

Final Report: Hood River Basin Surface Water Storage Feasibility Study

Oregon Water Resources Department Water Conservation,
Reuse and Storage Program

GA 0047 13

June 30, 2014



Oregon Water Resources Department



Hood River County Water Planning Group
on behalf of
Hood River County

This page was intentionally left blank

Table of Contents

Acronyms.....	iv
1 Introduction.....	1
2 Background.....	1
2.1 Description of Study Area.....	1
2.2 Water Planning Group History	2
3 Grant Requirements	3
3.1 Project Elements and Tasks	3
3.2 Project Accomplishments	5
Appendix A. Request for Proposals.....	10
Appendix B. Water Needs Assessment Report and Water Conservation Assessment.....	11
Appendix C. In-stream Flow Assessment	12
Appendix D. Memorandum of Agreement with the Bureau of Reclamation	13
Appendix E. Groundwater Design Report	14
Appendix F. Storage Assessment Documents	15
Appendix G. Stakeholder/Public Outreach and Participation	16
Appendix H. Joint Funding Agreement between Hood River County and the United States Geological Survey	17
Appendix I. Hood River Basin Study Report.....	18
Appendix J. Hood River Well Monitoring Network Report	19

Acronyms

AWS	Area Weighted Suitability
CMIP	Coupled Model Intercomparison Project
CMIP3	3 multi-model Coupled Model Intercomparison Project dataset
CMIP5	5 multi-model Coupled Model Intercomparison Project ensemble
CTWS	Confederated Tribes of Warm Springs
DHSVM	Distributed Hydrology Soils Vegetation Model
DoGAMI	Department of Geology and Mineral Industries
HRC	Hood River County
HRCWPG	Hood River County Water Planning Group
HSC	Habitat Suitability Criteria
ODFW	Oregon Department of Fish and Wildlife
OWRD	Oregon Water Resources Department
PHABSIM	Physical Habitat Simulation
Reclamation	United States Bureau of Reclamation
RFP	Request for Proposal
USGS	United States Geological Survey
WCRP	World Climate Research Programme
WPN	Watershed Professionals Network
WUA	Weighted Usable Area

1 Introduction

Impacts of climate change have become a growing reality for communities and municipalities dependent on glacier and snowmelt-fed water supplies. Irrigation districts, water districts, listed endangered species and recreationists in Hood River County (HRC) depend on Mt. Hood's glaciers and stakeholders in HRC have recognized the necessity to assess impacts of climate change and prepare for the resulting changes in future water supply. The Oregon Water Resources Department (OWRD) Hood River Basin Surface Water Storage Feasibility Study (OWRD Study) addresses this need with the following objectives: 1) an analysis of required irrigation, bypass, optimum peak, flushing and ecological flows; 2) comparative alternative analyses for water storage and water conservation and efficiency alternatives; 3) analyses of environmental harm or impacts from the proposed storage project and 4) evaluation of the need for and feasibility of using stored water to augment in-stream flows for aquatic life and other ecological values.

The OWRD Study is supplemented by in-kind resources from the United States Bureau of Reclamation (Reclamation) WaterSMART Basin Study (Hood River Basin Study) grant program where many of the tasks of the OWRD Study will be conducted by Reclamation. This is a final report documenting work completed under the OWRD Study.

2 Background

This section provides a background of the Hood River Basin and the Hood River County Water Planning Group (HRCWPG). A description of the geographic location, water resources, and communities are provided. A history of the HRCWPG is given as well as a timeline of the group's achievements leading up to the OWRD's Water Storage Reuse and Conservation application.

2.1 Description of Study Area

The Hood River Basin is located in Hood River County, Oregon, and encompasses the majority of the County as seen in Figure 1. The Hood River Basin extends from the summit of Mount Hood to the south, Surveyors Ridge to the east, the ridgeline of the Cascade Range to the west, and enters the Columbia River at River Mile 169.5. The City of Hood River as well as the communities of Parkdale, Mt. Hood, Dee, Pine Grove, and Oak Grove are within the 339 square-mile watershed.

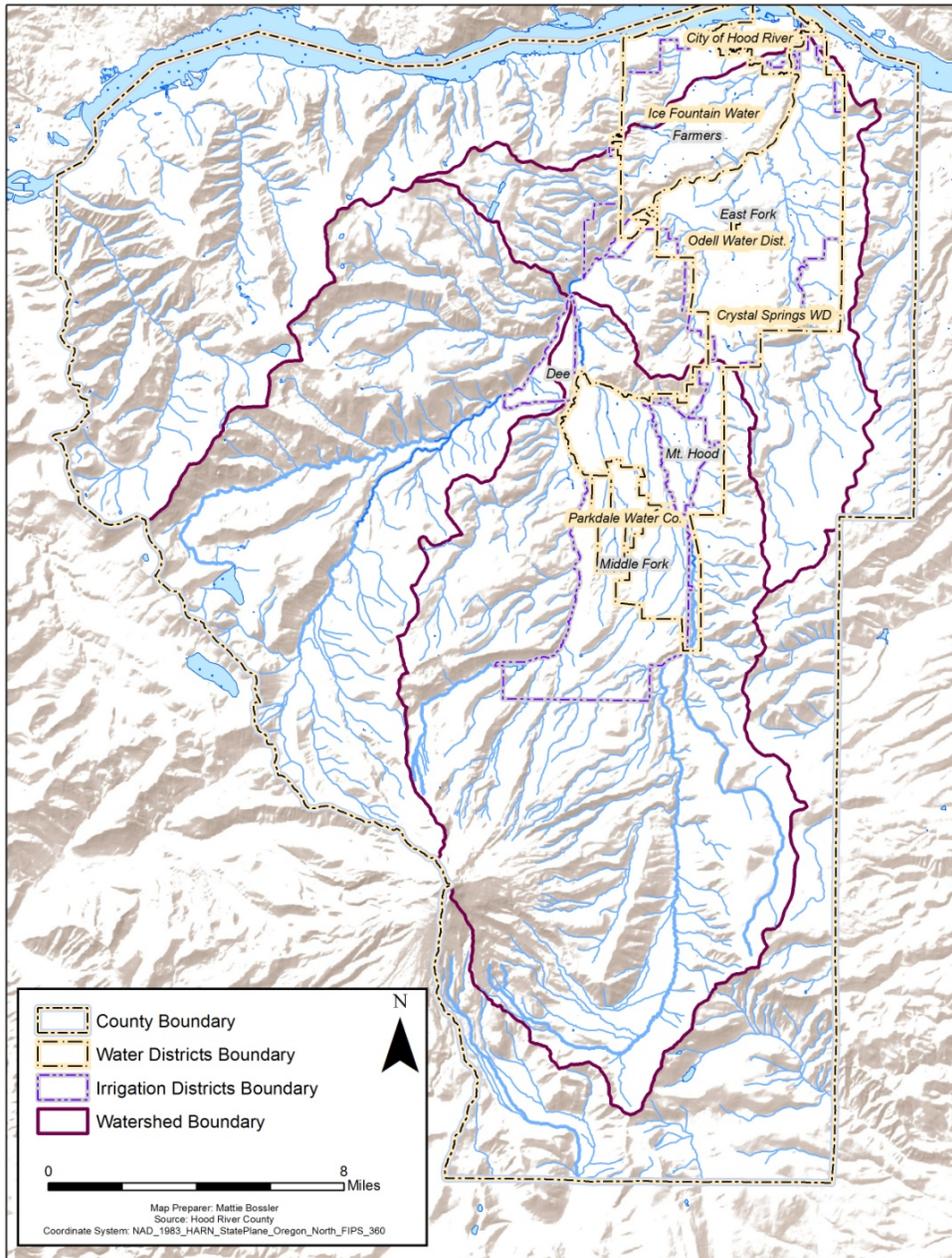


Figure 1: The Hood River watershed, irrigation and water district boundaries located in Hood River County, Oregon.

2.2 Water Planning Group History

The HRCWPG was formed in 2008 to assess future water needs for threatened and endangered aquatic species, irrigated agriculture, and recreation in the Hood River Basin. The HRCWPG includes HRC, the Hood River Watershed Group, major irrigation and water districts, the Hood River Soil and Water Conservation District, environmental groups, interested citizens and local resource specialists. The HRCWPG collected all existing water related documents and data for the Hood Basin from 2008 to 2011 and found large gaps in the available data and information related to future water supply and demand and the potential impact of climate change on water resources.

The HRCWPG decided to search for outside resources and expertise to address the identified gaps in data. In the spring of 2011, the HRCWPG applied for Reclamation WaterSMART Basin Study grant and was awarded \$200,000 of in-kind Reclamation staff expertise to address the needed data and information. The HRCWPG felt additional resources were needed and in December 2011 the Group applied for the OWRD Water Conservation and Storage Grant program and was awarded \$250,000 for contractual services. In spring 2012, the HRCWPG modified their Memorandum of Agreement with Reclamation to increase their in-kind resources to \$250,000 and match the OWRD funds exactly. The additional \$50,000 from Reclamation was to aide in understanding glacier impacts on the basin.

In April 2012, the HRCWPG prepared three separate request for proposals (RFP) to address different facets of the OWRD Study: an in-stream flow assessment, a water needs assessment, and a water conservation assessment (for full documentation of the three RFPs please refer to Appendix A). The RFP for the In-stream Flow Assessment required identification of stream flows necessary to maintain and enable recovery of key fish stocks in the Hood River Basin. The RFP for the Water Needs Assessment required an inventory of reported and actual use for potable, irrigation, industrial, and hydroelectric water users. The RFP for the Water Conservation Assessment required an analysis of potential potable, irrigation, industrial, and hydroelectric water conservation and efficiency improvements. Potential conservation through operational efficiencies/changes, infrastructure improvements/changes, and point of use technologies/methods were included as a requirement of the RFP as well. The HRCWPG selected Watershed Professionals Network (WPN) and Herrera Environmental Consultants (Herrera) to conduct the Water Needs and Conservation Assessment and Normandeau Associates, Inc (Normandeau) to conduct the In-stream Flow Assessment.

3 Grant Requirements

This section outlines the required elements and key tasks for the OWRD Study and to-date accomplishments of those tasks. The project tasks are summarized in Table 1, where a description, responsible entity, and appendix location of relevant documents are provided for each task. A summary outlining the to-date progress is also provided for each task.

3.1 Project Elements and Tasks

As a requirement of the OWRD Grant Agreement, the OWRD Study must contain the elements listed below. These elements are incorporated into the key tasks listed in Table 1.

- (a) Analyses of by-pass, optimum peak, flushing and other ecological flows of the affected stream and the impact of the storage project on those flows;
- (b) Comparative analyses of alternative means of supplying water, including but not limited to the costs and benefits of conservation and efficiency alternatives and the extent to which long-term water supply needs may be met using those alternatives;
- (c) Analyses of environmental harm or impacts from the proposed storage project; and
- (d) Evaluation of the need for and feasibility of using stored water to augment in-stream flows to conserve, maintain and enhance aquatic life, fish life and any other ecological values.
- (e) In addition, if the storage project is for municipal use, the Grant Agreement will require an analysis of local and regional water demand and the proposed storage project's relationship to existing and planned water supply projects.

Table 1. Key tasks required of the Hood River Basin Surface Storage Feasibility Study including a brief summary, entity responsible, and location of relevant documents for each task.

TASK	SUMMARY	RESPONSIBLE ENTITY(S)	ATTACHED INFORMATION
1. Grant Management	Administration of OWRD and Reclamation grants by overseeing contracts, fiscal accounting, and grant reporting.	HRC	NA
2. Assess Potential Impact of Climate Change on the Basin ¹	Existing climate modeling will be used to create a model specific to the study area. The model will be used to evaluate the potential impacts of climate change on water supply and demand including both human needs and the needs of the ecosystem as a whole.	Reclamation	Appendix D
3. Assess Hydrology of the Hood River Basin ²	Assess ground and surface water interaction using existing wells and well logs and define a scope of work for additional hydrologic analysis.	Reclamation and USGS	Appendix E
4. Analysis of Water Demands	Assess long term water supply needs based on past, current, and projected agricultural demands, domestic demands, and ecological needs. This would include analysis of by-pass, optimum peak, flushing, and other ecological flows in the Basin. This task would identify and quantify current and future water deficits that could potentially be met through above ground storage or other storage and conservation measures.	WPN and Normandeau	Appendix B Appendix C
5. Assess Physical Feasibility of Surface Storage and Other Alternatives	Existing data will be used to assess the suitability of the Basin for surface storage as well as the potential for conservation/efficiency projects to offset demand and the potential subsequent effects of implementation of all alternatives. Potential surface water sources will be analyzed for availability. Existing infrastructure and new infrastructure requirements will be assessed for surface storage as well as for any conservation or efficiency alternatives. Optimum location options for one or more off-channel surface reservoirs will be identified.	Reclamation and WPN	Appendix F Appendix H
6. Assess Regulatory and Ecological Feasibility of Surface Storage and Other Alternatives	Review of water rights, permitting issues, local, state, and federal regulations, and social/political considerations regarding surface storage, potential off-channel reservoir sites, and identified conservation and efficiency alternatives.	Reclamation, WPN, and HRC	Appendix F
7. Assess Economic Feasibility of Surface Storage and Other Alternatives ³	Comparative cost-benefit analyses of surface storage and identified conservation and efficiency alternatives.	Reclamation, WPN, and HRCWPG	Appendix H Appendix J
8. Stakeholder/Public Outreach and Participation	The HRCWPG meetings will be advertised and open to the public throughout the term of the study. Quarterly project progress reports will be made to the Hood River Watershed Group for additional stakeholder and public input.	Reclamation, WPN, Normandeau, HRCWPG, and HRC	Appendix G
9. Reclamation WaterSMART Basin Study Report	The final Hood River Basin Study Report for Reclamation WaterSMART Basin Study Grant will include the information from the OWRD Study as well as the work by Reclamation staff and HRCWPG on the impact of climate change and the hydrogeology of the Basin.	Reclamation, WPN, Normandeau, HRCWPG, and HRC	Appendix I

¹ Potential impacts of climate change on water supply and demands will be completed with either the World Climate Research Programme's (WCRP) Coupled Model Intercomparison Project (CMIP) Phase 3 multi-model dataset (CMIP3) or Phase 5 multi-model ensemble (CMIP5).

² Hydrologic analysis will include use of an existing coupled dynamic glacier and surface water hydrology model using the Distributed Hydrologic Soil and Vegetation Model (University of Washington) to evaluate the potential impacts of water supply changes, including climate change, on the Hood River system. Construct impacts model to evaluate the impacts of supply and demand changes, including surface water, groundwater, and impacts of climate change on future flow.

³ A cost-benefit analysis will be conducted on prioritized sites only selected through a collaborative process.

3.2 Project Accomplishments

This section provides a brief summary of the accomplishments of each of the key tasks for the OWRD Study. Many of these tasks have more complete explanations of work completed in the appendices and references to those appendices are provided.

Phase 1: Available Information and Information Gap Analysis

In November 2008, Hood River County and the watershed group organized a County-led water resources planning committee, now called the Hood River Water Planning Group (HRCWPG). The mission of this group is to inventory surface and ground water resources, evaluate current and future out-of-stream and in-stream water supply requirements, and formulate plans for managing water resources at the basin level. The broad composition of this group includes the County, watershed group, OWRD, major irrigation and water districts, the soil and water conservation district, environmental groups and local resource specialists.

Over the past 3 years, the group has worked to gather all existing reports, documents, and data relating to water in the Hood River Basin. In early 2011, existing data were gathered and inventoried. An analysis of the existing data by the group pointed to some large gaps in information and data. The primary data and information gaps were related to:

- Future supply/demand scenarios and how those would affect both human uses of water resources and ecological processes.
- Options for both conservation and storage that would provide for the ability to optimize water resources management for the benefit of both water users and ecological processes. This would include a trade-off analysis of the identified options.
- The potential impacts of climate change on water resources in terms of quantity, quality, and timing of supply availability.
- Hydrogeology in the Hood River Basin, in particular, the connections between surface water and ground water.

The HRCWPG collectively came to the conclusion that outside resources and expertise would be necessary to address the identified gaps in data and information. The HRCWPG identified funding options including Reclamation WaterSMART Basin Study. HRCWPG applied for the WaterSMART Basin Study grant in the late spring of 2011 and was notified in June of 2011 that the grant application was successful. The Basin Study grant award was for \$200,000.00 of in-kind Bureau of Reclamation staff expertise to address varying aspects of the above mentioned data and information deficiencies. In meetings with Bureau of Reclamation staff members, the need for additional resources was identified. The HRCWPG identified the Oregon Water Resources Department Water Conservation, Reuse and Storage Grant Program as a complimentary funding source that could help the group to reach its goals.

Phase 2: Planning Study Implementation

Task 1: Grant Management

Hood River County and the HRCWPG formalized the contracts for the OWRD and Reclamation grants in spring 2012 (see Memorandum of Agreement with Reclamation in Appendix D). From June 2012 to September 2012, the HRCWPG and Hood River County developed and released the request for proposals, evaluated the proposals, conducted interviews, and awarded contracts to two consultants: Herrera with assistance by WPN and Normandeau (see RFPs in Appendix A). From July 2012 to the present, Hood River County has conducted contract and fiscal administration for the OWRD and Reclamation grants.

Task 2: Assess Potential Impact of Climate Change on the Basin

In August 2012, Reclamation, in partnership with Herrera, selected the Distributed Hydrology Soils Vegetation Model (DHSVM) to assess potential impacts of climate change on the Basin. Reclamation selected the model because it covers the full geographic scale of the Hood River Basin. Reclamation has also undertaken efforts to calibrate a dynamic glacial component to incorporate Mount Hood glacial impacts on the Hood River. From November 2012 to September 2013, Reclamation, WPN, and University of Washington staff calibrated the model using historical streamflow data. Historical and project future flows for the Hood River Basin were generated in DHSVM in September 2013. A summary and interpretation of the generated streamflows are provided in the Hood River Basin Study Report (see Report in Appendix I).

Reclamation assessed impacts of climate change by inputting flow from the DHSVM model into a water resources model (using MODSIM from Colorado State University) on which construction was initiated in February 2013. The water resources model incorporates information and data collected or generated from other key tasks in the OWRD study: historical streamflows and projected future streamflows generated from DHSVM; basin infrastructure, in-stream needs, and water demands from the water needs assessment; water conservation potential from the water conservation assessment; potential storage sites from the storage assessment; and groundwater resources from the groundwater assessment. A summary and interpretation of the results from the water resources model are provided in the Hood River Basin Study Report (see Report in Appendix I).

Task 3: Assess Hydrology of the Hood River Basin

In October 2012, the HRCWPG contracted with the United States Geological Survey (USGS) to assist Reclamation with their groundwater assessment (see funding agreement in Appendix H). In November 2012, the HRCWPG and the USGS hosted a workshop of professionals with groundwater expertise related to the Hood River Basin, including representatives from the USGS, OWRD, Department of Geology and Mineral Industries (DoGAMI), local tribes, and county members, to gain information that would inform the development the objectives of the groundwater assessment. From December 2012 to February 2013, Reclamation began the development of a steady state groundwater model and prepared a draft design document that outlines the development of a preliminary water budget that describes the inflows and outflows from the aquifer and the development of the steady-state groundwater model (see full report in Appendix E). From February 2013 to April 2013, Reclamation calibrated the steady state groundwater model of the Basin with guidance from the USGS. From May 2013 to August 2013,

Reclamation began developing a transient groundwater model. In the Fall of 2013, evaluated future groundwater resources scenarios that could be implemented in the Hood River Basin. A summary and interpretation of these results are provided in Reclamation's final Groundwater Design Report (see Report in Appendix E).

In December 2012, the HRCWPG began efforts to expand the groundwater monitoring network in the Hood River Basin. Using recommendations from the USGS and OWRD hydrogeologists who monitor wells in the Hood River Basin, HRC selected 150 wells as ideal candidates to include in the monitoring network. In February 2013, HRCWPG sent a letter to landowners of the selected wells requesting participation in the well monitoring program. In March 2013, the HRCWPG and OWRD hydrogeologists monitored 18 wells in addition to the 14 wells they currently monitor, expanding the network to a total of 32 wells in the monitoring network. From the summer of 2013 to the present, an additional 28 wells were added to the network. The Hood River County Well Monitoring Network Report provides a more detailed summary of the progress achieved in developing the network as well as recommendations for continued administration and expansion of the network (see report in Appendix J).

In addition to the groundwater analysis, Reclamation evaluated changes to surface water supply using the water resources model described in Task 2. A summary and interpretation of these results is provided in the Hood River Basin Study Report (see Report in Appendix I).

Task 4: Analysis of Water Demands

From October 2012 to March 2013, WPN collected water rights information and data, water use reports, and geospatial information for the potable, irrigation, industrial, and hydroelectric water users in the Hood River Basin. From April 2013 to May 2013, WPN prepared a Water Needs Report documenting the use and projected demand of the major water users in the Hood River Basin. In February 2013, Reclamation began developing a water resources model, as described in Task 2 and 3, which will incorporate historic streamflows, projected future streamflows, basin infrastructure, in-stream needs, water demands, water conservation potential, potential storage sites, and groundwater resources.

From October 2012 to December 2012, Normandeau collected their hydraulic measurements of the five stream reaches (Green Point Creek, West Fork Hood River, Upper East Fork Hood River, Lower East Fork Hood River, and Neal Creek) in the Hood River Basin. In December 2012, Normandeau began building the Physical Habitat Simulation (PHABSIM) model using the hydraulic measurements from the five stream reaches. In January 2013, Oregon Department of Fish and Wildlife (ODFW) and the Confederated Tribes of Warm Springs (CTWS) reviewed habitat suitability criteria (HSC) for the PHABSIM model. In February 2013, Normandeau ran PHABSIM with the reviewed HSC and prepared draft results displaying the area weighted suitability (AWS, also called Weighted Usable Area (WUA)) relationship to flow. In the summer of 2013, Normandeau finalized these curves (see AWS curves in Appendix C). In the spring of 2014, Normandeau evaluated the streamflows generated in Reclamation's water resource model in PHABSIM as well. A summary of their analysis and interpretation of their results is provided in Normandeau's Final IFIM Report (see report in Appendix C).

Task 5: Assess Physical Feasibility of Surface Storage and Other Alternatives

In October 2012, the HRCWPG gathered available data and information from local stakeholders to select several locations in the Hood River Basin as potential water storage sites. In November 2012, the HRCWPG and other stakeholders accompanied Reclamation to tour and evaluate these locations. This reconnaissance level site visit allowed Reclamation design and geology experts to evaluate the geology of the sites proposed to them. During the site visit, visible outcrops were identified and potential dam height and crest length were estimated. This information was further refined in the office using topographic maps and other available resources to develop initial estimates of storage volume that could be created by the sites proposed to them. Reclamation prepared a report documenting the potential suitability of each site for storage based on these elements in December 2012 (see Appendix F for full report). This storage assessment was a cursory effort to document potential storage sites that had been proposed by HRCWPG. In spring of 2014, the HRCWPG prepared a more in-depth report to evaluate the physical feasibility of surface water storage in the Hood River Basin (see Appendix F for full report).

From February 2013 to April 2013, WPN and HRCWPG collected data to analyze conservation alternatives related to irrigation practices for patrons in each irrigation district in the Hood River Basin. From March 2013 to May 2013, WPN and HRCWPG analyzed conservation alternatives related to irrigation users using the data they had collected as well as potable water users, industrial users, and hydroelectric users and already available data. In June 2013, WPN completed a report documenting their assessment of these conservation alternatives (see Appendix E for full report).

Task 6: Assess Regulatory and Ecological Feasibility of Surface Storage and Other Alternatives

In October 2012, HRCWPG collected data to assess the regulatory and ecological feasibility of surface storage alternatives. As mentioned for work completed under Task 5, HRCWPG prepared a report assessing the physical feasibility of surface water storage alternatives; the report also evaluated the regulatory and ecological feasibility of each storage site which is available in Appendix F for full detail. From April 2013 to May 2013, WPN collected data related to conservation alternatives to assess their ecological and regulatory feasibility.

Task 7: Assess Economic Feasibility of Surface Storage and Other Alternatives

As mentioned in Task 5 and 6, the HRCWPG prepared a report evaluating the physical, regulatory, and ecological feasibility of surface water storage alternatives. This report also evaluated the economic feasibility of these alternatives (see report in Appendix F).

Task 8: Stakeholder/Public Outreach and Participation

Stakeholder and public outreach has been an important element of OWRD Study since the study's inception in 2011. In addition to the OWRD Study outreach, when the HRCWPG was initially formed in 2008, outreach was a major element built into its development. Monthly stakeholder meetings directly related to the OWRD Study have been conducted since December 2012 to the present date and the corresponding minutes are provided in Appendix G. Representatives from WPN and HRCWPG have also provided public outreach by presenting updates of this study at public meetings for the Hood River Watershed Group. Hugh McMahan, an At Large Member of the HRCWPG, wrote an article for Hood

River News in February 2013 providing information about the OWRD Study (see Appendix G for full article).

Task 9: Reclamation WaterSMART Basin Study Report

Reclamation completed the Hood River Basin Study Report in June 2014 and is available in Appendix I for full detail.

Appendix A. Request for Proposals

This appendix provides the three requests for proposals for the in-stream flow assessment, water needs assessment, and water conservation assessment.

Appendix B. Water Needs Assessment Report and Water Conservation Assessment

This appendix contains a final report from WPN's Water Needs Assessment and their Water Conservation Assessment.

Appendix C. In-stream Flow Assessment

This appendix contains the final report for the In-stream Flow Assessment.

Appendix D. Memorandum of Agreement with the Bureau of Reclamation

This appendix contains the Memorandum of Agreement with the Bureau of Reclamation for the WaterSMART Program which is providing in-kind resources to this Study.

Appendix E. Groundwater Design Report

This appendix contains the Bureau of Reclamation's Groundwater Design Report which provides the methodology and results from the Bureau's groundwater assessment.

Appendix F. Storage Assessment Documents

This appendix contains the following documents which provide documentation of key tasks 5-7 of this study: Reclamation's technical report of their tour of storage sites and a final report the HRCWPG prepared outlining ecological and regulatory and economic feasibility of storage sites.

Appendix G. Stakeholder/Public Outreach and Participation

This appendix contains all of the meeting minutes recorded from the HRCWPG meeting from December 2012 to the present and an article written by Hugh McMahan, At Large Member of the HRCWPG, describing the OWRD Study.

Appendix H. Joint Funding Agreement between Hood River County and the United States Geological Survey

This appendix contains the joint funding agreement between HRC and the USGS to provide assistance to Reclamation with their groundwater assessment.

Appendix I. Hood River Basin Study Report

This appendix provides the final report of the Hood River Basin Study completed by Bureau of Reclamation.

Appendix J. Hood River Well Monitoring Network Report

This appendix provides the final report of the Hood River Well Monitoring Network Report completed by Mattie Bossler.

