The Klamath Basin Secretarial Determination: Water Quality Considerations for Decisions about Dam Removal

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Outline

- Introduction to the Klamath Basin and related water quality issues
- Overview of Klamath Secretarial Determination and the role of water quality in it
- Provide background for talks following, by Singer, Perry, & Asarian
Take Home Messages

- Water quality is integral to Klamath Basin decision process regarding dam removal
  - Physical setting of reservoirs
  - Hydrological and land use modifications upstream
  - Affects on high priority uses downstream
- Secretarial Determination
  - Decision process about implementation of local Agreements
- New water quality studies and reports:
  - Reservoir sediment contaminants
  - Oxygen demand from resuspended reservoir sediments
  - Water temperature changes from dam removal
  - Qualitative assessment of likely future changes in water quality
PacifiCorp Hydroelectric Dams

- JC Boyle Dam 68 ft
- Copco 2 Dam 33 ft
- Copco 1 Dam 115 ft
- Iron Gate Dam 189 ft

- 82 megawatts (70,000 homes)
- No irrigation / drought relief
- Minimal flood benefit
- ~13,000,000 cubic yards sediment
- FERC Relicensing
  - Inadequate fish passage
  - Clean Water Act Requirements
The Secretarial Determination

- Decision by Secretary of Interior on implementation of two Agreements
  - *Klamath Hydroelectric Settlement Agreement (KHSA)*
    - Proposal to remove 4 PacifiCorp dams in 2020
    - Interim Measures to improve water quality and habitat
  - *Klamath Basin Restoration Agreement (KBRA)*
    - Restore streams, provide reliable water supplies
    - Basin-wide approach (upstream, downstream, tribs)
- Complementary, “Connected” actions
- Key questions: costs, risks & liabilities, restoration of salmonid fisheries, public interest
- Formal EIS / EIR process, 50-year period of analysis
- Multidisciplinary Federal Team, technical subteams
Water Quality in Keno Reach is inhospitable to fish during summers.
Effect of Reservoirs on Water Quality

- Receive water from upstream with poor quality
- Large cyanobacterial blooms (AFA, MSAE)
- Modify annual and seasonal nutrient dynamics
- Violations of water quality standards (in-reservoir and downstream)
- Shifts in timing of water temperature patterns
- Modified discharge patterns within Hydroelectric Area and downstream
- Sediment interception

Photo: http://www.thomasbdunklin.com/gallery/AerialAlgaeDams
Water Quality Subteam
New Investigations / Reports

- Added to large body of water-quality literature for the Klamath Basin
- Sediment chemistry & toxics (summarized here)
- Oxygen demand from mobilized reservoir sediment (See Maia Singer’s talk, this session)
- Water temperature modeling & climate change (See Russell Perry’s talk, this session)
- Anticipated future water quality conditions
- Final reports are on KlamathRestoration.gov
Reservoir Sediment Chemistry

Sediment Evaluation Framework

- Multi-level decision making process
- Common approach to sediment disposal around the Pacific Northwest (e.g., dredging operations)
- Comparison with established guidelines, evaluation of toxicity tests
- Adapted for Klamath Basin needs with added studies
Sediment Chemistry Study, 2009-2010

- Input from States & other agencies
  - Informed by results from preliminary study in 2006

- 77 samples from reservoirs + Estuary

- Broad range of chemicals analyzed
  - Dioxins/Furans, PCBs, OCs, VOCs, SVOCs, PAHs, PBDEs, Metals, Hg, Conventionals (TOC, Nutrients, Grain size)

- Elutriates, toxicity bioassays, bioaccumulation in lab tests, reservoir fish
Five Potential Exposure Pathways Evaluated
# Summary of Sediment Chemistry Effects for Five Exposure Pathways

<table>
<thead>
<tr>
<th>Exposure Pathway</th>
<th>Freshwater</th>
<th>Biota</th>
<th>Marine Biota</th>
<th>Terrestrial Biota</th>
<th>Humans</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Short term; suspended sediments</td>
<td>![Green]</td>
<td>![Blue]</td>
<td>![Blue]</td>
<td>![Blue]</td>
<td>![Blue]</td>
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<tr>
<td>2 Long term; exposed river bank or reservoir deposits</td>
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<td>![Black]</td>
<td>![Blue]</td>
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<td>![Blue]</td>
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<tr>
<td>3 Long term; new river channels; river bed deposits</td>
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<td>4 Long term; marine near-shore deposits</td>
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<tr>
<td>5 Long term; reservoir sediments (Dams-In)</td>
<td>![Green]</td>
<td>![Blue]</td>
<td>![Blue]</td>
<td>![Blue]</td>
<td>![Green]</td>
</tr>
</tbody>
</table>

- ![Black] No Adverse Effect
- ![Blue] One or more chemicals present, adverse effect unlikely
- ![Green] One or more chemicals present, limited adverse effect possible
- ![Red] At least one chemical detected with potential for significant adverse effect
- ![Dash] Exposure pathway incomplete or insignificant
Anticipated Future WQ Conditions

- **Dams in place**
  - Slower progress towards solutions
  - Mechanisms and implementation actions for TMDLs are unknown

- **Dams removed + KBRA**
  - Algal toxin issue largely eliminated in the lower Klamath River
  - Improved ability to meet TMDL targets for nutrients, chl – a, dissolved oxygen
  - Water temperature changes and flow variability help accelerate improvements
Wrap Up

- Water quality is integral to Klamath Basin decision process regarding dam removal
  - Physical setting, hydrological and land use modifications
  - Importance of looking upstream
- Secretarial Determination
  - Decision about implementation of locally derived Agreements (KHSA + KBRA)
  - Focused on critical questions for decision making
- Studies and reports available online
Questions and Comments?

KlamathRestoration.gov