Nomination
of the

# SUGAR CREEK

## Coal Refuse Pile and Mine Drainage Discharge Reclamation Project

for the
United States Department of the Interior
Federal Office of Surface Mining
2004 AML Reclamation Award

## ***Nomination Information***

### ***Project Name and Number:***

Sugar Creek Coal Refuse Pile and Mine Drainage Discharge Reclamation Project
Project No. AMD 03(1937)101.1

### ***Project Location:***

The project site is located in west-central Pennsylvania along State Route 68 between the Villages of Kaylor and Bradys Bend in Bradys Bend Township, Armstrong County. The project site is also located approximately 40 miles north-northeast of the City of Pittsburgh in the middle Sugar Creek watershed. Sugar Creek is a tributary to the Allegheny River which combines with the Monongahela River at the point in downtown Pittsburgh to form the Ohio River.

### ***Submitted By:***

**Pennsylvania Department of Environmental Protection**
Bureau of Abandoned Mine Reclamation, Cambria District Office
286 Industrial Park Road, Ebensburg, PA 15931-4119
Telephone: 814-472-1800
Fax: 814-472-1839

### ***Team Members Submitting the Nomination:***

| | |
|---|---|
| Roderick A. Fletcher, P.E. | Director, Bureau of Abandoned Mine Reclamation |
| J. Scott Horrell | Environmental Program Manager, Cambria District Office |
| Eric E. Cavazza, P.E. | Design Section Chief, Cambria District Office |
| Pamela J. Milavec | Environmental Services Section Chief, Cambria District Office |
| Dan Sammarco, P.E. | Design Engineer, Cambria District Office |
| William A. Dadamo, P.E. | Construction Section Chief, Cambria District Office |
| Thomas C. Malesky, P.E. | Construction Engineer, Cambria District Office |
| Donald C. Murray | Real Estate Specialist, Cambria District Office |
| Robert C. Nagle | Drafting Supervisor, Cambria District Office |
| Steve Bender | Environmental Project Inspector Suprv., Cambria District Office |
| Dale Yingling | Environmental Project Inspector, Cambria District Office |
| Kay Spyker | Water Pollution Biologist, Harrisburg Office |

### ***Construction Information:***

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|---|---|
| Project Contractor: | Casselman Enterprises, Inc., Somerset, Pennsylvania |
| Project Start Date: | September 19, 2002 |
| Project Completion Date: | September 10, 2003 |
| Final Project Construction Cost: | $660,019.95 |

### ***Date Nomination Submitted:***

March 2004

# THE SUGAR CREEK COAL REFUSE PILE AND MINE DRAINAGE DISCHARGE RECLAMATION PROJECT

## *EXECUTIVE SUMMARY*

The Sugar Creek coal refuse pile and mine drainage discharge reclamation project site is located in west-central Pennsylvania along State Route 68 between the Villages of Kaylor and Bradys Bend in Bradys Bend Township, Armstrong County. Figure 1 shows a local vicinity map of the project site. The project site is also located approximately 40 miles north-northeast of the City of Pittsburgh in the middle Sugar Creek watershed. Sugar Creek is a tributary to the Allegheny River which combines with the Monongahela River at the point in downtown Pittsburgh to form the Ohio River.

The Sugar Creek abandoned mine land reclamation project included the restoration of a 15-acre hazardous coal refuse pile and the passive treatment of an abandoned mine discharge, both of which were severely impacting water quality in Sugar Creek. The refuse pile was inventoried on the National Abandoned Mine Land Inventory as a high-priority health and safety hazard (keyword: DPE – Dangerous Pile or Embankment). The refuse material had been cast in the stream valley immediately adjacent to the Sugar Creek stream channel. Figure 2 shows an aerial view prior to reclamation of the project site showing the hazardous coal refuse pile situated along the southern bank of Sugar Creek. The pile was extremely steep, had very little vegetation, and presented a severe health and safety hazard for area residents who were using the pile for recreational activities such as ATV riding. ATV accidents, luckily resulting in only minor injuries, had been reported prior to reclamation. The toe of the pile extended into the stream channel and was constantly being eroded and undercut by the stream. The out-slope of the remaining refuse material approached 60 degrees and was very unstable. The mine drainage discharge at the site flowed from the abandoned Snow Hill Mine operated by North Penn Coal Company from the early 1930's until approximately 1960. Figure 3 shows a photograph of the discharge and the flow-monitoring weir. The mine was operated on the Lower Kittanning or "B" coal seam. The discharge was characterized as alkaline (70 – 140 mg/l as $CaCO_3$) with moderately high iron (15 –75 mg/l). The pH was circumneutral (6.0 - 6.8 s.u.), and the flow was moderate (80 – 320 gpm). The discharge severely impacted the stream water quality and habitat for over three miles downstream of the discharge to the point where Sugar Creek flows into the Allegheny River. The stream bottom was heavily coated with iron precipitate severely impacting aquatic life.

The refuse material was pulled back from the stream channel and regraded to stable slopes as part of the project. Large riprap was placed along the toe of the regraded pile for over 2,000 feet to prevent further erosion of the refuse into the stream channel of Sugar Creek. The pile was covered with limestone screenings and a soil cover and revegetated. A passive mine drainage treatment system was also constructed as part of the project. The system included a new wet seal with an air-trap at the discharging mine entry, a settling pond, and an aerobic wetland with limestone diversions designed to remove the primary contaminants from the mine drainage prior

to discharge to Sugar Creek. Work on the project began in September of 2002 and was completed in September of 2003.

Preliminary monitoring of the discharge from the passive treatment system constructed as part of this reclamation project and of the stream water quality downstream of the project has shown a dramatic improvement in water quality and a re-emerging community of aquatic life. Over three miles of the Sugar Creek have been restored, and this restoration has allowed for the re-establishment of indigenous aquatic life. Fish and macroinvertebrates have already begun to return to reclaim this waterway, once polluted by mine drainage. This project is exemplary because it combined the reclamation of a significant human health and safety problem resulting from past coal mining activities with aspects to allow for the environmental restoration of the barren landscape of the refuse pile and aquatic restoration of Sugar Creek which had been contaminated by this mine drainage discharge and eroding refuse material for over forty years. The Sugar Creek abandoned mine land reclamation project demonstrates the results that can be achieved when combining the reclamation of health and safety hazards with environmental restoration to maximize the benefits of abandoned mine reclamation work completed under Title IV of SMCRA.

## *MINING AND ABANDONED MINE PROBLEM HISTORY*

The Sugar Creek watershed has a long history of both coal and non-coal mining. Non-coal mining was conducted in the area to recover clay for firebricks and to recover limestone primarily for use in the extensive steel making industry that once thrived in the area. The coal was primarily mined to fuel the brick kilns and for domestic use. The abandoned mine features at the Sugar Creek project site resulted from coal mining conducted on the Lower Kittanning or “B” coal seam. The mine, known as the Snow Hill Mine, was operated originally by the Bradys Bend Coal Company and later by the North Penn Coal Company. The mine began operating around 1930, and operated until approximately 1960. Waste coal from the mine was conveyed to the surface and cast along the south side of Sugar Creek for approximately 2,000 feet creating the hazardous refuse pile that would remain an eyesore and safety hazard for local residents until implementation of the Sugar Creek project. Figure 4 shows a photogrph of the out-slope of the pile and the heavily degraded stream channel of Sugar Creek. Approximately 340,000 tons of refuse was cast in the stream valley during the life of the mine.

Following cessation of the mining operation, the mine was abandoned and groundwater began to fill the old workings. The workings filled up to a point where mine drainage began to discharge from the main mine portal directly into Sugar Creek. The poor quality of the discharge degraded the quality of the stream and caused most of the aquatic life to be unable to survive.

## *PROJECT BACKGROUND*

The Sugar Creek abandoned mine features were first evaluated for reclamation by PA-DEP-BAMR in the spring of 1992 at the request of local residents. Abandoned

mine features at the site included a mine drainage discharge, several collapsed mine openings and a 15-acre coal refuse pile with extremely steep and unstable slopes. The refuse pile qualified as a high-priority health and safety hazard, and was added to the Abandoned Mine Land Inventory as a priority 2 dangerous pile or embankment (DPE). The discharging portal and associated mine drainage qualified as priority 3 environmental degradation problems. The site was submitted for consideration along with many other sites, for funding under Pennsylvania's newly established 10% AMD Set-aside Program. By early 1993, a decision was made to further evaluate the Sugar Creek project site for possible reclamation. Preliminary contacts with all of the property owners to outline and discuss options for restoring the site were conducted during late 1993 and early 1994.

PA-DEP-BAMR established a sampling and monitoring program to analyze the deep mine discharge and its impact on Sugar Creek below the point where the discharge flowed into the stream. The sampling and monitoring for planning and project development purposes was carried out monthly from December of 1994 through December of 1996. During that Period, the flow rate ranged from a low of 80 gpm in August of 1996 to a peak of 208 gpm in April of 1995. The total iron concentration ranged from a low of 18.6 mg/l in June of 1996 to a peak of 73.6 mg/l in February of 1996. The majority of the iron was dissolved or ferrous iron. Manganese and aluminum concentrations were consistently very low (less than 1 mg/l for all sampling events except the August 1996 sampling date when the aluminum was 2.39 mg/l). The sulfates were consistently in the 150 – 300 mg/l range, and the pH was always in the range of 6.0 to 6.8.

The impact of the discharge on the aquatic environment of Sugar Creek was also evaluated during the planning phase of the project. Water quality sampling and biological surveys conducted upstream of the discharge indicated good water quality with a diverse macroinvertebrate population that included a number of pollution intolerant genera. Chemical sampling of the stream above and below the discharge point indicated that the in-stream iron concentration rose, on average, from 0.23 mg/l upstream to 1.62 mg/l downstream. Downstream of the discharge, biological surveys demonstrated that macroinvertebrate species richness and abundance were substantially decreased. Below the discharge, the stream bottom was heavily coated with iron precipitates which were adversely affecting aquatic life. The iron coating on the creek bottom was prevalent for over three miles downstream to the point where Sugar Creek empties into the Allegheny River. Erosion of refuse material into the stream channel was also noted and shown to be further degrading the aquatic habitat of Sugar Creek below the abandoned mine site.

## *PROJECT DESIGN APPROACH*

The Sugar Creek project was assigned for design in early 1997. Preliminary contact with the owner of the refuse material indicated that they were interested in pursuing re-processing of the refuse for use as fuel in an electric cogeneration power plant. Because removal or regrading of some of the refuse material would be necessary to construct a passive mine drainage treatment facility at the site, design activities were put on hold while the landowners pursued their interest in reprocessing

the refuse pile. By late 1999, the owners learned that the refuse material was of very poor quality and they could not generate any interest from any cogeneration facilities to reprocess the refuse. Design activities were reactivated in early 2000.

Analysis of the mine drainage discharges consistently indicated that the mine water was net alkaline with a moderate to high concentration of dissolved iron. The discharge did however periodically become net acid. In order to offset these periodic episodes of mine water discharge that was net acid, a small anoxic limestone drain (ALD) was planned to provide alkalinity during those periods. The ALD was not constructed due to elevation constraints discovered during construction. Other engineering difficulties at this site involved the complete capture of the discharge and the very limited space to construct a passive treatment system. A small tributary to Sugar Creek had to be relocated to accommodate construction of the treatment system.

Using the discharge monitoring data collected during the evaluation and planning phase of the project, a design flow rate of 170 gpm (the $80^{th}$ percentile) or 0.25 MGD was selected. A decision was also made to target the $80^{th}$ percentile of the total iron concentration observed during the pre-design discharge monitoring which was 37.6 mg/L.

The design of the passive treatment system was completed using the above design criteria. Due to the limitations of the proposed project site, including topography, the need to relocate a small tributary, and proximity to the stream, a passive treatment system consisting of a small anoxic limestone drain, and an approximate 0.3 acre (90 feet by 145 feet) settling pond followed by a multi-chambered aerobic wetland was laid out. The system was designed to allow for the rapid aeration of the mine water and for the necessary detention to allow for the oxidation, hydrolysis and precipitation of the iron sludge. The multi-chambered aerobic wetland treatment cells total approximately 0.8 acres (80 feet by 440 feet). Analysis of the on-site soils for engineering properties indicated that the material would be acceptable for construction of the earthen pond embankments.

In order to effectively reclaim the refuse pile, refuse material would need to be pulled back from the stream bank. The pile would require regrading to more stable slopes, and the pile would require capping with suitable soil material to allow for establishment of adequate vegetation to stabilize the refuse. Erosion protection in the form of riprap lining would also be incorporated into the project design to ensure the long-term stability of the re-contoured refuse pile.

## *PROJECT IMPLEMENTATION CHALLENGES*

Many challenges had to be overcome to implement the project including finding suitable access to the project site. Access to the site from State Route 68 would require crossing an active (at that time) railroad line and the construction of a ford crossing on Sugar Creek. Also, a small unnamed tributary to Sugar Creek that was impacted by the placement of the refuse material would require relocation in order to accommodate construction of the passive mine drainage treatment system. Finally, the old mine entry that the mine drainage had been discharging from for over forty years had accumulated

a significant plume of iron precipitate at the opening and in the discharge channel leading from the entry. Rehabilitation of the opening and capture of the discharge for routing into the passive treatment system would require careful planning and close monitoring during project construction.

Several permits and approvals were required for the project including a stream encroachment waiver, a wetland encroachment waiver, a stream re-location approval, a highway occupancy permit for access to the site from the state highway, and an NPDES permit for discharge of stormwater from construction activities. An agreement with the owner of the railroad line, Pittsburgh and Shawmut Railroad, was also required.

## *CONSTRUCTION SUMMARY*

The project design and permitting were completed in March of 2002, and bids were opened April 25, 2002. The contract for the project was awarded to Casselman Enterprises, Inc., 150 West Union Street, Somerset, PA 15501, and a notice to proceed was issued in August of 2002. Construction on the project began on September 19, 2002 and was completed on September 10, 2003. The bid price for the project was $597,060.00, and the final construction cost was $660,019.95.

The project was constructed as designed with the exception of the ALD. When the large plume of iron precipitate was removed from the face of the discharging mine entry, it became apparent that the invert of the mine opening was too low to accommodate the construction of the ALD. The limestone that was planned for use in the ALD was instead used to construct a series of four limestone diversions in the aerobic wetland. The diversions were constructed to distribute the flow more evenly throughout the aerobic wetland and to add a small amount of alkalinity to the mine water prior to discharge to Sugar Creek.

The principal items of work included 63,314 cubic yards of grading to re-contour the dangerous refuse pile slopes, 9,706 cubic yards of excavation for construction of the passive treatment system cells, placement of 22,748 cubic yards of soil cover material, construction of a new mine seal, 336 tons of high calcium carbonate ($CaCO_3$) content limestone (originally planned for use in the ALD) used for construction of limestone diversions, construction of several permanent channels, and placement of R-7 riprap for rock toe buttress to stabilize the toe of the regraded refuse pile. Figure 5 shows a photograph of the completed project with the passive mine drainage treatment system in the foreground and the re-contoured and reclaimed refuse pile in the background.

## *POST CONSTRUCTION MONITORING AND STREAM RESTORATION RESULTS*

The treatment system went on-line in August of 2003 and has been monitored for performance monthly since that time. Chemical and biological sampling of Sugar Creek has also been conducted to evaluate the effectiveness of the treatment system and to monitor the recovery of the aquatic ecosystem within Sugar Creek downstream of the project site. While the treatment system has been in full-scale operation for only six

months, Sugar Creek is already showing signs of recovery. The in-stream iron concentration within Sugar Creek below the old discharge site has consistently been below 0.5 mg/l. Other metals associated with the mine drainage discharge have been reduced to only trace amounts. Evidence of the severe iron coating and staining is already beginning to be flushed away. And most importantly, a macroinvertebrate study completed in November of 2003 shows that the number and diversity of aquatic species is already on the increase. The total number of taxa when compared to the pre-construction survey data increased from four to seven just below the site and from 7 to 12 near the mouth of Sugar Creek. The increases also show some pollution intolerant species beginning to colonize the stream below the reclamation project site. Biological surveys conducted prior to construction showed no pollution intolerant species below the point where the mine drainage discharge entered Sugar Creek. Minnows and other fish species have also been observed in the stream below the project site providing more evidence that the stream is recovering.

*Summary*

The Sugar Creek coal refuse pile and mine drainage discharge reclamation project reclaimed a 15-acre refuse pile, eliminating a significant human health and safety hazard, and coupled that effort with the construction of a passive mine drainage treatment system to treat the primary source of mine drainage in the Sugar Creek watershed. The combined reclamation effort not only made the site safer for local residents but also dramatically improved the aesthetics of the site by converting the once barren landscape of the refuse pile into a lush green hillside. The elimination of the erosion and sedimentation problems associated with the refuse pile coupled with the treatment of the abandoned mine drainage discharge is allowing for the aquatic restoration of the lower three miles of Sugar Creek. Figure 6 shows an aerial view of the completed reclamation project including the passive mine drainage treatment system and the re-contoured and revegetated refuse pile. The restoration of Sugar Creek will allow for the re-connection of the headwaters of the stream to the much larger Allegheny River providing spawning areas for native fish and enhanced recreational opportunities for local residents. The re-contouring of the refuse pile to more gentle slopes and the revegetation of the barren refuse pile material will provide improved wildlife habitat for deer, turkey and other native wildlife. This project is exemplary because it combined the reclamation of a significant human health and safety problem resulting from past coal mining activities with aspects to allow for the environmental restoration of the barren landscape of the refuse pile and aquatic restoration of Sugar Creek which had been contaminated by this mine drainage discharge and eroding refuse material for over forty years. The Sugar Creek abandoned mine land reclamation project demonstrates the results that can be achieved when combining the reclamation of high-priority health and safety hazards with environmental restoration to maximize the benefits of abandoned mine reclamation work completed under Title IV of SMCRA.

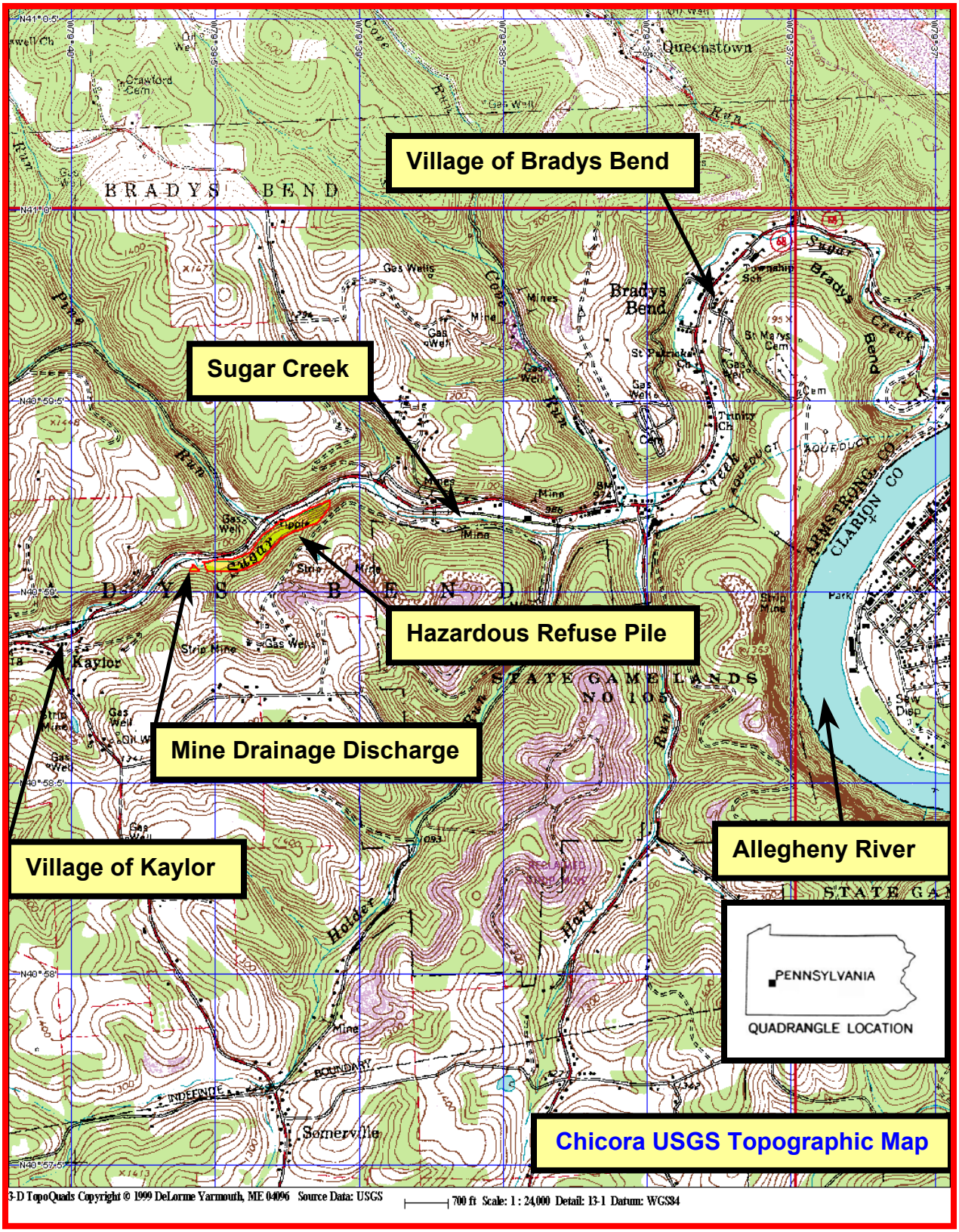


**FIGURE 1 –** Project Location Map (Source: DeLorme 3-D Topo Quads – 1999)

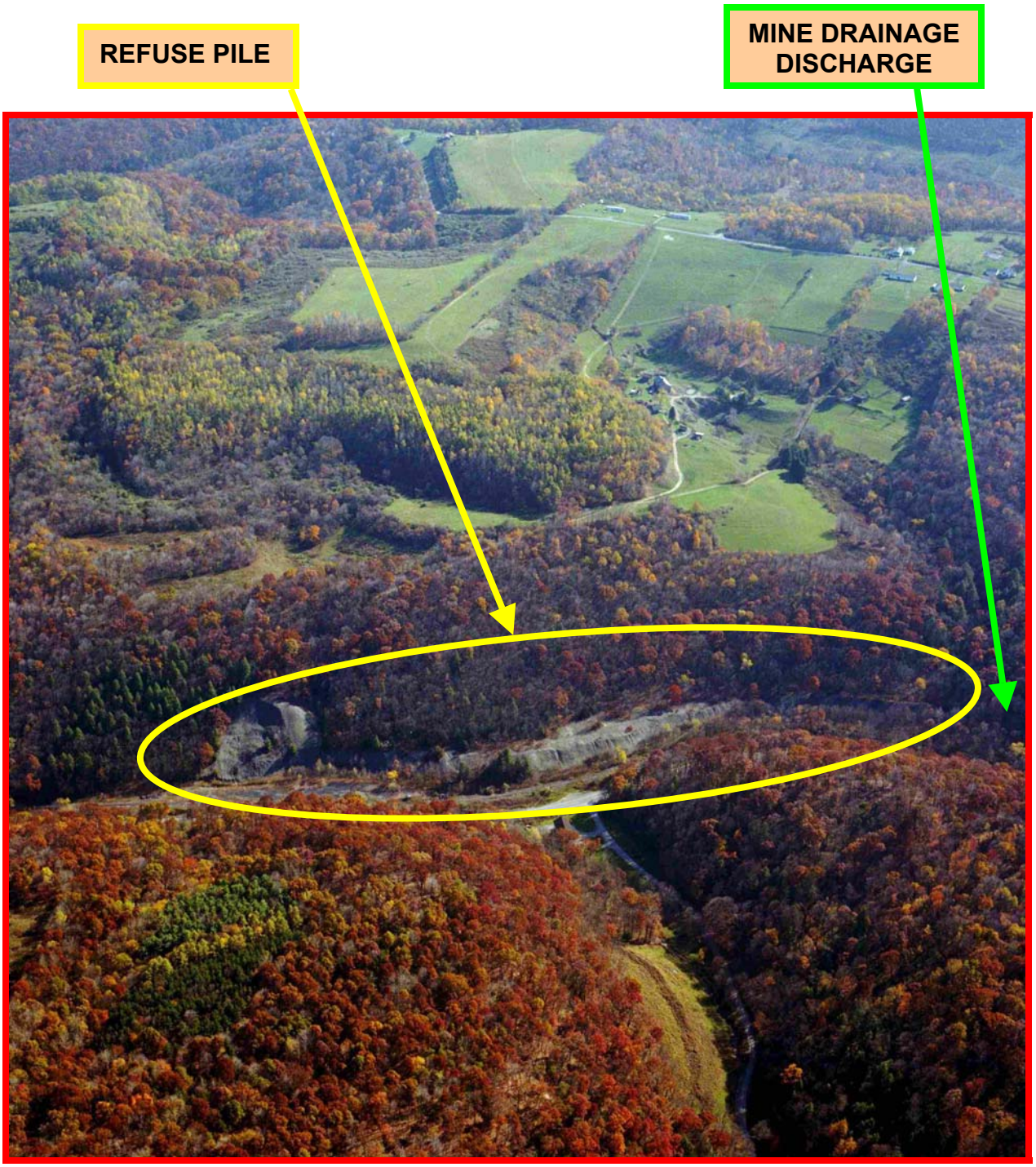


**FIGURE 1** – Photograph of the Sugar Creek Refuse Pile and Mine Drainage Reclamation Project site Prior to Restoration

**FIGURE 3 –** Photograph of Mine Drainage Discharge from the Abandoned North Penn Coal Company, Snow Hill Mine, Showing the Flow Monitoring Weir

**FIGURE 4 –** Photograph Showing the Extremely Steep Outslope of the Coal Refuse Pile with the Toe of the Pile Extending into the Stream Channel. The Iron Stained Stream Bottom of Sugar Creek is also Evident in the Photograph.

**FIGURE 5 –** Photograph of the Completed Passive Treatment System and the Reclaimed Coal Refuse Pile Restored as Part of the Sugar Creek Project

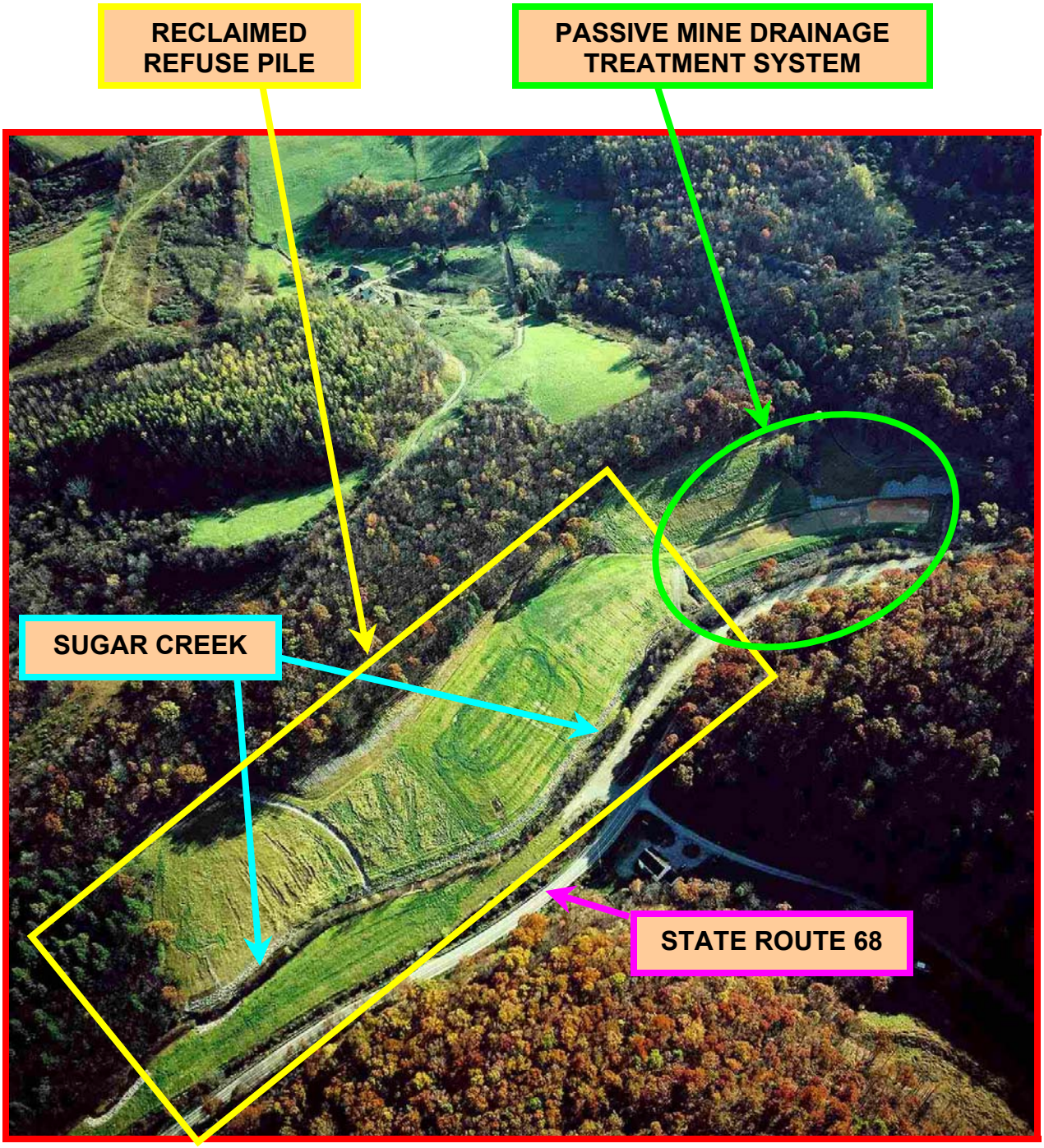


**FIGURE 6** – Photograph of the Sugar Creek Refuse Pile and Mine Drainage Reclamation Project Following Restoration