Groundwater Surface Water Interaction: Perspectives on Science and Policy

Bob Anderson, LHG
1. Technical framing
2. Policy overview of Washington State
What does this interaction “look like”?
Groundwater-Surface Water Interaction

- Gaining
- Losing
- Uncoupled

Water users and managers need to understand flow rates and locations.
How do we know what’s going on?
Technical Language Differences

**Hydrologists**

**Hydrogeologists**
Technical Language Differences

<table>
<thead>
<tr>
<th>Hydrologists</th>
<th>Hydrogeologists</th>
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<tr>
<td><strong>Time scale:</strong></td>
<td><strong>Months/years/decades.</strong></td>
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<td>• Hours/days</td>
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<td><strong>Spatial descriptors:</strong></td>
<td><strong>“upper/lower aquifer units”, “confining units”, aquitards”</strong></td>
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<td>• “sub-basins”, “reaches”, “diversions”, “side-channel”</td>
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<td><strong>Terminology:</strong></td>
<td><strong>“hydraulic gradients”, “equipotentials”, “flowpaths”, “transmissivity”, “capture zones”</strong></td>
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<td>• “mean/peak flows”, “100-year flood”, “recurrence intervals”, “return flow”, “baseflow”</td>
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Groundwater Flow Maps & Hydrographs

Figure 22. Potentiometric surface and generalized flow directions in hydrogeologic units, upper Yakima River Basin, Kittitas County, central Washington.

Figure 25. Water levels in wells (A) 20N/16E-30C01 and (B) 19N/15E-08B02, upper Yakima River Basin, Kittitas County, central Washington, May 2012–April 2013.
Surface Water Maps & Hydrographs
Getting data to “talk to each other”

**Hydrologists**

**Hydrogeologists**
Models Are A “Necessary Evil”

“Government, even in its best state, is but a necessary evil; in its worst state, an intolerable one”

Thomas Paine, 1775
Integration Through Models

from CA DWR  IWFM Modeling Workshop
What a Groundwater Model Looks Like

Model Grid and Boundary Conditions
What a Groundwater Model Looks Like

Aquifer Properties
Yay!...our model works!

Model Calibration

Spokane River @ Dartford

Sullivan Park North

Observed

Modeled
Streamflow Reduction from pumping
Now what?

Streamflow Enhancement from Injection
Now What?

Improved Riverware Return Flow Simulation

Figure 3. Simulated Return Flows above Grandview Gage – Comparison of Return Flow Assumptions from Phase 2 and Phase 3 Model

Simple RF Function

MODFLOW RF Function
Our modern day dilemma
“at the end of the day”

Regardless of their complexity, models are only as accurate as the data available to build them; and only as useful as the management frameworks they are intended to support.
Groundwater Surface Water
Washington State Policy Overview
Fishery Connections Run Deep

1973: Endangered Species Act
1974: Boldt Decision

Tribal Treaty Lands (1850’s)

"U.S. Census Office. 11th Census. 1890, V.10 page 34"
Fishery Connections Run Deep

1973: Endangered Species Act
1974: Boldt Decision
1998: Salmonid listings
In-stream Flow Legislation

- 1969 - In-stream flow program
  - Goal = salmonid production
- 1971 - Water resources act
  - Water Resource Inventory Areas (WRIAs)
1990’s Local Government’s Role

**Growth Management Act (1990)**: Established comprehensive local planning requirements, including critical areas designations and coordination between land use and water availability

- **Best Available Science**
- **Consideration to preserve and enhance fisheries**
- **Adopt development regulations to protect functions and values**
**Watershed Management Act (1998)**: Established a framework for locally-based watershed management planning to address water quantity issues at a watershed scale

- **Water Quantity Assessment**
  - Physical
  - Water rights
  - Instream flows

- **Water Quality/Habitat**
  - Optional

**Water Resource Inventory Areas (WRIAs)**
1990’s Influence of the Courts

- Hubbard (1994) - Groundwater permits can be conditioned on surface-water rights.

- Postema (2000) - A minimum streamflow set by rule must not be impaired by subsequent groundwater withdrawals (aka one molecule decision).
Closing Thoughts

Has science and policy regarding surface/groundwater interaction sufficiently converged?
Closing Thoughts

How does the Northwest “paradigm” align with SGMA?

- Water for People and Fish
- Integration through models
- Decision making through stakeholders
- Legal & regulatory tension