

Groundwater-Surface Water Interactions within the Chehalis River Basin

Presentation to the Chehalis Basin Partnership



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U.S. Geological Survey

Washington Water Science Center

Tacoma, Washington

<http://wa.water.usgs.gov/projects/chehalis/>

Study Objectives & Approach

- **Characterize Hydrologic and Hydrogeologic Setting of the Chehalis Basin**
 - **Well Inventory and Groundwater Level Measurements**
 - Available Online Now: <http://wa.water.usgs.gov/projects/chehalis/>
 - USGS Data Series Report: <http://pubs.usgs.gov/ds/512/>
 - **Groundwater – Surface Water Interactions/Surficial Hydrogeology**
 - USGS Scientific Investigation Report: June 2011
- **Provide New Surface Water Data for USACE Watershed modeling (Water Years 2010 – 2011)**
 - **Salzer Creek near Centralia**
 - **Elk Creek near Doty**

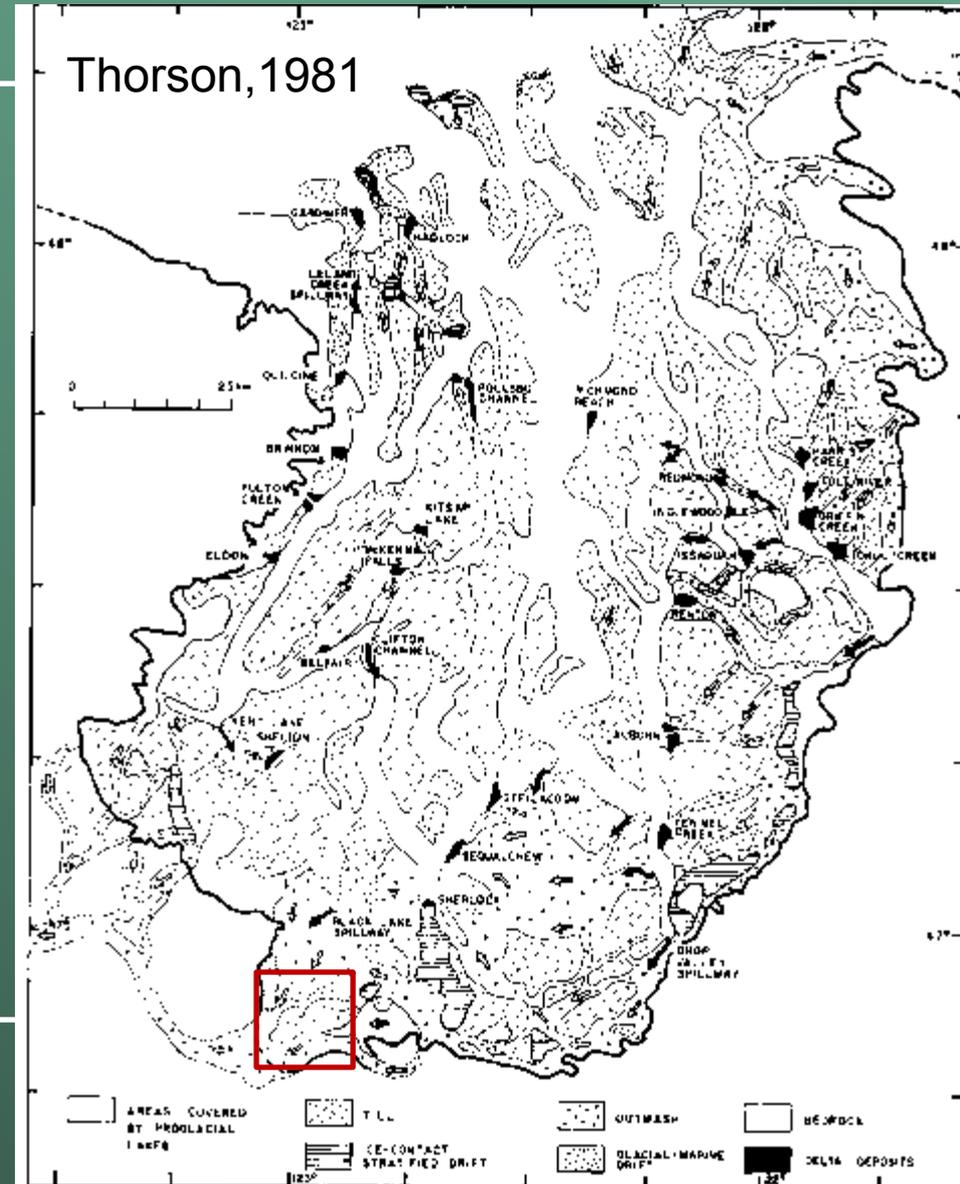
Presentation Outline

- **Characterization of Hydrogeology**
 - Geologic history and hydrogeologic units
 - Groundwater levels and flow paths within surficial aquifers
- **Refinement of Groundwater – Surface Water Interaction**
 - Finer-Scale Seepage Run
 - Distributed Temperature Sensor
 - 14-Well Monitoring Network



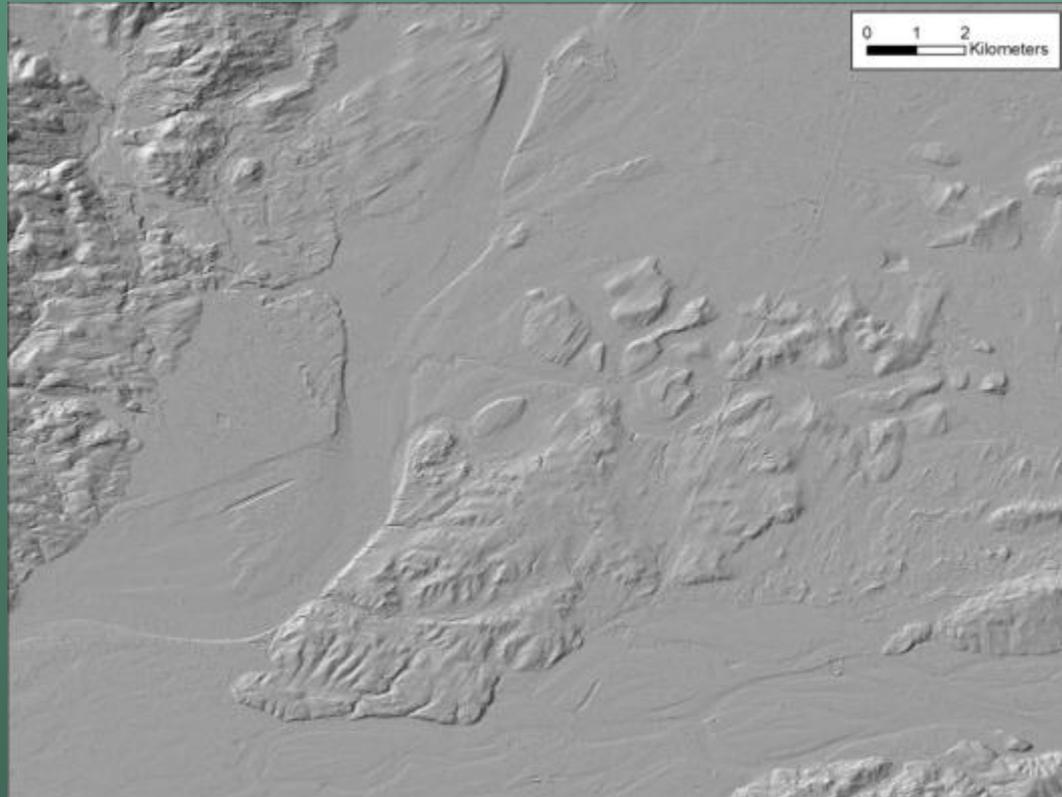
Geologic Overview

- Multiple Pleistocene Glaciations
 - Puget Lobe of Cordilleran Ice Sheet
 - Alpine Glaciers
- End moraine in Northern Chehalis Basin
- Glacial outwash in Chehalis river valley and major tributary valleys



Geologic Overview

- End moraine in Northern Chehalis Basin
- Puget Lobe Glacial outwash in Chehalis river valley and major tributary valleys
- Recent alluvium over outwash
- Older alpine glacial outwash on uplands of eastern and northern portions of Chehalis River Basin
- Basalt and marine/non-marine sedimentary rocks within uplands

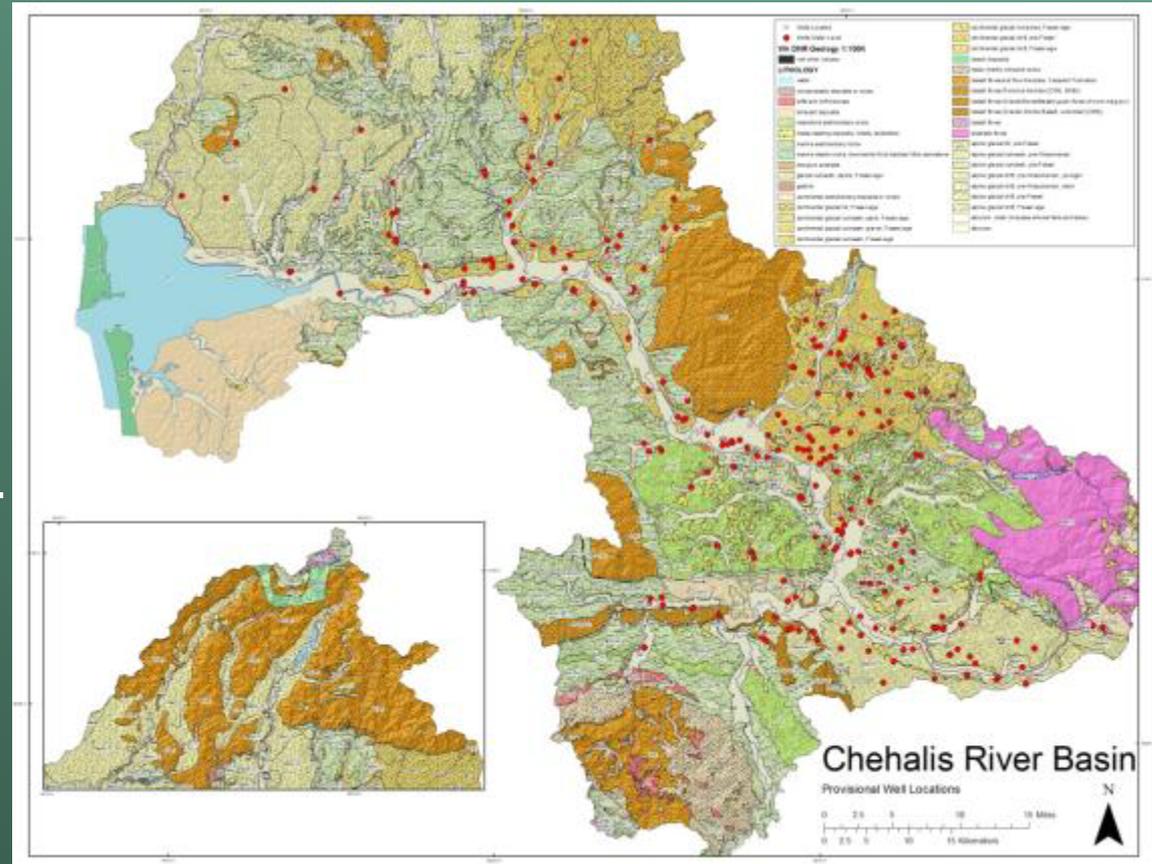


Characterization of Hydrogeology

- **Major hydrogeologic units**
 - **Major River Valleys**
 - Recent alluvium / glacial outwash: primary surficial aquifer
 - Tertiary bedrock: basal confining unit
 - **Uplands**
 - Older Pleistocene Alpine Glacial Outwash: surficial aquifer
 - Tertiary bedrock (basalt and marine/non-marine sedimentary rocks): minor aquifer

Characterization of Hydrogeology

- Combine Existing Geospatial Data of Aquifer Distributions with Well Logs Inventoried in 2009
- Spatial and Vertical Extent of Shallow Aquifers
- Representative Cross-Sections in Key Areas
- Generalized Groundwater Flow Paths in Shallow Aquifers



Preliminary Data – Subject to Revision

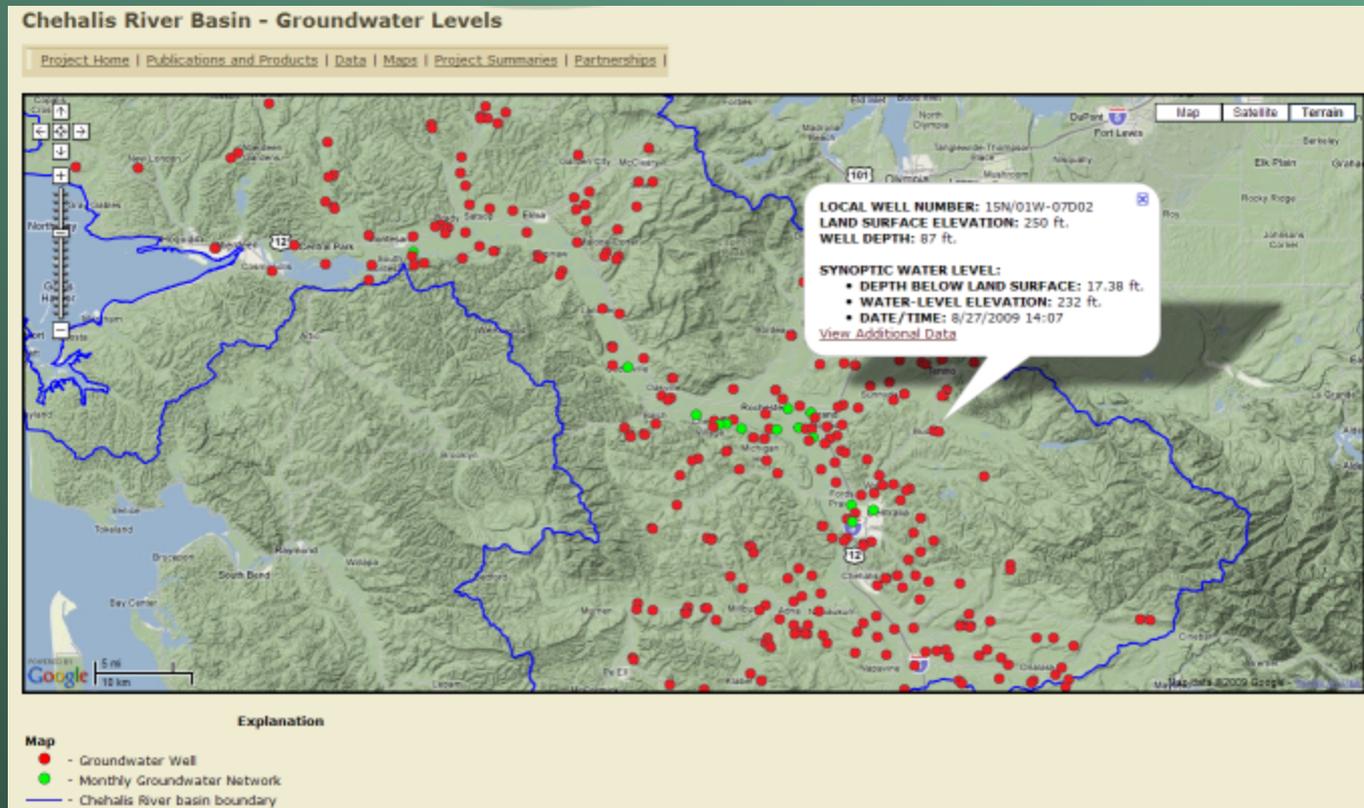
Well Inventory and Groundwater Level Measurement

- > 350 Wells Inventoried and Water Levels Measured
- Six Weeks (August – September 2009)
- Cooperation of Public, Local, WA Dept. of Ecology and Tribal Agencies

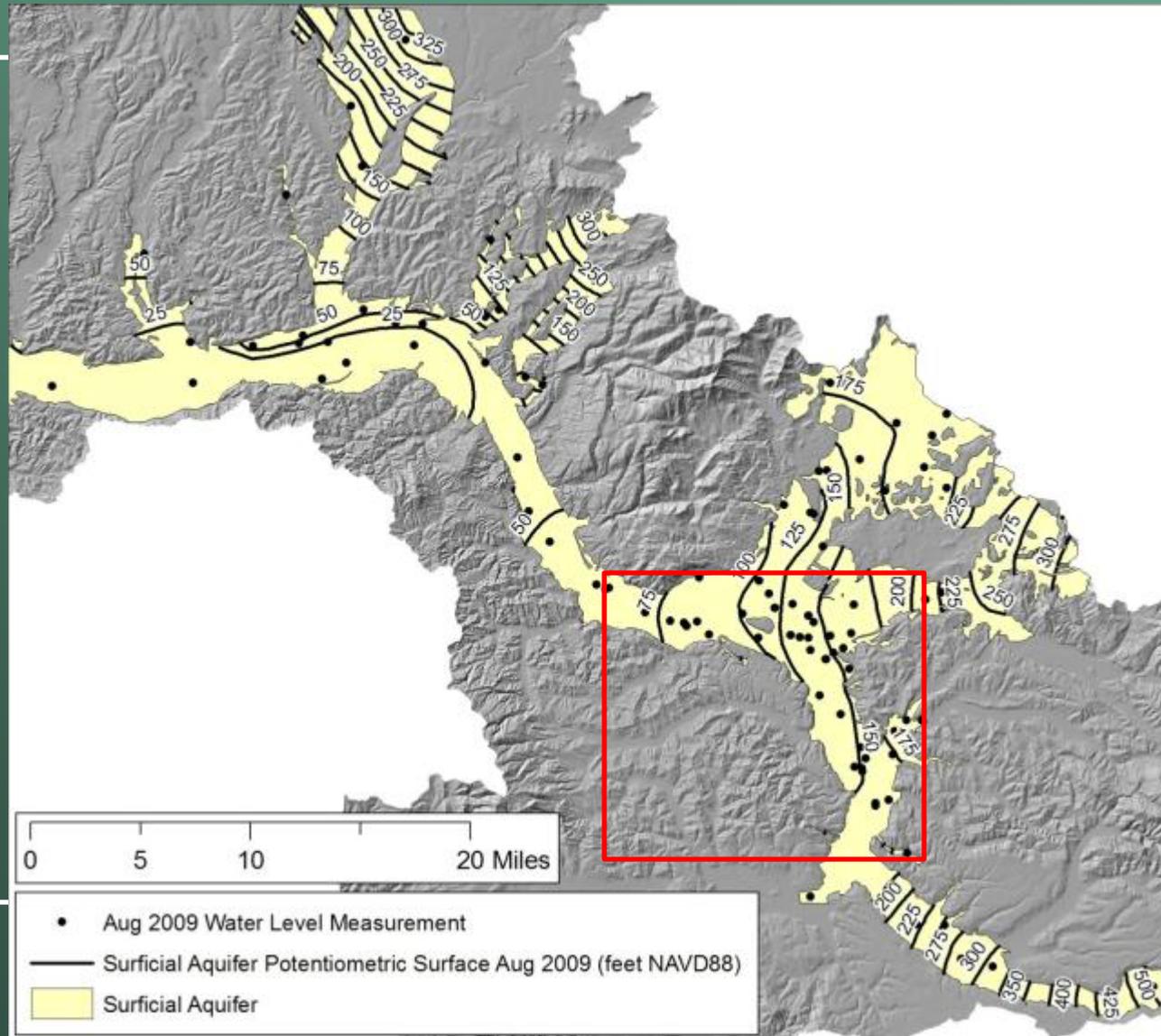


Well Inventory and Groundwater Level Measurement

- <http://wa.water.usgs.gov/projects/chehalis/sites.htm>



August 2009 Water Levels

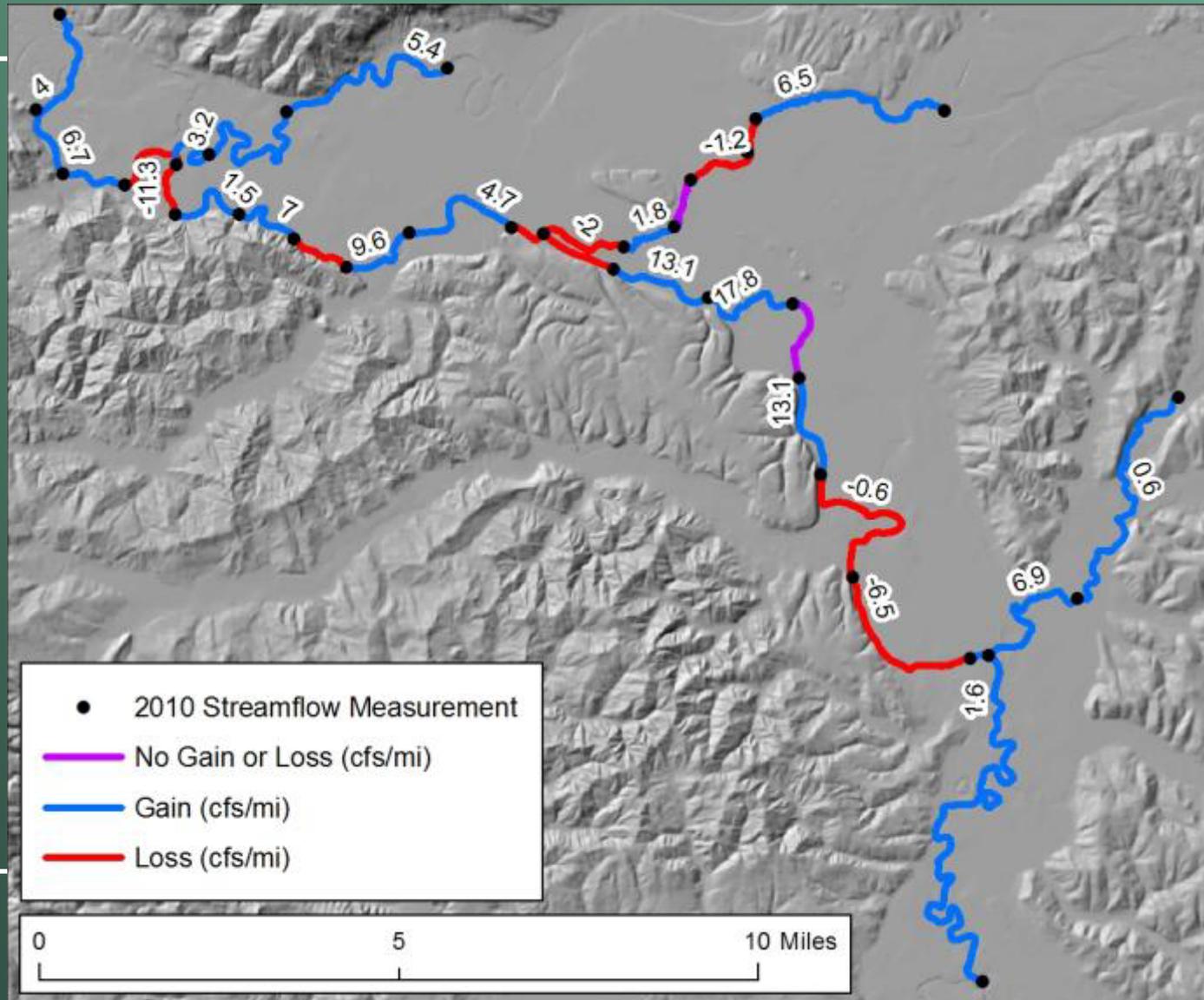


Seepage Run

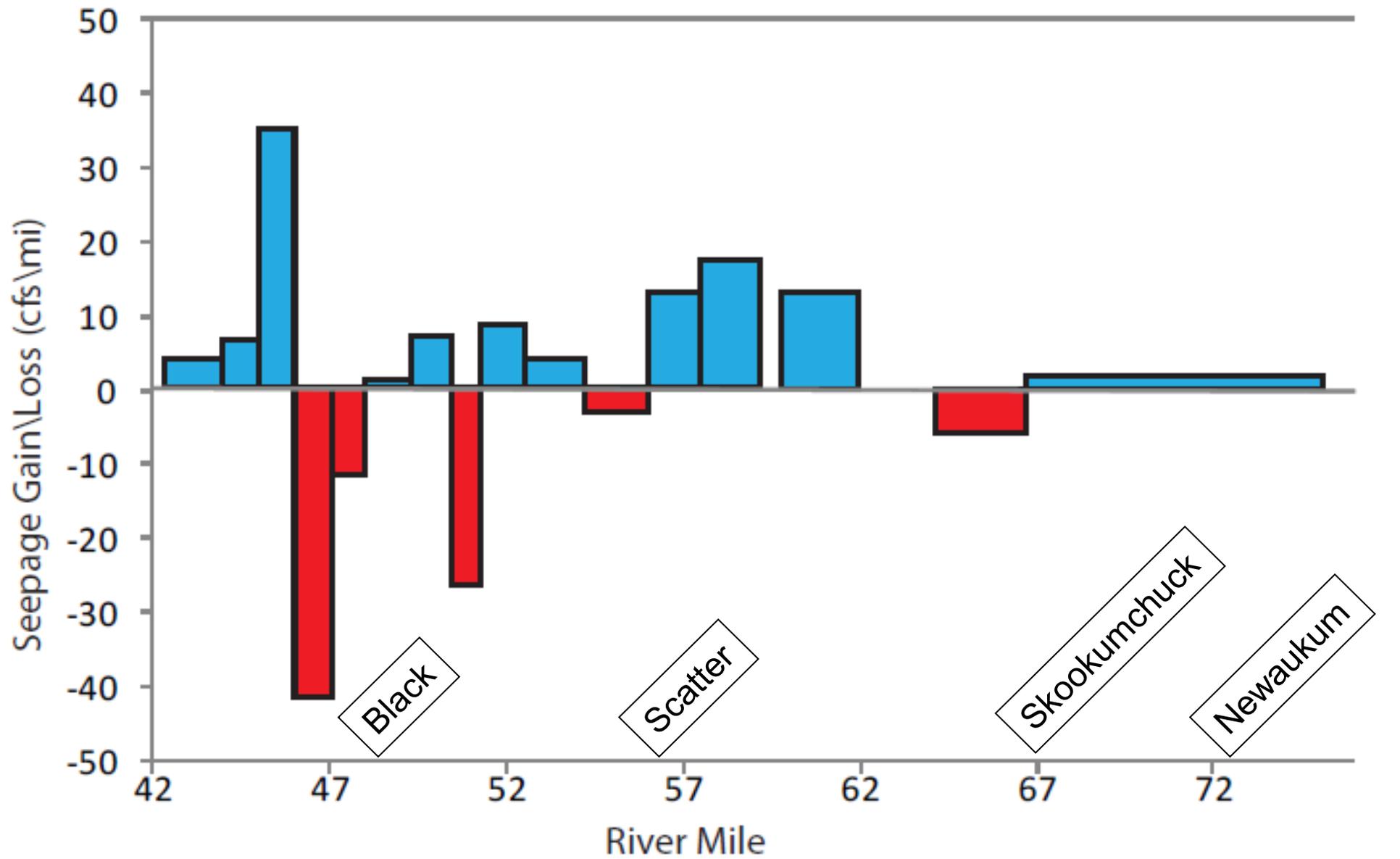
- Near-simultaneous measurements of discharge
- Accounting of inflows and diversions
- Bulk streamflow gained or lost by the river is calculated
- Three Days
- 41 Measurements



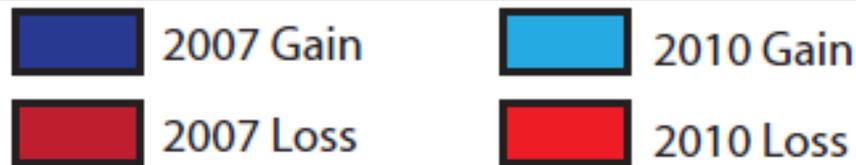
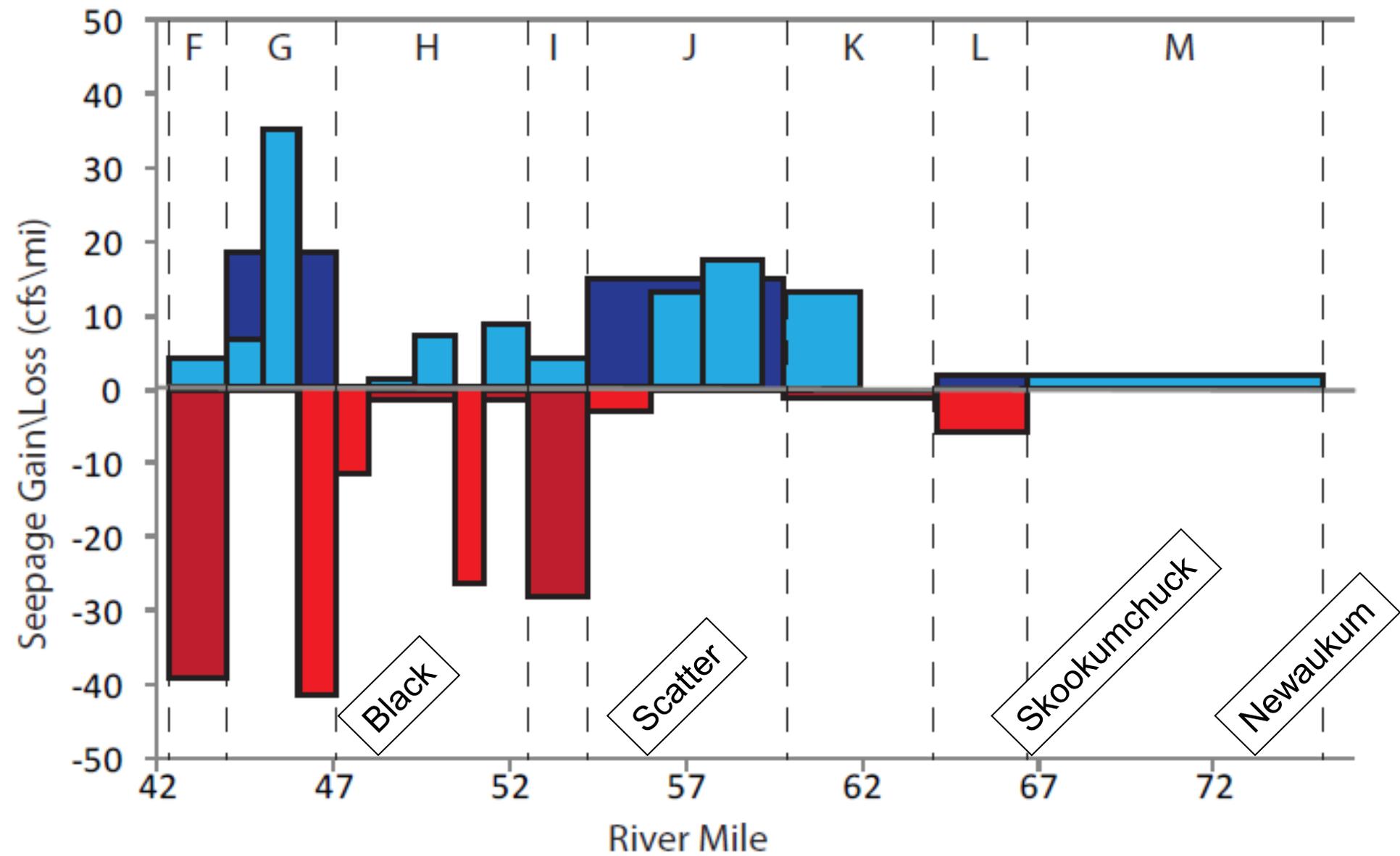
2010 Seepage Run



Preliminary Data – Subject to Revision



2010 Gain Preliminary Data – Subject to Revision
 2010 Loss



Preliminary Data – Subject to Revision

Fiber Optic DTS

- **Fiber Optic Distributed Temperature Sensor (DTS)**
 - Temperature as a tracer
 - Deployed coincident with seepage measurements
 - Deployed at start of reach with large gains in 2007 Seepage Run
 - Spatial refinement of groundwater-surface water interaction
 - Up to 1 km of spatially continuous temperature measurements

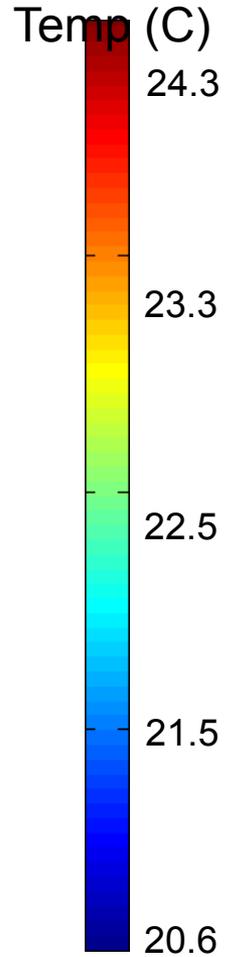
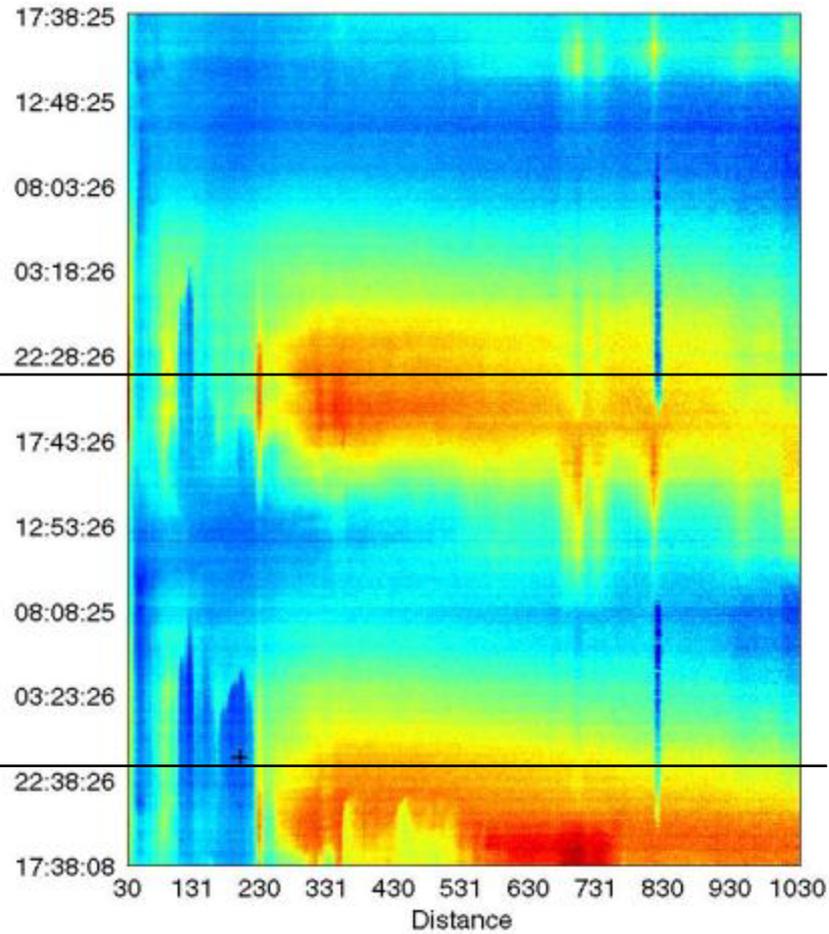
Fiber Optic DTS (near Grand Mound Gage)



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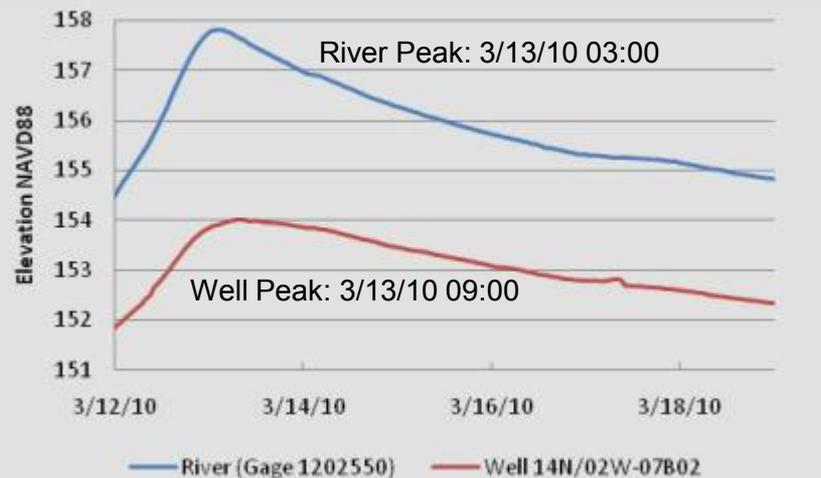
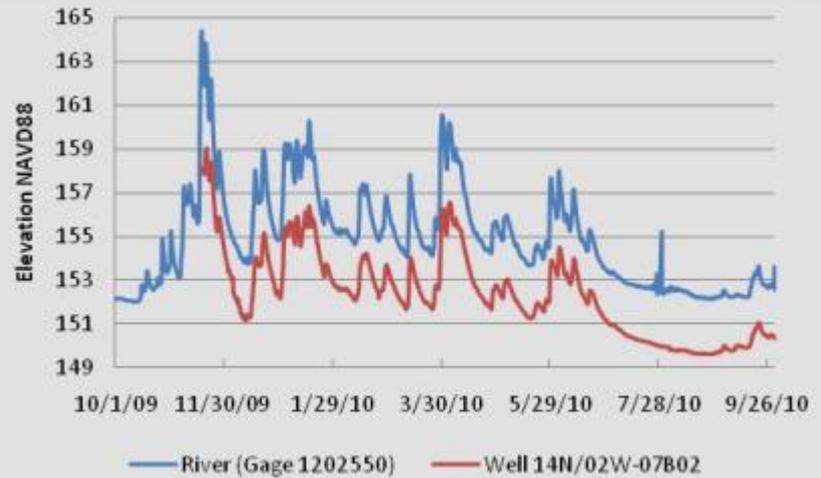
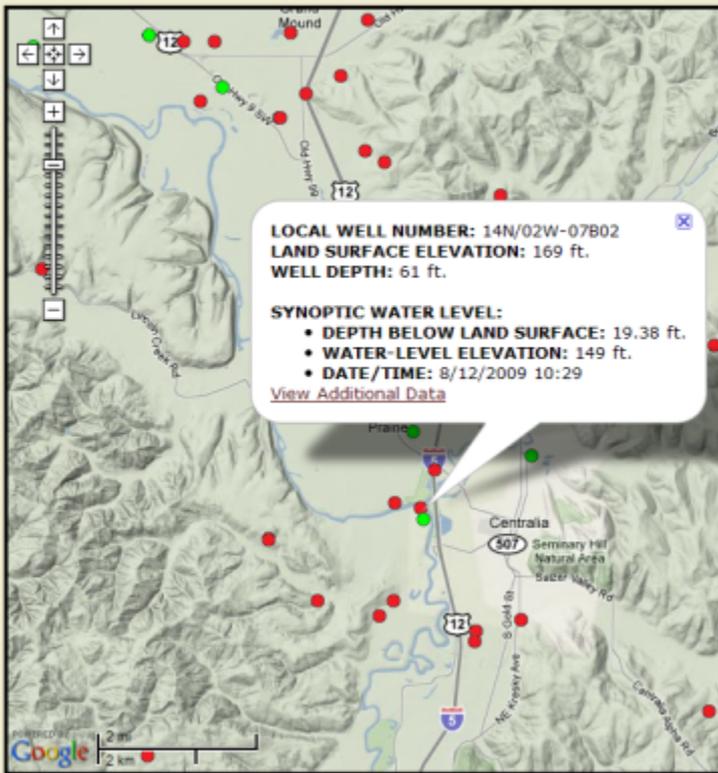


Preliminary Data – Subject to Revision

Well Monitoring: Chehalis/Skookumchuck Confluence

Chehalis River Basin - Groundwater Levels

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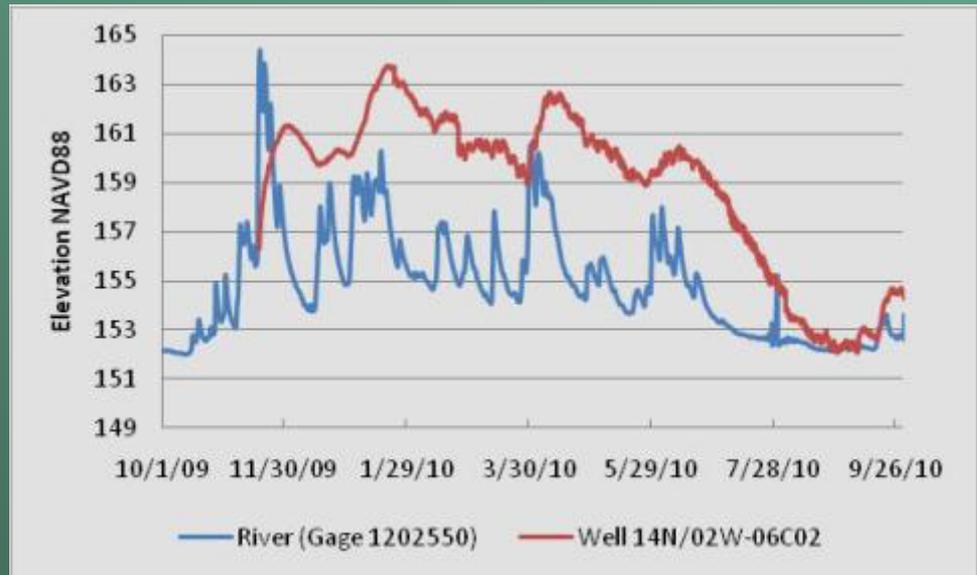
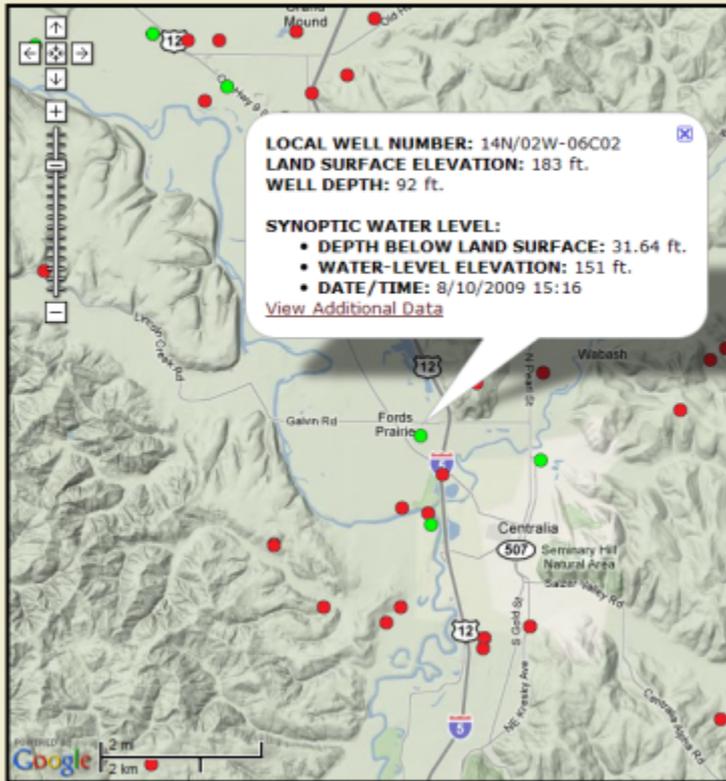


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Well Monitoring: Chehalis/Skookumchuck Confluence

Chehalis River Basin - Groundwater Levels

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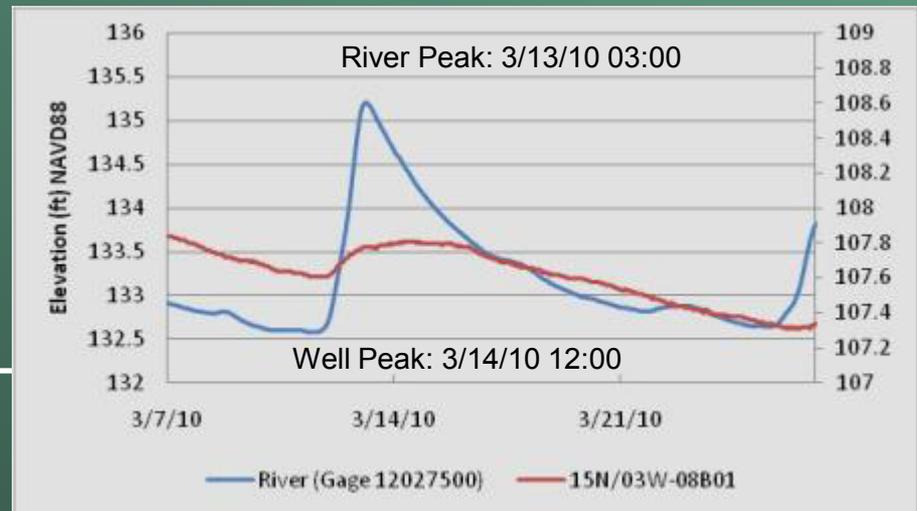
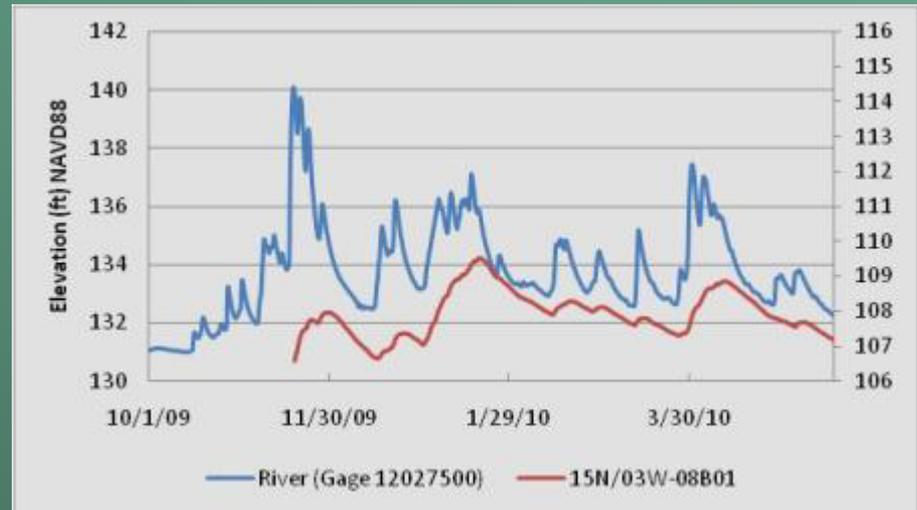
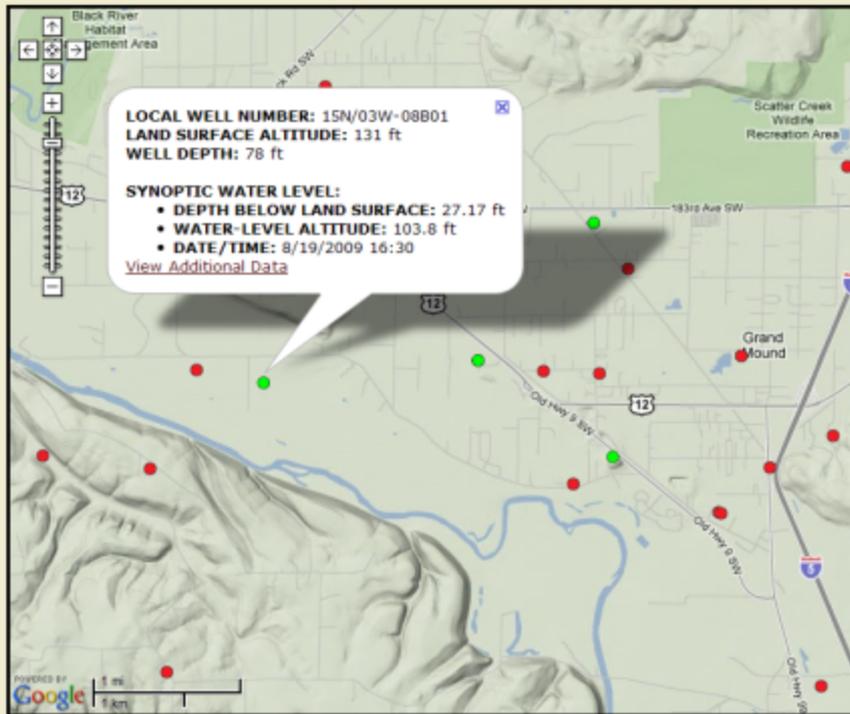


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Well Monitoring Chehalis/Scatter Creek Confluence

Chehalis River Basin - Groundwater Levels

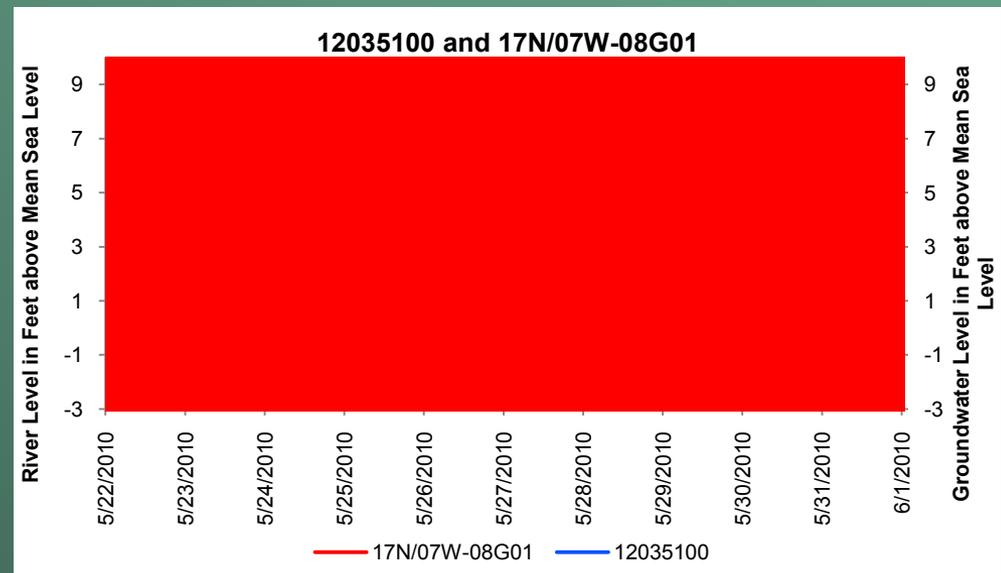
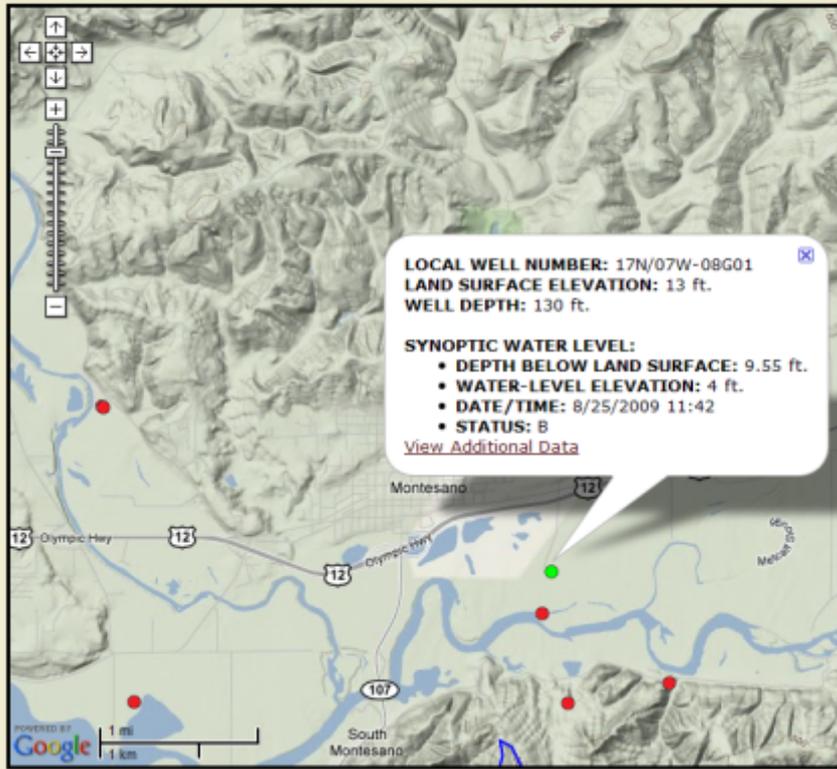
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Groundwater – Surface Water Interaction: Continuous Data

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Preliminary Data – Subject to Revision

Summary

- Alternating gains and losses within the Chehalis River
- Gains and losses change over time
- Water table of surficial aquifer is closely tied to river levels
 - Storm driven
 - Tidal
- Surficial aquifer consists of glacial and alluvial sediments and is bounded by Tertiary basalt and sedimentary rocks

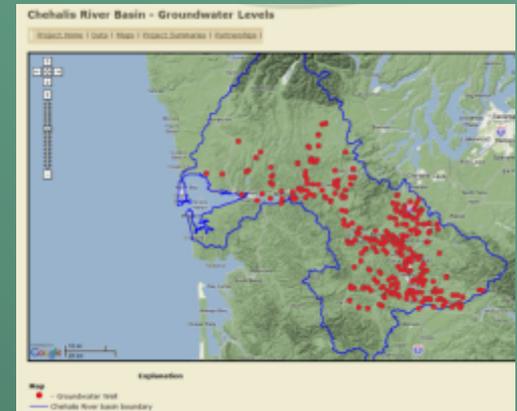
Study Products

- **Project Website:**
 - <http://wa.water.usgs.gov/projects/chehalis/>
 - **USGS Data Series Report**
 - Water Levels and Information of Inventoried Wells
 - <http://pubs.usgs.gov/ds/512/>
 - **USGS Scientific Investigation Report**
 - Characterization of Hydrogeology
 - Seepage Measurements (August 2010)
 - To Be Published June 2011
 - **New Streamflow Gages at Salzer Creek and Elk Creek (2 years of data collection)**
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USGS WA Water Science Center

USGS Chehalis Project Webpage:

<http://wa.water.usgs.gov/projects/chehalis/>



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