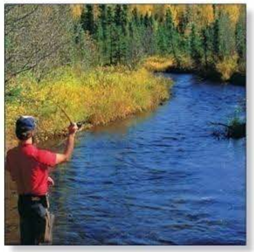
December Calibration Run

Presented by Allan Wylie, IDWR

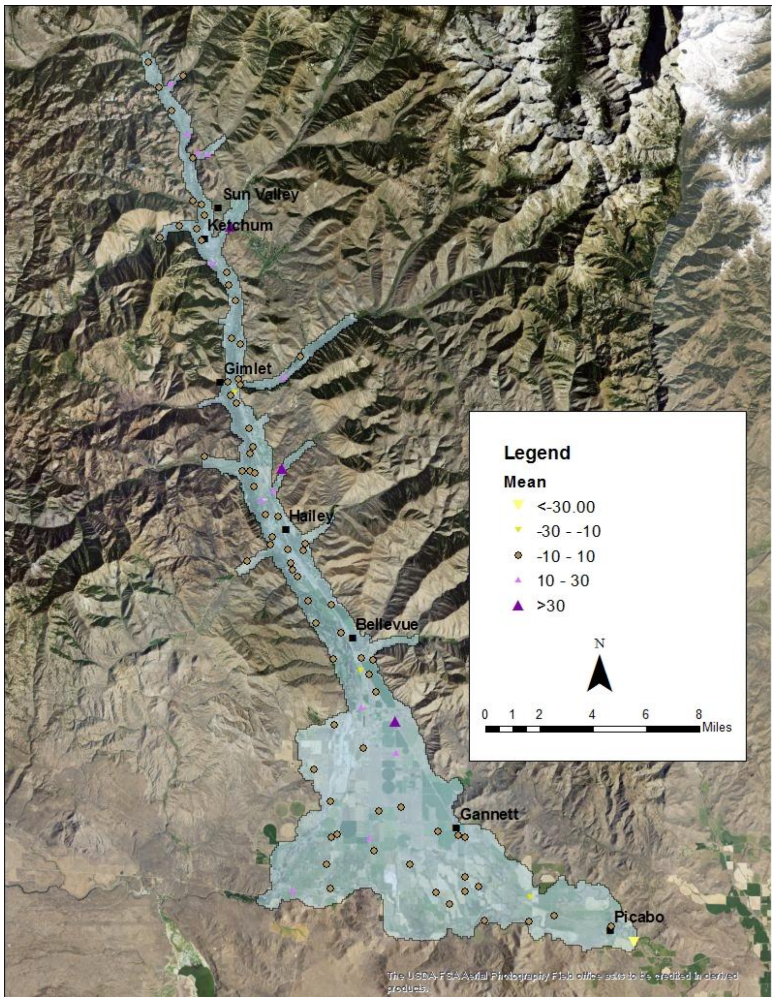
December 3, 2015



Important Changes

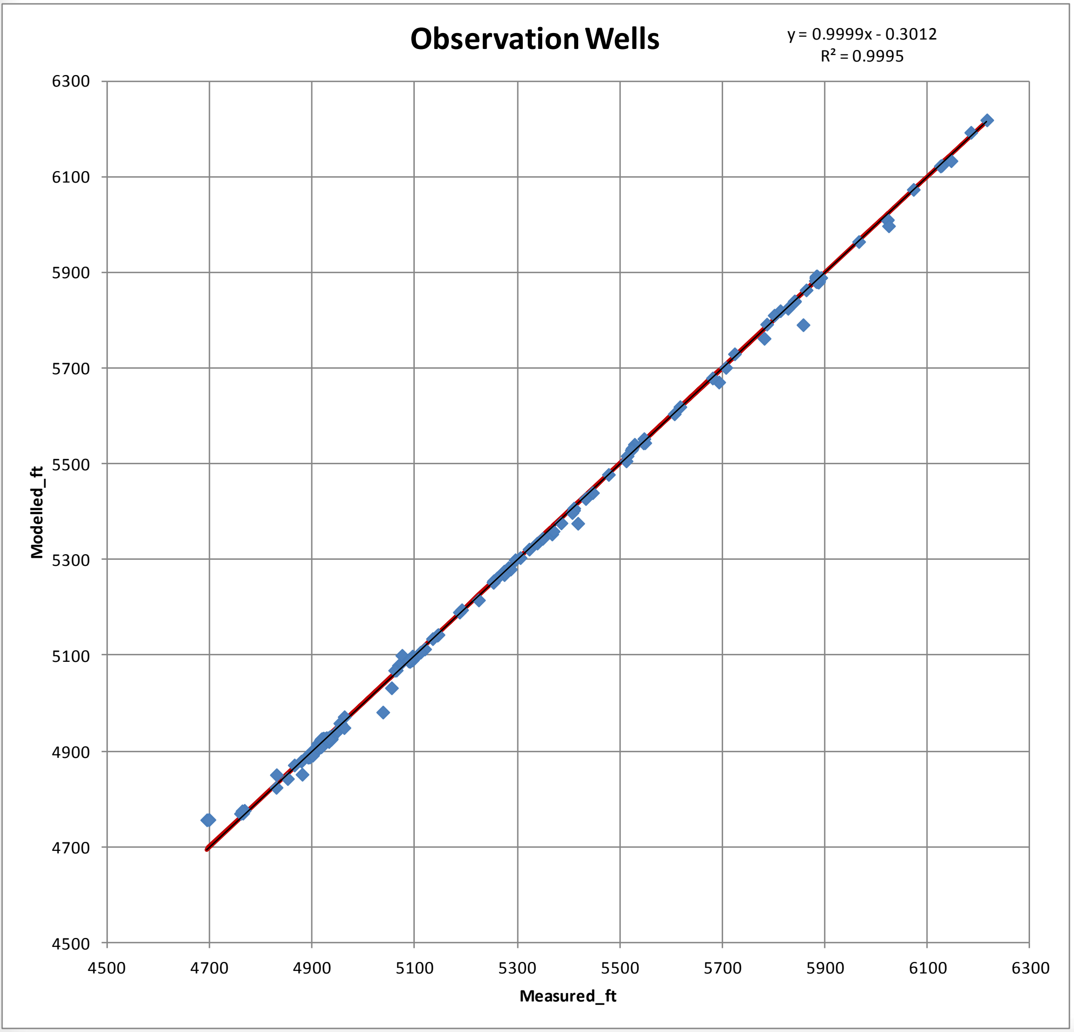
- Set maximum tributary underflow to 20% of average annual precipitation within the basin
- Set kriging limit for Sy to between 0.10 to 0.30
- Adjustments to river stage in Wood River Ranch to Stanton Crossing reach
- Discovered river cells in Silver Cr set in layer 2 and layer 3.
  - Results in three river cells at one X,Y location
  - Jason made adjustments to remove layer 2 and 3 cells

Observation Wells



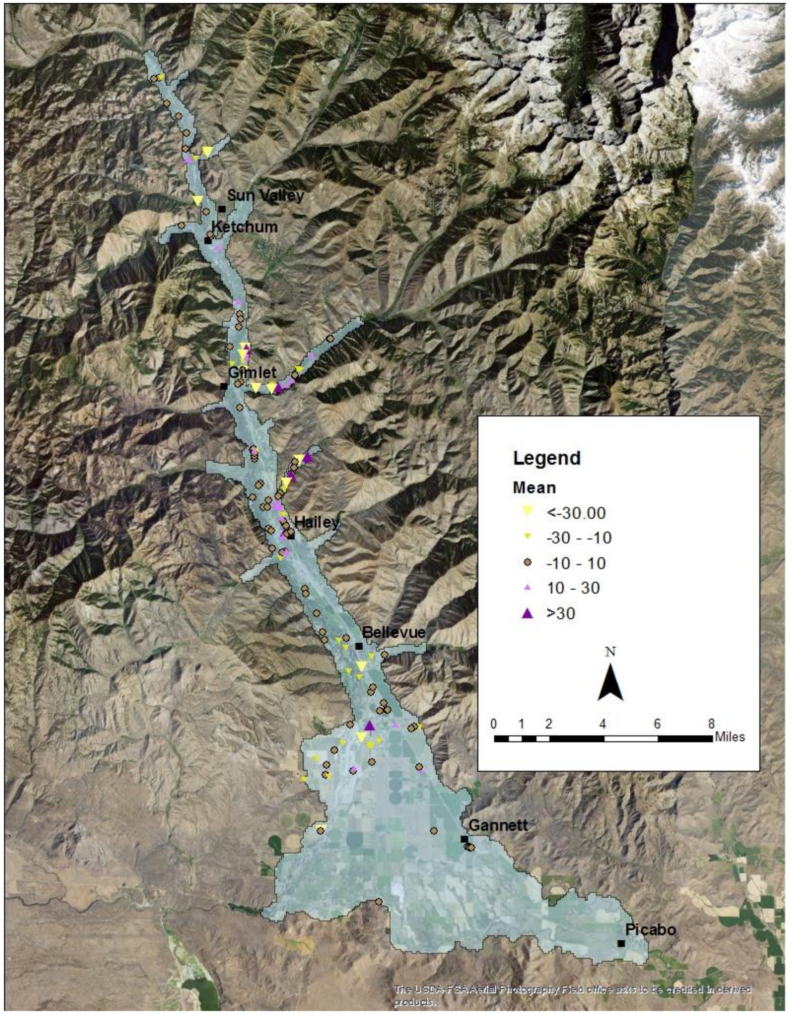
- Wells with GPS or surveyed location
- Measured by a trained technician
- Total head change from north to south is about 1,500 ft
  - 30 ft mismatch = 2%

Observation Wells



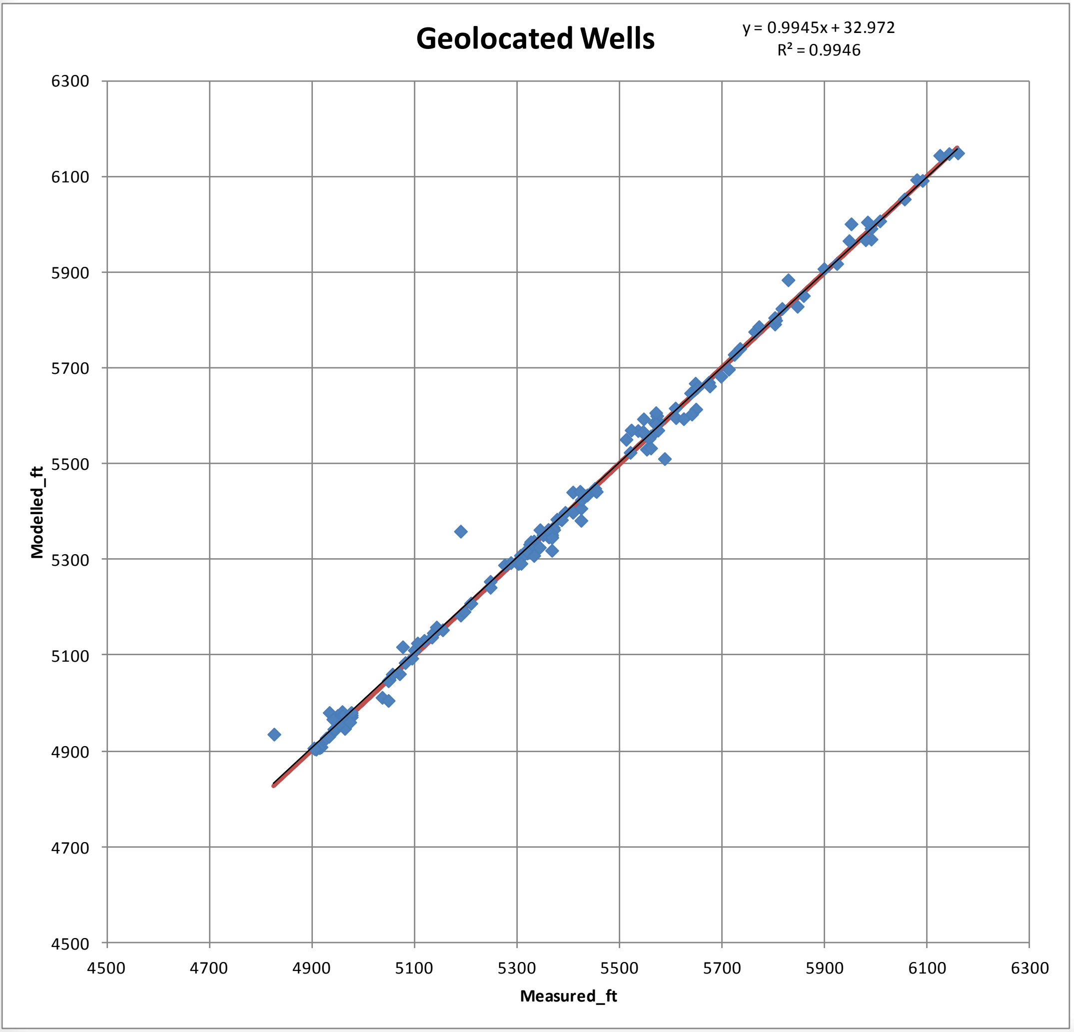
- Wells with GPS or surveyed location
- Measured by a trained technician
- If fit was perfect
  - Intercept = 0
  - Slope = 1
  - R^2 = 1
  - All points on the red line

Geo-located Wells



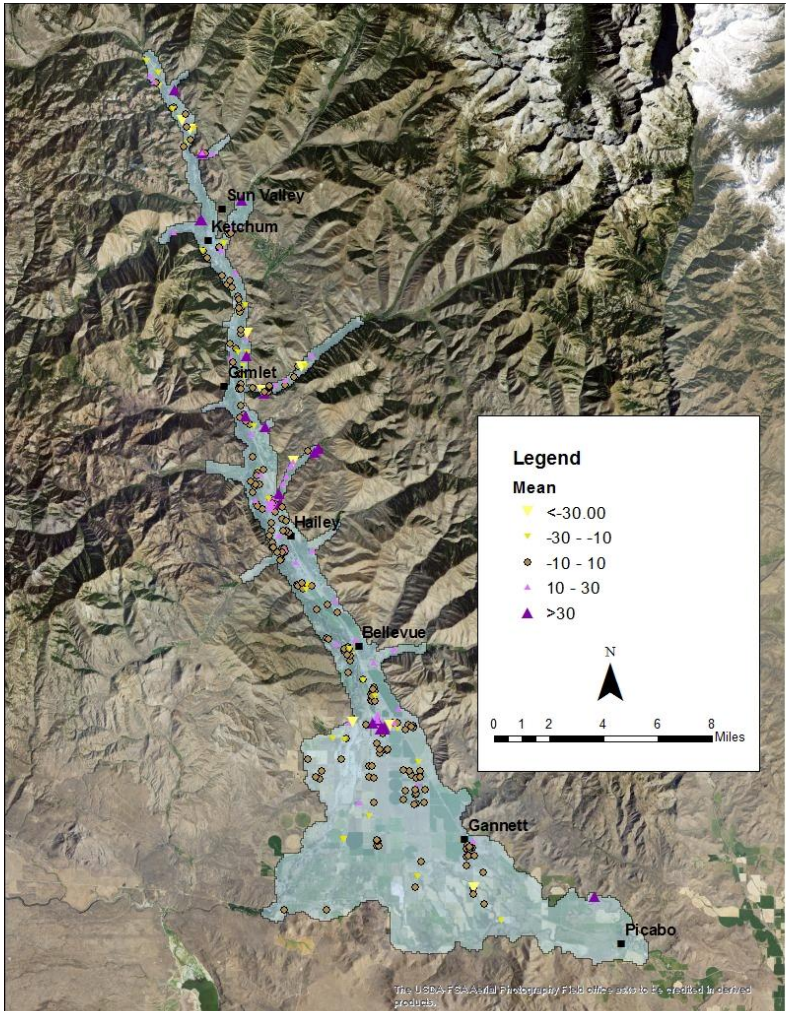
- Wells located by address
- Measured by driller

Geo-located Wells



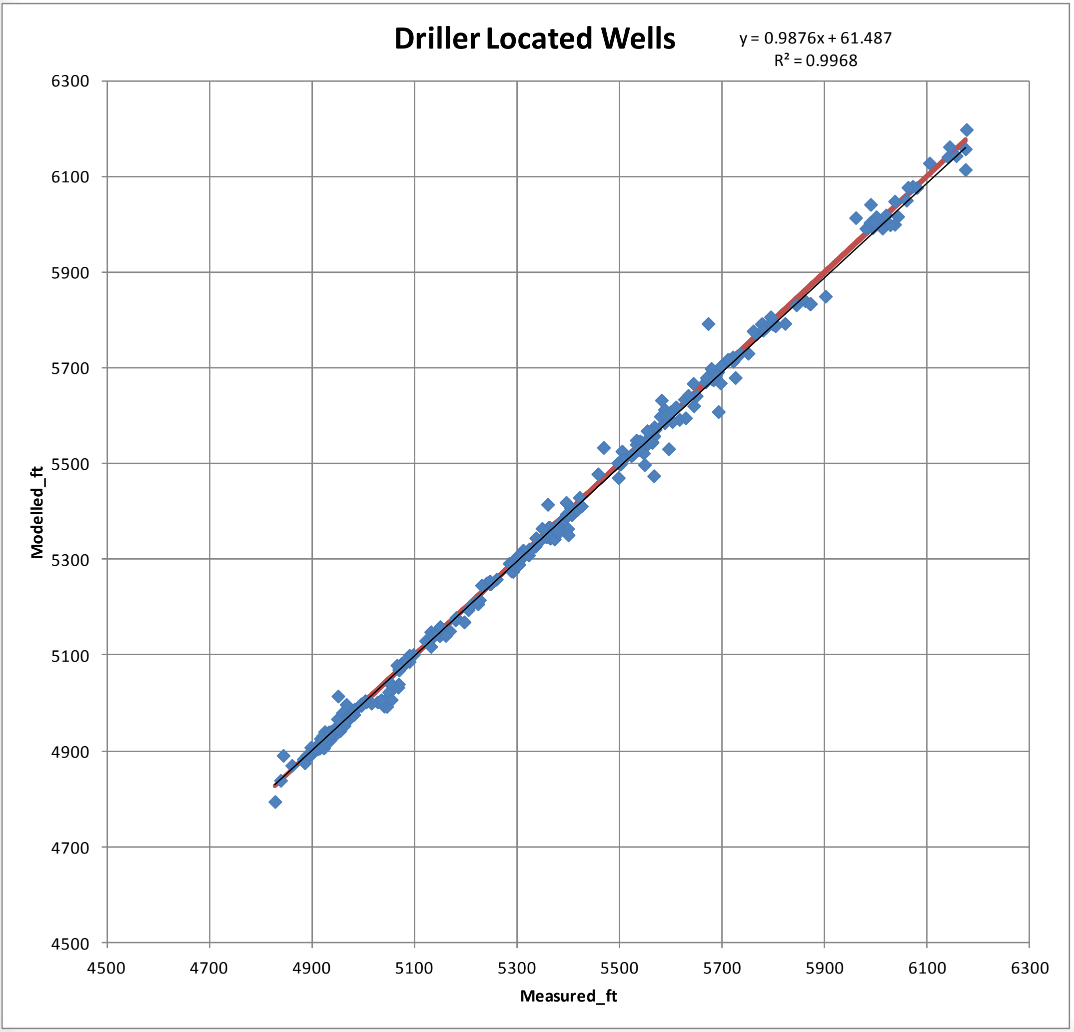
– Wells located by address
– Measured by driller
– If fit was perfect
  - Intercept = 0
  - Slope = 1
  - R^2 = 1
  - All points on the red line

Driller Wells



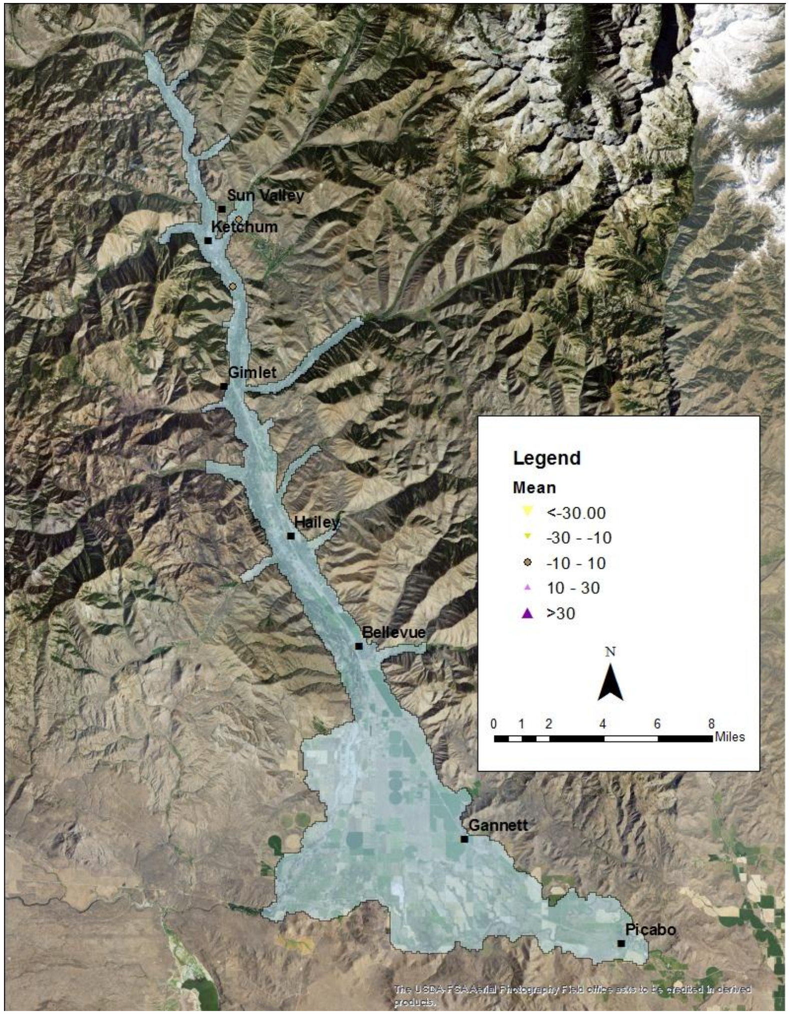
- Wells located by PLS
- Measured by driller

Driller Wells



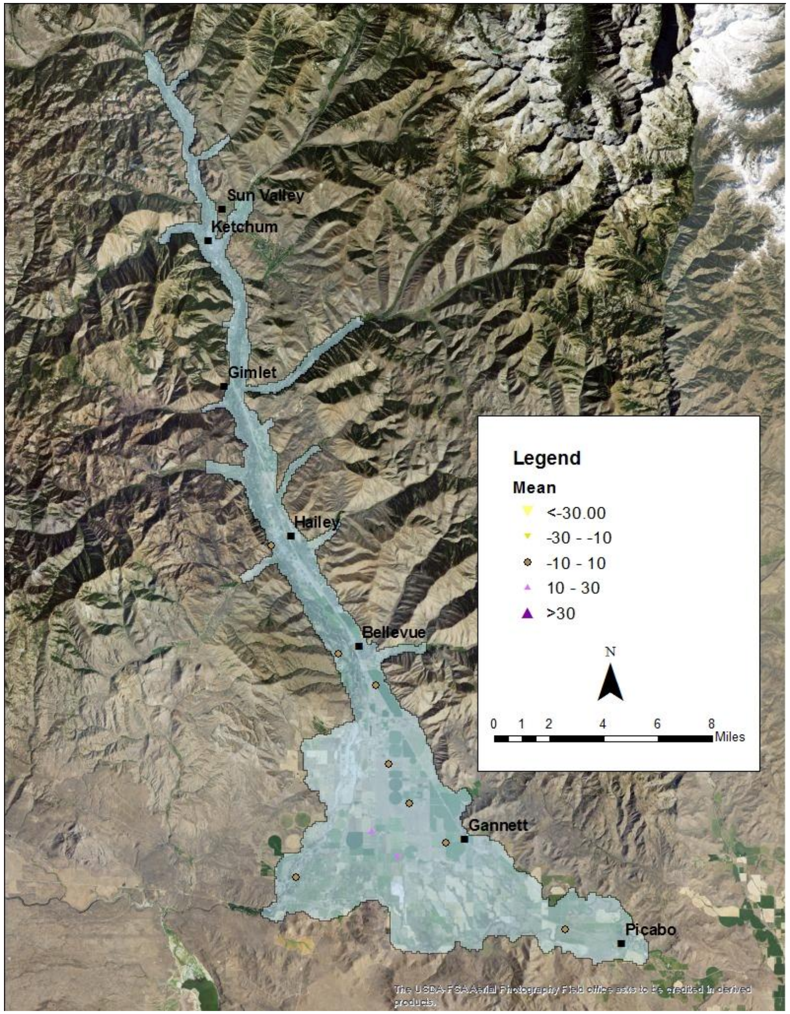
- Wells located by PLSS
- Measured by driller
- If fit was perfect
  - Intercept = 0
  - Slope = 1
  - $R^2 = 1$
  - All points on the red line

Sun Valley Wells



- Municipal production wells
- 2 well fields
- Measured by municipal employee
- One well from each field

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

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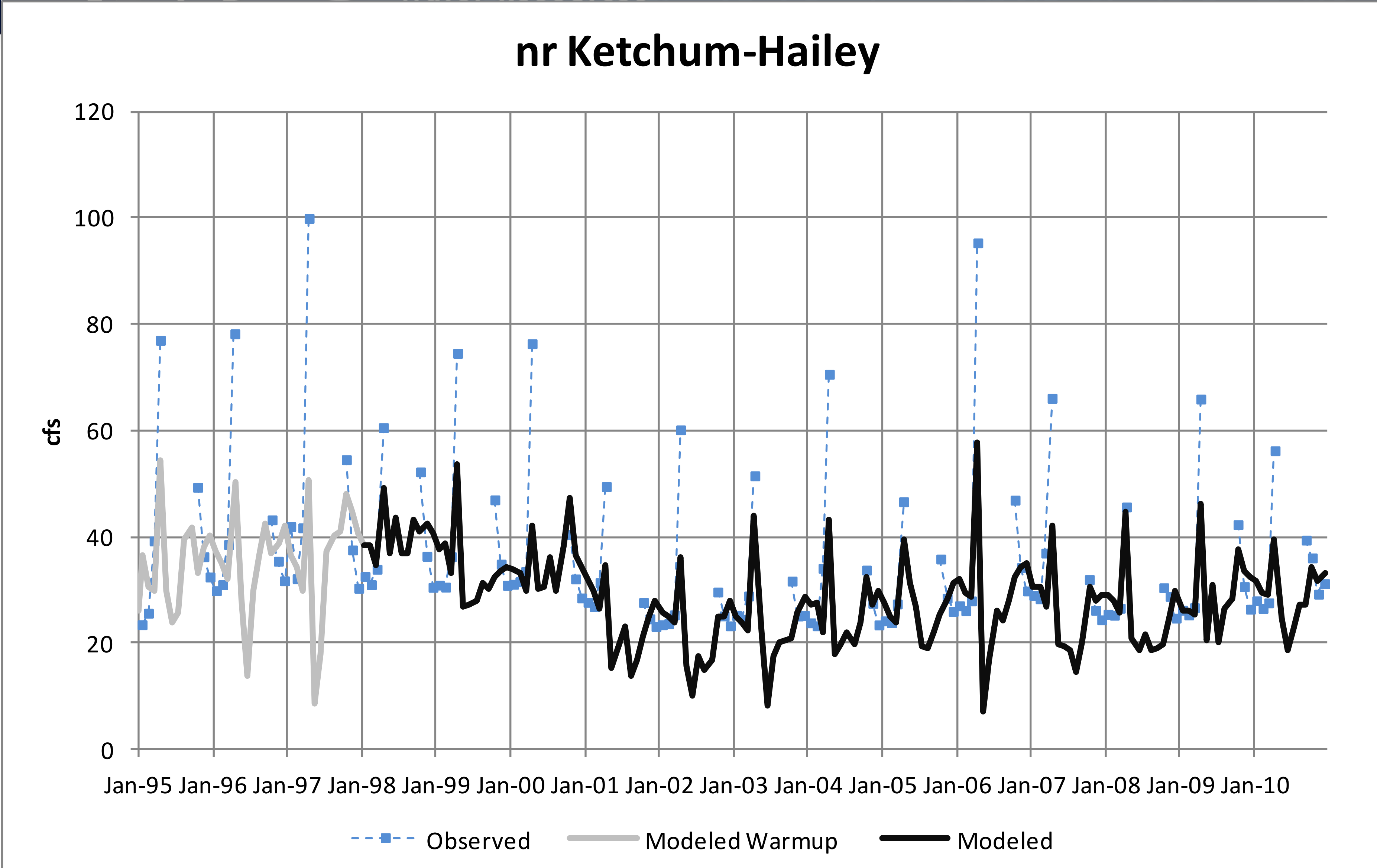
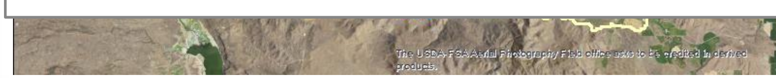
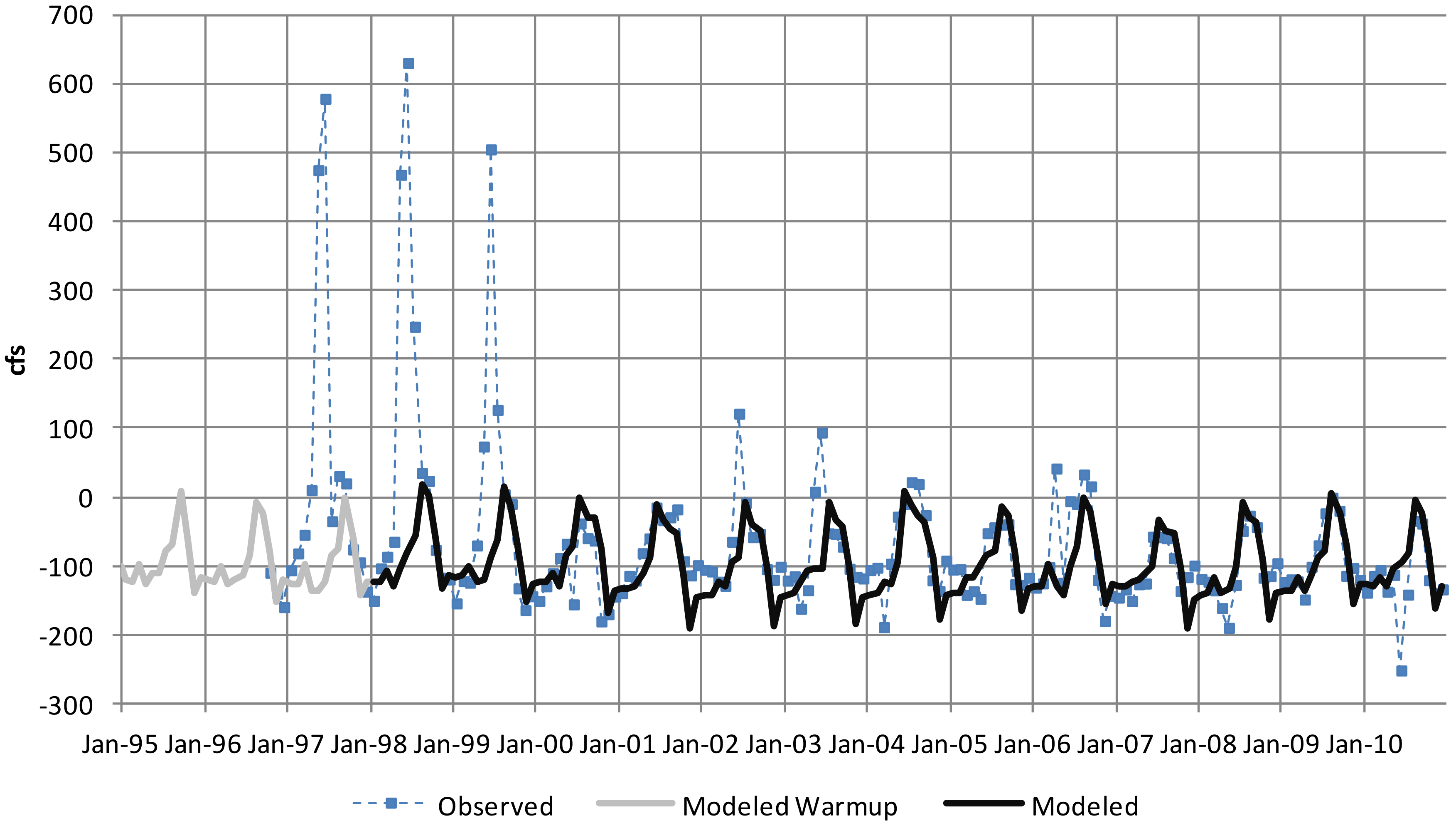
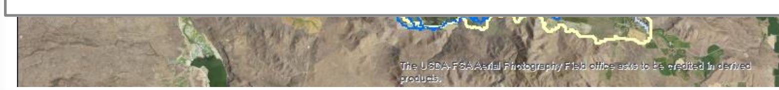




Hailey-Stanton Crossing





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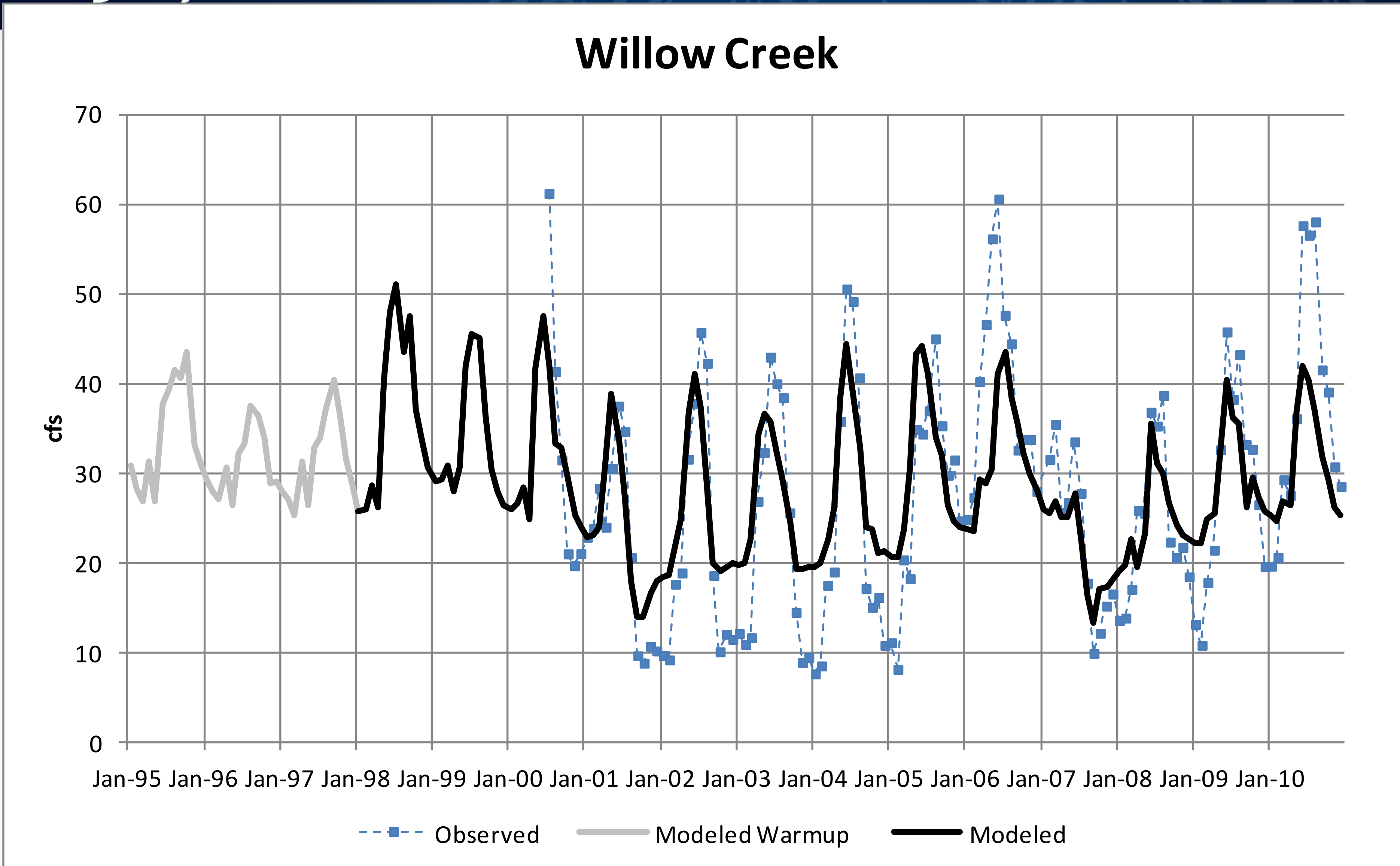

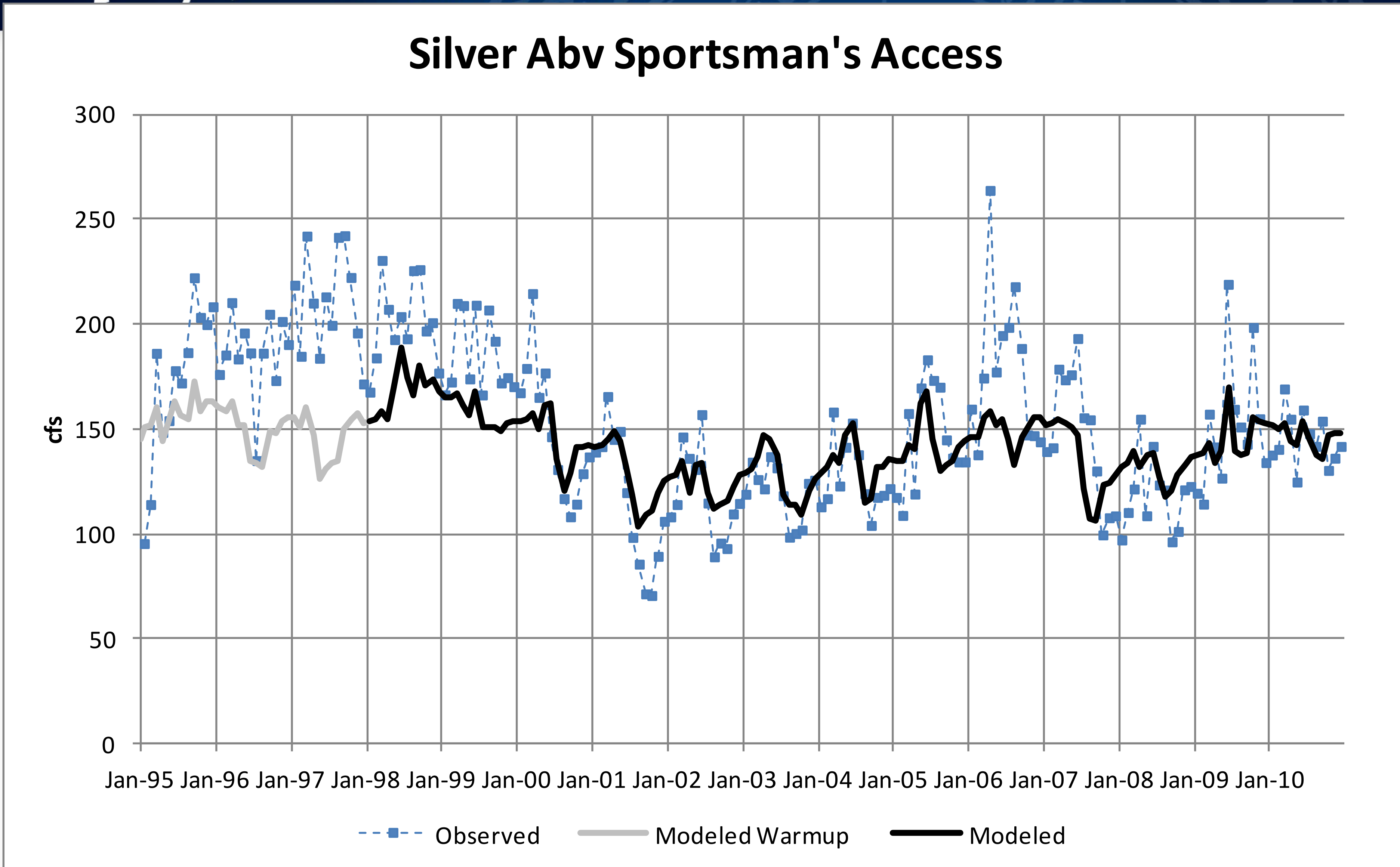
Silver Abv Sportsman's Access
300
250
200
150
100
50
0
cfs
Jan-95 Jan-96 Jan-97 Jan-98 Jan-99 Jan-00 Jan-01 Jan-02 Jan-03 Jan-04 Jan-05 Jan-06 Jan-07 Jan-08 Jan-09 Jan-10
Observed
Modeled Warmup
Modeled

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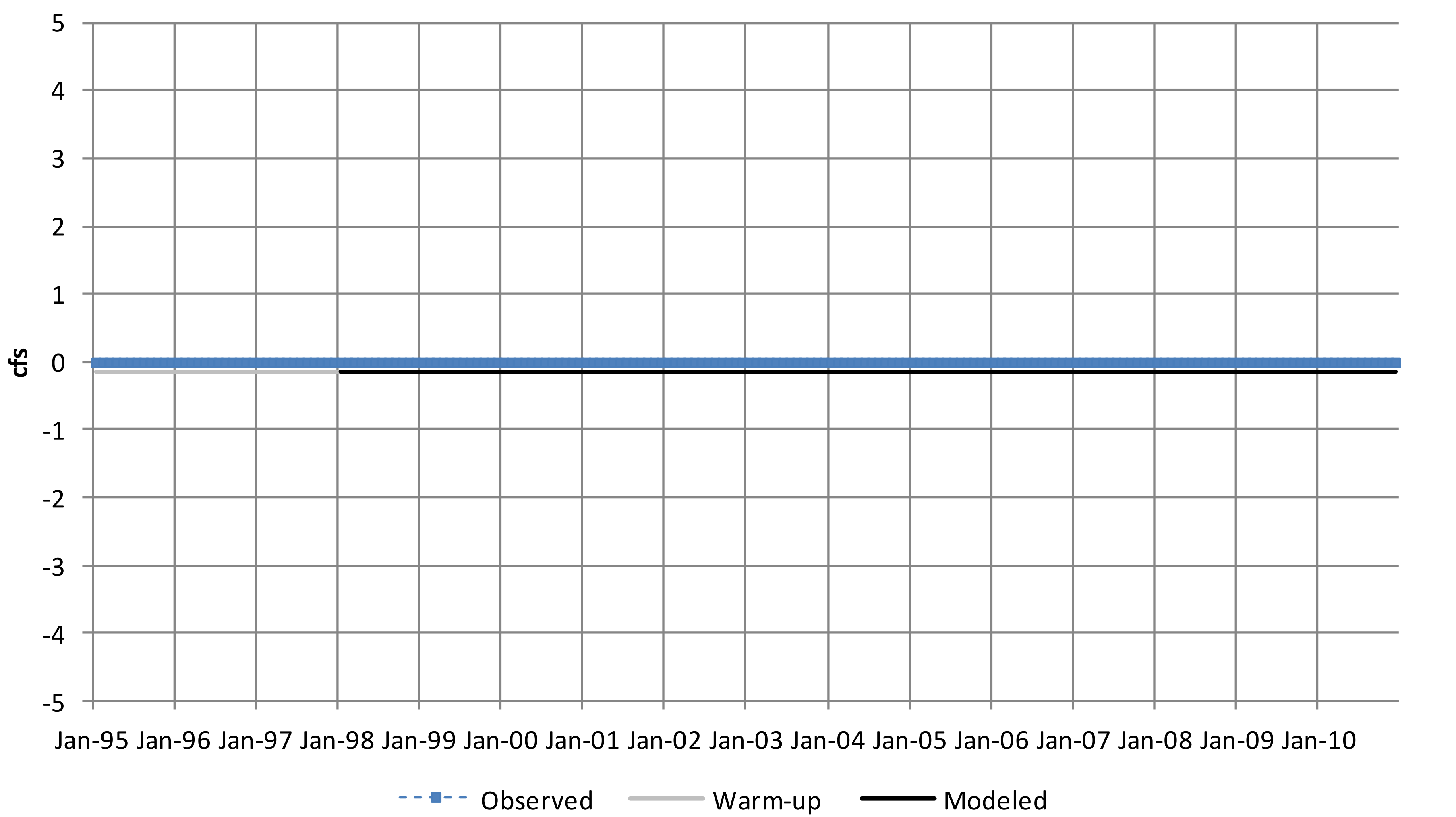
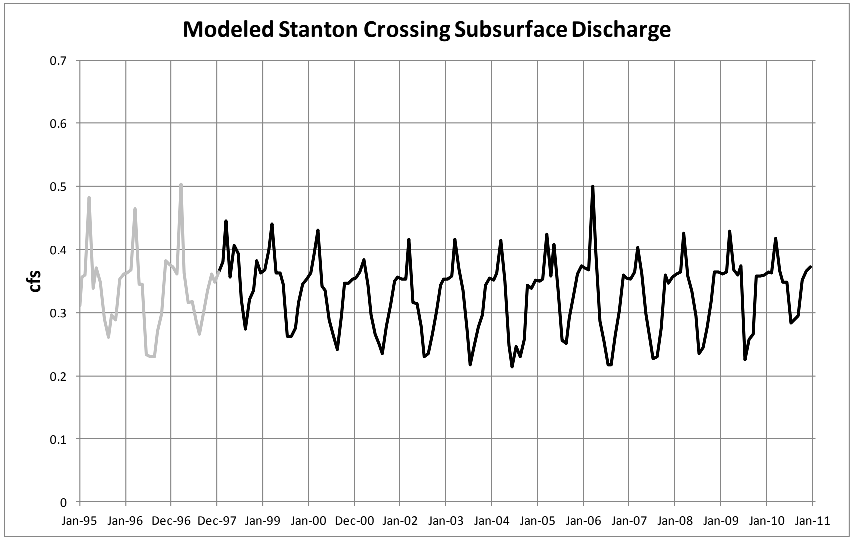
Silver Blw Sportsman's Access

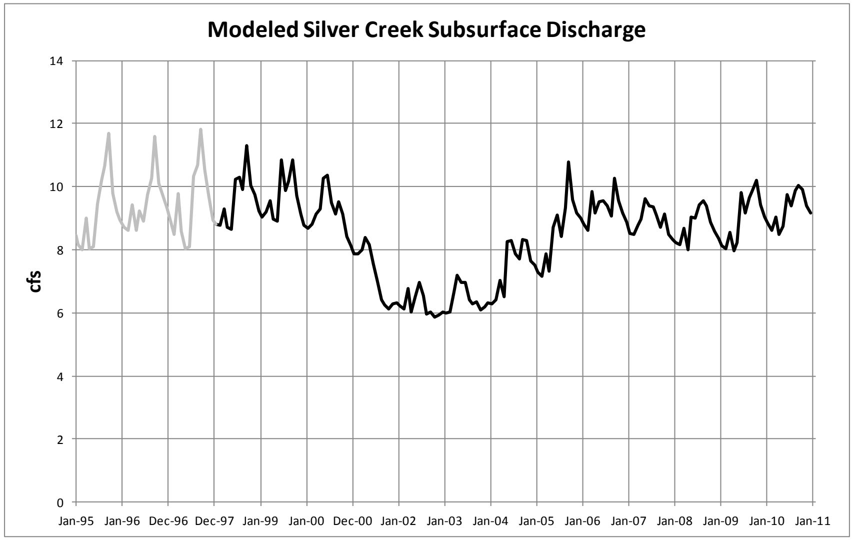


Subsurface Discharge From Model

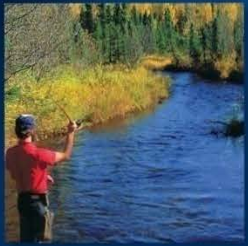


- Weight on these observations is low
- Stanton Crossing
  - Estimated ~ Negligible – 300 ac-f/yr
    - 0 - 0.41 cfs
    - Modeled = 0.33 cfs
      - 240 ac-ft

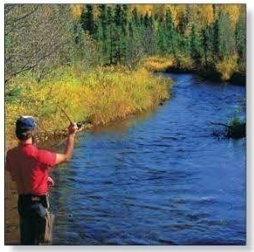
Subsurface Discharge From Model



- Weight on these observations is very low
- Silver Cr underflow
  - Estimated ~ 4,000 – 53,000 ac-f/yr
    - 5.5 – 73 cfs
    - Modeled = 8.6 cfs
      - 6,242 ac-ft

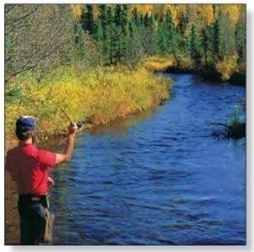
End

Outline

- 3nd Final Calibration
  - Specific yield in layer 1 was to low in places
  - Adjustments to dry bed assumptions
- Transient Calibration Run
- Are we there yet?
  - We expect to submit this version for review

Review

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

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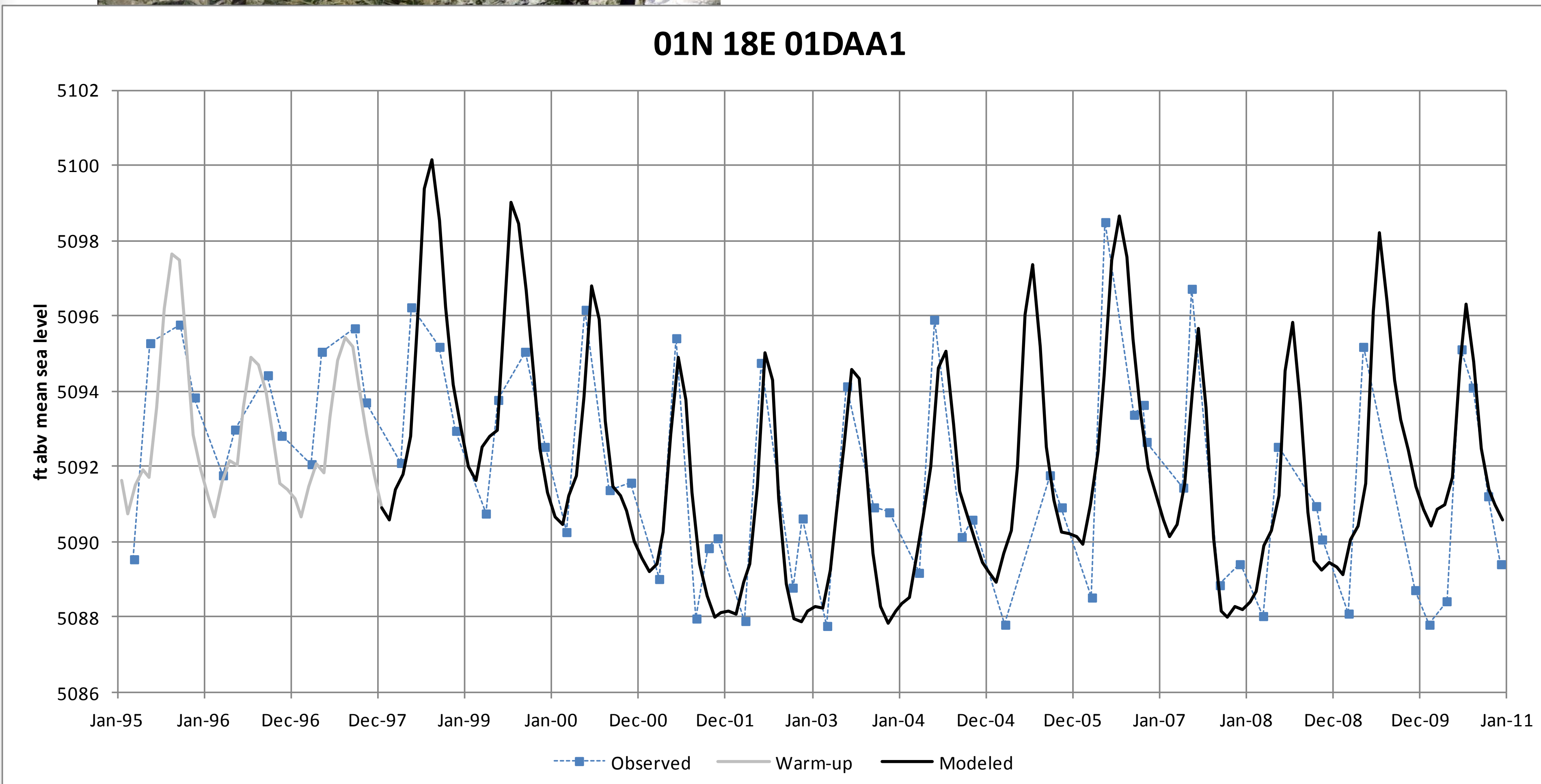
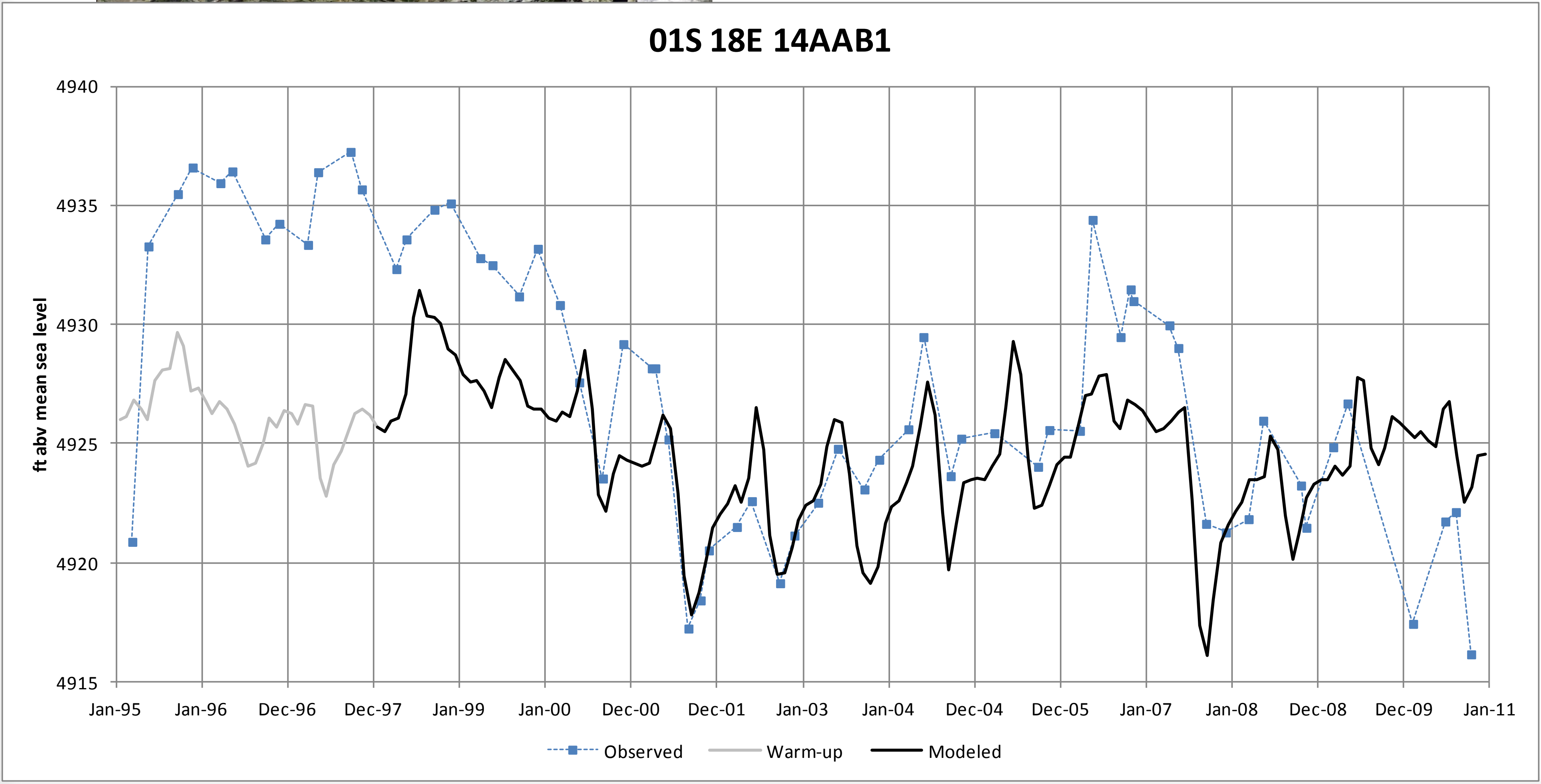
Observation Wells



Observation Wells



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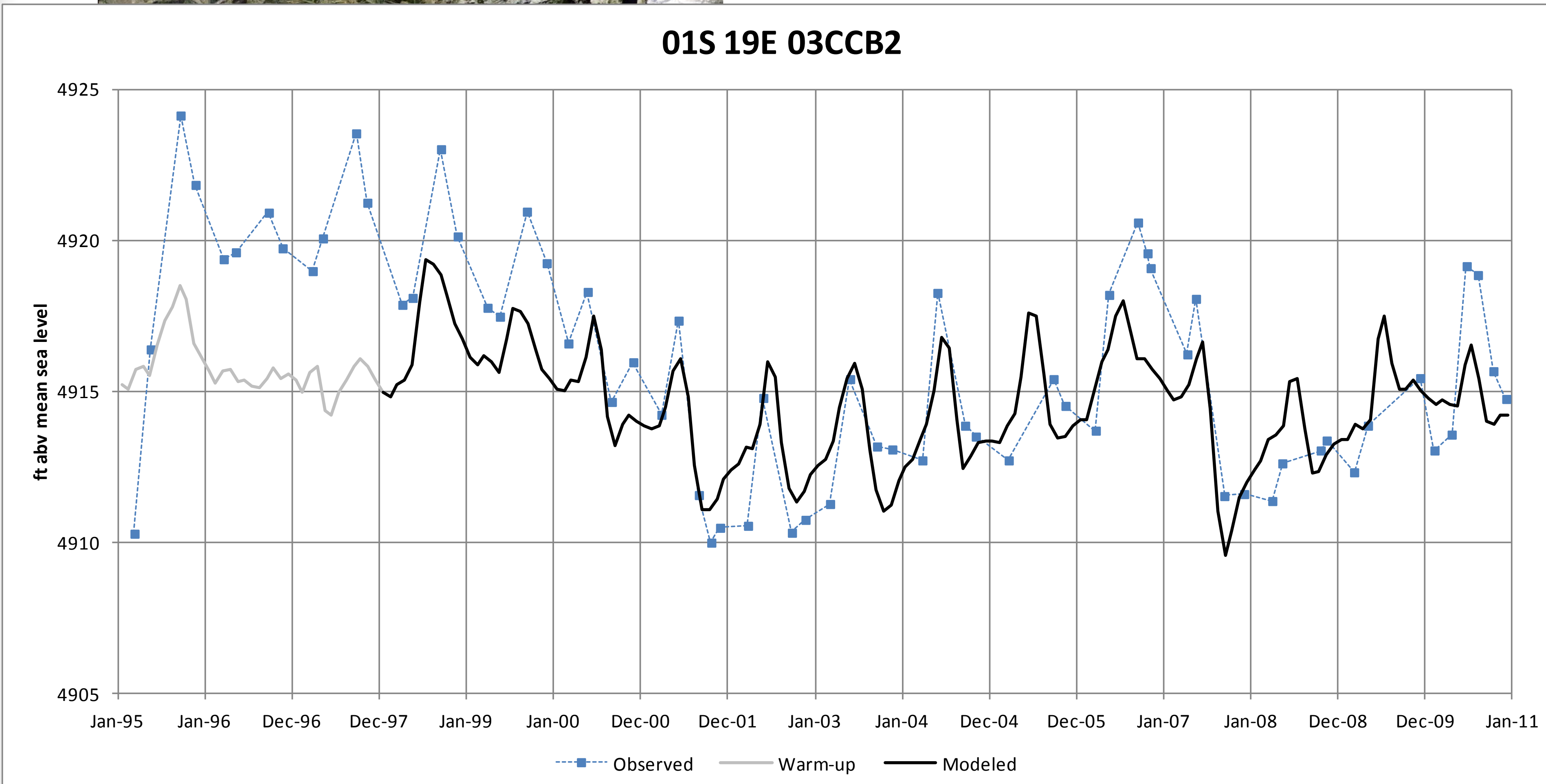

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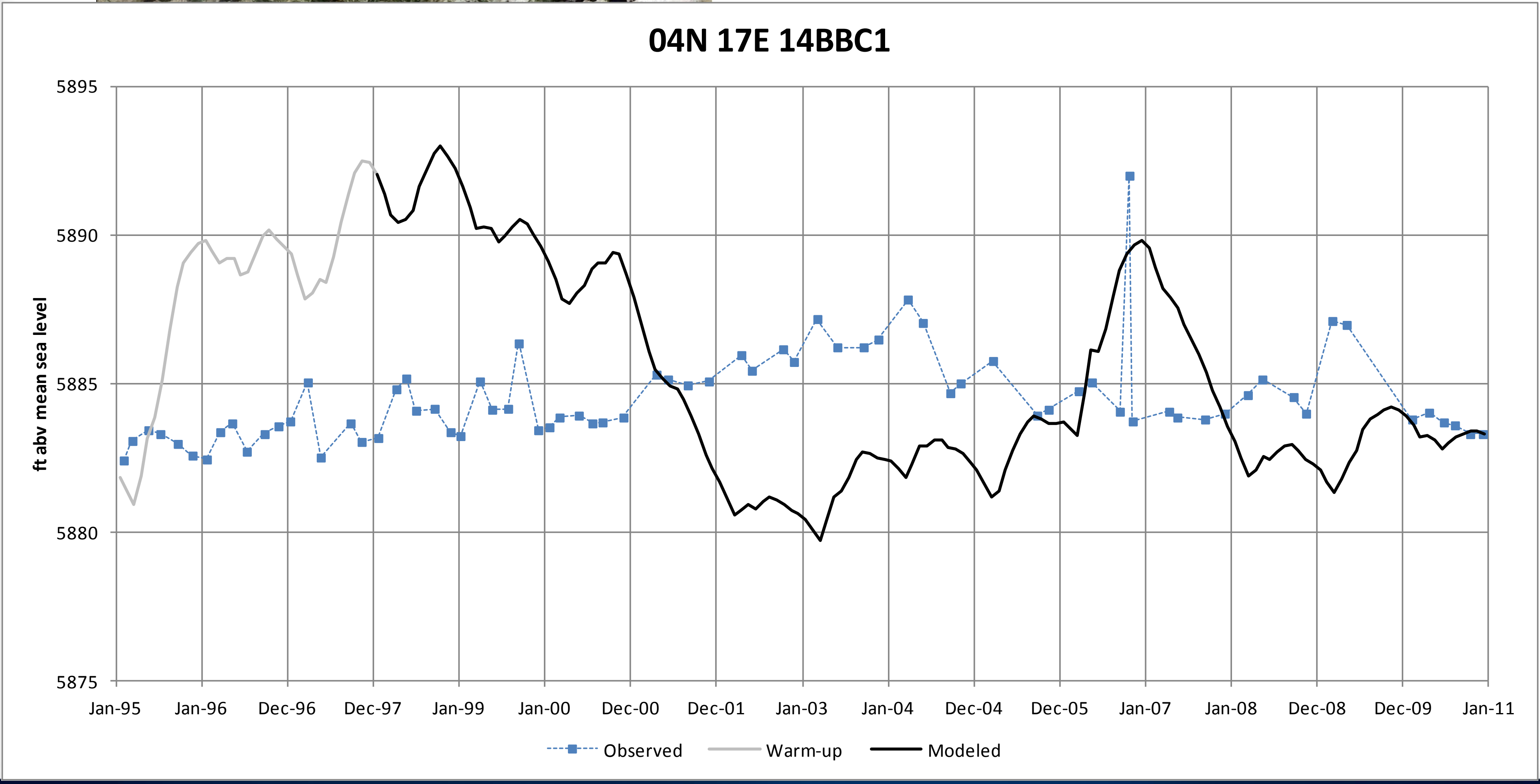
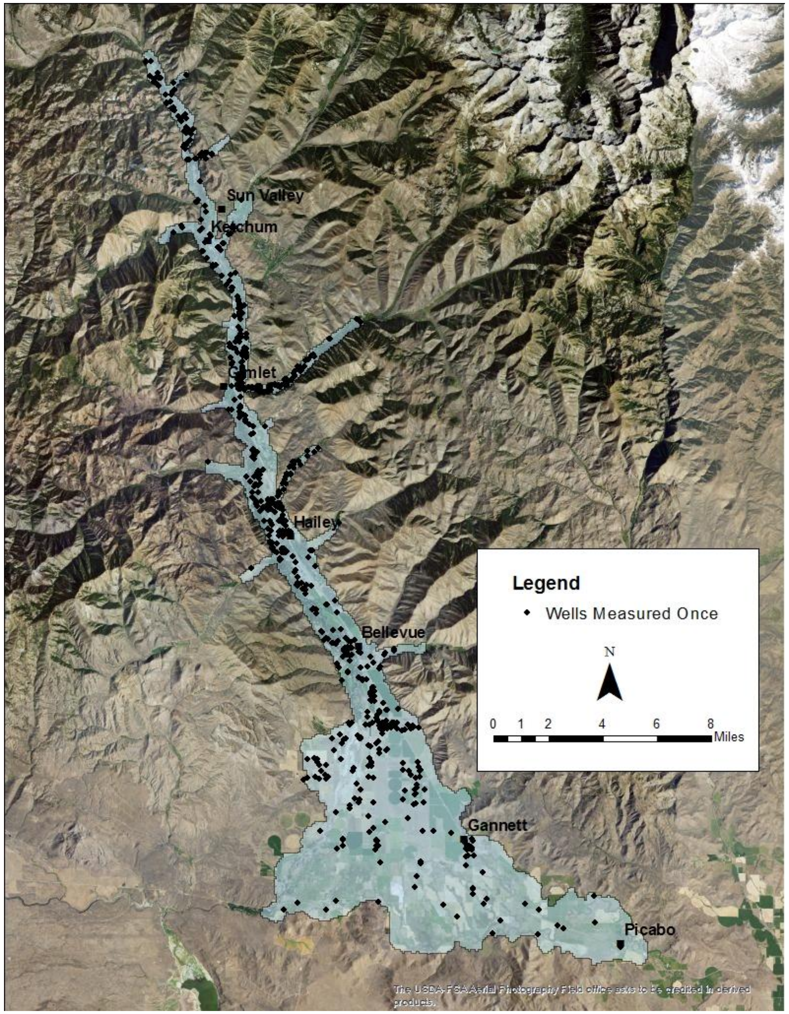
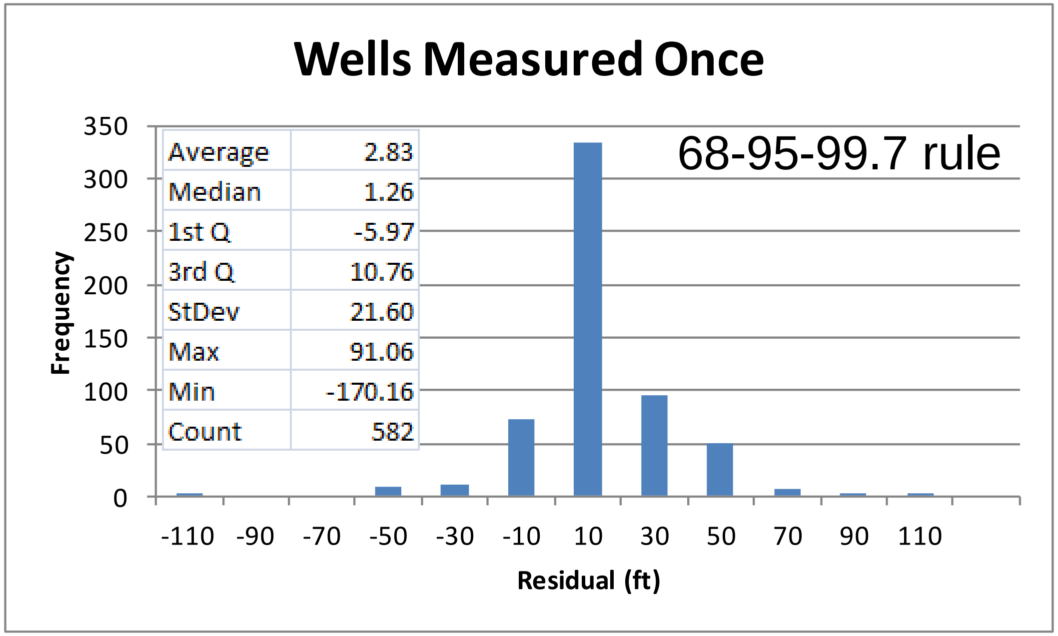
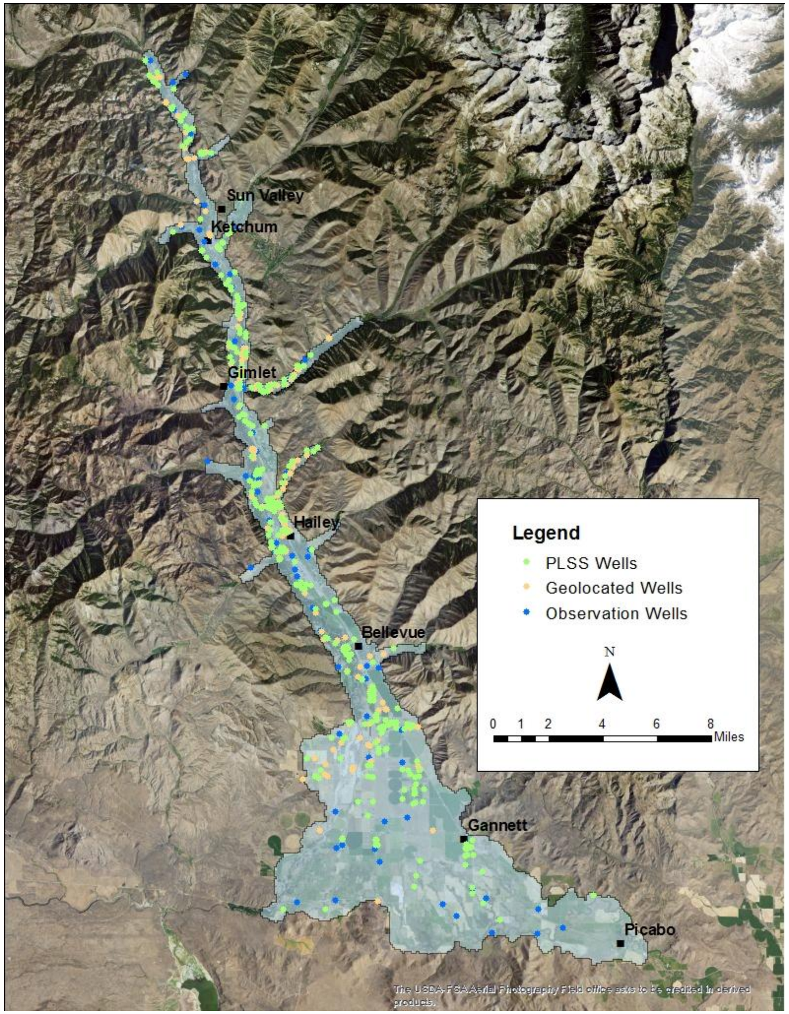


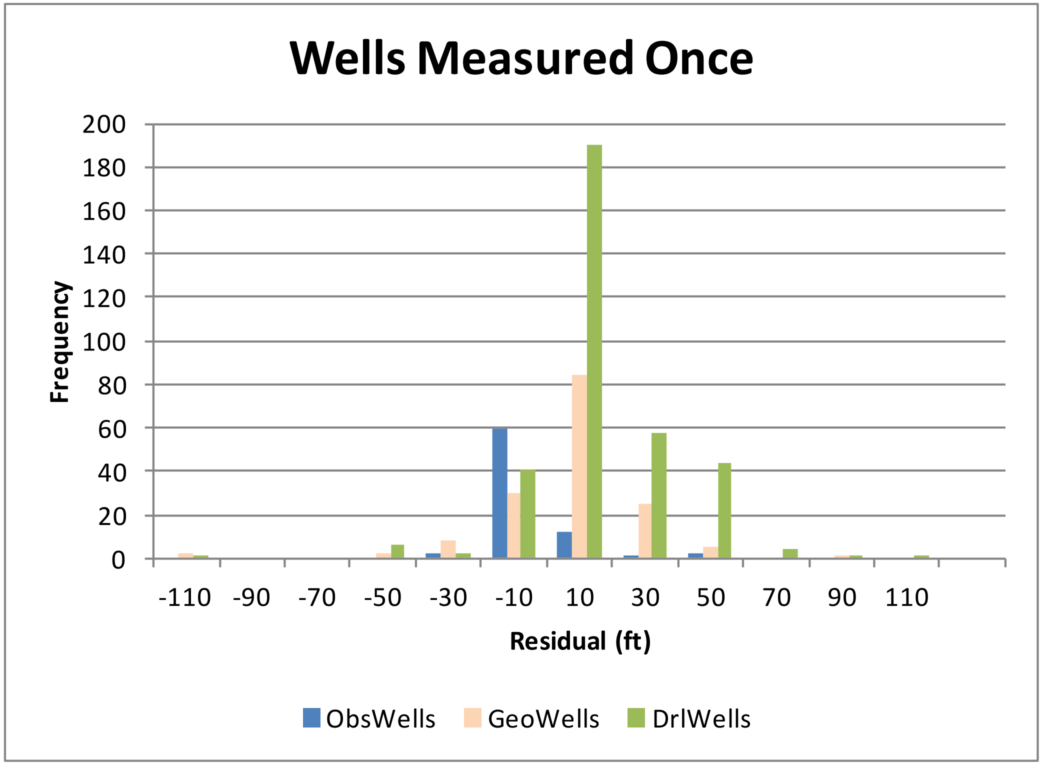
All Wells Measured Once



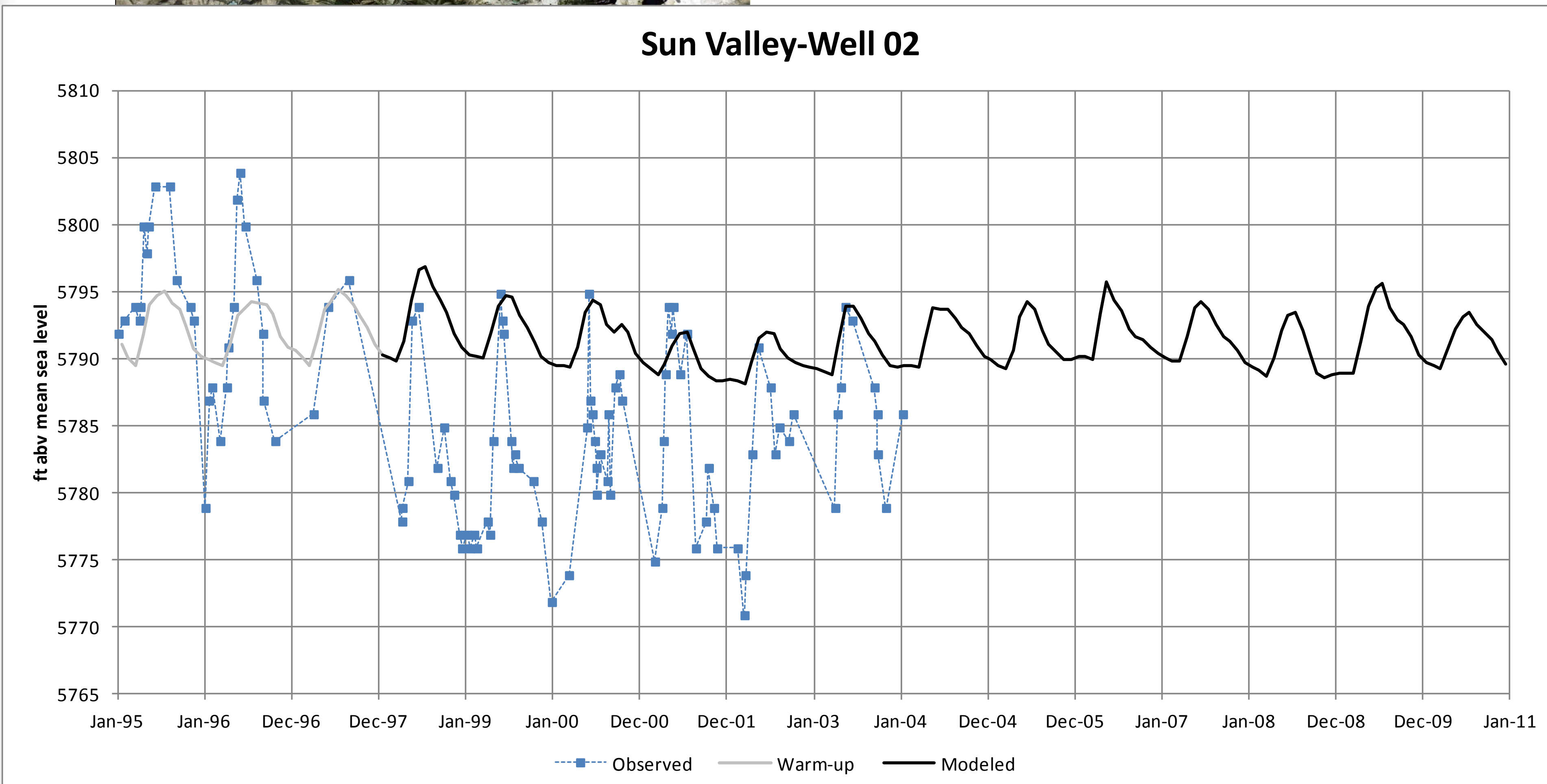


All Wells Measured Once

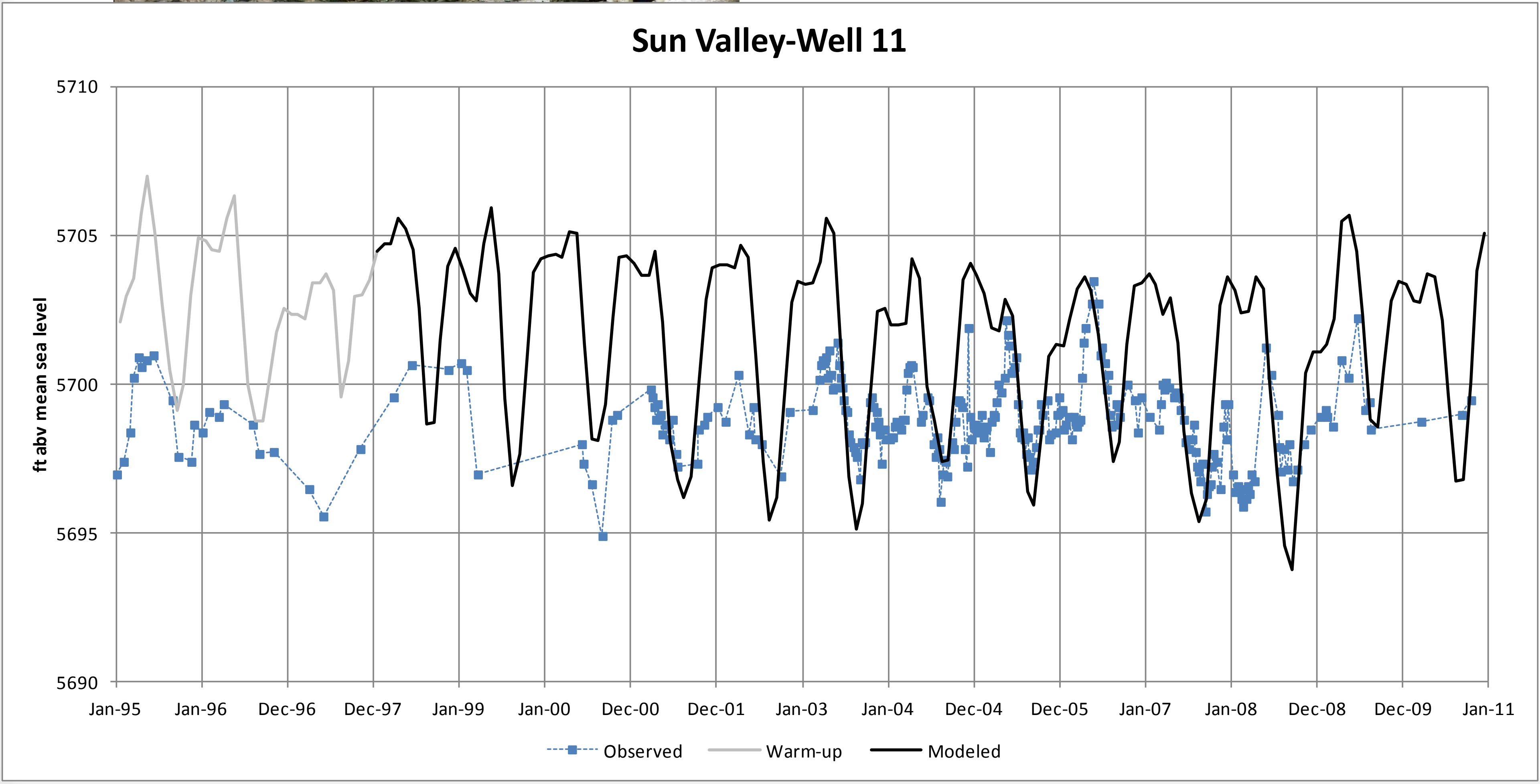




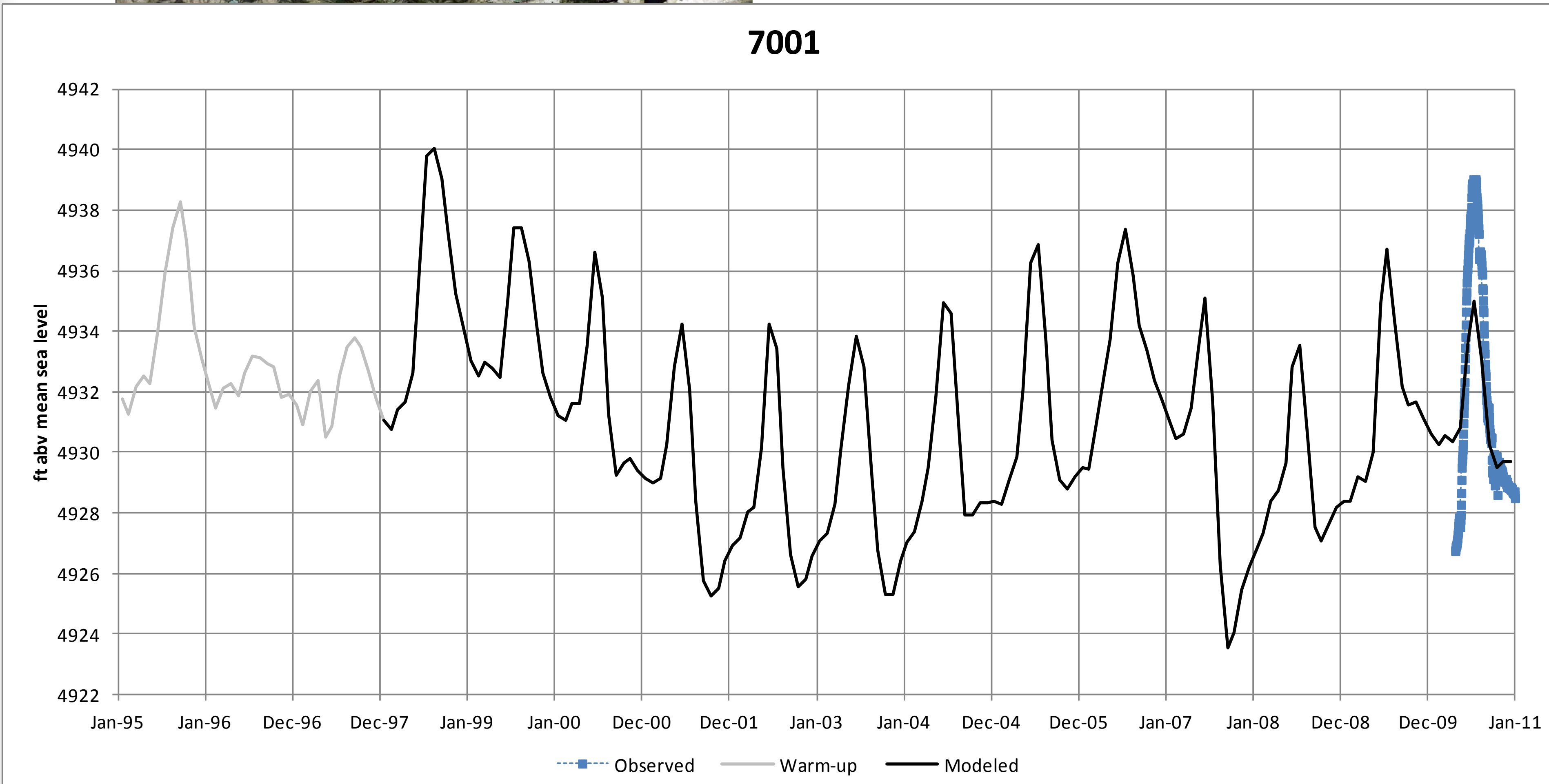
Sun Valley Wells



Sun Valley Wells



The Nature Conservancy Wells



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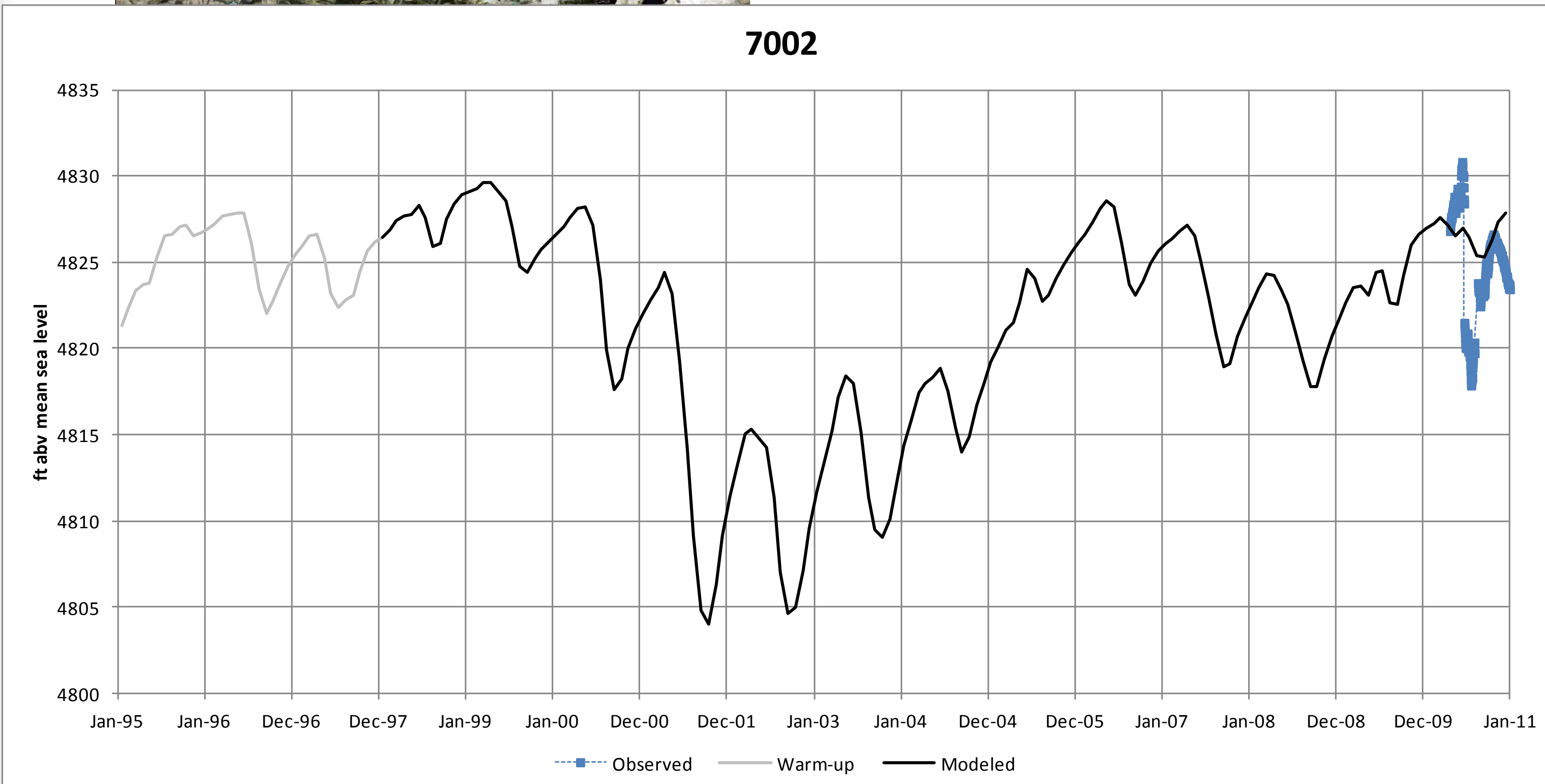

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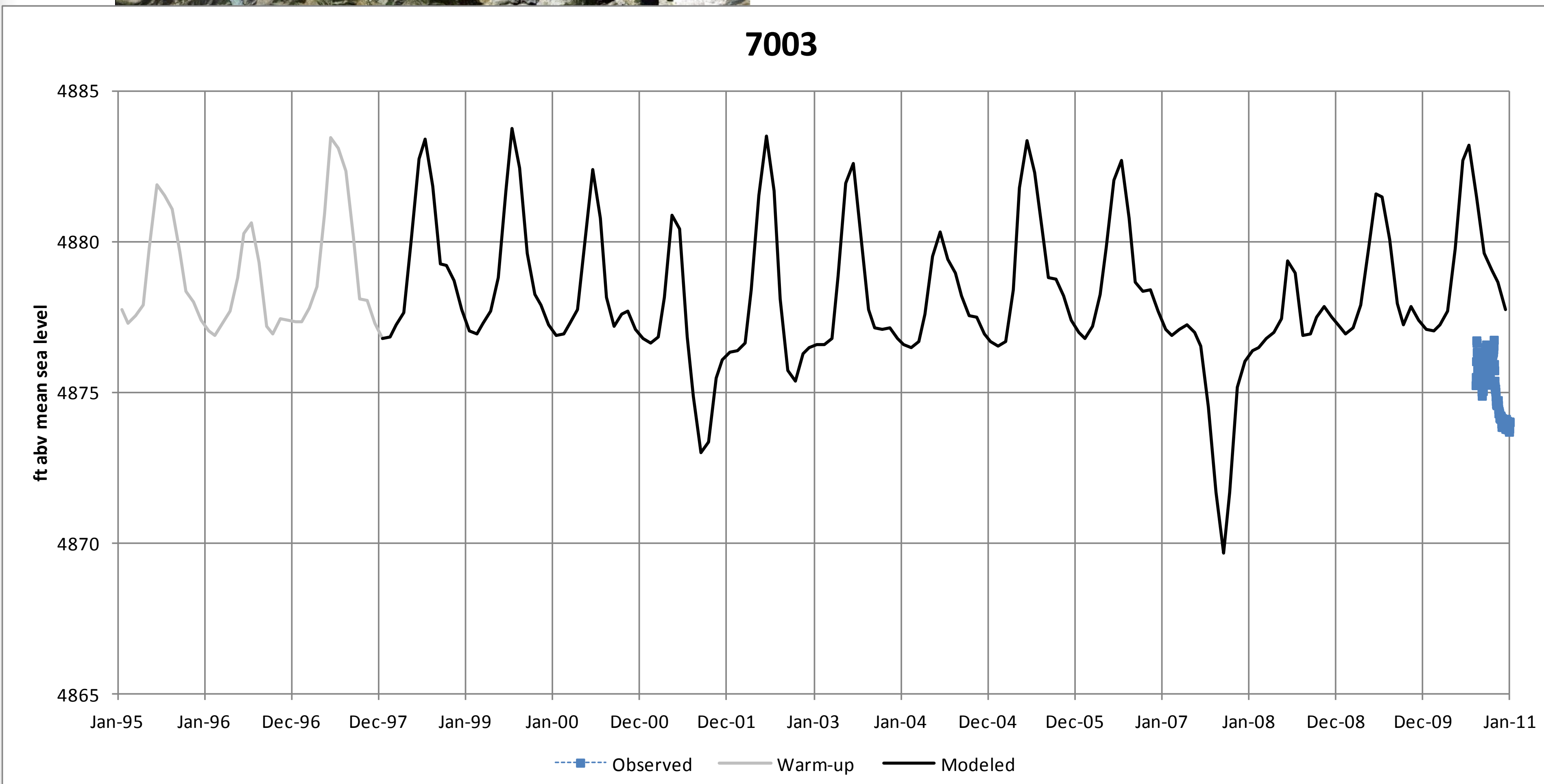

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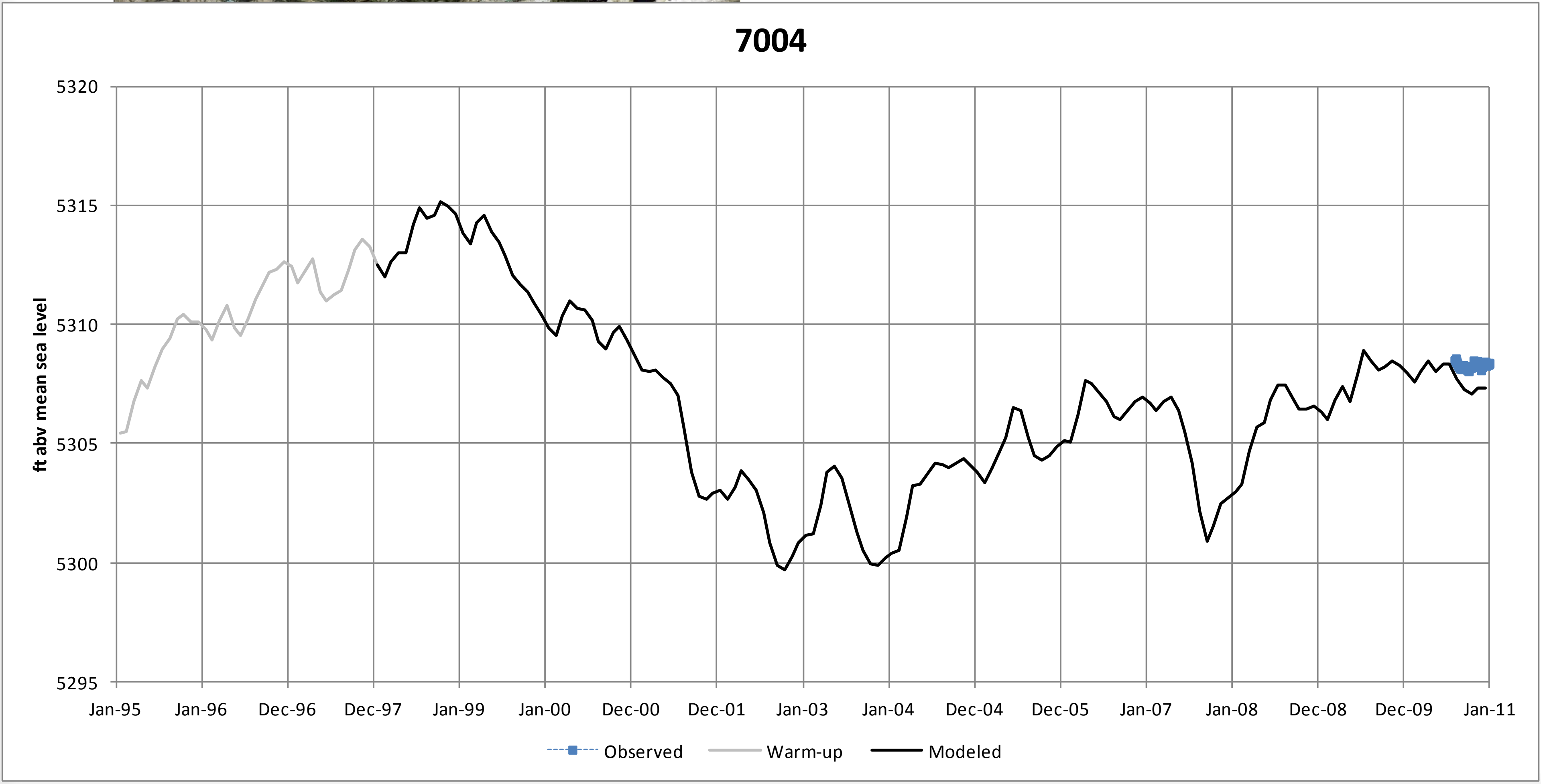

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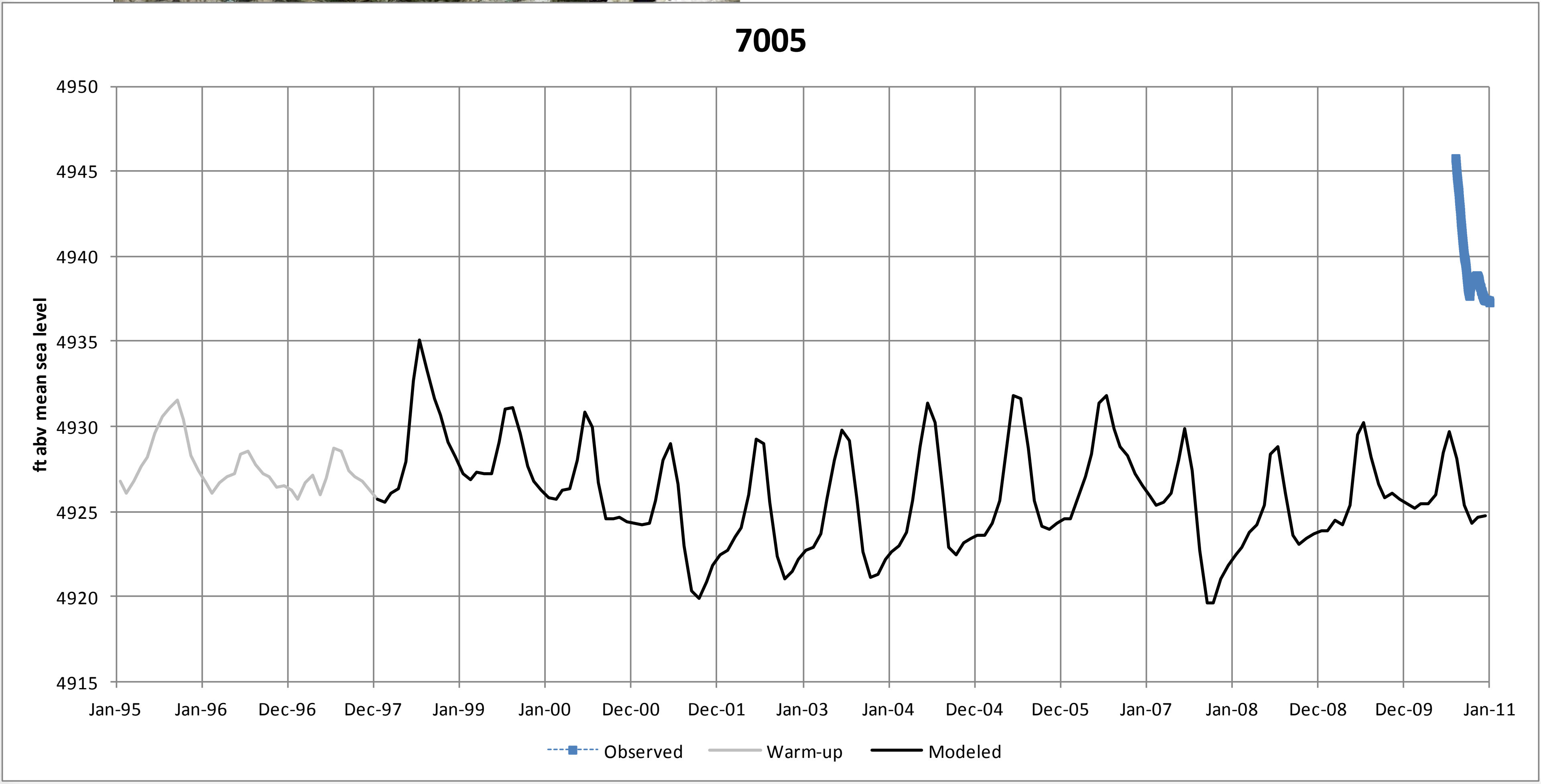

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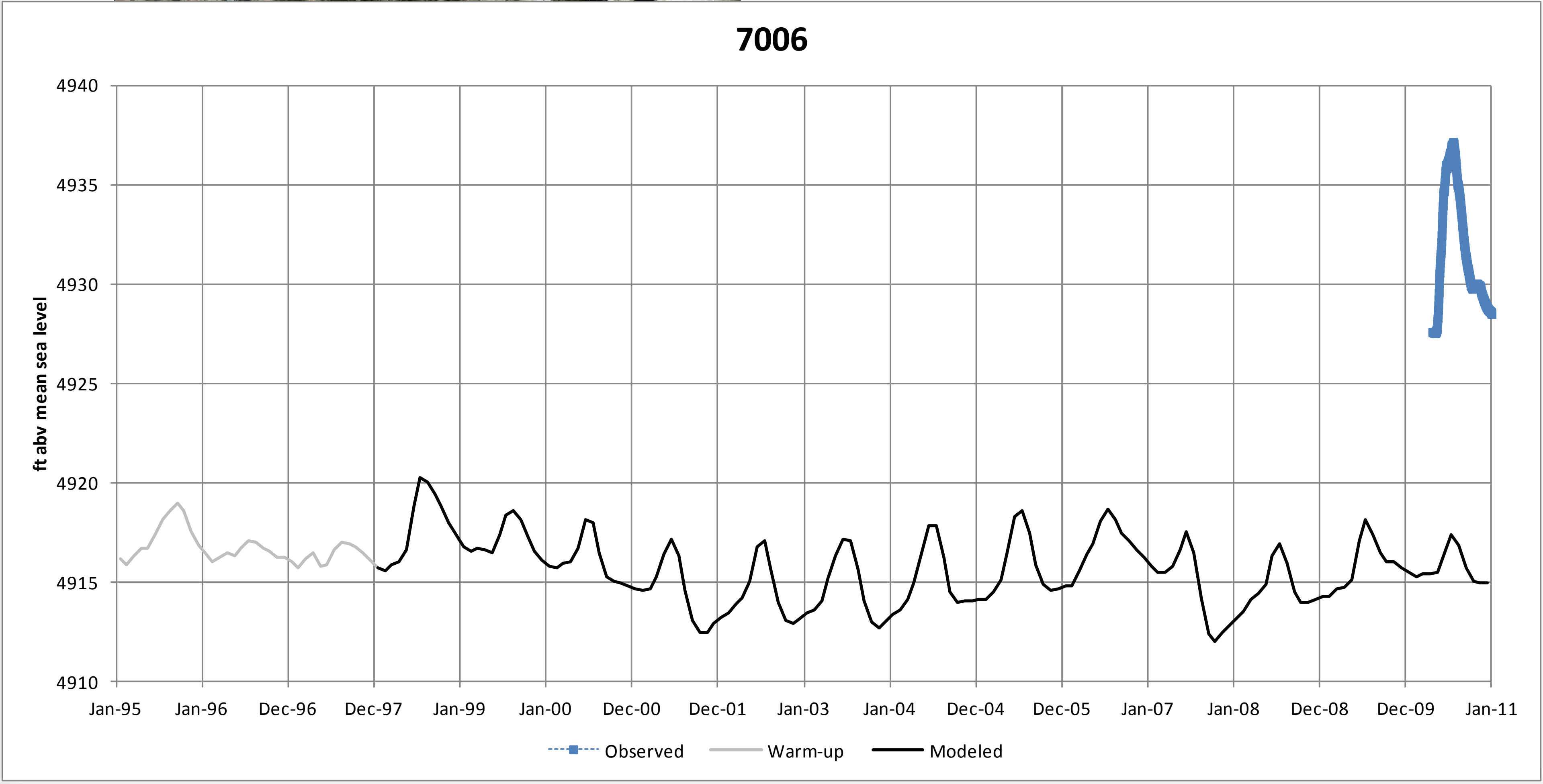

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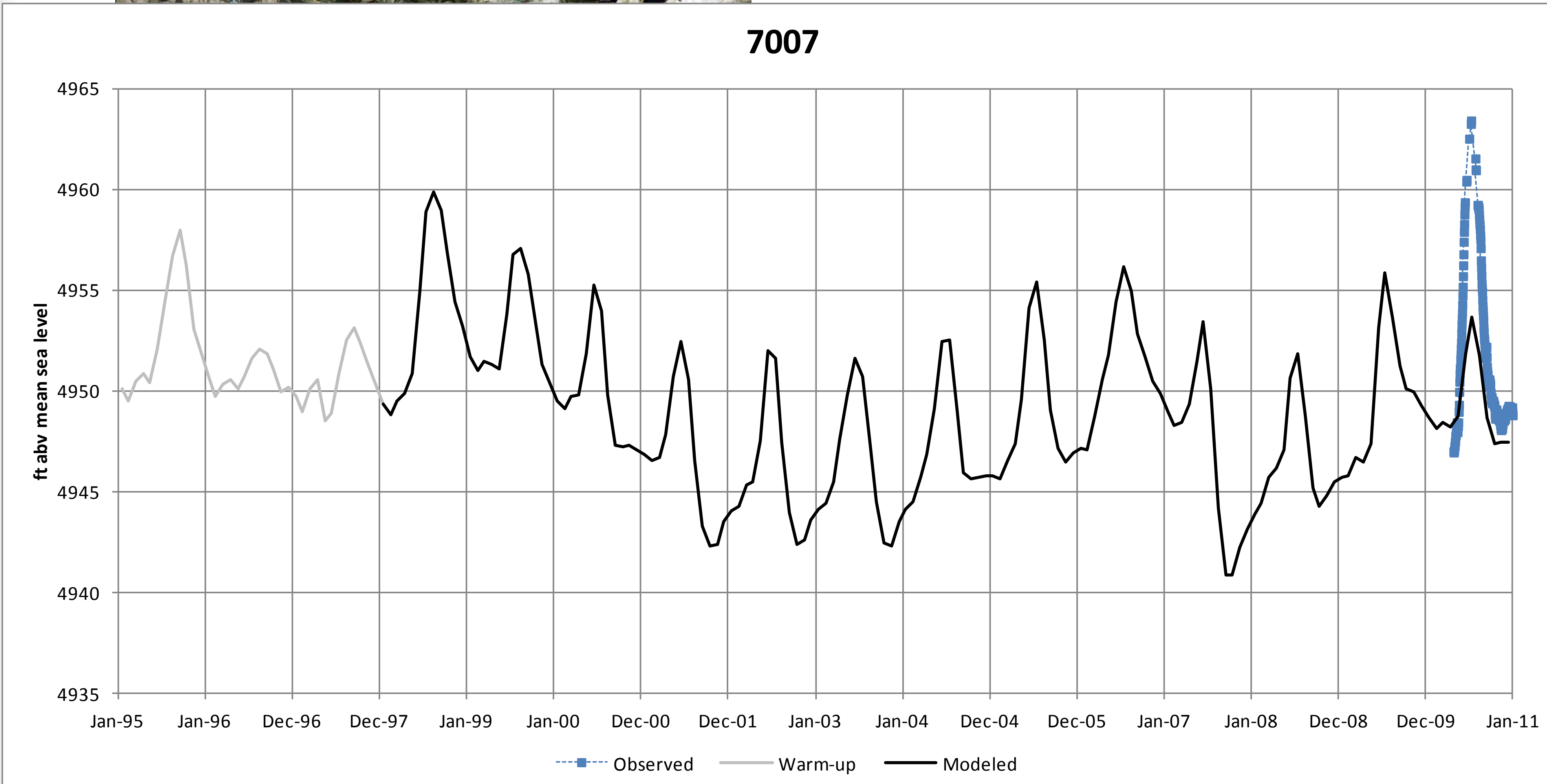

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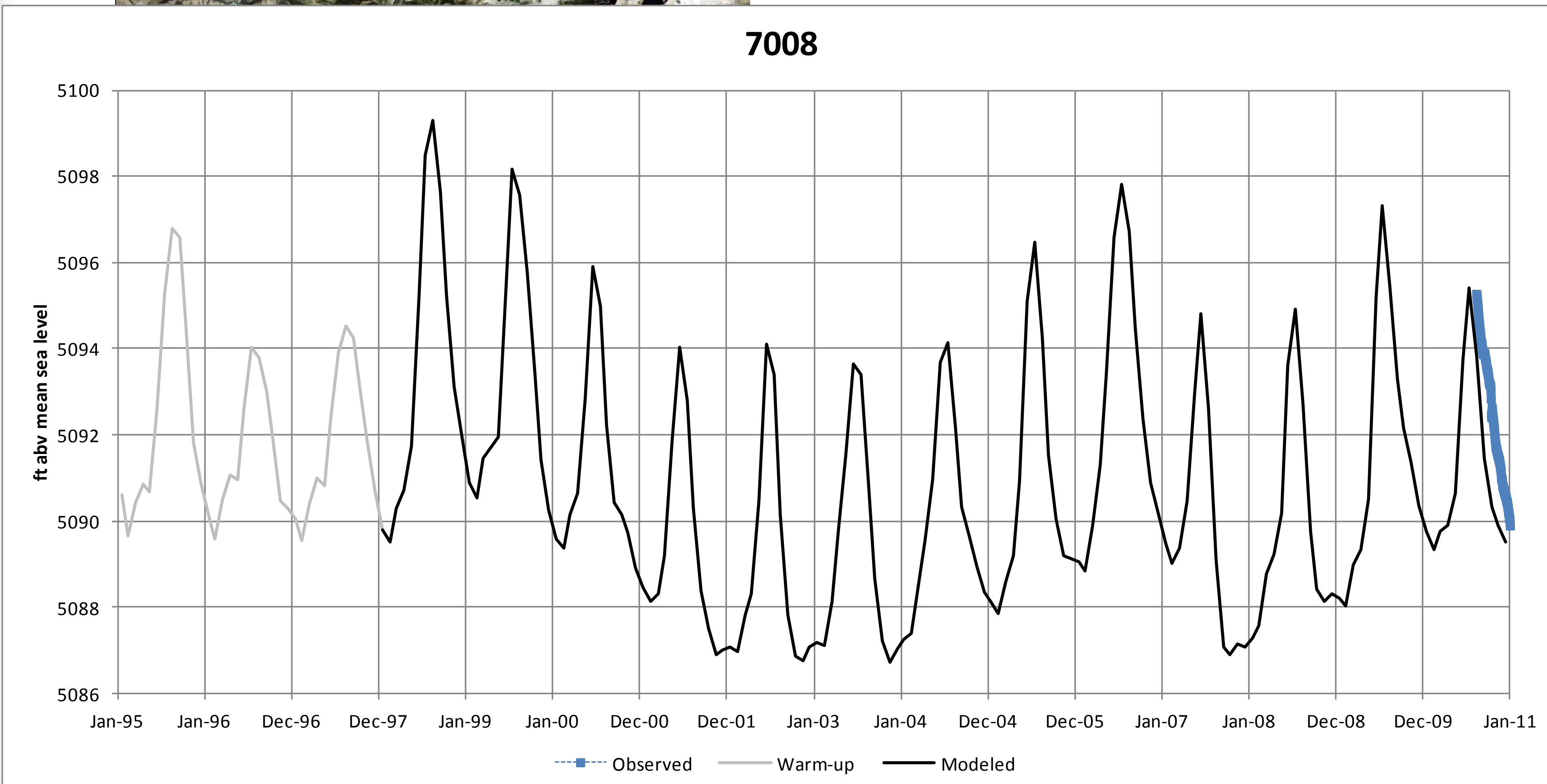

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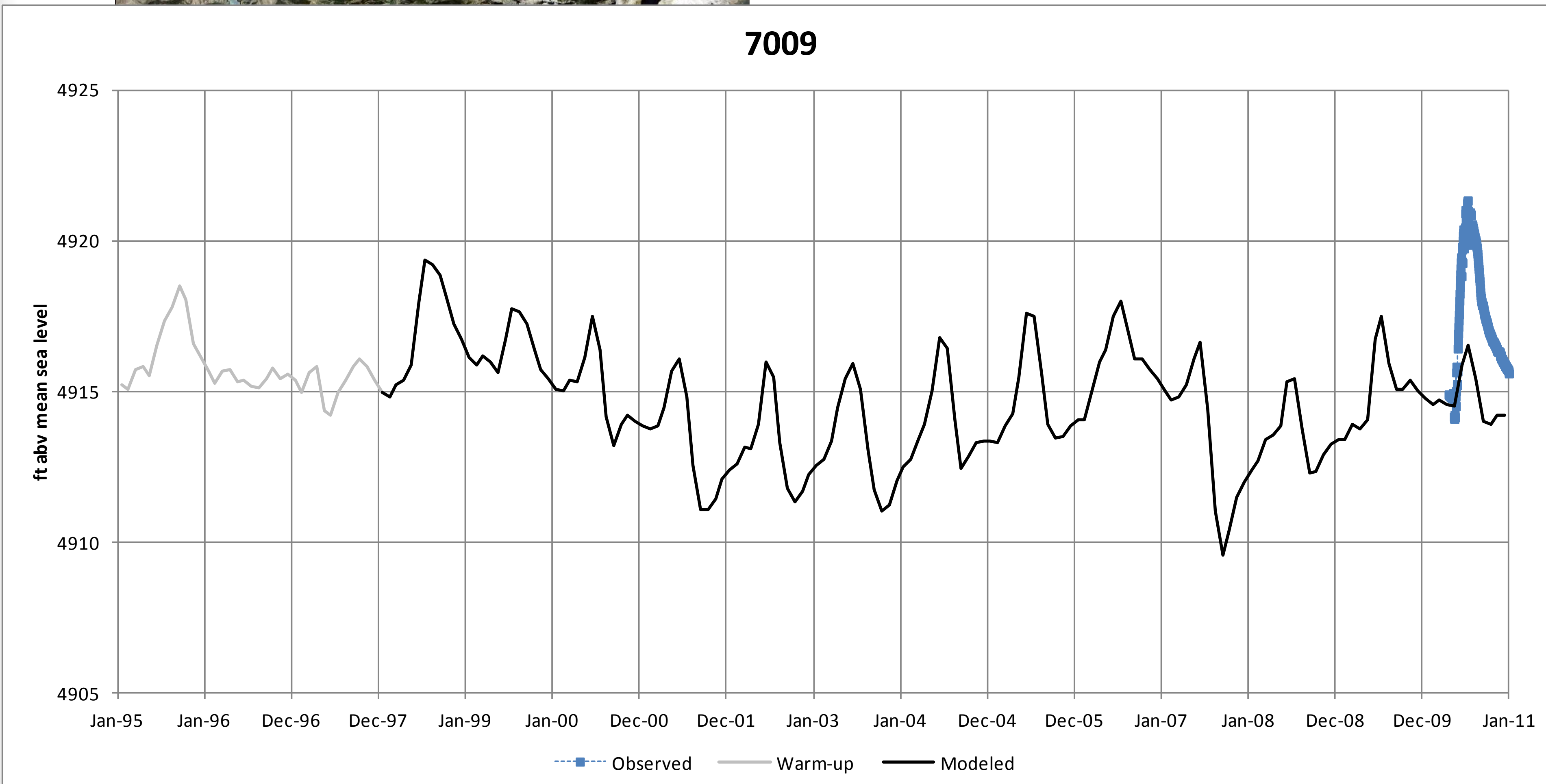

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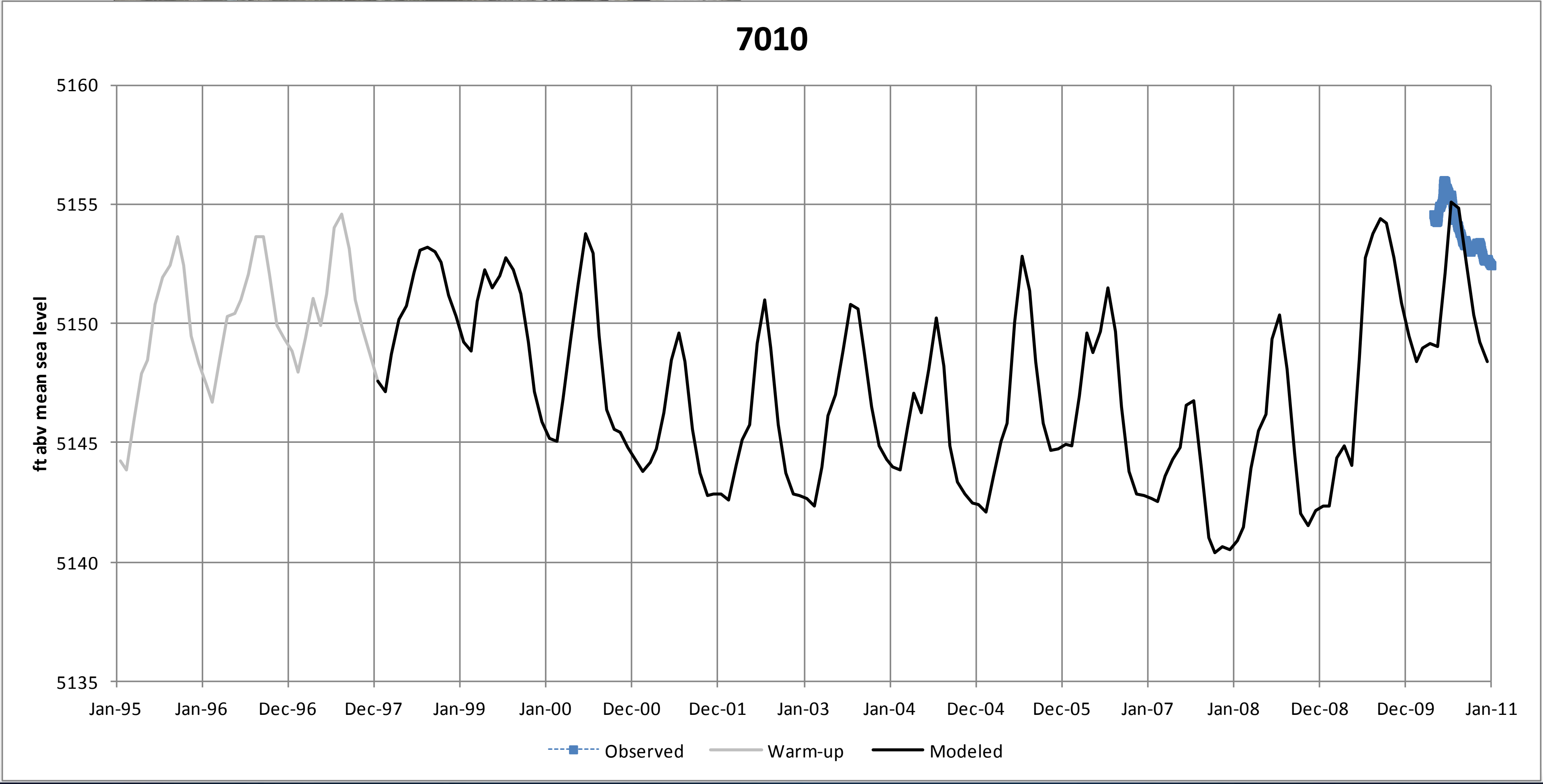
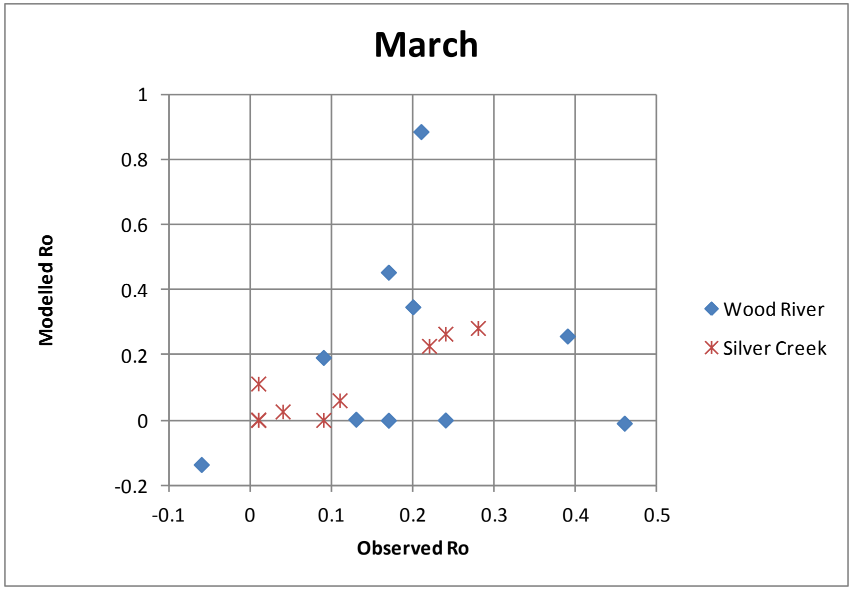
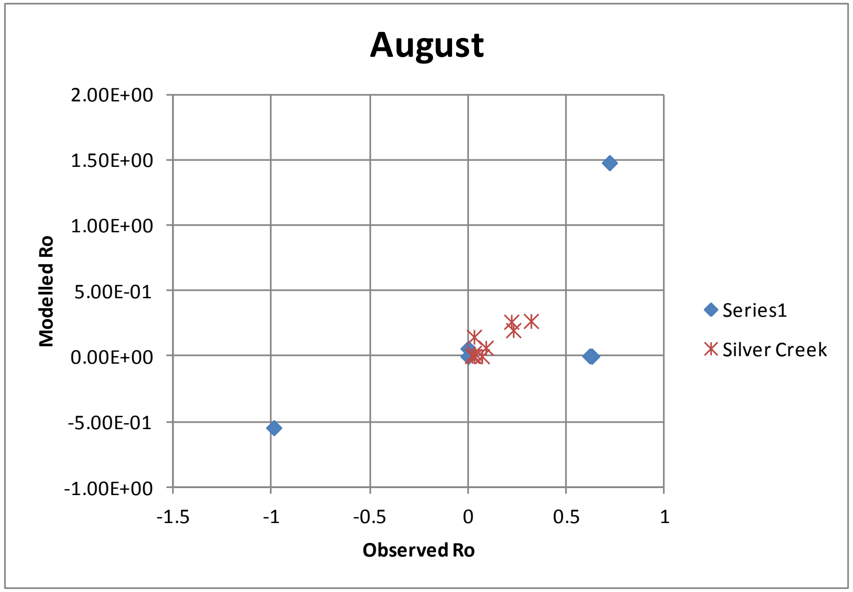


Sub-reach Targets



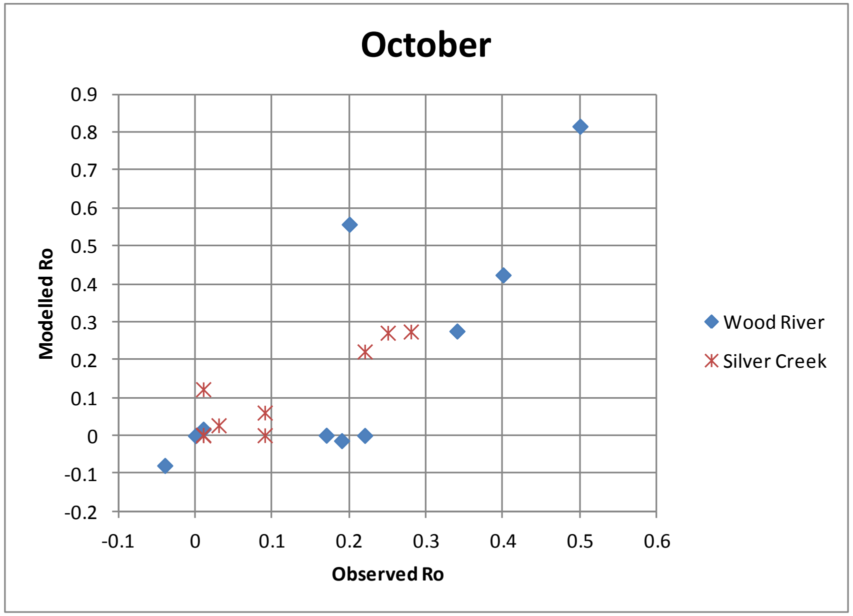
- March 2013 seepage run
- Match ratios to larger reach

Sub-reach Targets



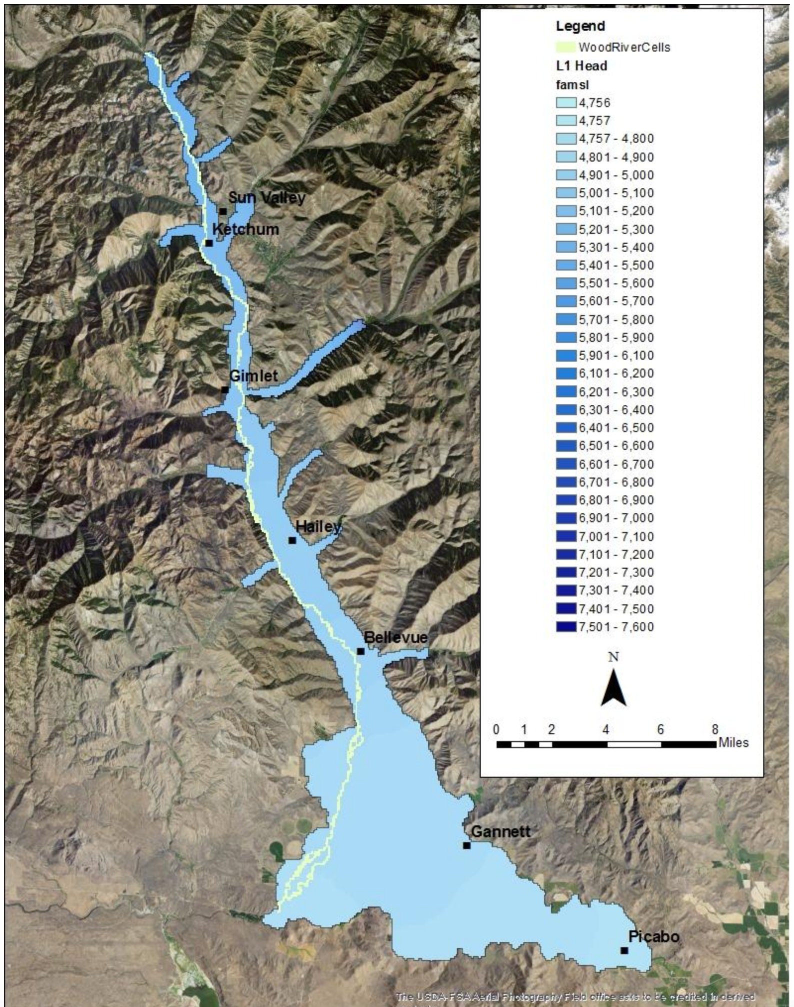
- August 2012 seepage run
- Match ratios to larger reach
- Flows for nr Ketchum to Hailey are unusual
- Seepage run results removed for nr Ketchum to Hailey

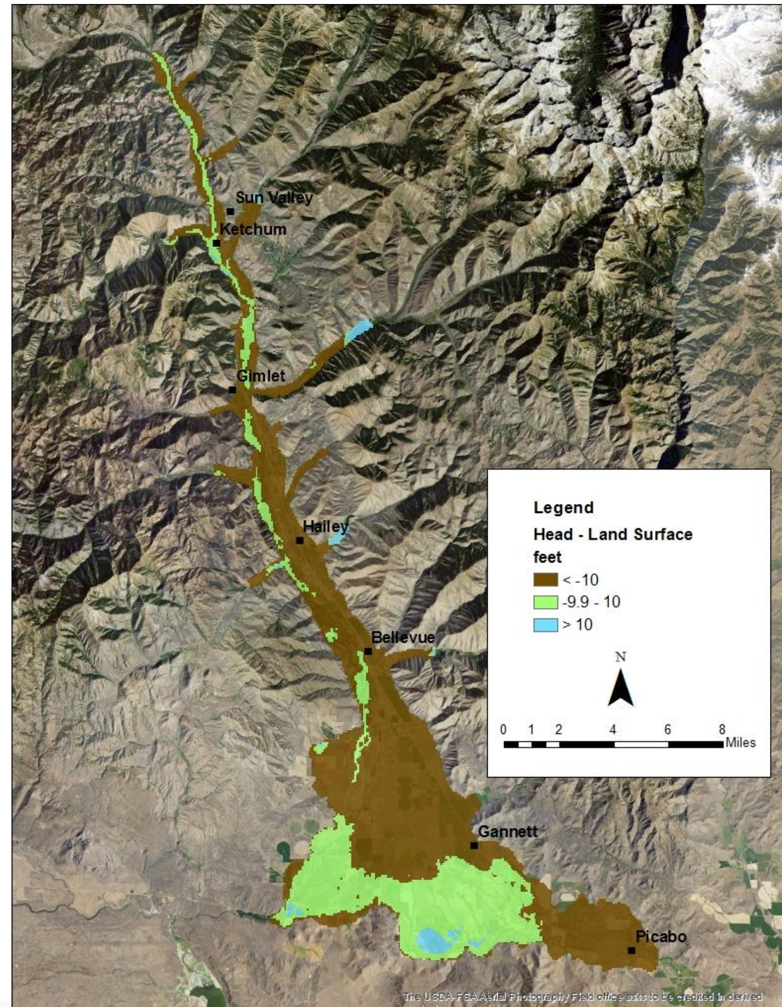
Sub-reach Targets



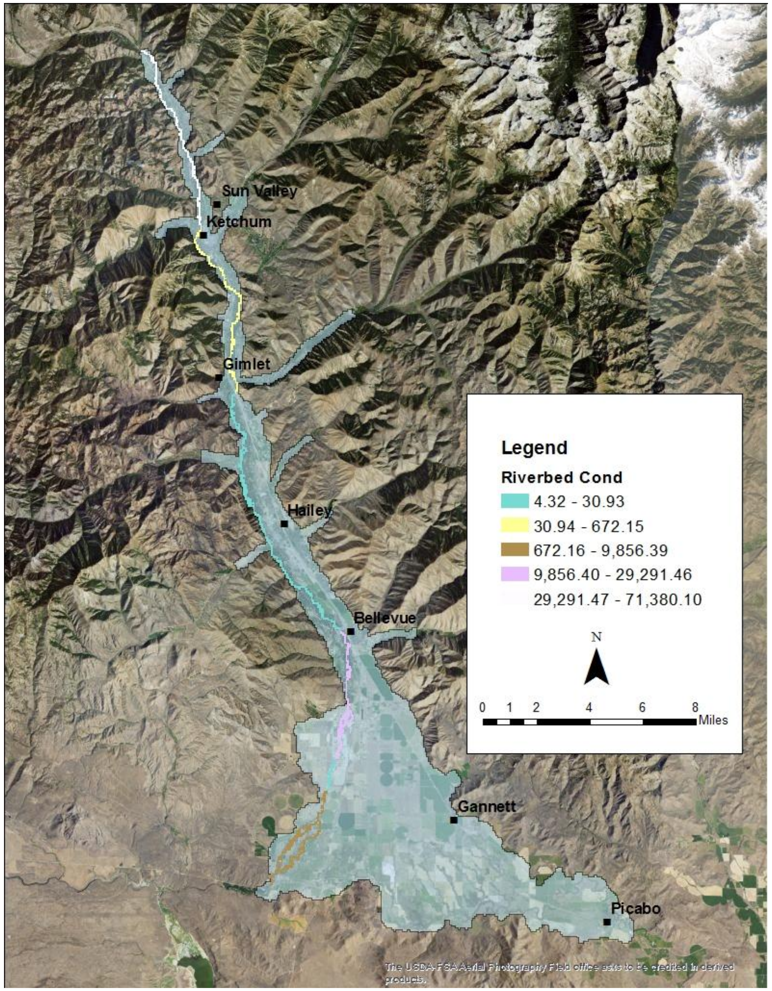
- October 2012 seepage run
- Match ratios to larger reach

Layer 1 Aquifer head (famsl)



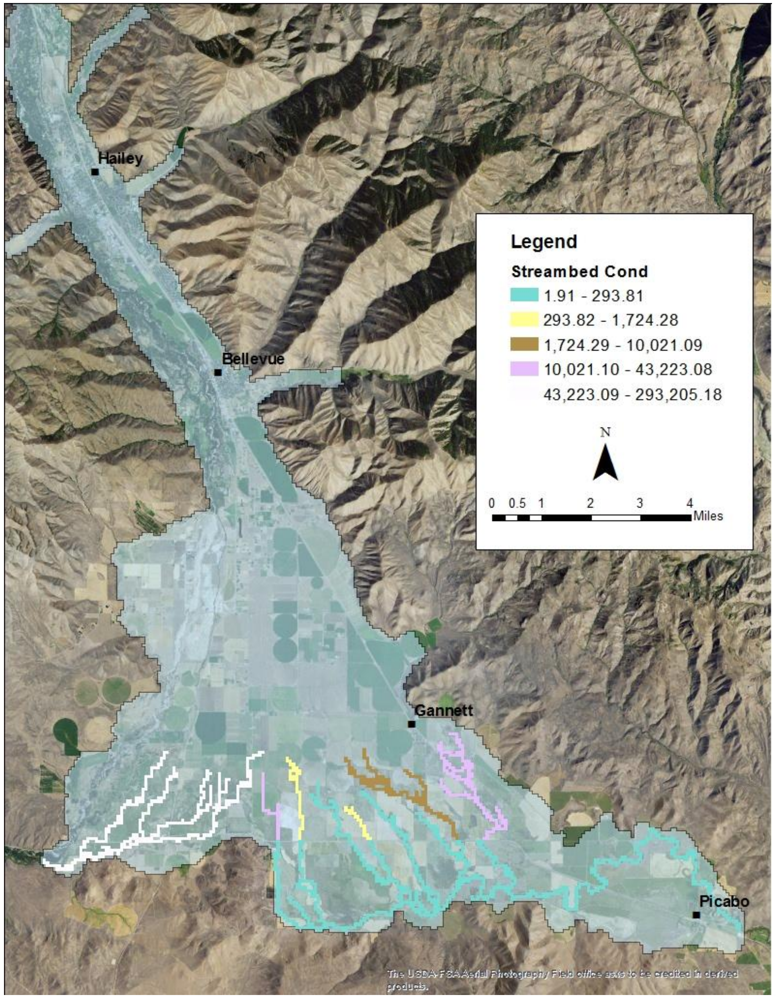


Riverbed Conductance



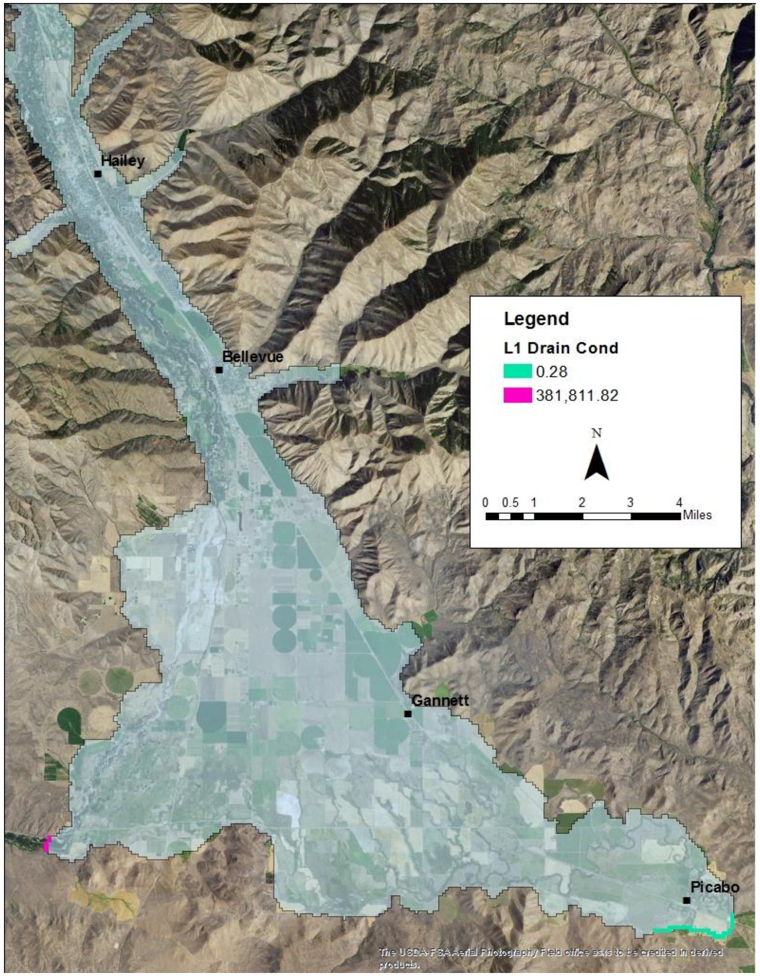
- Riverbed conductance in M^2/d
- Wood River

Streambed Conductance



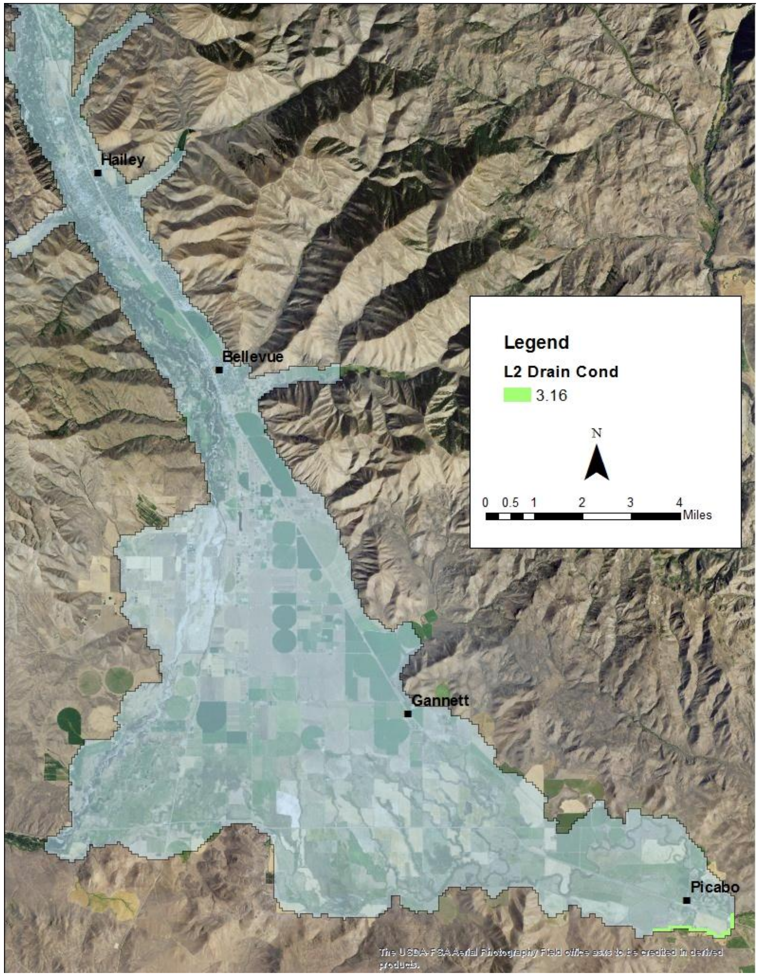
- Riverbed conductance in M^2/d
- Willow Cr, and Silver Cr

Drain Conductance



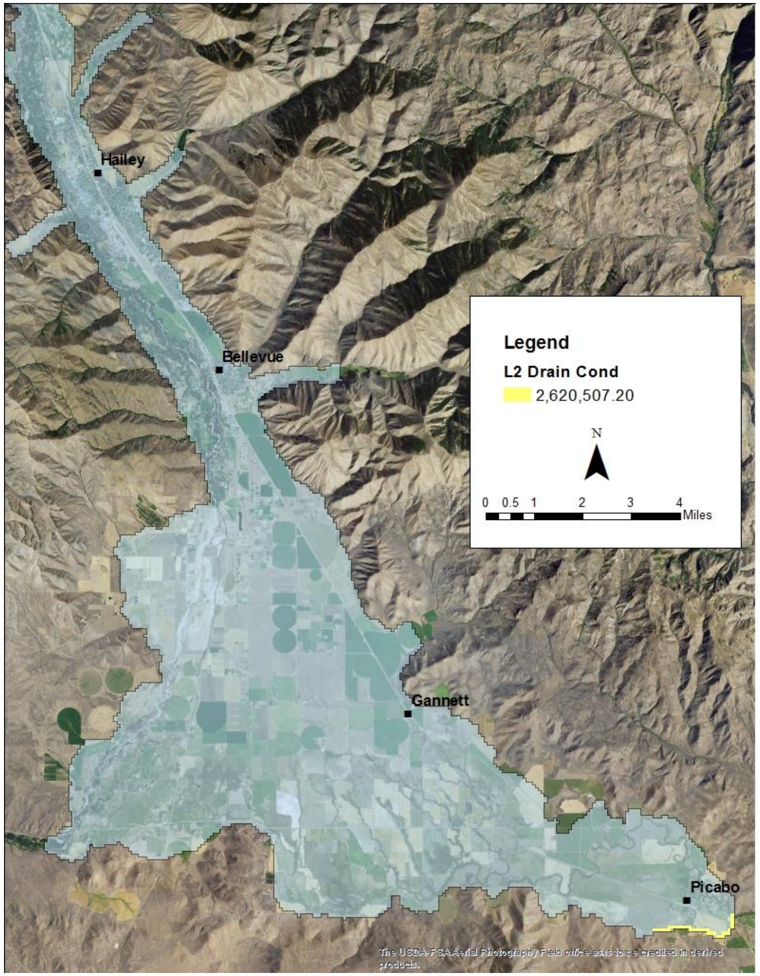
- Drain conductance in M^2/d
- Layer 1
  - Silver Creek
  - Stanton Crossing

Drain Conductance



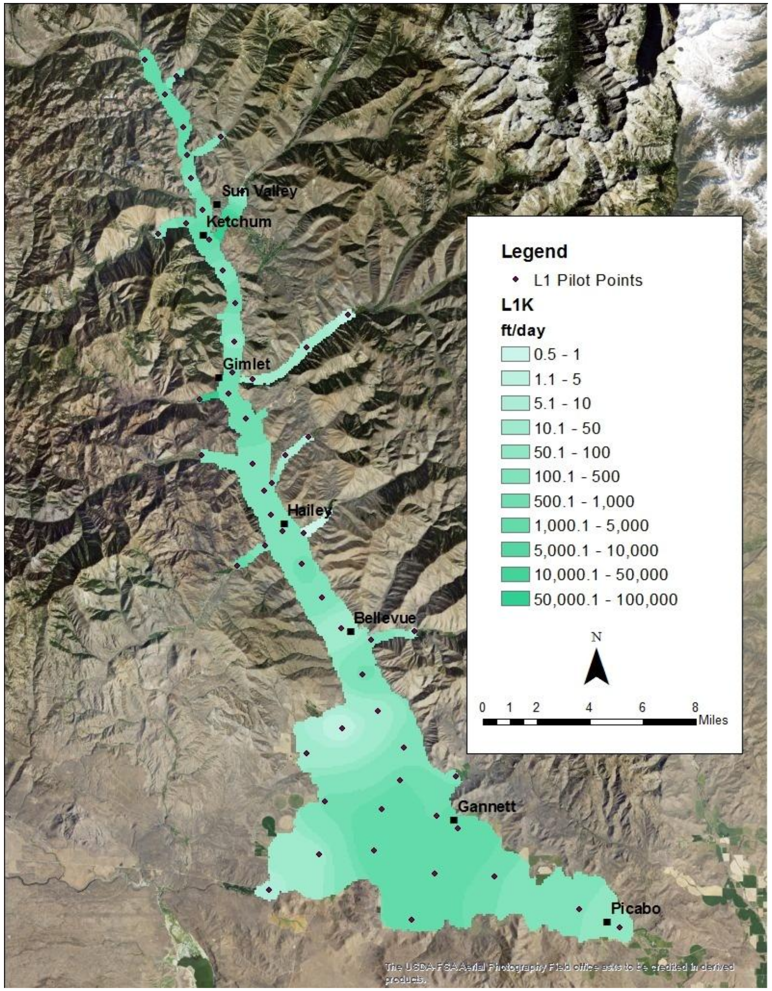
- Drain conductance in M^2/d
- Layer 2
  - Silver Creek

Drain Conductance



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

Layer 1 Hydraulic Conductivity



- Layer 1 modeled as non-time varying transmissivity
- Pilot points can be moved
- Number of pilot points not fixed
- Tributary valleys are in their own zones
- In valley and triangle
  - Min = 1.67 ft/day
  - Max = 4,412 ft/day
  - Mean = 715 ft/day

Layer 1 Hydraulic Conductivity

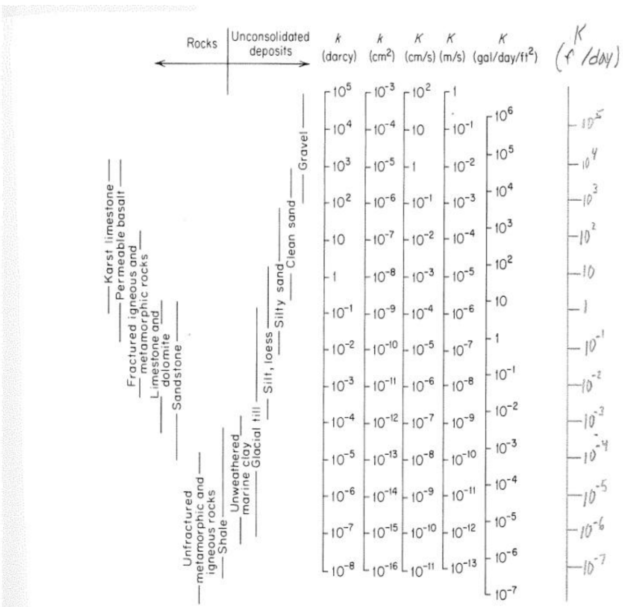


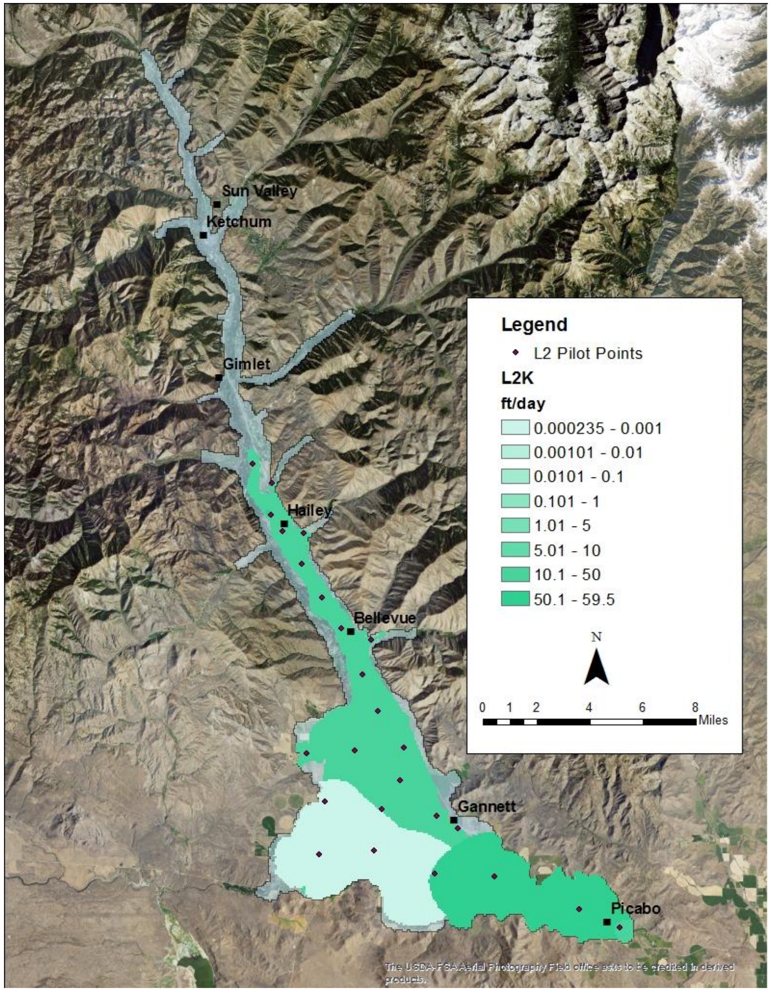
Table 2.3 Conversion Factors for Permeability and Hydraulic Conductivity Units

	Permeability, k^*			Hydraulic conductivity, K		
	cm²	ft²	darcy	m/s	ft/s	U.S. gal/day/ft²
cm²	1	1.08×10^{-3}	1.01×10^{8}	9.80×10^{2}	3.22×10^{3}	1.85×10^{9}
ft²	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

Groundwater, Freeze & Cherry, 1979

- Tributary valleys are in their own zones
  - Contain maximum and minimum values
- In valley and triangle
  - Min = 1.67 ft/day
  - Max = 4,412 ft/day
  - Mean = 715 ft/day
- 437 wells in Wood River alluvial sediments.

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 = 27 ft/day
  - Max = 52 ft/day
  - Mean = 33 ft/day

Layer 2 Hydraulic Conductivity

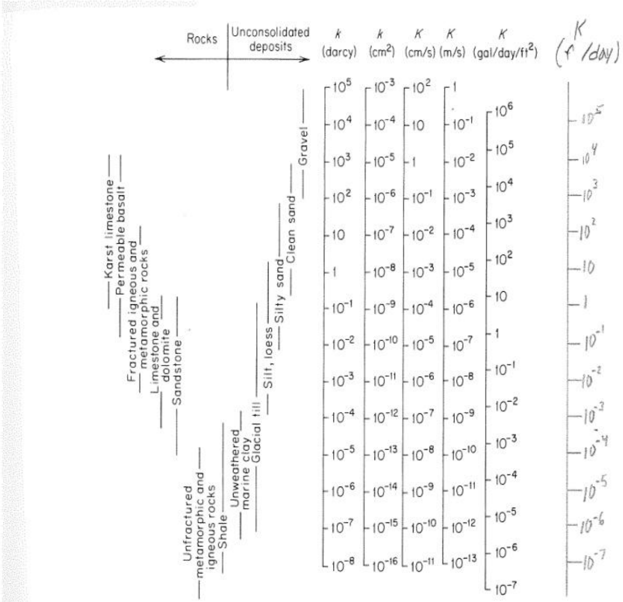


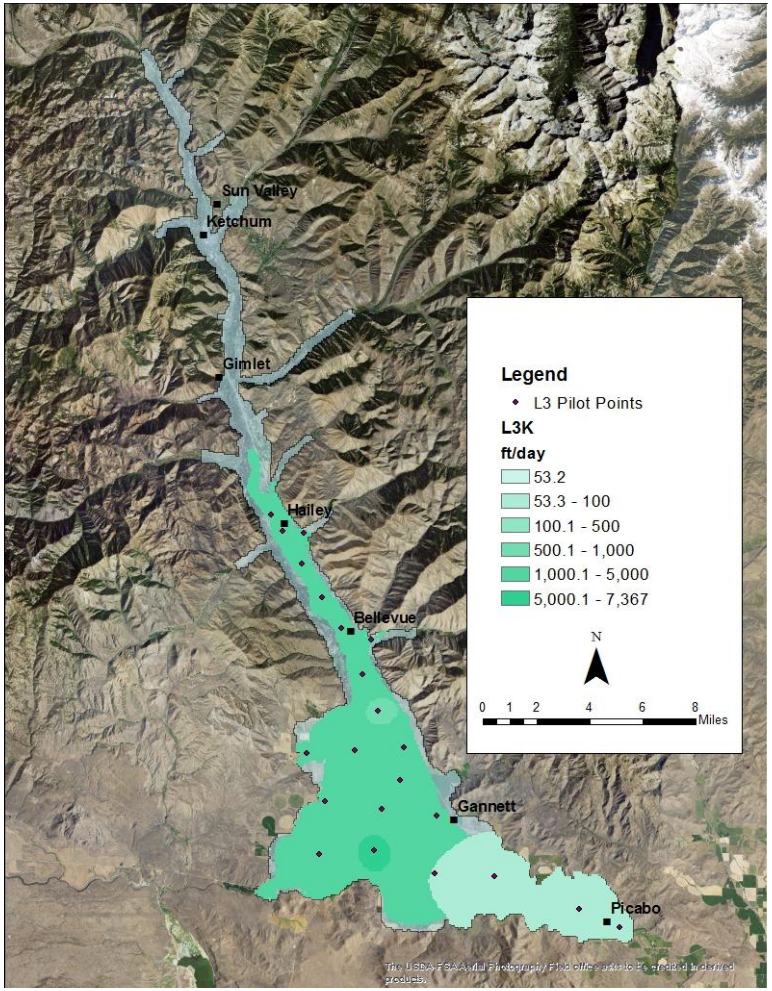
Table 2.3 Conversion Factors for Permeability and Hydraulic Conductivity Units

have	WANT Permeability, k^*			Hydraulic conductivity, K		
	cm^2	ft^2	darcy	m/s	ft/s	U.S. gal/day/ft^2
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/ft^2	5.42×10^{-10}	5.83×10^{-13}	5.49×10^{-2}	4.72×10^{-7}	1.55×10^{-6}	1

Groundwater, Freeze & Cherry, 1979

- Low hydraulic conductivity in confining layer
  - Min = 0.000236 ft/day
  - Max = 0.000469 ft/day
- Basalt
  - Min = 49.7 ft/day
  - Max = 59.4 ft/day
- Sand and gravel In valley and triangle
  - Min = 27 ft/day
  - Max = 52 ft/day
  - Mean = 33 ft/day
- 14 wells in Wood River alluvial sediments.

Layer 3 Hydraulic Conductivity



- Layer 3 modeled as confined
- Basalt
  - Min = 53.1 ft/day
  - Max = 68.2 ft/day
- Sand and gravel aquifer in valley and triangle
  - Min = 724 ft/day
  - Max = 7,365 ft/day
  - Mean = 2,595 ft/day

Layer 3 Hydraulic Conductivity

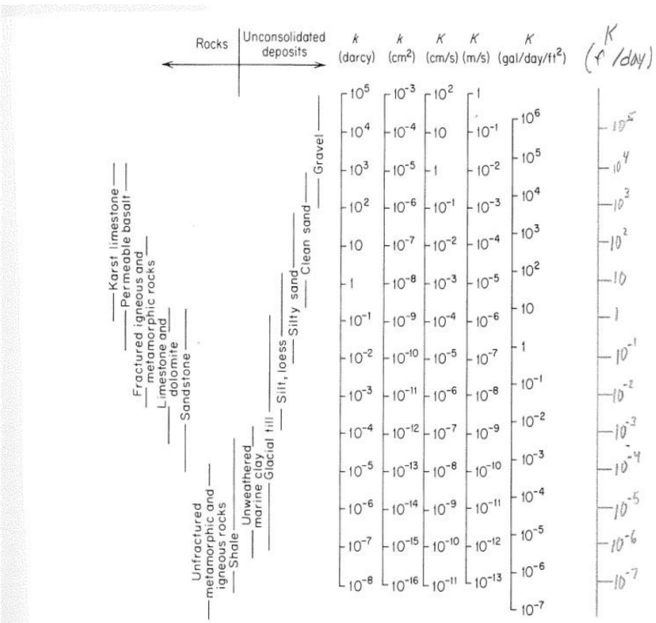


Table 2.3 Conversion Factors for Permeability and Hydraulic Conductivity Units

	Permeability, k*			Hydraulic conductivity, K		
	cm^2	ft^2	darcy	m/s	ft/s	U.S. gal/day/ft^2
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/ft^2	5.42×10^{-10}	5.83×10^{-13}	5.49×10^{-2}	4.72×10^{-7}	1.55×10^{-6}	1

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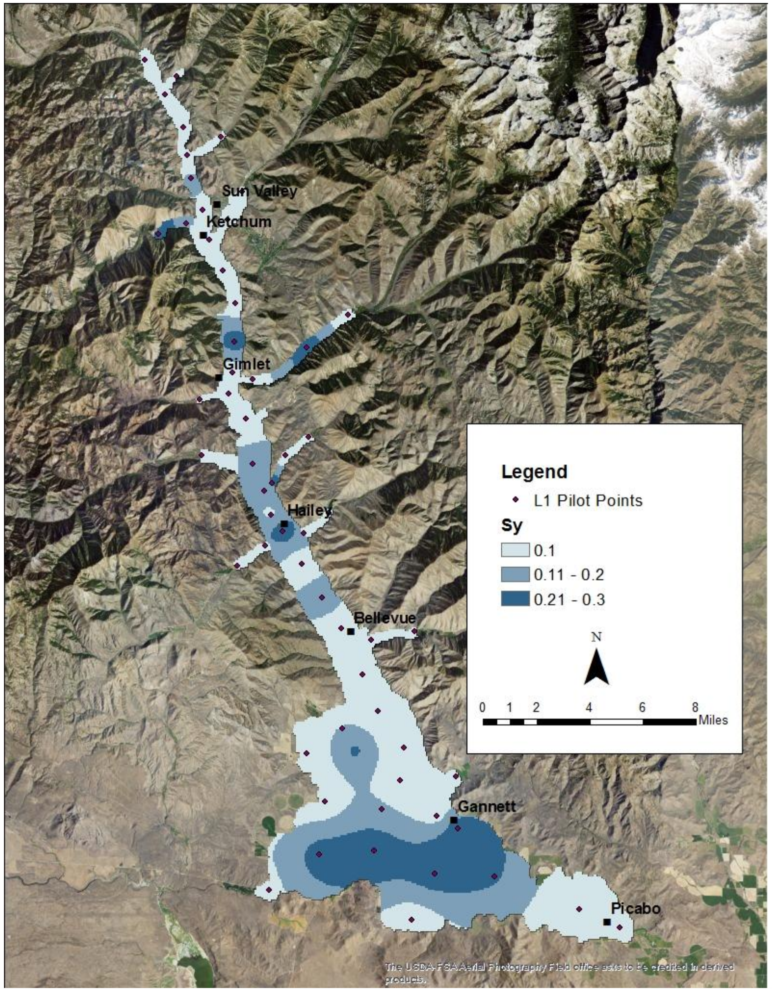
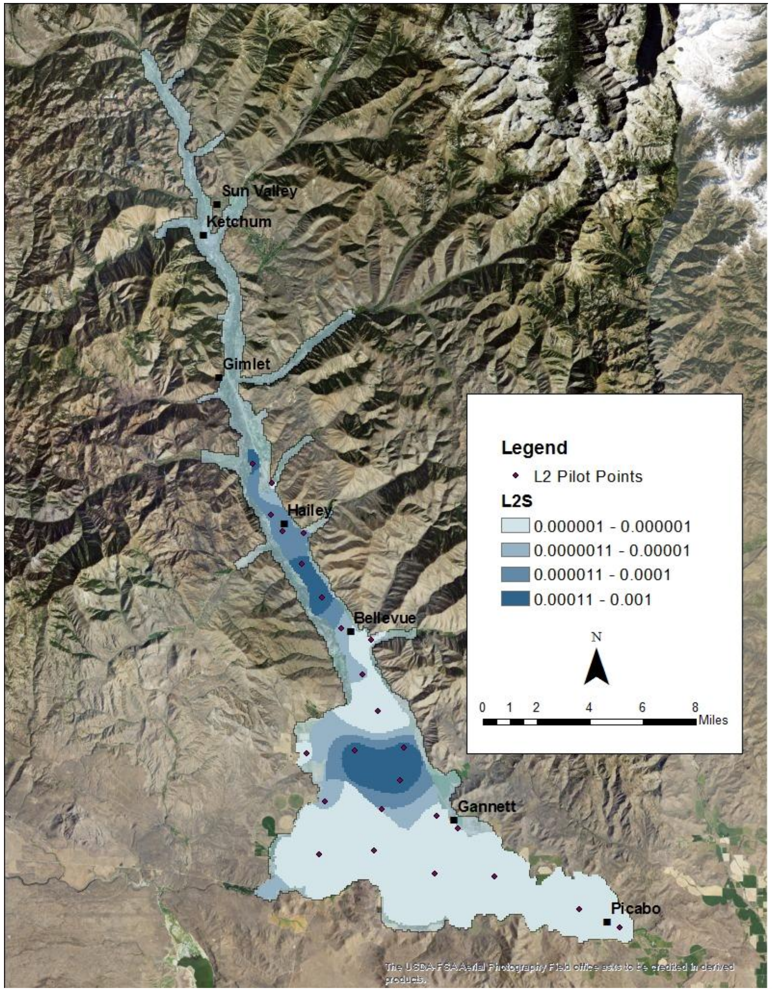
Layer 1 Storage



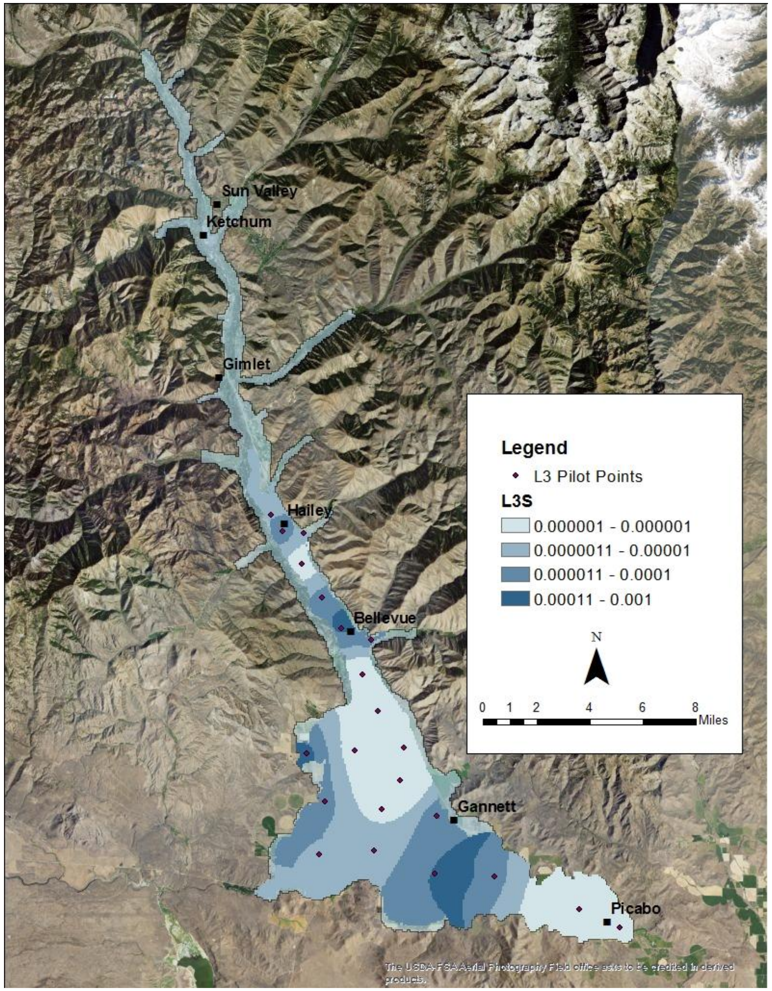
- Layer 1 temporarily modeled as non-time varying thickness
- Pilot points can be moved
- Number of pilot points not fixed

Layer 2 Storage



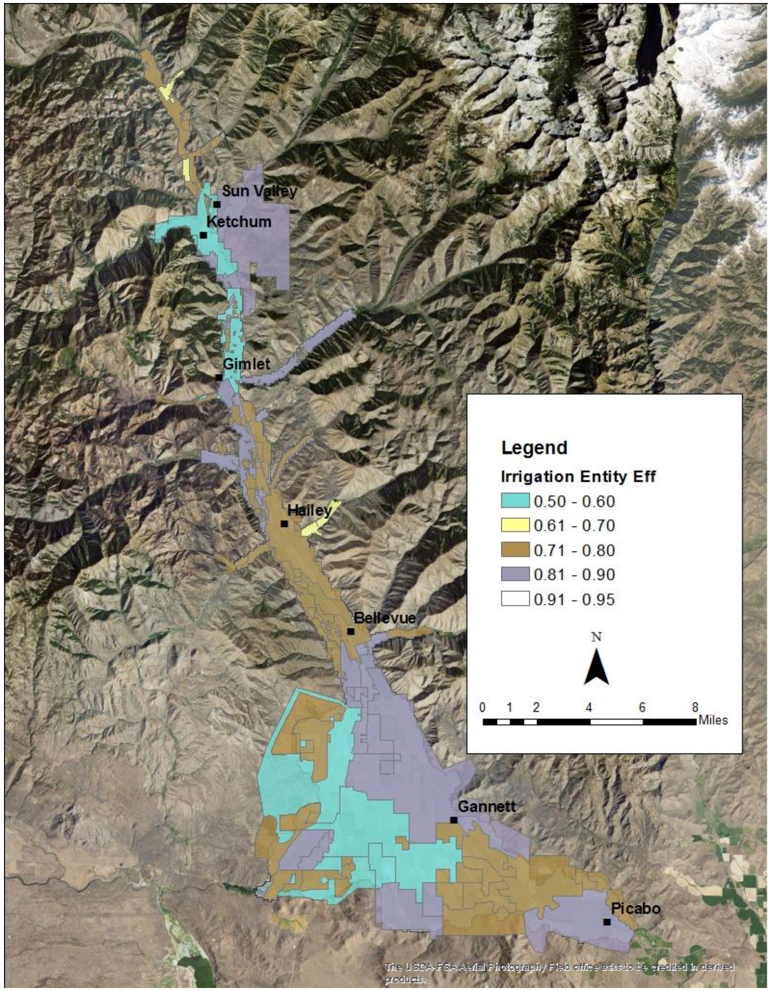
- Layer 2 modeled as storage
- Includes basalt in east
- Includes confining layer
- Pilot points can be moved
- Number of pilot points can be changed

Layer 3 Storage



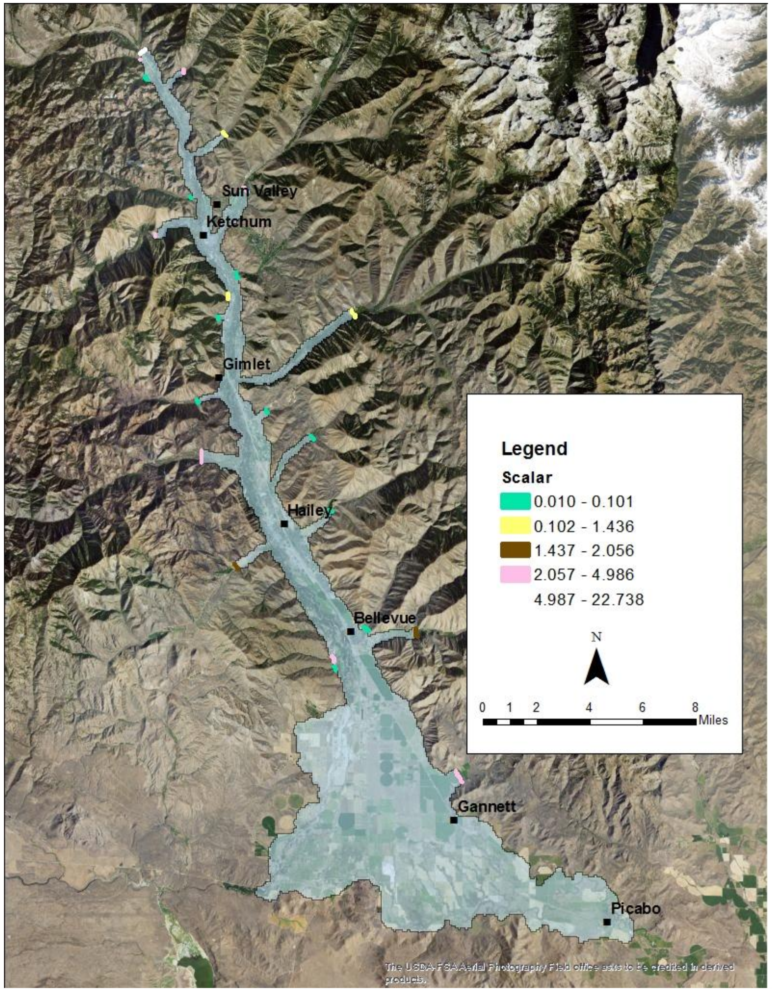
- Layer 3 modeled as storage
- Includes basalt in east
- Pilot points can be moved
- Number of pilot points can be changed

Surface Water Irrigation Efficiency



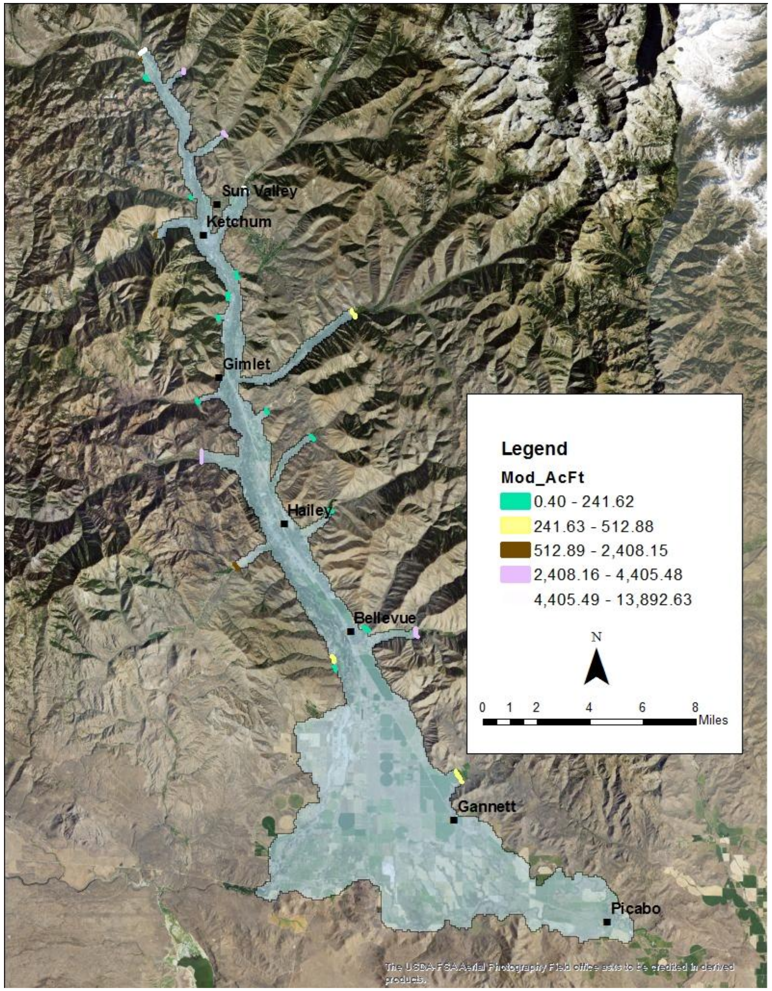
- CIR/Diversion
  - Efficiency of canal system and field irrigation system
- Inefficient fraction infiltrates into layer 1 aquifer
  - Note to the engineers
    - Low efficiency is not necessarily bad

Tributary Underflow



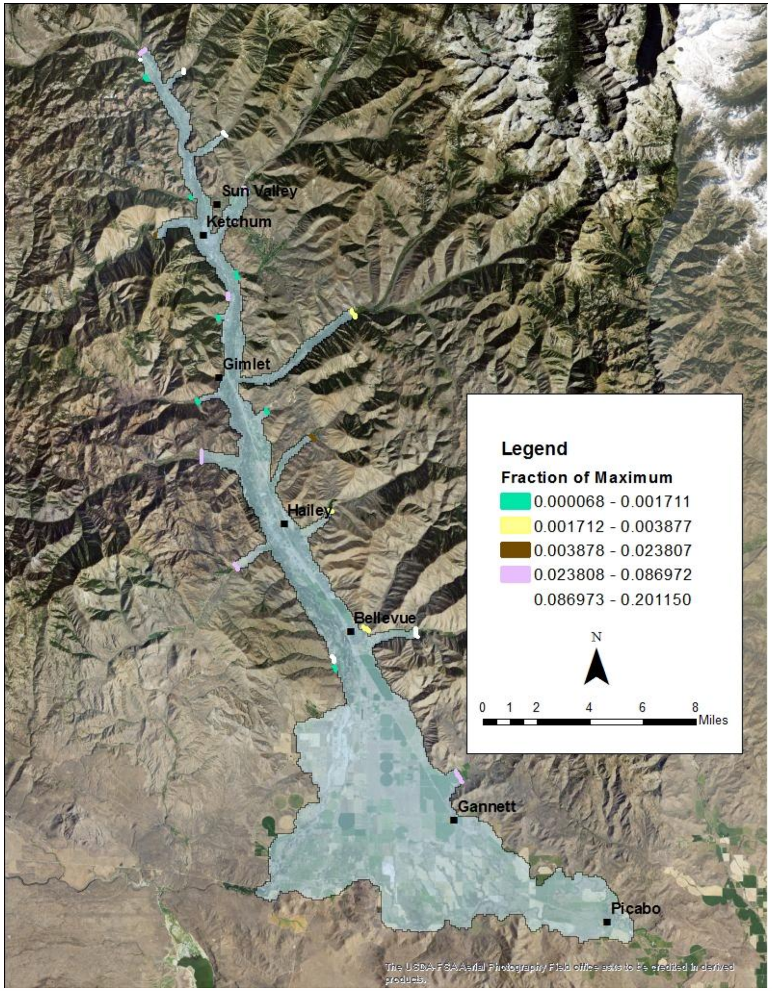
- Trib underflow adjusted using
  - Adjustment factors
    - Adjust average flux
  - Reduction factor
    - Adjust seasonal amplitude
  - Averaging period
    - 200 day, 300 day, 400 day , etc

Tributary Underflow



Tributary	Scalar	Av Basin Precip AcFt	Modeled AcFt	% Basin Av PPT
Adams Gulch	0.01	17600	8.51	0.05%
Chocolate Gulch	0.01	864	0.70	0.08%
Cold Springs Gulch	0.91	3341	159.26	4.77%
Clear Creek	0.01	2288	1.06	0.05%
Cove Canyon	3.59	11200	512.88	4.58%
Croy Creek	2.06	23595	1447.38	6.13%
Deer Creek	3.02	74213	4405.48	5.94%
Eagle Creek	3.40	17248	3442.80	19.96%
Elkhorn Gulch	0.02	12757	0.87	0.01%
East Fork	1.00	120629	467.69	0.39%
Greenhorn Gulch	0.08	30464	52.12	0.17%
Indian Creek	0.10	10149	241.62	2.38%
Lake Creek	1.44	17280	3441.64	19.92%
Lees Gulch	3.79	2240	450.58	20.12%
Ohio Gulch	0.01	4270	2.12	0.05%
Oregon Gulch	3.38	6919	1161.58	16.79%
Quigley Creek	0.09	15504	48.27	0.31%
Seamans Creek	1.93	18768	3740.12	19.93%
Slaughterhouse Gulch	0.08	11509	39.73	0.35%
Trail Creek	3.36	111274	9677.70	8.70%
Townsend Gulch	0.01	960	0.40	0.04%
Upper Big Wood River	22.74	313278	13892.63	4.43%
Warm Springs Creek	4.99	180735	2408.15	1.33%

Tributary Underflow



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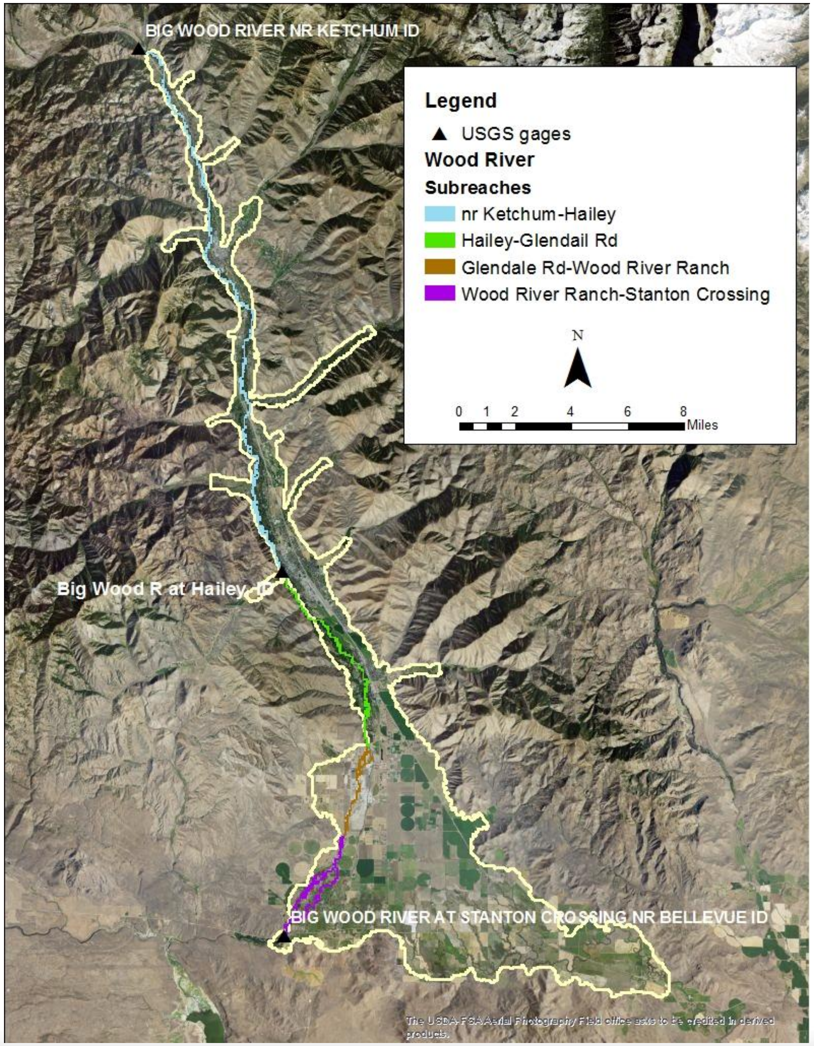
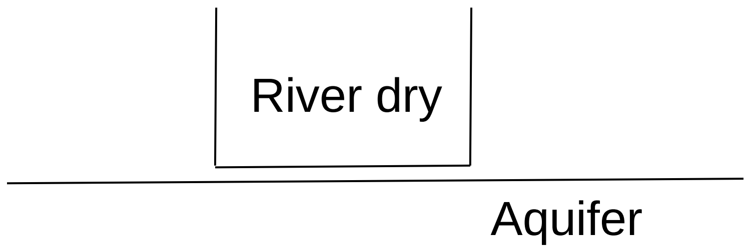
IDAHO Department of Water Resources

OLD Wood River Stage

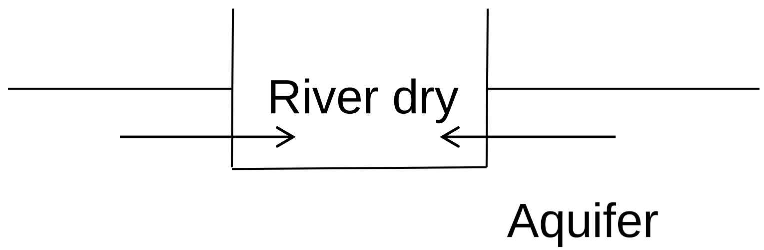


- Nr Ketchum to Hailey
  - Interpolate change between Nr Ketchum and At Hailey
- Hailey to Glendale Rd
  - Use change from At Hailey
- Glendale Rd to Wood River Ranch
  - Use steady state stage when dry bed is not dry
  - Stage = river bottom when dry bed is dry
- Wood River Ranch to At Stanton Crossing
  - Use At Stanton Crossing change

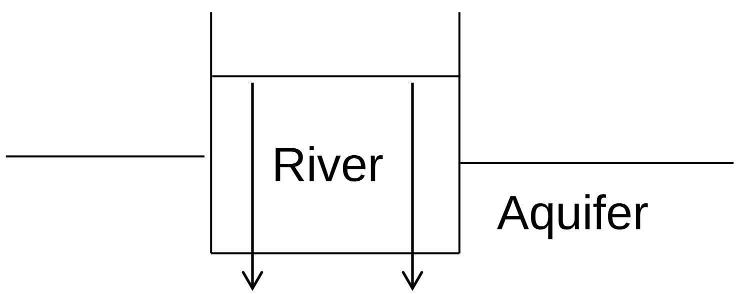
MODFLOW River Package



- River stage = river bottom
  - River dry perched above aquifer
  - No aquifer river interaction

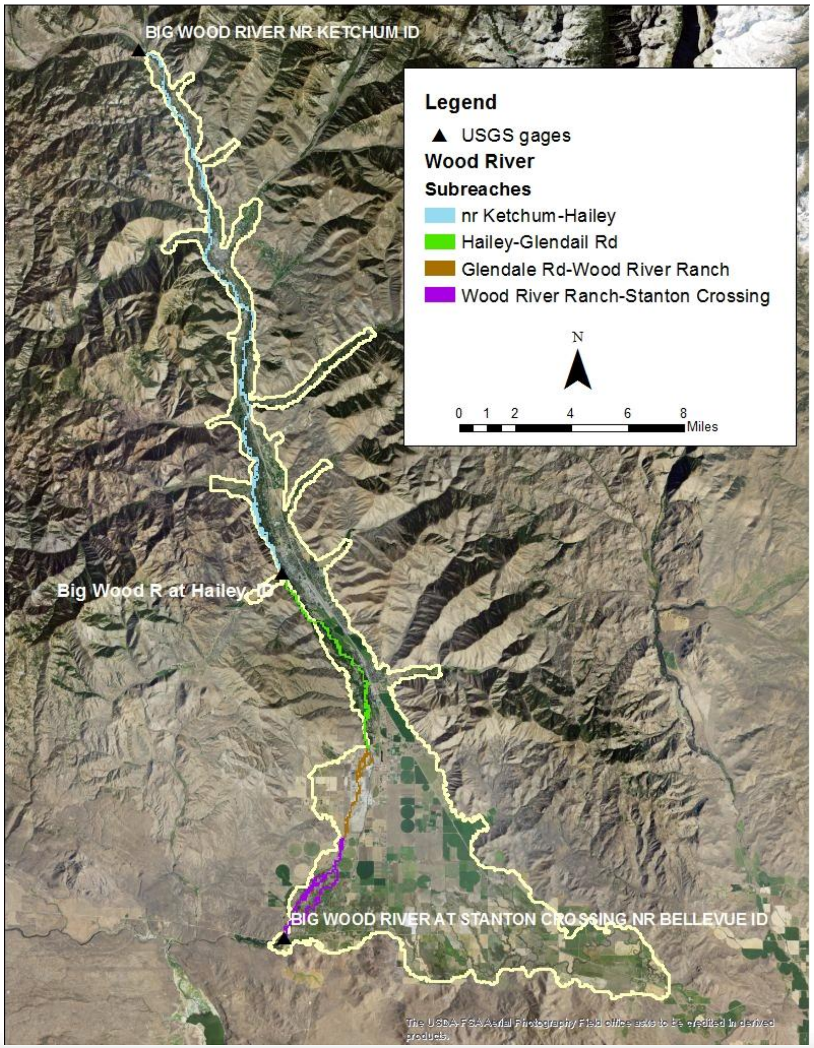


- River stage = river bottom
  - River intersects aquifer
  - River gains



- River stage above aquifer head
  - River loses water to aquifer

NEW Wood River Stage



- Nr Ketchum to Hailey
  - Interpolate change between Nr Ketchum and At Hailey
- Hailey to Glendale Rd
  - Use change from At Hailey
- Glendale Rd to Wood River Ranch
  - Use steady state stage when dry bed is not dry
  - Stage = river bottom when dry bed is dry
- Wood River Ranch to At Stanton Crossing
  - Stage = river bottom
    - when first goes dry until October
  - Use change from At Stanton Crossing rest of the year