Example scenario, Wood River Valley Groundwater Flow Model

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Purpose of Example Scenario

- Provide an example of how the Wood River Valley Groundwater Flow Model can be used to predict hydrologic effects of changes in water use
  - A 20% reduction in consumptive use of groundwater for irrigation was selected as an example of a change in water use
- The example scenario is NOT an administrative scenario
  - The example scenario is NOT based on any anticipated administrative action
  - The example scenario does NOT consider water right priority dates or other administrative characteristics
- The example scenario is based on preliminary model files
  - Simulation input and results are preliminary

Example Scenario

- 20% reduction in consumptive use of groundwater for irrigation
  - Includes 20% of all groundwater irrigation within model domain – agricultural, municipal, subdivisions, golf courses, yards irrigated by individual domestic wells – regardless of priority date or administrative status
  - Assumes surface water irrigation practices do not change
- Steady state scenario – model simulates average response to an average stress applied at a continuous rate for an extended period of time
  - does not reflect seasonal variation in irrigation use or seasonal variation in response
- Average consumptive use of groundwater from 1995-2010 used to calculate 20% reduction
  - does not reflect year to year variation in groundwater use for irrigation

Overview

- Calculating groundwater consumptive use for irrigation

- Simulating 20% reduction in groundwater consumptive use using the Wood River Valley Groundwater Flow Model

- Results of the model simulation
  - Change in aquifer head
  - Change in aquifer discharge
    - Increase in discharge to rivers
    - Decrease in seepage from rivers
    - Increase in groundwater underflow to ESPA near Picabo

Calculating consumptive use of groundwater

Consumptive use calculated monthly

Consumptive use on lands irrigated only by groundwater is assumed to be equal to CIR. CU = cir.gw

If surface water is insufficient to meet CIR on mixed source lands, CU of GW is assumed to be equal to CIR less portion supplied by SW

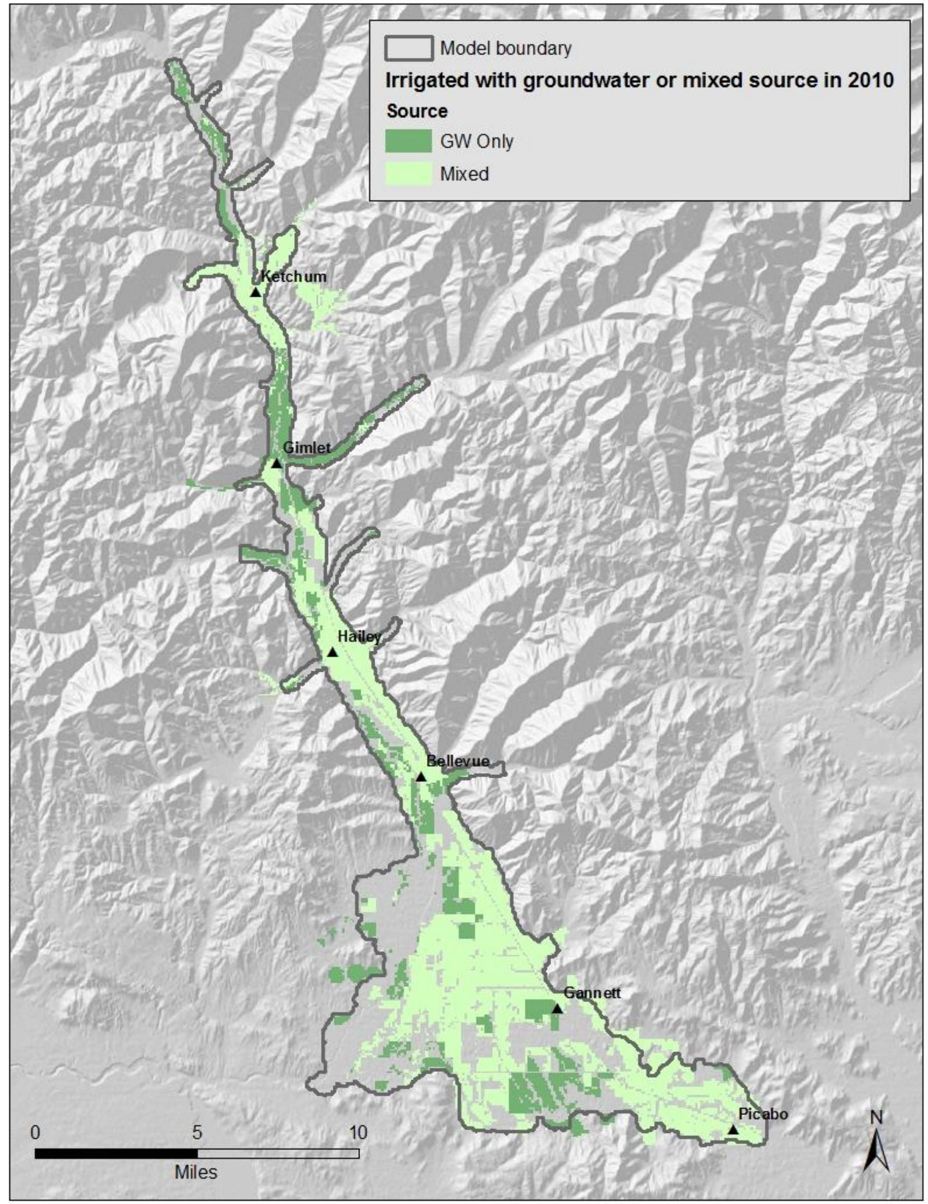
CU = cir.mix – hg.mix * eff

If surface water is sufficient to meet CIR and recorded groundwater diversions are zero, there is assumed to be no consumptive use of groundwater.

CU = 0

If surface water is sufficient to meet CIR and recorded groundwater diversions are not zero, CU of GW is assumed equal to CIR times fraction of water supply from GW.

CU = cir.mix * (GWDiv+gw.div.est-WWDiv)/(hg.mix+GWDiv+gw.div.est-WWDiv)



Consumptive use of groundwater

Average CU from GW in model simulation period is 31,712 AF/yr or 43.8 cfs (1995-2010)

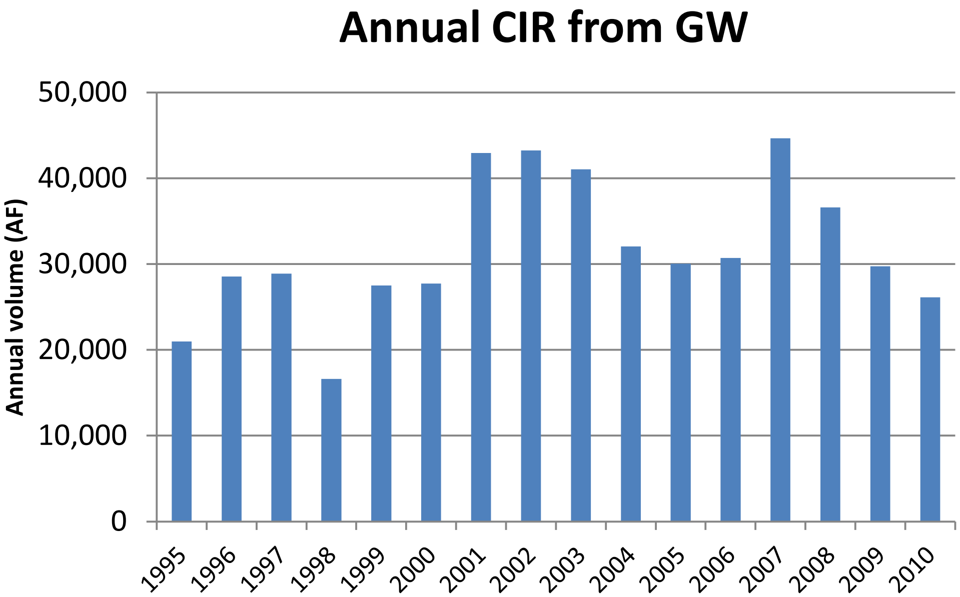
Highly variable, year 2007 CU was 2.7 times the 1998 CU and 1.4 times the average CU

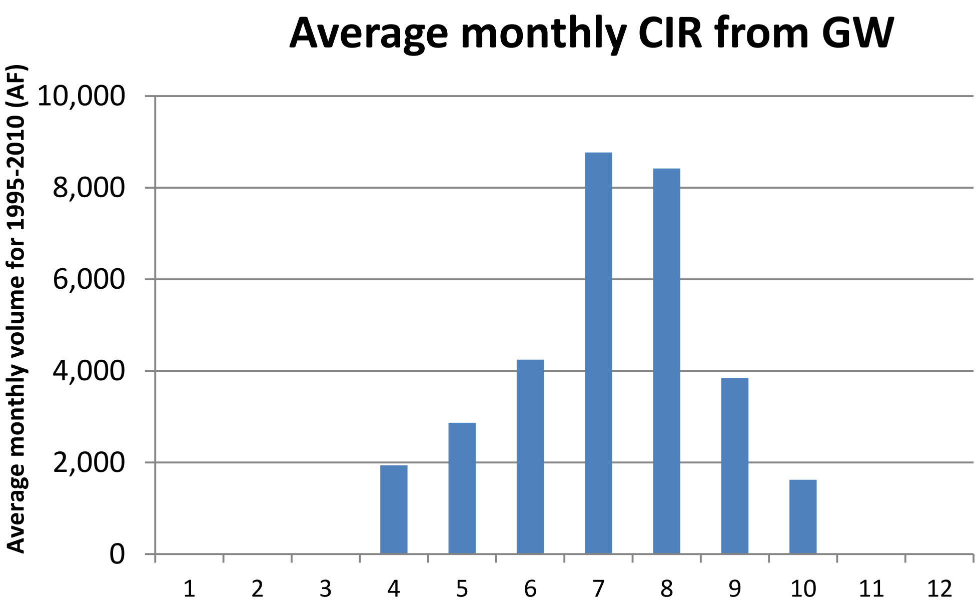
On average, 54% of groundwater consumptive use occurs in July and August, average CU rate in July and August is 140 cfs

Approximately 65% of the consumptive use occurs in agricultural areas, primarily in the triangle

Approximately 35% of the consumptive use occurs in urban areas and residential subdivisions in the upper valley

Additionally, four exchange wells irrigating areas overlying the ESPA diverted average of 2,324 AF/yr (1995-2010)





Reduction in pumping rate for simulated 20% reduction in consumptive use of groundwater

20% reduction of consumptive use of groundwater within irrigation entities plus 20% of diversions from exchange well diversions to the ESPA

CU red = 0.2 * 31,712 + 0.2 * 2,324

CU red = 6,807 AF/yr = 9.4 cfs

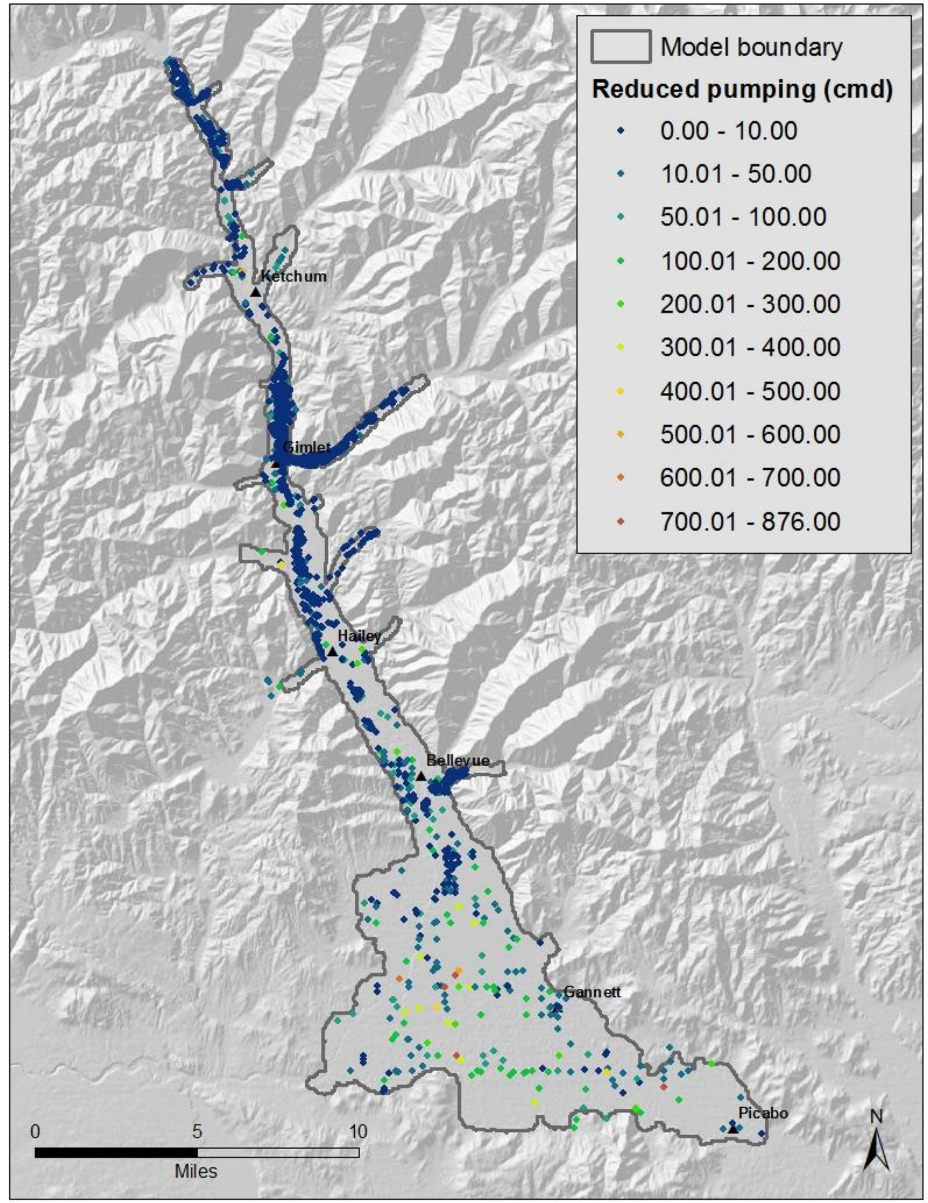
Change in consumptive use of groundwater affect stress applied at well location and location of corresponding incidental recharge

Reduction in pumping is reduction in consumptive use within irrigation entities divided by model irrigation efficiency, plus 20% of diversions from exchange well diversions to the ESPA

Q red = 9,779 AF/yr = 13.5 cfs

Reduction in pumping distributed to wells in irrigation entity based on ratio of average annual groundwater diversions (1995-2010)

168 AF/yr (0.2 cfs) occurs outside model boundary



Reduction in incidental recharge rate for simulated 20% reduction in consumptive use of groundwater

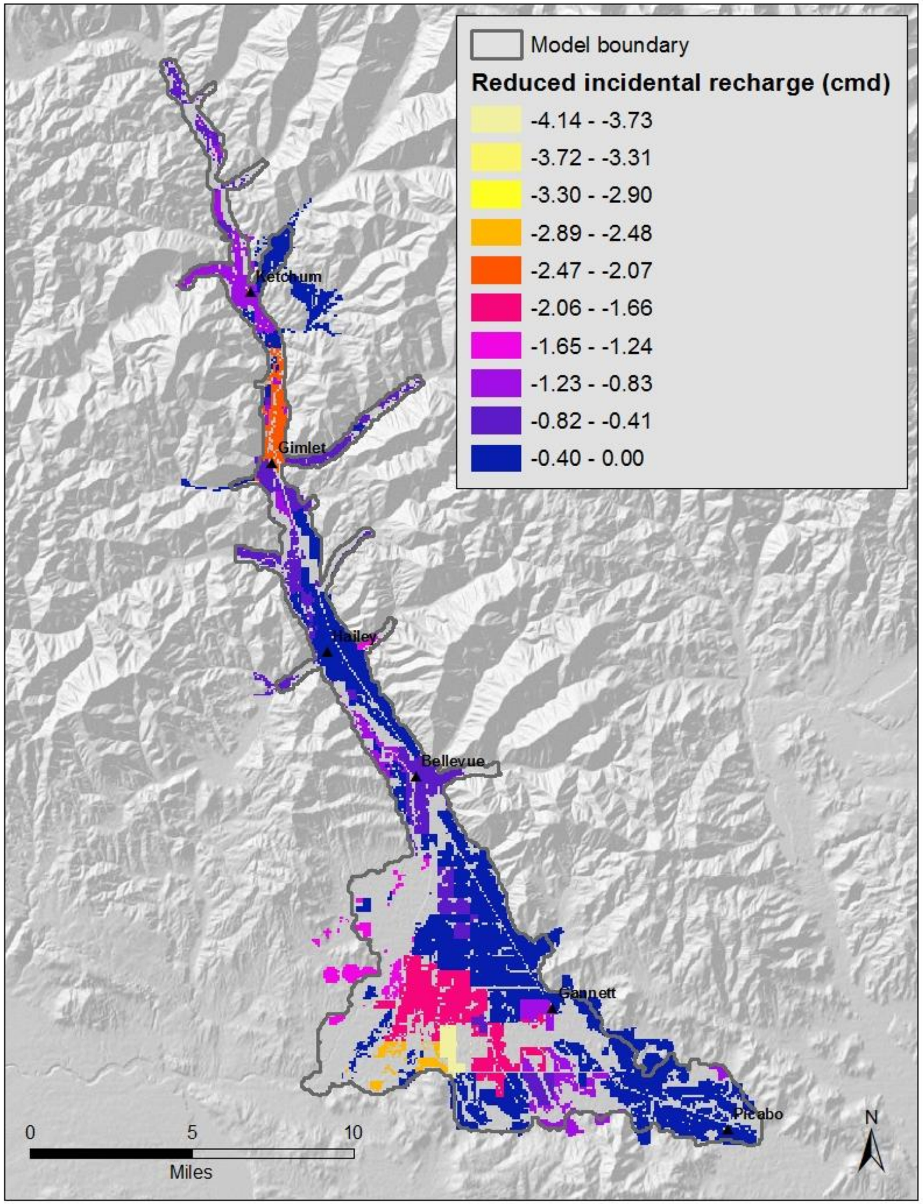
Reduction in incidental recharge

IncRech = CU/eff – CU

IncRechRed = 2,972 AF/yr = 4.1 cfs

Distributed to model cells with centroids located in groundwater only or mixed source lands within the irrigation entity

190 AF/yr (0.3 cfs) occurs outside of model boundary



Model simulation of 20% reduction in consumptive use of groundwater

Steady state

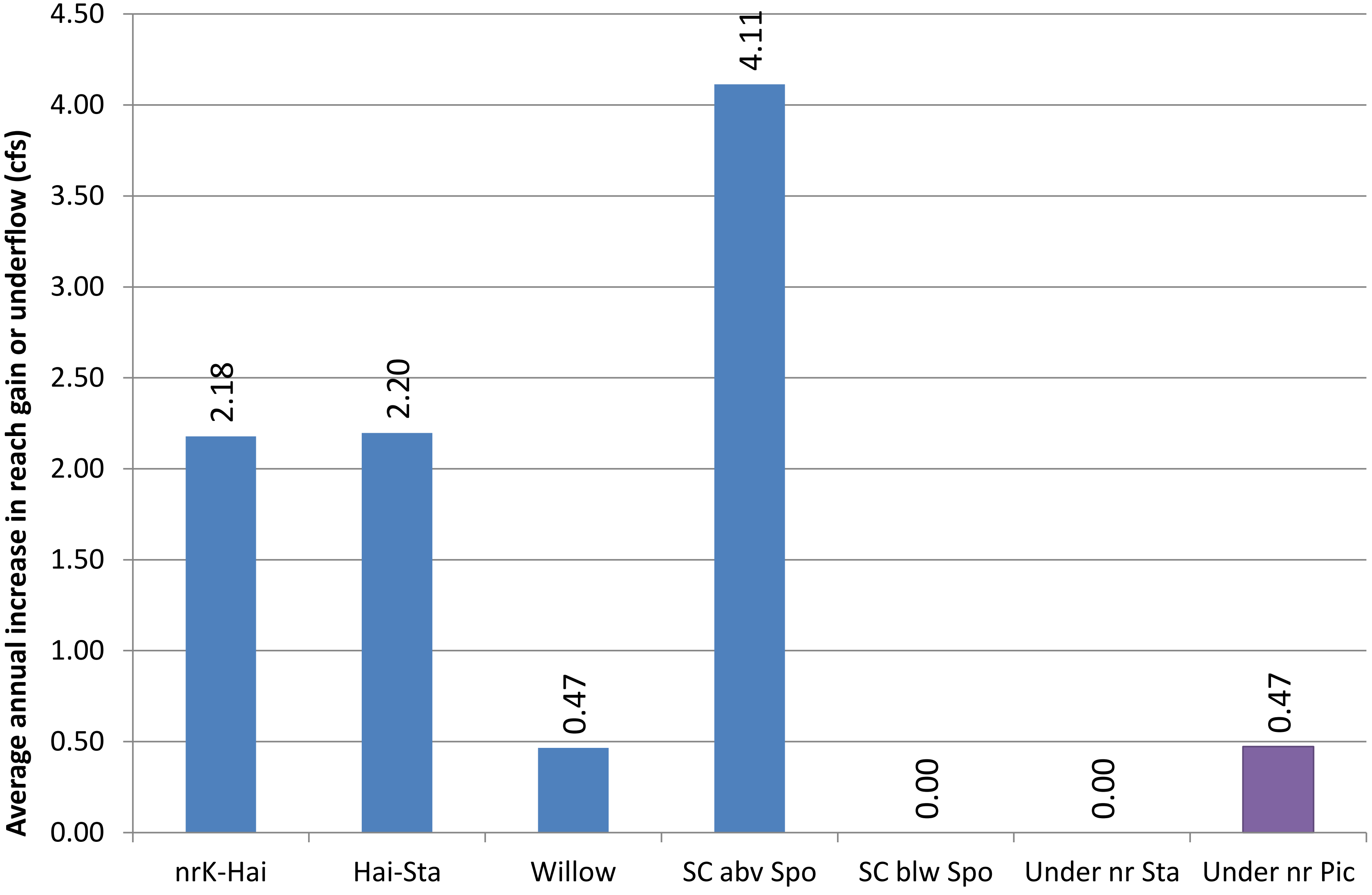
Baseline water budget and river stage based on average conditions from January 1995 through December 2010

Consumptive use reduction simulated by adding reduction in pumping to, and deducting reduced incidental recharge from, baseline well file

Extract results from baseline run and run with CU reduction. Impact of CU reduction is the difference between the results of the two runs.

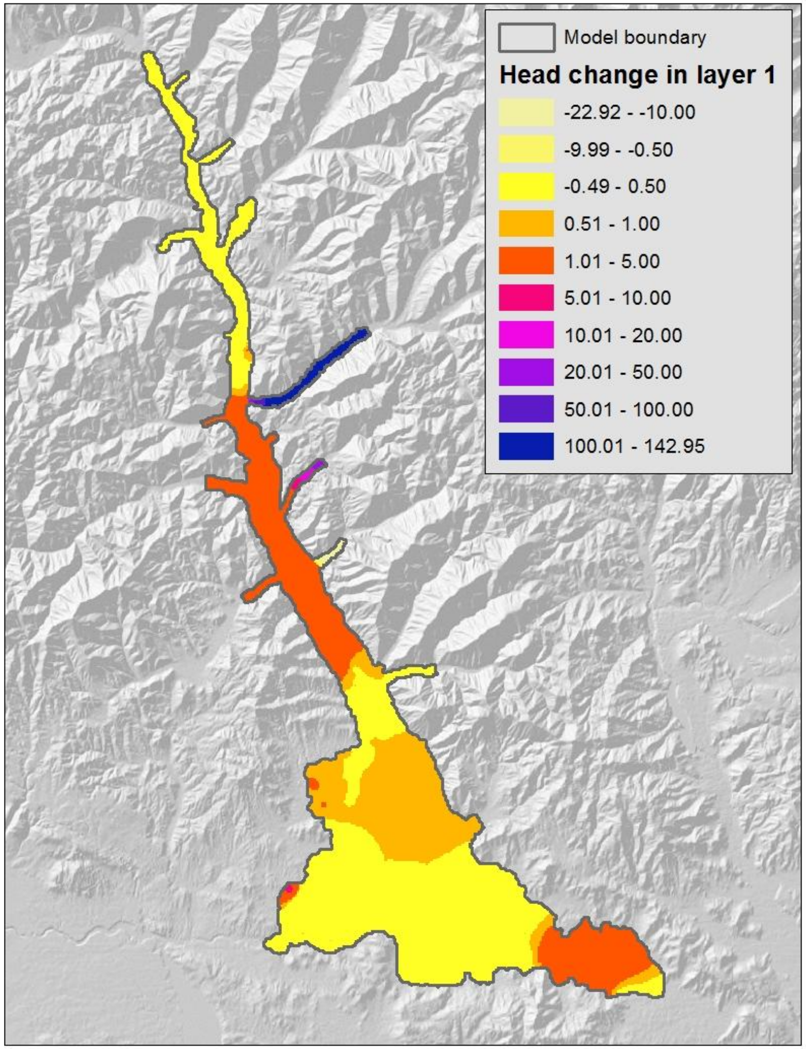
Reach	Baseline impact (cfs)	After reduction (cfs)	Change (cfs)	% of change
Net rech	119.60	129.02	9.43	100%
nrK-Hai	33.46	35.63	2.18	23%
Hai-Sta	-97.09	-94.89	2.20	23%
Willow	30.65	31.12	0.47	5%
SC abv Sports	143.50	147.61	4.11	44%
SC blw Sports	-0.15	-0.15	0.00	0%
Under nr Stanton	0.33	0.33	0.00	0%
Under nr Picabo	8.90	9.37	0.47	4%
Total impact	119.60	129.03	9.43	100%

River and drain response to 20% reduction in GW CU

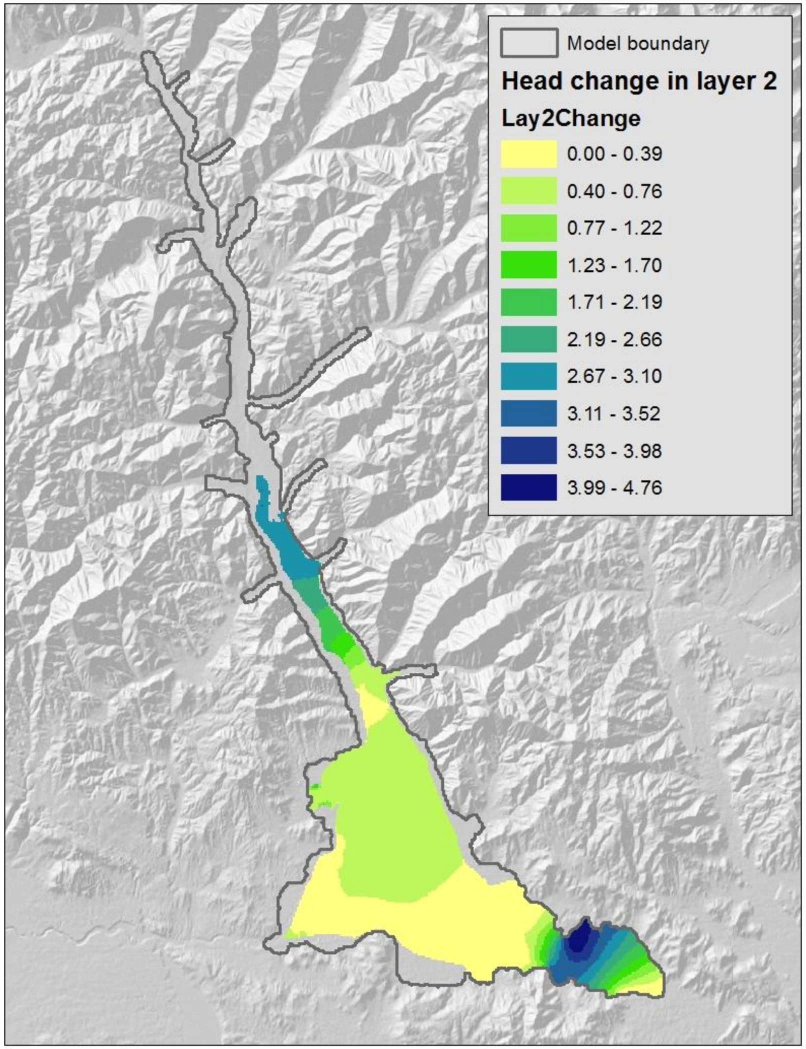


Head change in response to 20% reduction in GW CU

Head change in layer 1

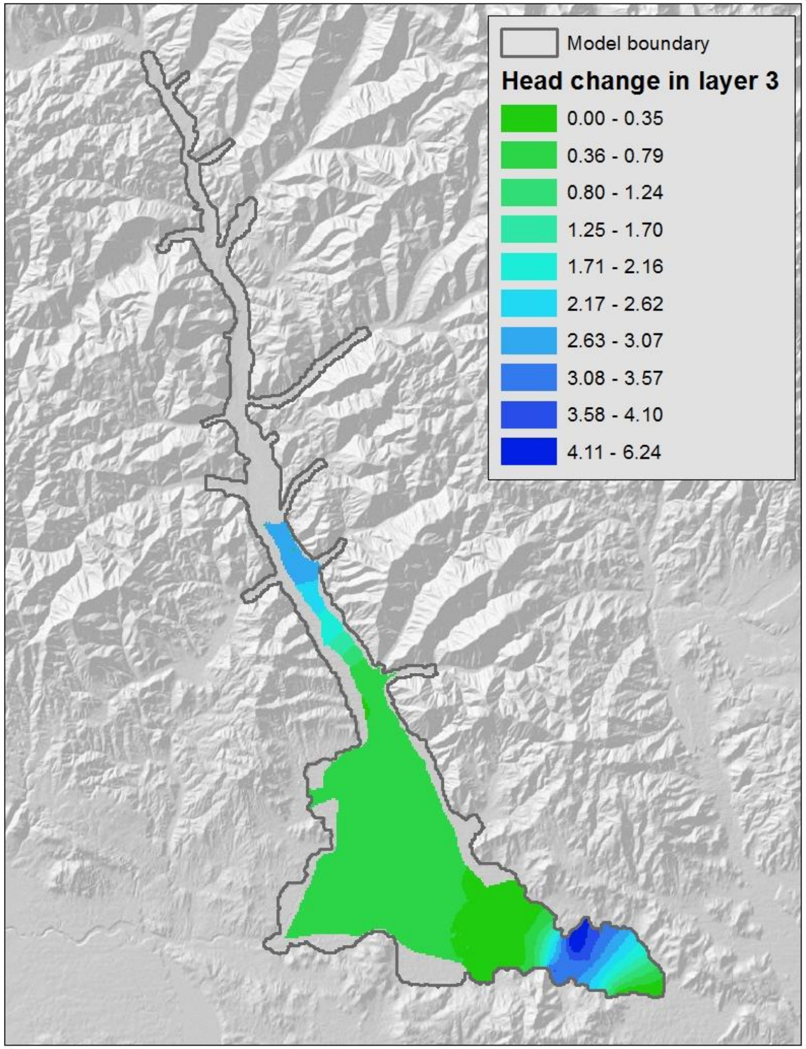


Head change in layer 2



Head change in response to 20% reduction in GW CU

Head change in layer 3



Discussion

- Steady state analysis predicts an average response to an average stress
  - Does not reflect seasonal nature of groundwater CU
  - Response in streamflow will be greater than average during some months and lower than the average during other months
  - Does not reflect year-to-year variation in groundwater CU
  - Response in streamflow will be greater in response to groundwater CU reduction in dry years such as 2001-2003 or 2007, and lower in response to CU reduction in wet years

- Changing the time period used for baseline conditions may change the results slightly because the number of perched river cells may change

- Quantification of groundwater use may be refined in future as additional data from Water District 37 become available

Questions?