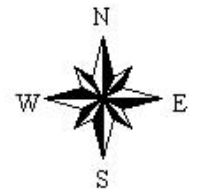
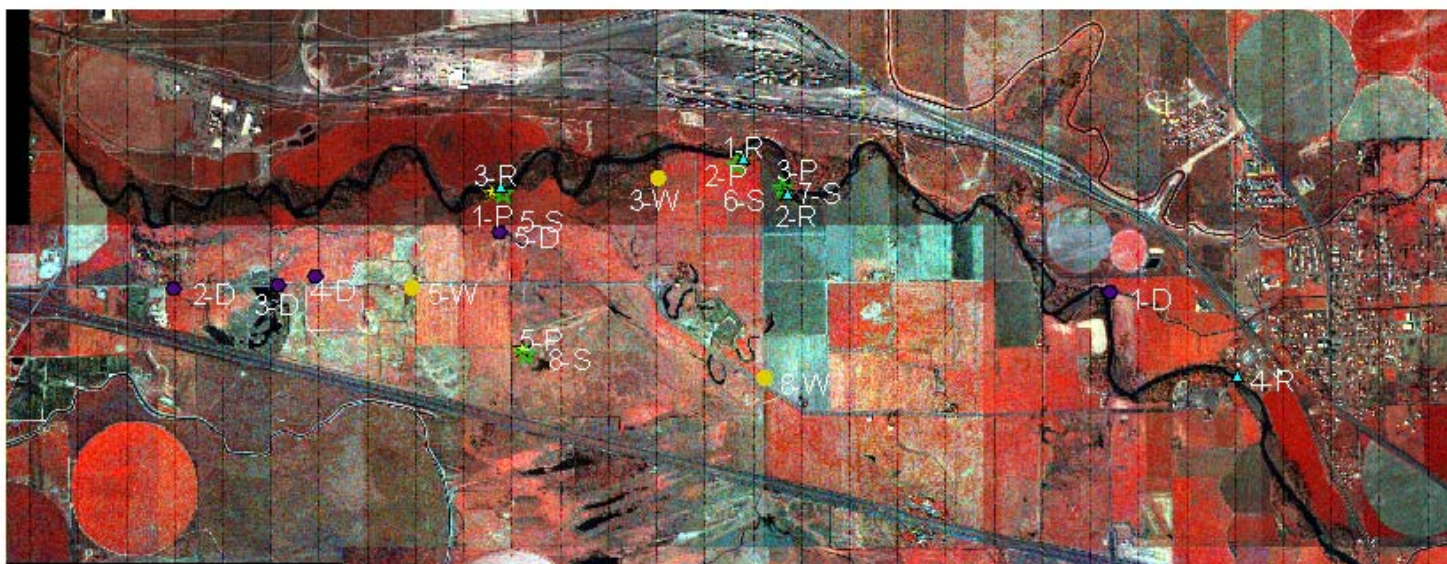


Echo Meadow Project

Winter Artificial Recharge to Cool Rivers

BPA PROJECT# 2001-015-00
2001 Progress and Status

IRZ Consulting & Engineering
Hermiston, Oregon



- ▲ 4 - River (R)
- ☆ 7 - Soil moisture monitoring (S)
- 5 - Drain
- 11 - Monitoring well (W)
- ☆ 5 - Piezometer (P)

Goals of Echo Meadows Project

- To significantly reduce river temperature by applying cold recharge water during the winter period of 2002 and 2003. Monitor and verify that winter artificial recharge can significantly cool rivers and streams. Verify if this method is cost effective, can meet the temperature standards of CWA, as well as determine if this method can be transferred to other river basins.
-

Problem

- Most rivers in the Northwest do not meet CWA temperature standards. Planting trees to shade streams is most commonly used to address high river temperature, but shading alone is not an effective way to reduce river temperatures to meet CWA standards. To-date, few realistic river temperature cooling projects have been proposed. The Echo Meadows Project, which utilizes winter groundwater recharge to augment stream flow in the summer period has the potential to address this problem.
-

Benefits of Echo Meadows Project

- ❑ Can significantly reduce river temperature to meet or nearly meet the **CWA temperature** standard.
 - ❑ Water recharged into groundwater will reach a constant temperature of **50 to 60 degrees** Fahrenheit when discharging into a river.
 - ❑ The return flow to rivers can be **timed** to coincide with critical low flow/high temperature period of the year.
 - ❑ Adds **large quantity** of water to the rivers during the critical low flow.
 - ❑ The return flow water creates a **natural riparian zone** vegetation along the stream banks.
 - ❑ This project can be easily **transferred** and duplicated in other Basins
 - ❑ It is **simple**; It is **inexpensive**; It does **not conflict** with other users.
 - ❑ It may help **resolve many water conflicts** throughout the Northwest
-

Objective and Tasks

- 14 Distinct Objectives
 - 51 Tasks for each year

Past Efforts

Baseline Analysis & Data Collection

■ 2001

- BPA =est. \$250,000

Matching Funds, Pre-Baseline

■ 1998-2000

- USBR=\$21,000
 - Oregon DEQ=\$25,000
 - Columbia Water Trust=\$75,000
-

2001 Baseline Data Collection

- Installed & Monitoring Network
 - 11 Monitoring Wells
 - 5 Piezometers wells
 - 8 Soil moisture monitoring sites
 - 4 River temperature sites
 - 5 Drains
-

Monitoring

- Groundwater depth
 - Hourly and Weekly
 - Water Quality
 - Weekly=indicator, Quarterly=complete
 - Groundwater Hydrological Test
 - River
 - Temperature and Water Quality
-

Monitoring

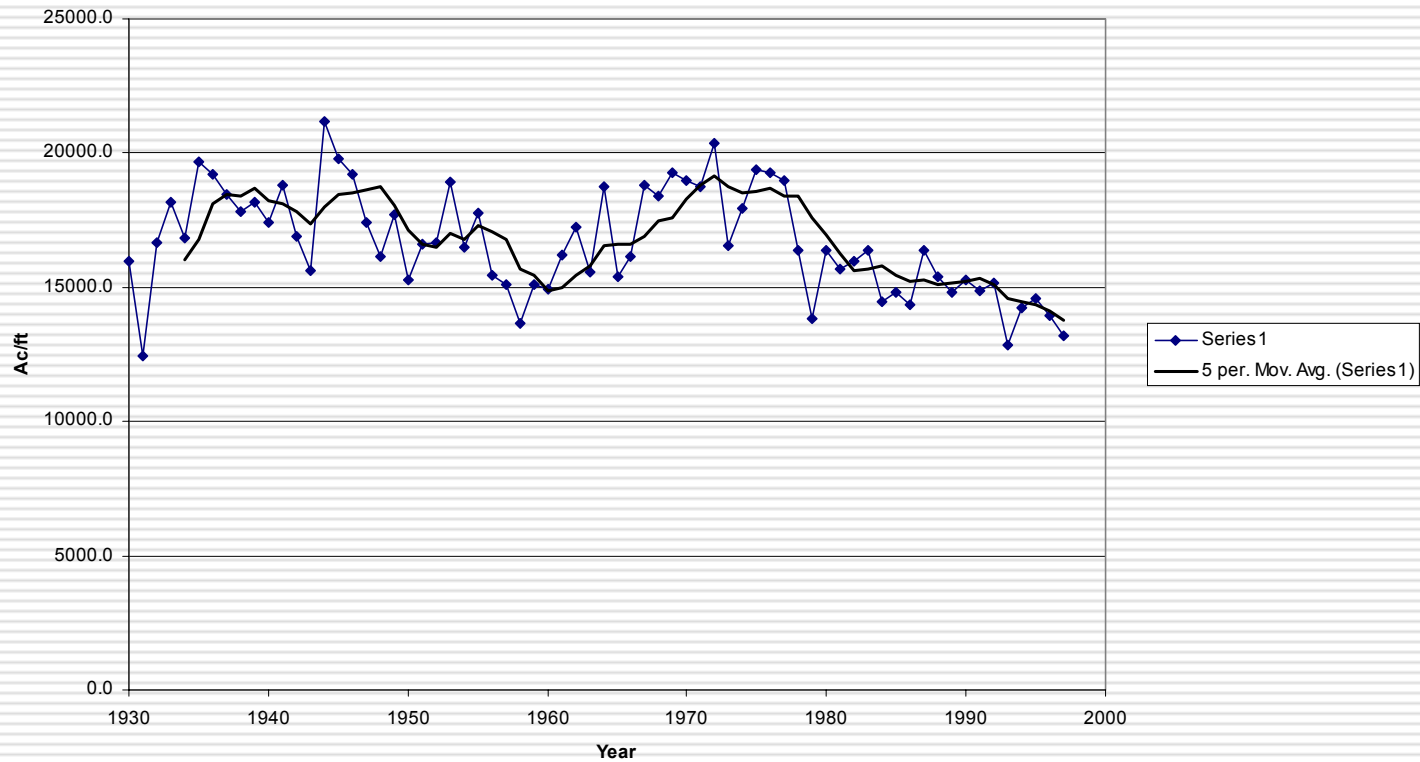
- ❑ Three Aerial Thermal Infrared Survey of the Umatilla River
 - ❑ Aerial Infrared of Landmass
-

Study results

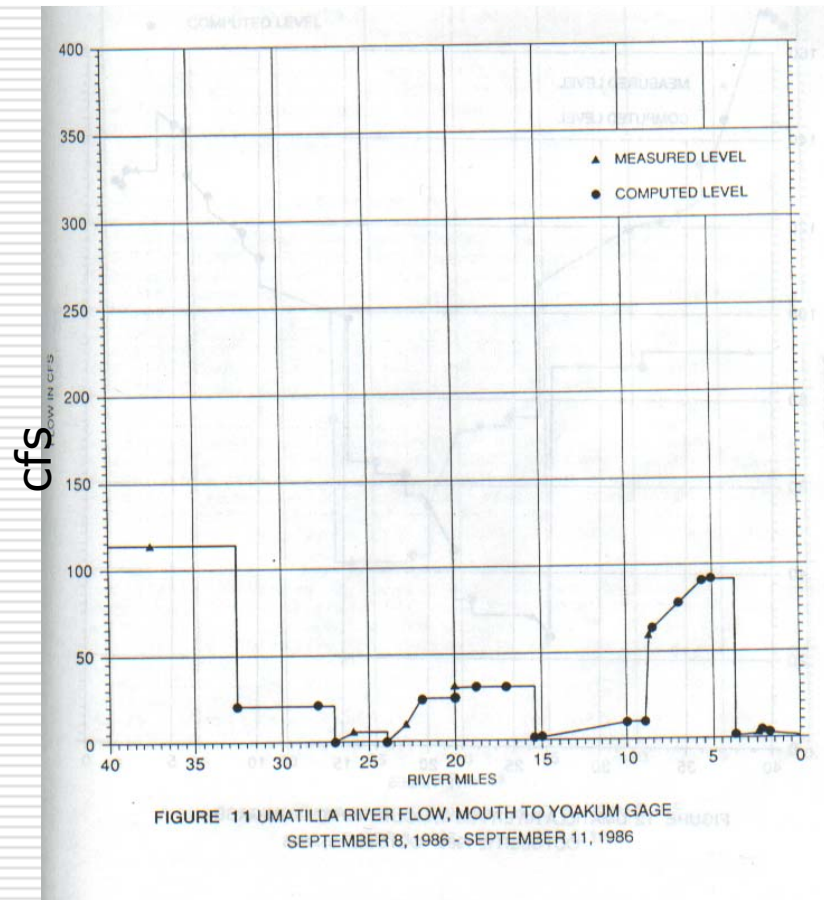
- Diversion history
 - Water rights (groundwater)
 - Reduced summer streamflow
-

Echo Meadows Diversions

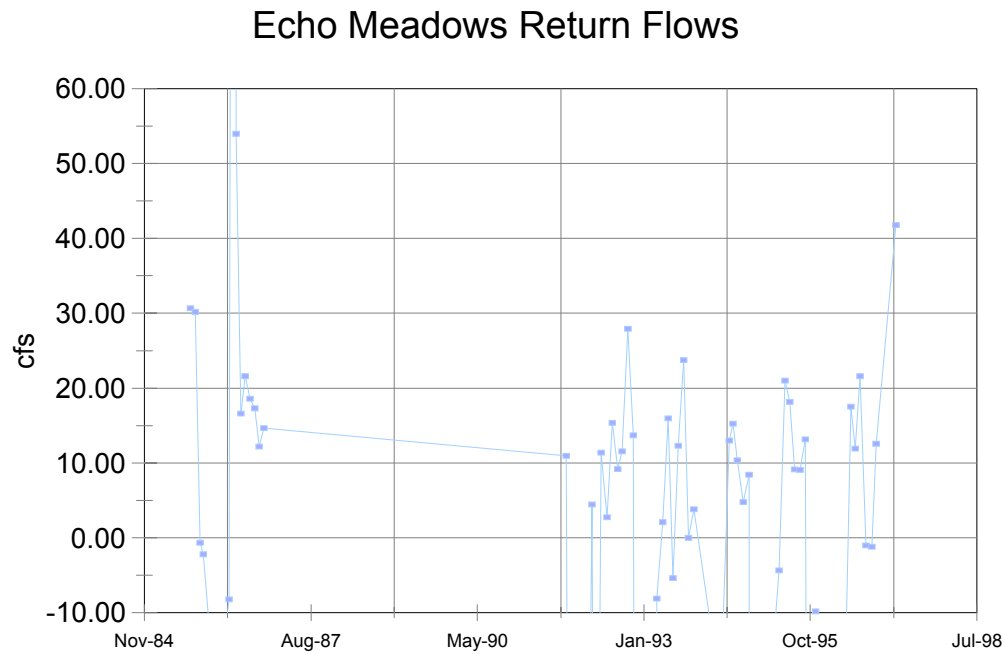
Echo Meadows Historic Diversions



Summer-time stream flows

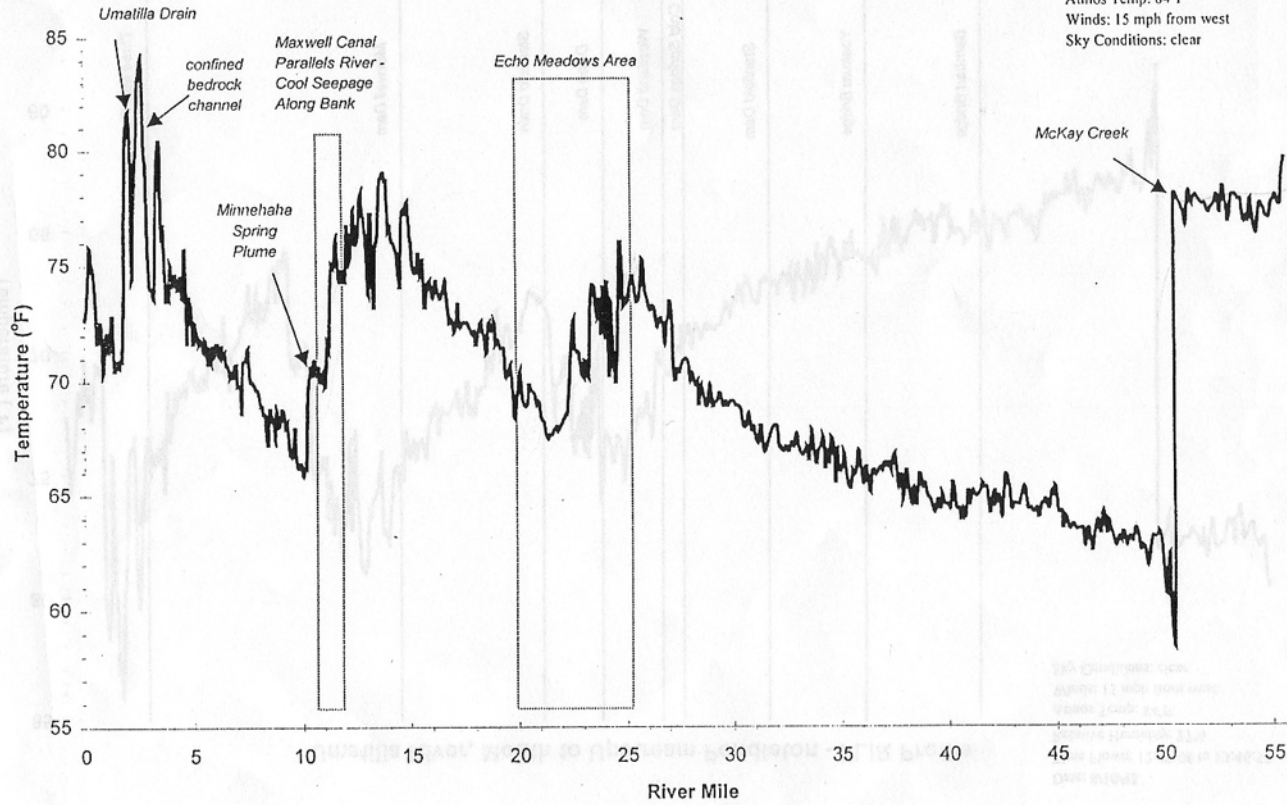


History of return Flows



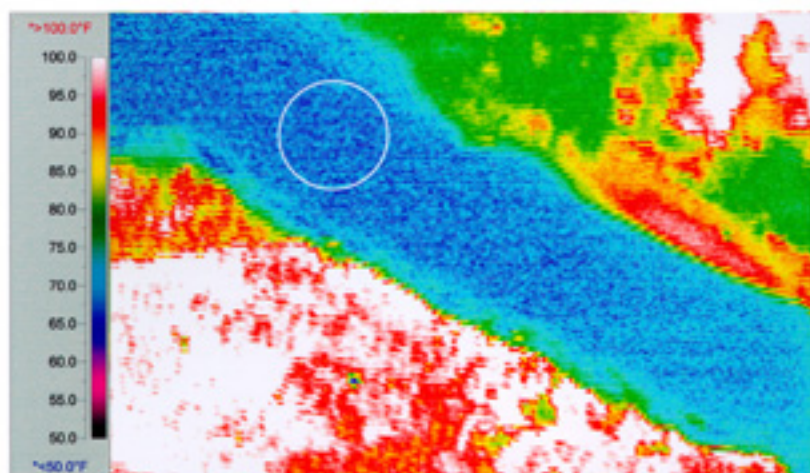
Umatilla River, Mouth to Upstream Pendleton - FLIR Profile

Date: 8/10/98
Time Flown: 12:49:08 to 13:46:57
Relative Humidity: 27%
Atmos Temp: 84°F
Winds: 15 mph from west
Sky Conditions: clear

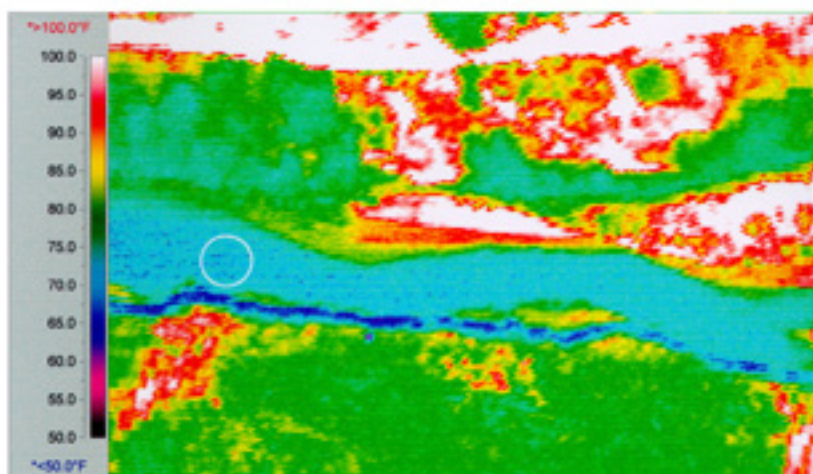


Echo Meadows Winter Artificial Recharge Project

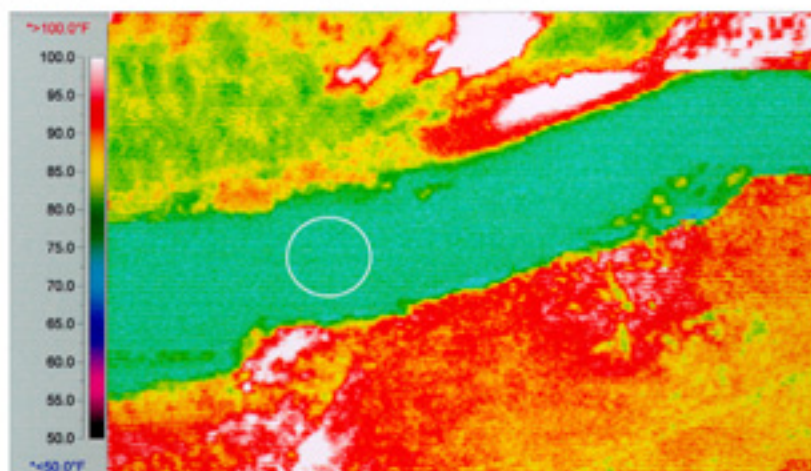
Selected views from aerial thermal infrared videos



22 June 1998 Min 64.6 Avg 67.4 Max 69.7



6 August 1998 Min 67.2 Avg 69.4 Max 72.4

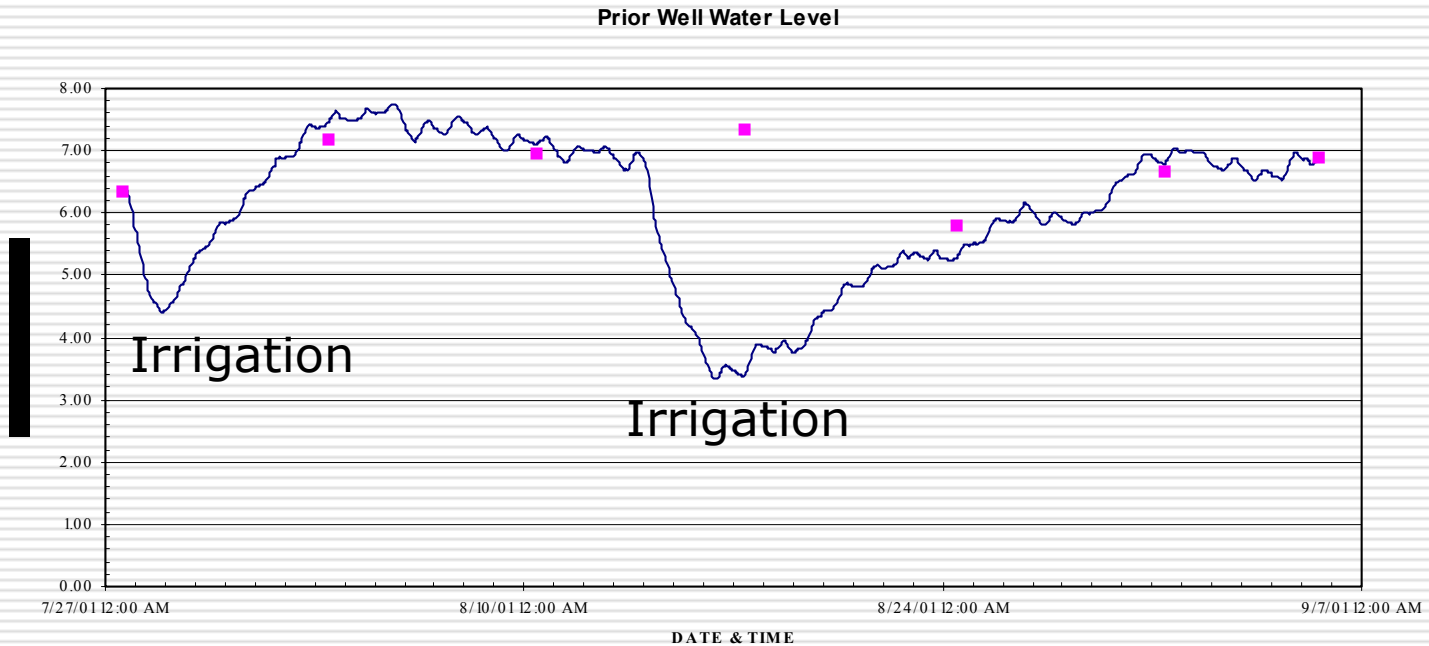


14 September 1998 Min 70.4 Avg 73.3 Max 75.9

Monitoring 2001

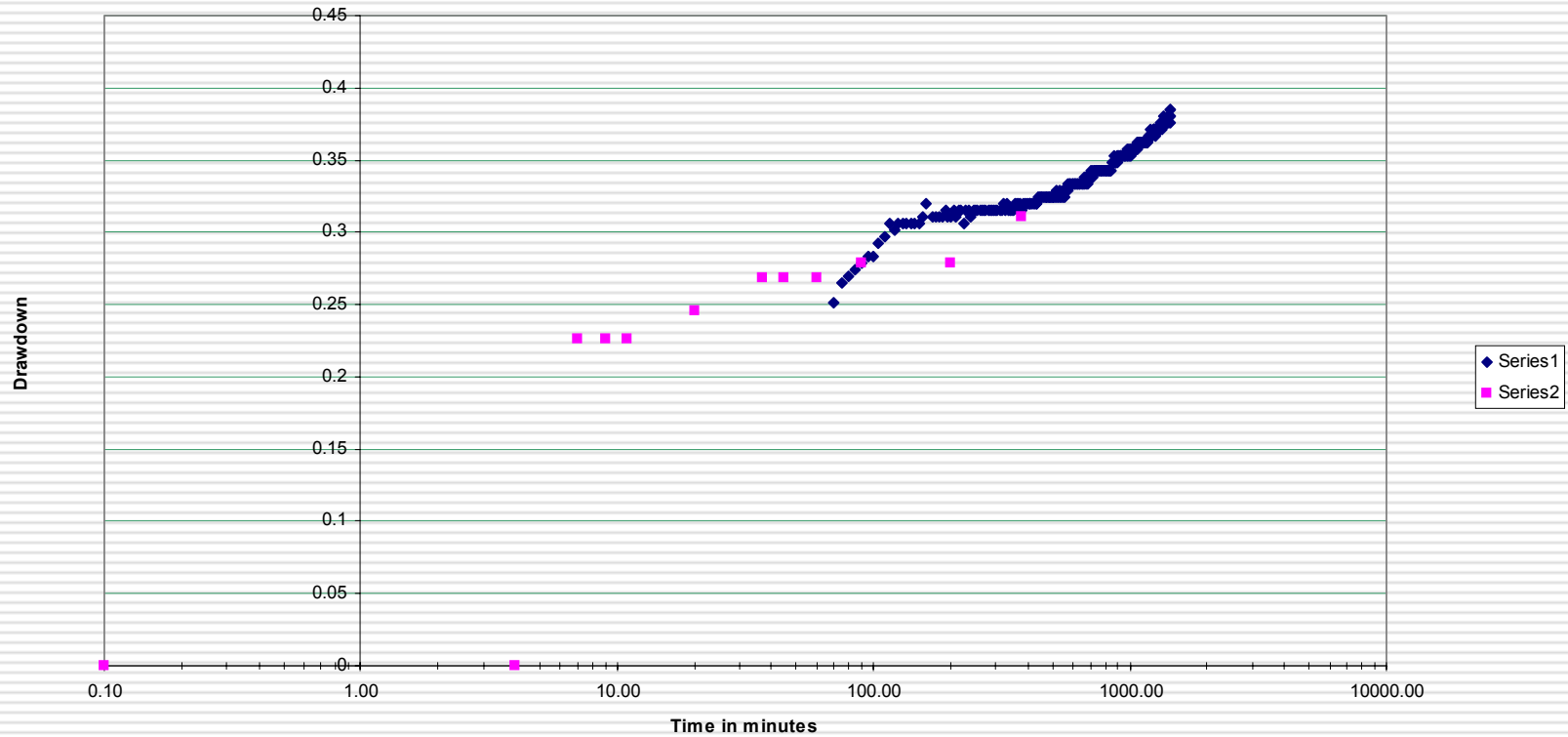
- Water levels
 - Pump tests
 - Water quality
 - Groundwater
 - Surface water
-

Groundwater level monitoring



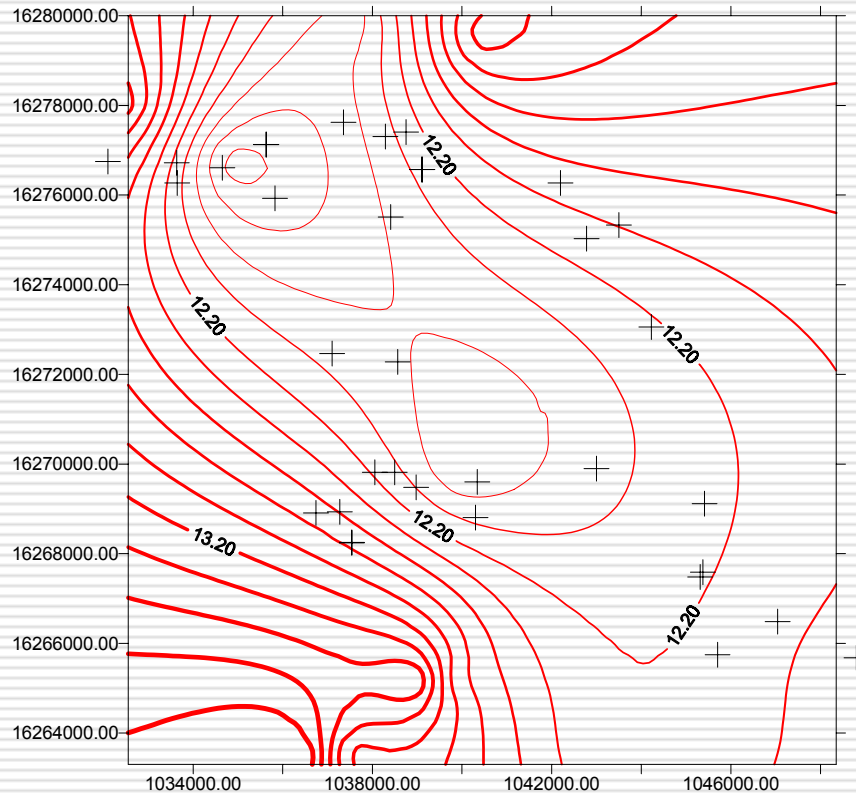
Pump tests in 2001

EMDMPW-3 Pump Test



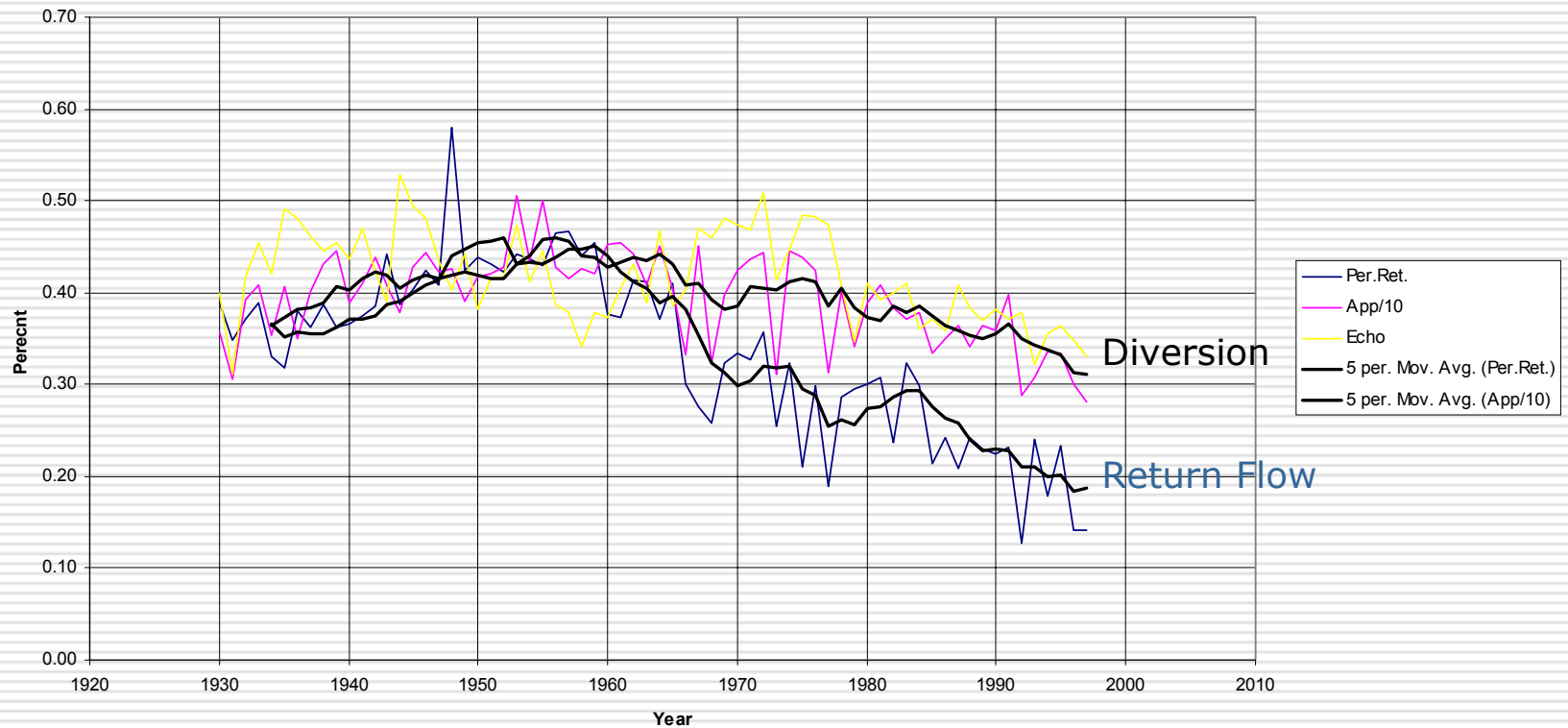
Groundwater quality

Groundwater temperature in Meadows

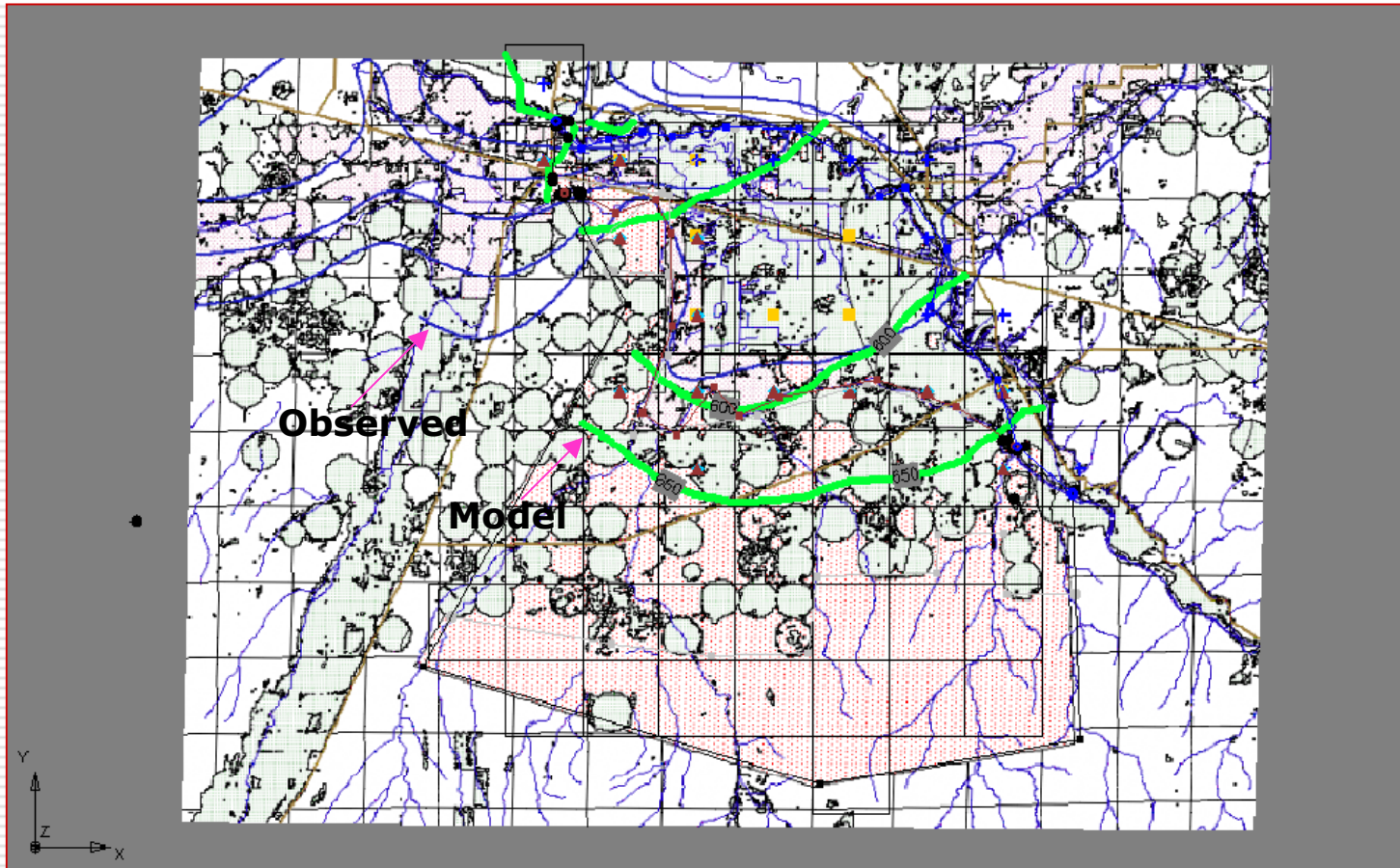


Application rates and return flow

Percent of Return Flow and Application Rate

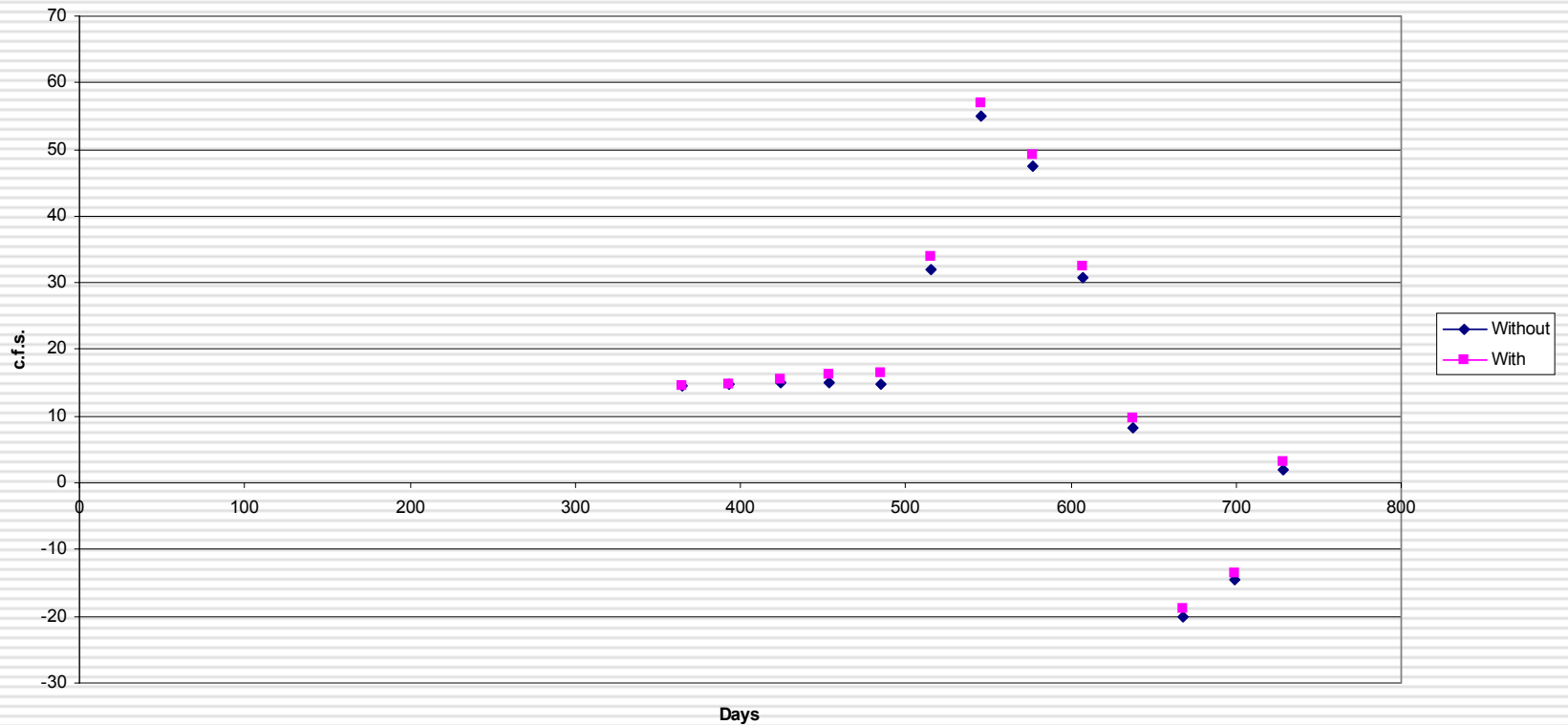


Model Heads vs Observed



Model Predictions

Umatilla Recharge



Conclusions

- ❑ Increased recharge will increase summer stream flows(est. 100%)
 - ❑ Groundwater quality better (very cold, nutrient and bacteria free) or equal to (pH, conductivity) surface water
 - ❑ Will be able to measure improvements at end of project
-

Conclusions

- FONZI
 - Trial application
 - Model calibration & Timing Prediction
 - February 2002-March 2002
 - Recharge Application
 - December 2002, Jan, Feb 2003
-