INITIAL CONSULTATION DOCUMENT

In Support of

FERC Exemption of Small Conduit Hydroelectric Facilities

For the

Bend Conduit Project

Submitted By:

The City of Bend

July 2011

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1.0 Introduction

This Initial Consultation Document (ICD) provides information to and requests information from interested Federal and State of Oregon agencies, tribal entities, non-governmental organizations, and members of the public (stakeholders or interested parties) regarding the City of Bend's (the City) intent to prepare and file an application for exemption of small conduit hydroelectric facilities. The exemption application will be filed with the Federal Energy Regulatory Commission (FERC or Commission) in accordance with the application procedures detailed at 18 CFR § 4.92.

1.1 Background

Bend relies on two water supply sources: 1) surface water from Bridge/Tumalo Creeks, and 2) groundwater from the Deschutes Regional Aquifer. The City's surface water supply system was developed in the 1920s as an unfiltered, gravity-operated system and provides approximately half of the City of Bend's annual municipal water supply. The existing system includes a diversion structure, an intake facility and two 11-mile water supply conduits that carry water from the intake facility on Bridge Creek to a water storage and disinfection facility at the Outback Reservoir site. The intake facility on Bridge Creek conveys water from Bridge Creek and Tumalo Creek.

The existing water supply conduits are at the end of their useful life, have several areas of known degradation and are at risk of failure. Access to the existing water supply conduits is difficult, since most of the alignment lies within heavily forested areas on U.S. Forest Service (USFS) land. The conduits also cross several private properties on City easements. In several easements, structures have been built directly over the existing water supply conduits alignments. Tree roots and structure loading have contributed to the poor condition of the conduits.

The primary objective of the proposed installation of a new water supply conduit is to replace the structurally failing conduits that leak and lack flow control. In addition, the design of the existing water supply conduits limits the speed at which the conduits can be shut off. Therefore, a break in the existing conduits could result in significant damage to nearby property and infrastructure.

The United States Environmental Protection Agency (USEPA) recently issued new regulations (Long Term 2 Enhanced Surface Water Treatment Rule) that require additional treatment for microbial pathogens, such as cryptosporidium, in surface water supplies by October 2012. The City of Bend has applied for and received a 2-year extension for this requirement from Oregon

Health Authority. In addition to the regulatory requirements, the aging surface water supply system is at increasing risk of failure and water quality degradation from a forest fire, and is in need of significant repair, replacements and upgrades.

Bend completed an alternatives study comparing the refurbishment of the existing surface water supply system, replacement of the Tumalo/Bridge Creek supply with groundwater, or building a Deschutes River diversion. After carefully considering key issues, including environmental protection, water supply reliability and flexibility, water quality, water rights, limitations on existing groundwater delivery infrastructure, long-term energy use and costs, and construction and operation costs, the City determined the refurbishment option was preferred.

The City proposes the following actions to support compliance with the USEPA regulations:

- Install a new 30-inch steel water supply conduit to replace the existing two water supply conduits from the water intake facility to the Outback Reservoir site (the lower portion of the conduit will be steel, but other portions may be constructed using other materials).
- Build a 13.6 MGD (21 cfs) membrane filtration water treatment plant at the Outback Reservoir site.
- Upgrade the Bridge Creek water intake facility to meet current standards as required.
- Build a hydropower plant to utilize the energy potential of the gravity water system and to help offset costs.

The information provided below, and the portion of the project that is subject to comments from the public and interested agencies, and requests to FERC for information, is limited to the proposed hydroelectric facilities (the powerhouse) described in this ICD. As mentioned previously, the City is proposing a hydropower generation facility at the Outback Reservoir site to take advantage of the water pressure created by the 1,100-foot elevation drop between the intake facility and the Outback Reservoir site. The proposed hydropower facility would generate renewable power only from the water used for beneficial municipal use under the City's existing water rights, in the City's water system, and the revenue generated from the proposed project would provide an economic, environmental and energy benefit to the City.

1.2 Regulatory Process

Conduit Exemption

The City's proposed hydroelectric facility qualifies for a Conduit Exemption because it meets the following requirements of 18 C.F.R. §4.30 (b)(28) :

i). Utilizes the hydroelectric potential of a conduit for electric power generation.

ii). Is located entirely on non-Federal lands.

iii). Is a municipal water supply and has an installed generating capacity of less than 40 MW.

iv). Is *not* an integral part of a dam.

v). Discharges the water it uses for power generation into a conduit and directly to a point of municipal consumption.

vi). Does not rely upon construction of a dam.

Definition of Conduit

Pursuant to 18 CFR 4.30, FERC defines a conduit as any tunnel, canal, pipeline, aqueduct, flume, ditch, or similar manmade water conveyance that is operated for the distribution of water for agricultural, municipal or industrial consumption, and not primarily for the generation of electricity. The term not primarily for the generation of electricity includes but is not limited to a conduit built for the distribution of water for agricultural, municipal or industrial consumption, and is operated for such a purpose and to which a hydroelectric facility has been or is proposed to be added.

Definition of Small Conduit Hydroelectric Facility

A small conduit hydroelectric facility is an existing or proposed hydroelectric facility that is constructed, operated or maintained for generation of electric power, and has an installed generating capacity of less than 40 MW in the case of a municipal water supply. The hydroelectric facility excludes the conduit on which it is located and associated transmission lines.

Three-Stage Consultation Process

The FERC regulations governing the conduit exemption process require the City to pursue the three-stage consultation process. This ICD initiates the first of the required stages. Using FERC's

regulations and guidance, the City will pursue the following three stages of the exemption process to facilitate the filing of the conduit exemption application with the FERC in the second quarter of 2012.

First stage - This stage commences with the distribution of this ICD to interested parties (see distribution list in Appendix A). The City will then meet with various agencies (as required) to foster stakeholder involvement, assist in determining the appropriate scope of any necessary studies, and assist in determining any analysis required to support the exemption application.

Second stage – The City will gather information needed for the development of any necessary study plans and will prepare the draft and final exemption applications. There is a FERC required 90-day review period of the draft exemption application. This stage ends when the City files the final application.

Third stage – The third stage of consultation commences with the filing of the exemption application with the FERC and ends when the FERC issues the exemption order.

Obtaining an Exemption

The procedures for obtaining an exemption for constructed or unconstructed small conduit hydroelectric facilities as defined above commences with the distribution of this ICD. Subsequent to the City receiving comments on the ICD, the City will prepare the draft exemption application and distribute it to the relevant agencies and stakeholders for comment. This allows the City to address any relevant concerns and to resolve any relevant identified issues in the final application. As required by 18 CFR 4.92, the application must include:

- An Introductory Statement – a formal notice of intent to file the application.
- Exhibit A – A description of the small conduit hydroelectric facility and proposed mode of operation as well as anticipated date to commence with construction.
- Exhibit E – A description of the environmental setting and anticipated impacts within the vicinity of the facility, which includes terrestrial resources, aquatic and wildlife resources, water quality resources, recreation and land use, socio-economics 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 conduit hydroelectric facility.
- Exhibit G – General location map that shows the physical structures of the small conduit 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. Both Exhibits F and G must conform to the Commissions specifications at 18 CFR 4.41.

The FERC does not require Exhibits B, C, and D to be filed as part of a Conduit Exemption Application.

The application will also contain appendices containing evidence that the City of Bend has the real property interests, identification of all Indian tribes potentially affected by the project, and agency consultation in the form of draft application comments or correspondences.

The City will submit the final application to the FERC and the relevant stakeholders and legal notices will be published. FERC then reviews the application and the agencies file any additional comments with the FERC.

FERC will issue 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 fish and wildlife agencies. The project must commence with actual construction within two years and be completed within four years from the effective date of the exemption order.

Table 1 - Small Conduit Exemption Schedule

18 CFR §	Lead	Activity	Time Frame	Deadline Dates
	Bend	Distribute ICD	1 Day	7/8/11
§4.38 (b)(2)	Bend	Publish Meeting Notice	15 days prior to joint meeting	7/26/2011
§4.38(b)(3)(ii)	Bend	Joint Meeting	30 – 60 days after distribution of ICD	8/10/2011
§4.38(b)(5)	Stakeholders	Stakeholder Comments Due	60 days after joint meeting	10/9/2011
§4.38(c)(1)	Bend	If necessary, conduct studies		
NA	Bend	Site Visit		Tentatively scheduled for 10/11/2011
§4.38(c)(4)	Bend	Distribute Draft Application		11/7/2011
§4.38(c)(5)	Stakeholders	Stakeholder Comments on Draft Application	90 days	11/7/20110-02/5/2012
§4.38(d)	Bend	Prepare, File and Distribute Final Application	14 days	2/17/2012
NA	FERC	Review final application and Issue Exemption	6 months	2/20/2012 - 8/7/2012

2.0 Application for Exemption of Small Conduit Hydroelectric Facilities

Pursuant to the requirements of 18 CFR §4.38(b)(2), the City is providing the information below to initiate the formal three-stage consultation process required to support the proposed filing of its application for exemption of a small conduit hydroelectric facility.

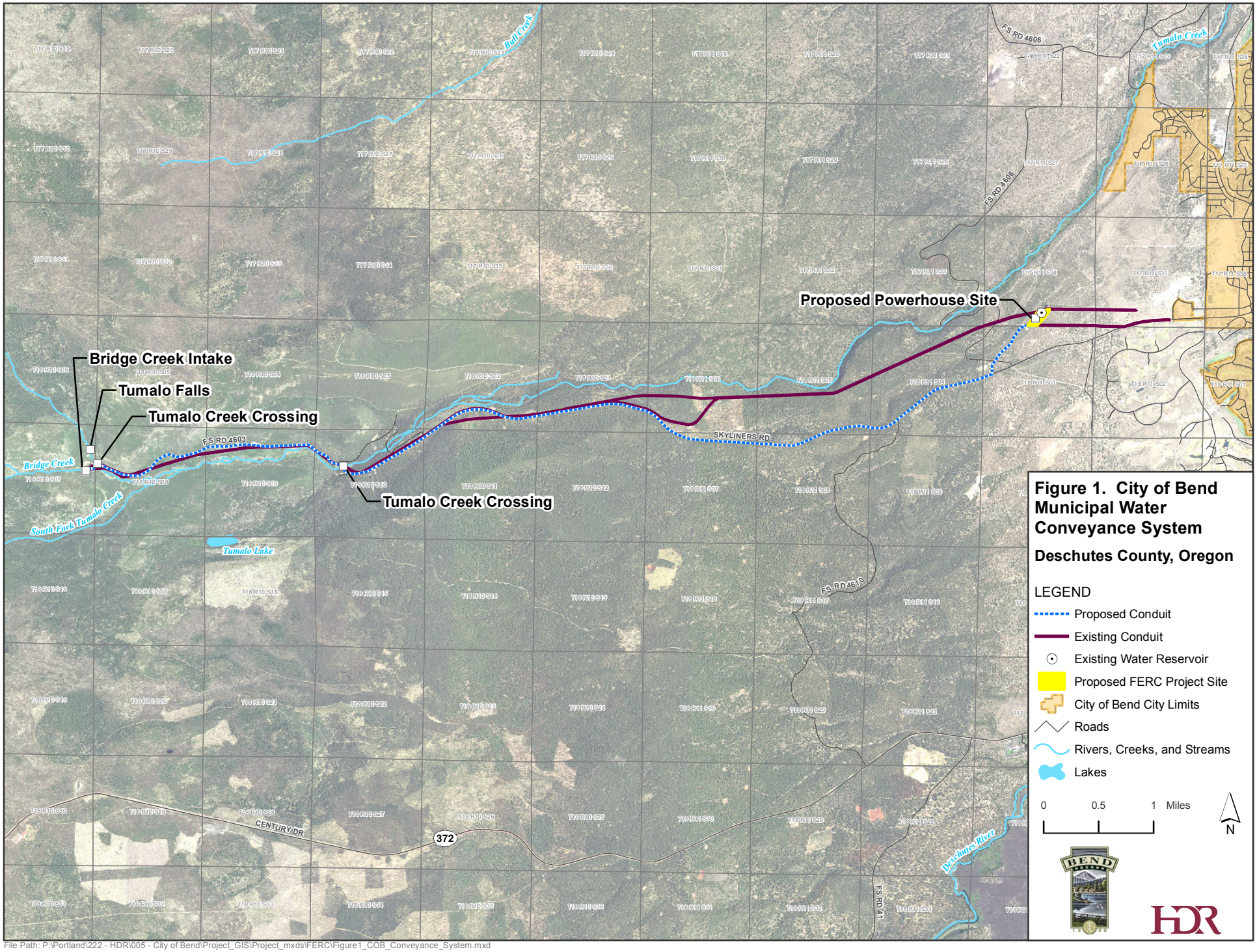
2.1 Project Maps

The only facility included in the conduit exemption application is the proposed powerhouse. The current design for the powerhouse proposes a 50-foot by 35-foot building that would be 15 to 20 feet tall.

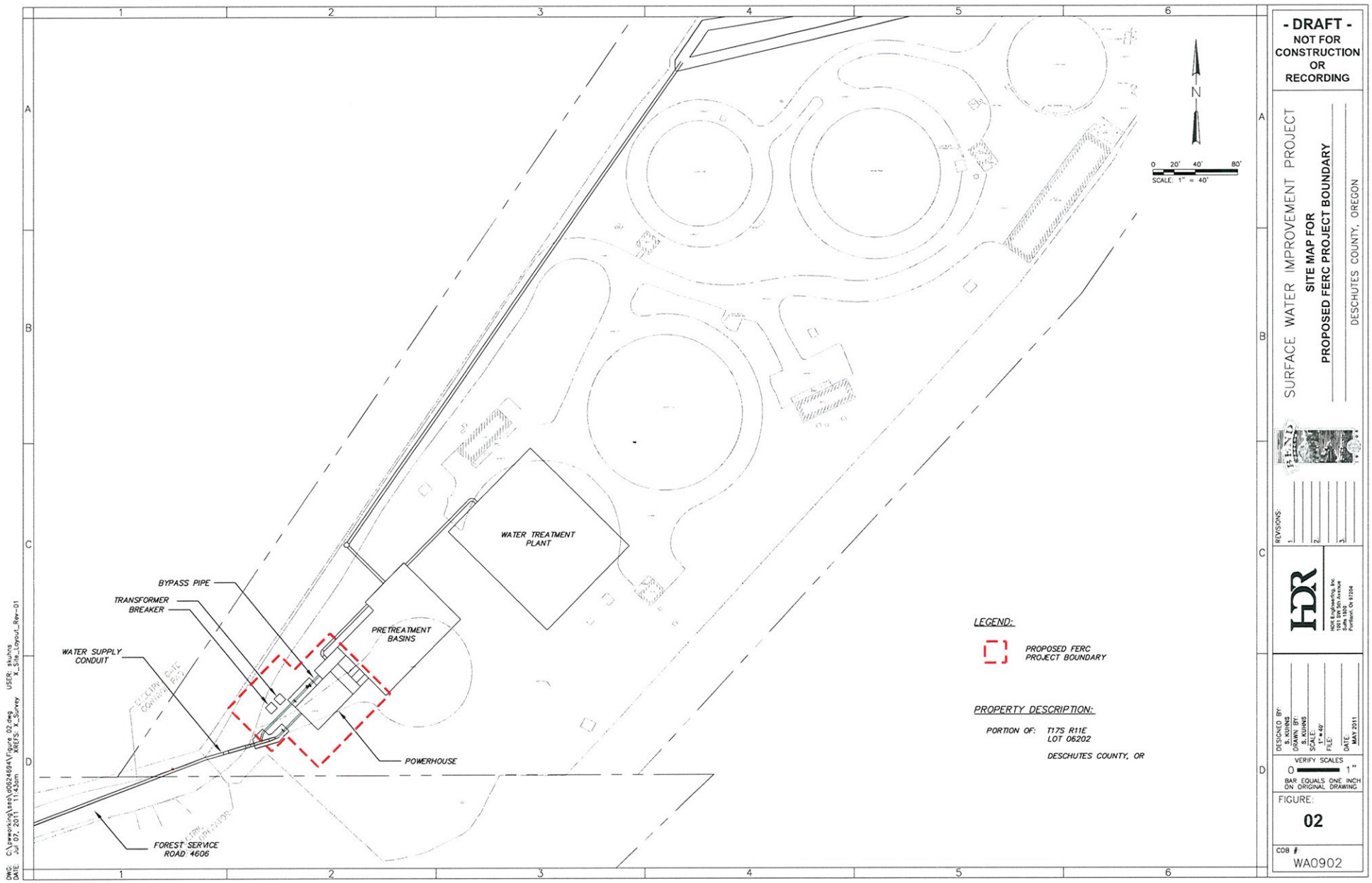
Figure 1 – Primary components and configuration of existing water supply system that originates at the City of Bend intake facility on Bridge Creek and terminates at the existing aboveground reservoir storage facility two miles west of the City of Bend at the city owned Outback facility.

Figure 2 – Consistent with FERC regulations and policy, only the actual hydroelectric generation equipment is proposed for inclusion in the FERC Project Boundary for the conduit exemption. The water conduit facilities are not included in the proposed project features that will be under FERC jurisdiction under the conduit exemption.

The City of Bend owns all the land within the proposed FERC Project Boundary, which represents the footprint of the Bend Powerhouse and associated substation as well as a 25-foot buffer surrounding the powerhouse and the substation.



File Path: P:\Portland\222 - HDR\005 - City of Bend\Project_GIS\Project_mxds\FERC\Figure1_COB_Conveyance_System.mxd



- DRAFT -
NOT FOR CONSTRUCTION OR RECORDING

SURFACE WATER IMPROVEMENT PROJECT

SITE MAP FOR PROPOSED FERC PROJECT BOUNDARY

DESCHUTES COUNTY, OREGON

REVISIONS:
1.
2.
3.

HDR Engineering, Inc.
1001 SW 5th Avenue
Suite 1800
Portland, OR 97204

DESIGNED BY: S. KUHNS
DRAWN BY: S. KUHNS
CHK'D BY:
SCALE: 1" = 40'
FILE:
DATE: MAY 2011

VERIFY SCALES
0 1"
BAR EQUALS ONE INCH ON ORIGINAL DRAWING

FIGURE: 02

COB # WA0902

DWG: C:\pwworking\seo\d0624694\Figure 02.dwg
DATE: Jul 07, 2011 11:43am
USER: skuhns
XREFS: X_Survey
X_Site_Layout_Rev-01

2.2 General Engineering Design

The proposed Bend Powerhouse building would enclose the generating equipment as well as all associated control and auxiliary equipment to maintain a suitable weather protected dry environment. The building would be simple concrete masonry or steel construction with minor architectural features. The arrangement will allow access to the equipment for maintenance and repairs, and include either an overhead crane or access by forklift for equipment disassembly.

Water used for generation at the Bend Powerhouse will discharge to the City of Bend Water Treatment Plant for treatment and distribution to the City's customers for beneficial municipal use, authorized under the City's existing water rights. A bypass valve will be installed in parallel to the turbine-generator to provide for uninterrupted water supply to the water treatment plant in case the turbine is out of service or flows exceed the turbine capacity or the State of Oregon water rights authorization to generate hydropower.

The City will prepare Exhibit F drawings for the FERC Draft Exemption Application depicting the generating facilities proposed to file with the small conduit exemption application.

2.3 Proposed Project Operation

The replacement water supply conduit would terminate in a hydroelectric powerhouse, which would regulate the flow to the water filtration facility. The powerhouse would be equipped with a single impulse turbine, rated approximately 1600 kW. The City plans a sustainable turbine operation not to exceed 21 cfs. The discharge of the turbine will be limited by the demands of the water system and subsequent beneficial use of water for municipal use. Discharge of the turbine will also be limited by the amount of surface water available at the intake and other constraints identified in this document. The turbine would discharge into a small afterbay that is integral with the water treatment plant pretreatment area.

A bypass valve will be located adjacent to the powerhouse, which would provide for continuation of the flow whenever the turbine is out of service or has reached its authorized capacity. The bypass valve will also be capable of a wide range of discharge to meet the flow requirements of the filtration plant and would discharge into the same or parallel afterbay. The turbine will be equipped with a synchronous generator and a speed controller. The afterbay and associated preliminary treatment facilities will be equipped with multiple electrically driven variable speed pumps, which would deliver the flow to the filtration plant with constant regulated pressure.

Automatic controls would adjust both the turbine and the pumps in a coordinated manner to smoothly adjust the flow rate to meet the demand of the water system.

The hydroelectric equipment will be enclosed within a concrete block or metal building, so noise level outside of the building would be quite low. Any water leakage within the building will be routed to a sump equipped with an oil-water separator to prevent any oil leakage from being discharged from the building. All critical water and power control functions would by operated by power from the station battery for high reliability.

2.4 Environmental Conditions

The proposed FERC Project Boundary for the Bend Powerhouse Project (Figure 2) covers approximately 0.04 acres of land, all of which is completely contained within Deschutes County Tax lot 1711000006202, entirely owned and managed by the City of Bend. As seen in Figures 3 through 5, the proposed powerhouse site consists of an existing graded and graveled area with a sporadic covering of herbaceous vegetation in association with disturbed and fallow areas (e.g. grasses and forbs). Due to this disturbance, the site does not contain any environmental or recreational resources. At this time, the City does not propose any hydropower house-specific protection, mitigation or enhancement measures to be included in the Conduit Exemption.

Figure 3 - View of Entrance to Existing Site Facing South

Figure 4 - North View of Existing Water Storage Tanks (proposed site in foreground)

Figure 5 - View of Proposed Site Facing West

2.5 Streamflow and Water Regime Information

Streamflow and water regime information used to evaluate hydropower flows is included in Appendix B (Technical Memorandum "Hydropower Flows" dated July 7, 2011). Appendix B includes drainage area, natural flow periodicity, monthly flow rates and durations, mean flow figures illustrating the mean daily streamflow curve for each month of the year at the point of diversion, location of the stream gauging station, and the method used to generate the streamflow data provided.

2.6 PURPA Statement

FERC certification of a Qualifying Facility (QF) gives the Applicant the right to sell energy and electrical capacity under the Section 201 of the Public Utility Regulatory Policies Act of 1978 (PURPA). The FERC regulations and policies governing certification of a QF are found at 18 CFR 292.202-292.209. The three types of facilities eligible to receive certification are Small Power Production Facilities (SPPs), Cogeneration Facilities, and Hydroelectric SSPs not located at a new dam or diversion. The proposed project qualifies as a QF based upon the projected power production capabilities being less than 80 MW. Its primary energy source is a renewable resource and the project is not owned by a company primarily engaged in sale or generation of power.

The City of Bend is going to seek benefits under Section 210 of PURPA.

2.7 Proposed Studies

The City is not currently proposing any environmental studies for the conduit exemption application based on the small project footprint and the lack of environmental resources within the proposed Project Boundary.

2.8 Notice to Fish and Wildlife Agencies

Pursuant to 18 CFR §4.301, the City of Bend herein notifies the U.S. Fish and Wildlife Service and the Oregon Department of Fish and Wildlife that it will be seeking an exemption from FERC licensing. The City of Bend is requesting from the mandatory conditioning agencies an estimate of the total costs the agencies anticipate they would incur to set the mandatory terms and conditions for the project.

2.9 Invitation to Comment

As required by Federal Energy Regulatory Commission (FERC) regulation 18 CFR, Part 4, Section 4.38(a) and (b), the City of Bend is requesting your review and comment on this ICD for exemption of proposed small conduit hydroelectric facilities.

Comments may be submitted electronically to Sandra Siemens at:

sandra.siemens@hdrinc.com

Comments must be submitted as part of the actual e-mail message, or as an attachment in Microsoft Word or portable document format (pdf) only. Emails submitted to e-mail addresses other than the one listed above, in other formats than those listed, or containing viruses will be rejected. Please put "Bend FERC Conduit Exemption" in the subject line of your email.

Comments may also be submitted in writing by mail. Written comments should be sent to: HDR/Bend Surface Water Improvement Project Office, 805 SW Industrial Way, Suite 4, Bend, OR 97701.

To help us reach as many interested parties as possible, please share this ICD with others who may be interested.

2.10 Joint Meeting

Also, as required by FERC regulation 18 CFR, Part 4, Subpart D, Section 4.38(b)(2), the City of Bend has scheduled a joint meeting to discuss the proposed project. The meeting is currently scheduled for August 10, 2011, from 2:00 to 4:00 p.m. at the Deschutes County Administration Building, Barnes Meeting Room (1300 N.W. Wall Street Bend, OR).

Appendix A

ICD Distribution List

APPENDIX A

Agency Type	Agency	Agency Con't	Title	Region	Address
FED	Bureau of Indian Affairs	U.S. Department of the Interior	Regional Director	Northwest Region	911 NE 11th Avenue Portland OR 97132
FED	United States Geological Survey		Regional Director	Western Region	345 Middlefield Road Menlo Park CA 94025
FED	Office of Senator Merkley		U.S. Senator		107 Russell Senate Office Building Washington DC 20510
FED	Office of Senator Wyden		U.S. Senator		230 Dirksen Senate Office Building Washington DC 20510
FED	U.S. Army Corps of Engineers		Division Commander	Northwestern Division	P.O. Box 2870 Portland OR 97208-2870
FED	U.S. Army Corps of Engineers		District Engineer	Portland District Office	P.O. Box 2946 Portland OR 97208-2946
FED	U.S. Army Corps of Engineers		Division Commander	South Pacific Division	1455 Market St San Francisco CA 94103-1398
FED	U.S. Bureau of Land Management	U.S. Department of the Interior	State Director	Oregon State Office	P.O. Box 2965 Portland OR 92708-3420
FED	National Oceanic and Atmospheric Administration	Regional Fisheries Office	Regional Administrator	Northwest Region	7600 Sand Point Way NE Seattle WA 98115-0070
FED	U.S. Bureau of Reclamation	U.S. Department of the Interior	Regional Director	Mid-Pacific Region	2800 Cottage Way Sacramento CA 95825-1886
FED	National Oceanic and Atmospheric Administration	Northwest Fisheries Science Center	Director	Northwest Region	2725 Montlake Boulevard East Seattle WA 98112-2097
FED	U.S. Bureau of Reclamation	U.S. Department of the Interior	Regional Director	Pacific Northwest Region	1150 Curtis Road Suite 100 Boise ID 83706-1234
FED	U.S. Department of Agriculture - Forest Service		Regional Forester	Pacific Northwest Region - 6	P.O. Box 3623 Portland OR 97208-3623
FED	U.S. Environmental Protection Agency		Regional Administrator	Region 10: Pacific Northwest	1200 Sixth Avenue Seattle WA 98101
FED	U.S. Fish and Wildlife Service	Klamath Falls Field Office	Field Supervisor	Region 8 - California and Nevada	1936 California Avenue Klamath Falls OR 97601
FED	U.S. Fish and Wildlife Service	Oregon Field Office	Field Supervisor	Region 1 - Pacific	2600 Southeast 98th Avenue Suite 100 Portland OR 97266-1398
FED	U.S. Fish and Wildlife Service		Regional Director	Region 1 - Pacific	911 NE 11th Avenue Portland OR 97232-4181
FED	U.S. Fish and Wildlife Service		Regional Director	Region 8 - California and Nevada	2800 Cottage Way Suite W-2606 Sacramento CA 95825-1846
FED	U.S. Department of Commerce	Office of the Secretary	Secretary		1401 Constitution Avenue NW Washington DC 20230

FED	U.S. Army Corps of Engineers		Commander	Headquarters	441 G Street NW Washington DC 20314
FED	United States Geological Survey	U.S. Department of the Interior	Director	Headquarters	12201 Sunrise Valley Dr Reston VA 20192
FED	U.S. Department of Agriculture - Forest Service		Chief	Headquarters	1400 Independence Ave SW Washington DC 20250-0003
FED	Naval Seafloor Cable Protection Office	Naval Facilities Engineering Command, NAVFAC-OFP/C		Ocean/Tidal Hydrokinetics	1322 Patterson Ave SE Suite 1000 Washington DC 20374-5065
FED	U.S. Forest Service			Headquarters	1400 Independence Avenue SW Washington DC 20250-0003
FED	U.S. Bureau of Reclamation	U.S. Department of the Interior	Commissioner	Headquarters	1849 C Street NW Washington DC 20240
FED	National Park Service	One Jackson Center	Regional Director	Pacific West Region	1111 Jackson Street Suite 700 Oakland CA 94607
FED	National Oceanic and Atmospheric Administration		Administrator	Headquarters	1401 Constitution Ave NW Room 6217 Washington DC 20230
FED	Federal Energy Regulatory Commission	Division of Dam Safety and Inspections	Regional Engineer	Portland Regional Office	805 SW Broadway Fox Tower - Suite 550 Portland OR 97205
FED	Federal Emergency Management Agency		Director	Headquarters	500 C Street SW Washington DC 20472
FED	National Park Service	U.S. Department of the Interior	Director	Headquarters	1849 C Street NW Washington DC 20240
FED	U.S. Environmental Protection Agency	Ariel Rios Building	Administrator	Headquarters	1200 Pennsylvania Ave NW Washington DC 20460
FED	U.S. Coast Guard	Navigation Standards Branch (Hydrokinetics)	Commandant (CG-5413)		2100 2nd St. SW Stop 7581 Washington DC 20593-7581
FED	U.S. Fish and Wildlife Service	U.S. Department of the Interior	Director	Headquarters	1849 C Street NW Room 3238 Washington DC 20240-0001
	U.S. Fish and Wildlife Service				20310 Empire Avenue Suite A100 Bend OR 97701
FED	Bureau of Indian Affairs	U.S. Department of the Interior	Director	Headquarters	1849 C Street NW MS 2624 MIB Washington DC 20240
FED	Advisory Council on Historic Preservation	Old Post Office Building	Executive Director	Headquarters	1100 Pennsylvania Ave NW Suite 803 Washington DC 20004
FED	U.S. Bureau of Land Management	U.S. Department of the Interior	Director	Headquarters	1849 C Street NW MIB 5655 Washington DC 20240
FED	Oregon Department of Fish & Wildlife		Alan Dale	High Desert Region	61374 Parrell Road Bend OR 97702
FED	Oregon Department of Fish & Wildlife			Fish Division	3406 Cherry Avenue N.E. Salem, OR 97303-4924

APPENDIX A

FED	Oregon Department of State Lands		Bethany Harrington	Eastern Region	1645 N.E. Forbes Road, Suite 112 Bend, OR 97701
FED	Oregon Department of State Lands				775 Summer Street N.E. Suite 100 Salem OR 97301-1279
FED	U.S. Army Corps of Engineers		Brian Wilson		1600 Executive Parkway Suite 210 Eugene OR 97401-2156
NGO	Pacific Coast Federation of Fishermen's Associations		Northwest Regional Director		P.O. Box 11170 Eugene OR 97440-3370
NGO	American Canoe Association		Executive Director		1340 Central Blvd. Suite 210 Fredericksburg VA 22401
NGO	American Whitewater		Executive Director		P.O. Box 1540 Cullowhee NC 28723
NGO	Hydropower Reform Coalition		National Coordinator		1101 14th St. NW Suite 1400 Washington DC 20005
NGO	Columbia River Gorge Commission		Executive Director		NE Wauna Ave P.O. Box 730 White Salmon WA 98672-0730
S	Oregon Parks & Recreation Department		SHPO		725 Summer Street NE Suite C Salem OR 97301
S	Oregon Department of Environmental Quality	Water Quality Division	Director		725 Summer Street NE Suite A Salem OR 97301
S	Oregon Department of Fish and Wildlife	Director's Office	Director		3406 Cherry Avenue NE Salem OR 97303
S	Oregon State Parks and Recreation Department	Officer of the Director	Director		725 Summer Street NE Suite C Salem OR 97301
S	Oregon Natural Resources Council		Administrator		5825 N. Greely Avenue Portland OR 97217
S	Oregon Department of Forestry		State Forester		2600 State Street Salem OR 97310
S	Office of the Attorney General	Justice Building	Attorney General		1162 Court Street NE Salem OR 97301
S	Oregon Department of Agriculture		Director		635 Capitol Street NE Salem OR 97301-2532
S	Office of the Governor		Governor		900 Court Street NE Room 254 Salem OR 97301-4047
S	Oregon Dept of Land Conservation and Development		Director		635 Capitol Street NE Suite 150 Salem OR 97310-2540
T	Confederated Tribes of the Warm Springs Reservation - Tribal Council		Chairman		P.O. Box C Warm Springs OR 97761-3001

T	Confederated Tribes of the Umatilla Indian Reservation				P.O. Box 638 Pendleton OR 97801
T	Confederated Tribes of the Umatilla Indian	Reservation			P.O. Box 638 Pendleton OR 97801
T	Confederated Tribes of the Umatilla Indian Reservation		Chairman		P.O. Box 638 Pendleton OR 97801-0638
T	Confederated Tribes of Coos Lower Umpqua and Siuslaw Indians		Chairman		1245 Fulton Avenue Coos Bay OR 97420
T	Hells Canyon Preservation Council		Conservation Director		PO Box 2768 La Grande OR 97850
T	Siletz Tribal Council		Chairman		P.O. Box 549 Siletz OR 97380-0549
T	Burns Paiute Tribe General Council		Chairman		H.C. 71 100 Pasigo Street Burns OR 97720
T	Klamath General Council		Chairman		P.O. Box 436 Chiloquin OR 97624-0436
T	Umpqua Watersheds		Executive Director		PO Box 101 Roseburg OR 97470
T	Coquille Indian Tribe		Chairman		P.O. Box 783 North Bend OR 97549
T	The Institute for Fisheries Resources		Program Director		PO Box 11170 Eugene OR 974403370
T	Cow Creek Government Offices		Chairperson		2371 N.E. Stevens Suite 100 Roseburg OR 97470-1338
T	Confederated Tribes of the Grand Ronde Community of Oregon		Chairperson		9615 Grand Ronde Road Grand Ronde OR 97347-0038
L	City of Bend		City Council		710 NW Wall Street Bend Oregon 97701
	Deschtues County Planning	Nick Lealack			117 NW Lafayette Avenue Bend OR 97701
L	Deschutes County Clerk		County Clerk		1300 NW Wall Street, Ste 200 Bend, OR 97701
L	Eileen Stein		City Manager		520 E. Cascade Ave P.O. Box 39 Sister, OR 97759
L	City of Redmond				716 SW Evergreen Ave Redmond, OR 97756
NGO	Upper Deschutes Watershed Council				700 NW Hill Street Bend OR 97701-2923
NGO	Tumalo Irrigation District	Elmer McDaniels	Manager		64697 Cook Avenue Bend OR 97701
NGO	Deschutes River Conservancy DRC				700 NW Hill Street Bend OR 97701-2923
NGO	Friends of Bend		Liz Rewick		16 NW Kansas Ave Bend, OR 97701
NGO	Bend Parks and Recreation		Executive Director		799 SW Columbia St Bend, OR 97709

Appendix B

Draft Technical Memorandum, Hydropower Flows, 7/5/2011

To: Heidi Lansdowne, PE, City of Bend

From: Bryan Black, PE

Project: Surface Water Improvement Project

Date: 07-07-2011

RE: Hydropower Flows, DRAFT

1 Background and Purpose

The City of Bend Oregon (City) is considering construction of a hydropower generation facility on its surface water supply system. The City has asked HDR to evaluate the economics of the hydropower facility. This memorandum describes the flows potentially available for hydropower generation as a first step in assessing the potential power generation revenue. Information and assumptions described in this memorandum should not be construed as operational commitments or restrictions.

2 Objectives and Approach

The objective of this analysis and memorandum is to evaluate the streamflows available for hydropower generation. Since operation of the powerhouse will be coincident with operation of the surface water supply system, the flows available for hydropower generation will not exceed the flows available for municipal water supply. Flows for hydropower generation are further constrained as noted below.

2.1 Water Supply Operations

The City operates two primary water sources: 1) Bridge / Tumalo Creek surface water and 2) groundwater. Surface water is used on a year-round basis. Groundwater is used primarily in summer to help meet peak water demands.

The City is in the process of installing filtration of the Bridge / Tumalo Creek water supply to meet new federal drinking water requirements by 2014. Filtration of the supply will provide the City access to water typically not available to them during snow-melt conditions when turbidity is increased. This typically occurs during the months of May through July, during periods when the City experiences significant peaking of water demands.

Flow through the turbine-generator system has four primary constraints:

- **Water demand.** The flow through the turbine would not exceed the municipal water demand;
- **Water availability.** The flow through the turbine could not exceed the amount of water available at the City's point of diversion into the Bridge Creek Intake;
- **Water rights.** The flow through the turbine would not exceed the

City's right to divert water; and

- **Operating procedures**. For the purpose of understanding hydropower revenue generation, the City is planning on a sustainable turbine operation of 21 cfs (13.6 mgd) or less.

Each of the four primary constraints are described further below. For the purpose of estimating power and revenue generated from the hydroelectric powerhouse, water demand and availability must be estimated on a monthly basis over a 50 year analysis period or until the controlling parameter reaches a steady state. The calculation approach in this memorandum is deterministic. The City may choose to evaluate alternate flow or demand scenarios to understand potential impacts on revenue generation.

3 Water Demands

The City's water demand forecast is contained in its Water Management and Conservation Plan (WMCP) dated June 2011[1] and its Optimization Final Report (Appendix C - Design Data Summary Report) dated February 2011[2]. **Table 1** summarizes the water demand forecast.

The water demand forecast summary referenced above was interpolated by year to estimate the Average Day Demand by year. Results are presented in **Appendix A, Table A-1**.

Historical water use from years 2007 through 2009 was analyzed to determine the percent of water used each month. **Figure 1** illustrates the historical monthly water demand pattern.

The monthly water demand pattern was applied to the average day demand forecast to estimate the monthly demand for water in million gallons per day (mgd) (**Table A-2)** through build-out.

[1] GSI Water Solutions, Inc., Murray, Smith and Associates, Inc., and HDR Engineering, Inc., t Water Management and Conservation Plan (City of Bend, Oregon, June 2011), http://www.ci.bend.or.us/depts/public_works/_water/master_plans/water_mgmt_and_conservation_master_plan.html

[2] Optimatics, Murray Smith and Associates, Inc., Water System Master Plan Update Optimization Study Final Report (City of Bend, February 2011), http://www.ci.bend.or.us/depts/public_works/_water/master_plans/2011_master_plan_update_appendices.html

Table 1. Water Demand Forecast Summary

Year	ADD (mgd)	MDD (mgd)	Notes
2010	14.3	32.2	
2020	21.7	48.8	
2030	29.1	65.5	
2041	37.1	83.5	Build-Out

Notes:

- 2010, 2020, 2030 projections are from Water Management and Conservation Plan dated June 2011
- Build-out projection are from the Optimization Report
- Build-out year estimated by linear extrapolation from years 2010 - 2030 ADD
- ADD=Average Day Demand
- MDD =Maximum Day Demand

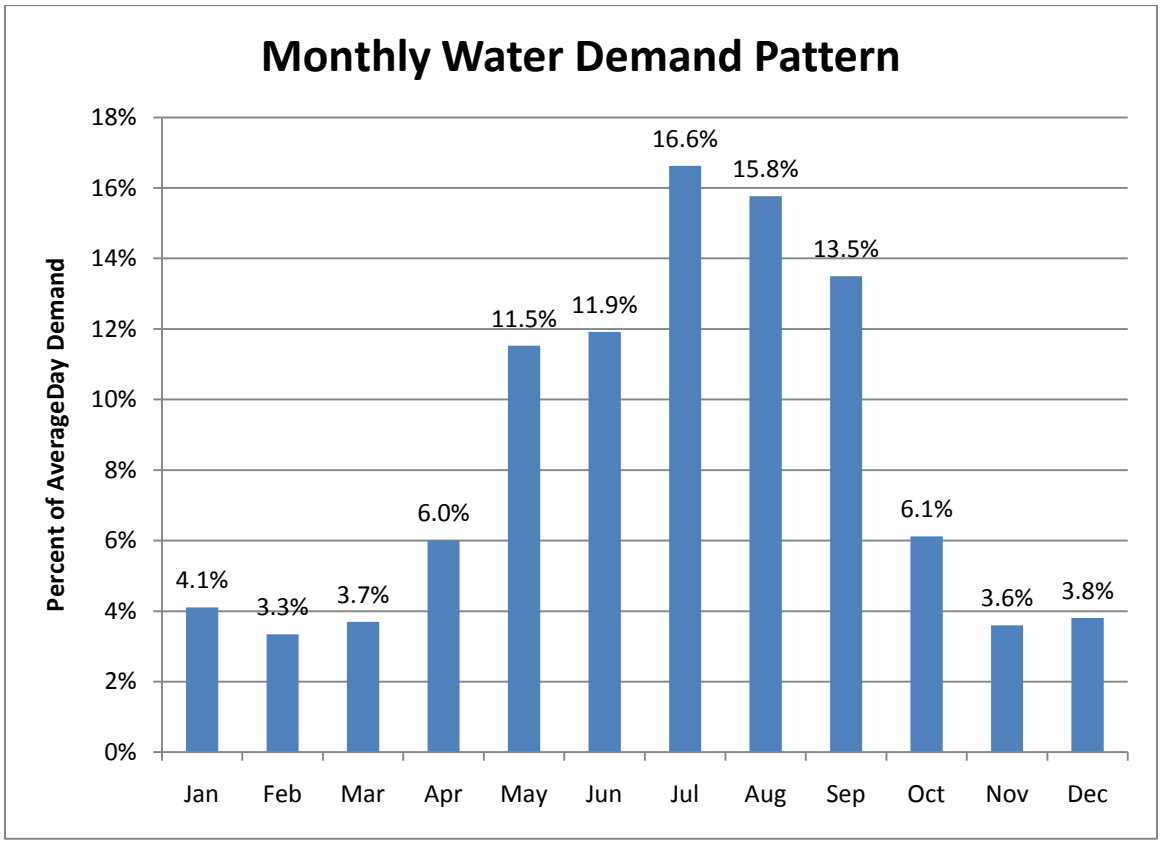


Figure 1 – Monthly Water Demand Pattern

4 Bridge Creek Hydrology and Water Availability

A streamflow gage was operated on Bridge Creek from August 1980 through September 1985, just upstream from the City's intake where it diverts water from Bridge Creek and water from Tumalo Creek that has been conveyed into Bridge Creek. Information on the gage location, drainage area, and link to the data are provided in **Table 2**.

Table 2 presents the monthly mean of discharge (flow) in cubic feet per second at the point of the City's intake for this period of record. The table illustrates the natural flow periodicity, monthly flow rates and durations. The method used to generate the streamflow data is described by the USGS in its website.

Typical water flow in Bridge Creek at the City's intake is the median (50th percentile) value based on the monthly discharge record. The City may decide to install fish passage facilities at the Intake if hydropower is installed. For the purposes of evaluating the flow available for diversion at the Intake, an assumed release of 2.1 cfs (1.36 mgd) for fish passage is subtracted from the median discharge. The resulting estimate of water typically available at the City's Intake is provided in **Table 3.** However, as described below, there are additional constraints on the City's use of surface water.

Table 3. Typical Water Available at City Intake (million gallons per day)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Typical Water Available at City's Intake (mgd)	15.1	15.4	12.9	12.3	27.2	39.7	23.5	13.8	11.8	12.3	11.8	14.1
Note: Water rights provide additional constraints on the City's use of surface water												

5 Water Rights

The City's water rights inventory includes permits, certificates and transfers. Chapter 11 of the City's Water Supply Alternatives Study[3] (WSAS) describes the City's water rights. Under Oregon law the Oregon Water Resources Department (OWRD) can authorize the use of existing water right certificates for generating

[3] Bob Willis and Jim Doane, Brown and Caldwell, Water Supply Alternatives Study (City of Bend, November 2009), http://www.ci.bend.or.us/depts/public_works/surface_water_improvement_project/surface_water_improvement_alternatives_final_report.html

Table 2. Bridge Creek Monthly Discharge (cubic feet per second)

USGS Surface-Water Monthly Statistics for the Nation

The statistics generated from this site are based on approved daily-mean data and may not match those published by the USGS in official publications. The user is responsible for assessment and use of statistics from this site. For more details on why the statistics may not match, click here.

USGS 14070700 BRIDGE CREEK NEAR BEND, OR.

Available data for this site Time-series: Monthly statistics GO

Deschutes County, Oregon
Hydrologic Unit Code 17070301
Latitude 44°01'52", Longitude 121°34'16" NAD27
Drainage area 6.58 square miles
Gage datum 1,580.00 feet above NGVD29

Output formats
HTML table of all data
Tab-separated data
Reselect output format

00060, Discharge, cubic feet per second,

Monthly mean in cfs (Calculation Period: 1980-09-01 -> 1985-09-30)

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1980									16.6	13.1	19.8	39.5
1981	27.1	32.9	22.3	21.2	28.0	26.9	17.0	17.4	15.8	16.2	17.1	23.9
1982	17.0	35.1	21.9	18.4	44.2	77.8	40.5	23.4	21.1	21.2	21.1	24.7
1983	25.4	21.5	22.0	20.6	68.3	74.9	39.5	24.3	22.5	21.5	22.3	22.4
1984	29.1	26.0	23.4	23.5	45.6	63.5	38.4	24.1	21.8	21.1	20.3	18.3
1985	17.0	16.0	16.0	24.7	43.7	57.9	23.3	19.1	19.5			
Mean of monthly Discharge	23	26	21	22	46	60	32	22	20	19	20	26

** No Incomplete data have been used for statistical calculation

http://waterdata.usgs.gov/nwis/monthly?referred_module=sw&site_no=14070700&por_14070700_1=546117,00060,1,1980-08,1985-09&format=html_table&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=parameter_selection_list

hydropower. The City's initial OWRD application will likely be for 18.2 cfs. Additional certificates for generating hydropower may be sought at a later date.

Chapter 11 of the WSAS evaluates the expected availability of water under the City's rights, given mean historical gaged streamflow on Tumalo Creek and priorities of other water rights holders. The water rights scenario used in this analysis assumes that water users are in "distribution" (water right holders take only their proportionate share of the streamflow) by the Watermaster starting July 1 and ending September 22. The water right holders include the City, Tumalo Irrigation District, and instream water rights. The basis for estimating total flow in the Tumalo Creek system has been updated to use gage flow + city use, rather than just gage flow. Under this scenario, the water rights available under mean conditions and limited by sustainable turbine operation, are estimated to be as presented in **Table 4**.

Table 4. Typical Water Rights Available up to Sustainable Turbine Operation (million gallons per day)

	Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Available for hydropower generation now													
85713	Certificate	7.9	7.9	7.9	7.9	7.9	7.9	0	0	2.1	7.9	7.9	7.9
85526	Certificate	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
31411	Certificate	0	0	0	0	0	0	2.3	3.3	3.1	0	0	0
31665	Certificate	0	0	0	0	0		1.5	1.3	0.4	0.3	0	0
	Subtotal	**11.8**	**11.8**	**11.8**	**11.8**	**11.8**	**11.8**	**7.7**	**8.5**	**9.5**	**12.1**	**11.8**	**11.8**
Potentially available for hydropower generation later													
	Subtotal	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**2.3**	**1.2**	**2.3**	**1.5**	**1.8**	**1.8**
Total		**13.6**	**13.6**	**13.6**	**13.6**	**13.6**	**13.6**	**10.0**	**9.7**	**11.8**	**13.6**	**13.6**	**13.6**

Notes:
•Sustainable turbine operation is anticipated to be 13.6 mgd or less as discussed in Section 2.1
•"Available for hydropower generation now" still requires FERC and OWRD approvals
•For water rights that start or terminate within the month, or that have an allocated rate that changes during the month, the total volume of water produced during the month was averaged across the month (i.e., total volume divided by the number of days in the month)
•Assumes distribution of water rights begins July 1 and ends September 22
•Assumes flow in Tumalo Creek system is mean of historical native flow; native flow is gaged flow plus City use

6 Hydropower Flows

The flow available for water supply is the minimum of the water demand, water available at the Intake, water diversion allowed under the City's water rights, and anticipated sustainable turbine operation. **Appendix A, Table A-3** presents the anticipated water supply available for hydropower generation.

7 Conclusions

- The flows available for hydropower generation would not exceed the flows through the surface water supply system to serve municipal drinking water needs.
- The flows through the surface water supply system are the minimum of the water demand, water availability, the diversion allowed under the City's water rights, and the City's anticipated sustainable turbine operation.
- The flows available for hydropower generation will be further constrained by the phasing schedule of OWRD water rights for hydropower generation.
- The City's surface water rights are limited in summer months.
- City demand for water in winter limits the flow available for hydropower generation in winter months, until approximately year 2033.

8 Recommendations

- Revised results from this memorandum should be used to create an economic analysis of hydropower.
- The City should review the economic analysis to assist the City with deciding whether to construct the hydro powerhouse either: 1) now with initial water supply system construction or 2) later in the future.
- Upon its review of this memorandum and the forthcoming hydropower economic analysis, the City should consider whether extending this analysis to consider alternate flow and demand scenarios would be useful to guide its decision-making.

Appendix A
Tables

Table A-1. Interpolated Average Day Demand (mgd)

Year	Summary ADD (mgd)	Interpolated ADD (mgd)
2010	14.3	14.3
2011		15.0
2012		15.8
2013		16.5
2014		17.3
2015		18.0
2016		18.7
2017		19.5
2018		20.2
2019		21.0
2020	21.7	21.7
2021		22.4
2022		23.2
2023		23.9
2024		24.7
2025		25.4
2026		26.1
2027		26.9
2028		27.6
2029		28.4
2030	29.1	29.1
2031		29.8
2032		30.6
2033		31.3
2034		32.1
2035		32.8
2036		33.5
2037		34.3
2038		35.0
2039		35.8
2040		36.5
2041		37.1

Notes:
Build-out Average Annual demand of 37.1 mgd is forecasted to occur in 2041

Table A-2. Water Demand Forecast, Average Day Demand and Estimated Monthly Demands (in million gallons per day)

	days/mo	31	28	31	30	31	30	31	31	30	31	30	31	365
	% demand	4.1%	3.3%	3.7%	6.0%	11.5%	11.9%	16.6%	15.8%	13.5%	6.1%	3.6%	3.8%	100.0%
Year	Interpolated ADD (mgd)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total (MG)
2010	14.3	6.9	6.2	6.2	10.4	19.4	20.7	28.0	26.5	23.5	10.3	6.3	6.4	5,220
2011	15.0	7.3	6.5	6.5	11.0	20.4	21.8	29.5	27.9	24.7	10.8	6.6	6.7	5,490
2012	15.8	7.6	6.9	6.9	11.5	21.4	22.9	30.9	29.3	25.9	11.4	6.9	7.1	5,760
2013	16.5	8.0	7.2	7.2	12.1	22.4	24.0	32.3	30.7	27.1	11.9	7.2	7.4	6,030
2014	17.3	8.3	7.5	7.5	12.6	23.4	25.0	33.8	32.0	28.3	12.4	7.5	7.7	6,300
2015	18.0	8.7	7.8	7.8	13.1	24.4	26.1	35.2	33.4	29.6	13.0	7.9	8.1	6,570
2016	18.7	9.1	8.2	8.2	13.7	25.4	27.2	36.7	34.8	30.8	13.5	8.2	8.4	6,840
2017	19.5	9.4	8.5	8.5	14.2	26.4	28.2	38.1	36.2	32.0	14.0	8.5	8.7	7,110
2018	20.2	9.8	8.8	8.8	14.8	27.4	29.3	39.6	37.5	33.2	14.6	8.8	9.1	7,380
2019	21.0	10.1	9.1	9.1	15.3	28.4	30.4	41.0	38.9	34.4	15.1	9.2	9.4	7,650
2020	21.7	10.5	9.4	9.4	15.8	29.5	31.5	42.5	40.3	35.6	15.6	9.5	9.7	7,921
2021	22.4	10.8	9.8	9.8	16.4	30.5	32.5	43.9	41.7	36.9	16.2	9.8	10.1	8,191
2022	23.2	11.2	10.1	10.1	16.9	31.5	33.6	45.4	43.0	38.1	16.7	10.1	10.4	8,461
2023	23.9	11.6	10.4	10.4	17.5	32.5	34.7	46.8	44.4	39.3	17.2	10.5	10.7	8,731
2024	24.7	11.9	10.7	10.7	18.0	33.5	35.8	48.3	45.8	40.5	17.8	10.8	11.1	9,001
2025	25.4	12.3	11.1	11.1	18.6	34.5	36.8	49.7	47.1	41.7	18.3	11.1	11.4	9,271
2026	26.1	12.6	11.4	11.4	19.1	35.5	37.9	51.2	48.5	42.9	18.8	11.4	11.7	9,541
2027	26.9	13.0	11.7	11.7	19.6	36.5	39.0	52.6	49.9	44.1	19.4	11.8	12.0	9,811
2028	27.6	13.4	12.0	12.0	20.2	37.5	40.0	54.1	51.3	45.4	19.9	12.1	12.4	10,081
2029	28.4	13.7	12.3	12.3	20.7	38.5	41.1	55.5	52.6	46.6	20.4	12.4	12.7	10,351
2030	29.1	14.1	12.7	12.7	21.3	39.5	42.2	57.0	54.0	47.8	21.0	12.7	13.0	10,622
2031	29.8	14.4	13.0	13.0	21.8	40.5	43.3	58.4	55.4	49.0	21.5	13.1	13.4	10,892

Table A-2. Water Demand Forecast, Average Day Demand and Estimated Monthly Demands (in million gallons per day)

	days/mo	31	28	31	30	31	30	31	31	30	31	30	31	365
	% demand	4.1%	3.3%	3.7%	6.0%	11.5%	11.9%	16.6%	15.8%	13.5%	6.1%	3.6%	3.8%	100.0%
Year	Interpolated ADD (mgd)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total (MG)
2032	30.6	14.8	13.3	13.3	22.3	41.5	44.3	59.9	56.8	50.2	22.0	13.4	13.7	11,162
2033	31.3	15.1	13.6	13.6	22.9	42.5	45.4	61.3	58.1	51.4	22.6	13.7	14.0	11,432
2034	32.1	15.5	14.0	13.9	23.4	43.5	46.5	62.8	59.5	52.7	23.1	14.0	14.4	11,702
2035	32.8	15.9	14.3	14.3	24.0	44.5	47.6	64.2	60.9	53.9	23.6	14.3	14.7	11,972
2036	33.5	16.2	14.6	14.6	24.5	45.5	48.6	65.7	62.3	55.1	24.2	14.7	15.0	12,242
2037	34.3	16.6	14.9	14.9	25.0	46.5	49.7	67.1	63.6	56.3	24.7	15.0	15.4	12,512
2038	35.0	16.9	15.2	15.2	25.6	47.5	50.8	68.6	65.0	57.5	25.2	15.3	15.7	12,782
2039	35.8	17.3	15.6	15.6	26.1	48.5	51.8	70.0	66.4	58.7	25.8	15.6	16.0	13,052
2040	36.5	17.6	15.9	15.9	26.7	49.5	52.9	71.5	67.7	59.9	26.3	16.0	16.4	13,323
2041	37.1	17.9	16.1	16.1	27.1	50.4	53.8	72.6	68.9	60.9	26.7	16.2	16.6	13,542

Notes:
Build-out Average Day Demand of 37.1 mgd is forecasted to occur in 2041

Table A-3. Anticipated Surface Water Supply Available for Hydropower Generation (in million gallons per day)

days/mo	31	28	31	30	31	30	31	31	30	31	30	31	365
Typical Water Right Available for Hydro generation through 2017	11.8	11.8	11.8	11.8	11.8	11.8	7.7	8.5	9.5	11.8	11.8	11.8	
Typical Water Right Available for Hydro generation after 2017	13.6	13.6	13.6	13.6	13.6	13.6	10.0	9.7	11.8	13.6	13.6	13.6	
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total Annual Production (MG)**
2013											7.2	7.4	446
2014	8.3	7.5	7.5	11.8	11.8	11.8	7.7	8.5	9.5	11.8	7.5	7.7	3,390
2015	8.7	7.8	7.8	11.8	11.8	11.8	7.7	8.5	9.5	11.8	7.9	8.1	3,441
2016	9.1	8.2	8.2	11.8	11.8	11.8	7.7	8.5	9.5	11.8	8.2	8.4	3,491
2017	9.4	8.5	8.5	12.3	13.6	13.6	10.0	9.7	11.8	12.3	8.5	8.7	3,861
2018	9.8	8.8	8.8	12.3	13.6	13.6	10.0	9.7	11.8	12.3	8.8	9.1	3,911
2019	10.1	9.1	9.1	12.3	13.6	13.6	10.0	9.7	11.8	12.3	9.2	9.4	3,961
2020	10.5	9.4	9.4	12.3	13.6	13.6	10.0	9.7	11.8	12.3	9.5	9.7	4,011
2021	10.8	9.8	9.8	12.3	13.6	13.6	10.0	9.7	11.8	12.3	9.8	10.1	4,061
2022	11.2	10.1	10.1	12.3	13.6	13.6	10.0	9.7	11.8	12.3	10.1	10.4	4,111
2023	11.6	10.4	10.4	12.3	13.6	13.6	10.0	9.7	11.8	12.3	10.5	10.7	4,161
2024	11.9	10.7	10.7	12.3	13.6	13.6	10.0	9.7	11.8	12.3	10.8	11.1	4,211
2025	12.3	11.1	11.1	12.3	13.6	13.6	10.0	9.7	11.8	12.3	11.1	11.4	4,261
2026	12.6	11.4	11.4	12.3	13.6	13.6	10.0	9.7	11.8	12.3	11.4	11.7	4,311
2027	13.0	11.7	11.7	12.3	13.6	13.6	10.0	9.7	11.8	12.3	11.8	12.0	4,361
2028	13.4	12.0	12.0	12.3	13.6	13.6	10.0	9.7	11.8	12.3	11.8	12.4	4,402
2029	13.6	12.3	12.3	12.3	13.6	13.6	10.0	9.7	11.8	12.3	11.8	12.7	4,438
2030	13.6	12.7	12.7	12.3	13.6	13.6	10.0	9.7	11.8	12.3	11.8	13.0	4,467

Table A-3. Anticipated Surface Water Supply Available for Hydropower Generation (in million gallons per day)

days/mo	31	28	31	30	31	30	31	31	30	31	30	31	365
Typical Water Right Available for Hydro generation through 2017	**11.8**	**11.8**	**11.8**	**11.8**	**11.8**	**11.8**	**7.7**	**8.5**	**9.5**	**11.8**	**11.8**	**11.8**	
Typical Water Right Available for Hydro generation after 2017	**13.6**	**13.6**	**13.6**	**13.6**	**13.6**	**13.6**	**10.0**	**9.7**	**11.8**	**13.6**	**13.6**	**13.6**	
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total Annual Production (MG)**
2031	13.6	13.0	12.9	12.3	13.6	13.6	10.0	9.7	11.8	12.3	11.8	13.4	4,493
2032	13.6	13.3	12.9	12.3	13.6	13.6	10.0	9.7	11.8	12.3	11.8	13.6	4,508
2033 and later	13.6	13.6	12.9	12.3	13.6	13.6	10.0	9.7	11.8	12.3	11.8	13.6	4,516

Notes:
•"Typical Water Right Available for Hydro generation through 2017" is minimum of "Typical Water Available Under City Water Rights Available for hydropower generation now Subtotal" and "Anticipated Initial OWRD Certificate to Use Water for Hydroelectric Purposes"
•"Typical Water Right Available for Hydro generation after 2017" is "Typical Water Available Under City Water Rights Potentially available for hydropower generation later Subtotal"
•"Anticipated Water Supply Available for Hydropower Generation" is Minimum of "Water Demand Forecast" and "Typical Water Available for Hydro Generation"