Overview of a Tiered Framework for Establishing Environmental Flows for California Streams

Eric Stein
Southern California Coastal Water Research Project
Roadmap for Today

• Overview of environmental flows needs for California
• Status of ongoing efforts
  – Challenges and opportunities
• Tiered framework for managing environmental flows
• Formation of a new Council workgroup
Hydrology is an Integrative Driver of Stream Health

If you can mitigate hydrologic alteration, you’ll solve a lot of other problems
Statewide Needs

• Set instream flow standards to protect biological communities

• Assess vulnerability of streams to future changes in flow conditions
  – Prioritize areas for restoration/management

• Evaluate/inform management actions
  – e.g., reservoir operations, water withdrawals
Setting Flow Targets to Inform Management Decisions

Select approach based on
- Stream type
- Ecological endpoint
- Management need
Why is it So Hard?

- California is a very complex/diverse state

- Hard to balance environmental flow needs with a broad range of other demands

- No mechanism for coordination and information sharing among agencies and with the public
Many Technical Approaches

![Diagram of flow regulation with sustainability boundaries]

- Presumptive Standard – Richter et al. 2013
- Functional Flows – Yarnell et al. 2015
- ELOHA – Carlisle et al. 2015

Graphs showing:
- Nantahala River lower: habitat-flow relation: mountain/deep
- Water usage analysis (WUA) habitat-discharge relation (mountain-deep species/life stages) from PHABSIM modeling.

- California Stream Condition Index vs. March streamflow alteration (observed / expected)
- Flow regime comparison: Natural flow regime vs. Functional flow regime
- Key flows: Peak flow, Spring recession flow, Wet-season initiation flow, Dry-season baseflow
Issues Vary Across the State...

<table>
<thead>
<tr>
<th>Physically Focused – engineering/geomorphology</th>
<th>Ecologically Focused – management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank Full</td>
<td>Spawning</td>
</tr>
<tr>
<td>100 year flood</td>
<td>Incubation</td>
</tr>
<tr>
<td>Bed Mobilization</td>
<td>Juvenile rearing</td>
</tr>
<tr>
<td>Effective Discharge</td>
<td>Fry migration</td>
</tr>
<tr>
<td>Peak Discharge</td>
<td>Smolt migration</td>
</tr>
</tbody>
</table>

Immigration

Spawning

Incubation

Juvenile rearing

Fry migration

Smolt migration

Embryo development

Salmon and trout life histories

Smoltification and emigration
Irrigation Diversions

Stormwater Retention

Use or Reuse of Treated Effluent

Groundwater withdrawals?
1. Alluvial fan
2. Pool-riffle
3. Plane bed
4. Anastomosing
5. Upland uniform
6. Cascade/step-pool
7. Headwater
8. Large meandering sand
9. Large uniform boulder

Channel types: Headwater, Alluvial fan, Upland uniform, Cascade / step-pool, Pool-riffle, Plane-bed, Anastomosing, Large uniform boulder, Large meandering sand

Prioritizing Areas for Protection

Drought and Climate Change
Sound science is vital to the management of natural resources, especially when managing water. The CDFW Instream Flow Program (IFP) develops instream flows required to maintain healthy conditions for aquatic and riparian species. Instream flows are determined by investigating the relationships between flow and available stream habitat for waterways throughout California as required by the California Water Action Plan, Public Resources Code §10080-10090 and Sec. §6951 mandates. Instream flow criteria, which must be scientifically defensible and comparable among studies, are transmitted to the State Water Resources Control Board (SWRCB) for consideration in water allocation and appropriation actions.

To ensure high quality science that is robust, credible, transparent, and relevant, IFP conducts flow studies, collects field data, develops guidelines for quality assurance, conducts outreach, and coordinates with other agencies and interested parties on program-related activities. The IFP coordinates study design, field data collection, and study implementation with CDFW Regional staff, SWRCB, U.S. Fish and Wildlife Service, and non-governmental organizations.
Local Effort

Policy for Maintaining Instream Flows in Northern California Coastal Streams

Effective February 4, 2014

Division of Water Rights
State Water Resources Control Board
California Environmental Protection Agency

Trinity River Restoration Program

Upper Santa Ana River Habitat Conservation Plan

Latest Information

Water Year 2017 is an “Extremely Wet” year for the Trinity River Basin as determined by the April-First season inflow forecast of 2,250,000 acre-feet. A graphic of the Trinity Management Council’s recommended flow schedule is available on the Current Restoration Flow Release Schedule page.

A US Bureau of Reclamation news release is HERE.
Cooperative Challenges

Lane, B., Dahlke, H., Pasternack, G., and Sandoval-Solis, S. (2017) Revealing the diversity of natural flow regimes in California with relevance for environmental flows applications, *JAWRA*

Need for a Coordinated Framework

Many programs are attempting to set environmental flows

- Different systems
- Different endpoints
- Different management needs

- Poor coordination
- Challenge in sharing data
- Uncertainty in which methods are most appropriate
- Inefficiencies/redundancy in developing requirements
- Difficulty in communicating to the public
Need for Agency Coordination

Statewide approach for setting coarse scale flow targets

Site specific e-flows where necessary

Data sharing (open data) + information dissemination to the public
Statewide Targets by Stream Class
Stream Gages

Local Targets

Sites of Interest

Input

\[ x_1 \]
\[ x_2 \]
\[ \ldots \]
\[ x_n \]

Simulation Model

Output

\[ y_1 \]
\[ y_2 \]
\[ \ldots \]
\[ y_m \]

Geomorphology

Ecology

Reach scale environmental flow methods

Flow targets
California e-Flows Framework

**Anticipated Products**

- Statewide stream classification
- First tier flow targets for each stream class
- Guidance for implementing site-specific e-flow recommendations
  - California E-flows users’ manual
- Case study applications in key areas
- Website clearinghouse for recommended approaches, key data layers, case studies

**Funded**

**Not Funded**
Environmental Flows Portal

- What is the current degree of hydrologic alteration?
- What are the main “stressors” affecting hydrologic condition?
- What are the risks to future hydrologic alteration?
- Has there been any environmental flows work done in my area?
- What tools or approaches are available? Appropriate?
  - How do I choose which tool to use?
  - What data is already available?

Are Our Aquatic Ecosystems Healthy?

California has many types of aquatic habitats. Follow the links below to learn more...

**Wetlands Portal**
Wetlands form along the shallow margins of deepwater ecosystems such as lakes, estuaries, and rivers. They also form in upland settings where groundwater or runoff makes the ground too wet for upland vegetation.

**Streams & Rivers Portal**
California's streams and rivers flow through diverse habitats, from mountain canyons, valleys, deserts, estuaries and urban areas. Riparian woodlands develop along stream banks and floodplains, linking forest, chaparral, scrubland, grassland, and wetlands. California lakes, supporting deep water, wetlands, riparian woodlands, offer a quiet refuge for plants, animals and humans alike.

**Estuaries Portal**
Estuaries are unique habitats found where rivers and the ocean mix. They feature a diverse array of plants and animals adapted to life along the mixing zone.

**Ocean & Coastal Portal**
California has 1,100 miles of shoreline and 220,000 square miles of state and federal oceanic habitat, featuring one of the world's most diverse marine ecosystems.
Recommendations

• Support development of an environmental flows workgroup

• Complete efforts currently underway
  – RIFE Manual
  – First tier statewide environmental flow recommendations

• Identify agency staff to partner with technical team
  – refine goals, objectives & structure

• Outline content for new portal

• Report back to Council in 6 months with more detailed plan
  – “charter”, participants, portal outline
Questions

Eric Stein
erais@sccwrp.org
www.sccwrp.org