

## Wells Project Water Quality Chronology (1988 – 2007)

Date	Description
<b>Water Quality Monitoring: Total Dissolved Gas</b>	
1998- Present	Since 1998, total dissolved gas (TDG) has been monitored in the forebay and the tailrace at Wells Dam using Hydrolab Minisonde sensors. The monitoring period goes from April 1 to September 15. In 2006, the program was extended to monitor TDG until November 31 to monitor TDG compliance at Wells Dam during the non-fish migration season. Douglas PUD is planning to once again extend the TDG monitoring period through November 2007 toward the collection of information for the 401 water quality certification for the Wells Project.
<b>Water Quality Monitoring: Temperature</b>	
1998- Present	The Hydrolab Minisonde sensors used in the TDG monitoring program also collects temperature information in the forebay and tailrace of the Wells Dam. Temperature data along with TDG data are monitored closely and calibrated monthly during the monitoring season (April 1 to September 15).
2001- Present	Since 2001, Douglas PUD has collected hourly water temperature data in the Wells Project. Temperature loggers have been deployed at sites throughout the Wells Reservoir and associated tributaries within Project Boundary. Vertical temperature profiles at select sites were also collected. Up until 2004, temperature loggers were typically deployed in the spring and retrieved in late fall. Starting in 2005, Douglas PUD extended the monitoring season to cover the entire year and implemented a more frequent downloading schedule to avoid temperature data gaps.
2005- Present	Douglas PUD collects water temperature data at Wells Dam by placing two thermistors into the flow emanating from the fishway attraction water pumps located in the tailrace of the dam. These probes are constantly submerged in the river and one probe is located on either side of the river. An average of the two probes is logged on the hour.
<b>Water Quality Monitoring: Other Parameters</b>	
1998- Present	At Wells Dam, turbidity readings are taken daily during the adult fish passage assessment period of May 1 to November 15 using a secchi disk. A standard secchi disk is lowered into the forebay on the west side of Wells Dam near the exit to the west fishway. Measurements are recorded in feet of visibility.
2005- Present	Dissolved oxygen and pH sensors have recently been added to the forebay Hydrolab Minisonde sensor that is used for the TDG monitoring program. Data has been collected during portions of the 2005 and 2006 monitoring periods and will be collected in 2007.
2005- Present	Although meteorological data are not a direct water quality issue, site specific weather information is an integral component for the development of water temperature models which can be used to support 401 water quality certification. Weather information applicable to the entire Wells Reservoir was unavailable until 2005 when Douglas PUD installed meteorological stations on the reservoir. Douglas PUD identified three sites that would most effectively characterize weather trends in the Wells Reservoir. These sites were Chief Joseph Dam (upper reservoir area), Bridgeport Bar (mid-reservoir area) and the Wells Project forebay (lower reservoir area). Since reliable meteorological information was already

	available near Chief Joseph Dam, NRG systems weather stations were erected at the other two identified sites. The parameters being collected are air temperature, relative humidity, dew point temperature, solar incidence, cloud cover, wind speed, and wind direction.
<b>Water Quality Studies/Assessments: Total Dissolved Gas</b>	
2005-2006	<i>Wells Dam Spillway Total Dissolved Gas Evaluation.</i> Columbia Basin Environmental. Douglas PUD has recently initiated a series of assessments aimed at gaining a better understand of TDG production dynamics resulting from spill operations at Wells Dam. Starting in 2005, Douglas PUD initiated several spill tests to examine the relationship between water spilled over the dam and the production of TDG.
2005	A detailed bathymetric survey was conducted for the Wells Reservoir and portions of the Okanogan and Methow rivers that are within the FERC Project boundary. The final product includes a digital elevation model and one-foot contours in GIS format of the entire reservoir and tailrace.
2005-2006	<i>Wells Project Limnology.</i> EES Consulting. In 2005, Douglas PUD implemented a study to begin collecting baseline information on the limnology of all waters within the Wells Project. The objective of this study was to assess seasonal water quality dynamics in the Wells Project and to collect information to fill water quality data gaps identified by Douglas PUD as necessary to support the water quality certification process administered by WDOE, pursuant to Section 401 of the Clean Water Act. The year long study began in May 2005 and collected physical, chemical, and biological water quality parameters.
2006	<i>Total Dissolved Gas Production Dynamics Study, Wells Hydroelectric Project FERC NO. 2149.</i> EES Consulting, Inc., Joe Carroll, ENSR, and Parametrix. In spring of 2006, Douglas PUD continued its series of TDG assessments at Wells Dam. The goal of the study was to gain a better understanding of the TDG production dynamics at Wells Dam during spill events up to 69.5 kcfs, which is the spill rate that occurs during the seven-day, 10-year frequency flood (7Q10) level assuming 9 out of 10 units are at full generation capacity. Specific objectives of the study were to 1) characterize TDG percent saturation in the Wells tailrace as a function of project operational conditions; 2) describe TDG levels and transport patterns in the Wells tailrace for several targeted operational scenarios in an effort to determine if the Project can be operated in compliance with the tailwater Washington Department of Ecology (WDOE) TDG waiver criteria for 7Q10 spill events; 3) quantify the extent of gassing of powerhouse flows due to interaction with spill; 4) evaluate how representative the TDG compliance monitoring stations located in the Wells forebay and tailrace are; 5) collect preliminary velocity information to support a Computational Fluid Dynamics (CFD) model of the tailrace; and 6) identify operational spill scenarios that move towards Project compliance with the tailwater WDOE TDG waiver criteria.

<b>Settlements and Agreements</b>	
1988-2005	<i>Vernita Bar Agreement.</i> This agreement specifies the water management measures that the Bonneville Power Administration and Grant, Chelan, and Douglas PUD will take in order to protect Fall Chinook salmon at Vernita Bar.
1997-2017	<i>1997 Agreement for the Hourly Coordination of the Projects on the Mid-Columbia River.</i> An agreement between the Mid-Columbia Projects, both Federal and PUD to increase the efficiency of the system to provide energy to the region while maintaining support for biological activities, recreation, and flood control. This agreement supersedes all of the previous hourly coordination agreements dating back to 1972.
2004	<i>Hanford Reach Fall Chinook Protection Program Agreement.</i> This agreement will replace and supersede the 1988 Vernita Bar Agreement. It was submitted to FERC by Grant PUD on April 19, 2004 and is awaiting approval.