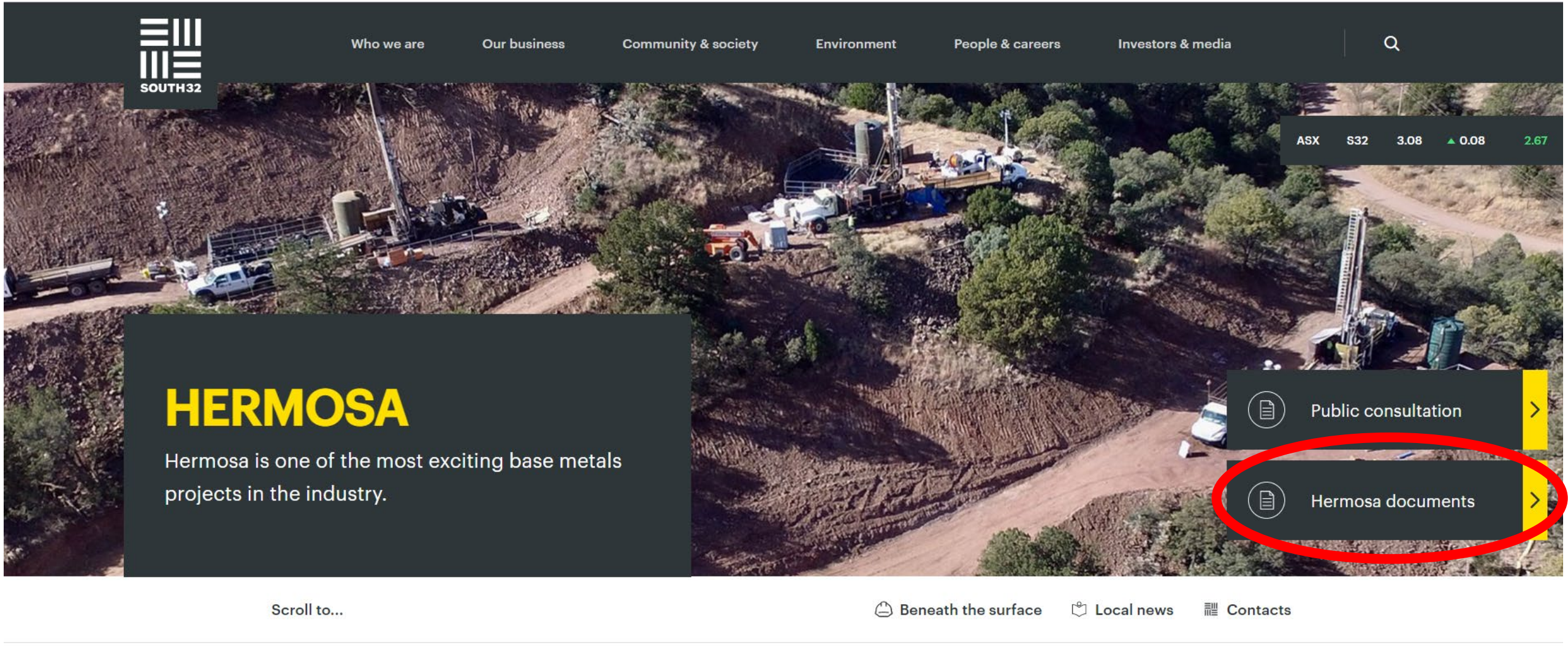
Overview of Groundwater and Surface Water Investigations – Town of Patagonia Flood and Flow Committee

May 13, 2021

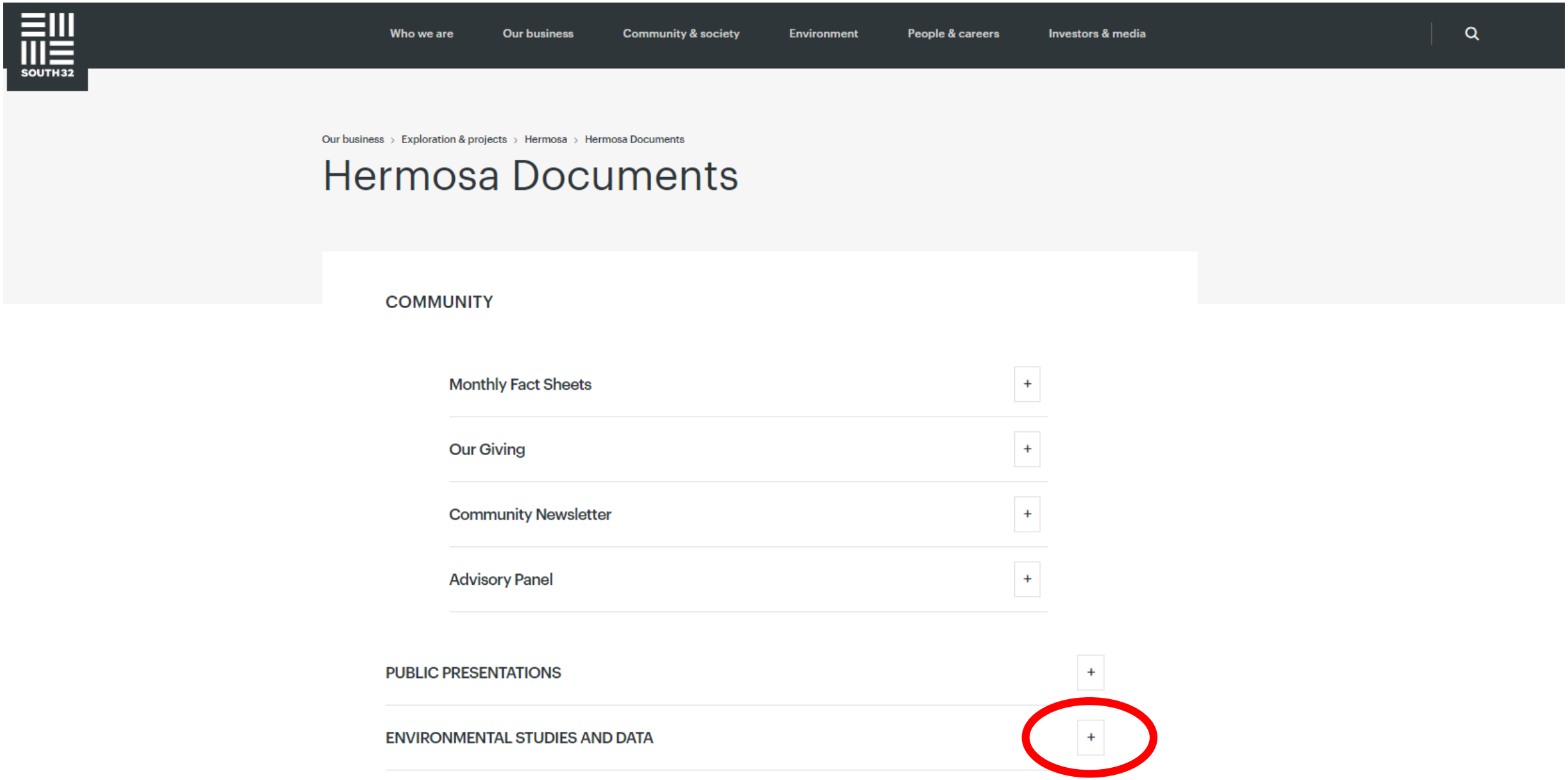
Hermosa hydrogeological investigations

Where to find new Hermosa documents

Website:www.south32.net/hermosa/documents



Where to find new Hermosa documents (cont.)



Spring and Seep Catalog update

Spring and Seep Catalog

Hermosa Project Area

- Water quality results extended through June sampling in 2020
- Addition of 50 new sites within the Patagonia Mts.
- Site summary pages all include potential impacts to groundwater contributions at the spring/seep from early dewatering
- Site descriptions include date visited, measured flows (when flowing), pH, temperature, and conductance
- Vegetation and wildlife encountered are detailed for each site
- Photographs of wet and dry season conditions are provided for most sites

Springs and Seeps: Example Summary Sheet

Hermosa Project Spring and Seep Survey Sample Site Summary, Patagonia, Arizona

Site ID	F6-01	**Interpretation of Groundwater Age:** Mixed source of modern water and deep groundwater.
Watershed	Flux Canyon	
Monitoring Period	11/2017 - 6/2020	**Potential Impacts/Effects:** Flows observed at this site, during site visits, have ranged from immeasurable (<0.25 gpm) to 4.4 gpm. No changes are predicted at this site.
Number of Visits	6	

Flows and Field Parameters (pH, Temp, SC)

Dry Season					Wet Season				
Date	Flow (gpm)	pH (s.u.)	Temp (C)	SC (µS/cm)	Date	Flow (gpm)	pH (s.u.)	Temp (C)	SC (µS/cm)
					11/9/2017	0.12	6.33	13.1	2717
5/30/2018	0.00	6.48	26.6	2848	11/29/2018	<0.25	6.70	9.7	1122
5/27/2019	1.10	6.59	20.2	2535	12/7/2019	4.41	5.75	13.4	918
6/10/2020	0.12	6.72	31.1	2610					

Water Quality Exceedances

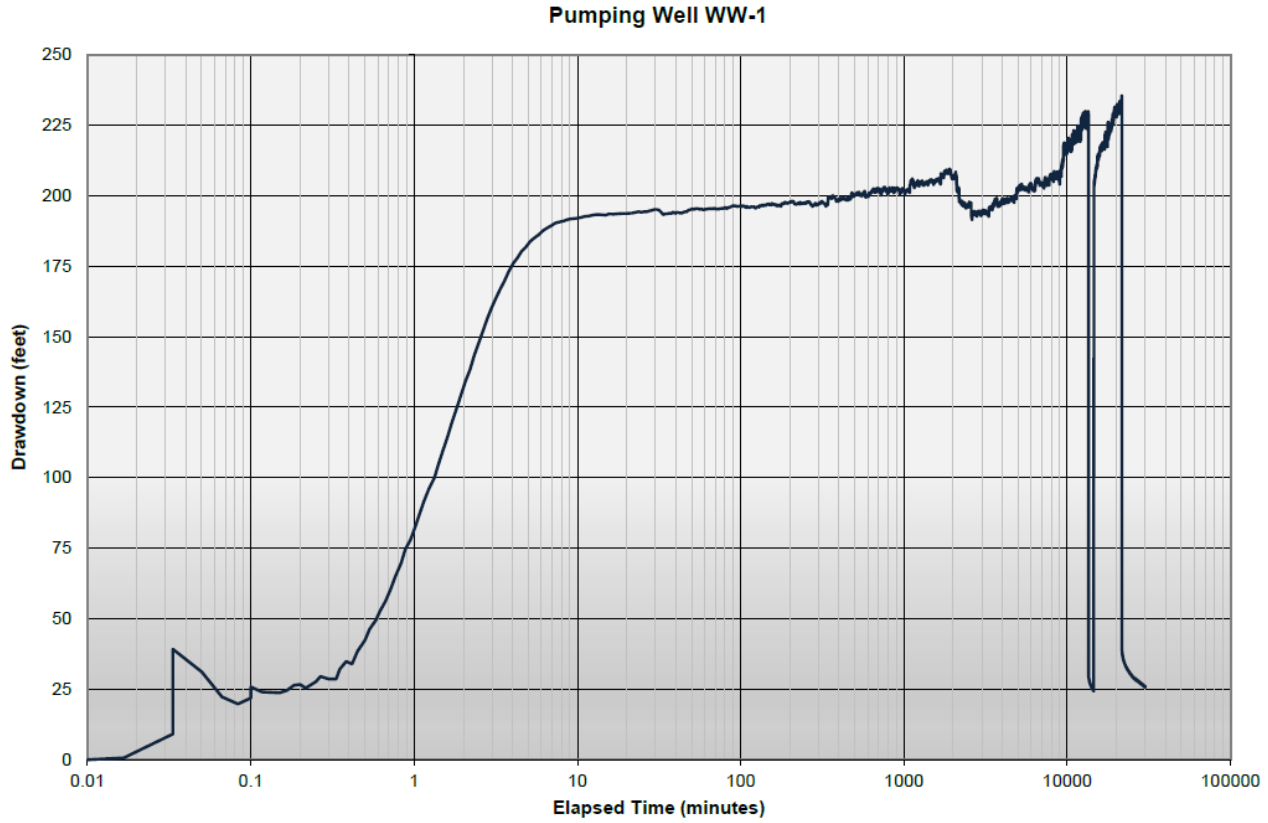
Dry Season		Wet Season	
Date	Parameter	Date	Parameter
		11/9/2017	Lead, zinc, pH
5/30/2018	Lead, zinc, pH	11/29/2018	Lead, cadmium, zinc
5/27/2019	Lead, cadmium, zinc	12/7/2019	Lead, Cadmium, copper, zinc, pH
6/10/2020	Lead, cadmium, zinc		

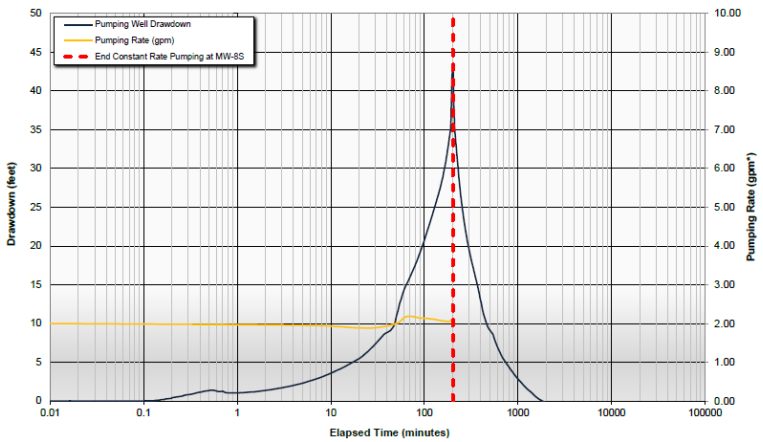
Aquatic and Vegetation Survey Findings: This site is located in rocky and cobbly section of Flux Canyon with exposed bedrock. Generally, water is present in shallow pools. Bullgrass (*Muhlenbergia emersleyi*) and riparian obligate rushes (*Juncus* spp.) are dominate perimeter vegetation along the drainage bottom. Hopbush (*Dodonaea viscosa*) and Texas bluestem (*Schizachyrium cirratum*) occur on the adjacent hillsides. Although there is no overstory canopy at the site, overstory trees along the drainage are dominated by Emory oak (*Quercus emoryi*). Non-native annual rabbitsfoot grass (*Polypogon monspeliensis*) and invasive plants, Lehmann lovegrass (*Eragrostis lehmanniana*) and Johnson grass (*Sorghum halepense*), have been observed. Aquatic invertebrates previously noted within the Flux Canyon drainage including beetles, boatmen, backswimmers, dragonflies, and damselflies. No aquatic vertebrates have been observed.

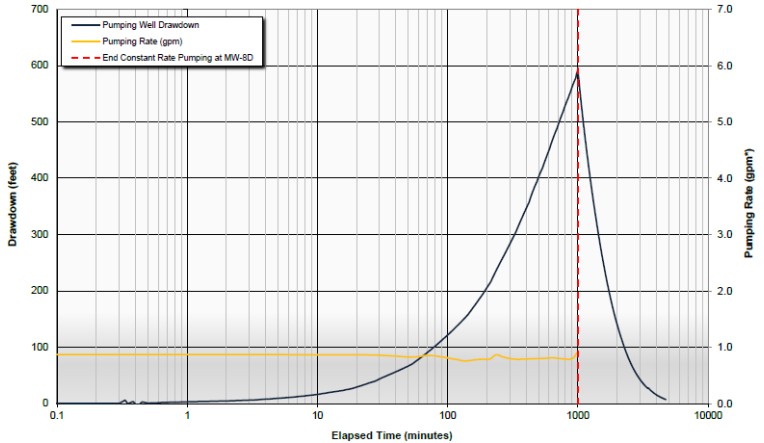
Dry Season Photo (5/30/2018)	Wet Season Photo (11/29/2018)
	

- Sample site identification
- Observed water quality in the field
- Water quality components that are of concern
- Plants and wildlife identified at the site
- Photos showing the site during wet and dry seasons

Aquifer testing at Hermosa (examples)

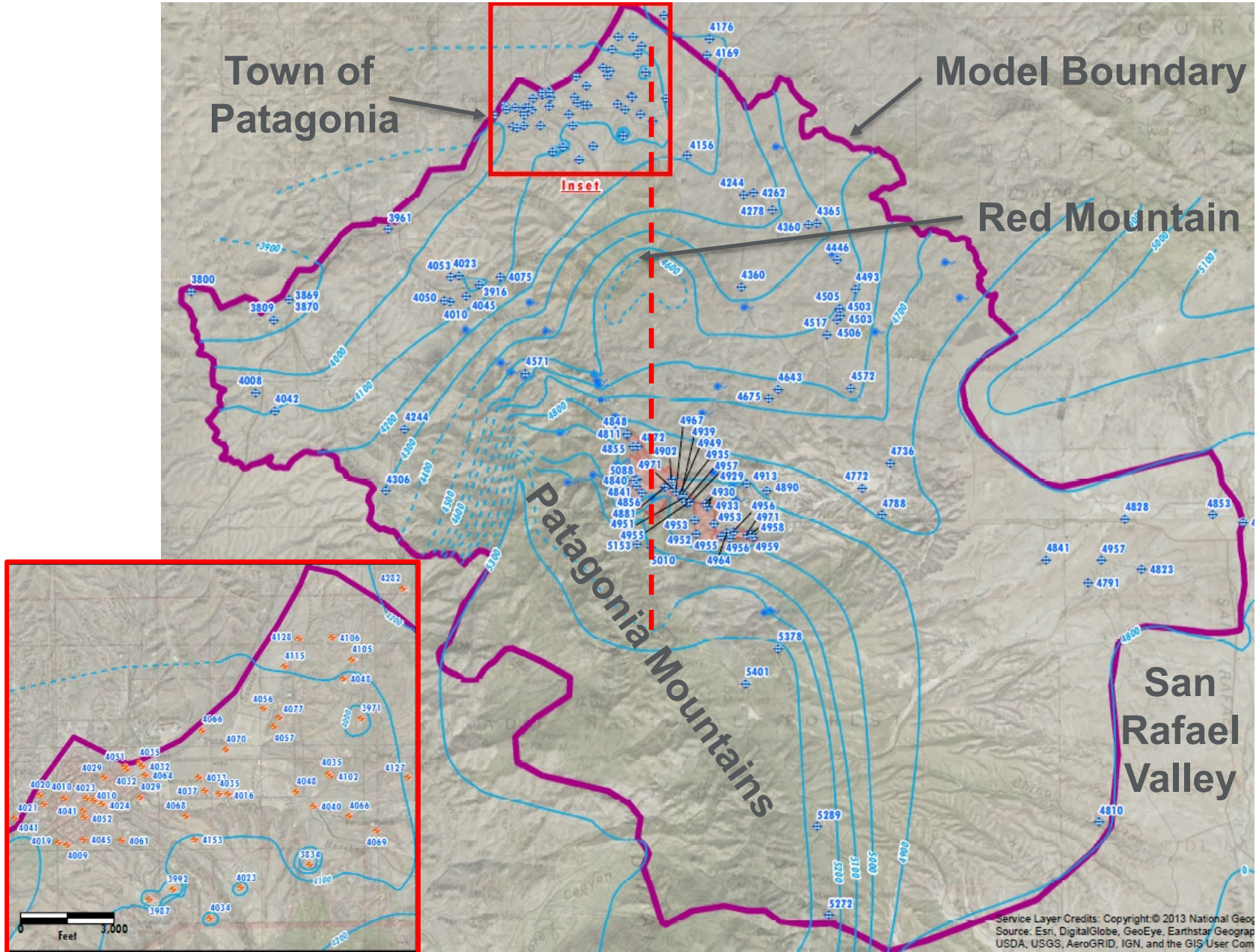






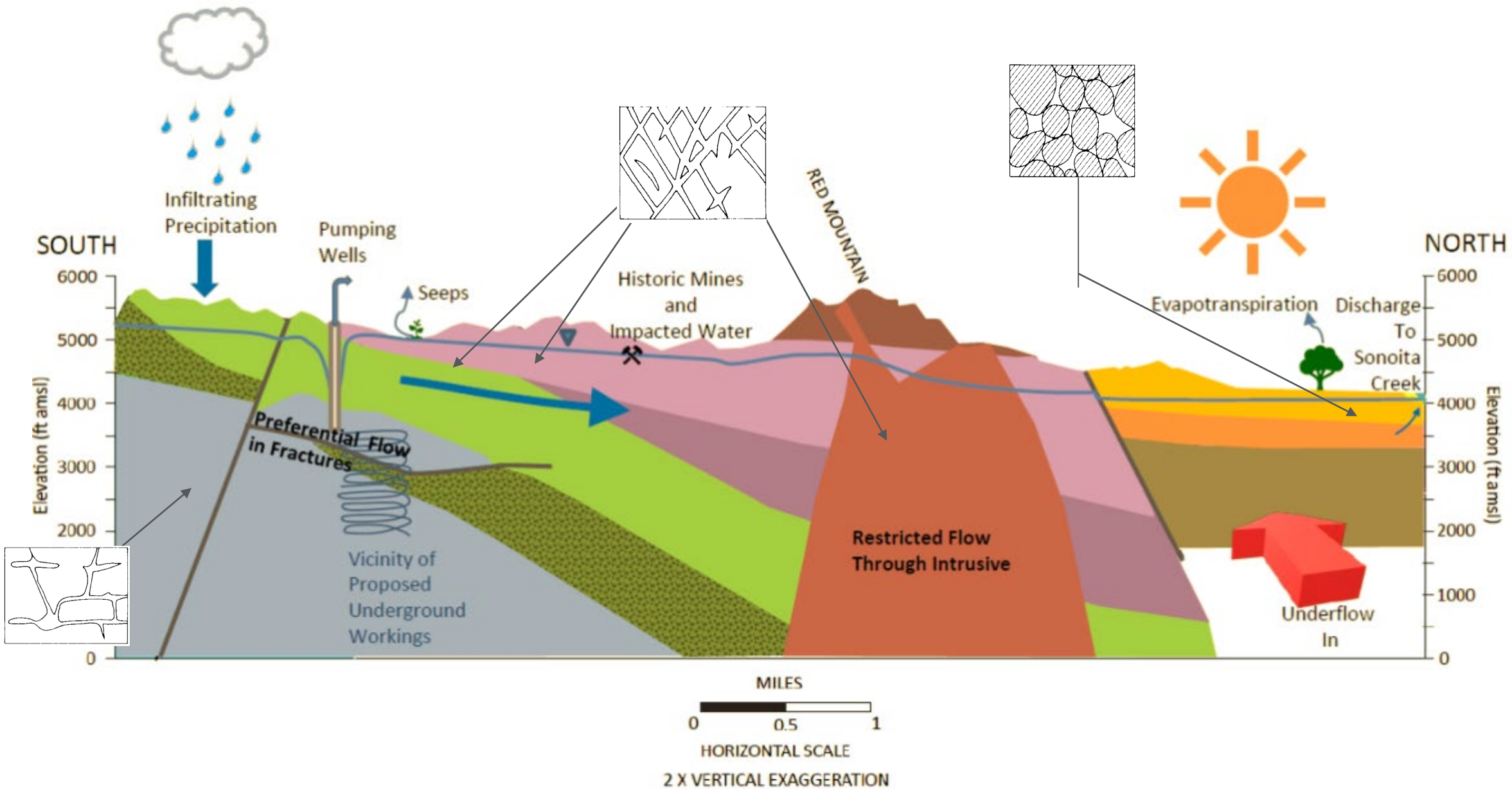
- A total of 11 different aquifer tests have been conducted on various wells at Hermosa conducted from 2017 through 2019
- Aquifer testing has been used to understand the range in permeability of the differing geologic materials (volcanic and sedimentary aquifer units)
- Some tests lasted only a few hours with less than 1 gpm
- The largest of the aquifer tests was at well WW-1, extending for approximately 15 days at 1,950 gpm

Groundwater measurements and model boundaries

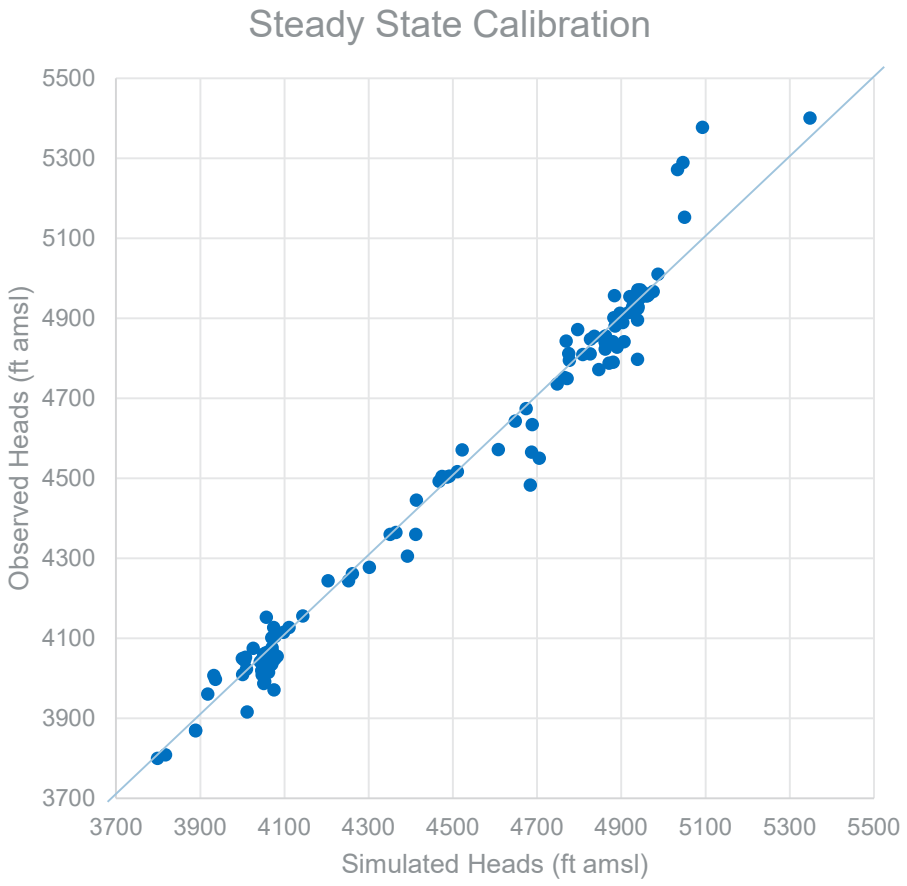


- Measured water levels indicate flow from Patagonia Mts. toward Sonoita Creek
- Groundwater is recharged at high elevations and moves towards the surrounding valleys.
- In some locations, springs have provided some guidance for groundwater elevations
- Opportunities to expand our understanding of hydrogeology south of Hermosa property

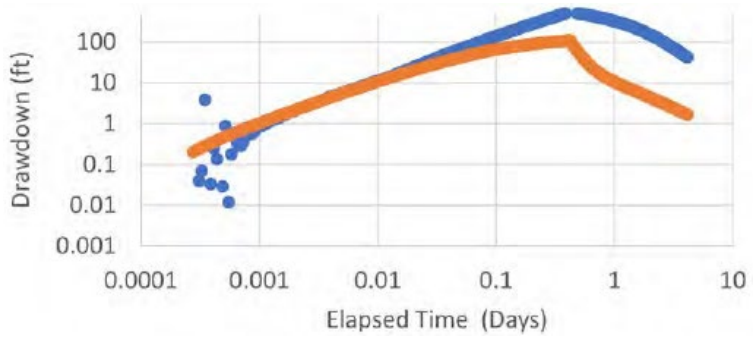
Conceptual geologic and groundwater flow model

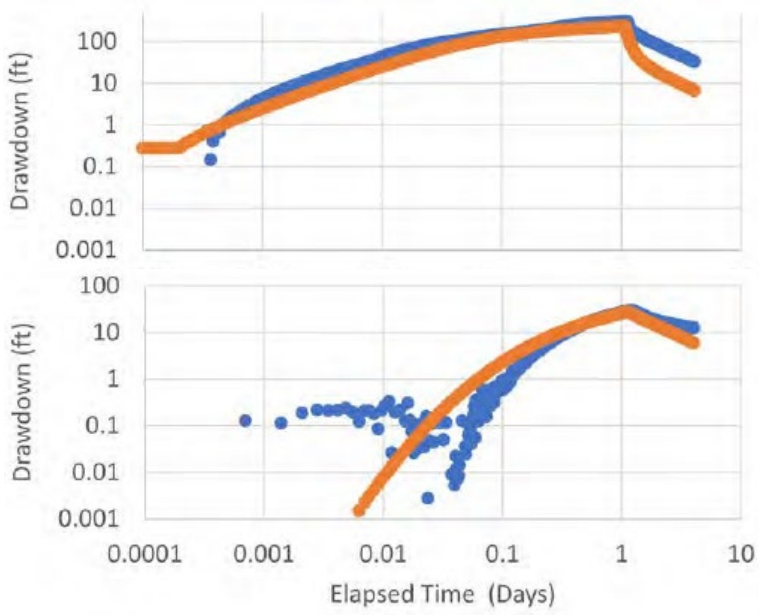


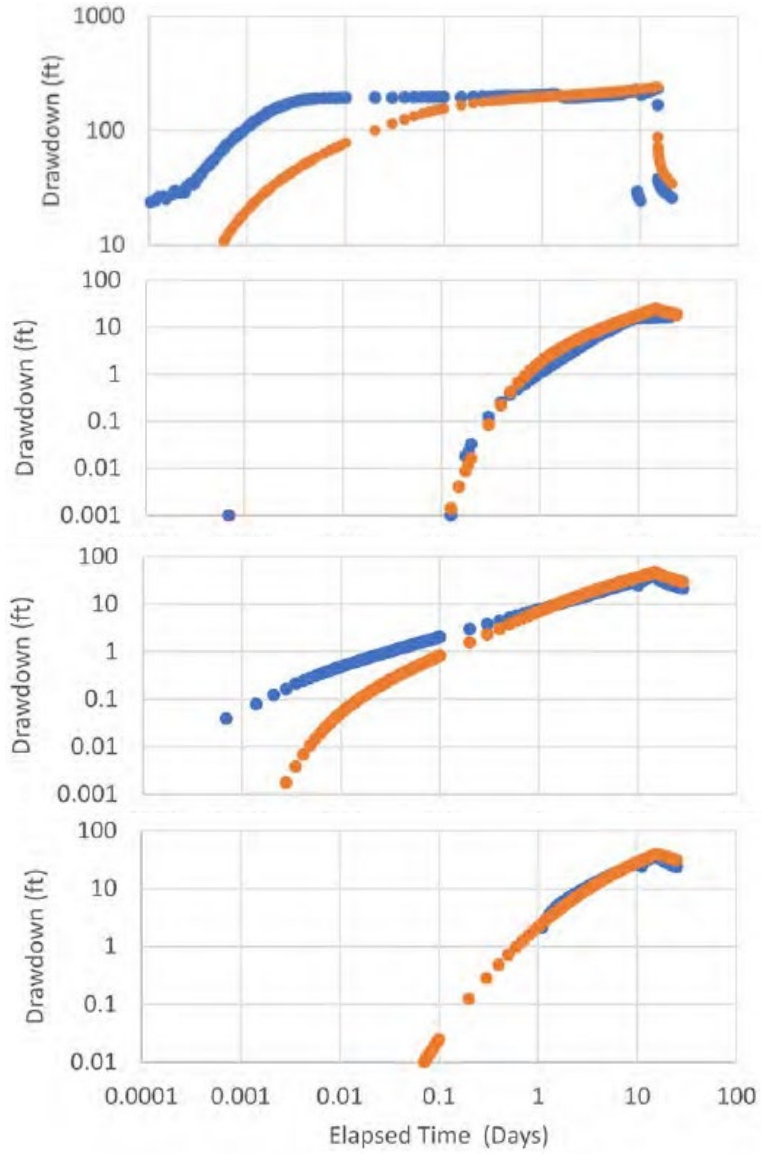
Numerical groundwater model calibration



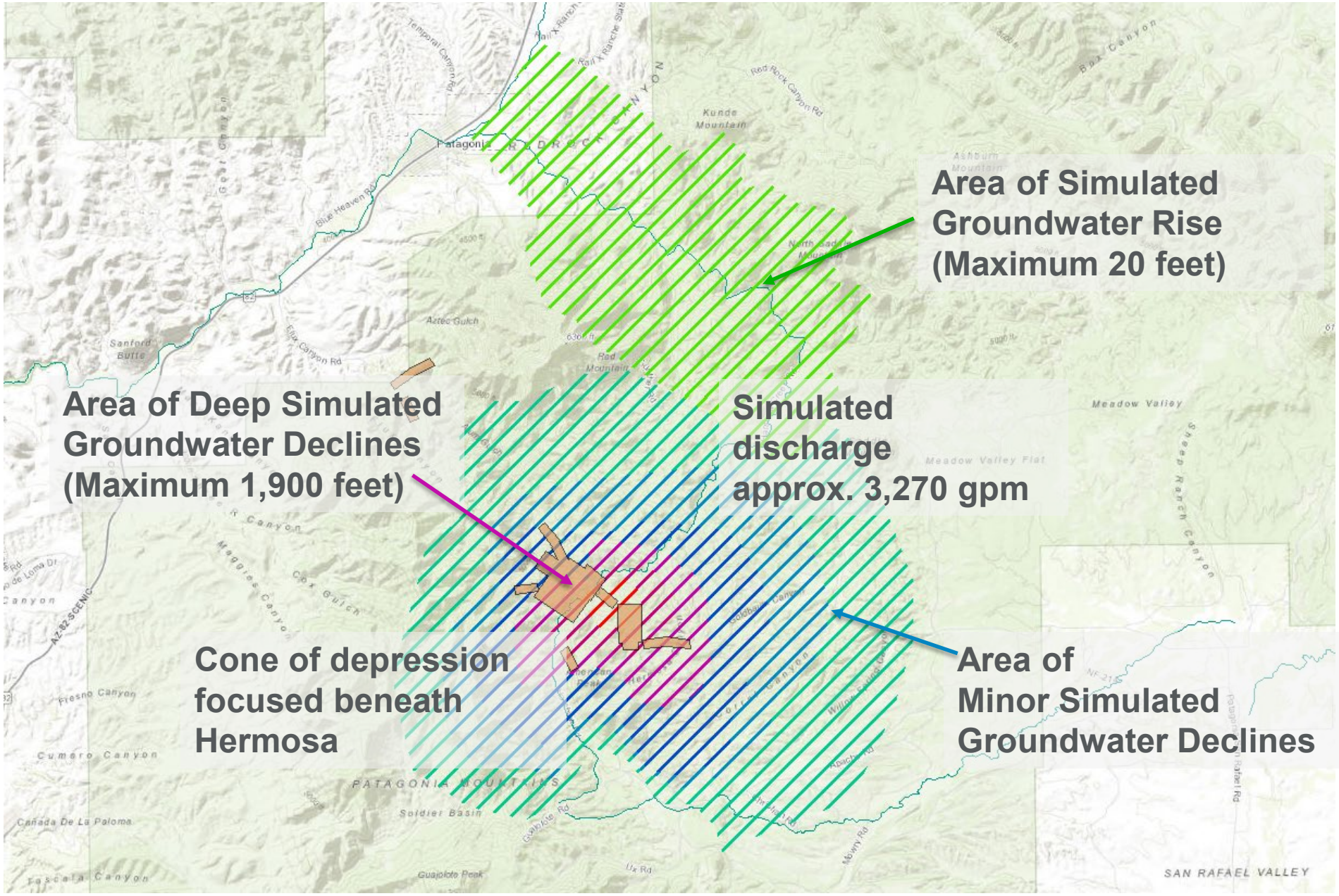
Residual Mean	0.235
Absolute Residual Mean	19.30
Residual Std. Deviation	29.68
Sum of Squares	130400
RMS Error	29.68
Number of Observations	148
Range in Observations	1601
Scaled Residual Std. Deviation	0.019
Scaled Absolute Residual Mean	0.012
Scaled RMS Error	0.019
Scaled Residual Mean	0.00015







Preliminary Impact Simulation for Exploration Dewatering



Questions?

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