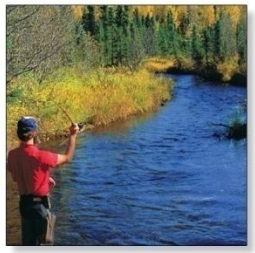
Preliminary Calibration Run

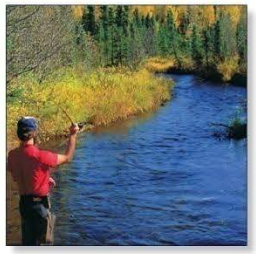
Presented by Allan Wylie, IDWR

June 4, 2015



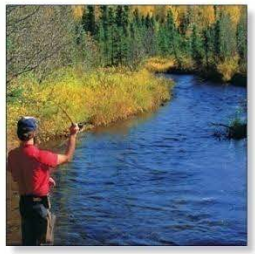
Outline

- **<u>Preliminary</u>** Transient Calibration Run
- This is **<u>Preliminary</u>**
- <u>NO</u> we are <u>NOT</u> there yet!!!



Review

- Recharge program
  - Tributary underflow
    - Adjusted by multiplying starting values by a factor
    - Adjust seasonal amplitude
    - Adjust averaging period
  - Surface water irrigation efficiency
  - Canal seepage fixed percentage of diversion
- Physical properties adjusted by changing values in MODFLOW input files
  - Aquifer hydraulic conductivity and storage
  - Riverbed conductance
  - Drain conductance

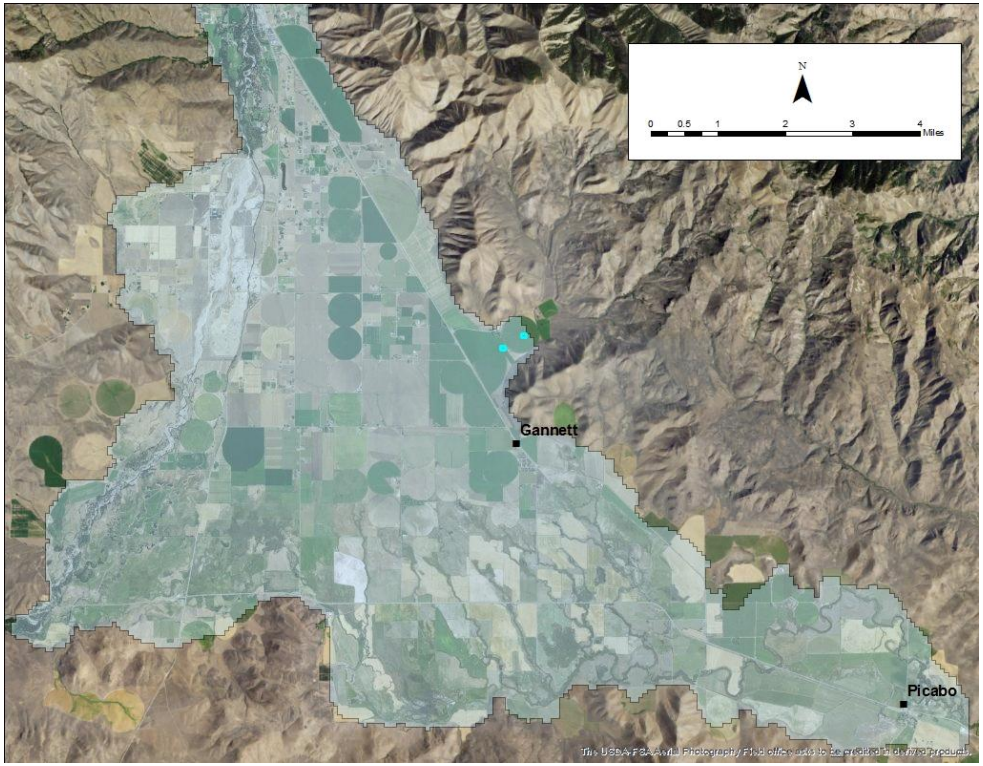


Changes since last meeting

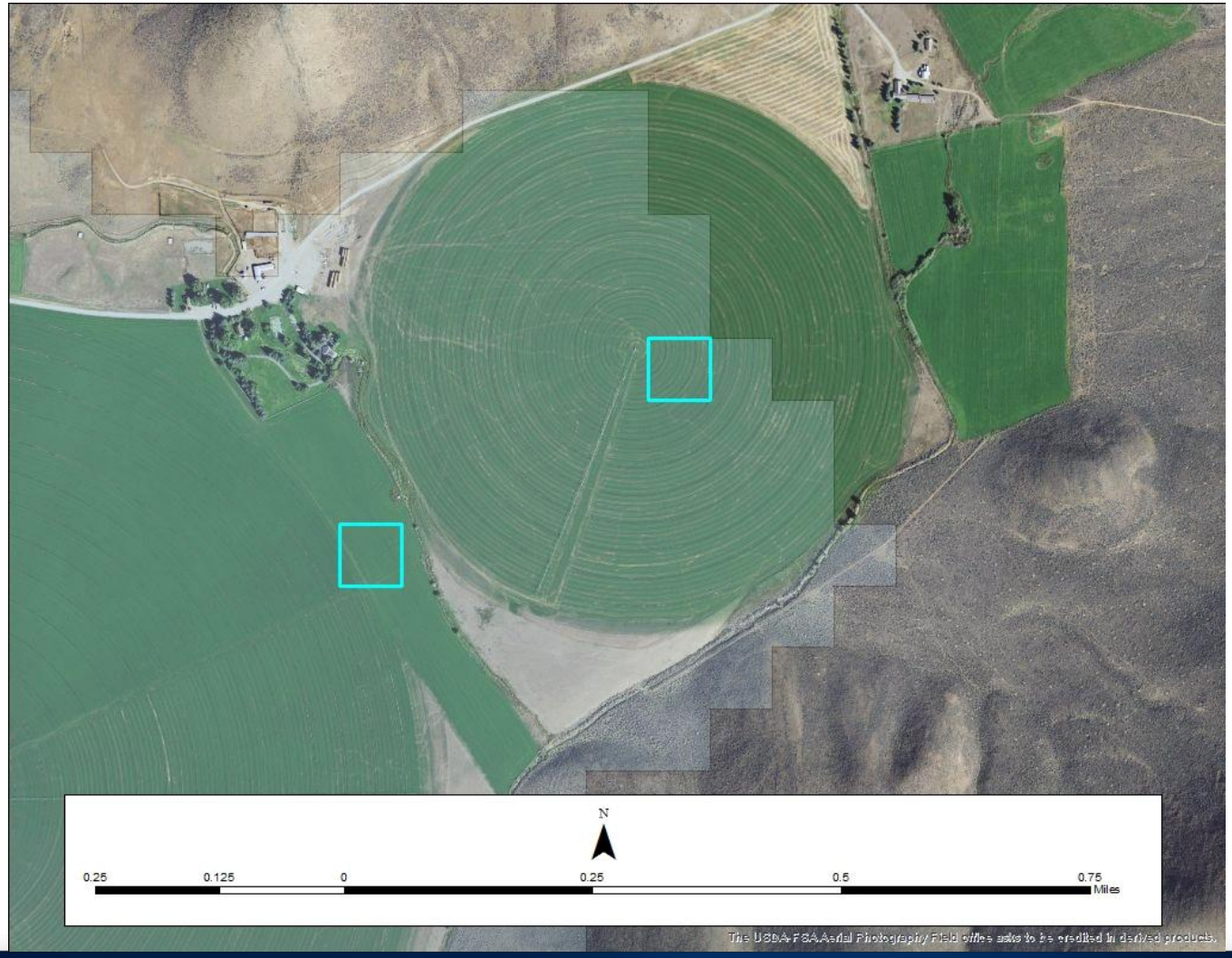
- Added more Nature Conservancy wells
- Transient Calibration Run
  - Analysis of a recent calibration run revieled that heads were above land surface in Cove Cr
    - We have no observation wells in Cove Cr
    - Added two drains with elevations set to land surface target discharge set to 0.0
  - Heads are now below land surface in Cove Cr except in late summer 1998 and 1999.
- Started work on the time varying transmissivity model
  - MODFLOW run takes several hours
  - MODFLOW frequently fails to converge and stops

Cove Drains

- Elevation of drains were set to land surface.
- Target discharge = 0.0
- Purpose is **NOT** to remove water but to alert PEST when head was above land surface.
- Water level now only above land surface in late summer of 1998 and 1999.
- Not retained in final model.



Cove Drains


N
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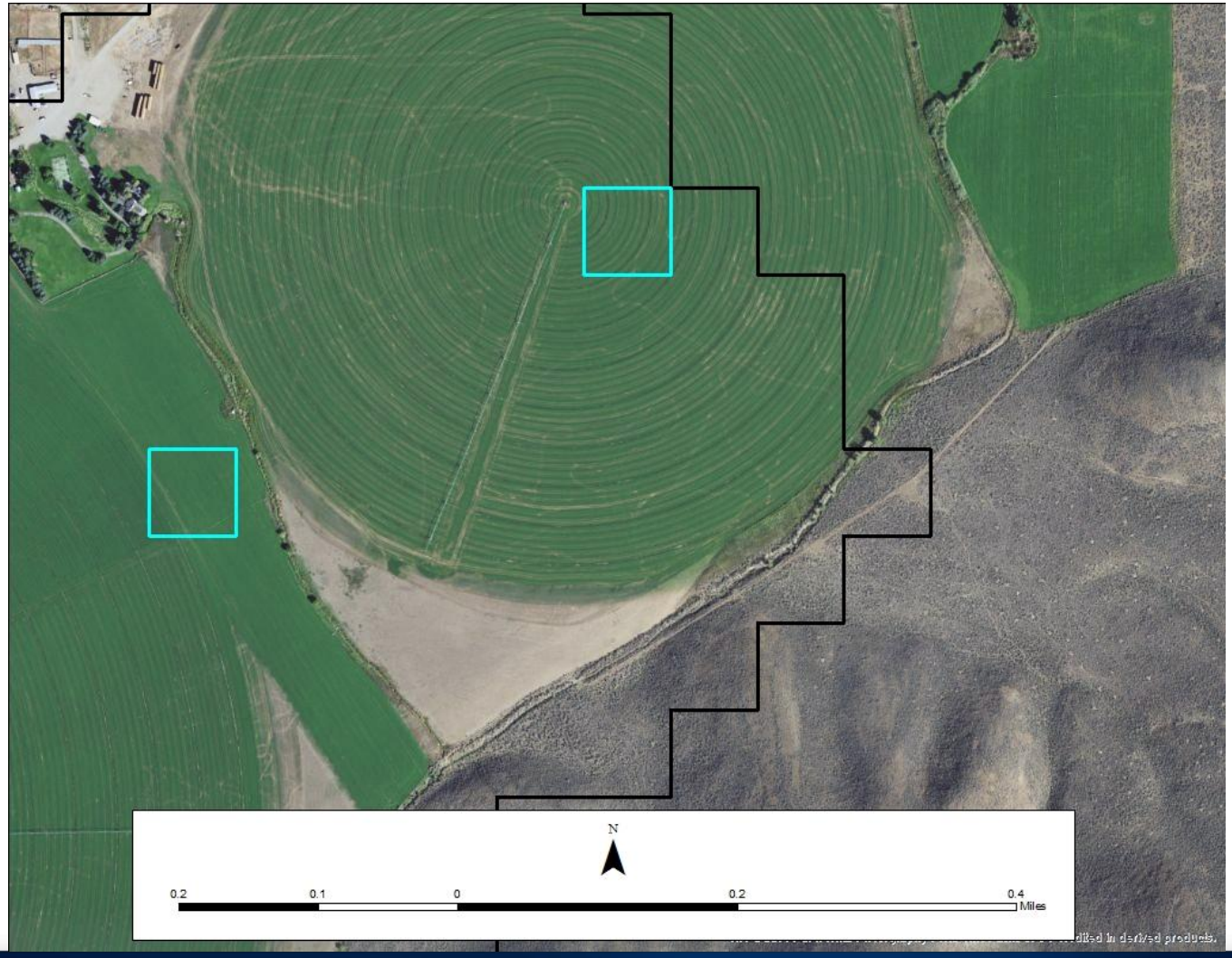
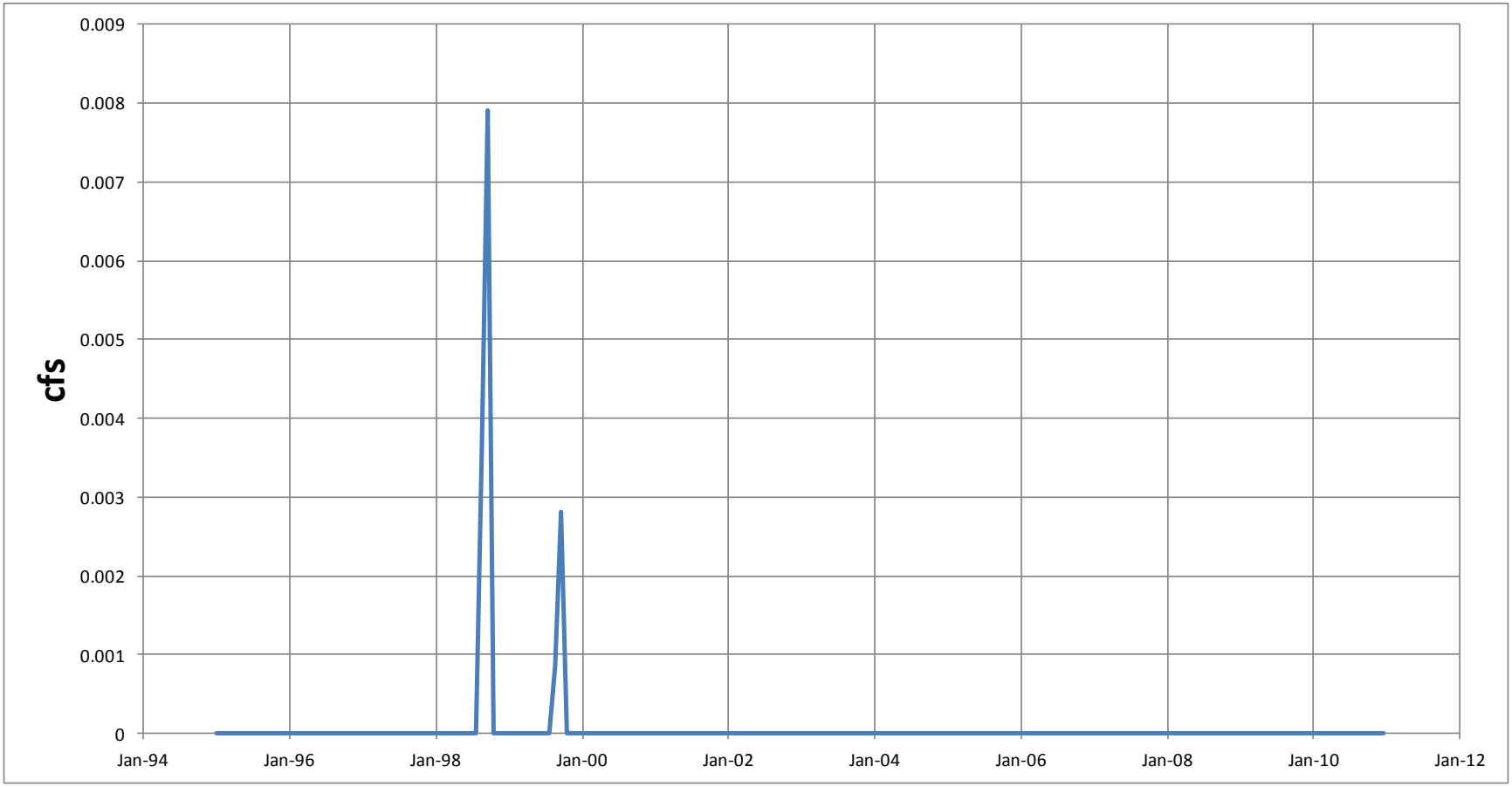
Miles
The USDA FSA Aerial Photography Field office asks to be credited in derived products.

Cove Drains



Cove Drains


cfs
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Jan-94
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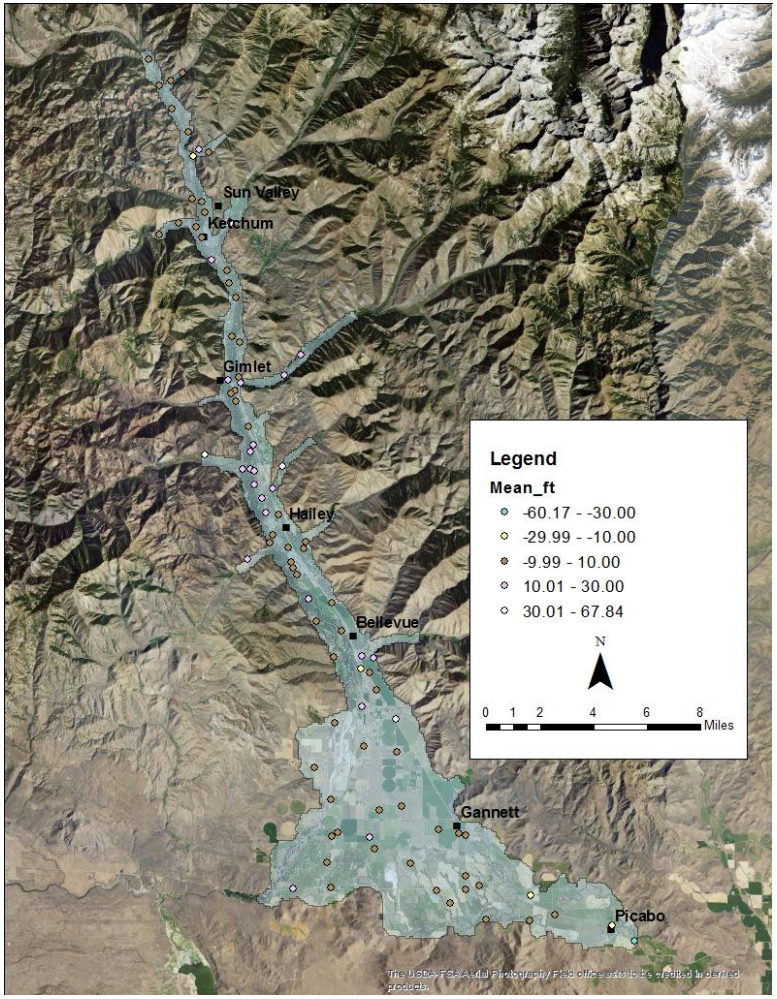
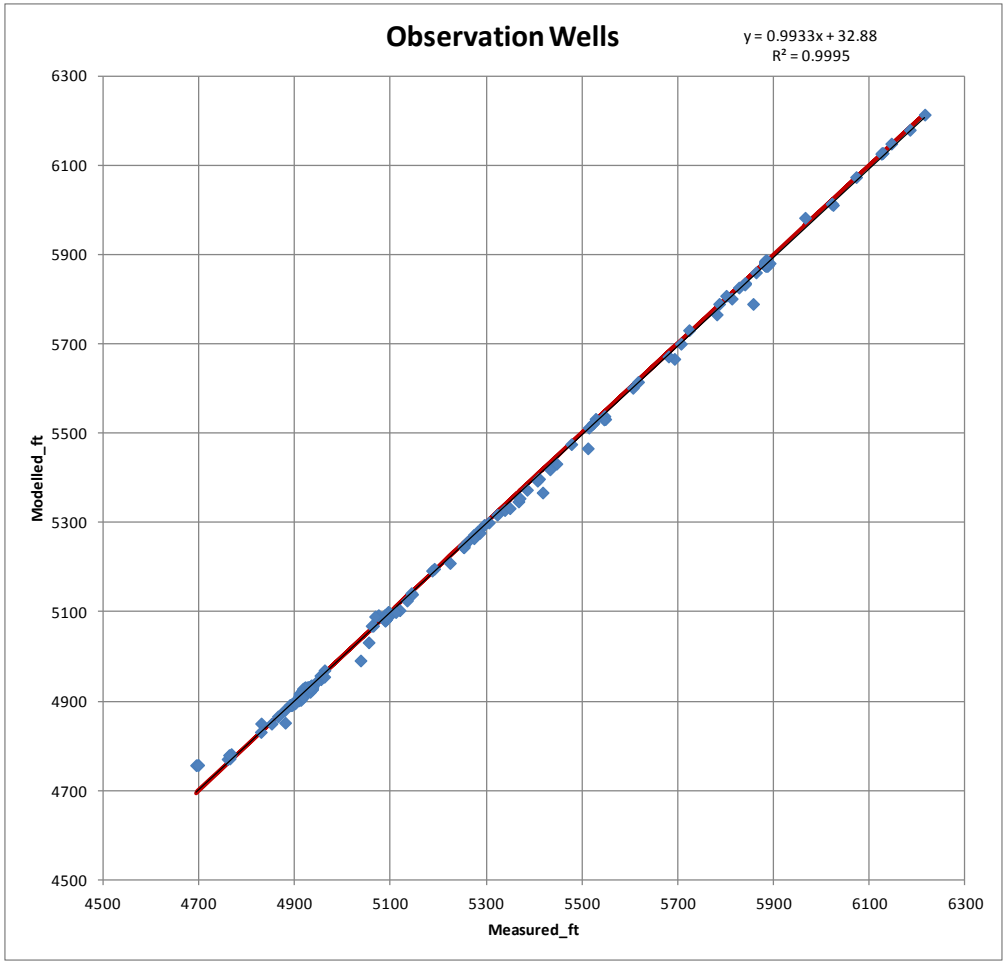
Jan-08
Jan-10
Jan-12

Observation Wells



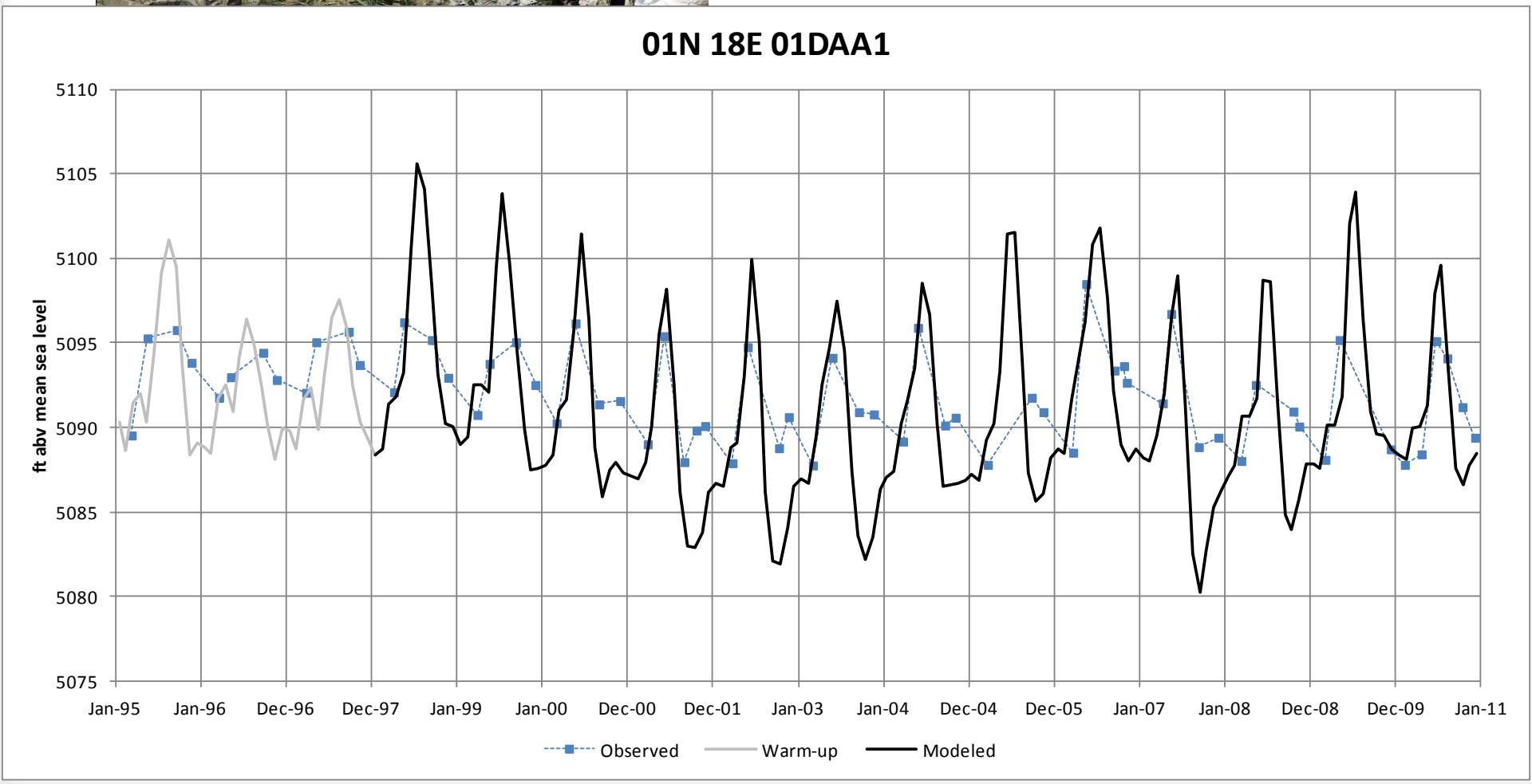
- Wells with GPS or surveyed location
- Measured by a trained technician

Observation Wells

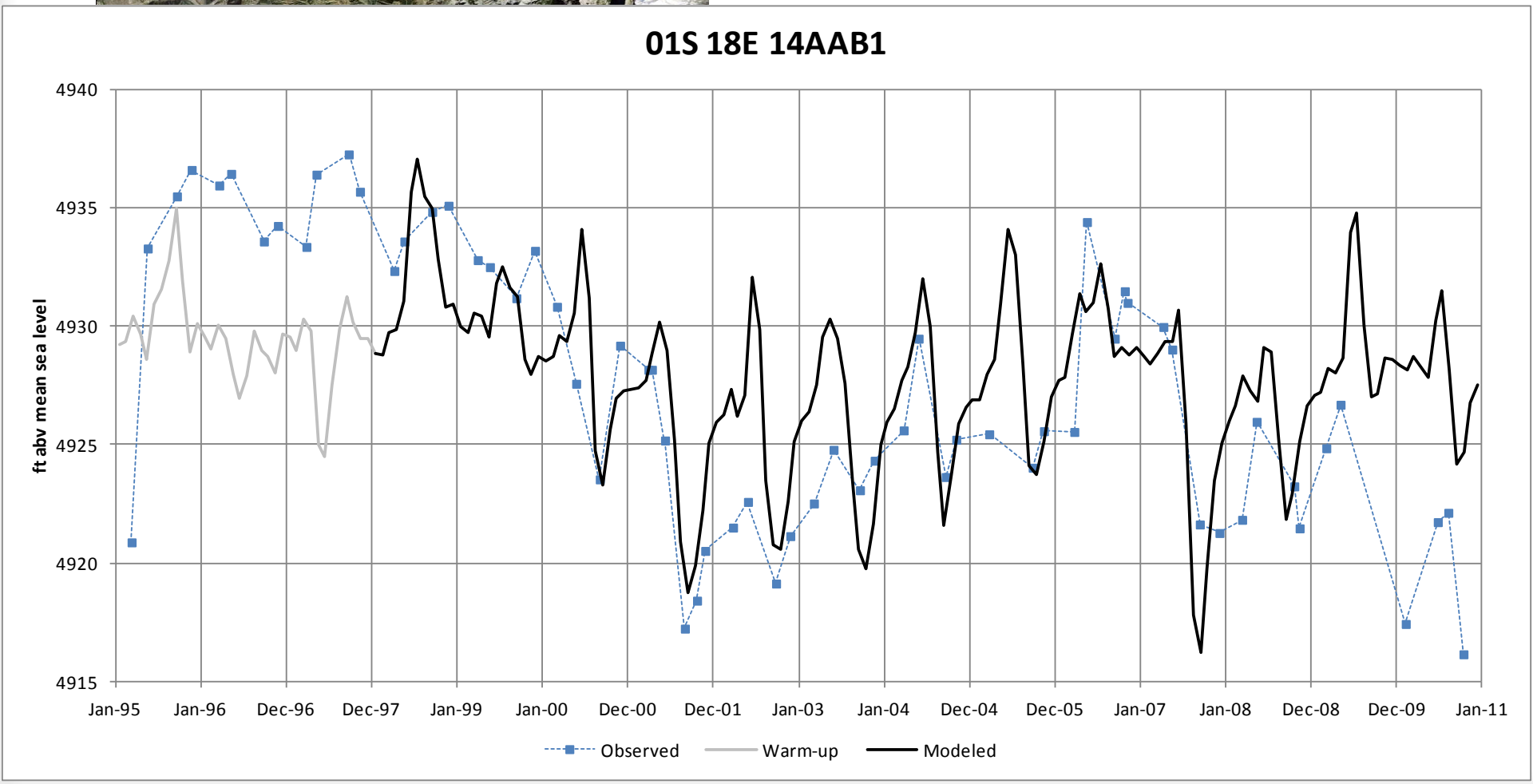


- Wells with GPS or surveyed location
- Measured by a trained technician
- If fit was perfect
  - Intercept = 0
  - Slope = 1
  - $R^2 = 1$
  - All points on the red line

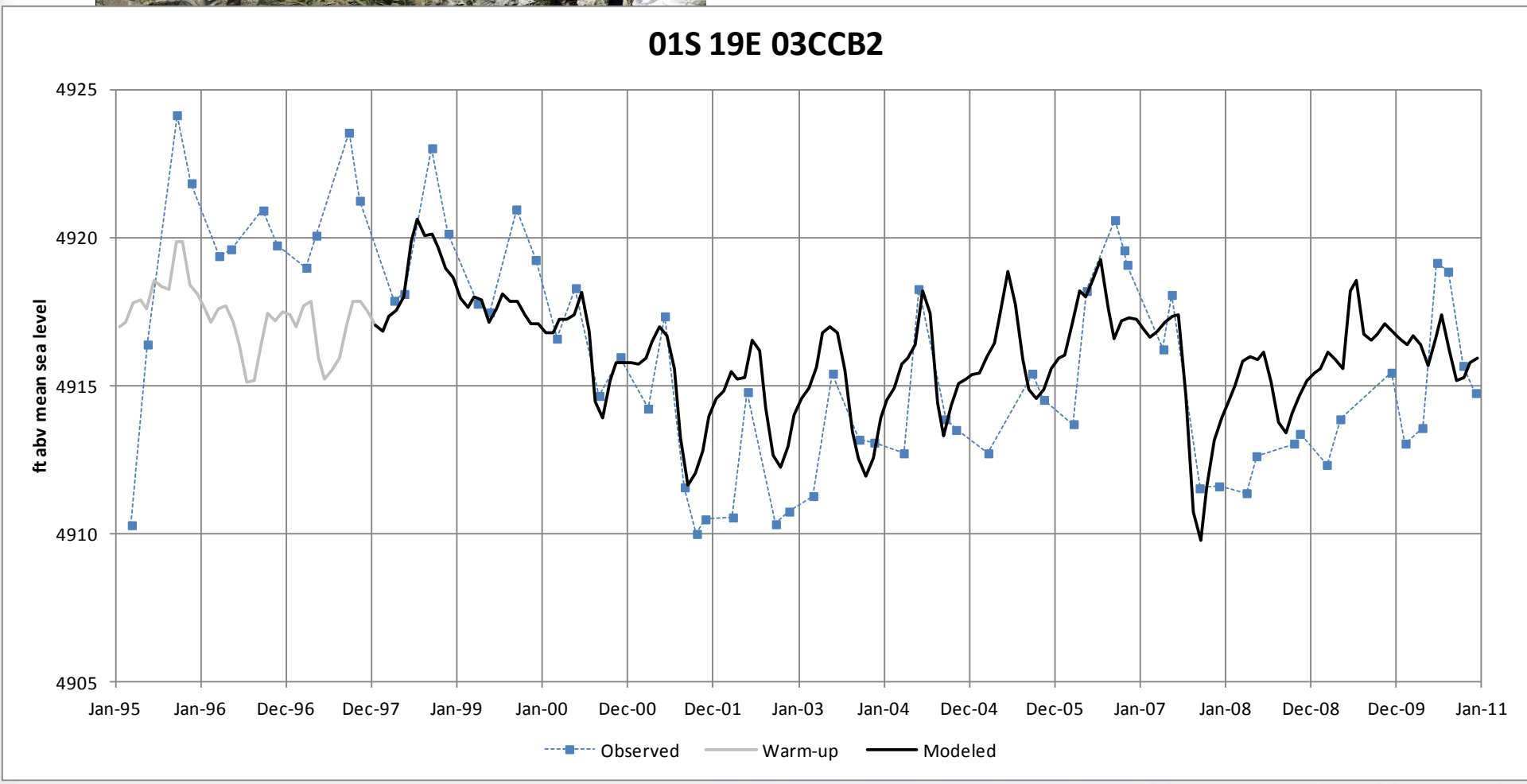
Observation Wells



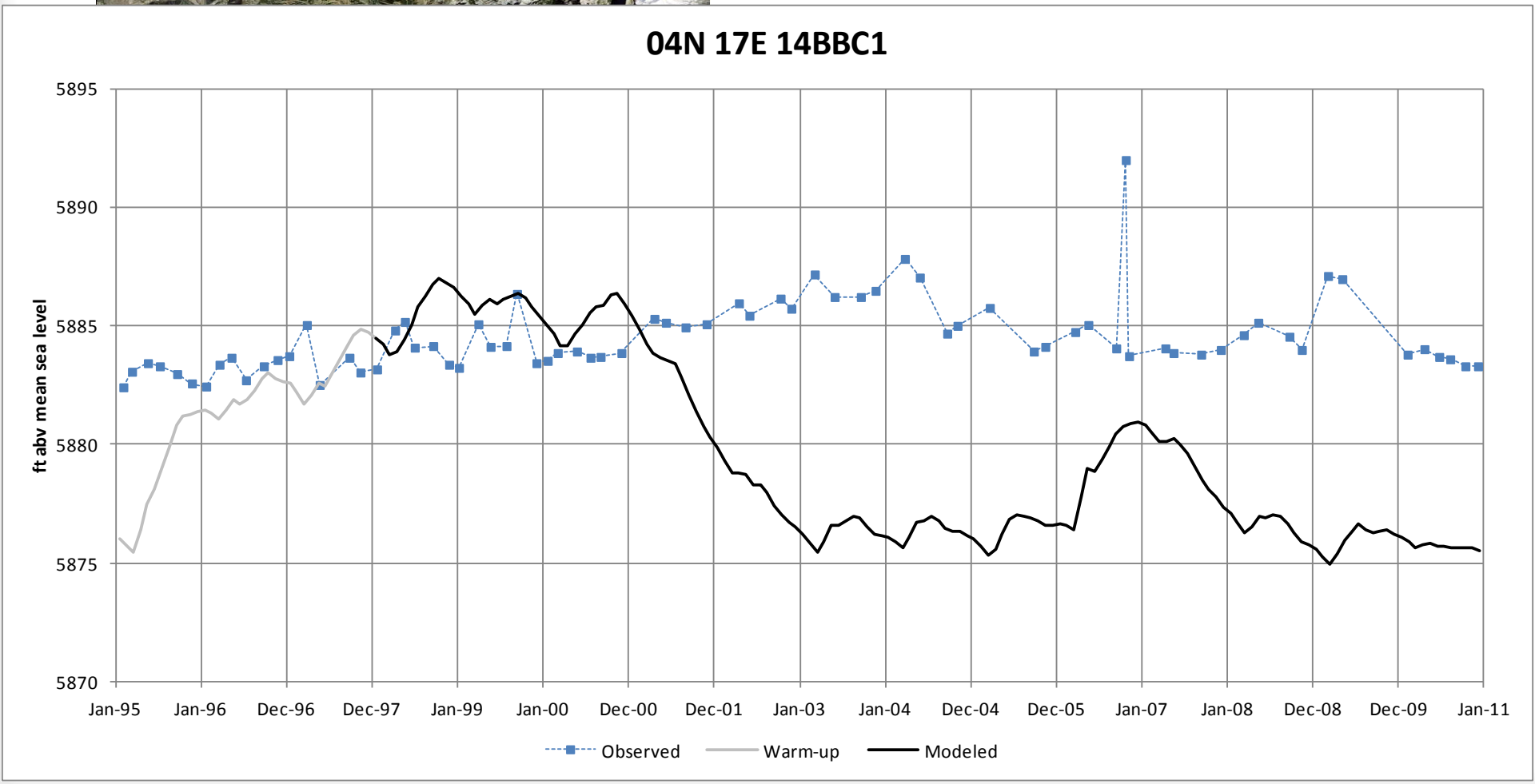
Observation Wells



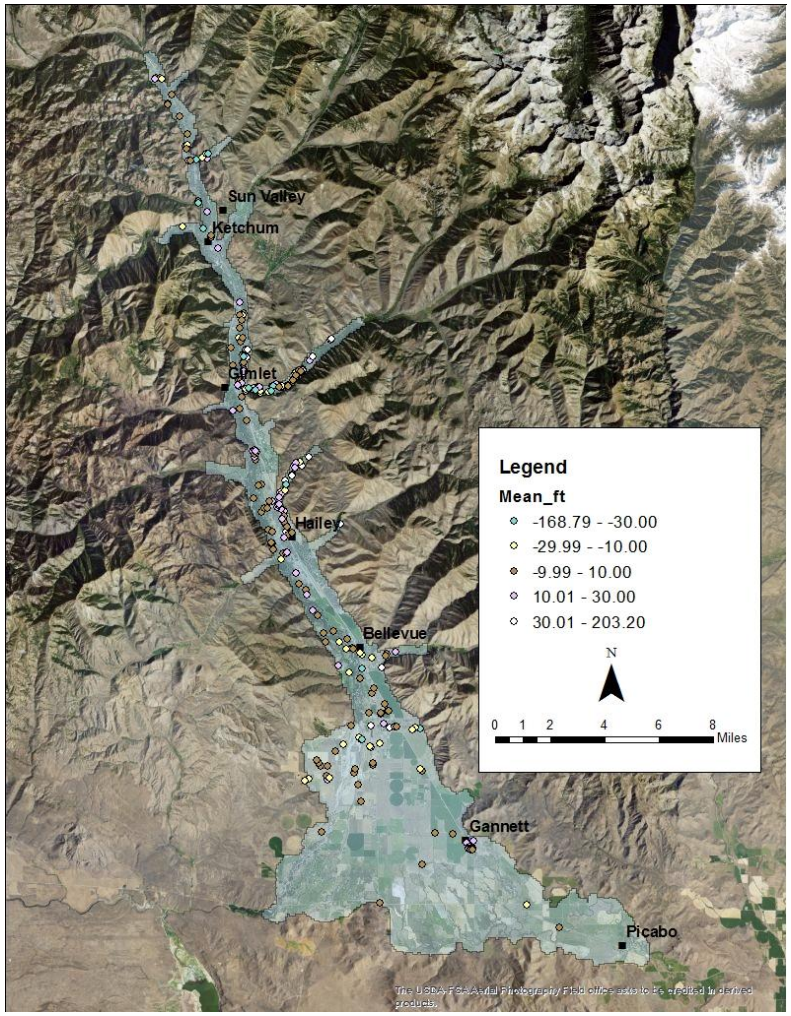
Observation Wells



Observation Wells

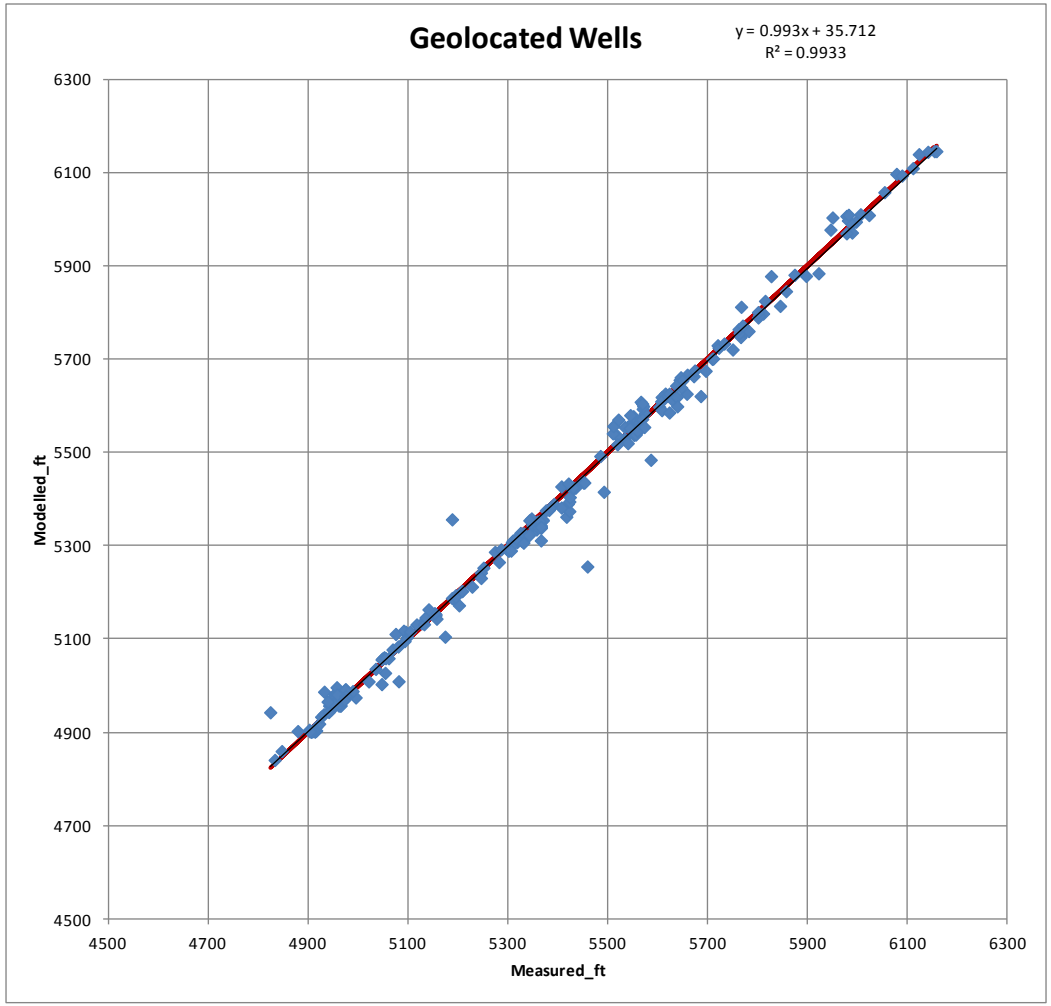


Geo-located Wells



- Wells located by address
- Measured by driller

Geo-located Wells



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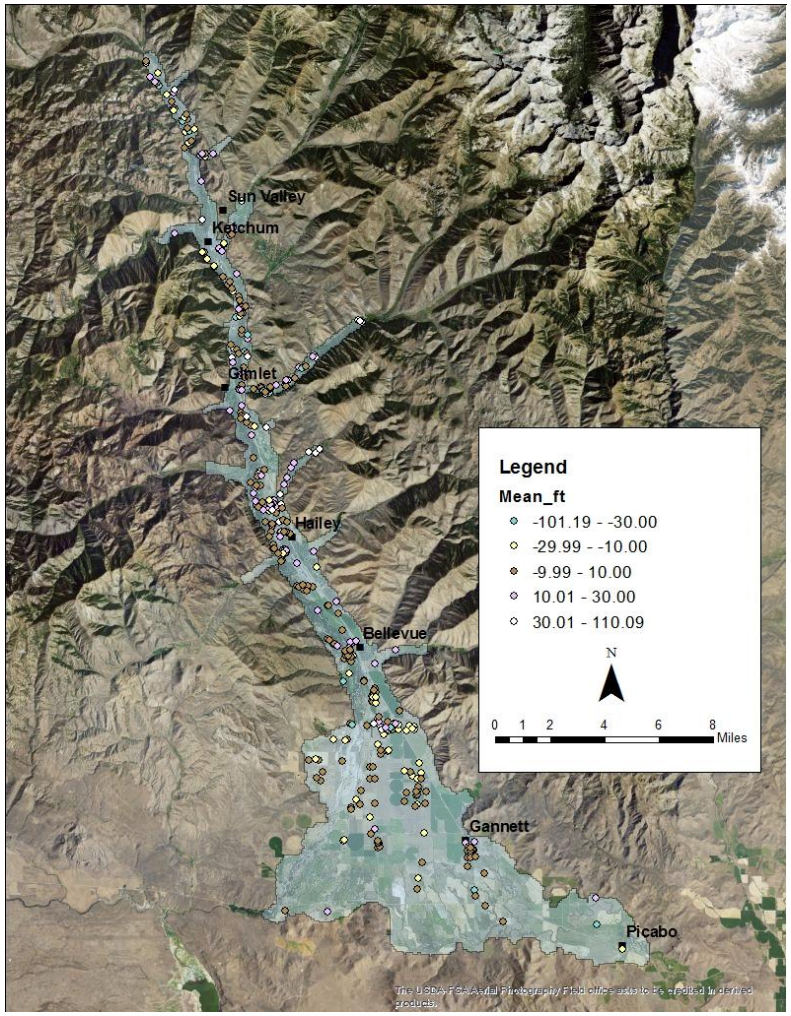
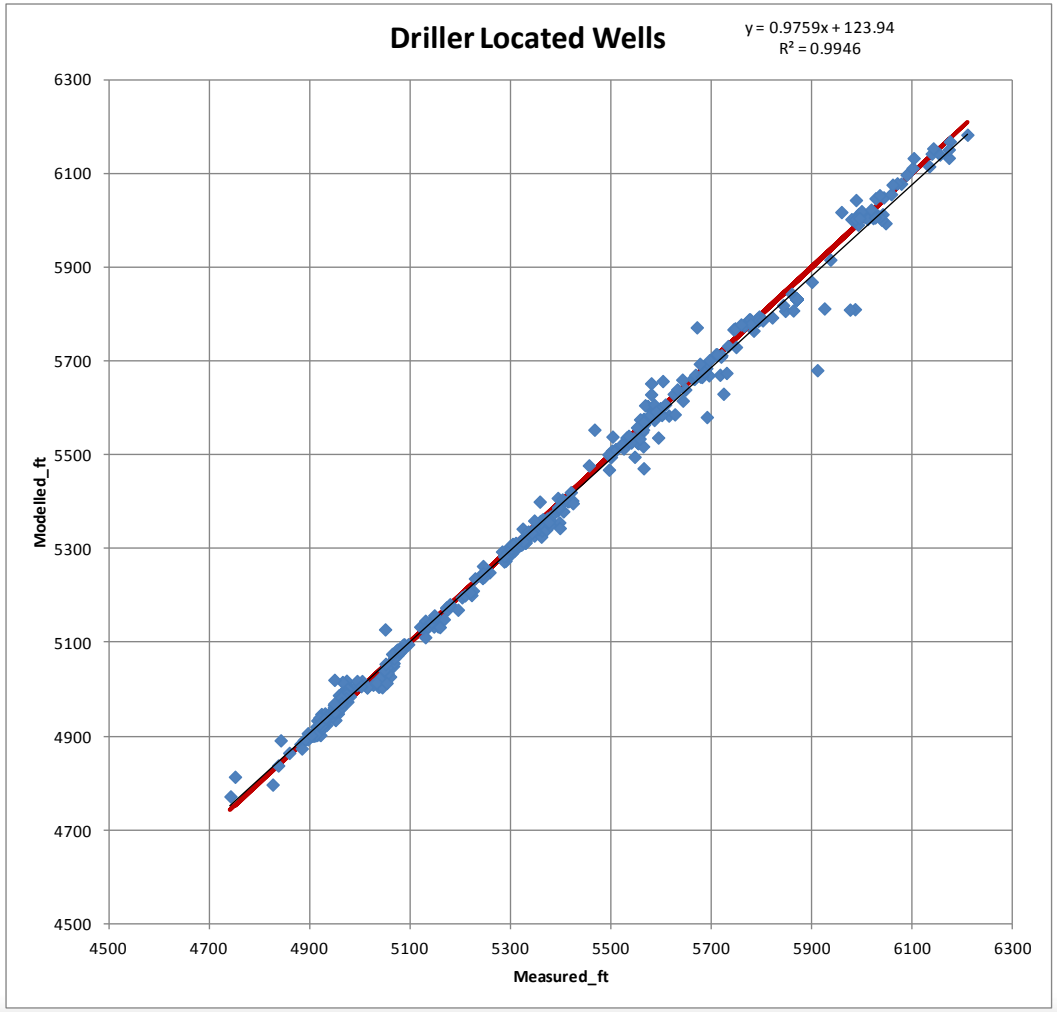
Driller Wells



- Wells located by PLS
- Measured by driller

Driller Wells



- Wells located by PLS
- Measured by driller
- If fit was perfect
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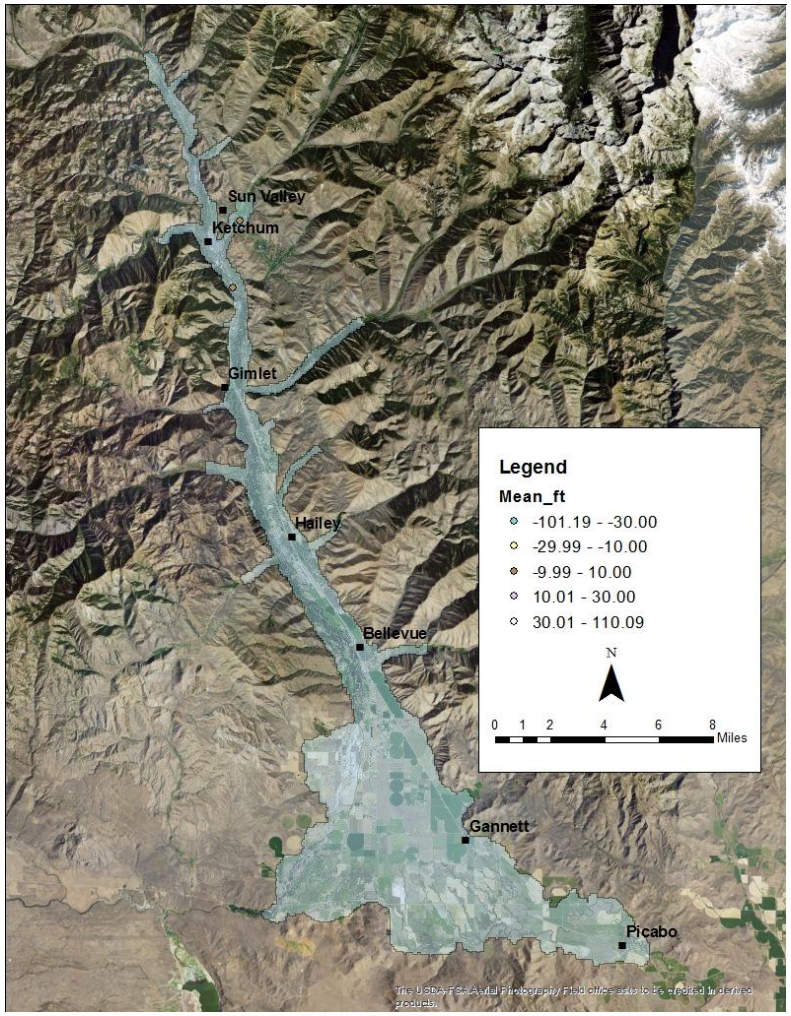
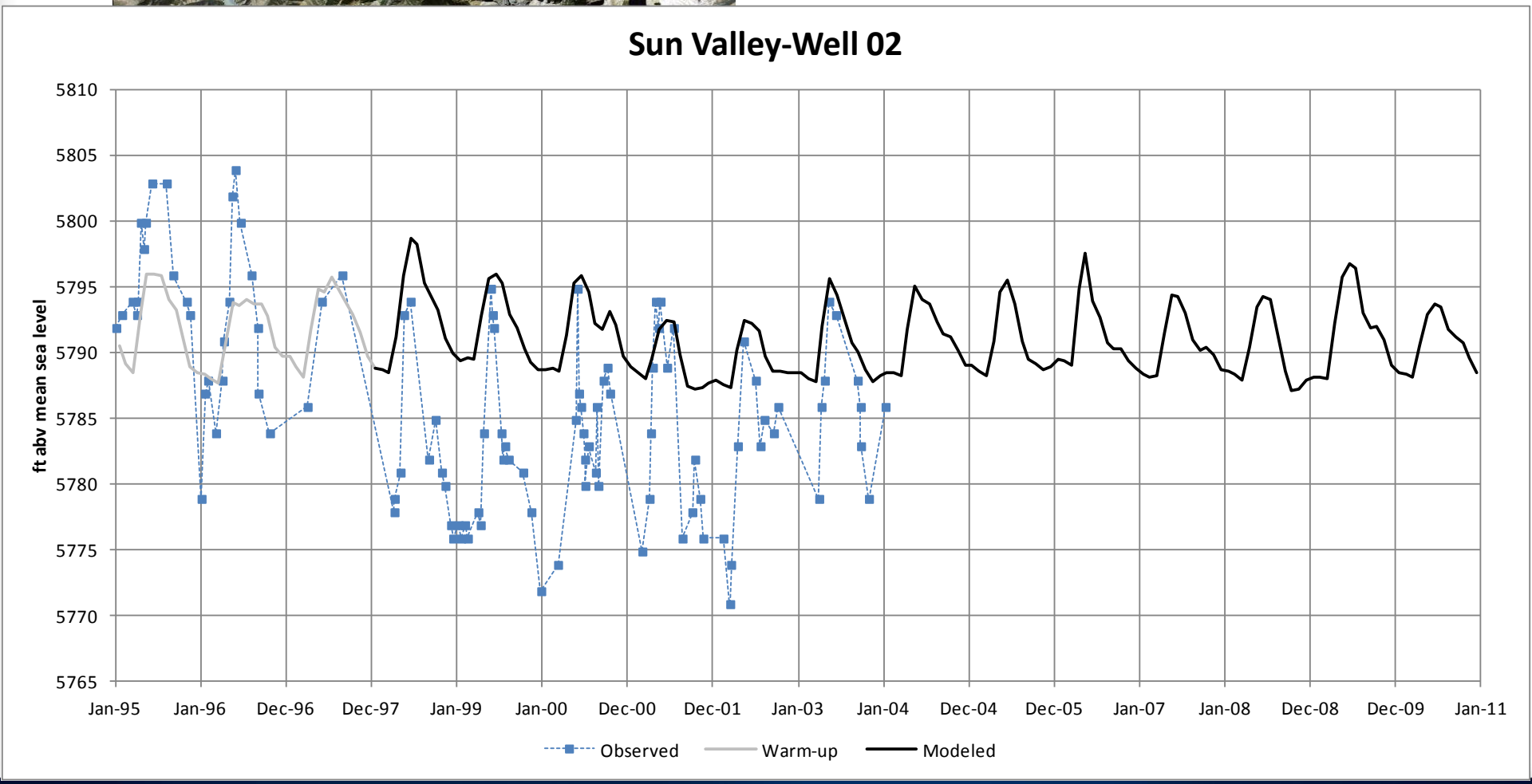
Sun Valley Wells

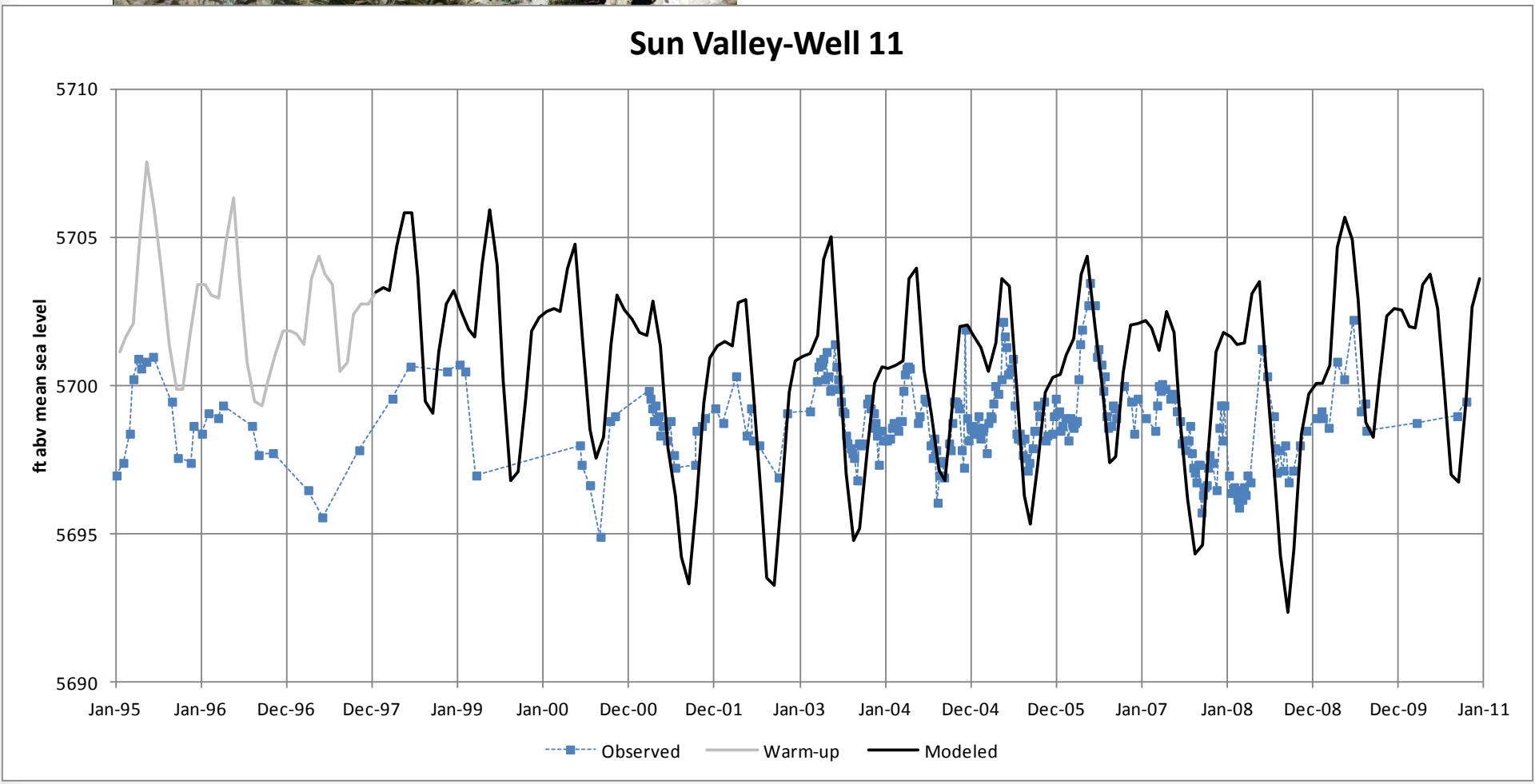


- Municipal production wells
- 2 well fields
- Measured by municipal employee

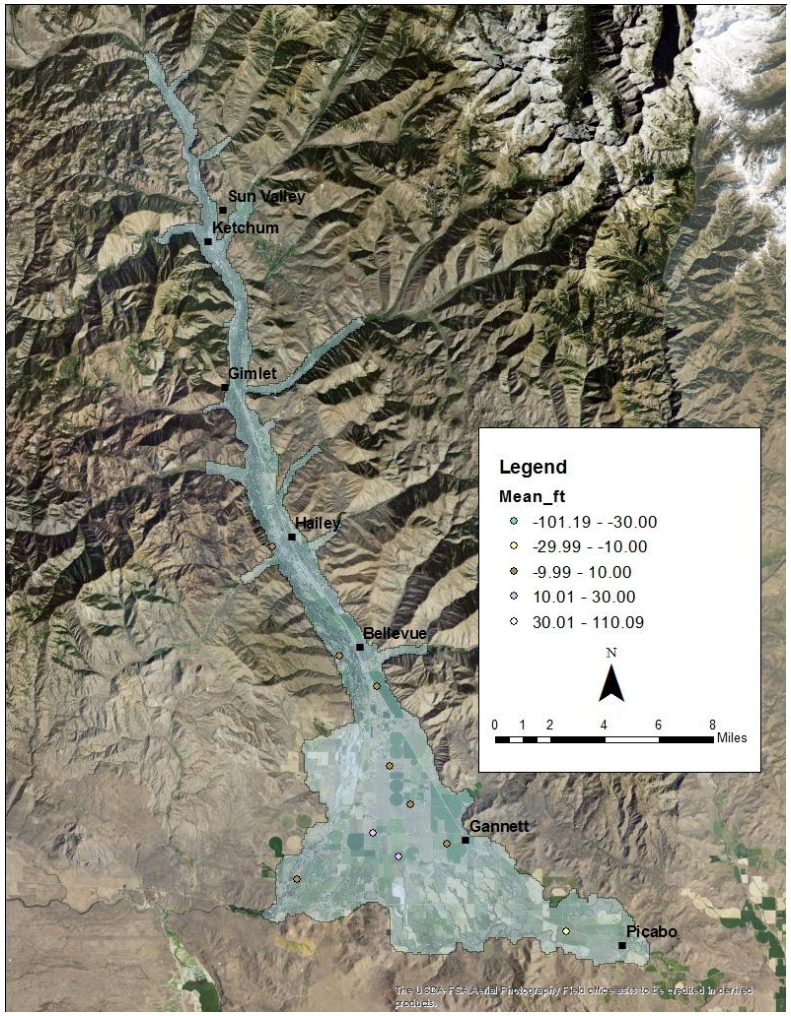
Sun Valley Wells



Sun Valley Wells

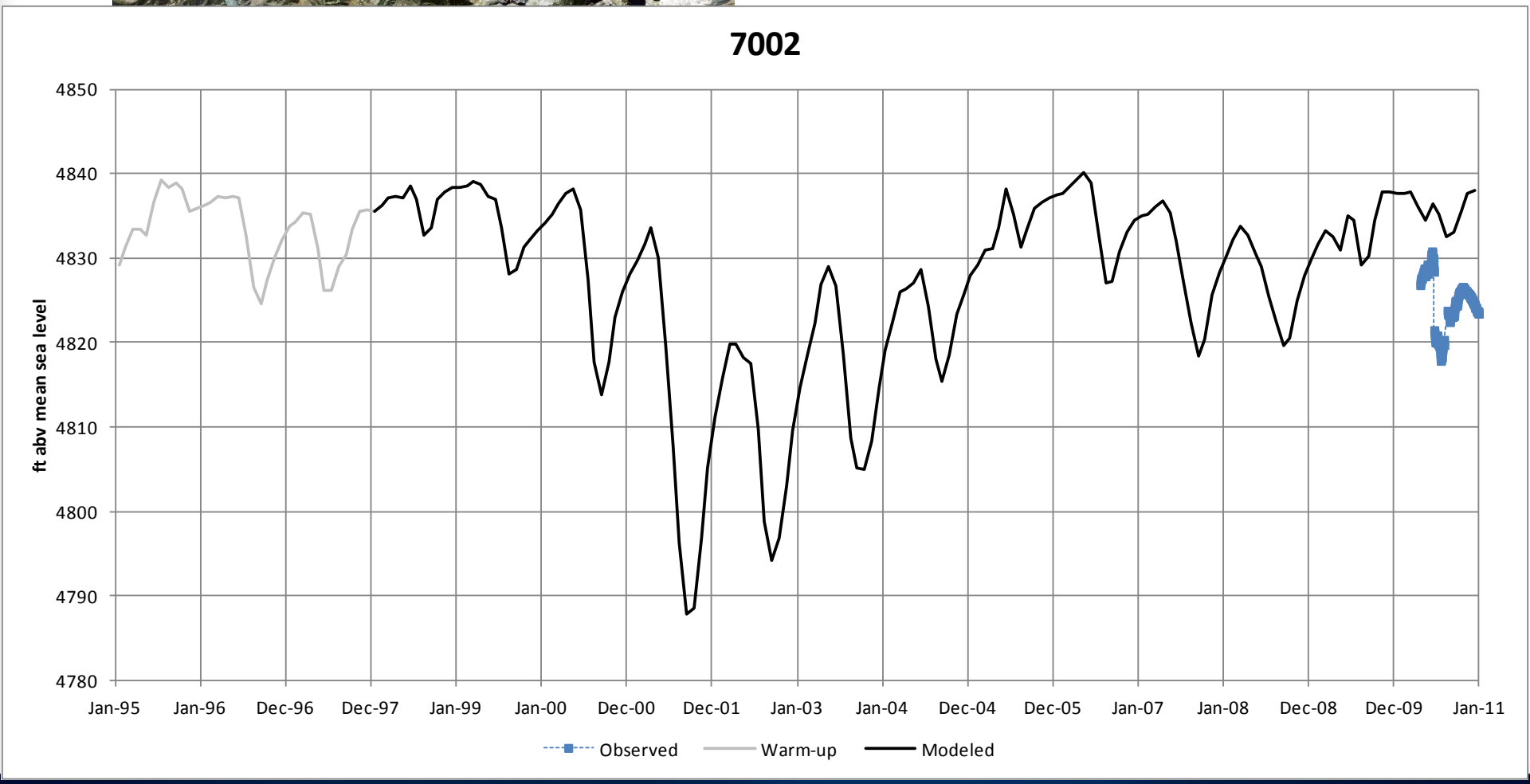


The Nature Conservancy Wells



- Graduate student installed transducers
- 12 wells
- 2 are wells we already use
- Not all wells useful for us
- Measurements every 15 min
- Mid 2010 to mid 2011
- Reduced 15 min frequency to one per day
- 5 domestic wells
  - Filtered out pumping events

The Nature Conservancy Wells



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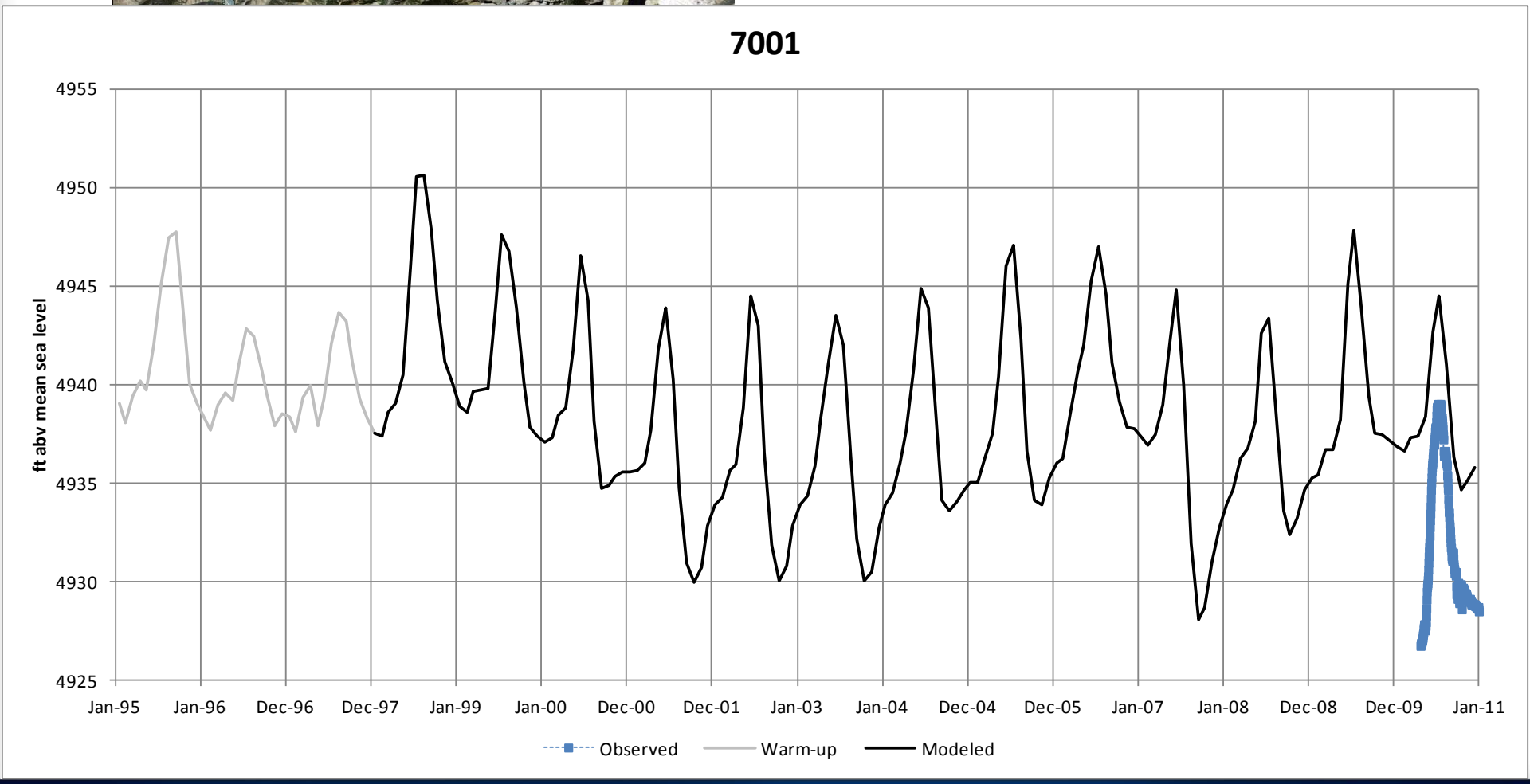

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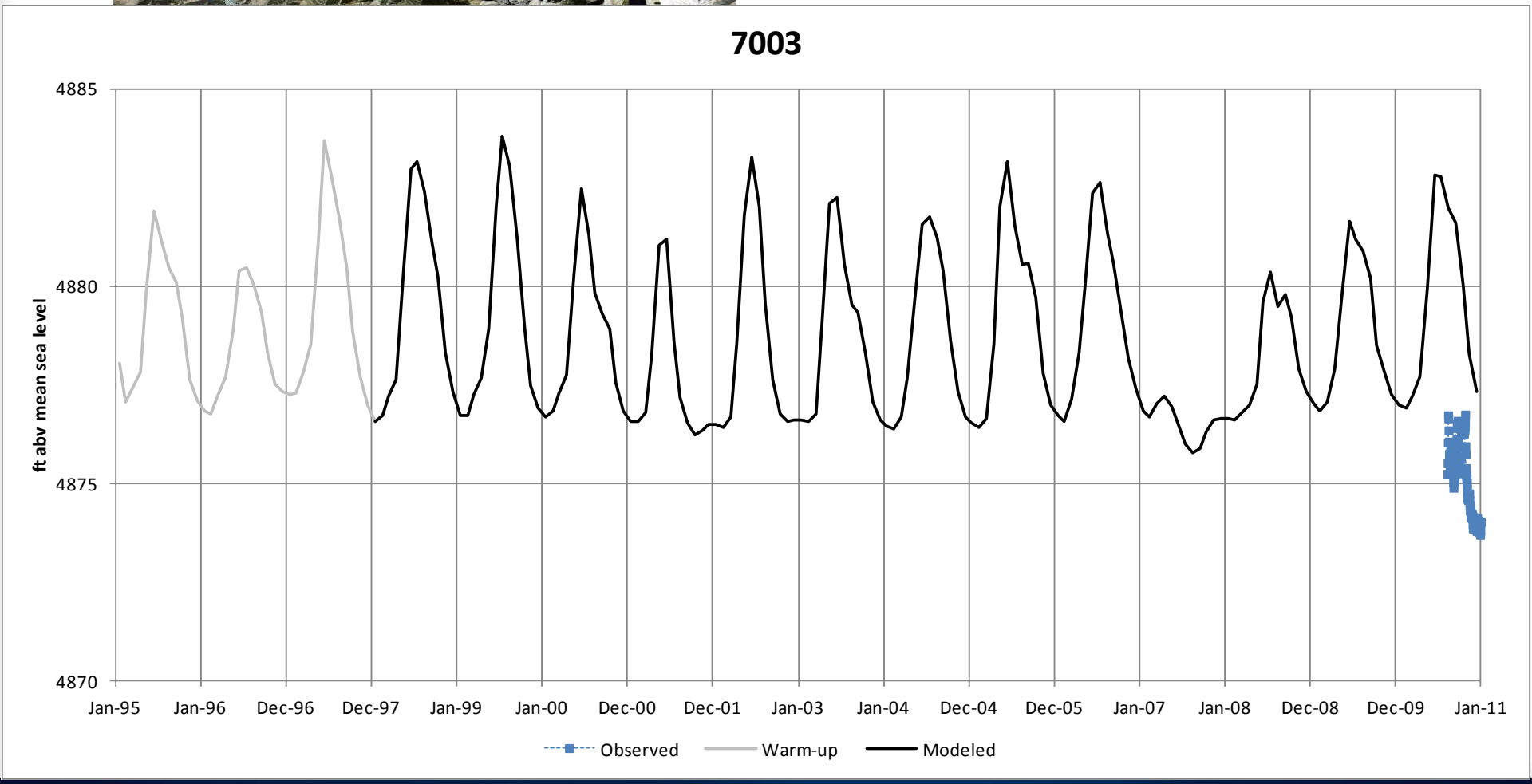

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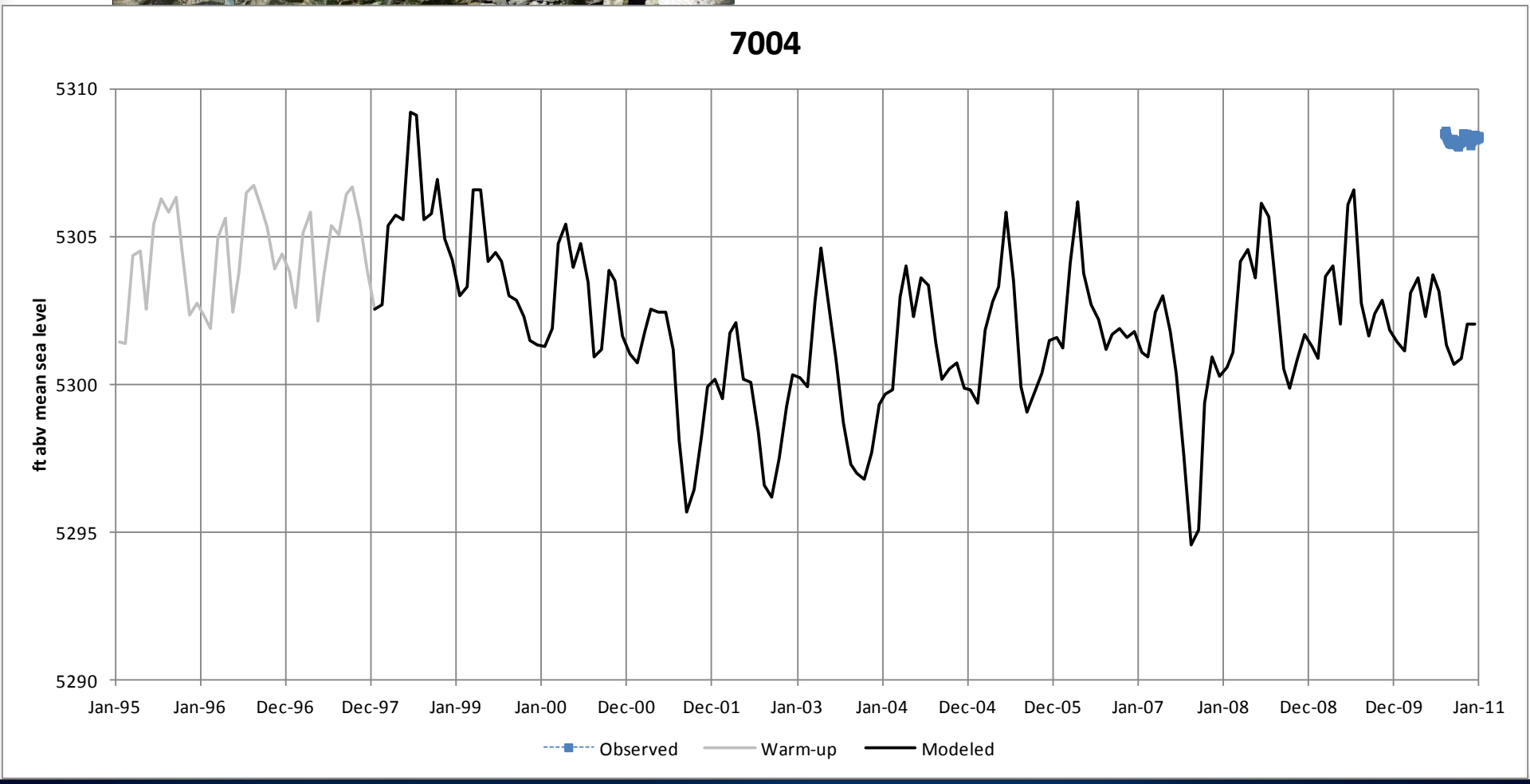

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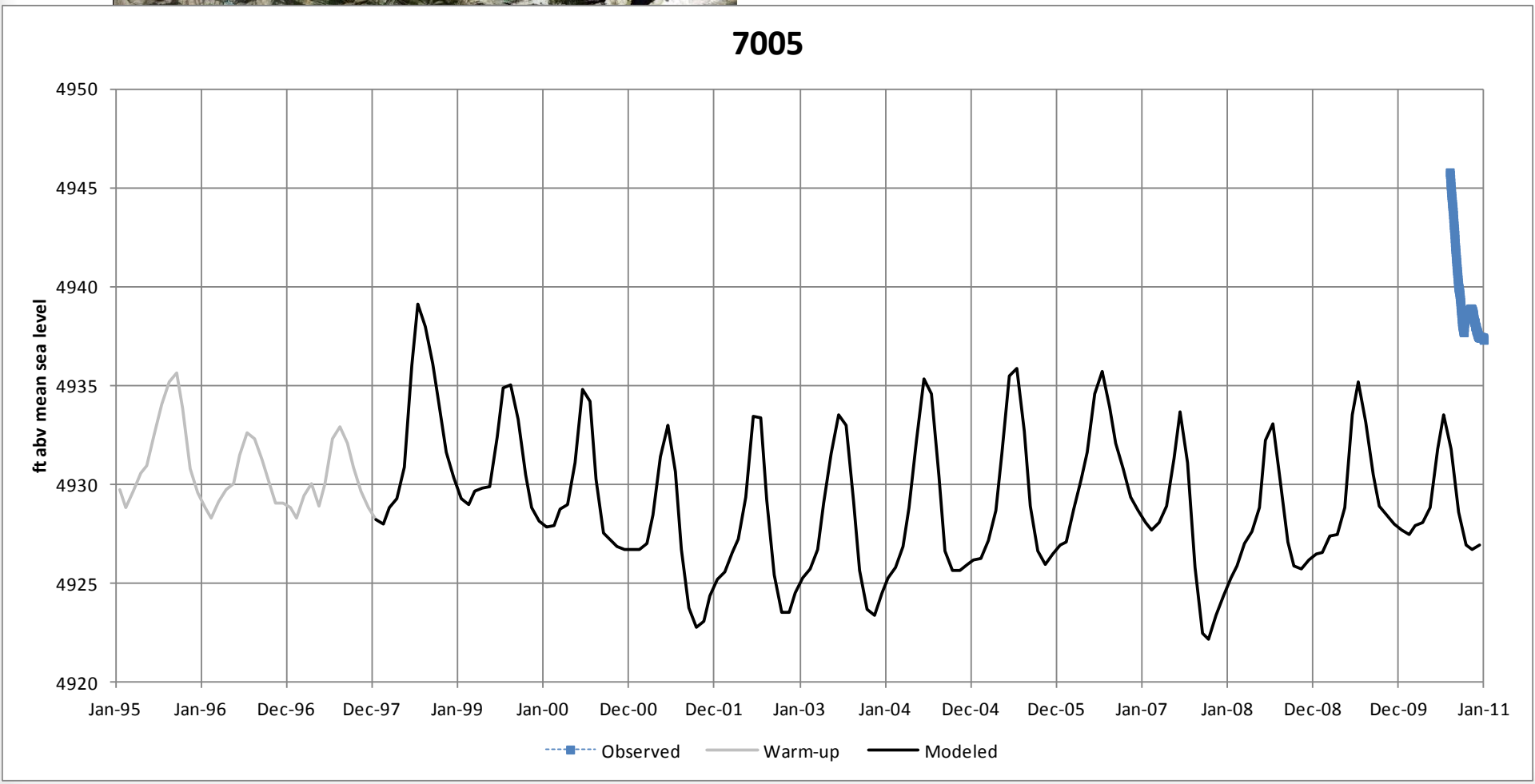

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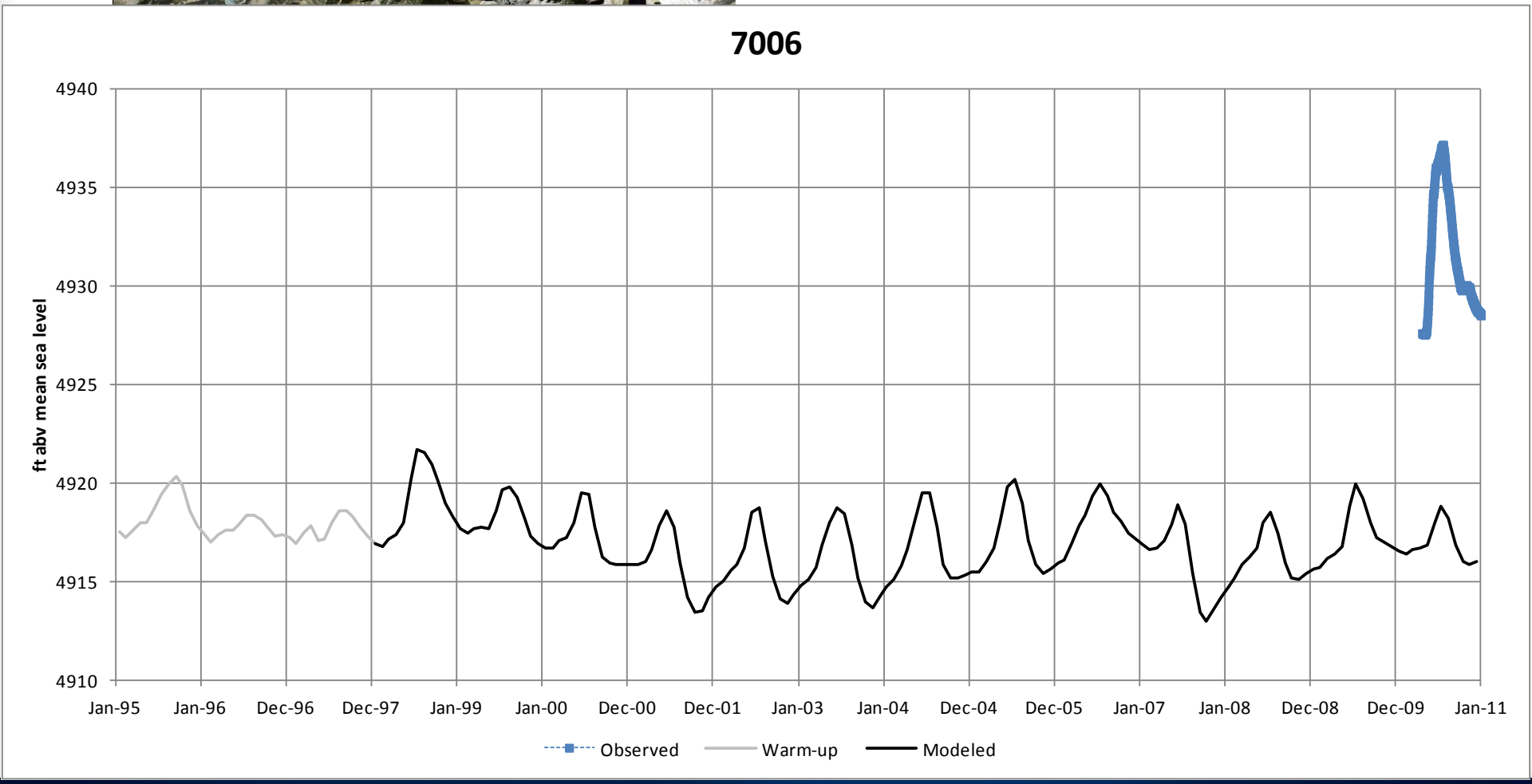

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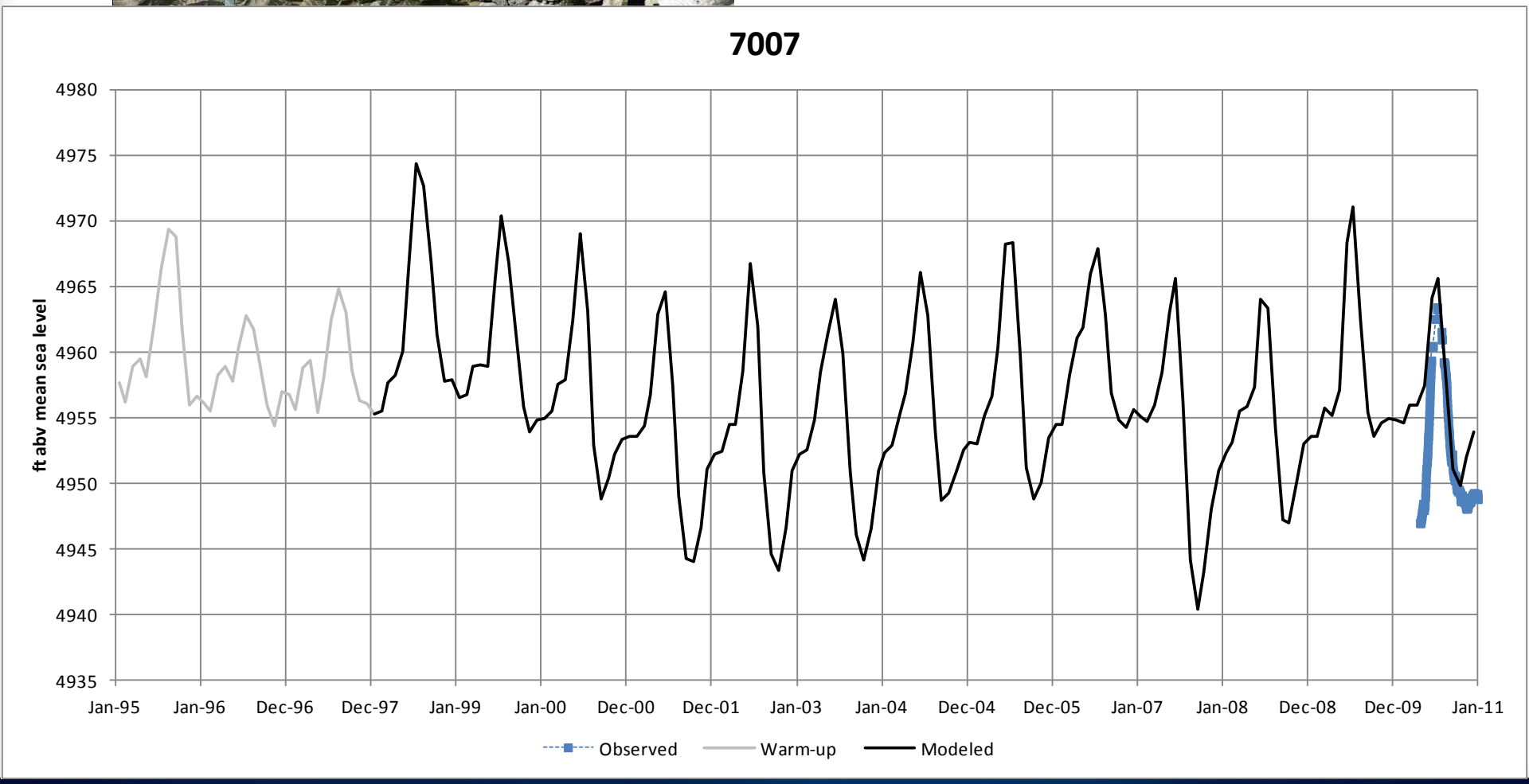

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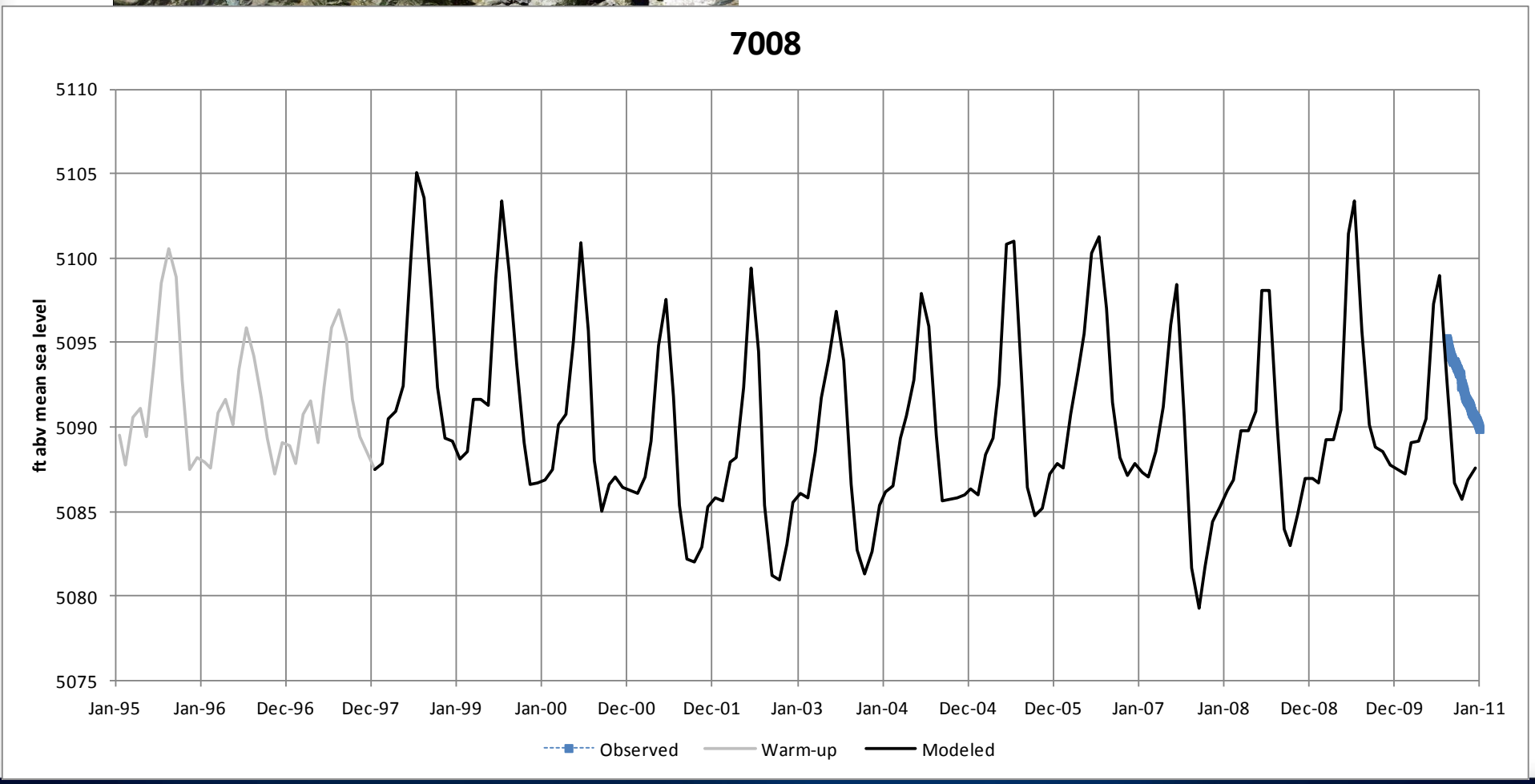

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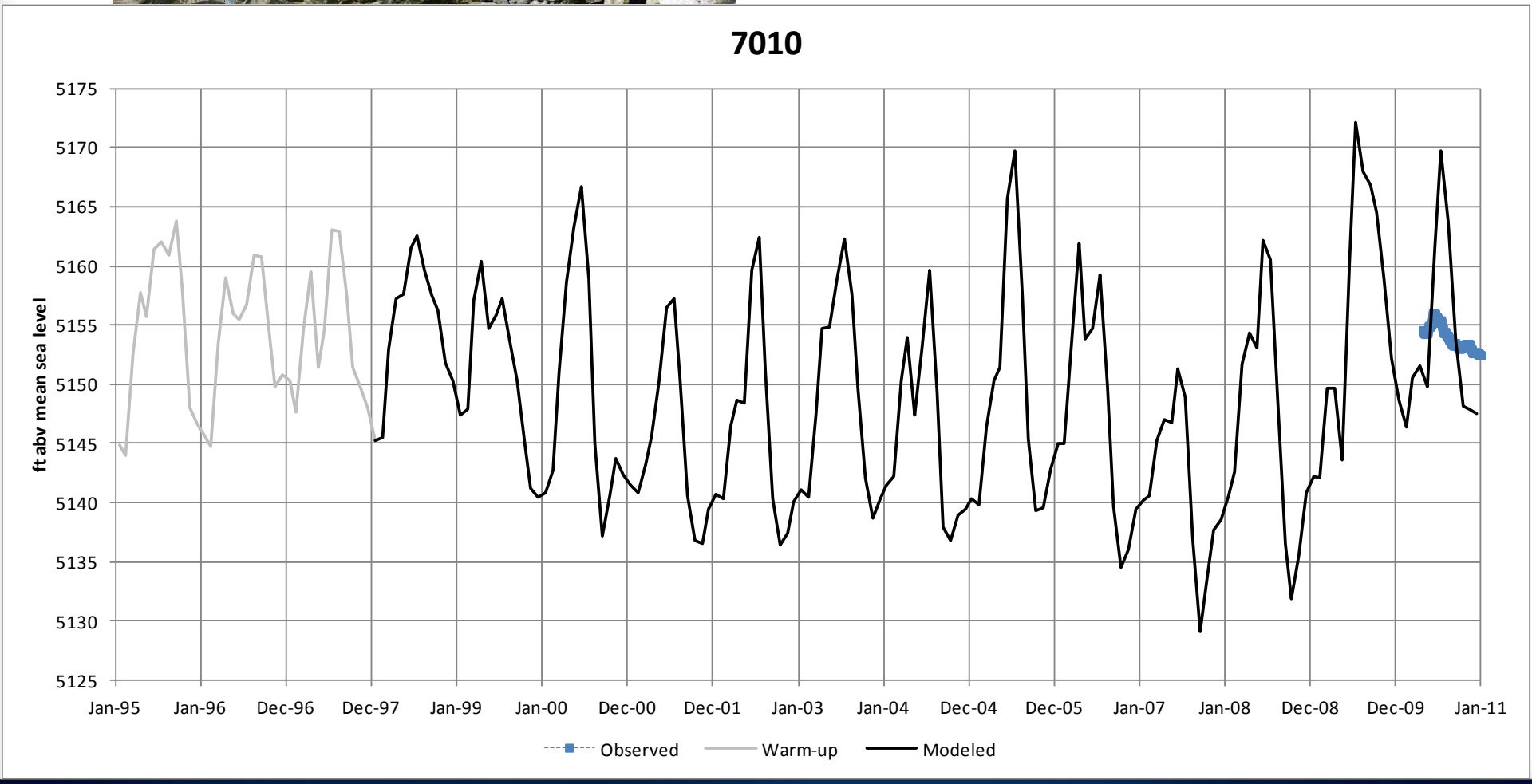

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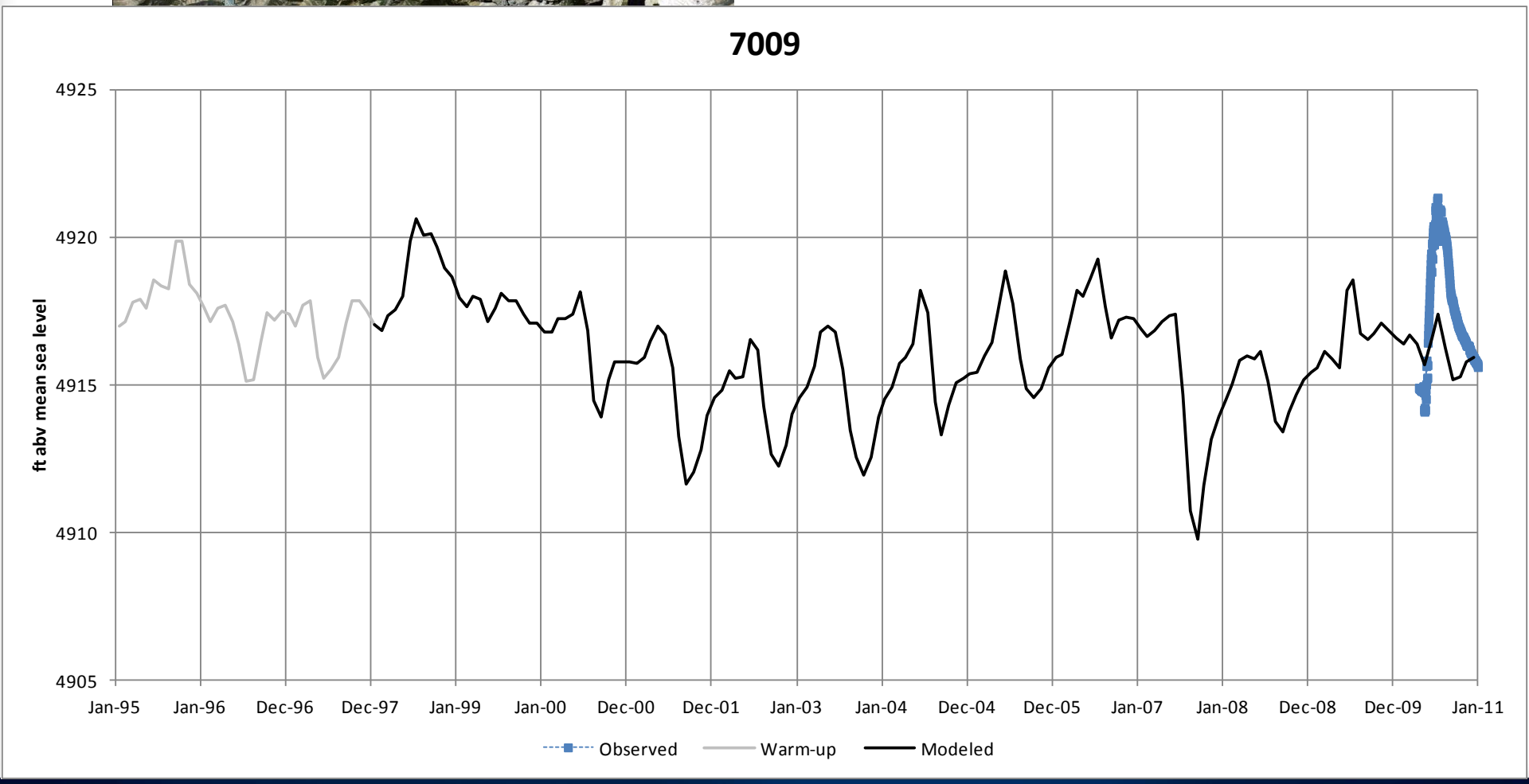
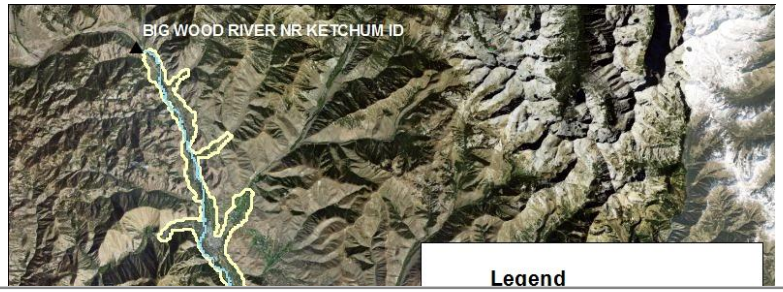
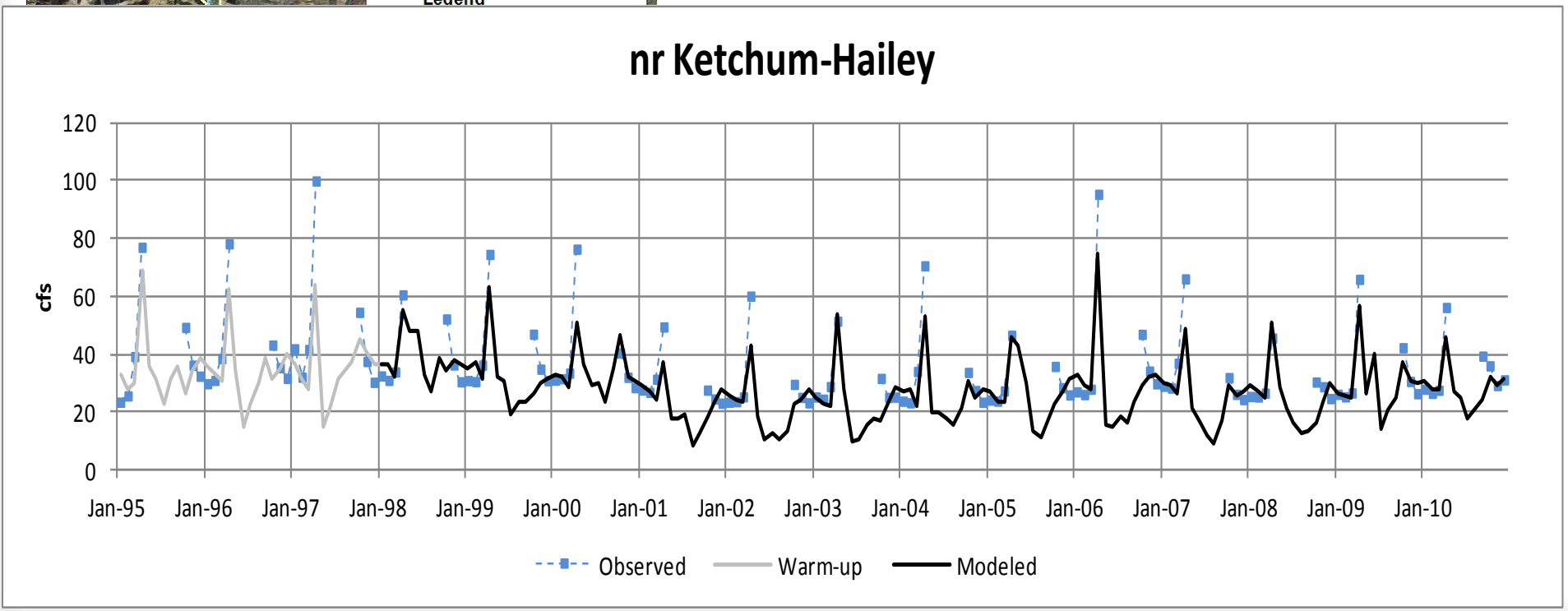


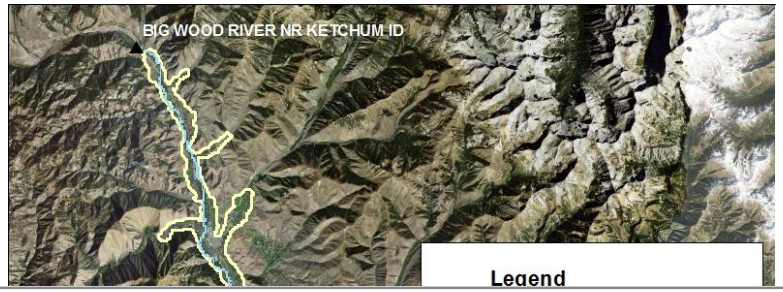
River Gains and Losses



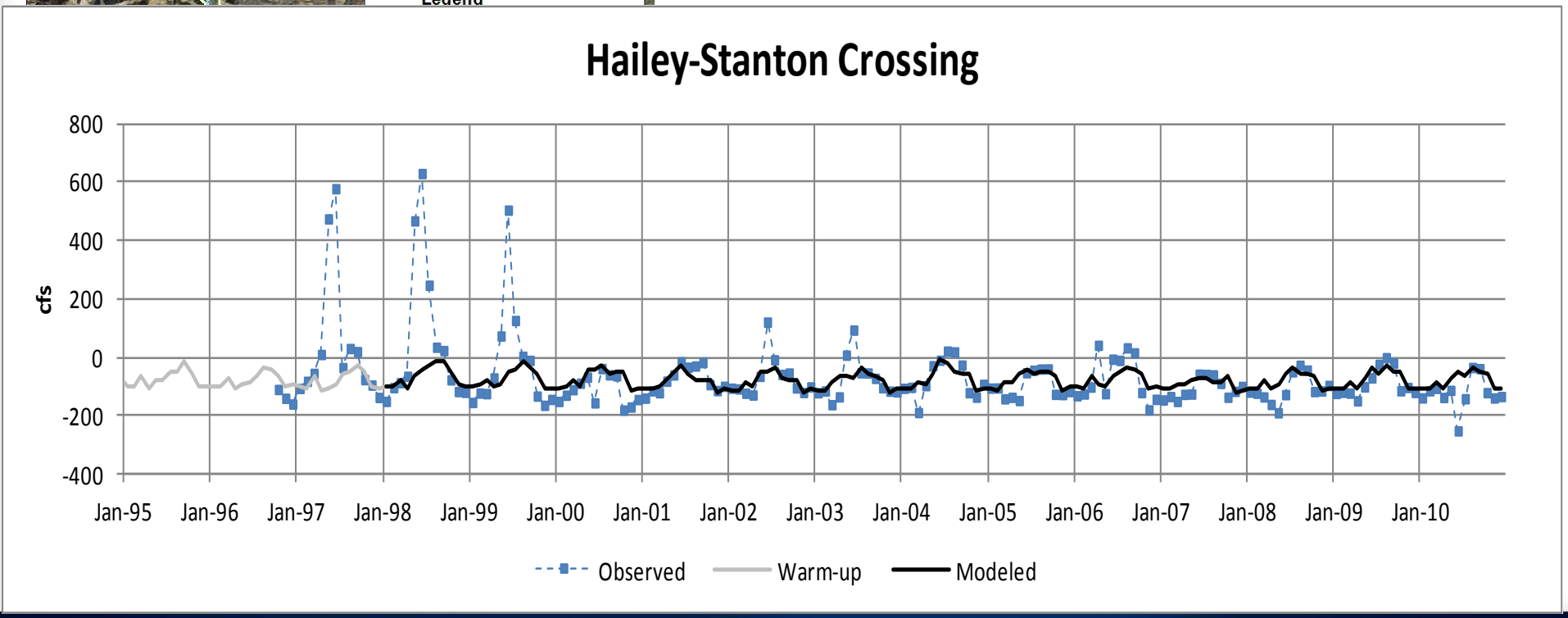
- Transient Gains
  - **Nr Ketchum – Hailey**



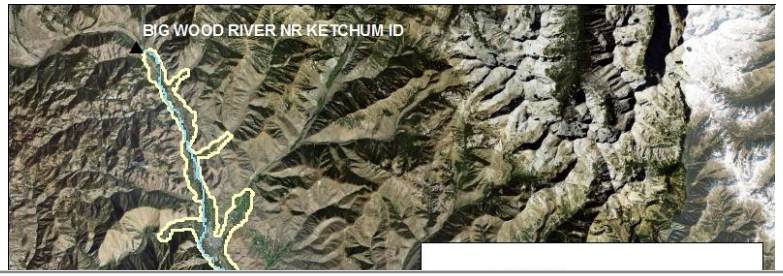
River Gains and Losses



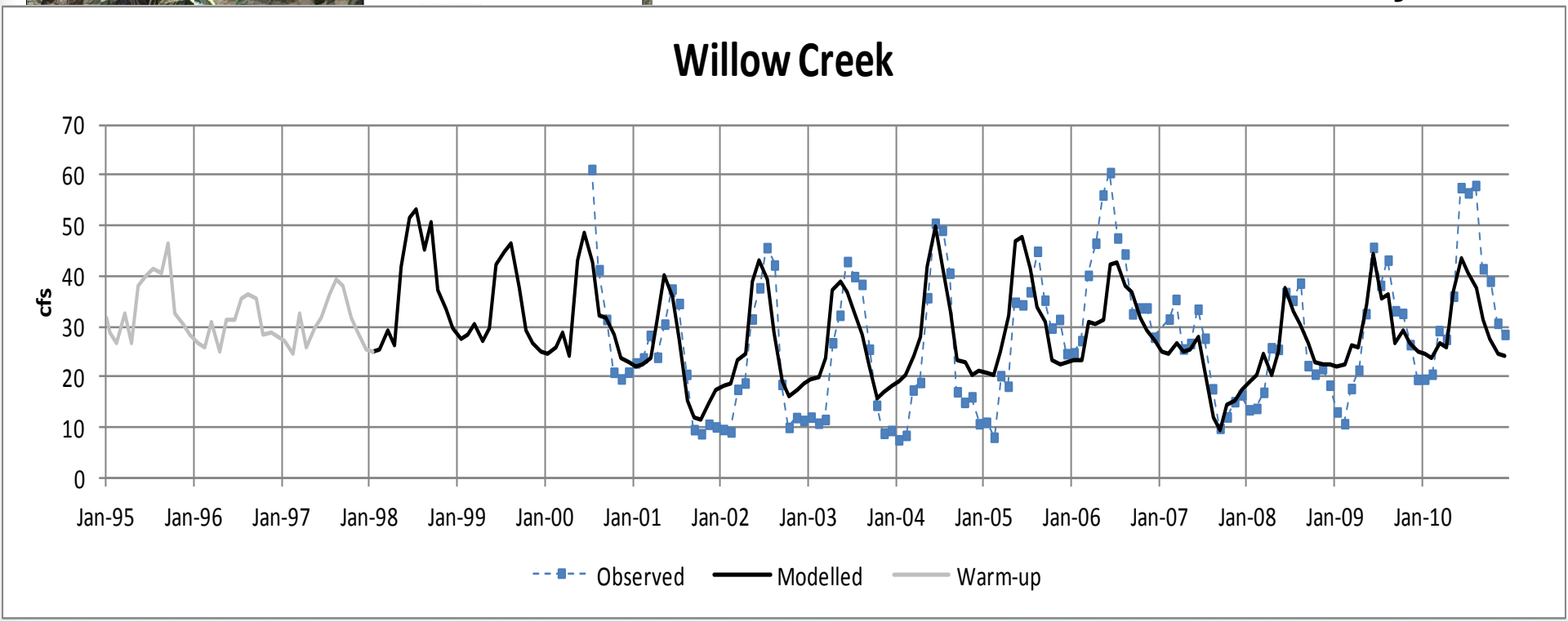
- Transient Gains
  - Nr Ketchum – Hailey



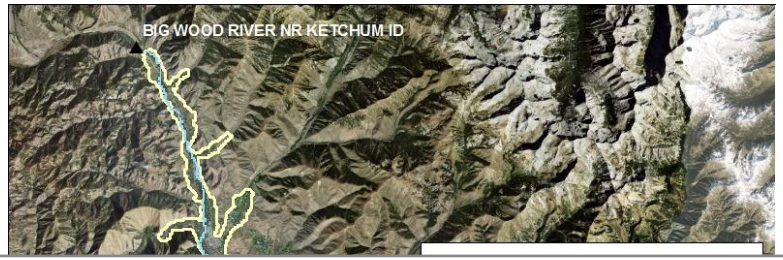
River Gains and Losses



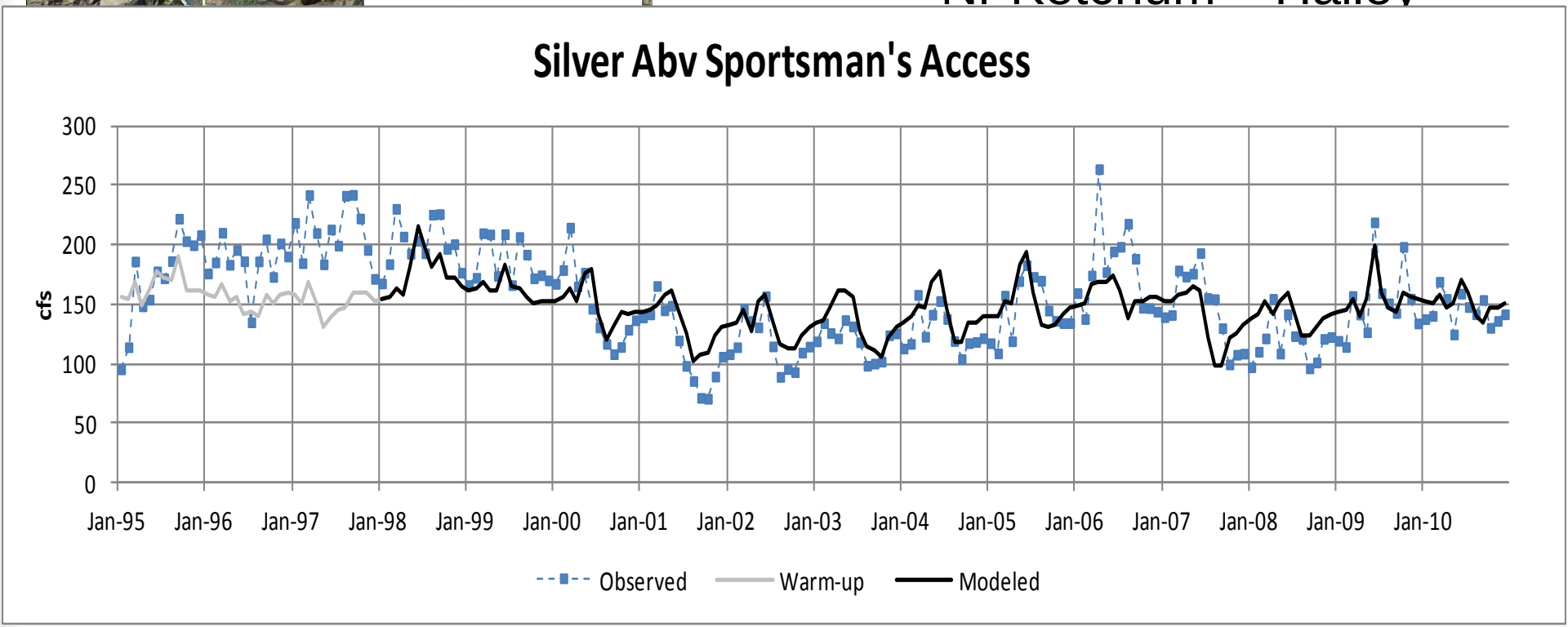
- Transient Gains
  - Nr Ketchum – Hailey



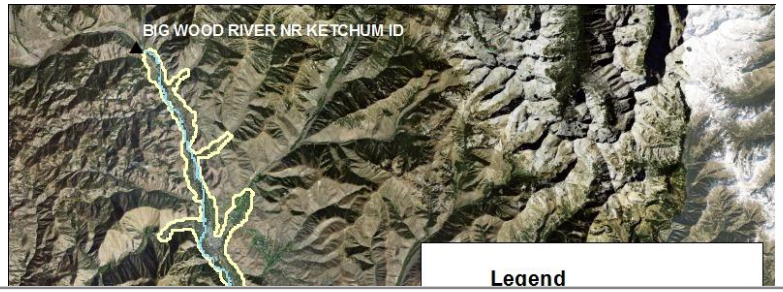
River Gains and Losses



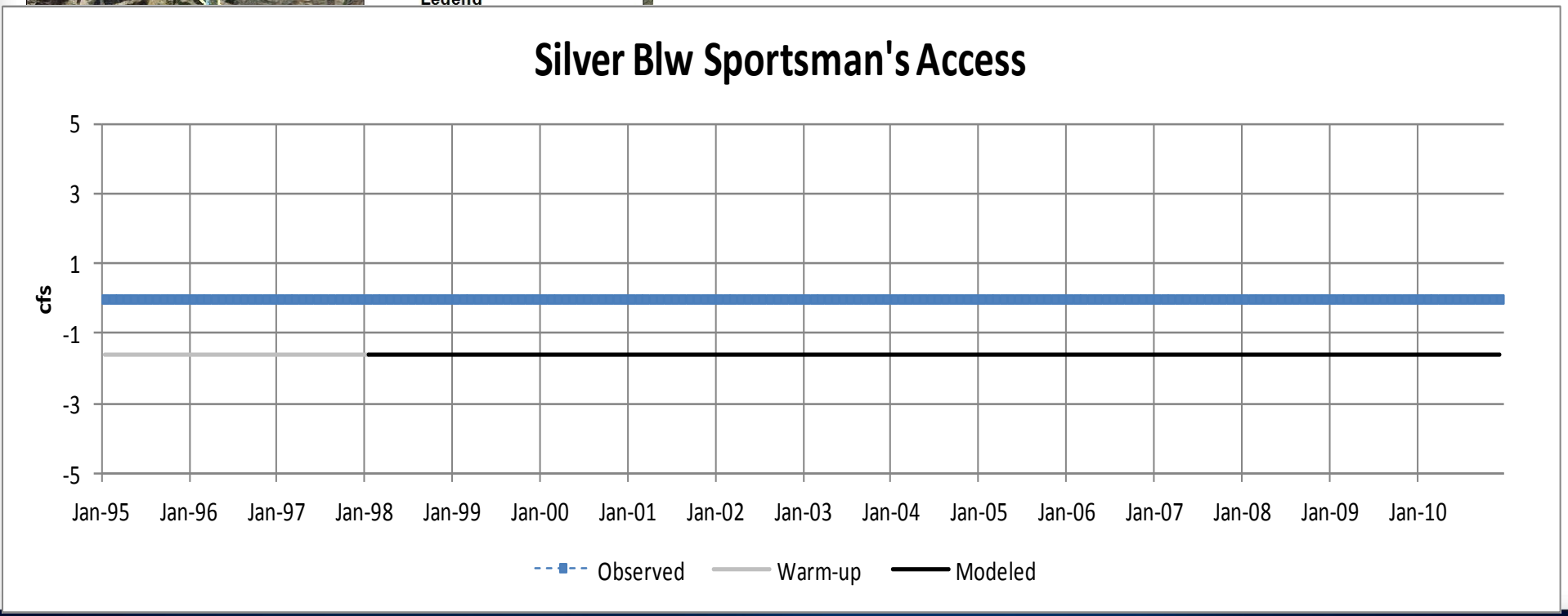
- Transient Gains
  - Nr Ketchum – Hailey



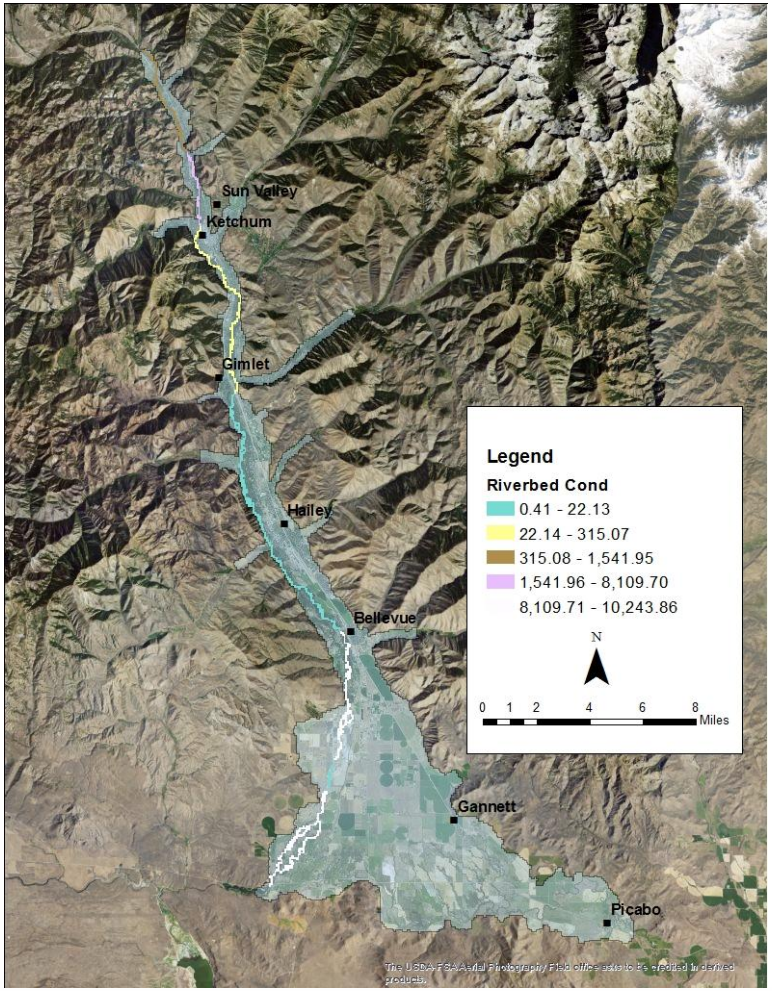
River Gains and Losses



- Transient Gains
  - Nr Ketchum – Hailey

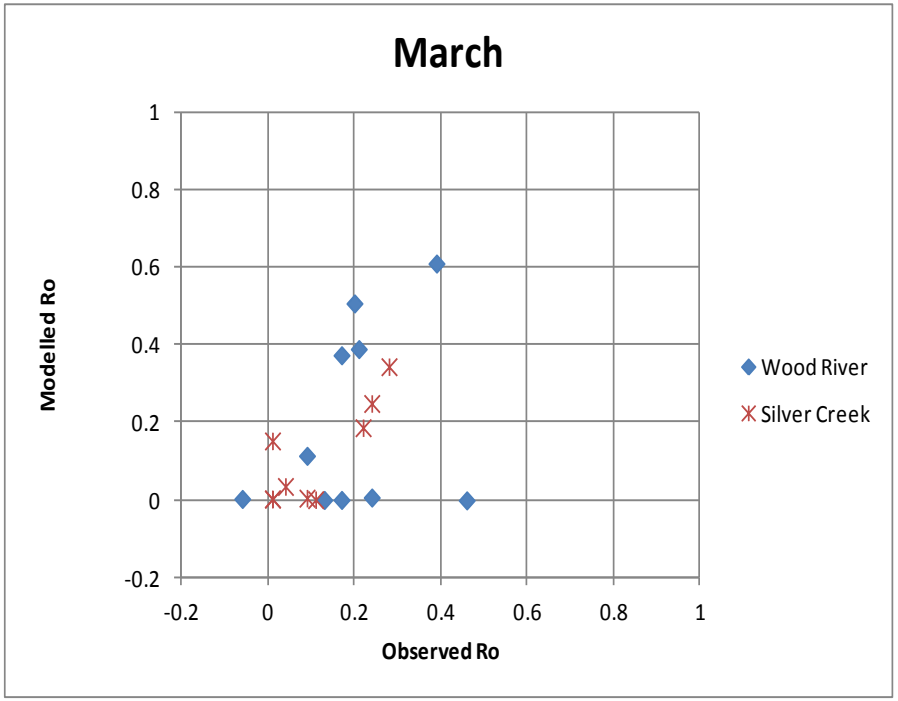


Riverbed Conductance



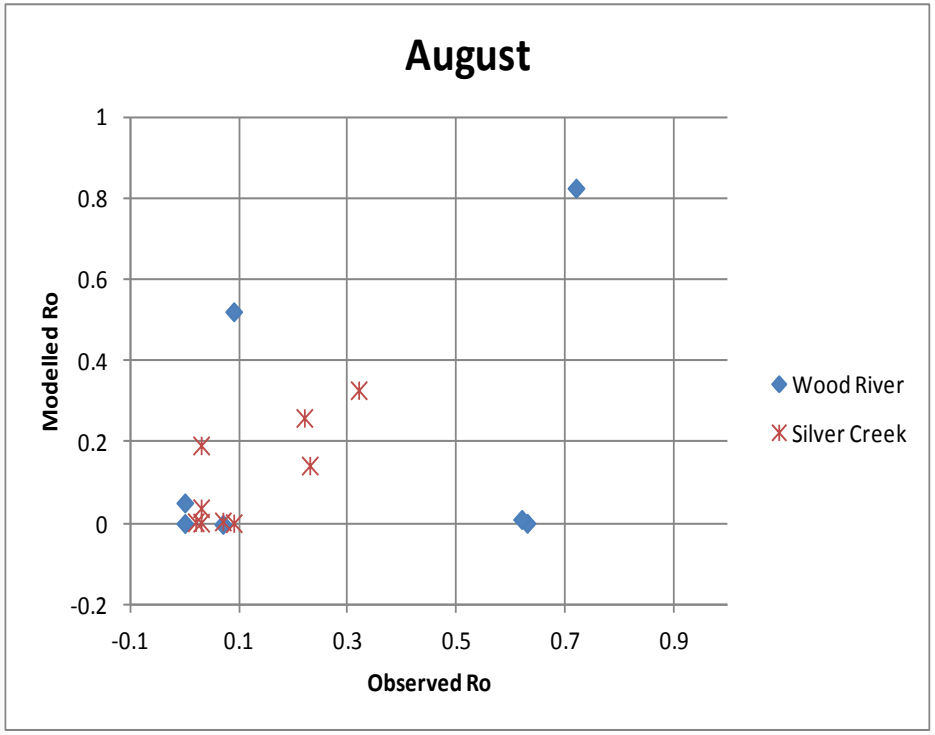
- Riverbed conductance in M^2/d
- Wood River

Sub-reach Targets



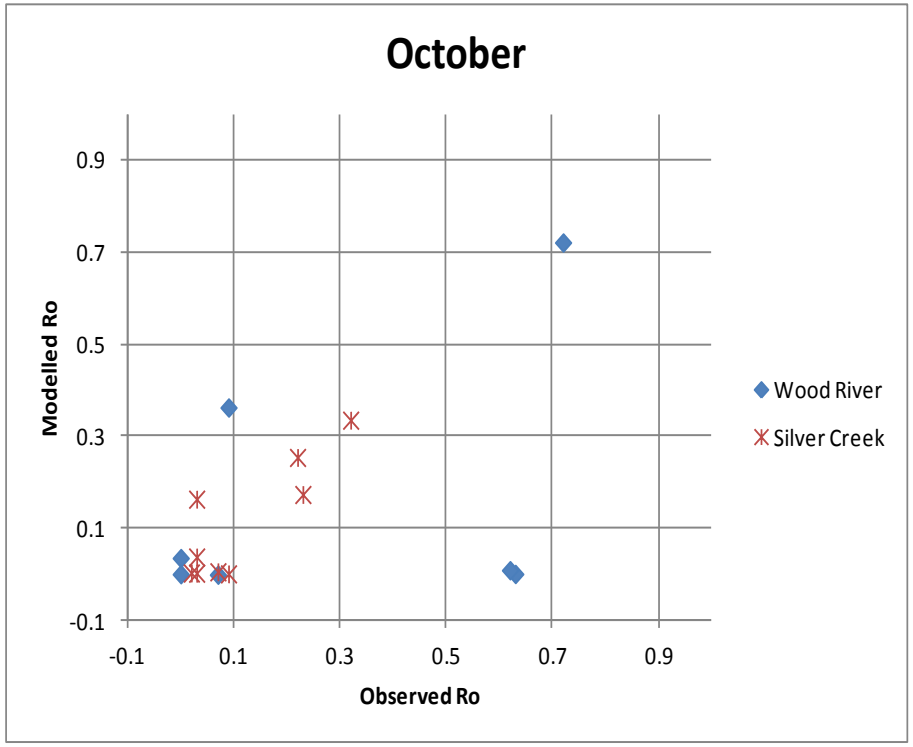
- March 2013 seepage run
- Match ratios to larger reach

Sub-reach Targets



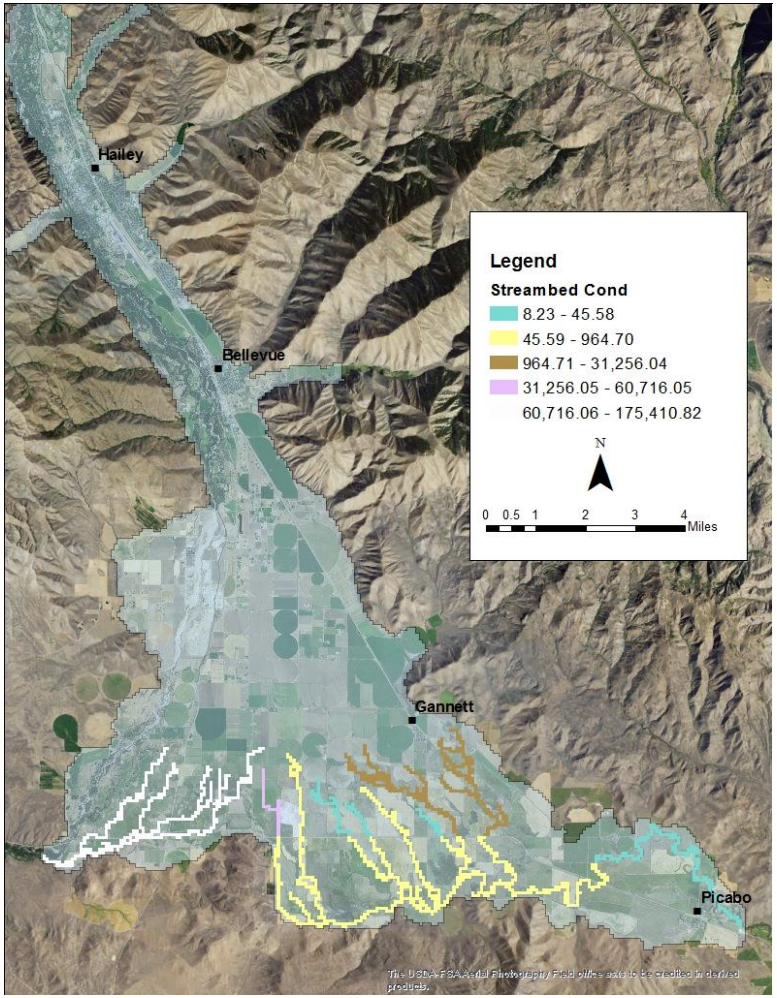
- August 2012 seepage run
- Match ratios to larger reach
- Flows for nr Ketchum to Hailey are unusual
- Seepage run results removed for nr Ketchum to Hailey

Sub-reach Targets



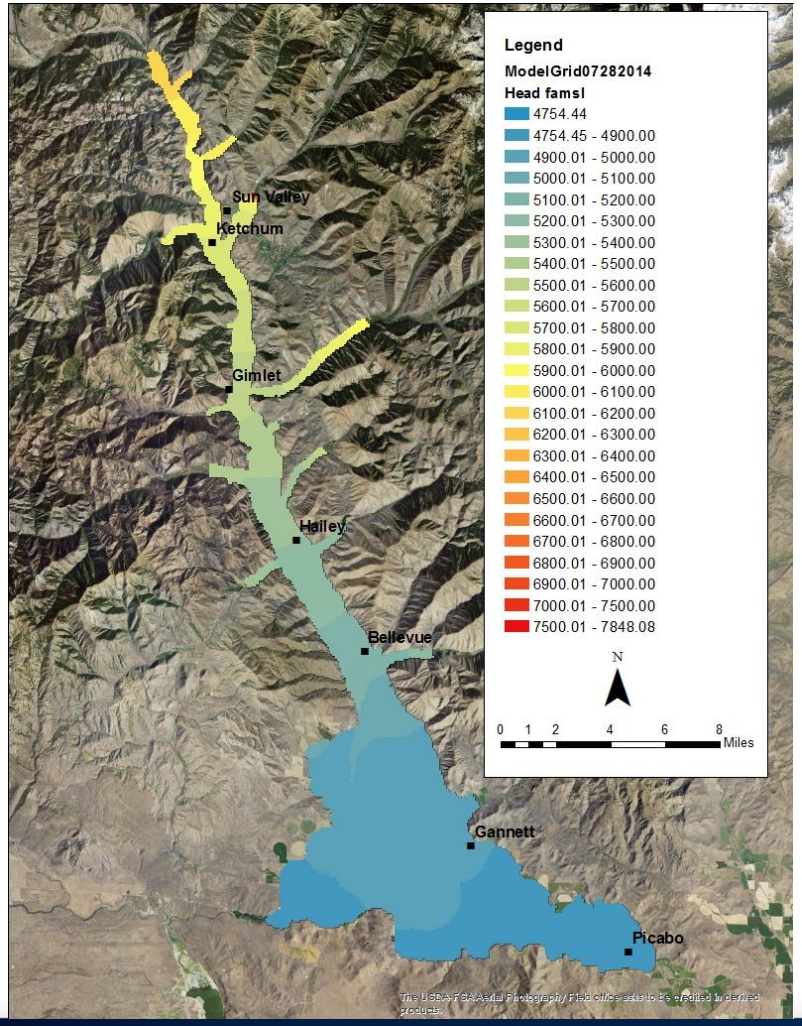
- October 2012 seepage run
- Match ratios to larger reach

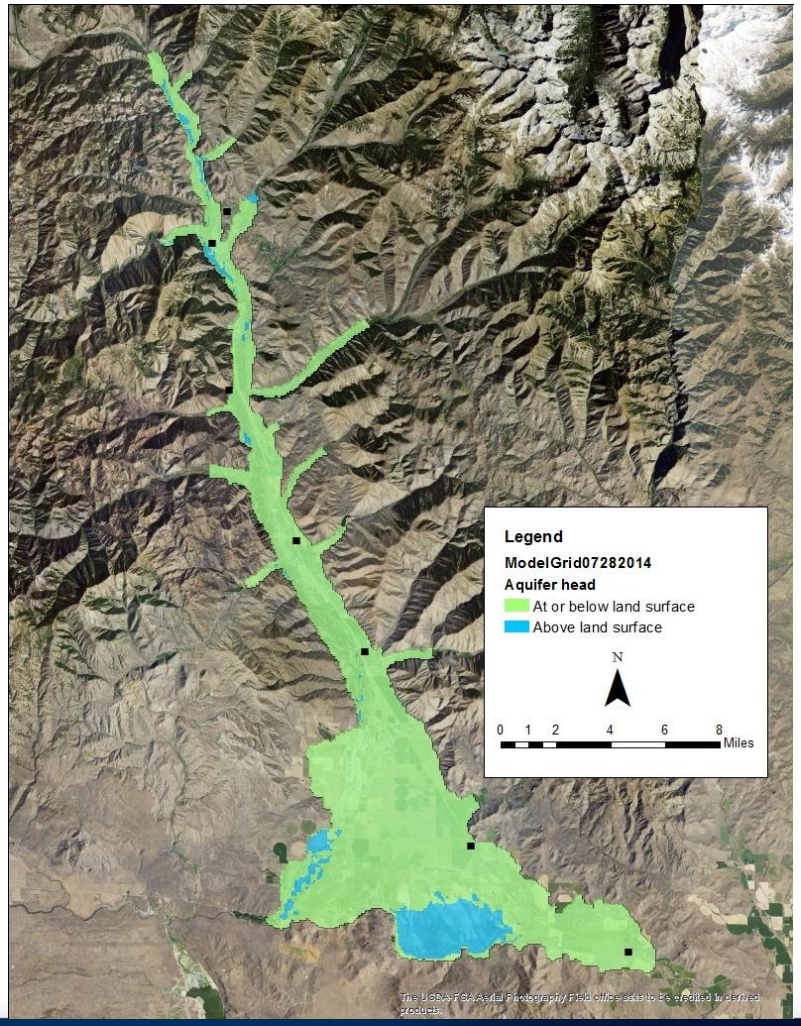
Streambed Conductance



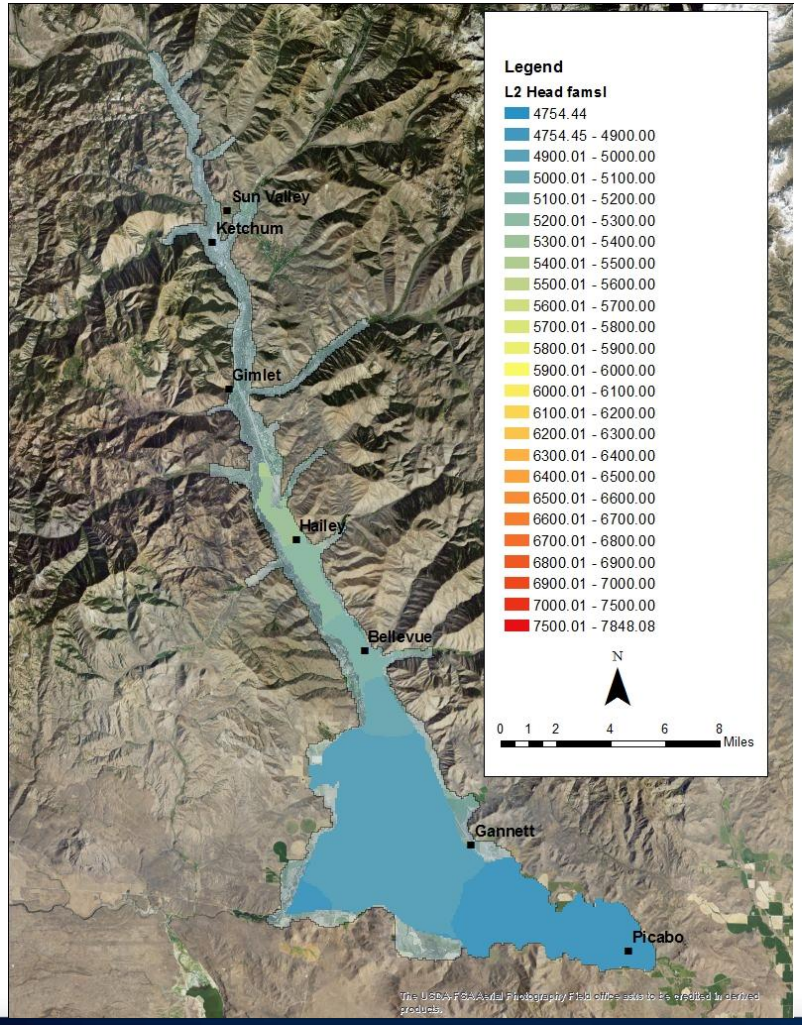
- Riverbed conductance in M^2/d
- Willow Cr, and Silver Cr

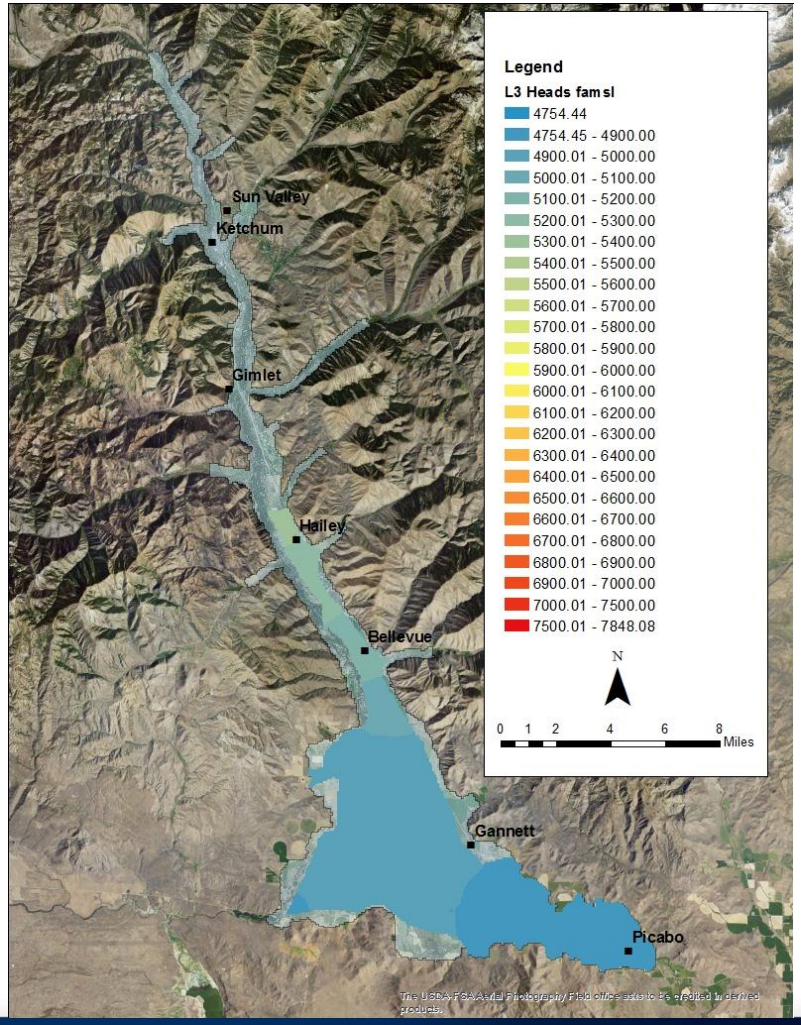
Layer 1 Aquifer head (famsl)





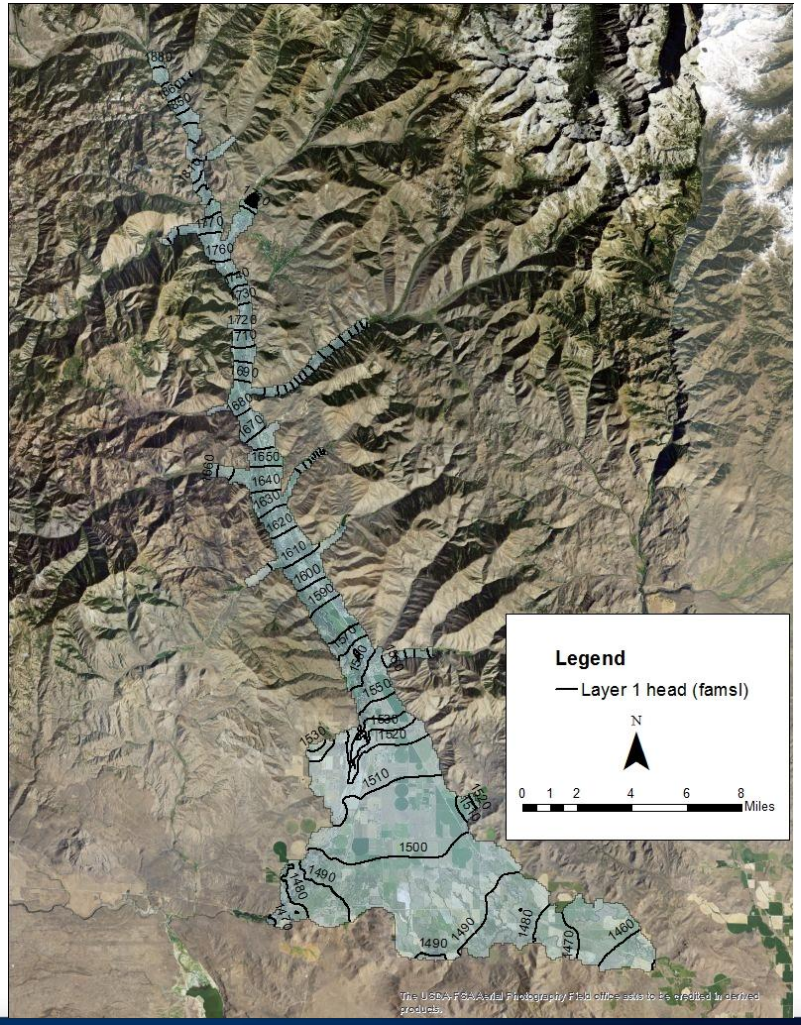
Layer 2 & 3 head (famsl)



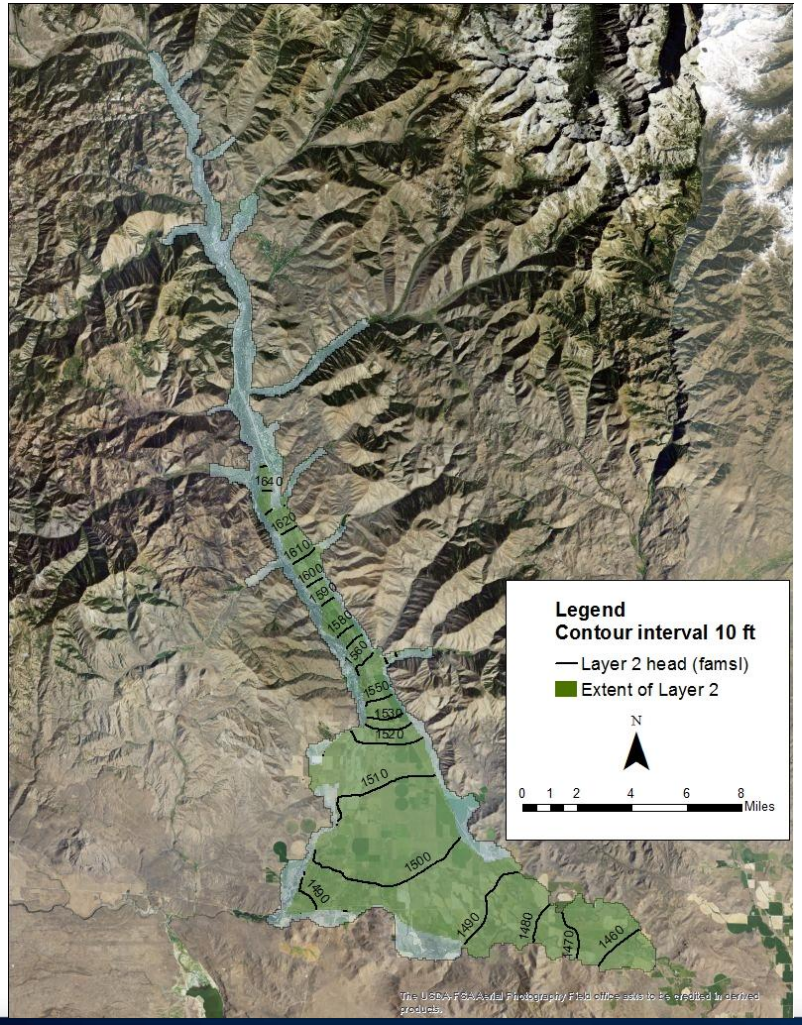


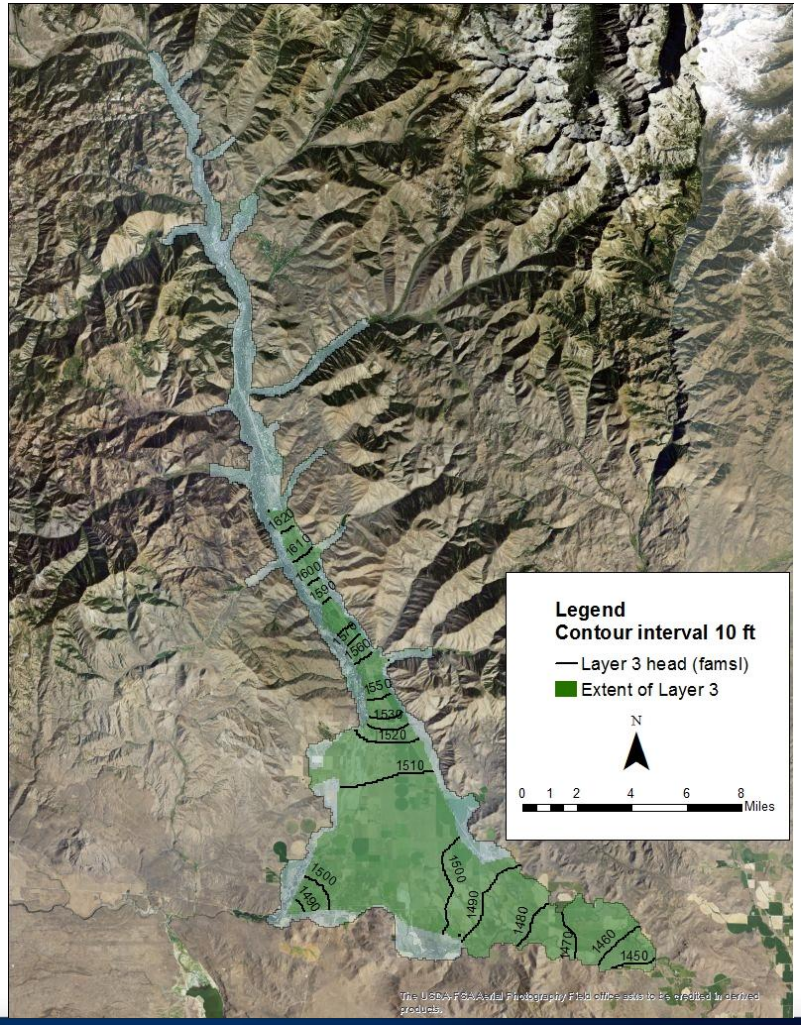
Layer 1 head (famsl)

- Once more with contour lines
- Contour interval 10 ft
- Steady state layer 1



Layer 2 & 3 head (famsl)

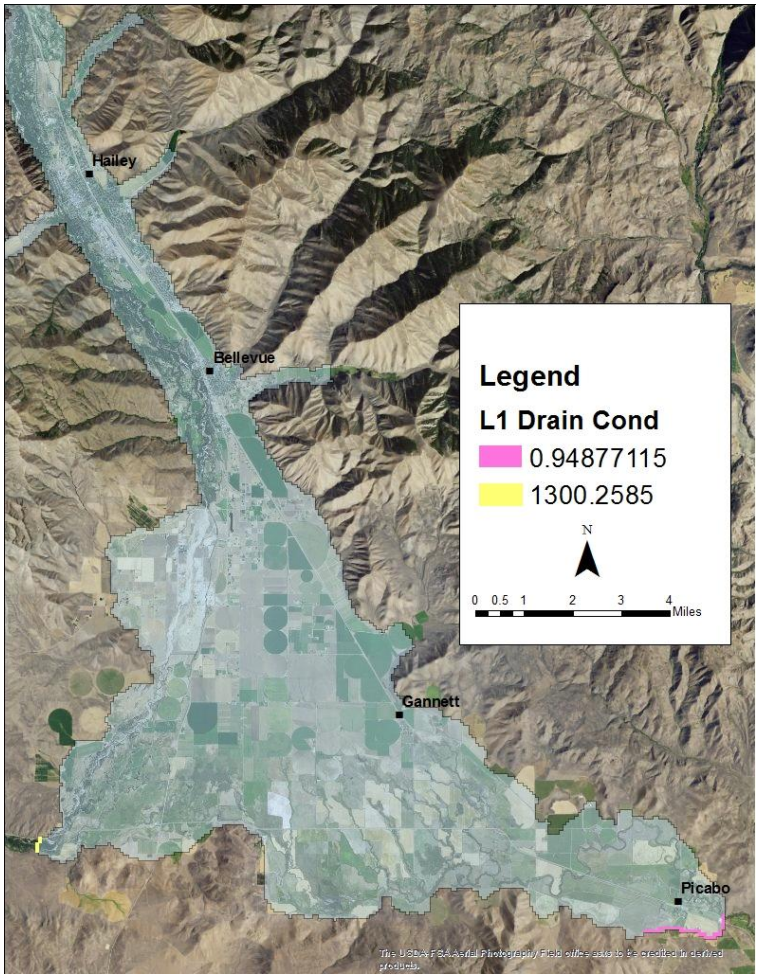




Subsurface Discharge From Model

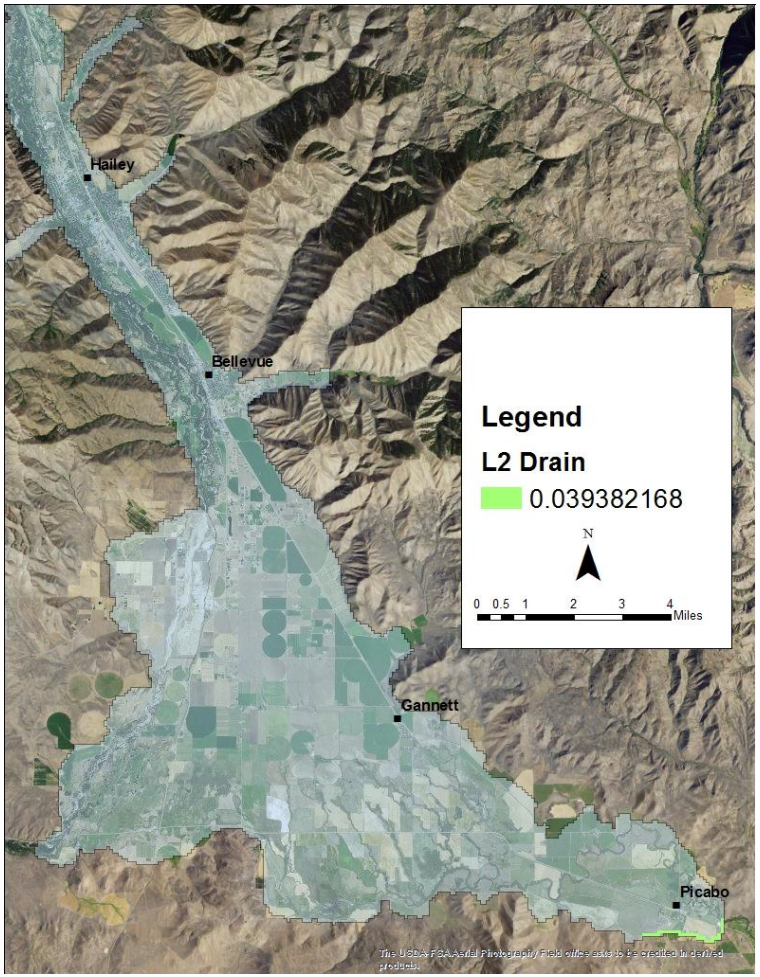
- Weight on these observations is low
- Stanton Crossing
  - Estimated ~ Negligible – 300 ac-f/yr
    - 0 - 0.41 cfs
    - Modeled = 0.41 cfs
- Silver Cr underflow
  - Estimated ~ 4,000 – 53,000 ac-f/yr
    - 5.5 – 73 cfs
    - Modeled = 7.0 cfs

Drain Conductance



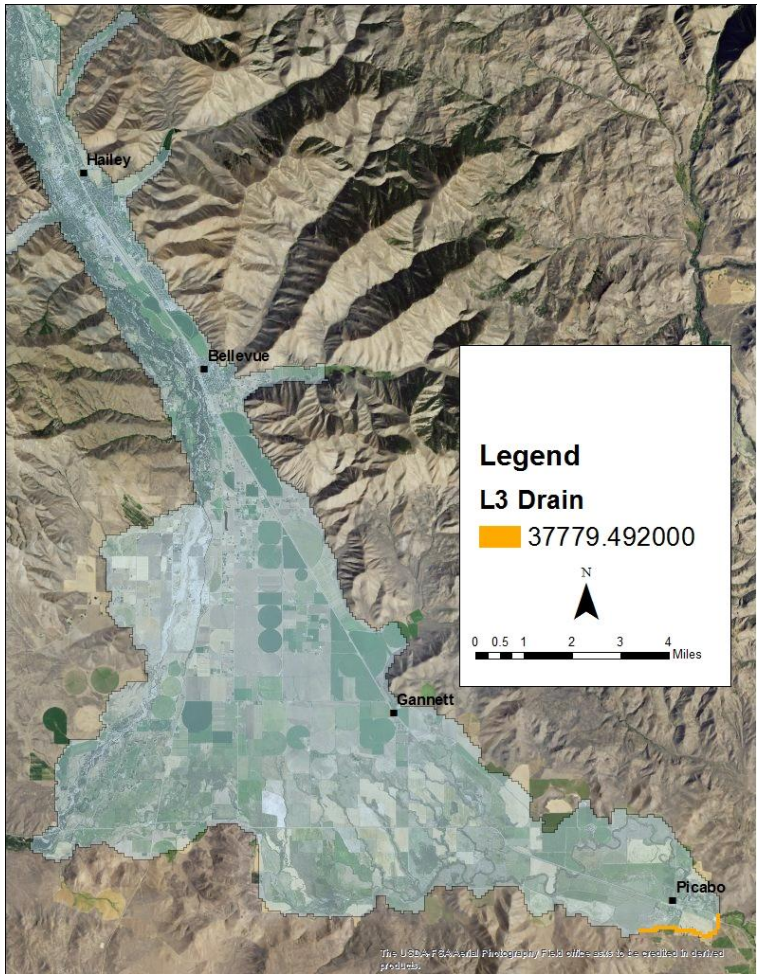
- Drain conductance in M^2/d
- Layer 1
  - Silver Creek
  - Stanton Crossing

Drain Conductance



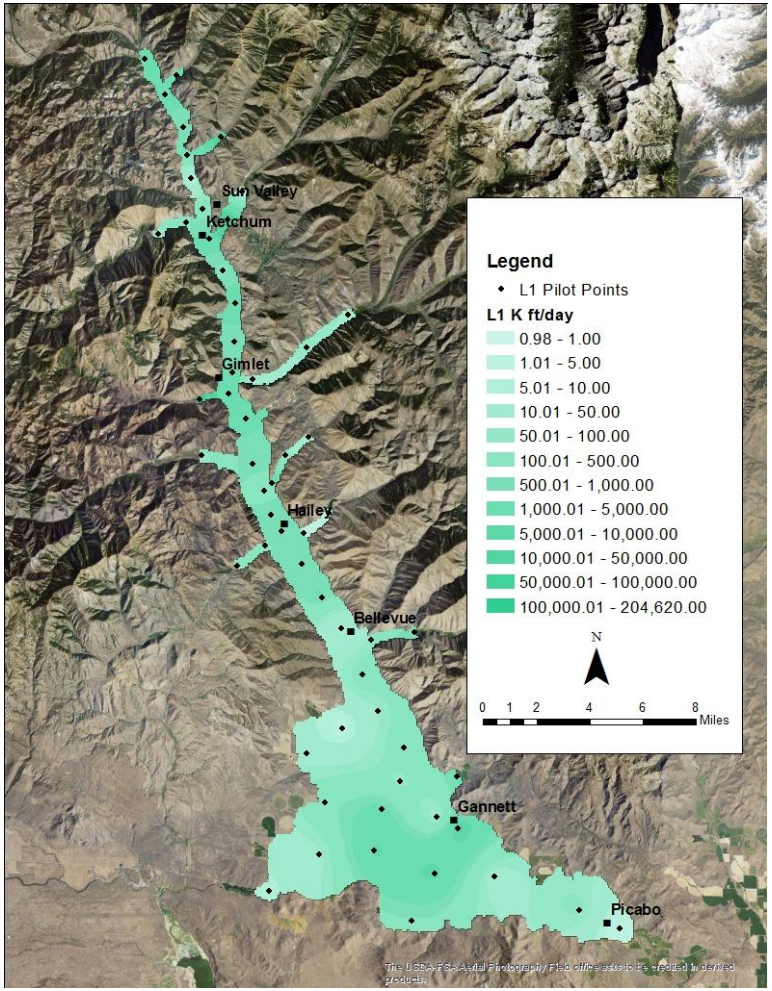
- Drain conductance in M^2/d
- Layer 2
  - Silver Creek

Drain Conductance



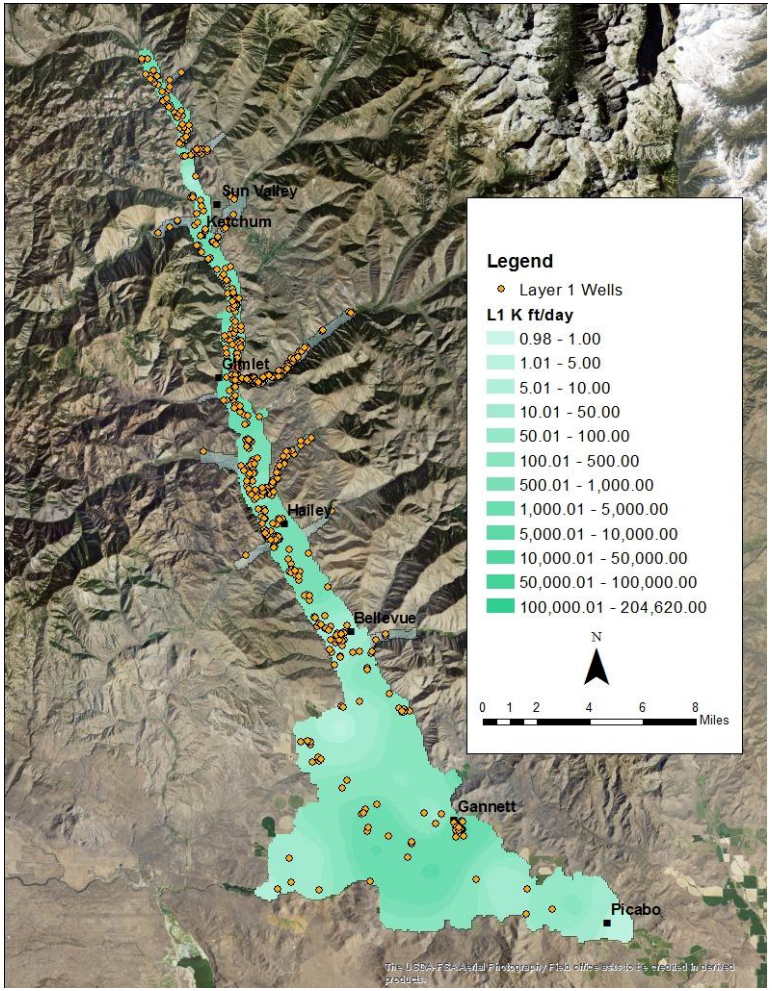
- Drain conductance in M^2/d
- Layer 3
  - Silver Creek

Layer 1 Hydraulic Conductivity



- Layer 1 temporarily modeled as non-time varying transmissivity
- Pilot points can be moved
- Number of pilot points not fixed
- Tributary valleys are in their own zones
  - Contain maximum and minimum values
- In valley and triangle
  - Min = 1.50 ft/day
  - Max = 14,421 ft/day
  - Median = 233.79 ft/day

Layer 1 Hydraulic Conductivity



- Tributary valleys are in their own zones
  - Contain maximum and minimum values
- In valley and triangle
  - Min = 1.50 ft/day
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  - Median = 233.79 ft/day
- 437 wells in Wood River Valley alluvial sediments.

Layer 1 Hydraulic Conductivity

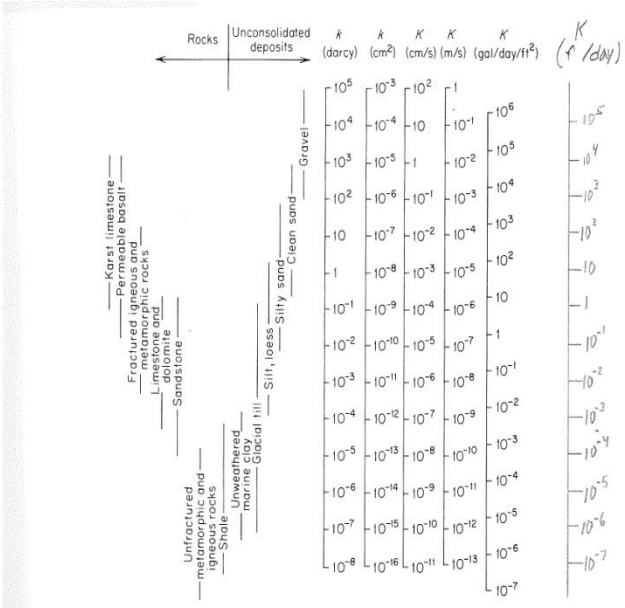

Table 2.3 Conversion Factors for Permeability and Hydraulic Conductivity Units

	Permeability, k*			Hydraulic conductivity, K		
	cm^2	ft^2	darcy	m/s	ft/s	U.S. gal/day/ft²
cm^2	1	1.08×10^{-3}	1.01×10^{8}	9.80×10^{2}	3.22×10^{3}	1.85×10^{9}
ft^2	9.29×10^{2}	1	9.42×10^{10}	9.11×10^{5}	2.99×10^{6}	1.71×10^{12}
darcy	9.87×10^{-9}	1.06×10^{-11}	1	9.66×10^{-6}	3.17×10^{-5}	1.82×10^{1}
m/s	1.02×10^{-3}	1.10×10^{-6}	1.04×10^{5}	1	3.28	2.12×10^{6}
ft/s	3.11×10^{-4}	3.35×10^{-7}	3.15×10^{4}	3.05×10^{-1}	1	6.46×10^{5}
U.S. gal/day/ft²	5.42×10^{-10}	5.83×10^{-13}	5.49×10^{-2}	4.72×10^{-7}	1.55×10^{-6}	1

- Tributary valleys are in their own zones
  - Contain maximum and minimum values
- In valley and triangle
  - Min = 1.50 ft/day
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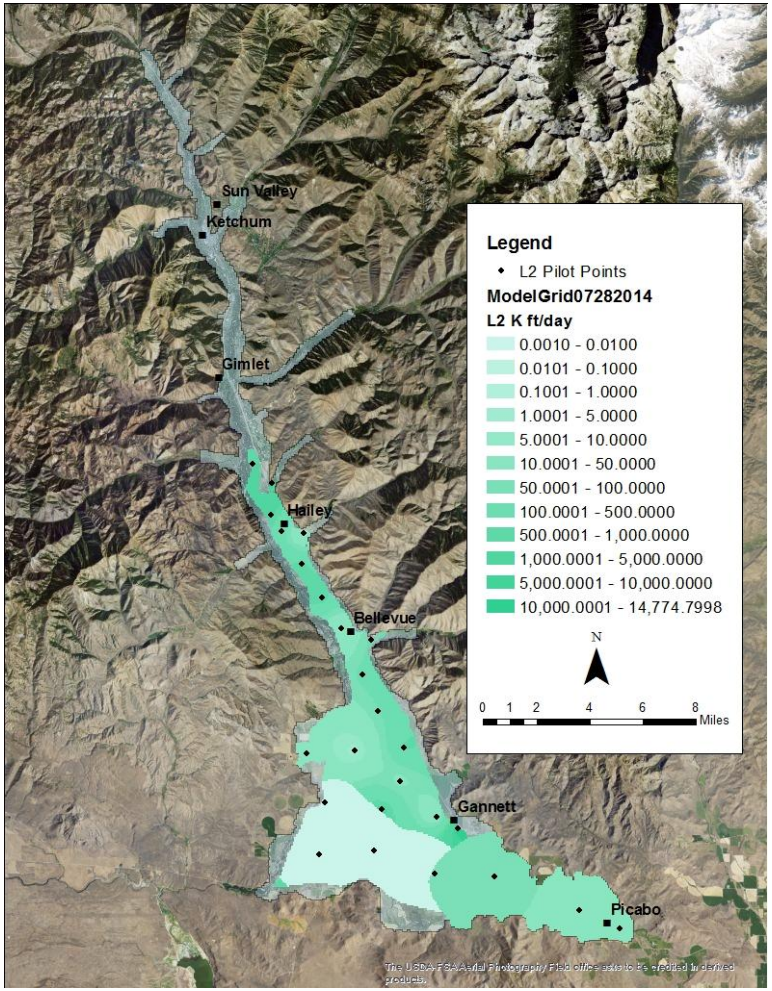
  - Median = 233.79 ft/day
- 437 wells in Wood River alluvial sediments.

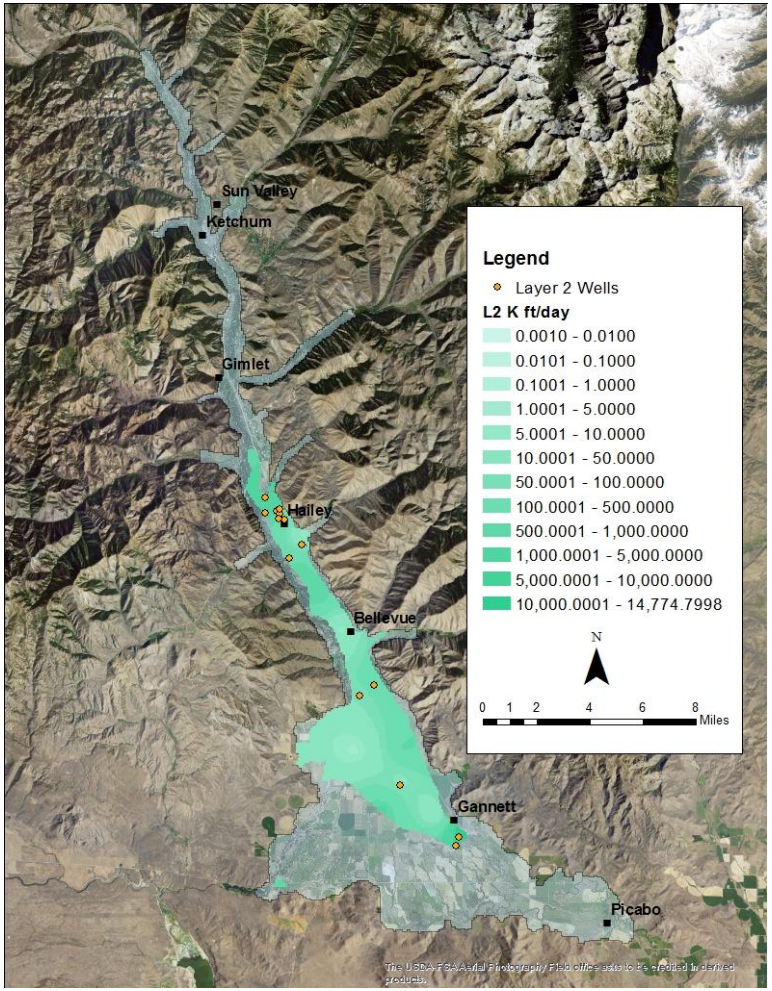
Groundwater, Freeze & Cherry, 1979

Layer 2 Hydraulic Conductivity



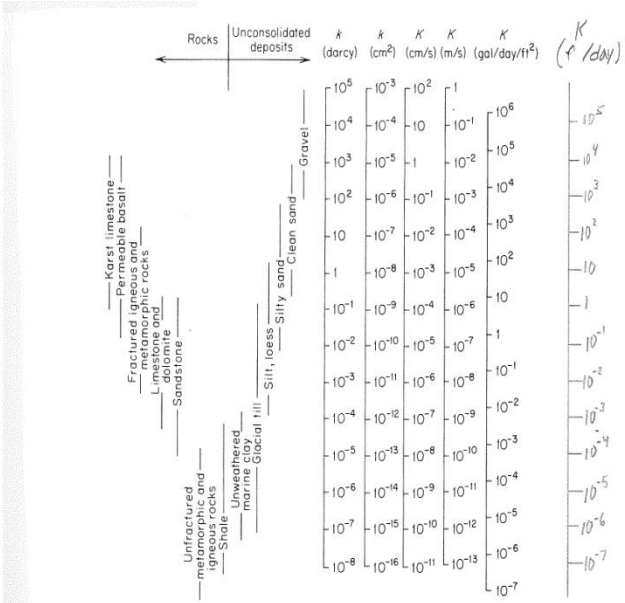
- Layer 2 modeled as confined
- Includes basalt in east
- Includes confining layer
- Sand and gravel aquifer in valley and triangle
  - Min = 3.36 ft/day
  - Max = 14,775 ft/day
  - Median = 91.0 ft/day

Layer 2 Hydraulic Conductivity



- Layer 2 modeled as confined
- Includes basalt in east
- Includes confining layer
- Sand and gravel aquifer in valley and triangle
  - Min = 3.36 ft/day
  - Max = 14,775 ft/day
  - Median = 91.0 ft/day
- 14 wells completed in layer 2 sand and gravel aquifer

Layer 2 Hydraulic Conductivity



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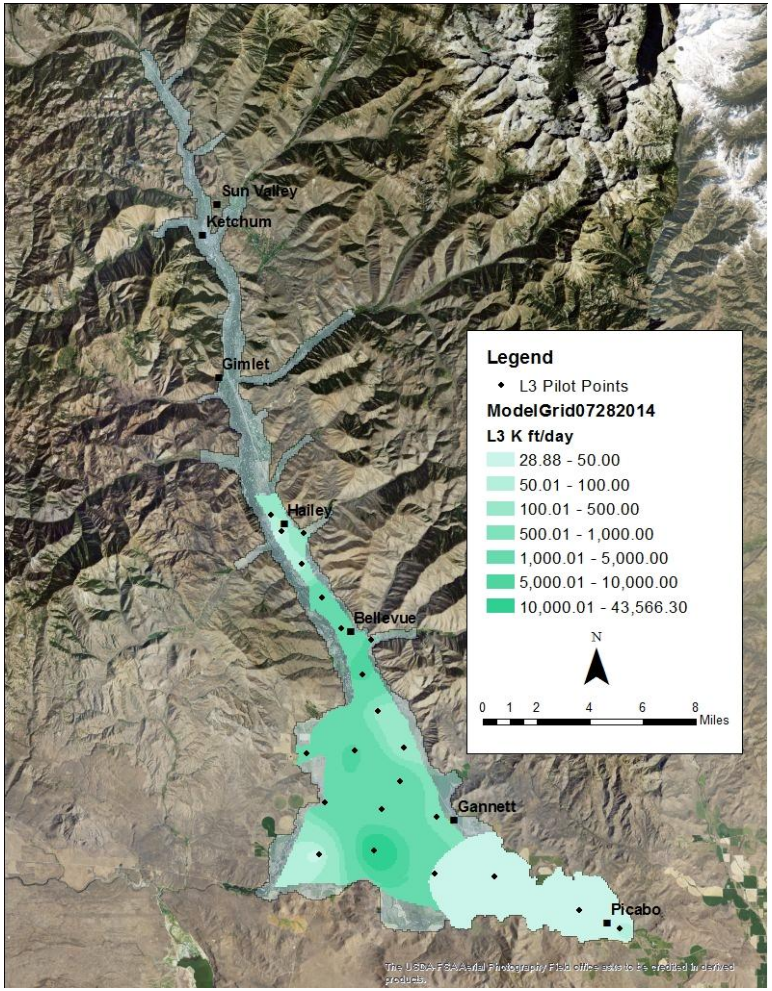
Groundwater Freeze & Cherry, 1979

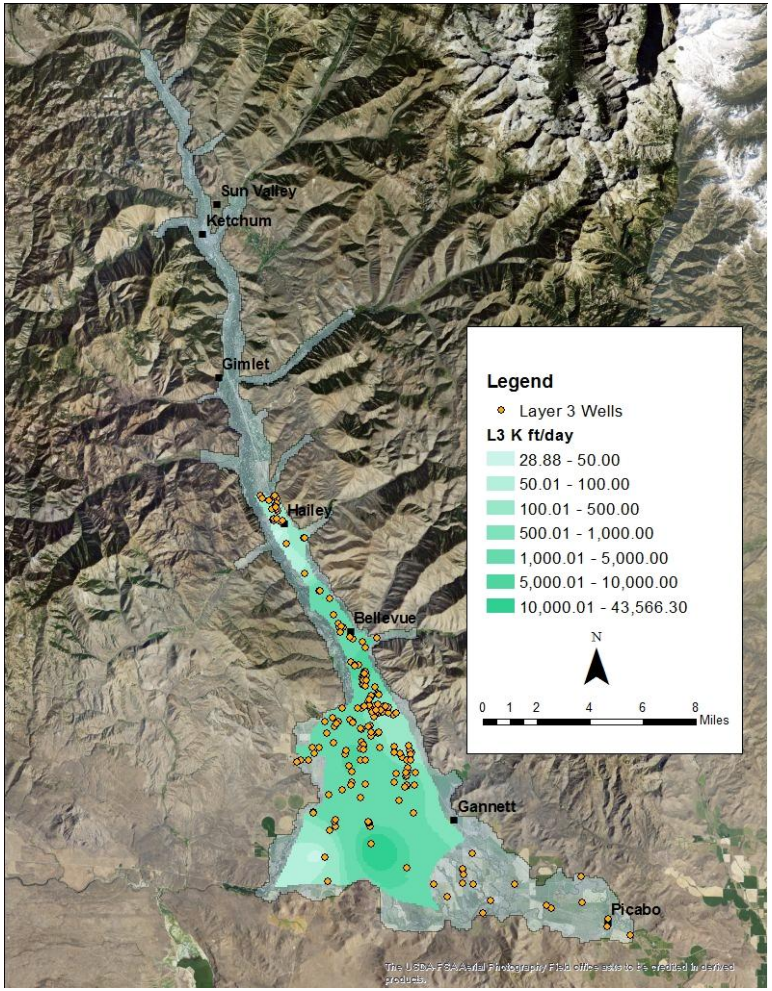
- Low hydraulic conductivity in confining layer
  - Min = 0.000985 ft/day
  - Max = 0.001002 ft/day
- Basalt intermediate value
  - Min = 38 ft/day
  - Max = 55 ft/day
- In valley and triangle
  - Min = 3.36 ft/day
  - Max = 14,775 ft/day
  - Median = 91.0 ft/day
- 14 wells in Wood River alluvial sediments.

Layer 3 Hydraulic Conductivity



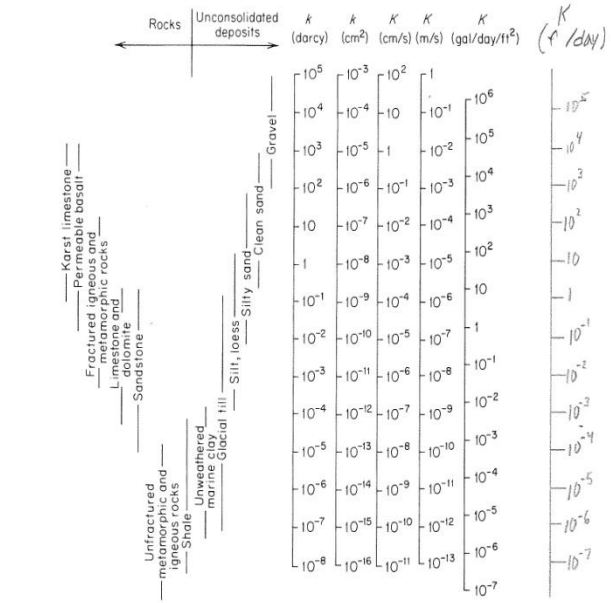
- Layer 3 modeled as confined
- Basalt
  - Min = 29 ft/day
  - Max = 51 ft/day
- Includes basalt in east
- Sand and gravel aquifer in valley and triangle
  - Min = 33.1 ft/day
  - Max = 43,566 ft/day
  - Median = 2,155 ft/day

Layer 3 Hydraulic Conductivity



- Sand and gravel aquifer in valley and triangle
  - Min = 33.1 ft/day
  - Max = 43,566 ft/day
  - Median = 2,155 ft/day
- 175 wells in layer 3 alluvial aquifer.

Layer 3 Hydraulic Conductivity



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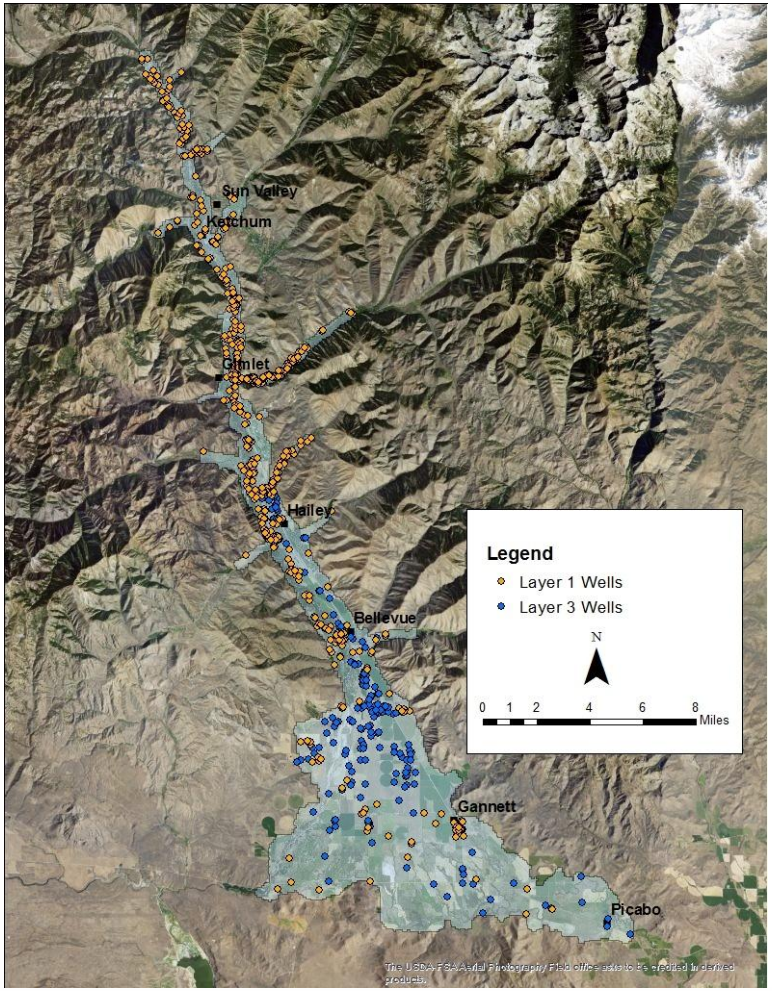
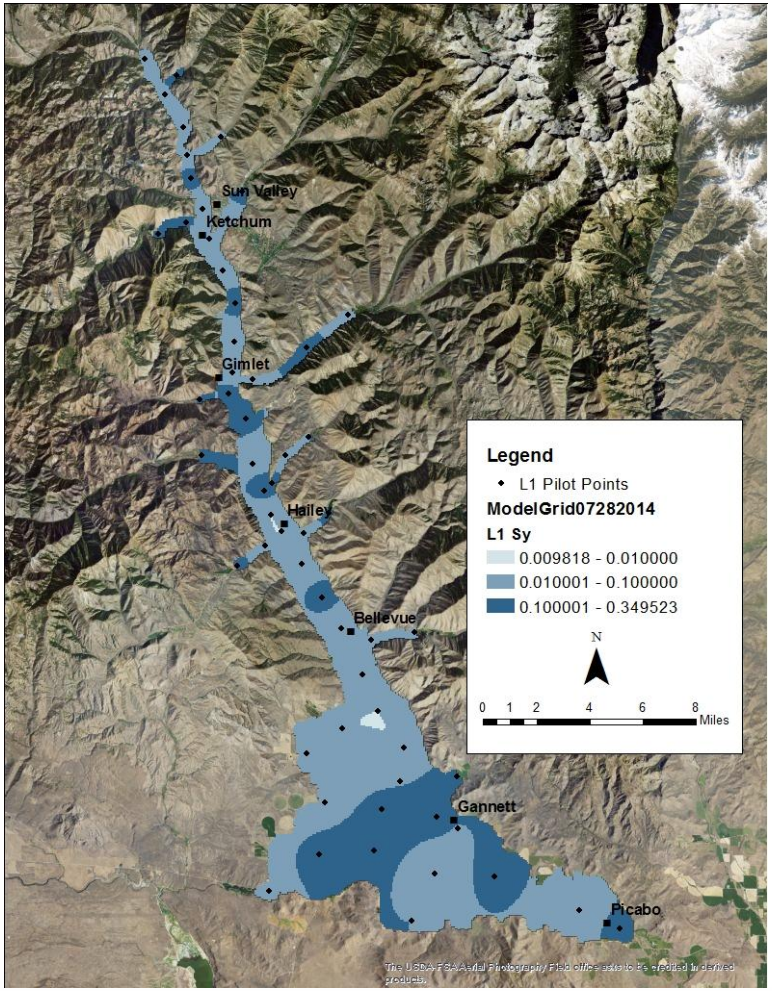


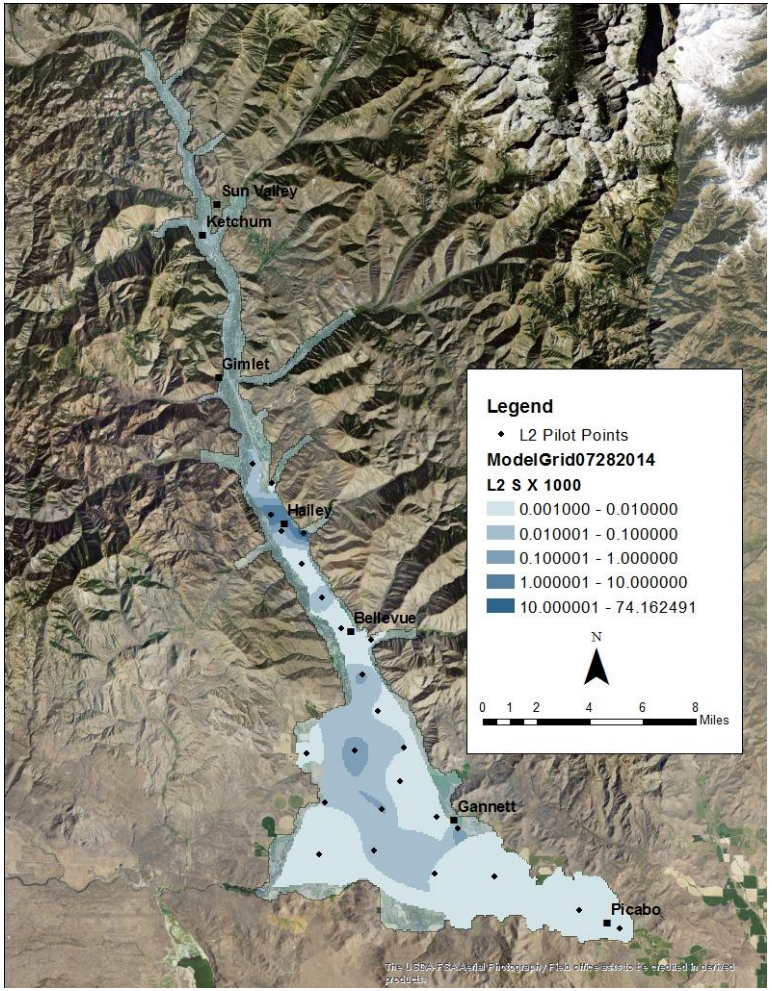
- Layer 1 sand and gravel aquifer
  - Min = 1.50 ft/day
  - Max = 14,421 ft/day
  - Median = 233.79 ft/day
- Layer 3 sand and gravel aquifer
  - Min = 33.1 ft/day
  - Max = 43,566 ft/day
  - Median = 2,155 ft/day

Layer 1 Storage



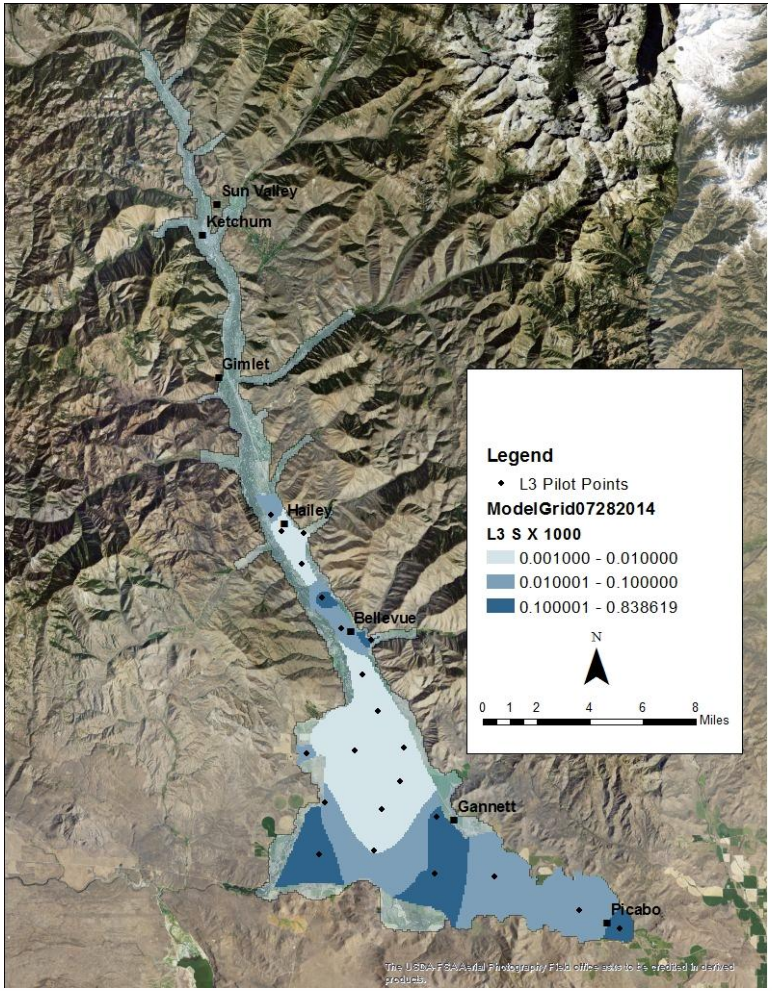
- Layer 1 temporarily modeled as non-time varying thickness
- Pilot points can be moved
- Number of pilot points not fixed

Layer 2 Storage



- Layer 2 modeled as storage
- Includes basalt in east
- Includes confining layer
- Pilot points can be moved
- Number of pilot points can be changed

Layer 3 Storage



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- Includes basalt in east
- Pilot points can be moved
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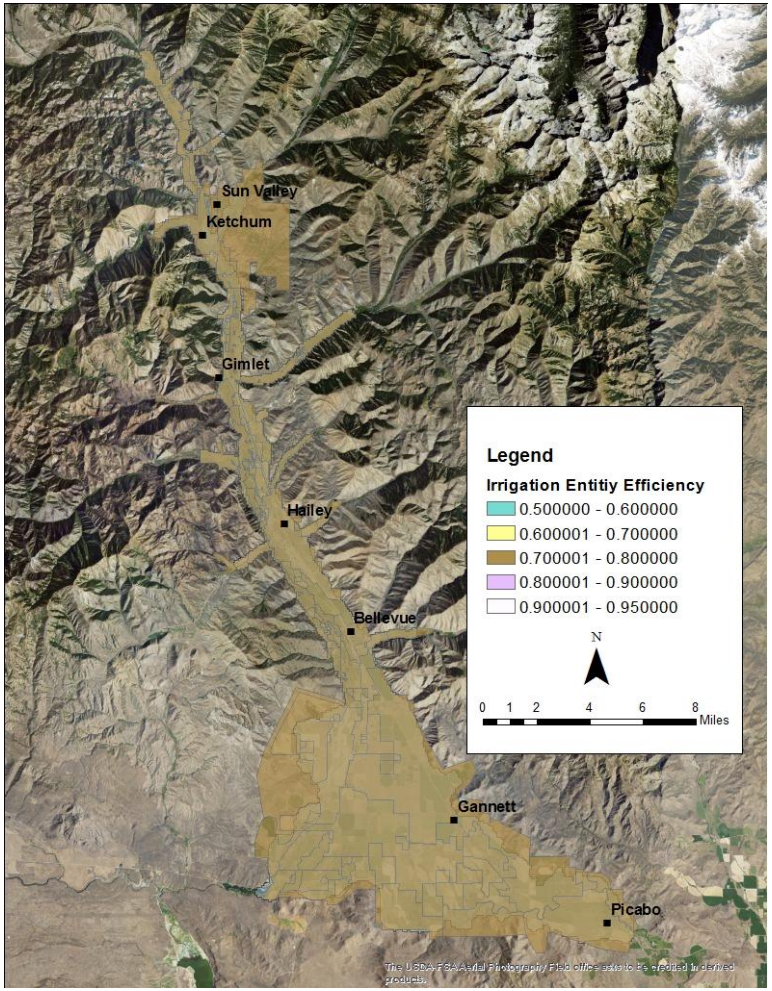
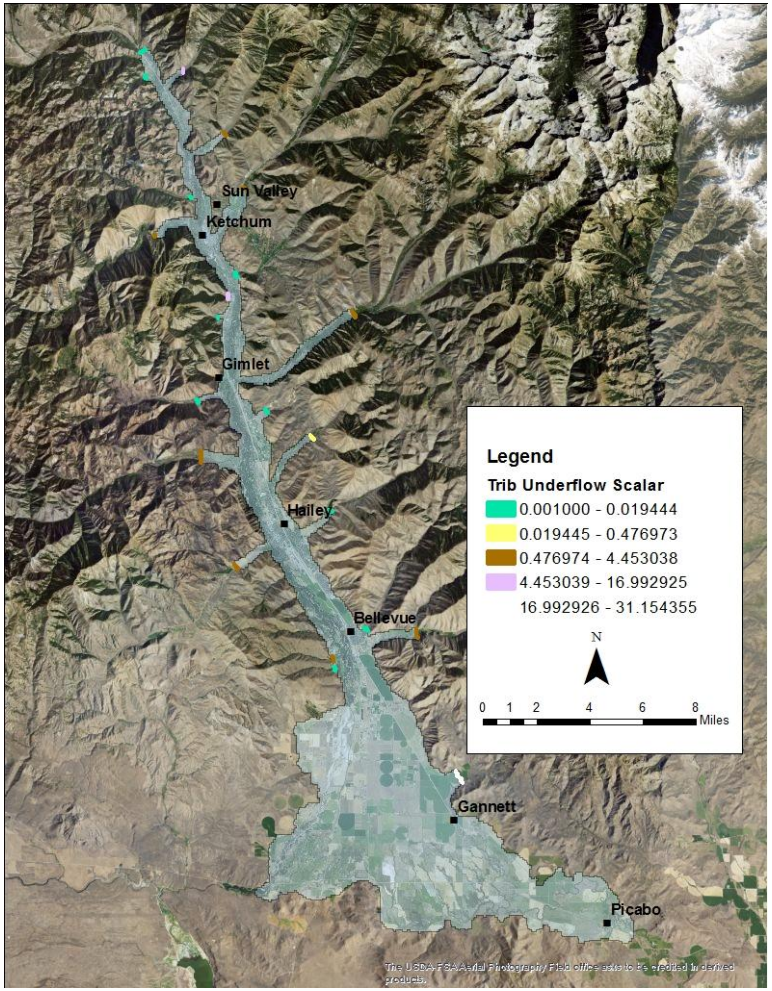
Surface Water Irrigation Efficiency



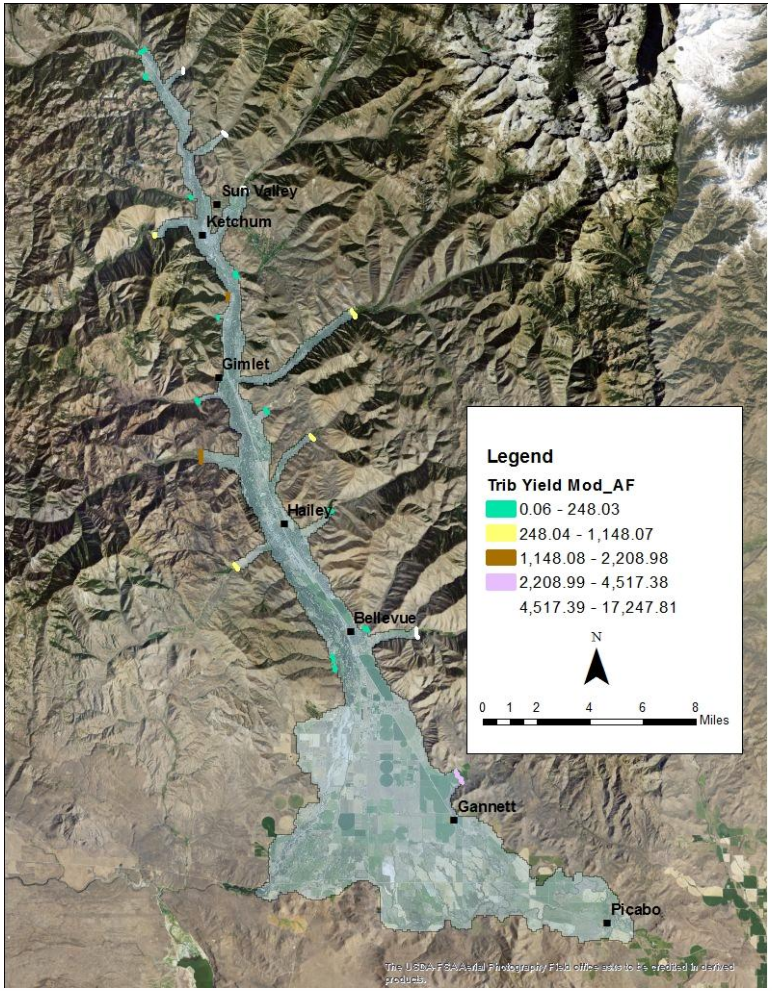
- Inefficient fraction infiltrates into layer 1 aquifer
  - Note to the engineers
    - Low efficiency is not necessarily bad

Tributary Underflow



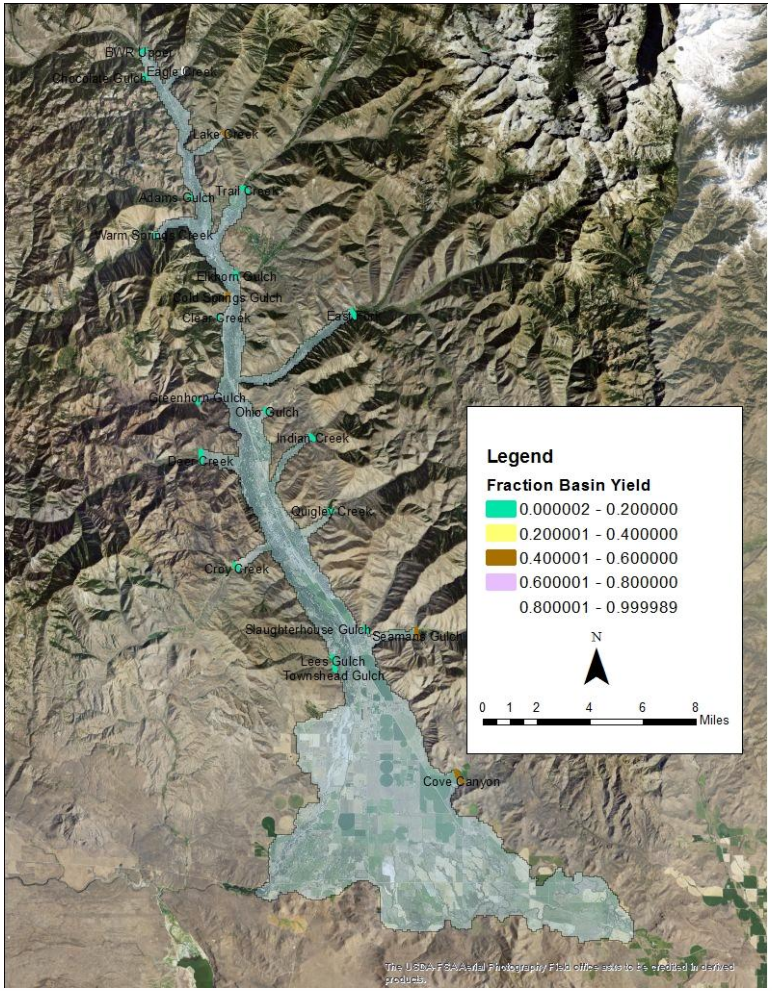
- Trib underflow adjusted using
  - Adjustment factors
    - Adjust average flux
  - Reduction factor
    - Adjust seasonal amplitude
  - Averaging period
    - 200 day, 300 day, 400 day , etc

Tributary Underflow



Name	Scalar	OrigEst	Mod_AF	BasinYld_AF	%BasinYield
Adams Gulch	0.0034	851	2.90	17,600	0.02%
BWR Upper	0.0010	487	0.49	313,278	0.00%
Chocolate Gulch	0.0194	52	1.01	864	0.12%
Clear Creek	0.0010	137	0.14	2,288	0.01%
Cold Springs Gulch	9.5162	200	1,903.23	3,341	56.97%
Cove Canyon	31.1544	145	4,517.38	11,200	40.33%
Croy Creek	1.5072	704	1,061.09	23,595	4.50%
Deer Creek	1.5109	1,462	2,208.98	74,213	2.98%
Eagle Creek	16.9929	1,015	17,247.81	17,248	100.00%
East Fork	1.4916	471	702.56	120,629	0.58%
Elkhorn Gulch	0.0074	51	0.38	12,757	0.00%
Greenhorn Gulch	0.0010	682	0.69	30,464	0.00%
Indian Creek	0.4770	2,407	1,148.07	10,149	11.31%
Lake Creek	3.6935	2,406	8,886.63	17,280	51.43%
Lees Gulch	1.8509	134	248.03	2,240	11.07%
Ohio Gulch	0.0010	256	0.26	4,270	0.01%
Quigley Creek	0.0035	560	1.98	15,504	0.01%
Seamans Gulch	4.4530	1,949	8,678.97	18,768	46.24%
Slaughterhouse Gulch	0.0011	506	0.57	11,509	0.00%
Townshead Gulch	0.0010	58	0.06	960	0.01%
Trail Creek	3.6749	2,898	10,649.74	111,274	9.57%
Warm Springs Creek	1.8353	607	1,114.06	180,735	0.62%

Tributary Underflow



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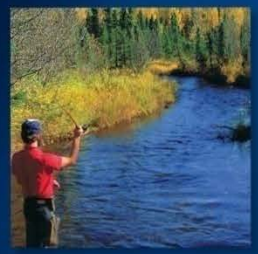
IDAHO Department of Water Resources



End