COLLABORATION ON CLIMATE CHANGE ANALYSIS IN THE PACIFIC NORTHWEST

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ABSTRACT

Climate change is likely to have a significant effect on the future of water management in the Pacific Northwest. Because many dams in this region such as those on the Columbia River are operated as a system and involve many different owners and operators, regional coordination among the various entities is extremely important. This is particularly true on issues like climate change, where the effects may vary considerably in different parts of the region.

In collaboration with the U.S. Bureau of Reclamation, Bonneville Power Administration, and other entities in the region, the U.S. Army Corps of Engineers Northwestern Division recently completed efforts to analyze the effects of climate change on water supply and water management activities in the Pacific Northwest using a regional approach. One of the major goals of this effort was to develop a common set of data, models, and tools that can be used by entities throughout the region to analyze climate change. This information was based on climate projections from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report produced in 2007. Subsequent to this effort, the IPCC issued their Fifth Assessment Report, and work is now underway by this regional group to update the analysis of the effects of climate change on water management activities. These coordinated efforts are focused on reducing the potential for duplication, overlap, and conflicting results on climate change activities undertaken by the various entities, while at the same time improving regional collaboration and coordination.

The overall approach used in this effort involved the following two main phases of work that will be described in further detail: (1) selection and adoption of future climate and hydrology data that was evaluated and then used to develop water supply forecasts to reflect future hydrologic and climate conditions; (2) simulation of expected future reservoir operations using long-term reservoir models to analyze potential changes in water management planning and operations.

The climate and hydrologic data used in the first phase of this effort was developed by the University of Washington Climate Impacts Group (UW CIG). They produced "downscaled" climate data that was incorporated into a regional hydrology model that was used to produce a set of river flows for locations throughout the Columbia River Basin and associated subbasins. The "downscaling" effort involved refining global climate data into smaller geographic areas, providing usable data that better captured the highly varied mountain and valley regions of the Pacific Northwest. Two future time periods were studied and included the 30-year period surrounding the 2020s (2010 to 2039) and the 30-year period surrounding the 2040s (2030 to 2059).

The study results suggested that the Columbia River Basin annual air temperatures will rise from 1 to 3 degrees Fahrenheit above the historical reference period by the 2020 period and from 2 to

5 degrees Fahrenheit by the 2040 period. This change would affect Columbia River Basin precipitation and snowpack patterns (more rain, less snow), seasonal river flows, hydroelectric generation, demand for electricity, and other key areas. Water temperature was not a part of this study, but may be included in future analysis. Overall, yearly precipitation changes in the study were minimal, averaging a 1 to 2 percent increase. All of the climate change scenarios analyzed exhibited a seasonal shift of higher flows in the winter and lower flows in the summer. This seasonal shift is due in part to more winter precipitation in the form of rain instead of snow and increased snowmelt earlier in the year due to warmer temperatures.

The results of the second phase of this effort that involved simulation of expected future reservoir operations varied depending on the basin or subbasin that was being evaluated. For example, for the overall Columbia River Basin, during the winter-early spring period (January to April) the runoff amounts for the 2020s ranged from 108 to 150 percent of normal for the unregulated flows at The Dalles Dam on the lower Columbia River just upstream of Portland, Oregon. For the 2040s, the runoff amounts for this same period ranged from 95 to 170 percent of normal for unregulated flows. In contrast, during the summer period of June to August, the runoff amounts for the 2020s ranged from 80 to 95 percent of normal for unregulated flows at the Dalles Dam. For the 2040s, the runoff amounts varied from 65 to 95 percent of normal for unregulated flows.

Based on the analysis of the affect of climate change on reservoir operation, it is anticipated that some changes may be needed in reservoir operations. For example, flood risk management procedures will need to account for a projected shift in the timing of the spring runoff, with the average monthly peak runoff shifting from June to May. Related to this, earlier releases of water may be needed from flood risk management projects to capture the early runoff. Also, impacts to the timing of federal hydropower system operations could also impact other operational objectives in the spring and summer such as for fish and wildlife. The increase in the spring flows could results in higher power generation and increased spill of water at many dams. The additional spill could increase total dissolved gas levels, which could negatively impact fish.