

**Case Study: Upper Tenmile Abandoned Mine Reclamation, Upper Tenmile Creek Mining Area NPL Site, Lewis and Clark County, Montana, USA**

<p><b>Site Overview</b></p>	<p>The Upper Tenmile Mining Creek Area Site covers about 53 square miles and contains over 150 known abandoned or inactive mine sites within or near the historic Rimini Mining District in the upper Tenmile Creek watershed. Mining within the Upper Tenmile Creek watershed has resulted in uncontrolled releases of metal contaminants to local streams from waste rock, tailings (waste material from processing of mineral ore), and contaminated mine discharge water. The watershed serves as the primary source of water for the City of Helena. Remediation within the Tenmile site involves removal of contaminated media (waste rock, tailings, soil) and permanent disposal in the regional waste repository (Luttrell repository). Another remediation activity is source control and treatment of contaminated mine discharge water.</p>
<p><b>GSR Project Outcome</b></p>	<p>Backfilling with clean fill materials in areas where contaminated media have been excavated and removed is a major component of the reclamation process. Historically, EPA has sourced clean backfill material from within the Helena valley, requiring haul trucks to make a round trip of 50 miles to deliver the materials, and the trucks are empty for half of the trip. Over the course of the project, tens of thousands of cubic yards of backfill materials are required. Several GSR BMPs have been, and are being employed, in order to conserve fuel and reduce the carbon footprint of the project. In addition, the BMPs substantially improved construction efficiency and schedule, reduced overall backfill and waste disposal costs, as well as provided a better finished product. Finally, in conjunction with the fuel and cost savings, a social benefit is the Community of Rimini experiences less truck traffic through the town.</p>
<p><b>Background &amp; Drivers</b></p>	<ul style="list-style-type: none"> <li>- EPA is committed to utilizing green remediation approaches whenever possible</li> <li>- Being a “good neighbor”</li> <li>- Material reuse</li> <li>- Cost savings</li> <li>- Simultaneous waste remediation and site reclamation</li> <li>- Project stakeholder coordination and cooperation</li> </ul>
<p><b>Regulatory Program</b></p>	<p>EPA Superfund, CERCLA</p>
<p><b>Site End Use</b></p>	<p>The land in the upper Tenmile Creek watershed is used for a variety of recreational purposes such as hunting, hiking, camping, four- wheeling, mountain biking, snowmobiling, recreational mining, and fishing. Increased recreational use is anticipated as new residential homes and recreational cabins are built in the future and as site cleanup activities improve water quality, fish habitat, and environmental conditions at the site.</p>



<p><b>Contaminants of Concern and Impacted Media</b></p>	<p>The major threat posed by the abandoned mines is the release of potentially harmful concentrations of heavy metals, primarily arsenic, cadmium, copper, lead and zinc. These mines and their associated waste piles and tailings contribute to the contamination of surface water, groundwater, and stream sediments throughout the drainage basin of upper Tenmile Creek and its tributaries.</p>
<p><b>Key Stakeholders in Project</b></p>	<p>The key stakeholders include U.S. Environmental Protection Agency, Montana Department of Environmental Quality, U.S. Forest Service, U.S. Fish and Wildlife, and private property owners.</p>
<p><b>Cleanup Objectives</b></p>	<p>Risk-based objectives:</p> <ul style="list-style-type: none"> <li>- Achieve acceptable exposure risks for residents and visitors</li> <li>- Achieve acceptable exposures risks for terrestrial and aquatic species</li> </ul>
<p><b>Remediation Strategy</b></p>	<p>Approximately 245,000 cubic yards of contaminated material will be excavated from 70 high priority mine sites. Excavated wastes will be disposed of in the Luttrell repository. Excavated areas will be backfilled with clean soils to appropriate slope contours and revegetated.</p>

**GSR Strategy/Best  
Management Practices  
(BMPs)**

Luttrell repository was constructed at the open pit of the defunct Basin Creek Mine. Existing mine roads within the Basin Creek Mine site, near Luttrell Repository, were built for large mine vehicle traffic, and as such are much larger than is required for the current site use. The material making up the existing roads and the large safety berms was determined to be suitable for backfill material, and a borrow area was established near the Luttrell Repository. This allowed for the implementation of several BMPs:

- Reuse of material for backfill that was eroding and contributing to sedimentation of downstream waterways at the Basin Creek Mine site.
- Reduced haul truck fuel consumption by shortening the haul routes for backfill materials from 50 miles to 14 miles.
- Back hauling material after mine waste has been disposed of at the Luttrell Repository. This enables trucks to haul material both to and from the repository, rather than running empty for 50% of the time.
- Simultaneous reclamation of the Basin Creek Mine site, to return the large haul roads to a typical forest road, for eventual transfer of land to the USFS.

Other BMPs used during the course of the project include:

- Reuse by Lewis and Clark County of large boulders (12" + in diameter) encountered during excavation for riprap. This also reduces the amount of material hauled to Luttrell Repository.
- During the remediation of wastes in Rimini Road, CDM Smith worked closely with the Lewis and Clark County public works department to develop and implement a plan to re-use boulders and cobbles excavated during waste removal for structural road fill during the road reconstruction in shallow groundwater areas. This resulted in improved stability of the reconstructed road in those areas..
- Rock generated from laying back the near vertical high wall in the Luttrell Repository for safety purposes, was cost-effectively crushed on-site and used for the repository leachate collection system and road maintenance needs throughout the Tenmile site. This further reduced the need for hauling of backfill materials from distant sources.



<p><b>GSR Metrics and/or Footprinting Tool(s)</b></p>	<p>Civil 3D was used to provide volumetric calculations (using LIDAR generated contours) for the excavation of mine wastes which influences both construction schedule and staging area design considerations. In addition, it allows for determinations regarding consolidation of mine waste in the on-site repository, which allows for the area of winter cover removal to be optimized. Finally, it is used to determine the volume of backfill available from the Basin Creek Mine area, and the optimized placement of backfill for restoration at the mine sites. This program provided the project with the ability to understand volumetric data to cost effectively manage the backfill material.</p>
<p><b>Lessons Learned [Optional]</b></p>	
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<p><b>Relevant Links [Optional]</b></p>	<p>Upper Tenmile Superfund Site, EPA Region 8:  <a href="http://www2.epa.gov/region8/upper-tenmile-creek-mining-area">http://www2.epa.gov/region8/upper-tenmile-creek-mining-area</a></p>
<p><b>References [Optional]</b></p>	