State of the Beaver
Silverton and San Juan County

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ALPINE WATER RESOURCES

Project Goals

- Study relationship between beaver and mine impacted water (MIW) and mine impacted landscapes in the San Juan Mountains.
- Work with collaborators to explore possible solutions at the intersection between beaver and areas affected by legacy mining
- Explore the role of beaver in mountain ecosystem restoration though diverse stakeholder and financial avenues

Participating Partners and Funding Sources

- Water Infrastructure Improvements for the Nation (WIIN ACT) grants
- Colorado Department of Public Health and Environment
- BLM (Abandoned Mine Lands Program), USFS, EPA
- Colorado Division Of Reclamation and Mining Safety
- Mountain Studies Institute (MSI)
- Colorado Department of Transportation
- Local Town and County Governments
- Ski Areas, Private Land Owners
- Trout Unlimited, EcoMetrics, Pinon Land Design
- Natural Resource Damages funds
- Bureau of Reclamation (Water SMART Drought Response Program)

Castor Canadensis Ecology

- ~200 million beaver in N. America before European arrival
- Nearly every stream was trapped from CO to CA between 1820-1840
- reduced to just 100,00 at start of 20th century
- Around 15 million today (<10% historic population)
- Found in every watershed in Western US
- Up to 52 beaver dams per km of stream in Wyoming
- Shaped entire landscapes (from arroyos to valleys)

“Before the emigrant's wagon ever rolled a mile, before the miner found his first color, before the government authorized a single road or trail, this inhospitable land had been traversed and mapped.” –Ross Tolle, 1959

“it was the persistent search for beaver that familiarized the white man with the western wilds, and eased the way for official explorers and settlers”. (LeRoy Hafen, 1933)

We went from coexistence to commodification about 200 years ago!

Castor Canadensis
Ecological Benefits

- Improve water quality
- Reduce sediment and turbidity
- Removal of metals and contamination
- Slow release of snowmelt for downstream agriculture uses
- Reduce spread of wildfires
- Mitigate flooding
- **Reduce transport of mining contamination?**
- **Increased Resiliency to changing climate?**

Beavers and Landscape Ecology

Two sections of Sevenmile Creek, Utah — where beavers have been active (left) and where heavy grazing is allowed [photo credit: Stacy Passmore]

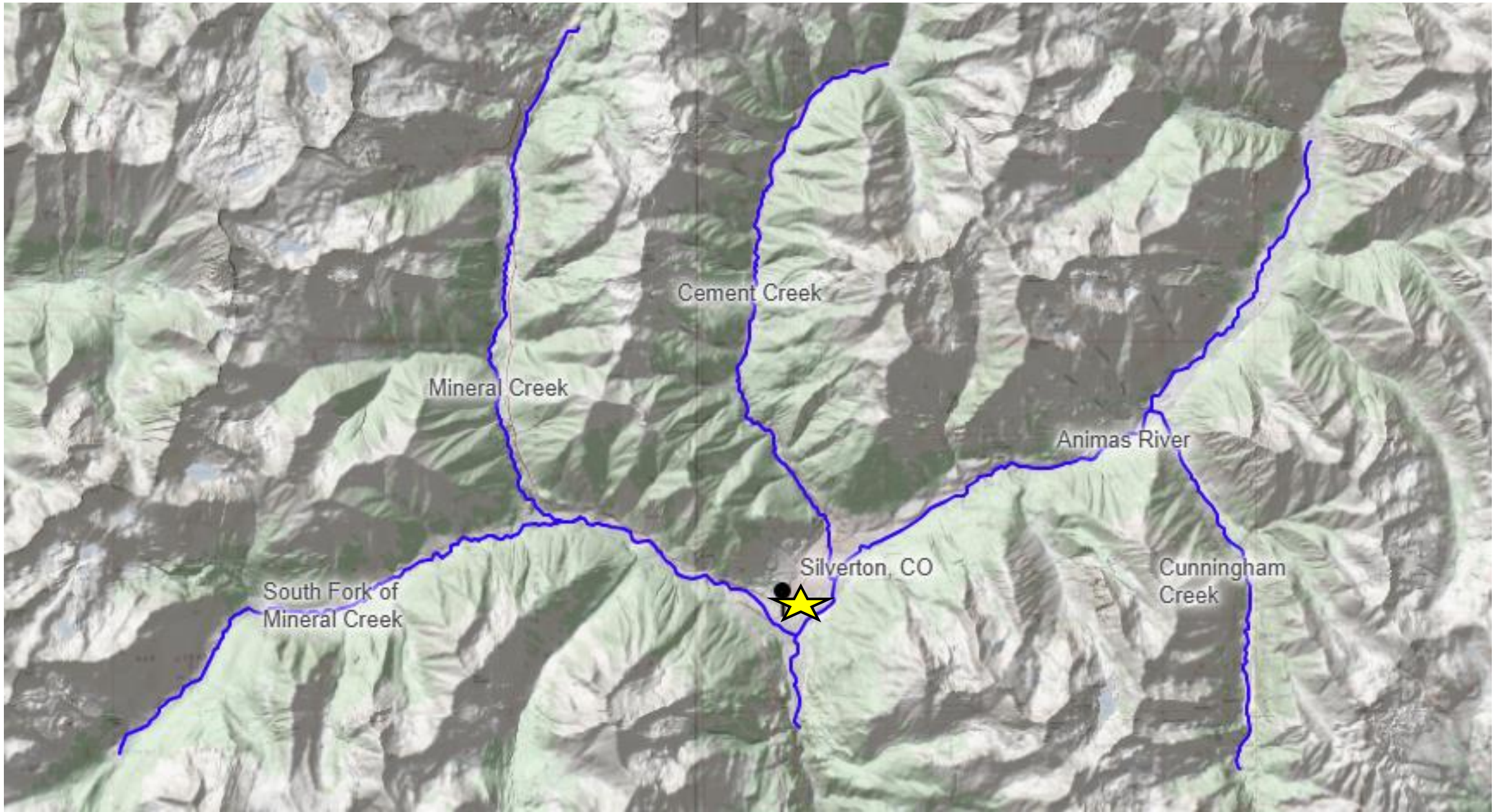
Credit:
Joe Wheaton, USU

Beavers are not just an animal, the are an ecosystem!

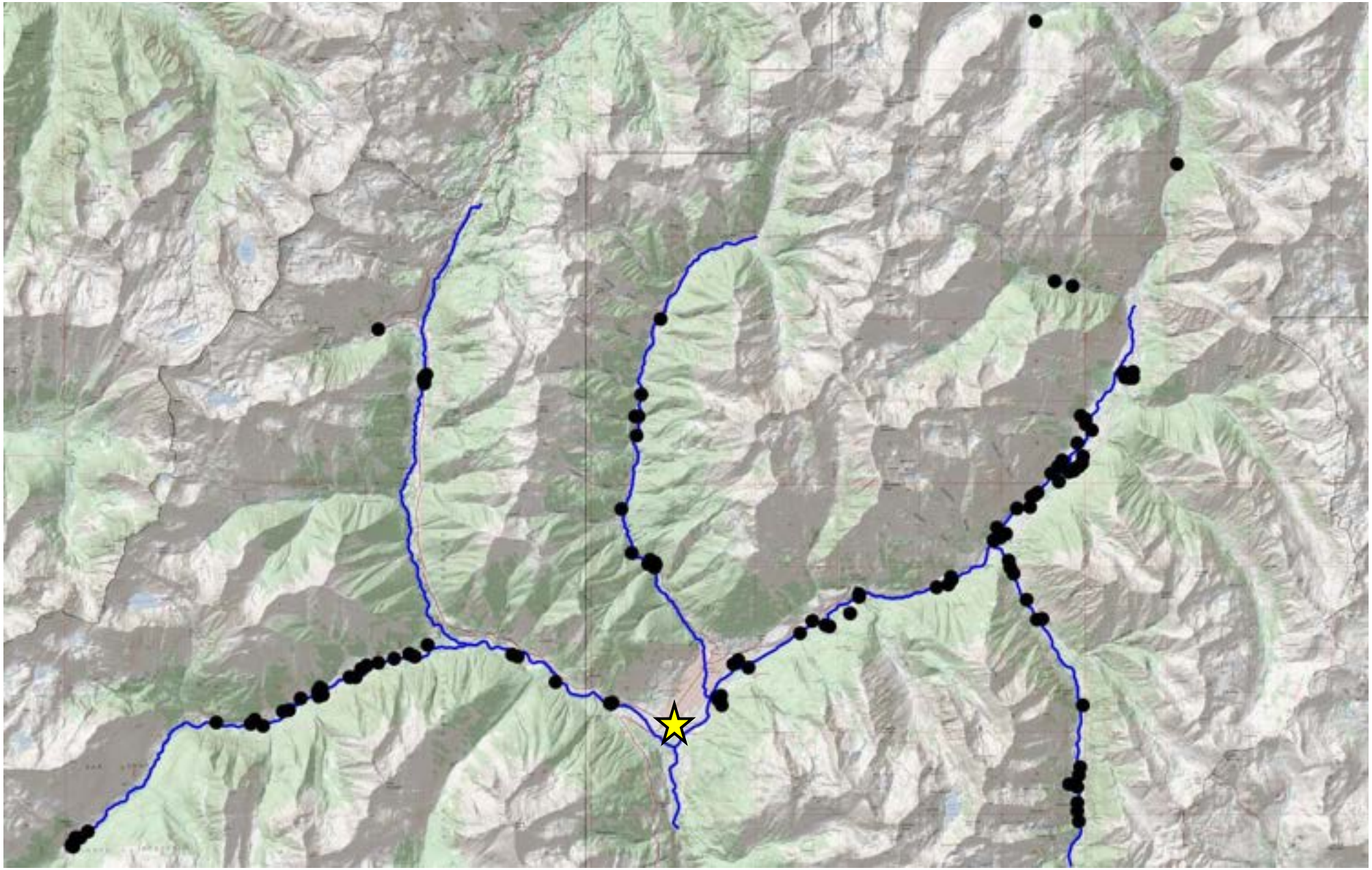
Habitat diversity
leads to
species biodiversity

Slide Credit: Torrey Ritter
Montana Dept Fish & Wildlif

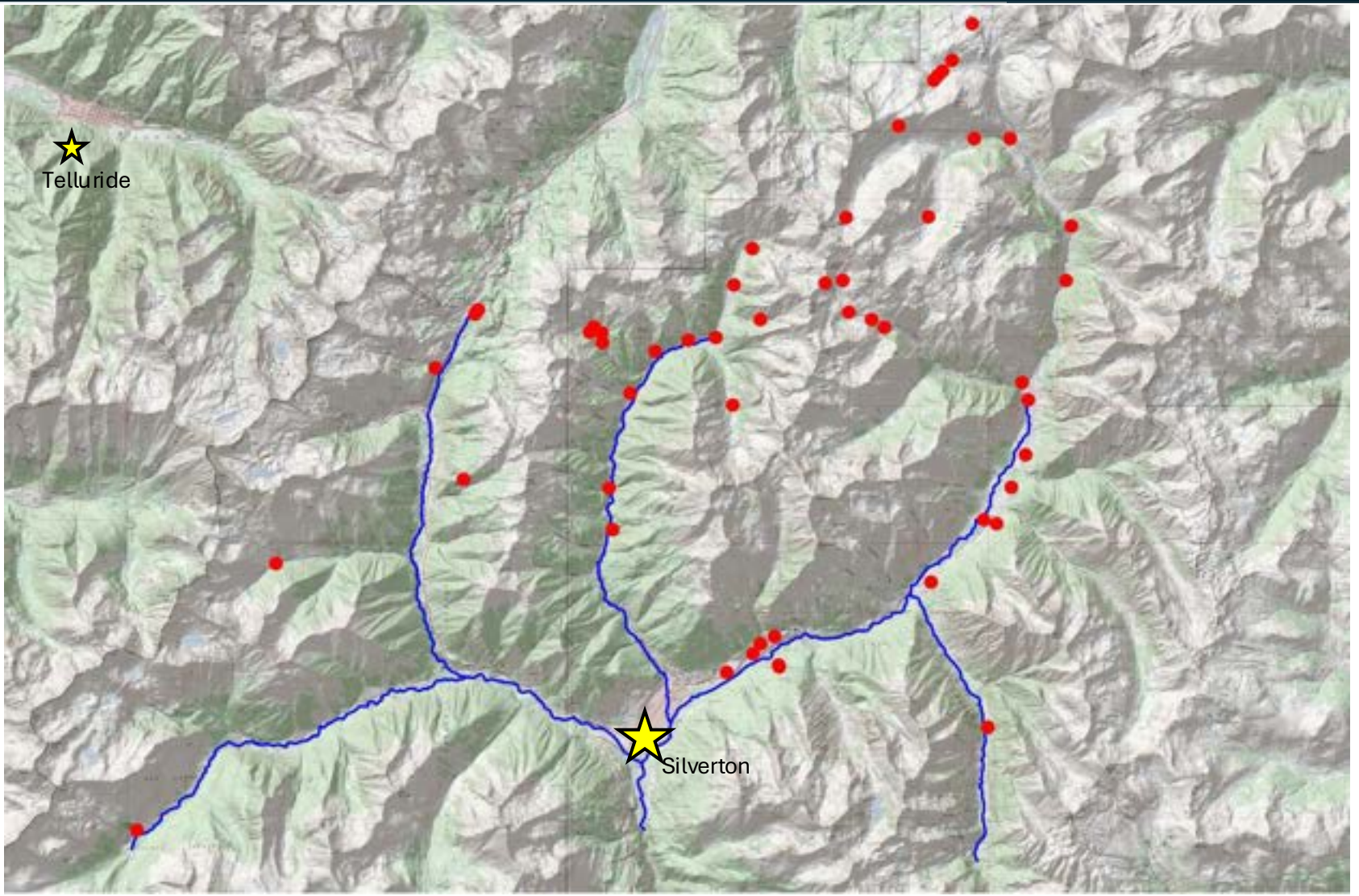
Focus Areas: Animas River Tributaries



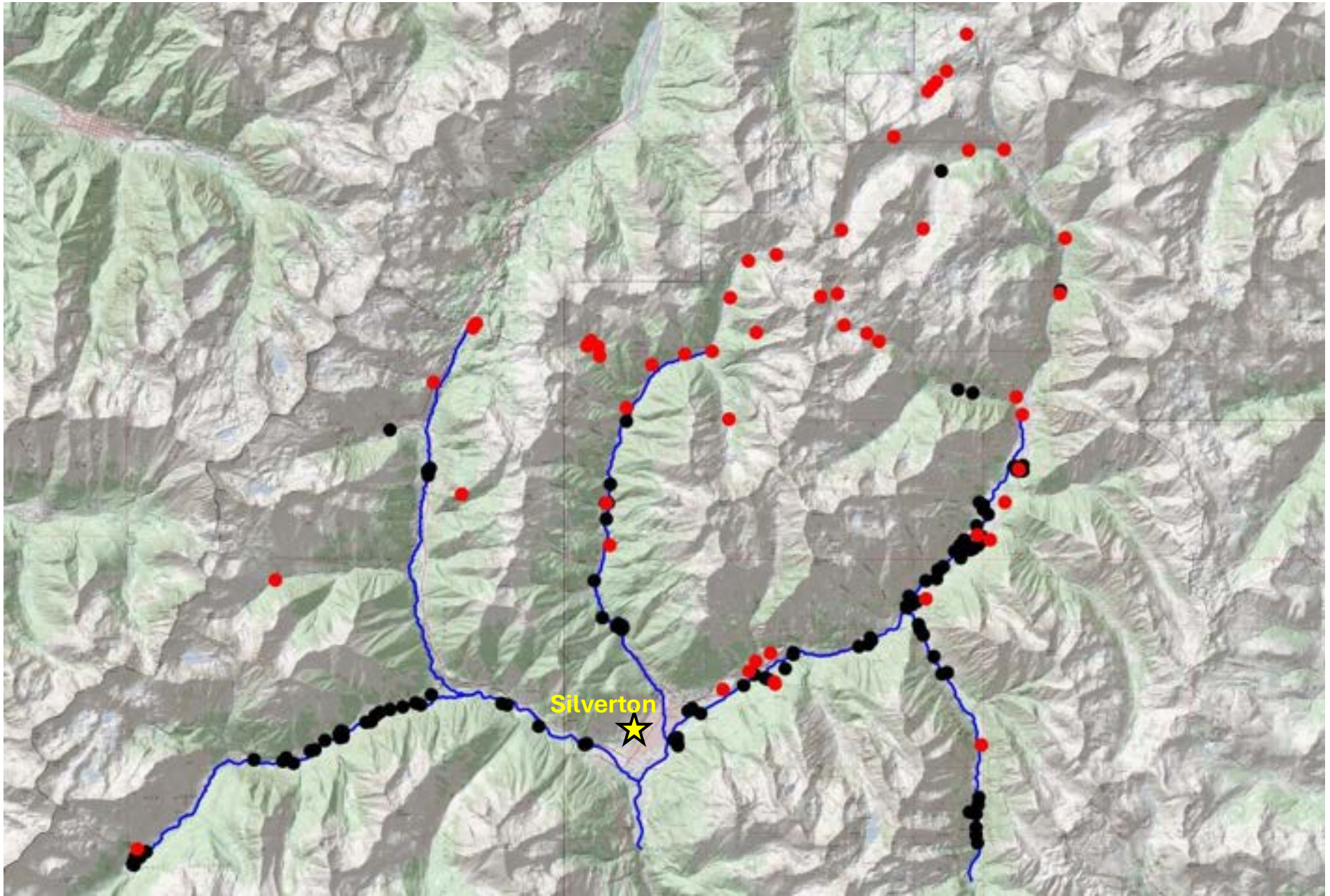
Current and Recent Beaver Activity

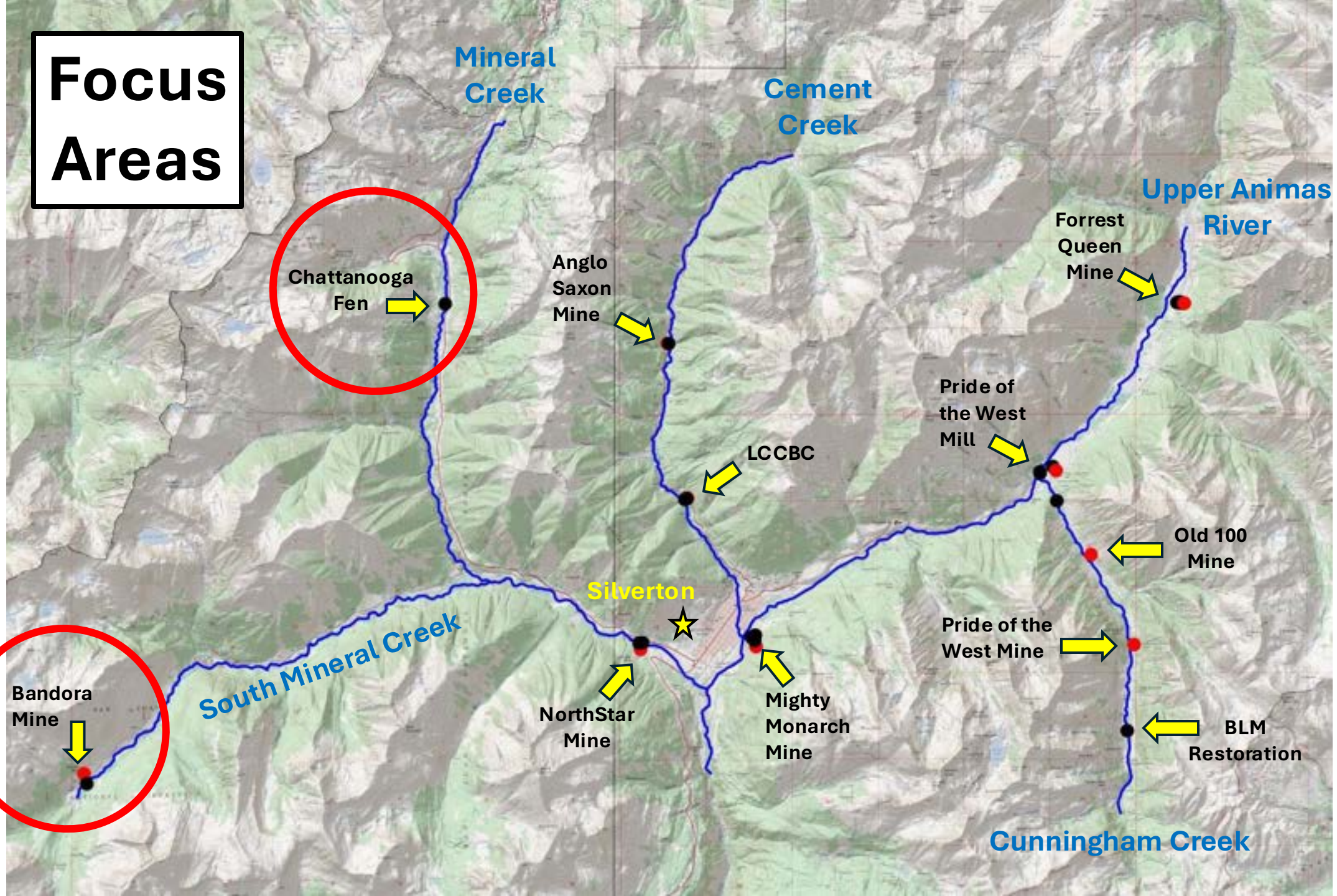


BPMD Contaminant Source Areas



BPMD Source Areas and Beaver Activity

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Cement Creek
Upper Animas River
Chattanooga Fen
Anglo Saxon Mine
Forrest Queen Mine
Pride of the West Mill
LCCBC
Old 100 Mine
Silverton
South Mineral Creek
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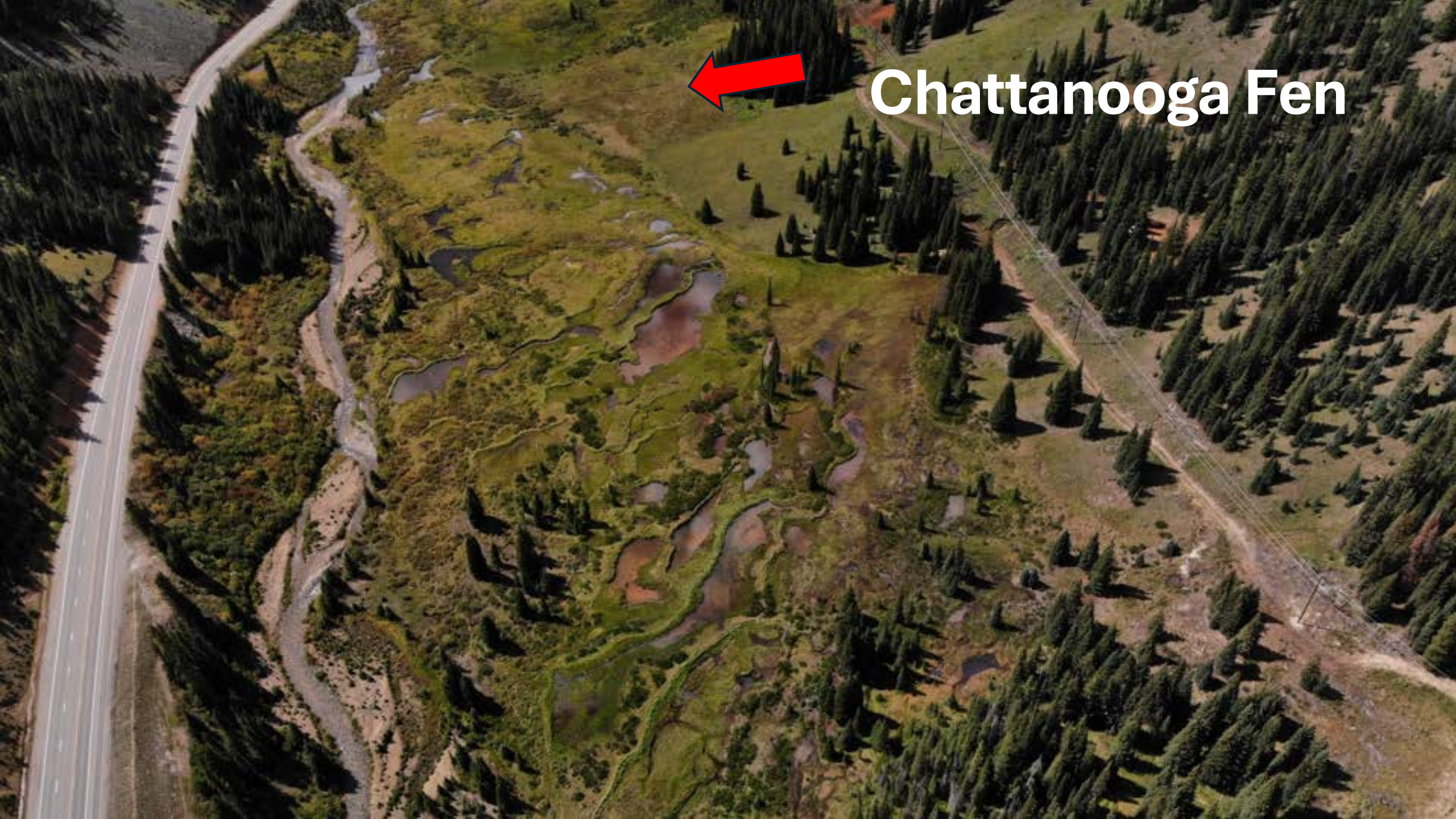
Bandora Mine
NorthStar Mine
Mighty Monarch Mine
BLM Restoration
Cunningham Creek

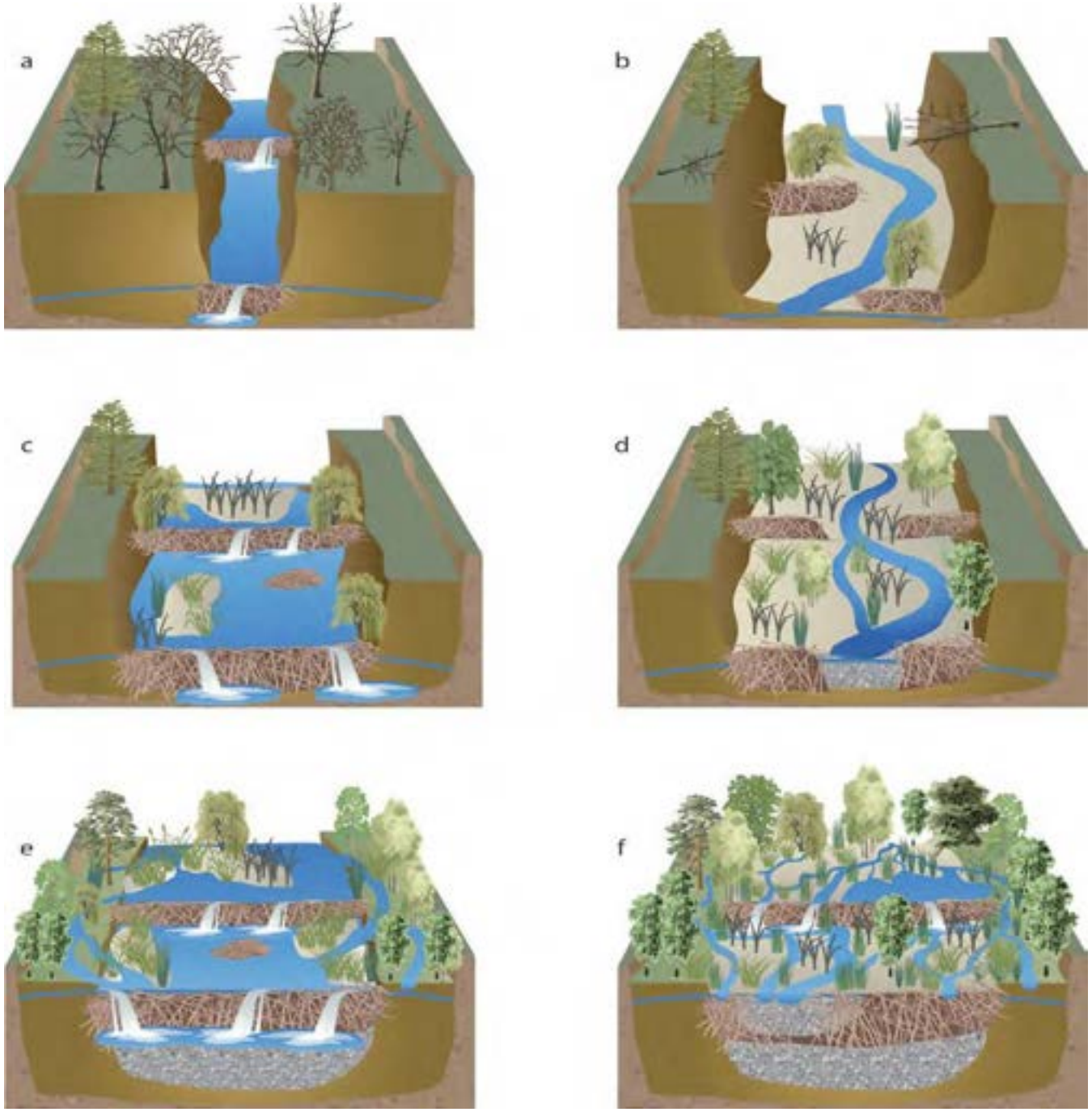

Chattanooga Fen


Large Avalanches
and Beaver Habitat
Brooklyn Avalanche Paths

New Beaver Dams 2024:

*Opportunity to add Post Assisted Log Structures
To reinforce dams

~90ft
~70ft
~50ft



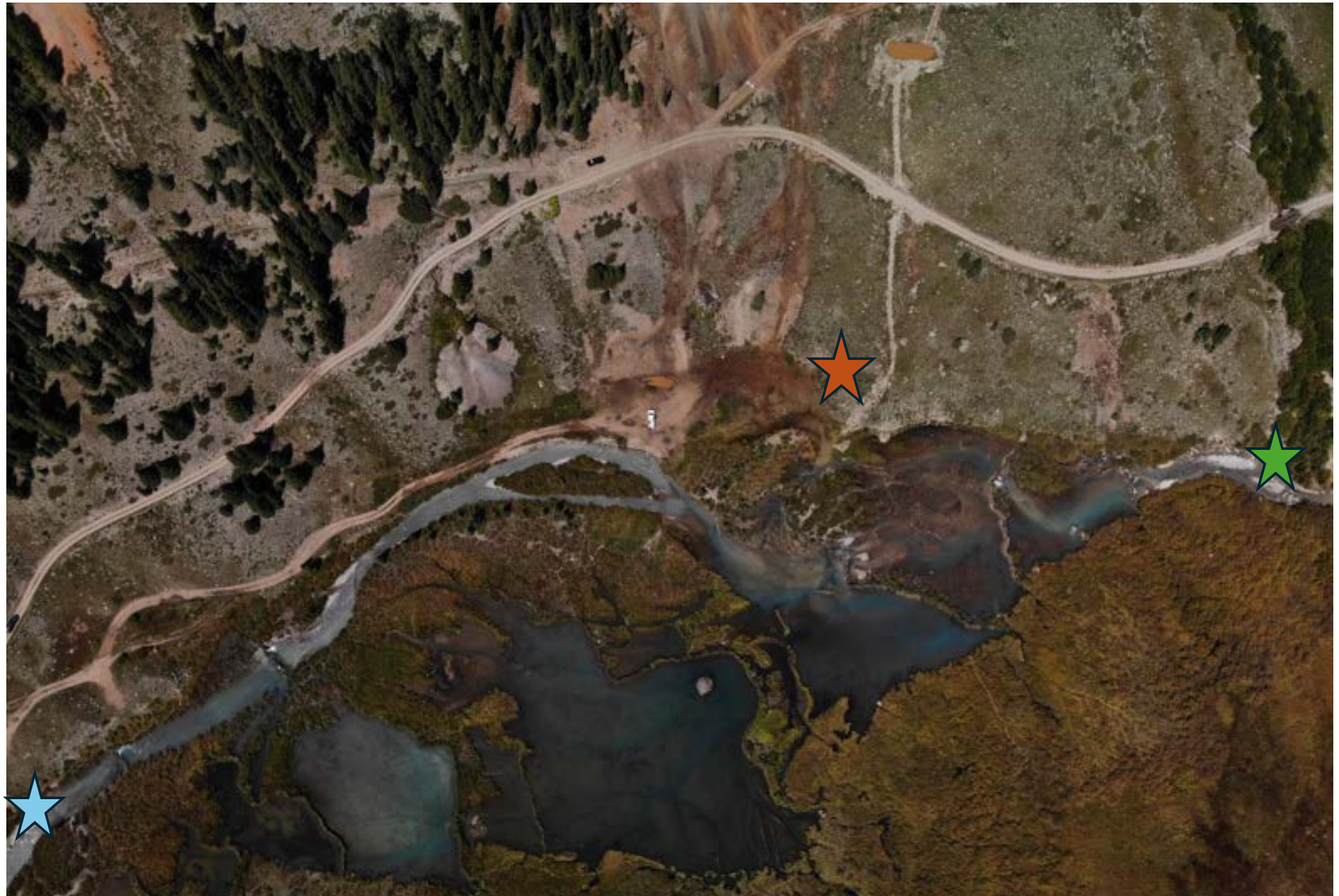
- A) beaver attempting to build dams within narrow incision trenches
- B) high stream power often results in blowouts, widen the incision trench, allowing an inset floodplain to form
- C) widened channel = lower power → allows beaver to build more stable dams
- D) High sediment loads fill behind dams which are temporarily abandoned and creates riparian vegetation growth
- E) Step D repeats until dams raise the water table enough to reconnect to former flood plain
- F) Highly complex stream ecosystem with high groundwater levels that create multithread channels connected to off channel wetlands that span the entire valley bottom!

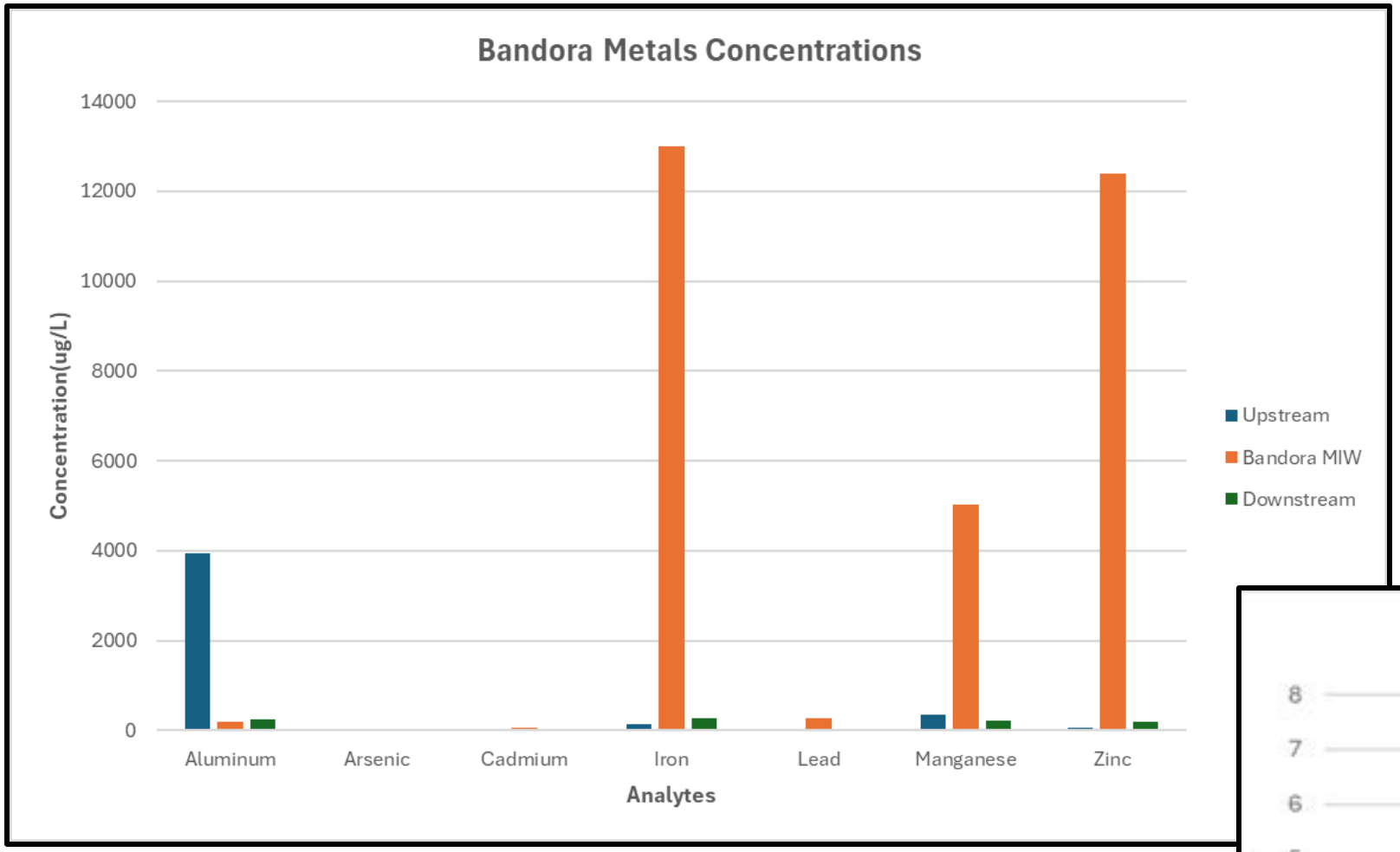
From Pollock et al., 2014

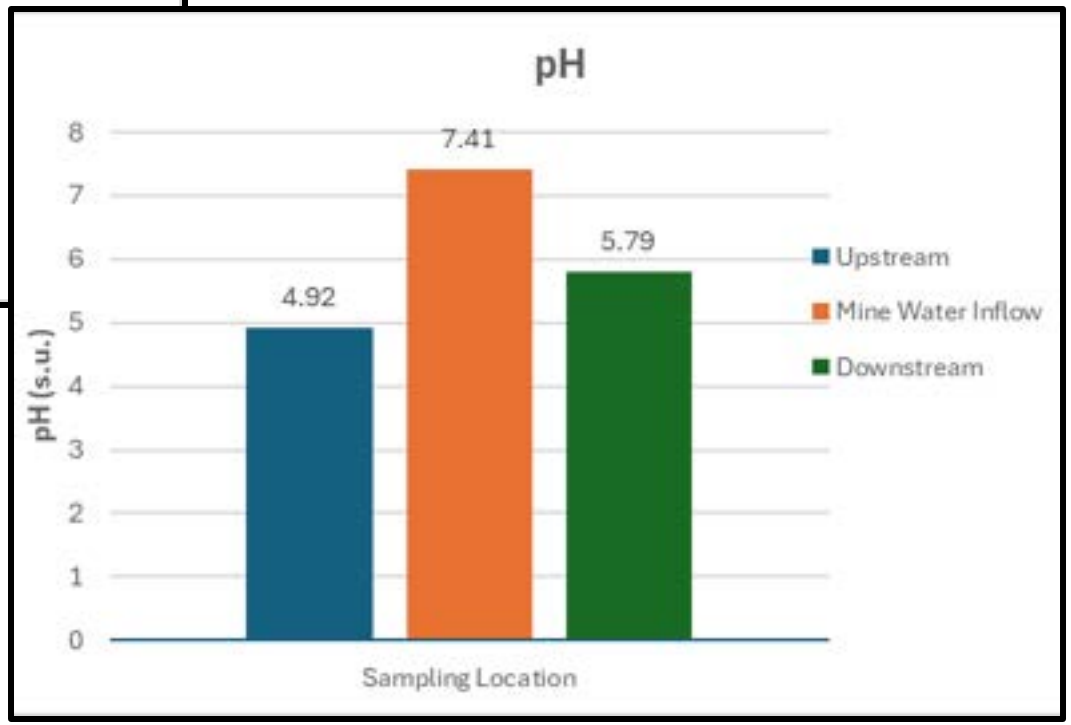
CDOT: Highway Infrastructure Protection Hwy 550 road culvert @ Chattanooga Turn


35D

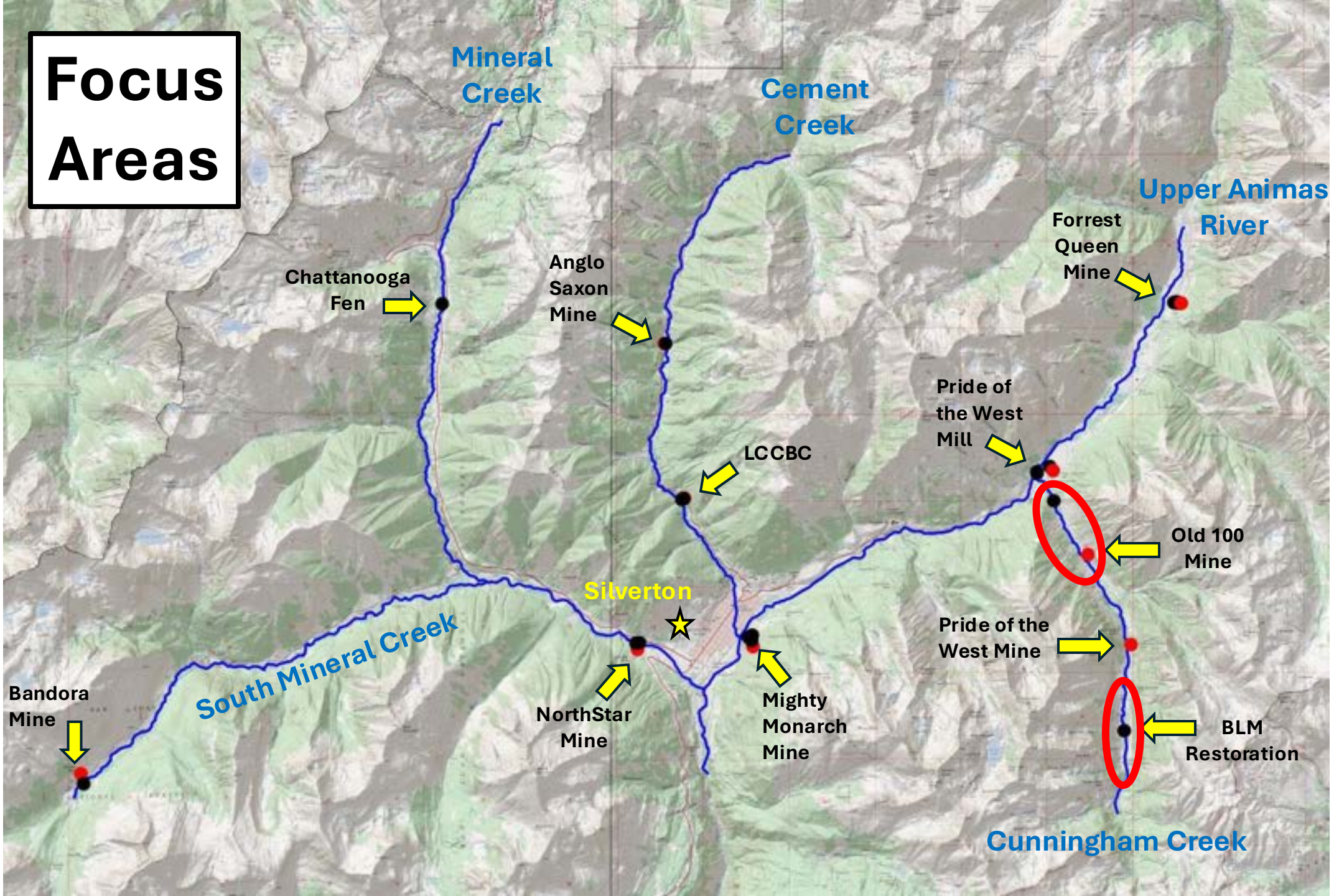

Bandora Mine







- Al decreases significantly across beaver habitat (pH dep.)
- MIW inflows higher pH & high Fe, Mn, Zn, minimal load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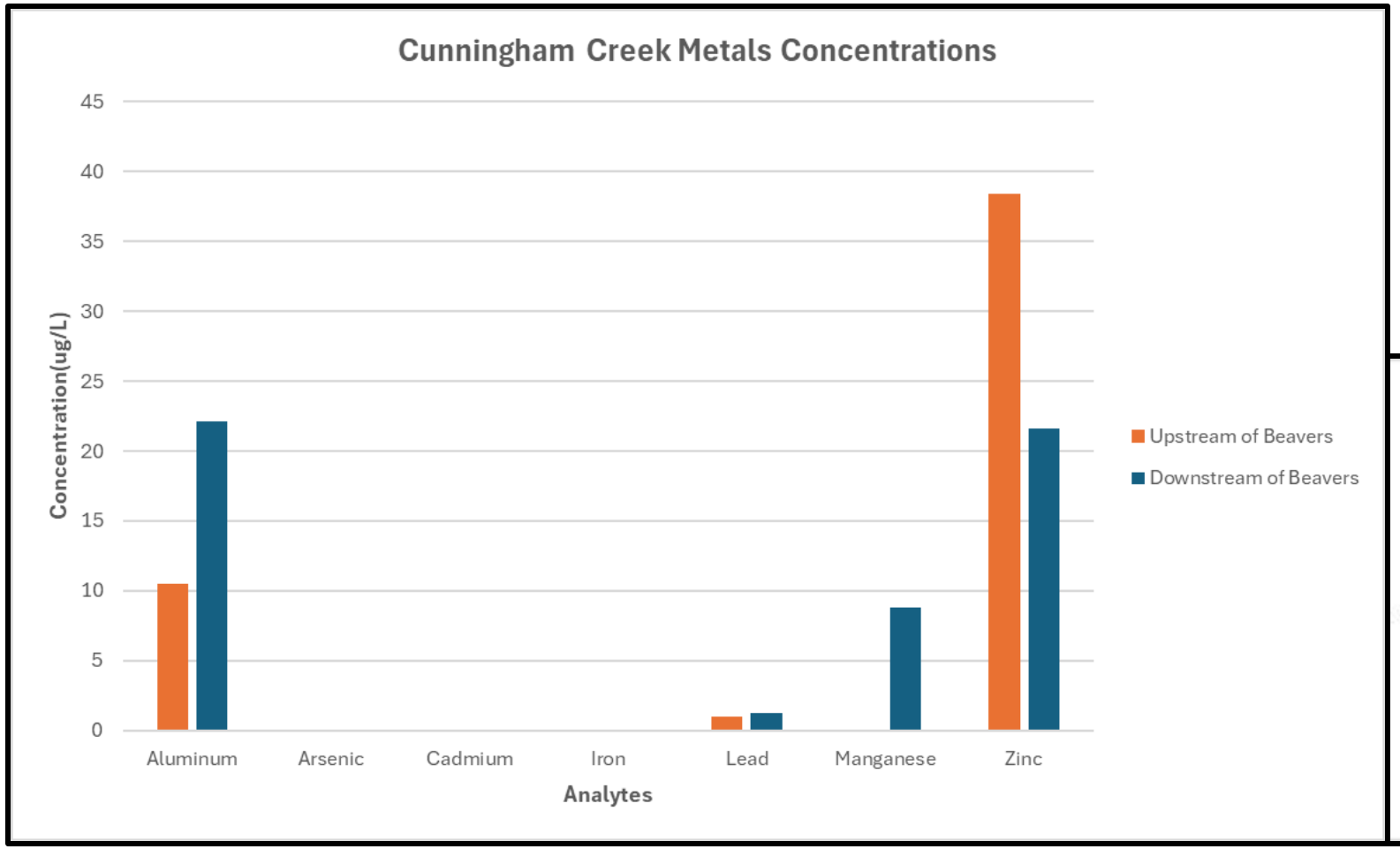
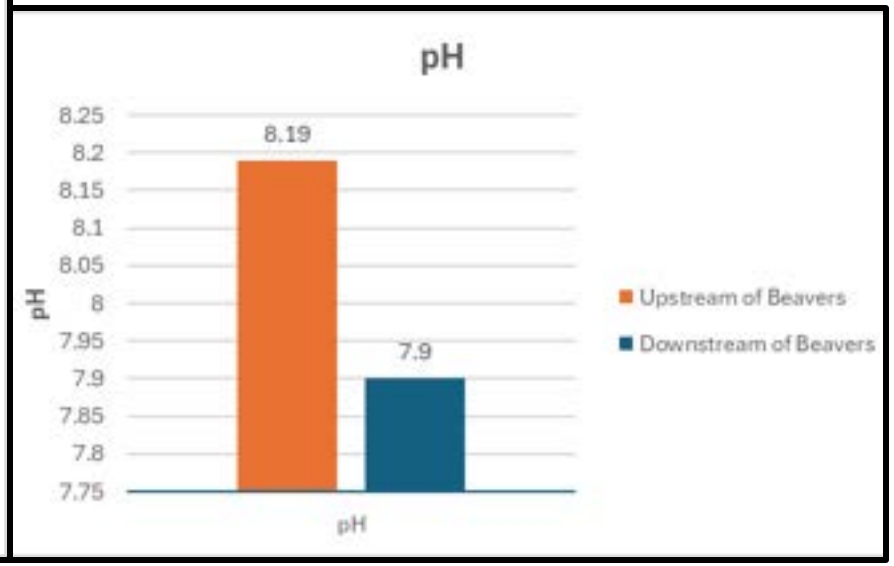
Cunningham Creek

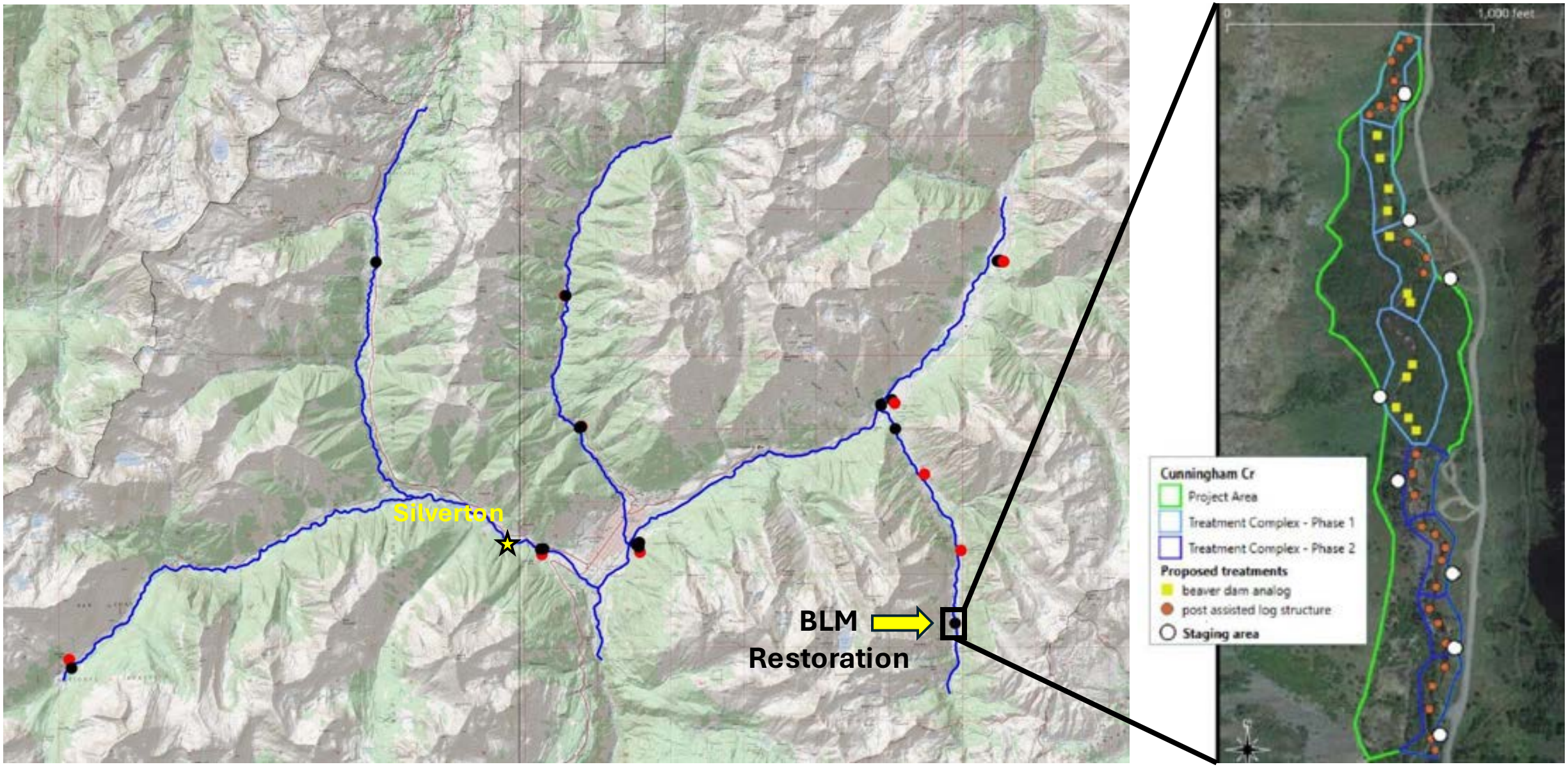
Cunningham Creek

Cunningham Creek Water Quality Upstream and Downstream of Beaver Activity and Mine Water inflows





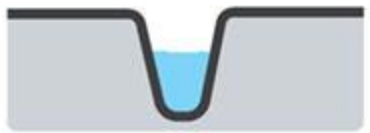
Cunningham Creek BDA & PAL Restoration




BLM x EcoMetrics

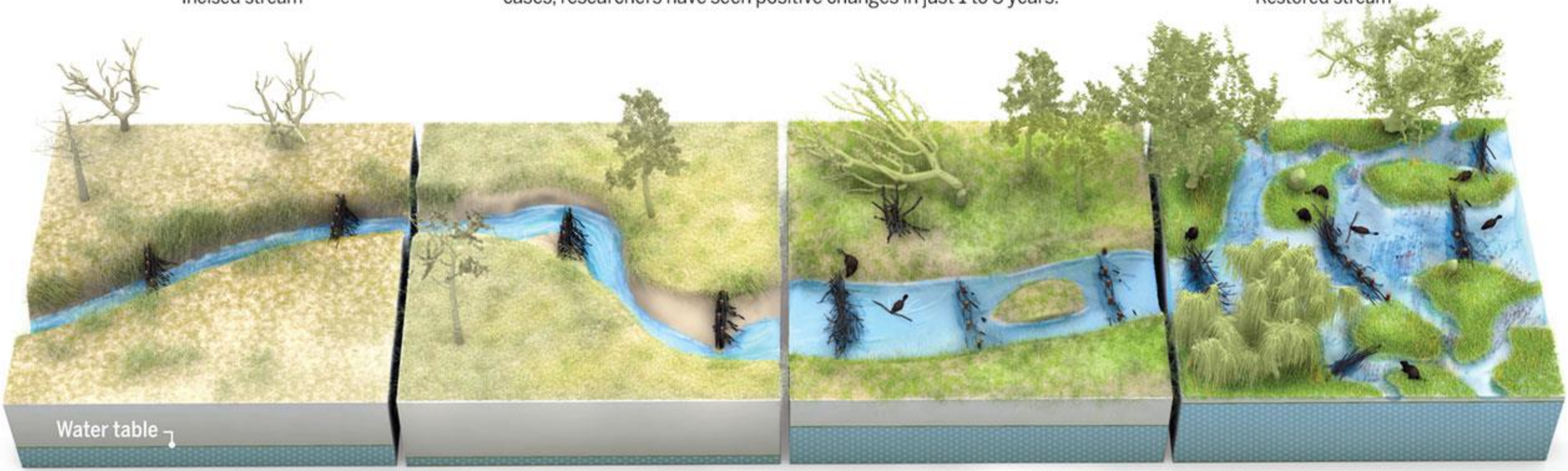
A stream comes back to life

Across the U.S. West, scientists and land managers are using beaver dam analogs (BDAs) to heal damaged streams, re-establish beaver populations, and aid wildlife. In some cases, researchers have seen positive changes in just 1 to 3 years.



Incised stream

Restored stream



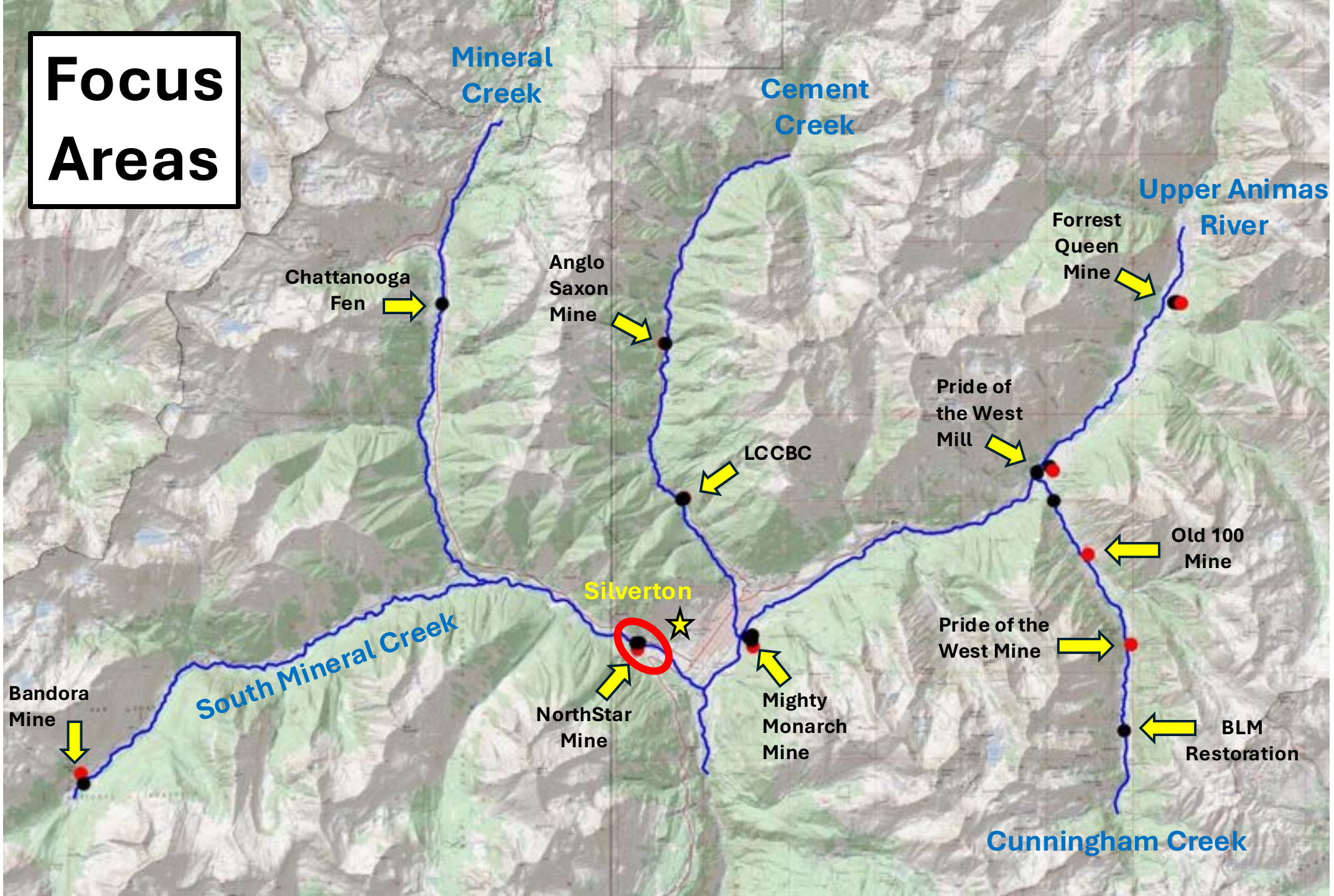
Adding dams
Beaver trapping and overgrazing have caused countless creeks to cut deep trenches and water tables to drop, drying floodplains. Installing BDAs can help.

Widening the trench
BDAs divert flows, causing streams to cut into banks, widening the incised channel, and creating a supply of sediment that helps raise the stream bed.

Beavers return
As BDAs trap sediment, the stream bed rebuilds and forces water onto the floodplain, recharging groundwater. Slower flows allow beavers to recolonize.

A complex haven
Re-established beavers raise water tables, irrigate new stands of willow and alder, and create a maze of pools and side channels for fish and wildlife.

Goldfarb, 2018 Science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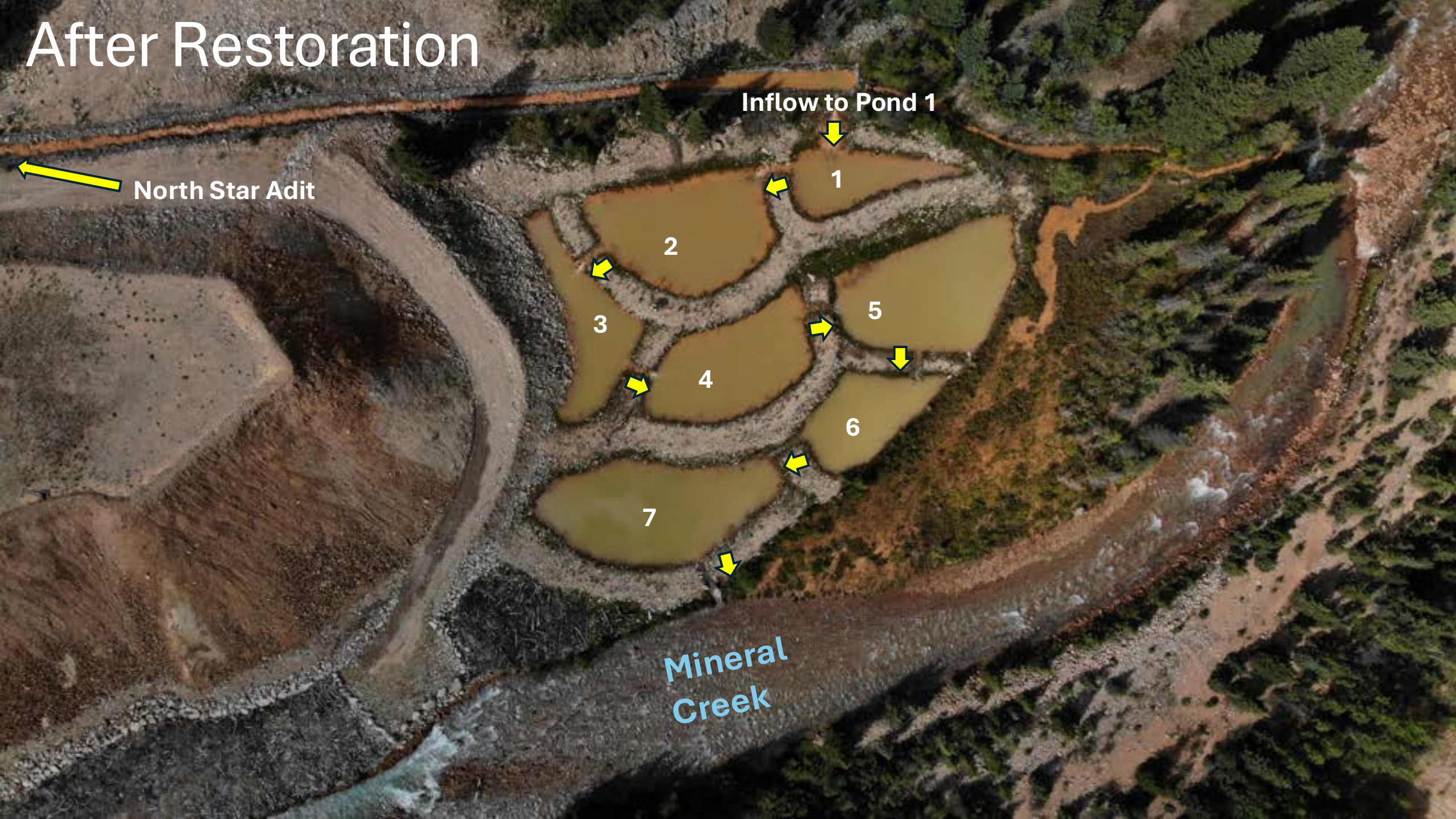
BLM Restoration
Cunningham Creek

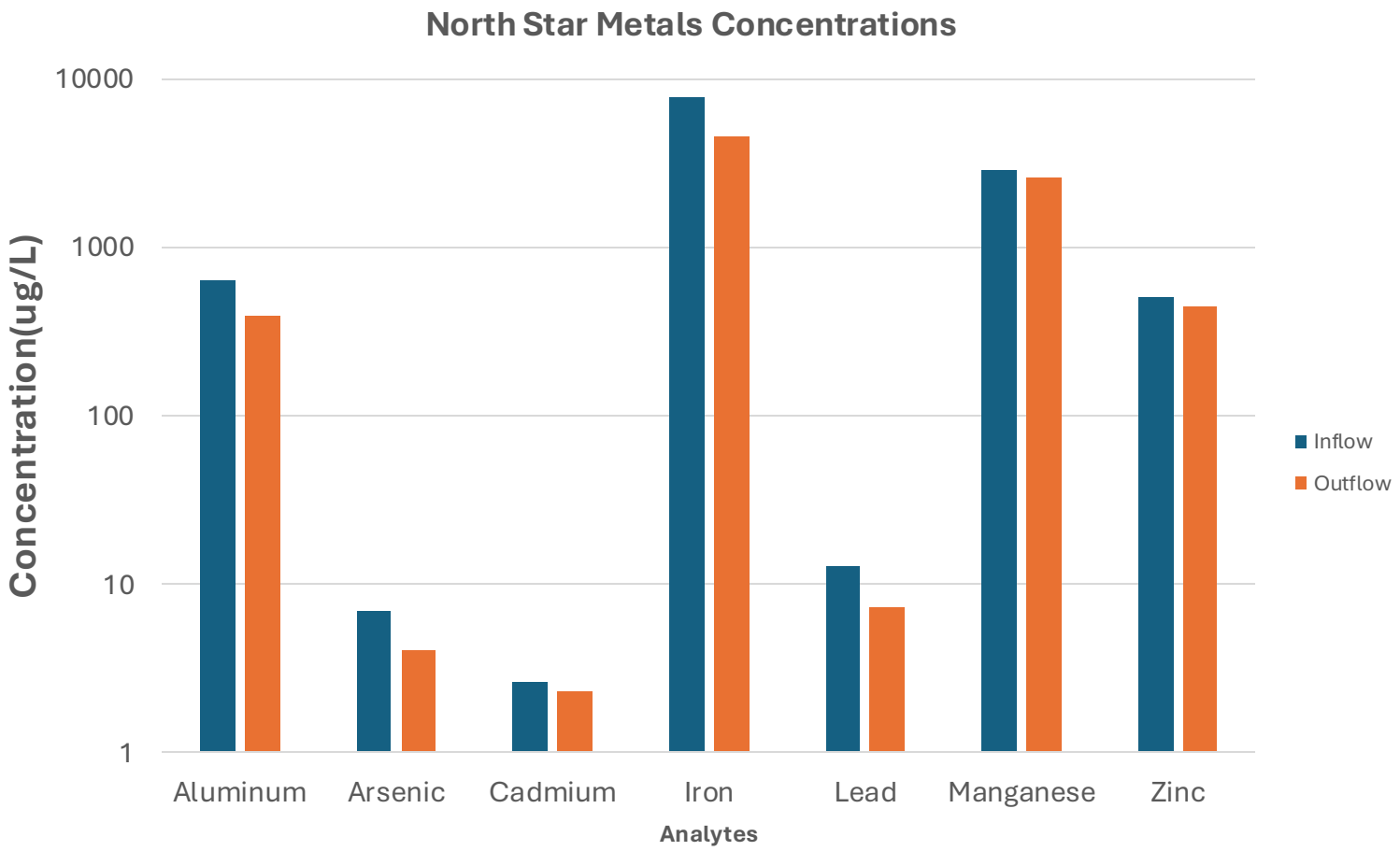
North Star Mine: Before Restoration

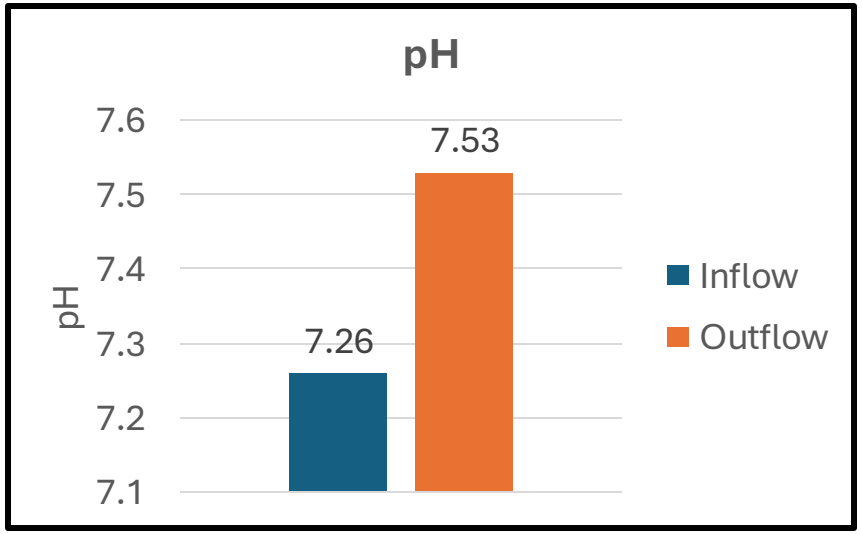
2020: Beaver dam at North Star Mine Portal


North Star Mine


After Restoration
Inflow to Pond 1
North Star Adit
1
2
3
4
5
6
7
Mineral Creek

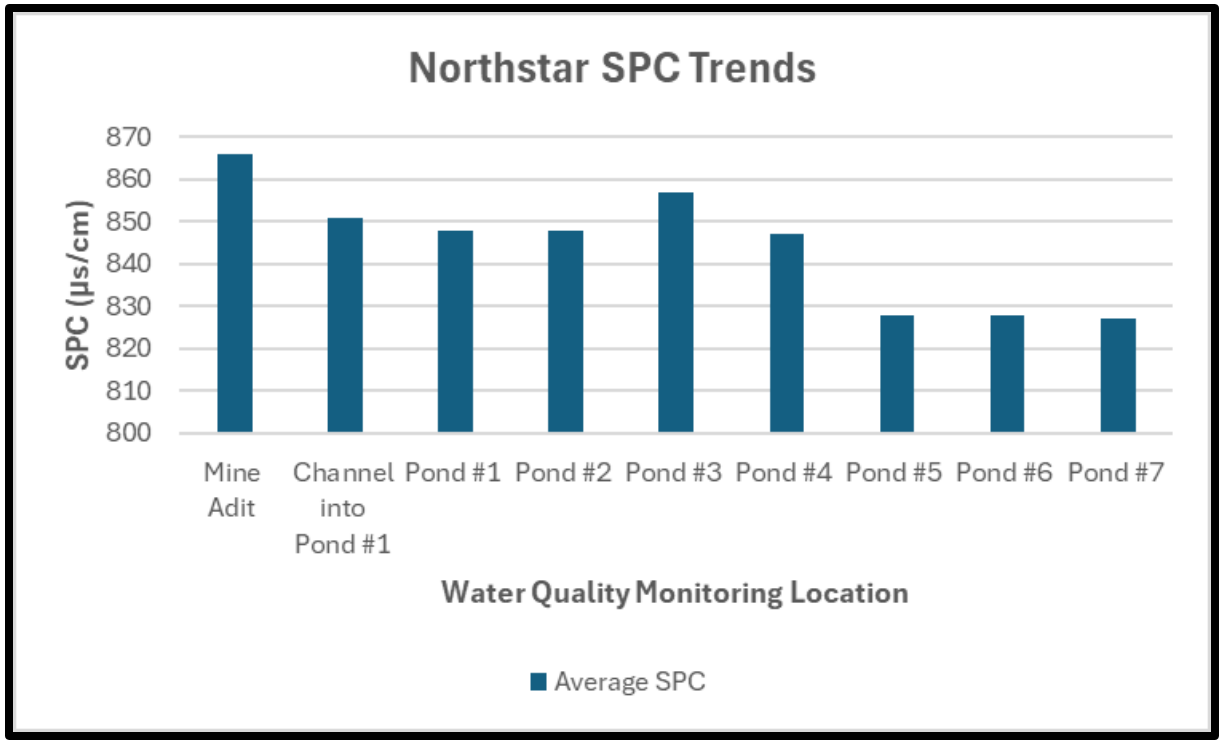
North Star Mine Impacted Water Quality Upstream and Downstream of Ponds

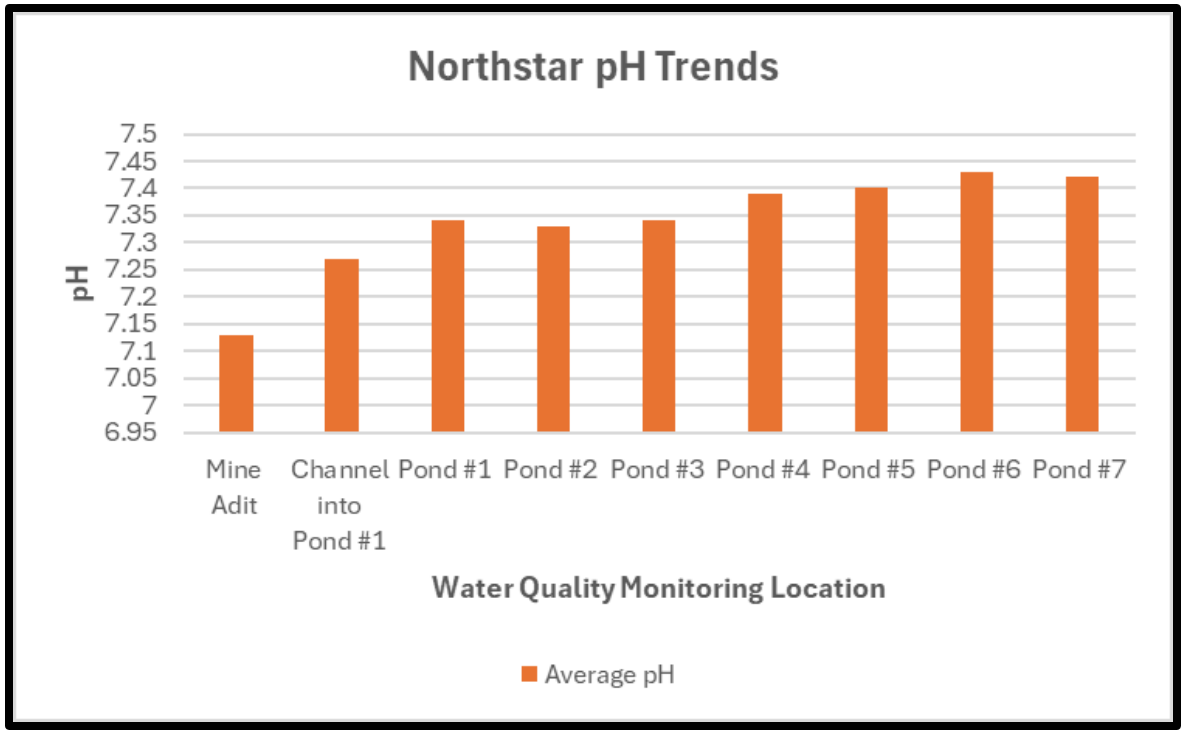




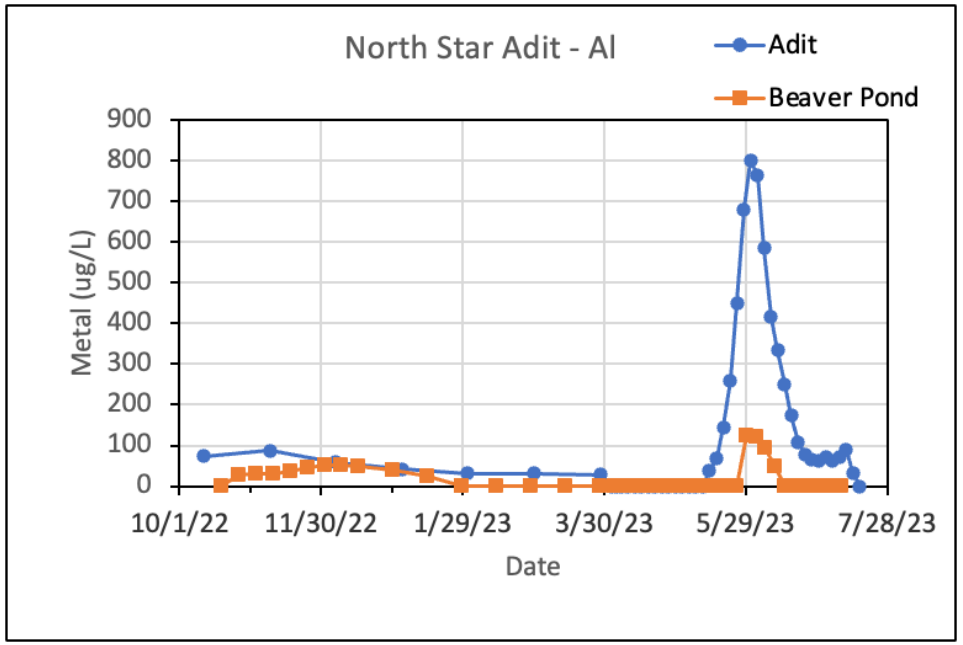
Average Water Quality from Four Site Visits

(May 2024- October 2024)

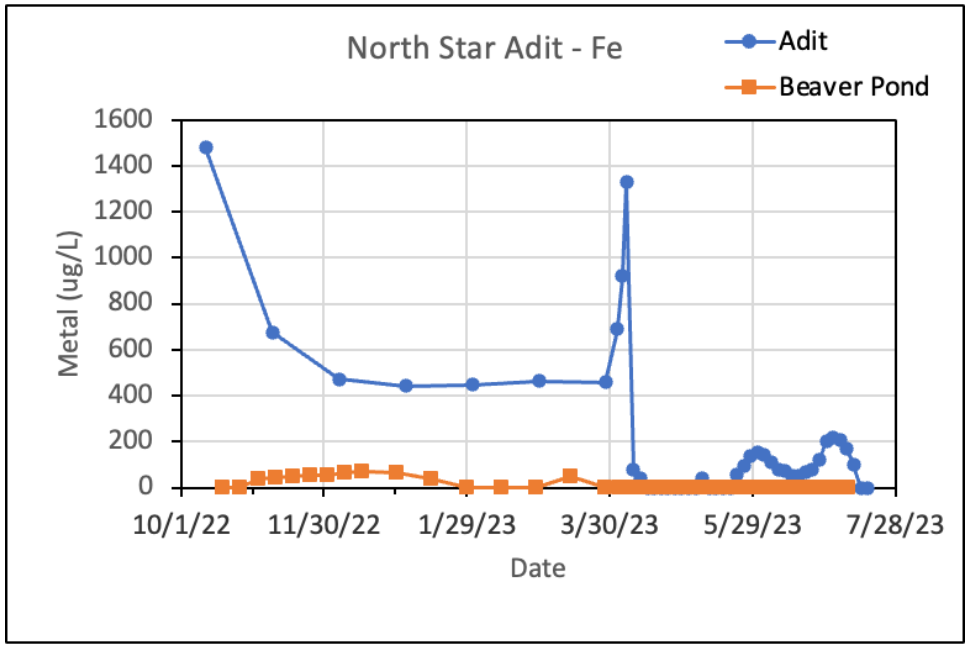




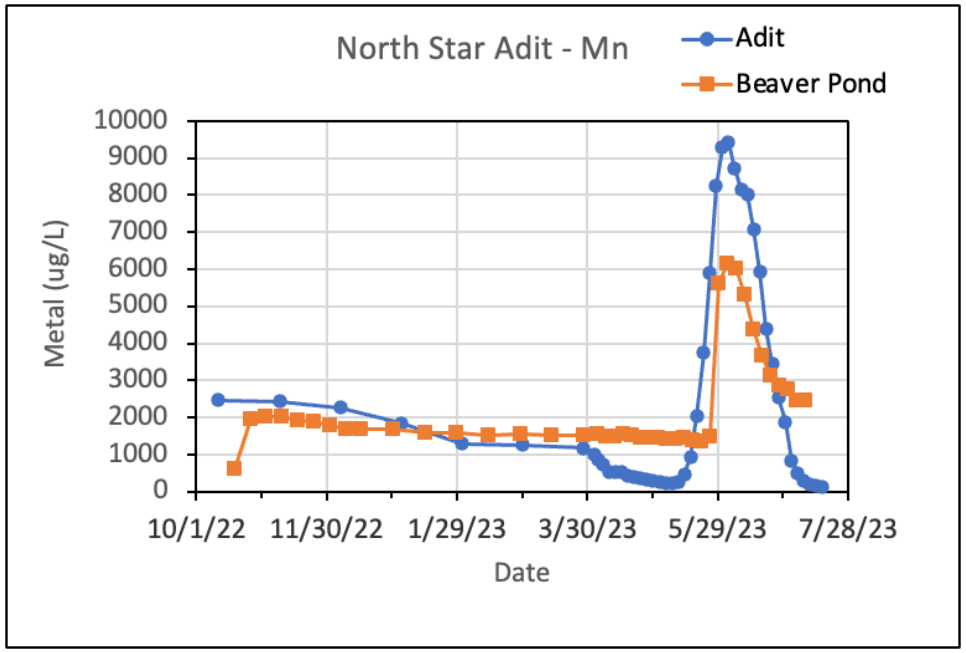
North Star Mine: DRMS/USGS Continuous Monitoring Data 2022-23



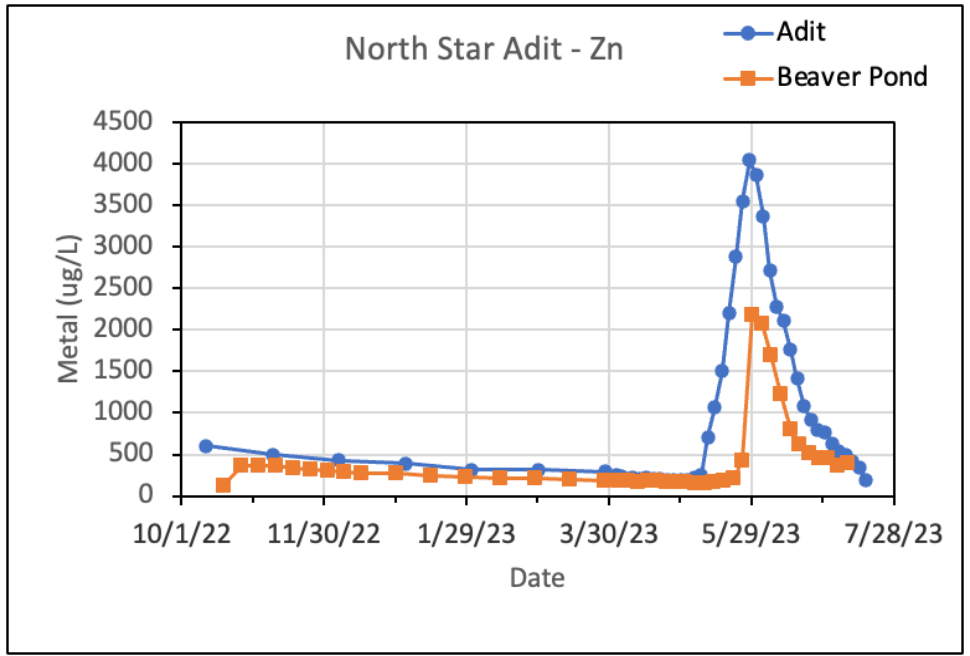
87% Decrease



Up to >90% Decrease



30% Decrease

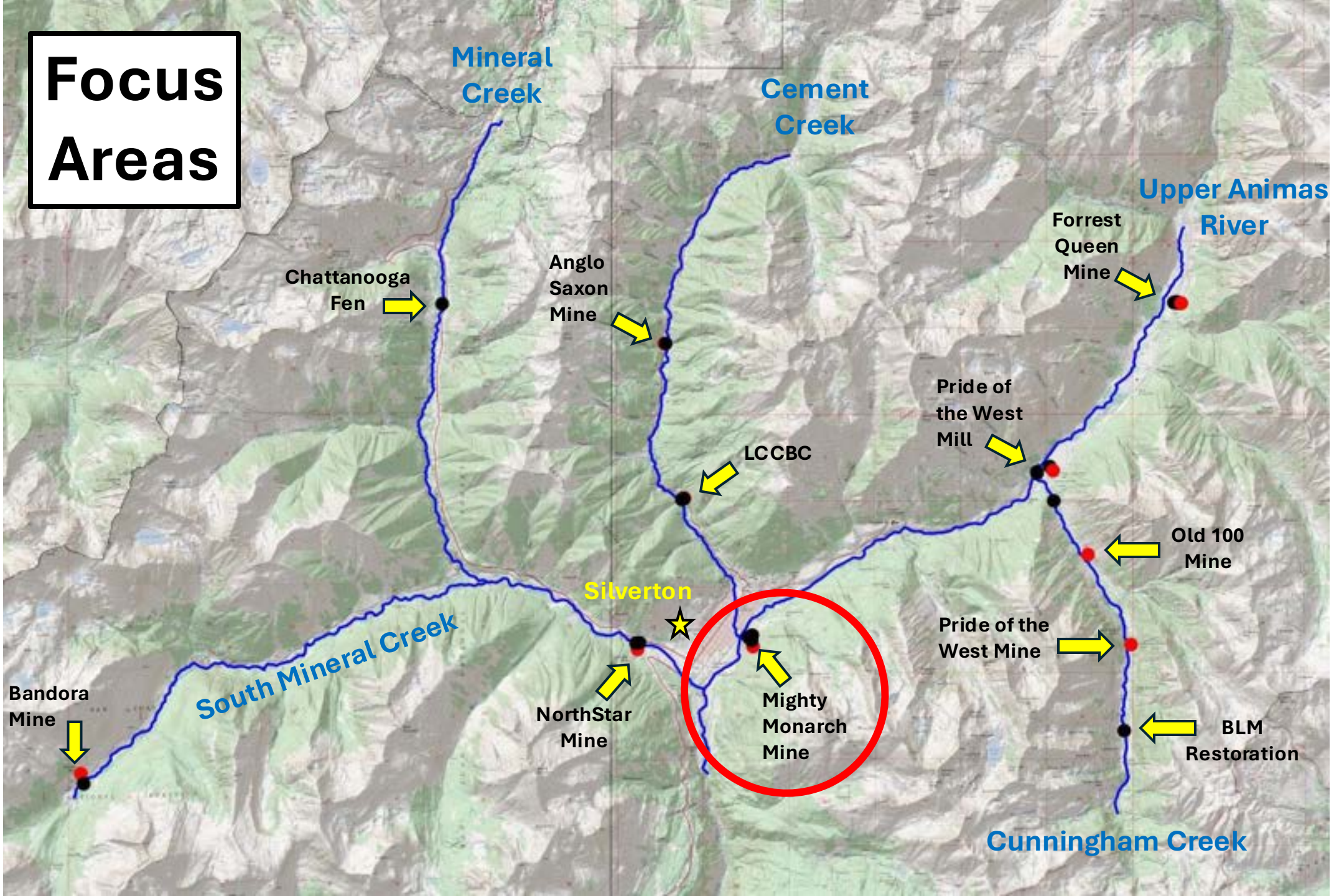


50% Decrease

North Star: Willow planting with Silverton Students

- Volunteer day with Summer School program
- Revegetation of wetland habitat
- Provide forage for beavers
- Creates wetland habitat for many animas
- Root structures reinforce earthen berms

Willow Transplanting with Silverton Public School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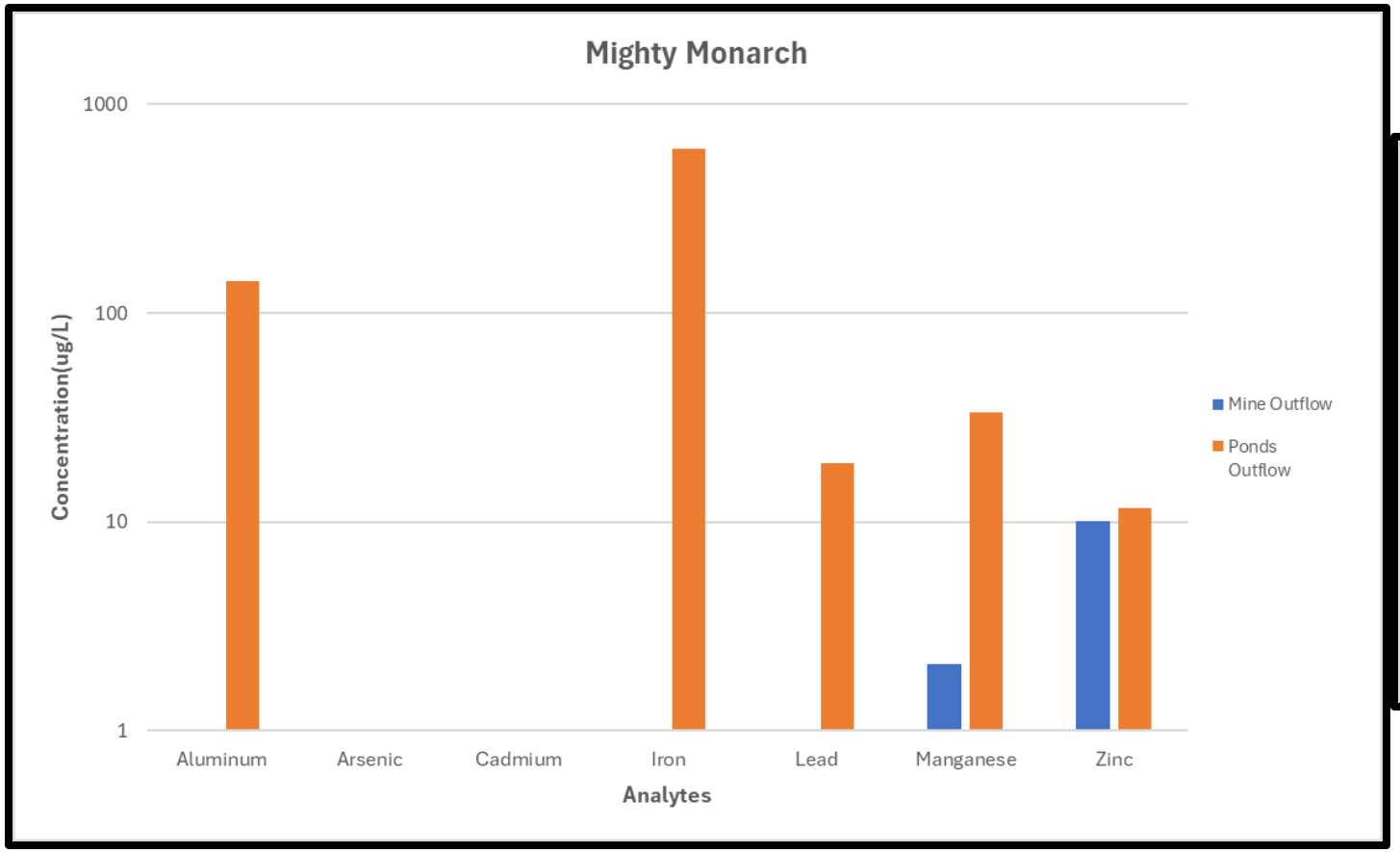
Cunningham Creek

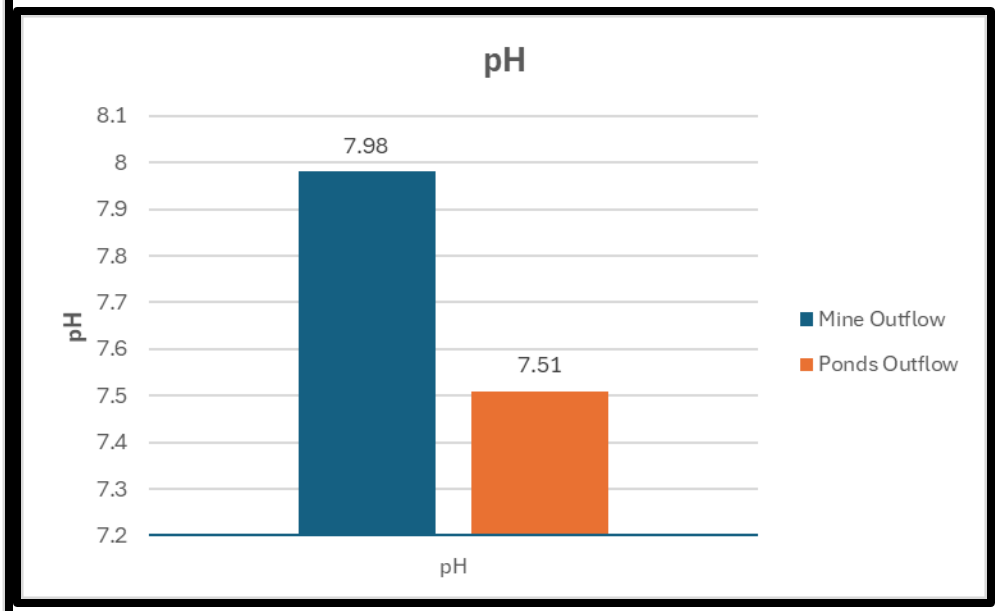
Mighty Monarch Mine & Kendall Beaver Ponds


Mine
Outflow
GW Inflows
Pond Outflow

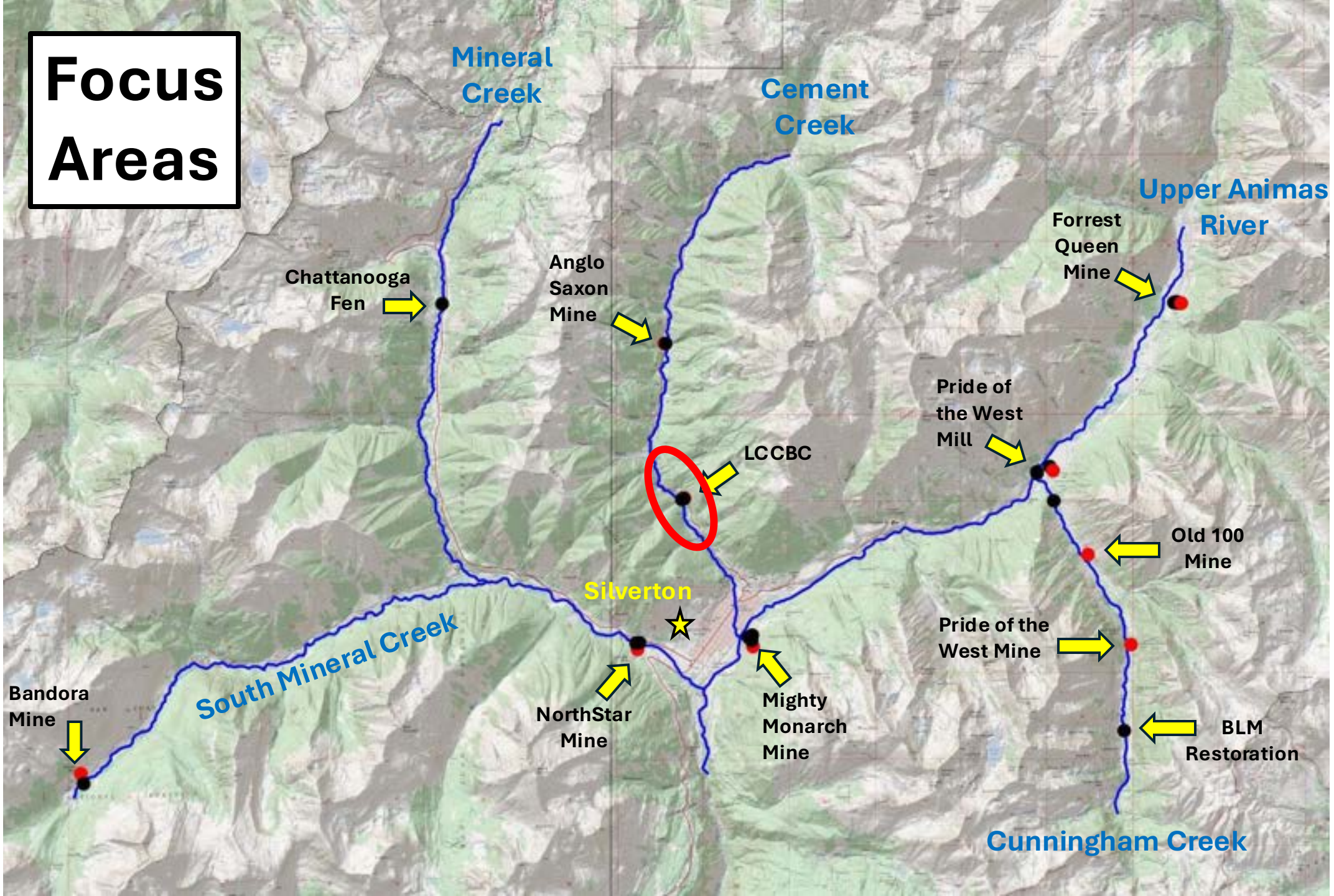
Mighty Monarch Mine

- Many decades of occupancy, utilizing mine discharge which is actually of better WQ than alluvial GW inputs






Lower Cement Creek
Beaver Complex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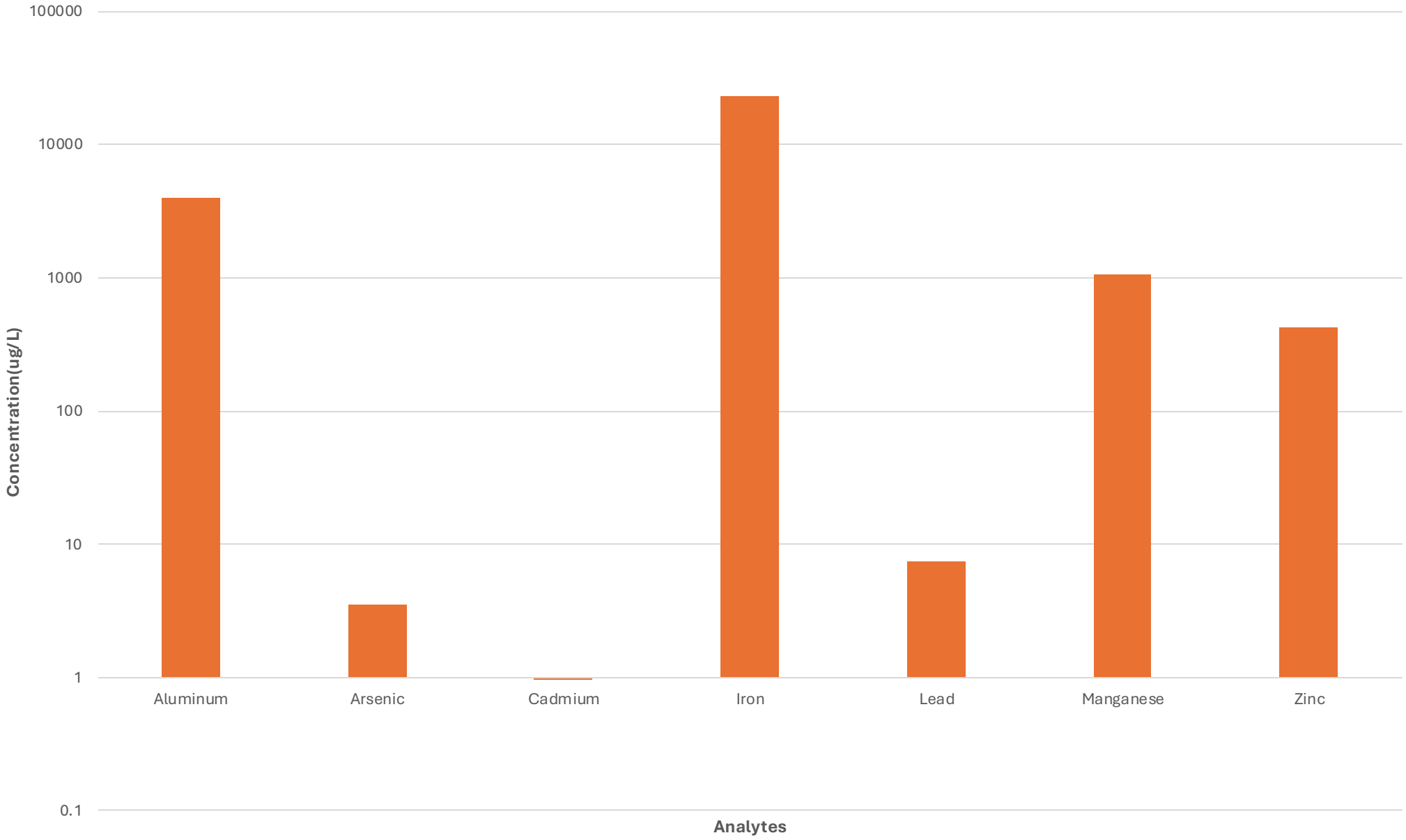
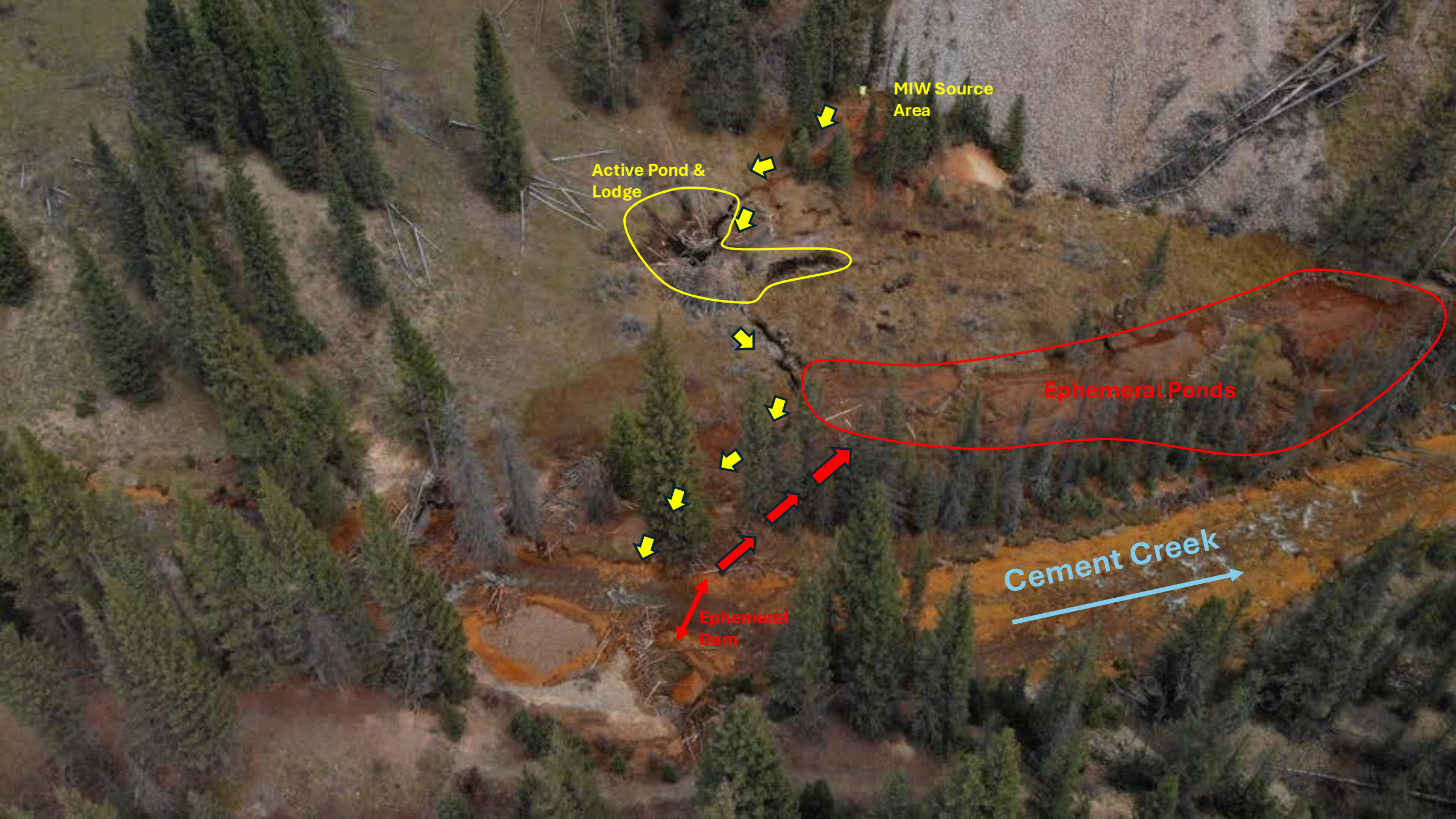
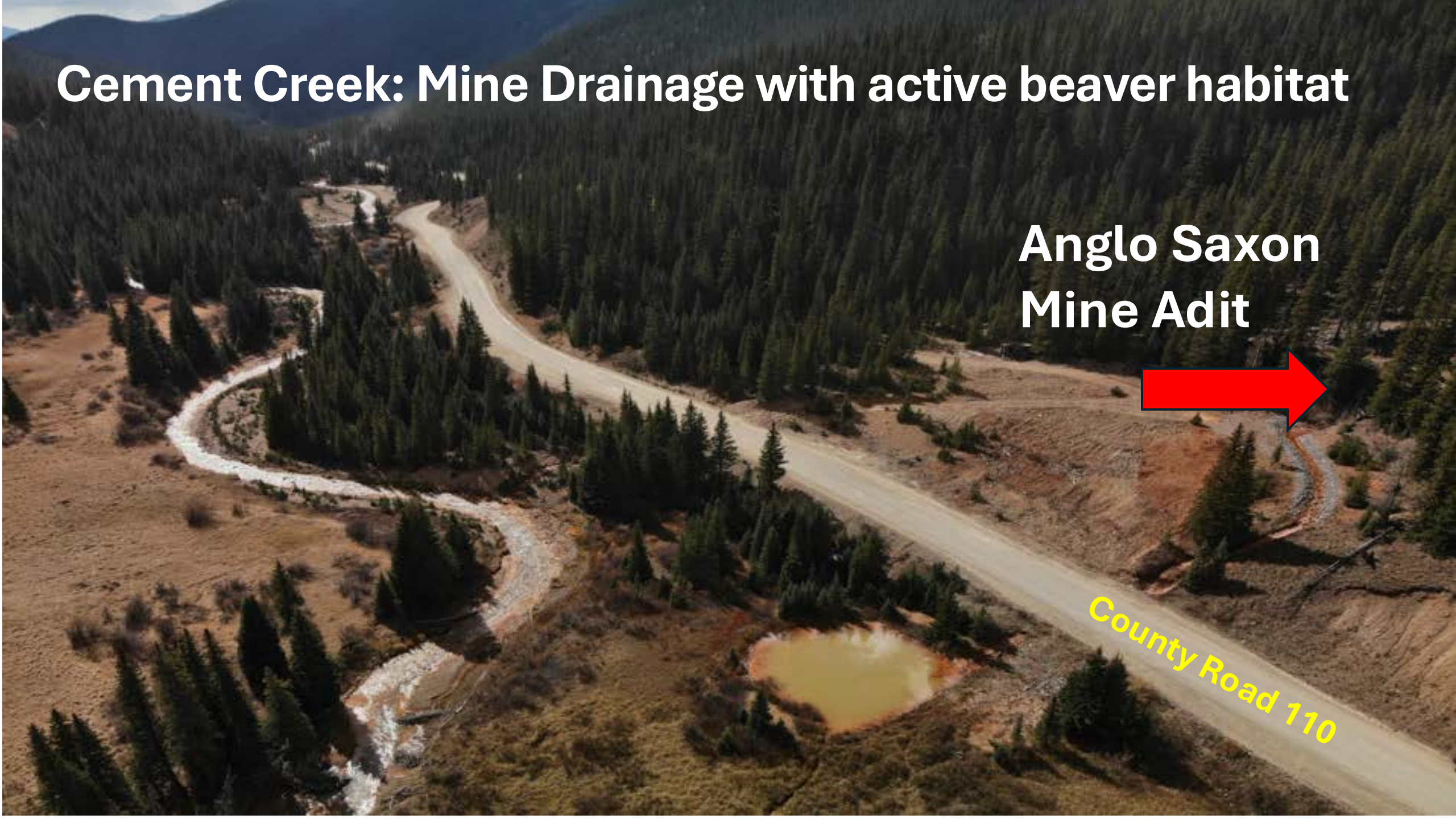
LCCBC Average Metals Concentrations



MIW Discharge to Beaver Pond Before Entering Cement Creek


MIW Source Area
Active Pond & Lodge
Ephemeral Ponds
Ephemeral Dam
Cement Creek

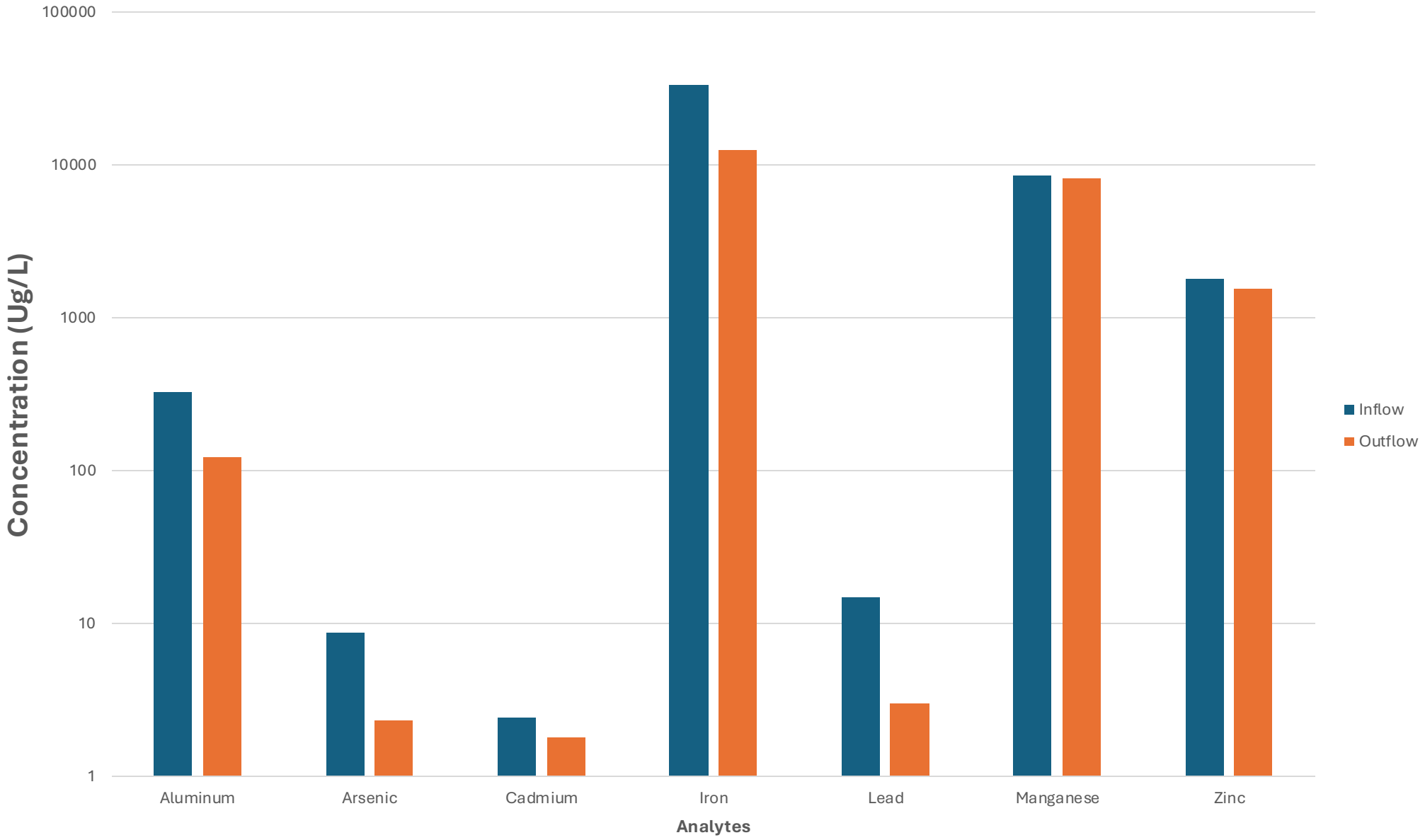

Large woody debris sourced
hundreds of feet above site

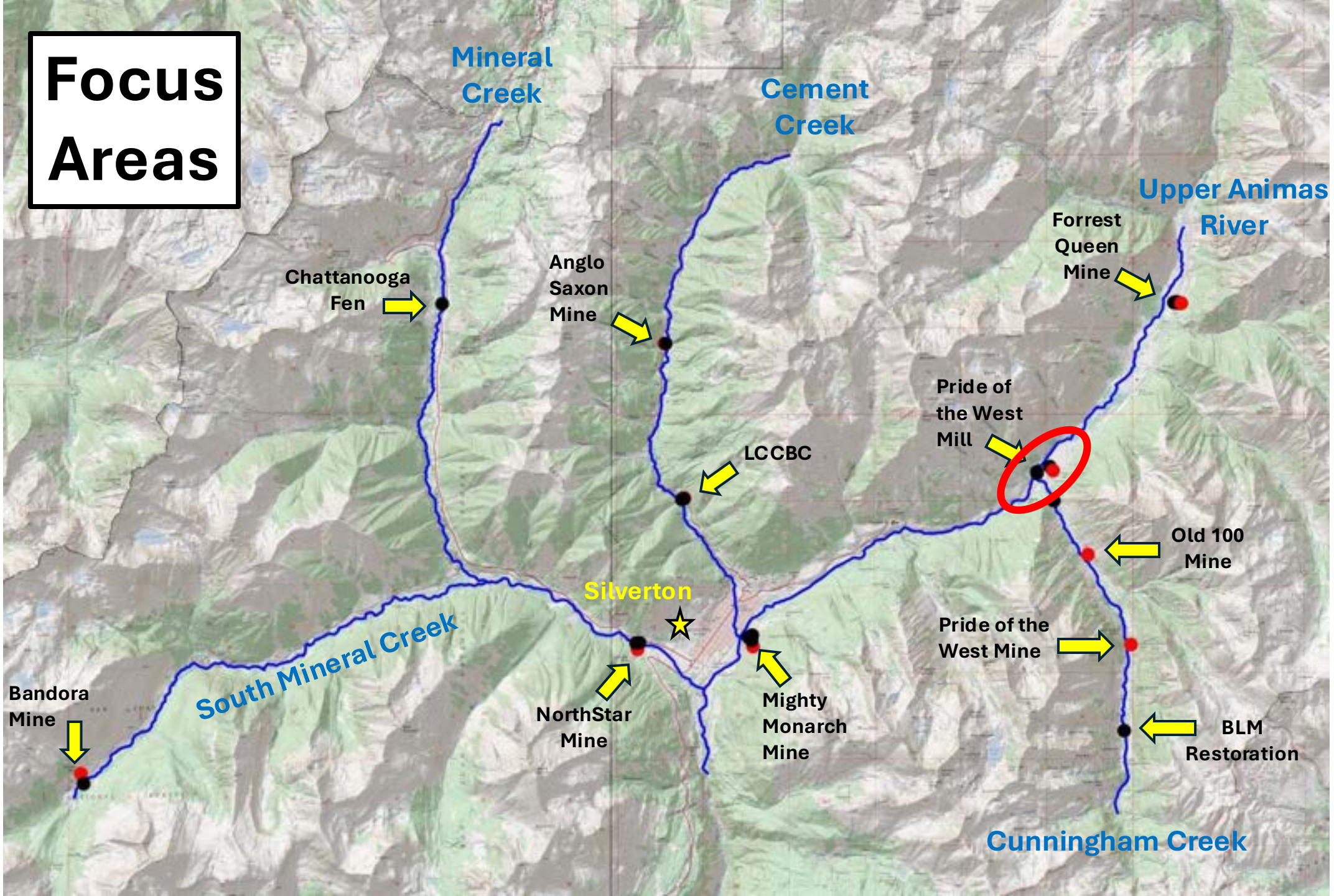

Cement Creek: Mine Drainage with active beaver habitat
Anglo Saxon
Mine Adit
County Road 110


Angle Saxon Mine Adit
Silverton Mtn. 2 Miles North
CR 110
Beaver Dam
construction

Other Evidence of Beaver Activity in Cement Creek (Anglo Saxon Mine)

Anglo Saxon Mine Metals Concentrations

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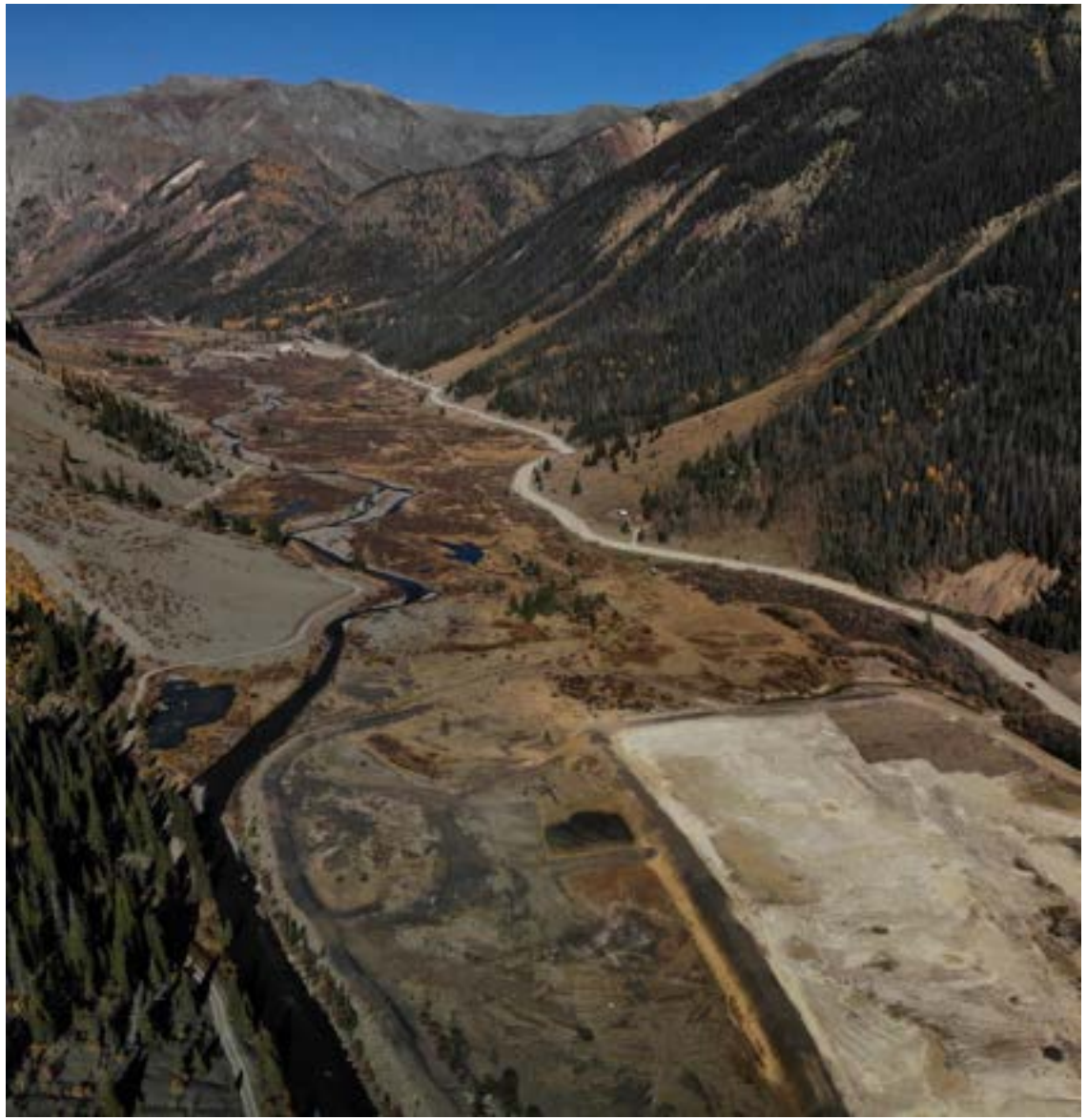
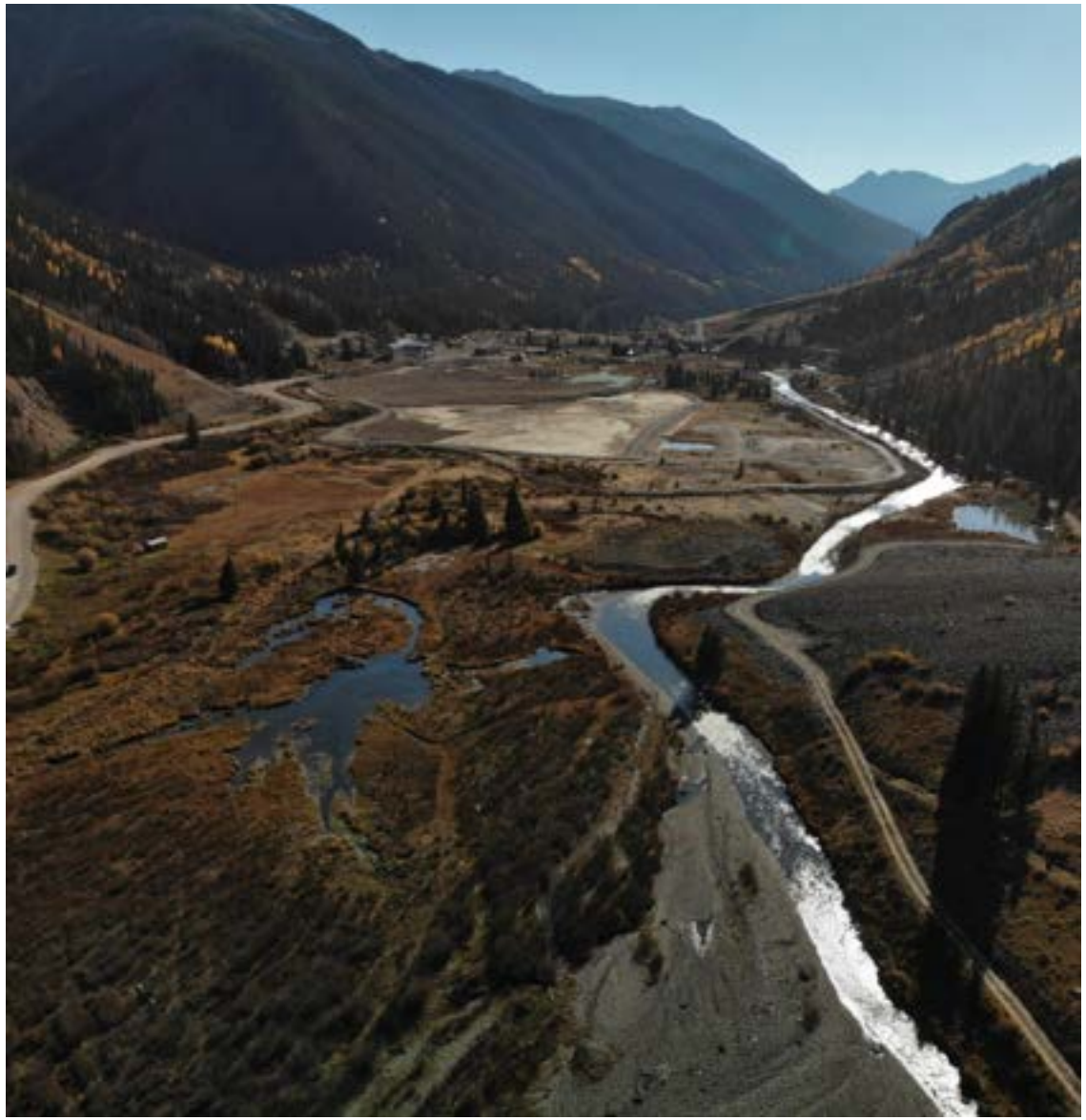
Pride of the West Mill

Mining Impacts: Animas River; mine tailings, channelization, and beaver habitat





Mining Impacts: Animas River beaver habitat and mine tailings, Kittimac

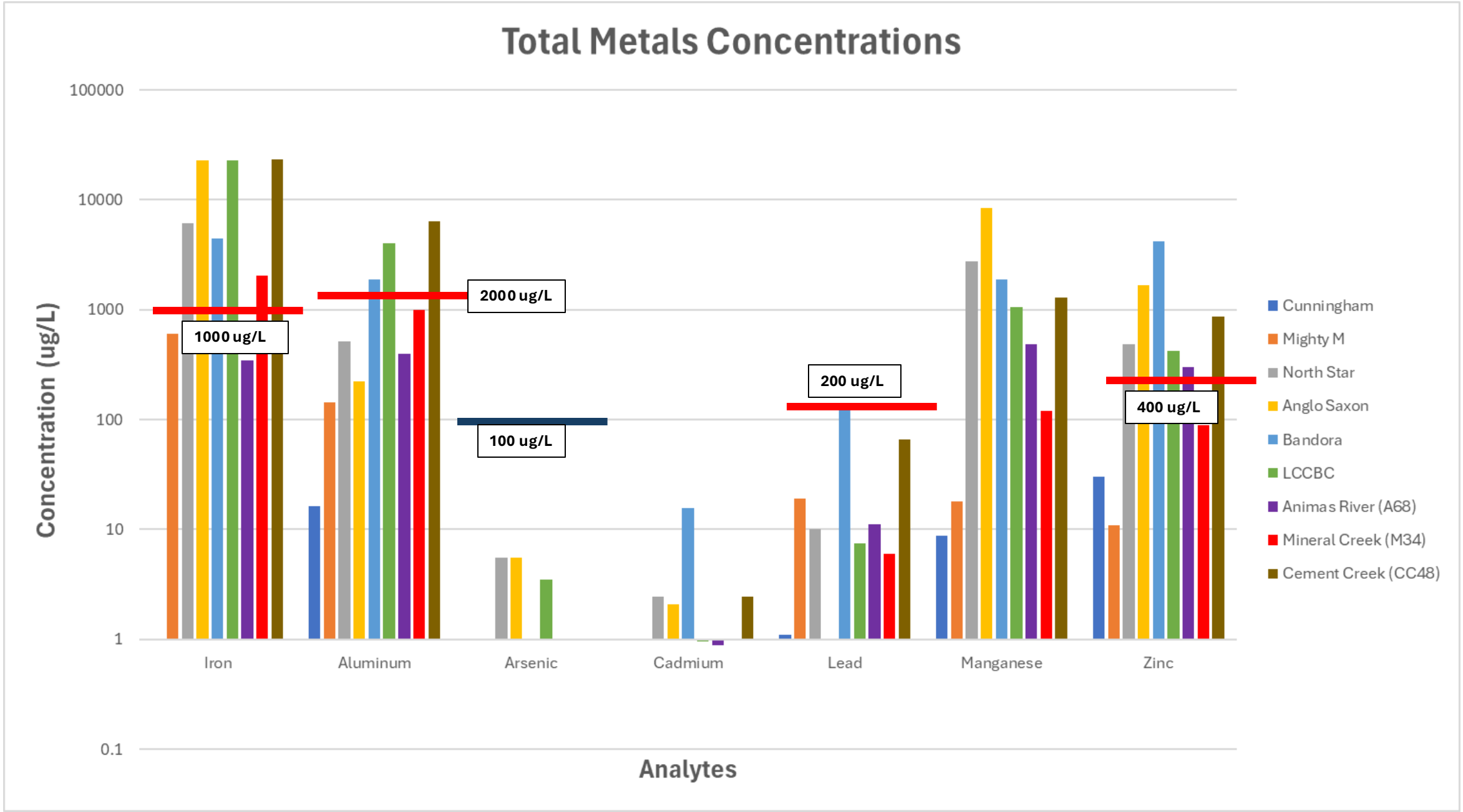
CR 2 Infrastructure Protection: Culvert @ Forest Queen

CR 2 Infrastructure Protection: Culvert at Forest Queen Mine

Exclusion Fence Installation December 2024

Min/ Max Metals Concentrations Across Active Beaver Sites in the Animas Watershed

Total Metals Summary Table	*Min (ug/L)*	*Max (ug/L)*	***	
Iron	145	33500	1000 ug/L	Chronic
Aluminum	10.5	3950	2000 ug/L	Chronic
Arsenic	2.3	8.7		
Cadmium	0.5	54.2		
Lead	1	281	200 ug/L	Recreational
Manganese	2.1	8570		
Zinc	10.1	12400	400 ug/L	Chronic
***** Animas River Approximate Metals Standards for Aquatic Life**				

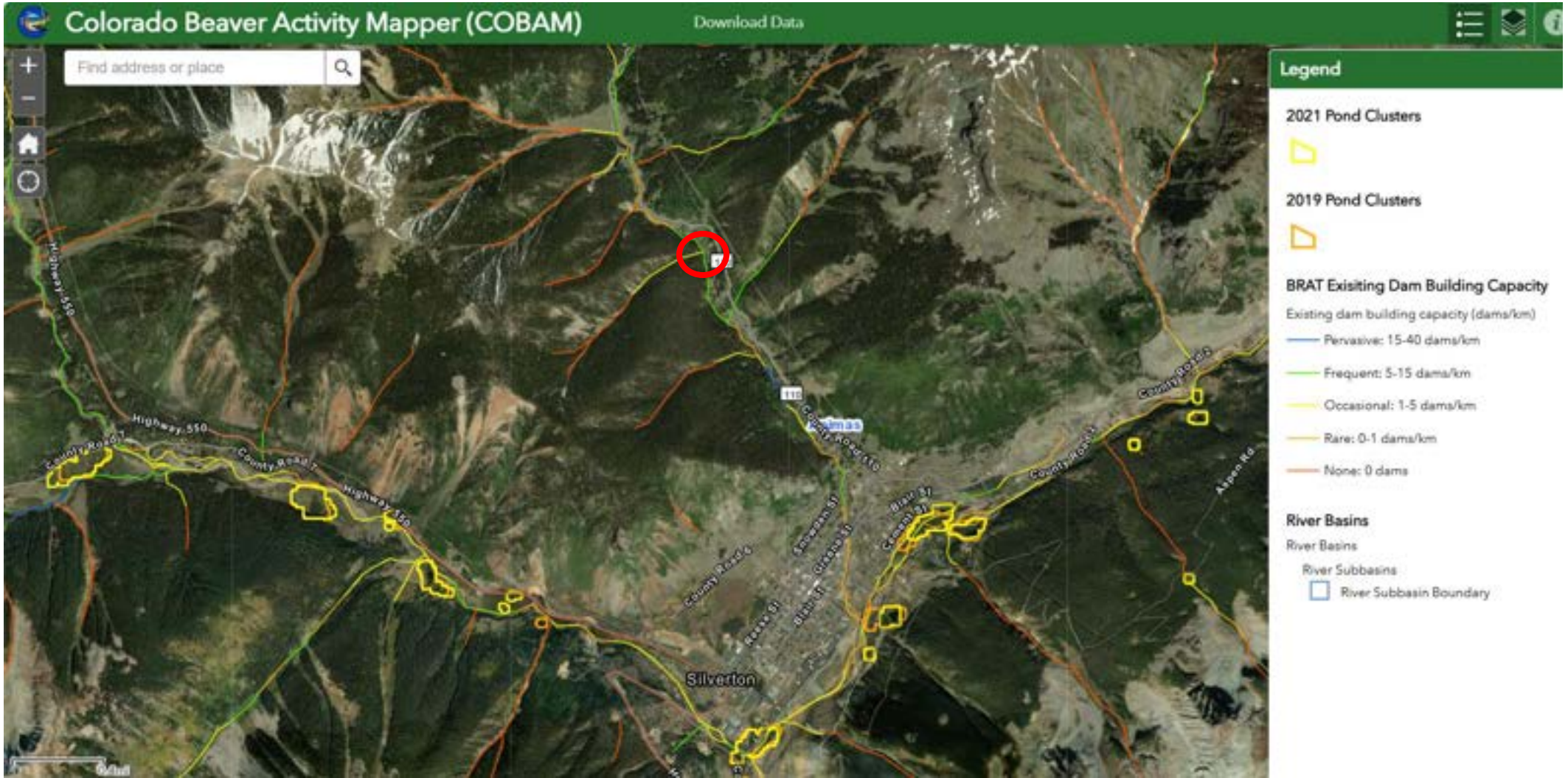


*Human Recreation standard

*Approximate AQUATIC LIFE Standards
Chronic toxicity, Animas River, (Hardness dependent)

Colorado Beaver Activity Mapper (COBAM)

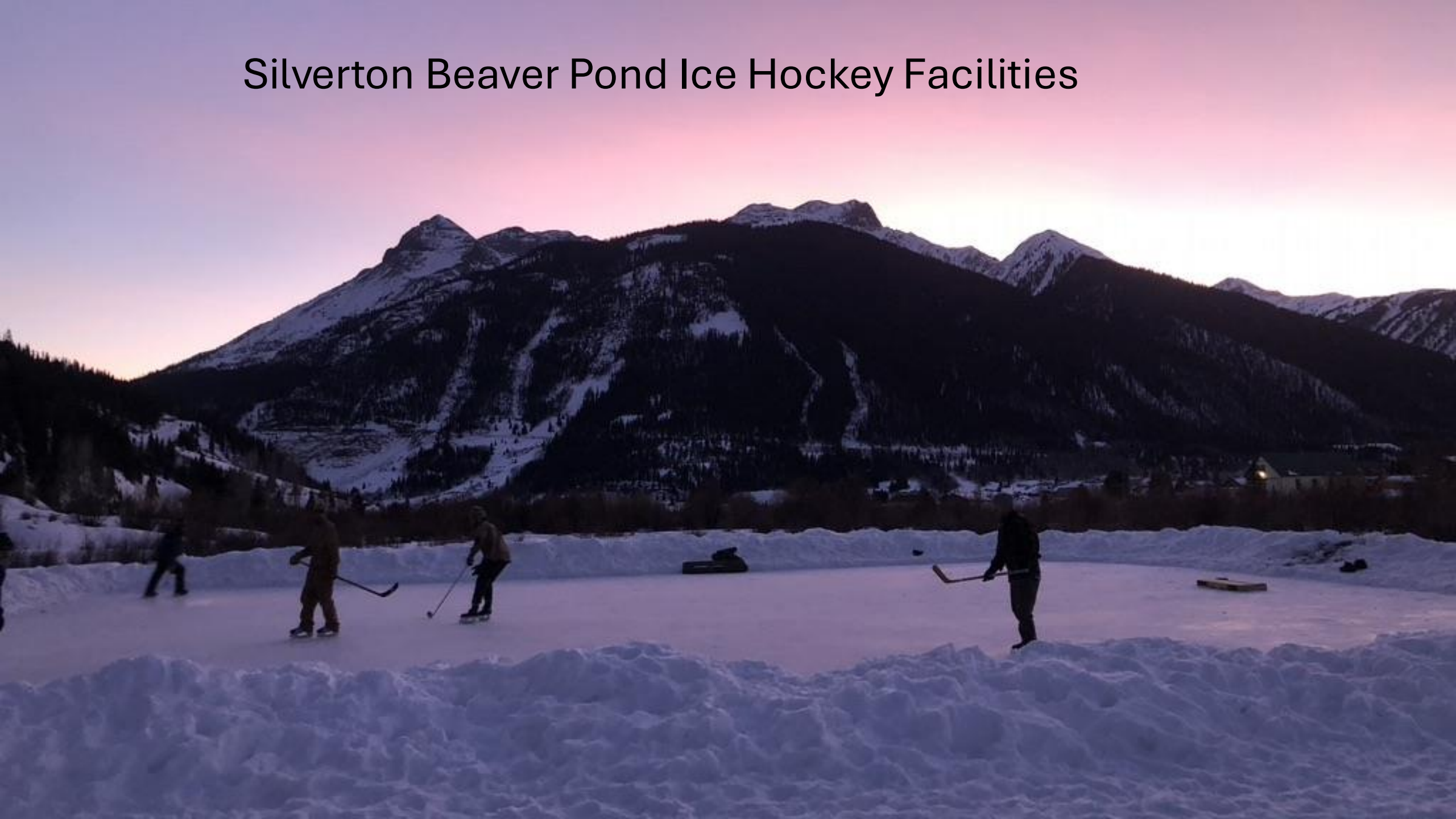
Artificial Intelligence based tool for watershed managers, ecologists, restoration practitioners to explore recent & historical beaver activity alongside potential habitat suitability to identify opportunities for conservation and riverscape restoration.



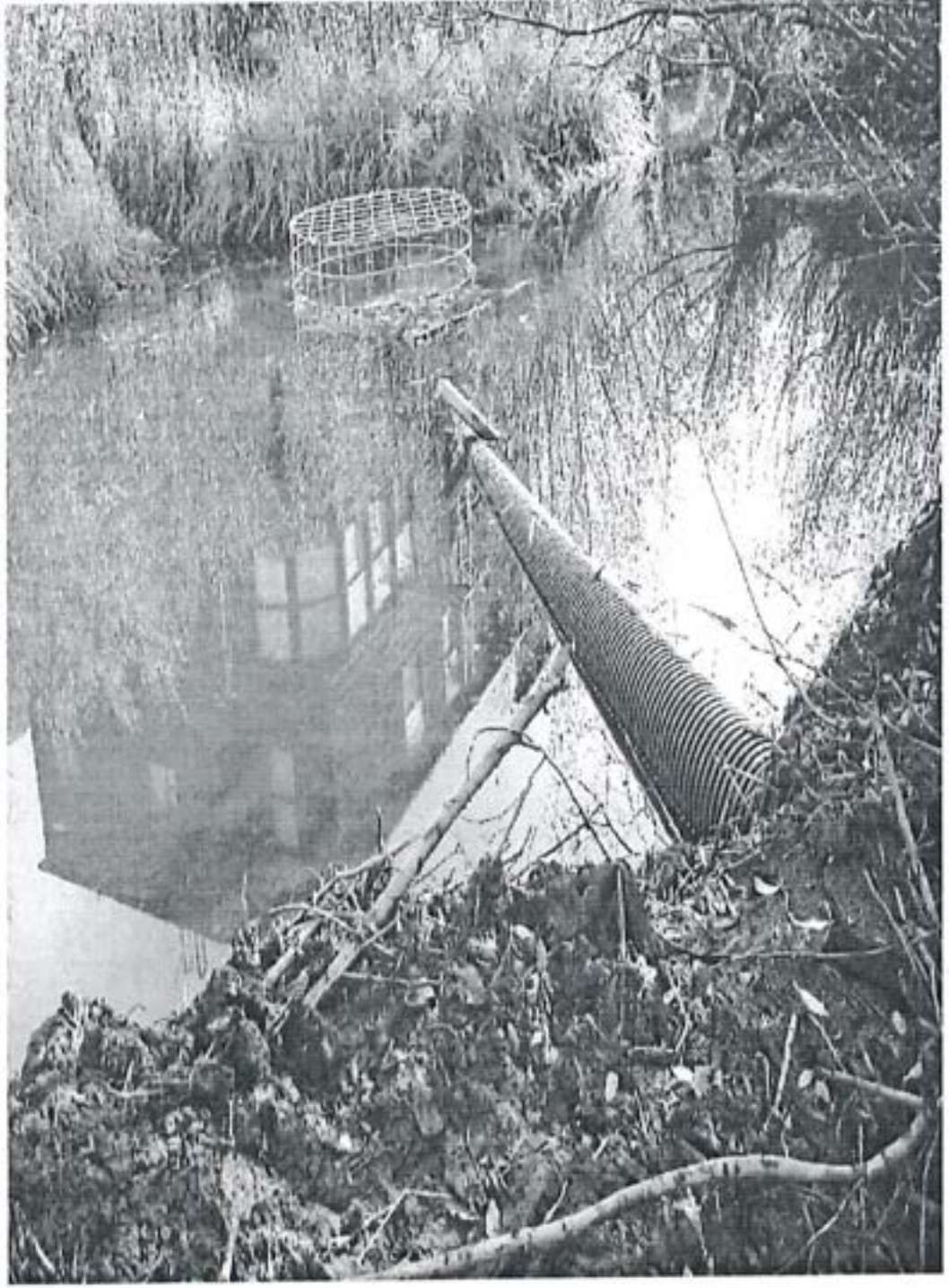
Next steps and call for collaboration

- Build a more robust dataset to examine impacts of beaver habitat on metals concentrations and load reductions at reach and watershed scales
- Examine Impacts of chronic exposure to MIW on beaver health
- Examine Terrestrial impacts to beaver health (Pb in soil/sediment)
- Coordinate with partners to develop multiple phases of beaver habitat enhancements (Stacking funding cycles/sources)
- Continued Education and Outreach → succinct articulation of beaver benefits to diverse user groups/resource values

Silverton Beaver Pond Ice Hockey Facilities



"Hobgood-Drew Wetland above the beaver dam behind 299 Spruce Street, a building whose foundation is continuously threatened when beavers back up water too high" (10/11/2005)



Hobgood-Drew Wetland above the beaver dam that is behind 299 South Spruce Street, a building whose foundation is continuously threatened when beavers back up water levels too high. Man-hours required to lower this dam each day is 1 hour. If the beaver deceiver continues to work as it has for over 1 month now, approximately 150 hours of labor can be used doing other important tasks during the busy field season. (10/11/05)

5 months after install

- No activity around the inflow fence
- Some activity over the dam section but no damming of outflow

Outfllow pipe

- Minimal maintenance
- 150 hrs per year x 17 years = 2,550 hours of labor saved

Process Based Restoration
LOW-TECH