

Yakima River Basin Study

Columbia River Pump Exchange Plan of Study

U.S. Bureau of Reclamation
Contract No. 08CA10677A ID/IQ, Task 4.15

Prepared by

HDR Engineering, Inc.
Jerry Kelso (Consultant to Reclamation)



U.S. Department of the Interior
Bureau of Reclamation
Pacific Northwest Region
Columbia-Cascades Area Office



State of Washington
Department of Ecology
Office of Columbia River

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The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

The Mission of the Washington State Department of Ecology is to protect, preserve and enhance Washington's environment, and promote the wise management of our air, land and water for the benefit of current and future generations.

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- A. Preliminary Schedule**
- B. Preliminary Budget**
- C. Outline of Planning Report/Environmental Impact Statement**

1.0 Introduction

This Plan of Study (POS) describes a proposed appraisal- and, potentially, feasibility-level study of a Columbia River Pump Exchange project for the Yakima River basin. The study is identified in the proposed Yakima River Basin Integrated Water Resource Management Plan (Integrated Plan) (Reclamation and Ecology 2011).

1.1 Plan of Study Purpose and Scope

The Integrated Plan identifies a wide variety of water supply and habitat restoration actions in the Yakima River basin. It also acknowledges uncertainties regarding implementation of the actions, future growth and development and potential climate change effects. Because of these uncertainties it is possible that additional actions may be needed to achieve the goals of the Integrated Plan. If this occurs, the pump exchange using water from the Columbia River could be added to or substituted for other projects in the Integrated Plan.

The need for additional water-supply enhancements would depend on the effectiveness of projects that are implemented as part of the Integrated Plan, how the Yakima Basin economy develops over time, and the timing of and manner in which climate change affects water supply availability.

The evaluation of a Columbia River to Yakima Basin transfer would involve an initial screening step and subsequent feasibility study, as outlined below. The feasibility study would be conducted only if the initial screening step demonstrates that an interbasin transfer is a viable option and the YRBWEP work group authorizes its inclusion as part of the Integrated Plan.

This Plan of Study outlines a two-step investigation of the pump exchange project:

Step 1: Appraisal Level Investigation of Water Availability and Supply Options. Step 1 would include:

- A detailed analysis of the physical and legal availability of water for diversion from the Columbia River
- A description of alternatives for configuration of pumping, routing and storing Columbia River water in the Yakima Basin and options for instream and out-of-stream uses of that water
- Estimates of capital and operation and maintenance costs for each alternative
- Evaluation of potential allocation of costs for each alternative.

The Columbia River water availability analysis in Step 1 would consider target flows under the Federal Columbia River Power System Biological Opinion (NMFS 2004 and 2010), effects on migration, spawning and rearing of salmonid fish; and cumulative impacts of other water withdrawal proposals such as Reclamation's Odessa Subarea Special Study of continuing phased development of the Columbia Basin Project to deliver surface water to lands currently using groundwater in the vicinity of Odessa, Washington.

At the end of Step 1, the YRBWEP Workgroup would consider the results and a determination would be made whether to carry out Step 2 of the study. The set of infrastructure alternatives may be narrowed for Step 2.

Step 2: Feasibility-Level Analysis Plus Environmental Review. Conduct more detailed, site specific analyses of alternatives and prepare a feasibility-level Project Report/Environmental Impact Statement (PR/EIS). Depending upon the outcome of the Wymer Dam and Columbia pump exchange project, potential removal of Roza Dam and whether to serve all or a part of the Roza diversion with the Columbia River water supply would also be evaluated.

1.2 Project Triggers from the Integrated Plan

The Integrated Plan calls for periodic reviews of progress annually to 2015 and at least every five years thereafter. If the periodic reviews find that implementation challenges or changing conditions actions within the Yakima River basin are inadequate to meet the purposes of the Integrated Plan, this would trigger steps to carry out additional projects for Yakima Basin water supply and habitat restoration and improvement.

If additional projects are needed and if the two-step feasibility study outlined above indicates the Columbia River Pump Exchange project is feasible, then steps to implement the Pump Exchange could be triggered, including a request for authorization of project funding.

1.3 Study Area

Figure 1 shows the study area and potential project configurations. Water from the Columbia River near Priest Rapids Dam or above Wanapum Dam would be pumped over the drainage divide into the Yakima River Basin. Water could be delivered to irrigation districts and/or to the Yakima River to support flow objectives for fish habitat. Water not used consumptively would flow down the Yakima River and rejoin the Columbia River at Pasco, Washington.

Storage within the Yakima River Basin could potentially be included in the project. Possible storage sites could include the proposed Wymer Reservoir in the Lmuma Creek canyon, or another off-channel reservoir constructed in either Burbank Creek or Selah Creek canyon.

2.0 Study Approach

2.1 Study Schedule

Step 1 of the study is expected to take approximately 18 months and Step 2, if performed, is expected to take approximately three to four years. Further information on the study schedule is shown in Attachment A.

2.2 Study Costs

Step 1 of the study is expected to cost approximately \$425,000. Step 2 is expected to cost approximately \$3.5 million. If a decision is made to proceed with Step 2, the cost of Step 2 will need to be refined, using findings from Step 1. Further information on costs of the study is shown in Attachment B.

2.3 Previous Investigations

The study will be informed by relevant studies conducted previously. A preliminary list of these studies includes:

- *Yakima Basin Study and Integrated Plan* (Ecology and Reclamation 2011)
- *Yakima Project Storage Study Draft Planning Report/Environmental Impact Statement* (Ecology and Reclamation 2008)
- Other applicable studies conducted under the Yakima River Basin Water Enhancement Project (YRBWEP) beginning in the early 1980's
- Pre-YRBWEP studies such as assessment of direct delivery to Roza Irrigation District in the 1970s.

2.4 Yakima River Basin Water Needs

Instream and out-of-stream needs in the Yakima River Basin were assessed in three Volume 2 technical memoranda prepared for the Yakima River Basin Study:

- *Water Needs for Out-of-Stream Uses*
- *Instream Flow Needs*
- *Modeling of Reliability and Flows*

For purposes of the Columbia River Pump Exchange Study, different quantities of water potentially needed from the Columbia River will be identified in the project alternatives. The quantities will be based on:

- Quantities that may be needed to substitute for one or more supply projects identified in the Integrated Plan, in the event those projects cannot be completed as planned
- Quantities that may be needed if climate change conditions modeled in the Yakima River Basin Study reduces available supplies and increases water needs in the Yakima River Basin.

At least two different quantities will be identified for use in developing project alternatives.

2.5 Technical Memoranda

A series of analyses will be performed for the Columbia River Pump Exchange project. Analysis and findings will be documented in a series of technical memoranda covering the various topics explored. In addition a draft and final report will be prepared at the end of Step 1 of the study.

If Step 2 is carried out, a similar series of technical memoranda will be prepared, also culminating in a draft and final report.

2.6 Pump Exchange Project Cost Estimates

During Step 1, appraisal level cost estimates will be developed for the infrastructure projects needed under each alternative. During Step 2, feasibility level cost estimates will be developed.

3.0 Step 1: Appraisal Level Investigation of Water Availability and Supply Options

Step 1 of the study will investigate the legal and physical availability of water from the Columbia River for purposes of water supply and habitat enhancement in the Yakima River Basin. It will also define alternative approaches and infrastructure options to pump, convey and possibly store water from the Columbia River in the Yakima River basin.

Step 1 activities are presented below in outline format. Italics are used to designate whether the activity will be performed primarily by Reclamation and Ecology or a contractor hired to provide professional services.

- A. Define purpose and need (*Reclamation and Ecology*)
- B. Investigate legal availability of water in the Columbia River (*Contractor*)
 - 1. Existing water rights
 - 2. Constraints related to Federal Columbia River Power System Biological Opinion (NMFS 2004 and 2010)
 - 3. Other potential future withdrawals (e.g. Odessa)
 - 4. Columbia River power system
 - 5. Indian trust assets
 - 6. State of Oregon
 - 7. Potential risks
 - 8. Other topics as needed
- C. Investigate physical availability of water for pumping to the Yakima River Basin (*Contractor*)
 - 1. Timing and quantity available
 - a. Annual and seasonal
 - b. Climate change considerations
 - c. Pumping rates
 - 2. Water quality considerations
 - 3. Potential risks
 - 4. Other topics as needed
- D. Initial Determination of pump exchange viability (*Reclamation and Ecology*)
- E. Define alternatives (*Contractor*)
 - 1. Identify alternative supply quantities
 - a. Quantity needed for substitution for other Integrated Plan projects
 - b. Quantity needed to address moderate to severe climate change

-
2. Review storage considerations vs. direct pump option
 - a.Storage sites and volumes (Wymer, Selah Creek, Burbank Creek)
 - b.Project configuration without storage
 3. Evaluate feasibility of Roza Dam removal at appraisal level
 - a.Replacement infrastructure
 - b.Dam removal considerations
 4. Define potentially viable alternatives (different combinations of water quantity, storage/non-storage and Roza Dam removal)
 5. Define instream and out-of-stream benefits of each potentially viable alternative at an appraisal level
 6. Assess infrastructure requirements of each potentially viable alternative (appraisal level)
 7. Assess power requirements and power recovery opportunities
 8. Assess the cost of each potentially viable alternative (appraisal level)
- F. Updated determination of pump exchange viability (*Reclamation and Ecology*)
- G. Appraisal level comparison of alternatives (*Contractor*)
- H. Selection of alternatives for Step 2 (if warranted) (*Reclamation and Ecology*)
- I. Preliminary allocation of costs (*Reclamation and Ecology*)
- J. Prepare Step 1 appraisal report (*Contractor*)
 1. Draft report
 2. Final report
- K. Public information/public involvement (*Reclamation and Ecology with Assistance from Contractor*)
- L. Project management (*Contractor, Reclamation and Ecology*)

4.0 Step 2: Feasibility Level Analysis Plus Environmental Review

If results from Step 1 indicate the Columbia River Pump Exchange Project is viable, and the YRBWEP Workgroup determines the project is necessary to achieve the goals of the Integrated Plan, then a request will be made for authorization and funding of Step 2 of the study to refine the alternatives, review environmental effects and select a preferred alternative.

A preliminary list of Step 2 activities is presented below in outline format. If a determination is made to proceed with Step 2, these activities should be reviewed and updated based on information from Step 1.

An overview schedule is included in Attachment A. A suggested Table of Contents for the PR/EIS is shown in Attachment C.

Italics are used to designate whether the activity will be performed primarily by Reclamation and Ecology or a contractor hired to provide professional services.

- A. Update statement of purpose and need from Step 1 (*Reclamation and Ecology*)
- B. Refine description of alternatives (*Reclamation and Ecology*)
 - 1. Project capacity (water quantity – one or more levels)
 - 2. Alternative combinations of storage vs. direct delivery, Roza Dam removal or not, and allocation to supply and flow/habitat purposes
- C. Feasibility level investigation of alternatives
 - 1. Engineering analysis (*Contractor*)
 - a. Siting and routing (including geotechnical investigation)
 - i. Pump station sites
 - Site requirements by alternative
 - Site availability by alternative
 - ii. Tunnel/pipeline routes
 - Route requirements by alternative
 - Route availability
 - Route constraints
 - Geotechnical investigations (desktop and field)
 - iii. Storage sites
 - Site requirements by alternative
 - Site availability
 - Site constraints
 - Geotechnical investigations (desktop and field)
 - iv. Power recovery sites
 - Site requirements by alternative
 - Site availability
 - b. Evaluate feasibility of Roza Dam removal
 - i. Replacement infrastructure
 - ii. Dam removal

-
- c. Facilities Design (feasibility level)
 - i. Alternative 1 facilities
 - Pump station
 - Tunnels/pipelines
 - Storage reservoir
 - Power recovery facilities
 - Other infrastructure as needed
 - ii. Alternative 2 facilities
(a – d same as above)
 - iii. Etc. (as needed for all Alternatives)
 - d. Power analysis
 - i. Power requirements
 - ii. Opportunities for power recovery
 - e. Effects on existing facilities in Yakima Basin
 - i. Effects of removing Roza Dam
 - Effects on water supply
 - Effects on stream flow and fish habitat
 - ii. Irrigation district capital facility requirements to enable use of Columbia River supply
 - iii. Modeling of Yakima Project system-wide operations with Columbia River supply
2. Environmental analysis and permitting requirements (Contractor)
 - a. Alternative 1 environmental effects and permitting
 - i. Surface water resources
 - ii. Ground water resources
 - iii. Hydropower resources
 - iv. Water quality and sediment
 - v. Vegetation and wildlife
 - vi. Anadromous fish
 - vii. Resident fish
 - viii. Aquatic invertebrates
 - ix. Threatened and endangered species
 - x. Recreation resources
 - xi. Land use and shoreline resources
 - xii. Socioeconomics (regional economy)

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- xiii. Public services and utilities
 - xiv. Transportation
 - xv. Air quality
 - xvi. Noise
 - xvii. Visual resources
 - xviii. Historic properties
 - xix. Indian sacred sites
 - xx. Environmental health
 - xxi. Environmental justice
- b. Alternative 2 environmental effects and permitting
 - (i – xxi same as above)
 - c. Etc. (as needed for all Alternatives)
 - d. No Action Alternative environmental effects and permitting
3. Cost Analysis (Contractor)
- a. Alternative 1 cost
 - b. Alternative 2 cost
 - c. Etc. (as needed for all Alternatives)
 - d. Updated allocation of cost
4. Benefits evaluation (Contractor)
- a. Alternative 1 benefits
 - i. Water supply benefits
 - ii. Stream flow and habitat benefits
 - iii. Power recovery
 - b. Alternative 2 benefits
 - c. Etc. (as needed for all alternatives)
 - d. No Action Alternative benefits
- D. Comparison of alternatives and selection of preferred alternative
- 1. Alternatives' ability to satisfy purpose and need (*Reclamation and Ecology*)
 - 2. Four-account analysis of alternatives per Principles and Guidelines (*Contractor*)
 - a. National Economic Development
 - b. Environmental Quality
 - c. Regional Economic Development
 - d. Social Evaluation
 - 3. Selection and justification of Preferred Alternative (*Reclamation and Ecology*)

E. Preparation of PR/EIS

1. Scoping (*Reclamation and Ecology*)
2. Prepare draft PR/EIS (*Contractor*)
3. Obtain comments on draft PR/EIS (*Reclamation and Ecology*)
4. Prepare final PR/EIS (*Contractor*)

F. Consultation and coordination (*Reclamation and Ecology*)

1. Public involvement
2. Agency coordination and consultation
 - a. State and Federal fish and wildlife agencies
 - b. Bonneville Power Administration
 - c. Grant County Public Utility District
 - d. Other agencies as applicable
3. Tribal consultation and coordination
4. Oregon and other basin states consultation and coordination
5. Compliance with Native American Graves Protection and Repatriation Act
6. Compliance with other Federal laws

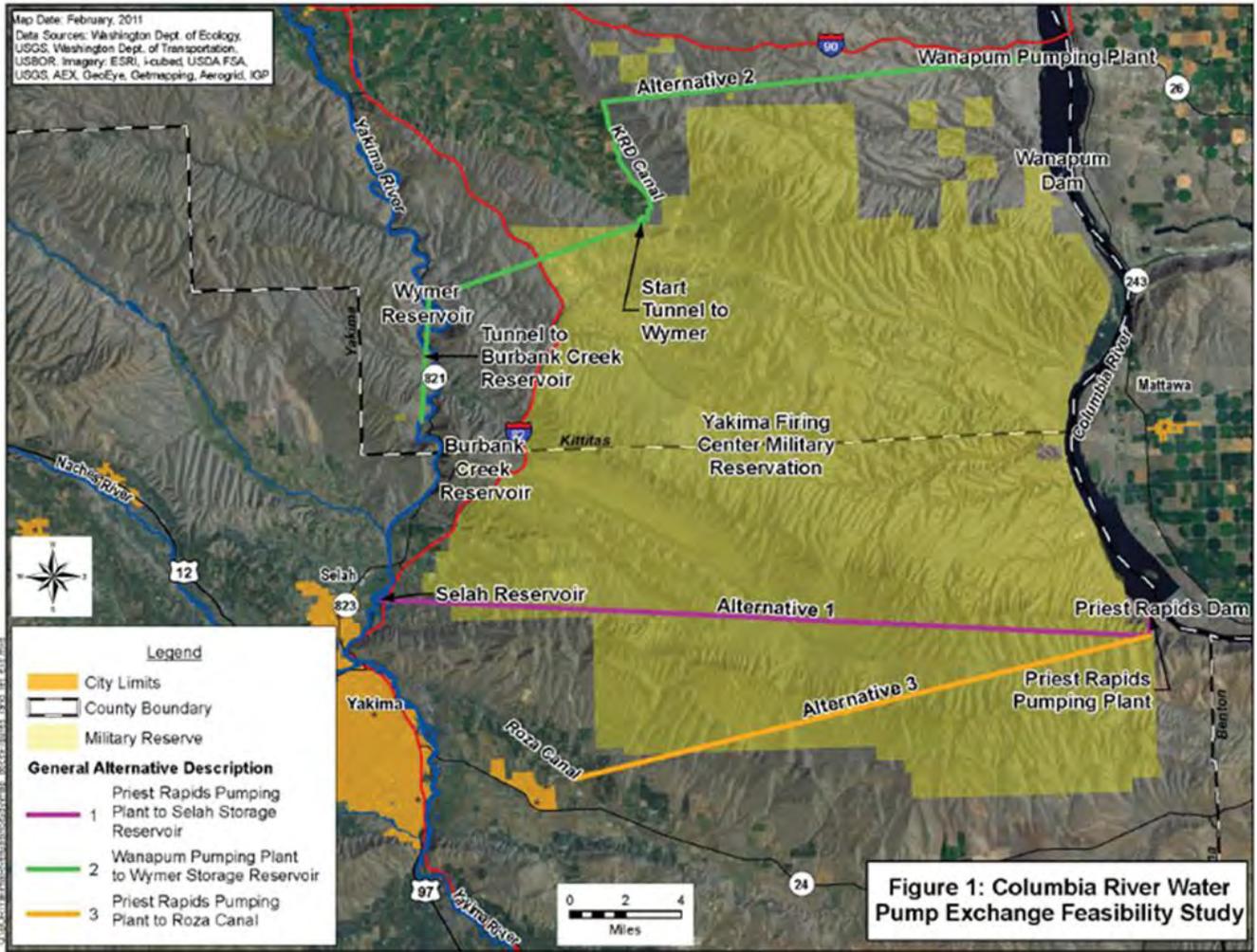
G. Project management (*Contractor, Reclamation and Ecology*)

5.0 References

- NMFS. 2004. *Operation of the Federal Columbia River Power System (FCRPS) Including 19 Bureau of Reclamation Projects in the Columbia Basin (revised and reissued pursuant to court order, NWF v. NMFS, Civ. No. CV 01-640-RE [D. Oregon])*. NOAA, National Marine Fisheries Service.
- NMFS. 2010. *Endangered Species Act Section 7(a)(2) Consultation Supplemental Biological Opinion. Supplemental Consultation on Remand for Operation of the Federal Columbia River Power System, 11 Bureau of Reclamation Projects in the Columbia Basin and ESA Section 10(a)(1)(A) Permit for Juvenile Fish Transportation Program*. NOAA, National Marine Fisheries Service.
- Reclamation and Ecology. 2008. *Draft Planning Report/Environmental Impact Statement for the Yakima River Basin Water Storage Feasibility Study*. U.S. Department of the Interior, Bureau of Reclamation and Washington State Department of Ecology.
- Reclamation and Ecology. 2011. *Yakima River Basin Study. Volume 1: Integrated Water Resource Management Plan. Volume 2: Technical Appendices*. U.S. Department of the Interior, Bureau of Reclamation and Washington State Department of Ecology.

6.0 List of Preparers

Name	Background	Responsibility
Andrew Graham, HDR Engineering	Water Resources Planner	Co-author
Leanne Greisen, HDR Engineering	Staff Engineer	Costs of Study
Stan Schweissing, HDR Engineering	Senior Engineer	Costs of Study
Jerry Kelso	Reclamation Planning & Management Consultant	Co-author
Robert Montgomery, Anchor QEA	Water Resources Engineer	Quality Control review



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Attachment A
Preliminary Schedule

Preliminary Schedule -- Columbia River Pump Exchange Study
Step 1: Appraisal Level Investigation of Water Availability and Supply Options

	Months from Initiation of Step 1																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Define Purpose and Need	█																	
Investigate Legal Availability of Water		█	█	█	█													
Investigate Physical Availability of Water		█	█	█	█													
Initial Determination of Pump Exchange Viability					█													
Define Alternatives																		
Identify Alternative Supply Quantities		█																
Review Storage vs. Direct Pump Option		█	█	█	█	█												
Evaluate Feasibility of Roza Dam Removal		█	█	█	█	█												
Define Alternatives (combinations of items above)							█											
Define Benefits of Each Alternative								█	█									
Assess Infrastructure Requirements (appraisal level)								█	█	█								
Assess Power Requirements and Recovery									█	█								
Cost of Alternatives (appraisal level)											█	█	█					
Update Determination of Viability														█				
Appraisal Level Comparison of Alternatives															█			
Selection of Alternatives for Step 2 (if warranted)															█			
Preliminary Allocation of Costs																█		
Draft Step 1 Report ¹																	█	
Final Step 1 Report																		█
¹ In addition to the Step 1 report, generally a memorandum will be completed at the conclusion of each task listed above (exact list of memoranda to be determined).																		

**Preliminary Schedule -- Columbia River Pump Exchange Study
Step 2: Feasibility Level Analysis Plus Environmental Review**

	Time From Initiation of Step 2															
	Year 1				Year 2				Year 3				Year 4			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Update Statement of Purpose and Need	■															
Refine Description of Alternatives	■															
Feasibility Level Investigation of Alternatives																
Engineering Analysis	■	■	■	■	■	■	■	■								
Environmental Analysis and Permitting Req'ts.									■	■	■	■				
Cost Analysis											■	■				
Benefits Evaluation											■	■				
Compare Alternatives & Select Preferred Alternative													■			
Prepare PR/EIS ¹																
Scoping									■	■	■	■				
Draft PR/EIS										■	■	■	■	■	■	■
Comment Period													■	■	■	■
Final PR/EIS															■	■
¹ In addition to the Step 1 report, generally a memorandum will be completed at the conclusion of each task listed above (exact list of memoranda to be determined).																

Attachment B
Preliminary Budget

**Preliminary Budget -- Columbia River Pump Exchange Study - DRAFT
(Costs of Contractor Services Only)**

Step 1: Appraisal Level Investigation of Water Availability and Supply Options

Activity	Cost
Define Purpose and Need	5,860
Investigate Legal Availability of Water	35,640
Investigate Physical Availability of Water	24,440
Initial Determination of Pump Exchange Viability	8,340
Define Alternatives	
Identify Alternative Supply Quantities	12,600
Review Storage Considerations vs. Direct Pump	26,200
Evaluate Feasibility of Roza Dam Removal	26,200
Define Alternatives (combinations of items above)	12,580
Define Benefits of Each Alternative	29,800
Assess Infrastructure Requirements (appraisal level)	39,700
Assess Power Requirements and Recovery	18,840
Assess Cost of Alternatives (appraisal level)	28,600
Updated Determination of Viability	6,740
Appraisal Level Comparison of Alternatives	25,700
Selection of Alternatives for Step 2 (if warranted)	8,340
Preliminary Allocation of Costs	25,400
Draft Step 1 Report	28,900
Final Step 1 Report	14,840
Public Information/Public Involvement	14,520
Project Management	31,220
Total Cost - Step 1	424,460

Step 2: Feasibility Level Analysis Plus Environmental Review

Activity	Cost
Update Statement of Purpose and Need	5,860
Refine Description of Alternatives	37,700
Feasibility Level Investigation of Alternatives	
Engineering Analysis	1,678,000
Environmental Analysis and Permitting Req'ts.	457,000
Cost Analysis	171,600
Benefits Evaluation	302,200
Compare Alternatives & Select Preferred Alternative	92,000
Prepare PR/EIS ¹	
Scoping	38,100
Draft PR/EIS	164,600
Process Comments	40,900
Final PR/EIS	84,300
Consultation and Coordination	164,800
Project Management	219,200
Total Cost - Step 2	3,456,260

Total Cost - Steps 1 and 2 **3,880,720**

Note: cost of Step 2 to be updated following completion of Step 1.

Attachment C
Outline of Planning Report/Environmental Impact Statement

Outline of PR/EIS (DRAFT) Columbia River Pump Exchange Project

Executive Summary

Chapter 1: Purpose and Need

- a. Introduction including location of potential projects,
- b. Purpose and Need for Action,
- c. Background of Basin Study
- d. Related permits, actions, and laws;
- e. Public involvement,
- f. Previous studies of the project area by Reclamation or others;
- g. Background and History,
 - 1) Yakima Basin
 - 2) Columbia River Basin
- h. Prior Investigations and Activities
 - 1) Yakima Basin
 - 2) Columbia River Basin
- i. Relationship of other water and related resources activities to this study, and
- j. How to read this document

Chapter 2: Alternatives

- a. Introduction
- b. Alternatives Formulation and Evaluation-
- c. No Action Alternative-
- d. Preferred Alternative:
 - 1) Alternative description
 - 2) Operations,
 - 3) Accomplishments,
 - 4) Economic and financial analysis- this alternative: Discuss National Economic Development evaluation, cost allocation, and cost sharing. Describe non-Federal interest and participation in project funding;
 - 5) Actions and permits,
- e. Other Viable Alternatives: Includes similar information included in the preferred alternative as noted above...
- f. Economic and Financial Analysis- All Alternatives.
 - 1) NED Benefit-Cost Analysis
 - 2) Cost Allocation
 - 3) Repayment
- g. Comparative Evaluation of Alternatives: Includes the preferred alternative, other viable alternatives, and the no action alternative. Evaluate each alternative on a number of parameters, e.g., economic, environmental, social, legal, institutional, and technical. Include a comparative discussion of how each alternative fulfills the goals outlined in the purpose and need. This analysis should also discuss areas of conflict, controversy, mitigation, and unresolved issues. Include a comparative four-account display consisting of the National Economic Development, Environmental Quality,

Regional Economic Development, and Social evaluations. The evaluations must be consistent with and supported by the environmental consequences analysis. Provide the rationale for selecting the recommended alternative.

- h. Selection of the Preferred Alternative
- i. Other Alternatives Considered but Eliminated from Further Study: Discuss additional alternatives that were previously considered, but eliminated from further study in this PR/PEIS. Also, provide justification for excluding these alternatives.
- j. Summary Comparison of Environmental Impacts of Alternative: Compare the environmental impacts of the alternatives included in the PR/PEIS. This comparison should be brief, since further analyses are included in the environmental consequences section.

Chapter 3: Affected Environment and Environmental Consequences

- a. Introduction
- b. Water Resources
- c. Groundwater Resources
- d. Hydropower Resources
- e. Sediment Resources
- f. Water Quality
- g. Vegetation and Wildlife
- h. Anadromous Fish
- i. Resident Fish
- j. Aquatic Invertebrates
- k. Threatened and Endangered Species
- l. Recreation Resources
- m. Land Use and Shoreline Resources
- n. Socioeconomics (Regional Economy)
- o. Public Services and Utilities
- p. Transportation
- q. Air Quality
- r. Noise
- s. Visual Resources
- t. Historic Properties
- u. Indian Sacred Sites
- v. Indian Trust Assets
- w. Public Health
- x. Environmental Justice
- y. Unavoidable Adverse Impacts
- z. Relationship between Short-term and Long-term Productivity
- aa. Irreversible and Irretrievable Commitments of Resources
- bb. Environmental Commitments

Chapter 4: Consultation and Coordination

- a. Public Involvement
- b. Agency Coordination and Consultation
- c. Tribal Consultation and Coordination

-
- d. Native American Graves Protection and Repatriation Act
 - e. Compliance with Other Federal Laws

Distribution List

List of Preparers

References

Glossary

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Appendices