Appendix E HDR Engineering Report

HDR | DTA

August 28, 2009

Steve Rigdon
Generation Manager
Yakama Power
111 Fort Rd.
Toppenish WA 98948

Subject: Drop 4 Feasibility Study - PRELIMINARY

Dear Mr. Rigdon:

In July of 2009, HDR Engineering Inc. (HDR, formerly DTA) was asked by Yakama Power to perform a feasibility study for a series of small potential hydroelectric project in conjunction with the Wapato Irrigation Project (WIP) facilities. We understand that Yakama Power has or would be potentially awarded a grant from the US Department of Energy (DOE) for up to $1,000,000 in matching funds to design and build hydroelectric projects with a combined rated capacity of at least one megawatt. Yakama Power intends to use this grant to add additional hydroelectric generation in conjunction with its existing hydro projects. Over the past year, HDR has been working with Yakama Power to repair and re-commission their two existing hydroelectric plants on the irrigation system. Yakama Power has identified a several other sites that could be used for hydroelectric generation and initial reconnaissance was conducted to inspect these sites. Most of these projects are on an irrigation system, and the units would therefore only generate from April through October each year. After reviewing prior studies of hydroelectric feasibility and reconnaissance of each site, it was determined that a powerhouse at Drop 4 on the main irrigation canal warranted further review. On August 5, 2009, HDR staff traveled to Harrah, WA to meet with Yakama representatives and collect data at the proposed project Drop 4 site. The site visit provided valuable data on: access issues; the condition of the existing irrigation canal and Drop 4 spillway; and potential sites for a small hydroelectric powerhouse near Drop 4. A conceptual design has been developed for a potential powerhouse layout and equipment configuration to support the development of a conceptual opinion of project capital costs and energy. The economic feasibility of the project has been evaluated using a range of economic assumptions to provide a preliminary assessment of the project economics, which we encourage you to review and confirm, as these assumptions may bear significantly on how this project is viewed. In addition, a review has been conducted of potential licensing and permitting requirements for a small hydroelectric powerhouse at Drop 4.

HDR | DTA
HDR Engineering, Inc.

5825 221st Place SE
Suite 202
Issaquah, WA 98027-8927

Phone: (425) 391-0523
Fax: (425) 391-6977
www.hdrinc.com

1.0 Summary

HDR has completed a basic study of the technical feasibility and potential regulatory issues involved with building a small hydroelectric powerhouse in conjunction with Drop 4 of the WIP. HDR has developed conceptual designs of a possible powerhouse layout utilizing the existing flow from the main canal and the Harrah drain. This layout depicts a vertical Kaplan turbine arrangement similar to the arrangement of the units at the Drop 2 and 3 powerhouses. Based on this conceptual design, HDR has prepared an opinion of the capital cost to support analysis of the economic feasibility of the project.

For operation of the new power plant, water that is currently diverted into the Harrah drain just downstream of Drop 3 would instead be rerouted through the main canal and discharged back into the Harrah Drain just downstream of Drop 4. The water will be returned to the Harrah Drain approximately one mile downstream of the current diversion. According to the Yakama Nation engineering department, this diversion would not interfere with any of the current consumptive water uses of the irrigation project. To generate one megawatt of renewable energy, a single hydroelectric turbine could potentially be installed in the new Drop 4 powerhouse. This arrangement assumes that all the flow will be passed through a single unit and a diversion will be built downstream of the powerhouse to route flow into the Harrah drain, when required.

The powerhouse layout considered includes a single, vertically configured Kaplan turbine-generator. The unit would have a rated capacity of 970 kW with an approximate gross head of twenty-three feet and a rated flow of 600 cfs. The head at the intake would be raised two feet above the current operating level with the use of stoplogs or a diversion weir positioned in the existing spillway. The powerhouse would be similar in design to that of Drop 2, but to save costs, the building would be constructed of steel siding with a removable roof hatch allowing access for maintenance with a mobile hydraulic crane. Preliminary energy production estimates indicate that this powerhouse arrangement is capable of producing up to 2,800,000 kWh of energy during a six-month irrigation season. The total cost of the proposed project, including final design, licensing, and construction would be approximately $4,500,000.

Another potential powerhouse layout would consist of a pair of submersible propeller turbines, formerly known as the Flygt design. The use of submerged units would allow the turbines to be installed inside the penstocks requiring a much smaller powerhouse footprint. HDR has requested budgetary pricing and efficiency information for a submerged turbine-generator manufactured by EAML (formerly Flygt) but only recently received a budgetary cost estimate for the equipment. The equipment costs for submerged units are somewhat less than a typical vertical unit since they are manufactured in standard sizes and do not require a custom-designed turbine-generator. While the equipment costs for submerged units are less than those for a vertical Kaplan turbine, this arrangement may require additional civil works that could potentially offset the savings on the turbine-generator units.

2.0 Previous Studies of Hydroelectric Production at Drop 4

A number of previous studies have been performed on the feasibility of new hydro electric development on Yakama Nation lands. We understand from Yakama Power that Harza previously performed an extensive study in 1994 to assess the feasibility of rehabilitating existing generation projects on the WIP canal as well as adding new hydroelectric generation. Harza also performed a study of hydroelectric development potential at the Klickitat fish hatchery and submitted a preliminary application to develop the project with the Federal Energy Regulatory Commission (FERC). Based on the work completed by Harza in the mid-1990s, Justin Jacob, a Yakama Nation engineer prepared a report in 2009 examining the potential for additional generation in conjunction with the WIP canal system. A summary of the findings of these studies is presented in this section.

The *Feasibility Study to Upgrade Hydroelectric Operations of Wapato Irrigation Project* was prepared for the Yakama Nation by Harza in July of 1994. Harza studied the existing canal infrastructure, examined the feasibility of upgrading Drop 2 and 3, modifying the pumping station at Drop 1 to provide electrical generation, and building an entirely new power plant at Drop 4. All site studies included a conceptual design, preliminary energy estimates, a capital cost estimate, an economic analysis, and a regulatory and licensing study. Three financing options were examined for these projects: a Federal low interest loan or grant, a conventional financing method, and a lease to an independent power producer.

Harza designed the new Drop 4 powerhouse with a siphon penstock supplying water to a single submersible Flygt turbine. Very limited civil works and no powerhouse structure were included in the design. This design was estimated to cost about $1.2 Million dollars. HDR has estimated that this cost equates to be approximately $2,200,000 2009 US dollars. HDR believes that the maintenance, operational restrictions, and additional outage time of the siphon penstock arrangement make this design undesirable. The small submersible turbine, however, may be a cost effective type of equipment for this type of project. For an average irrigation season, using flow records from the mid-1980s, Harza predicted 1,655,000 kWhrs of energy could be produced annually at the Drop 4 site. To increase the economic feasibility of all the hydroelectric projects on the irrigation system, Harza investigated extending the operations of the system for an additional three months at 60 percent of the canal capacity. Without extending operation of the canal, Harza did not feel that the Drop 4 hydroelectric development was economically feasible. They concluded that the Drop 1 project was more economical than Drop 4 and could be financed with the revenues from Drop 2.

Harza also looked at the possibility of extracting power from the inflow to the Klickitat Fish Hatchery. This project included two turbines, one producing 50 kW at Wonder Springs and the other producing 140 kW at Indian Ford Springs. The larger unit would operate at 150 feet of head with 15 cfs of flow and the smaller would operate at 68 feet of head with 12 cfs of flow. Harza filed an application for a FERC license under the Glennwood Hydro Electric Project in 1994, but

the project was never implemented. Plans are currently underway to remodel the Klickitat Fish Hatchery. With these new modifications to the hatchery, there may yet be opportunities to incorporate micro-hydroelectric units into the redesign of the hatchery facilities.

In April of 2009, Justin Jacob proposed a memorandum summarizing additional potential hydroelectric sites along the WIP canal. In addition to the locations studied by Harza, development at Drain 2 and Harrah Drain were also studied. A summary memorandum was presenting the generation potential at three locations along the canal. Table 1 provides a summary of the proposed projects and their potential capacity as determined by the Yakama engineering department.

Table 1: Hydroelectric Potential for the WIP below Drop 3

	Drain 2	Harrah Drain	Drop Four	Total
Flow (cfs)	150	150	431	
Head (ft)	12	18	21	
Power (kW)	153	229	767	1,149 kW

3.0 Engineering Overview

3.1 Site Description

In the course of completing this evaluation, several site visits were conducted in order to identify key factors that would impact the feasibility of constructing a new hydroelectric powerhouse at Drop 4. On August 5, 2009, Ken Fonnesbeck, P.E. and Leanne Andruszkiewicz, E.I.T. met at the Drop Four site with Yakama Nation engineers, Roger Henderson and Justin Jacob, to review the current site layout and discuss issues involving conceptual site layout, right-of-way, access, condition and operation of the Harrah Drain and its backwater, and potential modifications to the canal.

According to Yakama Nation engineers, the canal right-of-way extends 55 feet on either side of the canal centerline. At Drop 4, the canal is approximately 30 feet wide, leaving roughly 40 feet on either side of the canal to construct the powerhouse. Additional right-of-way may not be required for the powerhouse itself, but at a minimum a temporary easement will be needed for additional working room and laydown space required during construction. Drop 4 is accessed from Fort Road, approximately fifteen miles west of Interstate 84. Road access to the site is available from both sides of the canal via a one lane wide dirt road along the canal. Appropriately sized transmission lines appear to be located within one quarter mile of the project site. According to the Yakama engineers on site, the 37.5 kV lines are owned by the WIP. For purposes of this review, it has been assumed that the lines will handle the additional load easily, but an analysis of the local area transmission system should be conducted to ensure that the system is not currently overloaded

or if some obstacle or operational constraint exists that would prevent the existing transmission infrastructure from being used for this proposed facility.

The Harrah Drain backwater that is intended to be used to convey water back into the Harrah Drain is overgrown and must be cleared prior to operation of the powerhouse. This task is relatively inexpensive and can be completed easily by Yakama Power personnel in order to save contractor labor costs. During the site visit, the importance of the 150 cfs provided by the Harrah drain to downstream irrigators was noted, and it is therefore imperative that the flow to the Harrah drain be maintained in the event of a turbine outage. This can be accomplished by installing a new diversion structure to convey water from the main canal to the Harrah Drain downstream of Drop 4. The main canal will be required to convey an additional 150 cfs of flow for the powerhouse to operate at full capacity. Upstream of Drop 4, the canal appears to have sufficient freeboard to handle the additional 150 cfs without modification to the embankments. The downstream portion of the canal exhibits less freeboard than upstream of the drop, and the downstream embankments would in all likelihood need to be raised to accommodate the additional flow. During subsequent discussions, it was determined that an additional plan exists that would add 70 cfs of additional flow to this section of the canal in the next 5 to 10 years, for the purpose of draining the existing standing water.

3.2 Conceptual Layouts

A conceptual layout for a small hydroelectric powerhouse at Drop 4 has been developed based on the findings of previous hydroelectric feasibility studies, reconnaissance of the Drop 4 site, and HDR's extensive experience with the design and construction of small hydroelectric projects. (Refer to accompanying Figures 1 and 2). The layout includes a single vertical Kaplan turbine-generator unit in a powerhouse located just upstream of the existing Drop 4 spillway. The powerhouse would be built into the embankment of the canal to reduce headloss and the amount of new civil infrastructure required. The backslope of the embankment would be excavated and a reinforced concrete retaining wall would be recessed into the slope to serve as the back wall of the powerhouse. The other three walls and the roof of the powerhouse could be built of steel or masonry to reduce the overall cost of construction.

A section of the powerhouse roof would be removable, allowing a mobile hydraulic crane to be used to install and service the turbine-generator. A rock-lined trench from the main canal, downstream of Drop 4, would be dug back to convey the outflow from the turbine back into the canal. A diversion would be installed downstream of the proposed powerhouse to convey water from the main canal back into the Harrah Drain backwater, when required for downstream irrigation. The existing Harrah backwater reach would need to be cleaned out to provide for the increased flow back into the Harrah drain. A sketch of the proposed powerhouse layout is included as an attachment to this letter (Reference Figures 3 and 4).

3.3 Energy Production Estimates

The conceptual layouts and equipment selection identified and created in the course of this review were in turn used to develop preliminary head loss estimates and energy production estimates. This led to a plant capacity of 970 kW, based on the maximum combined flow for the main canal and the Harrah drain during the 2008 irrigation season. The material roughness coefficients of the various sections of the conveyances used are based on published data and friction factors were developed for use with the Darcy-Weibach equations. The head loss model was used to develop head loss coefficients for both powerhouse layouts as a function of the flow rate squared.

Based on the irrigation flow data for 2008 provided to us by Yakama Power and the head loss analysis, an energy model was developed to estimate the annual energy production for a powerhouse with a single vertical Kaplan turbine-generator unit. Typical efficiencies for a Kaplan turbine with an induction generator were used. The transformer losses and forced outage rate for the plant were based on experience with similar projects and assumed to be 2 percent and 3 percent respectively. For each powerhouse configuration, the energy model was run using the measured flow data from the 2008 irrigation season along with the flow data from 1985 (the Harza "wet" year) and 1993 (the Harza "dry" year). A comparison of the flows used in the Harza study with the measured 2008 irrigation flows indicates that the operations of the canal system have changed substantially in the past ten years. We understand that irrigation demand has increased in recent years leading to higher flows through the WIP canals.

Detailed results from the energy model are included as attachments to this letter. For a vertical Kaplan unit powerhouse layout the estimated annual energy production, assuming current canal operations, is approximately 2,800,000 kWh with a capacity factor of 0.33.

4.0 Regulatory Overview

4.1 Permitting Requirements

As an overview, the development of hydroelectric generation will require an application for exemption to be filed with the Federal Energy Regulatory Commission (FERC) as well as a 401 Water Quality Certification (401 WQC) from the U.S. Environmental Protection Agency (EPA). If the proposed Project would impact wetlands, a U.S. Army Corps of Engineers (USACE) Nationwide Permit would be required. Agency consultations will be required to obtain the necessary regulatory permits.

4.2 Jurisdiction

Under the authority of the Federal Power Act (FPA), FERC has the authority to issue a license or exemption to any new hydroelectric project, if the project is or will be:

1. Located on a navigable waterway of the U.S.;
2. Occupy any public lands and reservations of the United States;
3. Utilizes surplus water or water power from a U.S. government dam; or
4. Located on a body of water over which Congress has Commerce Clause jurisdiction, project construction occurred on or after August 26, 1935, and the project affects the interests of interstate or foreign commerce.

By virtue of this authority, the Drop 4 project is subject to FERC jurisdiction.

4.3 Permits

Federal Energy Regulatory Commission

It should be noted FERC requirements allow an abbreviated process and timeline for a certain classes of projects. In this instance, the FERC licensing exemption for small hydropower projects, applies to projects having output capacities of five megawatts or less, or those that will be built at an existing dam, projects that utilize a natural water feature for head, or to an existing project that has a capacity of five megawatts or less and proposes to increase capacity to not more than 5 MW.

The procedures for obtaining an exemption for constructed or unconstructed small hydropower projects, as mentioned above, commences with the preparation of a draft application for exemption. The Applicant prepares the draft exemption application and distributes to the relevant agencies and stakeholders for comment. This allows the Applicant to address any concerns and to resolve any identified issues in the final application. As required by 18 CFR §4.107 the application must include:

- An introductory statement– a formal notice of intent to file the application
- Exhibit A – consists of a description of the small hydroelectric facility and proposed mode of operation as well as an anticipated date to commence with construction. This information must be submitted in tabular form and provide the following information:
  - Brief description of any existing dam and impoundment proposed to be utilized by the Project and any other existing or proposed Project works;
  - Number of proposed generating units at the project, including auxiliary units, capacity, and provisions for future units;

  - The type of each hydraulic turbine;
  - Description of how the plant is to be operated;
  - Flow duration curve information;
  - Estimates of annual generation, average and design head, capacity of each turbine, and number and surface areas of impoundment used (if any); and
  - Description of the nature of any repair, reconstruction, or any other modification of a dam that would occur in association with construction or development of the proposed Project.

- Exhibit E - A description of the environmental setting and anticipated impacts within the vicinity of the facility, this includes terrestrial resources, aquatic and wildlife resources, water quality resources, geology and soils, recreation and land use, socioeconomics, and cultural resources. Special attention must be given to endangered or threatened plant and animal species, critical habitat and sites eligible for or included in the National Register of Historic Places.
- Exhibit F – A set of drawings, which depict the structures and equipment of the small hydroelectric facility, both Exhibits F and G must conform to the Commission's specifications at 18 CFR §4.41.
- Exhibit G - General location map that shows the physical structures of the small hydroelectric facility in relation to the conduit and any dam to which any of these structures are attached. The map must also show a proposed project boundary enclosing all project works to be exempted from licensing and the ownership of the parcels of land within the proposed boundary.

The exemption application will also contain appendices describing federally owned land, identification of all Indian tribes that may be affected by the project, and agency consultation in the form of draft application comments or correspondences.

The Applicant submits the final application to the FERC and the relevant stakeholders and legal notices are published. FERC reviews the application and the agencies file any additional comments with the FERC.

FERC then typically issues an order granting or denying the exemption. The order granting the exemption is subject to FERC standard terms and conditions as well as any terms and conditions set by the U.S. Fish and Wildlife Service, the National Marine Fisheries Service and state level fish and wildlife agencies.

Lead-time for preparation of draft application, preliminary agency consultation, and submittal of final application is approximately 2-3 months. This period includes a 30-day comment period for

agency review. FERC application review, notification, and issuance vary from 3 months to a year. The review time is dependent upon the completeness of the application and the level of pre-filing agency consultation.

Environmental Protection Agency

The Confederated Tribes and Bands of the Yakama Nation do not currently have approved water quality standards under the Clean Water Act. Approved water quality standards allow the Indian tribe to administer its water quality program. Therefore, it will be necessary for Yakama Power to apply for a 401 WQC with the EPA.

Joint Aquatic Resources Permit

If the proposed Project would impact wetlands, then a Joint Aquatic Resources Permit Application (JARPA) will be required. The JARPA permit streamlines the environmental permitting process, allowing the Applicant to submit the USACE Nationwide Permit and the 401 WQC simultaneously.

Washington State Permits

The Confederated Tribes and Bands of the Yakama Nation have the authority to plan for and regulate lands within their reservation. State and local governments do not have the authority to regulate tribal trust lands and lands held in trust for tribal members. Therefore, the Shoreline Management Act and shoreline master programs do not apply to this proposed Project.

Energy Development and Power Sales

A Settlement Agreement entered into on June 11, 2007, created a partnership between the Public Utility District No. 2 of Grant County and the Confederated Tribes and Bands of the Yakama Nation. This agreement included a "right of first refusal" on all tribal renewable energy development projects. In 2008, a power sales agreement was signed with Bonneville Power Administration. No additional power sales or interconnection agreements are necessary for the proposed Project.

5.0 Capital Cost Opinion and Project Economics

A cost opinion for the single vertical Kaplan powerhouse layout described above has been completed in order to support a review of project economics. Project features include: turbine-generator units; associated electrical equipment; power plant structure; water conveyance; and electrical transmission. Budgetary cost estimates for the power plant equipment for the vertical Kaplan powerhouse concept was requested from Andritz, Canadian Hydro, and Mavel. An

estimate from EAML, the current manufacturer of Flygt submerged Kaplan turbines was also obtained to determine if there were significant cost equipment savings with the use of this type of turbine. The costs of the powerhouse structure, intake, and outlet works were based on experience with other hydroelectric projects of similar size.

Assumptions:

- Cost of right-of-way easements or land acquisition are not included;
- Cost of cleaning the Harrah Drain are not included, and are expected to be performed by owner/operator;
- Mobilization costs are included at 5 percent of the anticipated project construction (hard) costs; and
- Canal bank raising of the downstream canal reach is to be self-performed and or provided by owner/operator.

Using these assumptions, including projected fees for engineering and licensing, and a 25 percent contingency due to the conceptual level of the design, we estimate the total cost of the conventional vertical turbine arrangement would be approximately $4,500,000. The cost of engineering for the project was assumed to be 10 percent of the capital cost with licensing costs of 3 percent of the capital cost. A summary of the conceptual cost opinion has been included as an attachment to this letter.

Overall, this project appears to be technically feasible. The economic feasibility will depend on more detailed design and estimated construction costs, a power purchase agreement, project financing, operating expenses, and the time in which Yakama Power wishes to recover its investment. After the construction loan has been repaid, the cost of energy will only include operating costs of the plant, periodic maintenance of the equipment, and the cost of any environmental licensing conditions. Assuming a power purchase agreement of $.06/kWh the project could produce a revenue stream of approximately $168,000 per year. Without taking into account government grant support, inflation, operating expenses, or financing costs this revenue stream could repay the capital cost of the project in approximately 30 years.

If this project is deemed economically feasible by the Yakama Nation, among other activities, a reasonable next step would be to develop a preliminary design of the small hydroelectric power plant. In parallel, the Tribe may also be advised to begin licensing and permitting of the project. Based on the final project economics, a final design for the plant can be completed. We estimate that the time required to complete the preliminary design, environmental studies, permitting, and final design will be approximately twelve to eighteen months, noting that the design process itself can be accomplished in a shorter time frame, but we will be dependent on vendor input for equipment details, (dimensions, weights, etc.) that will cause some delay. Once the permitting

process has been completed, we estimate that construction can be completed within one year, again depending on the equipment delivery schedule.

It is our pleasure to provide this study of the technical feasibility and potential permitting issues of the proposed micro-hydroelectric project for Yakama Power. If you have any further questions, comments or wish to proceed with our services please let us know.

Sincerely,

HDR Engineering Inc.

Leanne Andruszkiewicz, E.I.T
Associate Mechanical Engineer

Stephen D. Spain, P.E.
Vice-President, Northwest Region, Hydropower

Appendix F Resource Reports

Fisheries Resource Management
PO BOX 151
Toppenish, WA 98948
509-865-2255

To: **Rocco Clark —BIA Environmental Coordinator**

From: **Brad Parrish – FRM Biologist** BP

Thru: **Paul Ward------FRM Manager**

Date: **12-20-11**

Subject: No effect determination for Drop 4 Hydropower Project on Steelhead

This effect determination may be provided to Yakama Power and NMFS in order to comply with ESA requirements. The construction will occur in the WIP main canal where Steelhead have not been documented, however this project may affect flows in the Harrah Drain where Steelhead documentation has occurred. There is a possibility of a change in irrigation spill location to approximately two miles downstream from its original location from April 15th through October 30th. This change in spill location will result in a reduction of flows by 1/3 during this period through the approximate 2 miles. It is my determination that the proposed Drop 4 Hydropower Project **will not affect Steelhead populations** in the Yakima basin based on the following reasons.

- Steelhead Redds have not been identified in the affected portion of the project area for the last ten years.
- The habitat available within the affected reach is extremely marginal.

Yakama Nation
Wildlife Resource Management Program

To: Rocco Clark Jr.; BIA Environmental Coordinator

From: Mark Nuetzmann; WRMP Wildlife Biologist

Through: LeRoy Adams Jr.; WRMP Program Manager

Date: January 4, 2012

Subject: Drop 4 Project-Wildlife Report

The Yakama Nation proposes to install an inflow turbine at Drop 4 on the Wapato Irrigation Project (WIP) main canal to generate approximately one megawatt of supplemental hydroelectric power. The project site is located two miles southwest of Harrah, Washington near the intersection of Harrah Drain and McDonald Roads where the irrigation canal undergoes a 20-foot elevation drop. To increase the electrical generation potential at Drop 4, the drop height will be raised by 3 to 4 feet. This will be accomplished by backfilling the headworks and further excavating the tailrace.

The project will also involve the construction of a small powerhouse, a downstream diversion structure to route some of the water used in power generation into Harrah Drain, and approximately one-quarter mile of above-ground transmission line between Harrah Drain and the power plant. Temporary construction easements may be required for site access and construction staging. Preliminary project design was developed by Yakama Power (YP) staff and through consultation with electrical and mechanical engineers. Upon completion of the project, the Drop 4 hydroelectric system would be owned by YN and operated by YP.

The species accounts below are those federally listed and candidate species that are could potentially be located within Yakima County according to USFWS (see attached).

Northern Spotted Owl and associated habitat
The project area does not contain spotted owl habitat and is outside of any forested stands.

Confederated Tribes and Bands of the Yakama Nation
Wildlife Resource Management Program
P.O. Box 151, (4690 S.R. 22), Toppenish, WA 98948
(509) 865-5121 fax: (509)865-3619 www.ynwildlife.org

Grizzly Bear and Gray Wolf
The grizzly bear (federally listed as threatened) and gray wolf (federally listed as endangered) are unlikely to occur in the project area. The grizzly bear is wide ranging mammal that use large expanses of remote forest and meadow habitats and is extremely unlikely to reside in populated rural and farming areas such as the location of the proposed project. While the wolf prefers these types of habitats, it is also a generalist and will utilize a wide range of habitat types. The species is adaptable enough that it will also enter and forage in towns and farms, cross highways and open environments. Of the five confirmed wolf packs in Washington state, the nearest is in Kittitas County, approximately 60 miles to the north, although it is likely that there are other undetected wolves in the state. The project would not affect any habitat for any known wolf packs.

Wolverine
The wolverine, a federal candidate species, is found in high elevation alpine and subalpine habitats and survives on carrion and small prey. Wolverines are not habitat specialists, but instead require multiple habitat types over a large area to support their seasonal food, security, and reproduction needs. They require mixed habitat such as relatively undisturbed and unfragmented forests, alpine habitats, rough and rocky terrain, and other habitat types.

Fisher
Fishers are a federal candidate species. Prior to the recent reintroduction of fishers into the Olympic Peninsula, the species was considered to be extirpated in the state. Fishers use forest structures associated with late-successional forests, such as large live trees, snags and logs, for giving birth and raising their young, as well as for rest sites. Travel among den sites, rest sites, and foraging areas occurs under a dense forest canopy. No such habitat exists in the project area.

Yellow-billed Cuckoo
The yellow-billed cuckoo is a federal candidate species. According to the Seattle Audubon, the species is considered extirpated from the state. Any sightings within the state would be considered vagrants at this point. The habitat of the Yellow-billed Cuckoo in western North America is forested stream-sides. Cottonwoods and willows that form open woodlands with dense, low vegetation are particularly preferred. Cuckoos are generally absent from large, urban areas and dense forests. Historically, they nested along wooded rivers in eastern Washington. Habitat for this species is not present in the project area.

Marbled Murrelet
Marbled murrelets are sea birds that nest in the trees of old growth forests. The site is not habitat for this species.

Greater Sage Grouse
Greater sage-grouse, a federal candidate species, inhabit shrub-steppe and meadow steppe and are closely associated with sagebrush. Shrub-steppe is a descriptive term for plant communities consisting of one or more layers of perennial grass with a conspicuous, but discontinuous, layer of shrubs above. Forest vegetation is generally absent. Sage brush habitat of any significant amount is absent from the project area. Additionally, the only sage grouse seen in recent

memory are those that were released by the tribe in the East Satus area approximately 20 miles away.

Mardon Skipper
The mardon skipper, *Polites mardon*, is a federal candidate species. This small butterfly is found in only four disjunct geographic locations worldwide, two locations in Washington and one in Oregon and California. Within Washington, the species inhabits prairies of the south Puget Sound lowlands and meadows within and around the Yakama Nation. The species is found in open grassland sites and often associated with Idaho fescue, a species that is not found at the project area. Sites can vary in size from ½ acre or less meadows to larger grassland complexes. Site conditions can range from dry, open ridgetops to areas associated with wetlands or riparian habitats. Road construction through meadow habitat can threaten this species as well as other plant and animal species that inhabit meadow ecosystems.

Ute Ladies'-Tresses
Ute Ladies'-Tresses, *Spiranthes diluvialis*, is a federal endangered species. This species is known to occur in Okanogan and Chelan counties, although there is a great deal of uncertainty as to the species' actual distribution due to the limited extent of surveys, and the fact an occupied site may have to be surveyed for several years before these orchids flower and can be identified. The Montana Natural Heritage website describes these plants as being "restricted to calcareous, temporarily inundated wet meadow zones and segments of channels and swales where there is stable subsurface moisture and relatively low vegetation cover". No such habitat is located within the project area.

Whitebark Pine
Whitebark pine (*Pinus albicaulis*) is a federal Candidate Species found in montane and subalpine forests. The proposed project is not located in this habitat.

The proposed project is anticipated to have no effect on the federally listed and candidate species discussed above.

If you have any questions or need additional information, please call me at 865-5121 x6333 or email me at mnuetzmann@yakama.com.

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CRITICAL HABITAT; CANDIDATE SPECIES; AND SPECIES OF CONCERN
IN YAKIMA COUNTY
AS PREPARED BY
THE U.S. FISH AND WILDLIFE SERVICE
CENTRAL WASHINGTON FIELD OFFICE

(Revised August 1, 2011)

LISTED

Bull trout *(Salvelinus confluentus)* – Columbia River DPS
Gray wolf *(Canis lupus)*
Grizzly bear *(Ursus arctos horribilis)*
Marbled murrelet *(Brachyramphus marmoratus)*
Northern spotted owl *(Strix occidentalis caurina)*

Major concerns that should be addressed in your Biological Assessment of project impacts to listed animal species include:

1. Level of use of the project area by listed species.

2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project.

3. Impacts from project activities and implementation (e.g., increased noise levels, increased human activity and/or access, loss or degradation of habitat) that may result in disturbance to listed species and/or their avoidance of the project area.

Spiranthes diluvialis (Ute ladies'-tresses)

Major concerns that should be addressed in your Biological Assessment of project impacts to listed plant species include:

1. Distribution of taxon in the project vicinity.

2. Disturbance (trampling, uprooting, collecting, etc.) of individual plants and loss of habitat.

3. Changes in hydrology where taxon is found.

DESIGNATED

Critical habitat for the bull trout
Critical habitat for the northern spotted owl

PROPOSED

None

CANDIDATE

Fisher *(Martes pennanti)* - West Coast DPS
Greater sage grouse *(Centrocercus urophasianus)* – Columbia Basin DPS
Mardon skipper *(Polites mardon)*
North American wolverine *(Gulo gulo luteus)* – contiguous U.S. DPS
Yellow-billed cuckoo *(Coccyzus americanus)*
Pinus albicaulis (whitebark pine)

SPECIES OF CONCERN

Bald eagle *(Haliaeetus leucocephalus)*
Black swift *(Cypseloides niger)*
Burrowing owl *(Athene cunicularia)*
Ferruginous hawk *(Buteo regalis)*
Larch Mountain salamander *(Plethodon larselli)*
Loggerhead shrike *(Lanius ludovicianus)*
Long-eared myotis *(Myotis evotis)*
Northern goshawk *(Accipiter gentilis)*
Olive-sided flycatcher *(Contopus cooperi)*
Pacific lamprey *(Lampetra tridentata)*
Pallid Townsend's big-eared bat *(Corynorhinus townsendii pallescens)*
Peregrine falcon *(Falco peregrinus)*
Redband trout *(Oncorhynchus mykiss)*
River lamprey *(Lampetra ayresi)*
Sagebrush lizard *(Sceloporus graciosus)*
Sharptail snake *(Contia tenius)*
Townsend's ground squirrel *(Spermophilis townsendii)*
Western brook lamprey *(Lampetra richardsoni)*
Western gray squirrel *(Sciurus griseus griseus)*
Westslope cutthroat trout *(Oncorhynchus clarki lewisi)*
Astragalus columbianus (Columbia milk-vetch)
Calochortus longebarbatus var. *longebarbatus* (long-bearded sego lily)
Castilleja cryptantha (obscure paintbrush)
Cryptantha leucophaea (gray cryptantha)
Cypripedium fasciculatum (clustered lady's-slipper)
Erigeron basalticus (basalt daisy)
Lomatium tuberosum (Hoover's desert-parsley)
Sisyrinchium sarmentosum (pale blue-eyed grass)
Tauschia hooveri (Hoover's tauschia)

Fisheries Resource Management
PO BOX 151
Toppenish, WA 98948
509-865-2255

To: **Peggy Williamson—CHMM— Fulcrum Environmental Consulting**
From: **Nathan Longoria—Fisheries Biologist**

Reviewed: Ryan DeKnikker— Fisheries Biologist—YRWP

Date: **05-30-12**
Subject: **Fisheries comments on invasive species mitigation in concern to Drop 4**

The following is a statement of comments in regards to the installation of Drop 4 and mitigation practices for invasive species during the construction process.

Species Considered

Vertebrates
Lepomis gibbosus, pumpkinseed sunfish
Lepomis macrochirus, bluegill sunfish
Micropterus dolomieu, smallmouth bass
Micropterus salmoides, largemouth bass
Pomoxis nigromaculatus, black crappie
Carassius auratus, goldfish
Cyprinus carpio, common carp
Pimephales promelas, fathead minnow
Ameiurus melas, black bullhead
Ameiurus nebulosus, brown bullhead
Ictalurus punctatus, channel catfish
Perca flavescens, yellow perch

Invertebrates (These species are not present in the county, but should be mitigated against due to their prolific potential)
Dreissena polymorpha, Zebra mussel
Dreissena bugensis, Quagga mussel
Potamopyrgus antipodarum, New Zealand mud snail

Plants
Nasturtium officinale, water-cress
Callitriche stagnalis, pond water-starwort
Myriophyllum aquaticum, parrot feather
Myriophyllum spicatum, Eurasian water-milfoil
Iris pseudacorus, yellow iris
Lythrum salicaria, purple loosestrife
Nymphoides peltata, yellow floating-heart
Nymphaea odorata, white water-lily
Echinochloa crusgalli, Barnyard grass
Potamogeton crispus, curly pondweed

Other Biologics
Batrachochytrium dendrobatidis, Chytrid fungus
Saprolegnia sp.

Mitigation of Translocation

During the construction process there are multiple pathways that can result in translocation of invasive species. Through mitigation practices, one can control the introduction of invasive species in a practical way. The following mitigation prescriptions are recommended by the USFWS to control the above listed species.

All in Stream Equipment (from Excavators to Boots and Rakes)

- All equipment will be clean, inspected for leaks, and in good working order.
- Remove any visible invertebrates, aquatic plants, and soil.
- Pressure wash equipment with hot water (≥120° F) and allow to dry completely (4+ hours).
- Scrub all small gear and equipment, soak in hot water (≥120° F) for at least 5 minutes, and allow to dry completely (4+hours).
- Monitor and document the ambient air temperatures
- Document that heavy equipment was inspected.
- Monitor the water soak temperature and the soak time to meet stated targets.
- Conduct a secondary visual inspection after cleaning and drying.
- If not properly cleaned, Re-scrub, re-soak, re-dry, and re-inspect the equipment.

These prescriptions should be conducted before entering the water for the first time and after the completion of work.

Plants and Seed

- A licensed nursery will provide all trees and shrubs, and plants will be professionally inspected to identify any potential hazards within 48 hours of delivery to project site.

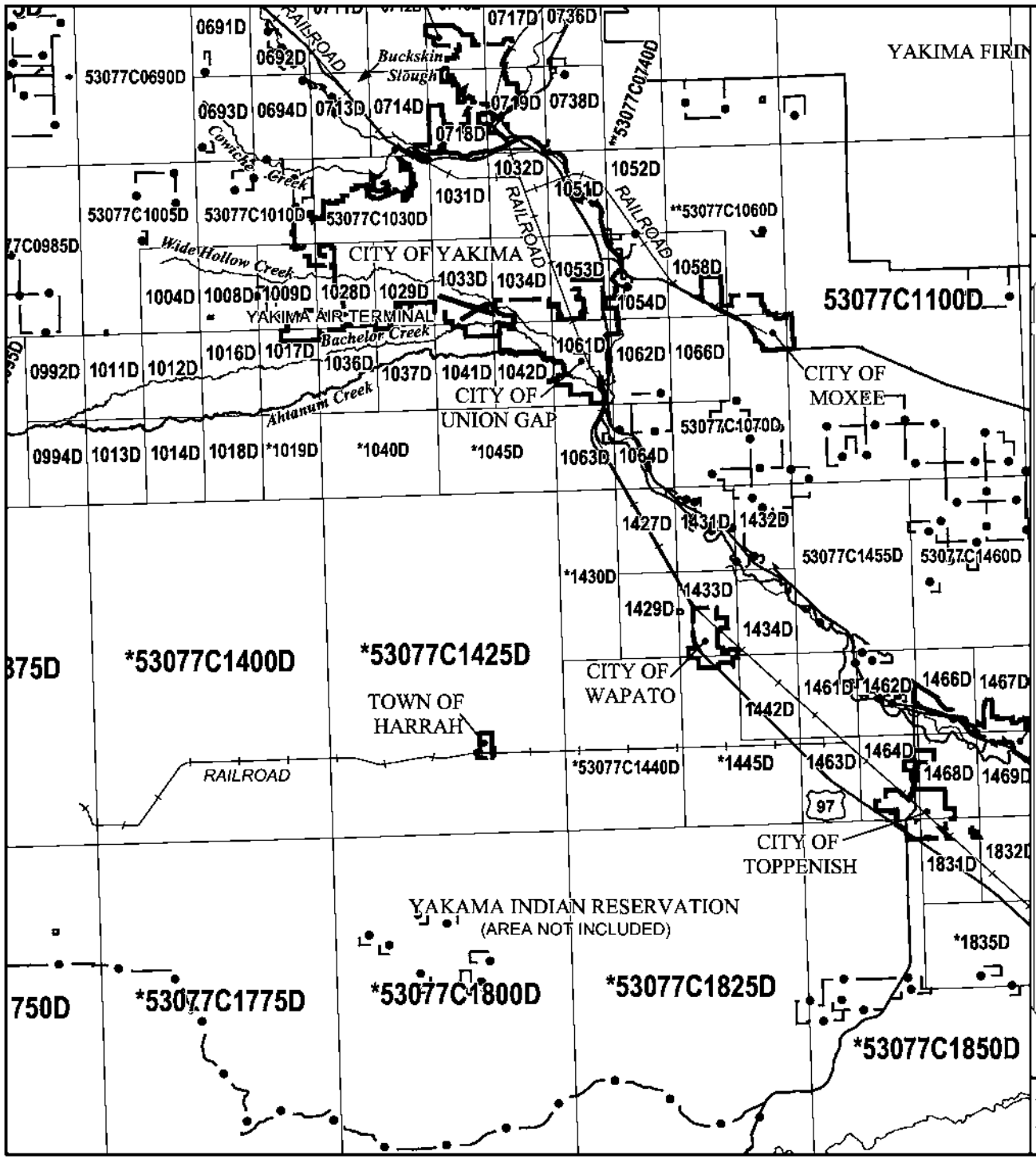
Appendix G Comparison Matrix: Issues Eliminated from Study

Appendix G Comparison Matrix: Issues Eliminated from Detailed Study

US Statutes, Executive Order, Or Identified Issue	Existing Conditions	Environmental Consequences		Identified Best Management or Mitigation Measures	
		Alternative A No Action	Alternative B Proposed Project	Alternative A No Action	Alternative B Proposed Project
Floodplain Management	The WIP Main Canal in the vicinity of the Drop 4 project is not located within a floodplain or floodway. The proposed project is not located within published US Federal Emergency Management Act (FEMA) mapping areas because it is tribal property and the project area is substantially removed from the primary Yakima River and Toppenish Creek flood area. The project is not identified in the Yakima County Geographical Information System (GIS) – Washington Land Information Portal (LIP) as being within a floodplain. The Yakima County GIS LIP identifies the Main Canal as a manmade canal. Refer to Appendix H for the FEMA Flood Insurance Rate Map (FIRM) and the Yakima County GIS LIP map. Refer to Appendix H for Floodplain documentation.	No Change	Under the proposed project no change to the regional floodplains, floodways, or floodplain management practices would occur.	None Required	None Required
Coastal Zone Management Act	The proposed project is located in Yakima County, which does not have any boundaries in direct contact with coastlines. The proposed action is not under the jurisdiction of the Coastal Zone Management Act. See Appendix I for a copy of the Coastal Zone Counties in Washington State	No Change	No Change	None Required	None Required
Sole Source Aquifers	The proposed project is not within a Sole Source Aquifer area. There are no proposed or pending Sole Source Aquifer designations in Yakima County. See Appendix J for a listing of Sole Source Aquifers in Washington State.	No Change	No Change	None Required	None Required
Wild and Scenic Rivers Act	There are three Wild and Scenic Rivers in the State of Washington – Klickitat, Skagit, and White Salmon. None of these are in the project area. See Appendix K for a listing of Washington State Wild and Scenic Rivers.	No Change	No Change	None Required	None Required
Farmland Protection Policy Act	This Drop 4 hydropower facility will be constructed within the existing WIP right-of-ways. This project will not result in farmland being removed from production or increase the density in this rural area. According to the United States Department of Agriculture (USDA) Web Soil Survey (WSS) data soil at the project site is primarily Warden silt loam, a non-hydric soil. The area of interest (AOI) was established as a conservative boundary to assist the Cultural and Archeological Survey resource report request. The AOI includes the construction area, access roads, and temporary construction staging and materials lay down areas. The WSS identified the majority of the AOI as prime farmland if irrigated. However approximately 0.3 acres of farmland of unique importance were identified within the AOI predominately located adjacent to the canal and spillway and within the current WIP right-of-way or gravel surfaced access roads. See Appendix L for USDA Soils information. According to the 2011 Cultural Monitoring report the soils located adjacent to the canal banks and the spillway are likely fill material built-up when the canal was constructed.	WIP will continue to operate the Main Canal and spillway using the existing right-of-ways and access roadways set aside for the purpose of irrigation conveyance in the 1930s.	Potential soil disturbing activities during construction are expected to be less than 0.125 acres (5,200 sf) total and be contained within the existing WIP right-of-way. Adjacent areas proposed for construction staging and material lay down are periodically mowed by the private landowner and will not require modification to the soil surface, such as grading or compaction, prior to temporary construction use.	None Required	None Required (see Soils in Table - Issues Identified with a Minor Consequence)

US Statutes, Executive Order, Or Identified Issue	Existing Conditions	Environmental Consequences		Identified Best Management or Mitigation Measures	
		Alternative A No Action	Alternative B Proposed Project	Alternative A No Action	Alternative B Proposed Project
Environmental Justice	There is no adverse environmental justice impact associated with the project. Environmental Justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. EPA has this goal for all communities and persons across this Nation. It will be achieved when everyone enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work. According to EPA EJ View web site the population in the Drop 4 area are identified as that has 40 to 200 persons per square mile, 40 to 100% who are identified as minorities, and 10 to 20% are identified with a per capita annual income of $16,000. By comparison the United States Census Bureau web site indicates that in Yakima County has a 2010 population of approximately 243,000 persons, an average population of 56.6 persons per square mile in 2010, a per capita annual income of $19,325 in 2010, and an average of 21.8% of the population below the poverty line in 2006 to 2010. According to the Yakima County Profile web page Yakima County's unemployment rate has risen every year for the last four years, and the rate edged upwards from 9.7 percent in 2010 to 9.9 percent in 2011. Roughly 2 percent of total covered employment in Washington state was in agriculture. In Yakima County, on an annual average basis, almost one in four jobs is an agricultural job (25%). According to the Yakima County Profile page the high percentage of agricultural work has a stabilizing effect on the Yakima County economy. Refer to Appendix M for Environmental Justice Documentation.	No Change	Approximately $168,000 of new seasonal revenue will be generated that can be utilized to fund differed maintenance and capital improvement projects on WIPs system. The project does not unfairly displace populations or impose environmental or health hazards on any specific population group. As a result of the project approximately 3 design and inspection professionals and approximately 20 local workers spanning 8 separate trades during the estimated 8 to 9 month construction project will be created. At the conclusion of the project one full time equivalent and one part time equivalent employment position will be available. Increasing potential short term temporary employment of approximately 20 workers and long term employment of one full time equivalent and one part time equivalent employment position in a community that has approximately 24,000 unemployed individuals, while of minor benefit, is not a significant consequence.	None Required	None required as environmental justice consequences of the proposed action have minor beneficial consequence.
Siting of Projects Near Hazardous Operations	The proposed project is not located near a hazardous operation that could adversely affect the project. EPA's Enviromapper identified two potential hazardous facilities near the project site. Both are located downgradient and neither present a significant hazard to construction or operation of a small-scale hydroelectric power plant. See Appendix N for a copy of the Enviromapper documentation and Washington State Department of Ecology Facility Site Atlas.	No Change	No Change	None Required	None required

Appendix H Floodplain and Wetlands Documentation



NATIONAL FLOOD INSURANCE PROGRAM

MAP INDEX

FIRM

FLOOD INSURANCE RATE MAP

YAKIMA COUNTY, WASHINGTON

AND INCORPORATED AREAS

(SEE LISTING OF COMMUNITIES TABLE)

MAP INDEX

PANELS PRINTED: 225, 250, 425, 427, 429, 430, 433, 440, 441, 445, 475, 500, 525, 850, 656, 657, 675 - 679, 681- 684, 690, 691 - 694, 705, 709 - 711, 713, 714, 717 - 719, 728, 730, 736, 738, 850, 950, 960, 965 - 967, 970, 980, 986, 988, 989, 992, 994, 995, 1004, 1005, 1008 - 1014, 1016 - 1018, 1028 - 1034, 1036, 1037, 1041, 1042, 1051 - 1054, 1058, 1061 - 1064, 1066, 1070, 1100, 1125, 1150, 1175, 1200, 1427 - 1429, 1431 - 1434, 1442, 1455, 1460 - 1464, 1466 - 1469, 1486, 1488, 1500, 1831, 1832, 1851 - 1854, 1858 - 1860, 1866, 1867, 1869, 1886 - 1889, 1893, 1894, 2251, 2252, 2256, 2257, 2259, 2276, 2277, 2281, 2283, 2284, 2325

MAP NUMBER
53077CIND0A

EFFECTIVE DATE
NOVEMBER 18, 2009

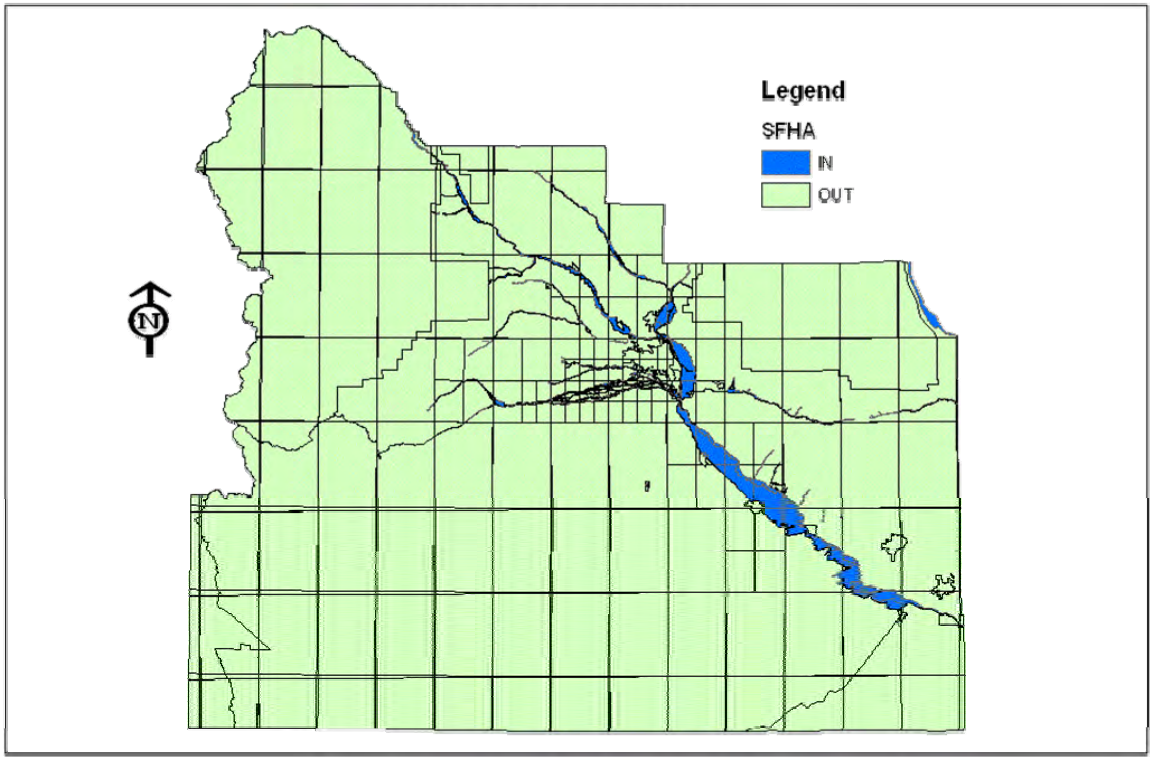
Federal Emergency Management Agency

DEPARTMENT OF ECOLOGY State of Washington http://www.ecy.wa.gov

FEMA Digital Q3 Flood Data

Yakima County

Special Flood Hazard Zone



U.S. Fish and Wildlife Service

National Wetlands Inventory

YN Drop 4 Vicinity

Jun 11, 2012

Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

Riparian

- Herbaceous
- Forested/Shrub

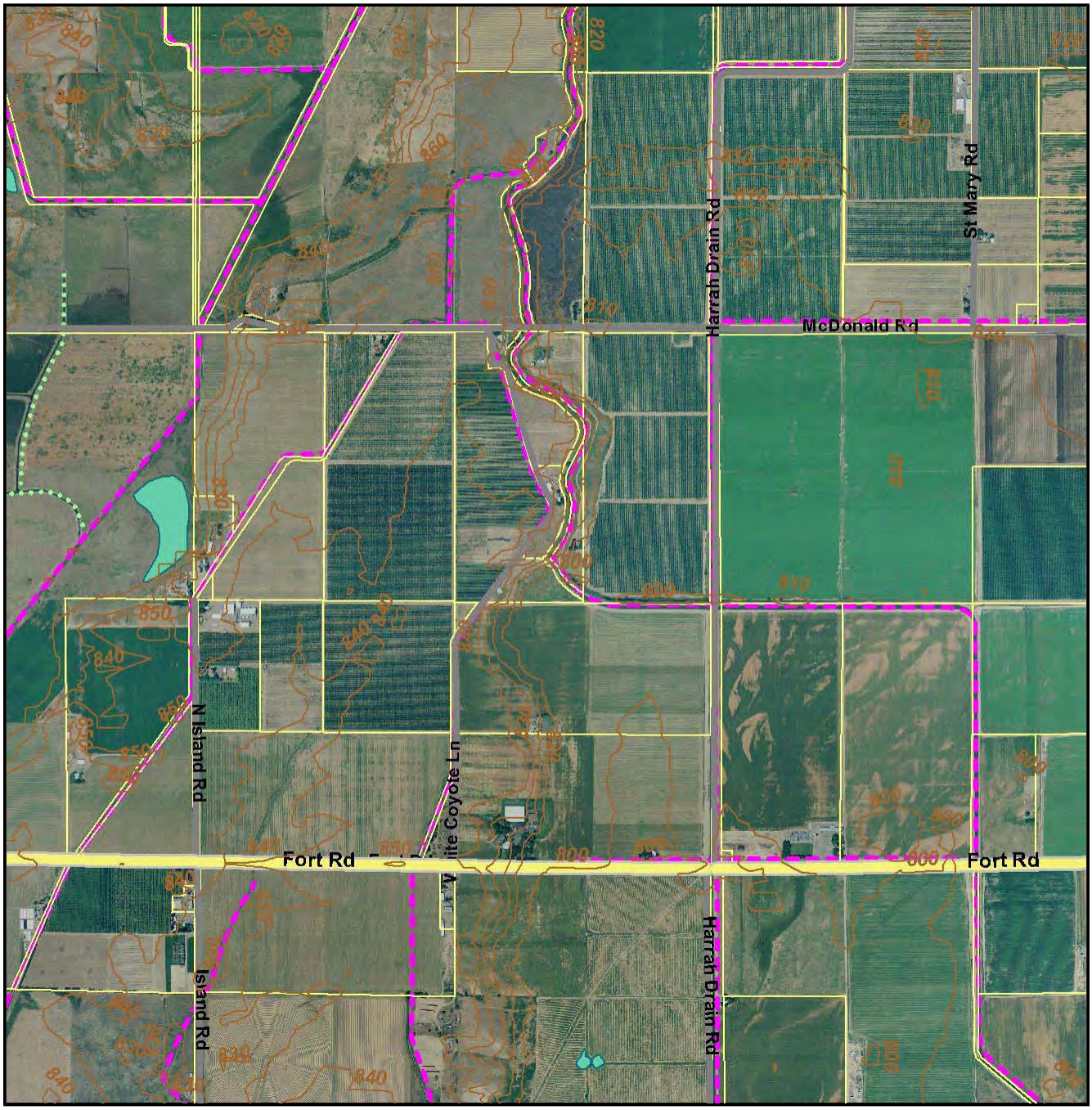
User Remarks:

Yakima County GIS - Washington

Land Information Portal

[Print Map]
[Close Map]

Yakimap.com



Map Center: **Range:18 Township:10 Section:4**

2008 Ortho Photography

City Limits
Sections
Contours

Existing Shoreline Environments:
Conservative/Natural/Rural/Urban
Potential Wetlands
Local Wetland Inventory
Stream Type - 2006 CAO
1/2/3/4/4 or
5/Undetermined/5/Man-Made

WWW.YAKIMAP.COM
Yakima County GIS
128 N 2nd Street
Yakima, WA 98901
(509)574-2992

One Inch = 1600 Feet
Feet 1000 2000

Printed On: 6/12/2012 8:40:42 AM

Urban Service Area Boundary(YCC Title 15A)

Urban Growth Boundary

Yakima County Zoning
YCC Title 15

- Forest Watershed (FW)
- Agriculture (AG)
- Remote/Extremely Limited (R/ELDP)
- Mountain Rural (MR)
- Valley Rural
- Rural Transitional (RT)
- Rural Settlement (RS)
- Highway/Tourist Commerical (HC)
- Mining (MIN)
- Planned Development (PD)
- Single Family Residential (R-1)
- Two Family Residential (R-2)
- Multi-Family Residential (R-3)
- Professional Business (B-1)
- Local Business (B-2)
- Commercial (C)
- Industrial (I)
- City Limit
- Federal Land/Tribal Trust
- Yakama Nation Closed Area

Yakima County Urban Area Zoning

YCC Title 15A

- Suburban Residential (SR)
- Single Family Residential (R1)
- Two Family Residential (R2)
- Multi-Family Residential (R3)
- Professional Business (B1)
- Local Business (B2)
- Historical Business (HB)
- Small Convenience Center (SCC)
- Large Convenience Center (LCC)
- Central Business District (CBD)
- General Commercial (GC)
- Light Industrial (M1)
- Heavy Industrial (M2)

City of Yakima Zoning

- (SR) Suburban Residential
- (R-1) Single-Family Residental
- (R-2) Two-Family Residental
- (R-3) Multi-Family Residental
- (B-1) Professional Business

- (B-2) Local Business
- (HB) Historical Business
- (SCC) Small Convenience Center
- (LCC) Large Convenience Center
- (CBD) Central Business District
- (GC) General Commercial
- (M-1) Light Industrial
- (M-2) Heavy Industrial
- (RD) Regional Development
- (AS) Airport Safety

Yakima County Plan2015 Designations

- Rural Settlement
- Rural Self-Sufficient
- Rural Remot/Limited Development
- Rural Transitional
- Forest Resource
- Agricultural Resource
- Urban (City Limit)
- Urban (Urban Growth Area)
- Federal/Yakama Nation Trust Land/Cosed Area

City of Yakima
Future Landuse Designations

- Low Density Residential
- Medium Density Residential
- High Density Residential
- Professional Office
- Neighborhood Commerical
- Large Convenience Center
- Arterial Commercial
- CDB Core Commerical Industrial
- Industrial

Flood Plain

- Flood Way
- Flood Plain

- Perennial Stream
- Intermittent Stream
- Lake or Pond
- Canal or Ditch
- Aquaduct/Siphon

Critical Areas

- Conservancy Wetlands
- Natural Wetlands

Rural Wetlands
Urban Wetlands

Type 1 Stream
Type 2 Stream
Type 3 Stream
Type 4 Stream
Type 4 or 5 Stream
Undetermined Stream
Type 5 Stream
Man-Made Stream

Potential Wetlands - Local Inventory

Utilities:

City of Yakima Water Pipes
City of Yakima Sewer Pipes
Nob Hill Water Pipes
Terrace Heights Water Pipes
Terrace Heights Sewer Pipes

Appendix I Coastal Zone Documentation

DEPARTMENT OF ECOLOGY State of Washington http://www.ecy.wa.gov

Coastal Zone Management (CZM)

Washington State Coastal Zone Management (CZM) Program

Washington State's coastal zone management program was approved by the federal government in 1976, making it the first to be approved. The program applies to the fifteen coastal counties which front on salt water.

The terms and features of a state's approved CZM program are provided in what is commonly known as a state's "CZM Program Document." Washington's program document, **Managing Washington's Coast** was most recently updated in 2003.

One of the features of the federal CZM program important to the states is "**Federal Consistency**." This simply means that any public federal project carried out by a federal agency, or private project licensed or permitted by a federal agency, or carried out with a federal grant, must be determined to be consistent with the state's CZM program.

The federal Coastal Zone Management Act also provides the states with special funding to assist in making improvements to their state CZM Program. Washington State participates in this voluntary **CZM Improvement Grants Program** which also goes by the shorter, but more bureaucratic name, Section 309 Program, after its section in the **Coastal Zone Management Act**. Washington State has used these funds primarily to update and amend the Shoreline Master Program Guidelines under the state's Shoreline Management Act.

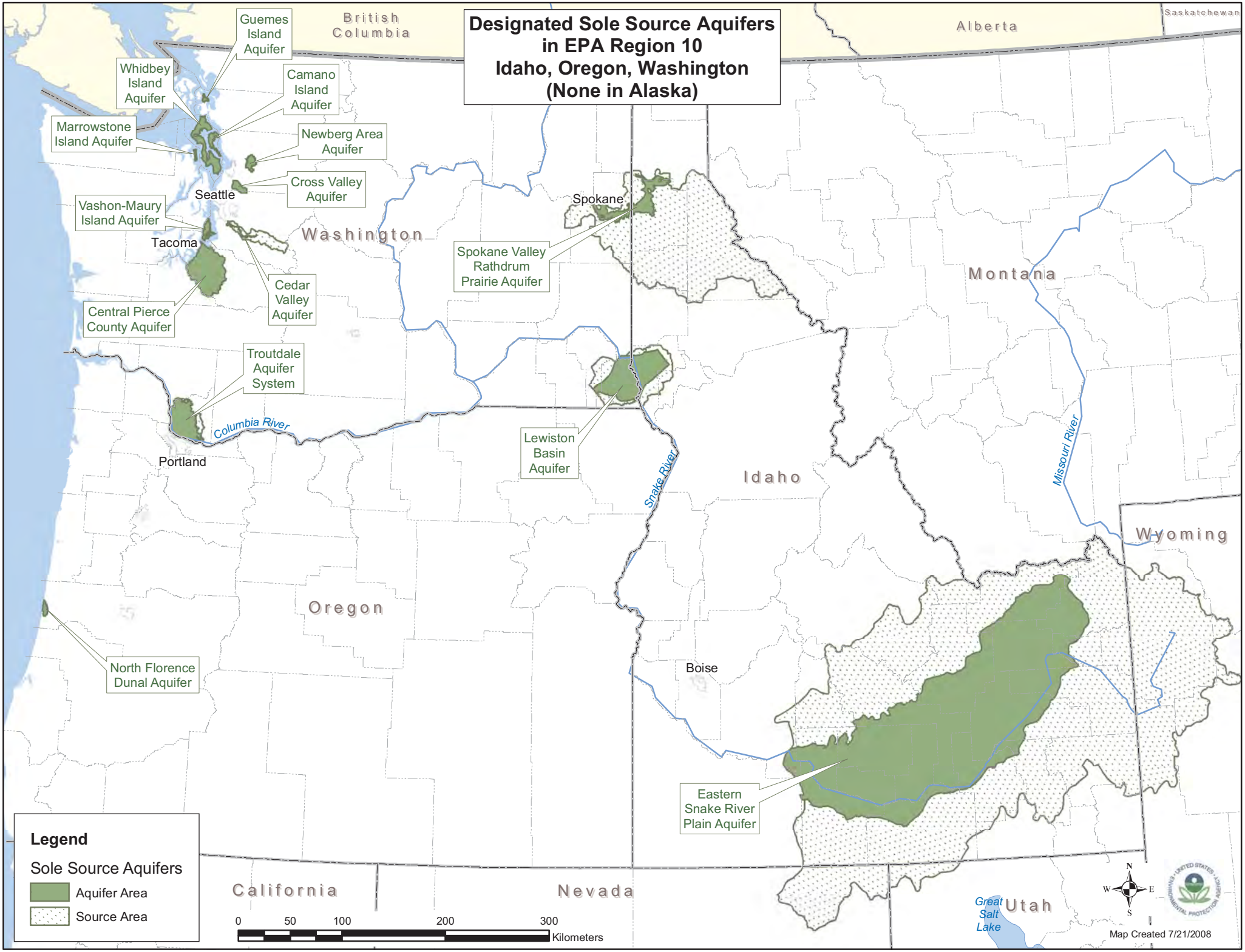
Coastal water quality has always been an important part of the federal – state coastal zone management program. In 1992 Congress provided for increased emphasis on coastal nonpoint pollution. Washington, along with other states in the national CZM program is developing a Coastal **Nonpoint Pollution Management** plan.

Washington State also participates in the federal **Coastal and Estuarine Land Conservation Program** (CELCP). The purpose of CELCP is to protect important coastal and estuarine areas having significant conservation, recreation, ecological, historical, or aesthetic values, and threatened by conversion. Although dedicated grant funds have not yet been authorized by Congress, a state plan has been drafted to assure Washington's eligibility for future participation.

To inquire about a Federal Consistency Determination, send an email to the Federal Consistency Coordinator, or telephone (360) 407-6068.

To ask a question about Washington's Coastal Zone Management Program, send an email to Brian Lynn

Appendix J Sole Source Aquifer Documentation


Designated Sole Source Aquifers
in EPA Region 10
Idaho, Oregon, Washington
(None in Alaska)
British Columbia
Alberta
Saskatchewan
Guemes Island Aquifer
Whidbey Island Aquifer
Camano Island Aquifer
Marrowstone Island Aquifer
Newberg Area Aquifer
Cross Valley Aquifer
Seattle
Vashon-Maury Island Aquifer
Tacoma
Washington
Spokane
Spokane Valley Rathdrum Prairie Aquifer
Montana
Cedar Valley Aquifer
Central Pierce County Aquifer
Troutdale Aquifer System
Columbia River
Portland
Lewiston Basin Aquifer
Snake River
Idaho
Missouri River
Wyoming
Oregon
North Florence Dunal Aquifer
Boise
Eastern Snake River Plain Aquifer
California
Nevada
Utah
Great Salt Lake
Legend
Sole Source Aquifers
Aquifer Area
Source Area
0 50 100 200 300
Kilometers
N
W
E
S
Map Created 7/21/2008

Appendix K Wild and Scenic River Documentation

Search

National Wild & Scenic Rivers

Designated Wild & Scenic Rivers

Select State Go

Rivers that pass through several states may have segments in each state designated. For example, the Klamath River has designations in California and Oregon. Many rivers also have numerous tributaries designated (e.g., Washington's Skagit River). Multiple listings of some rivers indicate more than one segment of the river is designated (e.g., the Missouri River in Nebraska).

Alabama

- Black Warrior River (Sipsey Fork)

Top of the Page

Alaska

- Alagnak River — National Park Service Site
- Alatna River
- Andreafsky River
- Aniakchak River
- Beaver Creek — Bureau of Land Management Site
- Birch Creek — Bureau of Land Management Site
- Charley River — National Park Service Site
- Chilikadrotna River
- Delta River — Bureau of Land Management Site
- Fortymile River — Bureau of Land Management Site
- Gulkana River— Bureau of Land Management Site
- Ivishak River
- John River
- Kobuk River
- Koyukuk River (North Fork)
- Mulchatna River
- Noatak River
- Nowitna River
- Salmon River
- Selawik River
- Sheenjek River
- Tinayguk River
- Tlikakila River
- Unalakleet River — Bureau of Land Management Site
- Wind River

Top of the Page

Arizona

- Fossil Creek
- Verde River — U.S. Forest Service Site

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Arkansas

- Big Piney Creek
- Buffalo River
- Cossatot River
- Hurricane Creek
- Little Missouri River
- Mulberry River
- North Sylamore Creek
- Richland Creek

Top of the Page

California

- Amargosa River
- American River (Lower)
- American River (North Fork) — Bureau of Land Management Site
- Bautista Creek
- Big Sur River
- Black Butte River
- Cottonwood Creek
- Eel River
- Feather River
- Fuller Mill Creek
- Kern River
- Kings River
- Klamath River — U.S. Forest Service Site
- Merced River — Bureau of Land Management Site
- Owens River Headwaters
- Palm Canyon Creek
- Piru Creek
- San Jacinto River (North Fork)
- Sespe Creek
- Sisquoc River
- Smith River
- Trinity River
- Tuolumne River — Bureau of Land Management Site

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Colorado

- Cache la Poudre River

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Connecticut

- Eightmile River
- Farmington River (West Branch) — Farmington River Committee Site

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Delaware

- White Clay Creek (See also Pennsylvania)

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Florida

- Loxahatchee River
- Wekiva River

Top of the Page

Georgia

- Chattooga River (See also North Carolina, South Carolina — U.S. Forest Service Site, Chattooga Net

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Idaho

- Battle Creek
- Big Jacks Creek
- Bruneau River
- Bruneau River (West Fork)
- Clearwater River (Middle Fork)
- Cottonwood Creek
- Deep Creek
- Dickshooter Creek
- Duncan Creek
- Jarbidge River
- Little Jacks Creek

- Owyhee River
- Owyhee River (North Fork)
- Owyhee River (South Fork)
- Red Canyon
- Rapid River
- Saint Joe River
- Salmon River
- Salmon River (Middle Fork)
- Sheep Creek
- Snake River (See also Oregon)
- Wickahoney Creek

Top of the Page

Illinois

- Vermilion River — State of Illinois Site

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Kentucky

- Red River

Top of the Page

Louisiana

- Saline Bayou

Top of the Page

Maine

- Allagash River — State of Maine Site

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Massachusetts

- Westfield River — Westfield River Wild & Scenic Advisory Committee Site
- Sudbury, Assabet and Concord Rivers
- Taunton River

Top of the Page

Michigan

- Au Sable River
- Bear Creek
- Black River
- Carp River
- Indian River
- Manistee River
- Ontonagon River
- Paint River
- Pere Marquette River
- Pine River
- Presque Isle River
- Sturgeon River (Hiawatha National Forest)
- Sturgeon River (Ottawa National Forest)
- Tahquamenon River (East Branch)
- Whitefish River
- Yellow Dog River

Top of the Page

Minnesota

- St. Croix River (Lower) (See also Wisconsin) — National Park Service Site
- St. Croix River (Upper) (See also Wisconsin) — National Park Service Site
- St. Croix River (Lower) (See also Wisconsin)

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Mississippi

- Black Creek

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Missouri

- Eleven Point River

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Montana

- Flathead River
- Missouri River — Bureau of Land Management Site

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Nebraska

- Missouri River (See also South Dakota) — National Park Service Site
- Missouri River (See also South Dakota) — National Park Service Site
- Niobrara River — National Park Service Site

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New Hampshire

- Lamprey River
- Wildcat Brook

Top of the Page

New Jersey

- Delaware River (Lower) (See also Pennsylvania)
- Delaware River (Middle) (See also Pennsylvania) — National Park Service Site
- Great Egg Harbor River
- Maurice River
- Musconetcong River

Top of the Page

New Mexico

- Jemez River (East Fork)
- Pecos River
- Rio Chama — Bureau of Land Management Site
- Rio Grande — Bureau of Land Management Site

Top of the Page

New York

- Delaware River (Upper) (See also Pennsylvania) — National Park Service Site

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North Carolina

- Chattooga River (See also Georgia, South Carolina) — U.S. Forest Service Site, Chattooga Net
- Horsepasture River
- New River — State of North Carolina Site
- Lumber River — State of North Carolina Site (Lumber River State Park)
- Wilson Creek

Top of the Page

Ohio

- Big and Little Darby Creeks — State of Ohio Site
- Little Beaver Creek — State of Ohio Site
- Little Miami River — State of Ohio Site

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Oregon

- Big Marsh Creek
- Chetco River — U.S. Forest Service Site
- Clackamas River
- Clackamas River (South Fork)
- Collawash River
- Crescent Creek
- Crooked River — Bureau of Land Management Site
- Crooked River (North Fork)
- Deschutes River — Bureau of Land Management Site
- Donner und Blitzen River
- Eagle Creek (Mt. Hood National Forest)
- Eagle Creek (Wallowa-Whitman National Forest
- Elk River — U.S. Forest Service Site
- Elkhorn Creek
- Fifteen Mile Creek
- Fish Creek
- Grande Ronde, River — Bureau of Land Management Site
- Hood River (East Fork)
- Hood River (Middle Fork)
- Illinois River — U.S. Forest Service Site
- Imnaha River
- John Day River — Bureau of Land Management Site
- John Day River (North Fork)
- John Day River (South Fork) — Bureau of Land Management Site
- Joseph Creek
- Klamath River — Bureau of Land Management Site
- Little Deschutes River
- Lostine River
- Malheur River
- Malheur River (North Fork)
- McKenzie River
- Metolius River
- Minam River
- North Powder River
- North Umpqua River — Bureau of Land Management Site
- Owyhee River — Bureau of Land Management Site
- Owyhee River (North Fork) — Bureau of Land Management Site
- Powder River
- Quartzville Creek — Bureau of Land Management Site
- Roaring River
- Roaring River (South Fork)
- Rogue River — Bureau of Land Management Site, U.S. Forest Service Site
- Rogue River (Upper) — U.S. Forest Service Site
- Salmon River — Bureau of Land Management Site
- Sandy River — Bureau of Land Management Site
- Smith River (North Fork) — U.S. Forest Service Site
- Snake River (See also Oregon)
- Sprague River (North Fork)
- Squaw Creek — Legislation pending to change the name to Whychus Creek.
- Sycan River
- Wallowa River — Bureau of Land Management Site
- Wenaha River
- West Little Owyhee River
- White River — Bureau of Land Management Site
- Wildhorse and Kiger Creeks
- Willamette River (North Fork of the Middle Fork)
- Zigzag River

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Pennsylvania

- Allegheny River
- Clarion River
- Delaware River (Lower) (See also New Jersey)
- Delaware River (Middle) (See also New Jersey) — National Park Service Site

- Delaware River (Upper) (See also New York) — National Park Service Site
- White Clay Creek (See also Delaware)

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Puerto Rico

- Rio Mameyes — U.S. Forest Service Site
- Rio de la Mina — U.S. Forest Service Site
- Rio Icacos — U.S. Forest Service Site

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South Carolina

- Chattooga River (See also Georgia, North Carolina) — U.S. Forest Service Site, Chattooga Net

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South Dakota

- Missouri River (See also Nebraska) — National Park Service Site
- Missouri River (See also Nebraska) — National Park Service Site

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- Obed River — National Park Service Site

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- Rio Grande — National Park Service Site, Rio Grande in Big Bend National Park

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- Virgin River Tributaries

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- Klickitat River
- Skagit River — U.S. Forest Service Site
- White Salmon River

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West Virginia

- Bluestone River — National Park Service Site

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- St. Croix River (Lower) (See also Minnesota) — National Park Service Site
- St. Croix River (Upper) (See also Minnesota) — National Park Service Site
- St. Croix River (Lower) (See also Minnesota)
- Wolf River

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Wyoming

- Snake River Headwaters
- Yellowstone River (Clarks Fork)

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Other Data

- Printable table of the National Wild &: Scenic Rivers System (PDF — Print as landscape).
- Instructions for the National Atlas Wild & Scenic Rivers Site (PDF).
- GIS shape files of the National Wild & Scenic Rivers System (270 KB Self-Extracting Zipped File).

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WASHINGTON STATE RIVERS ELIGIBLE FOR WILD AND SCENIC RIVER DESIGNATION[1]

Mt. Baker-Snoqualmie National Forest

Baker River
Beckler River
Bell Creek (South Fork Nooksack)
Boulder River
Buck Creek (Skagit)
Canyon Creek (South Fork Stilly)
Canyon Creek, South Fork (" ")
Carbon River
Clearwater River
Deception Creek
Deer Creek (North Fork Stilly)
Diobsud Creek
Downey Creek (Skagit)
Foss River
Foss River, East Fork
Foss River, West Fork
Greenwater River
Illabot Creek
Lennox Creek
Miller River
Miller River, East Fork
Miller River, West Fork
Noisy Creek
Nooksack River, North Fork
Nooksack River, Middle Fork
Nooksack River, South Fork
Pratt River
Rapid River
Sauk River, North Fork
Sauk River, South Fork
Silesia Creek
Skykomish River, North Fork
Skykomish River, South Fork
Snoqualmie River, North Fork
Snoqualmie River, Middle Fork
Snoqualmie River, South Fork
Stillaguamish River, North Fork Branch
Stillaguamish River, North Fork
Stillaguamish River, South Fork
Tolt River, South Fork
Taylor River
Troublesome Creek
Tye River
Wells Creek (North Fork Nooksack)
West Cady Creek
White Chuck River
White River

North Cascades National Park

Big Beaver Creek
Chilliwack River
Skagit River (undesignated reach)
Stehekin River
Agnes Creek
Bridge Creek
Thunder Creek
Fisher Creek

Gifford Pinchot National Forest

Cispus River
Clear Creek
Cowlitz River, Clear Fork
Cowlitz River, Muddy Fork
Cowlitz River
Green River
Lewis River, East Fork
Lewis River
Ohanapecosh River
Quartz Creek
Siouxon Creek
Smith Creek
Toutle River
White Salmon River (undesignated reach)
Wind River
Yellowjacket Creek

Olympic National Forest

Bogachiel River
Dosewallips River
Duckabush River
Dungeness River
Elwha River
Gray Wolf River
Hamma Hamma River
Hoh River
Humptulips River, East Fork
Humptulips River, Main Stem & West Fork
Skokomish River, South Fork
Sol Duc River
Quinault River
Wynoochee River

[1]Eligibility Determinations are made by the U.S. Forest Service or the National Park Service. Rivers in **bold** have been determined 'suitable' and recommended to Congress for Wild and Scenic River designation by the U.S. Forest Service/National Park Service.

Wenatchee National Forest

American River
Chiwawa River
Cle Elum River
Entiat River
Icicle Creek
Little Wenatchee River
Napeequa River
Waptus River
Wenatchee River
White River

Okanogan National Forest

Canyon Creek
Chewuch River
Granite Creek
Lost River
Methow River
Pasayten River
Ruby Creek
Twisp River
Wolf Creek

Colville National Forest

Kettle River
Salmo River, South Fork

Umatilla National Forest

Asotin Creek, North Fork
Bear Creek
Butte Creek
Sheep Creek
Tucannon River
Wenaha River, North Fork
Wenaha River, South Fork

Hanford Reach National Monument

Columbia River (51-mile free-flowing stretch)

Total Eligible Rivers: 112

(Total does not include undesignated eligible reaches of Skagit and White Salmon rivers)

Total Suitable/Recommended Rivers: 53

(Note that the fact that an eligible river has not been recommended for designation may be due to the fact that a suitability study and recommendation have not yet been performed, not that the river was deemed unsuitable.)

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