Building Resilient Water Quality Standards

Virtual WQS Academy
May 2023

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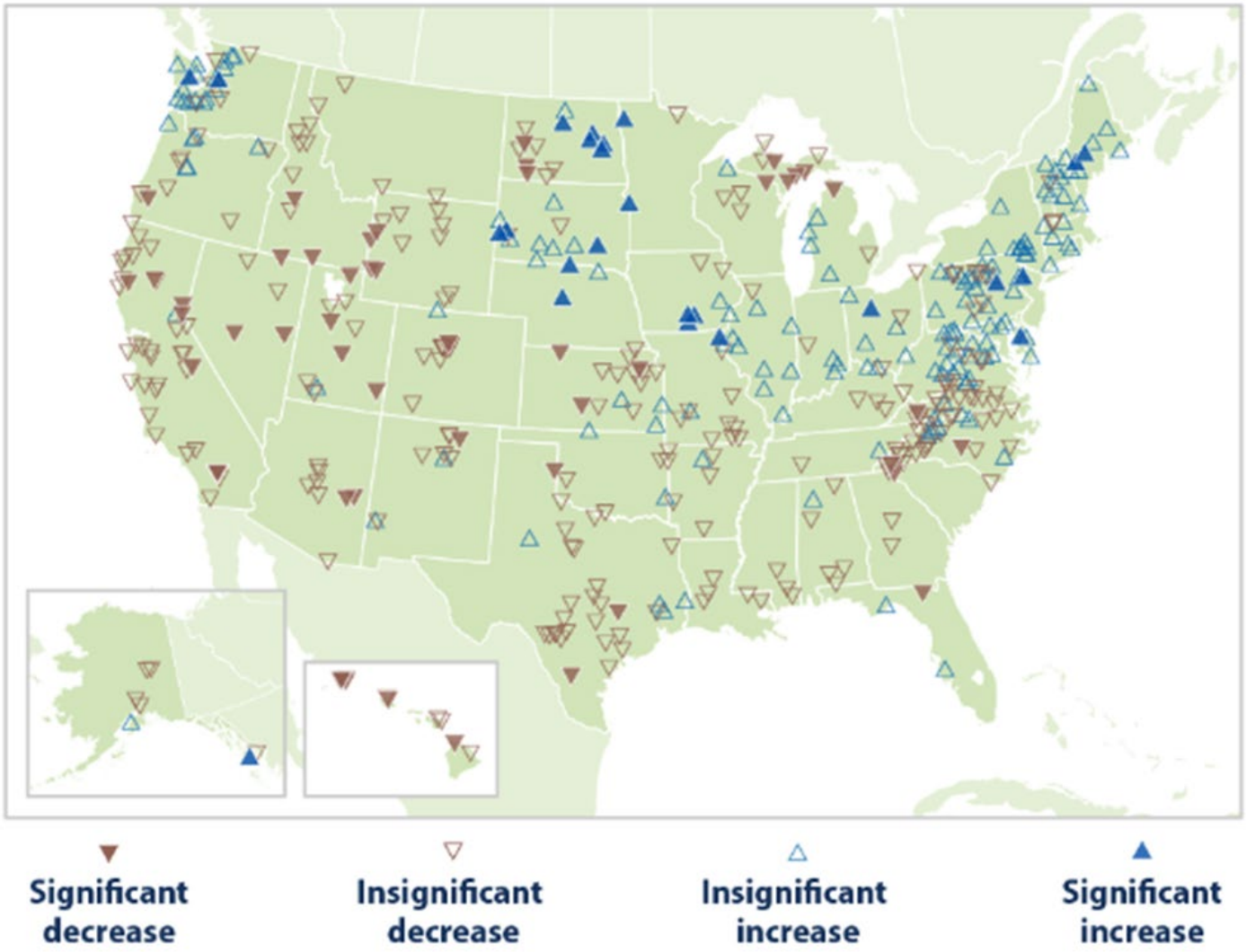
What does this module cover?

- Extreme weather impacts on water resources
- Importance of baseline monitoring
- How WQS can be used to build resilience to droughts and flooding
- Helpful resources moving forward

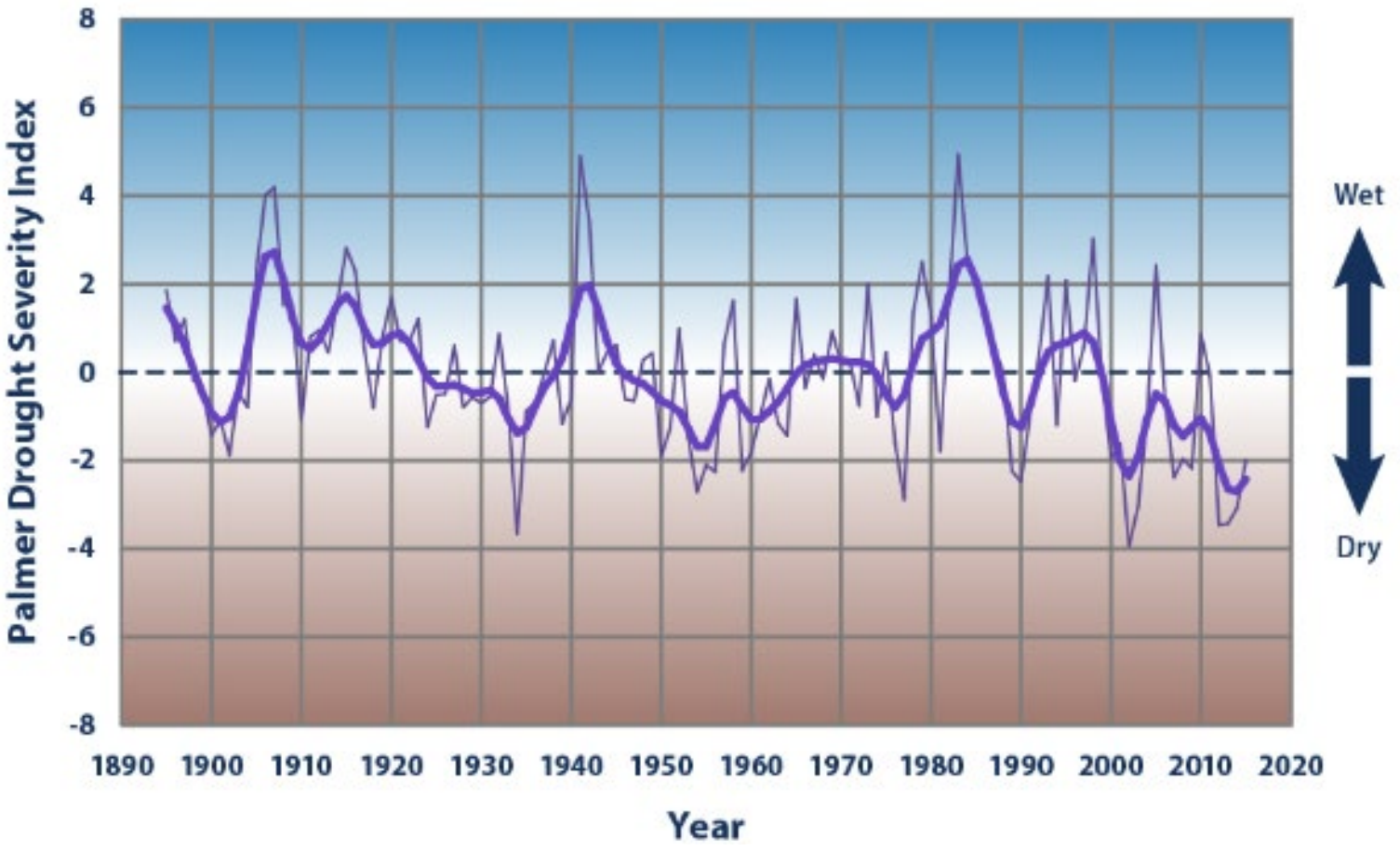
What is resiliency?

- The ability of a waterbody to recover after a disturbance and capacity to maintain ecological function in spite of a disturbance

Change in Frequency of River Flooding (1965-2015)



Drought Severity in Southwestern US (1895-2015)



Trends in our Environment

- Warmer summers and winters
- Elevated water temperatures
- Changing patterns of precipitation
- Increases in extreme weather events
- More frequent and severe droughts
- Recurrent flooding

"Understanding Climate Change Impacts on WQS" – see OW training module

Uncertainties Moving Forward

- Extreme weather in many locations is likely to result in future conditions different from the past.
- Water quality is impacted by anthropogenic and natural stressors.

What does this mean for WQS?

- Drought and flooding may make protection of some uses more difficult.
  - Flow alterations, increased erosion and sedimentation, increased hypoxia, changes to aquatic communities, loss of aquatic habitat, changes to DO and temperature…
- WQS programs can provide a holistic approach that promotes aquatic system resilience to extreme weather impacts.

Building Water Quality Resilience Through WQS

- **Phase 1** – Incorporate extreme weather considerations into state and tribal water monitoring strategies to generate long-term baseline data
- **Phase 2** – Incorporate knowledge gained from baseline data (and other sources) into the various components of WQS implementation
  - Designated Uses
  - Criteria
  - Antidegradation

Phase 1

Generating and Assessing Baseline Data

Importance of long-term baseline data

- Characterize background conditions
- Helps to reveal underlying water quality shifts that may be masked by:
  - Naturally occurring inter-annual variabilities
  - Human activities
- Results can help states and tribes prioritize waters for protection

Water Quality Monitoring Strategies

- Establish ideal geographic scope
- Choose indicators sensitive to drought and flooding stressors
- Long term and continuous data
  - Collect your own data
    - Biological and habitat assessments
  - Use existing data
    - Customize EPA existing datasets
    - Look for data collected by different agencies

Assessing Baseline Data

- Identify and create database of vulnerable waterbodies and their designated uses
- Define scope of potential drought/flooding vulnerabilities and risks
- Prioritize monitoring and protection efforts in those areas

Phase 2

Incorporate Baseline Info into WQS Implementation

Designated Uses

- Drought and flooding impacts
  - Aquatic life and wildlife uses
  - Shellfish consumption uses
  - Public water supply uses
  - Cultural/ceremonial uses

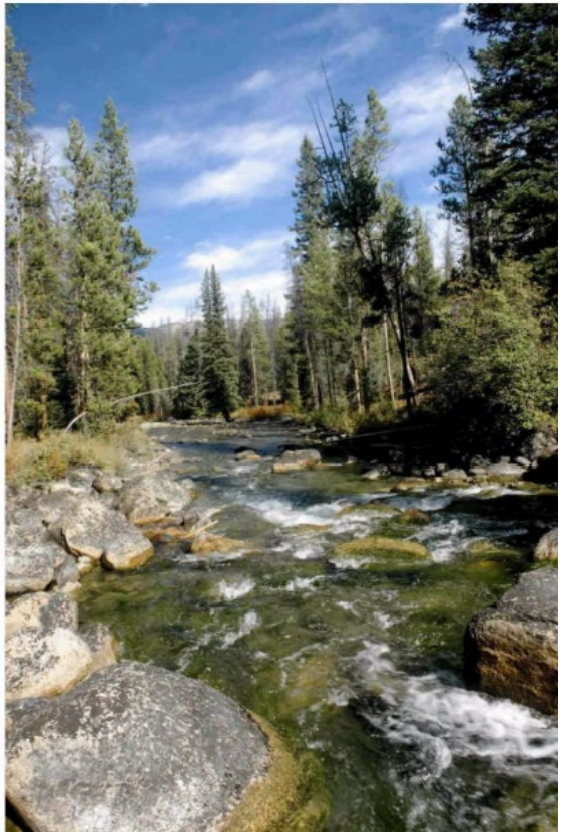
- Solution
  - Refine waterbody use designations to reflect the **specific** functions that are important to the public and state or tribal authorities

Designated Uses Considerations

- Focus on identifying vulnerable waters and DUs most at risk from negative impacts of extreme weather
- Consider uses to protect source water for public water supply

Criteria

- Adopt criteria for parameters sensitive to extreme weather impacts
- Such as:
  - Temperature
  - Dissolved Oxygen
  - Conductivity
  - Flow
  - Nutrients
  - Biocriteria



Criteria Considerations

- Develop site-specific criteria to improve watershed resilience
- Protect downstream waters
- Adopt seasonal criteria where uses are more vulnerable in specific seasons
- Develop protective duration and frequency values

Antidegradation

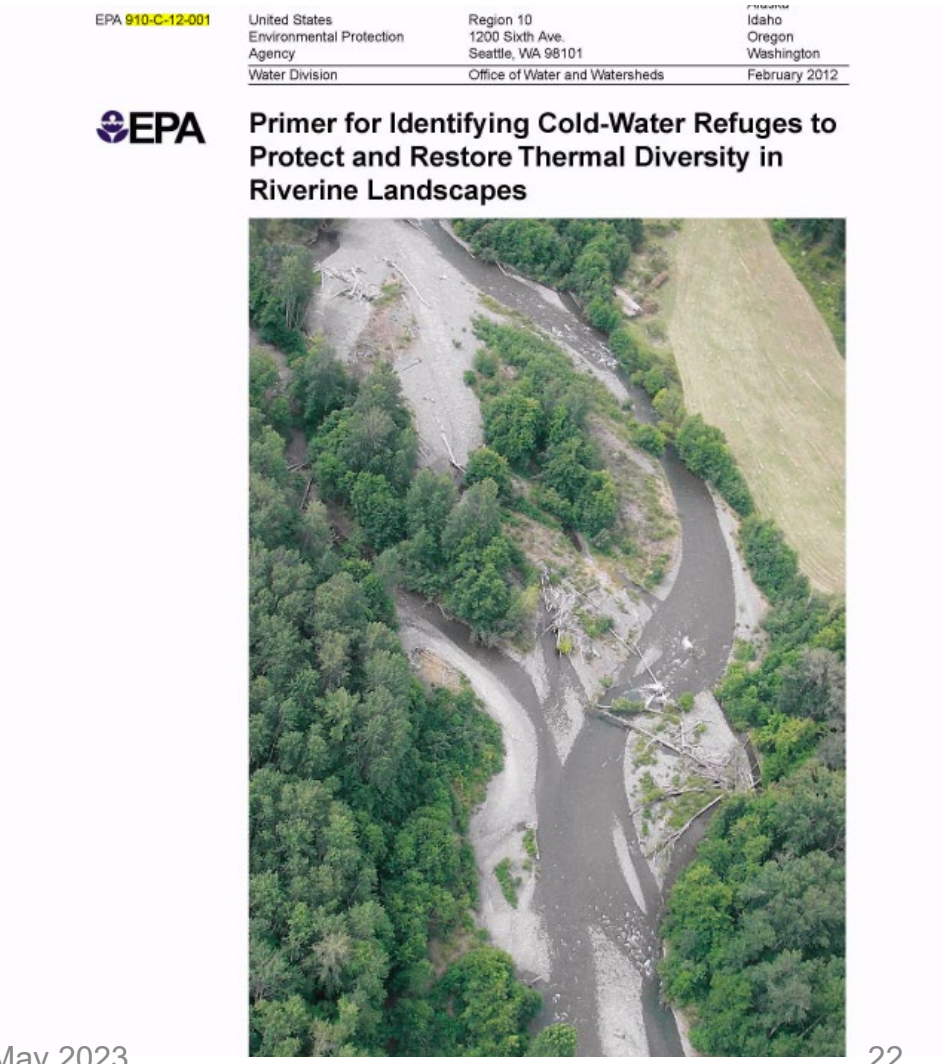
- Include conservative provisions to preserve the assimilative capacity of highest quality waters OR waters in most need of protection when developing antidegradation policy

Antidegradation Considerations

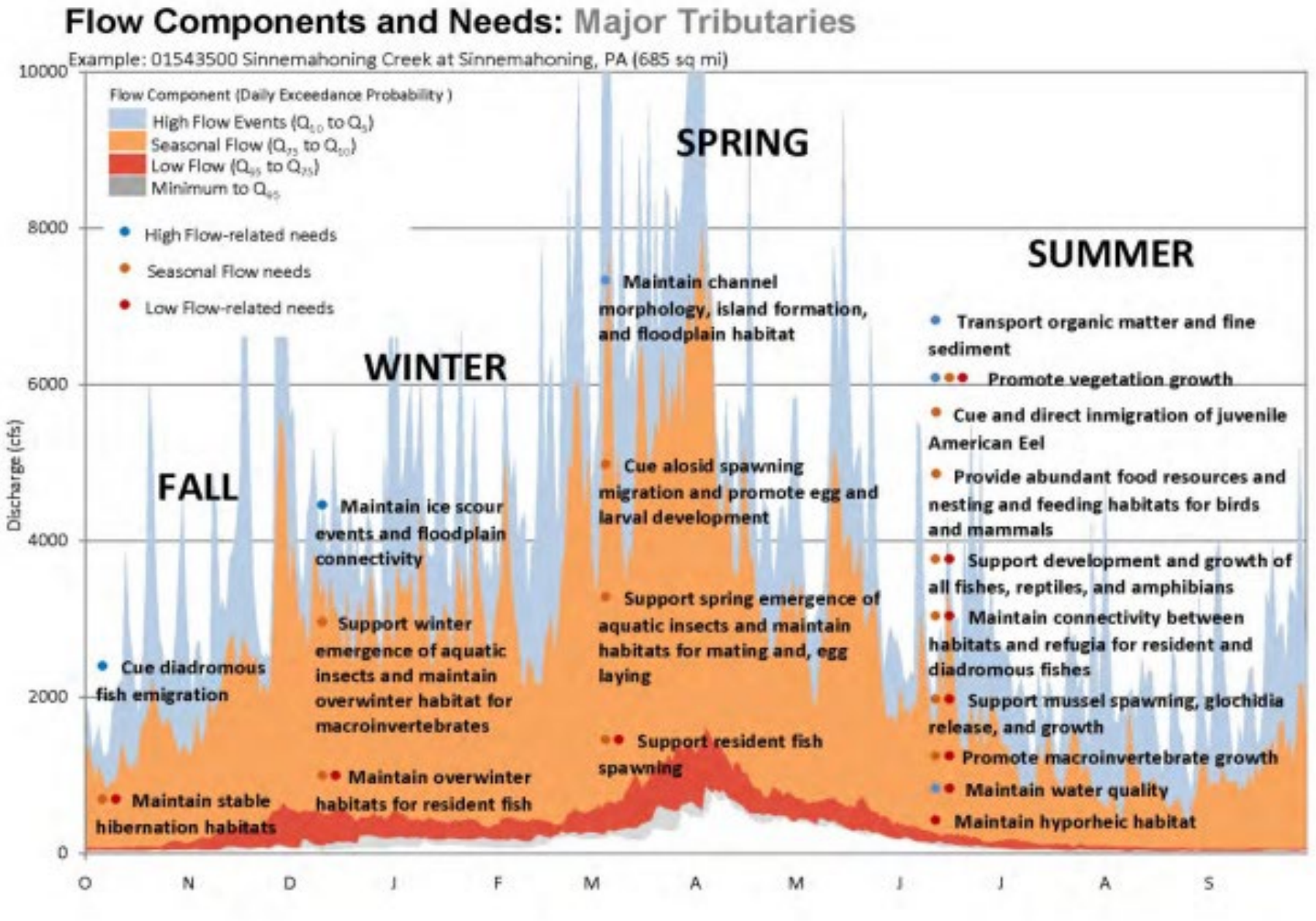
- Identify public water supply sources as waters for Tier 2 or Tier 3 protection to safeguard those resources
- Identify cold water refuges as Tier 3

Cold Water Refugia

- Identify key water reaches as Tier 3 to receive highest level of antidegradation protection
  - Consider headwater streams that are anticipated to remain cold under extreme weather conditions; and,
  - Areas with robust cold water aquatic life assemblages.



Phase 2



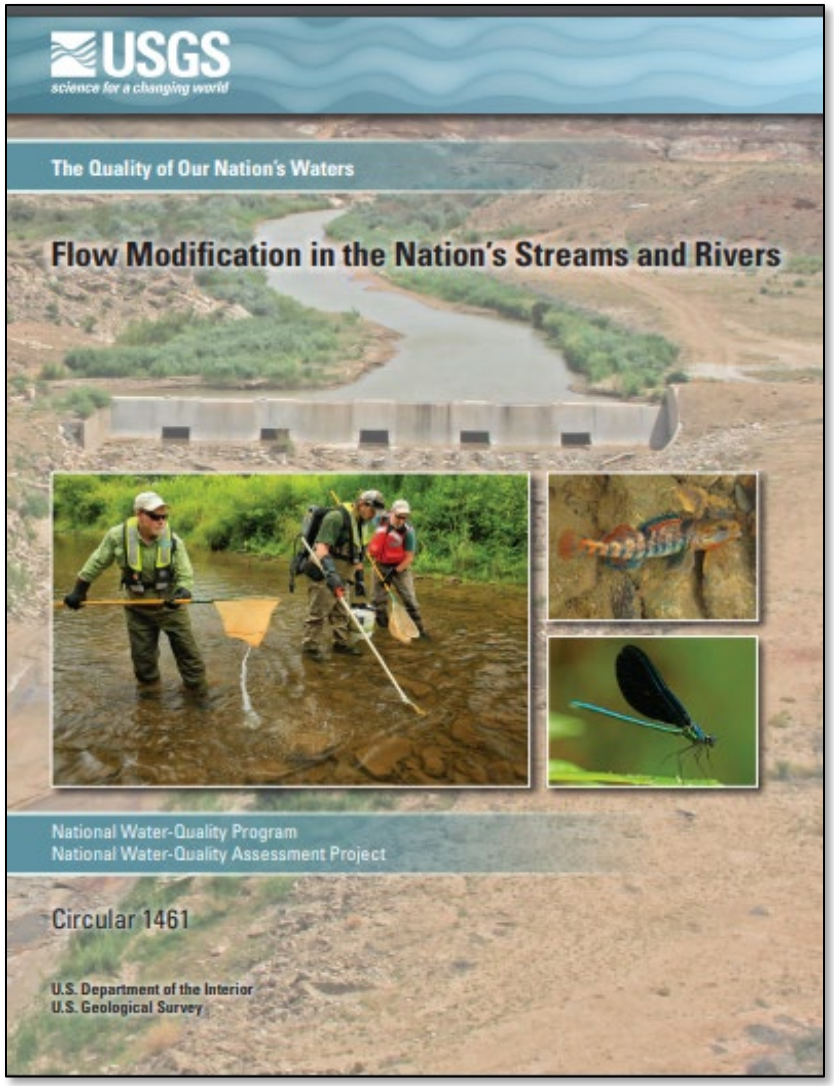
From DePhilip and Moberg, 2010

USGS Assessment 2010 & 2020

Human activities have altered flow in 1.2 million stream miles.

"Human influence on watershed hydrology is extensive and... ***may be the primary cause of ecological impairment in river and stream ecosystems."***

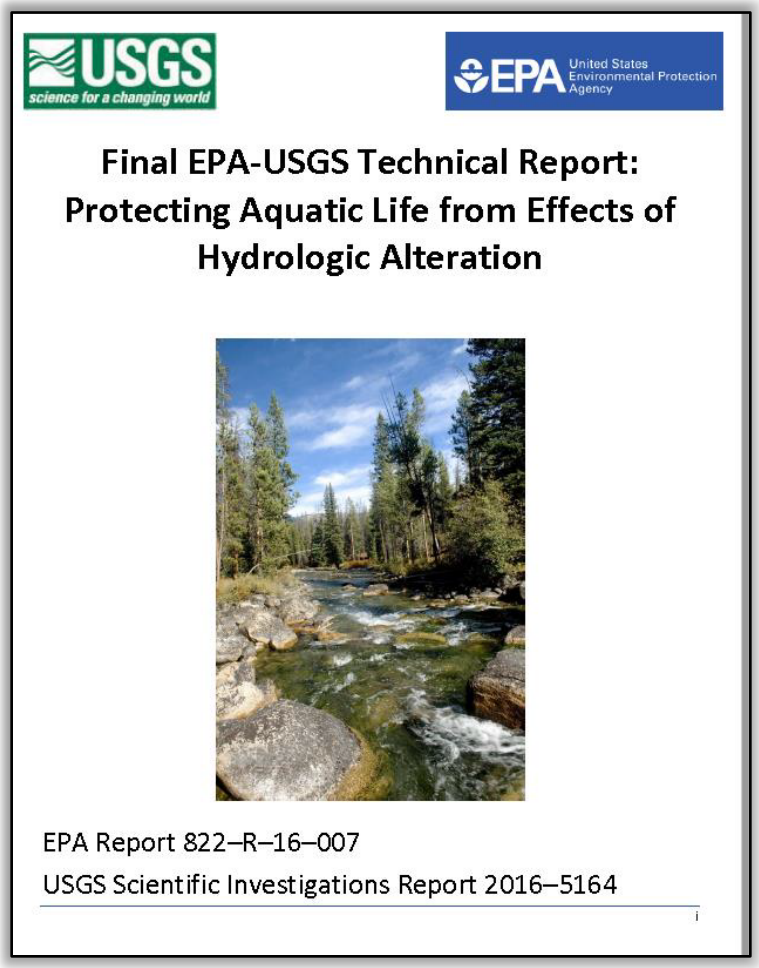
In every Region assessment, these changes are associated with loss of native fish, invertebrates and the ability of aquatic life to survive and reproduce.



Updated National Guidance on Hydrologic Alteration in WQS

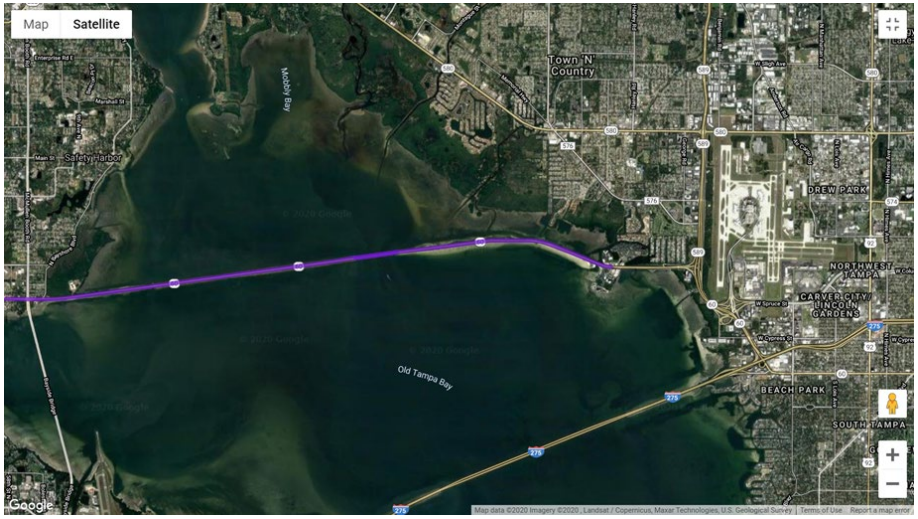
Published under CWA Section 304(a)(2) and 304(f) to provide support to states and tribes to advance protection of aquatic life from adverse effects of hydrologic alteration

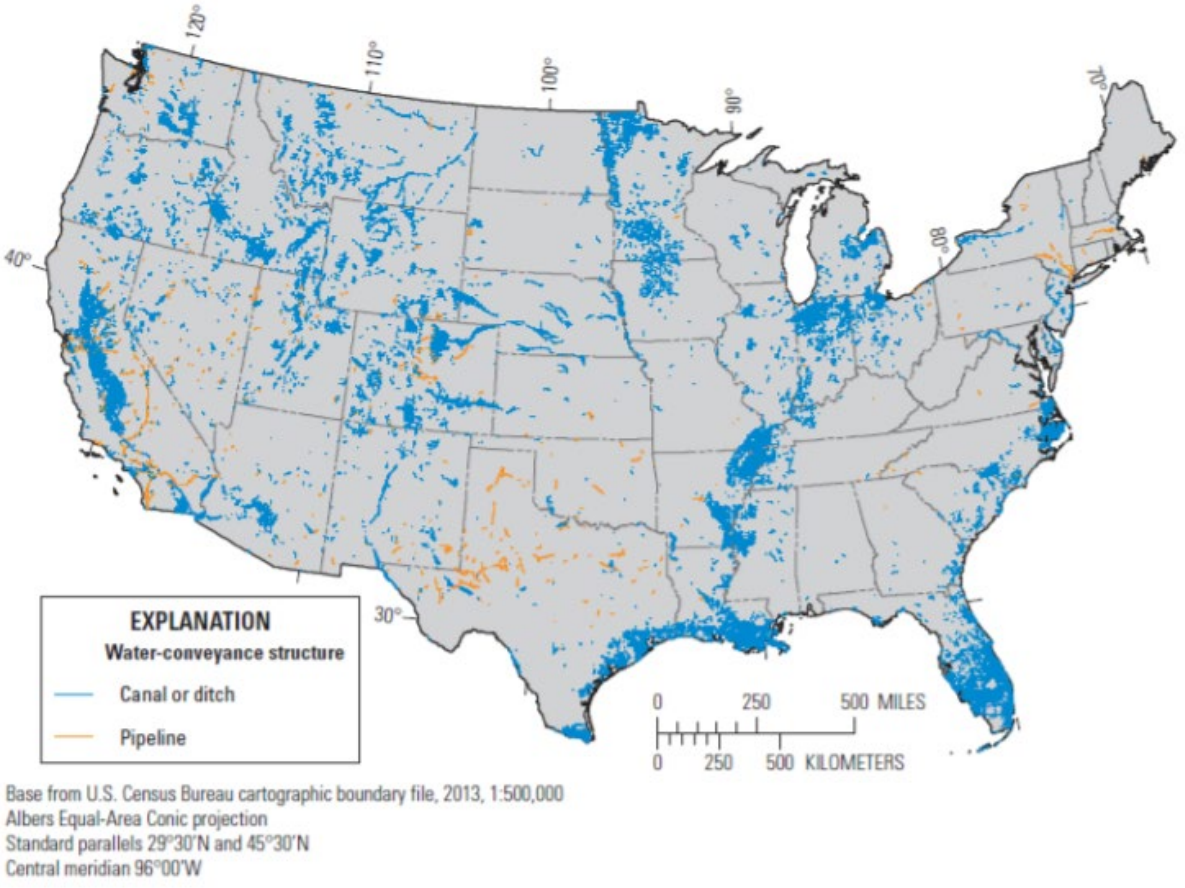
- Includes a literature review of the natural flow regime and effects of altering;
- Provides examples on effects of flow alterations on aquatic life and ecosystems, including changes to geomorphology, connectivity, water temperature and chemistry, and biological responses to changes in flow.
- Examples of narrative criteria developed by states and tribes to support the natural flow regime and healthy biota to be used to restore and maintain healthy flows.
- Provides a flexible framework for states and tribes to quantify flow regime targets that are protective of aquatic life; maintaining multiple components of the natural flow regime.
- Provides examples on how to apply CWA tools to protect aquatic life from altered flow.
- Addresses how climate change will exacerbate these effects.



Pollution from Barriers to Flow

- Dams
- Impoundments
- Culverts/Stream Crossings
- Causeways/Tidal Restrictions
- Rate of change, timing and delivery of flows





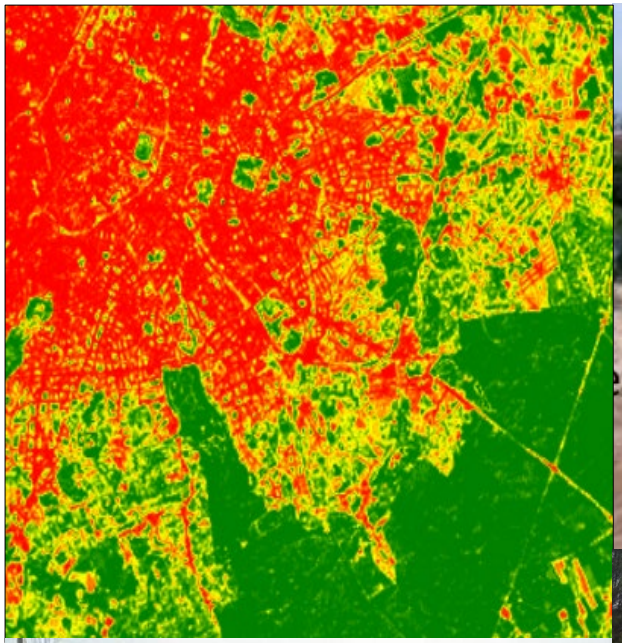
Base from U.S. Census Bureau cartographic boundary file, 2013, 1:500,000
Albers Equal-Area Conic projection
Standard parallels 29°30'N and 45°30'N
Central meridian 96°00'W

Diversions and Canals

Surface and Groundwater Withdrawals

Changes to Land Cover

- Storm Water
- Impervious Cover
- Reduced Base Flow



The response of the community as a measure biological integrity "The Flow-Ecology Relationship"

- Examine the response of the biological community to changes in flow

- Organisms respond in predictable ways to changes in the natural flow regime

Explicit Protections: Hydrologic Criteria

- Describe the desired water quality condition needed to protect a specified designated use (e.g., aquatic life uses, all life stages of trout, wetlands species).

- The adoption of explicit narrative flow criteria allows for a clear link between the natural flow regime and the protection of designated uses.

- Includes a description of the resource to be protected (e.g., aquatic life, balanced and indigenous species or spawning and reproduction.)

- Description of the flow/physical condition needed to be maintained to achieve the protection goal.

Example Narratives

VERMONT

Class A(1)—“Changes from natural flow regime shall not cause the natural flow regime to be diminished, in aggregate, by more than 5% of 7Q10 at any time;”

VIRGINIA

Man-made alterations in stream flow shall not contravene designated uses including protection of the propagation and growth of aquatic life.

MISSOURI

Waters shall be free from physical, chemical, or hydrologic changes that would impair the natural biological community.

TENNESSEE

Stream or other waterbody flows shall support the fish and aquatic life criteria. Stream flows shall support recreational uses.

Example Tribal Criteria

Bad River Band of the Lake Superior Tribe of Chippewa Indians

Natural hydrological conditions supportive of the natural biological community, including all flora and fauna, and physical characteristics naturally present in the waterbody shall be protected to prevent any adverse effects.

- Antidegradation Implementation.

Lowering of Water Quality: A lowering of water quality is defined as: the projected or observed diminished chemical, biological, or physical integrity of Reservation surface waters, including changes to water flow or water level;

Lac du Flambeau

Water levels, quantity and quality necessary for the growth and propagation of wild rice, shall be maintained.

North Carolina

Wetlands

- **Hydrological conditions necessary to support the biological and physical characteristics naturally present in wetlands** shall be protected to prevent adverse impacts on: **Water currents**, erosion or sedimentation patterns, Natural water temperature variations; chemical, nutrient and dissolved oxygen regime of the wetlands; movement of aquatic fauna; pH; **Water levels or elevations**.

Class SC Tidal Waters

- Salinity: **changes in salinity due to hydrological modification** shall not result in removal of the function of a PNA (primary nursery area).

Takeaways

- Extreme weather may add to and exacerbate existing stressors that may place more pressure on designated uses.
- Understand local water quality trends through baseline data to determine extreme weather sensitivities/ vulnerabilities and identify waters most at risk.
- WQS can increase resilience through many avenues.
- Protect waters now to prevent irreversible damage later.

Helpful Resources

See Electronic Student Manual for Websites…

- EPA's climate change website
- EPA's Climate Change and Water Website
- EPA's Climate Change and Water E-Newsletter and Archive
- EPA ORD Climate Change Research (human health, ecological, adaptation and mitigation, models, databases, tools)
- Climate Change Indicators in the United States Report, 2016
- U.S. Global Change Research Program (projection data, impacts, etc.)
- NOAA Climate Programs: Regional Integrated Science Assessments
- National Climate Assessment, 2014
- Climate Change Adaptation Resource Center

Questions?

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