situations where permittees are not in compliance with the permit, such situations are not authorized and not addressed in this BE. The analysis of effects in the BE assumes compliance with the proposed general permit and that the species of interest are exposed to waters meeting water quality standards, and examines what the likely effects on the species would be under that scenario.

The objective of this section of the Biological Evaluation is:

- To determine whether the provisions of the proposed General Permit for hydro-electric facilities located within the State of Idaho are protective of federally threatened and endangered aquatic and aquatic-dependent species present in Idaho.

The proposed General Permit in addition to the effluent limits for oil and grease, pH and monitoring requirement for temperature, provides for requirements that further minimizes the impact of the General Permit on T & E species. These additional requirements include the following:

- Monitoring requirements
- Reporting/Recordkeeping requirements
- 316(b) requirements to minimize the impacts of impingement and entrainment from cooling water intake structures
- BMP requirements to manage, minimize, and eliminate the use of petroleum based lubricants

There are three possible determinations of effects under the ESA (USFWS and NMFS 1998). The determinations and their definitions are:

- **No Effect (NE) -** the appropriate conclusion when the action agency determines its proposed action will not affect listed species or critical habitat.
- **May affect, is not likely to adversely affect (NLAA) -** the appropriate conclusion when effects on listed species are expected to be discountable, or insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.
- **May affect, likely to adversely affect (LAA) -** the appropriate conclusion if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial (see definition of "is not likely to adversely affect"). In the event there are some adverse effects, then

the proposed action "is likely to adversely affect" the listed species. An "is likely to adversely affect" determination requires formal section 7 consultation.

For the purposes of Section 7 of the ESA, any action that is reasonably certain to result in “take” is likely to adversely affect a proposed or listed species. The ESA (Section 3) defines “take” as “to harass, harm, pursue, hunt, shoot, wound, trap, kill, capture, collect or attempt to engage in any such conduct.” Further, the term “harass” is defined as “an intentional or negligent act that creates the likelihood of injuring wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns such as breeding, feeding, or sheltering” (50 CFR 17.3). NOAA Fisheries has interpreted “harm” as “an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, feeding, or sheltering” (64 FR 60727). The USFWS (1994) further defines “harm” as “significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering.”

5.1 Methodology

The methodology the EPA used to analyze what effects, if any, on ESA listed species would result from the issuance of the proposed General Permit looks at the risks posed to the species by exposure to discharges meeting the conditions of the proposed permit. There are four main steps to this analysis: 1) gather information on the critical exposure thresholds for the pollutants of concern - -pH, oil and grease, and temperature on the species of concern; 2) determine the receiving water concentrations of pH, oil and grease, and temperature resulting from the discharges limited by the requirements of the proposed permit; 3) consider the additional conditions of the permit; and 4) assess the effect on species of concern.

5.2 Impacts of Pollutants of Concern (pH, Temperature, Oil and Grease)

Oil and Grease

Oil and grease (O&G) is a measure of a variety of substances including fuels, motor oil, lubricating oil, hydraulic oil, cooking oil, and animal-derived fats. The concentration of these substances is typically measured within a body of water. Most sources of oil and grease are insoluble in water. However, agitation can create a temporary emulsion with water. Fatty material from plant and animal sources are made up of lipids which are polar molecules and partially soluble in water.

Toxicity varies among different types of oils and greases. Refined oils are generally more toxic than crude oils. Various hydrocarbons found in fuels can pose a wide range of human health problems, including affecting organs such as the liver and kidneys to blood disorders. In addition, some hydrocarbons are carcinogens.

Low levels of oil pollution can reduce aquatic organisms’ ability to reproduce and survive. Studies indicate that 0.3 – 0.6 mg/L of certain aromatic hydrocarbons can be lethal to aquatic organisms, while chronic concentrations over 50 µg/L may be harmful to estuarine species. Multiple studies have shown the harm that large oil spills (e.g., Exxon Valdez, Deepwater Horizon) have done to a variety of fish, mammals, birds, and invertebrates. Spilled hydrocarbons may initiate structural shifts in food web communities, promoting species that can readily process hydrocarbons. On the other hand, hydrocarbons may delay growth, increase mortality, and spread the toxicity effects up the food chain.

While it is generally accepted that soluble hydrocarbon accumulation takes place through the gills (large surface area, lipid rich), food intake may also be an important pathway (Perhar and Arhonditsis 2014). The toxic effects of hydrocarbons on fish include delayed growth, reduced survivorship, and carcinogenic and mutagenic activity. These responses are highlighted when exposure occurs at early life stages, and are tightly linked with derivatives of polycyclic aromatic hydrocarbons (PAH), metabolites, and chemically dispersed oil (Perhar and Arhonditsis 2014).

In a study of pink salmon embryos Brannon et al. (2006) found a lack of toxicity in naturally weathered Exxon Valdez crude oil (NWEVC), a limited solubility of the high molecular weight PAH (polycyclic aromatic hydrocarbons), high level of tidal and freshwater flushing of streams, and an extremely low tissue total PAH (TPAH) concentration in embryos actually removed from streams on oiled beaches following the spill.

Benthic invertebrates show a more varied response to oil pollution. Echinoderms and crustaceans are more vulnerable to contaminant exposure; while polychaetes, oligochaetes, and nematodes tend to be less sensitive (Perhar and Arhonditis 2014). When freshwater snails were exposed to municipal effluent containing PAH found in oil, their immune responses were reduced (Gust et al. 2013). A concentration of 1.5mg/L oil reduces growth and survival of aufwuchs, the particular algal and diatom community on which snails often feed (Klein and Jenkins 1981).

pH

With regard to salmonid species, most studies looked at the effects of pH on adults, while the life stages most sensitive to effects of pH are egg incubation and alevin/fry development. Data regarding the effects of pH on the aquatic biota are limited and dated.

In the development of USEPA's criteria, (USEPA 1986) two bioassay references on freshwater fish showed a lower pH limit of about 6.5 for normal development (EIFAC 1969; Mount 1973). Vulnerable life stages of Chinook salmon are sensitive to pH values below 6.5 and possibly at pH values greater than 9.0 (Marshall et al. 1992). For Chinook, Rombough (1983) reported that low pH decreases egg and alevin survival, but specific values are lacking. Adult salmonids seem to be at least as sensitive as most other fish to low pH including rainbow, brook, and brown trout and Chinook salmon (ODEQ 1995). In studies of biological changes with surface water acidification, Baker et al. (1990) found that decreased reproductive success may occur for highly acid-sensitive fish species (e.g., fathead minnow, striped bass) at pH values of 6.5 to 6.0. At pH values between 6.0 and 5.5, Baker et al. (1990) found decreased reproductive success in lake trout. The lower critical pH value for rainbow trout is approximately 5.5 (Baker et al. 1990). Based on the USEPA criteria documents and Baker et al. (1990), the low-end of Idaho's pH standard of 6.5 is considered protective for salmonids.

At the higher end of the pH scale, even less is known regarding effects on fish. In USEPA's review for water quality criteria development, the upper limit of 9.0 was obtained from only one reference (EIFAC 1969). Though no recent data have been generated, studies conducted earlier in the 20th century show salmonids, including both trout and salmon species, to be sensitive to pH values in the range of 9.2 to 9.7 (ODEQ 1995). Non-salmonid fish are, with some exceptions, more tolerant of high pH, with sensitivity appearing at or over pH 10 for most species tested (EIFAC 1969). Levels of pH greater than 9.0 may adversely affect benthic invertebrate populations, thereby altering the food base for salmonids (ODEQ 1995).

There is not much known about the biological thresholds of Idaho snails. A water body of pH below 5.2 is uninhabitable for freshwater snails (Økland 1992), but even at a pH of 6.0 or below, significant mortality can be observed (Marshall et al. 2008). All recovery plans associated with the snails mentioned that the primary conservation actions for these species are to "ensure state water quality standards for cold-water biota' are met (USFWS 1995, p. 31). For pH Idaho's water quality standard, which are designed to protect cold-water biota found in Idaho, calls for the range between 6.5 to 9.

Temperature

Water temperature has a significant effect on aquatic organisms that live or reproduce in the water, particularly Idaho's native coldwater fish such as salmon, bull trout, and steelhead and some amphibians (frogs and salamanders). When water temperature becomes too warm, salmon and trout suffer a variety of ill effects ranging from decreased spawning success to death.

Coldwater fish such as salmon and trout need cold waters during various stages of their lives. When temperatures increase above optimum ranges for these sensitive species, a variety of stresses can occur. The EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards summarized the research on thermal impacts to salmonids and trout. It identified temperatures that would trigger adverse impacts to different life stages of salmon including the following: reduced egg viability at temperatures > 13E, lethal impacts to juvenile rearing at temperatures > 23EC, and temperatures over > 18 – 20E leading to migration blockage, disease risk, and reduced swimming performance of adults. Temperatures >8 EC reduce egg survival for Bull Trout and temperatures >12EC put juvenile bull trout at a competitive disadvantage. Colder water holds more dissolved oxygen than warmer water, so as stream temperatures increase, the amount of dissolved oxygen available for fish and other aquatic organism's decreases. Thermal stress can also make fish more susceptible to toxic substances that may be present. Warmer water can also lead to algal blooms that can further deplete the water's dissolved oxygen and cause changes in stream pH.

Richards and Arrington (2008) found that the Bliss Rapids Snail has demonstrated both optimum survival and peak growth at water temperatures around 15-17°C (59-63°F). Temperatures higher than that often allow invasive Potamopyrgus antipodarum (New Zealand mud snail) to outcompete the native Bliss Rapids snails (Richards, 2004). Water temperature requirements of Snake River physa have not been identified. Based on available information, Snake River physa appear to be able to tolerate water temperatures slightly above the cold water standard of 22°C (71.6°F), although their upper temperature limit has not been identified (USFWS 1995). Bliss Rapids snail and Banbury Springs lanx are found in springs where they flow at temperatures from 14 to 16°C (57.2 to 60.8°F) year around. Bruneau Hot Springs snail has a temperature tolerance between 11-35°C (52-95°F) (Mladenka 1992, p. 85). Cold water typically holds more oxygen, and water tends to displace it as it warms, thus most invertebrates will fare better in colder waters.

5.3 Determining Receiving Water Concentrations as a Result of Permit Limits

The methodology the EPA used to determine the receiving water concentrations of pH, oil and grease, and temperature change resulting from the discharges limited by the requirements of the proposed permit are described below.

The EPA gather data from existing permitted hydro-electric facilities and permit applications and used the data to determine exposure concentrations resulting from the proposed effluent limits and then compared those results with known effect endpoints of the species of concern.

Sources of data came from the following:

- Similar hydro-electric facilities covered under individual NPDES permits issued by Oregon, which contain similar effluent limits and conditions as those proposed in this General Permit. From these facilities, DMR data was obtained for flows and effluents.
- Hydro-electric facilities located in Idaho covered by individual NPDES permits covering effluent limits for sanitary wastewater only. From these facilities DMR data was obtained for receiving water flow.

- Hydro-electric facilities located in Idaho that had previously submitted applications for NPDES individual permits. Date from these facilities yielded average discharge through the turbines and from those discharges that would be authorized by this General Permit.
- Hydro-electric facilities covered under a similar general permit issued by EPA Region 1. From these facilities DMR data was examined to determine typical pollutant discharge concentrations, pH and temperature ranges, and effluent flow volumes.

The types of data pulled from the DMRs and applications are:

- Effluent and bypass flow data from various sized facilities for comparison with total flow through turbines/ spillways with effluent flow (Table 11 & Table 12). From this data the EPA derived the percentage of effluent flows compared to total flows (also Tables 11 & 12).
- Effluent concentration for pollutants covered by this General Permit (Tables 16 – 17).
- Design flows and critical receiving water flows (1Q10 and 7Q10) (Table 13).

From this data, the potential exposure concentrations can be determined.

Table 11. Percentage of Authorized Discharges to Total Discharges – Daily Values (Oregon Dams)

Hydroelectric Facility	Flow through turbines (cfs)			Effluent Flows authorized by this General Permit (cfs)			Percentage of authorized flows compared to flow through turbines		
	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max
Oxbow	20135	6697.9	62856	15.02	7.76	18.54	0.07	0.12	0.29
Hells Canyon	20321.3	7709.5	62858	9.6	5.00	12.05	0.05	0.06	0.19

Table 12. Percentage of Authorized Discharges to Total Discharges – Daily Values (Idaho Dams).

Hydroelectric Facility		Flow through turbines (gpd)	Flows authorized by this GP (gpd)	Percentage of authorized flows compared to flow through turbines
Barber Dam	Turbine 1	646,298,892	11,520	0.001782457
	Turbine 2	646,300,332	10,080	0.001559646
Rock Creek No. 2		59,452,514	8,640	0.014532607
Lowline Rapids		710,939,941	8,640	0.001215293
Geo Bon II		245,594,656	5,760	0.002345328
Dietrich Drop		597,842,405	6,480	0.001083898
Haxelton A	Turbine 1	430,877,041	1,440	0.000334202
	Turbine 2	430,877,041	1,440	0.000334202
	Turbine 3	430,877,041	1,440	0.000334202

Elk Creek		19,389,506	30	0.000154723
Bypass	Turbine 1	430,877,041	1,440	0.000334202
	Turbine 2	430,877,041	1,440	0.000334202
	Turbine 3	430,877,041	1,440	0.000334202
Brownlee		2.26E+10	800,000	0.003536522

Table 13. Percentage of Discharge Flows that would be Authorized Under the GP Compared to Critical Receiving Water Flows (7Q10 and 1Q10).

Facility	Wastewater flow authorized by GP (gpd)	Receiving Water Critical Flow		Percent of flow from authorized discharges	
		7Q10 (gpd)	1Q10 (gpd)	7Q10	1Q10
Albini Falls Dam Max discharge	1,200	3,007,694,328	2,110,548,164	3.98977E-05	5.68573E-05
Cabinet Gorge Dam – Design capacity	1,200	2,940,593,697	1,092,889,731	4.08081E-05	0.000109801

Table 14. Flow Data Summarized.

Discharge from Authorized Waste streams (gallons per day) (from DMRs)	
Number of data points	265
Average volume	23,899
Minimum	5
Maximum	660,000

Table 15. Temperature Data Summarized

Temperature from Authorized Waste streams (degrees Fahrenheit) (from DMRs)	
Number of data points	182
Average temperature	55 (12.7 EC)
Minimum	33EF (.6EC)
Maximum	79EF (26EC)

Table 16. pH Data Summarized.

pH ranges from Authorized Waste streams (standard units) (from DMRs)	
Number of data points	279
Average pH	6.97
Minimum	5.12
Maximum	11.35

Table 17. Oil and Grease Data Summarized

Oil and Grease Concentrations from Authorized Waste streams (from DMRs)	
Number of data points	93
Average concentration	5.5 mg/L
Minimum	5 (detection limit)
Maximum	23 mg/L

From the data gathered, the EPA derived the percentage of effluent flow (outfalls covered by the permit) to total hydro-electric facility discharge flow (water flow through turbines and over the dam). As shown in Tables 11 and 12, the discharge flow is a very small percentage of flow through the turbines. For example, the discharges from the Oxbow facility is 0.07 percent of the flow through the turbine. The significance of these differences is that the concentration of any pollutant present in the discharges would be greatly diluted once the discharges are combined with the water flowing through the turbines.

Oil and grease exposure concentration

To determine the exposure concentration from oil and grease that result from the proposed effluent limit, the EPA used a simple mass balance equation presented below. The lowest daily flow through the turbines was used to develop a conservative estimate.

$$C_e = (C_{avg} * Q_{avgf}) / (Q_t + Q_{avgf})$$

Where:

Cavg = average Oil and Grease concentration (5.5 mg/L) (from Table 17)

Qavgf = average authorized flow reported (23,899 gpd) (from Table 14)

Qt = minimum flow reported through turbines (19,389,506 gpd) (from Table 12)

Substituting the values listed above into the equation, results in an oil and grease concentration of 0.007 mg/L in the facility total discharge. If the maximum oil and grease concentration is used (23 mg/L) as reported in a DMR, the calculated oil and grease concentration is 0.028 mg/L. As stated previously, this is a conservative estimate using the lowest daily flow value through the turbines. The next lowest volume is 59,452,514 gallons per day. The median flow for the hydro-electric facilities examined was 430,877,041 gallons per day. Using the median flow volume and the maximum oil and grease concentration results in an oil and grease concentration of 0.0013 mg/L. The median flow and average oil and grease value result in a calculated oil and grease concentration of 0.0003 mg/L. It is important to note that, these are all "end of pipe" concentrations and do not account for mixing with the receiving waters downstream of the hydro-electric facilities. When combined with the critical flows examined above, the expected oil and grease concentrations are many orders of magnitude below any concentrations of concern. See Section 5.2 for threshold concentrations of oil and grease that trigger adverse impacts to aquatic organisms. The table below provides a summary of the comparisons.

Comparison of Biological Critical Thresholds to Discharge Concentrations

	Chronic Threshold	Lethal Threshold	Max discharge Conc	Median discharge Conc.
Aquatic Organisms	50ug/l (.05mg/l)	0.3 – 0.6 mg/L	.028 mg/L	.00013 mg/l

In addition to the resulting concentration of oil and grease from the proposed effluent limit, the BMP requirements would lead to further reduction of oil and grease contamination from spills and leaks, and to the reduction to the elimination of reliance on petroleum based lubricants.

Temperature exposure

The proposed General Permit does not impose a temperature limit on cooling water discharges and instead imposes a monitoring requirement. The rationale for not imposing a temperature limit is based on the EPA's assumption that these discharges are not going to cause an exceedance of the State of Idaho's temperature standard. However, to determine the impact of this assumption on threatened and endangered species, the EPA analyzed the data submitted by the facilities described above to determine if the increased heat from the discharges would raise the temperature of the receiving water and whether that increase would impact species of concern. For this analysis, data was used from the two Oregon facilities the Oxbow Hydroelectric facility and the Hells Canyon Hydroelectric facility. These facilities had temperature data for the water flowing through the turbines along with the temperature of discharges that would be covered by the proposed General Permit. This data is summarized in Table 15. Flow and temperature data were used with the energy balance equation below to calculate the thermal impact the cooling water discharge would have on the temperature of the receiving water. The calculation applied a 25% mixing zone and a 100% mixing zone for demonstration purposes. The calculations are shown in Appendix C.

$$\in T = T_f - T_a E$$

Where:

Qr	River flow	Qr =Qa + Qe	Qe	effluent flow
Qa	flow from turbine	Qa = Qr-Qe	MZ	mixing zone %
Ta	ambient temperature		Te	effluent temperature

Tf temperature at mz boundary $Q_r * T_f = Q_a * MZ * T_a + Q_e * T_e \rightarrow T_f = \frac{(Q_a*MZ*T_a+Q_e*T_e)}{(Q_a*MZ+Q_e)}$

ΔT change in temperature $\Delta T = T_f - T_a$ (see results in Table below)

	Maximum ΔT [C]		
	25% MZ	100% MZ	Month of Max
Oxbow	0.01764EC	0.00444	July
Hells Canyon	0.01603EC	0.00402	July
This is the maximum change in receiving water temperature due to the addition of cooling water for both Oxbow and Hells Canyon during conditions of 25% mixing zone allowed and complete (100%) mixing			

Comparing all the temperature data reported for both facilities (almost 200 observations), the maximum temperature increase at Oxbow was 0.01764E C with a 25% mixing zone and 0.01603E C at Hells Canyon with a 25% mixing zone. This maximum increase occurred during only one month of the year – July. While the waterbody itself may exceed the thresholds determined to be protective of salmonids and trout, the thermal load that the discharge of cooling water from hydro-electric plants would contribute to the receiving water's temperature would be insignificant (less than 0.02EC). The EPA considers this a de minimus temperature increase and would not result in an impact on the receiving water's support of aquatic uses or specifically, the species of concern.

pH Exposure

Although pH was not modeled like oil and grease and temperature above, it is expected to react in a similar fashion. Due to the large amount of available dilution, even when pH may be discharged at the low or high end of the allowable concentration (Table 16), the buffering capacity of the receiving water will prevent a change in the pH of the waterbody.

As demonstrated above, the low volume of wastewater effluent discharged by hydro-electric facilities expected to be covered by the General Permit and the effluent limits proposed by this General Permit in relation to the total volume of waters released from a hydroelectric dam result in an insignificant impact on the overall pH of the receiving water. When evaluated further in combination with the flows in the receiving waters, the potential for any impact is further reduced.

5.4 Determination of Effect on Species of Concern

The potential exposure conditions developed above in Section 5.1 were compared to the know effect levels for the threatened and endangered species of concern or suitable surrogates to determine if any species may be adversely affected by contaminants of concern from the wastewater flow.

5.4.1 Fish

Temperature

Where bull trout, Snake River sockeye, Snake River Spring, Summer, and Fall chinook salmon, Snake River steelhead are found in proximity to the discharges from hydroelectric facilities, the maximum temperature change resulting from cooling water discharges would be 0.017EC, which the EPA considers de minimis. Therefore, the EPA concludes **the temperature change resulting from facilities covered by the General Permit is insignificant and thus is not adversely to affect bull trout, Snake River**

sockeye, Snake River Spring, Summer, and Fall chinook salmon, and Snake River steelhead. As mentioned above, the waterbody itself may exceed the thresholds determined to be protective of salmonids and trout, but the thermal load from the discharge of cooling water from hydro-electric plants would not impact the receiving water's temperature.

pH

The proposed permit would require discharges to keep the pH of the discharge between 6.5 and 9.0. Discharge monitoring data demonstrates that hydroelectric facilities discharges have an average pH of 6.97, which is within the permitted limits. This is within the range protective of salmonids, bull trout and steelhead. Therefore, the EPA concludes the **effluent limit for pH limit is not likely adversely to affect bull trout, Snake River sockeye, Snake River Spring, Summer, and Fall chinook salmon, and Snake River steelhead.**

Oil and grease

The results are all at least two orders of magnitude below concentrations where effects may occur to aquatic species and represent extremely conservative analyses. Actual operating conditions may result in concentrations lower than those provided above. In addition to the effluent limits imposed by the General Permit, the BMP provisions would further reduce or eliminate the amount of oil and grease being discharged by the hydroelectric facilities. Therefore, the EPA concludes the **effluent limit for oil and grease is not likely to adversely to affect bull trout, Snake River sockeye, Snake River Spring, Summer, and Fall chinook salmon, and Snake River steelhead.**

5.4.2 Invertebrates

Temperature

The EPA concludes **the temperature change resulting from facilities covered by the General Permit, is insignificant and thus is not likely adversely affect Snake River physa, Bliss Rapids snails, and Banbury Springs lanx.**

pH

The proposed permit would require discharges to keep the pH of the discharge between 6.5 and 9.0. Discharge monitoring data demonstrates that hydroelectric facilities discharges have an average pH of 6.97, which is within the permitted limits. There are little data concerning pH tolerance range of Snake River physa, Bliss Rapids snails, and Banbury Springs lanx. Nevertheless, since the limit is based on the State of Idaho's pH water quality standard for the protection of aquatic life, a reasonable assumption is that this range will be protective of Snake River physa, Bliss Rapids snails, and Banbury Springs lanx. Therefore, the EPA concludes **the effluent limit for pH is not likely to adversely affect Snake River physa, Bliss Rapids snails, and Banbury Springs lanx**.

Oil and grease

The results are all at least an order of magnitude below concentrations where effects may occur to aquatic species and represent extremely conservative analyses. Actual operating conditions will result in concentrations lower than those provided above. In addition to the effluent limits imposed by the General Permit, the BMP provisions would further reduce the amount of oil and grease being discharged by the hydroelectric facilities. Therefore, the EPA concludes **the effluent limit for oil and grease is not likely to adversely affect Snake River physa, Bliss Rapids snails, and Banbury Springs lanx**.

5.4.3 Plants

Ute Ladies Tresses Orchid range overlaps with locations of hydroelectric facilities. The major threat to the orchid is related to habitat alteration due to development demand on water use, grazing and invasion of exotic plant species. The impacts of this General Permit - - regulating the discharge of outfalls from hydroelectric facilities - - are unrelated to major threats endangering the number and distribution of Ute Ladies Tresses Orchid. Therefore, the EPA concludes **the effluent limits and requirements of this General Permit is not likely to adversely affect Ute Ladies Tresses Orchid.**

5.5 Clean Water Act 316(b) Requirements

The proposed General Permit calls for a series of measures be implemented at hydroelectric facilities to minimize the impacts of entrainment and impingement from cooling water intake structures. These measures are in response to the requirements of 316(b) of the Clean Water Act and implementing regulations at 40 CFR125.90). The General Permit pertains to facilities would not fall under the regulations (drawing less than 2MGD of cooling water or using less than 25% of the intake for cooling water), therefore the EPA developed the measures based on best professional judgement. The measures include the following:

- Manage the intake operations to minimize injury to resident fish and other aquatic species in the river.
- Manage tailrace operations to prevent fish access to the draft tube areas to minimize injury of fish and other aquatic species.
- Return all observed live impinged fish to the source water to the extent practicable in a manner that maximizes their chance of survival.
- Do not spray impinged fish or invertebrates with chlorinated water.
- The permittee must design an impingement and entrainment monitoring program for the facility to identify what species are impinged and or entrained.
- Maintain a physical screening or exclusion technology that is consistent with the objectives of guidelines found in National Marine Fisheries Service Northwest Region's Anadromous Salmonid Passage Facility Design, Chapter 11: Fish Screen and Bypass Facilities.

In addition to the above measures, the permit calls for facilities to provide specific information to the EPA at the time of application for permit renewal so that the EPA will have more complete information to revise this section of the general permit to be more effective if need be. The information requested includes characteristics of facility's cooling water intake system, receiving water, aquatic species indigenous to those waters the results from the monitoring impingement and entrainment program.

All of the facilities that would potentially be eligible for coverage under the proposed General Permit are existing facilities, with many being in place since the 1960's and 19270's. To date, no facility has been required to comply with the 316(b) of the Clean Water Act. The General Permit will bring added protections to listed species through practices that address the impacts of impingement and entrainment from cooling water intake structures, if they haven't already had to through other agency permitting and licensing requirement. Therefore, the EPA believes that the addition of 316(b) requirements to the other permit requirements - - effluent limits, BMPs, and monitoring and reporting requisites results in a General Permit that would be beneficial to threatened and endangered species of concern.

5.6 Determination of Effect on Critical Habitat

Critical habitat has been designated for bull trout, Snake River sockeye, Snake River spring/summer and fall chinook, and Snake River steelhead. (see section 2.1). In designating critical habitat, the Services focused on certain habitat features, Primary Constituents Elements (PCE), that are essential to support one of more of the life stages of these species. The determination of effect of the proposed General Permit on the critical habitat of the above species will be based on effect of the General Permit on PCEs.

The proposed General Permit will only have an effect on PCE's pertaining to water quality and food sources. Other PCE's would not be impacted by proposed effluent and BMPs to limit discharges of pH and oil and grease. Determining the impact of the proposed effluent limits on PCEs for water quality, food sources, and temperature, the EPA draws on the analysis completed in Section 5.1 of the impacts of the same pollutants on salmonids and invertebrates. The EPA determined that the effluent limits and BMPs would not adversely affect salmon, trout, and various species of snails. The EPA believes the same analyses and conclusions may be applied to determining the impact of the effluent limits and BMPs on PCEs related to water quality and aquatic based food sources. Tables 18, 19, 20 summarize the determinations on PCEs for salmonids, bull trout, and steelhead.

Table 18: Effects on PCEs of SR sockeye, SR spring/summer and fall chinook Critical Habitat

Primary Constituent Elements		**Effect**
Site	**Site Attribute**	
Spawning and juvenile rearing areas	Access (sockeye) Cover/shelter Food (juvenile rearing) Riparian vegetation Space (Chinook) Spawning gravel Water quality Water temperature (sockeye) Water quantity	No Effect No Effect No measurable effect No Effect No Effect No Effect No measurable effect No measurable effect No Effect
Juvenile migration corridors	Cover/shelter Food Riparian vegetation Safe passage Space Substrate Water quality Water quantity Water temperature Water velocity	No Effect No measurable effect No Effect No Effect No Effect No Effect No measurable effect No Effect No measurable effect No Effect
52Adult migration corridors	Cover/shelter Riparian vegetation Safe passage Substrate Water quality Water quantity Water temperature Water velocity	No Effect No Effect No Effect No Effect No measurable effect No Effect No measurable effect No Effect

Table 19. Effects on PCEs or SR Steelhead Critical Habitat

Primary Constituent Elements		**Species Life History Event**
Site Type Site	**Site Attribute**	
Freshwater spawning	Substrate Water quality Water quantity	No Effect No Measurable Effect No Effect
Freshwater rearing	Flood plain connectivity Forage Natural cover Water quality Water quantity	No Effect No Measurable Effect No Effect No Measurable Effect No Effect
Freshwater migration	Free of artificial obstructions Natural cover Water quality Water quantity	No Effect No Effect No Measurable Effect No Effect

Table 20. Effects on PCEs of Bull Trout Critical Habitat

Site Attribute (PCE)	Effect
springs, seeps, groundwater sources, and hyporheic flows to contribute to water quality and quantity and provide thermal refugia	No Effect
minimal migration impediments between the habitats that support the various life history stages	No Effect
abundant food base	No Measurable Effect
complex river, stream, lake, reservoir, aquatic environments and process;	No Measurable Effect
water temperatures ranging from 2 to 15C, with adequate thermal refugia available for temperatures that exceed the upper end of this range;	No Measurable Effect
Spawning and rearing areas with sufficient amount, size, and composition of substrate with minimal fine sediment;	No Effect
Natural Hydrograph	No Effect
Sufficient water quality and quantity	No Measurable Effect
Sufficiently low levels of nonnative predatory, interbreeding, or competing species	No Effect

5.7 Summary of Effects Determinations

A summary of the effects determination for the listed species of concern addressed in this BE are summarized in Table 21 below.

Table 21 Summary of Effects Determination on T&E Species of Concern and Critical Habitat

Species	Status	Critical Habitat	Effects Determination	Critical Habitat Effects
Fish				
Bull Trout (Salvelinus confluentus)	Threatened	Yes	NLAA	NLAA
Snake River Fall and Spring/Summer Chinook Salmon (Oncorhynchus tshawytscha)	Threatened	Yes	NLAA	NLAA
Snake River Steelhead (Oncorhynchus mykiss)	Threatened	Yes	NLAA	NLAA
Snake River Sockeye Salmon (Oncorhynchus nerka)	Endangered	Yes	NLAA	NLAA
Kootenai River White Sturgeon (Acipenser transmontanus)	Endangered	Yes	NE	NE
Invertebrates				
Banbury Springs Lanx (Lanx sp.)	Endangered	No	NLAA	N/A
Bliss Rapids Snail (Taylorconcha serpenticola)	Threatened	No	NLAA	N/A
Bruneau Hot Spring Snail	Endangered	No	NE	N/A

(Pyrgulopsis brunaeuensis)				
Snake River Physa Snail (Physa natricina)	Endangered	No	NLAA	N/A
Plants				
Ute Ladies' Tresses (Spiranthes divulvialis)	Threatened	No	NLAA	N/A
Water Howelia (Howelia aquatilis)	Threatened	No	NE	N/A

6 Cumulative Effects and Interdependent/Interrelated Actions

Cumulative effects include the effects of future state, tribal, local, or private actions on endangered or threatened species or critical habitat that are reasonably certain to occur in the action area considered in this BE. Future federal actions or actions on federal lands that are not related to the proposed action are not considered in this section.

Future anticipated nonfederal actions that may occur in or near surface waters in the state of Idaho include timber harvest, grazing, mining, agriculture, urban development, municipal and industrial wastewater discharges, road building, sand and gravel operations, aquaculture, off-road vehicle use, fishing, hiking, and camping. These nonfederal actions are likely to continue having adverse effects on the endangered and threatened species, and their habitat.

There are also nonfederal actions likely to occur in or near surface waters in the state of Idaho that are likely to have beneficial effects on the endangered and threatened species. These include implementation of riparian improvement measures, best management practices associated with timber harvest, grazing, agricultural activities, urban development, road building and abandonment, recreational activities, and other nonpoint source pollution controls.

Interdependent actions are defined as actions with no independent use apart from the proposed action. Interrelated actions include those that are part of a larger action and depend on the larger action for justification. No interdependent/interrelated actions are expected to result from the proposed general permit for hydro-electric facilities in the state of Idaho.

7 Essential Fish Habitat Analysis for Idaho's NPDES Permit for Hydroelectric Dams

7.1 Essential Fish Habitat Background

In this section, Essential Fish Habitat (EFH) is assessed for potential adverse impacts from the issuance by the EPA of the proposed General Permit for discharges of wastewaters from hydroelectric facilities in Idaho.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires Federal agencies to consult with NMFS on activities that may adversely affect Essential Fish Habitat (EFH).

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting this definition of EFH: Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and spawning, breeding, feeding, or growth to maturity and covers a species' full life cycle (50 CFR 600.110). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

The objective of this EFH assessment is to determine whether or not the proposed action(s) "may adversely affect" designated EFH for relevant commercially, federally-managed fisheries species within the proposed action area. It also describes conservation measures proposed to avoid, minimize, or otherwise offset potential adverse effects to designated EFH resulting from the proposed action.

Pursuant to the MSA the Pacific Fisheries Management Council (PFMC) has designated EFH for three species of federally-managed Pacific salmon: chinook; coho; and Puget Sound pink salmon. Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers identified by the PFMC, and longstanding, naturally-impassable barriers. The following waters have been designated EFH for Chinook in Idaho:

> Hells Canyon, Lower Snake-Asotin, Upper Salmon, Pahsimeroi, Middle Salmon-Panther, Lemhi, Middle Fork Salmon, Lower Middle Fork Salmon, Upper Middle Fork Salmon, Lower Middle Fork Salmon, Middle Salmon – Chamberlain, South Fork Salmon, Lower Salmon, Little Salmon, Upper Selway, Lower Selway, Lochsa, Middle Fork Clearwater, South Fork Clearwater, Clearwater, Lower North Fork Clearwater.

7.2 Description of the Action/Action Area

See Section 1 for a description of the action and the action area.

7.3 Potential Adverse Effects of Proposed Project on Salmon EFH

The General Permit for hydroelectric facilities will cover facilities that may be within the EFH for chinook salmon including habitats for migration spawning, and rearing.

Water quality is an important component of EFH. The General Permit covers the discharge of wastewater from the facility and not the flow of water through turbines. The effects of discharges authorized by the

General Permit on chinook salmon EFH are the same as those described for fish species of concern covered in Section 5.0. A summary of the effects determinations made for ESA listed species is found in Table 21 in Section 5.7. Effluent limitations, BMPs, and 316(b) requirements provide restrictions that are sufficient to prevent harm to life states of threatened and endangered species in the action area. The issuance of the General Permit was found to not likely to adversely affect any of the listed salmon and their critical habitat. Therefore, the General Permit would be expected to have no adverse effects on essential fish habitat for any salmon.

7.4 EFH Conservation Measures

Conservation measures in the permit include, but are not limited to:

- Monitoring and reporting requirements for discharges to ensure discharge meet effluent limits;
- Establish and update, as necessary, BMPs to reduce and/or eliminate the use of petroleum based lubricants, eliminate spills and leaks of oil, grease, and hydraulic fluids, and preventative maintenance programs; and
- Require measures to minimize impingement and entrainment of aquatic species.

In addition, facilities covered by the proposed General Permit must ensure the proper operation and maintenance of water management and wastewater treatment systems and the control of the discharge or potential release of pollutants to the receiving water

7.5 Conclusions

Based on the data available and analysis based on that data for hydro-electric generating facilities discharge, the issuance of the General Permit for hydro-electric generating facilities will not adversely affect designated EFH for relevant commercially, federally-managed fisheries species within Idaho.

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APPENDIX A

Figures, Maps, and Illustrations

Figure 3: Diagram of Flow and Discharge from a Smaller Hydroelectric Facility

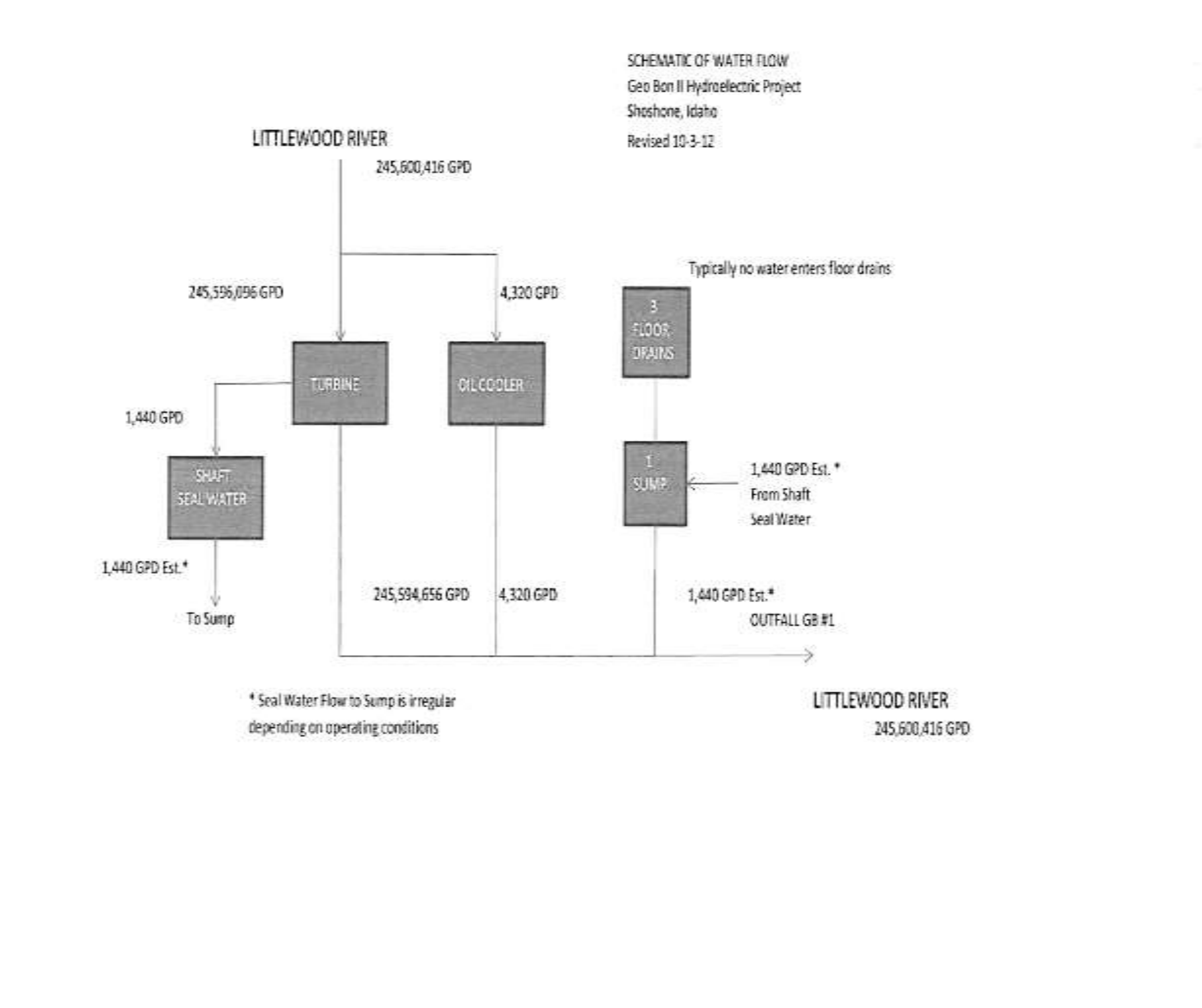
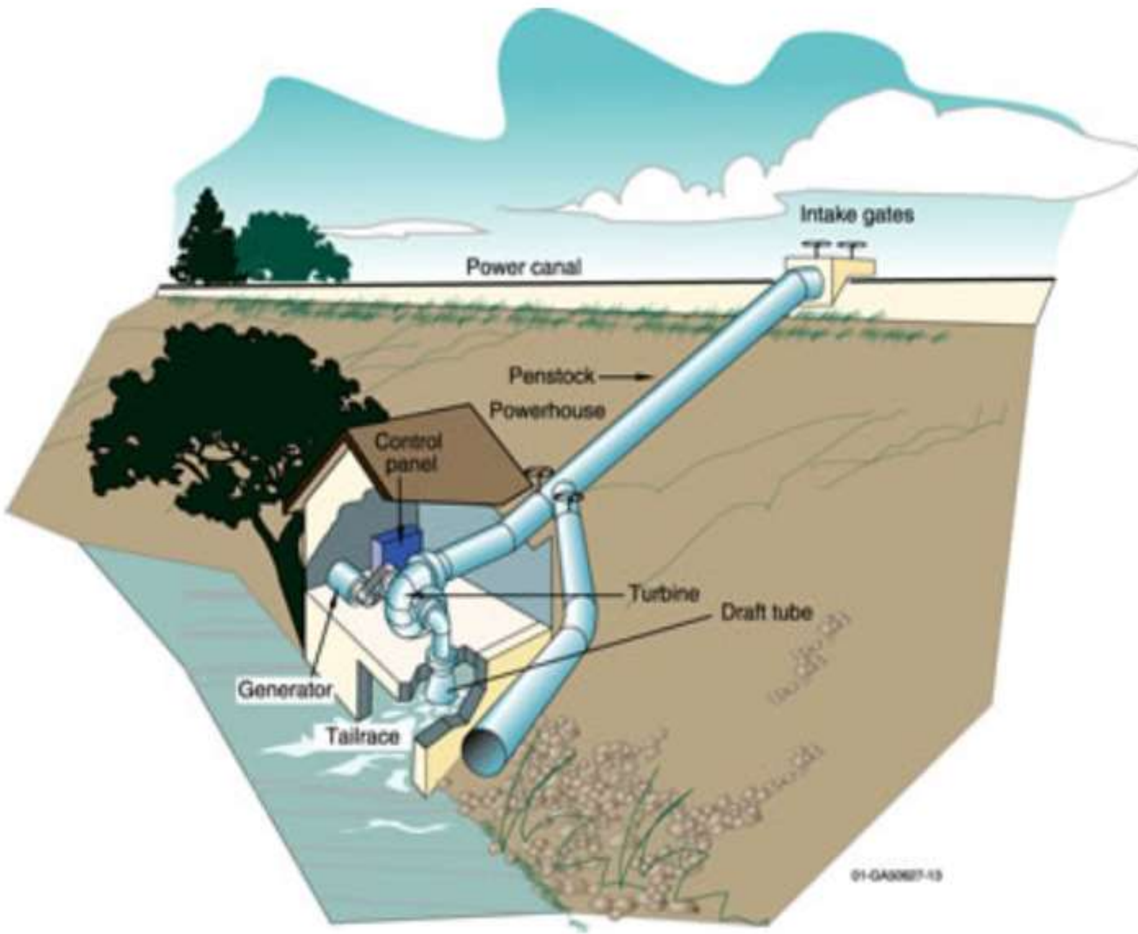


Figure 4: Diagram of a Small Hydroelectric Facility



From Office of Energy Efficiency & renewable Energy website

Figure 5. Diagram of Flow from Large Hydro-electric Facility

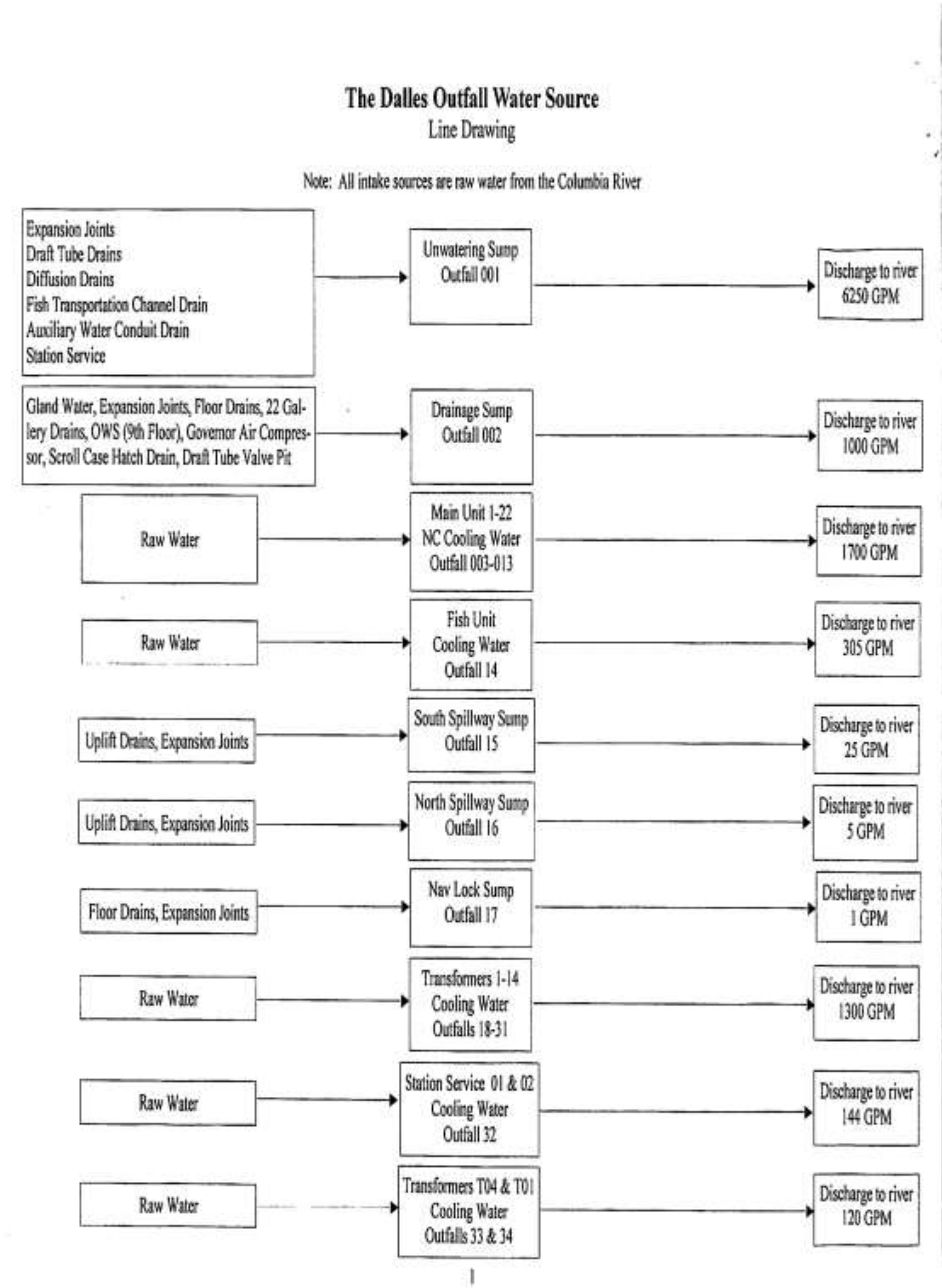


Figure 6: Illustration of Outfalls from Large Hydroelectric Facility

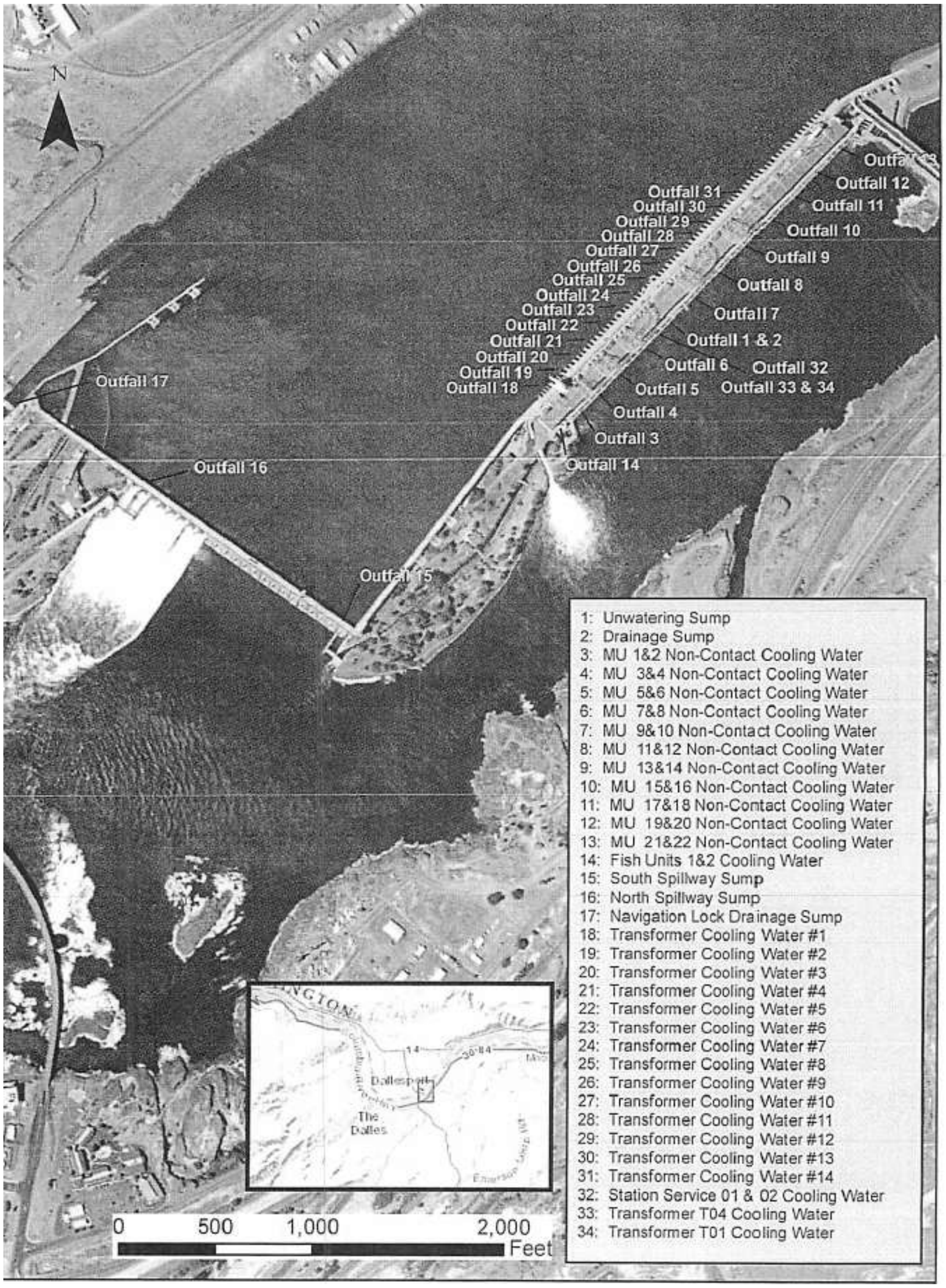


Figure 7 Map of Steelhead ESU and Hydro-Electric Generating Facilities Overlap

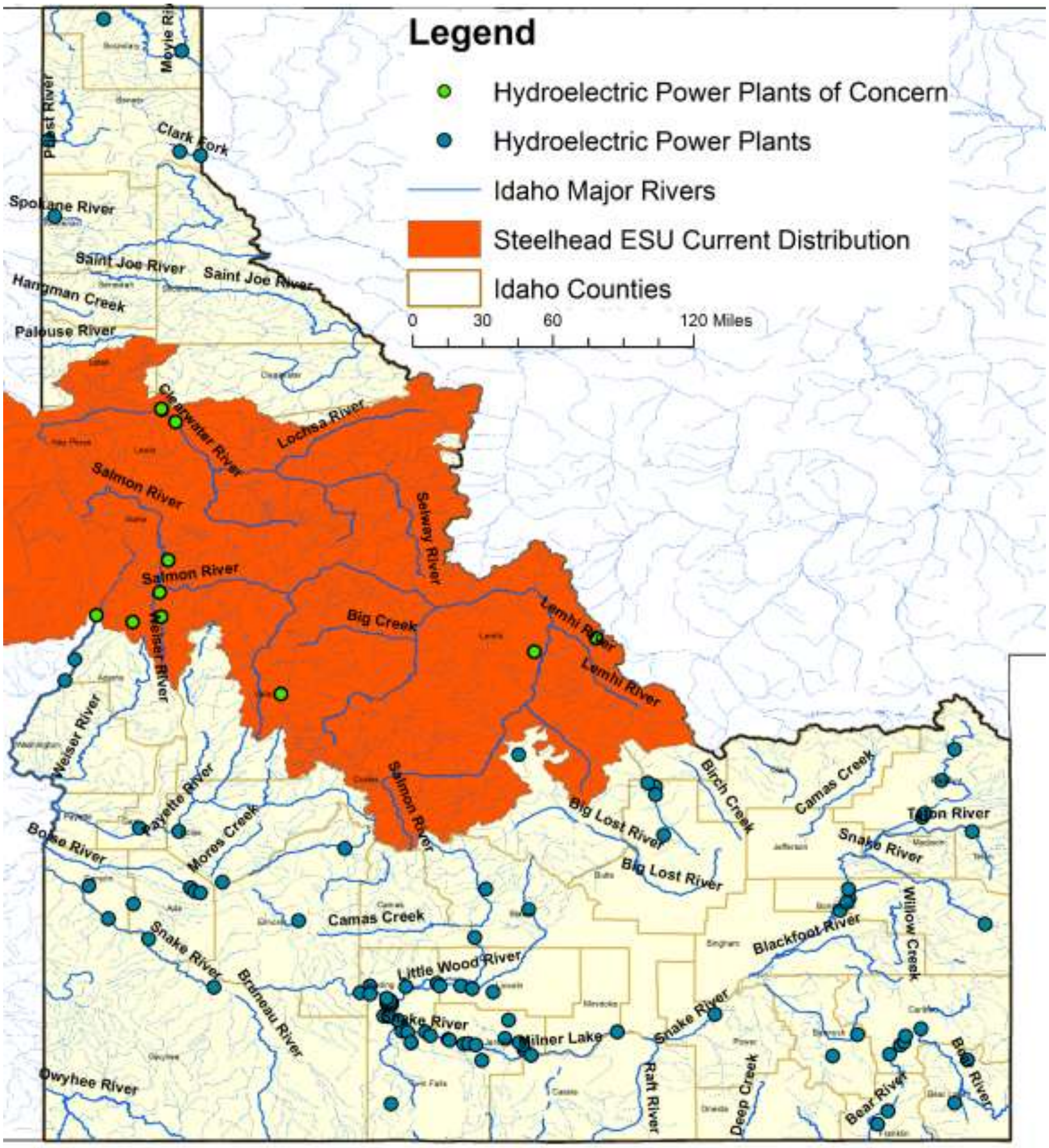


Figure 8. Map of Sockeye ESU and Hydro-Electric Generating Facilities Overlap

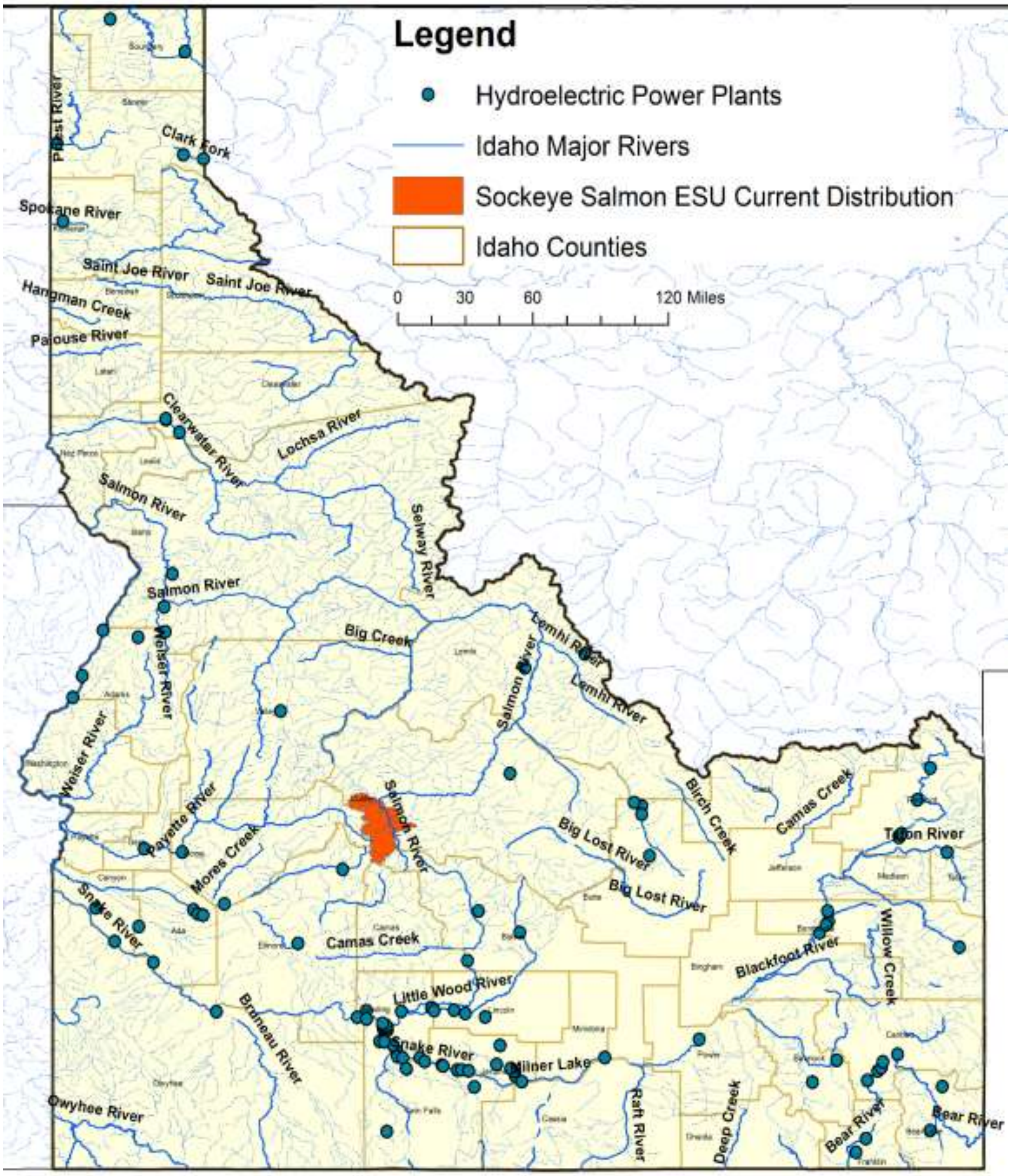


Figure 9. Map of Chinook Salmon ESU and Hydro-Electric Generating Facilities Overlap

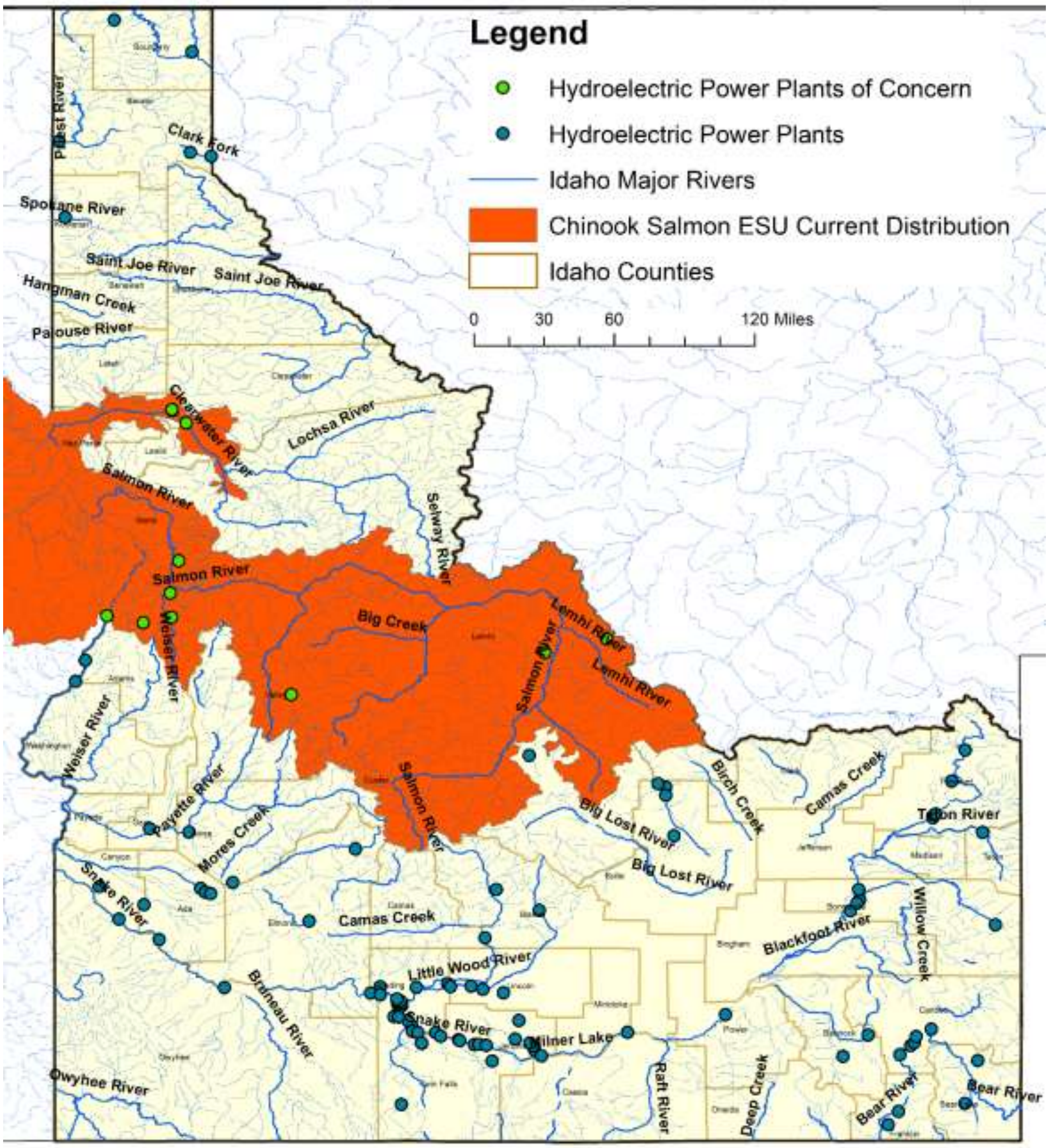


Figure 10. Map of Sturgeon Critical Habitat and Hydro-Electric Generating Facilities Overlap

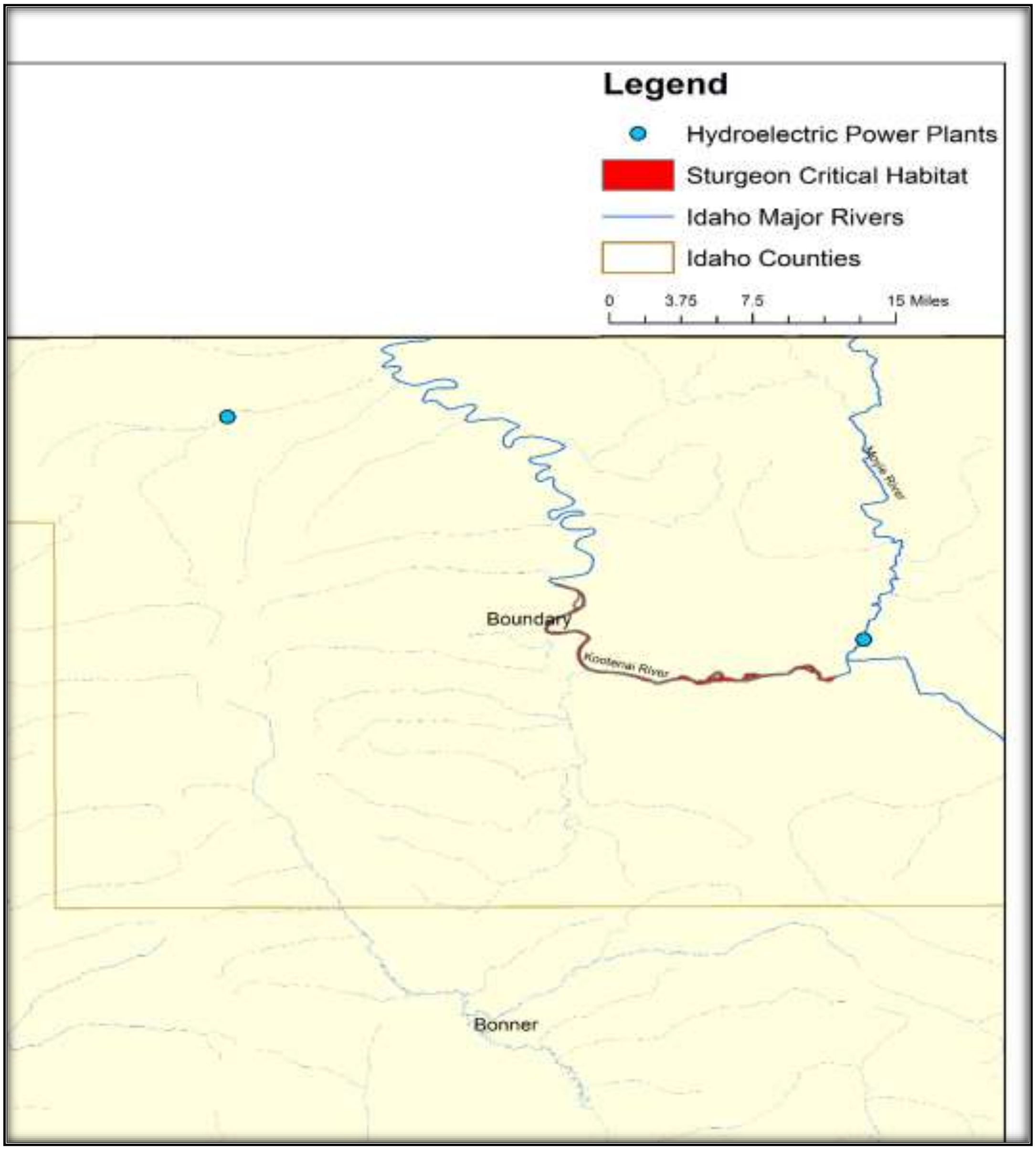


Figure 11. Map of Bull Trout Critical Habitat and Hydro-Electric Generating Facilities Overlap

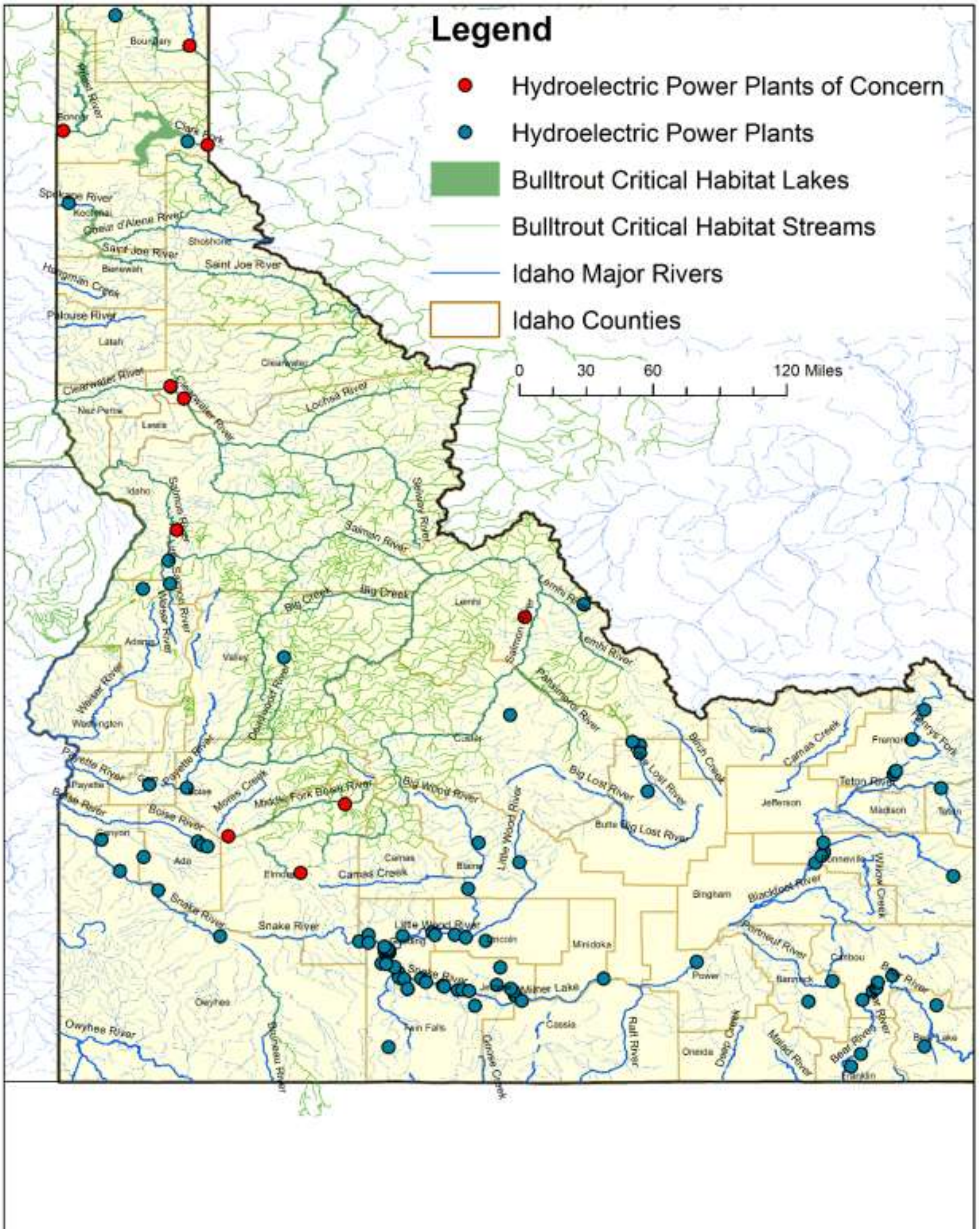


Figure 12. Map of Banbury Springs Lanx Known Range and Hydro-Electric Generating Facilities Overlap

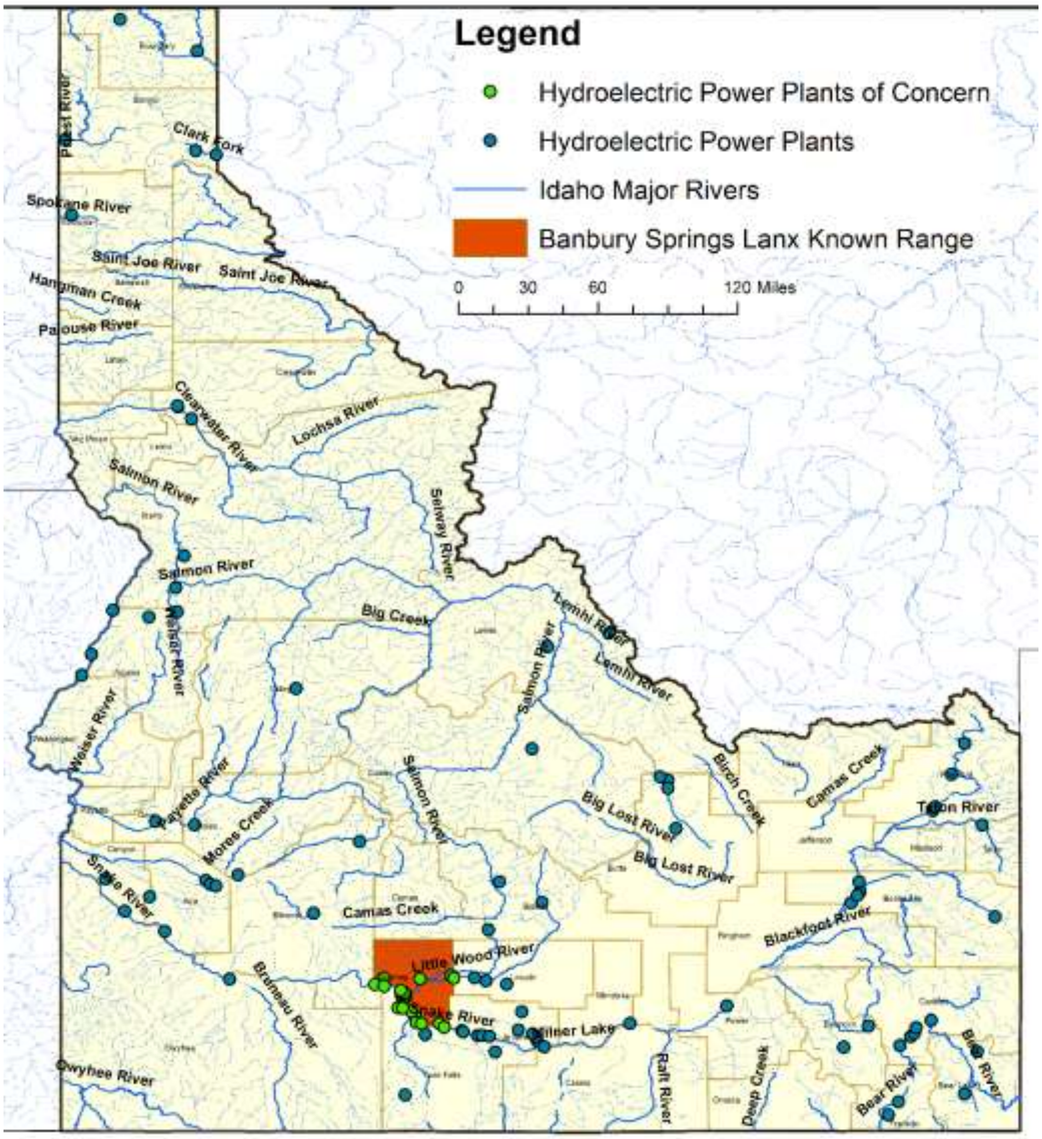


Figure 13. Map of Bruneau Hot Spring Snail Known Range and Hydro-Electric Generating Facilities Overlap

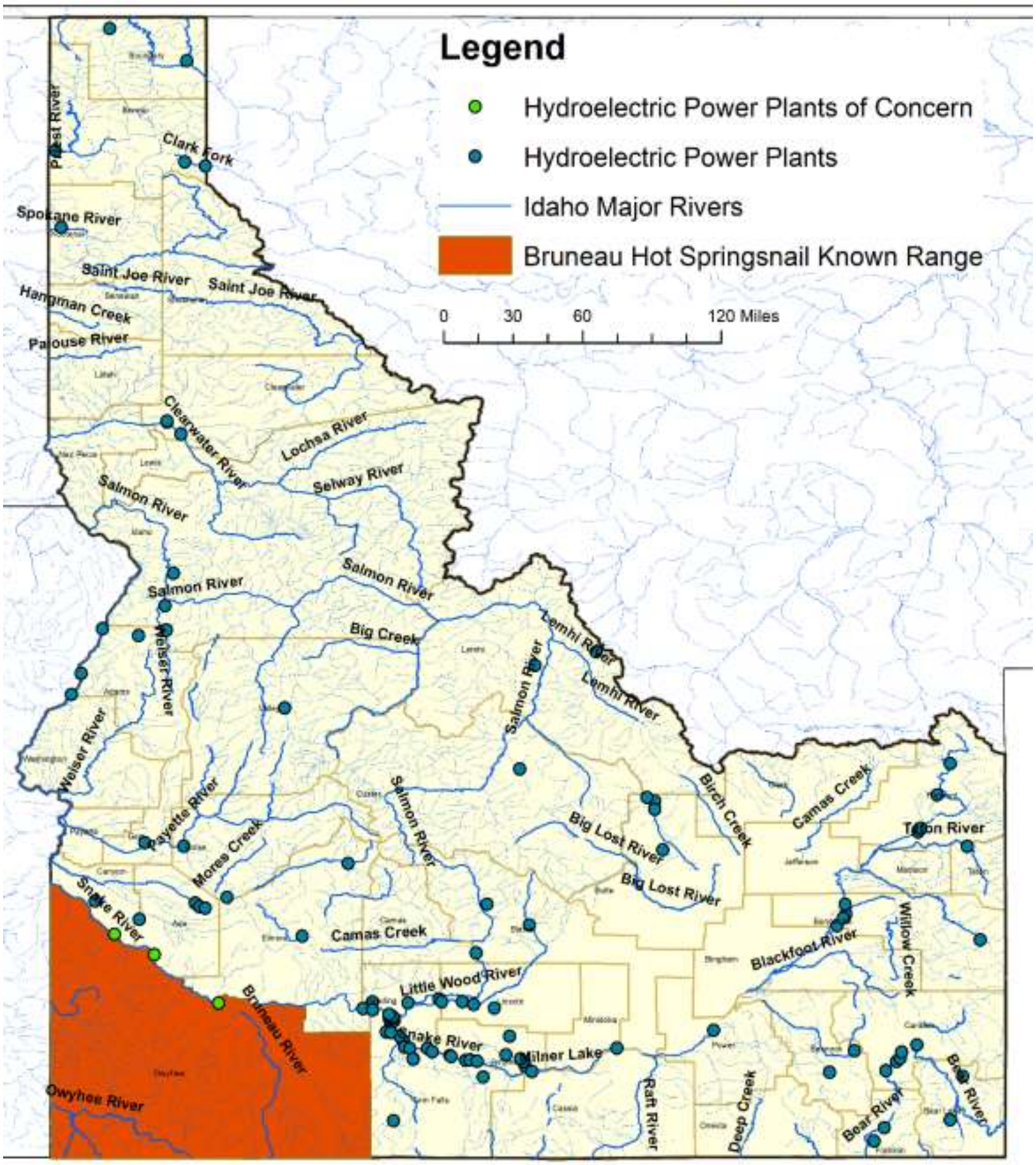


Figure 14. Bliss Rapids Snail known range and Hydro-Electric Facilities Overlap

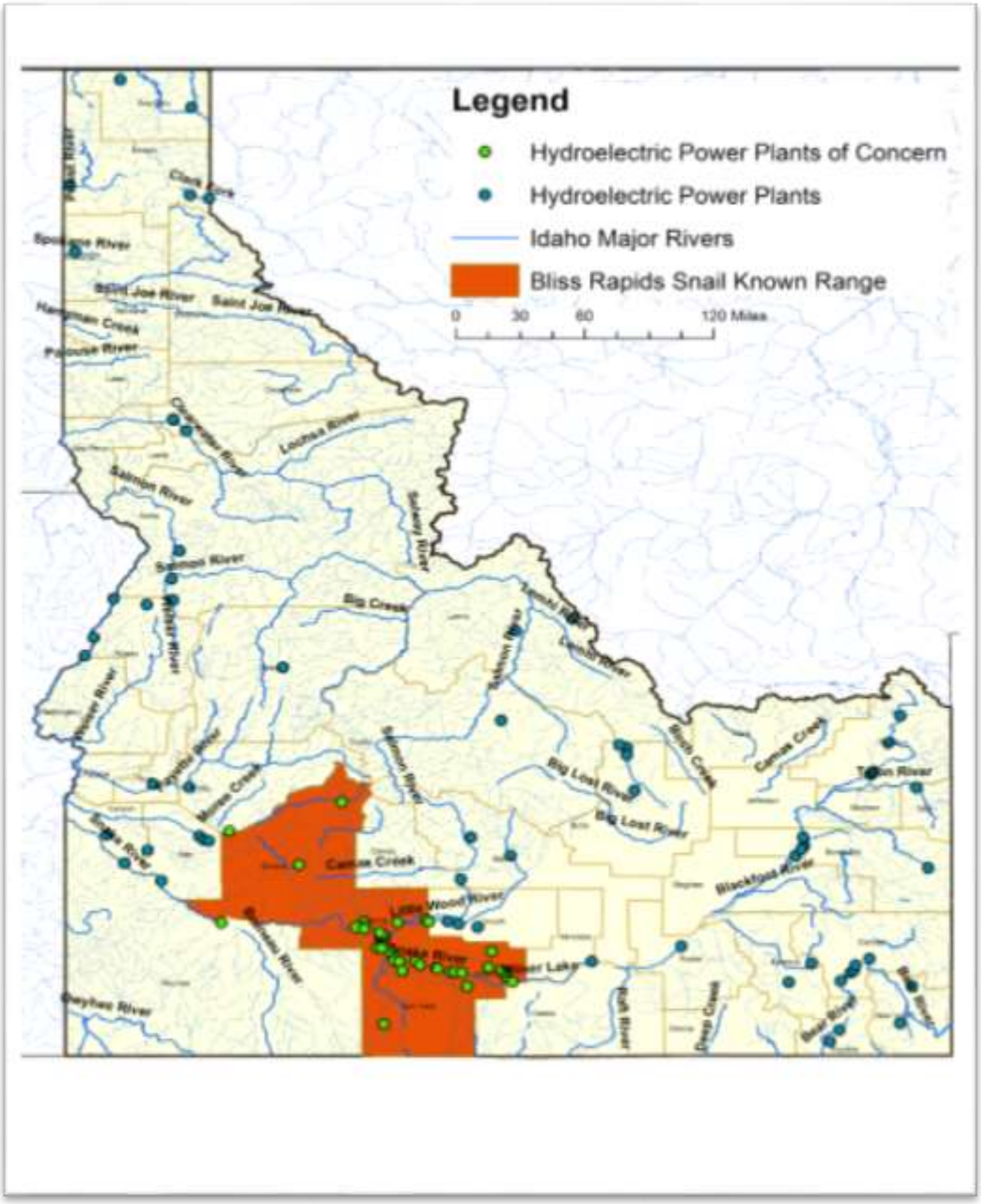


Figure 15. Snake River Physa Snail Known Range and Hydro-Electric Generating Facilities Overlap

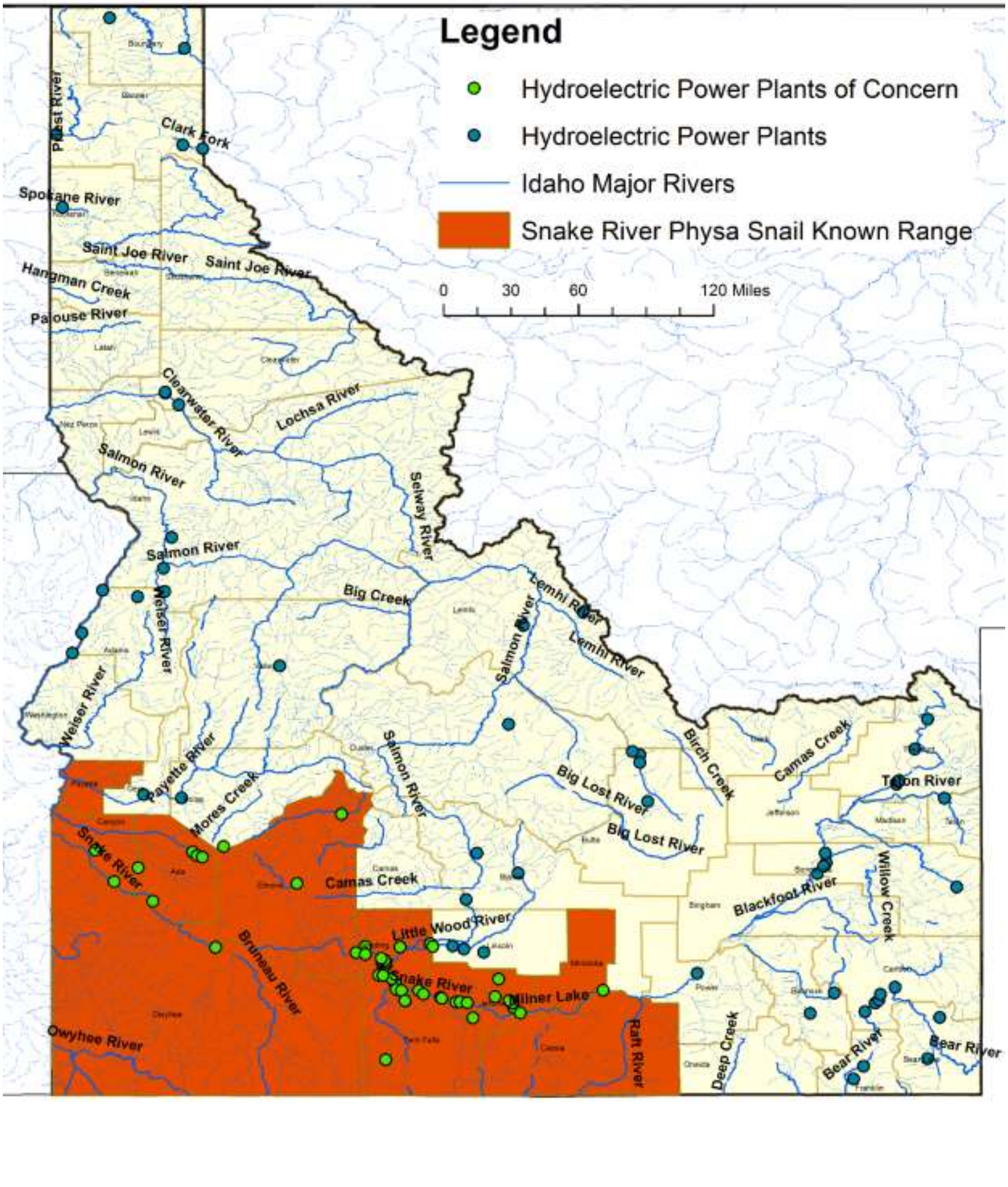


Figure 16: Ute's Ladies Tresses Range and Location of Hydroelectric Facilities

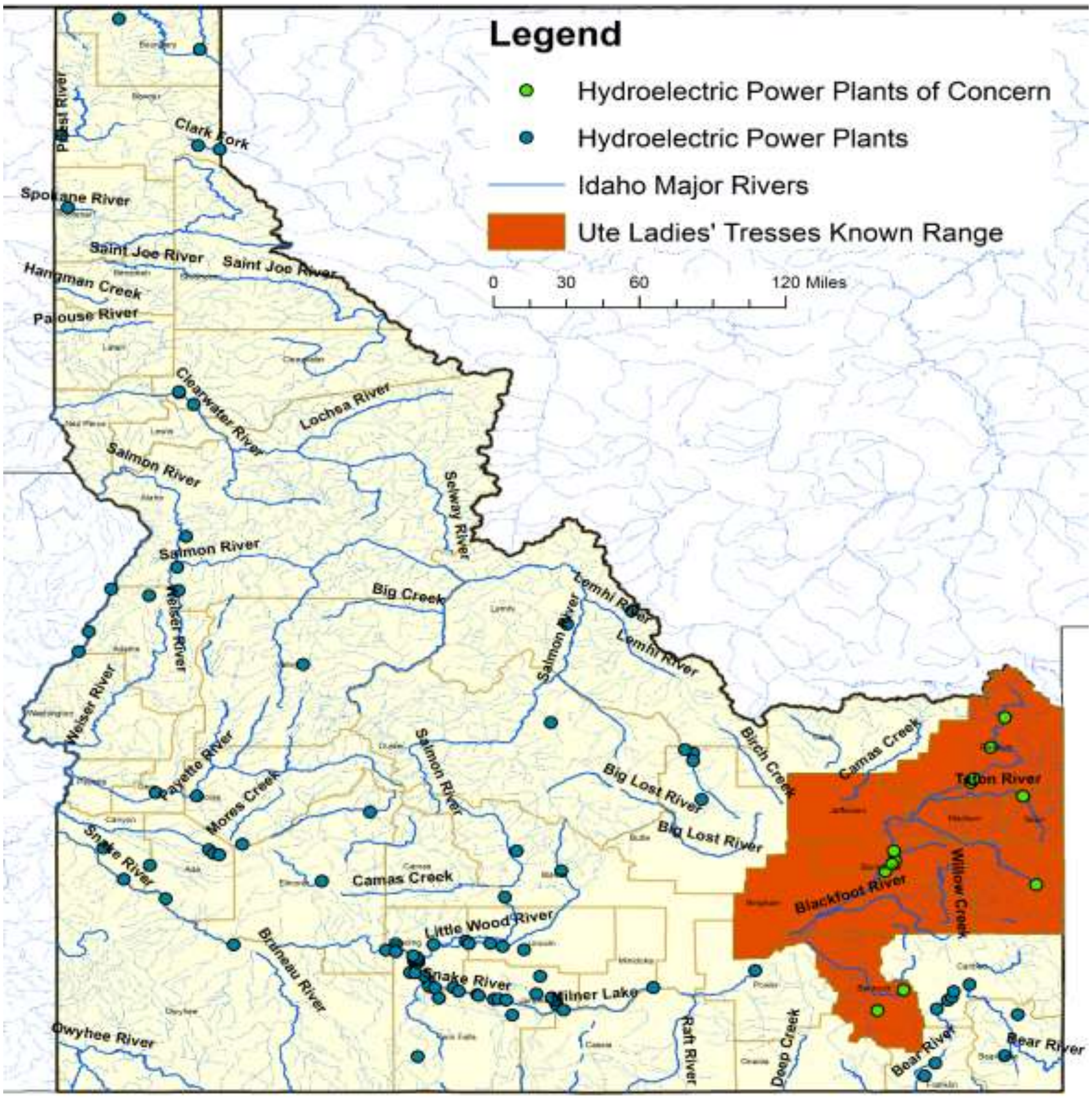
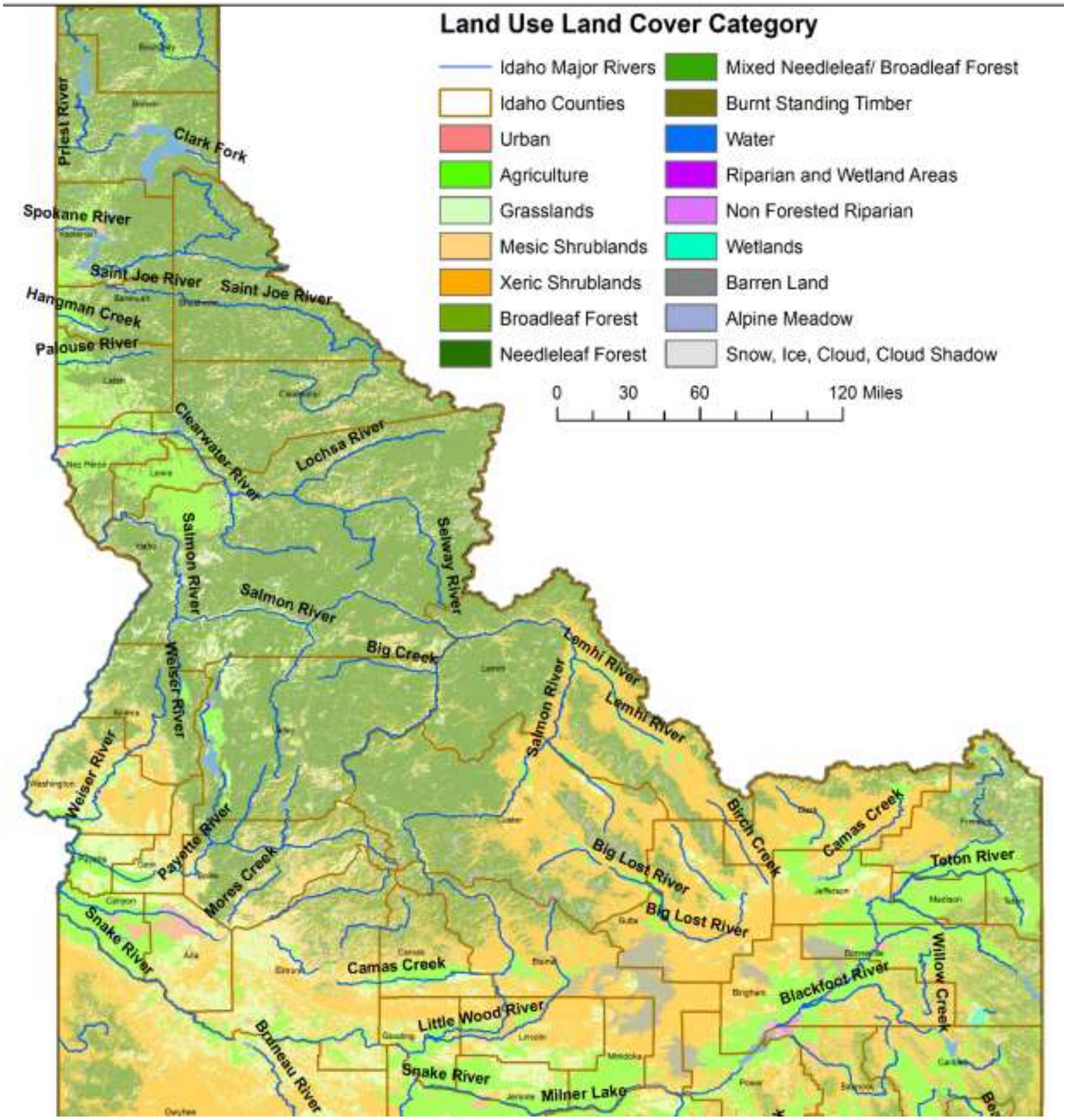


Figure 17. Location where Water Howellia is found within the State of Idaho (Latah County)

From: USDA-Natural Resources Conservation Service Boise, Idaho Technical Note No. 51 January 2013 Revision

Figure 18. Land use layer of state of Idaho



APPENDIX ***B***

***Table 22*. Hydroelectric Facilities Identified by NWPCC* as Located within the State of Idaho**

Name	Technology	Resource Type	Average Energy (MWa)	Service Month	Site	County
Albeni Falls 1- 3	Storage	Hydro	31.0	May	Pend Oreille R.	Bonner
American Falls 1 - 3	Storage w/Div	Hydro		Mar	Snake R.	Power
Amy Ranch	Conduit	Hydro	0.4		Deep Cr.	Butte
Anderson Ranch 1 - 2	Storage	Hydro	16.0	Dec	Boise R.	Elmore
Arrowrock 1 - 2	Storage	Hydro	9.2	April	Boise R.	Ada
Ashton 1 - 3	ROR	Hydro	4.8	Aug	Henrys Fk.	Fremont
Atlanta Power Station (Kirby)	ROR R w/Div	Hydro	0.2		Boise R, M Fk	Elmore
Barber Dam	ROR	Hydro	2.0	Aug	Boise R.	Ada
Bell Mountain	Conduit	Hydro	0.1	Dec	Bell Mt Cr. & Mahogany Cr.	Butte/Lemhi
Billingsley Creek	Diversion	Hydro	0.1		Billlingsley Cr.	Gooding
Birch Creek	Canal	Hydro		Apr	Birch Cr.	Clark
Birch Creek B	Conduit	Hydro			Birch Cr.	Gooding
Black Canyon 1 - 2	Storage	Hydro	8.0		Payette R.	Gem
Black Canyon No. 3	Canal	Hydro			N. Gooding Main Cnl.	Gem
Blind Canyon	Diversion	Hydro		Apr	Blind Canyon Spr.	Gooding
Bliss 1 - 3	ROR	Hydro	42.0	Nov	Snake R.	Gooding
Boise River Diversion 1- 3	ROR	Hydro	2.0	May	Boise R.	Ada

Name	Technology	Resource Type	Average Energy (MWa)	Service Month	Site	County
Box Canyon	ROR R w/Div (spring)	Hydro	0.5		Box Canyon Spr.	Twin Falls
Briggs Creek	Diversion	Hydro			Briggs Cr.	Gooding
Brownlee 1- 5	ROR R. w/Div.	Hydro	340.0	Aug	Snake R.	Washington
Buffalo River (Pond's Lodge)	Diversion	Hydro	0.2		Buffalo R. (Henrys Fk. Snake)	Fremont
Bypass	Canal	Hydro		Mar	N. Side Main Cnl.	Jerome
C.J. Strike 1- 3	ROR	Hydro		May	Snake R.	Owyhee
Cabinet Gorge 1 - 4	ROR R. w/Div.	Hydro	123.8	Sep	Clark Fork R.	Bonner
Cascade 1 & 2	Storage w/Div	Hydro	12.0		Payette R. N. Fk.	Valley
Cedar Draw Creek (Crystal Springs)	Diversion	Hydro		Jan	Cedar Draw Cr.	Twin Falls
Chester Diversion 1-3	ROR	Hydro	1.4	Mar	Henrys Fk.	Fremont
Clear Lake	Diversion	Hydro		Dec	Snake R. (Off-stream)	Gooding
Clearwater Hatchery (Dworshak)	HY	Hydro	1.8		N.Fk. Clearwater R.	Clearwater
Derr Creek	Diversion	Hydro	0.1		Derr Cr.	Bonner
Dietrich Drop	Canal	Hydro		Aug	Milner-Gooding Cnl.	Lincoln
Doug Hull	Canal	Hydro	0.1		Twin Falls Cnl Lateral 28	Twin Falls
Dry Creek	Conduit	Hydro	2.0	Dec	Dry Cr.	Butte
Dworshak 1 - 3	Storage	Hydro	209.0	Jun	Clearwater R.	Clearwater

Name	Technology	Resource Type	Average Energy (MWa)	Service Month	Site	County
Elk Creek (El Dorado Hydro Elk Creek)	Diversion	Hydro		Apr	Elk Cr.	Idaho
Falls River	Diversion	Hydro		Aug	Fall R.	Fremont
Fargo Drop	Canal	Hydro		Apr	Near Homedale on Deer Flat Canal, ID:	Canyon
Faulkner	Canal	Hydro			N. Side Main "Y" Cnl.	Gooding
Felt	ROR R. w/Div.	Hydro			Teton R.	Teton
Felt Hydroelectric Plant		Hydro			Teton R.	Teton
Fisheries Development No. 1	Diversion	Hydro			Billingsley Cr.	Gooding
Ford	HY	Hydro			Jim Ford Cr.	
Forgy	Conduit	Hydro			Unnamed Spring	Adams
Gem State	ROR R. w/Div.	Hydro	28.0	Nov	Snake R.	Bingham
Geo-Bon No. 2 (Notch Butte)	Diversion	Hydro			Little Wood R.	Lincoln
Georgetown	Conduit	Hydro			Georgetown Cr.	Bear Lake
Grace 3 - 5	ROR R. w/Div.	Hydro	23.2		Bear R.	Caribou
Hailey	Conduit	Hydro			Indian Cr.	Blaine
Hazelton A	Canal	Hydro		Jun	N. Side Main Cnl.	Jerome
Hazelton B	Canal	Hydro		Apr	N. Side Main Cnl.	Jerome
Horseshoe Bend Hydroelectric	HY	Hydro		Apr	Payette R.	Boise
Idaho Falls City Plant 3	ROR	Hydro	5.0	Jul	Snake R.	Bonneville

Name	Technology	Resource Type	Average Energy (MWa)	Service Month	Site	County
Idaho Falls Lower No. 1 (Unit 2)	ROR	Hydro		Apr	Snake R.	Bonneville
Idaho Falls Lower No. 2 (Unit 1)	ROR	Hydro		Aug	Snake R.	Bonneville
Idaho Falls Upper Plant 4	ROR	Hydro		Sep	Snake R.	Bonneville
Ingram Warm Springs Ranch A	Diversion	Hydro			Warm Spring Cr.	Custer
Ingram Warm Springs Ranch B	Diversion	Hydro	1.1		Warm Spring Cr.	Custer
Island Park 1 & 2	Storage	Hydro		Apr	Henrys Fk.	Fremont
Jim Ford Creek 1-3 (Ford Hydro LP)	Diversion	Hydro	0.8	Mar	Jim Ford Cr.	Clearwater
Jim Knight	Canal	Hydro			S. Gooding Main Cnl.	Gooding
John Day Creek (Cereghino)	Diversion	Hydro	0.7		John Day Cr.	Idaho
Kasel-Witherspoon	Diversion	Hydro		Dec	Snake R., Trib.	Twin Falls
Kaster Riverview	Diversion	Hydro	0.2		Box Canyon Spr.	Twin Falls
Koyle Ranch 1-3	Diversion	Hydro		Dec	Big Wood R.	Gooding
Last Chance Canal 1- 3	ROR R w/Div	Hydro	0.9	Feb	Bear R.	Caribou
Lateral No. 10	Canal	Hydro		Nov	Lataeral No. 10 Cnl.	Twin Falls
Lemoyne	Conduit	Hydro			Conyers Ditch	Gooding
Little Mac (Cedar Draw)	Diversion	Hydro	1.1	May	Cedar Draw	Twin Falls
Little Wood Reservoir	Diversion	Hydro			Little Wood R.	Blaine
Little Wood River Ranch	Storage	Hydro		Feb	Little Wood R.	Lincoln

Name	Technology	Resource Type	Average Energy (MWa)	Service Month	Site	County
LM Angus Ranch	HY	Hydro			Warm Springs Cr.	
Low Line Canal Drop (South Forks Hydro)	Canal	Hydro			Low Line Canal	Twin Falls
Low Line Midway	Canal	Hydro	0.9	Aug	Low Line Canal	Twin Falls
Lower Low Line (aka Low Line Rapids)	Canal	Hydro	0.3		Low Line Cnl.	Twin Falls
Lower Malad	Diversion	Hydro			Big Wood R.	Gooding
Lower Salmon Falls 1- 4	ROR	Hydro	26.0		Snake R.	Gooding
LQ-LS Drains	Diversion	Hydro	1.3		LS Drain & LQ Drain	Twin Falls
Lucky Peak 1 - 3	Storage w/Div	Hydro	32.2	Oct	Boise R.	Ada
Magic Dam	Storage	Hydro		May	Big Wood R.	Blaine
Marsh Valley	Diversion	Hydro	0.9	Apr	Portneuf Marsh Valley Cnl.	Bannock
Mile 28 (1 & 2)	Canal	Hydro			Milner-Gooding Cnl.	Jerome
Milner 1 & 2 (A)	Diversion	Hydro	1.0	Sep	Snake R.	Twin Falls
Milner 3 (B)	Diversion	Hydro	1.0	Sep	Snake R.	Twin Falls
Minidoka 6-9	Storage	Hydro	8.0	Jun	Snake R.	Minidoka
Mink Creek	Diversion	Hydro		Dec	Mink Cr.	Franklin
Mora Canal Drop	Canal	Hydro	0.9	Jun	Mora Canal	Ada
Moyie River 1 & 3 (Moyie Springs)	Storage w/Div	Hydro	2.7	Jan	Moyie R.	Boundary
Moyie River 2 (Moyie Springs)	Storage w/Div	Hydro	0.0	Jan	Moyie R.	Boundary

Name	Technology	Resource Type	Average Energy (MWa)	Service Month	Site	County
Moyie River 4 (Moyie Springs)	Storage w/Div	Hydro	0.0	Feb	Moyie R.	Boundary
Mud Creek A	Diversion	Hydro			Mud Cr.	Twin Falls
Mud Creek B	Canal	Hydro			Present Ditch	Twin Falls
N-32 (Northside Canal) (Marco Ranch)	Diversion	Hydro	0.3		N. 32 Lateral Cnl.	Jerome
Nicholson	Conduit	Hydro			Uncle Ike Cr.	Butte
O.J. Power Company	Diversion	Hydro			Mill Cr.	Oneida
Oneida 1- 3	Storage w/Div	Hydro	6.3		Bear R.	Franklin
Palisades 1 - 4	Storage	Hydro	66.0	Feb	Snake R.	Bonneville
Paris	Diversion	Hydro	0.3		Weilenmann Cnl.	Bear Lake
Portneuf River	ROR R w/Div	Hydro	0.5		Portneuf R.	Bannock
Post Falls (Middle channel) 1 - 6	Storage	Hydro	9.8	Jul	Spokane R. (Post Falls, ID)	Kootenai
Preston	Conduit	Hydro			Berquist Spr.	Franklin
Pristine Springs	Off-stream	Hydro			Well discharging to Warm Cr. via canal.	Gooding
Reynolds Irrigation District	Canal	Hydro			Reynolds ID Main Cnl.	Owyhee
Rim View (Upper Powerhouse)	HY	Hydro	0.2		Niagara Springs	Gooding
Rock Creek #1	Diversion	Hydro			Rock Cr.	Twin Falls
Rock Creek #2	Diversion	Hydro			Rock Cr.	Twin Falls
Sagebrush	Canal	Hydro			S. Gooding Main Cnl.	Lincoln

Name	Technology	Resource Type	Average Energy (MWa)	Service Month	Site	County
Sahko	Diversion	Hydro		Jan	Kastelu Drain	Twin Falls
Schaffner	Conduit	Hydro			Sandy Cr., W. Fk.	Lemhi
Shingle Creek	Diversion	Hydro	0.2		Shingle Cr., S. Fk.	Idaho
Shoshone Falls 1- 3	ROR R. w/Div.	Hydro	9.0	Aug	Snake R.	Jerome
Shoshone/Shoshone II	Diversion	Hydro			Little Wood R.	Lincoln
Smith Creek (Smith Falls) 1 - 3	Diversion	Hydro	9.0	Apr	Smith Cr.	Boundary
Snake River Pottery	Diversion	Hydro			Snake R. Trib.	Gooding
Snedigar Ranch	Diversion	Hydro			Coulee Cr.	Twin Falls
Soda (Soda Point) 1 & 2	Storage	Hydro	3.0		Bear R.	Caribou
Soda Creek 4	Diversion	Hydro			Soda Creek	Caribou
Soda Creek 5	Diversion	Hydro			Soda Creek	Caribou
St. Anthony	Diversion	Hydro	0.5		Henrys Fk.	Fremont
Stevenson No. 1	Conduit	Hydro	0.1		Snake R. Trib.	Gooding
Stevenson No. 2	Conduit	Hydro	0.1		Snake R. Trib.	Gooding
Sunshine	Diversion	Hydro		Sep	Lake Cr.	Lemhi
Swan Falls 1 & 2	ROR	Hydro	26.0		Snake R.	Ada
Telford	Diversion	Hydro	0.1		Bell Mountian Cr.	Butte
Thousand Springs 1 - 3	HY	Hydro		Aug	Snake R. (Off-stream)	Gooding
Tuttle Ranch (Ravenscroft)	Diversion	Hydro	0.5		Big Wood R.	Gooding

Name	Technology	Resource Type	Average Energy (MWa)	Service Month	Site	County
Twin Falls (IPC)	ROR R. w/Div.	Hydro		Mar	Snake R.	Twin Falls
Upper Malad	Diversion	Hydro		Jun	Big Wood R.	Gooding
Upper Salmon 1 & 2 (A)	Storage w/Div	Hydro	18.0	Sep	Snake R.	Twin Falls
Upper Salmon 3 & 4 (B)	Storage w/Div	Hydro	16.0	Sep	Snake R.	Twin Falls
White Ranch (Mud Cr.)	Conduit	Hydro	0.2		Mud Cr.	Twin Falls
White Water Ranch A	Diversion	Hydro			Stoddard Cr.	Gooding
White Water Ranch C	Diversion	Hydro	0.1		Stoddard Cr.	Gooding
Wilson Lake	Canal	Hydro			N. Side Main Cnl.	Jerome
Oxbow 1 - 4	ROR R. w/Div.	Hydro	137.0	Jul	Snake R.	Baker
Hell's Canyon 1 - 3	ROR R w/Div	Hydro	275.0	Oct	Snake R.	Wallowa
Y-8 (Northside Canal)	Canal	Hydro	0.1		N. Side Main "Y" Cnl.	Gooding

* NWPCC Northwest Power Conservation Council

APPENDIX C

TEMPERATURE ANALYSIS USING TEMPERATURE AND FLOW DATA FROM THE OXBOW AND HELLS CANYON HYDROELECTRIC FACILITIES AS REPORTED THROUGH THEIR DMRS TO THE STATE OF OREGON. (SEE TABLE BELOW FOR TEMPERATURE DATA)

Equations		
Qr	river flow	$Q_r = Q_a + Q_e$
Qe	effluent flow	
Qa	flow from turbine	$Q_a = Q_r - Q_e$
MZ	mixing zone %	
Ta	ambient temperature	
Te	effluent temperature	
Tf	temperature at mixing zone boundary	$Q_r * T_f = Q_a * MZ * T_a + Q_e * T_e \rightarrow T_f = \frac{(Q_a * MZ * T_a + Q_e * T_e)}{(Q_a * MZ + Q_e)}$
ΔT	change in temperature	$\Delta T = T_f - T_a$

Oxbow									
						MZ	25%	Complete Mixing	
	Qr [cfs]	Qa [cfs]	Ta [C]	Qe [cfs]	Te [C]	Tf [C]	ΔT [C]	Tf [C]	ΔT [C]
Min	6710	6697.873	2.8	7.7	3.9	2.8	0	2.8	0
Max	62870	62856.25	23.3	18.4	25.6	23.3	0.018	23.3	0.004
Average	20149.9	20134.94	12.4	15.0	14.3	12.4	0.007	12.4	0.002

St Dev	12105.62	12105.05	6.3	2.2	6.4	6.3	0.003	6.3	0.001
CV	0.60	0.60	0.51	0.15	0.44	0.5	0.50	0.51	0.505
95%	48000	47984.8	22.2	18.2	23.9	22.2	0.014	22.2	0.004
5%	9090	9073.675	3.3	11.0	5	3.3	0.003	3.3	0.001

Oxbow						Tf [C]		ΔT [C]	
	Qr [cfs]	Qa [cfs]	Ta [C]	Qe [cfs]	Te [C]	25% MZ	100% MZ	25% MZ	100% MZ
Min	6710	6697.9	2.8	7.7	3.9	2.8	2.8	0.0000	0.0000
Max	62870	62856.2	23.3	18.4	25.6	23.3	23.3	0.0176	0.0044
Average	20149.9	20134.9	12.4	15.0	14.3	12.4	12.4	0.0069	0.0017
St Dev	12105.6	12105	6.3	2.2	6.4	6.3	6.3	0.0035	0.0009
CV	0.60	0.60	0.51	0.15	0.44	0.5	0.5	0.5036	0.5046
95%	48000	47984.8	22.2	18.2	23.9	22.2	22.2	0.0140	0.0035
5%	9090	9073.7	3.3	11.0	5.0	3.3	3.3	0.0027	0.0007

Hells Canyon									
						MZ	25%	Complete Mixing	
	Qr [cfs]	Qa [cfs]	Ta [C]	Qe [cfs]	Te [C]	Tf [C]	ΔT [C]	Tf [C]	ΔT [C]
Min	7720.0	7709.5	1.1	5.0	4.4	1.1	0.0000	1.1	0.0000
Max	62870.0	62858.3	23.3	12.5	26.1	23.3	0.0160	23.3344	0.0040
Average	20330.8	20321.3	11.7	9.6	15.5	11.7	0.0079	11.7	0.0020
St Dev	11991.3	11991.0	6.6	1.9	6.0	6.6	0.0031	6.6	0.0008
CV	0.59	0.59	0.56	0.20	0.39	0.56	0.3881	0.56	0.3888
95%	44593.6	44583.0	21.7	12.3	25.0	21.7	0.0140	21.7	0.0035
5%	9737.2	9724.9	2.2	6.2	7.1	2.2	0.0039	2.2	0.0010

Hells Canyon						Tf [C]		ΔT [C]	
	Qr [cfs]	Qa [cfs]	Ta [C]	Qe [cfs]	Te [C]	25% MZ	100% MZ	25% MZ	100% MZ
Min	7720.0	7709.5	1.1	5.0	4.4	1.1	1.1	0.0000	0.0000
Max	62870.0	62858.3	23.3	12.5	26.1	23.3	23.3	0.0160	0.0040
Average	20330.8	20321.3	11.7	9.6	15.5	11.7	11.7	0.0079	0.0020
St Dev	11991.3	11991.0	6.6	1.9	6.0	6.6	6.6	0.0031	0.0008
CV	0.59	0.59	0.56	0.20	0.39	0.56	0.56	0.3881	0.3888
95%	44593.6	44583.0	21.7	12.3	25.0	21.7	21.7	0.0140	0.0035
5%	9737.2	9724.9	2.2	6.2	7.1	2.2	2.2	0.0039	0.0010

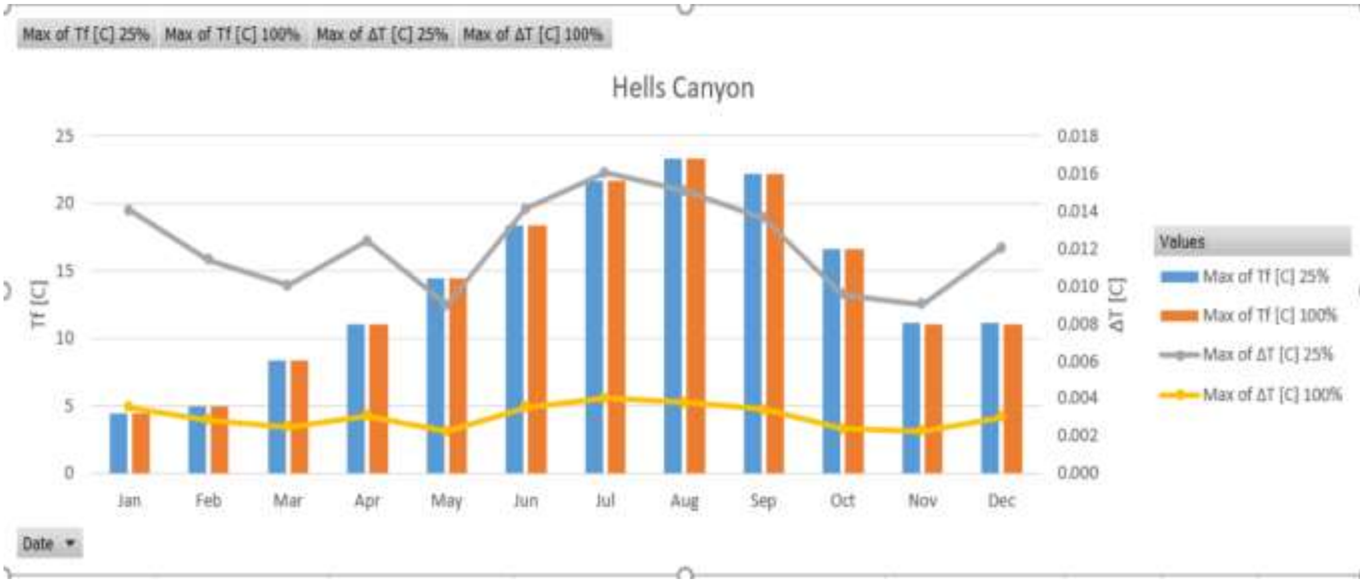
Results

Bars represent the final temperature of the receiving water and use the left axis.

Lines represent the change in temperature of the receiving water due to the addition of cooling water and use the right axis.

Blue is considering a mixing zone of 25%

Orange is considering complete mixing or a mixing zone of 100%.



Bars represent the final temperature of the receiving water and use the left axis.

Lines represent the change in temperature of the receiving water due to the addition of cooling water and use the right axis.

Blue is considering a mixing zone of 25%

Orange is considering complete mixing or a mixing zone of 100%.

	Maximum ΔT [C]		
	25% MZ	100% MZ	
Oxbow	0.01764	0.00444	
Hells Canyon	0.01603	0.00402	
This is the maximum change in receiving water temperature due to the addition of cooling water for both Oxbow and Hells Canyon during conditions of 25% mixing zone allowed and complete (100%) mixing.			

Temperature Conversion

Celsius = (Fahrenheit - 32)*(5/9)

	Oxbow					Hells Canyon			
	Ambient Temp (Ta)		Effluent Temp (Te)			Ambient Temp (Ta)		Effluent Temp (Te)	
Date	Fahrenheit	Celsius	Fahrenheit	Celsius	Date	Fahrenheit	Celsius	Fahrenheit	Celsius
1/16/1995	37	2.8	42	5.6	1/16/1995	37	2.8	46	7.8
2/15/1995	38	3.3	43	6.1	2/17/1995	36	2.2	44	6.7
3/15/1995	46	7.8	49	9.4	3/16/1995	43	6.1	50	10.0
4/14/1995	48	8.9	54	12.2	4/16/1995	47	8.3	56	13.3
5/15/1995	54	12.2	58	14.4	5/21/1995	57	13.9	65	18.3
6/15/1995	63	17.2	66	18.9	6/15/1995	62	16.7	70	21.1
7/15/1995	68	20.0	72	22.2	7/16/1995	67	19.4	72	22.2
8/17/1995	71	21.7	74	23.3	8/14/1995	70	21.1	70	21.1
9/14/1995	70	21.1	73	22.8	9/23/1995	69	20.6	79	26.1
10/16/1995	60	15.6	64	17.8	10/22/1995	58	14.4	62	16.7
11/15/1995	50	10.0	53	11.7	11/15/1995	50	10.0	54	12.2
12/15/1995	46	7.8	51	10.6	12/17/1995	45	7.2	53	11.7
1/15/1996	41	5.0	43	6.1	1/15/1996	40	4.4	47	8.3
2/15/1996	37	2.8	42	5.6	2/15/1996	36	2.2	45	7.2

3/15/1996	43	6.1	48	8.9	3/19/1996	44	6.7	52	11.1
4/16/1996	52	11.1	58	14.4	4/22/1996	52	11.1	60	15.6
5/14/1996	56	13.3	61	16.1	6/18/1996	65	18.3	69	20.6
6/14/1996	64	17.8	67	19.4	7/30/1996	71	21.7	78	25.6
7/15/1996	69	20.6	72	22.2	8/24/1996	71	21.7	75	23.9
8/15/1996	72	22.2	76	24.4	9/17/1996	69	20.6	74	23.3
9/16/1996	70	21.1	71	21.7	10/19/1996	60	15.6	64	17.8
10/15/1996	63	17.2	65	18.3	11/22/1996	49	9.4	55	12.8
11/15/1996	52	11.1	54	12.2	12/15/1996	44	6.7	54	12.2
12/16/1996	47	8.3	49	9.4	1/21/1997	39	3.9	48	8.9
1/15/1997	39	3.9	44	6.7	2/15/1997	37	2.8	47	8.3
2/15/1997	38	3.3	43	6.1	3/25/1997	47	8.3	57	13.9
3/15/1997	42	5.6	47	8.3	4/15/1997	47	8.3	57	13.9
4/21/1997	52	11.1	56	13.3	5/15/1997	58	14.4	66	18.9
5/15/1997	62	16.7	66	18.9	6/17/1997	64	17.8	72	22.2
6/17/1997	64	17.8	70	21.1	7/19/1997	70	21.1	74	23.3
7/17/1997	70	21.1	75	23.9	8/15/1997	72	22.2	78	25.6
8/15/1997	73	22.8	75	23.9	9/20/1997	69	20.6	76	24.4
9/22/1997	70	21.1	72	22.2	10/17/1997	58	14.4	66	18.9

10/15/1997	62	16.7	62	16.7	11/24/1997	47	8.3	56	13.3
11/15/1997	51	10.6	54	12.2	12/20/1997	43	6.1	51	10.6
12/16/1997	45	7.2	47	8.3	1/15/1998	36	2.2	45	7.2
1/15/1998	38	3.3	41	5.0	2/24/1998	41	5.0	51	10.6
3/15/1998	47	8.3	47	8.3	3/15/1998	42	5.6	52	11.1
4/15/1998	49	9.4	53	11.7	4/15/1998	47	8.3	56	13.3
5/15/1998	59	15.0	64	17.8	5/13/1998	57	13.9	65	18.3
6/19/1998	63	17.2	69	20.6	6/20/1998	62	16.7	69	20.6
7/15/1998	70	21.1	73	22.8	7/15/1998	70	21.1	77	25.0
8/15/1998	74	23.3	78	25.6	8/22/1998	74	23.3	77	25.0
9/15/1998	72	22.2	76	24.4	9/19/1998	72	22.2	79	26.1
10/16/1998	60	15.6	63	17.2	10/17/1998	60	15.6	68	20.0
11/23/1998	49	9.4	53	11.7	11/19/1998	50	10.0	54	12.2
12/15/1998	45	7.2	50	10.0	12/16/1998	44	6.7	53	11.7
1/15/1999	37	2.8	40	4.4	1/22/1999	35	1.7	46	7.8
2/18/1999	39	3.9	42	5.6	2/11/1999	37	2.8	47	8.3
3/15/1999	43	6.1	46	7.8	3/20/1999	42	5.6	52	11.1
4/15/1999	47	8.3	52	11.1	4/17/1999	47	8.3	55	12.8
5/17/1999	54	12.2	58	14.4	5/15/1999	53	11.7	62	16.7

6/21/1999	64	17.8	67	19.4	6/20/1999	62	16.7	69	20.6
7/15/1999	68	20.0	71	21.7	7/19/1999	68	20.0	73	22.8
8/14/1999	72	22.2	74	23.3	8/16/1999	71	21.7	76	24.4
9/16/1999	68	20.0	71	21.7	9/13/1999	69	20.6	75	23.9
10/15/1999	60	15.6	64	17.8	10/20/1999	59	15.0	65	18.3
11/16/1999	51	10.6	57	13.9	11/15/1999	52	11.1	59	15.0
12/17/1999	46	7.8	49	9.4	12/23/1999	43	6.1	49	9.4
1/15/2000	40	4.4	43	6.1	1/11/2000	39	3.9	47	8.3
2/15/2000	40	4.4	45	7.2	2/16/2000	38	3.3	47	8.3
3/15/2000	44	6.7	49	9.4	3/25/2000	44	6.7	53	11.7
4/17/2000	54	12.2	58	14.4	4/15/2000	51	10.6	59	15.0
5/15/2000	58	14.4	63	17.2	5/16/2000	56	13.3	63	17.2
6/15/2000	62	16.7	66	18.9	6/20/2000	63	17.2	69	20.6
7/15/2000	68	20.0	72	22.2	7/25/2000	69	20.6	74	23.3
8/13/2000	72	22.2	75	23.9	9/18/2000	68	20.0	74	23.3
9/19/2000	67	19.4	71	21.7	10/24/2000	58	14.4	61	16.1
10/16/2000	59	15.0	64	17.8	11/13/2000	52	11.1	57	13.9
11/15/2000	51	10.6	57	13.9	12/7/2000	52	11.1	57	13.9
12/15/2000	44	6.7	46	7.8	1/19/2001	37	2.8	43	6.1

1/16/2001	40	4.4	43	6.1	2/16/2001	34	1.1	40	4.4
2/17/2001	37	2.8	39	3.9	3/18/2001	38	3.3	43	6.1
3/14/2001	39	3.9	41	5.0	4/13/2001	45	7.2	54	12.2
4/15/2001	47	8.3	51	10.6	5/21/2001	54	12.2	59	15.0
5/16/2001	52	11.1	55	12.8	7/16/2001	64	17.8	67	19.4
6/15/2001	56	13.3	59	15.0	8/13/2001	70	21.1	75	23.9
7/17/2001	61	16.1	65	18.3	10/25/2001	61	16.1	64	17.8
8/15/2001	69	20.6	73	22.8	11/23/2001	52	11.1	57	13.9
9/17/2001	69	20.6	72	22.2	12/21/2001	43	6.1	49	9.4
10/17/2001	62	16.7	65	18.3	1/18/2002	38	3.3	45	7.2
11/15/2001	53	11.7	57	13.9	2/28/2002	36	2.2	41	5.0
12/19/2001	46	7.8	48	8.9	4/1/2002	41	5.0	50	10.0
1/15/2002	41	5.0	43	6.1	5/20/2002	54	12.2	58	14.4
2/15/2002	38	3.3	39	3.9	6/27/2002	62	16.7	66	18.9
3/15/2002	39	3.9	41	5.0	8/19/2002	70	21.1	72	22.2
4/16/2002	50	10.0	54	12.2	9/18/2002	68	20.0	73	22.8
5/28/2002	57	13.9	61	16.1	10/14/2002	62	16.7	64	17.8
6/15/2002	60	15.6	63	17.2	11/17/2002	51	10.6	55	12.8
7/13/2002	65	18.3	67	19.4	12/18/2002	43	6.1	47	8.3

8/15/2002	69	20.6	73	22.8
9/16/2002	68	20.0	71	21.7
10/18/2002	59	15.0	63	17.2
11/18/2002	49	9.4	51	10.6
12/15/2002	44	6.7	46	7.8
1/15/2003	41	5.0	44	6.7
2/15/2003	40	4.4	42	5.6
3/15/2003	42	5.6	45	7.2
4/15/2003	48	8.9	52	11.1
5/15/2003	54	12.2	59	15.0
6/15/2003	64	17.8	66	18.9

1/29/2003	40	4.4	50	10.0
2/16/2003	38	3.3	46	7.8
4/21/2003	49	9.4	58	14.4
5/28/2003	57	13.9	67	19.4
6/16/2003	64	17.8	71	21.7