

CSI Meets Groundwater:

Autopsying the Effect of a “500-year” Flood on a Sand and Gravel Aquifer in Ames, IA

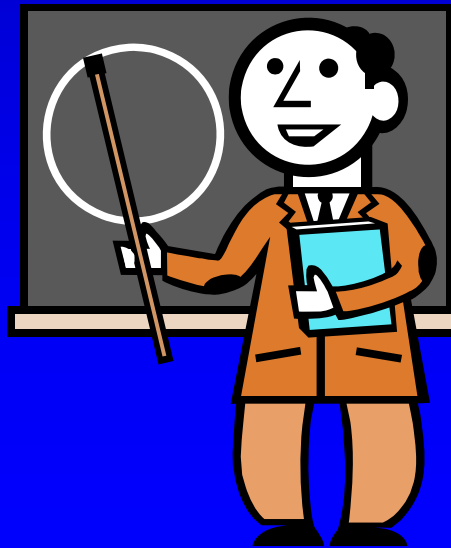


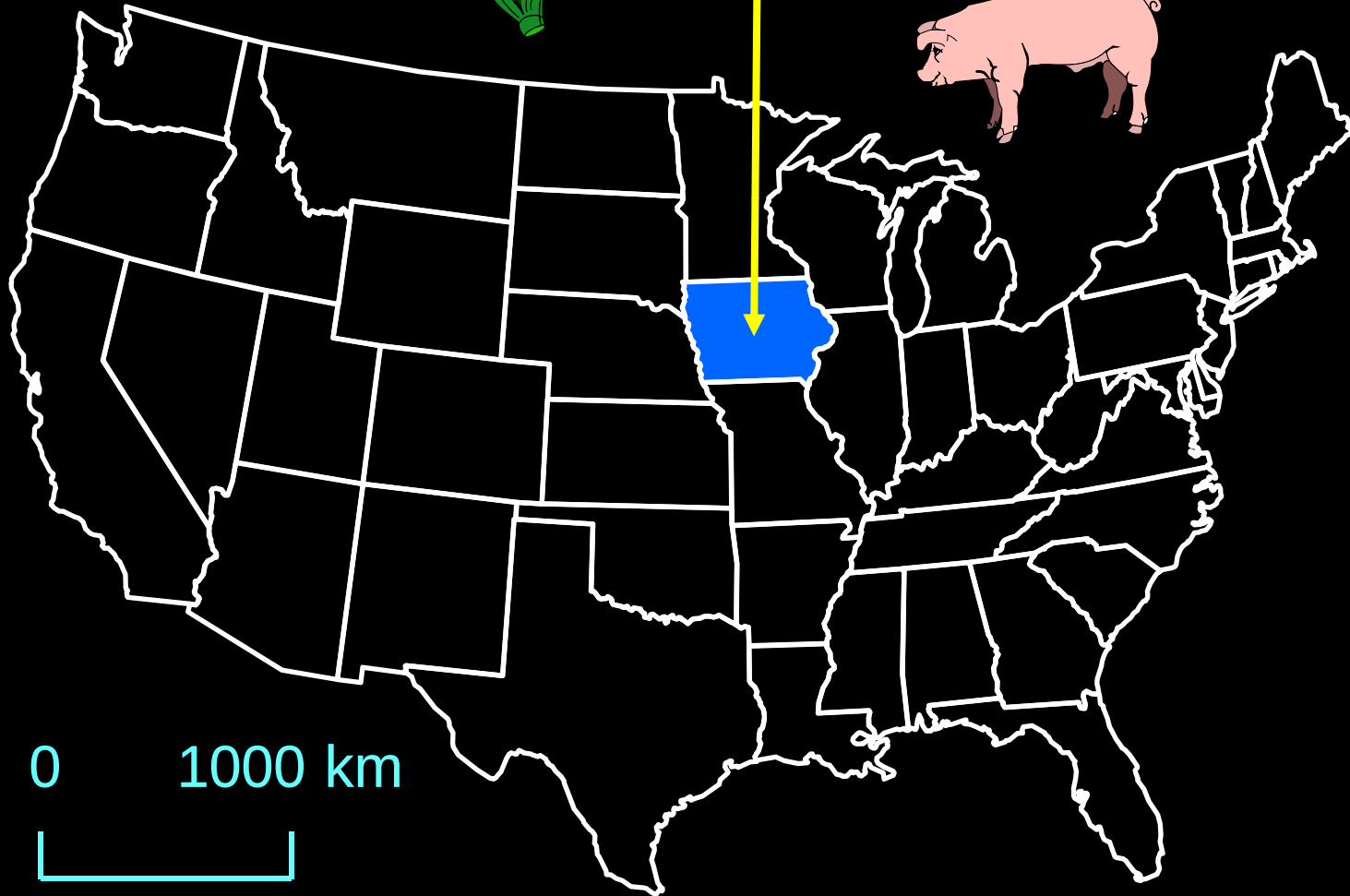
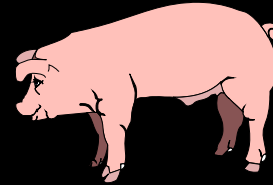
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Acknowledgments

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- Funding from the City of Ames and Iowa Water Center/USGS

**Floods flush out
the aquifer and
contaminate our
drinking water!**



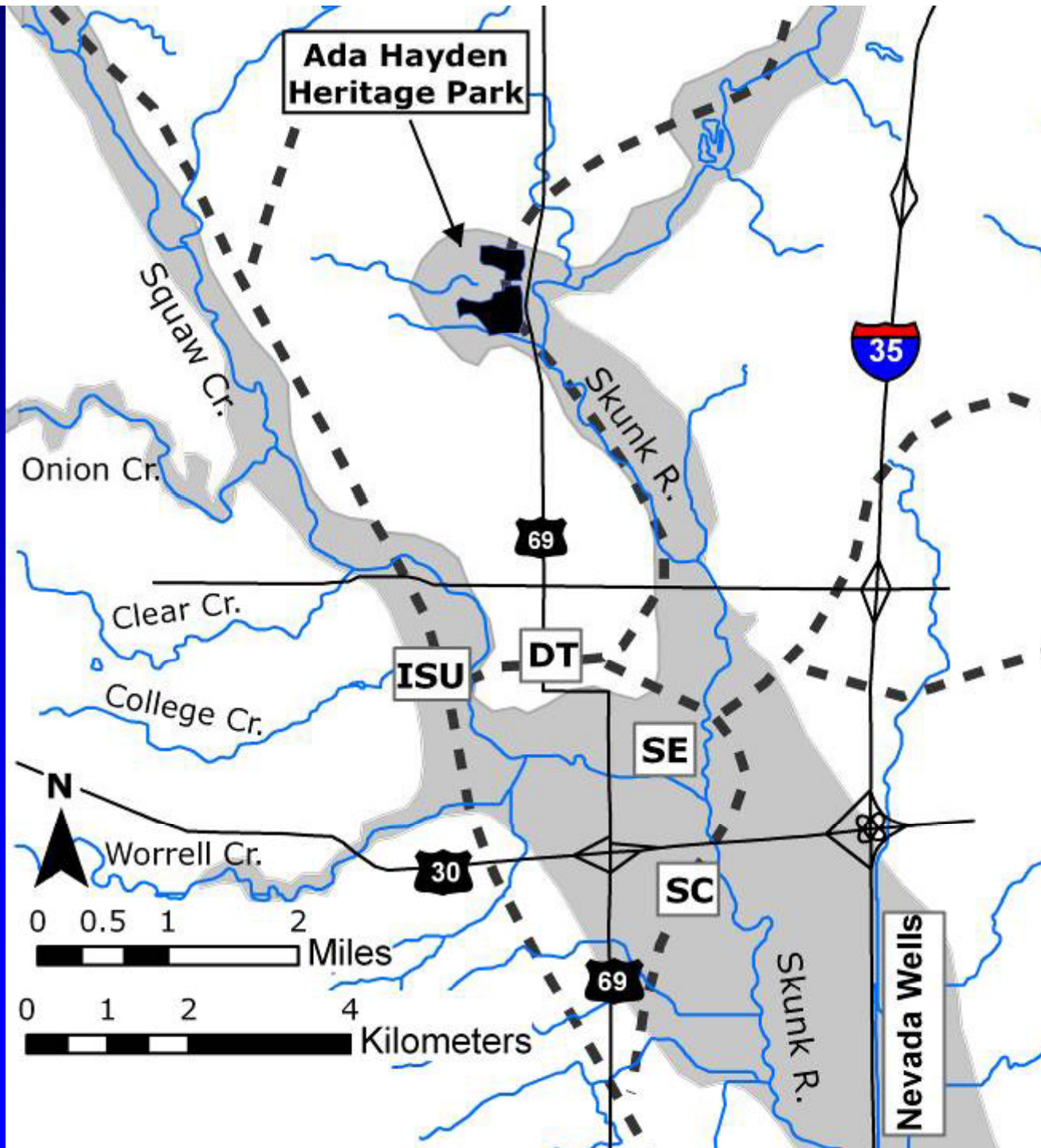


0 1000 km



Map of Ames Aquifer and Region

22 wells in 4 well fields



Ada Hayden Park



South Skunk River

River Valley
Park



Cemetery



Downtown
Well Field

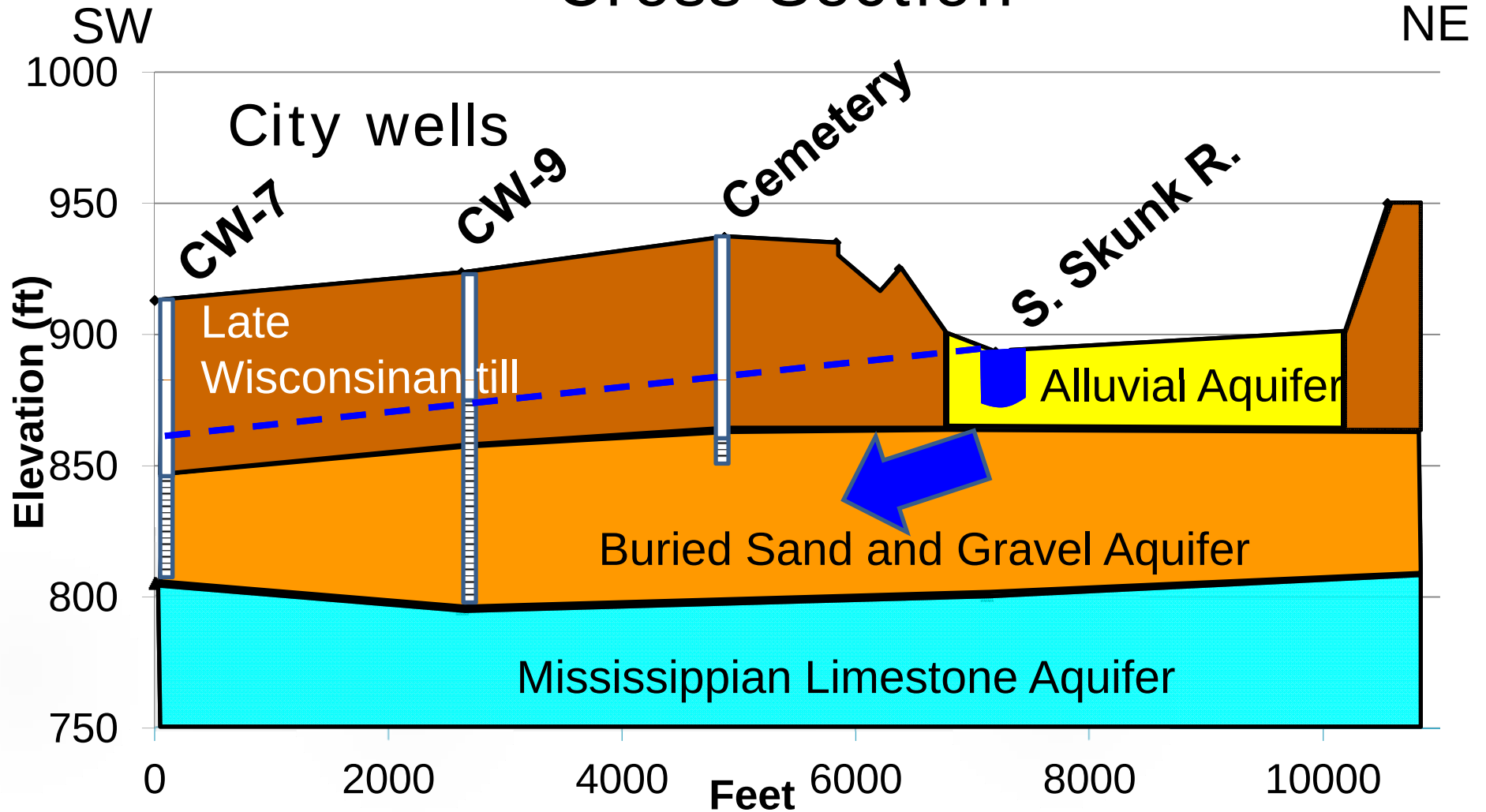
Skunk R.



0 0.5 1 2 Kilometers

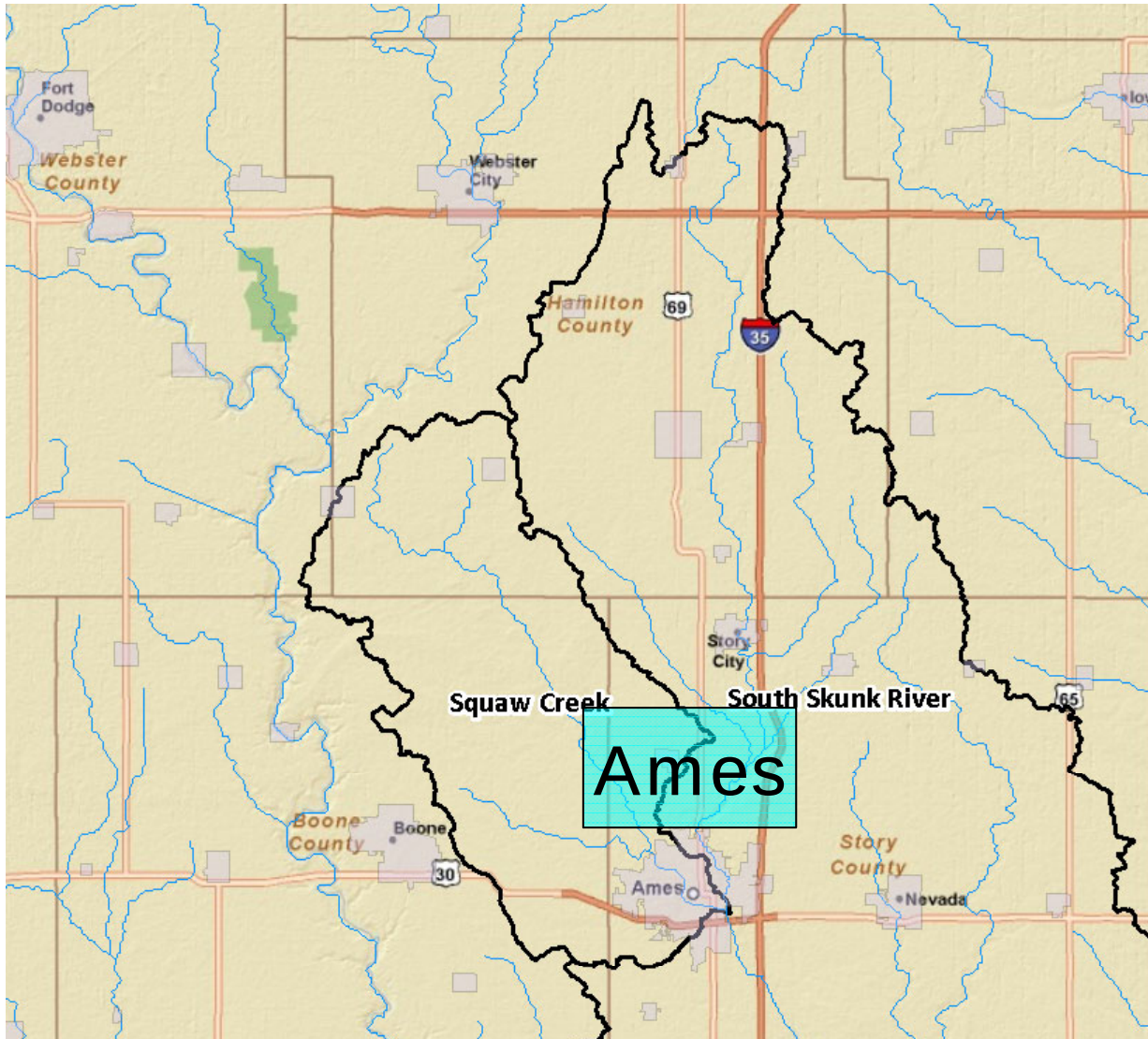


Cross Section



The August 11, 2010 flood

- High soil moisture from previous winter's snowfall
- Stream stages high from recent heavy rainfall
- Repeated, intense rainfall in three events

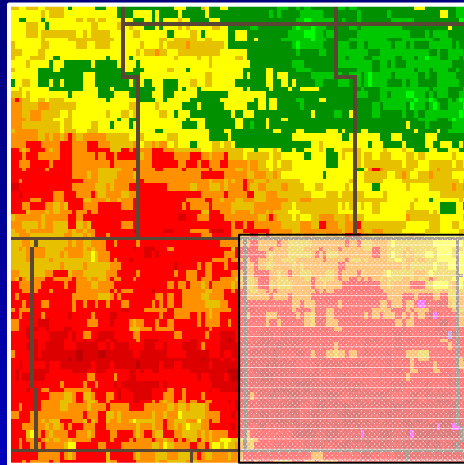


Squaw Creek and South Skunk River Watersheds

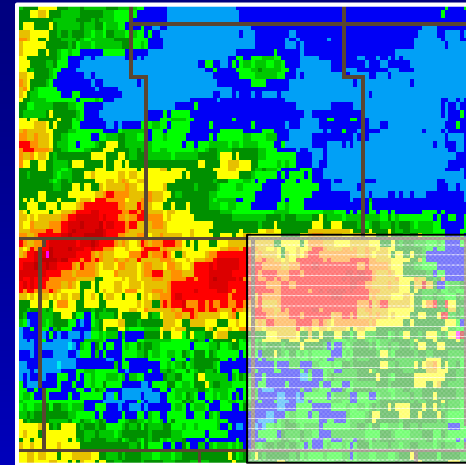
S. Skunk River area = 329 mi²
Squaw Creek = 227 mi²
About 69% in row crops

Q2 Rainfall Estimates

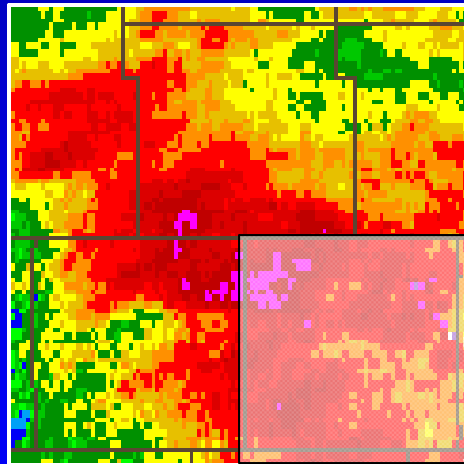
24 hrs
ending 8/9
7 am CDT



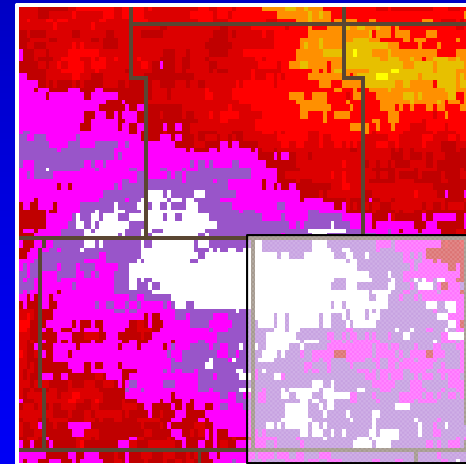
24 hrs
ending
8/10
7 am CDT



24 hrs
ending
8/11
7 am CDT

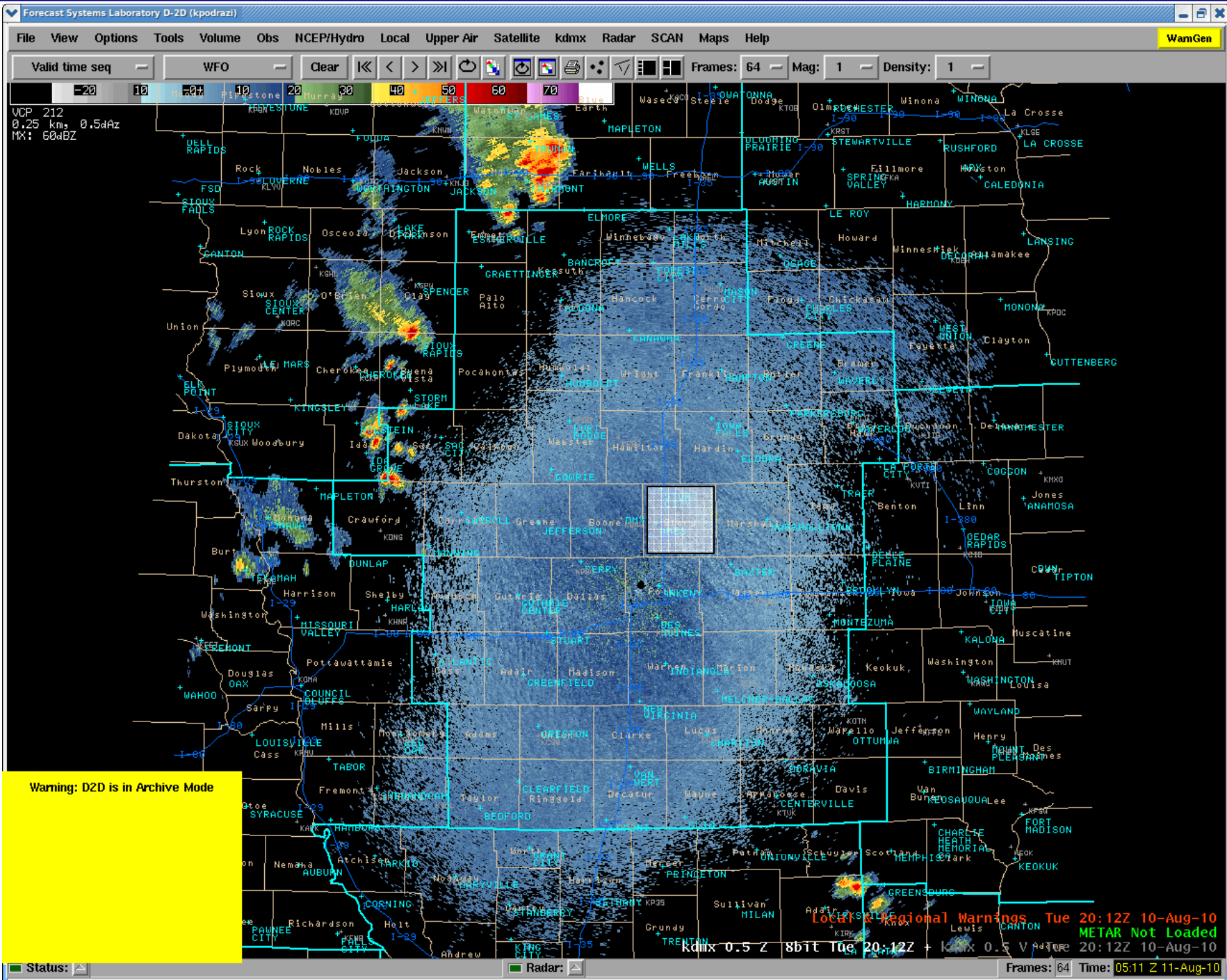


72 hrs
ending
8/11
7 am CDT



Precipitation [in]





July 2012 in Squaw Creek



My Office Flood of August 11, 2010



Des Moines Register

Flood of August 11, 2010

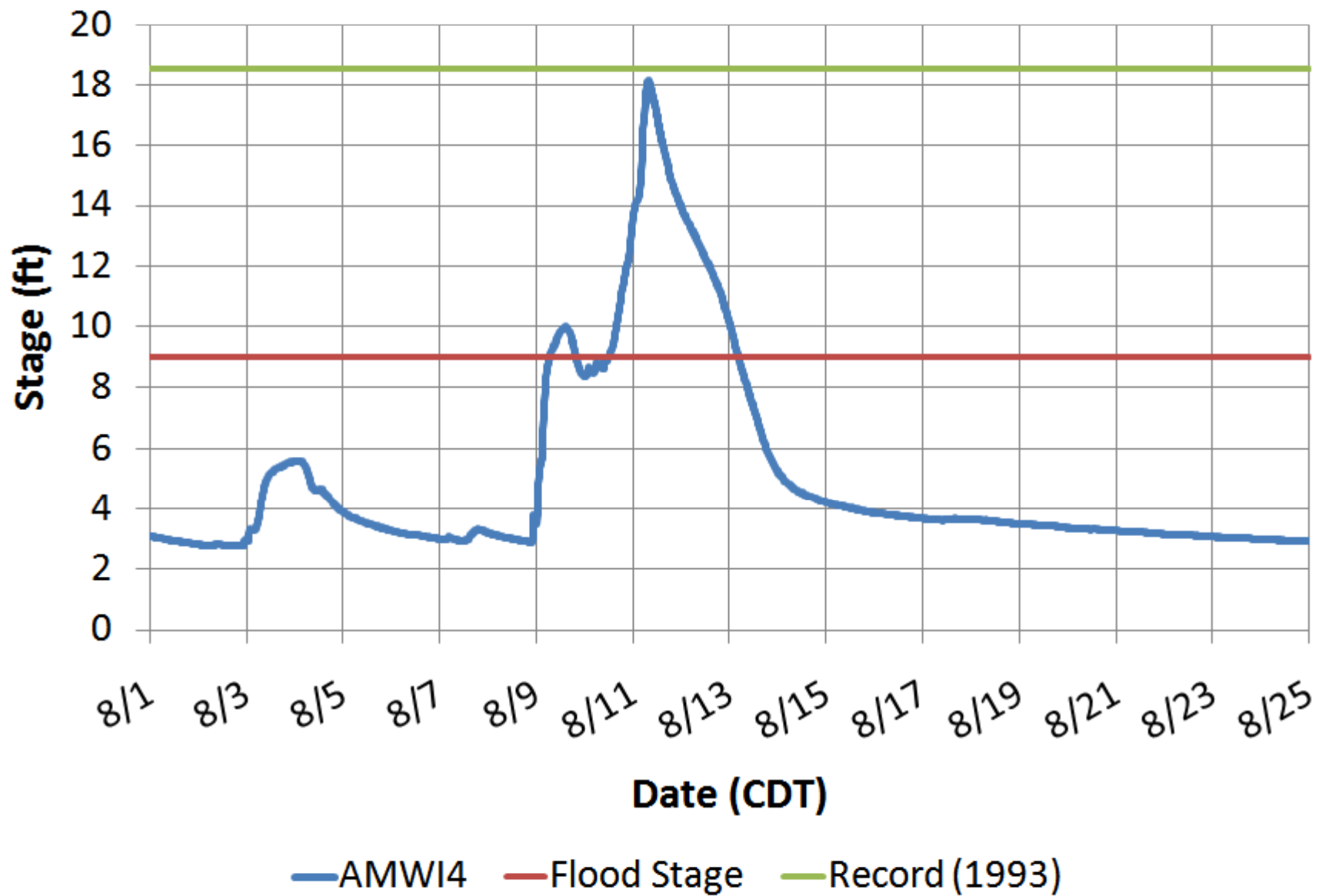


Des Moines Register

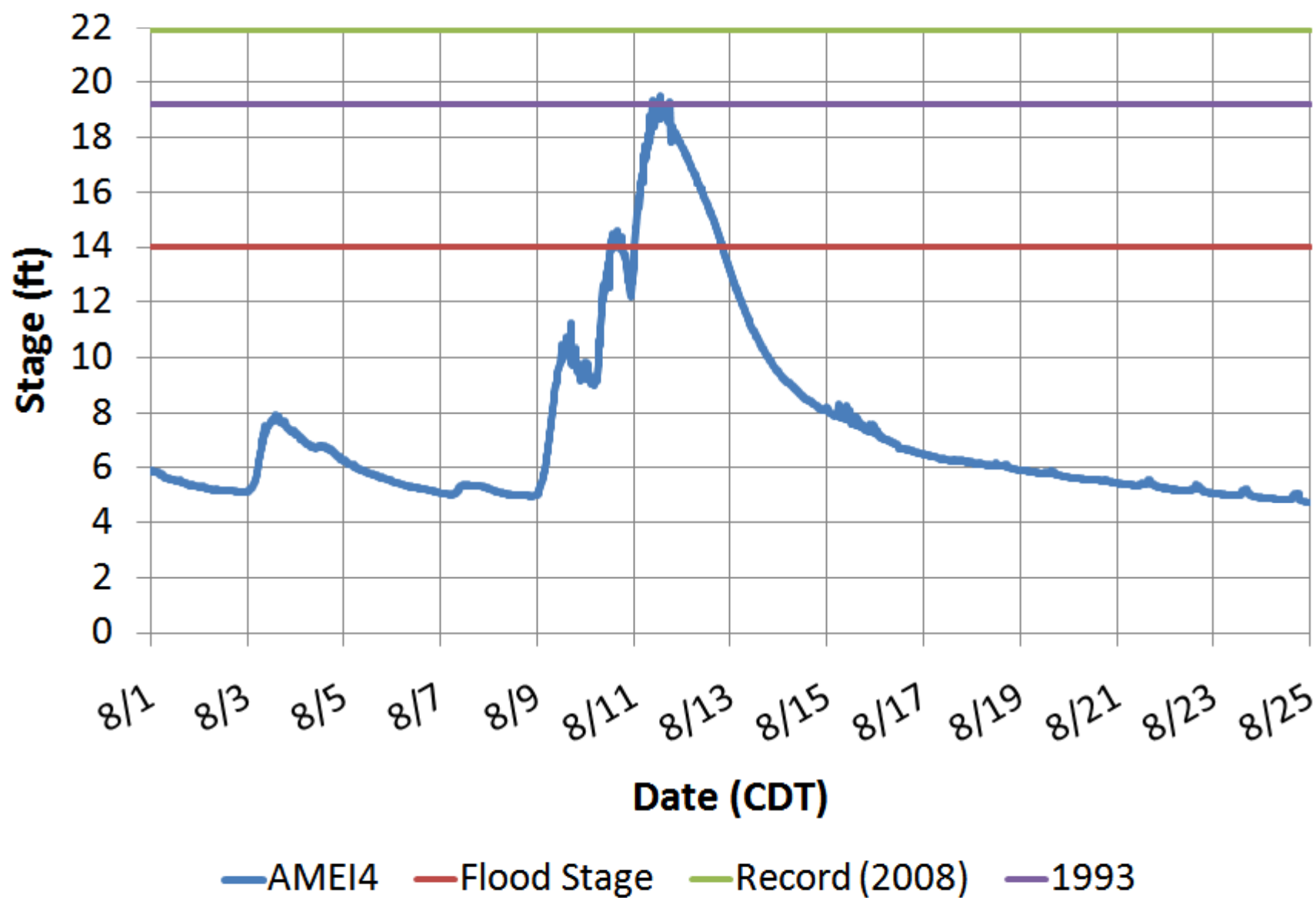
Raising Hilton Coliseum



Squaw Creek, Ames Lincoln Way



South Skunk River, Ames W Riverside Rd



Recent “500-year” floods

1993

2008

2010

**If you build it,
they will come!**

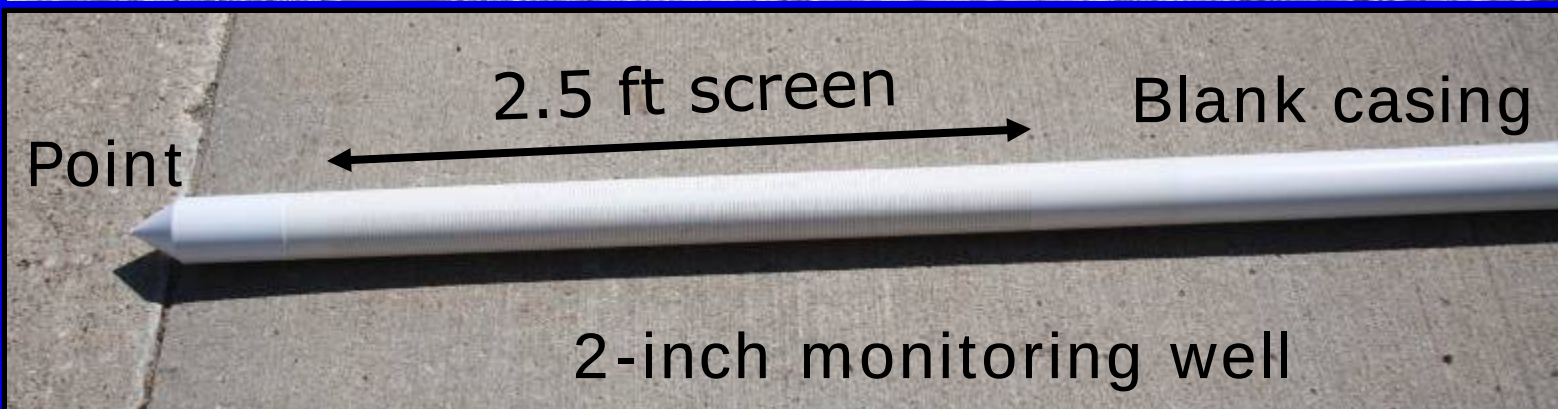




Field of
Dreams

Piezometer
Nest at
River
Valley Park

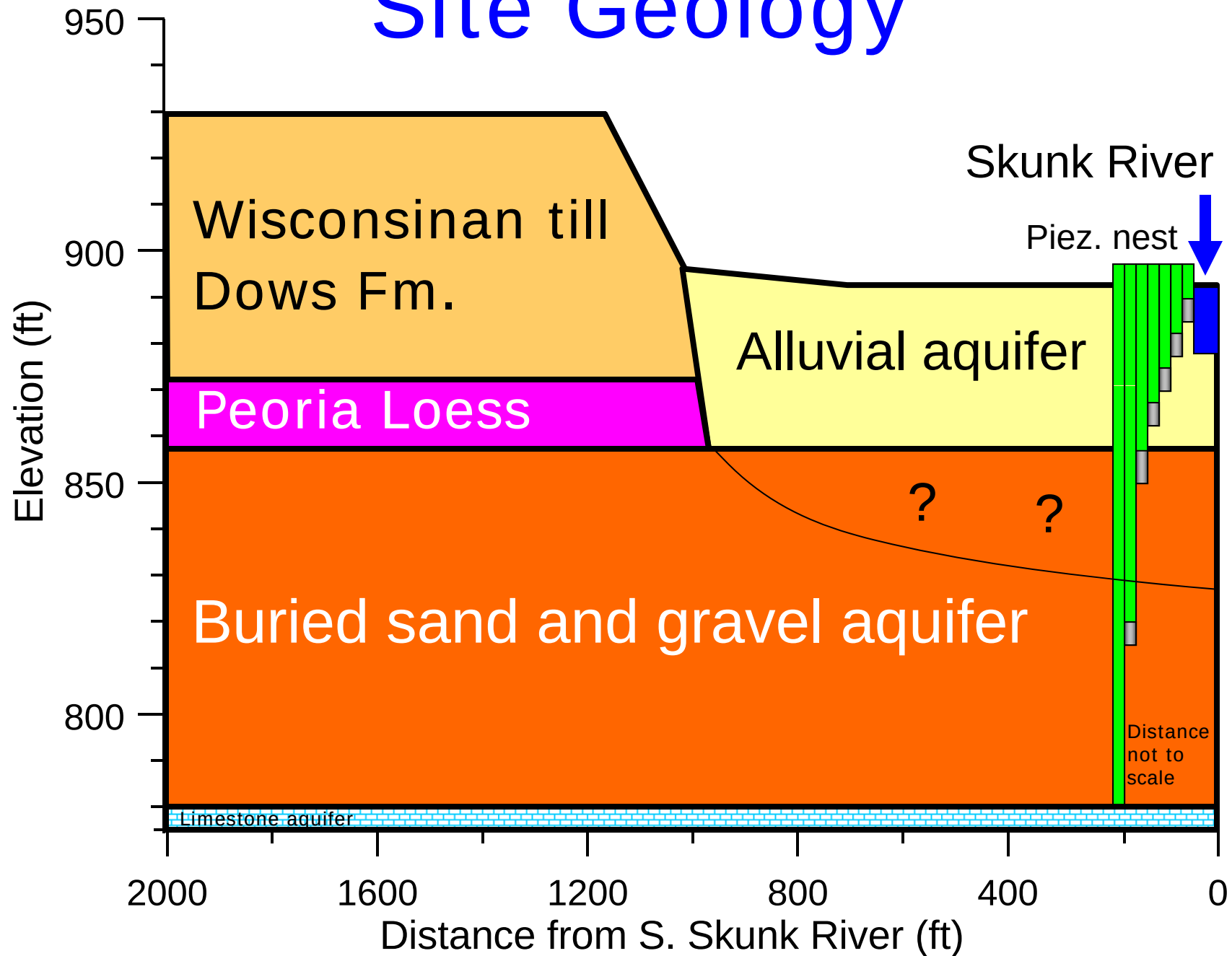
Wells instrumented with pressure transducers/temperature sensors



Piezometer Nest



Site Geology





8/11/2010

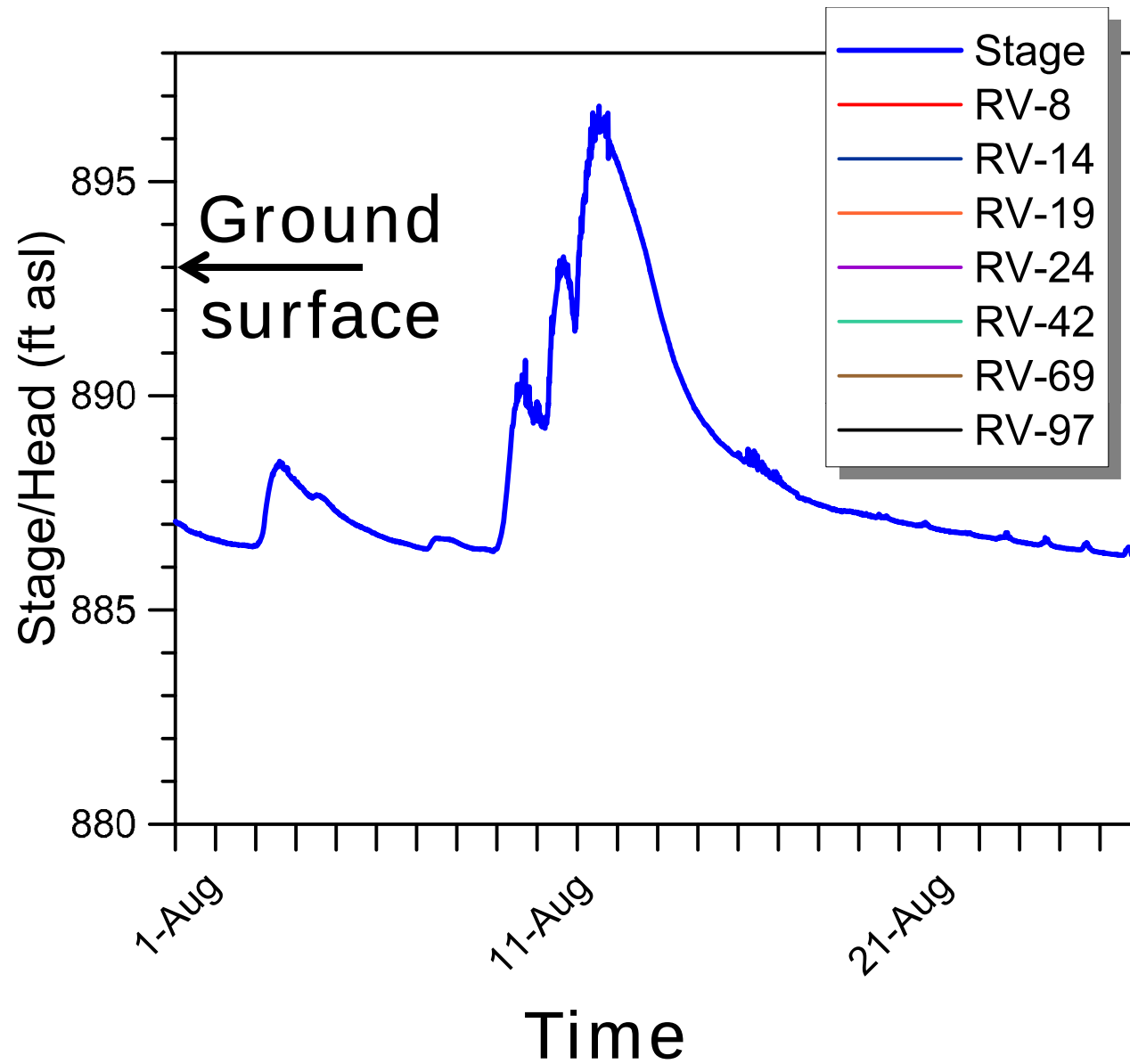


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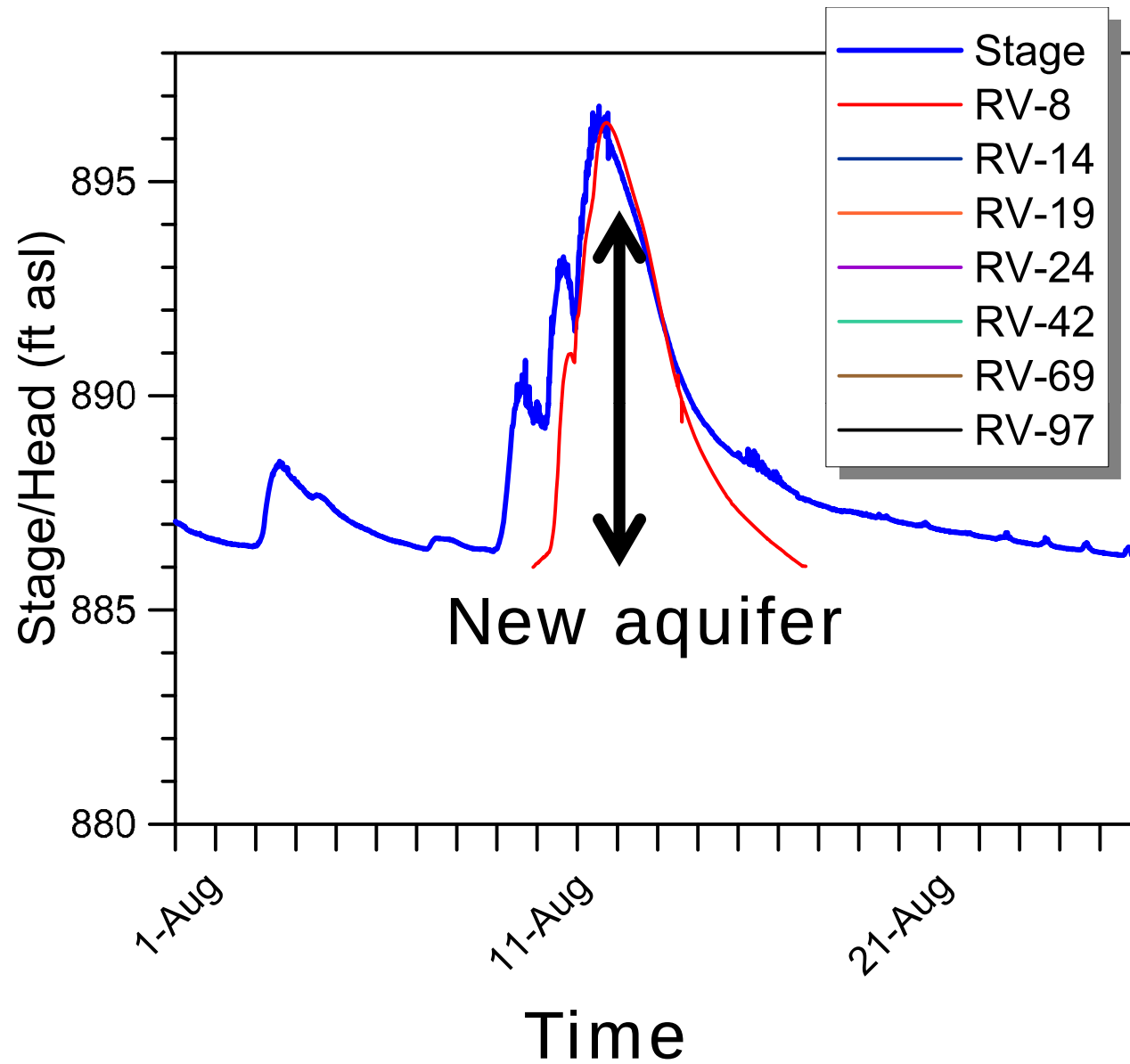


8/13/2010

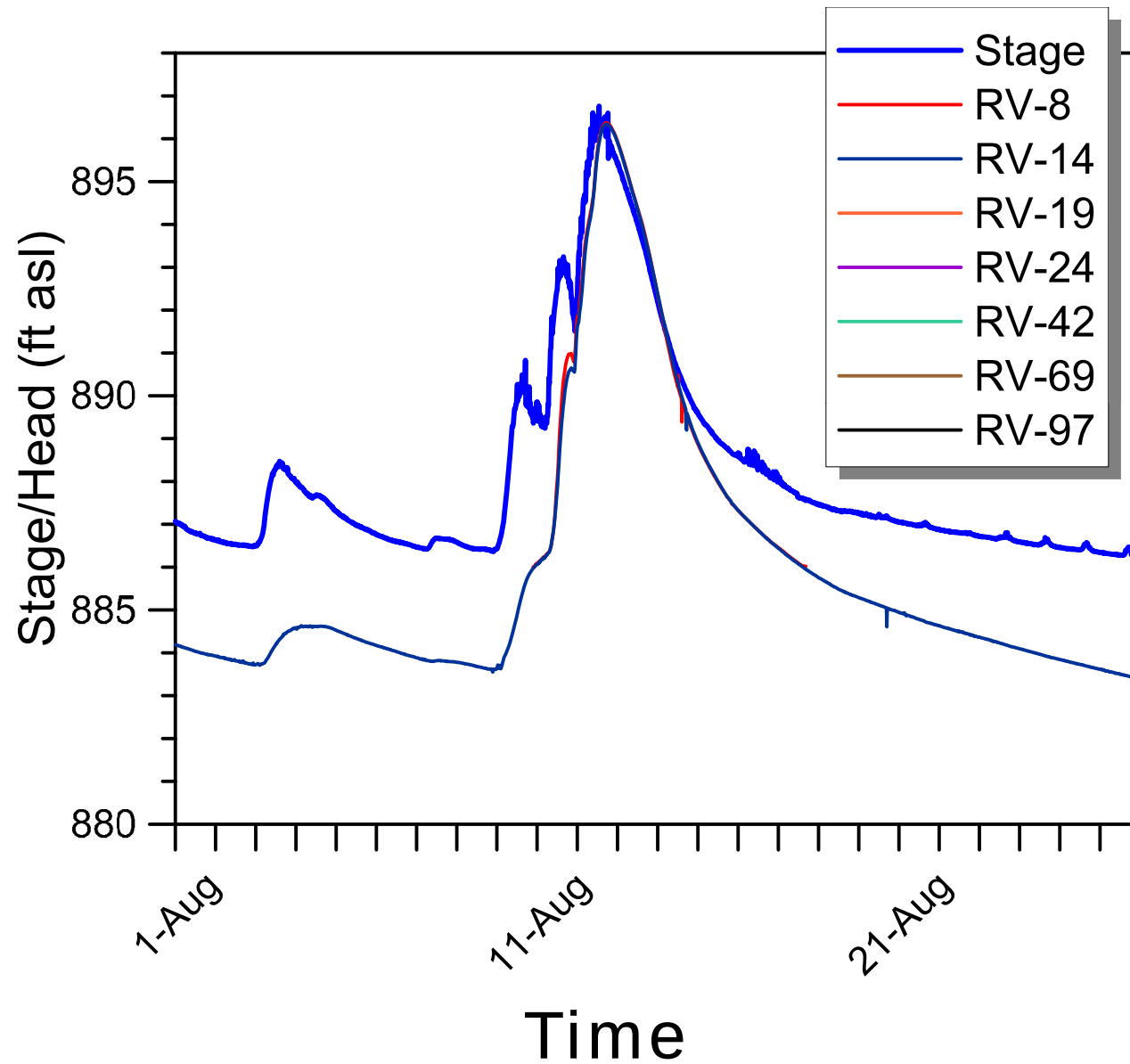
Skunk River Stage

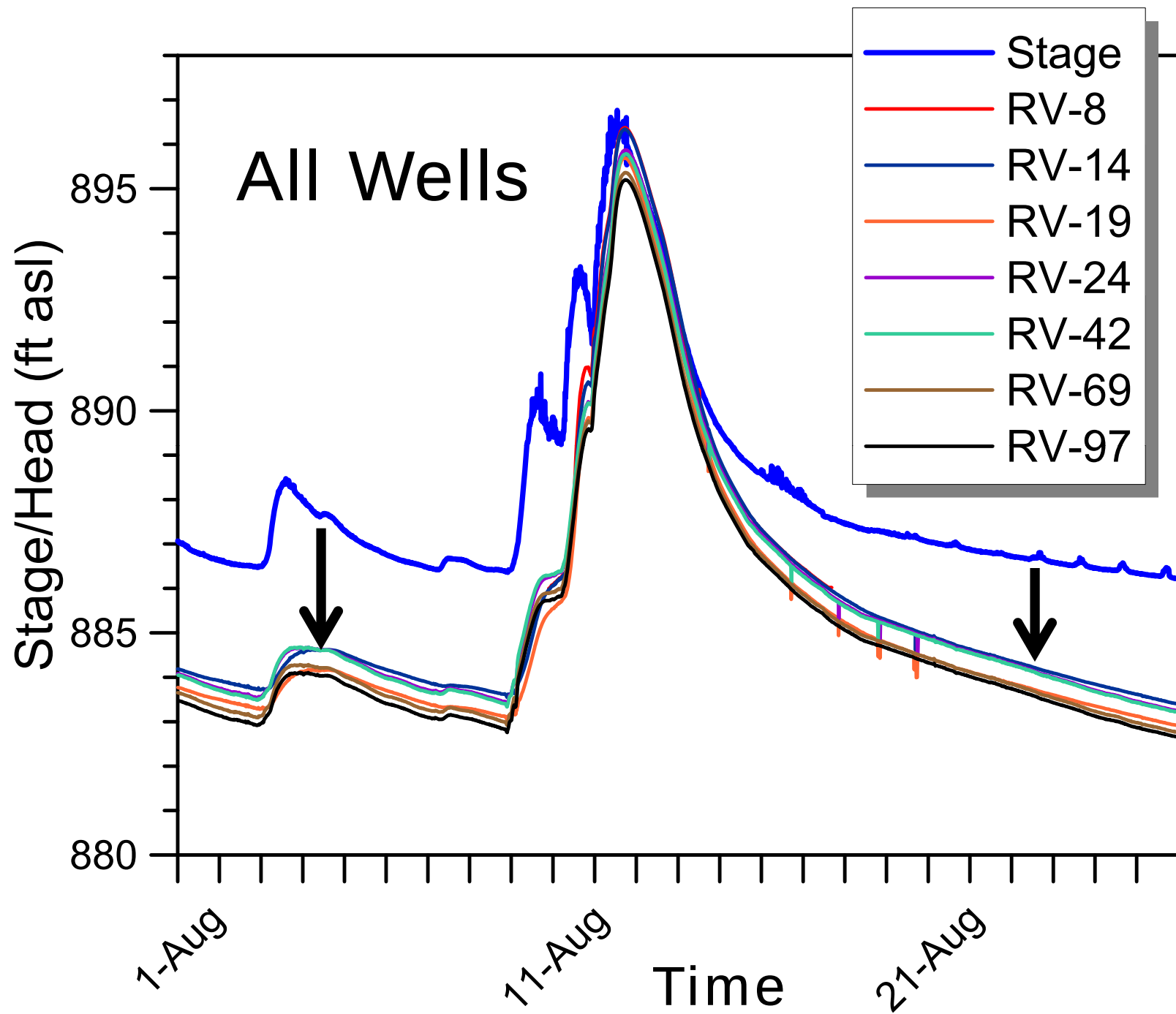


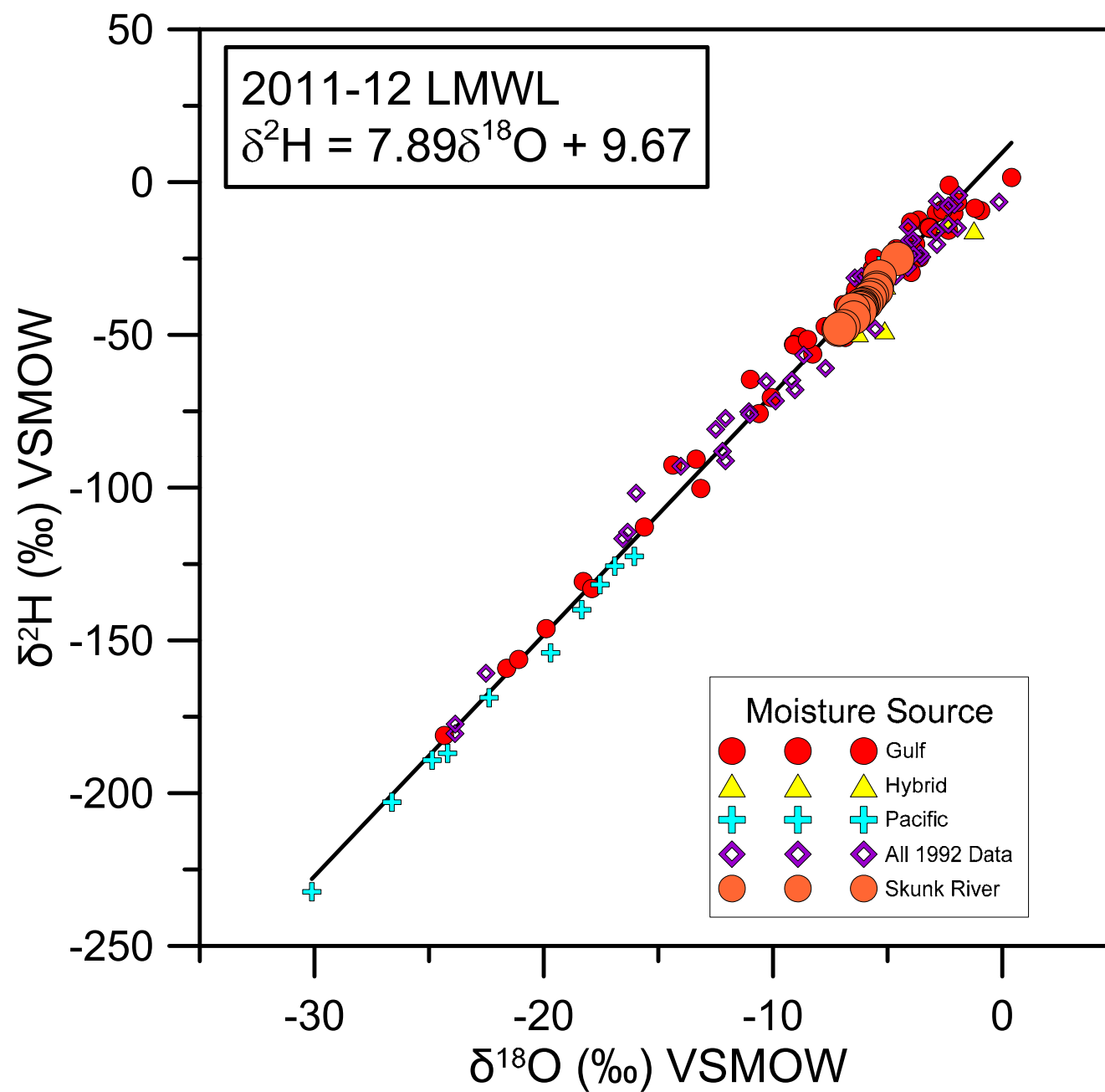
Well RV-8 @ 8 ft



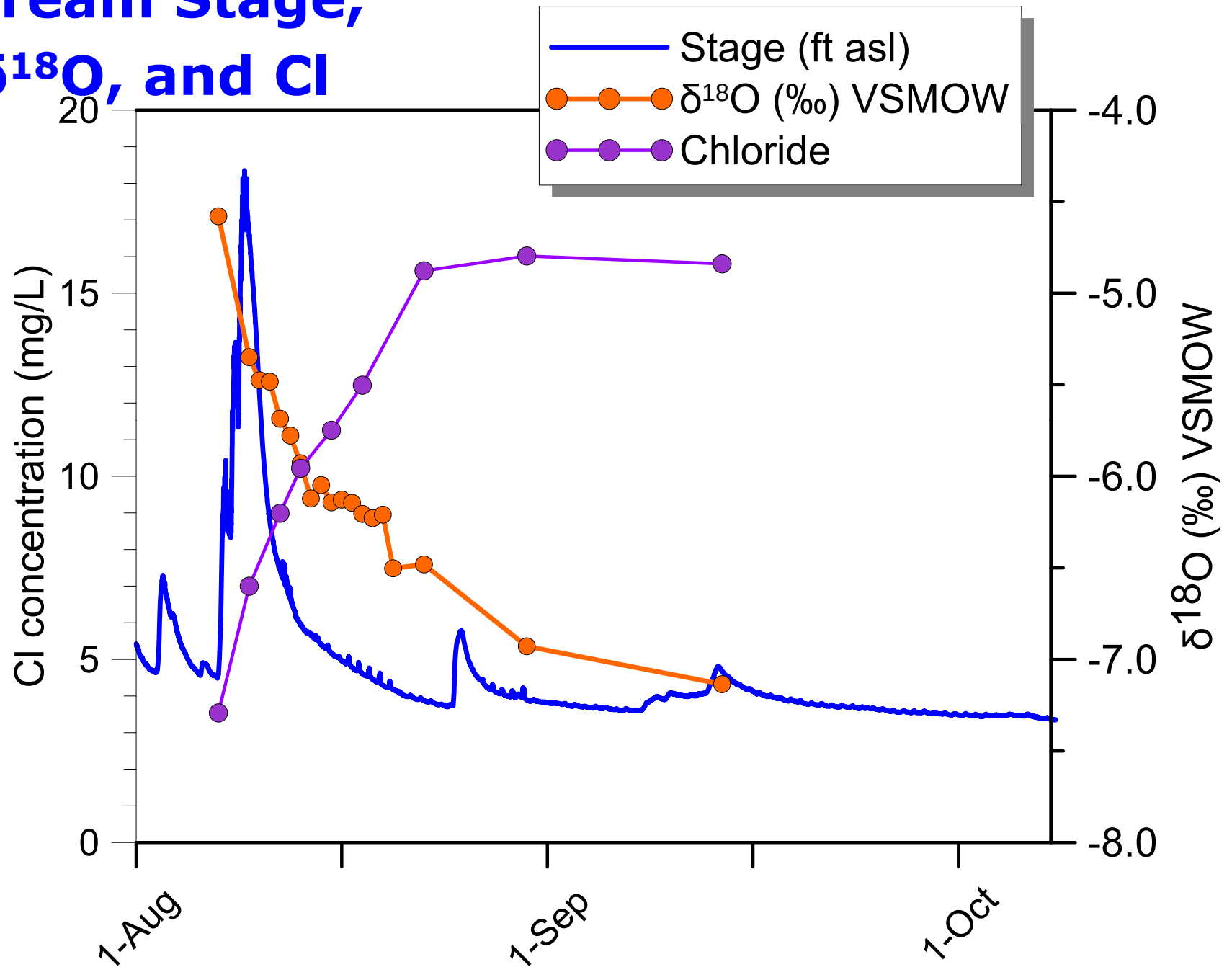
Well RV-14 @ 14 ft



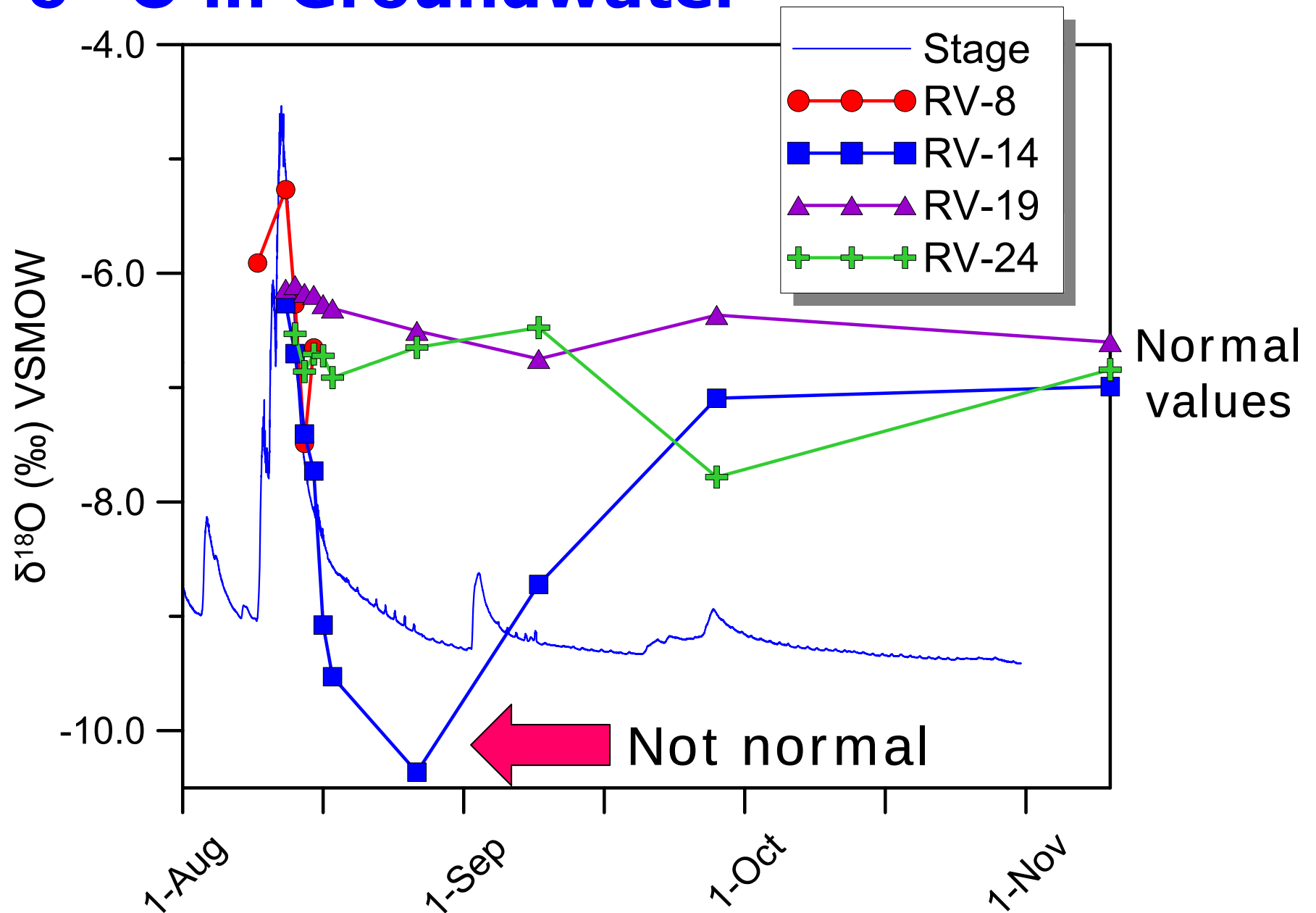




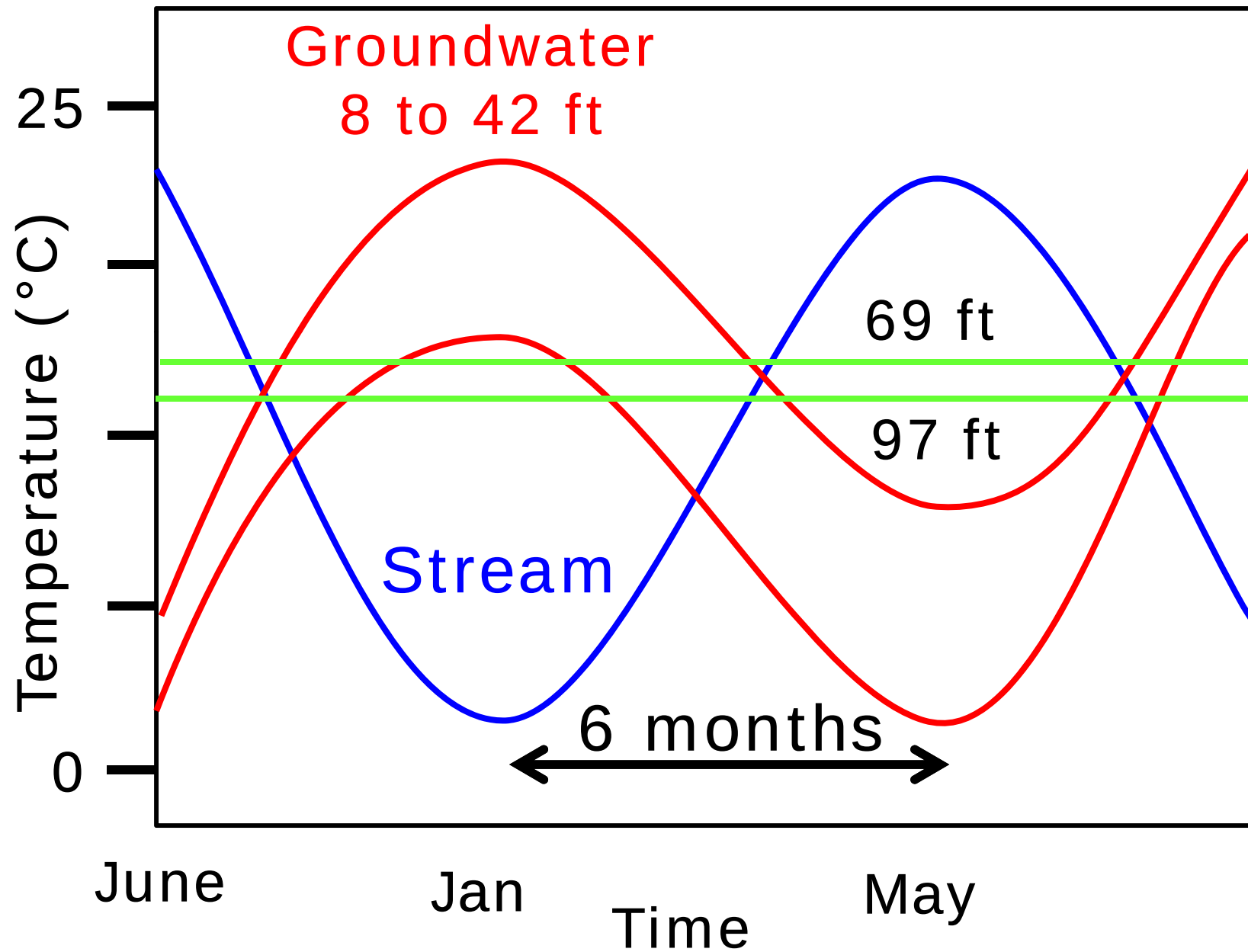
Stream Stage, $\delta^{18}\text{O}$, and Cl



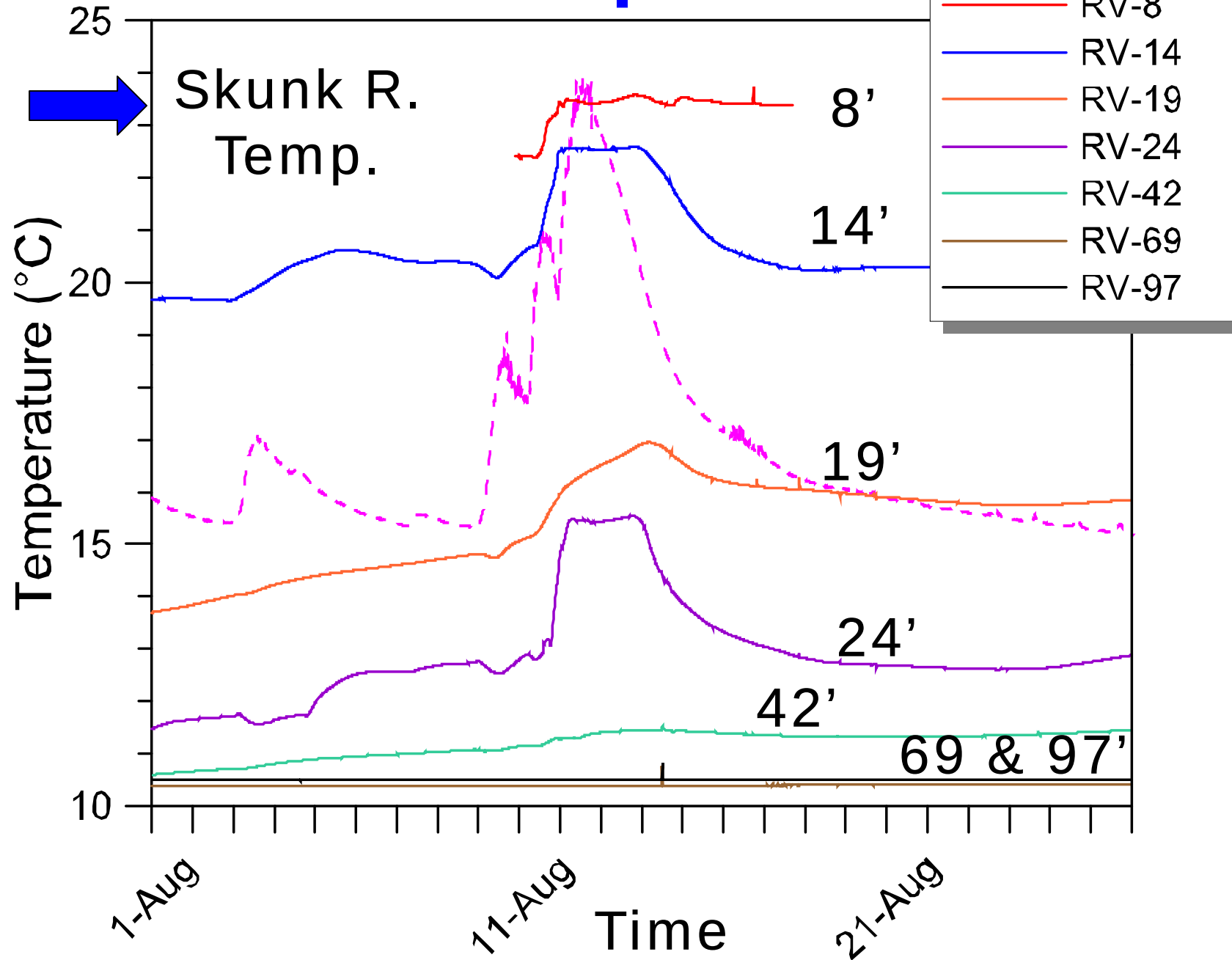
$\delta^{18}\text{O}$ in Groundwater



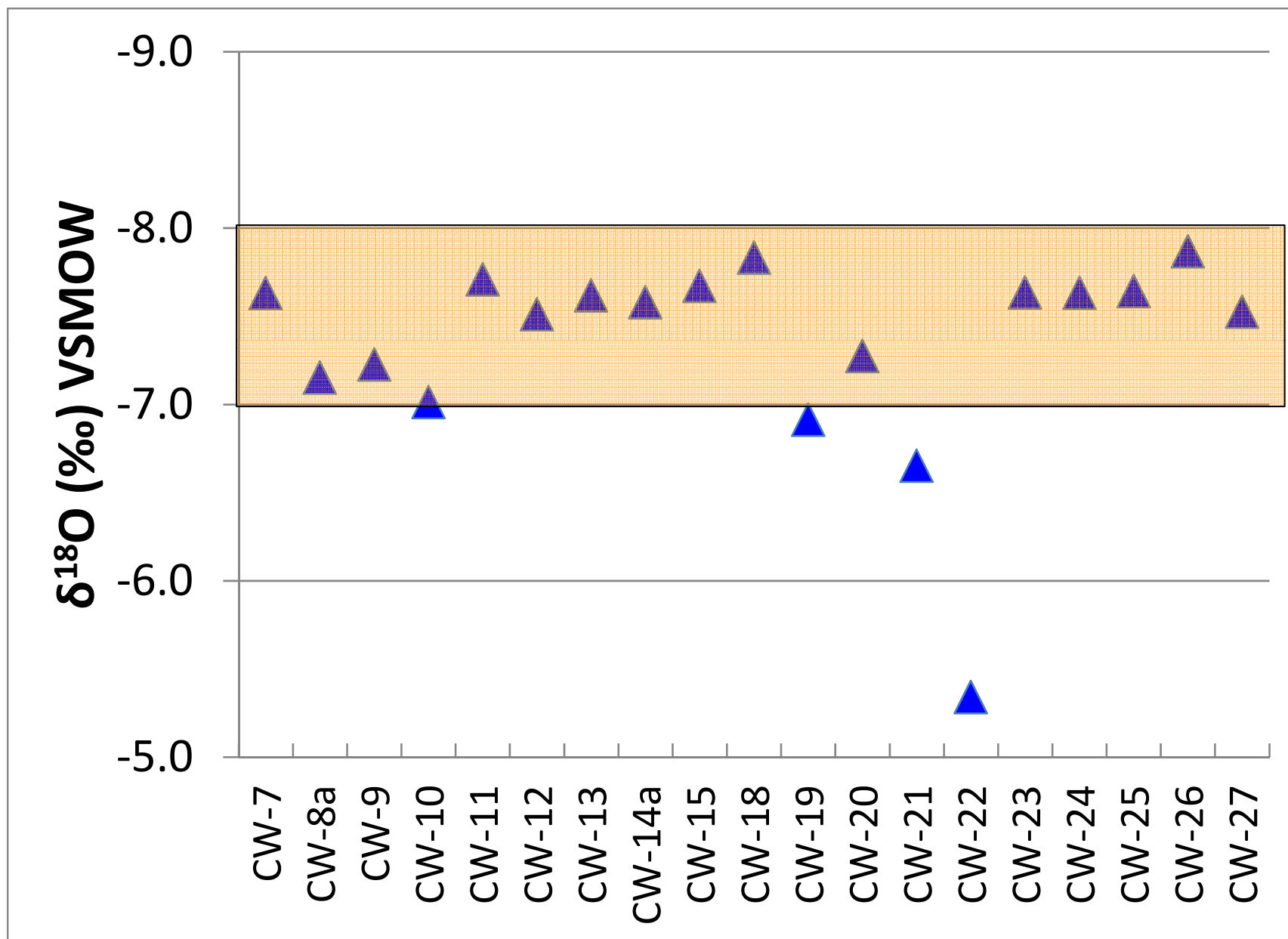
Seasonal Temperature Variation



Groundwater Temperature



Isotopic Composition - City Wells



Final Autopsy



- Flood water mostly Gulf precipitation
 - Produced 10 ft of new aquifer
 - Isotopically enriched and Cl-depleted water to 14 ft; normal in 3 months
- Pressure increase on aquifer
 - Losing reach relationship maintained
 - Injection of heat along high-K zones
- Floods don't flush the aquifer

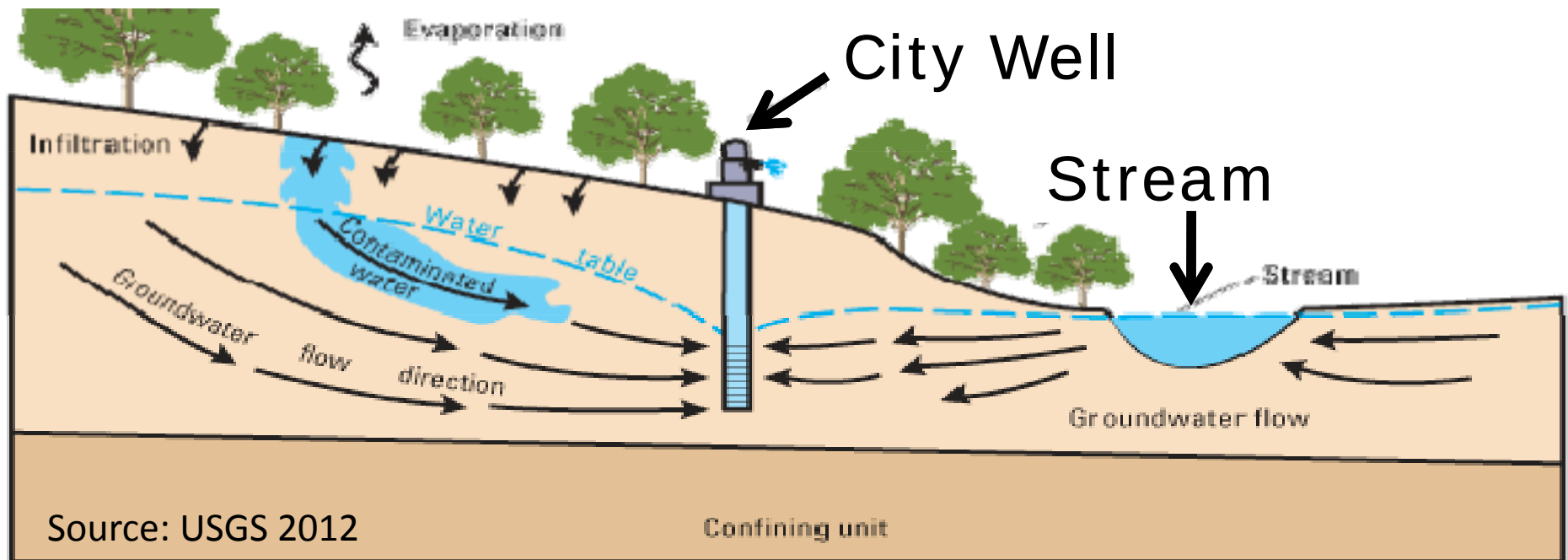
Flooding on South Duff Avenue



August 11, 2010



Induced Infiltration



Heat Injection

