

Integrating Water Supply Management And Ecological Flow Requirements

Mark P. Smith and Colin Apse
The Nature Conservancy

Richard M. Vogel and Stacey Archfield
Tufts University

Annette Huber-Lee and Jack Sieber
Stockholm Environment Institute

Collaborative Science and Technology Network for Sustainability
Progress Review Workshop
October 18-19, 2005

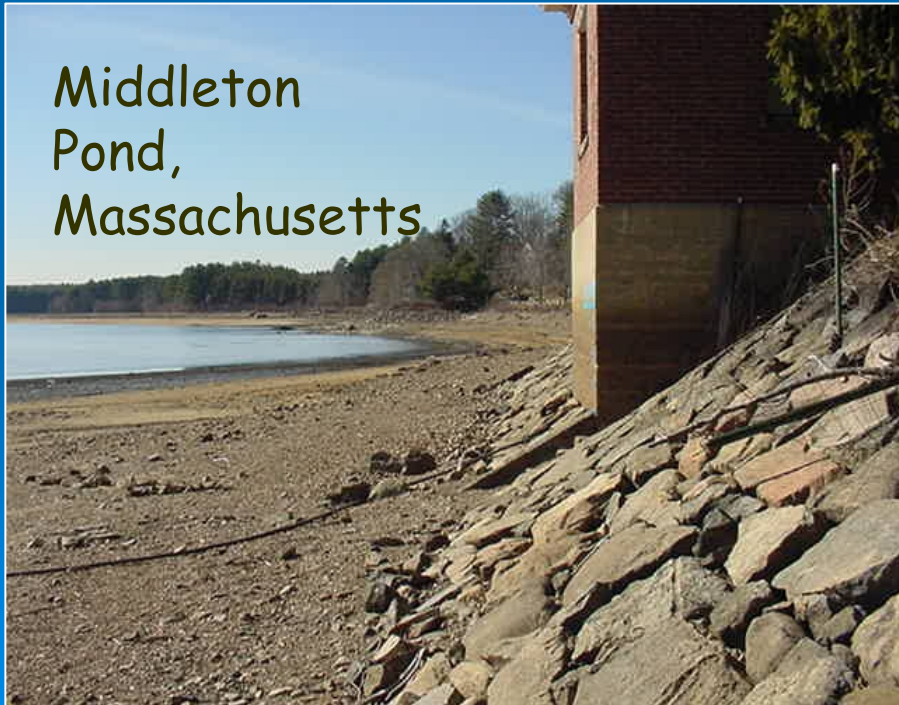


The Setting and Problem

Suboptimal Policies For Water Supplies Can Result In Negative Impacts To Both Water Supplies And To Ecological Functions

Water Supply Shortages

Middleton
Pond,
Massachusetts



Inadequate Stream Flows

Ipswich River,
MA



The Setting and Problem

Addressing these issues involves three areas of water resource management:

- Instream Flow Needs
- Water Supply (Reservoir) Management
- Demand Management

There is very little literature or real-world application integrating these three areas.

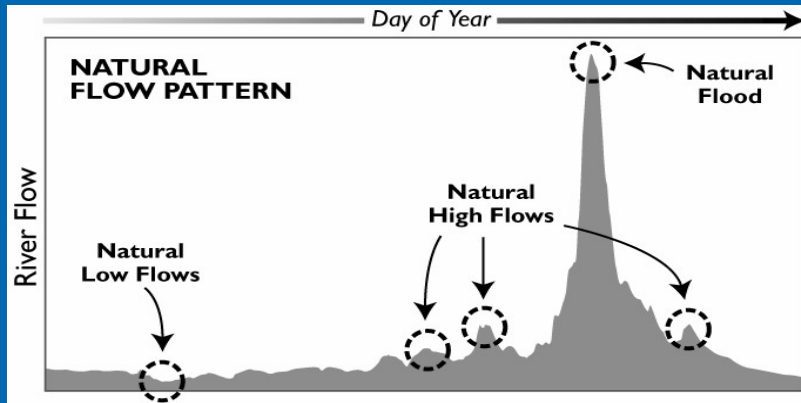
Competition for Water

- There is growing awareness that water is in limited supply in the East, especially during droughts
- When there's plenty of water, competition among different water needs should be irrelevant
- Limited state standards exist for instream flow
- Usually there are no standards for water supply reliability
- Usually there are no requirements for the proactive use of drought plans to protect water supplies and the environment

Growing Understanding of Ecological Flow Requirements

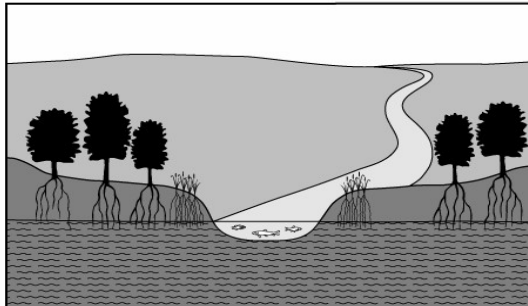
- Scientific literature demonstrates that riverine ecosystems need flow variability
- Need to account for “flow components” such as extreme low flow, base flow, high pulses, overbank flows, and floodplain maintenance flows
- By more precisely defining flow needs using these components we can identify improved, balanced water release operating rules

It's Not Just a Matter of Water Volume...



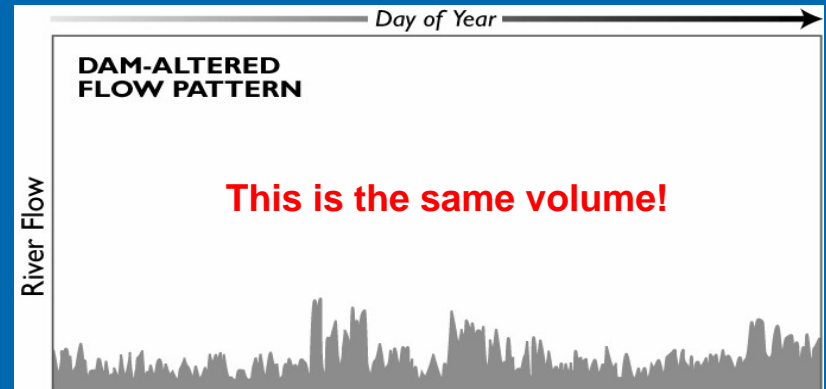
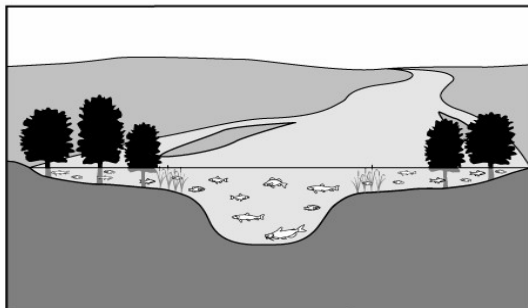
Natural Low Flow

- Fish have adequate oxygen and can move up- or downstream to feed
- Riparian vegetation sustained by shallow ground water table
- Insects feed on organic material carried downstream
- Birds supported by healthy riparian vegetation and aquatic prey



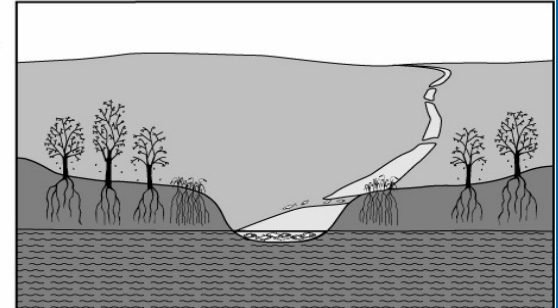
Natural Flood

- Fish are able to feed and spawn in floodplain areas
- Riparian plant seeds germinate on flood-deposited sediments
- Insects emerge from water to complete their lifecycle
- Wading birds and waterfowl feed on fish and plants in shallow flooded areas



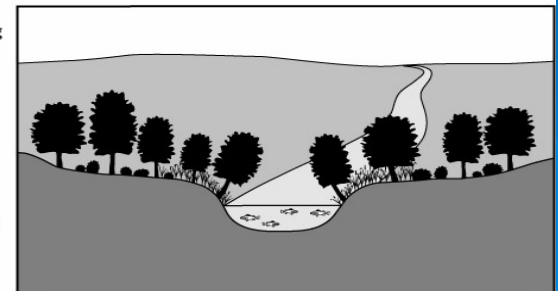
Inadequate Low Flow

- Fish are overcrowded in poor-quality water, cannot move to other feeding areas
- Riparian plants wilt when ground water table drops too low
- Insects suffer when water levels rise and fall erratically
- Birds unable to feed, rest, or breed in tree canopy

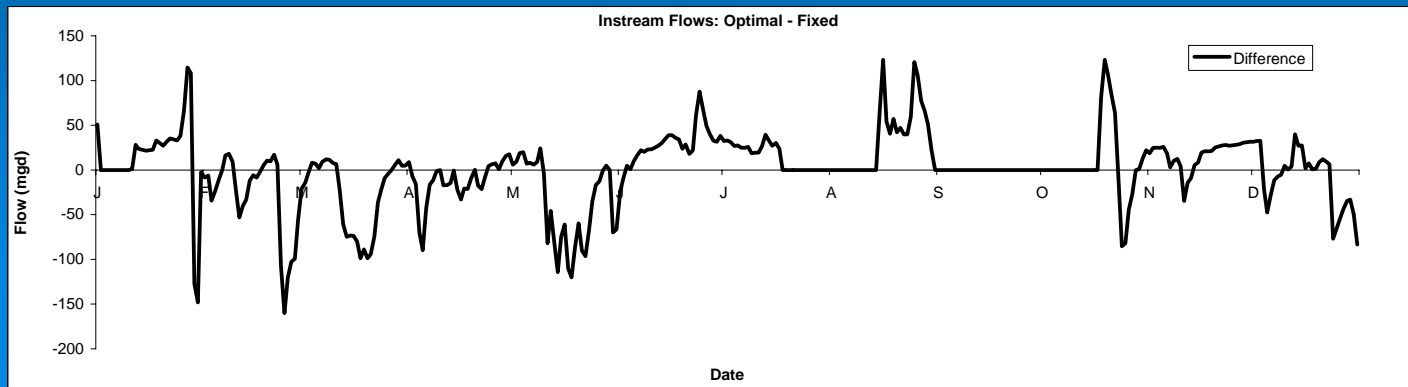
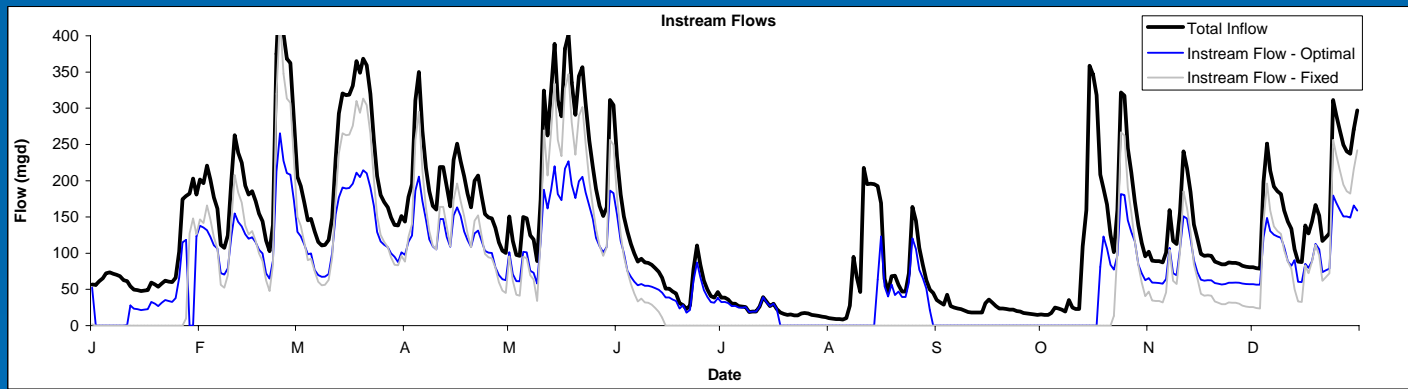
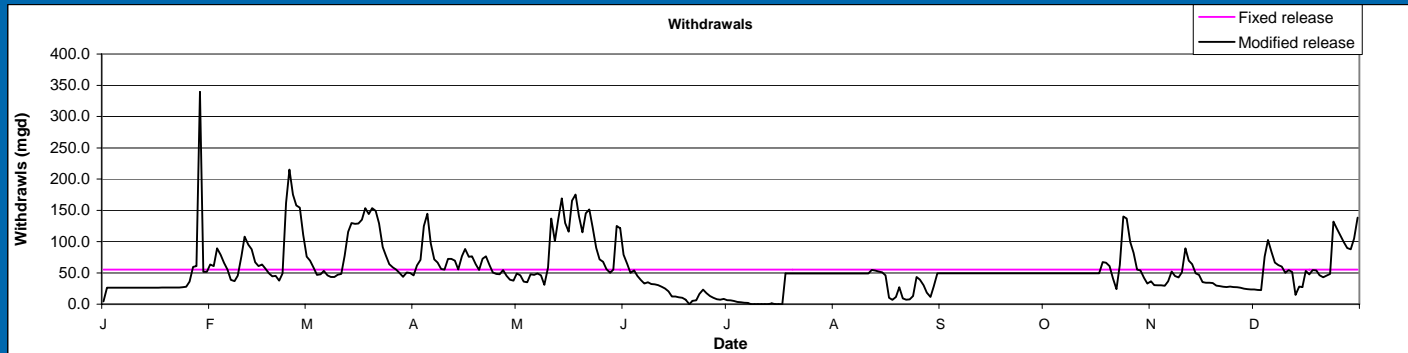


Absence of Flood

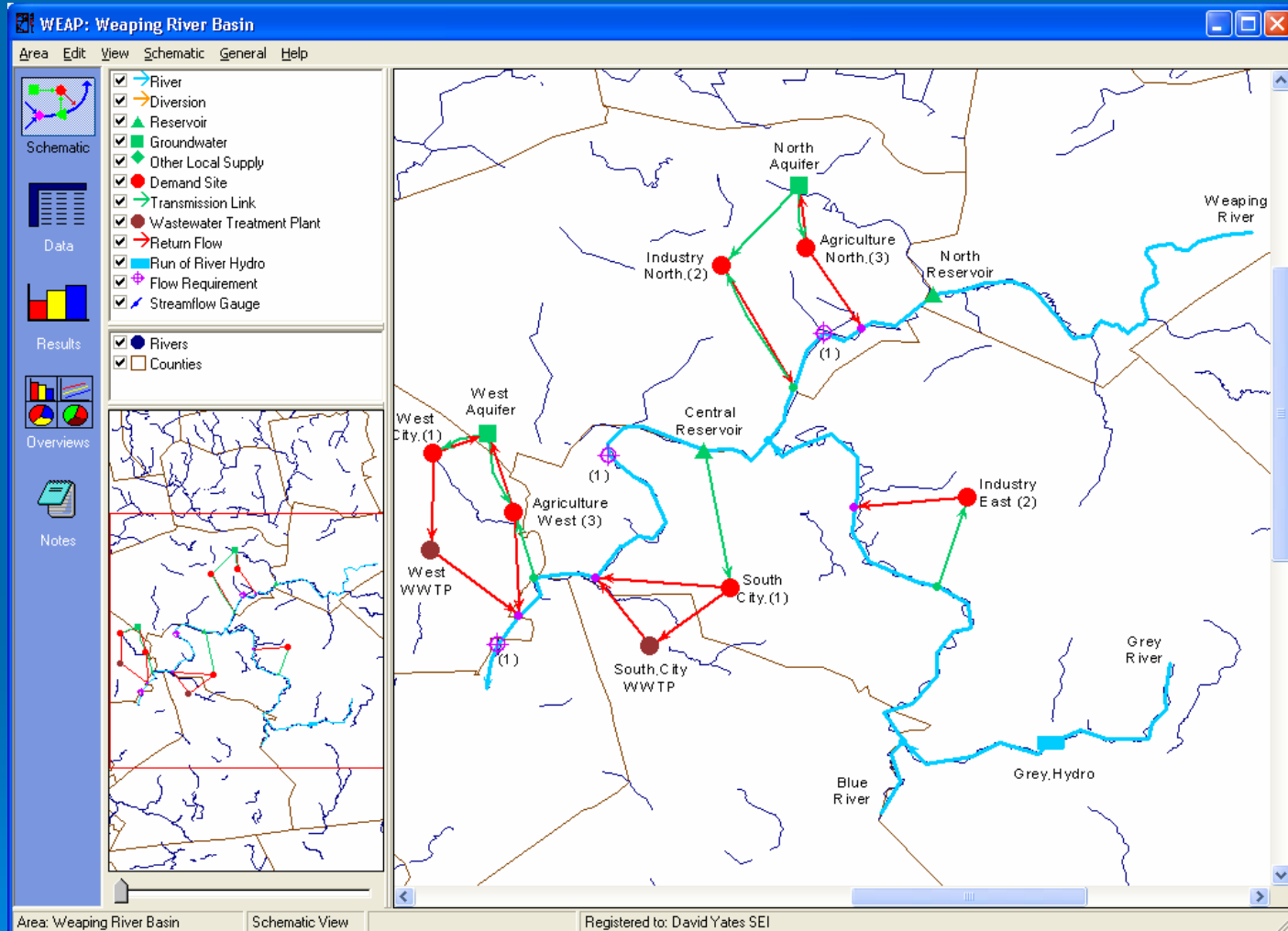
- Fish unable to access floodplain for spawning and feeding
- Riparian vegetation encroaches into river channel
- Insect habitats smothered by silt and sand
- Many birds cannot use riparian areas when plant species change



Developing a Decision Support System (DSS) that considers water supply demands, ecological flow requirements and drought management



Delivering the DSS Through a Tested Program: SEI's Water Evaluation and Planning Tool (WEAP)



WEAP is being made available free to all AwwaRF member utilities

Decision Support System

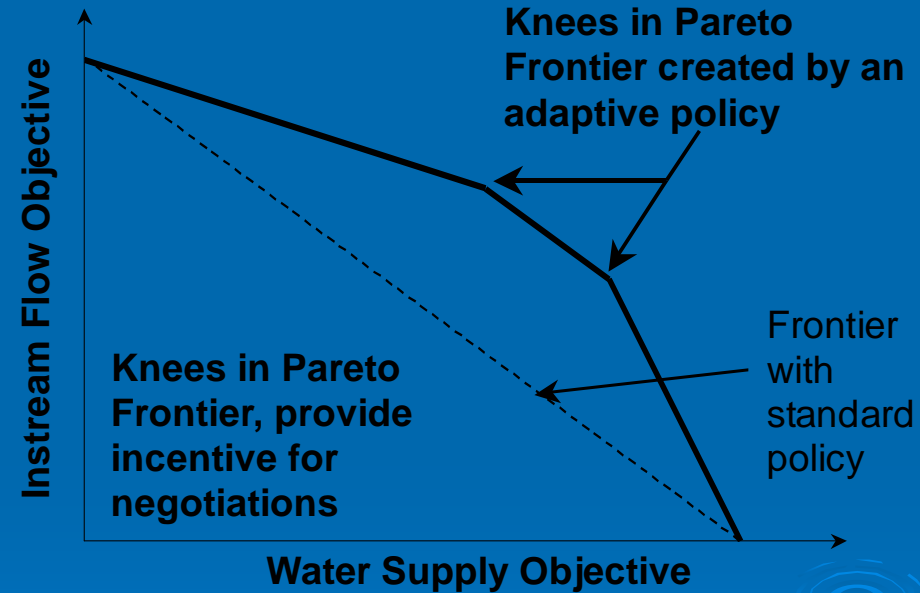
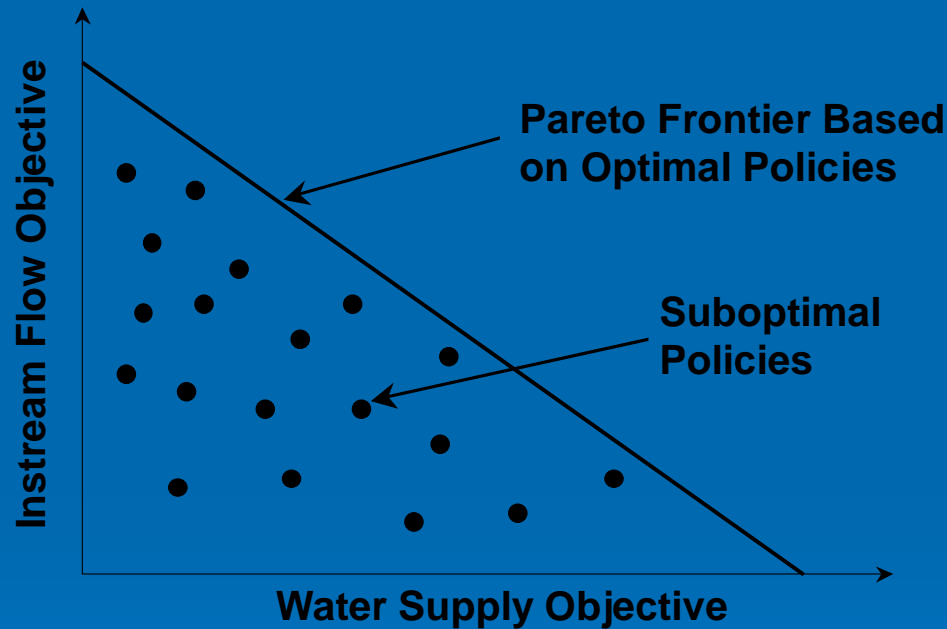
The DSS in WEAP will demonstrate that by:

- refining the quantity and timing of reservoir releases
- actively managing demands through adaptive drought management and conservation measures
- defining key ecological flow parameters more precisely

the reliability of a water supply yield can be maintained and ecological flows requirements can be met on a more consistent basis

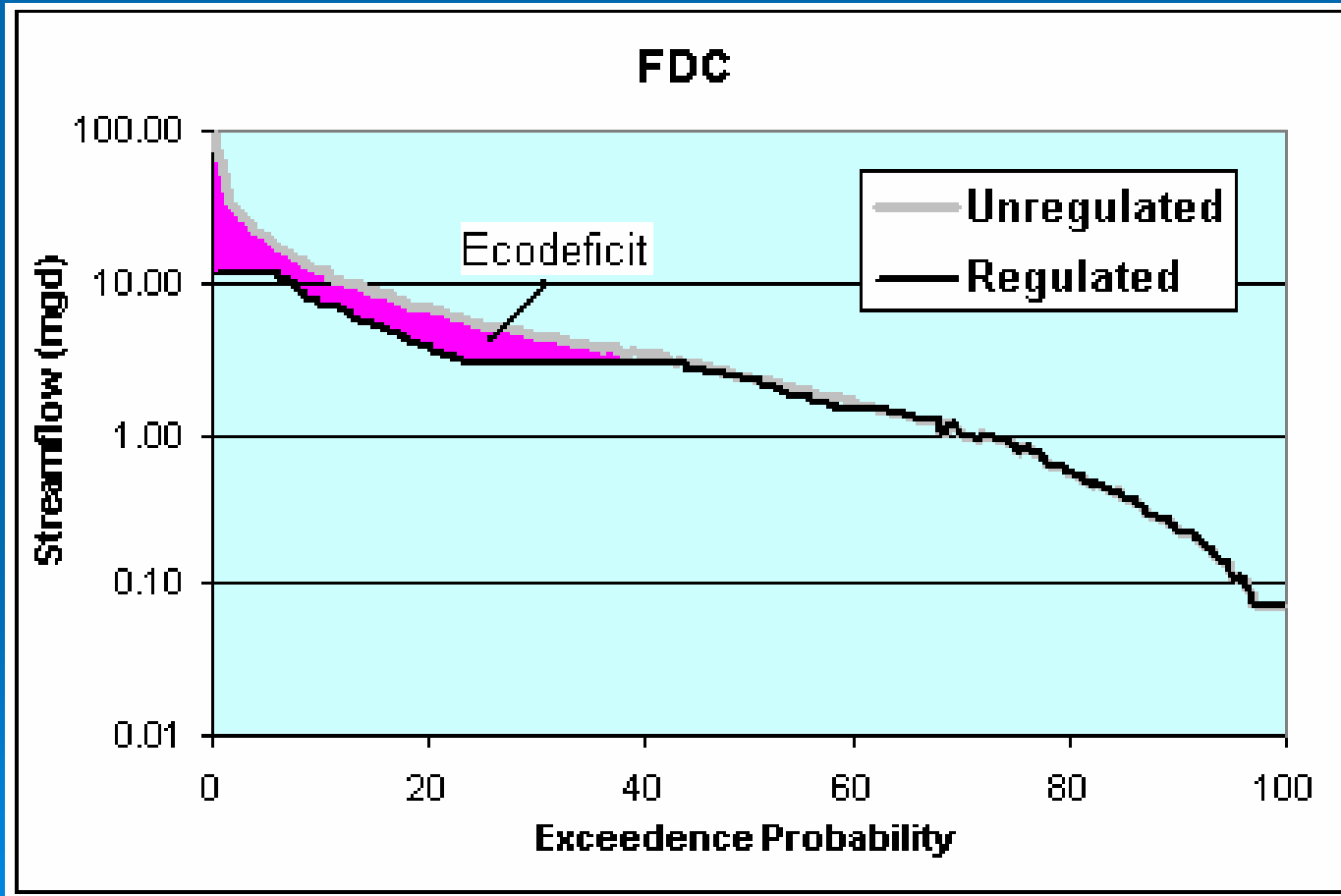
The background of the slide features several concentric, glowing blue circles of varying sizes, resembling ripples on water, positioned in the lower half of the frame.

Using Optimization to Define Potential Solutions

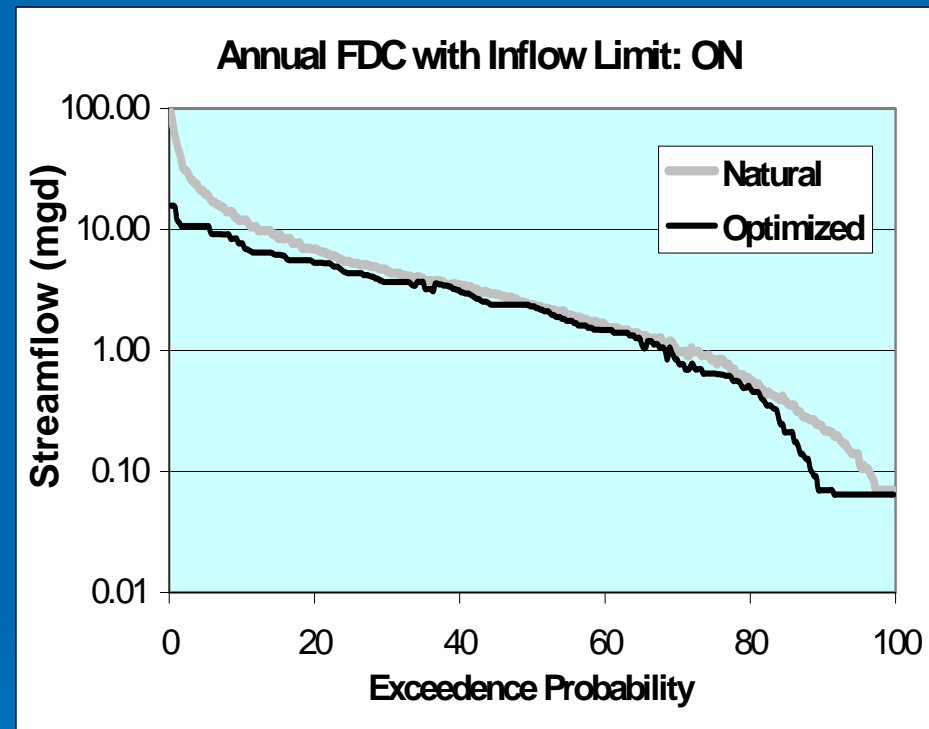
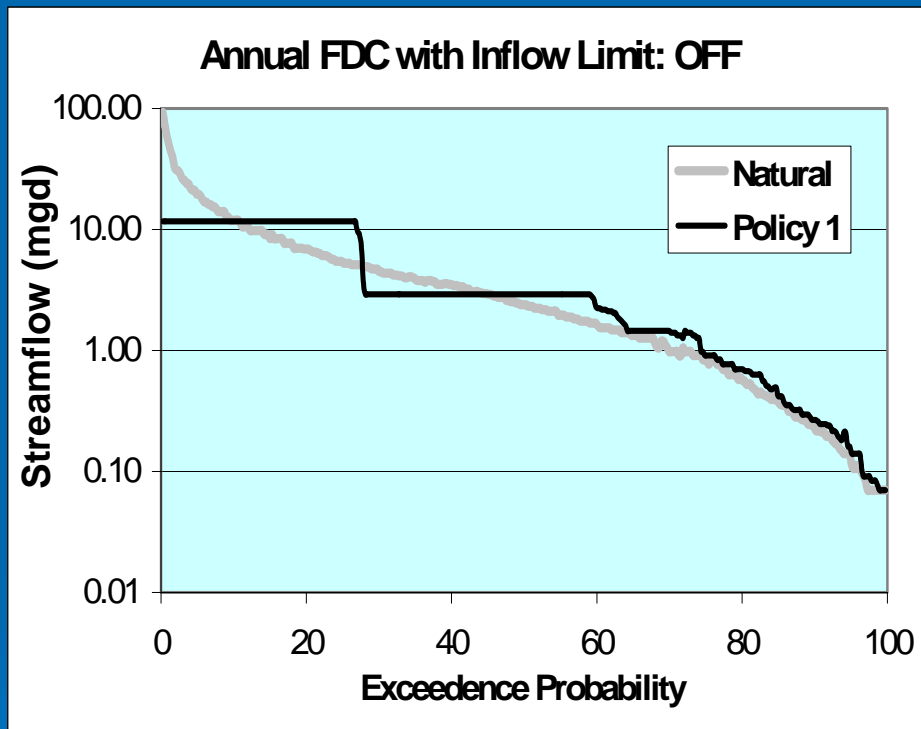


Zero-sum dilemma addressed through adaptive management approaches designed to modify both water supply and instream flow requirements

The Ecodeficit - An New Measure to Evaluate Water Supply Reliability in Relation to Ecological Flow Needs

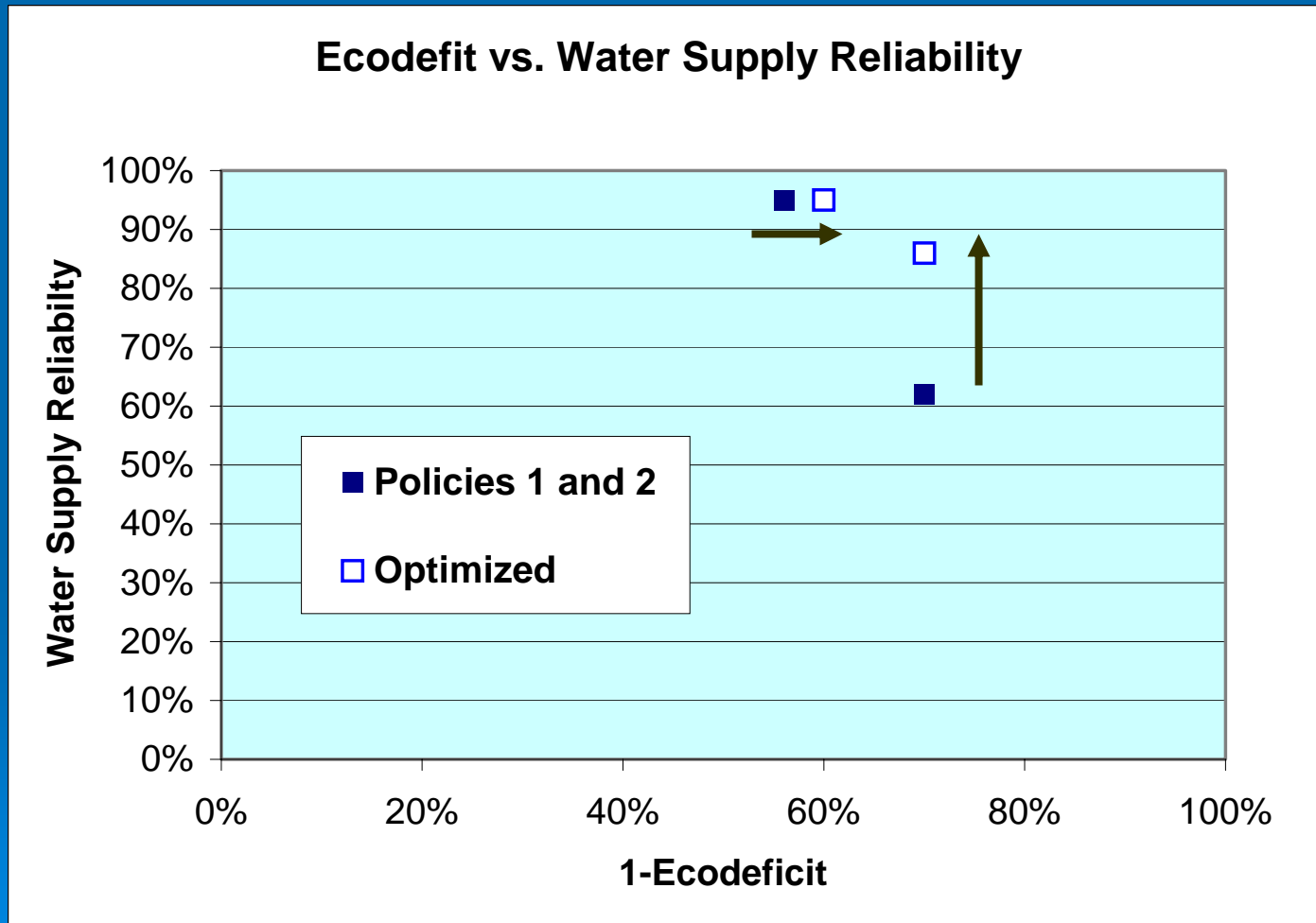


Evaluating Instream Flow Policies Using Ecodeficit



Initial Modeling Based on Seasonal Minimum Flow Requirements vs. Optimized Releases

Finding Gains for both Water Supply and Ecosystems



Expected Outcomes

1. Demonstration Projects- Testing Approach with Water Suppliers in New England
2. Application for the Eight Mid-Atlantic and New England States Developing Streamflow Policies
3. Assist Federal Agencies - USGS/EPA/USFWS- Efforts on Flow Issues
4. Potential Global Reach through the Water Evaluation and Assessment Planning (WEAP)
5. Articles in both Environmental and Water Management Journals

Integrating Water Supply Management And Ecological Flow Requirements

Funding Provided By:
U.S. Environmental Protection Agency

**Collaborative Science and Technology Network
for Sustainability**

EPA Grant # X3-83238601-0

