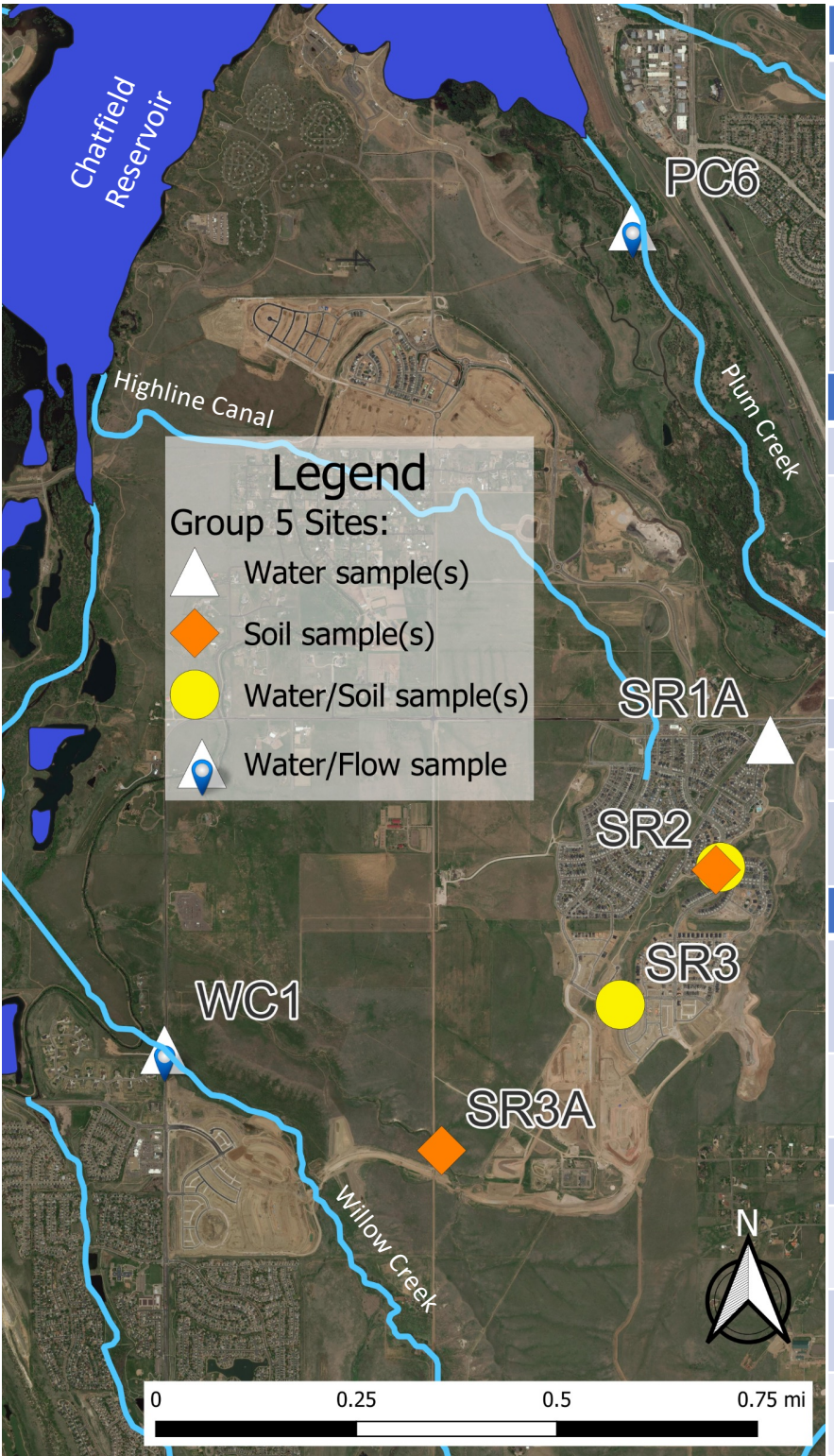
Sterling Gulch and Willow Creek 2022

Group 5: Makenna Green, David Hoppmann-Piñeiro, Wren Nelson, Maren Prokup, Lillia Shub, and Everett Urban



Key Points	Recommendations
• SR1A, SR2, and SR3 all had pH above 8 • WC1 and PC6 had high coliform and *E.coli* • Se in water exceeded CDPHE Chronic standards for both WC1 and PC6 • SR3A soil had As levels above EPA Drinking Water Standards • P and Zn exceeded CDPHE Chronic standards • Mn exceeds EPA Human Recreation and Fishing Standard for PC6	• Monitor concrete runoff and construction for effects on pH from the Sterling Ranch development • Track sources of *E. coli* and coliform • SR3A should be monitored for erosion and concentrations of As, Se, and P • Analyze sources of P and Zn at all sites • Limit transport of Mn to the Chatfield Reservoir inlet

Table 1: Site Information

Site ID	Latitude	Longitude	Site Description
SR1A	39.506111	-105.030833	Storm drain off Titan Rd. at downstream end of Sterling Ranch housing development.
SR2	39.499167	-105.034167	Storm drain under Eagle River St.
SR3	39.491667	-105.041389	Storm drain off Sterling Ranch Ave., between Chalk Creek Pl and Swan River St.
SR3A	39.483889	-105.053889	Unnamed gulch off Roxborough Park Rd.
WC1	39.489444	-105.073056	Creek underneath N. Rampart Range Rd.
PC6	39.533611	-105.040556	Creek within Chatfield State Park on the southeast side of the Chatfield Reservoir.

Table 2: Water Quality Characteristics

Site	pH	Conductivity (μS/cm)	Alkalinity (mg $CaCO_3$/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Flowrate (cfs)	Key
PC6	8.4* 8.1**	828* 1030**	134* 144**	0.007*	7.97**	15.7* 20**	* data taken on 5/17/2022 ** data taken on 5/20/2022
SR1A	8.2*	587*	74.3*	0.001*	N/A	N/A	
SR2	8.7* 10**	869* 196**	111* 38.5**	0.007*	N/A	N/A	
SR3	10* 9.5**	1230* 1150**	98.5* 31.5**	0.005*	N/A	N/A	
WC1	8.7* 8.4 **	720* 787**	132* 190**	0.021*	9.29**	0.68**	

Table 3: Metals, anions, organics, and pathogens analysis in water and soil before and during storm event

Standards		Metal Concentrations [mg/L]						Anion Concentration [mg/L]	Pathogen Concentrations [MPN/100 mL]		Organic Concentrations [mg/L]	
		As	P	Se	Fe	Mn	Zn	Cl^-	Total Coliform	E. Coli	COD	DOC
EPA Aquatic Life Chronic[1]		0.15	N/A	N/A	1.0	N/A	0.12	230	N/A	N/A	N/A	N/A
EPA Aquatic Life Acute[1]		0.34	N/A	N/A	N/A	N/A	0.12	860	N/A	N/A	N/A	N/A
EPA Human Recreation and Fishing[2]		1.80E-05	N/A	0.17	N/A	0.05	7.4	N/A	N/A	N/A	N/A	N/A
EPA Drinking Water[3]		0.01	N/A	0.05	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
EPA Secondary Drinking Water[4]		N/A	N/A	N/A	0.3	0.05	5	250	N/A	N/A	N/A	N/A
CDPHE Chronic[5]		20	0.11	0.0046	WS	1.43	0.0082	250	200	126	N/A	N/A
CDPHE Acute[5]		0.34	N/A	0.0184	N/A	2.59	0.11	N/A	200	N/A	N/A	N/A
USDA Livestock [6]		0.01	N/A	0.05	0.3	0.05	25	1500	200	N/A	N/A	N/A
Detection Limit		0.0168	0.029	0.011	0.0003	0.0001	0.0003	0.1	1	1	3.0	0.10
Site ID	Type	05/17/2022										
SR1A	Water	BDL	0.15	BDL	0.039	0.011	0.012	40.9	3130	52	21.6	8.07
SR2		BDL	0.24	BDL	0.043	0.003	0.009	96.9	2360	<1	45.1	16.4
SR3		BDL	0.074	BDL	0.1	0.007	0.01	122	187	<1	33.7	13
WC1		BDL	BDL	BDL	0.20	0.02	0.018	13.9	1480	1130	8.05	5.09
PC6		BDL	BDL	BDL	0.67	0.42	0.009	120	644	173	11.7	4.84
05/20/2022												
SR2	Water	BDL	0.078	BDL	0.35	0.035	0.036	15.1	>2419.6	118	18.5	6.35
SR3		BDL	0.1	BDL	0.46	0.054	0.044	7.35	>2419.6	208	20.8	7.13
WC1 (D)		BDL	BDL	0.026	0.005	0.019	0.002	43.3	816	411	13	2.86
PC6 (D)		BDL	BDL	0.018	0.041	0.59	BDL	121	1730	98.5	12.1	4.63
05/17/2022												
$SR2^{\Delta}$	Soil TCLP	0.032	0.07	0.067	0.012	1.403	0.166					
SR2•		0.022	0.22	0.064	0.004	1.3	0.013					
SR3		0.042	BDL	0.075	0.07	2.8	0.099					
$SR3A^{s}$		0.042	1.677	0.066	0.001	1.4	BDL					
$SR3A^{m}$		0.023	2.532	0.04	0.013	1.3	0.004					
SR2•	Soil CDMG	BDL	0.3	BDL	0.016	0.001	0.004					
$SR3A^{s}$		0.017	0.21	BDL	0.008	0.001	0.003					
$SR3A^{m}$		BDL	1.4	BDL	0.13	0.026	0.007					

1 https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table
2 https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table
3 https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations
4 https://www.epa.gov/sdwa/secondary-drinking-water-standards-guidance-nuisance-chemicals
5 https://cdphe.colorado.gov/water-quality-control-commission-regulations
6 https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_051302.pdf

Notes:
BDL= Below Detection Limit
N/A= data not available
Red = above calibration range
WS= Water Supply, implied N/A

(D) = Dissolved
$^{\Delta}$ = in storm drain
• = in gulch outside of drain
^{s} = sediment with just one type
^{m} = mix of sediments