Introduction and Project Overview

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Project Overview

The full title of the research project described in this report is: "A Comprehensive Hydrologic Data Base Incorporating IPCC Climate Change Scenarios to Support Long-Range Water Planning in the Columbia River Basin". For the remainder of the report we will refer to the project using the abbreviated title "The Columbia Basin Climate Change Scenarios Project" (CBCCSP). The project is a collaborative venture between the University of Washington Climate Impacts Group and five regional study partners. Primary funding for the project was provided by the Washington State Department of Ecology via Washington State House Bill 2860 (HB2860). Supplemental funding was provided by four additional regional study partners:

- The Bonneville Power Administration
- The Northwest Power and Conservation Council
- Oregon Water Resources Department
- British Columbia Ministry of the Environment

The Pacific Climate Impacts Consortium at the University of Victoria, BC also provided in kind support and funding for collaborative research which contributed materially to this project. Additional study partnerships (without financial support) include:

- Montana Department of Natural Resources
- Idaho Department of Water Resources
- US Bureau of Reclamation, Boise Regional Office
- US Army Corps of Engineers, Seattle and Portland Districts

As discussed in more detail below, the primary objective of the project is to provide a comprehensive and up-to-date database of simulated hydrologic data incorporating climate change information from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report to support of long-term water resources planning in the Pacific Northwest Columbia River basin, and the assessment of climate change impacts on the terrestrial, fluvial, and coastal marine environments.

1. Background and Motivation for the Project

As the scientific consensus on the nature of global climate change and public awareness of the impacts of climate change on western water resources has grown in recent years, the need to incorporate climate change scenarios in water planning efforts and policy decisions has been widely acknowledged in the West, perhaps most notably in California.

Here in the Pacific Northwest (PNW), although a number of pilot water planning efforts incorporating climate change have been carried out for specific water resources systems in the past five years or so, currently there is no comprehensive, up-to-date, self-consistent and publicly available source of hydrologic scenarios incorporating climate change information available to guide water planners and policy makers in the PNW. In the PNW Columbia River basin, the lack of appropriate hydrologic scenarios quantifying the impacts of regional climate change on water resources has generated particularly great concern because the region is currently investing, on a large scale, in comprehensive water resources planning efforts for the Columbia associated with salmon restoration, water supply, flood control, hydropower production, and the complex transboundary relationship between Canada and the US. Despite a growing awareness that climate change is likely to significantly impact the success of these planning efforts, the lack of water planning scenarios that reflect expected changes in climate for the 21st century has been a formidable obstacle to incorporating climate change information into water planning efforts and related policy decisions.

One of the central challenges of producing a set of comprehensive and self-consistent climate change streamflow scenarios for the Columbia basin is that water planning must be conducted at a wide range of spatial scales from relatively small-scale studies for individual sub-basins of the Columbia (e.g. the Yakima and Okanogan basins) to large scale studies encompassing the entire Columbia basin (e.g. for system-wide flood control and regional hydropower planning). Fine-scale hydrologic models are effective tools for providing detailed hydrologic information at the watershed scale, but are prohibitively expensive to implement and run over the continental scales that are needed

for basin-wide planning efforts. Previous large-scale modeling efforts for the Columbia (e.g. 1/8th degree latitude longitude resolution hydrologic simulations used to support pilot planning studies at the NW Power and Conservation Council) have been successful at providing useful climate change scenarios for large-scale planning, but have limited ability to accurately resolve smaller sub-basins of interest to other stakeholders.

Estimating the effects of regulation and diversions on river flows is also an important element of water resources planning. For main-stem planning and for some sub-basins, sophisticated water resources models are available to estimate these effects. In these cases naturalized flow scenarios are needed for planning. Many smaller watersheds, however, currently do not have access to simulation models of this type, and scenarios of estimated "regulated" flows would be valuable.

The project has implemented improved technical methods and models and a scope of work designed to produce a comprehensive hydrologic data base for the entire Columbia River basin, providing climate change planning scenarios appropriate for both basin-wide planning efforts and more detailed planning studies in moderate and small sub-basins. In addition, pilot studies for four different basins (including the Methow, Walla Walla, Upper Yakima, and Upper Kettle) using fine scale hydrologic models are included in the study to help assess the potential advantages of implementing these more costly approaches in small-scale watersheds.

2. Overview of Study Approach and Methods:

The methods developed for the study incorporate a number of important improvements in the hydrologic models and the scenario generation process. The most important of these changes is the increased spatial resolution of the macro-scale hydrologic model (Chapter 5, this report), however important improvements in the downscaling procedures used to translate GCM simulations to driving data for the hydrologic models were also developed especially for this project to support daily time step analysis at the finer spatial scales incorporated in this project (Chapter 6, this report).

Another important component of climate change research designed to support water planning and adaptation is that it will require frequent updating with each successive IPCC assessment effort to reflect the improved understanding of impacts. Although the primary objective of the research in this proposal is the creation of hydrologic data bases to support long-range planning in the next five years or so, an important secondary objective of the project is to construct and archive a set of calibrated hydrologic models and end-to-end data processing code to allow relatively rapid updates of the hydrologic data bases on an ongoing basis.

The primary final products of this project are a set of hydrologic databases encompassing 297 streamflow locations, GIS layers for key hydrological and meteorological variables (Chapter 8, this report), and a web site (Chapter 9, this report) for serving these data resources to a diverse user community (Chapter 2, this report). This report is intended to serve both as a technical resource and a user's guide for the project. Additional information and instructions for accessing the project databases are also available on the study website (http://www.hydro.washington.edu/2860/).

3. Citations and Acknowledgements

If you use the data or information from this project, please include the following acknowledgement in any publications or reports:

Data and information for this study was provided by the Columbia Basin Climate Change Scenarios Project (PI: Alan F. Hamlet), University of Washington, http://www.hydro.washington.edu/2860/

This project has involved a very large group of academic researchers, management and agency professionals, and basin stakeholders. A detailed acknowledgement of all the participants would fill many pages, but here at least is a listing (in alphabetical order) of some key participants in the study by affiliation:

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