

## **A Restoration Plan for Large Acid Mine Drainage Discharges in the Lower Chartiers Creek Watershed Basin**

### **Chartiers Nature Conservancy**

#### **Background**

Chartiers Creek arises in Washington County and flows northward into Allegheny County to its confluence with the Ohio River in McKees Rocks (one mile downstream of the Point). The Pittsburgh coal seam occurs throughout the watershed and has been extensively mined. Long abandoned underground coal mines in the middle watershed have produced polluted drainage for decades. The first major uncontrolled mine discharge to Chartiers Creek occurs at the Wingfield Pines site in the Borough of Upper St Clair. Moving downstream (north), Chartiers Creek is degraded by contaminated flows from deep mine entries along the main stem and by AMD-polluted tributaries. Major AMD discharges occur in Coal Run, Millers Run, McLaughlin Run, Scrubgrass Run, Georges Run, and Whiskey Run. Beyond Whiskey Run (Carnegie PA), there are no more known inputs of AMD to Chartiers Creek. Figure 1 depicts the major discharges in Lower Chartiers Creek.

In 2001, the Chartiers Nature Conservancy (CNC) received a Growing Greener grant to assess major mine drainage problems in the lower watershed. The work plan included flow measurements and chemical sampling at eight discharge locations and the collection, digitization, and integration of mine maps for mines responsible for the discharges. As of January, 2003 the project is on schedule. Twelve months of sampling were completed in December 2002. All mine maps have been collected and final digitization is underway. A final report will be submitted by CNC to PADEP by June 30, 2003.

In 2001, the CNC developed a Rivers Conservation Plan for the lower watershed. The Plan identified abandoned mine drainage as one of the primary water quality concerns of Chartiers Creek. Other problems were identified such as sewer overflows and nonpoint runoff from agricultural, industrial and commercial properties. These problems are being addressed by other entities in the watershed. The mine drainage problems are generally being neglected.

With the data collected in the assessment in hand, CNC now is requesting funding for the development of the restoration plan for the large mine drainage discharges in the lower watershed.

## **Work to Date**

Table 1 shows the average flow rate and chemical characteristics of the ten largest deep mine discharges to the main stem of Chartiers Creek. Eight of the discharges were monitored in 2002 by CNC with funding provided by the Growing Greener grant. Flow rates and samples were collected monthly. Data for the Wingfield Pines discharge were obtained from the Greensburg District Mining Office. The data were for samples and flows measured by the local mine inspector and Citizens for Land Stewardship.

Mine maps were collected from various sources (OSM, PADEP, CONSOL, and University of Pittsburgh Library), scanned into computer format, geo-referenced and formatted into a GIS system. Interaction using computers with the sites topography and local mine maps can now be accomplished. Members of PADEP staff attended the initial demonstration that was held at GAI Consultants, Inc., offices in September 2002. The maps show the mines and mine features responsible for the discharges. Using the topographic features of the maps, mine pool drainage basins were developed. Figure 1 shows the mine pool drainage basis associated with the Presto-Sygen discharge. Additional maps for each discharge are being developed for the assessment final report (due June 30, 2003).

## **Proposal Scope of Work**

### Restoration Plan

A restoration plan will be developed for managing and remediating large deep mine discharges in the lower Chartiers Creek watershed. The restoration plan will include the following elements

- Review of the hydrogeological setting of the watershed
- Review of historical activities that have affected Chartiers Creek
- Review of historical mine drainage assessments and studies
- Summary of recent discharge assessment activities by CNC and others
- Contaminant loading calculations for the discharges
- Assessment of the impact that the discharges have on the quality of Chartiers Creek
- Survey of fish and invertebrate abundance in Chartiers Creek and AMD-affected streams
- Identification of key property owners
- Presentation of a prioritization matrix that facilitates the identification of priority remediation projects
- Presentation of several conceptual remediation plans for each discharge and a detailed presentation of the preferred alternative

The assessment of AMD impacts on Chartiers Creek will fill in data gaps. The 2002 assessment focused on discharges. No in stream samples were collected. Three rounds of in stream samples will be collected from Chartiers Creek and AMD-impacted tributaries to document water chemistry above and below major AMD inflows. Flows will be measured with a flow velocity meter, where possible.

A fish and invertebrate survey will be conducted during the summer of 2004 at in stream points affected by inflows of mine drainage. *Sampling procedures to be provided by GAI.* Sampling stations will be established above and below AMD inflows on Millers Run, Coal Run, McLaughlin Run, Scrubgrass Run, Georges Run, and Whiskey Run. Similar surveys will be conducted on Chartiers Creek above and below the inflows of the Wingfield Pines, Woodville, and Presto Sygan discharges. The Wingfield Pines upstream station represents Chartiers Creek above any inflows of untreated mine drainage. A station will be established in Chartiers Creek below the inflow of Whiskey Run. This is the last inflow of mine drainage to Chartiers Creek.

County property maps will be obtained so that important landowners can be easily determined. Owners of properties that would be affected by possible treatment systems or the piping of water from discharges to treatment areas will be identified.

The prioritization matrix will be developed to determine for each discharge: the environmental impact of the flow; the feasibility of passive or active treatment plans; the availability of land for construction of a treatment system; the cost of treatment; the potential reuse of products produced by the system; and the public benefits of the project. This is a preliminary matrix list. The final matrix elements will be determined after discussions with CNC, DEP, and our consultants.

A detailed remediation plan will be developed for the eight discharges monitored in 2002 by CNC. Each plan will include: a presentation of the discharge characteristics and its impact on the receiving stream(s); an explanation of the selected treatment plan; a prediction of the treatment system effluent chemistry and its affect on the receiving stream; a cost estimate; an O&M&R estimate; and a plan view of the proposed system (plotted on USGS or Allegheny County topographic and tax maps). The individual plans will be prepared so that they can be readily extracted from the Restoration Plan and incorporated into proposals or other watershed reports.

The Allegheny Land Trust is developing a treatment plan for the Wingfield Pines discharge. CNC will stay apprised of the Trust's progress and assure that its plans are incorporated into the Restoration Plan.

CNC is aware of the DEP's current TMDL activities in the Chartiers Creek watershed. The final TMDL report for Chartiers Creek should be available before this project begins. CNC will thoroughly review the TMDL report and assure that none of the activities undertaken in this project repeat efforts already completed in the TMDL development. CNC will meet with the DEP in the early stages of the Restoration Plan development to assure that our AMD remediation plans and the prioritization process incorporate appropriate TMDL concerns.

The Restoration Plan will be developed with public input. Three public meetings will be sponsored by CNC to support the project. There will be a project kick-off meeting to announce our intentions and solicit immediate input from the public. There will be a

mid-project public meeting where remediation alternatives will be presented and, again, public input will be requested. There will be a final public meeting where the final Restoration Plan is presented.

#### Mine Water Usage Investigation

Our project team has significant experience in identifying and developing systems that extract value from untreated mine pools, mine discharges and mine treatment system products. CNC believes that the Chartiers Creek watershed is an ideal location to promote use of the mine water. Several potential uses that have already been identified are: production of pigment-grade iron oxide; production of a commercial-grade water for use in industrial applications; use of the temperature characteristics of mine water for cooling and heat-pump applications; generation of electricity with low-head turbines and trout hatcheries. These applications and the proposed investigation process are discussed below.

- FeOOH Production. The discharges are primarily contaminated with Fe. One of our consultants, Hedin Environmental, has recently produced a marketable iron oxide product from mine drainage. Dr. Hedin will use this knowledge to assess the iron oxide production potential of the Chartiers Creek discharges. The analysis will include an estimate of the proportion of long-term costs that could be off-set with royalties from iron oxide recovery.
- Water Production. The treatment systems will produce alkaline water with low metal concentrations. Several of the polluted mine discharges emanate within several thousand feet of industrial parks that contain businesses that are major users of city water. A market for treated mine water, as an alternative to city water, might be identified. A complete analysis of the treated water will be conducted for use in discussions with potential industrial water users. (The sample will be collected from the Scrubgrass treatment system.) CNC will identify major water users within two miles of each discharge and survey these users for information on the quantity of water used, the quality requirements, and their ability to switch to a commercial-grade mine drainage product. The costs to provide additional water treatment (chlorination, uv, etc.) and to deliver water to customers will be determined. Follow-up discussions will be held with potential users of the treated mine water to determine the issues influencing a decision to purchase a treated water product.

It is possible that an industry that could use treated mine water does not exist near the discharges. However, the presence of 500,000 – 1,000,000 gallons per day of commercial-grade water might be useful for attracting new industry to the area. Industries that would value use large quantities of treated mine water will be identified and described in the report.

- Exploitation of Temperature Characteristics The deep mine discharges have a constant temperature of 50-55°C. This constant temperature could have value to an industrial process that requires cooling. One of our consultants,

Robert Hedin, recently attended a conference in Britain where the use of mine pools to operate heat pumps was described. The feasibility of adapting this technology to the Chartiers Creek mine pools will be evaluated. Estimates will be made of the heating and cooling potential of each discharge. Values (\$) will be determined for these potentials and the cost of installing appropriate technologies will be determined.

- Power Generation Some of the discharges are a result of head pressure that exists within the partially flooded abandoned mines. This head might be used to drive low-head turbines and generate electricity.
- Fish Hatcheries Trout hatcheries in the commonwealth typically experience difficulties during dry, hot summers. Successful trout raising is accomplished through the use of a ample supply of water that is cool, has a high oxygen and is alkaline. These conditions should exist for mine drainage treatment facilities constructed in the Chartiers Creek valley. One of our project consultants, GAI, recently worked with Duquesne Light Corp to establish a trout raising facility at their Warwick Mine treatment plant in Greene County.

Other uses for the mine water and treatment products that arise will be evaluated by CNC and our consultants. The results of the Uses Investigation will be presented as a stand-alone chapter in the Restoration Plan. We will present the chapter (as a report) to a Growing Greener conference so that the results will be of value to other groups who are considering this unique and topical aspect of AMD and AMD treatment.

#### Treatment Plans for Two Sites

Two of the projects developed in the restoration plan will be developed into detailed conceptual plans. We will select the first and second priority projects as identified in the prioritization process. The projects will be developed to a point of confidence where the submittal of a design/construct proposals to future rounds of Growing Greener would be justified. The treatment plans will include system layouts, property ownership determinations, analyses of key engineering issues, permitting recommendations, construction cost estimates, system operation and maintenance expectations and costs, and identification of customers for system products. *More on these project plans*

#### **Related projects in the Watershed**

Although significant, mine drainage problems are not the only problems in the watershed. In 2001 the CNC developed a Rivers Conservation Plan for the lower watershed. The plan identified abandoned mine drainage and sewer overflows as the primary water quality concern of Chartiers Creek. It is our understanding that the Allegheny County Sanitary Authority (ALCOSAN) and local municipalities have been negotiating with the USEPA relative to the sewer overflow issue. Addressing the sewage overflows will vastly improve the quality of Chartiers Creek but without mitigating the major mine

discharges Chartiers Creek will remain severely polluted. Thus, the CNC proposes to continue to coordinating the efforts of the local watershed organizations to address the mine drainage problem.

In addition to the assessment of the major mine drainage problems currently being completed, CNC is involved with two other significant projects. These projects are indicative of not only our determination but our ability to accomplish projects that will improve our stream. These other two projects are briefly discussed below.

#### Chartiers Creek TMDL Study

*Fill in with details of TMDL study.*

#### Wingfield Pines Project

A 1500 gpm flow of iron-contaminated water occurs on the site of the abandoned Wingfield Pines Golf Club in the Township of Upper St. Clair. The Allegheny Land Trust recently purchased the property and received Growing Greener funding in 2001 to develop a treatment system design for the site. Chartiers Nature Conservancy supports the Allegheny Land Trust on this project and has partnered with them on other watershed projects in the past. The CNC will incorporate the plans and expectations for the treatment system into the restoration plan.

#### Scrubgrass AMD Treatment System

The Scrubgrass treatment system was constructed in 1998, using 319 funding, to treat an alkaline, Fe-contaminated discharge located in Scott Township. The treatment system was recently renovated to increase its retention time and to facilitate future iron sludge removal. The renovation project was funded by a 2000 Growing Greener grant to the Scott Conservancy. Much has been learned about the challenges of suburban AMD treatment from the Scrubgrass system. This information will be put to good use in the restoration plan because several of the AMD discharges occur in urban or suburban settings.

#### University of Pittsburgh Engineering Study

In the autumn of 2002, four senior engineering students from the University of Pittsburgh's Environmental Engineering Department developed conceptual plans for passive treatment of the McLaughlin and Woodville discharges. The work was completed as part of their senior engineering project. The report recommends that the Woodville discharge be piped to the mouth of McLaughlin Run where it should be combined with the McLaughlin discharge and treated with a passive anoxic limestone drainage and wetland system.