



Evaluation of Alternative Ground-Water Pumping Schemes as an Approach to Mitigating Problems of Critical Low Flow in the Spokane River at Spokane, Washington

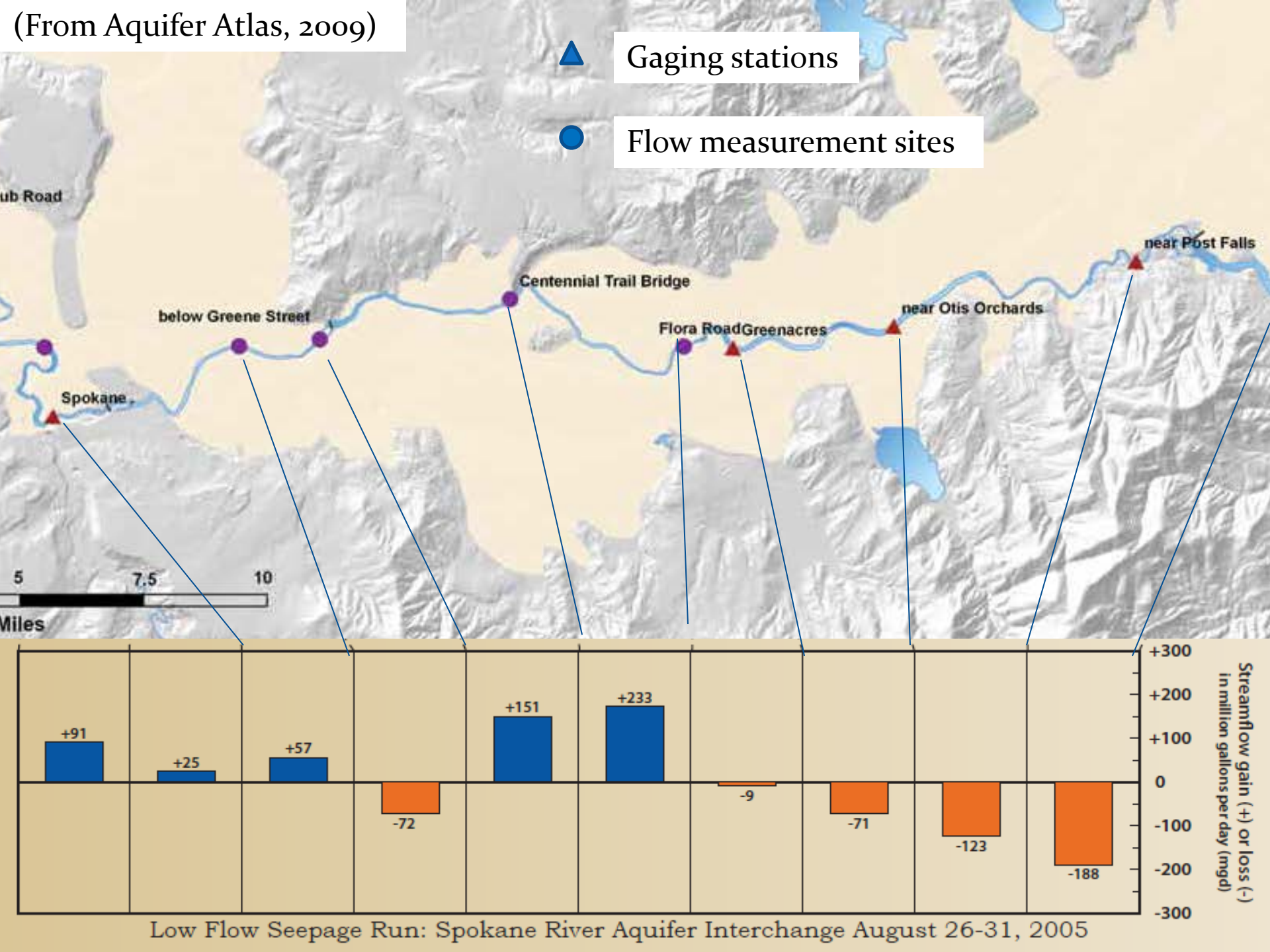
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Ralston Hydrologic Services, Inc.

April 2014

Project Description

- Utilize the 2006 bi-state Modflow ground-water model to evaluate effects of ground-water pumping on the flow of the Spokane River at the Spokane gage.
- Use existing river discharge and ground-water level data to evaluate the viability of the model results.
- Project started in February 2014 and is scheduled to be completed in January 2015.
- Project funded by the Idaho Water Resources Board
- This talk provides a summary of activities to date.

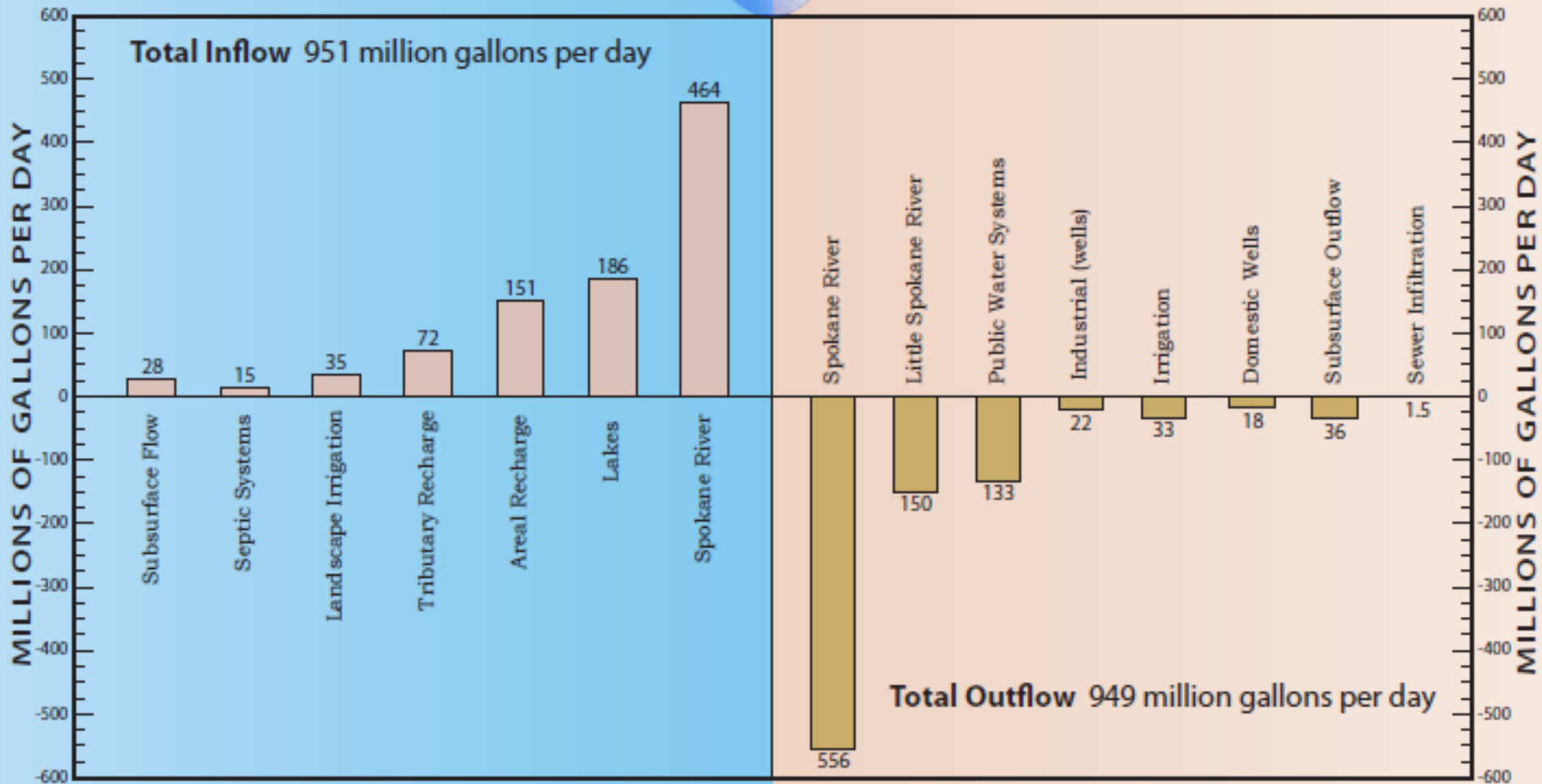
(From Aquifer Atlas, 2009)



IN



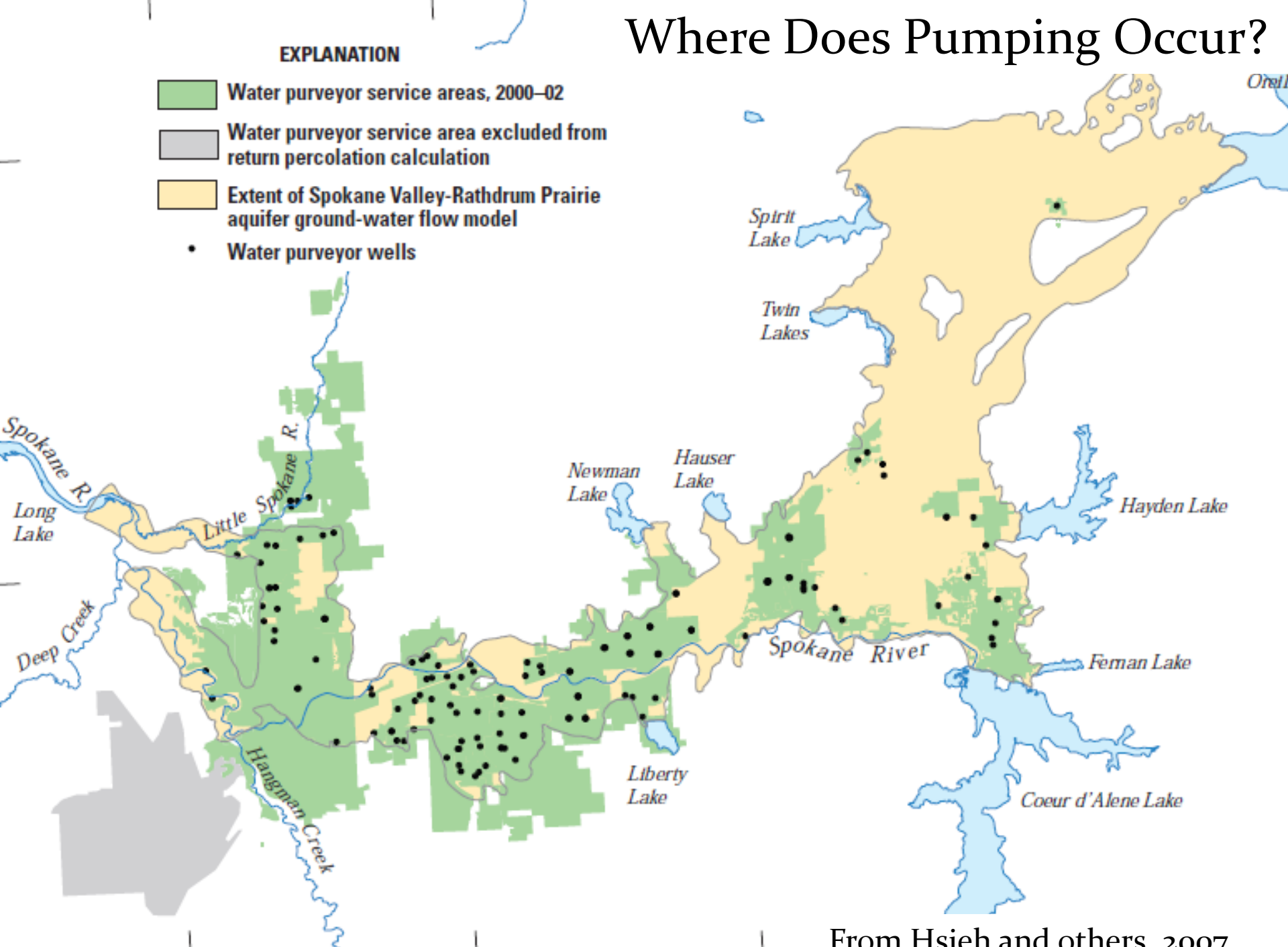
OUT



The groundwater budget component values shown in this graph represent average conditions, 1990-2005.

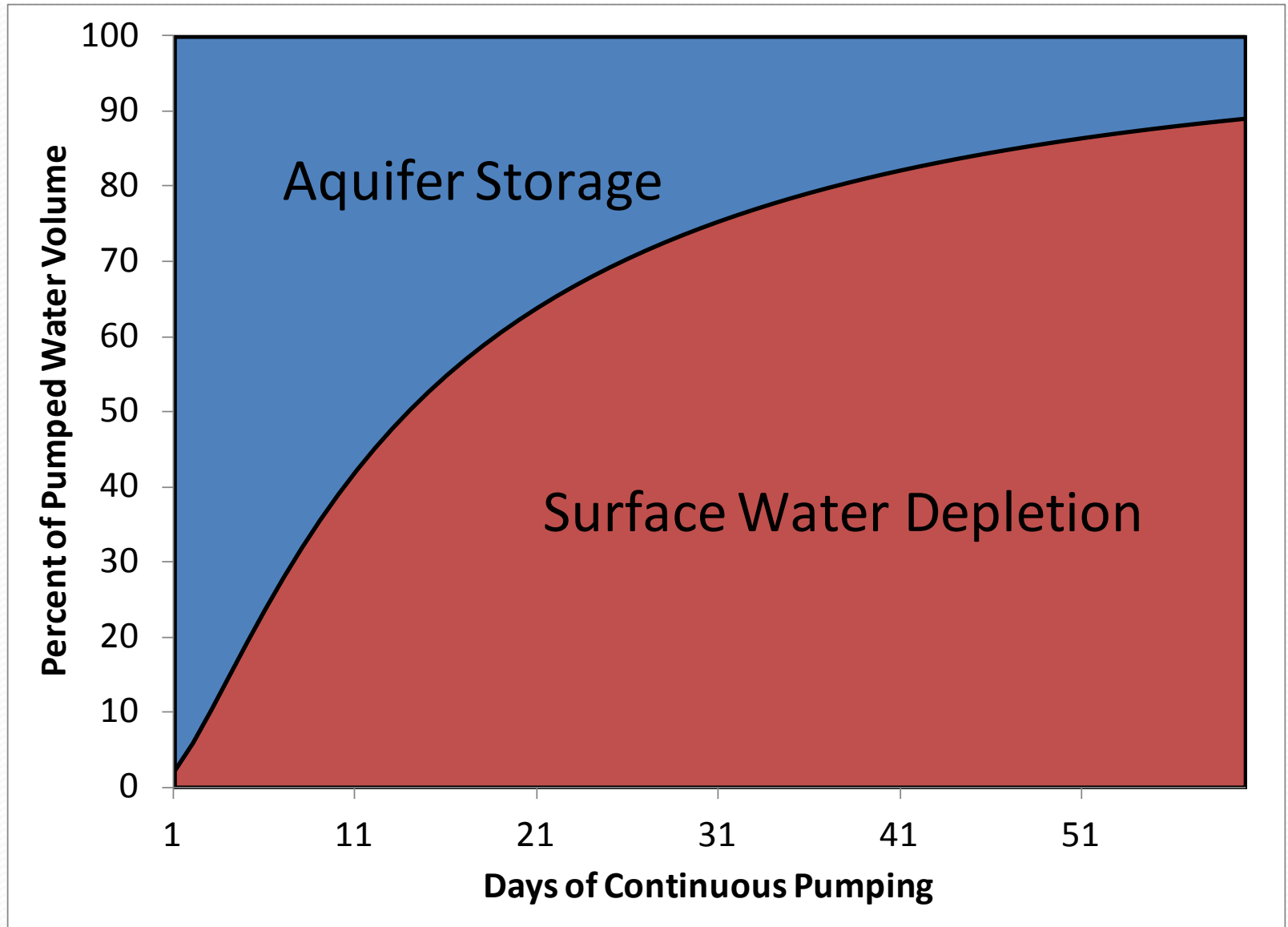
Approximate water balance (from Water Atlas, 2009)

Where Does Pumping Occur?

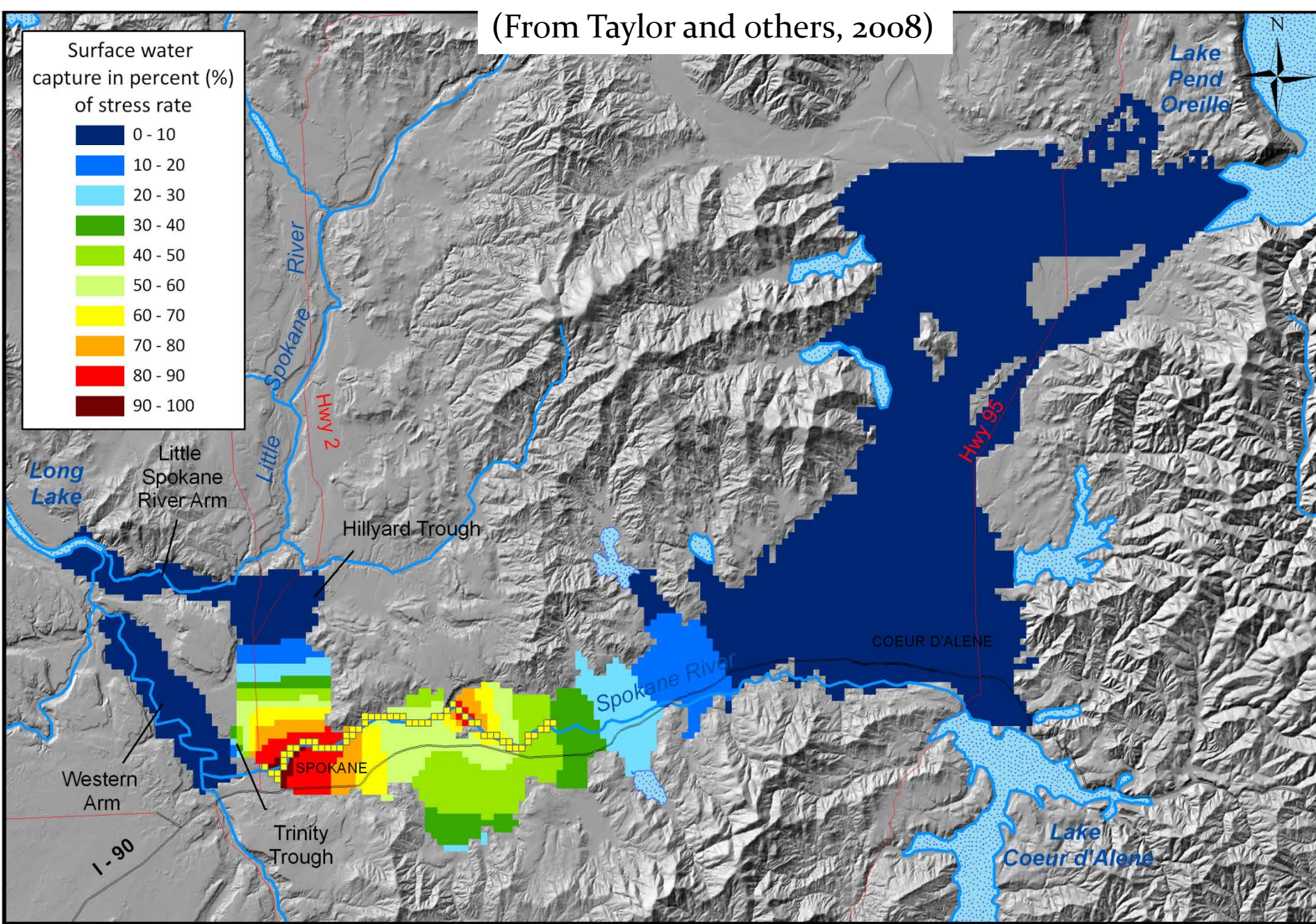


From Hsieh and others, 2007

What is the source of the pumped water?

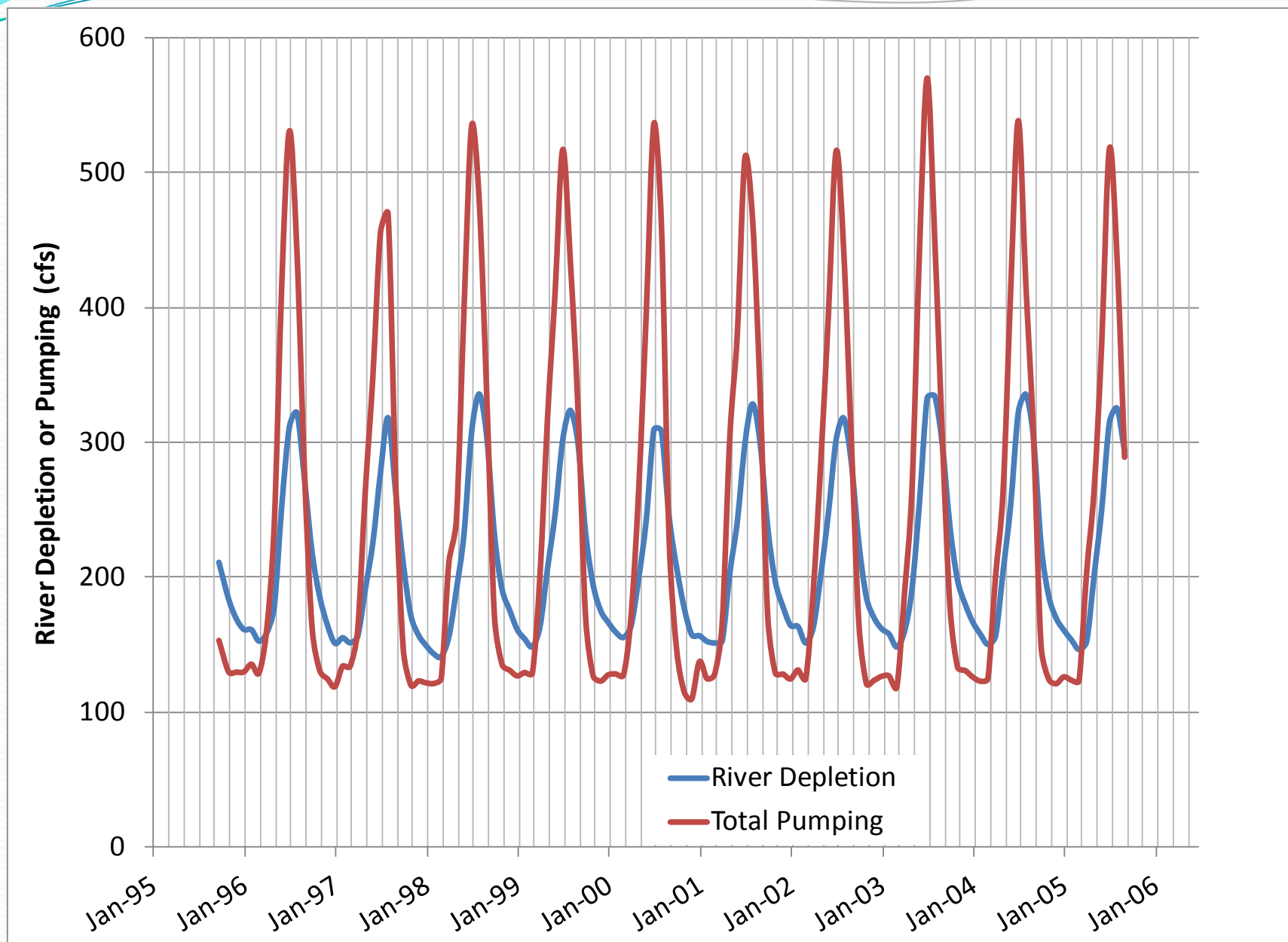


(From Taylor and others, 2008)

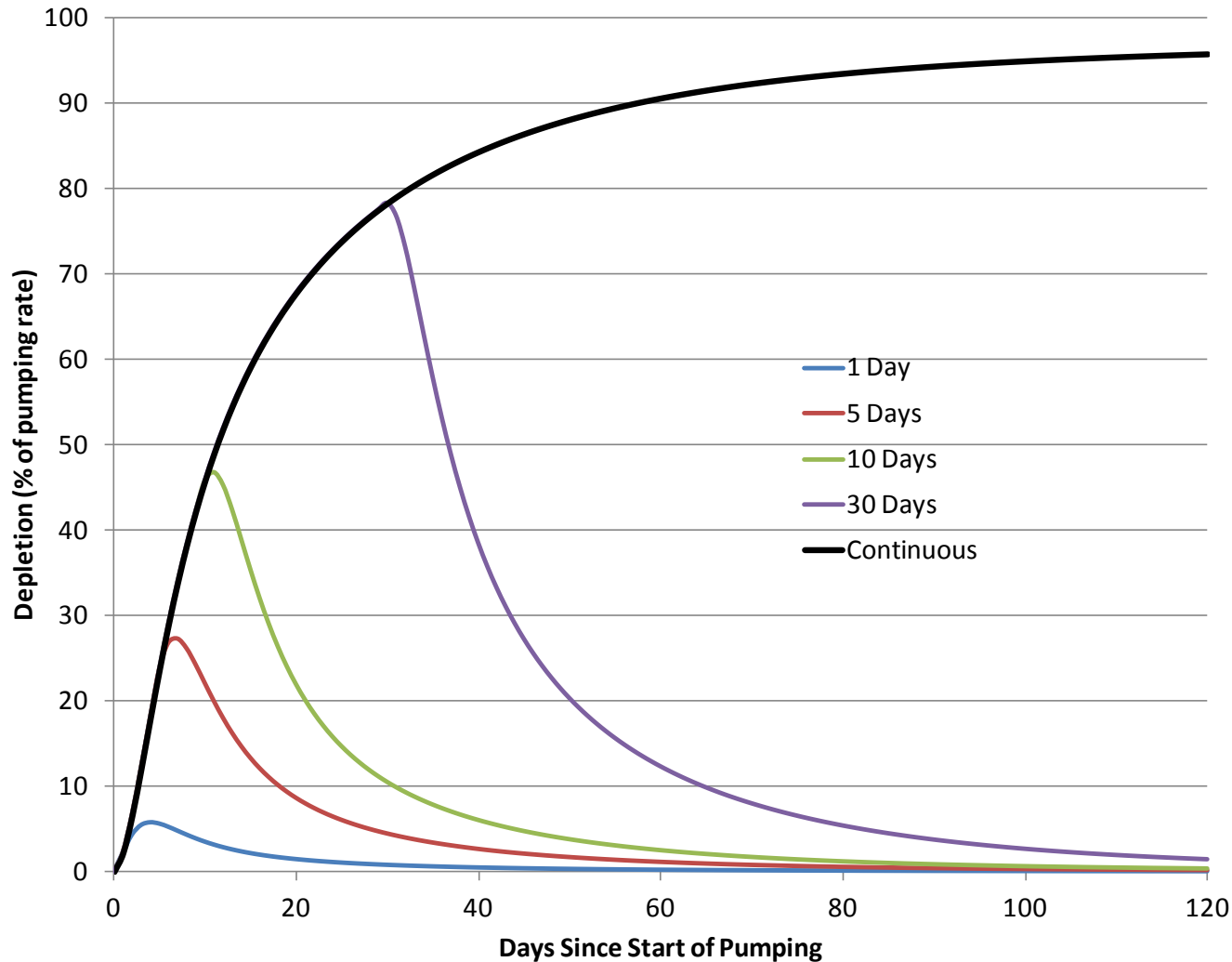


Model predicted percent surface water capture after one month of pumping

Model Estimated Effects of Pumping on the Spokane River



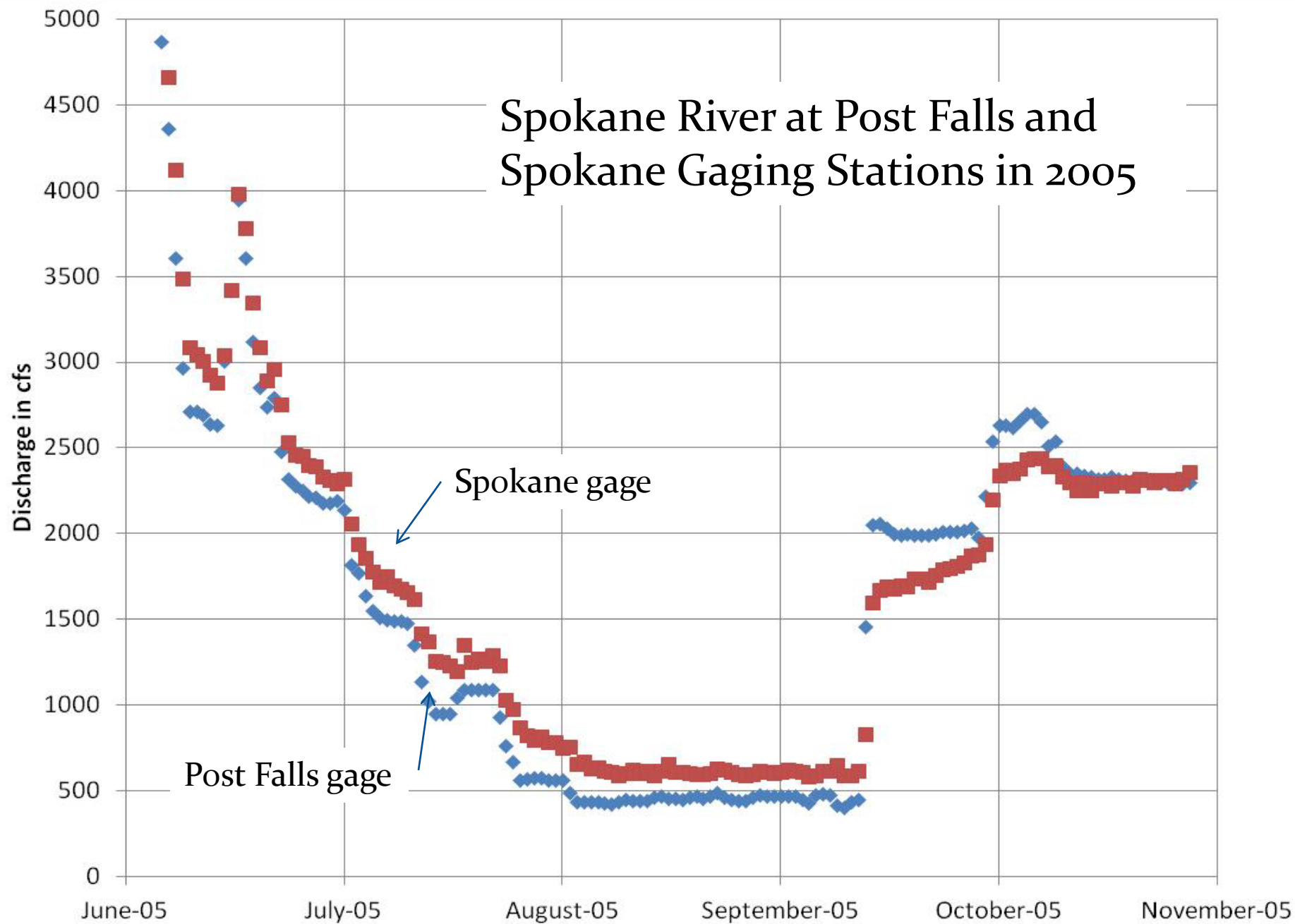
Effect of Duration of Pumping (or Cessation) on River Depletion



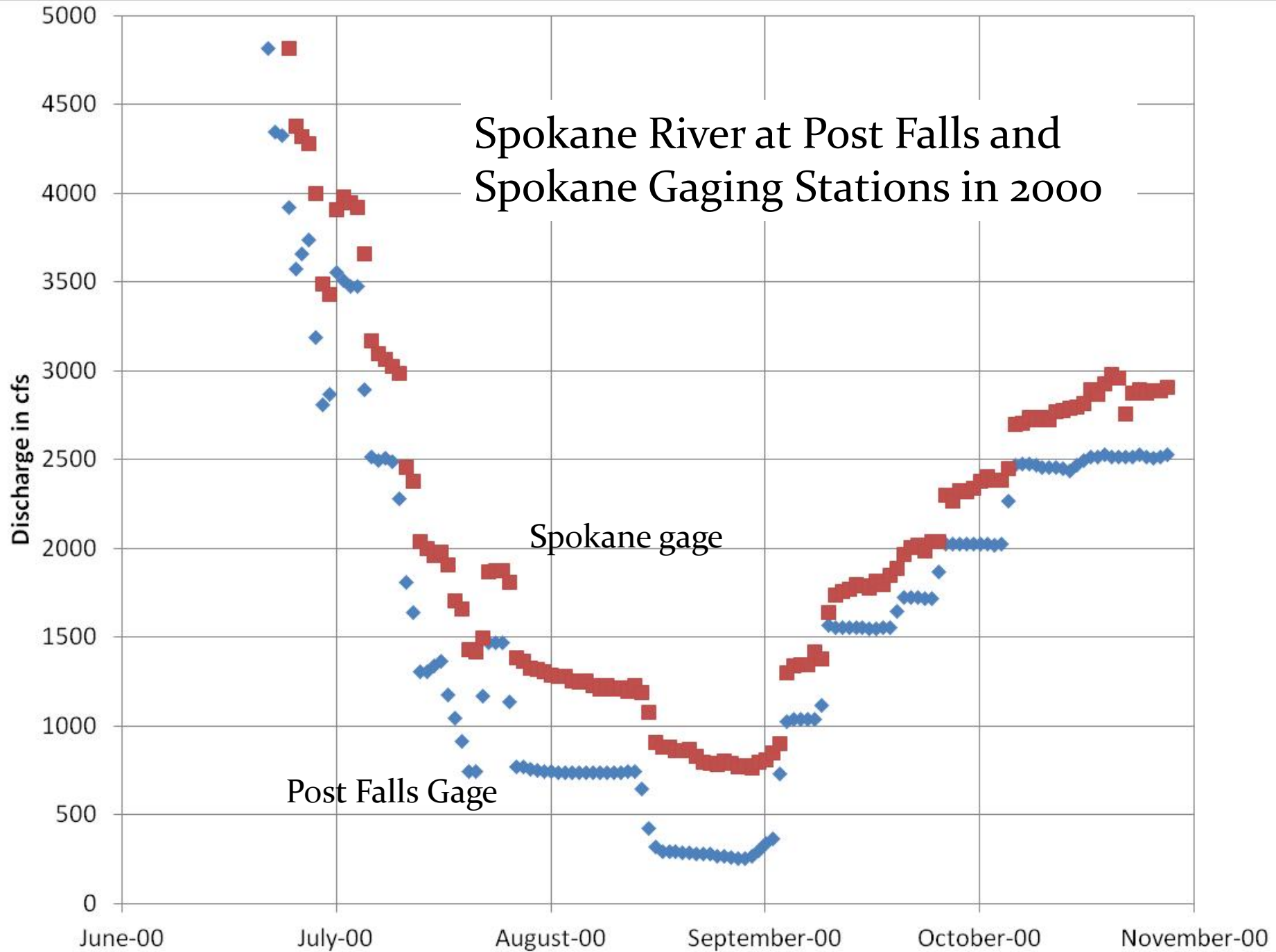
Col 106, Row
149; about
Broadway Exit
on I-90

Project Approach

- Two paths that will be merged at the end.
 - Analysis of field data including river gains and losses and water-level responses to change in river stage.
 - Modflow model analysis.
- Use analysis of field data in an iterative approach to address questions relative to the application of the Modflow model for this purpose.
 - Run the model to reproduce measured flow in the river at various sites.
 - Run the model to reproduce a measured ground-water response to changes in river stage.



Spokane River at Post Falls and Spokane Gaging Stations in 2000



Data Logger Sites for the 6-Minute Study (Copied from Covert and others 2005)

Map ID	Logger ID	Location
1	63677	Spokane R at PF gage
2	63729	Guy's Garage
6	62801	CID Mission & Barker
7	62803	Spokane R at Gun Club
8	62811	Spokane R Harvard Rd. Gage
9	63101	CID on Lynden
10	63102	Spokane R Greene St. Gage
11	63108	Trent & Barker
12	63114	2nd and Best
13	63119	Idaho Rd (1000' S of Trent)
14	63126	24th and Adams
15	63131	Idaho Rd (30' S of pipeline)
18	64480	CID (north-yellow)
22	64718	Yardley Pit 208
24	64720	Barker N Riverbank
25	70591	Trinity
27	71429	Mayfair
34	71419	Barker S Riverbank
35	71420	Lynden & Euclid
36	71421	Chatteroy Obs well
37	71422	SCC
38	71423	3rd & Havana Nested East
39	71424	Bowdish & Frederick 208
40	71425	Sullivan Park South
41	71426	Denver & Marietta
42	71427	Franklin Park
43	71428	Hale's Ae (east)
44	71410	Mayfair
45	71430	NW corner Olive & Fiske
47	71433	Spokane R blw Sullivan
48	71434	NECC
49	71435	Felts Field
50	71436	City Parcel #3
51	71437	Holy Cross Obs well
52	71441	Inland Empire Paper
53	71445	Houston & Regal
54	71446	CID @ Barker & Euclid
55	71447	Sullivan Rd (Krispy Kreme lot)
56	64037	ERO-Guy's office

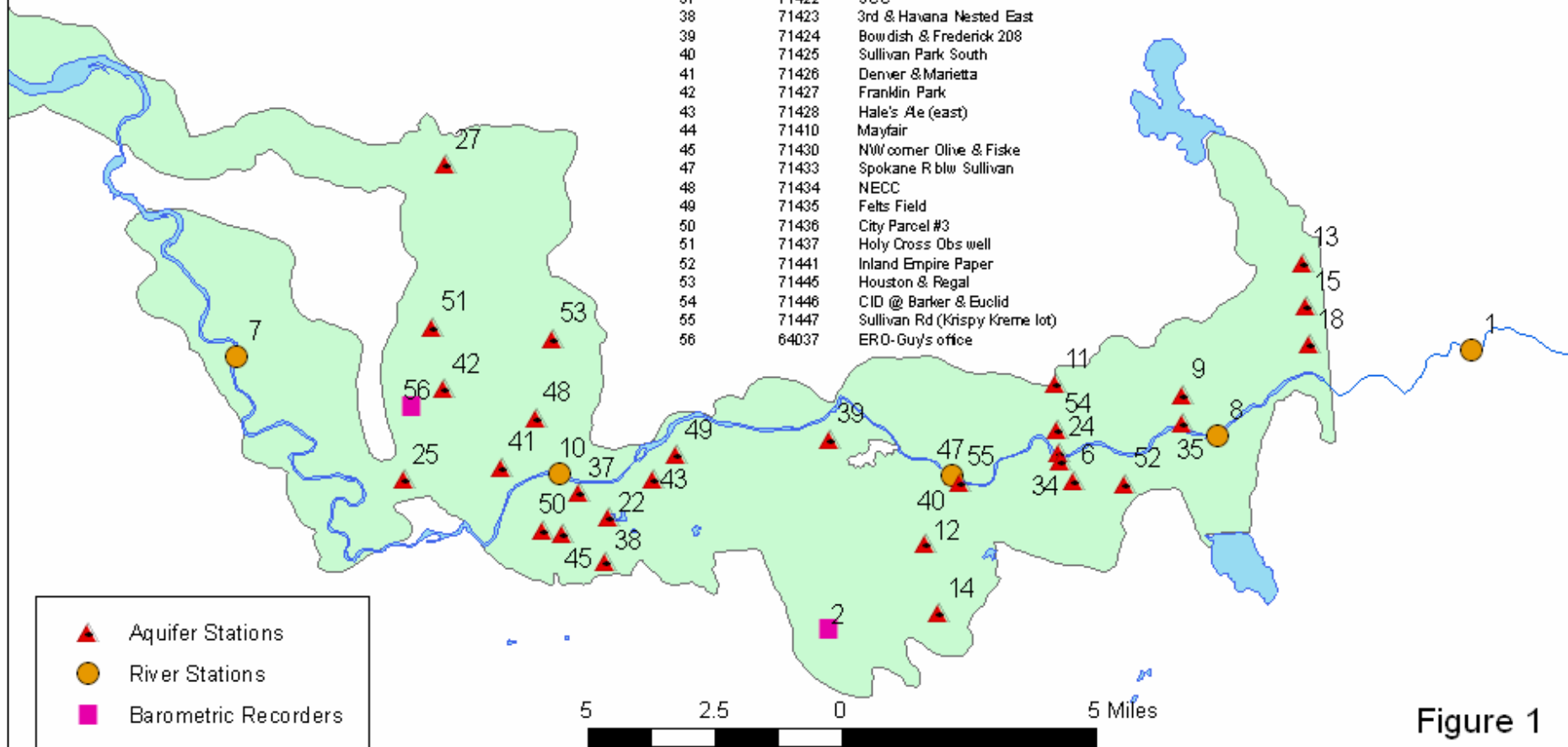
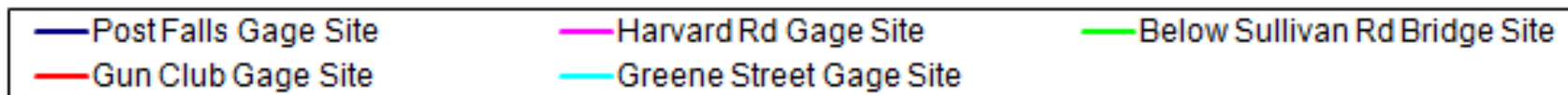
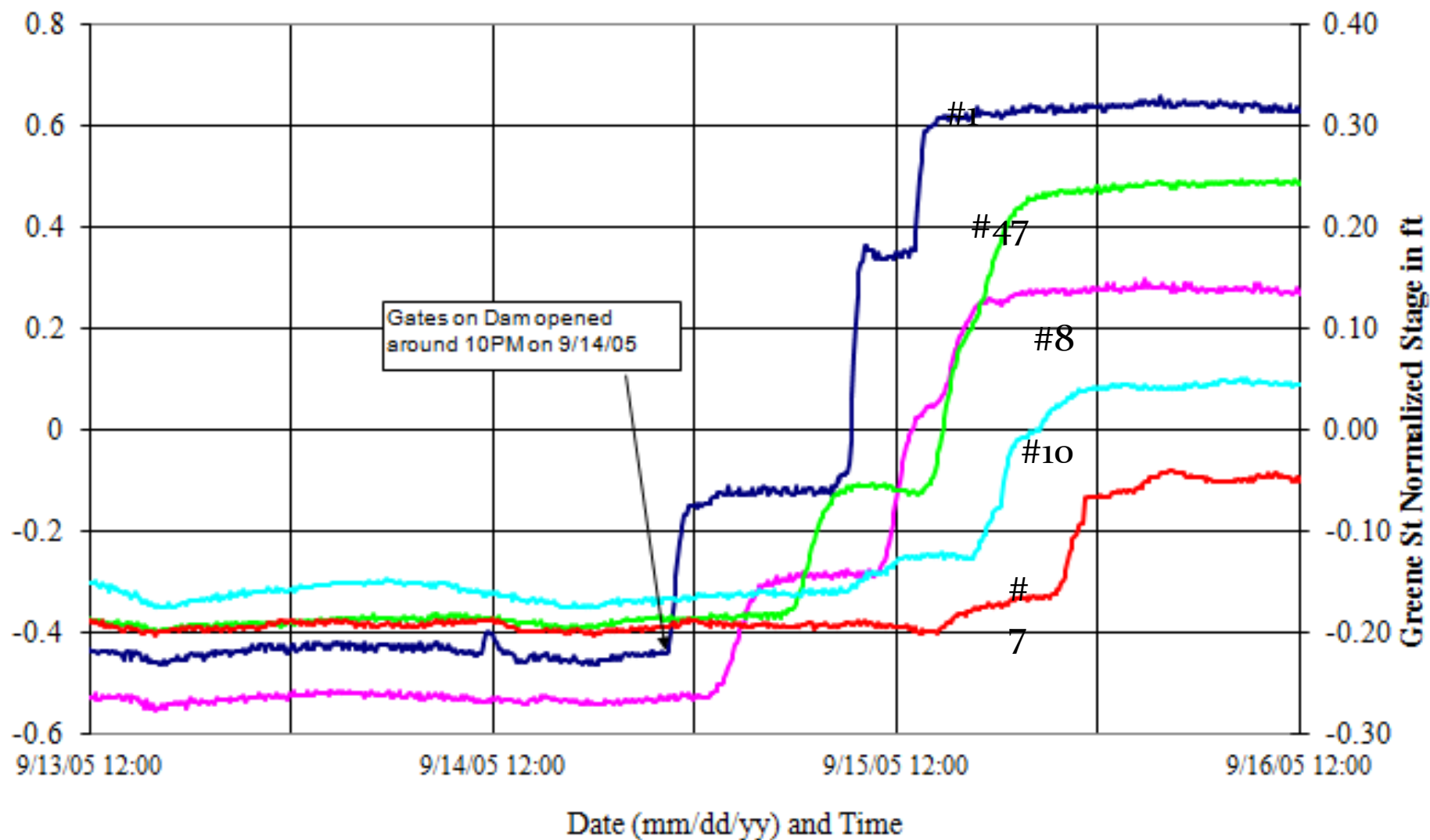
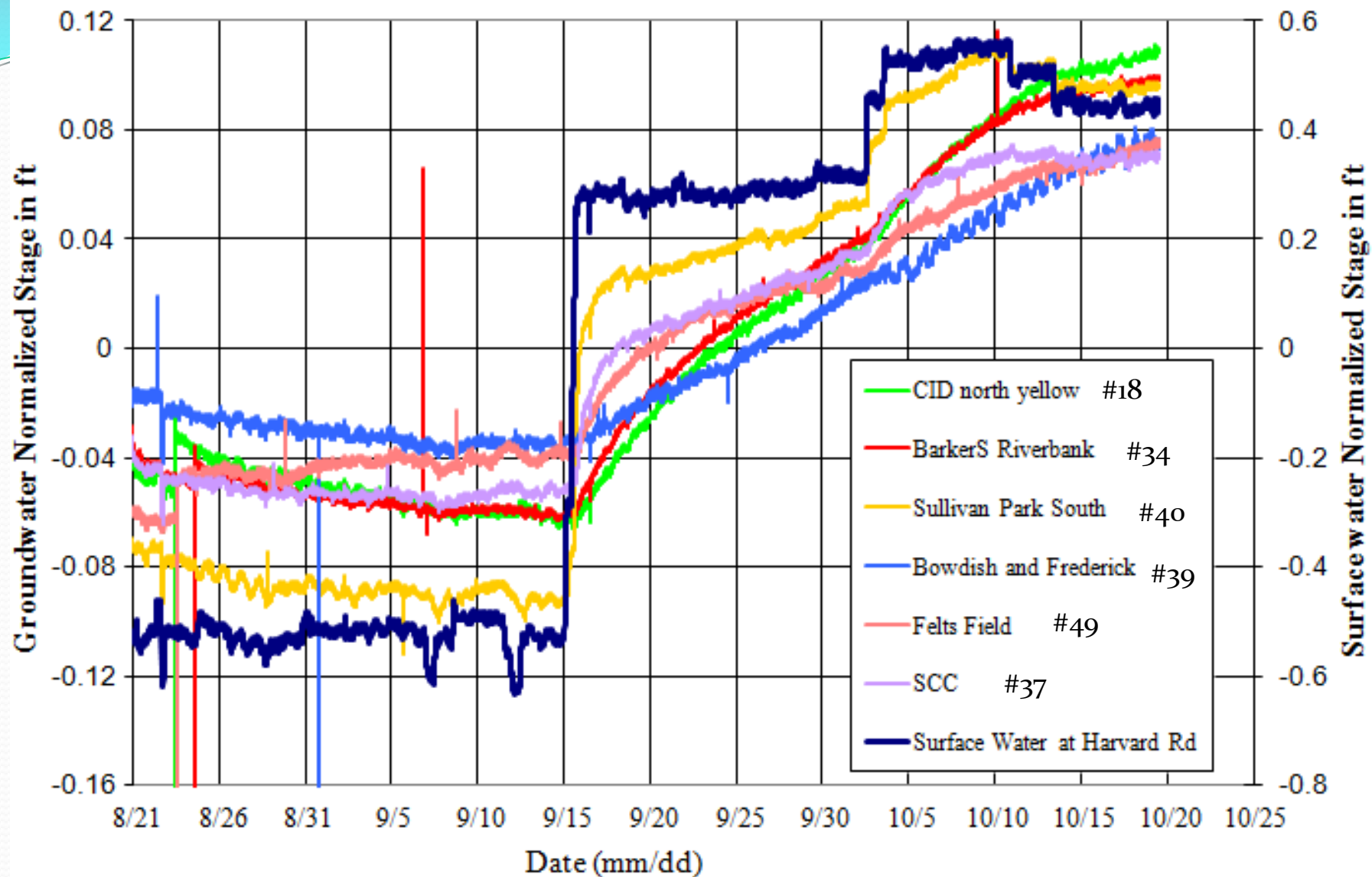


Figure 1

Normalized Stage in ft



Stage in the Spokane River from the 6-Minute Study (Copied from Covert and others 2005)



Example hydrographs from “6 minute” study (Copied from Covert and others (2005))

Current Status

- We are assembling and analyzing field data, particularly the results of the “6 minute study” (thanks to great help from Guy and John at WDOE).
- We are reviewing the possible constraints of the current MODFLOW model and underlying data set relative to our study objectives.
- We are plotting a path forward to achieving the objectives of the project. The title says it all.
- Evaluation of Alternative Ground-Water Pumping Schemes as an Approach to Mitigating Problems of Critical Low Flow in the Spokane River at Spokane, Washington



Thank you!