

Final Report: DEP Growing Greener Grant SW10395 (ME#351277) July 2001– June 2003

Evaluation of Discharges From Abandoned Coal Mines in the Lower Chartiers Creek Watershed

Technical Report

What was project supposed to accomplish?

The two year DEP Growing Greener \$50,800 study of nine major AMD discharges to the main channel of Chartiers Creek between Bridgeville and Carnegie concluded in July 2003. Consultants who conducted the technical aspects were GAI Consultants and Hedin Environmental, Inc. The study: “Evaluation of Mine Discharges from Abandoned Coal Mines in the Lower Chartiers Creek Watershed” aimed at monitoring the flow and chemistry of each surface discharge and gathering and scanning maps of the deep underlying mines in order to enable developing a GIS map-based hydrologic model. The study served to update our understanding of this leading threat to water quality in the lower Chartiers watershed, since it was last studied by the 1970 Operation Scarlift survey. In that thirty-year span much had changed. New discharges appeared, others disappeared, discharges changed in chemistry and flow, and information about the mines grew. With the completion of the Lower Chartiers Creek Rivers Conservation Plan (March 2001), this study was considered the first implementation of its recommendations. The study serves as the first step, an understanding of the discharges and their causes, and now advantages us toward remediating AMD impact.

Goal: To understand AMD surface discharges and their mine pool sources

Objectives: Measure discharges and develop GIS-based hydrologic model

Method:

- Monitor flow and chemistry monthly for one year to characterize nine major surface discharges;
- Compile and scan deep mine maps to characterize underground topography and mine pools.

Chartiers Creek dissects the Pittsburgh Coal seam. Discharges on the east side of the creek are hydrologically separated from ones on the west. The Pittsburgh Coal outcrop crosses Chartiers Creek just south of Bridgeville and Millers Run, southwest of Gladden. The primary mining method to extract coal in the study area was to deep mine. Within Allegheny County nine major discharges from underground mines begin at about “Mile 16” (Bridgeville) with the Wingfield Pines discharge (located on an 80 acre site recently acquired by The Allegheny Land Trust) and end at “Mile 7” with the Whiskey Run discharge (Parkway West). These discharges degrade water quality below Bridgeville in the last 16 miles of the main channel as it reaches the Ohio River. Adding a 3 mile section of the ‘old back’ (original) channel that skirts Bridgeville and Scott Township, and almost 8 miles of tributaries (Coal Run .2, Millers Run 4.0, Presto seep .2, Mclaughlin Run 1.0, Woodville seep .1, Scrubgrass Run .2, Georges Run 1.5, Whiskey Run .7) gives about 27 miles of creek water with poor chemistry and brownish iron-laden turbidity, which challenges aquatic life, habitat and aesthetics.

What was done and how did it differ from plan?

What were the successes and reasons for success?

What problems were encountered and how were they solved?

Each discharge was measured for flow (gallons per minute – GPM) and chemistry (pH, temperature, alkalinity, iron, aluminum, manganese, sulfate, acidity, conductivity). Flows were measured by a variety of means including flumes, weir, stream gauge or timed container fills from piped discharges. Chemistry was measured with field devices or PADEP lab analyses. Maps for the underlying mines were obtained and geo-referenced to form a GIS database. Maps were obtained from the Office of Surface Mining and the University of Pittsburgh Library. A base map for the area was prepared by the Works Progress Administration (WPA). Some of these maps were originally prepared by the Pittsburgh Coal Company. Contours (underground topography) of the mine floor elevations were developed by GAI and discharge points were referenced. The result is a topographical representation of the mine substructures that provides dimensional understanding of the location, variable contours and elevations, slopes and direction, capacity, mine pool sources and discharges. It is interesting to note that the “recharge area”, the mine sprawl that drains each discharge, ranges from 1080 acres (Whiskey Run) to 4400 acres (Scrubgrass/Woodville). Six hundred forty acres (640) equal one square mile. That gives some idea of the sprawling dimensions of the mines that honeycomb beneath.

For the most part monitoring and compiling maps went according to plan. There were some technical difficulties installing one large weir at Gladden site, but it was finally done near the end of the project. Before its installation, flows were calculated using an indirect instream flow meter. Two others site required instream or tank-filling flow measures. Compiling maps from a couple sources took longer than expected and some were not as detailed as others, but for the most part this task was satisfactorily completed and accomplished according to plan. The entire project proceeded on schedule through the combined competence and dedication of engineering and environmental consultants.

How does the work contribute to the solution of original problems?

The original problem was to update an understanding of the chemistry, physical characteristics and underlying mine sources for discharges. This project accomplished exactly that and is described comprehensively by engineering and ecological detail in the consultants bound report by GAI Consultants and Hedin Environmental, Inc. The following is a brief description of the monitoring and mine structures for each site.

Whiskey Run

The Whiskey Run discharge is located in Green Tree Borough and is the northern most of the discharge points. It is easily seen after defoliation on the right inbound on the Parkway West about a half mile past the Carnegie exit. It appears as a chocolate brown cone on the hillside. The fouled Whiskey Run then continues about .7 mile under the Parkway and emptying into Chartiers just below the Parkway crossing at a point of about 7 miles from the Ohio River. It is an upwelling in iron deposit. While it has the lowest pH, its flow volume is among the lowest of the nine discharges and accounts for the lowest iron loading. A small flume was installed for flow measure.

There are four mines in the vicinity. There is probably no pool. The discharge point is at the lowest part of the mine workings, so that water can flow along the floor to the opening with no intervening pool. There are indications that a drain to Whiskey Run was installed in order to direct the discharge to the existing outlet.

Based on an average discharge of 170 gpm and a drainage area of 1080 acres (1.7 sq mi), the average recharge (continuing feed of water) is .16 gpm/acre.

Hope Hollow

Located in Scott Township about 1.5 miles southwest of the Whiskey Run discharge and a quarter mile east on Hope Hollow Road, the largest measured discharge is easily seen gushing down about 30 feet from under the high railroad bridge. This outlet and seeping from the entire hillside fouls Georges Run for its 1 ½ mile-run to the main channel. It's a very visible eyesore and sometimes it is foul-smelling. During the course of the year, another discharge was investigated on the opposite side of the same hill and at the same elevation. Its chemistry was similar, but about 10 % of the flow (50 gpm). It has been named the "O'Hommel Discharge", because it is on property owned by the O'Hommel Corp. It comes from the original main entrance to the Mansfield Mine. The main discharge has moderate flow, but the second largest iron loading and acidity.

There are four identified mines that may drain to this site. The Recharge area is about 2,550 acres with an average inflow of about .20 gpm/acre. Adding the O'Hommel discharge would net an average discharge of 600 gpm and .23 gpm/acre inflow. If O'Hommel was sealed, all of the drainage could be directed to the Hope Hollow discharge, which could be directed to another location for more effective remediation. The drainage originates at an elevation of 1010 land, goes west to the outlet at 884. Mining occurred in the early 1900's. There is probably only a small local pool at the discharge.

Scrubgrass & Woodville

Located in Scott Township both discharges share the same hill and mines, are 1,200 feet apart, have similar chemistry, and are 1 mile upstream on the main channel from Hope Hollow. The first passive remediation project was initiated at Scrubgrass in 1995 by the Scott Conservancy and Scott Township and monitored by an environmental studies program at Chartiers Valley High School. This site can be visited by the public and is a short distance off Scrubgrass Road from the intersection of Bower Hill/Woodville Road. The remediation project features ponds, active aeration system to speed oxidation and settling and wetland vegetation. However remediation is not complete and the remaining .2 mile of Scrubgrass Run is degraded, especially since the discharge accounts for practically all of the flow in the summer and most of the year. The upper part of the creek functions more as stormwater runoff. The normal flow could be disappearing into the mines

The discharge at Scrubgrass is net alkaline, relatively low flow and consequent iron loading, but relative iron content is high enough and the site is accessible enough, that Hedin Environmental began to pilot an iron recovery process. Flow is measured with a weir.

The adjacent Woodville discharges from a higher elevation and tumbles 40 feet down an embankment above the railroad. In the dormant season this brown cone is easily seen from an office building's parking lot (ChemTech) that is across the old back channel as it rejoins the new main channel. The discharge is piped under the railroad to the back channel and adds a distinct stain at that confluence of the big channels. Flow is measured from a flume that was installed about 20 down from the upwelling. This site was studied by senior engineering students of the University of Pittsburgh in Fall of 2002. They proposed remediation by passively piping the discharge along the railroad for 1.7 miles to the mouth of McLaughlin Run on the back channel, where both the McLaughlin and Woodville could be passively treated on a small floodplain. Since the discharge is over 40 feet above grade, they estimated that there was enough "head" (water pressure) to carry the discharge that far.

The flow upwells from a thick iron deposit and is the smallest volume of all of the discharges at 120 gpm. It also has high iron content, but with low flow accounts for a small iron loading.

The mines that drain both discharges are several and have a combined recharge of about 4,400 acres and an average recharge flow of about .07 gpm/acre. Drainage originates at 1010 feet and drain at about 830. Again mining occurred in the early 1900's. There may be a couple small pools at the sites. It may

be possible to seal one of these discharges and direct drainage to one or the other or to a remote site. Mine maps are not detailed enough to make any assumptions without further investigation. However since it is probable that much of Scrubgrass Run, as an active creek, is disappearing into the mines that feed these discharges, it may be possible to seal the creek and restore its normal flow. This could decrease the discharges and result in reducing pollutants entering Chartiers Creek.

McLaughlin Run

This discharge is located in Bridgeville at about 3 miles southwest of the Woodville discharge. It comes from an 18" pipe running under McLaughlin Run Road and a road side business and empties into McLaughlin Run creek, which continues degraded for a 1 mile run to the back channel. Flow was measured with a timed-tub-fill. At 230 gpm, the flow ranks 6th. It ranks 2nd in aluminum and has moderate acidity. It is 6th in iron loading and 4th with iron content.

Because of the network of mines under and nearby, there are several speculations about the source of drainage and where the drainage is pooling. Some of these mines may be leaking into each other from miles around, such as from Bethel Park and Mt Lebanon. Barriers between them may or may not be functioning. Without further investigation, the recharge area is estimated to be 1700 acres with an average inflow of .13 gpm/acre. It may be possible to seal this discharge and redirect it to the south toward, but not necessarily to, Wingfield Pines.

This, in addition to what so far has been discussed, would tend to underscore that many of these discharges may be related due to topography, mine network and mine elevations. It also underscores the need for continuing comprehensive and systematic investigation of the mines in these sub-watersheds.

Coal Run

This discharge is located in South Fayette Township and is about .7 miles southwest of the McLaughlin Run discharge and .3 mile south of the Bridgeville exit on Washington Ave. Unlike any of the other discharges it, this one emerges from the within the streambed of Coal Run, just 100 feet upstream from the Rt 50/Washington Ave crossing. One discharge is several inches above stream flow at base flow, but quickly is submerged with any runoff. Its reported flow is 910 gpm, but this is not an isolated discharge, like the others, which are measured by flumes, weirs and pipes. It is the discharge-laden stream-flow. Nonetheless the iron loading ranks third at 158 kg/day, higher than its closest cousin, Wingfield Pines (114), which lies several hundred yards upstream and across Chartiers Creek. It fouls about .2 miles of Coal Run before joining Chartiers. The alkalinity concentrations, 350-450 mg/L are very high values for AMD. Since it was measured during Operation Scarlift (1960s), its flow and iron have been halved. It has also become substantially more alkaline.

Unfortunately the existing maps do not show the full extent of mining, so that the extent of the recharge area and potential mine pool cannot be determined.

Wingfield Pines

This discharge is located in Upper St Clair Township in the 80 acre floodplain that The Allegheny Land Trust just acquired. Located at 'mile 16', it is the uppermost AMD discharge in Allegheny County. It discharges directly into Chartiers Creek, instead of into any tributary. This was not one of the original eight sites included in this CNC DEP Growing Greener Grant. The Allegheny Land Trust had its own GG Grant to monitor and design remediation. Monitoring was done by a local conservation group, USS Citizens for Land Stewardship. They agreed to volunteer their data to our final report in order to complete our profiling of all of the major AMD discharges to Chartiers Creek in the lower watershed.

CNC and our technical consultants will continue to collaborate as partners in the AMD remediation effort.

Wingfield Pines has the highest flow of all nine discharges at 1500 gpm. The discharge upwells in a concrete structure located at the base of a surface mine highwall. It is strongly net alkaline for an AMD discharge at 425 mg/L. While the iron content at 14 mg/L is the lowest of the nine, the iron loading, given the flow volume, ranks 4th.

Some of the mining appears to have been done in the 1930-40s and one nearby mine was active into the 1970s. Here again speculation about the actual mine structures, contours, and whether tunneling barriers are intact leads to possibilities of sealing, raising a pool and relocating the discharge. The recharge area is estimated to be 1300 acres with a relatively high recharge rate of 1.15 gpm/acre (highest among the other discharges).

Presto-Sygan

This discharge is located in South Fayette Township on the west side of Chartiers. It flows from an old stone structure and flow is measured with a flume 30 feet away. The flow ranks 4th. Unlike the other discharges it has the highest amount of aluminum (aluminum hydroxide solids). At 12.9 mg/L with an obvious milky white sediment and turbidity, it has almost four times the aluminum of the second highest other aluminum discharge (McLaughlin). It has the third highest acid loading. Compared to the other discharges, it has the most variable flow and chemistry. Comparing these findings with those of Operation Scarlift of forty years ago, it had twice the acidity and two-thirds greater flow.

There are many mines that drain to this point giving it the second highest recharge area at 3400 acres, but with the flow measures, the average recharge is comparatively low at .12 gpm/acre. Mine drainage originates near Oakdale at an elevation of 1020 and the discharge is at 830. A large pool would be expected to cover about 200 acres with the top of it at the discharge elevation (830). There may be two other pools within the mine complex and almost 2 miles northwest of the discharge pool. One of these pools may discharge to Thoms Run during high flow conditions. A large pipe is located there, and has evidence of mine drainage with orange staining and should be monitored in the future.

Gladden

Located in South Fayette and west along Rt 50 from the Bridgeville I79 ramp, this discharge comes from a steep ravine at the junction of RT50/Millers Run Rd, and after 200 feet enters Miller Run Creek. With its second highest flow (1430 gpm), it degrades 4 miles of Millers Run before it enters Chartiers Creek just upstream of the Presto-Sygan discharge. It has the highest iron and second highest manganese content, and with its high flow accounts for the highest acid and iron loading (half of all of discharges combined).

Operation Scarlift data is still similar to current measures for flow and iron concentrations, except for acidity which has declined in the last 30 years.

A large portion of the mine maps are non-detailed, so additional investigation is needed. The recharge area is about 1,600 acres with an average flow of .89 gpm/acre. The mine drainage originates at 1020 and discharges at 900 elevation. Much of the site terrain was modified during construction of the four-lane portion of Rt50 after mine maps were drafted. There is probably a pool at an elevation that is the same as the discharge, but may only be about 10 acres. Another pool may exist about 1.4 miles northwest of the discharge and could be 270 acres.

The high drainage area and flow may be a result of being less urbanized with more infiltration or could be a result of rainfall and loss of stream into the mine. This potential stream loss should be investigated.

Summary

In aggregate the discharges are net alkaline, adding about 3,781 kg (8,500 lb)/day of alkalinity to Charters Creek. This explains why the main channel maintains a circumneutral pH of about 8.0. Locally however, there are acidity problems in about 6 miles of tributaries below the points of four of the discharges. These include the 4 miles of Millers Run, 1 mile of McLaughlin, .7 miles of Whiskey Run and .2 miles of Georges Run (Hope Hollow). They add about 1354 kg (3000lb)/day.

Mine maps were identified for most of the discharges in detail, enough that the probable extent of mine pools and their paths could be established. The extent of mine drainage zones was also established. The mine discharges drain approximately 16,000 acres (excluding Coal Run) of abandoned mines. Most of the mines had an average recharge of about 0.15 gpm/acre of mine drainage area. The two exceptions were Gladden and Wingfield Pines discharges (the highest flows by total volume, but having the lowest recharge area), which were closer to 1.0 gpm/acre of mine drainage area.

This mine map and information adds a new and significant dimension to AMD remediation. It can be used to determine not only the best, but also a technically feasible location for treatment. The most important consideration for passive treatment is land area, not volume. Suitable land area that is close to these discharges is a scarce resource. Understanding the mine sprawl and contours may suggest ways of re-engineering discharges to accommodate available areas for remediation.

Technical data, maps and comprehensive description are given in the Technical Report of GAI Consultants and Hedin Environmental.

What else needs to be done?

The objectives of understanding the characteristics of the discharges and hydrology have been achieved. The next step to be done is to use this data and understanding for designing remediation.

What are plans for disseminating results of work?

A comprehensive summary of the project will be published on Chartiers Nature Conservancy website and in the fall 2003 issue of our newsletter, which is sent to 400 subscribers that include public and official agencies, local and national watershed groups, members, and schools

How well did spending align with budget?

Spending was limited to budget, which was supplemented with some private funds procured for the project by the DEP grant manager. Contractors and the grant administrator spend within their budgets.

Enhancements

Attention to AMD in Chartiers Watershed

The project drew attention of watershed community, universities, and public. There are six local volunteer watershed organizations with memberships totaling about 500. These organizations supported the initiation of the project and informed their members. Two universities conducted three ancillary research and design projects on sampling sites. Six tours were conducted for 61 individuals representing these organizations and state agencies. Articles were published in two issues of watershed newsletters and reached almost 1000 people representing official and private agencies, foundations, universities, watershed groups, and individual subscribers. Volunteer hours performing monitoring, touring, site preparation and other support totaled 160 hours. Public relations with land owners created more education and awareness and gathered more support. Foremost was that this project was the first comprehensive AMD assessment project in over 30 years and reawakened attention to the number one problem affecting water quality in the Chartiers Creek Watershed.

Summary for Sharing with the Public

The two year DEP Growing Greener \$50,800 study of nine major AMD discharges to the main channel of Chartiers Creek between Bridgeville and Carnegie concluded in July 2003. Consultants who conducted the technical aspects were GAI Consultants and Hedin Environmental, Inc. The study: “Evaluation of Mine Discharges from Abandoned Coal Mines in the Lower Chartiers Creek Watershed” aimed at monitoring the flow and chemistry of each surface discharge and gathering and scanning maps of the deep underlying mines in order to enable developing a GIS map-based hydrologic model. The study served to update our understanding of this leading threat to water quality in the lower Chartiers watershed, since it was last studied by the 1970 Operation Scarlift survey. In that thirty-year span much had changed. New discharges appeared, others disappeared, discharges changed in chemistry and flow, and information about the mines grew. With the completion of the Lower Chartiers Creek Rivers Conservation Plan (March 2001), this study was considered the first implementation of its recommendations. The study serves as the first step, an understanding of the discharges and their causes, and now advantages us toward remediating AMD impact.