



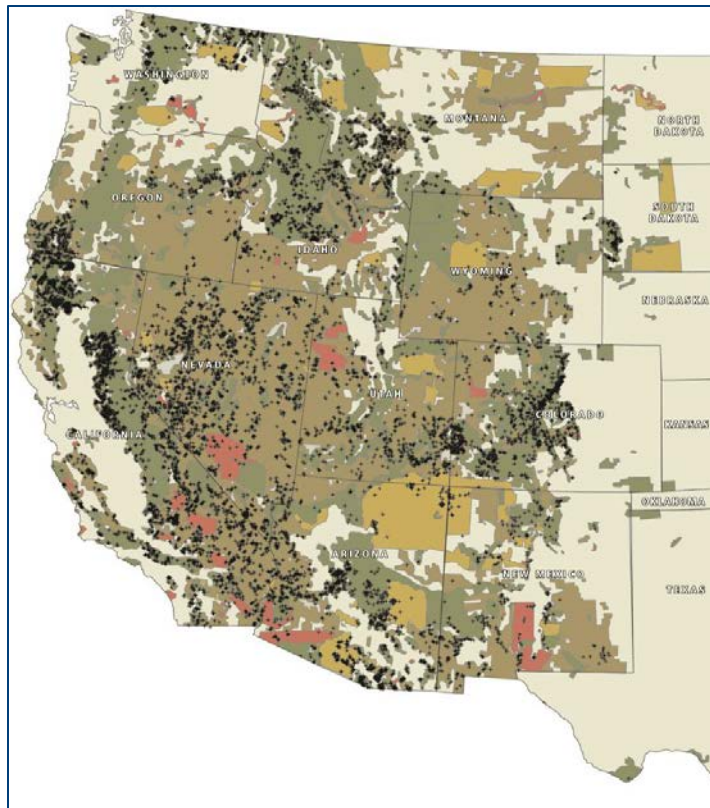
Abandoned Mines Across Colorado and TU's AML Program

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Mining Legacy in the Western United States



- Over 500,000 abandoned mines in the Western U.S.
- 40% of western watershed headwaters are polluted with mine wastes
- Approximately 100,000 abandoned mines exist on public lands today in 13 western states
 - Estimated clean-up costs range between \$9.6 to \$21 billion dollars

Sources: abandonedmines.gov, and EPA

Mining Legacy in Colorado



Evans Gulch near Leadville, CO

- ✦ Approximately 23,000 abandoned mines in Colorado
- ✦ > 80% of Colorado's most impaired waterways are the result of mining operations.
 - Equates to approximately 1,800 miles of impaired streams across our state.
- ✦ Total of 5,105 abandoned mines on BLM and USFS land
- ✦ Cost to clean-up this total ranges between \$493 million to \$1.1 billion

✦ Sources: Center for Western Priorities "The Mining Burden" and DRMS Website



- ✎ Past practices vs. Current Regulation
 - DRMS
 - MLRB
 - CDPHE, Permits

Why are AML Sites Such a Big Issue?

Acid mine drainage

- Formed when pyrite, frequently uncovered during mining, is exposed and reacts with air and water to form sulfuric acid and dissolved iron.
- Can precipitate to form the red, orange, or yellow sediments in the bottom of streams containing mine drainage
- Dissolves heavy metals such as copper, lead, mercury into ground or surface water
- Rate and degree by which acid-mine drainage proceeds can be increased by the action of certain bacteria.



Kayakers in the Animas River after the Gold King accident.

Source: cbsnews.com

Sources: <http://www.sosbluewater.org/epa-what-is-acid-mine-drainage%5B1%5D.pdf>

Two Main Categories:

Point Source

- A single identifiable source of pollution
- Examples: pipe, treatment discharge, or draining mine (Anything requiring a National Pollutant Discharge Elimination System (NPDES permit))
- Usually requires active treatment

Non-point Source

- Inputs or impacts that occur over a wide area and not attributed to a single source. Can be treated passively.
- Examples: Interaction between surface water and mine tailings/waste



Why are AML Sites Such a Big Issue?

Serious safety concerns

- Many people are injured and killed every year while "just exploring" abandoned mines
- Victims of mining accidents have encountered deadly odorless gases, fell down holes that opened under their weight, drowned in near-freezing pools of water at the bottom of shafts, and were buried in unpredictable cave-ins.

- Source:
<http://mining.state.co.us/Programs/Abandoned/Pages/StayOut,StayAlive.aspx>



Why are AML Sites Such a Big Issue?

Represent Colorado's History and Future

- Colorado's heritage is mining. It's what led many people to the state in 1859, and was the most important economic activity for many years.
- Today, they represent a unique opportunity for collaborative research, innovative legislation and lasting partnerships.



TU's Role in Mine Reclamation Work



- Focus on watersheds that exceed State water quality standards
 - Grant funded projects
 - Private funding for match and construction
 - Federally and State funded projects



TU's Role in Mine Reclamation Work



- ✦ Expansion of program reach over past 6 years
 - Project design, engineering, contracting, management, oversight, and reporting
 - Over \$1.2 million spent during FY 2016 on construction alone in Colorado
 - All projects focused on WQ improvement or mine reclamation

- ✦ Throughout CO, we have implemented projects that collectively restored 10 stream miles and reclaimed over 82 acres of mine tailings and waste rock.

Our Program Goals



- 🍃 The People:
 - Protecting downstream drinking supplies
 - Protecting and improving recreation
- 🍃 The Environment:
 - Improving water quality
 - Protecting and developing fisheries
 - Habitat and ecosystem restoration
- 🍃 The Place:
 - Historical preservation
 - Safety

TU Current Project Sites: Kirwin District

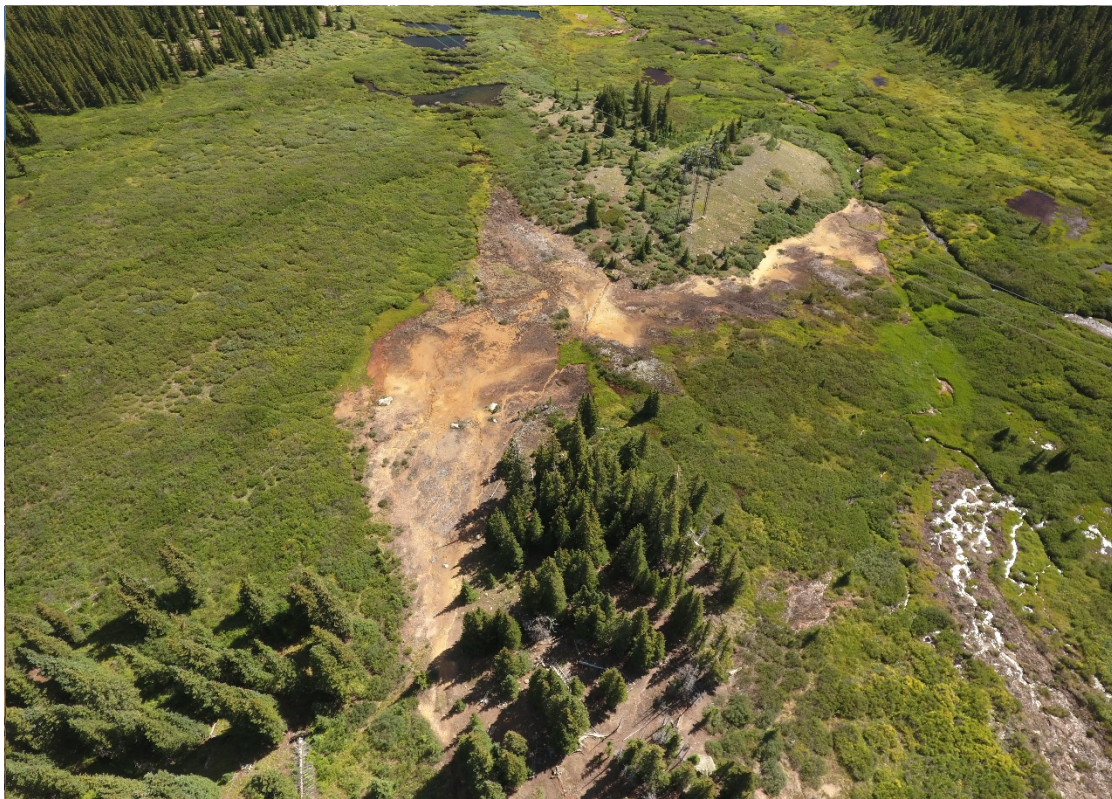
- Historic mining operations within the Kirwin area targeted gold, copper and molybdenum deposits, and have left behind the degraded landscape that visibly exists in the watershed today.
- Mine waste and tailings piles are scattered throughout the riparian and uplands areas with numerous piles coming in contact with surface water sources.



TU Current Project Sites: Waldorf and Leavenworth



- ✎ Located in historic Argentine Mining District. Development and production began in late 1860's through 1950s.
- ✎ Goals included: Reduction of sediment loading, reduction of exposure pathways, establishment of native veg, reclamation of up to 3.66 acres of tailings and surface flow control over those newly reclaimed areas



TU Current Project Sites: Waldorf and Leavenworth



Project work included:

- Installation of a semi-permanent earthen ditch in DTA 3
- Excavation, consolidation, and capping of tailings in an on-site repository above DTA 4
- In-situ phytostabilization of the dispersed tailings
- Development and build-out of drainage channels running through DTA I



TU Current Project Sites: Waldorf and Leavenworth



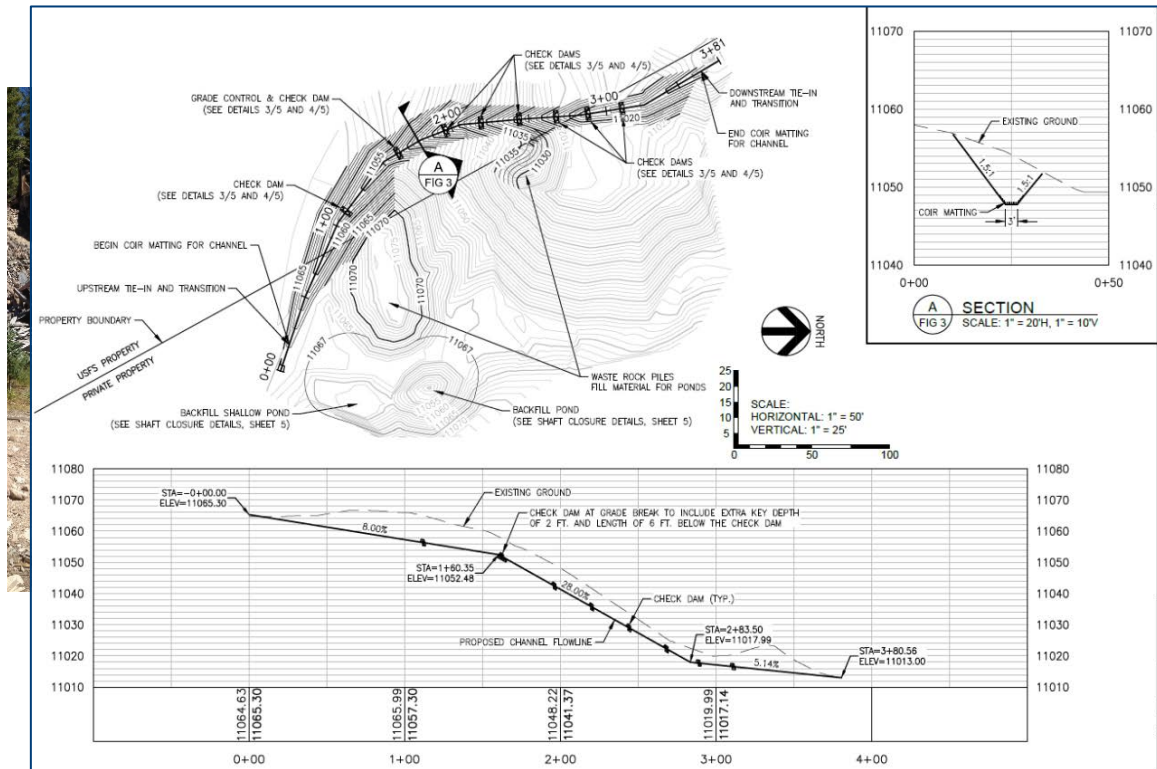
- ❏ Adverse winter weather conditions occurred during application and of amendments at DTAI-2 which may have affected even and complete incorporation. As a result, the lime took longer to release.
- ❏ 2018 values across DTA 1&2 are showing that that release did occur and pHs across the site are in the 8 range.



TU Current Project Sites: Illinois Gulch



- Located southeast of Breckenridge, CO in Summit County. Silver producer until 1920s when fire, flood and access problems forced mine to shut down.
- TU assisted agencies in 2012-14 watershed sampling
 - OPP sites on 7/2/14 showed 10X increase at Zn due to Mtn. Pride



TU Current Project Sites: Illinois Gulch



TU Current Project Sites: Illinois Gulch

- Excavation, lining and backfilling of historic vertical shaft and its associated mine pool
 - Excavation, soil lifts, lining, grading, lining, filling and grading



TU Current Project Sites: Illinois Gulch



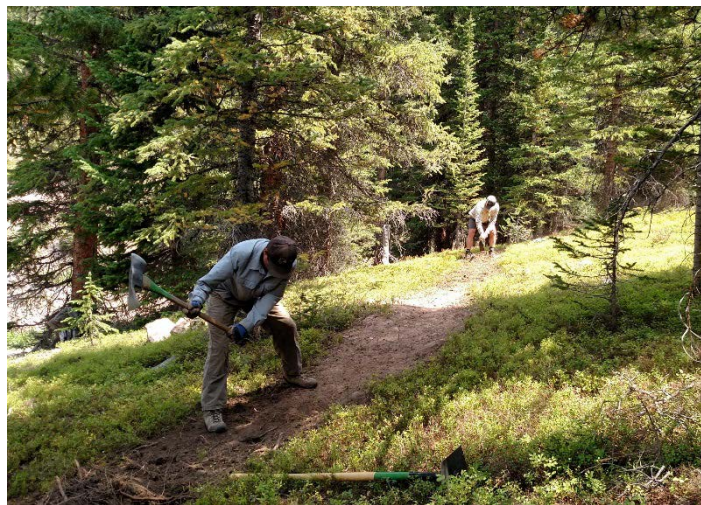
TU Current Project Sites: Illinois Gulch

- Consolidated and capped of approximately 3,200 cubic yards of mine waste
- Mine waste was capped with lime and approximately two feet of clean, native fill material.
- Following capping, the recontoured hill slope was revegetated using mushroom compost, Richlawn, native seed and Woodstraw.



TU Current Project Sites: Illinois Gulch

- Realignment of approximately 1,035 feet of the Pinball Alley trail around the project site to connect to existing trail sections



Questions?

