THE USGS WILLAMETTE INTEGRATED WATER SCIENCE (IWS) PROGRAM: OVERVIEW OF UPCOMING RESEARCH AND GAGING IN THE WILLAMETTE RIVER BASIN 2023-2031

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In February 2022, the US Geological Survey (USGS) announced that the Willamette River Basin was selected as the fourth USGS Integrated Water Science (IWS) program. As the fourth of 10 planned intensively studied IWS watersheds across the nation, the Willamette River Basin will be the focus of major investments in water monitoring, research and predictive modeling to enhance the nation's ability to observe, understand and predict water availability. USGS defines the phrase "water availability" as the spatial and temporal distribution of water quantity and quality in both surface and groundwater, as related to human and ecosystem needs and as affected by human and natural influences. Each IWS basin is representative of a broader geographic region and encompasses a variety of threats to water availability; hence, lessons learned in the Willamette River Basin will be used to help quantify and forecast water availability in other Pacific Northwest basins. Integrating advances in monitoring, research, and modeling across all IWS basins, (which presently include the Delaware, Illinois, Upper Colorado, and Trinity-San Jacinto River basins), will support modernization of water monitoring programs and improvements in understanding and predicting water availability nationwide. The selection of the Willamette River Basin in 2022 kicked off a large, multi-faceted science initiative encompassing several distinct, complementary programs that will each extend for a decade or longer assuming sufficient funding through congressional appropriations.

Each IWS basin received complementary funding from two distinct programs. Those are the USGS Next Generation Observing System (NGWOS) program and the USGS Integrated Water Availability Assessments (IWAAs) program. The coupled NGWOS and IWAAs efforts will yield near-term data and information to support water management decisions regarding spring Chinook Salmon (*Oncorhynchus tshawytscha*), winter steelhead (*O. mykiss*), Pacific Lamprey (*Entosphenus tridentatus*) and Bull Trout (*Salvelinus confluentus)* in the Willamette River Basin. In the Willamette River Basin, NGWOS will initially focus modernizing and expanding the water monitoring network, including installing new streamflow and water temperature gages on unregulated spawning reaches in the Cascade Range and mouths of major salmon-bearing rivers. Additionally, new remote sensing data and surveys will be used to map bathymetry, substrates, thermal conditions and other attributes in the historical spawning reaches, including those upstream of US Army Corps of Engineer dams. The NGWOS program will also initiate a wide portfolio of other gaging and research and development activities (including "super gages") that will help build the "water monitoring network of the future." The Willamette IWAAs program will entail a phased effort to characterize patterns of water availability for humans and ecosystems. From 2024-2026 (Phase 1), the Willamette IWAAs program will launch a major study to characterize patterns of hydrologic and thermal variability and implications for surface water withdrawals for municipal, industrial and irrigation uses and habitat for spring Chinook Salmon, winter steelhead, and Pacific Lamprey. This 2024-2026 effort will incorporate a blend

of trend analyses and modeling applied across a study area extending from small, unregulated streams high in the Cascades Range historically used for spawning and rearing to downstream reaches extending to the mouth of the Willamette River. From 2027-2031 (Phase 2), the WRB IWAAs program will conduct a more comprehensive, basin-wide evaluation of water availability for a broader suite of human and ecosystem needs, utilizing coupled surface water, groundwater and water quality models.

The planned scope and suite of activities for NGWOS monitoring and IWAAs studies are in development, and USGS hopes to partner with the Willamette River Basin science community and water managers to inform new data collection, analyses, and modeling over the funded life of the overarching WRB IWS program. Stakeholder input is integral to the Willamette River Basin IWS program in three distinct and important ways.

1. Stakeholder input adds value to upcoming monitoring and research activities because it will enable USGS researchers to envision how new data and interpretive studies resulting from the Willamette River Basin IWS program will establish a foundation on which complementary data and studies can be initiated in the future.

2. Secondly, stakeholders can help USGS researchers understand how and whether deliverables will provide valuable information to them in Phase 1 and Phase 2 of the IWAAs program.

3. Third, stakeholders can identify how next generation monitoring methodologies paired with interpretive science tools applied in the IWAAs program will support stakeholders beyond the funding horizon of the overarching Willamette River Basin IWS program.

To ensure that basin partners can be updated on progress and provide input to shape Willamette IWS activities, a comprehensive outreach plan is in development, including stakeholder meetings, surveys, and newsletters.