# Determination of Ground-Water and Surface-Water Interactions Using Multiple Methods, In and Near Fish Creek, Jackson Hole, Wyoming

**by J.D. Wheeler[1], C.A. Eddy-Miller[1], J.E. Constantz[2], and D.J. Leemon[3]**

[1]U.S. Geological Survey Wyoming Water Science Center; [2]U.S. Geological Survey Branch of Regional Research, Menlo Park; [3]Teton Conservation District

Teton Conservation District Est. 1946

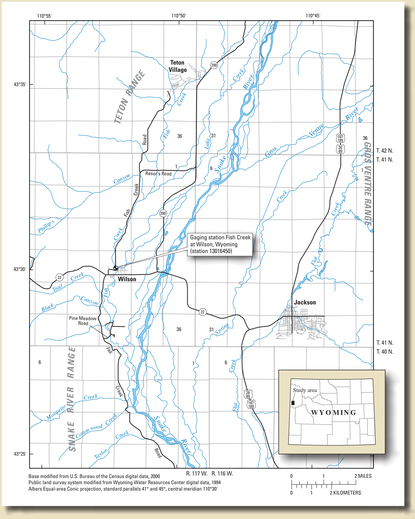


**Figure 1.** General location of Fish Creek, Wyoming.

*Concurrent discharge measurements on Fish Creek, Wyoming.*

## Overview

- Fish Creek is a 15-river mile long tributary to the Snake River (drainage area: 71 mi$^2$ at gaging station 13016450)
- Bounded by the Teton and Snake River Ranges to the west and braided Snake River system to the east (fig. 1)
- Surficial geology in valley: unconsolidated Quaternary alluvial, glacial till, and glacial outwash deposits
- Flow in creek intermittent in upper reaches near Teton Village, becomes perennial near Resor's Road (Resor's Bridge) (fig. 2)
- Significant hydrologic factors:
  - Highly permeable and heterogenous substrate
  - Close proximity to Teton fault system
  - Local flood irrigation practices
  - Water-level fluctuations in shallow unconfined aquifer
- Climate in drainage area:
  - Mean annual air temperature: 35–40°F
  - Mean annual precipitation range: 16 inches (valley) to 40 inches (mountains)
  - Highly variable due to altitude and seasonal changes

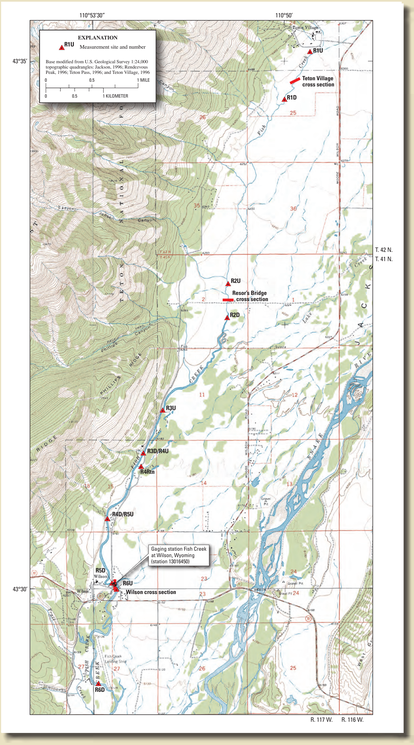


**Figure 2.** Fish Creek study area, reaches, and site locations, Wyoming.

## Problem

- Anecdotal reports of increased algal growth in Fish Creek
- Increased development occurring near Teton Village and Wilson
- Need to understand shallow, dynamic ground-water system
- Past studies and current data collection show strong interaction between ground water and surface water

*Algal growth in and development near Fish Creek.*

## Approaches

- **Seepage investigation** during two different flow regimes; high flow and base flow
- **Heat as a tracer** to characterize and model near-stream ground-water and surface-water interactions and streambed properties
- **Distributed Temperature System (DTS)** to attempt to identify specific zones of ground water input to creek

## Seepage Investigation

### Study Design

- August
  - Higher flow (fig. 3)
  - Irrigation input to system
- November
  - Base flow conditions (fig. 3)
  - Ground-water levels dropping post-irrigation
- Six reaches along study area
- Discharge measurements made using SonTek ADV Flowtrackers
- Error estimates of each measurement considered in calculations

### Results

- Reaches with significant gains and without significant gains identified (fig. 4)
- Results published in USGS SIR 2005-5133 (Wheeler and Eddy-Miller) available online at *http://pubs.usgs.gov/sir/2005/5133/*

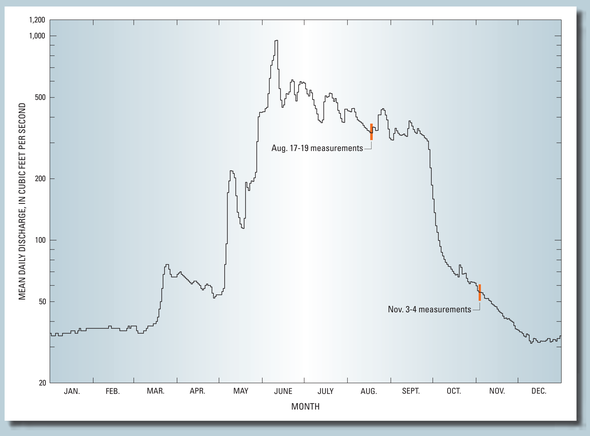


**Figure 3.** Mean daily discharge during 2004 at Fish Creek at Wilson gaging station (station 13016450) (site R5D).

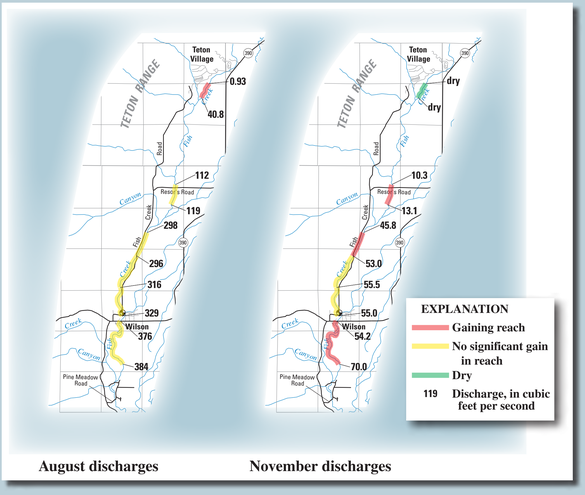


**Figure 4.** Discharges during August and November 2004, Fish Creek.