Final Technical Report

for

City of Bend

Preliminary Report

Timing of Hydro Project

Bend, Oregon

February 2012

HDR

ONE COMPANY | *Many Solutions*℠

805 SW Industrial Way, Suite 4
Mill A Building
Bend, OR 97702
541.323.2331 Phone 541.323.2561 Fax

Table of Contents

1. INTRODUCTION 1

1.1 Background 1
1.2 Objective 1
1.3 Organization of Report 2
1.4 Limitations of the Analyses 3

2. THE HYDRO PROJECT 4

2.1 Introduction 4
2.1.1 Description of the Hydro Project 4
2.1.2 Construction Cost 4
2.1.3 Operation and Maintenance 5
2.2 Revenue Projections 5
2.2.1 Power Purchase Agreement 5
2.2.2 Energy Projection 6
2.2.3 Renewable Energy Credits 7

3. FINANCIAL AND ECONOMIC ANALYSES 8

3.1 Definition of Options 8
3.1.1 Timing of Hydro 8
3.1.2 Project Ownership 8
3.2 Alternative 1: Hydro Now 8
3.2.1 Hydro Now Construction Costs 8
3.2.2 Hydro Now Operation and Maintenance Expenditures 9
3.2.3 Hydro Now Revenue 9
3.2.4 Hydro Now Findings 9
3.3 Alternative 2: Hydro Later 11
3.3.1 Hydro Later Construction Costs 11
3.3.2 Hydro Later Operation and Maintenance Expenditures 12
3.3.3 Hydro Later Revenue 12
3.3.1 Hydro Later Findings 12
3.4 Assumptions 14
3.5 Analysis of Potential Risks to the Economics of the Hydro Project 14
3.5.1 Construction Costs Increase 25% 15
3.5.2 O&M Costs Increase 25% 15
3.5.3 No Growth in Water Sales 15
3.5.4 Reduced Growth in Water Sales 15
3.5.5 High Construction, Reduced Growth 15
3.5.6 Hydro Later 15
3.5.7 Findings from Analyses of Potential Risks 16

4. RECOMMENDED CONCEPT FOR THE HYDRO PROJECT 17

4.1 Comparison of Net Present Value 17
4.2 Comparison of Potential Rate Impacts 18

4.3 PRELIMINARY FINDINGS 19

Tables

Table 2–1: Projected Construction Costs for Hydro Project 5
Table 2–2: Projected Energy and Annual Revenue 7
Table 3–1: Projected Construction Costs of Hydro Now 9
Table 3–2: Summary of Hydro Now Annual Revenue Projections 9
Table 3–3: Hydro Now Annual Net Revenue 10
Table 3–4: Projected Construction Costs of Hydro Later 11
Table 3–5: Annual Revenue Projections 12
Table 3–6: Hydro Later Annual Net Revenue 13
Table 3–7: Comparison of Potential Risks to the Hydro Project Economics ($millions) 14
Table 4–1: Comparison of Cash Flows ($millions)—Reduced Growth Assumptions 17
Table 4–2: Comparison of Cash Flows ($millions)—WMCP Demand Assumptions 18

Figures

Figure 3-1: Hydro Now Estimated Annual Net Revenue ($millions) 11
Figure 3-2: Hydro Later Estimated Annual Net Revenue ($millions) 13
Figure 4-1: Comparison of Annual Net Revenue ($millions) 18

1. Introduction

1.1 Background

The City of Bend (City) is updating its water supply and related source facilities to improve reliability and comply with the US Environmental Protection Agency (EPA) Long Term 2 Surface Water Treatment Rule (LT2 rule)[1]. Among other improvements, this update will include the construction of a new pipeline and the addition of a water treatment plant (WTP). The pipeline has an elevation drop of about 1,009-feet over 10 miles. Therefore, the City may develop a hydroelectric plant ("the Hydro Project") that would generate electricity by harnessing the energy provided by the water being delivered to the new WTP.

The City retained HDR Engineering, Inc. (HDR) to prepare and manage various services during the final design and construction process, including:

- Engineering,
- Management,
- Financial,
- Environmental, and
- Regulatory services.

The specific project elements for which HDR is responsible are identified in the December 2010 Design Criteria Report prepared by HDR.

As part of the project, the City requested that HDR conduct various funding and financial analyses. This technical report provides the City with the results of those analyses. Specifically, the report documents HDR's analysis of the financial and economic feasibility of the Hydro Project, including its hydroelectric generation and energy revenue potential.

1.2 Objective

The objective of the funding and financial analysis task is to provide the City with information to make an informed decision on:

- Timing for construction of the Hydro Project.
- Ownership options for construction and operation for the Hydro Project.

The City conducted a Value Engineering Study (VE Study) for its water supply strategy. Among other recommendations, the VE Study recommended the City refine certain aspects of the hydro revenue analysis. Specifically, the VE Study recommended the City consider:

[1] "LT2 Rule"; Water: Long Term 2 Enhanced Surface Water Treatment Rule; Safe Water Drinking Act; U.S. EPA; http://water.epa.gov/lawsregs/rulesregs/sdwa/lt2/regulations.cfm; accessed 06/29/2011.

- Loss of the Business Energy Tax Credit (BETC) funding
- Refinement of flows through the Hydro Project, and
- Revision of the resulting revenue forecast.

This technical report discusses the financial benefit to the City of two options for timing of the Hydro Project. These options are:

1. Hydro Now. Construct the Hydro Project as part of the current construction project.

2. Hydro Later. Construct the Hydro Project to be operational in 2018.

Based on the results of the analyses, the City can make a decision on the timing for construction of the Hydro Project.

1.3 Organization of Report

This report contains four sections. Each section is listed below with a brief description. Also listed below are descriptions of the additional funding and financial analyses that are included as Appendices to this technical report.

- Section 1: Introduction. The Introduction is the section you are now reading, which provides a brief overview of the study and report.
- Section 2: The Hydro Project. This section describes the Hydro Project facilities, costs, and revenue generating potential.
- Section 3: Financial and Economic Analyses. This section summarizes the results of HDR's financial and economic analyses concerning the ownership and timing options for the Hydro Project.
- Section 4: Recommended Concept for the Hydro Project. This section provides the City with a recommendation on the timing for the Hydro Project.
- Appendix A: PacifiCorp's Oregon Schedule 37. This Appendix is a full copy of PacifiCorp's Oregon Schedule 37 tariff, downloaded from PacifiCorp's website.
- Appendix B: Power Sales Options. This memorandum provides a brief discussion of the power sales options available to the City under PacifiCorp's Oregon Schedule 37.
- Appendix C: Draft Hydropower Cost Technical Memorandum. This appendix contains a draft technical memorandum prepared by HDR to describe the potential costs (both capital and O&M) of the hydropower project.
- Appendix D: Draft Hydropower Flows Technical Memorandum. This appendix contains a draft technical memorandum prepared by HDR to describe the flows potentially available for hydropower generation.

- Appendix E: Detailed Tables from Economic Feasibility Model. This appendix includes the full detail from HDR's economic feasibility spreadsheet model. Some sections within this technical report refer to specific tables within Appendix E.
- Appendix F: July 20, 2011 Council Presentation. The City and HDR presented preliminary information to the City Council on July 20, 2011. That presentation material is included in this appendix.

1.4 Limitations of the Analyses

It is important to note that these analyses are based on design cost estimates, water rights and flows forecasts, and power price sales schedules that may change over time. To the varying degrees with which the assumptions of these analyses become realities, the results of these analyses and the impacts on the Hydro Project will also vary. This technical report is based on HDR's research and analysis. The discussions herein provide the City with HDR's current estimate as to the financial and economic feasibility of the Hydro Project as of July 2011.

2. The Hydro Project

2.1 Introduction

The City is considering construction of a hydropower generation facility on its Bridge Creek water supply system. The City asked HDR to evaluate the financial and economic feasibility of the Hydro Project. This section of the technical report describes the facilities included as part of the Hydro Project.

2.1.1 Description of the Hydro Project

The Hydro Project includes multiple components. The components of the Hydro Project include:

1. Intake improvements that would be built only if the Hydro Project is installed, including:
    a. Intake structure and screens, and
    b. Fish ladder.
2. Powerhouse construction including:
    a. Purchase of turbine-generator equipment,
    b. Installation turbine-generator equipment, and
    c. Construction of electrical interconnection.

2.1.2 Construction Cost

In addition to the capital components listed above, the City would avoid the need for a redundant pressure-reducing valve (PRV) if the powerhouse were installed with initial construction.

The City's Construction Manager/General Contractor (CM/GC), Mortenson Construction, prepared a 30% estimate of construction costs. Details of the cost estimate are provided in a Mortenson 30%-estimate report dated 22-Apr-2011 and summarized in the Draft Technical Memorandum on Hydropower costs included in Appendix C of this technical report. Mortenson escalated the cost estimate to the anticipated mid-point of construction of October 2012.

Table 2–1 lists the estimated construction costs of the Hydro Project. The estimated construction costs presented in Table 2–1 do not include certain design and permitting costs that are already committed to the project. The costs and savings shown are based on the addition of the Hydro Project to the base water supply project at the time of initial construction.

Table 2–1: Projected Construction Costs for Hydro Project

Component	Cost
Intake Structure & Screens	$1,123,641
Fish Ladder	294,914
Turbine and Generator	1,410,000
Hydroelectric Powerplant	2,278,576
Services during Construction	500,000
Total Project Cost	$5,607,131
Less: Avoided Cost - Redundant PRV	(410,349)
Net Project Cost	$5,196,782

2.1.3 Operation and Maintenance

Operations and maintenance (O&M) expenditures for the Hydro Project are expected to be minimal. Typically, the turbine and generating unit is durable over time, with only periodic maintenance required. Expenditures associated with Hydro Project O&M are expected to be primarily labor-based, as staff will need to conduct a daily check of operations at the Hydro Project. The labor costs associated with these inspections will be relatively minimal, as City Staff will already be at the treatment plant daily.

Annual maintenance may be classified as electrical and mechanical. Electrical maintenance requires technical equipment and personnel to clean, recalibrate, and measure electronic devices. These devices may include batteries, breakers, relays, transformers, fuses, meters, and generators. Mechanical maintenance includes inspection of the turbines for wear, hydraulic pump systems, piping, and valve systems. Maintenance issues may include repairs lasting 2 to 3 days, rehabilitation every 20 to 40 years lasting 4 to 6 weeks, and any unexpected repairs that could last hours to months.

2.2 Revenue Projections

2.2.1 Power Purchase Agreement

As a requirement to connect to the PacifiCorp system, the Hydro Project's electrical energy will be sold to PacifiCorp under its Oregon Schedule 37 tariff.[2] Under Schedule 37, the City would enter into a purchase power agreement (PPA) with PacifiCorp, and sell all power from the Hydro Project to PacifiCorp. Schedule 37 provides four options for the sale of power. These options are discussed in detail in Appendix B to this technical report.

In order to obtain a project specific draft PPA, the City must provide in writing to PacifiCorp, general project information required for the completion of a PPA, including, but not limited to:

[2] A copy of PacifiCorp's Oregon Schedule 37 is provided as Appendix A.

(a) Demonstration of ability to obtain certification as a qualifying facility.[3]

(b) Design capacity (in mega watts, or MW), station service requirements, and net amount of power to be delivered to PacifiCorp's electric system.

(c) Generation technology and other related technology applicable to the site.

(d) Proposed site location.

(e) Schedule of expected monthly power deliveries.

(f) Calculation or determination of minimum and maximum annual deliveries.

(g) Motive force or fuel plan.

(h) Proposed on-line date and other significant dates required to complete the milestones.

(i) Proposed contract term and pricing provisions (i.e., fixed, deadband, gas indexed).

(j) Status of interconnection or transmission arrangements.

(k) Point of delivery or interconnection.

2.2.2 Energy Projection

The amount of energy generated by the Hydro Project will depend on the amount of water delivered to the WTP. HDR estimated the amount of energy production potential by the Hydro Project using engineering calculations of the potential energy of the water coming to the WTP, and the rated efficiency of the proposed turbine. The amount of energy in the water is a function of the drop in elevation and other factors of the pipeline.[4] Appendix D is a draft technical memorandum that presents the estimated water flows available to the Hydro Project. Additionally, HDR prepared energy projections based on a reduced assumption on the growth in water sales. Under the Reduced Growth in Water Sales, HDR assumed that the City's average-day demand in 2013 is 11.70 million gallons per day (MGD). HDR applied a 1.5% growth rate to the estimated 2013 demands annually through 2020. Thereafter, HDR applied the same rate of growth in water demands as were included in the City's adopted Water Management and Conservation Plan (WMCP).

The price received for the energy sold also depends on the time of day energy production occurs. Based on the Schedule 37 tariff, these periods are:

[3] Generating facilities that receive special rate and regulatory treatment are known as qualifying facilities (QFs). QFs include qualifying small power production facilities and qualifying cogeneration facilities. For more, see: "What is a Qualifying Facility"; FERC; http://www.ferc.gov/industries/electric/gen-info/qual-fac/what-is.asp.

[4] The potential energy of the water coming to the WTP is measured by an engineering term called "Net Head". Among other factors, the net head accounts for variations in flow conditions within the planned pipeline. The Hydro Project will likely use a Pelton turbine, which is common in applications with relatively high net head.

- On-Peak is the hours between 6:00 a.m. and 10:00 p.m. Monday through Saturday excluding NERC holidays.
- Off-Peak is all other hours.

The details of the energy generation are included in Appendix E. Table 2–2 provides a summary of the projected energy generation for the first ten years of Hydro Project operation under the reduced growth in water sales assumptions. Also shown in Table 2–2 are the Schedule 37 rates and annual revenue projections.

Table 2–2: Projected Energy and Annual Revenue

Year	Expected On-Peak (kWh)	Expected Off-Peak (kWh)	On-Peak Energy Price ($/kWh)	Off-Peak Energy Price ($/kWh)	Total Power Sales Revenue
2014	3,831,514	3,005,127	$0.0796	$0.0610	$488,301
2015	3,858,671	3,026,427	0.0816	0.0627	504,625
2016	3,893,890	3,054,050	0.0839	0.0646	523,989
2017	4,294,223	3,368,039	0.0860	0.0665	593,278
2018	4,322,787	3,390,442	0.0887	0.0687	616,355
2019	4,351,785	3,413,185	0.0876	0.0674	611,265
2020	4,388,951	3,442,335	0.0885	0.0679	622,157
2021	4,440,128	3,482,475	0.0933	0.0723	666,047
2022	4,500,611	3,529,913	0.0984	0.0770	714,663
2023	4,562,717	3,578,623	0.0933	0.0715	681,573

The energy and revenue projections shown above are based on the assumption that the Hydro Project will be fully operational by the start of 2014 and that the PPA with PacifiCorp is based on the Fixed Avoided Cost pricing option discussed in Appendix B to this technical report.

2.2.3 Renewable Energy Credits

In addition to the sale of energy, the City may potentially sell renewable energy credits (RECs). RECs are sold on a $/MWh basis and represent energy produced from qualified renewable energy sources. In lieu of new renewable infrastructure, RECs are available to other electrical energy generators to meet their renewable energy requirements. There is currently no formal trading index for RECs as there is with electrical energy sales. RECs are negotiated on a case-by-case basis.

For the purposes of this analysis, HDR assumed that the City would not earn any revenue from the sale of RECs. The market for RECs has been in decline for the last few years, and based on our analyses, the City would not need REC revenue to break even on the Hydro Project. Any REC revenue earned in the future would only add to the cash flow for the City from the Hydro Project.

3. Financial and Economic Analyses

3.1 Definition of Options

The City faces two decisions on developing the Hydro Project. The first decision is one of timing. That is, whether the City should develop the Hydro Project now as part of the WTP construction, or later after completion of the WTP.

The second decision related to how the project is implemented: either by the City as sole owner and operator or with a third party. HDR analyzed each of these questions.

3.1.1 Timing of Hydro

HDR analyzed two Hydro Project timeframes as part of this analysis:

1. Hydro Now (2014) – This scenario assumes City-only ownership of the Hydro Project. Under this alternative, Hydro Project construction is complete by the end of 2013 and operational by the beginning of 2014. Construction would occur as part of the City's WTP construction process, to benefit from economies of scale in materials and construction costs.
2. Hydro Later (2018) – For modeling purposes, this scenario also assumes City-only ownership. Under this option, the City would construct the Hydro Project as a separate project after the WTP construction is complete. If a private party developer is able to structure a package that offers a greater economic benefit to the City, this alternative may provide the extra time needed to structure the partnership agreements.

3.1.2 Project Ownership

HDR prepared a separate technical memorandum that summarizes the Hydro Project ownership alternatives. Based on the WTP project schedule and our analyses of the Hydro Project economics, the City is currently considering the Hydro Project without a private partner. For private developers, the City will make available a Hydro Project memorandum that describes the Hydro Project and its economics. The City will consider alternatives proposed by private developers. However, City-only ownership appears to be the best available option for the City at this time.

3.2 Alternative 1: Hydro Now

3.2.1 Hydro Now Construction Costs

The construction costs for the Hydro Now alternative, which are included in Table 2–1, are presented again in Table 3–1 below. Mortenson Construction escalated its cost estimate to the anticipated mid-point of construction of October 2012. Therefore, HDR did not add inflation to the costs presented in Table 3–1.

Table 3–1: Projected Construction Costs of Hydro Now

Component	Cost
Intake Structure & Screens	$1,123,641
Fish Ladder	294,914
Turbine and Generator	1,410,000
Hydroelectric Powerplant	2,278,576
Services during Construction	500,000
Total Project Cost	$5,607,131
Less: Avoided Cost - Redundant PRV	(410,349)
Net Project Cost	$5,196,782

3.2.2 Hydro Now Operation and Maintenance Expenditures

Anticipated Hydro Project O&M considerations are described in Section 2.1.3 - Operation and Maintenance. Expenditures associated with Hydro Project O&M are expected to be minimal. Based on previous work conducted by Black & Veatch Corporation, HDR assumed that Hydro Project O&M expenditures will be $35,200 annually.[5] Actual O&M expenditures will vary from this base estimate depending on when the Hydro Project is operational and the effects of inflation.

3.2.3 Hydro Now Revenue

The first ten years of revenue for the Hydro Now alternative under the reduced growth in water sales assumptions are presented in Table 2–2: Projected Energy and Annual Revenue. This information is summarized in Table 3–2 below.

Table 3–2: Summary of Hydro Now Annual Revenue Projections

Year	Hydro Revenue	Year	Hydro Revenue
2014	$488,301	2019	$611,265
2015	504,625	2020	622,157
2016	523,989	2021	666,047
2017	593,278	2022	714,663
2018	616,355	2023	681,573

3.2.4 Hydro Now Findings

HDR estimated two measures to determine the feasibility of implementing the Hydro Project now. The first measure is a traditional net present value of the projected cash flow using a discount rate of 5.5%. With the cash flows presented above, the net present value of the Hydro Now alterative under the

[5] The O&M expenditure estimate is in 2013 dollars, consistent with the assumed year of completion for Hydro Project construction. HDR assumed that O&M costs will escalate at 3.5% annually.

reduced growth in water sales assumptions is estimated to be $9.85 million. The net present value under the WMCP demand assumptions is estimated to be $11.69 million.

In addition to evaluating the net present value, HDR also estimated the annual net revenue for the Hydro Project assuming the expenditures and revenue above. Net revenue was estimated by subtracting the estimated O&M expenditures and a hypothetical debt service[6] from revenue. Net revenue is an indicator of the impact that the Hydro Project would have on the City's water ratepayers. A larger positive number indicates that the Hydro Project is expected to produce more revenue than required to fund its O&M expenditures and debt service. The net revenue would be available to the City to offset water rates. A negative number would indicate that water rates might be required to cover a portion of the O&M expenditures and/or debt service.

Table 3–3 presents the first five years of estimated annual net revenue under the Hydro Now scenario with the reduced growth in water sales assumptions. Projected net revenue is expected to provide modest downward pressure on water rates in the first year.

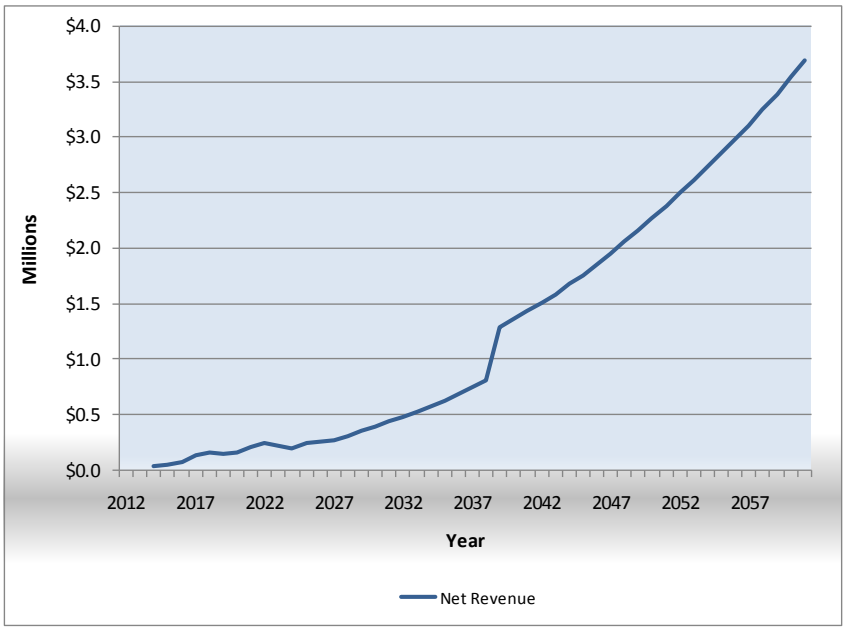
Table 3–3: Hydro Now Annual Net Revenue

Description	2014	2015	2016	2017	2018
Gross Revenue	$488,301	$504,625	$523,989	$593,278	$616,355
Less:					
Operating Expense	36,432	37,707	39,027	40,393	41,807
Debt Service	417,699	417,699	417,699	417,699	417,699
Available Revenue	$34,171	$49,219	$67,263	$135,186	$156,849

The net revenue is expected to increase as power rates and water sales increase over time. Figure 3-1 presents a forecast of net revenue during the study period under the reduced growth in water sales assumptions.

[6] The hypothetical debt service assumes financing the project costs, issuance costs and reserve requirement over 25 years at 5.25% interest. The hypothetical debt service assumes the issuance costs are 1.5% of the gross bond proceeds; and the reserve requirements are 8.0% of the gross bond proceeds.

Figure 3-1: Hydro Now Estimated Annual Net Revenue ($millions)



The estimate of net revenue assumes the hypothetical debt services is fully repaid by 2038, which results in a significant increase of annual net revenue in the following year. Using the reduced growth in water sales assumptions, the annual net revenue after the debt retirement is estimated to be approximately $1.29 million. For the WMCP demand assumptions, the annual net revenue after the debt retirement is estimated to be approximately $1.43 million.

3.3 Alternative 2: Hydro Later

3.3.1 Hydro Later Construction Costs

Table 3–4 below presents the assumed construction costs for the Hydro Later alternative. The Hydro Now costs were adjusted for inflation, and additional costs of project re-initiation were added to the estimates. In addition, this alternative does not include the benefit of reduced construction costs from eliminating the redundant pressure-reducing valve.

Table 3–4: Projected Construction Costs of Hydro Later

Component	Cost
Intake Structure & Screens	$1,234,210
Fish Ladder	323,934
Turbine and Generator	1,535,215
Hydroelectric Powerplant	2,502,793
Services during Construction	549,201
Project Reinitiation	164,760
	———————
Total Project Cost	$6,310,113

The construction costs presented in Table 3–4 do not include adjustments to account for the loss of economies of scale in the construction of the Hydro Project contemporaneously with the WTP. As a result, the construction costs for the Hydro Later alternative could be much higher than that presented here.

3.3.2 Hydro Later Operation and Maintenance Expenditures

Hydro Project O&M considerations are described in Section 2.1.3 - Operation and Maintenance. Expenditures associated with Hydro Project O&M are expected to be minimal. Based on previous work conducted by Black & Veatch Corporation, HDR assumed that Hydro Project O&M expenditures will be $35,200 annually.[7] Actual O&M expenditures will vary from this base estimate depending on when the Hydro Project is operational and the effects of inflation.

3.3.3 Hydro Later Revenue

Table 3–5 summarizes the first ten years of revenue for the Hydro Later alternative using the reduced growth in water sales assumption.

Table 3–5: Annual Revenue Projections

Year	Hydro Revenue	Year	Hydro Revenue
2018	$616,355	2023	$681,573
2019	611,265	2024	666,097
2020	622,157	2025	709,762
2021	666,047	2026	733,483
2022	714,663	2027	744,789

3.3.1 Hydro Later Findings

As with the Hydro Now alternative, HDR estimated two measures to determine the feasibility of implementing the Hydro Project later. The first measure is a traditional net present value of the projected cash flow using a discount rate of 5.5%. With the cash flows presented above, the net present value of the Hydro Later alterative using the reduced growth in water assumptions is estimated to be $8.47 million. Using the WMCP demand assumptions, the net present value is estimated to be $9.97 million.

In addition to evaluating the net present value, HDR estimated annual net revenue for the Hydro Project assuming the expenditures and revenue above. Net revenue was determined by subtracting the estimated O&M expenditures and a hypothetical debt service[8] from revenue. Table 3–6 presents the

[7] The O&M expenditures estimate is in 2013 dollars, consistent with the assumed year of completion for Hydro Project construction. HDR assumed that O&M expenditures will escalate at 3.5% annually.

[8] The hypothetical debt service assumptions for the Hydro Later alternative are the same as those used for the Hydro Now alternative. See footnote 6.

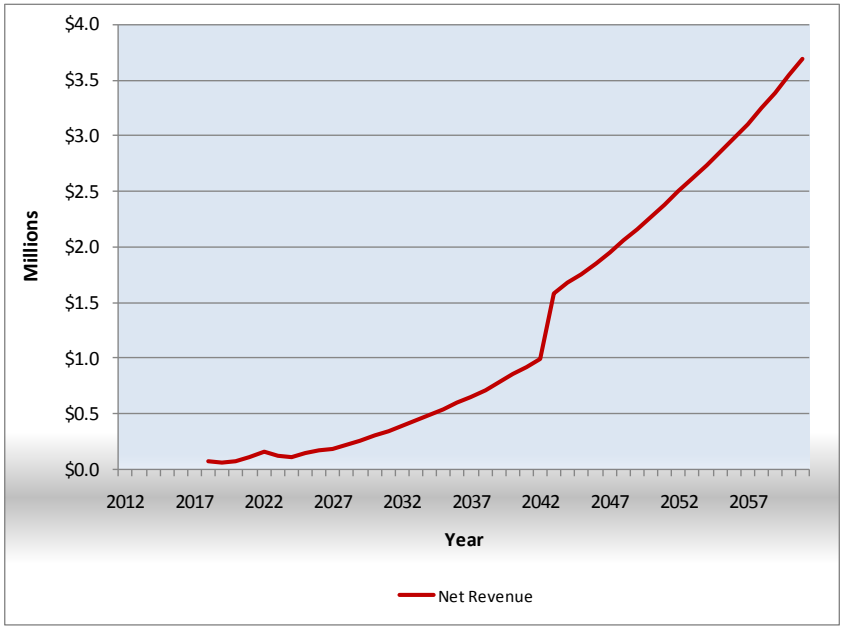
first five years of estimated annual net revenue under the Hydro Later scenario using the reduced growth in water sales assumptions. Projected net revenue is expected to provide modest downward pressure on water rates in the first year of Hydro Project operations.

Table 3–6: Hydro Later Annual Net Revenue

Description	2018	2019	2020	2021	2022
Gross Revenue	$616,355	$611,265	$622,157	$666,047	$714,663
Less:					
Operating Expense	41,807	43,270	44,784	46,352	47,974
Debt Service	507,184	507,184	507,184	507,184	507,184
Available Revenue	$67,364	$60,811	$70,188	$112,511	$159,505

The net revenue is expected to increase as power rates and water sales increase over time. Figure 3-2 presents a forecast of net revenue during the study period using the reduced growth in water sales assumptions.

Figure 3-2: Hydro Later Estimated Annual Net Revenue ($millions)



The estimate of net revenue assumes the hypothetical debt services is fully repaid by 2042 which results in a significant increase of annual net revenue in the following year. Using the reduced growth in water sales assumptions, the annual net revenue after the debt retirement is estimated to be approximately $1.58 million. For the WMCP demand assumptions, the annual net revenue after the debt retirement is estimated to be approximately $1.70 million.

3.4 Assumptions

Assumptions and detailed calculations are included as Appendix E of this technical report. Additionally, Appendix F contains the presentation to the Bend City Council during its July 20, 2011 work session.

3.5 Analysis of Potential Risks to the Economics of the Hydro Project

As part of our analysis, HDR considered a variety of risks that may affect the financial viability of the Hydro Project. Of all the risks considered, three key risks were analyzed in detail to provide the City with a comparison of alternative outcomes. The key risks analyzed are:

1. **Higher Than Expected Cost of Facilities.** Any construction project is subject to uncertain costs of labor, materials, etc. Higher construction costs equate to a higher initial investment and can directly impact the economic and financial feasibility of the Hydro Project.
2. **Higher Than Expected Costs of Operation.** Operation and maintenance of the project is important to ensure consistent electricity production and prevent outages. Though O&M expenditures are expected to represent a small portion of the Hydro Project's costs, the financial feasibility of the project may be affected by higher than expected O&M expenditures.
3. **Lower Than Expected Water Sales.** The City's hydropower production is limited by the amount of water it delivers to its water customers. Therefore, the financial and economic analyses depend on water availability and the water demand forecast.

HDR conducted a sensitivity analyses for the three risks discussed above to improve the understanding of how these risks affect the financial and economic feasibility of the Hydro Project. The sensitivity analyses were conducted by altering one or more variables in the analyses and measuring the impact those variables had on the net present value and first year net revenue.

Table 3–7 presents HDR's comparison of the three risks under varying conditions. The first scenario is the Base Case, which is the Hydro Now alternative with the water flows based on the WMCP demand assumptions.

Table 3–7: Comparison of Potential Risks to the Hydro Project Economics ($millions)

Description	Net Present Value	1st Year Net Revenue
Base Case	$11.69	$0.13
Construction Cost Increase 25%	10.53	0.02
O&M Costs Increase 25%	11.45	0.12
No Growth in Water Sales	7.11	0.03
Reduced Growth in Water Sales	9.85	0.03
High Construction, Reduced Growth	8.69	(0.07)
Hydro Later (2018)	9.97	0.20

Each scenario is described below.

3.5.1 Construction Costs Increase 25%

Under this scenario, HDR increased the construction costs on the hydro facilities by 25%. The resulting net present value is approximately $10.53 million. The first year net revenue is expected to be approximately $23,000.

3.5.2 O&M Costs Increase 25%

As described in Section 3.2.2, the O&M expenditures under the Base Case are estimated to be $35,200 annually in 2013 dollars (i.e., $36,432 in 2014). When increased by 25% to $45,540 for 2014 (and escalated thereafter by 3.5% annually), the net present value for the Hydro Project is approximately $11.45 million. The first year net revenue under this scenario is approximately $118,000.

3.5.3 No Growth in Water Sales

Water demands in the Base Case reflect the City's WMCP forecast. To test the impact of reduced growth, HDR developed a scenario where water sales decline to an average daily demand of approximately 11.70 MGD by 2013, and stay at that level for the entire study period. This represents a condition of no growth in water demand through the 50-year analysis period. Under this scenario, the net present value of the Hydro Project is approximately $7.11 million. The first year net revenue is estimated to be approximately $31,000.

3.5.4 Reduced Growth in Water Sales

The Reduced Growth in Water Sales scenario is a modification to the No Growth in Water Sales scenario described in Section 3.5.3 above. Under this scenario, water demands in 2013 are estimated to be 11.70 MGD on an average-day basis. The water sales are then increased by 1.5 percent annually through 2021. After 2021, the annual increase in water sales is equal to the percentage increase forecast in the City's WMCP.

The net present value of this scenario is expected to be approximately $9.85, with the first year net revenue equal to approximately $34,000.

3.5.5 High Construction, Reduced Growth

HDR combined the high construction costs (Section 3.5.1) and reduced growth in water sales (Section 3.5.4 to estimate the impacts of combining those two risks. Under this scenario, the net present value is estimated to be $8.69 million, and the first year net revenue is expected to be approximately $70,000 negative. That means, under this combined scenario, the City might have cash outflows in the first year that exceed revenue by approximately $70,000. The cash flow improves annually and is expected to have a positive value of $30,000 by 2017.

3.5.6 Hydro Later

The final scenario measures the impact of a project delay. This delay could be a purposeful decision by the City to delay the project or the result of an unforeseen delay in the project. The net present value of this scenario is expected to be approximately $9.97 million with the first year net revenue equal to approximately $198,000.

3.5.7 Findings from Analyses of Potential Risks

Although it is impossible to analyze all risks within a feasibility study, the key elements of risks were evaluated using a sensitivity analysis. Under the scenarios analyzed, the net present value continued to be significantly positive. This provides further evidence that the Hydro Project will generate a net benefit to the City. Under the combined High Construction, Reduced Growth scenario, the first year net revenue is expected to be negative. If these two risks were simultaneously experienced by the City, the City might need to provide cash flow to the Hydro Project for an estimated 3 years.

4. Recommended Concept for the Hydro Project

4.1 Comparison of Net Present Value

Table 4–1 presents the results of the economic feasibility analysis by scenario assuming the reduced growth in water sales assumptions. These analyses estimated the net present value of the Hydro Project through 2061.

Table 4–1: Comparison of Cash Flows ($millions)—Reduced Growth Assumptions

Description	Hydro Now (2014) Undiscounted Cash Flow	Hydro Now (2014) Net Present Value	Hydro Later (2018) Undiscounted Cash Flow	Hydro Later (2018) Net Present Value
Net Construction	($5.20)	($4.69)	($6.31)	($4.59)
O&M	(4.39)	(0.98)	(4.23)	(0.86)
Revenue	77.08	15.48	74.97	13.83
Terminal Value	0.68	0.04	1.46	0.09
Totals	$68.18	**$9.85**	$65.89	**$8.47**

The present value is comprised of four values. These are:

- Net construction costs estimate. That is the total construction costs less the benefit for the Hydro Now alternative in eliminating a redundant pressure-reducing valve.
- O&M expenditures.
- Revenue from the sale of power
- Terminal value. The estimated value of the Hydro Project at the end of the analysis period.

The economic analysis shows that the Hydro Now alternative with the reduced growth in water sales assumptions has an expected net present value of $9.85 million and that the Hydro Later alternative has an expected net present value of $8.47 million. However, as noted in Section 3.3.1, the construction costs for the Hydro Later alternative may be underestimated due to the loss of economies of scale during WTP construction.

Table 4-2 presents the results of the economic feasibility analysis by scenario using the WMCP demand assumptions.

Table 4–2: Comparison of Cash Flows ($millions)—WMCP Demand Assumptions

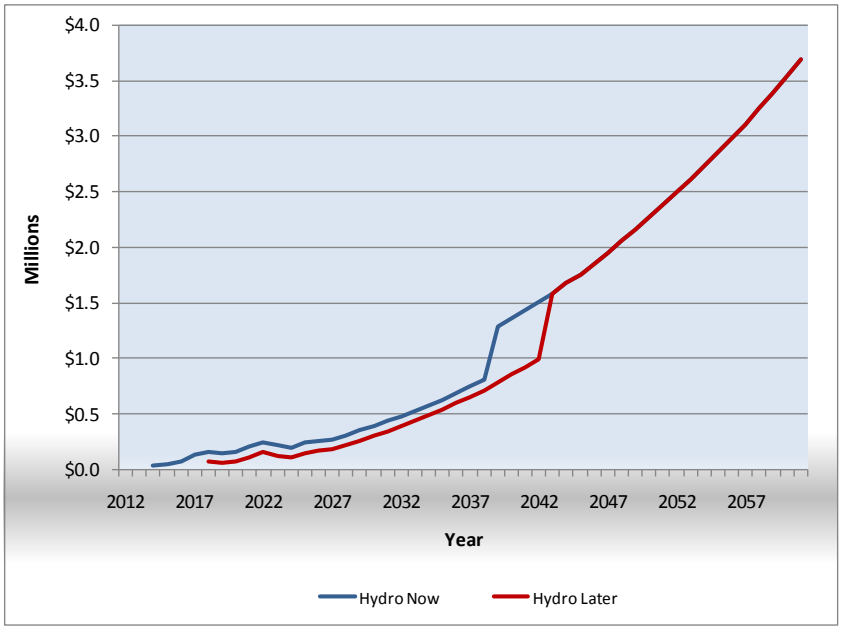
Description	Hydro Now (2014) Undiscounted Cash Flow	Hydro Now (2014) Net Present Value	Hydro Later (2018) Undiscounted Cash Flow	Hydro Later (2018) Net Present Value
Net Construction	($5.20)	($4.69)	($6.31)	($4.59)
O&M	(4.39)	(0.98)	(4.23)	(0.86)
Revenue	81.78	17.32	79.24	15.34
Terminal Value	0.68	0.04	1.46	0.09
Totals	$72.87	**$11.69**	$70.16	**$9.97**

The economic analysis shows that the Hydro Now alternative with WMCP demand assumptions has an expected net present value of $11.69 million and that the Hydro Later alternative has an expected net present value of $9.97 million.

4.2 Comparison of Potential Rate Impacts

Figure 4-1 presents a comparison of the net revenue available by year for both the Hydro Now and Hydro Later alternatives using the reduced growth in water sales assumptions. Annual net revenue is expected to be the same after the hypothetical debt service is retired for both alternatives (i.e., 2038 for Hydro Now, 2042 for Hydro Later).

Figure 4-1: Comparison of Annual Net Revenue ($millions)



Both alternatives are expected to provide rate relief for the City's water customers. However, the Hydro Now alternative is expected to provide more rate relief over the Hydro Project's expected life.

4.3 Preliminary Findings

Table 4–1 and Table 4-2 presents the net present value for both the Hydro Now and Hydro Later alternatives using assumptions based on both the reduced growth in water sales and the WMCP demand forecast. Based on these findings, both alternatives provide net economic benefit to the City. However, the Hydro Now alternative is expected generate $1.39 million more in net present value benefit to the City under the reduced growth in water sales assumptions than the Hydro Later alternative. This finding results from the energy revenue generated that exceeds the expenditures on the Hydro Project in the early years of its operation.

Both the Hydro Now and Hydro Later alternatives are expected to generate revenue that exceeds the expected expenditures on O&M and debt service. This positive net revenue is expected to provide financial benefits to the City's ratepayers. Although the benefit to ratepayers in the early years is modest, the benefit grows over time and represents a significant value to the City.

Based on the findings from the net present value and the rate impact analyses, the Hydro Now alternative provides the best economic and financial benefits to the City.

City of Bend
Draft Timing of Hydro Technical Report

APPENDIX

A

PacifiCorp Schedule 37

HDR ONE COMPANY | Many Solutions℠

Available

To owners of Qualifying Facilities making sales of electricity to the Company in the State of Oregon.

Applicable

For power purchased from Qualifying Facilities with a nameplate capacity of 10,000 kW or less or that, together with any other electric generating facility using the same motive force, owned or controlled by the same person(s) or affiliated person(s), and located at the same site, has a nameplate capacity of 10,000 kW or less. Owners of these Qualifying Facilities will be required to enter into a written power sales contract with the Company.

Definitions

Cogeneration Facility

A facility which produces electric energy together with steam or other form of useful energy (such as heat) which are used for industrial, commercial, heating or cooling purposes through the sequential use of energy.

Qualifying Facilities

Qualifying cogeneration facilities or qualifying small power production facilities within the meaning of section 201 and 210 of the Public Utility Regulatory Policies Act of 1978 (PURPA), 16 U.S.C. 796 and 824a-3.

Small Power Production Facility

A facility which produces electric energy using as a primary energy source biomass, waste, renewable resources or any combination thereof and has a power production capacity which, together with other facilities located at the same site, is not greater than 80 megawatts.

On-Peak Hours or Peak Hours

On-peak hours are defined as 6:00 a.m. to 10:00 p.m. Pacific Prevailing Time Monday through Saturday, excluding NERC holidays.

Due to the expansions of Daylight Saving Time (DST) as adopted under Section 110 of the U.S. Energy Policy Act of 2005, the time periods shown above will begin and end one hour later for the period between the second Sunday in March and the first Sunday in April and for the period between the last Sunday in October and the first Sunday in November.

Off-Peak Hours

All hours other than On-Peak.

West Side Gas Market Index

The monthly indexed gas price shall be the average of the price indexes published by Platts in "Inside FERC's Gas Market Report" monthly price report for Northwest Pipeline Corp. Rock Mountains, Northwest Pipeline Corp. Canadian Border, and Rockies/Northwest Stanfield, OR.

Excess Output

Excess output shall mean any increment of Net Output delivered at a rate, on an hourly basis, exceeding the Facility Nameplate Capacity. PacifiCorp shall pay Seller the Off-peak Price as described and calculated under pricing option 5 for all Excess Output.

(continued)

Same Site
Generating facilities are considered to be located at the same site as the QF for which qualification for the standard rates and standard contract is sought if they are located within a five-mile radius of any generating facilities or equipment providing fuel or motive force associated with the QF for which qualification for the standard rates and standard contract is sought.

Person(s) or Affiliated Person(s)
A natural person or persons or any legal entity or entities sharing common ownership, management or acting jointly or in concert with or exercising influence over the policies or actions of another person or entity. Two facilities will not be held to be owned or controlled by the same person(s) or affiliated person(s) solely because they are developed by a single entity. Two facilities will not be held to be owned or controlled by the same person(s) or affiliated person(s) if such common person or persons is a "passive investor" whose ownership interest in the QF is primarily related to utilizing production tax credits, green tag values and MACRS depreciation as the primary ownership benefit. A unit of Oregon local government may also be a "passive investor" if the local governmental unit demonstrates that it will not have an equity ownership interest in or exercise any control over the management of the QF and that its only interest is a share of the cash flow from the QF, which share will not exceed 20%. The 20% cash flow share limit may only be exceeded for good cause shown and only with the prior approval of the Commission.

Shared Interconnection and Infrastructure
QFs otherwise meeting the separate ownership test and thereby qualified for entitlement to the standard rates and standard contract will not be disqualified by utilizing an interconnection or other infrastructure not providing motive force or fuel that is shared with other QFs qualifying for the standard rates and standard contract so long as the use of the shared interconnection complies with the interconnecting utility's safety and reliability standards, interconnection contract requirements and Prudent Electrical Practices as that term is defined in the interconnecting utility's approved standard contract.

Dispute Resolution
Upon request, the QF will provide the purchasing utility with documentation verifying the ownership, management and financial structure of the QF in reasonably sufficient detail to allow the utility to make an initial determination of whether or not the QF meets the above-described criteria for entitlement to the standard rates and standard contract. Any dispute concerning a QF's entitlement to the standard rates and standard contract shall be presented to the Commission for resolution.

Self Supply Option
Owner shall elect to sell all Net Output to PacifiCorp and purchase its full electric requirements from PacifiCorp or sell Net Output surplus to its needs at the Facility site to PacifiCorp and purchase partial electric requirements service from PacifiCorp, in accordance with the terms and conditions of the power purchase agreement and the appropriate retail service.

(continued)

Pricing Options

1. Fixed Avoided Cost Prices

Prices are fixed at the time that the contract is signed by both the Qualifying Facility and the Company and will not change during the term of the contract. Fixed Avoided Cost Prices are available for a contract term of up to 15 years and prices under a longer term contract (up to 20 years) will thereafter be under either the Firm Market Indexed, the Banded Gas Market Indexed or the Gas Market Indexed Avoided Cost pricing option.

2. Gas Market Indexed Avoided Cost Prices

Fixed prices apply during the resource sufficiency period (2010 through 2013), thereafter a portion of avoided cost prices are indexed to actual monthly West Side Gas Market Index prices. The remaining portion of avoided cost prices will be fixed at the time that the contract is signed by both the Qualifying Facility and the Company and will not change during the term of the contract. Prices are available for a term of up to 20 years.

3. Banded Gas Market Indexed Avoided Cost Prices

Fixed prices apply during the resource sufficiency period (2010 through 2013), thereafter a portion of avoided cost prices are indexed to actual monthly West Side Gas Market Index prices. The remaining portion of avoided cost prices will be fixed at the time that the contract is signed by both the Qualifying Facility and the Company and will not change during the term of the contract. The gas indexed portion of the avoided cost prices are banded to limit the amount that prices can vary with changes in gas prices. Prices are available for a term of up to 20 years.

4. Firm Market Indexed Avoided Cost Prices

Firm market index avoided cost prices are available to Qualifying Facilities that contract to deliver firm power. Monthly on-peak / off-peak prices paid are a blending of Dow Jones Index Firm day-ahead Mid-Columbia, California Oregon Border (COB), Four Corners and Palo Verde on-peak and off-peak prices. The monthly blending matrix is available upon request.

5. Non-firm Market Index Avoided Cost Prices

Non- Firm market index avoided cost prices are available to Qualifying Facilities that do not elect to provide firm power. Qualifying Facilities taking this option will have contracts that do not include minimum delivery requirements, default damages for construction delay, for under delivery or early termination, or default security for these purposes. Monthly On-Peak / Off-Peak prices paid are a blending of Dow Jones Index Non-firm day-ahead Mid-Columbia, California Oregon Border (COB), Four Corners and Palo Verde on-peak and off-peak prices. The monthly blending matrix is available upon request.

(continued)

Monthly Payments

A Qualifying Facility shall select the option of payment at the time of signing the contract under one of three Pricing Options as specified above. Once an option is selected the option will remain in effect for the duration of the Facility's contract.

Fixed Avoided Cost Prices

In accordance with the terms of a contract with a Qualifying Facility, the Company shall pay for all separately metered kilowatt-hours of On-Peak and Off-Peak generation at the fixed prices as provided in this tariff. The definition of On-Peak and Off-Peak is as defined in the definitions section of this tariff.

Gas Market Indexed Avoided Cost Prices

In accordance with the terms of a contract with a Qualifying Facility, the Company shall pay for all separately metered kilowatt-hours of On-Peak and Off-Peak generation at On-Peak and Off-Peak prices calculated each month.

To calculate the Off-Peak price, multiply the West Side Gas Market Index price in $/MMBtu by 0.715 to get actual gas price in cents/kWh. The Off-Peak Energy Adder is added to the actual gas price to get the Off-Peak Price.

The On-Peak price is the Off-Peak price plus the On-Peak Capacity Adder.

Banded Gas Indexed Avoided Cost Prices

In accordance with the terms of a contract with a Qualifying Facility, the Company shall pay for all separately metered kilowatt-hours of On-Peak and Off-Peak generation at On-Peak and Off-Peak prices calculated each month.

To calculate the Off-Peak price, multiply the West Side Gas Market Index price in $/MMBtu by 0.715 to get actual gas price in cents/kWh. This price is banded such that the actual gas price shall be no lower than the Gas Market Index Floor nor greater than the Gas Market Index Ceiling as listed in the price section of this tariff. The Off-Peak Energy Adder is added to the actual gas price to get the Off-Peak Price.

The On-Peak price is the Off-Peak price plus the On-Peak Capacity Adder.

Firm Market Indexed and Non-firm Market Index Avoided Cost Prices

In accordance with the terms of a contract with a Qualifying Facility, the Company shall pay for all separately metered kilowatt-hours of On-Peak and Off-Peak generation at the market prices calculated at the time of delivery. The definition of On-Peak and Off-Peak is as defined in the definitions section of this tariff.

(continued)

Avoided Cost Prices

Pricing Option 1 – Fixed Avoided cost Prices ¢/kWh

Deliveries During Calendar Year	On-Peak Energy Price	Off-Peak Energy Price
	(a)	(b)
2010	5.12	3.95
2011	5.51	4.21
2012	5.87	4.36
2013	6.14	4.50
2014	7.96	6.10
2015	8.16	6.27
2016	8.39	6.46
2017	8.60	6.65
2018	8.87	6.87
2019	8.76	6.74
2020	8.85	6.79
2021	9.33	7.23
2022	9.84	7.70
2023	9.33	7.15
2024	9.03	6.81
2025	9.47	7.22
2026	9.65	7.36
2027	9.68	7.35
2028	10.04	7.67

(continued)

Avoided Cost Prices (Continued)

Pricing Option 2 – Gas Market Indexed Avoided Cost Prices ¢/kWh

Deliveries During Calendar Year	Fixed Prices		Gas Market Index		Forecast	Estimated Prices (3)	
	On-Peak Energy Price	Off-Peak Energy Price	On-Peak Capacity Adder (1)	Off-Peak Energy Adder	West Side Gas Market Index Price (2) $/MMBtu	On-Peak Energy Price	Off-Peak Energy Price
	(a)	(b)	(c)	(d)	(e)	(f)	(g)
			Avoided Firm Capacity Costs / (0.876 * 90.4% * 57%)	Total Avoided Energy Costs - ((e) * 0.715)		(g) + (c)	((e) * 0.715) + (d)
2010	5.12	3.95	Market Based Prices 2010 through 2013				
2011	5.51	4.21					
2012	5.87	4.36					
2013	6.14	4.50					
2014			1.86	1.38	$6.61	7.96	6.10
2015			1.89	1.40	$6.81	8.16	6.27
2016			1.92	1.41	$7.07	8.39	6.46
2017			1.96	1.41	$7.32	8.60	6.65
2018			1.99	1.44	$7.60	8.87	6.87
2019			2.03	1.45	$7.40	8.76	6.74
2020			2.06	1.47	$7.44	8.85	6.79
2021			2.10	1.53	$7.97	9.33	7.23
2022			2.14	1.59	$8.55	9.84	7.70
2023			2.18	1.51	$7.89	9.33	7.15
2024			2.21	1.45	$7.50	9.03	6.81
2025			2.25	1.51	$7.98	9.47	7.22
2026			2.29	1.52	$8.17	9.65	7.36
2027			2.33	1.57	$8.08	9.68	7.35
2028			2.37	1.64	$8.43	10.04	7.67
2029			2.42	1.71	$8.83	10.43	8.02
2030			2.46	1.78	$9.15	10.78	8.32
2031			2.50	1.81	$9.32	10.98	8.48
2032			2.55	1.84	$9.49	11.17	8.62

(1) Avoided Firm Capacity Costs are equal to the fixed costs of a SCCT as identified in the Company's 2008 IRP.

(2) A heat rate of 0.715 is used to adjust gas prices from $/MMBtu to ¢/kWh

(3) Estimated avoided cost prices based upon forecast West Side Gas Market Index prices.
Actual prices will be calculated each month using actual index gas prices.

(continued)

Avoided Cost Prices (Continued)

Pricing Option 3 – Banded Gas Market Indexed Avoided Cost Prices ¢/kWh

Deliveries During Calendar Year	Fixed Prices		Banded Gas Market Index				Forecast West Side Gas Market Index Price (2)	Estimated Prices (3)	
	On-Peak Energy Price	Off-Peak Energy Price	On-Peak Capacity Adder (1)	Off-Peak Energy Adder	Gas Market Index Floor 90%	Gas Market Index Ceiling 110%	$/MMBtu	On-Peak Energy Price	Off-Peak Energy Price
	(a)	(b)	(c) Avoided Firm Capacity Costs / (0.876 * 90.4% * 57%)	(d) Total Avoided Energy Costs - ((e) * 0.715)	(e) (g) * 0.715 * 90%	(f) (g) * 0.715 * 110%	(g)	(h) (i) + (c)	(i) MIN(MAX(((g) * 0.715) , (e)) , (f)) + (d)
2010	5.12	3.95	Market Based Prices 2010 through 2013						
2011	5.51	4.21							
2012	5.87	4.36							
2013	6.14	4.50							
2014			1.86	1.38	4.25	5.20	$6.61	7.96	6.10
2015			1.89	1.40	4.38	5.36	$6.81	8.16	6.27
2016			1.92	1.41	4.55	5.56	$7.07	8.39	6.46
2017			1.96	1.41	4.71	5.76	$7.32	8.60	6.65
2018			1.99	1.44	4.89	5.98	$7.60	8.87	6.87
2019			2.03	1.45	4.76	5.82	$7.40	8.76	6.74
2020			2.06	1.47	4.79	5.85	$7.44	8.85	6.79
2021			2.10	1.53	5.13	6.27	$7.97	9.33	7.23
2022			2.14	1.59	5.50	6.72	$8.55	9.84	7.70
2023			2.18	1.51	5.08	6.21	$7.89	9.33	7.15
2024			2.21	1.45	4.83	5.90	$7.50	9.03	6.81
2025			2.25	1.51	5.14	6.28	$7.98	9.47	7.22
2026			2.29	1.52	5.26	6.43	$8.17	9.65	7.36
2027			2.33	1.57	5.20	6.36	$8.08	9.68	7.35
2028			2.37	1.64	5.42	6.63	$8.43	10.04	7.67
2029			2.42	1.71	5.68	6.94	$8.83	10.43	8.02
2030			2.46	1.78	5.89	7.20	$9.15	10.78	8.32
2031			2.50	1.81	6.00	7.33	$9.32	10.98	8.48
2032			2.55	1.84	6.11	7.46	$9.49	11.17	8.62

(1) Avoided Firm Capacity Costs are equal to the fixed costs of a SCCT as identified in the Company's 2008 IRP.

(2) A heat rate of 0.715 is used to adjust gas prices from $/MMBtu to ¢/kWh

(3) Estimated avoided cost prices based upon forecast West Side Gas Market Index prices.
Actual prices will be calculated each month using actual index gas prices.

(continued)

Example of Gas Pricing Options available to the Qualifying Facility
An example of the two gas pricing options using different assumed gas prices is provided at the end of this tariff.

Qualifying Facilities Contracting Procedure

Interconnection and power purchase agreements are handled by different functions within the Company. Interconnection agreements (both transmission and distribution level voltages) are handled by the Company's transmission function (PacifiCorp Transmission Services) while power purchase agreements are handled by the Company's merchant function (PacifiCorp Commercial and Trading).

It is recommended that the owner initiate its request for interconnection 18 months ahead of the anticipated in-service date to allow time for studies, negotiation of agreements, engineering, procurement, and construction of the required interconnection facilities. Early application for interconnection will help ensure that necessary interconnection arrangements proceed in a timely manner on a parallel track with negotiation of the power purchase agreement.

1. Qualifying Facilities up to 10,000 kW

APPLICATION: To owners of existing or proposed QFs with a design capacity less than or equal to 10,000 kW who desire to make sales to the Company in the state of Oregon. Such owners will be required to enter into a written power purchase agreement with the Company pursuant to the procedures set forth below.

I. Process for Completing a Power Purchase Agreement

A. Communications

Unless otherwise directed by the Company, all communications to the Company regarding QF power purchase agreements should be directed in writing as follows:

PacifiCorp
Manager-QF Contracts
825 NE Multnomah St, Suite 600
Portland, Oregon 97232

The Company will respond to all such communications in a timely manner. If the Company is unable to respond on the basis of incomplete or missing information from the QF owner, the Company shall indicate what additional information is required. Thereafter, the Company will respond in a timely manner following receipt of all required information.

(continued)

B. Procedures

1. The Company's approved generic or standard form power purchase agreements may be obtained from the Company's website at www.pacificorp.com, or if the owner is unable to obtain it from the website, the Company will send a copy within seven days of a written request.

2. In order to obtain a project specific draft power purchase agreement the owner must provide in writing to the Company, general project information required for the completion of a power purchase agreement, including, but not limited to:

   (a) demonstration of ability to obtain QF status;
   (b) design capacity (MW), station service requirements, and net amount of power to be delivered to the Company's electric system;
   (c) generation technology and other related technology applicable to the site;
   (d) proposed site location;
   (e) schedule of monthly power deliveries;
   (f) calculation or determination of minimum and maximum annual deliveries;
   (g) motive force or fuel plan;
   (h) proposed on-line date and other significant dates required to complete the milestones;
   (i) proposed contract term and pricing provisions (i.e.,fixed, deadband, gas indexed);
   (j) status of interconnection or transmission arrangements;
   (k) point of delivery or interconnection;

3. The Company shall provide a draft power purchase agreement when all information described in Paragraph 2 above has been received in writing from the QF owner. Within 15 business days following receipt of all information required in Paragraph 2, the Company will provide the owner with a draft power purchase agreement including current standard avoided cost prices and/or other optional pricing mechanisms as approved by the Oregon Public Utilities Commission in this Schedule 37.

4. If the owner desires to proceed with the power purchase agreement after reviewing the Company's draft power purchase agreement, it may request in writing that the Company prepare a final draft power purchase agreement. In connection with such request, the owner must provide the Company with any additional or clarified project information that the Company reasonably determines to be necessary for the preparation of a final draft power purchase agreement. Within 15 business days following receipt of all information requested by the Company in this paragraph 4, the Company will provide the owner with a final draft power purchase agreement.

(continued)

B. Procedures (continued)

5 After reviewing the final draft power purchase agreement, the owner may either prepare another set of written comments and proposals or approve the final draft power purchase agreement. If the owner prepares written comments and proposals the Company will respond in 15 business days to those comments and proposals.

6. When both parties are in full agreement as to all terms and conditions of the draft power purchase agreement, the Company will prepare and forward to the owner within 15 business days, a final executable version of the agreement. Following the Company's execution a completely executed copy will be returned to the owner. Prices and other terms and conditions in the power purchase agreement will not be final and binding until the power purchase agreement has been executed by both parties.

II. Process for Negotiating Interconnection Agreements

[NOTE: Section II applies only to QFs connecting directly to PacifiCorp's electrical system. An off-system QF should contact its local utility or transmission provider to determine the interconnection requirements and wheeling arrangement necessary to move the power to PacifiCorp's system.]

In addition to negotiating a power purchase agreement, QFs intending to make sales to the Company are also required to enter into an interconnection agreement that governs the physical interconnection of the project to the Company's transmission or distribution system. The Company's obligation to make purchases from a QF is conditioned upon the QF completing all necessary interconnection arrangements. It is recommended that the owner initiate its request for interconnection 18 months ahead of the anticipated in-service date to help ensure that necessary interconnection arrangements proceed in a timely manner on a parallel track with negotiation of the power purchase agreement.

Because of functional separation requirements mandated by the Federal Energy Regulatory Commission, interconnection and power purchase agreements are handled by different functions within the Company. Interconnection agreements (both transmission and distribution level voltages) are handled by the Company's transmission function (including but not limited to PacifiCorp Transmission Services) while power purchase agreements are handled by the Company's merchant function (including but not limited to PacifiCorp's Commercial and Trading Group).

(continued)

II. Process for Negotiating Interconnection Agreements (continued)

A. Communications

Initial communications regarding interconnection agreements should be directed to the Company in writing as follows:

PacifiCorp
Director – Transmission Services
825 NE Multnomah St, Suite 1600
Portland, Oregon 97232

Based on the project size and other characteristics, the Company will direct the QF owner to the appropriate individual within the Company's transmission function who will be responsible for negotiating the interconnection agreement with the QF owner. Thereafter, the QF owner should direct all communications regarding interconnection agreements to the designated individual, with a copy of any written communications to the address set forth above.

B. Procedures

Generally, the interconnection process involves (1) initiating a request for interconnection, (2) undertaking studies to determine the system impacts associated with the interconnection and the design, cost, and schedules for constructing any necessary interconnection facilities, and (3) executing an interconnection agreement to address facility construction, testing, acceptance, ownership, operation and maintenance issues. Consistent with PURPA and Oregon Public Utility Commission regulations, the owner is responsible for all interconnection costs assessed by the Company on a nondiscriminatory basis. For interconnections impacting the Company's Transmission and Distribution System, the Company will process the interconnection application through PacifiCorp Transmission Services.

(continued)

Example of Gas Pricing Options given Assumed Gas Prices ¢/kWh

Banded Gas Market Index

Year	Prices Listed in the Tariff				Example using assumed Gas Prices						Compared to Fixed Prices	
	On-Peak Capacity Adder	Off-Peak Energy Adder	Gas Market Index Floor 90%	Gas Market Index Ceiling 110%	Assumed Gas Price $/MMBtu	Actual Energy Price	Fuel Index Floor / Ceiling Component	Fuel Index Type of Price	Price Paid to QF Off-Peak Price	Price Paid to QF On-Peak Price	Off-Peak Price	On-Peak Price
	(a)	(b)	(c)	(d)	(e)	(f) (e) x 0.715	(g)	(h)	(i) (b) + (g)	(j) (a) + (i)	(k)	(l)
2014	1.86	1.38	4.25	5.20	$3.00	2.15	4.25	Floor	5.63	7.49	6.10	7.96
					$5.00	3.58	4.25	Floor	5.63	7.49		
					$7.00	5.01	5.01	Actual	6.39	8.25		
					$9.00	6.44	5.20	Ceiling	6.58	8.44		
					$12.00	8.58	5.20	Ceiling	6.58	8.44		

Gas Market Method

Year	Prices Listed in the Tariff				Example using assumed Gas Prices						Compared to Fixed Prices	
	On-Peak Capacity Adder	Off-Peak Energy Adder	Fuel Index Floor 90%	Fuel Index Ceiling 110%	Assumed Gas Price $/MMBtu	Actual Energy Price	Fuel Index Floor / Ceiling Component	Fuel Index Type of Price	Price Paid to QF Off-Peak Price	Price Paid to QF On-Peak Price	Off-Peak Price	On-Peak Price
	(a)	(b)	(c)	(d)	(e)	(f) (e) x 0.715	(g)	(h)	(i) (b) + (f)	(j) (a) + (i)	(k)	(l)
2014	1.86	1.38	Not Relevant		$3.00	2.15	Not Relevant		3.53	5.39	6.10	7.96
					$5.00	3.58			4.96	6.82		
					$7.00	5.01			6.39	8.25		
					$9.00	6.44			7.82	9.68		
					$12.00	8.58			9.96	11.82		

City of Bend
Draft Timing of Hydro Technical Report

APPENDIX

B

Power Sales Options

HDR ONE COMPANY | Many Solutions℠ **Memorandum**

To: City of Bend **Date:** July 5, 2011

From: Paul Matthews, HDR
Joe Healy, HDR

RE: City of Bend Hydro Project Power Sales Options

1. Introduction

The City of Bend (City) is considering the development of a hydroelectric plant ("the Hydro Project") that would generate electricity by harnessing the energy provided by the water being delivered to the City's new water treatment plant. The Hydro Project electrical energy output will be sold to PacifiCorp under Oregon Schedule 37. This memorandum provides a brief discussion of the power sales options available under Oregon Schedule 37.

2. Rate Schedule 37

The Hydro Project electrical energy output will be sold to PacifiCorp under Schedule 37 rates and requirements. Schedule 37 provides four options for the sale of power. The options are as follows:

- Fixed Avoided Cost Prices
- Gas Market Indexed Avoided Cost Prices
- Banded Gas Market Indexed Avoided Cost Prices
- Firm Market Indexed Avoided Cost Prices

Descriptions of each option are provided below.

2.1 Fixed Avoided Cost Prices

Prices are fixed at the time that the contract is signed by both the City ("the Qualifying Facility") and PacifiCorp ("the Company") and will not change during the term of the contract. Fixed Avoided Cost Prices are available for a contract term of up to 15 years and prices under a longer-term contract (up to 20 years) will thereafter be scheduled under one of the other three options described below.

2.2 Gas Market Indexed Avoided Cost Prices

Fixed prices apply during the resource sufficiency period (2010 through 2013), thereafter a portion of avoided cost prices are indexed to actual monthly West Side Gas Market Index prices. The remaining portion of avoided cost prices will be fixed at the time that the contract is signed by both the Qualifying

Facility and the Company and will not change during the term of the contract. Prices are available for a term of up to 20 years.

2.3 Banded Gas Market Indexed Avoided Cost Prices

Fixed prices apply during the resource sufficiency period (2010 through 2013), thereafter a portion of avoided cost prices are indexed to actual monthly West Side Gas Market Index prices. The remaining portion of avoided cost prices will be fixed at the time that the contract is signed by both the Qualifying Facility and the Company and will not change during the term of the contract. The gas indexed portion of the avoided cost prices are banded to limit the amount that prices can vary with changes in gas prices. Prices are available for a term of up to 20 years.

2.4 Firm Market Indexed Avoided Cost Prices

Firm market index avoided cost prices are available to Qualifying Facilities that contract to deliver firm power. Monthly on-peak/off-peak prices paid are a blending of Dow Jones Index Firm day-ahead Mid-Columbia, California Oregon Border (COB), Four Corners and Palo Verde on-peak and off-peak prices. The monthly blending matrix is available upon request.

The first option provided for a fixed rate until 2028, after that time they are based on market price. The difference between the two gas market based rates is that one has not limit on high and low rate, wherein the other is limited within a band as the low and high rate, regardless of actual market prices. The rates will be effective over the term of the contract, but can be changed until the City enters into a purchase power contract. Any modification to the current rate schedule requires the approval of the Oregon Public Utility Commission.

3. Conclusions

Determining the best rate option under Schedule 37 is a matter of risk and reward. While the fixed rate option provides a known revenue stream, it will not change when market prices are high. On the other hand, it will not go down when market prices are low. Rate options will be evaluated further as the City moves forward with its Power Purchase Agreement.

City of Bend
Draft Timing of Hydro Technical Report

APPENDIX

C

Draft Hydropower Cost Technical Memorandum

ONE COMPANY | Many Solutions℠

To: Heidi Lansdowne, PE, City of Bend

From: Bryan Black, PE

Project: Surface Water Improvement Project

Date: 07-26-2011

RE: Hydropower Costs, DRAFT

1 Background

The City of Bend Oregon is considering construction of a hydropower generation facility on its Bridge Creek water supply system. The City has asked HDR to evaluate the economics of the hydropower facility. This memorandum describes the potential costs (capital and O&M) of hydropower to provide input to the economic analysis.

2 Objectives and Approach

The objective of this analysis and memorandum is to evaluate the costs of hydropower to provide input to an economic evaluation. The costs of hydropower include initial capital costs of construction and also on-going costs associated with operations and maintenance (O&M) of the facility.

Costs associated with construction of the Bridge Creek water supply system (base system costs) are not included in this analysis. This analysis focuses on the incremental costs associated with installation of hydropower generation and required or desired associated facilities.

Economic decisions such as whether to install hydropower typically ignore sunk costs (i.e.; costs that have already been incurred). Therefore, sunk costs are ignored in this analysis and only current or future costs are included. One relevant sunk cost is design and permitting of the hydropower installation. The City is proceeding design and permitting regardless of whether hydropower is installed initially to make sure the supply system is compatible with initial or future installation of hydropower facilities.

3 Capital Costs

The capital costs of hydropower installation include multiple components.

Cost components of hydropower cost include:

1) Intake improvements that would be built only if hydropower is installed, including:
   a) Intake structure and screens;
   b) Fish ladder;
2) Construction of the hydroelectric powerhouse including:
   a) Pre-purchase of turbine-generator equipment;
   b) Installation turbine-generator equipment;
   c) Construction of electrical interconnection;

There are also some costs that would be avoided by installation of the powerhouse with initial construction:

1) A redundant pressure dissipating valve with piping.

The City's CM/GC contractor, Mortenson Construction, has prepared a 30% estimate of construction costs. Mortenson's cost estimate is documented in a summary estimate dated 22-Apr-2011, with details listed in a 30% estimate report dated 22-Apr-2011. The cost estimate is escalated to the anticipated mid-point of construction, so the cost basis is October 2012.

The estimated capital costs associated with adding hydropower generation facilities to the base water supply project are listed in **Table 1**.

Table 1. Capital Costs Associated with Hydropower Installation

Item	Total Construction Cost Estimate	Notes
Intake Structure & Screens	$1,123,641	Screens are required upon hydropower installation. Building renovation is needed to support screen O&M
Fish Ladder	$294,914	Fish ladder is required upon hydropower installation, unless ODFW waiver is obtained
Hydroelectric Powerplant	$3,688,576	Includes turbine-generator at $1.41M
Avoided Cost - Redundant Pressure Dissipating valve and line	-$410,349	Turbine-generator functions also as a redundant pressure dissipating valve (PDV). If T-G not installed, redundant PDV and piping is required
Engineering Services During Construction	$500,000	
Total	$5,196,782	Anticipated additional project cost to add hydropower to base water supply project
Notes: PDV = Pressure dissipating valve Cost Basis is October 2012		

3.1 Avoided Costs by Hydropower Installation

The turbine-generator functions as a redundant pressure dissipating valve. If the turbine-generator were not installed, a redundant pressure dissipating valve and piping would need to be installed instead. **Appendix A, Table A-1** provides the cost estimate detail for the pressure dissipating valve that is summarized as an avoided cost in **Table 1**.

4 Operation and Maintenance Costs

Operation and Maintenance (O&M) costs were estimated in the City's Water Supply Alternatives Study (WSAS) dated 2009. Table 7-8 of the WSAS lists the annual O&M cost of a single turbine-generator installation as $35,200 (year 2013 dollars).

5 Conclusions

- Additional facilities and costs are required for the City to generate hydropower with the Bridge Creek water supply system
- The net additional costs will most likely be in the range of $5.2M.

6 Recommendations

- The City should use the estimated costs of adding hydropower contained herein to evaluate the economics of installing and operating hydropower facilities including the anticipated revenue stream associated with power generation and sales.

City of Bend
Draft Timing of Hydro Technical Report

APPENDIX

D

Draft Hydropower Flow Technical Memorandum

HDR ONE COMPANY | *Many Solutions*℠

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

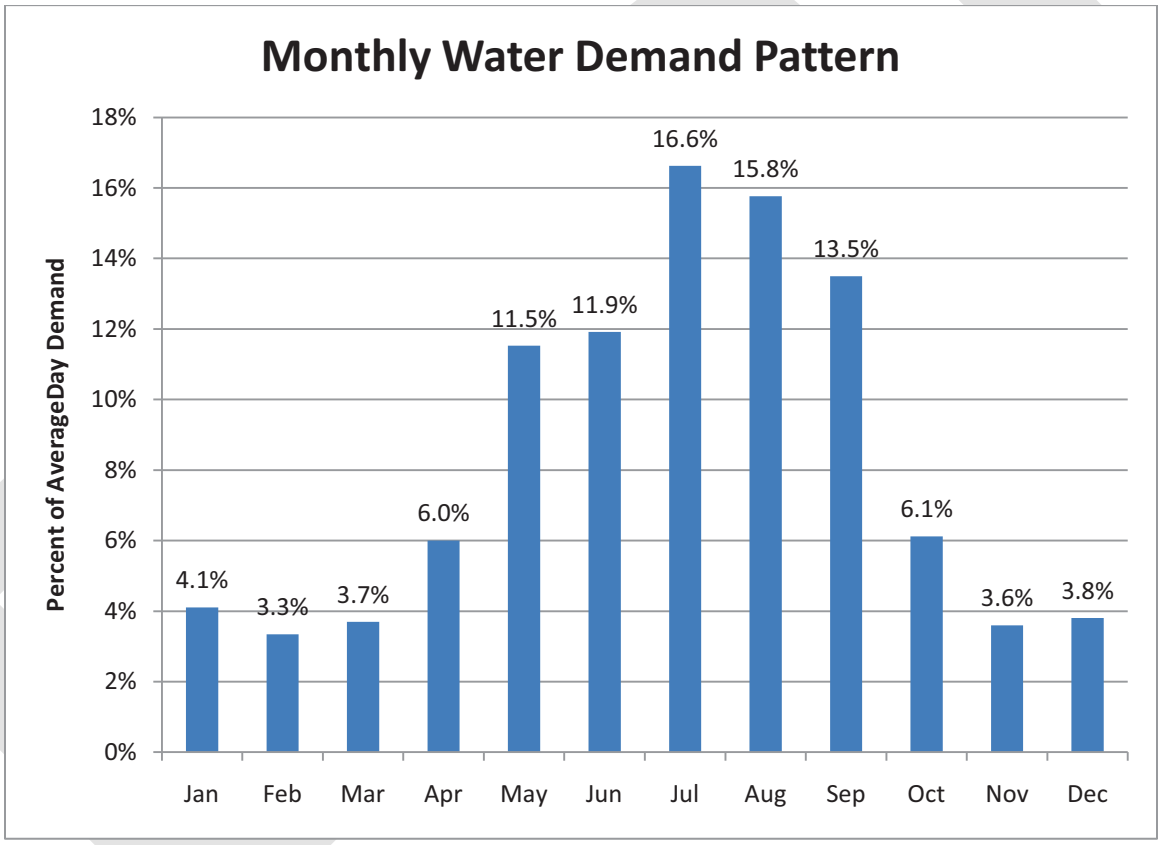


Figure 1 – Monthly Water Demand Pattern

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"

City of Bend
Draft Timing of Hydro Technical Report

APPENDIX

E

Detailed Tables from Economic Feasibility Model

HDR ONE COMPANY | Many Solutions℠

Table 1
City of Bend
Hydroelectric NPV Analysis
Comparison of Cash Flows

	Net Present Value Analysis				Undiscounted Cash Flow Analysis			
Scenario	Net Present Value	Rank	Percent from Highest	Difference from Highest	Undiscounted Cash Flow	Undiscounted Rank	Percent from Highest	Difference from Highest
Hydro Now (2014)	$11,693,121	1	0.0%	$0	$72,871,603	1	0.0%	$0
Hydro Later (2018)	9,973,635	2	14.7%	(1,719,485)	70,158,411	2	3.7%	(2,713,193)

Table 2
City of Bend
Hydroelectric NPV Analysis
Summary of Cash Flows

		Hydro Now (2014)		Hydro Later (2018)	
Year	Discount Factor	Cash Flow	Discounted Cash Flow	Cash Flow	Discounted Cash Flow
2012	94.8%	($423,000)	($400,948)	$0	$0
2013	89.8%	(4,773,782)	(4,289,016)	0	0
2014	85.2%	545,132	464,242	0	0
2015	80.7%	567,445	458,051	0	0
2016	76.5%	593,725	454,279	(451,091)	(345,146)
2017	72.5%	674,841	489,426	(5,859,022)	(4,249,231)
2018	68.7%	705,139	484,739	705,139	484,739
2019	65.2%	701,128	456,854	701,128	456,854
2020	61.8%	716,807	442,721	716,807	442,721
2021	58.5%	766,491	448,727	766,491	448,727
2022	55.5%	821,731	455,987	821,731	455,987
2023	52.6%	777,043	408,710	777,043	408,710
2024	49.9%	754,098	375,964	754,098	375,964
2025	47.3%	801,158	378,603	801,158	378,603
2026	44.8%	824,009	369,101	824,009	369,101
2027	42.5%	831,542	353,057	831,542	353,057
2028	40.2%	873,965	351,724	873,965	351,724
2029	38.1%	915,952	349,405	915,952	349,405
2030	36.2%	961,559	347,680	961,559	347,680
2031	34.3%	1,008,616	345,682	1,008,616	345,682
2032	32.5%	1,059,140	344,074	1,059,140	344,074
2033	30.8%	1,103,804	339,890	1,103,804	339,890
2034	29.2%	1,152,510	336,386	1,152,510	336,386
2035	27.7%	1,203,359	332,917	1,203,359	332,917
2036	26.2%	1,260,380	330,514	1,260,380	330,514
2037	24.9%	1,311,870	326,082	1,311,870	326,082
2038	23.6%	1,369,732	322,715	1,369,732	322,715
2039	22.3%	1,430,140	319,381	1,430,140	319,381
2040	21.2%	1,497,871	317,069	1,497,871	317,069
2041	20.1%	1,559,045	312,813	1,559,045	312,813
2042	19.0%	1,627,781	309,578	1,627,781	309,578
2043	18.0%	1,699,540	306,375	1,699,540	306,375
2044	17.1%	1,779,990	304,149	1,779,990	304,149
2045	16.2%	1,852,665	300,064	1,852,665	300,064
2046	15.4%	1,934,314	296,955	1,934,314	296,955
2047	14.6%	2,019,553	293,878	2,019,553	293,878
2048	13.8%	2,115,104	291,736	2,115,104	291,736
2049	13.1%	2,201,439	287,815	2,201,439	287,815
2050	12.4%	2,298,422	284,829	2,298,422	284,829
2051	11.7%	2,399,667	281,872	2,399,667	281,872
2052	11.1%	2,513,149	279,813	2,513,149	279,813
2053	10.6%	2,615,705	276,049	2,615,705	276,049
2054	10.0%	2,730,895	273,180	2,730,895	273,180
2055	9.5%	2,851,148	270,341	2,851,148	270,341
2056	9.0%	2,985,918	268,360	2,985,918	268,360
2057	8.5%	3,107,737	264,747	3,107,737	264,747
2058	8.1%	3,244,547	261,992	3,244,547	261,992
2059	7.7%	3,387,368	259,265	3,387,368	259,265
2060	7.3%	3,547,414	257,360	3,547,414	257,360
2061	6.9%	3,692,106	253,893	3,692,106	253,893
Terminal Value	6.5%	675,691	44,043	1,456,973	94,968
Totals		$72,871,603		$70,158,411	
Net Present Value			$11,693,121		$9,973,635
Check					

Table 3
City of Bend
Hydroelectric NPV Analysis
Comparison of Cash Flows ($millions)

	Hydro Now (2014)		Hydro Later (2018)	
Description	Undiscounted Cash Flow	Net Present Value	Undiscounted Cash Flow	Net Present Value
Net Construction	($5.20)	($4.69)	($6.31)	($4.59)
O&M	(4.39)	(0.98)	(4.23)	(0.86)
Revenue	81.78	17.32	79.24	15.34
Terminal Value	0.68	0.04	1.46	0.09
Totals	$72.87	**$11.69**	$70.16	**$9.97**

Table 4
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - Capital Improvement Plan

Description	Line	2012	2013	2014	2015	2016	2017	2018	Totals
Turbine & Generator	1	$423,000	$987,000						$1,410,000
Intake Structure & Fish Screens	2		1,123,641						1,123,641
Fish Ladder	3		294,914						294,914
Concrete	4		1,184,114						1,184,114
Powerhouse (PH) Structure	5		1,184,114						1,184,114
Code Check & Design Update	6								0
PH Bid Ph. & Contractor Mobiliza	7								0
Total (w/o Inflation)		$423,000	$4,773,782	$0	$0	$0	$0	$0	$5,196,782
Expected Expenditure Rates		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
Expected Inflation Rate		0.0%	0.0%	2.0%	2.0%	2.5%	3.0%	3.5%	
Inflation Factor		1.000	1.000	1.020	1.040	1.066	1.098	1.137	
Expected CIP w/Inflation		$423,000	$4,773,782	$0	$0	$0	$0	$0	$5,196,782
Redundant PRV Avoided Cost		$410,349							

Table 5
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - CIP with Inflation

Description	Line	2012	2013	2014	2015	2016	2017	2018	Total
Turbine & Generator	1	$423,000	$987,000	$0	$0	$0	$0	$0	$1,410,000
Intake Structure & Fish Screens	2	0	1,123,641	0	0	0	0	0	1,123,641
Fish Ladder	3	0	294,914	0	0	0	0	0	294,914
Concrete	4	0	1,184,114	0	0	0	0	0	1,184,114
Powerhouse (PH) Structure	5	0	1,184,114	0	0	0	0	0	1,184,114
Code Check & Design Update	6	0	0	0	0	0	0	0	0
PH Bid Ph. & Contractor Mobiliz	7	0	0	0	0	0	0	0	0
Total (w/ Inflation)		$423,000	$4,773,782	$0	$0	$0	$0	$0	$5,196,782

Check

Table 6
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - Funding Sources for Improvements

Description	2012	2013	2014	2015	2016	2017	2018	Total
New Debt / City Funded	$423,000	$4,773,782	$0	$0	$0	$0	$0	$5,196,782
External Funding	0	0	0	0	0	0	0	0
Total	$423,000	$4,773,782	$0	$0	$0	$0	$0	$5,196,782
Check	OK	OK	OK	OK	OK	OK	OK	OK

Table 7
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - Useful Life Estimates

Item	Life (years)
Turbine & Generator	50
Intake Structure & Fish Screens	50
Fish Ladder	50
Concrete	100
Powerhouse (PH) Structure	50
Code Check & Design Update	NA
PH Bid Ph. & Contractor Mobilization	NA

Table 8
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - Capital Timing Lookup Table

Item	Total Initial CIP	Total Initial Net CIP	Initial CIP Year	CIP Year Completion
Turbine & Generator	$1,410,000	$1,410,000	Multiple	2013
Intake Structure & Fish Screens	1,123,641	1,123,641	2013	2013
Fish Ladder	294,914	294,914	2013	2013
Concrete	1,184,114	1,184,114	2013	2013
Powerhouse (PH) Structure	1,184,114	1,184,114	2013	2013
Code Check & Design Update	0	0	2012	2012
PH Bid Ph. & Contractor Mobiliza	0	0	2012	2012

Table 9
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - Capital Cost Projections

	Capital							
Year	Turbine & Generator	Intake Structure & Fish Screens	Fish Ladder	Concrete	Powerhouse (PH) Structure	Code Check & Design Update	PH Bid Ph. & Contractor Mobilization	Total Capital
2012	$423,000	$0	$0	$0	$0	$0	$0	$423,000
2013	987,000	1,123,641	294,914	1,184,114	1,184,114	0	0	4,773,782
2014	0	0	0	0	0	0	0	0
2015	0	0	0	0	0	0	0	0
2016	0	0	0	0	0	0	0	0
2017	0	0	0	0	0	0	0	0
2018	0	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0
2041	0	0	0	0	0	0	0	0
2042	0	0	0	0	0	0	0	0
2043	0	0	0	0	0	0	0	0
2044	0	0	0	0	0	0	0	0
2045	0	0	0	0	0	0	0	0
2046	0	0	0	0	0	0	0	0
2047	0	0	0	0	0	0	0	0
2048	0	0	0	0	0	0	0	0
2049	0	0	0	0	0	0	0	0
2050	0	0	0	0	0	0	0	0
2051	0	0	0	0	0	0	0	0
2052	0	0	0	0	0	0	0	0
2053	0	0	0	0	0	0	0	0
2054	0	0	0	0	0	0	0	0
2055	0	0	0	0	0	0	0	0
2056	0	0	0	0	0	0	0	0
2057	0	0	0	0	0	0	0	0
2058	0	0	0	0	0	0	0	0
2059	0	0	0	0	0	0	0	0
2060	0	0	0	0	0	0	0	0
2061	0	0	0	0	0	0	0	0
Terminal Value	(19,740)	(22,473)	(5,898)	(603,898)	(23,682)	0	0	(675,691)

Table 10
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - O&M and Cost Projections

	Costs					
Year	Annual O&M	Annual O&M Escalation Rate	O&M Escalation Factor	R&R	Third-Party Costs	Total Costs
2012	$0	3.50%	0.966			$0
2013	0	3.50%	1.000			0
2014	36,432	3.50%	1.035			36,432
2015	37,707	3.50%	1.071			37,707
2016	39,027	3.50%	1.109			39,027
2017	40,393	3.50%	1.148			40,393
2018	41,807	3.50%	1.188			41,807
2019	43,270	3.50%	1.229			43,270
2020	44,784	3.50%	1.272			44,784
2021	46,352	3.50%	1.317			46,352
2022	47,974	3.50%	1.363			47,974
2023	49,653	3.50%	1.411			49,653
2024	51,391	3.50%	1.460			51,391
2025	53,190	3.50%	1.511			53,190
2026	55,051	3.50%	1.564			55,051
2027	56,978	3.50%	1.619			56,978
2028	58,972	3.50%	1.675			58,972
2029	61,036	3.50%	1.734			61,036
2030	63,173	3.50%	1.795			63,173
2031	65,384	3.50%	1.857			65,384
2032	67,672	3.50%	1.923			67,672
2033	70,041	3.50%	1.990			70,041
2034	72,492	3.50%	2.059			72,492
2035	75,029	3.50%	2.132			75,029
2036	77,655	3.50%	2.206			77,655
2037	80,373	3.50%	2.283			80,373
2038	83,186	3.50%	2.363			83,186
2039	86,098	3.50%	2.446			86,098
2040	89,111	3.50%	2.532			89,111
2041	92,230	3.50%	2.620			92,230
2042	95,458	3.50%	2.712			95,458
2043	98,799	3.50%	2.807			98,799
2044	102,257	3.50%	2.905			102,257
2045	105,836	3.50%	3.007			105,836
2046	109,540	3.50%	3.112			109,540
2047	113,374	3.50%	3.221			113,374
2048	117,342	3.50%	3.334			117,342
2049	121,449	3.50%	3.450			121,449
2050	125,700	3.50%	3.571			125,700
2051	130,100	3.50%	3.696			130,100
2052	134,653	3.50%	3.825			134,653
2053	139,366	3.50%	3.959			139,366
2054	144,244	3.50%	4.098			144,244
2055	149,292	3.50%	4.241			149,292
2056	154,518	3.50%	4.390			154,518
2057	159,926	3.50%	4.543			159,926
2058	165,523	3.50%	4.702			165,523
2059	171,316	3.50%	4.867			171,316
2060	177,312	3.50%	5.037			177,312
2061	183,518	3.50%	5.214			183,518

* O&M Start Year 2014

Table 11
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - Revenue Projections

	Revenue					
Year	Power Sales	Third Party Share	City Power Sales Rev.	Third-Party Agreement	Green Tags & Other	Total Revenue
2012	$0	0.0%	$0		$0	$0
2013	0	0.0%	0		0	0
2014	581,564	0.0%	581,564		0	581,564
2015	605,152	0.0%	605,152		0	605,152
2016	632,751	0.0%	632,751		0	632,751
2017	715,234	0.0%	715,234		0	715,234
2018	746,946	0.0%	746,946		0	746,946
2019	744,398	0.0%	744,398		0	744,398
2020	761,591	0.0%	761,591		0	761,591
2021	812,843	0.0%	812,843		0	812,843
2022	869,705	0.0%	869,705		0	869,705
2023	826,696	0.0%	826,696		0	826,696
2024	805,489	0.0%	805,489		0	805,489
2025	854,347	0.0%	854,347		0	854,347
2026	879,060	0.0%	879,060		0	879,060
2027	888,520	0.0%	888,520		0	888,520
2028	932,937	0.0%	932,937		0	932,937
2029	976,989	0.0%	976,989		0	976,989
2030	1,024,731	0.0%	1,024,731		0	1,024,731
2031	1,074,000	0.0%	1,074,000		0	1,074,000
2032	1,126,812	0.0%	1,126,812		0	1,126,812
2033	1,173,844	0.0%	1,173,844		0	1,173,844
2034	1,225,001	0.0%	1,225,001		0	1,225,001
2035	1,278,388	0.0%	1,278,388		0	1,278,388
2036	1,338,036	0.0%	1,338,036		0	1,338,036
2037	1,392,243	0.0%	1,392,243		0	1,392,243
2038	1,452,918	0.0%	1,452,918		0	1,452,918
2039	1,516,237	0.0%	1,516,237		0	1,516,237
2040	1,586,983	0.0%	1,586,983		0	1,586,983
2041	1,651,275	0.0%	1,651,275		0	1,651,275
2042	1,723,239	0.0%	1,723,239		0	1,723,239
2043	1,798,339	0.0%	1,798,339		0	1,798,339
2044	1,882,247	0.0%	1,882,247		0	1,882,247
2045	1,958,501	0.0%	1,958,501		0	1,958,501
2046	2,043,854	0.0%	2,043,854		0	2,043,854
2047	2,132,927	0.0%	2,132,927		0	2,132,927
2048	2,232,446	0.0%	2,232,446		0	2,232,446
2049	2,322,888	0.0%	2,322,888		0	2,322,888
2050	2,424,122	0.0%	2,424,122		0	2,424,122
2051	2,529,767	0.0%	2,529,767		0	2,529,767
2052	2,647,802	0.0%	2,647,802		0	2,647,802
2053	2,755,071	0.0%	2,755,071		0	2,755,071
2054	2,875,139	0.0%	2,875,139		0	2,875,139
2055	3,000,440	0.0%	3,000,440		0	3,000,440
2056	3,140,436	0.0%	3,140,436		0	3,140,436
2057	3,267,663	0.0%	3,267,663		0	3,267,663
2058	3,410,070	0.0%	3,410,070		0	3,410,070
2059	3,558,684	0.0%	3,558,684		0	3,558,684
2060	3,724,727	0.0%	3,724,727		0	3,724,727
2061	3,875,624	0.0%	3,875,624		0	3,875,624

Third-Party Term (years): 0

Table 12
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - Depreciation Analysis

66,223,204

	Depreciation Rates							Depreciable Assets						
Year	Turbine & Generator	Intake Structure & Fish Screens	Fish Ladder	Concrete	Powerhouse (PH) Structure	Code Check & Design Update	PH Bid Ph. & Contractor Mobilization	Turbine & Generator	Intake Structure & Fish Screens	Fish Ladder	Concrete	Powerhouse (PH) Structure	Code Check & Design Update	PH Bid Ph. & Contractor Mobilization
2012	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	$423,000	$0	$0	$0	$0	$0	$0
2013	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2014	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2015	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2016	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2017	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2018	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2019	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2020	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2021	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2022	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2023	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2024	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2025	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2026	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2027	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2028	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2029	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2030	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2031	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2032	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2033	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2034	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2035	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2036	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2037	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2038	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2039	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2040	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2041	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2042	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2043	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2044	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2045	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2046	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2047	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2048	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2049	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2050	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2051	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2052	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2053	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2054	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2055	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2056	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2057	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2058	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2059	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2060	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2061	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0

Table 13
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - Summary of Cash Flows

Year	Discount Factor	Capital	Discounted Capital	O&M	Discounted O&M	Revenue	Discounted Revenue	Terminal Value	Discounted Terminal Value	Total	Discounted Total
2012	94.8%	($423,000)	($400,948)	$0	$0	$0	$0	$0	$0	($423,000)	($400,948)
2013	89.8%	(4,773,782)	(4,289,016)	0	0	0	0	0	0	(4,773,782)	(4,289,016)
2014	85.2%	0	0	(36,432)	(31,026)	581,564	495,268	0	0	545,132	464,242
2015	80.7%	0	0	(37,707)	(30,438)	605,152	488,489	0	0	567,445	458,051
2016	76.5%	0	0	(39,027)	(29,861)	632,751	484,140	0	0	593,725	454,279
2017	72.5%	0	0	(40,393)	(29,295)	715,234	518,720	0	0	674,841	489,426
2018	68.7%	0	0	(41,807)	(28,739)	746,946	513,478	0	0	705,139	484,739
2019	65.2%	0	0	(43,270)	(28,195)	744,398	485,049	0	0	701,128	456,854
2020	61.8%	0	0	(44,784)	(27,660)	761,591	470,381	0	0	716,807	442,721
2021	58.5%	0	0	(46,352)	(27,136)	812,843	475,863	0	0	766,491	448,727
2022	55.5%	0	0	(47,974)	(26,621)	869,705	482,609	0	0	821,731	455,987
2023	52.6%	0	0	(49,653)	(26,117)	826,696	434,827	0	0	777,043	408,710
2024	49.9%	0	0	(51,391)	(25,621)	805,489	401,585	0	0	754,098	375,964
2025	47.3%	0	0	(53,190)	(25,136)	854,347	403,738	0	0	801,158	378,603
2026	44.8%	0	0	(55,051)	(24,659)	879,060	393,760	0	0	824,009	369,101
2027	42.5%	0	0	(56,978)	(24,192)	888,520	377,249	0	0	831,542	353,057
2028	40.2%	0	0	(58,972)	(23,733)	932,937	375,457	0	0	873,965	351,724
2029	38.1%	0	0	(61,036)	(23,283)	976,989	372,688	0	0	915,952	349,405
2030	36.2%	0	0	(63,173)	(22,842)	1,024,731	370,521	0	0	961,559	347,680
2031	34.3%	0	0	(65,384)	(22,409)	1,074,000	368,091	0	0	1,008,616	345,682
2032	32.5%	0	0	(67,672)	(21,984)	1,126,812	366,058	0	0	1,059,140	344,074
2033	30.8%	0	0	(70,041)	(21,567)	1,173,844	361,457	0	0	1,103,804	339,890
2034	29.2%	0	0	(72,492)	(21,158)	1,225,001	357,544	0	0	1,152,510	336,386
2035	27.7%	0	0	(75,029)	(20,757)	1,278,388	353,674	0	0	1,203,359	332,917
2036	26.2%	0	0	(77,655)	(20,364)	1,338,036	350,878	0	0	1,260,380	330,514
2037	24.9%	0	0	(80,373)	(19,978)	1,392,243	346,060	0	0	1,311,870	326,082
2038	23.6%	0	0	(83,186)	(19,599)	1,452,918	342,314	0	0	1,369,732	322,715
2039	22.3%	0	0	(86,098)	(19,228)	1,516,237	338,609	0	0	1,430,140	319,381
2040	21.2%	0	0	(89,111)	(18,863)	1,586,983	335,932	0	0	1,497,871	317,069
2041	20.1%	0	0	(92,230)	(18,505)	1,651,275	331,318	0	0	1,559,045	312,813
2042	19.0%	0	0	(95,458)	(18,155)	1,723,239	327,732	0	0	1,627,781	309,578
2043	18.0%	0	0	(98,799)	(17,810)	1,798,339	324,185	0	0	1,699,540	306,375
2044	17.1%	0	0	(102,257)	(17,473)	1,882,247	321,622	0	0	1,779,990	304,149
2045	16.2%	0	0	(105,836)	(17,142)	1,958,501	317,205	0	0	1,852,665	300,064
2046	15.4%	0	0	(109,540)	(16,817)	2,043,854	313,772	0	0	1,934,314	296,955
2047	14.6%	0	0	(113,374)	(16,498)	2,132,927	310,376	0	0	2,019,553	293,878
2048	13.8%	0	0	(117,342)	(16,185)	2,232,446	307,922	0	0	2,115,104	291,736
2049	13.1%	0	0	(121,449)	(15,878)	2,322,888	303,693	0	0	2,201,439	287,815
2050	12.4%	0	0	(125,700)	(15,577)	2,424,122	300,406	0	0	2,298,422	284,829
2051	11.7%	0	0	(130,100)	(15,282)	2,529,767	297,154	0	0	2,399,667	281,872
2052	11.1%	0	0	(134,653)	(14,992)	2,647,802	294,805	0	0	2,513,149	279,813
2053	10.6%	0	0	(139,366)	(14,708)	2,755,071	290,757	0	0	2,615,705	276,049
2054	10.0%	0	0	(144,244)	(14,429)	2,875,139	287,609	0	0	2,730,895	273,180
2055	9.5%	0	0	(149,292)	(14,156)	3,000,440	284,496	0	0	2,851,148	270,341
2056	9.0%	0	0	(154,518)	(13,887)	3,140,436	282,247	0	0	2,985,918	268,360
2057	8.5%	0	0	(159,926)	(13,624)	3,267,663	278,371	0	0	3,107,737	264,747
2058	8.1%	0	0	(165,523)	(13,366)	3,410,070	275,358	0	0	3,244,547	261,992
2059	7.7%	0	0	(171,316)	(13,112)	3,558,684	272,378	0	0	3,387,368	259,265
2060	7.3%	0	0	(177,312)	(12,864)	3,724,727	270,224	0	0	3,547,414	257,360
2061	6.9%	0	0	(183,518)	(12,620)	3,875,624	266,513	0	0	3,692,106	253,893
Terminal Value	6.5%							675,691	44,043	675,691	44,043
Totals		($5,196,782)		($4,385,985)		$81,778,679		$675,691		$72,871,603	
Net Present Value			($4,689,964)		($983,540)		$17,322,582		$44,043		$11,693,121
Check											

Table 14
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - Capital Improvement Plan

Description	Line	2012	2013	2014	2015	2016	2017	2018	Totals
Turbine & Generator	1					$423,000	$987,000		$1,410,000
Intake Structure & Fish Screens	2						1,123,641		1,123,641
Fish Ladder	3						294,914		294,914
Concrete	4						1,389,288		1,389,288
Powerhouse (PH) Structure	5						1,389,288		1,389,288
Code Check & Design Update	6						50,000		50,000
PH Bid Ph. & Contractor Mobiliz	7						100,000		100,000
Total (w/o Inflation)		$0	$0	$0	$0	$423,000	$5,334,131	$0	$5,757,131
Expected Expenditure Rates		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
Expected Inflation Rate		0.0%	0.0%	2.0%	2.0%	2.5%	3.0%	3.5%	
Inflation Factor		1.000	1.000	1.020	1.040	1.066	1.098	1.137	
Expected CIP w/Inflation		$0	$0	$0	$0	$451,091	$5,859,022	$0	$6,310,113
Redundant PRV Avoided Cost		$0							

Table 15
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - CIP with Inflation

Description	Line	2012	2013	2014	2015	2016	2017	2018	Total
Turbine & Generator	1	$0	$0	$0	$0	$451,091	$1,084,123	$0	$1,535,215
Intake Structure & Fish Screens	2	0	0	0	0	0	1,234,210	0	1,234,210
Fish Ladder	3	0	0	0	0	0	323,934	0	323,934
Concrete	4	0	0	0	0	0	1,525,997	0	1,525,997
Powerhouse (PH) Structure	5	0	0	0	0	0	1,525,997	0	1,525,997
Code Check & Design Update	6	0	0	0	0	0	54,920	0	54,920
PH Bid Ph. & Contractor Mobiliz	7	0	0	0	0	0	109,840	0	109,840
Total (w/ Inflation)		$0	$0	$0	$0	$451,091	$5,859,022	$0	$6,310,113

Check

Table 16
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - Funding Sources for Improvements

Description	2012	2013	2014	2015	2016	2017	2018	Total
New Debt / City Funded	$0	$0	$0	$0	$451,091	$5,859,022	$0	$6,310,113
External Funding	0	0	0	0	0	0	0	0
Total	$0	$0	$0	$0	$451,091	$5,859,022	$0	$6,310,113
Check	OK	OK	OK	OK	OK	OK	OK	OK

Table 17
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - Useful Life Estimates

Item	Life (years)
Turbine & Generator	50
Intake Structure & Fish Screens	50
Fish Ladder	50
Concrete	100
Powerhouse (PH) Structure	50
Code Check & Design Update	NA
PH Bid Ph. & Contractor Mobilization	NA

Table 18
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - Capital Timing Lookup Table

Item	Total Initial CIP	Total Initial Net CIP	Initial CIP Year	CIP Year Completion
Turbine & Generator	$1,535,215	$1,535,215	Multiple	2017
Intake Structure & Fish Screens	1,234,210	1,234,210	2017	2017
Fish Ladder	323,934	323,934	2017	2017
Concrete	1,525,997	1,525,997	2017	2017
Powerhouse (PH) Structure	1,525,997	1,525,997	2017	2017
Code Check & Design Update	54,920	54,920	2017	2017
PH Bid Ph. & Contractor Mobiliza	109,840	109,840	2017	2017

Table 19
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - Capital Cost Projections

	Capital							
Year	Turbine & Generator	Intake Structure & Fish Screens	Fish Ladder	Concrete	Powerhouse (PH) Structure	Code Check & Design Update	PH Bid Ph. & Contractor Mobilization	Total Capital
2012	$0	$0	$0	$0	$0	$0	$0	$0
2013	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0
2015	0	0	0	0	0	0	0	0
2016	451,091	0	0	0	0	0	0	451,091
2017	1,084,123	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840	5,859,022
2018	0	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0
2041	0	0	0	0	0	0	0	0
2042	0	0	0	0	0	0	0	0
2043	0	0	0	0	0	0	0	0
2044	0	0	0	0	0	0	0	0
2045	0	0	0	0	0	0	0	0
2046	0	0	0	0	0	0	0	0
2047	0	0	0	0	0	0	0	0
2048	0	0	0	0	0	0	0	0
2049	0	0	0	0	0	0	0	0
2050	0	0	0	0	0	0	0	0
2051	0	0	0	0	0	0	0	0
2052	0	0	0	0	0	0	0	0
2053	0	0	0	0	0	0	0	0
2054	0	0	0	0	0	0	0	0
2055	0	0	0	0	0	0	0	0
2056	0	0	0	0	0	0	0	0
2057	0	0	0	0	0	0	0	0
2058	0	0	0	0	0	0	0	0
2059	0	0	0	0	0	0	0	0
2060	0	0	0	0	0	0	0	0
2061	0	0	0	0	0	0	0	0
Terminal Value	(144,500)	(123,421)	(32,393)	(839,298)	(152,600)	(54,920)	(109,840)	(1,456,973)

Table 20
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - O&M and Cost Projections

	Costs					
Year	Annual O&M	Annual O&M Escalation Rate	O&M Escalation Factor	R&R	Third-Party Costs	Total Costs
2012	$0	3.50%	0.966			$0
2013	0	3.50%	1.000			0
2014	0	3.50%	1.035			0
2015	0	3.50%	1.071			0
2016	0	3.50%	1.109			0
2017	0	3.50%	1.148			0
2018	41,807	3.50%	1.188			41,807
2019	43,270	3.50%	1.229			43,270
2020	44,784	3.50%	1.272			44,784
2021	46,352	3.50%	1.317			46,352
2022	47,974	3.50%	1.363			47,974
2023	49,653	3.50%	1.411			49,653
2024	51,391	3.50%	1.460			51,391
2025	53,190	3.50%	1.511			53,190
2026	55,051	3.50%	1.564			55,051
2027	56,978	3.50%	1.619			56,978
2028	58,972	3.50%	1.675			58,972
2029	61,036	3.50%	1.734			61,036
2030	63,173	3.50%	1.795			63,173
2031	65,384	3.50%	1.857			65,384
2032	67,672	3.50%	1.923			67,672
2033	70,041	3.50%	1.990			70,041
2034	72,492	3.50%	2.059			72,492
2035	75,029	3.50%	2.132			75,029
2036	77,655	3.50%	2.206			77,655
2037	80,373	3.50%	2.283			80,373
2038	83,186	3.50%	2.363			83,186
2039	86,098	3.50%	2.446			86,098
2040	89,111	3.50%	2.532			89,111
2041	92,230	3.50%	2.620			92,230
2042	95,458	3.50%	2.712			95,458
2043	98,799	3.50%	2.807			98,799
2044	102,257	3.50%	2.905			102,257
2045	105,836	3.50%	3.007			105,836
2046	109,540	3.50%	3.112			109,540
2047	113,374	3.50%	3.221			113,374
2048	117,342	3.50%	3.334			117,342
2049	121,449	3.50%	3.450			121,449
2050	125,700	3.50%	3.571			125,700
2051	130,100	3.50%	3.696			130,100
2052	134,653	3.50%	3.825			134,653
2053	139,366	3.50%	3.959			139,366
2054	144,244	3.50%	4.098			144,244
2055	149,292	3.50%	4.241			149,292
2056	154,518	3.50%	4.390			154,518
2057	159,926	3.50%	4.543			159,926
2058	165,523	3.50%	4.702			165,523
2059	171,316	3.50%	4.867			171,316
2060	177,312	3.50%	5.037			177,312
2061	183,518	3.50%	5.214			183,518
* O&M Start Year	2018					

Table 21
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - Revenue Projections

	Revenue					
Year	Power Sales	Third Party Share	City Power Sales Rev.	Third-Party Agreement	Green Tags & Other	Total Revenue
2012	$0	0.0%	$0		$0	$0
2013	0	0.0%	0		0	0
2014	0	0.0%	0		0	0
2015	0	0.0%	0		0	0
2016	0	0.0%	0		0	0
2017	0	0.0%	0		0	0
2018	746,946	0.0%	746,946		0	746,946
2019	744,398	0.0%	744,398		0	744,398
2020	761,591	0.0%	761,591		0	761,591
2021	812,843	0.0%	812,843		0	812,843
2022	869,705	0.0%	869,705		0	869,705
2023	826,696	0.0%	826,696		0	826,696
2024	805,489	0.0%	805,489		0	805,489
2025	854,347	0.0%	854,347		0	854,347
2026	879,060	0.0%	879,060		0	879,060
2027	888,520	0.0%	888,520		0	888,520
2028	932,937	0.0%	932,937		0	932,937
2029	976,989	0.0%	976,989		0	976,989
2030	1,024,731	0.0%	1,024,731		0	1,024,731
2031	1,074,000	0.0%	1,074,000		0	1,074,000
2032	1,126,812	0.0%	1,126,812		0	1,126,812
2033	1,173,844	0.0%	1,173,844		0	1,173,844
2034	1,225,001	0.0%	1,225,001		0	1,225,001
2035	1,278,388	0.0%	1,278,388		0	1,278,388
2036	1,338,036	0.0%	1,338,036		0	1,338,036
2037	1,392,243	0.0%	1,392,243		0	1,392,243
2038	1,452,918	0.0%	1,452,918		0	1,452,918
2039	1,516,237	0.0%	1,516,237		0	1,516,237
2040	1,586,983	0.0%	1,586,983		0	1,586,983
2041	1,651,275	0.0%	1,651,275		0	1,651,275
2042	1,723,239	0.0%	1,723,239		0	1,723,239
2043	1,798,339	0.0%	1,798,339		0	1,798,339
2044	1,882,247	0.0%	1,882,247		0	1,882,247
2045	1,958,501	0.0%	1,958,501		0	1,958,501
2046	2,043,854	0.0%	2,043,854		0	2,043,854
2047	2,132,927	0.0%	2,132,927		0	2,132,927
2048	2,232,446	0.0%	2,232,446		0	2,232,446
2049	2,322,888	0.0%	2,322,888		0	2,322,888
2050	2,424,122	0.0%	2,424,122		0	2,424,122
2051	2,529,767	0.0%	2,529,767		0	2,529,767
2052	2,647,802	0.0%	2,647,802		0	2,647,802
2053	2,755,071	0.0%	2,755,071		0	2,755,071
2054	2,875,139	0.0%	2,875,139		0	2,875,139
2055	3,000,440	0.0%	3,000,440		0	3,000,440
2056	3,140,436	0.0%	3,140,436		0	3,140,436
2057	3,267,663	0.0%	3,267,663		0	3,267,663
2058	3,410,070	0.0%	3,410,070		0	3,410,070
2059	3,558,684	0.0%	3,558,684		0	3,558,684
2060	3,724,727	0.0%	3,724,727		0	3,724,727
2061	3,875,624	0.0%	3,875,624		0	3,875,624

Third-Party Term (years): 0

Table 22
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - Depreciation Analysis

	Depreciation Rates							Depreciable Assets						
Year	Turbine & Generator	Intake Structure & Fish Screens	Fish Ladder	Concrete	Powerhouse (PH) Structure	Code Check & Design Update	PH Bid Ph. & Contractor Mobilization	Turbine & Generator	Intake Structure & Fish Screens	Fish Ladder	Concrete	Powerhouse (PH) Structure	Code Check & Design Update	PH Bid Ph. & Contractor Mobilization
2012	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	$0	$0	$0	$0	$0	$0	$0
2013	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	0	0	0	0	0	0	0
2014	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	0	0	0	0	0	0	0
2015	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	0	0	0	0	0	0	0
2016	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	451,091	0	0	0	0	0	0
2017	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2018	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2019	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2020	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2021	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2022	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2023	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2024	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2025	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2026	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2027	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2028	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2029	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2030	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2031	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2032	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2033	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2034	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2035	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2036	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2037	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2038	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2039	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2040	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2041	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2042	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2043	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2044	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2045	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2046	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2047	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2048	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2049	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2050	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2051	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2052	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2053	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2054	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2055	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2056	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2057	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2058	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2059	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2060	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2061	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840

Table 23
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - Summary of Cash Flows

Year	Discount Factor	Capital	Discounted Capital	O&M	Discounted O&M	Revenue	Discounted Revenue	Terminal Value	Discounted Terminal Value	Total	Discounted Total
2012	94.8%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2013	89.8%	0	0	0	0	0	0	0	0	0	0
2014	85.2%	0	0	0	0	0	0	0	0	0	0
2015	80.7%	0	0	0	0	0	0	0	0	0	0
2016	76.5%	(451,091)	(345,146)	0	0	0	0	0	0	(451,091)	(345,146)
2017	72.5%	(5,859,022)	(4,249,231)	0	0	0	0	0	0	(5,859,022)	(4,249,231)
2018	68.7%	0	0	(41,807)	(28,739)	746,946	513,478	0	0	705,139	484,739
2019	65.2%	0	0	(43,270)	(28,195)	744,398	485,049	0	0	701,128	456,854
2020	61.8%	0	0	(44,784)	(27,660)	761,591	470,381	0	0	716,807	442,721
2021	58.5%	0	0	(46,352)	(27,136)	812,843	475,863	0	0	766,491	448,727
2022	55.5%	0	0	(47,974)	(26,621)	869,705	482,609	0	0	821,731	455,987
2023	52.6%	0	0	(49,653)	(26,117)	826,696	434,827	0	0	777,043	408,710
2024	49.9%	0	0	(51,391)	(25,621)	805,489	401,585	0	0	754,098	375,964
2025	47.3%	0	0	(53,190)	(25,136)	854,347	403,738	0	0	801,158	378,603
2026	44.8%	0	0	(55,051)	(24,659)	879,060	393,760	0	0	824,009	369,101
2027	42.5%	0	0	(56,978)	(24,192)	888,520	377,249	0	0	831,542	353,057
2028	40.2%	0	0	(58,972)	(23,733)	932,937	375,457	0	0	873,965	351,724
2029	38.1%	0	0	(61,036)	(23,283)	976,989	372,688	0	0	915,952	349,405
2030	36.2%	0	0	(63,173)	(22,842)	1,024,731	370,521	0	0	961,559	347,680
2031	34.3%	0	0	(65,384)	(22,409)	1,074,000	368,091	0	0	1,008,616	345,682
2032	32.5%	0	0	(67,672)	(21,984)	1,126,812	366,058	0	0	1,059,140	344,074
2033	30.8%	0	0	(70,041)	(21,567)	1,173,844	361,457	0	0	1,103,804	339,890
2034	29.2%	0	0	(72,492)	(21,158)	1,225,001	357,544	0	0	1,152,510	336,386
2035	27.7%	0	0	(75,029)	(20,757)	1,278,388	353,674	0	0	1,203,359	332,917
2036	26.2%	0	0	(77,655)	(20,364)	1,338,036	350,878	0	0	1,260,380	330,514
2037	24.9%	0	0	(80,373)	(19,978)	1,392,243	346,060	0	0	1,311,870	326,082
2038	23.6%	0	0	(83,186)	(19,599)	1,452,918	342,314	0	0	1,369,732	322,715
2039	22.3%	0	0	(86,098)	(19,228)	1,516,237	338,609	0	0	1,430,140	319,381
2040	21.2%	0	0	(89,111)	(18,863)	1,586,983	335,932	0	0	1,497,871	317,069
2041	20.1%	0	0	(92,230)	(18,505)	1,651,275	331,318	0	0	1,559,045	312,813
2042	19.0%	0	0	(95,458)	(18,155)	1,723,239	327,732	0	0	1,627,781	309,578
2043	18.0%	0	0	(98,799)	(17,810)	1,798,339	324,185	0	0	1,699,540	306,375
2044	17.1%	0	0	(102,257)	(17,473)	1,882,247	321,622	0	0	1,779,990	304,149
2045	16.2%	0	0	(105,836)	(17,142)	1,958,501	317,205	0	0	1,852,665	300,064
2046	15.4%	0	0	(109,540)	(16,817)	2,043,854	313,772	0	0	1,934,314	296,955
2047	14.6%	0	0	(113,374)	(16,498)	2,132,927	310,376	0	0	2,019,553	293,878
2048	13.8%	0	0	(117,342)	(16,185)	2,232,446	307,922	0	0	2,115,104	291,736
2049	13.1%	0	0	(121,449)	(15,878)	2,322,888	303,693	0	0	2,201,439	287,815
2050	12.4%	0	0	(125,700)	(15,577)	2,424,122	300,406	0	0	2,298,422	284,829
2051	11.7%	0	0	(130,100)	(15,282)	2,529,767	297,154	0	0	2,399,667	281,872
2052	11.1%	0	0	(134,653)	(14,992)	2,647,802	294,805	0	0	2,513,149	279,813
2053	10.6%	0	0	(139,366)	(14,708)	2,755,071	290,757	0	0	2,615,705	276,049
2054	10.0%	0	0	(144,244)	(14,429)	2,875,139	287,609	0	0	2,730,895	273,180
2055	9.5%	0	0	(149,292)	(14,156)	3,000,440	284,496	0	0	2,851,148	270,341
2056	9.0%	0	0	(154,518)	(13,887)	3,140,436	282,247	0	0	2,985,918	268,360
2057	8.5%	0	0	(159,926)	(13,624)	3,267,663	278,371	0	0	3,107,737	264,747
2058	8.1%	0	0	(165,523)	(13,366)	3,410,070	275,358	0	0	3,244,547	261,992
2059	7.7%	0	0	(171,316)	(13,112)	3,558,684	272,378	0	0	3,387,368	259,265
2060	7.3%	0	0	(177,312)	(12,864)	3,724,727	270,224	0	0	3,547,414	257,360
2061	6.9%	0	0	(183,518)	(12,620)	3,875,624	266,513	0	0	3,692,106	253,893
Terminal Value	6.5%							1,456,973	94,968	1,456,973	94,968
Totals		($6,310,113)		($4,232,426)		$79,243,978		$1,456,973		$70,158,411	
Net Present Value			($4,594,377)		($862,921)		$15,335,965		$94,968		$9,973,635
Check											

Table 24
City of Bend
Hydroelectric NPV Analysis
Energy by Scenario (kWh)

	Hydro Now (2014)			Hydro Later (2018)			Unused Hydro Now + 3rd Party			Unused Hydro Later + 3rd Party		
Year	Net Energy (Max.)	Outages or Other Losses (%)	Expected Energy (kWh)	Net Energy (Max.)	Outages or Other Losses (%)	Expected Energy (kWh)	Net Energy (Max.)	Outages or Other Losses (%)	Expected Energy (kWh)	Net Energy (Max.)	Outages or Other Losses (%)	Expected Energy (kWh)
2012	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0
2013	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0
2014	8,142,402	0.0%	8,142,402	0	0.0%	0	0	0.0%	0	0	0.0%	0
2015	8,256,694	0.0%	8,256,694	0	0.0%	0	8,256,694	0.0%	8,256,694	0	0.0%	0
2016	8,390,098	0.0%	8,390,098	0	0.0%	0	8,390,098	0.0%	8,390,098	0	0.0%	0
2017	9,237,342	0.0%	9,237,342	0	0.0%	0	9,237,342	0.0%	9,237,342	0	0.0%	0
2018	9,347,483	0.0%	9,347,483	9,347,483	0.0%	9,347,483	9,347,483	0.0%	9,347,483	0	0.0%	0
2019	9,456,175	0.0%	9,456,175	9,456,175	0.0%	9,456,175	9,456,175	0.0%	9,456,175	9,456,175	0.0%	9,456,175
2020	9,586,394	0.0%	9,586,394	9,586,394	0.0%	9,586,394	9,586,394	0.0%	9,586,394	9,586,394	0.0%	9,586,394
2021	9,668,734	0.0%	9,668,734	9,668,734	0.0%	9,668,734	9,668,734	0.0%	9,668,734	9,668,734	0.0%	9,668,734
2022	9,772,697	0.0%	9,772,697	9,772,697	0.0%	9,772,697	9,772,697	0.0%	9,772,697	9,772,697	0.0%	9,772,697
2023	9,874,826	0.0%	9,874,826	9,874,826	0.0%	9,874,826	9,874,826	0.0%	9,874,826	9,874,826	0.0%	9,874,826
2024	10,000,894	0.0%	10,000,894	10,000,894	0.0%	10,000,894	10,000,894	0.0%	10,000,894	10,000,894	0.0%	10,000,894
2025	10,073,678	0.0%	10,073,678	10,073,678	0.0%	10,073,678	10,073,678	0.0%	10,073,678	10,073,678	0.0%	10,073,678
2026	10,170,304	0.0%	10,170,304	10,170,304	0.0%	10,170,304	10,170,304	0.0%	10,170,304	10,170,304	0.0%	10,170,304
2027	10,265,000	0.0%	10,265,000	10,265,000	0.0%	10,265,000	10,265,000	0.0%	10,265,000	10,265,000	0.0%	10,265,000
2028	10,367,998	0.0%	10,367,998	10,367,998	0.0%	10,367,998	10,367,998	0.0%	10,367,998	10,367,998	0.0%	10,367,998
2029	10,404,583	0.0%	10,404,583	10,404,583	0.0%	10,404,583	10,404,583	0.0%	10,404,583	10,404,583	0.0%	10,404,583
2030	10,457,288	0.0%	10,457,288	10,457,288	0.0%	10,457,288	10,457,288	0.0%	10,457,288	10,457,288	0.0%	10,457,288
2031	10,502,367	0.0%	10,502,367	10,502,367	0.0%	10,502,367	10,502,367	0.0%	10,502,367	10,502,367	0.0%	10,502,367
2032	10,558,644	0.0%	10,558,644	10,558,644	0.0%	10,558,644	10,558,644	0.0%	10,558,644	10,558,644	0.0%	10,558,644
2033	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2034	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2035	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2036	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097
2037	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2038	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2039	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2040	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097
2041	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2042	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2043	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2044	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097
2045	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2046	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2047	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2048	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097
2049	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2050	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2051	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2052	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097
2053	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2054	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2055	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2056	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097
2057	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2058	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2059	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2060	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097
2061	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
* Year Online	2014			2018			2015			2019		

Table 25
City of Bend
Hydroelectric NPV Analysis
Revenue

			Hydro Now (2014)			Hydro Later (2018)			Unused Hydro Now + 3rd Party			Unused Hydro Later + 3rd Party		
Year	On-Peak Energy Price ($/kWh)	Off-Peak Energy Price ($/kWh)	Expected On-Peak (kWh)	Expected Off-Peak (kWh)	Revenue	Expected On-Peak (kWh)	Expected Off-Peak (kWh)	Revenue	Expected On-Peak (kWh)	Expected Off-Peak (kWh)	Revenue	Expected On-Peak (kWh)	Expected Off-Peak (kWh)	Revenue
2012	$0.0587	$0.0436	0	0	$0	0	0	$0	0	0	$0	0	0	$0
2013	$0.0614	$0.0450	0	0	0	0	0	0	0	0	0	0	0	0
2014	$0.0796	$0.0610	4,563,312	3,579,090	581,564	0	0	0	0	0	0	0	0	0
2015	$0.0816	$0.0627	4,627,365	3,629,328	605,152	0	0	0	4,627,365	3,629,328	605,152	0	0	0
2016	$0.0839	$0.0646	4,702,130	3,687,968	632,751	0	0	0	4,702,130	3,687,968	632,751	0	0	0
2017	$0.0860	$0.0665	5,176,958	4,060,384	715,234	0	0	0	5,176,958	4,060,384	715,234	0	0	0
2018	$0.0887	$0.0687	5,238,685	4,108,798	746,946	5,238,685	4,108,798	746,946	5,238,685	4,108,798	746,946	0	0	0
2019	$0.0876	$0.0674	5,299,601	4,156,575	744,398	5,299,601	4,156,575	744,398	5,299,601	4,156,575	744,398	5,299,601	4,156,575	744,398
2020	$0.0885	$0.0679	5,372,580	4,213,814	761,591	5,372,580	4,213,814	761,591	5,372,580	4,213,814	761,591	5,372,580	4,213,814	761,591
2021	$0.0933	$0.0723	5,418,727	4,250,008	812,843	5,418,727	4,250,008	812,843	5,418,727	4,250,008	812,843	5,418,727	4,250,008	812,843
2022	$0.0984	$0.0770	5,476,991	4,295,706	869,705	5,476,991	4,295,706	869,705	5,476,991	4,295,706	869,705	5,476,991	4,295,706	869,705
2023	$0.0933	$0.0715	5,534,228	4,340,598	826,696	5,534,228	4,340,598	826,696	5,534,228	4,340,598	826,696	5,534,228	4,340,598	826,696
2024	$0.0903	$0.0681	5,604,882	4,396,012	805,489	5,604,882	4,396,012	805,489	5,604,882	4,396,012	805,489	5,604,882	4,396,012	805,489
2025	$0.0947	$0.0722	5,645,672	4,428,005	854,347	5,645,672	4,428,005	854,347	5,645,672	4,428,005	854,347	5,645,672	4,428,005	854,347
2026	$0.0965	$0.0736	5,699,826	4,470,479	879,060	5,699,826	4,470,479	879,060	5,699,826	4,470,479	879,060	5,699,826	4,470,479	879,060
2027	$0.0968	$0.0735	5,752,897	4,512,103	888,520	5,752,897	4,512,103	888,520	5,752,897	4,512,103	888,520	5,752,897	4,512,103	888,520
2028	$0.1004	$0.0767	5,810,620	4,557,377	932,937	5,810,620	4,557,377	932,937	5,810,620	4,557,377	932,937	5,810,620	4,557,377	932,937
2029	$0.1048	$0.0800	5,831,124	4,573,459	976,989	5,831,124	4,573,459	976,989	5,831,124	4,573,459	976,989	5,831,124	4,573,459	976,989
2030	$0.1093	$0.0835	5,860,662	4,596,626	1,024,731	5,860,662	4,596,626	1,024,731	5,860,662	4,596,626	1,024,731	5,860,662	4,596,626	1,024,731
2031	$0.1141	$0.0872	5,885,926	4,616,441	1,074,000	5,885,926	4,616,441	1,074,000	5,885,926	4,616,441	1,074,000	5,885,926	4,616,441	1,074,000
2032	$0.1191	$0.0910	5,917,466	4,641,178	1,126,812	5,917,466	4,641,178	1,126,812	5,917,466	4,641,178	1,126,812	5,917,466	4,641,178	1,126,812
2033	$0.1243	$0.0949	5,907,025	4,632,989	1,173,844	5,907,025	4,632,989	1,173,844	5,907,025	4,632,989	1,173,844	5,907,025	4,632,989	1,173,844
2034	$0.1297	$0.0991	5,907,025	4,632,989	1,225,001	5,907,025	4,632,989	1,225,001	5,907,025	4,632,989	1,225,001	5,907,025	4,632,989	1,225,001
2035	$0.1353	$0.1034	5,907,025	4,632,989	1,278,388	5,907,025	4,632,989	1,278,388	5,907,025	4,632,989	1,278,388	5,907,025	4,632,989	1,278,388
2036	$0.1412	$0.1079	5,924,445	4,646,652	1,338,036	5,924,445	4,646,652	1,338,036	5,924,445	4,646,652	1,338,036	5,924,445	4,646,652	1,338,036
2037	$0.1474	$0.1126	5,907,025	4,632,989	1,392,243	5,907,025	4,632,989	1,392,243	5,907,025	4,632,989	1,392,243	5,907,025	4,632,989	1,392,243
2038	$0.1538	$0.1175	5,907,025	4,632,989	1,452,918	5,907,025	4,632,989	1,452,918	5,907,025	4,632,989	1,452,918	5,907,025	4,632,989	1,452,918
2039	$0.1605	$0.1226	5,907,025	4,632,989	1,516,237	5,907,025	4,632,989	1,516,237	5,907,025	4,632,989	1,516,237	5,907,025	4,632,989	1,516,237
2040	$0.1675	$0.1280	5,924,445	4,646,652	1,586,983	5,924,445	4,646,652	1,586,983	5,924,445	4,646,652	1,586,983	5,924,445	4,646,652	1,586,983
2041	$0.1748	$0.1335	5,907,025	4,632,989	1,651,275	5,907,025	4,632,989	1,651,275	5,907,025	4,632,989	1,651,275	5,907,025	4,632,989	1,651,275
2042	$0.1824	$0.1394	5,907,025	4,632,989	1,723,239	5,907,025	4,632,989	1,723,239	5,907,025	4,632,989	1,723,239	5,907,025	4,632,989	1,723,239
2043	$0.1904	$0.1454	5,907,025	4,632,989	1,798,339	5,907,025	4,632,989	1,798,339	5,907,025	4,632,989	1,798,339	5,907,025	4,632,989	1,798,339
2044	$0.1987	$0.1518	5,924,445	4,646,652	1,882,247	5,924,445	4,646,652	1,882,247	5,924,445	4,646,652	1,882,247	5,924,445	4,646,652	1,882,247
2045	$0.2073	$0.1584	5,907,025	4,632,989	1,958,501	5,907,025	4,632,989	1,958,501	5,907,025	4,632,989	1,958,501	5,907,025	4,632,989	1,958,501
2046	$0.2164	$0.1653	5,907,025	4,632,989	2,043,854	5,907,025	4,632,989	2,043,854	5,907,025	4,632,989	2,043,854	5,907,025	4,632,989	2,043,854
2047	$0.2258	$0.1725	5,907,025	4,632,989	2,132,927	5,907,025	4,632,989	2,132,927	5,907,025	4,632,989	2,132,927	5,907,025	4,632,989	2,132,927
2048	$0.2356	$0.1800	5,924,445	4,646,652	2,232,446	5,924,445	4,646,652	2,232,446	5,924,445	4,646,652	2,232,446	5,924,445	4,646,652	2,232,446
2049	$0.2459	$0.1879	5,907,025	4,632,989	2,322,888	5,907,025	4,632,989	2,322,888	5,907,025	4,632,989	2,322,888	5,907,025	4,632,989	2,322,888
2050	$0.2566	$0.1960	5,907,025	4,632,989	2,424,122	5,907,025	4,632,989	2,424,122	5,907,025	4,632,989	2,424,122	5,907,025	4,632,989	2,424,122
2051	$0.2678	$0.2046	5,907,025	4,632,989	2,529,767	5,907,025	4,632,989	2,529,767	5,907,025	4,632,989	2,529,767	5,907,025	4,632,989	2,529,767
2052	$0.2795	$0.2135	5,924,445	4,646,652	2,647,802	5,924,445	4,646,652	2,647,802	5,924,445	4,646,652	2,647,802	5,924,445	4,646,652	2,647,802
2053	$0.2917	$0.2228	5,907,025	4,632,989	2,755,071	5,907,025	4,632,989	2,755,071	5,907,025	4,632,989	2,755,071	5,907,025	4,632,989	2,755,071
2054	$0.3044	$0.2325	5,907,025	4,632,989	2,875,139	5,907,025	4,632,989	2,875,139	5,907,025	4,632,989	2,875,139	5,907,025	4,632,989	2,875,139
2055	$0.3176	$0.2427	5,907,025	4,632,989	3,000,440	5,907,025	4,632,989	3,000,440	5,907,025	4,632,989	3,000,440	5,907,025	4,632,989	3,000,440
2056	$0.3315	$0.2532	5,924,445	4,646,652	3,140,436	5,924,445	4,646,652	3,140,436	5,924,445	4,646,652	3,140,436	5,924,445	4,646,652	3,140,436
2057	$0.3459	$0.2643	5,907,025	4,632,989	3,267,663	5,907,025	4,632,989	3,267,663	5,907,025	4,632,989	3,267,663	5,907,025	4,632,989	3,267,663
2058	$0.3610	$0.2758	5,907,025	4,632,989	3,410,070	5,907,025	4,632,989	3,410,070	5,907,025	4,632,989	3,410,070	5,907,025	4,632,989	3,410,070
2059	$0.3767	$0.2878	5,907,025	4,632,989	3,558,684	5,907,025	4,632,989	3,558,684	5,907,025	4,632,989	3,558,684	5,907,025	4,632,989	3,558,684
2060	$0.3931	$0.3003	5,924,445	4,646,652	3,724,727	5,924,445	4,646,652	3,724,727	5,924,445	4,646,652	3,724,727	5,924,445	4,646,652	3,724,727
2061	$0.4103	$0.3134	5,907,025	4,632,989	3,875,624	5,907,025	4,632,989	3,875,624	5,907,025	4,632,989	3,875,624	5,907,025	4,632,989	3,875,624

Table 26
City of Bend
Hydroelectric NPV Analysis
Energy Estimate and Assumptions

Description	Value	Unit
Rated Power	1,580	kW
Annual Energy	9,808,000	kWhrs
Plant Factor	0.71	non-dim
Head		
Gross Head*	1009	feet
Headloss Coefficient	2.70E-01	ft/(cfs)^2
Net Head	812	feet
** Based on 30% Water Transmission Conduit Drawings*		
Turbine		
Type	Pelton	
Max Flow	21	cfs
Rated Head	812	feet
Peak Efficiency	89%	
Rated Power	1,580	kW
Generator/Transformer		
Generator Efficiency	95%	
Outage Factor	1.5%	
Transformer Losses	2%	
Constants:		
Density	*63*	*lb/ft^3*
Gravity	*32.174*	*ft/s^2*
*lb*ft^2/s^3 per watt*	*0.04214*	

Table 27
City of Bend
Hydroelectric NPV Analysis
Net Head (cfs)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2012	1009	1009	1009	1009	1009	1009	1009	1009	1009	1009	1009	1009
2013	1009	1009	1009	1009	1009	1009	1009	1009	1009	1009	1009	1009
2014	964	973	973	911	890	890	944	948	920	912	972	970
2015	960	969	969	911	890	890	944	948	920	912	969	967
2016	956	966	966	911	890	890	944	948	920	912	966	963
2017	952	963	963	911	890	890	944	948	920	912	962	960
2018	947	959	959	911	890	890	944	948	920	912	959	956
2019	943	955	955	911	890	890	944	948	920	912	955	952
2020	938	951	951	911	890	890	944	948	920	912	951	948
2021	933	947	947	911	890	890	944	948	920	912	947	944
2022	928	943	943	911	890	890	944	948	920	912	943	939
2023	923	939	939	911	890	890	944	948	920	912	938	935
2024	917	935	935	911	890	890	944	948	920	912	934	930
2025	912	930	930	911	890	890	944	948	920	912	929	925
2026	906	926	926	911	890	890	944	948	920	912	925	920
2027	900	921	921	911	890	890	944	948	920	912	920	915
2028	894	916	916	911	890	890	944	948	920	912	920	910
2029	890	911	911	911	890	890	944	948	920	912	920	905
2030	890	906	906	911	890	890	944	948	920	912	920	899
2031	890	900	902	911	890	890	944	948	920	912	920	894
2032	890	895	902	911	890	890	944	948	920	912	920	890
2033	890	890	902	911	890	890	944	948	920	912	920	890
2034	890	890	902	911	890	890	944	948	920	912	920	890
2035	890	890	902	911	890	890	944	948	920	912	920	890
2036	890	890	902	911	890	890	944	948	920	912	920	890
2037	890	890	902	911	890	890	944	948	920	912	920	890
2038	890	890	902	911	890	890	944	948	920	912	920	890
2039	890	890	902	911	890	890	944	948	920	912	920	890
2040	890	890	902	911	890	890	944	948	920	912	920	890
2041	890	890	902	911	890	890	944	948	920	912	920	890
2042	890	890	902	911	890	890	944	948	920	912	920	890
2043	890	890	902	911	890	890	944	948	920	912	920	890
2044	890	890	902	911	890	890	944	948	920	912	920	890
2045	890	890	902	911	890	890	944	948	920	912	920	890
2046	890	890	902	911	890	890	944	948	920	912	920	890
2047	890	890	902	911	890	890	944	948	920	912	920	890
2048	890	890	902	911	890	890	944	948	920	912	920	890
2049	890	890	902	911	890	890	944	948	920	912	920	890
2050	890	890	902	911	890	890	944	948	920	912	920	890
2051	890	890	902	911	890	890	944	948	920	912	920	890
2052	890	890	902	911	890	890	944	948	920	912	920	890
2053	890	890	902	911	890	890	944	948	920	912	920	890
2054	890	890	902	911	890	890	944	948	920	912	920	890
2055	890	890	902	911	890	890	944	948	920	912	920	890
2056	890	890	902	911	890	890	944	948	920	912	920	890
2057	890	890	902	911	890	890	944	948	920	912	920	890
2058	890	890	902	911	890	890	944	948	920	912	920	890
2059	890	890	902	911	890	890	944	948	920	912	920	890
2060	890	890	902	911	890	890	944	948	920	912	920	890
2061	890	890	902	911	890	890	944	948	920	912	920	890

Table 28
City of Bend
Hydroelectric NPV Analysis
Turbine Efficiency (non-dimensinal)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2015	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2016	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2017	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2018	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2019	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2020	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2021	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2022	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2023	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2024	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2025	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2026	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2027	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2028	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2029	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2030	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2031	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2032	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2033	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2034	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2035	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2036	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2037	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2038	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2039	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2040	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2041	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2042	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2043	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2044	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2045	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2046	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2047	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2048	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2049	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2050	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2051	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2052	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2053	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2054	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2055	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2056	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2057	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2058	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2059	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2060	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2061	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%

Table 29
City of Bend
Hydroelectric NPV Analysis
Expected Energy Potential (kWh)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Gross	Year Net
2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	665,000	545,500	603,800	857,100	865,300	837,400	601,200	666,400	699,000	886,700	587,200	620,500	8,435,100	8,142,402
2015	690,600	567,000	627,600	857,100	865,300	837,400	601,200	666,400	699,000	886,700	610,400	644,800	8,553,500	8,256,694
2016	716,000	609,300	651,200	857,100	865,300	837,400	601,200	666,400	699,000	886,700	633,200	668,900	8,691,700	8,390,098
2017	740,900	609,300	674,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	655,900	692,700	9,569,400	9,237,342
2018	765,500	630,100	697,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	678,200	716,100	9,683,500	9,347,483
2019	789,600	650,600	720,200	899,500	998,100	965,900	780,800	760,500	865,600	925,700	700,300	739,300	9,796,100	9,456,175
2020	813,400	694,800	742,600	899,500	998,100	965,900	780,800	760,500	865,600	925,700	722,000	762,100	9,931,000	9,586,394
2021	836,700	690,800	764,700	899,500	998,100	965,900	780,800	760,500	865,600	925,700	743,500	784,500	10,016,300	9,668,734
2022	859,600	710,500	786,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	764,600	806,700	10,124,000	9,772,697
2023	882,000	729,900	807,900	899,500	998,100	965,900	780,800	760,500	865,600	925,700	785,500	828,400	10,229,800	9,874,826
2024	903,900	775,700	829,000	899,500	998,100	965,900	780,800	760,500	865,600	925,700	805,900	849,800	10,360,400	10,000,894
2025	925,400	767,700	849,800	899,500	998,100	965,900	780,800	760,500	865,600	925,700	826,000	870,800	10,435,800	10,073,678
2026	946,400	786,100	870,200	899,500	998,100	965,900	780,800	760,500	865,600	925,700	845,800	891,300	10,535,900	10,170,304
2027	966,800	804,200	890,200	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,200	911,500	10,634,000	10,265,000
2028	986,700	851,200	909,800	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	931,300	10,740,700	10,367,998
2029	998,100	839,200	929,000	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	950,600	10,778,600	10,404,583
2030	998,100	856,200	947,800	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	969,400	10,833,200	10,457,288
2031	998,100	872,800	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	987,800	10,879,900	10,502,367
2032	998,100	920,800	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,938,200	10,558,644
2033	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2034	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2035	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2036	998,100	933,700	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,951,100	10,571,097
2037	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2038	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2039	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2040	998,100	933,700	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,951,100	10,571,097
2041	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2042	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2043	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2044	998,100	933,700	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,951,100	10,571,097
2045	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2046	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2047	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2048	998,100	933,700	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,951,100	10,571,097
2049	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2050	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2051	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2052	998,100	933,700	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,951,100	10,571,097
2053	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2054	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2055	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2056	998,100	933,700	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,951,100	10,571,097
2057	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2058	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2059	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2060	998,100	933,700	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,951,100	10,571,097
2061	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
Monthly Avg.	908,516	805,612	860,936	860,976	950,208	919,554	738,792	724,434	820,980	886,332	793,082	891,390		
Monthly Net (Avg.)	876,990	777,657	831,062	831,100	917,236	887,645	713,156	699,296	792,492	855,576	765,562	860,459	**Average Net=**	**9,808,000**
Days	31	28	31	30	31	30	31	31	30	31	30	31	365	
Days (Leap Yr)	31	29	31	30	31	30	31	31	30	31	30	31	366	

Table 30
City of Bend
Hydroelectric NPV Analysis
Raw Flow to Outback (cfs)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2012												
2013												
2014	12.9	11.6	11.6	19.1	21.0	21.0	15.5	15.0	18.2	19.0	11.7	12.0
2015	13.5	12.1	12.1	19.1	21.0	21.0	15.5	15.0	18.2	19.0	12.2	12.5
2016	14.0	12.6	12.6	19.1	21.0	21.0	15.5	15.0	18.2	19.0	12.7	13.0
2017	14.6	13.1	13.1	19.1	21.0	21.0	15.5	15.0	18.2	19.0	13.2	13.5
2018	15.1	13.6	13.6	19.1	21.0	21.0	15.5	15.0	18.2	19.0	13.7	14.0
2019	15.7	14.1	14.1	19.1	21.0	21.0	15.5	15.0	18.2	19.0	14.2	14.5
2020	16.2	14.6	14.6	19.1	21.0	21.0	15.5	15.0	18.2	19.0	14.7	15.0
2021	16.8	15.1	15.1	19.1	21.0	21.0	15.5	15.0	18.2	19.0	15.2	15.6
2022	17.3	15.6	15.6	19.1	21.0	21.0	15.5	15.0	18.2	19.0	15.7	16.1
2023	17.9	16.1	16.1	19.1	21.0	21.0	15.5	15.0	18.2	19.0	16.2	16.6
2024	18.4	16.6	16.6	19.1	21.0	21.0	15.5	15.0	18.2	19.0	16.7	17.1
2025	19.0	17.1	17.1	19.1	21.0	21.0	15.5	15.0	18.2	19.0	17.2	17.6
2026	19.5	17.6	17.6	19.1	21.0	21.0	15.5	15.0	18.2	19.0	17.7	18.1
2027	20.1	18.1	18.1	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	18.6
2028	20.7	18.6	18.6	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	19.1
2029	21.0	19.1	19.1	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	19.7
2030	21.0	19.6	19.6	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	20.2
2031	21.0	20.1	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	20.7
2032	21.0	20.6	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2033	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2034	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2035	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2036	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2037	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2038	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2039	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2040	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2041	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2042	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2043	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2044	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2045	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2046	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2047	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2048	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2049	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2050	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2051	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2052	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2053	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2054	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2055	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2056	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2057	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2058	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2059	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2060	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2061	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0

Table 31
City of Bend
Hydroelectric NPV Analysis
Headloss Estimate

Description	Value	Unit	Notes
Length of Conveyance	50,300	feet	*Based on 30% Water Transmission Conduit Drawings
Pipe Diameter	30	inches	
Maximum Flow Rate	21	cfs	
Maximum Velocity	4.3	ft/s	
Velocity Head	0.3	ft	
Headloss (max flow)	**119**	ft	
Headloss Coefficient	0.27	ft/(cfs)^2	
Frictional Headloss - Upper Section			
Length of Conveyance	15,000	feet	
Pipe Diameter	30	inches	
Maximum Velocity	4.3	ft/s	
Velocity Head	0.3	ft	
Pipe Material	Ductle Iron	non-dim	
Equivilent Roughness	0.00085	feet	*Cast Iron
Relative Roughness	0.00034	non-dim	
Reynolds Numer	5.08E+05	non-dim	
Friction Factor (Darcy)	0.017		*Moody Chart
Frictional Headloss	**29**	**feet**	
Frictional Headloss - Lower Section			
Length of Conveyance	35,300	feet	
Pipe Diameter	29	inches	
Maximum Velocity	4.6	ft/s	
Velocity Head	0.3	ft	
Pipe Material	Concrete-Lined Steel	non-dim	
Equivilent Roughness	0.001	feet	*Smooth Concrete
Relative Roughness	0.000413793	non-dim	
Reynolds Numer	5.26E+05	non-dim	
Friction Factor (Darcy)	0.018		*Moody Chart
Frictional Headloss	**86**	**feet**	
Constants:			
inches/ft	*12*		
Viscocity	*1.05E-05*	*ft^2/s*	*Water at 70 deg. F

Table 32
City of Bend
Hydroelectric NPV Analysis
Minor Losses

Conveynace Element	Minor Loss Coefficient (non-dim)	Unit Headloss (feet)	Quantity (non-dim)	Total Headloss (feet)
Intake and Fish Screen	1.00	0.28	1	0.28
Pipe Bends	0.25	0.07	36	2.56
Valves	0.50	0.14	8	1.14
Powerhouse	1.00	0.28	1	0.28
Total Minor Loss	**15.00**			**4.27**

Table 1
City of Bend
Hydroelectric NPV Analysis
Comparison of Cash Flows

	Net Present Value Analysis				Undiscounted Cash Flow Analysis			
Scenario	Net Present Value	Rank	Percent from Highest	Difference from Highest	Undiscounted Cash Flow	Undiscounted Rank	Percent from Highest	Difference from Highest
Hydro Now (2014)	$9,853,903	1	0.0%	$0	$68,177,748	1	0.0%	$0
Hydro Later (2018)	8,466,655	2	14.1%	(1,387,248)	65,889,064	2	3.4%	(2,288,684)

Table 2
City of Bend
Hydroelectric NPV Analysis
Summary of Cash Flows

		Hydro Now (2014)		Hydro Later (2018)	
Year	Discount Factor	Cash Flow	Discounted Cash Flow	Cash Flow	Discounted Cash Flow
2012	94.8%	($423,000)	($400,948)	$0	$0
2013	89.8%	(4,773,782)	(4,289,016)	0	0
2014	85.2%	451,869	384,818	0	0
2015	80.7%	466,917	376,904	0	0
2016	76.5%	484,962	371,061	(451,091)	(345,146)
2017	72.5%	552,885	400,978	(5,859,022)	(4,249,231)
2018	68.7%	574,548	394,965	574,548	394,965
2019	65.2%	567,995	370,105	567,995	370,105
2020	61.8%	577,372	356,602	577,372	356,602
2021	58.5%	619,695	362,789	619,695	362,789
2022	55.5%	666,689	369,953	666,689	369,953
2023	52.6%	631,920	332,378	631,920	332,378
2024	49.9%	614,706	306,468	614,706	306,468
2025	47.3%	656,572	310,276	656,572	310,276
2026	44.8%	678,432	303,892	678,432	303,892
2027	42.5%	687,811	292,032	687,811	292,032
2028	40.2%	727,310	292,704	727,310	292,704
2029	38.1%	768,787	293,266	768,787	293,266
2030	36.2%	811,044	293,257	811,044	293,257
2031	34.3%	853,704	292,589	853,704	292,589
2032	32.5%	900,773	292,627	900,773	292,627
2033	30.8%	946,039	291,310	946,039	291,310
2034	29.2%	995,958	290,693	995,958	290,693
2035	27.7%	1,048,567	290,093	1,048,567	290,093
2036	26.2%	1,106,760	290,230	1,106,760	290,230
2037	24.9%	1,162,456	288,943	1,162,456	288,943
2038	23.6%	1,224,026	288,386	1,224,026	288,386
2039	22.3%	1,288,888	287,837	1,288,888	287,837
2040	21.2%	1,360,781	288,049	1,360,781	288,049
2041	20.1%	1,429,228	286,766	1,429,228	286,766
2042	19.0%	1,505,075	286,241	1,505,075	286,241
2043	18.0%	1,584,975	285,722	1,584,975	285,722
2044	17.1%	1,673,666	285,981	1,673,666	285,981
2045	16.2%	1,757,708	284,684	1,757,708	284,684
2046	15.4%	1,850,979	284,162	1,850,979	284,162
2047	14.6%	1,949,171	283,636	1,949,171	283,636
2048	13.8%	2,058,045	283,866	2,058,045	283,866
2049	13.1%	2,157,253	282,038	2,157,253	282,038
2050	12.4%	2,266,252	280,842	2,266,252	280,842
2051	11.7%	2,378,028	279,331	2,378,028	279,331
2052	11.1%	2,501,954	278,566	2,501,954	278,566
2053	10.6%	2,611,769	275,633	2,611,769	275,633
2054	10.0%	2,731,027	273,193	2,731,027	273,193
2055	9.5%	2,851,148	270,341	2,851,148	270,341
2056	9.0%	2,985,918	268,360	2,985,918	268,360
2057	8.5%	3,107,737	264,747	3,107,737	264,747
2058	8.1%	3,244,547	261,992	3,244,547	261,992
2059	7.7%	3,387,368	259,265	3,387,368	259,265
2060	7.3%	3,547,414	257,360	3,547,414	257,360
2061	6.9%	3,692,106	253,893	3,692,106	253,893
Terminal Value	6.5%	675,691	44,043	1,456,973	94,968
Totals		$68,177,748		$65,889,064	
Net Present Value			$9,853,903		$8,466,655
Check					

Table 3
City of Bend
Hydroelectric NPV Analysis
Comparison of Cash Flows ($millions)

	Hydro Now (2014)		Hydro Later (2018)	
Description	Undiscounted Cash Flow	Net Present Value	Undiscounted Cash Flow	Net Present Value
Net Construction	($5.20)	($4.69)	($6.31)	($4.59)
O&M	(4.39)	(0.98)	(4.23)	(0.86)
Revenue	77.08	15.48	74.97	13.83
Terminal Value	0.68	0.04	1.46	0.09
Totals	$68.18	**$9.85**	$65.89	**$8.47**

Table 4
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - Capital Improvement Plan

Description	Line	2012	2013	2014	2015	2016	2017	2018	Totals
Turbine & Generator	1	$423,000	$987,000						$1,410,000
Intake Structure & Fish Screens	2		1,123,641						1,123,641
Fish Ladder	3		294,914						294,914
Concrete	4		1,184,114						1,184,114
Powerhouse (PH) Structure	5		1,184,114						1,184,114
Code Check & Design Update	6								0
PH Bid Ph. & Contractor Mobiliza	7								0
Total (w/o Inflation)		$423,000	$4,773,782	$0	$0	$0	$0	$0	$5,196,782
Expected Expenditure Rates		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
Expected Inflation Rate		0.0%	0.0%	2.0%	2.0%	2.5%	3.0%	3.5%	
Inflation Factor		1.000	1.000	1.020	1.040	1.066	1.098	1.137	
Expected CIP w/Inflation		$423,000	$4,773,782	$0	$0	$0	$0	$0	$5,196,782
Redundant PRV Avoided Cost		$410,349							

Table 5
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - CIP with Inflation

Description	Line	2012	2013	2014	2015	2016	2017	2018	Total
Turbine & Generator	1	$423,000	$987,000	$0	$0	$0	$0	$0	$1,410,000
Intake Structure & Fish Screens	2	0	1,123,641	0	0	0	0	0	1,123,641
Fish Ladder	3	0	294,914	0	0	0	0	0	294,914
Concrete	4	0	1,184,114	0	0	0	0	0	1,184,114
Powerhouse (PH) Structure	5	0	1,184,114	0	0	0	0	0	1,184,114
Code Check & Design Update	6	0	0	0	0	0	0	0	0
PH Bid Ph. & Contractor Mobiliz	7	0	0	0	0	0	0	0	0
Total (w/ Inflation)		$423,000	$4,773,782	$0	$0	$0	$0	$0	$5,196,782

Check

Table 6
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - Funding Sources for Improvements

Description	2012	2013	2014	2015	2016	2017	2018	Total
New Debt / City Funded	$423,000	$4,773,782	$0	$0	$0	$0	$0	$5,196,782
External Funding	0	0	0	0	0	0	0	0
Total	$423,000	$4,773,782	$0	$0	$0	$0	$0	$5,196,782
Check	OK	OK	OK	OK	OK	OK	OK	OK

Table 7
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - Useful Life Estimates

Item	Life (years)
Turbine & Generator	50
Intake Structure & Fish Screens	50
Fish Ladder	50
Concrete	100
Powerhouse (PH) Structure	50
Code Check & Design Update	NA
PH Bid Ph. & Contractor Mobilization	NA

Table 8
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - Capital Timing Lookup Table

Item	Total Initial CIP	Total Initial Net CIP	Initial CIP Year	CIP Year Completion
Turbine & Generator	$1,410,000	$1,410,000	Multiple	2013
Intake Structure & Fish Screens	1,123,641	1,123,641	2013	2013
Fish Ladder	294,914	294,914	2013	2013
Concrete	1,184,114	1,184,114	2013	2013
Powerhouse (PH) Structure	1,184,114	1,184,114	2013	2013
Code Check & Design Update	0	0	2012	2012
PH Bid Ph. & Contractor Mobiliza	0	0	2012	2012

Table 9
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - Capital Cost Projections

	Capital							
Year	Turbine & Generator	Intake Structure & Fish Screens	Fish Ladder	Concrete	Powerhouse (PH) Structure	Code Check & Design Update	PH Bid Ph. & Contractor Mobilization	Total Capital
2012	$423,000	$0	$0	$0	$0	$0	$0	$423,000
2013	987,000	1,123,641	294,914	1,184,114	1,184,114	0	0	4,773,782
2014	0	0	0	0	0	0	0	0
2015	0	0	0	0	0	0	0	0
2016	0	0	0	0	0	0	0	0
2017	0	0	0	0	0	0	0	0
2018	0	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0
2041	0	0	0	0	0	0	0	0
2042	0	0	0	0	0	0	0	0
2043	0	0	0	0	0	0	0	0
2044	0	0	0	0	0	0	0	0
2045	0	0	0	0	0	0	0	0
2046	0	0	0	0	0	0	0	0
2047	0	0	0	0	0	0	0	0
2048	0	0	0	0	0	0	0	0
2049	0	0	0	0	0	0	0	0
2050	0	0	0	0	0	0	0	0
2051	0	0	0	0	0	0	0	0
2052	0	0	0	0	0	0	0	0
2053	0	0	0	0	0	0	0	0
2054	0	0	0	0	0	0	0	0
2055	0	0	0	0	0	0	0	0
2056	0	0	0	0	0	0	0	0
2057	0	0	0	0	0	0	0	0
2058	0	0	0	0	0	0	0	0
2059	0	0	0	0	0	0	0	0
2060	0	0	0	0	0	0	0	0
2061	0	0	0	0	0	0	0	0
Terminal Value	(19,740)	(22,473)	(5,898)	(603,898)	(23,682)	0	0	(675,691)

Table 10
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - O&M and Cost Projections

	Costs					
Year	Annual O&M	Annual O&M Escalation Rate	O&M Escalation Factor	R&R	Third-Party Costs	Total Costs
2012	$0	3.50%	0.966			$0
2013	0	3.50%	1.000			0
2014	36,432	3.50%	1.035			36,432
2015	37,707	3.50%	1.071			37,707
2016	39,027	3.50%	1.109			39,027
2017	40,393	3.50%	1.148			40,393
2018	41,807	3.50%	1.188			41,807
2019	43,270	3.50%	1.229			43,270
2020	44,784	3.50%	1.272			44,784
2021	46,352	3.50%	1.317			46,352
2022	47,974	3.50%	1.363			47,974
2023	49,653	3.50%	1.411			49,653
2024	51,391	3.50%	1.460			51,391
2025	53,190	3.50%	1.511			53,190
2026	55,051	3.50%	1.564			55,051
2027	56,978	3.50%	1.619			56,978
2028	58,972	3.50%	1.675			58,972
2029	61,036	3.50%	1.734			61,036
2030	63,173	3.50%	1.795			63,173
2031	65,384	3.50%	1.857			65,384
2032	67,672	3.50%	1.923			67,672
2033	70,041	3.50%	1.990			70,041
2034	72,492	3.50%	2.059			72,492
2035	75,029	3.50%	2.132			75,029
2036	77,655	3.50%	2.206			77,655
2037	80,373	3.50%	2.283			80,373
2038	83,186	3.50%	2.363			83,186
2039	86,098	3.50%	2.446			86,098
2040	89,111	3.50%	2.532			89,111
2041	92,230	3.50%	2.620			92,230
2042	95,458	3.50%	2.712			95,458
2043	98,799	3.50%	2.807			98,799
2044	102,257	3.50%	2.905			102,257
2045	105,836	3.50%	3.007			105,836
2046	109,540	3.50%	3.112			109,540
2047	113,374	3.50%	3.221			113,374
2048	117,342	3.50%	3.334			117,342
2049	121,449	3.50%	3.450			121,449
2050	125,700	3.50%	3.571			125,700
2051	130,100	3.50%	3.696			130,100
2052	134,653	3.50%	3.825			134,653
2053	139,366	3.50%	3.959			139,366
2054	144,244	3.50%	4.098			144,244
2055	149,292	3.50%	4.241			149,292
2056	154,518	3.50%	4.390			154,518
2057	159,926	3.50%	4.543			159,926
2058	165,523	3.50%	4.702			165,523
2059	171,316	3.50%	4.867			171,316
2060	177,312	3.50%	5.037			177,312
2061	183,518	3.50%	5.214			183,518

* O&M Start Year 2014

Table 11
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - Revenue Projections

	Revenue					
Year	Power Sales	Third Party Share	City Power Sales Rev.	Third-Party Agreement	Green Tags & Other	Total Revenue
2012	$0	0.0%	$0		$0	$0
2013	0	0.0%	0		0	0
2014	488,301	0.0%	488,301		0	488,301
2015	504,625	0.0%	504,625		0	504,625
2016	523,989	0.0%	523,989		0	523,989
2017	593,278	0.0%	593,278		0	593,278
2018	616,355	0.0%	616,355		0	616,355
2019	611,265	0.0%	611,265		0	611,265
2020	622,157	0.0%	622,157		0	622,157
2021	666,047	0.0%	666,047		0	666,047
2022	714,663	0.0%	714,663		0	714,663
2023	681,573	0.0%	681,573		0	681,573
2024	666,097	0.0%	666,097		0	666,097
2025	709,762	0.0%	709,762		0	709,762
2026	733,483	0.0%	733,483		0	733,483
2027	744,789	0.0%	744,789		0	744,789
2028	786,283	0.0%	786,283		0	786,283
2029	829,823	0.0%	829,823		0	829,823
2030	874,217	0.0%	874,217		0	874,217
2031	919,088	0.0%	919,088		0	919,088
2032	968,445	0.0%	968,445		0	968,445
2033	1,016,080	0.0%	1,016,080		0	1,016,080
2034	1,068,450	0.0%	1,068,450		0	1,068,450
2035	1,123,596	0.0%	1,123,596		0	1,123,596
2036	1,184,415	0.0%	1,184,415		0	1,184,415
2037	1,242,829	0.0%	1,242,829		0	1,242,829
2038	1,307,212	0.0%	1,307,212		0	1,307,212
2039	1,374,985	0.0%	1,374,985		0	1,374,985
2040	1,449,893	0.0%	1,449,893		0	1,449,893
2041	1,521,458	0.0%	1,521,458		0	1,521,458
2042	1,600,533	0.0%	1,600,533		0	1,600,533
2043	1,683,774	0.0%	1,683,774		0	1,683,774
2044	1,775,924	0.0%	1,775,924		0	1,775,924
2045	1,863,544	0.0%	1,863,544		0	1,863,544
2046	1,960,520	0.0%	1,960,520		0	1,960,520
2047	2,062,545	0.0%	2,062,545		0	2,062,545
2048	2,175,387	0.0%	2,175,387		0	2,175,387
2049	2,278,702	0.0%	2,278,702		0	2,278,702
2050	2,391,952	0.0%	2,391,952		0	2,391,952
2051	2,508,127	0.0%	2,508,127		0	2,508,127
2052	2,636,607	0.0%	2,636,607		0	2,636,607
2053	2,751,135	0.0%	2,751,135		0	2,751,135
2054	2,875,271	0.0%	2,875,271		0	2,875,271
2055	3,000,440	0.0%	3,000,440		0	3,000,440
2056	3,140,436	0.0%	3,140,436		0	3,140,436
2057	3,267,663	0.0%	3,267,663		0	3,267,663
2058	3,410,070	0.0%	3,410,070		0	3,410,070
2059	3,558,684	0.0%	3,558,684		0	3,558,684
2060	3,724,727	0.0%	3,724,727		0	3,724,727
2061	3,875,624	0.0%	3,875,624		0	3,875,624

Third-Party Term (years): 0

Table 12 66,223,204
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - Depreciation Analysis

	Depreciation Rates							Depreciable Assets						
Year	Turbine & Generator	Intake Structure & Fish Screens	Fish Ladder	Concrete	Powerhouse (PH) Structure	Code Check & Design Update	PH Bid Ph. & Contractor Mobilization	Turbine & Generator	Intake Structure & Fish Screens	Fish Ladder	Concrete	Powerhouse (PH) Structure	Code Check & Design Update	PH Bid Ph. & Contractor Mobilization
2012	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	$423,000	$0	$0	$0	$0	$0	$0
2013	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2014	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2015	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2016	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2017	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2018	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2019	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2020	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2021	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2022	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2023	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2024	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2025	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2026	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2027	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2028	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2029	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2030	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2031	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2032	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2033	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2034	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2035	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2036	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2037	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2038	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2039	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2040	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2041	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2042	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2043	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2044	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2045	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2046	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2047	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2048	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2049	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2050	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2051	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2052	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2053	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2054	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2055	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2056	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2057	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2058	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2059	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2060	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0
2061	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,410,000	1,123,641	294,914	1,184,114	1,184,114	0	0

Table 13
City of Bend
Hydroelectric NPV Analysis
Hydro Now (2014) - Summary of Cash Flows

Year	Discount Factor	Capital	Discounted Capital	O&M	Discounted O&M	Revenue	Discounted Revenue	Terminal Value	Discounted Terminal Value	Total	Discounted Total
2012	94.8%	($423,000)	($400,948)	$0	$0	$0	$0	$0	$0	($423,000)	($400,948)
2013	89.8%	(4,773,782)	(4,289,016)	0	0	0	0	0	0	(4,773,782)	(4,289,016)
2014	85.2%	0	0	(36,432)	(31,026)	488,301	415,844	0	0	451,869	384,818
2015	80.7%	0	0	(37,707)	(30,438)	504,625	407,341	0	0	466,917	376,904
2016	76.5%	0	0	(39,027)	(29,861)	523,989	400,922	0	0	484,962	371,061
2017	72.5%	0	0	(40,393)	(29,295)	593,278	430,272	0	0	552,885	400,978
2018	68.7%	0	0	(41,807)	(28,739)	616,355	423,705	0	0	574,548	394,965
2019	65.2%	0	0	(43,270)	(28,195)	611,265	398,300	0	0	567,995	370,105
2020	61.8%	0	0	(44,784)	(27,660)	622,157	384,262	0	0	577,372	356,602
2021	58.5%	0	0	(46,352)	(27,136)	666,047	389,924	0	0	619,695	362,789
2022	55.5%	0	0	(47,974)	(26,621)	714,663	396,574	0	0	666,689	369,953
2023	52.6%	0	0	(49,653)	(26,117)	681,573	358,495	0	0	631,920	332,378
2024	49.9%	0	0	(51,391)	(25,621)	666,097	332,090	0	0	614,706	306,468
2025	47.3%	0	0	(53,190)	(25,136)	709,762	335,412	0	0	656,572	310,276
2026	44.8%	0	0	(55,051)	(24,659)	733,483	328,551	0	0	678,432	303,892
2027	42.5%	0	0	(56,978)	(24,192)	744,789	316,223	0	0	687,811	292,032
2028	40.2%	0	0	(58,972)	(23,733)	786,283	316,437	0	0	727,310	292,704
2029	38.1%	0	0	(61,036)	(23,283)	829,823	316,549	0	0	768,787	293,266
2030	36.2%	0	0	(63,173)	(22,842)	874,217	316,099	0	0	811,044	293,257
2031	34.3%	0	0	(65,384)	(22,409)	919,088	314,998	0	0	853,704	292,589
2032	32.5%	0	0	(67,672)	(21,984)	968,445	314,611	0	0	900,773	292,627
2033	30.8%	0	0	(70,041)	(21,567)	1,016,080	312,877	0	0	946,039	291,310
2034	29.2%	0	0	(72,492)	(21,158)	1,068,450	311,851	0	0	995,958	290,693
2035	27.7%	0	0	(75,029)	(20,757)	1,123,596	310,850	0	0	1,048,567	290,093
2036	26.2%	0	0	(77,655)	(20,364)	1,184,415	310,594	0	0	1,106,760	290,230
2037	24.9%	0	0	(80,373)	(19,978)	1,242,829	308,921	0	0	1,162,456	288,943
2038	23.6%	0	0	(83,186)	(19,599)	1,307,212	307,985	0	0	1,224,026	288,386
2039	22.3%	0	0	(86,098)	(19,228)	1,374,985	307,064	0	0	1,288,888	287,837
2040	21.2%	0	0	(89,111)	(18,863)	1,449,893	306,912	0	0	1,360,781	288,049
2041	20.1%	0	0	(92,230)	(18,505)	1,521,458	305,272	0	0	1,429,228	286,766
2042	19.0%	0	0	(95,458)	(18,155)	1,600,533	304,396	0	0	1,505,075	286,241
2043	18.0%	0	0	(98,799)	(17,810)	1,683,774	303,532	0	0	1,584,975	285,722
2044	17.1%	0	0	(102,257)	(17,473)	1,775,924	303,454	0	0	1,673,666	285,981
2045	16.2%	0	0	(105,836)	(17,142)	1,863,544	301,826	0	0	1,757,708	284,684
2046	15.4%	0	0	(109,540)	(16,817)	1,960,520	300,978	0	0	1,850,979	284,162
2047	14.6%	0	0	(113,374)	(16,498)	2,062,545	300,134	0	0	1,949,171	283,636
2048	13.8%	0	0	(117,342)	(16,185)	2,175,387	300,051	0	0	2,058,045	283,866
2049	13.1%	0	0	(121,449)	(15,878)	2,278,702	297,916	0	0	2,157,253	282,038
2050	12.4%	0	0	(125,700)	(15,577)	2,391,952	296,419	0	0	2,266,252	280,842
2051	11.7%	0	0	(130,100)	(15,282)	2,508,127	294,613	0	0	2,378,028	279,331
2052	11.1%	0	0	(134,653)	(14,992)	2,636,607	293,558	0	0	2,501,954	278,566
2053	10.6%	0	0	(139,366)	(14,708)	2,751,135	290,341	0	0	2,611,769	275,633
2054	10.0%	0	0	(144,244)	(14,429)	2,875,271	287,623	0	0	2,731,027	273,193
2055	9.5%	0	0	(149,292)	(14,156)	3,000,440	284,496	0	0	2,851,148	270,341
2056	9.0%	0	0	(154,518)	(13,887)	3,140,436	282,247	0	0	2,985,918	268,360
2057	8.5%	0	0	(159,926)	(13,624)	3,267,663	278,371	0	0	3,107,737	264,747
2058	8.1%	0	0	(165,523)	(13,366)	3,410,070	275,358	0	0	3,244,547	261,992
2059	7.7%	0	0	(171,316)	(13,112)	3,558,684	272,378	0	0	3,387,368	259,265
2060	7.3%	0	0	(177,312)	(12,864)	3,724,727	270,224	0	0	3,547,414	257,360
2061	6.9%	0	0	(183,518)	(12,620)	3,875,624	266,513	0	0	3,692,106	253,893
Terminal Value	6.5%							675,691	44,043	675,691	44,043
Totals		($5,196,782)		($4,385,985)		$77,084,824		$675,691		$68,177,748	
Net Present Value			($4,689,964)		($983,540)		$15,483,364		$44,043		$9,853,903
Check											

Table 14
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - Capital Improvement Plan

Description	Line	2012	2013	2014	2015	2016	2017	2018	Totals
Turbine & Generator	1					$423,000	$987,000		$1,410,000
Intake Structure & Fish Screens	2						1,123,641		1,123,641
Fish Ladder	3						294,914		294,914
Concrete	4						1,389,288		1,389,288
Powerhouse (PH) Structure	5						1,389,288		1,389,288
Code Check & Design Update	6						50,000		50,000
PH Bid Ph. & Contractor Mobiliz	7						100,000		100,000
Total (w/o Inflation)		$0	$0	$0	$0	$423,000	$5,334,131	$0	$5,757,131
Expected Expenditure Rates		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
Expected Inflation Rate		0.0%	0.0%	2.0%	2.0%	2.5%	3.0%	3.5%	
Inflation Factor		1.000	1.000	1.020	1.040	1.066	1.098	1.137	
Expected CIP w/Inflation		$0	$0	$0	$0	$451,091	$5,859,022	$0	$6,310,113
Redundant PRV Avoided Cost		$0							

Table 15
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - CIP with Inflation

Description	Line	2012	2013	2014	2015	2016	2017	2018	Total
Turbine & Generator	1	$0	$0	$0	$0	$451,091	$1,084,123	$0	$1,535,215
Intake Structure & Fish Screens	2	0	0	0	0	0	1,234,210	0	1,234,210
Fish Ladder	3	0	0	0	0	0	323,934	0	323,934
Concrete	4	0	0	0	0	0	1,525,997	0	1,525,997
Powerhouse (PH) Structure	5	0	0	0	0	0	1,525,997	0	1,525,997
Code Check & Design Update	6	0	0	0	0	0	54,920	0	54,920
PH Bid Ph. & Contractor Mobiliz	7	0	0	0	0	0	109,840	0	109,840
Total (w/ Inflation)		$0	$0	$0	$0	$451,091	$5,859,022	$0	$6,310,113

Check

Table 16
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - Funding Sources for Improvements

Description	2012	2013	2014	2015	2016	2017	2018	Total
New Debt / City Funded	$0	$0	$0	$0	$451,091	$5,859,022	$0	$6,310,113
External Funding	0	0	0	0	0	0	0	0
Total	$0	$0	$0	$0	$451,091	$5,859,022	$0	$6,310,113
Check	OK	OK	OK	OK	OK	OK	OK	OK

Table 17
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - Useful Life Estimates

Item	Life (years)
Turbine & Generator	50
Intake Structure & Fish Screens	50
Fish Ladder	50
Concrete	100
Powerhouse (PH) Structure	50
Code Check & Design Update	NA
PH Bid Ph. & Contractor Mobilization	NA

Table 18
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - Capital Timing Lookup Table

Item	Total Initial CIP	Total Initial Net CIP	Initial CIP Year	CIP Year Completion
Turbine & Generator	$1,535,215	$1,535,215	Multiple	2017
Intake Structure & Fish Screens	1,234,210	1,234,210	2017	2017
Fish Ladder	323,934	323,934	2017	2017
Concrete	1,525,997	1,525,997	2017	2017
Powerhouse (PH) Structure	1,525,997	1,525,997	2017	2017
Code Check & Design Update	54,920	54,920	2017	2017
PH Bid Ph. & Contractor Mobiliza	109,840	109,840	2017	2017

Table 19
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - Capital Cost Projections

	Capital							
Year	Turbine & Generator	Intake Structure & Fish Screens	Fish Ladder	Concrete	Powerhouse (PH) Structure	Code Check & Design Update	PH Bid Ph. & Contractor Mobilization	Total Capital
2012	$0	$0	$0	$0	$0	$0	$0	$0
2013	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0
2015	0	0	0	0	0	0	0	0
2016	451,091	0	0	0	0	0	0	451,091
2017	1,084,123	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840	5,859,022
2018	0	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0
2041	0	0	0	0	0	0	0	0
2042	0	0	0	0	0	0	0	0
2043	0	0	0	0	0	0	0	0
2044	0	0	0	0	0	0	0	0
2045	0	0	0	0	0	0	0	0
2046	0	0	0	0	0	0	0	0
2047	0	0	0	0	0	0	0	0
2048	0	0	0	0	0	0	0	0
2049	0	0	0	0	0	0	0	0
2050	0	0	0	0	0	0	0	0
2051	0	0	0	0	0	0	0	0
2052	0	0	0	0	0	0	0	0
2053	0	0	0	0	0	0	0	0
2054	0	0	0	0	0	0	0	0
2055	0	0	0	0	0	0	0	0
2056	0	0	0	0	0	0	0	0
2057	0	0	0	0	0	0	0	0
2058	0	0	0	0	0	0	0	0
2059	0	0	0	0	0	0	0	0
2060	0	0	0	0	0	0	0	0
2061	0	0	0	0	0	0	0	0
Terminal Value	(144,500)	(123,421)	(32,393)	(839,298)	(152,600)	(54,920)	(109,840)	(1,456,973)

Table 20
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - O&M and Cost Projections

	Costs					
Year	Annual O&M	Annual O&M Escalation Rate	O&M Escalation Factor	R&R	Third-Party Costs	Total Costs
2012	$0	3.50%	0.966			$0
2013	0	3.50%	1.000			0
2014	0	3.50%	1.035			0
2015	0	3.50%	1.071			0
2016	0	3.50%	1.109			0
2017	0	3.50%	1.148			0
2018	41,807	3.50%	1.188			41,807
2019	43,270	3.50%	1.229			43,270
2020	44,784	3.50%	1.272			44,784
2021	46,352	3.50%	1.317			46,352
2022	47,974	3.50%	1.363			47,974
2023	49,653	3.50%	1.411			49,653
2024	51,391	3.50%	1.460			51,391
2025	53,190	3.50%	1.511			53,190
2026	55,051	3.50%	1.564			55,051
2027	56,978	3.50%	1.619			56,978
2028	58,972	3.50%	1.675			58,972
2029	61,036	3.50%	1.734			61,036
2030	63,173	3.50%	1.795			63,173
2031	65,384	3.50%	1.857			65,384
2032	67,672	3.50%	1.923			67,672
2033	70,041	3.50%	1.990			70,041
2034	72,492	3.50%	2.059			72,492
2035	75,029	3.50%	2.132			75,029
2036	77,655	3.50%	2.206			77,655
2037	80,373	3.50%	2.283			80,373
2038	83,186	3.50%	2.363			83,186
2039	86,098	3.50%	2.446			86,098
2040	89,111	3.50%	2.532			89,111
2041	92,230	3.50%	2.620			92,230
2042	95,458	3.50%	2.712			95,458
2043	98,799	3.50%	2.807			98,799
2044	102,257	3.50%	2.905			102,257
2045	105,836	3.50%	3.007			105,836
2046	109,540	3.50%	3.112			109,540
2047	113,374	3.50%	3.221			113,374
2048	117,342	3.50%	3.334			117,342
2049	121,449	3.50%	3.450			121,449
2050	125,700	3.50%	3.571			125,700
2051	130,100	3.50%	3.696			130,100
2052	134,653	3.50%	3.825			134,653
2053	139,366	3.50%	3.959			139,366
2054	144,244	3.50%	4.098			144,244
2055	149,292	3.50%	4.241			149,292
2056	154,518	3.50%	4.390			154,518
2057	159,926	3.50%	4.543			159,926
2058	165,523	3.50%	4.702			165,523
2059	171,316	3.50%	4.867			171,316
2060	177,312	3.50%	5.037			177,312
2061	183,518	3.50%	5.214			183,518
* O&M Start Year	2018					

Table 21
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - Revenue Projections

	Revenue					
Year	Power Sales	Third Party Share	City Power Sales Rev.	Third-Party Agreement	Green Tags & Other	Total Revenue
2012	$0	0.0%	$0		$0	$0
2013	0	0.0%	0		0	0
2014	0	0.0%	0		0	0
2015	0	0.0%	0		0	0
2016	0	0.0%	0		0	0
2017	0	0.0%	0		0	0
2018	616,355	0.0%	616,355		0	616,355
2019	611,265	0.0%	611,265		0	611,265
2020	622,157	0.0%	622,157		0	622,157
2021	666,047	0.0%	666,047		0	666,047
2022	714,663	0.0%	714,663		0	714,663
2023	681,573	0.0%	681,573		0	681,573
2024	666,097	0.0%	666,097		0	666,097
2025	709,762	0.0%	709,762		0	709,762
2026	733,483	0.0%	733,483		0	733,483
2027	744,789	0.0%	744,789		0	744,789
2028	786,283	0.0%	786,283		0	786,283
2029	829,823	0.0%	829,823		0	829,823
2030	874,217	0.0%	874,217		0	874,217
2031	919,088	0.0%	919,088		0	919,088
2032	968,445	0.0%	968,445		0	968,445
2033	1,016,080	0.0%	1,016,080		0	1,016,080
2034	1,068,450	0.0%	1,068,450		0	1,068,450
2035	1,123,596	0.0%	1,123,596		0	1,123,596
2036	1,184,415	0.0%	1,184,415		0	1,184,415
2037	1,242,829	0.0%	1,242,829		0	1,242,829
2038	1,307,212	0.0%	1,307,212		0	1,307,212
2039	1,374,985	0.0%	1,374,985		0	1,374,985
2040	1,449,893	0.0%	1,449,893		0	1,449,893
2041	1,521,458	0.0%	1,521,458		0	1,521,458
2042	1,600,533	0.0%	1,600,533		0	1,600,533
2043	1,683,774	0.0%	1,683,774		0	1,683,774
2044	1,775,924	0.0%	1,775,924		0	1,775,924
2045	1,863,544	0.0%	1,863,544		0	1,863,544
2046	1,960,520	0.0%	1,960,520		0	1,960,520
2047	2,062,545	0.0%	2,062,545		0	2,062,545
2048	2,175,387	0.0%	2,175,387		0	2,175,387
2049	2,278,702	0.0%	2,278,702		0	2,278,702
2050	2,391,952	0.0%	2,391,952		0	2,391,952
2051	2,508,127	0.0%	2,508,127		0	2,508,127
2052	2,636,607	0.0%	2,636,607		0	2,636,607
2053	2,751,135	0.0%	2,751,135		0	2,751,135
2054	2,875,271	0.0%	2,875,271		0	2,875,271
2055	3,000,440	0.0%	3,000,440		0	3,000,440
2056	3,140,436	0.0%	3,140,436		0	3,140,436
2057	3,267,663	0.0%	3,267,663		0	3,267,663
2058	3,410,070	0.0%	3,410,070		0	3,410,070
2059	3,558,684	0.0%	3,558,684		0	3,558,684
2060	3,724,727	0.0%	3,724,727		0	3,724,727
2061	3,875,624	0.0%	3,875,624		0	3,875,624

Third-Party Term (years): 0

Table 22
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - Depreciation Analysis

	Depreciation Rates							Depreciable Assets						
Year	Turbine & Generator	Intake Structure & Fish Screens	Fish Ladder	Concrete	Powerhouse (PH) Structure	Code Check & Design Update	PH Bid Ph. & Contractor Mobilization	Turbine & Generator	Intake Structure & Fish Screens	Fish Ladder	Concrete	Powerhouse (PH) Structure	Code Check & Design Update	PH Bid Ph. & Contractor Mobilization
2012	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	$0	$0	$0	$0	$0	$0	$0
2013	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	0	0	0	0	0	0	0
2014	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	0	0	0	0	0	0	0
2015	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	0	0	0	0	0	0	0
2016	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	451,091	0	0	0	0	0	0
2017	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2018	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2019	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2020	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2021	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2022	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2023	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2024	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2025	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2026	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2027	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2028	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2029	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2030	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2031	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2032	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2033	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2034	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2035	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2036	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2037	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2038	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2039	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2040	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2041	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2042	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2043	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2044	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2045	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2046	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2047	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2048	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2049	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2050	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2051	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2052	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2053	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2054	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2055	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2056	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2057	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2058	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2059	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2060	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840
2061	2.00%	2.00%	2.00%	1.00%	2.00%	0.00%	0.00%	1,535,215	1,234,210	323,934	1,525,997	1,525,997	54,920	109,840

Table 23
City of Bend
Hydroelectric NPV Analysis
Hydro Later (2018) - Summary of Cash Flows

Year	Discount Factor	Capital	Discounted Capital	O&M	Discounted O&M	Revenue	Discounted Revenue	Terminal Value	Discounted Terminal Value	Total	Discounted Total
2012	94.8%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2013	89.8%	0	0	0	0	0	0	0	0	0	0
2014	85.2%	0	0	0	0	0	0	0	0	0	0
2015	80.7%	0	0	0	0	0	0	0	0	0	0
2016	76.5%	(451,091)	(345,146)	0	0	0	0	0	0	(451,091)	(345,146)
2017	72.5%	(5,859,022)	(4,249,231)	0	0	0	0	0	0	(5,859,022)	(4,249,231)
2018	68.7%	0	0	(41,807)	(28,739)	616,355	423,705	0	0	574,548	394,965
2019	65.2%	0	0	(43,270)	(28,195)	611,265	398,300	0	0	567,995	370,105
2020	61.8%	0	0	(44,784)	(27,660)	622,157	384,262	0	0	577,372	356,602
2021	58.5%	0	0	(46,352)	(27,136)	666,047	389,924	0	0	619,695	362,789
2022	55.5%	0	0	(47,974)	(26,621)	714,663	396,574	0	0	666,689	369,953
2023	52.6%	0	0	(49,653)	(26,117)	681,573	358,495	0	0	631,920	332,378
2024	49.9%	0	0	(51,391)	(25,621)	666,097	332,090	0	0	614,706	306,468
2025	47.3%	0	0	(53,190)	(25,136)	709,762	335,412	0	0	656,572	310,276
2026	44.8%	0	0	(55,051)	(24,659)	733,483	328,551	0	0	678,432	303,892
2027	42.5%	0	0	(56,978)	(24,192)	744,789	316,223	0	0	687,811	292,032
2028	40.2%	0	0	(58,972)	(23,733)	786,283	316,437	0	0	727,310	292,704
2029	38.1%	0	0	(61,036)	(23,283)	829,823	316,549	0	0	768,787	293,266
2030	36.2%	0	0	(63,173)	(22,842)	874,217	316,099	0	0	811,044	293,257
2031	34.3%	0	0	(65,384)	(22,409)	919,088	314,998	0	0	853,704	292,589
2032	32.5%	0	0	(67,672)	(21,984)	968,445	314,611	0	0	900,773	292,627
2033	30.8%	0	0	(70,041)	(21,567)	1,016,080	312,877	0	0	946,039	291,310
2034	29.2%	0	0	(72,492)	(21,158)	1,068,450	311,851	0	0	995,958	290,693
2035	27.7%	0	0	(75,029)	(20,757)	1,123,596	310,850	0	0	1,048,567	290,093
2036	26.2%	0	0	(77,655)	(20,364)	1,184,415	310,594	0	0	1,106,760	290,230
2037	24.9%	0	0	(80,373)	(19,978)	1,242,829	308,921	0	0	1,162,456	288,943
2038	23.6%	0	0	(83,186)	(19,599)	1,307,212	307,985	0	0	1,224,026	288,386
2039	22.3%	0	0	(86,098)	(19,228)	1,374,985	307,064	0	0	1,288,888	287,837
2040	21.2%	0	0	(89,111)	(18,863)	1,449,893	306,912	0	0	1,360,781	288,049
2041	20.1%	0	0	(92,230)	(18,505)	1,521,458	305,272	0	0	1,429,228	286,766
2042	19.0%	0	0	(95,458)	(18,155)	1,600,533	304,396	0	0	1,505,075	286,241
2043	18.0%	0	0	(98,799)	(17,810)	1,683,774	303,532	0	0	1,584,975	285,722
2044	17.1%	0	0	(102,257)	(17,473)	1,775,924	303,454	0	0	1,673,666	285,981
2045	16.2%	0	0	(105,836)	(17,142)	1,863,544	301,826	0	0	1,757,708	284,684
2046	15.4%	0	0	(109,540)	(16,817)	1,960,520	300,978	0	0	1,850,979	284,162
2047	14.6%	0	0	(113,374)	(16,498)	2,062,545	300,134	0	0	1,949,171	283,636
2048	13.8%	0	0	(117,342)	(16,185)	2,175,387	300,051	0	0	2,058,045	283,866
2049	13.1%	0	0	(121,449)	(15,878)	2,278,702	297,916	0	0	2,157,253	282,038
2050	12.4%	0	0	(125,700)	(15,577)	2,391,952	296,419	0	0	2,266,252	280,842
2051	11.7%	0	0	(130,100)	(15,282)	2,508,127	294,613	0	0	2,378,028	279,331
2052	11.1%	0	0	(134,653)	(14,992)	2,636,607	293,558	0	0	2,501,954	278,566
2053	10.6%	0	0	(139,366)	(14,708)	2,751,135	290,341	0	0	2,611,769	275,633
2054	10.0%	0	0	(144,244)	(14,429)	2,875,271	287,623	0	0	2,731,027	273,193
2055	9.5%	0	0	(149,292)	(14,156)	3,000,440	284,496	0	0	2,851,148	270,341
2056	9.0%	0	0	(154,518)	(13,887)	3,140,436	282,247	0	0	2,985,918	268,360
2057	8.5%	0	0	(159,926)	(13,624)	3,267,663	278,371	0	0	3,107,737	264,747
2058	8.1%	0	0	(165,523)	(13,366)	3,410,070	275,358	0	0	3,244,547	261,992
2059	7.7%	0	0	(171,316)	(13,112)	3,558,684	272,378	0	0	3,387,368	259,265
2060	7.3%	0	0	(177,312)	(12,864)	3,724,727	270,224	0	0	3,547,414	257,360
2061	6.9%	0	0	(183,518)	(12,620)	3,875,624	266,513	0	0	3,692,106	253,893
Terminal Value	6.5%							1,456,973	94,968	1,456,973	94,968
Totals		($6,310,113)		($4,232,426)		$74,974,631		$1,456,973		$65,889,064	
Net Present Value			($4,594,377)		($862,921)		$13,828,985		$94,968		$8,466,655
Check											

Table 24
City of Bend
Hydroelectric NPV Analysis
Energy by Scenario (kWh)

	Hydro Now (2014)			Hydro Later (2018)			Unused Hydro Now + 3rd Party			Unused Hydro Later + 3rd Party		
Year	Net Energy (Max.)	Outages or Other Losses (%)	Expected Energy (kWh)	Net Energy (Max.)	Outages or Other Losses (%)	Expected Energy (kWh)	Net Energy (Max.)	Outages or Other Losses (%)	Expected Energy (kWh)	Net Energy (Max.)	Outages or Other Losses (%)	Expected Energy (kWh)
2012	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0
2013	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0
2014	6,836,641	0.0%	6,836,641	0	0.0%	0	0	0.0%	0	0	0.0%	0
2015	6,885,099	0.0%	6,885,099	0	0.0%	0	6,885,099	0.0%	6,885,099	0	0.0%	0
2016	6,947,940	0.0%	6,947,940	0	0.0%	0	6,947,940	0.0%	6,947,940	0	0.0%	0
2017	7,662,262	0.0%	7,662,262	0	0.0%	0	7,662,262	0.0%	7,662,262	0	0.0%	0
2018	7,713,230	0.0%	7,713,230	7,713,230	0.0%	7,713,230	7,713,230	0.0%	7,713,230	0	0.0%	0
2019	7,764,970	0.0%	7,764,970	7,764,970	0.0%	7,764,970	7,764,970	0.0%	7,764,970	7,764,970	0.0%	7,764,970
2020	7,831,286	0.0%	7,831,286	7,831,286	0.0%	7,831,286	7,831,286	0.0%	7,831,286	7,831,286	0.0%	7,831,286
2021	7,922,603	0.0%	7,922,603	7,922,603	0.0%	7,922,603	7,922,603	0.0%	7,922,603	7,922,603	0.0%	7,922,603
2022	8,030,524	0.0%	8,030,524	8,030,524	0.0%	8,030,524	8,030,524	0.0%	8,030,524	8,030,524	0.0%	8,030,524
2023	8,141,340	0.0%	8,141,340	8,141,340	0.0%	8,141,340	8,141,340	0.0%	8,141,340	8,141,340	0.0%	8,141,340
2024	8,270,208	0.0%	8,270,208	8,270,208	0.0%	8,270,208	8,270,208	0.0%	8,270,208	8,270,208	0.0%	8,270,208
2025	8,368,861	0.0%	8,368,861	8,368,861	0.0%	8,368,861	8,368,861	0.0%	8,368,861	8,368,861	0.0%	8,368,861
2026	8,486,049	0.0%	8,486,049	8,486,049	0.0%	8,486,049	8,486,049	0.0%	8,486,049	8,486,049	0.0%	8,486,049
2027	8,604,491	0.0%	8,604,491	8,604,491	0.0%	8,604,491	8,604,491	0.0%	8,604,491	8,604,491	0.0%	8,604,491
2028	8,738,185	0.0%	8,738,185	8,738,185	0.0%	8,738,185	8,738,185	0.0%	8,738,185	8,738,185	0.0%	8,738,185
2029	8,837,322	0.0%	8,837,322	8,837,322	0.0%	8,837,322	8,837,322	0.0%	8,837,322	8,837,322	0.0%	8,837,322
2030	8,921,303	0.0%	8,921,303	8,921,303	0.0%	8,921,303	8,921,303	0.0%	8,921,303	8,921,303	0.0%	8,921,303
2031	8,987,522	0.0%	8,987,522	8,987,522	0.0%	8,987,522	8,987,522	0.0%	8,987,522	8,987,522	0.0%	8,987,522
2032	9,074,689	0.0%	9,074,689	9,074,689	0.0%	9,074,689	9,074,689	0.0%	9,074,689	9,074,689	0.0%	9,074,689
2033	9,123,436	0.0%	9,123,436	9,123,436	0.0%	9,123,436	9,123,436	0.0%	9,123,436	9,123,436	0.0%	9,123,436
2034	9,193,035	0.0%	9,193,035	9,193,035	0.0%	9,193,035	9,193,035	0.0%	9,193,035	9,193,035	0.0%	9,193,035
2035	9,263,791	0.0%	9,263,791	9,263,791	0.0%	9,263,791	9,263,791	0.0%	9,263,791	9,263,791	0.0%	9,263,791
2036	9,357,425	0.0%	9,357,425	9,357,425	0.0%	9,357,425	9,357,425	0.0%	9,357,425	9,357,425	0.0%	9,357,425
2037	9,408,876	0.0%	9,408,876	9,408,876	0.0%	9,408,876	9,408,876	0.0%	9,408,876	9,408,876	0.0%	9,408,876
2038	9,483,011	0.0%	9,483,011	9,483,011	0.0%	9,483,011	9,483,011	0.0%	9,483,011	9,483,011	0.0%	9,483,011
2039	9,558,111	0.0%	9,558,111	9,558,111	0.0%	9,558,111	9,558,111	0.0%	9,558,111	9,558,111	0.0%	9,558,111
2040	9,657,923	0.0%	9,657,923	9,657,923	0.0%	9,657,923	9,657,923	0.0%	9,657,923	9,657,923	0.0%	9,657,923
2041	9,711,401	0.0%	9,711,401	9,711,401	0.0%	9,711,401	9,711,401	0.0%	9,711,401	9,711,401	0.0%	9,711,401
2042	9,789,493	0.0%	9,789,493	9,789,493	0.0%	9,789,493	9,789,493	0.0%	9,789,493	9,789,493	0.0%	9,789,493
2043	9,868,551	0.0%	9,868,551	9,868,551	0.0%	9,868,551	9,868,551	0.0%	9,868,551	9,868,551	0.0%	9,868,551
2044	9,973,962	0.0%	9,973,962	9,973,962	0.0%	9,973,962	9,973,962	0.0%	9,973,962	9,973,962	0.0%	9,973,962
2045	10,028,984	0.0%	10,028,984	10,028,984	0.0%	10,028,984	10,028,984	0.0%	10,028,984	10,028,984	0.0%	10,028,984
2046	10,110,263	0.0%	10,110,263	10,110,263	0.0%	10,110,263	10,110,263	0.0%	10,110,263	10,110,263	0.0%	10,110,263
2047	10,192,217	0.0%	10,192,217	10,192,217	0.0%	10,192,217	10,192,217	0.0%	10,192,217	10,192,217	0.0%	10,192,217
2048	10,300,909	0.0%	10,300,909	10,300,909	0.0%	10,300,909	10,300,909	0.0%	10,300,909	10,300,909	0.0%	10,300,909
2049	10,339,521	0.0%	10,339,521	10,339,521	0.0%	10,339,521	10,339,521	0.0%	10,339,521	10,339,521	0.0%	10,339,521
2050	10,400,142	0.0%	10,400,142	10,400,142	0.0%	10,400,142	10,400,142	0.0%	10,400,142	10,400,142	0.0%	10,400,142
2051	10,449,855	0.0%	10,449,855	10,449,855	0.0%	10,449,855	10,449,855	0.0%	10,449,855	10,449,855	0.0%	10,449,855
2052	10,526,403	0.0%	10,526,403	10,526,403	0.0%	10,526,403	10,526,403	0.0%	10,526,403	10,526,403	0.0%	10,526,403
2053	10,524,955	0.0%	10,524,955	10,524,955	0.0%	10,524,955	10,524,955	0.0%	10,524,955	10,524,955	0.0%	10,524,955
2054	10,540,497	0.0%	10,540,497	10,540,497	0.0%	10,540,497	10,540,497	0.0%	10,540,497	10,540,497	0.0%	10,540,497
2055	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2056	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097
2057	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2058	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2059	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
2060	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097	10,571,097	0.0%	10,571,097
2061	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014	10,540,014	0.0%	10,540,014
* Year Online	2014			2018			2015			2019		

Table 25
City of Bend
Hydroelectric NPV Analysis
Revenue

			Hydro Now (2014)			Hydro Later (2018)			Unused Hydro Now + 3rd Party			Unused Hydro Later + 3rd Party		
Year	On-Peak Energy Price ($/kWh)	Off-Peak Energy Price ($/kWh)	Expected On-Peak (kWh)	Expected Off-Peak (kWh)	Revenue	Expected On-Peak (kWh)	Expected Off-Peak (kWh)	Revenue	Expected On-Peak (kWh)	Expected Off-Peak (kWh)	Revenue	Expected On-Peak (kWh)	Expected Off-Peak (kWh)	Revenue
2012	$0.0587	$0.0436	0	0	$0	0	0	$0	0	0	$0	0	0	$0
2013	$0.0614	$0.0450	0	0	0	0	0	0	0	0	0	0	0	0
2014	$0.0796	$0.0610	3,831,514	3,005,127	488,301	0	0	0	0	0	0	0	0	0
2015	$0.0816	$0.0627	3,858,671	3,026,427	504,625	0	0	0	3,858,671	3,026,427	504,625	0	0	0
2016	$0.0839	$0.0646	3,893,890	3,054,050	523,989	0	0	0	3,893,890	3,054,050	523,989	0	0	0
2017	$0.0860	$0.0665	4,294,223	3,368,039	593,278	0	0	0	4,294,223	3,368,039	593,278	0	0	0
2018	$0.0887	$0.0687	4,322,787	3,390,442	616,355	4,322,787	3,390,442	616,355	4,322,787	3,390,442	616,355	0	0	0
2019	$0.0876	$0.0674	4,351,785	3,413,185	611,265	4,351,785	3,413,185	611,265	4,351,785	3,413,185	611,265	4,351,785	3,413,185	611,265
2020	$0.0885	$0.0679	4,388,951	3,442,335	622,157	4,388,951	3,442,335	622,157	4,388,951	3,442,335	622,157	4,388,951	3,442,335	622,157
2021	$0.0933	$0.0723	4,440,128	3,482,475	666,047	4,440,128	3,482,475	666,047	4,440,128	3,482,475	666,047	4,440,128	3,482,475	666,047
2022	$0.0984	$0.0770	4,500,611	3,529,913	714,663	4,500,611	3,529,913	714,663	4,500,611	3,529,913	714,663	4,500,611	3,529,913	714,663
2023	$0.0933	$0.0715	4,562,717	3,578,623	681,573	4,562,717	3,578,623	681,573	4,562,717	3,578,623	681,573	4,562,717	3,578,623	681,573
2024	$0.0903	$0.0681	4,634,939	3,635,269	666,097	4,634,939	3,635,269	666,097	4,634,939	3,635,269	666,097	4,634,939	3,635,269	666,097
2025	$0.0947	$0.0722	4,690,228	3,678,633	709,762	4,690,228	3,678,633	709,762	4,690,228	3,678,633	709,762	4,690,228	3,678,633	709,762
2026	$0.0965	$0.0736	4,755,905	3,730,144	733,483	4,755,905	3,730,144	733,483	4,755,905	3,730,144	733,483	4,755,905	3,730,144	733,483
2027	$0.0968	$0.0735	4,822,284	3,782,207	744,789	4,822,284	3,782,207	744,789	4,822,284	3,782,207	744,789	4,822,284	3,782,207	744,789
2028	$0.1004	$0.0767	4,897,212	3,840,974	786,283	4,897,212	3,840,974	786,283	4,897,212	3,840,974	786,283	4,897,212	3,840,974	786,283
2029	$0.1048	$0.0800	4,952,771	3,884,550	829,823	4,952,771	3,884,550	829,823	4,952,771	3,884,550	829,823	4,952,771	3,884,550	829,823
2030	$0.1093	$0.0835	4,999,837	3,921,465	874,217	4,999,837	3,921,465	874,217	4,999,837	3,921,465	874,217	4,999,837	3,921,465	874,217
2031	$0.1141	$0.0872	5,036,949	3,950,573	919,088	5,036,949	3,950,573	919,088	5,036,949	3,950,573	919,088	5,036,949	3,950,573	919,088
2032	$0.1191	$0.0910	5,085,801	3,988,888	968,445	5,085,801	3,988,888	968,445	5,085,801	3,988,888	968,445	5,085,801	3,988,888	968,445
2033	$0.1243	$0.0949	5,113,121	4,010,315	1,016,080	5,113,121	4,010,315	1,016,080	5,113,121	4,010,315	1,016,080	5,113,121	4,010,315	1,016,080
2034	$0.1297	$0.0991	5,152,126	4,040,908	1,068,450	5,152,126	4,040,908	1,068,450	5,152,126	4,040,908	1,068,450	5,152,126	4,040,908	1,068,450
2035	$0.1353	$0.1034	5,191,781	4,072,010	1,123,596	5,191,781	4,072,010	1,123,596	5,191,781	4,072,010	1,123,596	5,191,781	4,072,010	1,123,596
2036	$0.1412	$0.1079	5,244,257	4,113,168	1,184,415	5,244,257	4,113,168	1,184,415	5,244,257	4,113,168	1,184,415	5,244,257	4,113,168	1,184,415
2037	$0.1474	$0.1126	5,273,092	4,135,784	1,242,829	5,273,092	4,135,784	1,242,829	5,273,092	4,135,784	1,242,829	5,273,092	4,135,784	1,242,829
2038	$0.1538	$0.1175	5,314,640	4,168,371	1,307,212	5,314,640	4,168,371	1,307,212	5,314,640	4,168,371	1,307,212	5,314,640	4,168,371	1,307,212
2039	$0.1605	$0.1226	5,356,729	4,201,382	1,374,985	5,356,729	4,201,382	1,374,985	5,356,729	4,201,382	1,374,985	5,356,729	4,201,382	1,374,985
2040	$0.1675	$0.1280	5,412,668	4,245,255	1,449,893	5,412,668	4,245,255	1,449,893	5,412,668	4,245,255	1,449,893	5,412,668	4,245,255	1,449,893
2041	$0.1748	$0.1335	5,442,639	4,268,762	1,521,458	5,442,639	4,268,762	1,521,458	5,442,639	4,268,762	1,521,458	5,442,639	4,268,762	1,521,458
2042	$0.1824	$0.1394	5,486,405	4,303,089	1,600,533	5,486,405	4,303,089	1,600,533	5,486,405	4,303,089	1,600,533	5,486,405	4,303,089	1,600,533
2043	$0.1904	$0.1454	5,530,712	4,337,840	1,683,774	5,530,712	4,337,840	1,683,774	5,530,712	4,337,840	1,683,774	5,530,712	4,337,840	1,683,774
2044	$0.1987	$0.1518	5,589,788	4,384,174	1,775,924	5,589,788	4,384,174	1,775,924	5,589,788	4,384,174	1,775,924	5,589,788	4,384,174	1,775,924
2045	$0.2073	$0.1584	5,620,624	4,408,360	1,863,544	5,620,624	4,408,360	1,863,544	5,620,624	4,408,360	1,863,544	5,620,624	4,408,360	1,863,544
2046	$0.2164	$0.1653	5,666,176	4,444,087	1,960,520	5,666,176	4,444,087	1,960,520	5,666,176	4,444,087	1,960,520	5,666,176	4,444,087	1,960,520
2047	$0.2258	$0.1725	5,712,106	4,480,111	2,062,545	5,712,106	4,480,111	2,062,545	5,712,106	4,480,111	2,062,545	5,712,106	4,480,111	2,062,545
2048	$0.2356	$0.1800	5,773,022	4,527,888	2,175,387	5,773,022	4,527,888	2,175,387	5,773,022	4,527,888	2,175,387	5,773,022	4,527,888	2,175,387
2049	$0.2459	$0.1879	5,794,661	4,544,860	2,278,702	5,794,661	4,544,860	2,278,702	5,794,661	4,544,860	2,278,702	5,794,661	4,544,860	2,278,702
2050	$0.2566	$0.1960	5,828,635	4,571,507	2,391,952	5,828,635	4,571,507	2,391,952	5,828,635	4,571,507	2,391,952	5,828,635	4,571,507	2,391,952
2051	$0.2678	$0.2046	5,856,497	4,593,359	2,508,127	5,856,497	4,593,359	2,508,127	5,856,497	4,593,359	2,508,127	5,856,497	4,593,359	2,508,127
2052	$0.2795	$0.2135	5,899,397	4,627,006	2,636,607	5,899,397	4,627,006	2,636,607	5,899,397	4,627,006	2,636,607	5,899,397	4,627,006	2,636,607
2053	$0.2917	$0.2228	5,898,586	4,626,370	2,751,135	5,898,586	4,626,370	2,751,135	5,898,586	4,626,370	2,751,135	5,898,586	4,626,370	2,751,135
2054	$0.3044	$0.2325	5,907,296	4,633,201	2,875,271	5,907,296	4,633,201	2,875,271	5,907,296	4,633,201	2,875,271	5,907,296	4,633,201	2,875,271
2055	$0.3176	$0.2427	5,907,025	4,632,989	3,000,440	5,907,025	4,632,989	3,000,440	5,907,025	4,632,989	3,000,440	5,907,025	4,632,989	3,000,440
2056	$0.3315	$0.2532	5,924,445	4,646,652	3,140,436	5,924,445	4,646,652	3,140,436	5,924,445	4,646,652	3,140,436	5,924,445	4,646,652	3,140,436
2057	$0.3459	$0.2643	5,907,025	4,632,989	3,267,663	5,907,025	4,632,989	3,267,663	5,907,025	4,632,989	3,267,663	5,907,025	4,632,989	3,267,663
2058	$0.3610	$0.2758	5,907,025	4,632,989	3,410,070	5,907,025	4,632,989	3,410,070	5,907,025	4,632,989	3,410,070	5,907,025	4,632,989	3,410,070
2059	$0.3767	$0.2878	5,907,025	4,632,989	3,558,684	5,907,025	4,632,989	3,558,684	5,907,025	4,632,989	3,558,684	5,907,025	4,632,989	3,558,684
2060	$0.3931	$0.3003	5,924,445	4,646,652	3,724,727	5,924,445	4,646,652	3,724,727	5,924,445	4,646,652	3,724,727	5,924,445	4,646,652	3,724,727
2061	$0.4103	$0.3134	5,907,025	4,632,989	3,875,624	5,907,025	4,632,989	3,875,624	5,907,025	4,632,989	3,875,624	5,907,025	4,632,989	3,875,624

Table 26
City of Bend
Hydroelectric NPV Analysis
Energy Estimate and Assumptions

Description	Value	Unit
Rated Power	1,580	kW
Annual Energy	8,913,000	kWhrs
Plant Factor	0.64	non-dim
Head		
Gross Head*	1009	feet
Headloss Coefficient	2.70E-01	ft/(cfs)^2
Net Head	812	feet
** Based on 30% Water Transmission Conduit Drawings*		
Turbine		
Type	Pelton	
Max Flow	21	cfs
Rated Head	812	feet
Peak Efficiency	89%	
Rated Power	1,580	kW
Generator/Transformer		
Generator Efficiency	95%	
Outage Factor	1.5%	
Transformer Losses	2%	
Constants:		
Density	*63*	*lb/ft^3*
Gravity	*32.174*	*ft/s^2*
*lb*ft^2/s^3 per watt*	*0.04214*	

Table 27
City of Bend
Hydroelectric NPV Analysis
Net Head (cfs)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2012	1009	1009	1009	1009	1009	1009	1009	1009	1009	1009	1009	1009
2013	1009	1009	1009	1009	1009	1009	1009	1009	1009	1009	1009	1009
2014	988	992	992	960	890	890	944	948	920	962	992	991
2015	987	991	991	959	890	890	944	948	920	960	991	990
2016	986	991	991	957	890	890	944	948	920	959	991	990
2017	986	990	990	956	890	890	944	948	920	957	990	989
2018	985	990	990	954	890	890	944	948	920	956	989	988
2019	984	989	989	953	890	890	944	948	920	954	989	988
2020	984	988	988	951	890	890	944	948	920	953	988	987
2021	982	987	987	947	890	890	944	948	920	949	987	986
2022	980	986	986	944	890	890	944	948	920	945	986	984
2023	979	984	984	940	890	890	944	948	920	942	984	983
2024	977	983	983	936	890	890	944	948	920	938	983	981
2025	975	981	981	931	890	890	944	948	920	933	981	980
2026	973	980	980	926	890	890	944	948	920	929	979	978
2027	971	978	978	921	890	890	944	948	920	924	978	976
2028	968	976	976	916	890	890	944	948	920	919	976	974
2029	966	974	974	911	890	890	944	948	920	913	974	972
2030	963	972	972	911	890	890	944	948	920	912	972	970
2031	961	970	970	911	890	890	944	948	920	912	970	968
2032	959	968	968	911	890	890	944	948	920	912	968	966
2033	956	966	966	911	890	890	944	948	920	912	966	964
2034	953	964	964	911	890	890	944	948	920	912	964	961
2035	951	962	962	911	890	890	944	948	920	912	961	959
2036	948	959	959	911	890	890	944	948	920	912	959	956
2037	945	957	957	911	890	890	944	948	920	912	956	954
2038	942	954	954	911	890	890	944	948	920	912	954	951
2039	938	952	952	911	890	890	944	948	920	912	951	948
2040	935	949	949	911	890	890	944	948	920	912	948	945
2041	931	946	946	911	890	890	944	948	920	912	945	942
2042	927	943	943	911	890	890	944	948	920	912	942	939
2043	923	939	939	911	890	890	944	948	920	912	939	935
2044	919	936	936	911	890	890	944	948	920	912	935	931
2045	914	932	932	911	890	890	944	948	920	912	931	928
2046	910	928	928	911	890	890	944	948	920	912	928	924
2047	905	924	924	911	890	890	944	948	920	912	924	919
2048	899	920	920	911	890	890	944	948	920	912	920	915
2049	894	916	916	911	890	890	944	948	920	912	920	910
2050	890	911	911	911	890	890	944	948	920	912	920	905
2051	890	906	906	911	890	890	944	948	920	912	920	900
2052	890	901	902	911	890	890	944	948	920	912	920	895
2053	890	896	902	911	890	890	944	948	920	912	920	890
2054	890	890	902	911	890	890	944	948	920	912	920	890
2055	890	890	902	911	890	890	944	948	920	912	920	890
2056	890	890	902	911	890	890	944	948	920	912	920	890
2057	890	890	902	911	890	890	944	948	920	912	920	890
2058	890	890	902	911	890	890	944	948	920	912	920	890
2059	890	890	902	911	890	890	944	948	920	912	920	890
2060	890	890	902	911	890	890	944	948	920	912	920	890
2061	890	890	902	911	890	890	944	948	920	912	920	890

Table 28
City of Bend
Hydroelectric NPV Analysis
Turbine Efficiency (non-dimensinal)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2012	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2014	87%	86%	86%	89%	89%	89%	89%	89%	89%	89%	86%	86%
2015	87%	86%	86%	89%	89%	89%	89%	89%	89%	89%	86%	86%
2016	87%	86%	86%	89%	89%	89%	89%	89%	89%	89%	86%	86%
2017	87%	86%	86%	89%	89%	89%	89%	89%	89%	89%	86%	86%
2018	87%	86%	86%	89%	89%	89%	89%	89%	89%	89%	86%	87%
2019	87%	86%	86%	89%	89%	89%	89%	89%	89%	89%	87%	87%
2020	87%	87%	87%	89%	89%	89%	89%	89%	89%	89%	87%	87%
2021	88%	87%	87%	89%	89%	89%	89%	89%	89%	89%	87%	87%
2022	88%	87%	87%	89%	89%	89%	89%	89%	89%	89%	87%	87%
2023	88%	87%	87%	89%	89%	89%	89%	89%	89%	89%	87%	88%
2024	89%	88%	88%	89%	89%	89%	89%	89%	89%	89%	88%	88%
2025	89%	88%	88%	89%	89%	89%	89%	89%	89%	89%	88%	88%
2026	89%	88%	88%	89%	89%	89%	89%	89%	89%	89%	88%	88%
2027	89%	88%	88%	89%	89%	89%	89%	89%	89%	89%	88%	89%
2028	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2029	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2030	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2031	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2032	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2033	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2034	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2035	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2036	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2037	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2038	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2039	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2040	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2041	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2042	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2043	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2044	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2045	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2046	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2047	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2048	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2049	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2050	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2051	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2052	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2053	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2054	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2055	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2056	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2057	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2058	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2059	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2060	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
2061	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%

Table 29
City of Bend
Hydroelectric NPV Analysis
Expected Energy Potential (kWh)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Gross	Year Net
2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	459,200	371,600	411,400	666,400	865,300	837,400	601,200	666,400	699,000	680,200	400,200	424,100	7,082,400	6,836,641
2015	466,500	377,300	417,600	675,300	865,300	837,400	601,200	666,400	699,000	689,400	406,400	430,800	7,132,600	6,885,099
2016	473,800	396,900	424,200	684,400	865,300	837,400	601,200	666,400	699,000	698,700	412,800	437,600	7,197,700	6,947,940
2017	481,300	389,300	430,900	693,500	998,100	965,900	780,800	760,500	865,600	708,000	419,300	444,500	7,937,700	7,662,262
2018	488,900	395,400	437,700	702,700	998,100	965,900	780,800	760,500	865,600	717,500	425,900	451,500	7,990,500	7,713,230
2019	496,600	401,600	444,600	712,100	998,100	965,900	780,800	760,500	865,600	727,000	432,700	458,600	8,044,100	7,764,970
2020	504,500	422,500	451,600	721,400	998,100	965,900	780,800	760,500	865,600	736,600	439,500	465,800	8,112,800	7,831,286
2021	520,300	420,800	465,700	740,200	998,100	965,900	780,800	760,500	865,600	755,800	453,300	480,400	8,207,400	7,922,603
2022	536,500	433,900	480,300	759,200	998,100	965,900	780,800	760,500	865,600	775,400	467,500	495,500	8,319,200	8,030,524
2023	553,300	447,500	495,400	778,600	998,100	965,900	780,800	760,500	865,600	795,200	482,100	511,000	8,434,000	8,141,340
2024	569,900	478,000	510,900	798,200	998,100	965,900	780,800	760,500	865,600	815,400	497,200	527,000	8,567,500	8,270,208
2025	585,700	476,000	526,900	818,100	998,100	965,900	780,800	760,500	865,600	835,800	512,800	543,500	8,669,700	8,368,861
2026	601,900	490,900	543,400	838,200	998,100	965,900	780,800	760,500	865,600	856,500	528,800	560,500	8,791,100	8,486,049
2027	618,400	506,300	560,400	858,500	998,100	965,900	780,800	760,500	865,600	877,400	545,400	576,500	8,913,800	8,604,491
2028	635,300	539,300	576,400	879,000	998,100	965,900	780,800	760,500	865,600	898,400	560,600	592,400	9,052,300	8,738,185
2029	652,600	535,100	592,300	899,500	998,100	965,900	780,800	760,500	865,600	919,700	576,100	608,800	9,155,000	8,837,322
2030	670,200	549,800	608,600	899,500	998,100	965,900	780,800	760,500	865,600	925,700	591,900	625,400	9,242,000	8,921,303
2031	685,000	562,300	622,400	899,500	998,100	965,900	780,800	760,500	865,600	925,700	605,300	639,500	9,310,600	8,987,522
2032	700,100	595,500	636,400	899,500	998,100	965,900	780,800	760,500	865,600	925,700	618,900	653,900	9,400,900	9,074,689
2033	715,500	587,900	650,700	899,500	998,100	965,900	780,800	760,500	865,600	925,700	632,800	668,400	9,451,400	9,123,436
2034	731,000	601,000	665,200	899,500	998,100	965,900	780,800	760,500	865,600	925,700	646,900	683,300	9,523,500	9,193,035
2035	746,800	614,300	680,000	899,500	998,100	965,900	780,800	760,500	865,600	925,700	661,300	698,300	9,596,800	9,263,791
2036	762,900	650,300	695,000	899,500	998,100	965,900	780,800	760,500	865,600	925,700	675,900	713,600	9,693,800	9,357,425
2037	779,100	641,700	710,300	899,500	998,100	965,900	780,800	760,500	865,600	925,700	690,700	729,200	9,747,100	9,408,876
2038	795,600	655,700	725,800	899,500	998,100	965,900	780,800	760,500	865,600	925,700	705,700	745,000	9,823,900	9,483,011
2039	812,200	669,900	741,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	721,000	761,000	9,901,700	9,558,111
2040	829,100	708,700	757,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	736,500	777,200	10,005,100	9,657,923
2041	846,100	698,900	773,600	899,500	998,100	965,900	780,800	760,500	865,600	925,700	752,200	793,600	10,060,500	9,711,401
2042	863,300	713,700	790,000	899,500	998,100	965,900	780,800	760,500	865,600	925,700	768,100	810,200	10,141,400	9,789,493
2043	880,600	728,700	806,600	899,500	998,100	965,900	780,800	760,500	865,600	925,700	784,200	827,100	10,223,300	9,868,551
2044	898,100	770,400	823,400	899,500	998,100	965,900	780,800	760,500	865,600	925,700	800,400	844,100	10,332,500	9,973,962
2045	915,700	759,200	840,400	899,500	998,100	965,900	780,800	760,500	865,600	925,700	816,900	861,200	10,389,500	10,028,984
2046	933,300	774,700	857,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	833,500	878,600	10,473,700	10,110,263
2047	951,100	790,300	874,800	899,500	998,100	965,900	780,800	760,500	865,600	925,700	850,300	896,000	10,558,600	10,192,217
2048	968,900	834,800	892,200	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	913,600	10,671,200	10,300,909
2049	986,700	821,900	909,700	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	931,200	10,711,200	10,339,521
2050	998,100	837,800	927,400	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	949,000	10,774,000	10,400,142
2051	998,100	853,800	945,100	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	966,800	10,825,500	10,449,855
2052	998,100	900,900	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	984,600	10,904,800	10,526,403
2053	998,100	885,900	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,903,300	10,524,955
2054	998,100	902,000	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,919,400	10,540,497
2055	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2056	998,100	933,700	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,951,100	10,571,097
2057	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2058	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2059	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
2060	998,100	933,700	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,951,100	10,571,097
2061	998,100	901,500	959,500	899,500	998,100	965,900	780,800	760,500	865,600	925,700	865,600	998,100	10,918,900	10,540,014
Monthly Avg.	741,864	631,348	685,976	820,186	950,208	919,554	738,792	724,434	820,980	842,188	651,430	706,844		
Monthly Net (Avg.)	716,121	609,440	662,173	791,726	917,236	887,645	713,156	699,296	792,492	812,964	628,825	682,317	**Average Net=**	**8,913,000**
Days	31	28	31	30	31	30	31	31	30	31	30	31	365	
Days (Leap Yr)	31	29	31	30	31	30	31	31	30	31	30	31	366	

Table 30
City of Bend
Hydroelectric NPV Analysis
Raw Flow to Outback (cfs)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2012												
2013												
2014	8.9	8.0	8.0	13.4	21.0	21.0	15.5	15.0	18.2	13.2	8.0	8.2
2015	9.0	8.1	8.1	13.6	21.0	21.0	15.5	15.0	18.2	13.4	8.2	8.4
2016	9.1	8.2	8.2	13.8	21.0	21.0	15.5	15.0	18.2	13.6	8.3	8.5
2017	9.3	8.4	8.4	14.0	21.0	21.0	15.5	15.0	18.2	13.8	8.4	8.6
2018	9.4	8.5	8.5	14.2	21.0	21.0	15.5	15.0	18.2	14.0	8.5	8.7
2019	9.6	8.6	8.6	14.5	21.0	21.0	15.5	15.0	18.2	14.3	8.7	8.9
2020	9.7	8.7	8.7	14.7	21.0	21.0	15.5	15.0	18.2	14.5	8.8	9.0
2021	10.0	9.0	9.0	15.1	21.0	21.0	15.5	15.0	18.2	14.9	9.0	9.3
2022	10.3	9.3	9.3	15.6	21.0	21.0	15.5	15.0	18.2	15.3	9.3	9.5
2023	10.6	9.5	9.5	16.0	21.0	21.0	15.5	15.0	18.2	15.8	9.6	9.8
2024	10.9	9.8	9.8	16.5	21.0	21.0	15.5	15.0	18.2	16.3	9.9	10.1
2025	11.2	10.1	10.1	17.0	21.0	21.0	15.5	15.0	18.2	16.8	10.2	10.4
2026	11.6	10.4	10.4	17.5	21.0	21.0	15.5	15.0	18.2	17.3	10.5	10.7
2027	11.9	10.7	10.7	18.0	21.0	21.0	15.5	15.0	18.2	17.8	10.8	11.1
2028	12.3	11.1	11.0	18.6	21.0	21.0	15.5	15.0	18.2	18.3	11.1	11.4
2029	12.6	11.4	11.4	19.1	21.0	21.0	15.5	15.0	18.2	18.8	11.4	11.7
2030	13.0	11.7	11.7	19.1	21.0	21.0	15.5	15.0	18.2	19.0	11.8	12.1
2031	13.3	12.0	12.0	19.1	21.0	21.0	15.5	15.0	18.2	19.0	12.1	12.4
2032	13.7	12.3	12.3	19.1	21.0	21.0	15.5	15.0	18.2	19.0	12.4	12.7
2033	14.0	12.6	12.6	19.1	21.0	21.0	15.5	15.0	18.2	19.0	12.7	13.0
2034	14.3	12.9	12.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	13.0	13.3
2035	14.7	13.2	13.2	19.1	21.0	21.0	15.5	15.0	18.2	19.0	13.3	13.6
2036	15.1	13.6	13.6	19.1	21.0	21.0	15.5	15.0	18.2	19.0	13.6	14.0
2037	15.4	13.9	13.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	14.0	14.3
2038	15.8	14.2	14.2	19.1	21.0	21.0	15.5	15.0	18.2	19.0	14.3	14.7
2039	16.2	14.6	14.6	19.1	21.0	21.0	15.5	15.0	18.2	19.0	14.7	15.0
2040	16.6	14.9	14.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	15.0	15.4
2041	17.0	15.3	15.3	19.1	21.0	21.0	15.5	15.0	18.2	19.0	15.4	15.8
2042	17.4	15.7	15.7	19.1	21.0	21.0	15.5	15.0	18.2	19.0	15.8	16.2
2043	17.9	16.1	16.1	19.1	21.0	21.0	15.5	15.0	18.2	19.0	16.2	16.5
2044	18.3	16.5	16.5	19.1	21.0	21.0	15.5	15.0	18.2	19.0	16.6	17.0
2045	18.7	16.9	16.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	17.0	17.4
2046	19.2	17.3	17.3	19.1	21.0	21.0	15.5	15.0	18.2	19.0	17.4	17.8
2047	19.7	17.7	17.7	19.1	21.0	21.0	15.5	15.0	18.2	19.0	17.8	18.2
2048	20.2	18.1	18.1	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	18.7
2049	20.7	18.6	18.6	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	19.1
2050	21.0	19.0	19.0	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	19.6
2051	21.0	19.5	19.5	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	20.1
2052	21.0	20.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	20.6
2053	21.0	20.5	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2054	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2055	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2056	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2057	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2058	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2059	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2060	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0
2061	21.0	21.0	19.9	19.1	21.0	21.0	15.5	15.0	18.2	19.0	18.2	21.0

Table 31
City of Bend
Hydroelectric NPV Analysis
Headloss Estimate

Description	Value	Unit	Notes
Length of Conveyance	50,300	feet	*Based on 30% Water Transmission Conduit Drawings
Pipe Diameter	30	inches	
Maximum Flow Rate	21	cfs	
Maximum Velocity	4.3	ft/s	
Velocity Head	0.3	ft	
Headloss (max flow)	**119**	ft	
Headloss Coefficient	0.27	ft/(cfs)^2	
Frictional Headloss - Upper Section			
Length of Conveyance	15,000	feet	
Pipe Diameter	30	inches	
Maximum Velocity	4.3	ft/s	
Velocity Head	0.3	ft	
Pipe Material	Ductle Iron	non-dim	
Equivilent Roughness	0.00085	feet	*Cast Iron
Relative Roughness	0.00034	non-dim	
Reynolds Numer	5.08E+05	non-dim	
Friction Factor (Darcy)	0.017		*Moody Chart
Frictional Headloss	**29**	**feet**	
Frictional Headloss - Lower Section			
Length of Conveyance	35,300	feet	
Pipe Diameter	29	inches	
Maximum Velocity	4.6	ft/s	
Velocity Head	0.3	ft	
Pipe Material	Concrete-Lined Steel	non-dim	
Equivilent Roughness	0.001	feet	*Smooth Concrete
Relative Roughness	0.000413793	non-dim	
Reynolds Numer	5.26E+05	non-dim	
Friction Factor (Darcy)	0.018		*Moody Chart
Frictional Headloss	**86**	**feet**	
Constants:			
inches/ft	*12*		
Viscocity	*1.05E-05*	*ft^2/s*	*Water at 70 deg. F

Table 32
City of Bend
Hydroelectric NPV Analysis
Minor Losses

Conveynace Element	Minor Loss Coefficient (non-dim)	Unit Headloss (feet)	Quantity (non-dim)	Total Headloss (feet)
Intake and Fish Screen	1.00	0.28	1	0.28
Pipe Bends	0.25	0.07	36	2.56
Valves	0.50	0.14	8	1.14
Powerhouse	1.00	0.28	1	0.28
Total Minor Loss	**15.00**			**4.27**

City of Bend
Draft Timing of Hydro Technical Report

APPENDIX

F

July 20, 2011 Council Presentation

HDR ONE COMPANY | Many Solutions℠

Surface Water Project

Timing of Hydropower

Presented by Paul Matthews and Tom Hickmann

July 20, 2011

Presentation Overview

- *Frame Decision*
- *History*
- *Base Assumptions*
- *Summary of Analysis*
- *Private Parties*
- *Risk/Sensitivity Analysis*
- *Summary and Preliminary Conclusions*
- *Next Steps/Questions*

August 3rd Decision to Be Made

Should the City Construct the Hydro Project Now (2014)?

- Is doing the Hydro Project now the least-cost solution?
- Is the Hydro Project economically feasible?
- How will the Hydro Project impact water rates?

History

Hydro Project Cost History

- Prior estimates for design, permitting, and construction of powerhouse/intake approx. $13.5 million
- Costs reduction based on simplified design
- Current estimate for construction of powerhouse/intake approx. $5.6 million
- Value Engineering recommended refinement of hydro revenue analysis
  - Loss of BETC funding
  - Refinement of flows
  - Revenue forecasting review

Base Assumptions

Key Operational Assumptions

- Hydro Project fully operational in 2014
- Later option, Hydro Project fully operational by 2018
- Power production limited by beneficial use of water
- Water demands based on City's approved Water Management and Conservation Plan (WMCP)
- All power sold to PacifiCorp under its Schedule 37

Risk within the Assumptions

Variables that Affect the Outcome

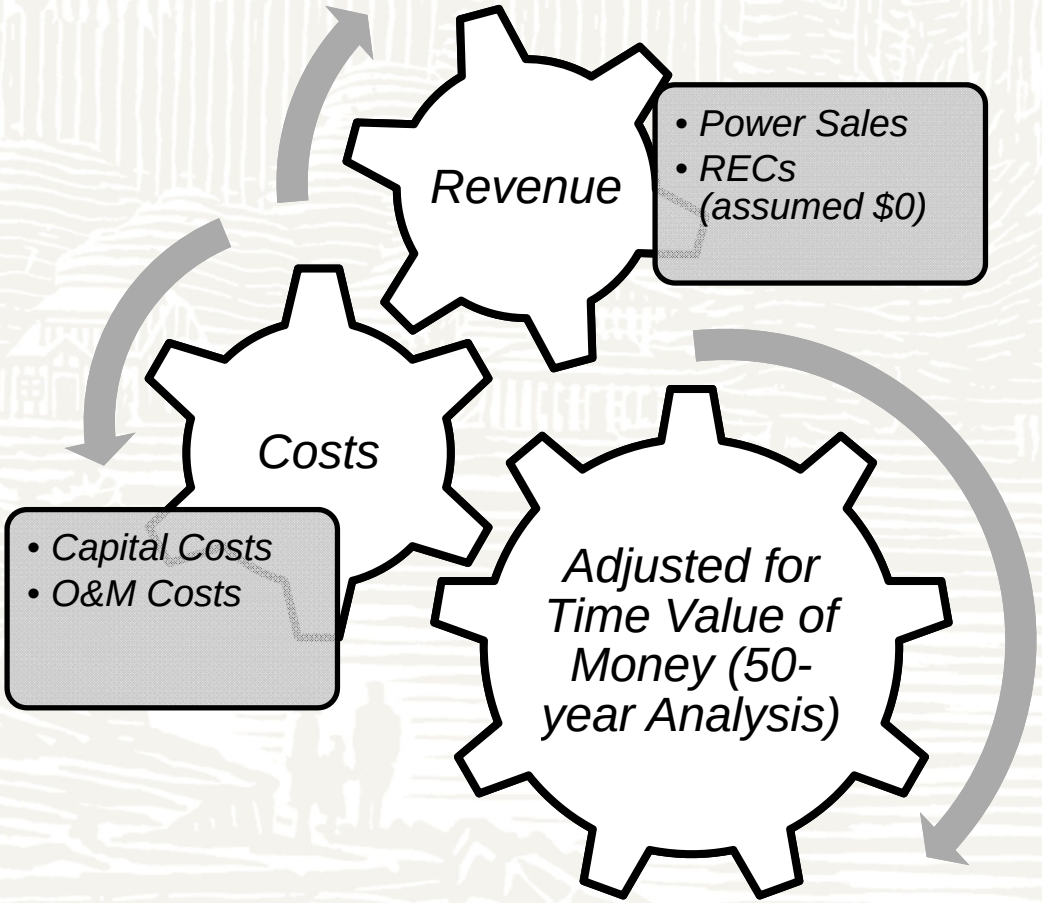
- Construction costs
- O&M costs
- Growth, demand, and water sales
- Revenue from Renewable Energy Credits
- Permitting timeline

Least-Cost Solution

Capital Expenditures Without Inflation ($millions)

Description	Hydro Now (2014)	Hydro Later (2018)
Intake Structure & Screens	$1.12	$1.12
Fish Ladder	0.29	0.29
Turbine and Generator	1.41	1.41
Hydroelectric Powerplant	2.28	2.28
Avoided Cost - Redundant PRV	(0.41)	0.00
Services during Construction	0.50	0.50
Project Reinitiation	0.00	0.15
Net Project Cost	$5.20	$5.76

Hydro Power Economic Feasibility



Hydro Revenue Projections

Power Sales

- PacifiCorp Schedule 37 Rate
- Power Purchase Agreement
- Energy production based on water demands met from Outback
- Projections assume no value for RECs

Results of Economic Analyses

Cash Flows & NPV Analyses ($millions)

	Hydro Now (2014)		Hydro Later (2018)	
Description	Undiscounted Cash Flow	Net Present Value	Undiscounted Cash Flow	Net Present Value
Net Capital	($5.20)	($4.69)	($6.31)	($4.59)
O&M	(4.39)	(0.98)	(4.23)	(0.86)
Revenue	81.78	17.32	79.24	15.34
Terminal Value	0.68	0.04	1.46	0.09
Totals	$72.87	**$11.69**	$70.16	**$9.97**

Hydro Power Impact on Rates

First-Year Cash Flow ($thousands)

Description	Hydro Now (2014)
Gross Revenue	$582
Less:	
Operating Expense	36
Debt Service	418
Available Revenue	$127

Annual net revenue after debt service is paid off (year 2040) = $1.5 million.

Private Party Participation

Reviewed

- Ownership options
- Project costs
- Schedule impacts

Risks

- Delayed schedule
- Legal & contractual
- Public acceptance – coordination of water supply with powerhouse operation
- Developer default
- Quality of facility
- Quality of maintenance

Private Party Participation

Concluded

- No compelling reason for private partnership
- Institutional barriers to private partnering arrangements
- Schedule risks for incorporating private parties

Next Steps

- Provide project information document for private parties to review
- If private party can enhance benefits to the City, City can consider partnership

Review of Economic Risks

Potential Risks to the Analysis

- Construction costs more than expected
- O&M costs more than expected
- Growth in water sales less than expected

Economic Sensitivity to Risks

Sensitivity Analysis ($millions)

Description	Net Present Value	1st Year Available Revenue
Base Case	$11.69	$0.13
Construction Cost Increase 25%	10.53	0.02
O&M Costs Increase 25%	11.45	0.12
No Growth in Water Sales	7.11	0.03
Reduced Growth in Water Sales	9.85	0.03
High Construction, Reduced Growth	8.69	(0.07)
Hydro Later (2018)	9.97	0.20

Review Base Assumptions

Key Operational Assumptions

- Hydro Project fully operational in 2014
- Later option, Hydro Project fully operational by 2018
- Power production limited by beneficial use of water
- Water demands based on City's approved WMCP
- All power sold to PacifiCorp under its Schedule 37

Potential Risks to the Analysis

- Construction costs more than expected
- O&M costs more than expected
- Growth in water sales less than expected

Preliminary Findings

Hydro Project Is Expected To:

- Generate revenue in first years exceeding debt service and operating expenditures
- Provide modest revenue offset for water rate payers in early years—benefits grow over time
- Provide enough clean energy to power approximately 1,000 homes
- Have an economic value in excess of the City's investment of approximately $11.7 million

Next Steps

Council Decision on Hydro Now/Later	• August 3, 2011
FERC Conduit Exemption Process	• Scoping meeting August 10, 2011
Conduit Material Purchase	• Bidding: July 26 – August 16, 2011 • Contract Approval: September 7, 2011
Turbine Procurement	• September, 2011
OWRD Expedited Process	• Application in October, 2011

Questions?

Similar Turbine, courtesy Canyon Hydro

ONE COMPANY | *Many Solutions*℠

805 SW Industrial Way, Suite 4
Mill A Building
Bend, OR 97702
541.323.2331 Phone 541.323.2561 Fax