

Group 3: East Plum Creek at Lowell Ranch – 2023

Aeryn Aurand, JD Carson, Alex Chavez, Hannah Fristed, Emma Haskell, Katie Wilson

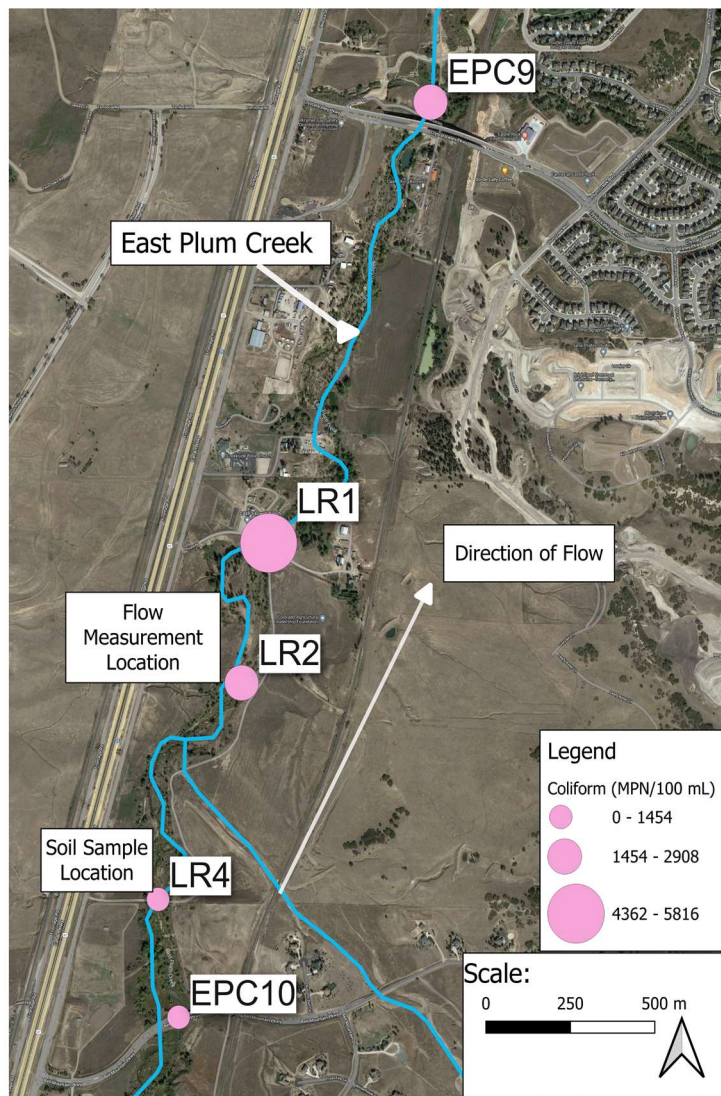


Figure 1. Site of interests with total Coliform concentrations at East Plum Creek: Lowell Ranch.

Table 1. Site information for East Plum Creek at Lowell Ranch

Site ID	Latitude	Longitude	Site Description
EPC10	39.316°	104.879°	East Plum Creek at Bell Mountain Parkway
LR1	39.327°	104.877°	East Plum Creek at Lowell Ranch (CALF H.Q.)
LR2	39.323°	104.879°	East Plum Creek at Lowell Ranch (Cow Pasture)
LR4	39.319°	104.880°	East Plum Creek at Lowell Ranch (Culvert Failure)
EPC9	39.339°	104.871°	East Plum Creek Gulch at Crystal Valley Parkway

Main Findings

- Data shows TN accumulated downstream surpassing proposed CDPHE limits at EPC9, while TP decreased downstream in compliance.
- Soil leachate samples were taken at LR4 from the stream bank at the beaver dam, and at the beaver pond which exhibited elevated levels for TP, NO₃⁻, and Se.
- Notable erosion was present along the reach of EPC, recent precipitation events heavily impacted initial reclamation attempts at LR2 and a culvert failure at LR4 led to a roadway being washed out.
- Stream connectivity fluctuates with flow rates and is affected by sediment islands, causing non-traversable conditions for aquatic life.
- LR4's beaver pond and dam, in addition to the culvert failure, suspected to cause a surge in total coliform concentrations from LR4 to LR1.
- The culvert failure requires reclamation, with provided recommendations of overall structural changes or culvert redesign.

Table 2. Measured water quality parameters and flow rates

Date	Site ID	pH*	Conductivity (µS/cm)	Temp** (°C)	Dissolved Oxygen [▲] (mg/L)	Alkalinity* (mg CaCO ₃ /L)	Turbidity (NTU)	Flow Rate* (cfs)
5/16/2023	EPC10	7.53	160	18.2	7.8	18	70.5	N/M
5/16/2023	LR4	7.38	193	12.7	8.0	26	131	N/M
5/16/2023	LR2	7.42	204	13.8	7.6	26	189	75.5
5/16/2023	LR1	7.39	211	11.1	7.9	31	744	N/M
5/16/2023	EPC9	7.42	176	18.4	7.4	29	168	N/M

N/M = Not Measured; *Standard limit 6.5 to 9 [4]; **Daily Max 24.3°C; [▲]Standard min limit 20 mg CaCO₃/L [1]. *Flow rate measured on May 19th, 2023.

Table 3. Metals, anions, solids, organics, nutrients, and pathogens

2023 Group 3 – East Plum Creek at Lowell Ranch			Concentrations												
			Metals (mg/L)					Anions (mg/L)		Solids (mg/L)	Organics (mg/L)	Nutrients (mg/L)		Pathogens (mpn/100 mL)	
			As	Fe	Mn	Se	Tl	NO ₂ ⁻ - N	NO ₃ ⁻ - N	TSS	TOC	TP	TN	Coliform	<i>E. coli</i>
EPA	Aquatic Life Chronic [1]		0.15	1.0	-	-	-	-	-	-	-	-	-	-	-
	Aquatic Life Acute [1]		0.34	-	-	-	-	-	-	-	-	-	-	-	-
	Human Recreation [2]		1.8E-05	-	0.05	0.17	2.4E-04	-	10	-	-	-	-	-	-
	Drinking Water [3]		0.01	-	-	0.05	0.002	1	10	-	-	-	-	-	-
	Secondary Drinking Water [3]		-	0.3	0.05	-	-	-	-	-	-	-	-	-	-
CDPHE	Regulation 38 Chronic [4]		2.0E-05*	1.0*	1.7**	0.0046	-	0.05	-	-	-	0.11 [▲]	0.53*	-	126
	Regulation 38 Acute [4]		0.34	-	3.1**	0.0184	-	-	10	-	-	-	-	-	-
USDA	USDA Livestock [5]		0.01	0.3	0.05	0.05	-	10	30	-	-	-	-	200	-
	Detection Limit (mg/L)		0.0168	0.0003	0.0001	0.0109	0.0049	0.1	0.1	-	0.17	0.029	0.17	1	1
Sample	Site ID	Date	As	Fe	Mn	Se	Tl	NO ₂ ⁻ - N	NO ₃ ⁻ - N	TSS	TOC	TP	TN	Coliform	<i>E. coli</i>
Water	EPC10	5/16/2023	BDL	1.31	0.060	BDL	BDL	ND	0.10	108	9.05	BDL	0.35	850	75
	LR4	5/16/2023	BDL	1.68	0.068	BDL	BDL	BDL	0.08	134	8.98	BDL	0.37	1100	31
	LR2	5/16/2023	BDL	2.41	0.091	BDL	BDL	BDL	0.10	248	8.96	BDL	0.37	2100	10
	LR1	5/16/2023	0.018	8.71	0.092	BDL	BDL	BDL	0.12	320	9.14	0.38	0.39	4600	20
	EPC9	5/16/2023	BDL	2.05	0.076	BDL	BDL	BDL	0.13	289	9.26	0.063	0.55	2000	110
Soil	LR4 - 1	5/16/2023	BDL	0.165	0.006	0.007	BDL	BDL	0.55	N/M	N/M	0.10	N/M	N/M	N/M
	LR4 - 2	5/16/2023	BDL	1.61	0.039	0.006	0.013	BDL	2.6	N/M	N/M	0.34	N/M	N/M	N/M
Notes:															
A/BDL = Above/Below Detection Limit							[1] US EPA National Recommended Water Quality Criteria - Aquatic Life Criteria Table; freshwater standards (https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table)								
N/M = Not Measured							[2] US EPA National Recommended Water Quality Criteria - Human Health Criteria Table; consumption of water & organisms (https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table)								
*Total Recoverable Standards (all other standards are for dissolved metals)							[3] US EPA Drinking Water (https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations)								
**Calculated using Table Value Standards assuming 111 mg CaCO ₃ /L average low flow hardness [6]							[4] CDPHE Regulation 38 for Upper South Platte River Basin (https://cdphe.colorado.gov/water-quality-control-commission-regulations)								
▲Phosphorus standard is 0.03 mg/L within Chatfield Reservoir and 0.11 mg/L for most tributaries							[5] USDA Livestock Drinking Water (https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_051302.pdf)								
For information on other constituents, please see Data Appendix							[6] Chatfield Reservoir Storage Reallocation Feasibility Study 2013								
*Average of Regulation 38 proposed standards for cold and warm waters															
Bolded values represent total samples.															
Reclamation Recommendations – Culvert Failure							Recommendations – Water Quality								
<ul style="list-style-type: none"> Close the road and remove culvert from LR4 stream. Research more strategies to discourage beaver activity in the area such as wider spillways. Add a bridge pier to control flow, preserve road crossing, reduce erosion, and maintain stream connectivity. 							<ul style="list-style-type: none"> Add vegetation as a filter for constituents from runoff such as coliform and <i>E. coli</i>. Add structural improvements to the bank along East Plum Creek to prevent erosion using vegetation or riprap. Return to all sites and perform ecological risk assessment to further monitor constituents of concern. 								