Conservation of surface and ground water in a Western watershed experiencing rapid loss of irrigated agricultural land to development

USDA Integrated Research, Education, and Extension Competitive Grants Program—National Integrated Water Quality Program (NIWQP)

Project partners:

Humboldt State University (HSU)

Fremont-Madison Irrigation District (FMID)

Friends of the Teton River (FTR)

Henry's Fork Foundation (HFF)

Program Description and Goals

Goal of the National Integrated Water Quality Program (NIWQP):

- improve the quality of surface water and groundwater resources
- reflect input from stakeholder groups and organizations to improve water resources

"Projects **MUST** address water … issues in **agricultural, rural, and/or urbanizing watersheds**."

NIWQP Themes in this Project

- Environmental Restoration
- Watershed Management
- Water Conservation and Agricultural Water Management
- Water Policy and Economics

Project Specifications

- Watershed-Scale Project

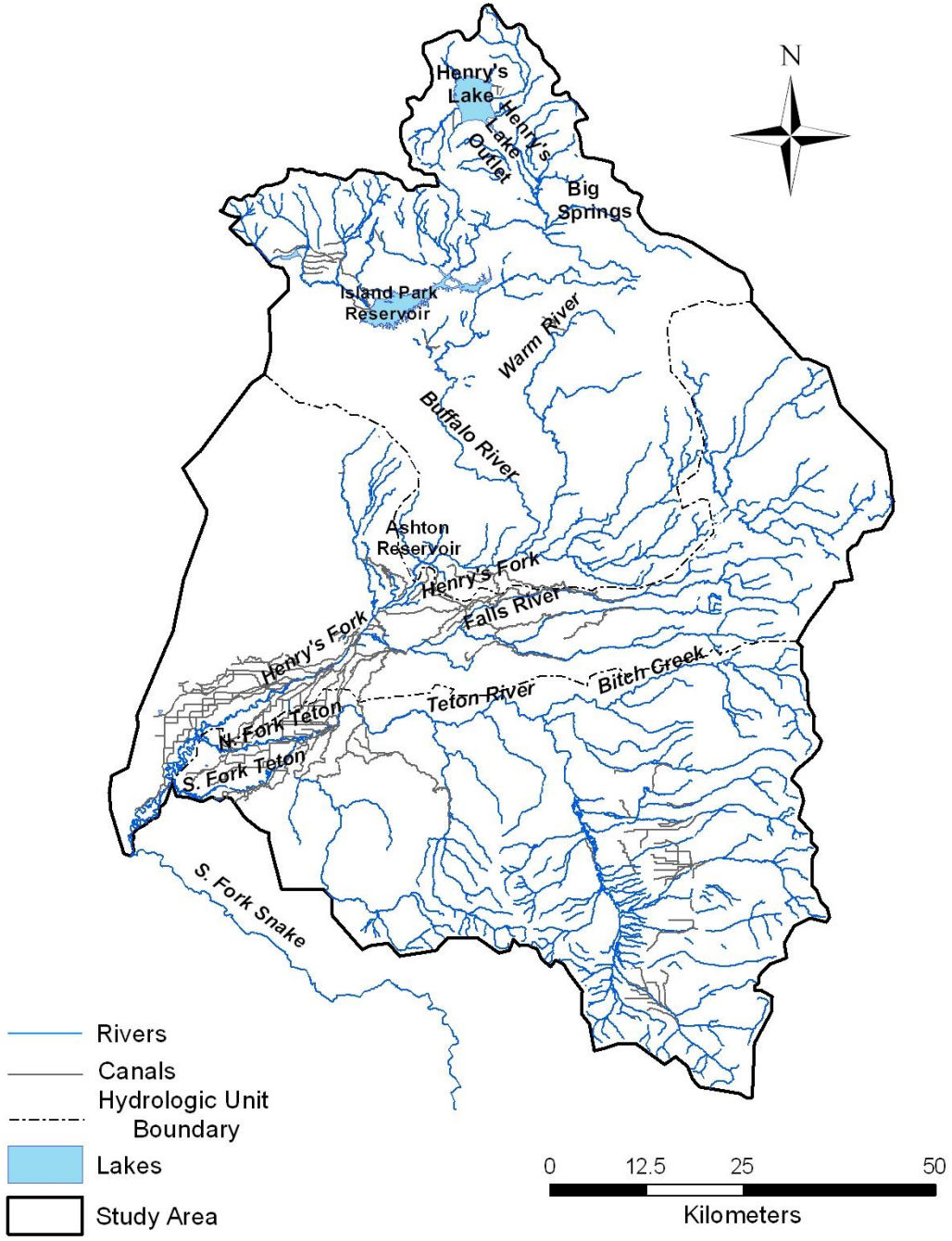
  - Integrate education, research, extension

- Issues to address

  - Cause of water resource degradation and conservation of water resources at watershed scale

  - Use of tools, management strategies and new technologies to improve water conservation

- Grant Eligibility
  - Colleges and universities only
  - May subcontract to non-eligible organizations as necessary



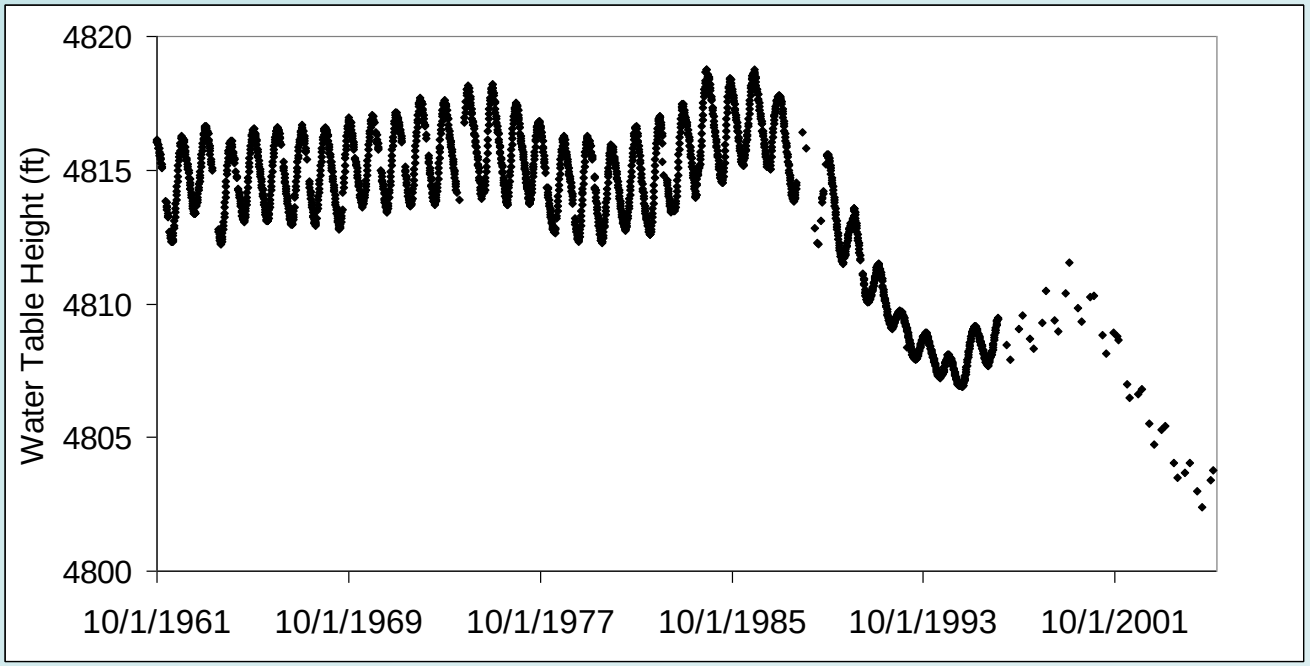
PROJECT AREA

- Henry's Fork watershed, including Teton subwatershed
- Focus is on traditionally irrigated lands
- 275,000 acres irrigated
- Water supply: 2.7 million acre-feet
- Withdrawn water: 1.8 million acre-feet
- Return flow: 0.7 mil. a-f
- Outflow: 1.6 million a-f

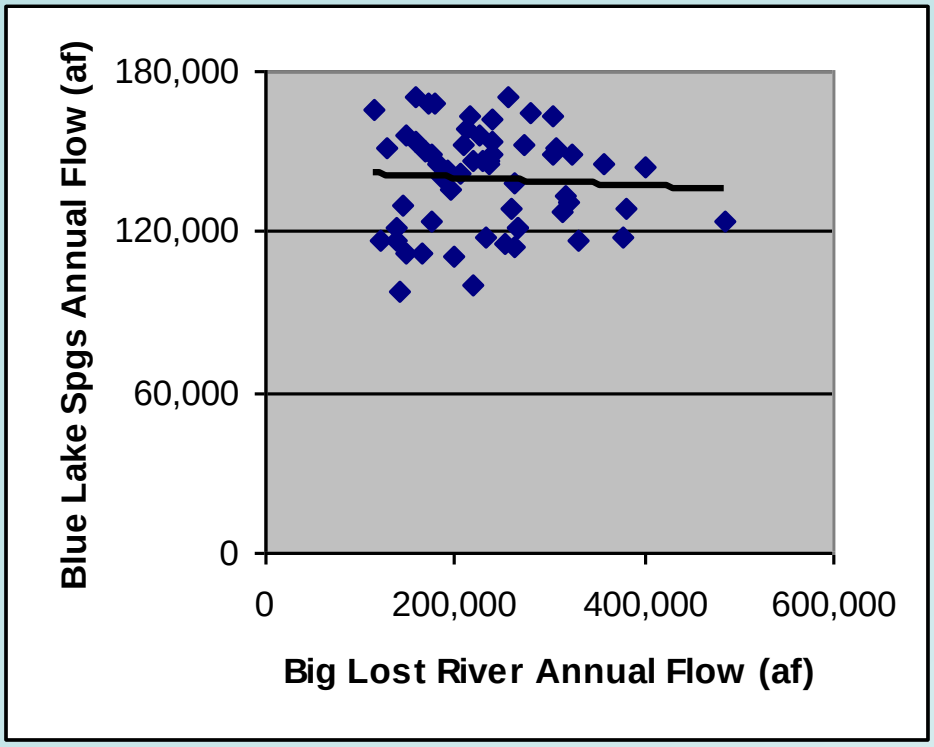
Issues Identified in 2006 Meetings:

- Decreases in ground water tables
- Theoretical water savings from urbanization
- Challenges of irrigating in an urbanizing landscape
- Projecting effects of water management actions across the watershed and into the future

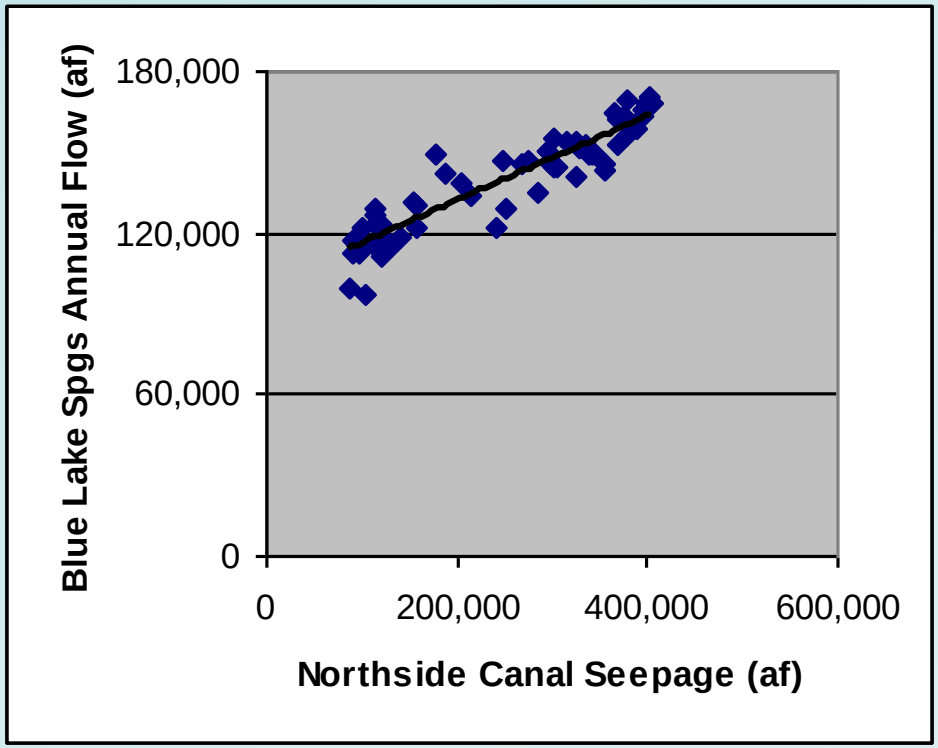
Water table height in a well located in the southwestern part of the Henry's Fork watershed.



Example of connection between water management and hydrology: Discharge from Eastern Snake Plain Aquifer



Function of Big Lost River Flow



Function of seepage from irrigation

Project Objectives

- Education
  - Provide experiential training to an interdisciplinary team of students
- Research
  - Develop quantitative models of ground and surface water flow under historic, current, and future water/land use
  - Identify economic, regulatory, and physical mechanisms that will
    1. encourage water conservation
    2. facilitate efficient water management

Project Objectives (continued)

- Extension
  - Prepare and distribute educational materials describing the watershed's hydrologic system and water conservation benefits and strategies
  - Facilitate development of a water conservation/management strategy to increase water availability for agriculture while enhancing ecological benefits in key stream reaches

Senior Project Team

Name	Title and affiliation	Expertise
Mark Baker	Asst. Prof. of Politics, HSU	Community-based natural resource management
Yvonne Everett	Assoc. Prof. of Natural Resources, HSU	Natural resource planning
Brad Finney	Prof. of Environmental Engineering HSU	Hydrology and water resource management
Steve Steinberg	Assoc. Prof. GIS/Remote Sensing, HSU	Spatial Analysis/GIS
Dale Swensen	Executive Director, FMID	Irrigation management
Steve Trafton	Executive Director, HFF	Fisheries conservation
Rob Van Kirk	Assoc. Prof. of Statistics, HSU	Project Director
Amy Verbeten	Education and Outreach Director, FTR	Experiential and environmental education

Graduate Student Team

Name	Undergraduate Training	Current Studies
Brian Apple	BS in Forestry, California Polytechnic State University	Master of Environmental Systems: Engineering emphasis
Lora Liegel	BA in Geography, Oregon State University	Master of Social Sciences: Environment and Community emphasis
Kimberly Peterson	BS in Mathematics, Idaho State University	Master of Environmental Systems: Mathematical Modeling emphasis

Budget

	2009	2010	2011	Total
Students	$ 81,672	$ 88,296	$ 30,900	$ 200,868
Faculty	$ 48,197	$ 52,541	$ 89,581	$ 190,319
HFF, FTR, FMID, HFWC	$ 23,900	$ 23,900	$ 24,250	$ 72,050
Materials, Publications, Travel	$ 19,800	$ 10,500	$ 23,100	$ 53,400
Subtotal	$ 173,569	$ 175,237	$ 167,831	$ 516,637
Indirect costs	$ 34,713	$ 35,047	$ 33,566	$ 103,326
Total	$ 208,282	$ 210,284	$ 201,397	$ 619,963

Stakeholder Involvement

1. Identify important water management issues and information/data needs
2. Review preliminary model results; refine model scenarios and outputs
3. Use results to develop water conservation and management strategy

Timeline

2009

Spring

- Design field sampling programs
- Begin stakeholder involvement: HFWC and Teton Valley forums/groups

Summer

- Meet with key stakeholders/decision-makers
- Collect hydrologic data
- Identify and interview stakeholders
- Begin investigation of water conservation strategies

Fall

- Analyze field data
- Compile spatial data
- Begin hydrologic model development
- Continue investigation of water conservation strategies

2010

Spring

- Analyze spatial data to support model development
- Complete preliminary hydrologic model
- Present model to stakeholders

Summer

- Collect additional field data as needed
- Obtain stakeholder input to refine model and identify outputs
- Henry's Fork Watershed Council field trip
- Develop educational and outreach materials

Fall

- Apply hydrologic model to future scenarios
- Integrate hydrologic model results with water conservation strategies
- Develop tools and products to communicate results for stakeholders
- Give presentations at professional meetings and conferences

2011

Spring

- Deliver results to stakeholders and outline conservation strategy
- Students finish theses
- Communicate with other NIWQP projects

Summer

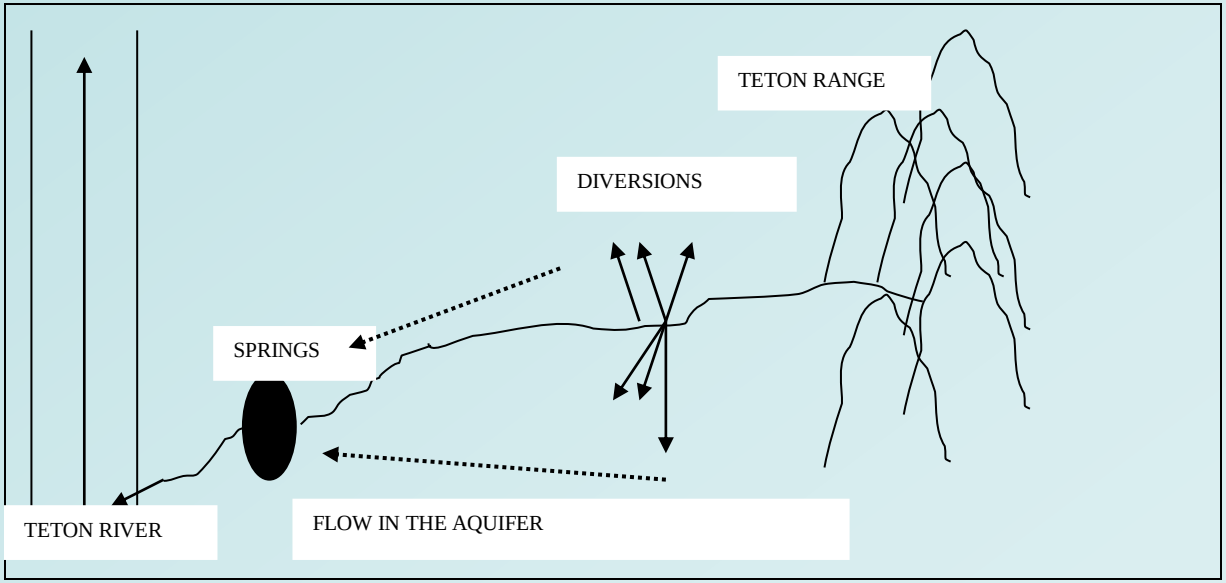
- Disseminate educational materials and presentation results in public forums
- Submit papers for publication
- Finalize water conservation strategy document

Fall

- WIRE final water conservation strategy document
- Evaluate project through WIRE process
- Complete presentation and publication of results

Example of model output: Teton Creek

1. Snowmelt flows from the Teton Range and enters Teton Creek
2. Much diverted for irrigation and the remaining flows through main channel
3. Some water seeps back into the aquifer from the channel and diversion canals
4. Springs produce gains from recharge
5. Any water remaining after diversions enters the Teton River at the confluence
6. All of the water that does not seep into the aquifer through the canals is used consumptively by crops and is lost from the system.



A schematic of Teton Creek

Modeled different irrigation practices:

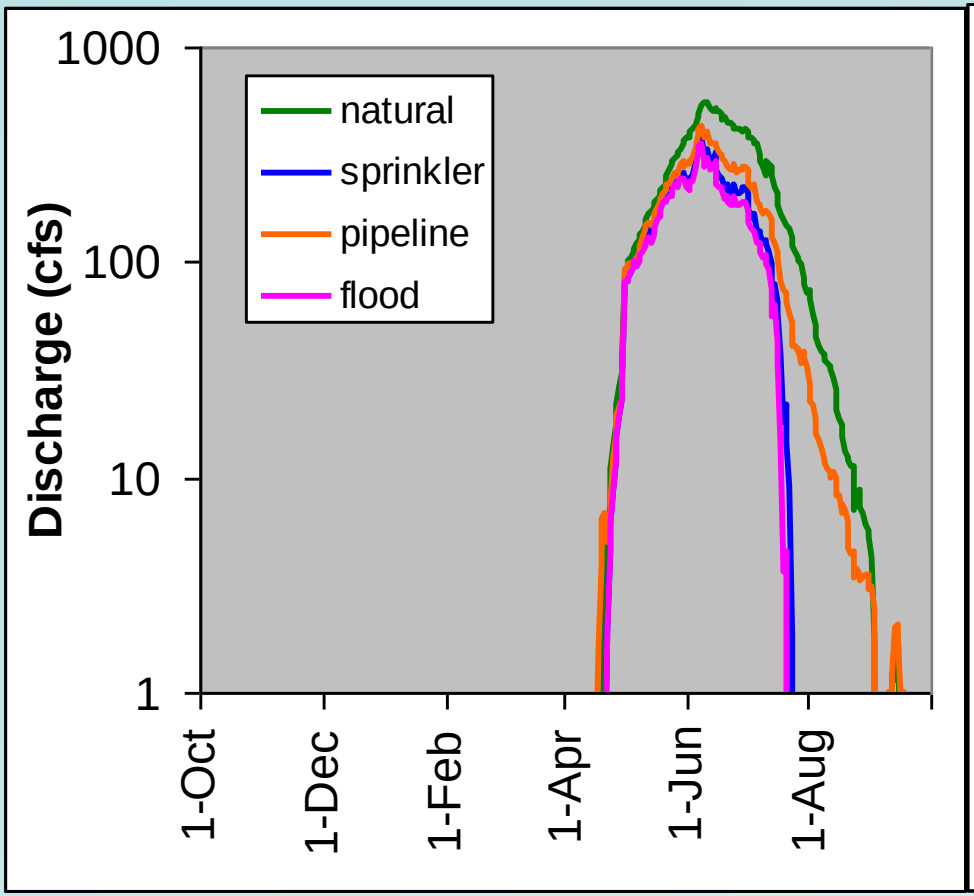
natural scenario; historic flood irrigation; current sprinkler irrigation; hypothetically pipelining all canals

The model was designed to see what effects that flood, sprinkler, and pipelining practices have on the hydrologic regime.

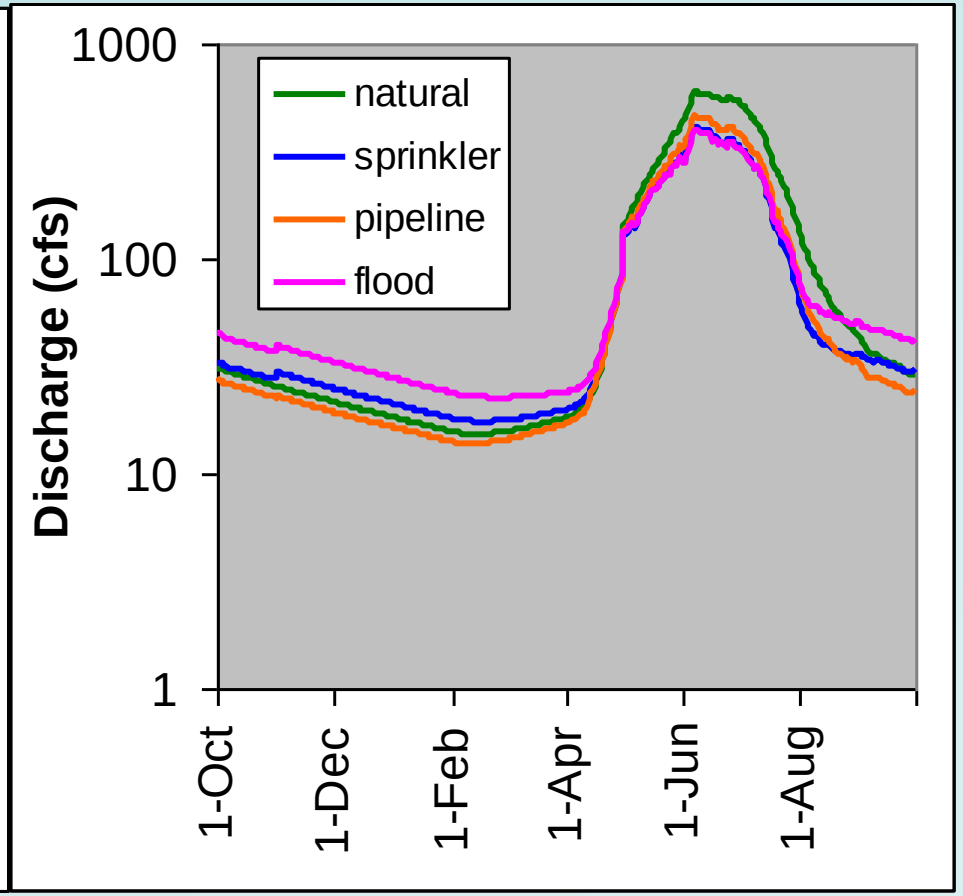
Assumptions of Model

- Natural: seepage to the aquifer only occurs from the channel and no diversions take place
- Flood: seepage occurs not only in the channel, but also in the canals and when the water is spread to the crops
- Sprinkler: seepage occurs in the channel and the canals
- Pipelining: seepage only occurs in the channel

Results of Model



Average flow in Teton Creek above Highway 33



Average flow in Teton Creek at Teton River confluence

Your Suggestions

- What do you perceive as the important water management issues in the watershed? Ideas for solutions?
- What are the best ways to involve watershed residents and stakeholders and share information?
- Who else should we reach, and how can we reach them?
- Logistical support: access, data, other???