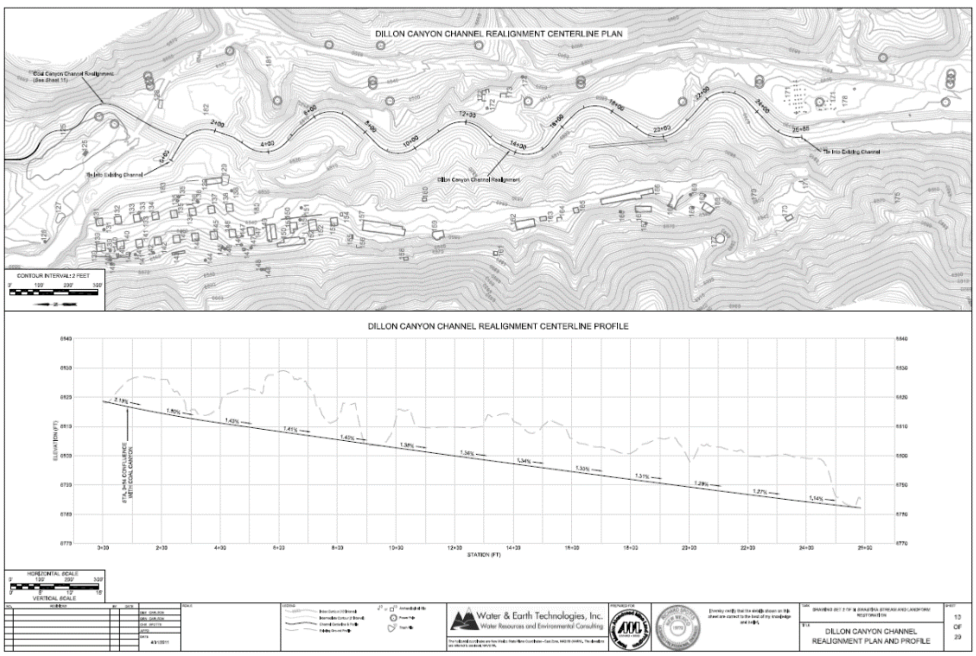
The Swastika Mine and Dutchman Canyon Reclamation Project

Raton, New Mexico



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Construction Start Date: April 3, 2012
Construction Completion Date: October 5, 2012
Total Construction Cost: $4,485,131.22

Responsible Organizations:

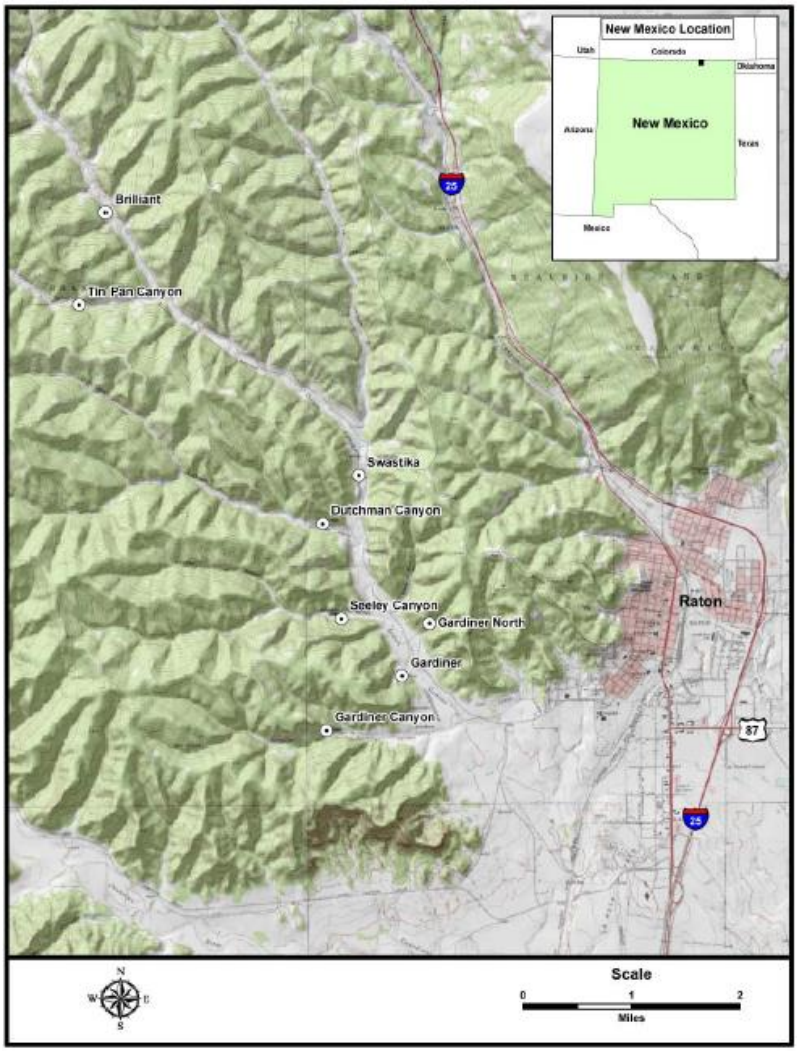
Construction:
Kiewit New Mexico, 814 Solutions
Design Engineer:
Water & Earth Technologies Inc., Habitat Management Inc., GeoFluv (Nicholas Bugosh)
NEPA Affiliates:
Scott Altenbach (bat report), Museum of New Mexico Office of Archaeological Studies, New Mexico Historic Preservation Division – Dept. of Cultural Affairs
New Mexico AML Program Staff:
Fernando Martinez, John Kretzmann P.E., Mike Tompson P.E., Lloyd Moiola, Steven Lakatos, James Smith P.E., Randall Armijo, Zoe Isaacson, Daisy Levine, Dina Vigil, Connie Romero
Project Management:
Water & Earth Technologies Inc., Habitat Management Inc., KS Berry
Consultant for Archaeology during Construction:
Parametrix
Land Ownership:
Vermejo Park Ranch (Gus Holm – Ranch Manager)
Utilities:
City of Raton Public Service, CenturyLink, Springer Electric Coop,
Public Outreach:
RiverSource
Permitting:
U.S. Army Corps of Engineers (Deanna Cummings)

Date Submitted: May 14, 2021

Nominated for:
Western Region Award
National Award

Project Background

Location



The project site is located northeast corner of New Mexico in Colfax County, next to the town of Raton and adjacent to the border with Colorado. The site within the Vermejo Park Ranch, which was purchased from Penzoil by Ted Turner in 1996. The ranch has a long history of coal, oil and gas extraction.

The ranch contains a few different historic coal camps, most somewhat near in proximity to each other. Seven coal mining settlements and mines were established on the ranch: Blossburg, Brilliant, Tin Pan Canyon, and Swastika in Dillon Canyon and Gardiner, Koehler, and Waldron canyon nearby.
(The Swastika mine was renamed Brilliant #2 in 1940 because of the use of the swastika symbol by Germany during World War II)

Mining History

Coal mining in this area began in the late 1860s and continued into the 1960s. Coal was the most valuable mineral resource of Colfax County. The early discovery of gold in the surrounding hills drew investors and miners beginning in 1866, but by 1881 coal had become a much more important commodity.

In 1909 Colfax County produced 74.8 percent of all coal mined in the territory of New Mexico with 2,027,639 tons produced. In 1918 the average was 9.5 tons per day per man for loading coal and 7.0 tons per day in mining. Principally because the railroads converted from coal to oil for fuel by 1954, the production of coal at that time was reduced to a few local shipments to nearby towns for domestic use. In the early days of coal mining, coal was sold to Colorado, Kansas, Texas, Oklahoma, Nebraska, Arizona, and other New Mexico towns such as Hurley, Bayard, and Silver City. By 1925 it was also being shipped to Chihuahua and the Pacific coast. In 1945 a small amount, 75,000 tons, was sent to Europe. The coal mines in Vermejo Park collectively employed 3,563 miners in 1911.

On March 1, 1894, an explosion in a mine killed five men. It was caused by poor ventilation and the accumulation of methane. Eight to ten miners were also killed at Blossburg in a mine in 1898. The mine was sealed, leaving the bodies inside. On October 5, 1906, a mine explosion at the Dutchman No. 3 Mine at Blossburg killed ten men and wrecked the mine. It was believed to have been caused by leaving an air door open, which short-circuited the ventilation system and created an accumulation of methane. The methane ignited when two men came in contact with the gas with their open lights. The bodies were never recovered. In 1944 a mine explosion killed six men in the Swastika mine. The men were mostly immigrants from many different countries who had responded to company advertisements for workers, published as far away as Europe. Italians were a notably visible group among early mining camps, often living together in enclaves within the camp. Today, Italians and Greeks continue to make a valuable contribution to the social fabric of Raton.

Work forces at the mines were usually divided into outside mine workers and underground workers (who were paid more). Boys under twelve could not work in the mines. Miners had to pay rent and electricity for their houses, which were built by the company. Houses mostly consisted of four rooms, sometimes five, and a cellar with a charge of $3.50 per room per month. Also, $2.50 was deducted for doctor and hospital services, $.50 for blacksmithing, $1.50 for a miner's lamp, and $3.00 per ton of coal delivered to houses. Pay was issued once a month. The paymaster would come from Raton with an average of $24,000 in cash, accompanied by three or four armed guards. Payments were made in the evening, and consequently, saloons got a good share of the money. There was no system of credit at the stores in the mining camps, which were all owned by the company. Instead, if a miner needed money, after three days of working he could go to the mine office and get his accumulated pay in scrip. He first obtained a scrip order at the mine office, which he then took to either the store or saloon and got a book of coupons (scrip) in return, which he could then use as cash. The scrip was issued in denominations from 10 cents to $5.00. When the miner received his regular paycheck, the amount of scrip used was deducted from his pay. After the mines closed, the buildings and equipment were sold for scrap.

All of the mining was conducted using underground mining methods, primarily room and pillar methods, although some areas of longwall mining may have been employed in the later mining efforts. It is unknown if the pillars were removed when the mines were closed and therefore some areas of open mine workings may still exist underground. Mining activities primarily progressed horizontally from portals located on the sides of the canyons, although some reference is made to shafts located higher up on the plateau above the canyons. Deposits of gob are typically co-located with the mine openings. The last coal mine developed in Dillon Canyon was the Swastika Mine.


The Dillon Canyon stream channel adjacent to the Swastika Mine was straightened to accommodate mining operations as shown in this historic photograph of the tipple. Later the railroad tracks were removed and the road was rerouted to its current straight alignment atop the east stream bank. Straightening stream channels shortens the flow path, which increases the slope of the channel bottom. Increased slope means faster flow. Faster flows erode the banks and channel bottom.

Notice the lack of trees on the hillside having been harvested by the mining operation and coal camp residents.

Problem Description

Mine operations occurring before the existence of the Surface Mining Control and Reclamation Act (SMCRA) acted in the most expedient way possible. Coal that was mined but could not be sold (coal waste, or "gob") was dumped in angle-of-repose piles stretching along the base of the hillsides adjacent to the mine portals. At the Swastika mine site, nearly 200,000 cubic yards of coal waste had been abandoned in several steep, unstable piles. The largest of these piles was placed immediately adjacent to the Dillon Canyon stream channel and was collapsing into the stream over a significant reach. In locations where the pile blocked drainages serving the subwatersheds on the hillside behind the pile, channels eroded through the coal waste as material was washed into the stream. In addition, visible precipitate in the channel indicated that chemicals leached from the pile by stormwater infiltration were degrading the stream.

In addition to degradation caused by the coal waste, the stream channel had been straightened during the historic mining period to accommodate rail facilities serving the mine, and a half-mile long reach of the channel had become deeply incised between steep, eroding stream banks. The Project was undertaken to halt these ongoing impacts from historic mining by reshaping the unstable piles of coal waste into a geomorphic landform that integrates a relocated and restored stream channel. In addition, preserving wetland areas and improving riparian habitat in the restored stream channel were goals of the project.

At the Dutchman Canyon location, seeps from old mine workings are collected into two ponds. The water, with a pH of 10.6, was being directly conveyed into an adjacent stream via a dilapidated culvert.

Coal gob pile left on the hillside with adjacent straightened stream at the base. The gob material was not terribly acidic (pH 4.2) but did degrade the quality of the adjacent stream channel.

The road is the location of the old rail line and is prohibiting the stream from adding any sinuosity.

A dilapidated culvert conveying the overflow from ponds at the Dutchman Canyon mine site into a nearby stream channel.

Project Overview

The goal of the geomorphic reclamation design for Swastika project was to restore functional drainage to the landscape and create stable landforms from the coal waste material that could be successfully revegetated and would blend into the surrounding undisturbed topography.

Because of the significant estimated volume of coal waste material to be reclaimed, every opportunity to use coal waste for fill was exploited by the design. Above the estimated maximum groundwater level, the degraded channel was backfilled with coal waste. The landform flanking the restored channel was also constructed of coal waste, except within the meander belt, where coal waste was precluded to prevent its exposure by downstream migration of the meanders. Whenever it was possible, the geomorphic reclamation design for Swastika reshaped steep or unstable coal waste piles into geomorphic landforms without requiring the removal of material to other locations.

Highlights of the project:

- Project lasted six months; Kiewit (contractor) brought in heavy equipment for specific time periods of use on the project;
- Ranch road was rerouted and engineered with proper grading and culvert crossings;
- Straight stream channel was replaced with a sinuous path, slowing down the flow during rain events; Length of channel was increased from 3,050 to 3,350 feet;
- Coal gob was moved to lessen the slope; Borrow areas were created and replaced with gob material; At least one foot of clean fill was placed over the coal waste landform, with appropriate amendments, to provide a surface for reclamation. Coal waste was excavated from the geomorphic landforms in the immediate vicinity of tributary channels and swales conveying runoff from the hillside across the reclaimed land and into the restored channel. In these areas the coal waste was replaced with clean fill to avoid the exposure of gob if the channels and swales experience some degradation;
- 197,825 cubic yards of coal gob and 223,381 cubic yards of clean material were moved; this sometimes double or triple hauling; 11 acres of gob were reclaimed, 75 acres of disturbance;
- Geotextile and fabric were installed along the slopes of the channel to stabilize the slope before the vegetation could establish'
- 400 cubic yards per acre of compost were placed over gob and poor soils;

- Lime, gypsum and fertilizer were amended at rates determined by the soil test results;
- Wood chip erosion control logs were manufactured onsite from wood provided by the ranch;
- Upland seedmix (12.02 PLS lbs/ac) and wetland seed mix (7.21 PLS lbs/ac)were both hand broadcasted;
- WoodStraw mulch from Forest Concepts ("French Fries") were applied at a rate of 4,000 lbs/acre;
- Narrowleaf cottonwoods, willow clumps and wetland plants were salvaged where feasible and replanted after the stream contouring work was completed.

At the Dutchman Canyon area, 0.6 acres of wetland area was created to further treat the outflow from the ponds before it traveled into the nearby stream through a newly constructed low-water crossing.

Innovative Use of Current Technology

Fluvial geomorphology is the study of how flows naturally produce the shape of the landscapes, producing streams and landforms that are stable given the soils, vegetation and the climate. Fluvial geomorphology provides information for both stream restoration and landform restoration by measuring the features of stream reaches and landforms in the vicinity of the project that have achieved a natural "dynamic stability" and are NOT eroding due to storm runoff. A geomorphic approach tries to produce landforms that are more attractive, diverse and stable than traditional planar terrace reclamation techniques that were used in the past for reclaiming mining disturbances. Geomorphic design was accomplished using Natural Regrade with GeoFluv™ to incorporate stable drainage and topographic variety into the reconstructed portion of Dillon Canyon. The approach aimed at having the reclaimed landform visually compatible with the surrounding valley. In addition to climate characteristics for the project area, features measured in the undisturbed or "template" streams and landforms that are used as design criteria to create a geomorphic design include:

- Landform ridge-to-head-of-channel length, drainage density, and interdependent slope and maximum slope length (lower slopes allow stable landforms to exhibit longer maximum slope lengths, while higher slopes require shorter slope lengths).
- Channel gradient, sinuosity, meander frequency and radius of curvature, as well as cross-sectional characteristics like bottom width, width-to-depth ratio, bankful discharge and channel side slopes.

Natural Regrade with GeoFluv™ is an AutoCAD (Computer Aided Design) based software system that incorporates geomorphic analyses with 3-dimensional civil design for developing reclaimed land and stream forms. Geomorphic design criteria for landforms in Natural Regrade with GeoFluv™ result in a design characterized by an irregular landform surface and non-uniform slopes. The diverse topography and varied aspect of the resulting landform is conducive to the establishment of diverse vegetation, improving aesthetics and the habitat value of reclaimed areas. Whereas traditional reclamation design sought to concentrate flows at hydraulic conveyance structures like downdrains, geomorphic design strives to prevent flows from concentrating as long as possible. Runoff channels that develop naturally exhibit concave longitudinal slopes; i.e., they start steeper and become flatter as they proceed downstream, in spite of the occasional appearance of a "step" or waterfall feature. Therefore, providing many small conveyances and preventing flows from concentrating has the result that the channels with the steepest slopes will convey very little discharge, thereby reducing erosive forces. With increasing distance from the ridgeline, discharges increase as flow converges in collector channels, but channel gradients decrease.

Equipment was enabled with GPS to provide the topography designed by the engineer.

Difficulty of Achieving Reclamation Under Existing Conditions

<u>Special and Unique Considerations</u>

Historic Preservation

Serious efforts were made to protect all identified historical artifacts that were identified during the design phase. Areas that contained foundations or other structures were designated as Avoidance Areas and roped off before construction started. As the project progressed, a number of archaeological features were exposed, including in areas that had been planned for use as combination soil borrow/coal waste repositories and in the channel realignment excavation. When possible, geomorphic designs were modified as required and alternative locations for placing coal waste and borrowing capping soil were identified to preserve these newly discovered archaeological features. However, preserving two service pits constructed beneath the rail line was fundamentally incompatible with stream restoration at the site. These features were fully excavated and documented before construction in their vicinity resumed. The construction team cooperated to shift work areas and maintain progress even when work was halted for archaeological documentation.

Archeological feature uncovered during construction is documented before excavation of the channel resumes.

Archaelogical excavation of a residential area taking place while the surrounding area is being excavated for borrow material and gob deposition.

Unknown depth to Bedrock

When designing the channel, questions remained as to the depth of bedrock. Assumptions had to be made and the design was adjusted when it was encountered nearer to the surface than expected. This happened in three to four locations along the channel.

On-site Difficulty of the Project

Narrow Canyon

Space was very limited due to the canyon topography. Finding areas to bury gob material was difficult when accounting for depth to bedrock, utilities and archaeological avoidance areas. And adding sinuosity to a straightened stream channel also reduced the working space.

Powerlines

Two different powerlines ran through the project area 1) Burro Canyon high-voltage line owned by the Arkansas River Power Authority (ARPA, which serves as the primary power supply for the City of Raton and carries 69,000 Volts, and 2) Kiota switch, a 3-phase line owned by the Springer Electric Cooperative which serves the New Mexico port of entry on I-25 as well as a radio station located north of Dillon Canyon. A phone line also ran to an inholding ranch a few miles away.

Wildlife

Even though bears and rattlesnakes were present in the project area, the real threat to project success were the elk that frequented the stream as a water source. When planting vegetation, heavy browsing had to be anticipated.

Bears prints in the stream channel.

A transplanted narrowleaf cottonwood being protected from the plentiful elk in the area.

On-site Effectiveness

<u>Effective/Innovative Use of Technology</u>

GPS-enabled equipment allowed the operators to follow the engineering plans as drawn. This was relatively new even for a big construction company like Kiewit in 2012 when the project took place. Traditional suvey staking was not necessary.

Landscape Conforms to the Natural Environment

Geomorphic reclamation of hillsides blends in perfectly with the surrounding terrain. See the photos included to for a good illustration. Water running down the hillside from above the project was conveyed through the project site as a natural channel or swale would do.

Clockwise from top left: Gob Pile 3 during construction; Gob Pile 3 after reclamation; Dillon Canyon channel in 2019; Dillon Canyon channel immediately after construction

Elimination of Significant Health or Safety Problems

A concrete block bulkhead with bat gate was constructed in an open adit and steel grate was constructed above a water well left over from the residential community. Steep slopes on the various gob piles were also graded out to more walkable terrain.

Concrete block bulkhead with bat gate centered in the middle.

Steel grate placed over rock-lined 25-ft deep mining community water well.

Funding

Effective Use of Funds

A large "time and materials" contract was a relatively new procurement method for the New Mexico AML Program. There was concern as to what would happen if an inefficient contractor was chosen for the project. Fortunately, Kiewit is a very efficient construction company and having WET and HMI providing the project management made everything run smoothly. Kiewit was chosen through an intensive procurement process through the New Mexico State Purchasing Division with potential contractors providing an in-depth proposal on their qualifications and evidence of past work. There was almost no project down time due to archaeological investigations or engineering redesigns.

Leveraging – Use of Partners for Funding and Technology

This project would not have been possible without the great cooperation of our partners. The Vermejo Park Ranch was very accommodating and provided help whenever called upon. OSMRE provided guidance and answered questions about funding and eligibility issues. The New Mexico Historic Preservation Division was patient and understanding while we were identifying and recording previously unknown archaeological features in the construction path which enabled us to keep the project moving. The various utility companies came out to the site upon request and made sure the project operated in a safe manner while protecting valuable infrastructure. Nicholas Bugosh of GeoFluv answered important questions about geomorphic reclamation design and helped with the subsequent Geomorphic Tour that visited various example project sites. Biologist Scott Altenbach was able to investigate the open adit and recommended the gate that was installed. The U.S. Army Corps of Engineers advised on the proper permit to obtain and how to mitigate the wetlands that were going to be temporarily impacted. Many others took part in the project and value of their experience and insights were most helpful.

Benefits to the Community

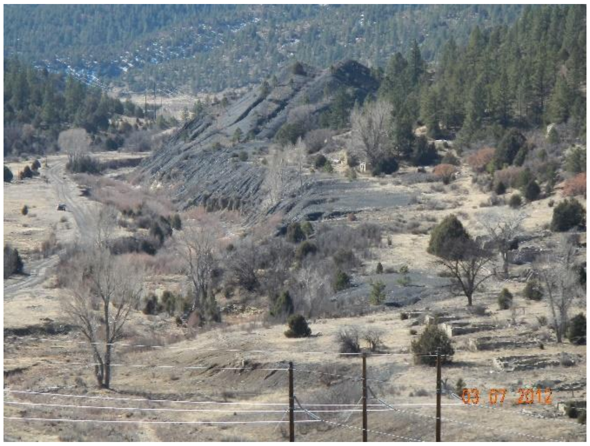
Community Support for the Project

Various schools from the region visited the site during field trips. They used nets to help catch fish that would have been impacted by the construction and transferred them to a safe haven upstream. The students heard from local residents that grew up in mining town, tested water quality and planted willows and cottonwood trees. All visitors agreed that they were very much in favor of the project and appreciated the opportunity to visit the private property that is usually off limits to the public.

Clockwise from top left: Zoe Isaacson giving a talk to midde school students; RiverSource learning about wetlands; the contractor giving a tour to students; high school students helping plant cottonwood trees

Long-term Benefits to the Community

The Dillon Canyon watershed is tributary to the Canadian River with its confluence located about 2.8 miles downstream from the project area. The Canadian River flows into Conchas Reservoir approximately 40 miles downstream of the project area. The coal gob piles addressed in the project were generally steep and actively eroding, sometimes contributing sediment directly into streams. The potential existed for precipitation to infiltrate through gob piles and seep back into streams and groundwater, possibly impacting these resources. Better quality water in the streams and more vegetative coverage are a benefit to the downstream users of the water source and the abundant wildlife in the area.



Surface Mining Control and Reclamation Act

The Spirit and Intent of SMCRA

This project might be considered a classic example of cleaning up old abandoned coal mines. Bringing a stream back to a functional state and removing coal gob piles that are not growing any vegetation is exactly why SMCRA is in place. SMCRA main intent is to safeguard hazardous coal mine openings and reclaim the environment affected by coal mining waste. An open adit and dangerous well were both safeguarded and no longer pose a danger to the public or wildlife.

Gob Pile 3 before construction took place.

Gob Pile 3 in 2019.

Increased Public Awareness of SMCRA

Local organizations and school groups brought to the site learned how a fee on active coal production is being used to clean up old coal mining problems. Residents of Raton that hadn't been to the mines in years had the opportunity to come on a walking tour of the reclamation. Many told stories about their childhood growing up in the mining camps. All visitors were made aware of the important role SMCRA is playing in reclaiming abandoned coal mines throughout the country.

Albuquerque TV station KOAT flew up to site to do a segment on the reclamation project. Interviews allowed staff to explain how SMCRA helps clean up the environment and provide jobs.

Transferability to Other AML Projects

The site is used as a showcase to showcase the benefits of geomorphic reclamation. People visiting the site now have a difficult time grasping that they are looking at an abandoned coal mine. The hillsides blend in with the natural surrounding landscapes and it is hard to tell the difference between the two. And the recontoured stream channel is also a learning tool for those that visit the site.

One stop on a Geomorphic Tour of sites in May 2014 was this project.

Additional Photos:

Culvert being placed on the new road route. The route was actually the old route created during the mining era. Note the preserved archaeological features in the foreground.

Compaction tests being conducted at the site of a culvert installation.

Gob regrading occurring near archaeological features. Great care was shown not to affect the pre-existing structures and artifacts.

Gob Pile 3 being reduced in size by excavating and transporting the material to borrow area repositories.

Gob pile being regraded to a lesser slope.

Regraded gob pile with clean growth material at the locations of drainage channels.

Clumps of willows soaking in the water before planting.

Planting willows and cottowoods in the newly constructed stream channel.

The channel along a reclaimed gob pile towards the end of construction.

Newly planted vegetation and erosion protective fabric planted on the sides of the channel.

Lime was used to neutralize the potential and the Sodium Adsorption Ratio, Gypsum was used to neutralize the SAR, and Fertilizer was used for nitrogen and to modify the C:N ratio of the compost

Site before construction:

Site immediately after construction:

Site before construction:

Site immediately after construction:

Site before construction:

Site immediately after construction:

View of the reclaimed Dillon Canyon in 2019.