NATIONAL ASSOCIATION OF ABANDONED MINED LANDS

Nomination Category: Environmental Contamination and Physical Hazard

Nomination Submitted by: Julie Annear, State of Colorado Division of Reclamation, Mining and Safety

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Project Name: Fairday Mine Reclamation Project
Project Location: Boulder County, Colorado

Project Start Date: July 6th, 2018

Project Completion Date: September 18th, 2018

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Project Partners
United States Forest Service
Boulder County
James Creek Watershed Initiative

General Contractor
McCollums's Excavating
P.O. Box 790
Nederland CO 80466

Project Cost: $115,400
Funded By: United States Forest Service

Date Submitted: June 11th, 2021

Background

The Fairday mine is located on United States Forest Service (USFS) lands southwest of Jamestown in Boulder County at an elevation of 7,900 feet. The mine was founded in 1865 and produced silver and lead intermittently until the late 1950's. In 1956 the mine was reopened after vanadium and uranium were discovered at the site. The mine was active until 1971 at which time it was abandoned. The Fairday mine remains the largest uranium producer in Boulder County. From 1956 through 1971 over 180,000 pounds of uranium oxide were produced from the mine. (Please see the attached Location and Access Route Map)

The Fairday Mine Reclamation (Fairday) project site is located in a remote mountain valley adjacent to an unnamed tributary to James Creek. James Creek serves as a water supply to the nearby town of Jamestown, the Lefthand Water District in Boulder County and other downstream water users. The creek also has a healthy aquatic life population. The Fairday mine originally contained two waste piles, tailings and an open draining adit with a depth of over 1800 feet. In 2005, the USFS consolidated over 3,700 cubic yards of radioactive mine waste and tailings containing uranium and other heavy metals into a repository at the mine site. The repository is located adjacent to the unnamed tributary. Surface flow in the upper portion of the tributary is intermittent. The part of the tributary traversing the lower part of the project is fed continuously by groundwater and has perennial flow. The flood of 2013, a 300 year event, eroded the toe of the existing repository and exposed more than 800 cubic yards of additional radioactive mine waste and tailings. The flood also obliterated the roads to the site which were not repaired prior to the inception of the project. The USFS contacted several contractors to look at the site in 2016. However, the contractors were reluctant to undertake the reclamation of the site due to the lack of road access.

The goal of the project was to repair the existing repository and move the additional waste rock and tailings that were exposed during the flood to a new upland repository away from the tributary. Also, at the request of the local watershed group, three off-site erosion features related to the flood totaling over one acre, were included in the project. These areas were cleared of trash, graded, seeded, mulched and covered with biodegradable erosion control mat and straw wattles. As a cost saving measure, engineering and design was completed in-house by DRMS in the summer of 2017. A CERCLA Removal Action was approved by the USFS and the project was bid in the fall of 2017. Construction took place in the summer of 2018.

The project work included:

- Installation of erosion control measures.
- Construction and improvement of over 3 miles of access roads to the site.
- Clearing the tributary channel of wooden debris and trash.
- Excavation of exposed waste rock and tailings on cut bank slopes.
- Consolidation of waste rock in a new upland repository.
- Repair of the existing repository.
- Armoring the tributary channel and repository with geotextile and large rip rap.
- Excavation, transport and placement of one foot of topsoil over all disturbed areas.
- Stream channel restoration and construction of drop structures and catch basins.
- Removal and reclamation of roads and borrow areas.
- Grading and reclamation of three off-site erosion features.
- Seeding, application of mulch and revegetation of all disturbed areas with native plants and trees.

The total site area is approximately 4.0 acres.
(Please see attached site map)

Abandoned Mine Problem - Radioactive-Metal Laden Sediment-1 mile Above Jamestown Water Intake

The Colorado Geological Survey (CGS) conducted an assessment of the physical and environmental hazards associated with the Fairday mine complex prior to the time that reclamation was completed. In particular, the CGS evaluated the radiation associated with the site compared to the background radiation in the surrounding area. **The evaluation indicated that the radiation levels at Fairday significantly exceeded background levels of radiation in the area and the exposed tailings represented a risk to public health and safety**.

Prior to reclamation, surface flow in the unnamed tributary to James Creek continually came in contact with waste rock and tailings from the damaged Fairday repository and the new cut bank slopes. **Sediment containing uranium, vanadium, thallium, strontium, arsenic, mercury and lead was continuously eroded into the tributary**. The tributary merges with James Creek about 0.25 mile downstream of the mine, and about 1.5 miles upstream of Jamestown. The intake for the Jamestown water supply is on James Creek, downstream from the mine site.

In addition to the water quality impacts to James Creek, there is considerable human interaction with the site. The immediate area around the mine is not populated with houses or businesses. However, the site is frequently used by the public for camping and other recreational purposes. A hiking trail traverses the site and, prior to reclamation, tourists regularly came into contact with radioactive, metal-laden material while visiting these public lands. The area is a corridor for wildlife such as bears, elk, and moose. James Creek is also a popular fishery.

The adit was previously safeguarded with a bat grate by the Division of Reclamation, Mining and Safety (DRMS). Prior to safeguarding, the adit also received significant visitation from hikers and mountain bikers.

Photo #1-Cut Bank Slopes containing Radioactive Metal- Laden Waste Rock/Wooden Debris Deposited by Flood Pre-Reclamation

Construction

Access

Contractor mobilization and site preparation began in early July of 2018. The first phase of the project involved re-establishing over three miles of road across rugged terrain, consisting of what was previously a county road adjacent to James Creek and the mine access road.

A portion of the access route followed what was once a 4WD county road, most of which was obliterated in the flood of 2013. In some places, the road could not be re-established and it was necessary to use a portion of James Creek for daily access. A ramp was constructed down the hillside into the stream and the ATV, excavator and skid steer used a portion of the stream channel for ingress

and egress to the mine site. Construction had to take place after peak runoff because the access route that crosses James Creek is impassable during high flow.

The mine access road originally branched off the 4WD County road and followed the unnamed tributary to the site. However, the mine road was completely destroyed during the flood. Because of the narrow valley, the only access to the site followed the existing stream channel. Prior to construction, the channel was strewn with large boulders and overgrown with willows and trees. Construction of the new mine access road involved moving large boulders, clearing trees and removing willows. Most of the clearing and grubbing had to be completed by hand in order to preserve as much of the existing vegetation as possible. Boulders were stockpiled for later use in armoring the channel. Harvested trees were limbed and stockpiled for erosion control on the revegetated slopes. Willows were dug by hand and transplanted later in the reconstructed stream channel.

Because of the site's proximity to James Creek and the tributary, care was taken to limit any possible contamination of the waterways and riparian areas. Prior to initiating construction, sediment control measures including silt fence, straw bales and straw wattles were installed. Several culverts were installed in the tributary adjacent to the repository in order to divert the flow so that it could be repaired and for the construction of the access road. A settlement pond was excavated downstream from the project area in order to capture sediment from the project site before it entered James Creek.

Photo #2 – Mine Access Road Prior to Construction

Photos #3 and #4- Reclaimed Mine Site Access Road

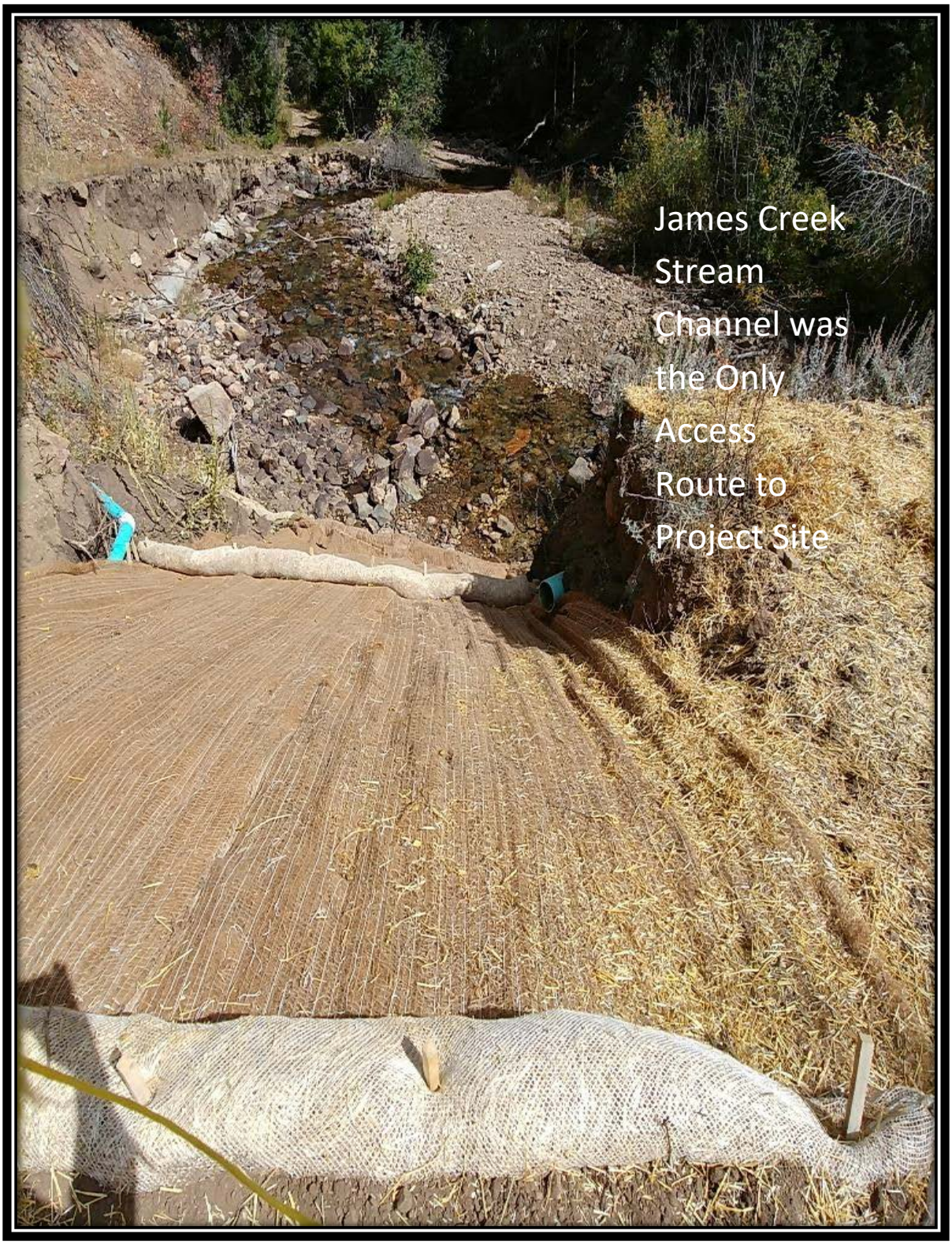


Photo #5 - Reclaimed Access Ramp into James Creek (The Remains of the County Road can be Seen in the Upper Left Part of the Photo)

Equipment and Materials

The steep grade and narrow width of the access route restricted the type of equipment that could be brought to the site. It was not possible to bring a pickup truck, dump truck or large excavator to the site because of the difficult access. Consequently, vehicle access was limited to an ATV, mini excavator and skid steer.

Because of the challenging site conditions, the contractor was required to obtain all of the rip rap and topsoil from borrow areas approximately ¼ mile from the mine site. The construction crew and all of the fuel, geotextile, mulch, erosion control materials, seed and trees had to be transported from the staging area over 3 miles to the site by ATV.

It is estimated that the skid steer made more than **3,600** trips to move contaminated material from the cut bank slopes to the upland repository. The excavator and skid steer also made more than **3,100** trips to and from the borrow areas to the site to transport rip rap and topsoil. The ATV logged more than **1,000** miles in the process of moving materials and personnel to the site. Transport of materials was complicated by the fact that there was only one narrow road into and out of the mine site. Consequently, the excavator and skid steer could not move materials to the site from the borrow area simultaneously.

Despite the labor intensive task of harvesting and transporting materials from the adjacent property, the use of on-site materials made the project possible and resulted in significant cost savings.

Photo # 6-Armoring the Channel with Riprap

Photo #7-Transporting Materials and Personnel with the ATV

Reclamation of Cut Bank Slopes and Consolidation of Materials

The channel of the tributary was clogged with wood, boulders and other debris deposited by the flood. Prior to beginning excavation of the cut bank slopes, debris had to be cleared from the channel and transported to the topsoil borrow pit for disposal. Following the removal of the debris, the contractor excavated tailings and waste rock from the cut banks to achieve a 2H:1V slope gradient. Waste rock was transported to and consolidated in an upland repository above the channel. Care was taken to contour the repository so that it conformed to the characteristics of the natural landscape. Because of the steep topography of the area, extensive field and geologic reconnaissance was completed to identify the appropriate location for the upland repository. The site was required to have a suitable grade and aspect. It also had to be located away from groundwater, surface water flow and the effluent from the draining mine adit.

Following removal of the waste rock, the lower portions of the slopes abutting the channel were covered with geotextile, topsoil and armored with rip rap. Several courses of rip rap were placed below the bed of the channel adjacent to the streambank to prevent undercutting of the armored slopes during storm events. Drop structures and stilling basins were constructed to slow the flow of water in the channel and catch sediment. Obtaining the necessary amount of large rip rap to complete the project was very challenging. There was a limited quantity of suitable material in the near vicinity of the project site and the skid steer did not have the capacity to transport large rip rap. Consequently, the excavator had to travel over ½ mile in some cases to obtain the necessary material.

Concurrent with excavation and consolidation of the waste rock, topsoil was harvested from the borrow area and moved by skid steer to the upland repository. A one foot layer of topsoil was used to cap the upland repository as well as the cut bank slopes. All disturbed areas were seeded and mulched with straw. Biodegradable erosion control mat, straw wattles and previously harvested trees were placed on the reclaimed slopes and upland repository to minimize erosion.

Photo #8 - Cut Bank Slopes- Exposed Tailings and Mine Waste (Pre-Reclamation)

Photos #9 and #10- Reclaimed Cut Bank Slopes-Upper Repository is at the Top Left of the Photos

Photo #11- Exposed Waste Rock and Tailings on Cut Bank Slope
Pre-Reclamation

Photos #12 and #13 - Reclaimed Cut Bank Slopes

Photos #14, #15 and #16- Cut Bank Slopes and Repository Pre and Post-Reclamation Looking Downstream

Photo by Navarro

Repair of Existing Repository and Stream Channel Restoration

Following reclamation of the cut bank slopes, the exposed waste rock and tailings on the side slopes of the original repository were graded, covered with one foot of topsoil and then armored with rip rap. This process was time consuming and difficult because the repository was adjacent to an active stream channel. Also, the flood reduced the thalweg of portions of the tributary by over 18 feet, leaving the repository sides almost vertical. Originally, the reclamation plan included moving the channel away from the toe of the repository to achieve a 2H:1V slope gradient on the side of the repository abutting the tributary. However, initial excavation of the new channel exposed additional mine waste, not clean material. Consequently, additional rip rap had to be installed at the toe of the repository in order to stabilize it. Care was taken to reconstruct the stream channel so that the repository was protected while assuring that it conformed to the natural characteristics of the channel above and below the mine. The reconstructed channel included drop structures, stilling basins and meanders to slow the flow of water through the reclaimed area. The pre-flood alignment of the channel was reestablished where possible. The additional mine waste in the area opposite the repository was reclaimed in situ with one foot of topsoil and then revegetated.

Photos # 17 and #18 - Toe of Existing Repository -Pre and Post-Reclamation

Project Partnerships

The project was a collaborative effort between Federal, State and local governments as well as the local stakeholders: The USFS, DRMS, Boulder County and the James Creek Watershed Initiative collaborated on the reclamation plan design as well as the logistics of road construction. More than 150 trees were donated to the project and planted by volunteers, the USFS and the DRMS. The project was funded by the USFS and managed by DRMS and USFS.

Photo # 19- Volunteers Planted Over 150 Trees at the Site

Photo # 20-Ponderosa, Juniper and Limber Pine were Planted at the Site

Historical Preservation

Numerous artifacts and a timbered mine portal were located on the project site. Care was taken during planning and construction to preserve the artifacts and insure that the portal was left intact.

Photo #21-Mine Portal Safeguarded with Bat Grate

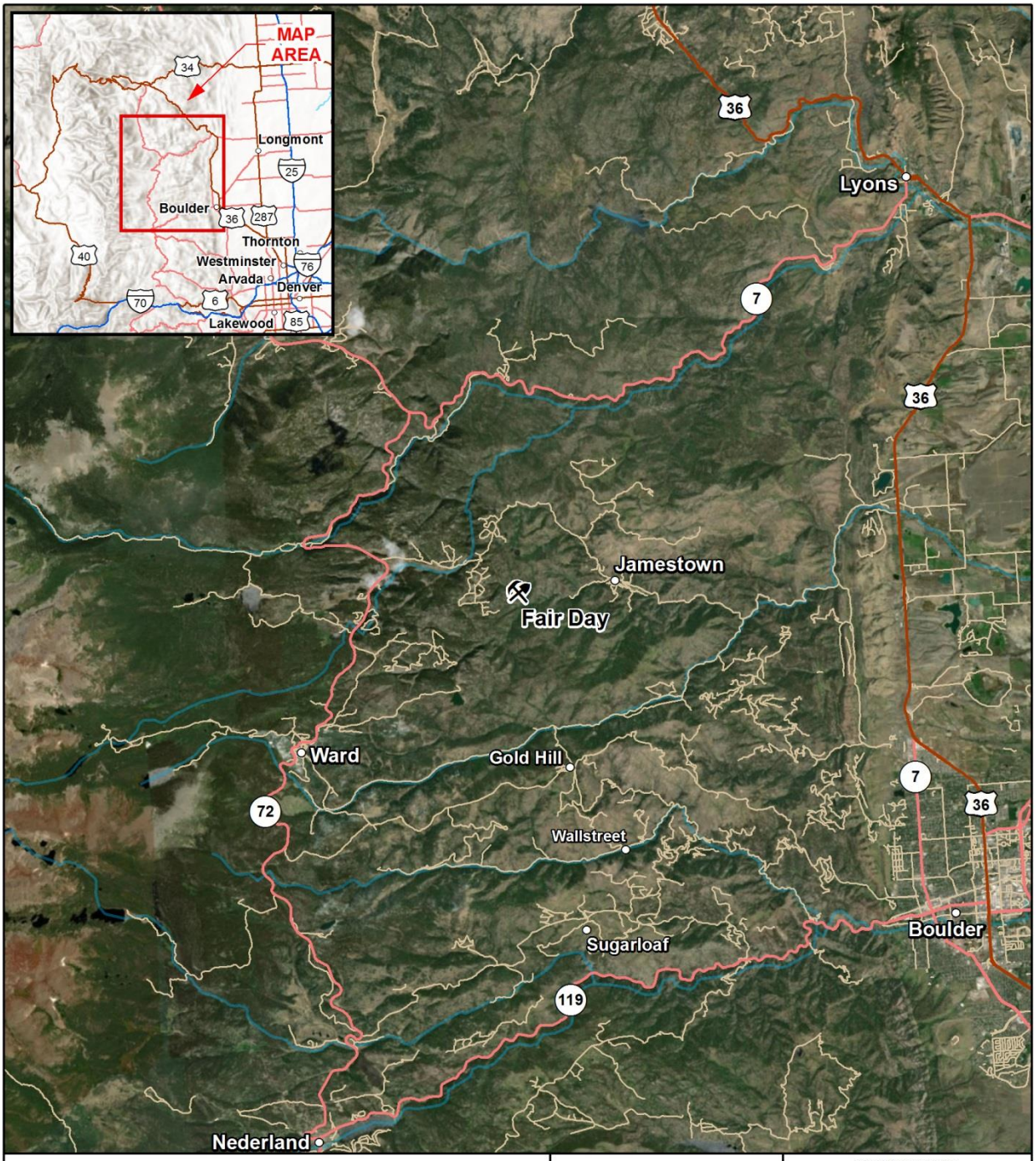
Budget

The final cost of the project was $115,400. There were considerable cost savings because all of the engineering and design was completed by DRMS. Also, all of the topsoil and rip rap were obtained from borrow areas adjacent to the site. Trees were donated to the project and planted by volunteers. Willows that were removed to create the mine access road were replanted and harvested trees were used for erosion control.

Post reclamation

Reclamation activities completely eliminated any contact between the surface water flow in the tributary and the Fairday waste rock and tailings. Consequently, radioactive material containing arsenic, lead and mercury is no longer being eroded into the tributary and transported to James Creek and the surrounding wetlands. In addition, the reclamation project eliminated the exposure of human visitors and wildlife to contaminated substrate. The DOE completed a post-reclamation survey of the area in June of 2019, following the completion of the reclamation. The survey indicates that, with the exception of a small area outside the project area, **radiation at the reclaimed site no longer exceeds that of the background levels of radiation in the immediate vicinity.** (Please see Figure #1) In addition**, the adit is no longer accessible to humans and there is evidence that bats are using the opening**.

A site inspection was conducted by DRMS in June of 2019 and 2021. Grasses and forbs were well established and the newly planted trees had a survival rate of 95 percent. There was no erosion of either of the repositories and the channel was stable. Annual inspections of the site will be conducted in the future.



Mine Location
City, Town, or Place
U.S. Highway
State Highway
Local Road
River or Stream
N
0 1 2 4 MILES

U.S. DEPARTMENT OF ENERGY
OFFICE OF LEGACY MANAGEMENT

Work Performed by
Navarro Research & Engineering, Inc.
Under DOE Contract Number DE-LM0000421

Fair Day Mine
Location Map – LMID 5494

DATE PREPARED: December 11, 2018

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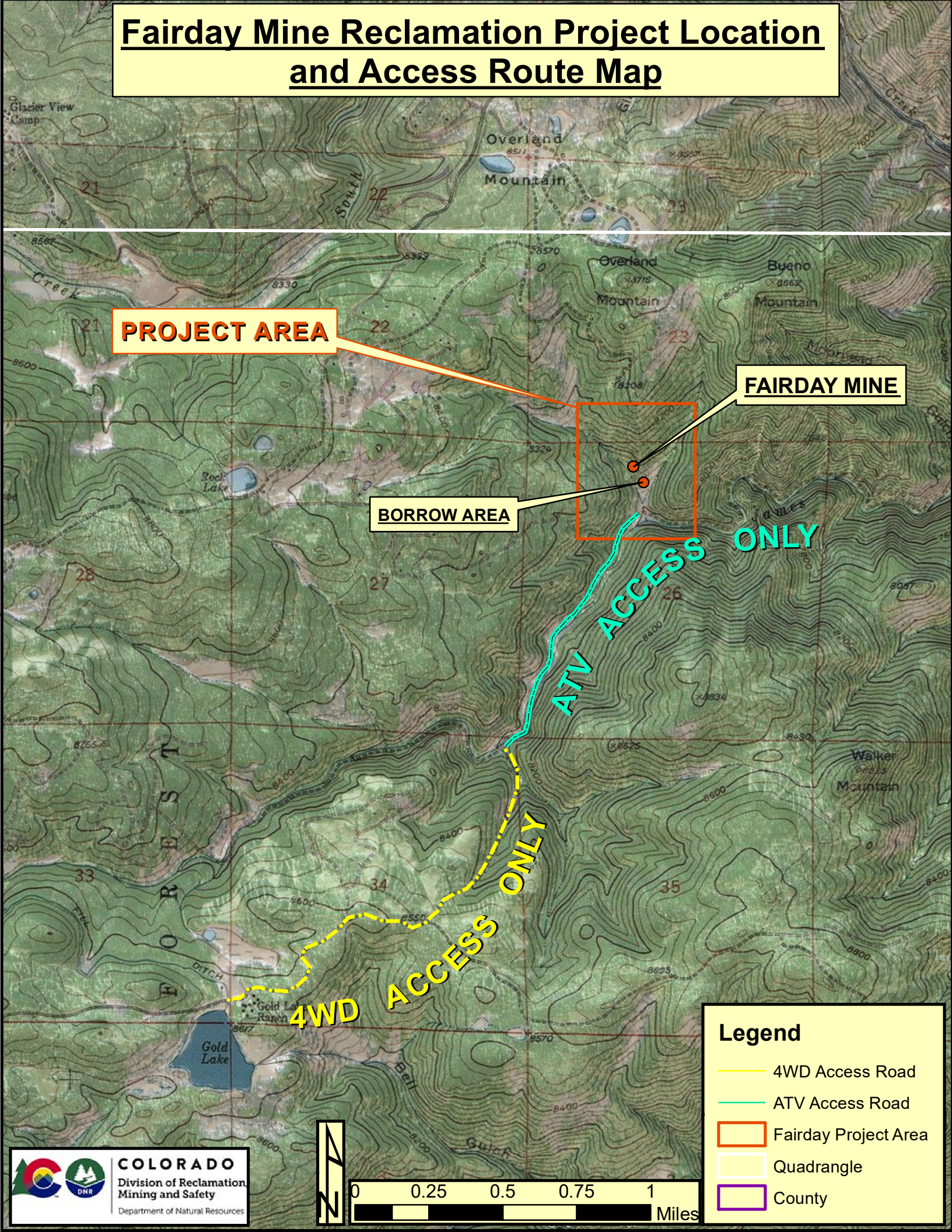
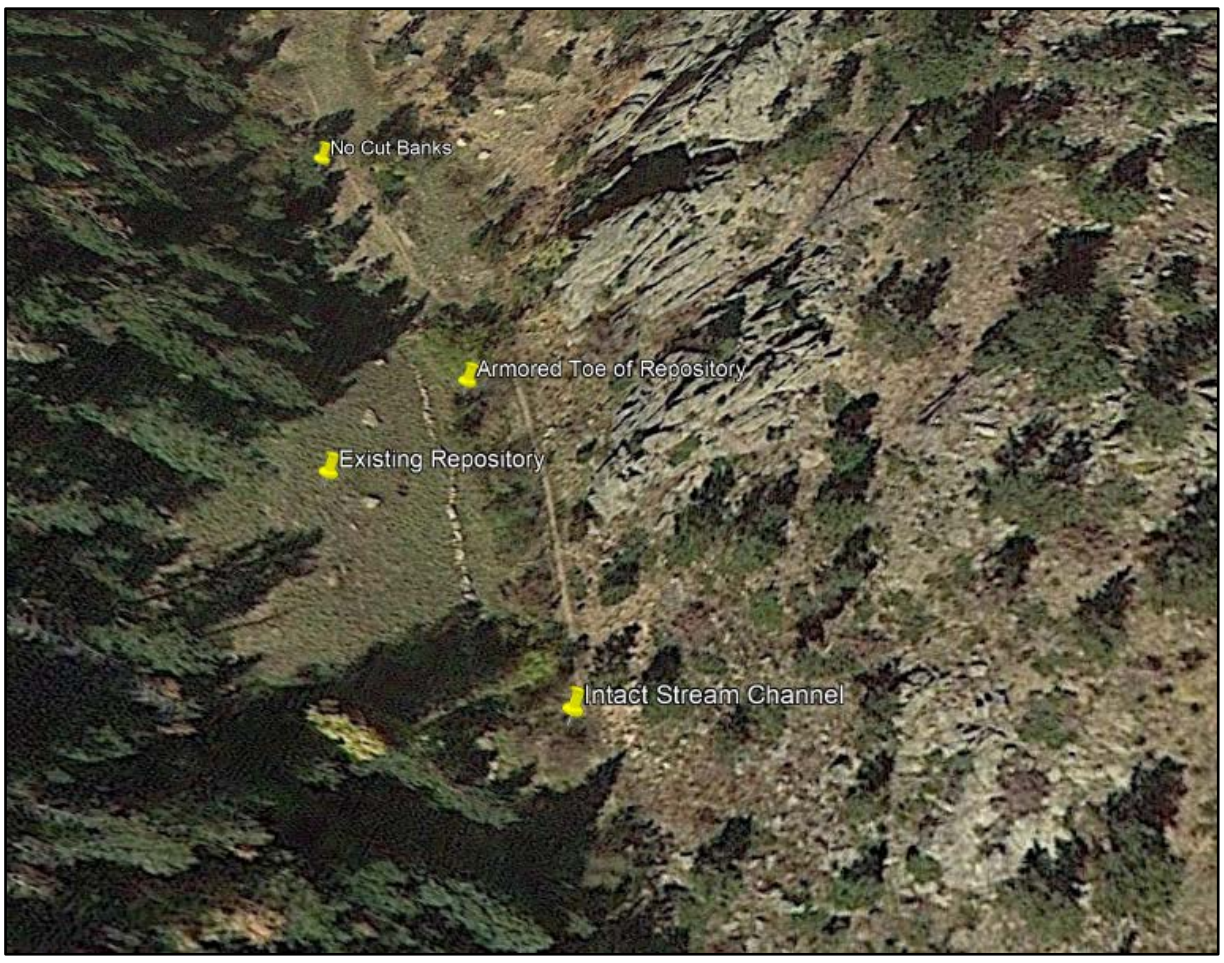
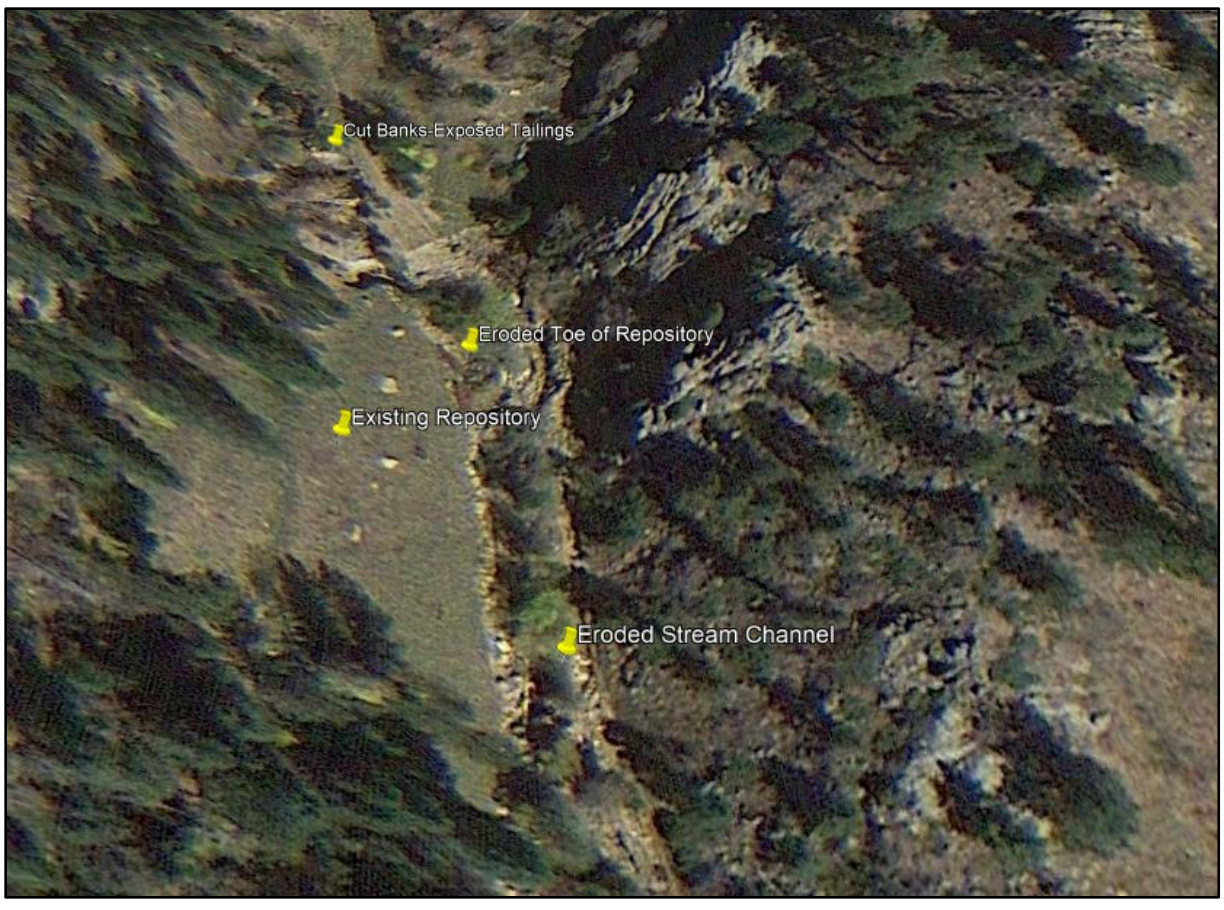
Fairday Mine Reclamation Project Location and Access Route Map



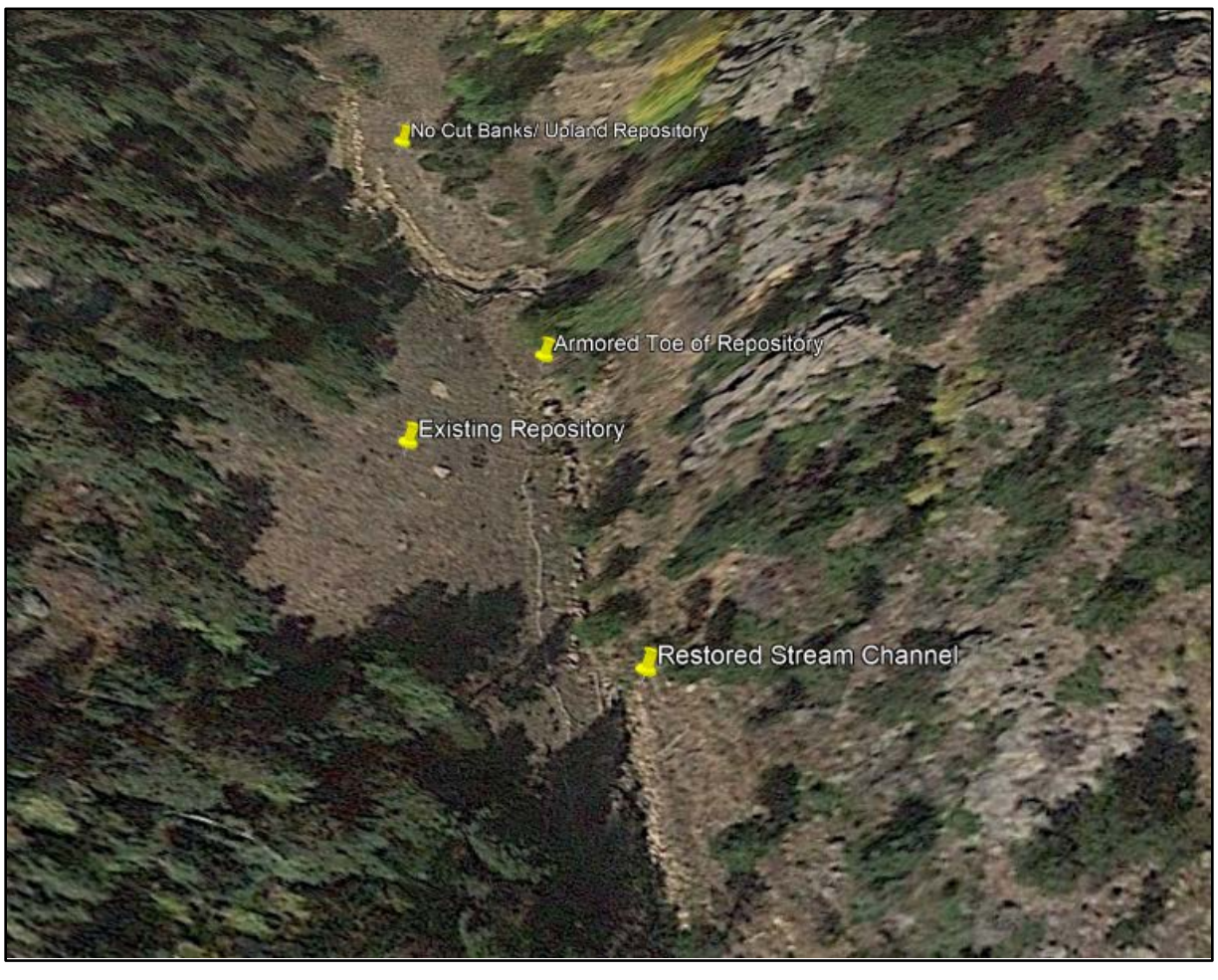
Fairday Mine Reclamation – Historic Site Images



2012 – Pre Flood

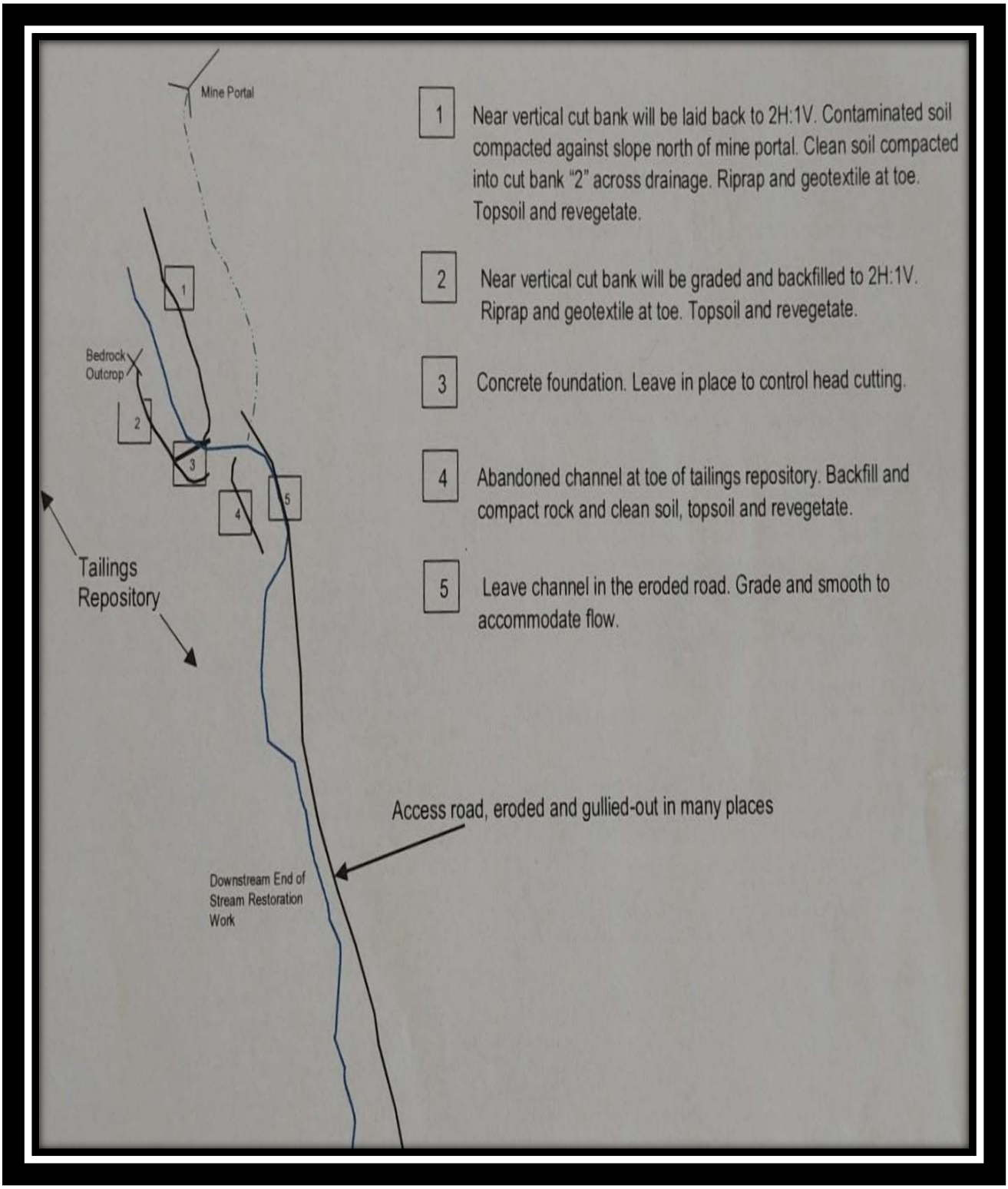


2014 – Post Flood



2021 – Post-Reclamation

Fairday Mine Project Site Map



(Figure #1)

<u>Fairday Mine Gamma Radiation</u>

<u>After Reclamation (June 2019)</u>

United States Department of Energy

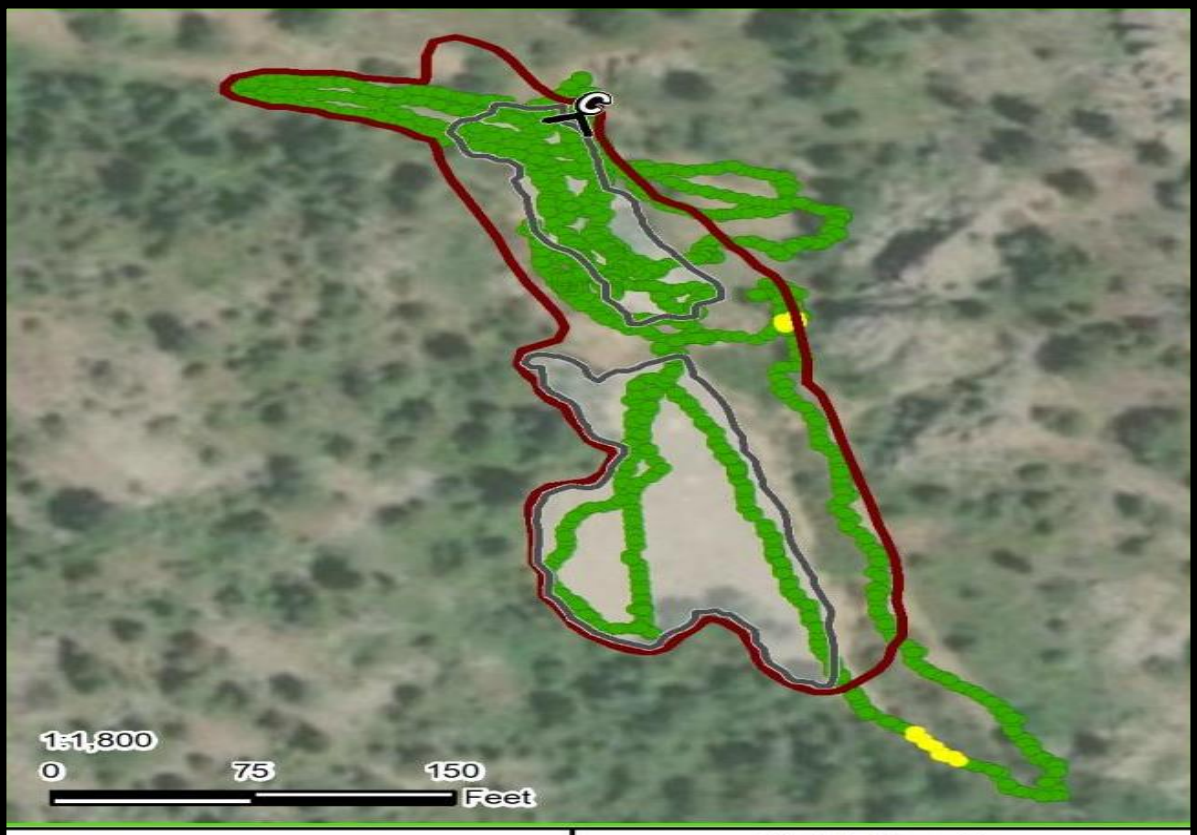
All Values are Above Background in µR/hr (*Background = 17 µR/hr*)	
Mean	66
Minimum	0
Maximum	475
Standard Deviation	74
Gamma Radiation Measurements	4088

Statistics are only calculated for points within the total disturbed area.

Gamma Radiation Survey
µR/hr Above Background
- 0–32
- 32–64
- 64–256
- >256

N

- Adit - Closed
- Adit - Collapsed
- Total Disturbed Area
- Background Area
- Waste Rock Pile
- Trench
- Private Property



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OFFICE OF LEGACY MANAGEMENT

Work Performed by
Navarro Research & Engineering, Inc.
Under DOE Contract Number DE-LM0000421

Gamma Radiation Survey
Fair Day Mine — LMID 5494

Photo #22- <u>One Year Post Reclamation</u>- Reclaimed and Revegetated Repository- Armored on Both Sides of Channel and Topsoil Cap

Photo #23<u>- Two Years Post Reclamation</u>-Left Side of Photo-Tailings that were Reclaimed In-Situ

Photos #24 and #25 - Existing Repository-Pre and Post Reclamation