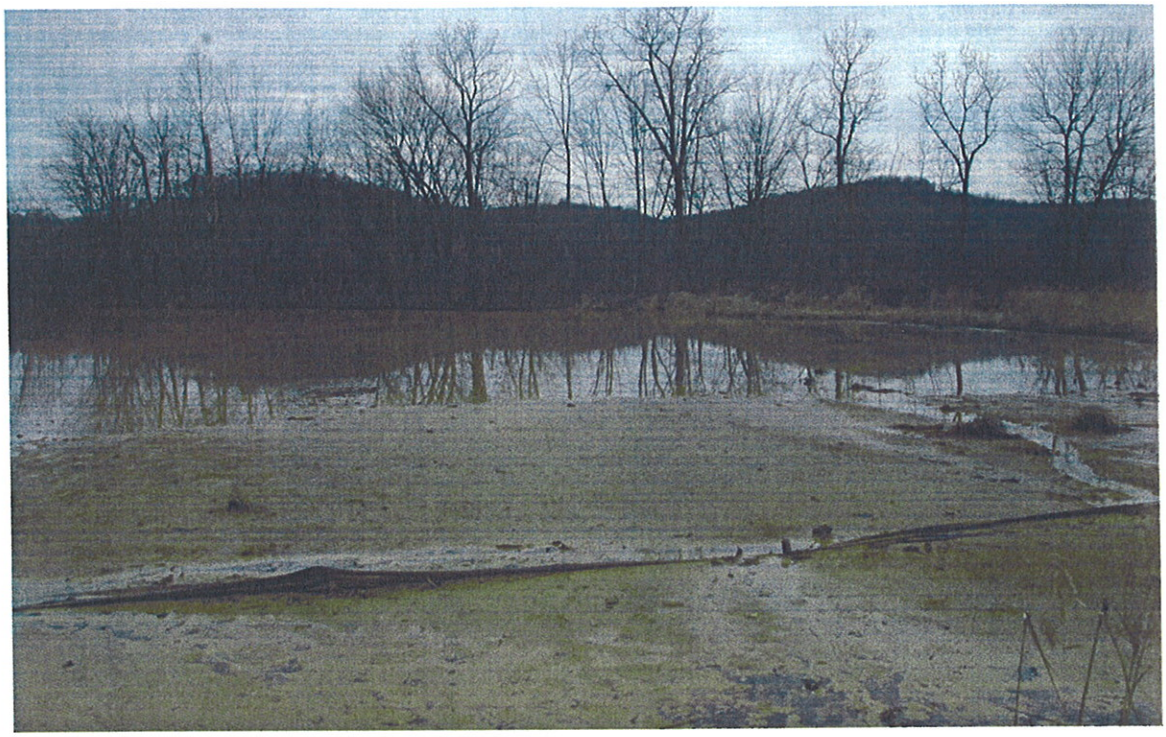
APPENDIX A
PHOTOGRAPHS

VIEW FROM TYSON ROAD

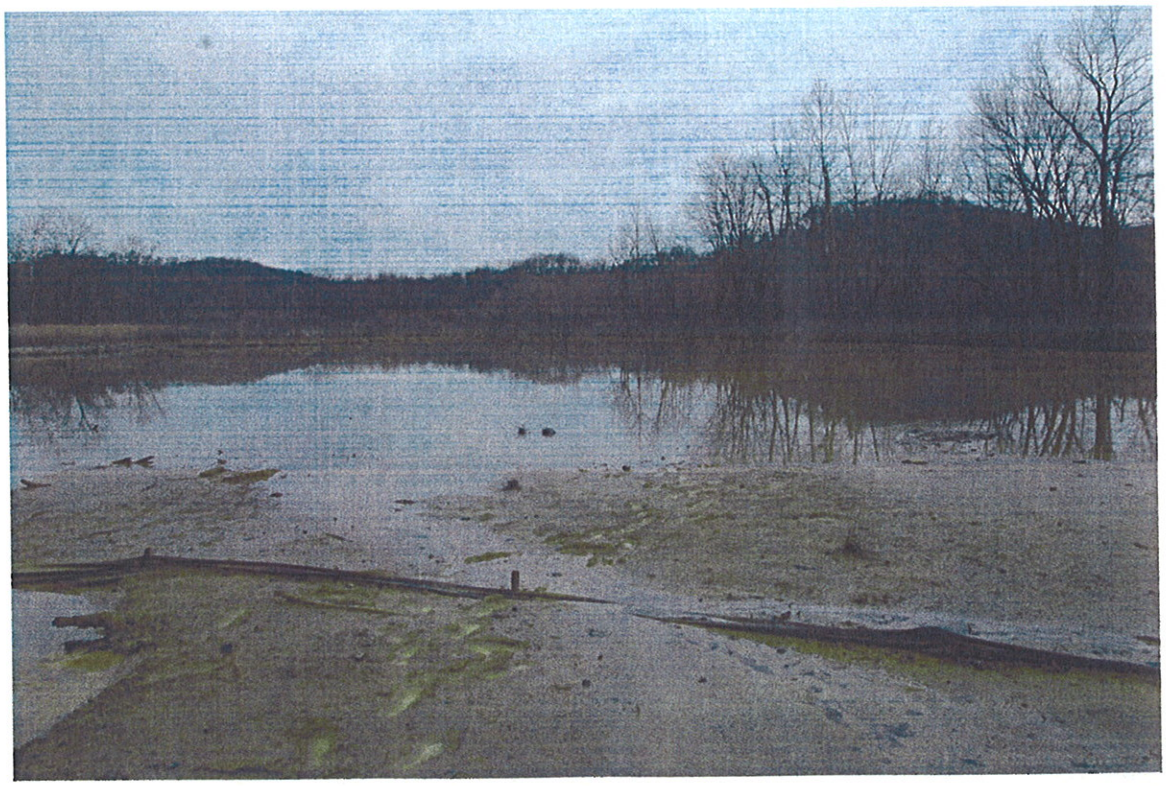
MM-280 VERTICAL DISCHARGE PIPE (INSTALLED 2003 BY B&N)

VIEW LOOKING TOWARD WILLS CREEK LAKE EMBAYMENT

VIEW AS DISCHARGE ENTERS EMBAYMENT



OVERVIEW OF EMBAYMENT (NOTICE SILT FENCING COMPLETELY COVERED BY SEDIMENT)



OVERVIEW OF EMBAYMENT

OVERVIEW OF GOB PILE, LOOKING TOWARD TYSON ROAD

VIEW OF GOB PILE, LOOKING TOWARD LAKE

VIEW OF LIMITED RIPARIAN AREA BETWEEN DISCHARGE AND GOB PILE

VIEW OF FORESTED AREA TO THE NORTH OF DISCHARGE AREA

APPENDIX B

AGENCY COORDINATION AND CORRESPONDENCE; ODNR MEMORANDUM

Muskingum Watershed
Conservancy District

1319 Third Street NW, P.O. Box 349, New Philadelphia, Ohio 44663-0349
Phone (330) 343-6647 or Toll Free (877) 363-8500 Fax (330) 364-4161
www.mwcd.org • e-mail: info@mwcd.org

September 17, 2008

Colonel Dana R. Hurst
District Engineer
U.S. Army Corps of Engineers
Huntington District
502 8th Street
Huntington, WV 25701-2070

Dear Colonel Hurst,

This letter is to establish the Muskingum Watershed Conservancy District's (MWCD's) support for the Wills Creek Mason Mine 280 Project under Section 1135 of the Water Resources Development Act of 1986. The MWCD intends to serve as the non-federal sponsor for the work, but cannot commit to the funding at this time until it is able to levy an assessment for maintenance in the watershed. I understand this letter does not financially or legally obligate the MWCD or the Federal Government for the project at this time.

The MWCD is aware of the U.S. Army Corps of Engineers (USACE) draft Detailed Project Report which recommends reconstruction of the current mine discharge headwall, construction of a discharge treatment system and enhancement of existing wetlands to treat the water discharging from the Mason Mine 280 complex prior to it entering Wills Creek Lake, as well as encapsulating the nearby gob pile with sediments removed from the project area. The estimated total project cost for the project is $1.4 million, of which the non-federal sponsor's cost share of 25 percent of this cost is $350,000.

Upon the collection of a maintenance assessment by the MWCD, the MWCD will have the ability, the capability and the full legal authority to fulfill these obligations and intends to enter into a Project Cooperation Agreement with the Department of the Army for implementation of this project.

Very truly yours,

John M. Hoopingarner
Executive Director/Secretary
hoop@mwcdlakes.com

Charles Mill Lake ▪ Pleasant Hill Lake ▪ Beach City Lake ▪ Wills Creek Lake ▪ Atwood Lake ▪ Leesville Lake ▪ Tappan Lake ▪ Clendening Lake ▪ Piedmont Lake ▪ Seneca Lake

OHIO
Department of Natural Resources

George V. Voinovich • *Governor*
Donald C. Anderson • *Director*

May 12, 1998

James S. Everman
Chief, Planning Division
U.S. Army Corps of Engineers
502 Eighth Street
Huntington, West Virginia 25701

RE: MM280 Acid Mine Drainage Section 1135 Project Proposal

Dear Mr. Everman:

The Ohio Department of Natural Resources Division of Mines and Reclamation, hereafter called the "sponsor", is interested in obtaining Corps of Engineers assistance through the 1135 Program in addressing ecosystem degradation/water quality problems related to acid mine drainage at Wills Creek Lake.

The sponsor is aware of the 1135 requirements concerning the non-federal cost share and that the non-federal sponsor will provide 25% of the estimated project construction costs in cash and in-kind services; at least 5% of the total project cost must be matched in be in the form of cash. According to the Preliminary Restoration Plan (PRP), the total estimated cost of the MM280 AMD project is $980,000.00. DMR is also aware that after project completion, operation and maintenance cost associated with this project will be the responsibility of the non-federal sponsor.

Please consider this letter as our non-binding letter of intent to participate as the non-federal sponsor for the MM-280 AMD project. The DMR understands that this letter of intent does not financially or contractually obligate the State of Ohio and further that any obligation of the DMR would be subject to Section 126.07 of the Ohio Revised Code.

The DMR looks forward to continuing our collaborating with the ACOE in this water quality improvement project.

If you have any questions concerning this matter please contact Harry Payne at 614-265-1076.

Sincerely,

Lisa J. Morris, Chief
Ohio Division of Mines and Reclamation
1855 Fountain Square Ct.
Columbus, Ohio 43224-1327

Cc: Gary Novak
Barry Passmore

Attachments not all copied.

ODNR
Division of Mineral
Resources Management

Memo

To: Paul Ziemkiewicz, Ph.D., WVU

From: Cheryl Socotch

CC: Barry Passmore, ACOE; Gary Novak, DMRM

Date: May 20, 2002

Re: Wills Creek Lake, MM-280 Acid Mine Drainage Abatement Project

---

The ODNR, Division of Mineral Resources Management and the Army Corp of Engineers are working on a number of aquatic restoration projects located within the Wills Creek Lake region, which is part of the Muskingum Watershed Conservancy District (MWCD) of Ohio. Based on the complexity of the projected mine drainage project, the members of the project team would ask that your agency assist in the review and/or possibly provide your insight and recommendations for a scope of project on the following joint reclamation project:

MM-280 Acid Mine Drainage Project:

The Wills Creek watershed is located in Coshocton, Guemsey, and Muskingum county(s) and is located approximately 55 miles east of Columbus, Ohio. The *Muskingum Mine 280 AMD* proposed project site is located in Monroe Township, Muskingum County, along the south shoreline approximately four (4) miles above the damn off of State Route 83 and Tyson Road (see **Location Map**).

I have also included a Project Fact Sheet prepared by ACOE, Project Manager, Barry Passmore which provides historical information, existing features, and project expectations.

HISTORY AND BACKGROUND:

According to the Division's AML Project Officer, Gary Novak, some of the major problems were first noticed at this location in the early 1990's when pressure developed as a result of build-up of iron precipitate from underground mine waters which then caused a 'blow-out" of a once-sealed mine portal along Tyson Road. As a result of this rupture, it was estimated that over 1800 gpm of low pH and high metal laden waters discharged directly into Wills Creek Lake and created a 20-foot subsidence hole on the north side of Tyson Road. Subsequent reclamation activities included excavation and creation of a proper drain channel and backfilling the subsidence hole.

The AMD discharge is located at the mapped entry to the underground *Muskingum Mine 280* (MM-280) that was abandoned in 1965. According to the OGS (Ohio Geologic Survey) Abandoned Underground Mine Maps/Inventory the Middle Kittanning (#6) coal seam was mined at this location. There are numerous abandoned underground mine complexes in the general vicinity although the *Mason Bros Coal Co* mines *Cn-161* and *Cn-164* are considered contributors to the outflow of MM-280. A three (3) to five (5) acre coal refuse pile is also located west of the project site and within the flood easement of the lake.

AMD currently discharges through two (2) 14-inch diameter culverts beneath Tyson Road (see attached photos). As indicated earlier in this narrative, these culverts were installed through the OSMRE emergency program when the iron flocculate plugged the flow of mine water from the mine. Pressure from the mine water caused the seal to rupture and discharge flows reportedly up to 1800 gpm of acid mine water directly into Wills Creek Lake which also left a large subsidence hole on the north side of the township road.

As expected, the proposed reclamation project would include treatment of the mine drainage and re-establish aquatic habitat destroyed by the AMD discharge outlet. Due to the historical nature of the iron precipitate to clog the outlets and create additional hazards and inherent problems, we need to improve the discharge outlet to reduce the oxidation of the iron. There is also an area that encompasses approximately 10 to 15 acres of aquatic wildlife habitat that has been destroyed as a result of over 30 years of acid mine drainage flowing through into Will Creek Lake.

DISCUSSION OF WATER QUALITY:

In order to characterize the flow and chemistry from the MM-280 mine discharge, the Division installed an ISCO continuous sampler at the outlet. There was little water quality information collected from this site previously; in fact, only four (4) samples were collected in 1995 that are reflected later in this memo in table format. The sampler system consisted of the ISCO sampler, which held up to 24-500 ml poly bottles, and included continual measurements from a YSI multi-probe for DO, pH, conductivity and temperature. The system also included Flowlink software for measurements and calculations and a Plasti-Fab V-trapezoidal flume for flows.

The ISCO sampler was installed by DMR project officer, Gary Novak, with the assistance of ODNR's Division of Civilian Conservation Corp (CCC) in September 1999. Sampling began on September 3, 1999 although there were later problems with the trapezoidal flume and the software. As a result, there were no flow measurements recorded for sampling collection during a good portion of the month of September.

It appears after reviewing the cumulative water data results, sampling, which included the actual collection of samples to be sent for laboratory analysis, during the fall of 1999 (early September 1999 through November 21, 1999), included collection of three (3) samples per day. Due to concerns of possible vandalism during Ohio's deer gun season and cold temperatures, the probe and sampler were removed temporarily until later that following spring. Sampling resumed on April 11, 2000 and continued until July 5, 2000. Physical sample collection (for lab analyses) was reduced during this period from two (2) or three (3) samples per day to one (1) sample per day. These samples were collected by the continuous sampler on each day in the morning hours (approx 9:30 am).

As indicated earlier in this narrative, at least four (4) samples were collected from the MM-280 mine outlet during 1995. These sample results are reflected in **TABLE 1.** Unfortunately, flow measurements were not recorded during the earlier sampling events.

TABLE 1

PARAMETER	DATE				AVG	99-2000 Avg
	5/22/95	8/1/95	9/1/95	10/4/95		
pH (S.U.)	4.7	5.3	3.1	4.4	4.3	4.8
Acidity (as $CaCO^3$)	522	1043	344	395	576	398
Alkalinity (as $CaCO^3$)	-0-	-0-	-0-	-0-	-0-	-0-
Cond (umhos/cm)	2540	2900	2620	2890	2737	2480
T.Diss Solids (mg/l)	2584	2852	2765	2788	2747*	
Sulfate (SO^4) mg/l	1267	1672	1355	1690	1496	1626
Chloride (Cl) mg/l	9	10	46	13	19.5	
T. Calcium (mg/l)	179	240	202	260	220	
T. Magnesium (mg/l)	46.2	52	55	58	53	
T. Sodium (mg/l)	176.5	280	230	230	229	227
T. Potassium (mg/l)	19.8	16.9	12.7	17.5	16.7	
T. Iron (mg/l)	35.1	290	204	289	204	207
T. Manganese (mg/l)	3.77	3.86	3.02	4.25	3.72	3.5
T. Aluminum (mg/l)	8.8	3.92	0.4	7.76	5.2	3.1
Hardness (mg/l)	733	758	669	893	763	

Due to the voluminous amount of samples collected and subsequently sent for lab analysis from the ISCO sampler, it is difficult to list all sample results in this memo. At least 160 samples were collected from the time period from September 1999 through July 5, 2000. As indicated earlier, some problems were encountered with the flume and flow meter during a portion of the initial sampling month (Sept) so flow measurements are not available for some of the water quality data.

TABLE 2 reflects an average of the laboratory analyses of the more recent samples collected from the ISCO sampler from the period of September 1999 through July 2000. As you can see, there has been little change in water chemistry since the mine water was initially sampled in 1995. The mine discharges are characteristically very acid or net acid (>300 mg/l). Overall, acidity remained fairly consistent over the sampling period with an average of **398 mg/l**. Sulfate levels also seemed to remain constant through the low and high flow/seasonal monitoring period (**avg 1626 mg/l**). In addition,

concentrations of total iron remained constant although were slightly higher during low flow (fall) monitoring with average around **200 mg/.** During November '99 and April '00 samples were collected for ferrous (dissolved) iron although lab reports indicate the levels were higher than the total iron concentration. For instance, sample collected on 11/10/99 revealed total iron concentration of **250 mg/l** and ferrous iron level of **271 mg/l**. Analytical results of samples collected on 4/28/00 (total iron **172 mg/l**; ferrous iron **174 mg/l**) and again on 5/2/00 (total iron **226 mg/l**; ferrous iron **237 mg/l**) reveal similar concentrations. I plan on collecting more recent dissolved (ferrous) and ferric samples within the next week.

There were fluctuations in pH, which ranged from low pH of **3.2** for steady period of time and pH close to **5.0 – 5.5** during a good portion of the sampling/monitoring period. Total aluminum (avg **3.1 mg/l**), specific conductance (avg **2480 ummos/cm)**, and total manganese (avg **3.5 mg/l**) remained fairly constant throughout the low/high sampling period. Sodium concentrations seemed fairly high with a constant (avg **230 mg/l**).

Overall, discharge from MM-280 mine complex is net acid, low pH with high metal concentrations (mostly iron and sulfate).

TABLE 2

PARAMETER	**MONTHLY AVG**				**AVG**
	SEPT/OCT	NOV	APR/MAY	JUN/JUL	
pH (S.U.)	5.8	5.7	4.1	3.9	4.8
Acidity (as $CaCO^3$)	395	419	410	368	398
Alkalinity (as $CaCO^3$)	-0-	-0-	-0-	-0-	-0-
Cond (umhos/cm)	2475	2500	2460	2485	2480
Sulfate (SO^4) mg/l	1715	1705	1580	1505	1626
T. Sodium (mg/l)	230	230	182	185	229
T. Iron (mg/l)	257	255	224	172	207
T. Manganese (mg/l)	3.7	3.8	3.5	3.0	3.5
T. Aluminum (mg/l)	3.7	3.5	3.1	2.0	3.1

The YSI multi-parameter probe and trapezoidal V-notch flume collected periodic flows, conductivity, pH, temperature and dissolved oxygen (DO) readings during the monitor period. Due to time constraints and the amount of data to review at this time, loadings have not been calculated at this report time period.

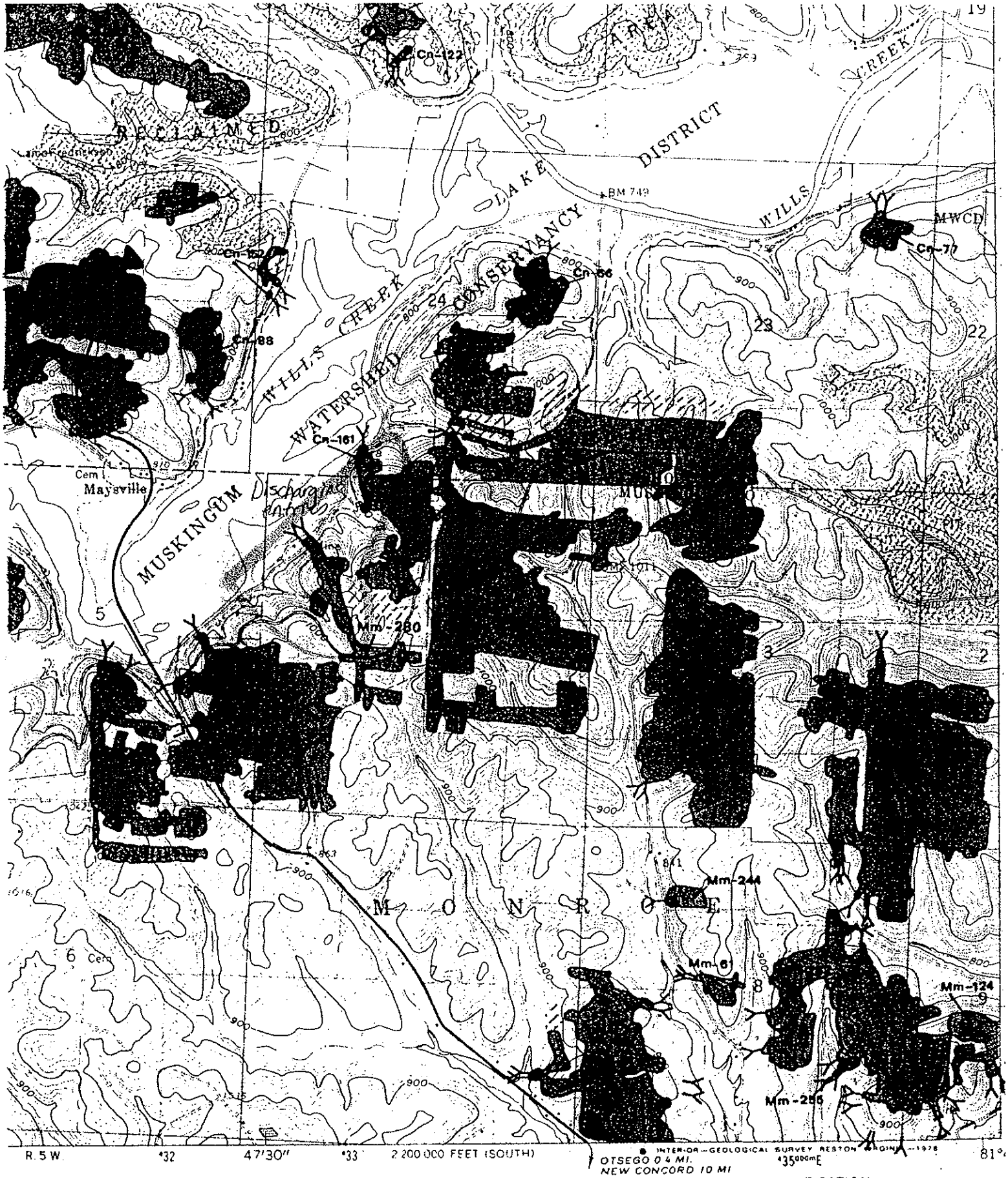
Some general, although alarming observations of the data reflects extreme fluctuations in flow from the mine discharge. Early flow data revealed fluctuations from early morning lows (avg. 15-40 gpm), which

later in the early afternoon exceeded 80 gpm. During late April, flows fluctuate from 50 gpm in early part of the day (10 am – noon) and exceed 220 gpm later in day, into evening hours. I have included some graphs that display the variation in flow and different intervals of a 24-hour monitoring period. At this time it is difficult to explain the change which appeared at times to reflect a "pattern" although was not reflective of area rainfall events, or other sources (industry, or other discharges into mine complex). It appeared, for want of no better words than, to "change as the tide comes in and out" or as the lunar affects tidal waters. For instance, flows varied from **15 gpm** to up **400 gpm** during June 2000. This makes it quite difficult for design of treatment system as flow can fluctuate from one extreme to another. There does not appear to be an significant change in metal concentrations based on the change in flow although certain metal concentrations were higher during low flow periods (iron, aluminum, and sulfate) than in spring (typically high flow periods) although pH measurements in the spring were much lower than during sampling in the fall. I have provided some of the tables created by the ISCO sampler for your review.

Dissolved oxygen concentrations also ranged from very low (< 1.0 mg/l) to measurements as high as 20.0 mg/l in June, 2000. Typically, DO measurements were less than 5.0 mg/l. Mine water discharge temperature was generally around 54° F.

Rather than overload you with vast amount of water quality data from our lab and flow measurements, I am including representative sample results from each month. I have also included some of the tables recorded from the continuous sampler software that reveal flow, pH, conductivity, and temperature readings each hour. Please review the enclosed materials, maps and other information contained in this memo. I will be happy to discuss this information, data or anything relative to MM-280 or nearby mining in the Wills Creek watershed area. I believe Barry Passmore (ACOE) and Harry Payne were hopeful either you or possibly Jeff Skousen would be able to visit the area and project site and assist in possible remediation/recommendations, etc.

ATTACHMENTS



ROAD CLASSIFICATION

Primary highway, hard surface

Secondary highway.

Light-duty road, hard or improved surface

1 MILE

5000' 6000' 7000 FEET

1 KILOMETER

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
6950 Americana Parkway, Suite H
Reynoldsburg, Ohio 43068-4127

(614) 469-6923
Fax: (614) 469-6919

October 2, 2003

Jason C. Hobbins
Burgess & Niple
5085 Reed Road
Columbus, OH 43220

Re: Wills Creek Lake AMD Remediation

Dear Mr. Hobbins:

This is in response to your August 1, 2003 letter requesting information we may have regarding the occurrence or possible occurrence of Federally-listed threatened or endangered species in the vicinity of the proposed site. The proposed project involves remediation of acid mine drainage (AMD) at Mason Mine 280, on the south shoreline of Wills Creek Lake, Coshocton and Muskingum Counties, Ohio. Project plans have not been finalized, but a Preliminary Restoration Plan Fact Sheet supplied to the Service by the Army Corps of Engineers describes the preferred method. This method consists of routing AMD to a single location and passing it over anoxic limestone beds.

There are no Federal wilderness areas, wildlife refuges, or designated Critical Habitat within the vicinity of the proposed site.

THREATENED AND ENDANGERED SPECIES COMMENTS: The proposed project lies within the range of the **Indiana bat** (*Myotis sodalis*), a Federally-listed endangered species. Summer habitat requirements for the species are not well defined but the following are thought to be of importance:

1. Dead or live trees and snags with peeling or exfoliating bark, split tree trunk and/or branches, or cavities, which may be used as maternity roost areas.

2. Live trees (such as shagbark hickory) which have exfoliating bark.

3. Stream corridors, riparian areas, and upland woodlots which provide forage sites.

Should the proposed site contain trees exhibiting any of the characteristics listed above, we recommend that they and surrounding trees be saved wherever possible. If they must be cut, they should not be cut between April 15 and September 15.

If desirable trees are present and if the above time restriction is unacceptable, mist net or other surveys should be conducted to determine if bats are present. The survey should be designed and conducted in coordination with the endangered species coordinator for this office. The survey should be conducted in June or July since the bats would only be expected in the project area from approximately April 15 to September 15.

The project area lies within the range of the **bald eagle** (*Haliaeetus leucocephalus)*, a Federally-listed threatened species. We recommend that you contact Mr. Mark Shieldcastle, with the Ohio Department of Natural Resources, Division of Wildlife, (419) 898-0960, for the location(s) of the eagle nest(s) in the county. If any nests are located within ½ mile of the project site, further coordination with this office is necessary. If the nest is active, we recommend that work at the site be restricted from mid-January through July to allow pre-nesting activities, incubation, and raising of the young.

The proposed project lies within the range of three Federally-endangered mussel species, the **clubshell mussel** (*Pleurobema clava*), **purple catspaw pearly mussel** (*Epioblasma obliquata obliquata*), and **fanshell** (*Cyprogenia stegaria*). Because the proposed project would result in improved water quality in and downstream of Wills Creek Lake, the project would likely have a beneficial effect on these species. However, in order to avoid any possible adverse effects, best construction techniques should be used to minimize erosion, in particular, on slopes. All disturbed areas should be mulched and revegetated following construction.

Should additional information on listed or proposed species or their critical habitat become available or if new information reveals effects of the action that were not previously considered, this determination may be reconsidered. If project plans change or if portions of the proposed project were not evaluated, it is our recommendation that you contact our office for further review.

This technical assistance letter is submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C.661 et seq.), the Endangered Species Act of 1973, as amended, and is consistent with the intent of the National Environmental Policy Act of 1969, and the U.S. Fish and Wildlife Service's Mitigation Policy.

If you have questions, or if we may be of further assistance in this matter, please contact Jeromy Applegate at extension 21 in this office.

Sincerely,

Mary Knapp

Mary Knapp, Ph.D.
Supervisor

cc: ODNR, DOW, SCEA Unit, Columbus, OH

[redacted]

BURGESS & NIPLE

Conversation Record

Burgess & Niple

With: Mark Shieldcastle By: Joe Chestnutt

Of: ODNR Date: 10/22/05 Time: 10:00

☑ ~~By~~ Telephone Telephone No: 419 895-0960 x23

☐ Visit Site: _____ City: _____

Job No: 33094 Project: MM250

Regarding: Bald Eagle nests w/in 1/2 mile of project site

Conversation Items: Mr. Shieldcastle confirmed there is a nest over 2.5 miles west of the site near the confluence of Wills Creek & the Muskingum River

⇒ Outside 1/2 mile radius of site.

Follow-up Activity: _____

Ohio Department of Natural Resources

BOB TAFT, GOVERNOR — SAMUEL W. SPECK, DIRECTOR

Division of Natural Areas and Preserves
Nancy Strayer, Acting Chief
1889 Fountain Square, Bldg. F-1
Columbus, OH 43224-1388
Phone: (614) 265-6453; Fax: (614) 267-3096

August 6, 2003

Jason C. Hobbins, Environmental Technician
Burgess & Niple, Limited
5085 Reed Road
Columbus, Ohio 43220

Dear Mr. Hobbins:

I have reviewed our Natural Heritage maps and files for the Wills Creek Lake – MM280 project area, including a one-mile radius, northeast of Marquand Mills, in Coshocton and Muskingum Counties on the Wills Creek Quad. Enclosed is a map showing the location of one rare plant record, *Lechea villosa*. Scientific name, common name and status also are displayed on the map. This plant was last recorded as observed in 1968 in a sandpit one-half mile east of SR 76 at Wills Creek Bridge.

There are no existing or proposed state nature preserves or scenic rivers at the project site. We are also unaware of any unique geologic features, breeding or non-breeding animal concentrations, champion trees, or state parks, forests or wildlife areas within a one-mile radius of the project area. However, the project is within the Muskingum Watershed Conservancy District, which should be contacted for additional information on potential impacts associated with this project.

Our inventory program has not completely surveyed Ohio and relies on information supplied by many individuals and organizations. Therefore, a lack of records for any particular area is not a statement that rare species or unique features are absent from that area. Please note that although we inventory all types of plant communities, we only maintain records on the highest quality areas. Also, we do not have data for all Ohio wetlands. The Division of Wildlife can be contacted at 614-265-6300 for additional data on its statewide wetland inventory. For National Wetlands Inventory maps, please contact Madge Fitak in the Division of Geological Survey at 614-265-6576.

Please contact me at 614-265-6472 if I can be of further assistance.

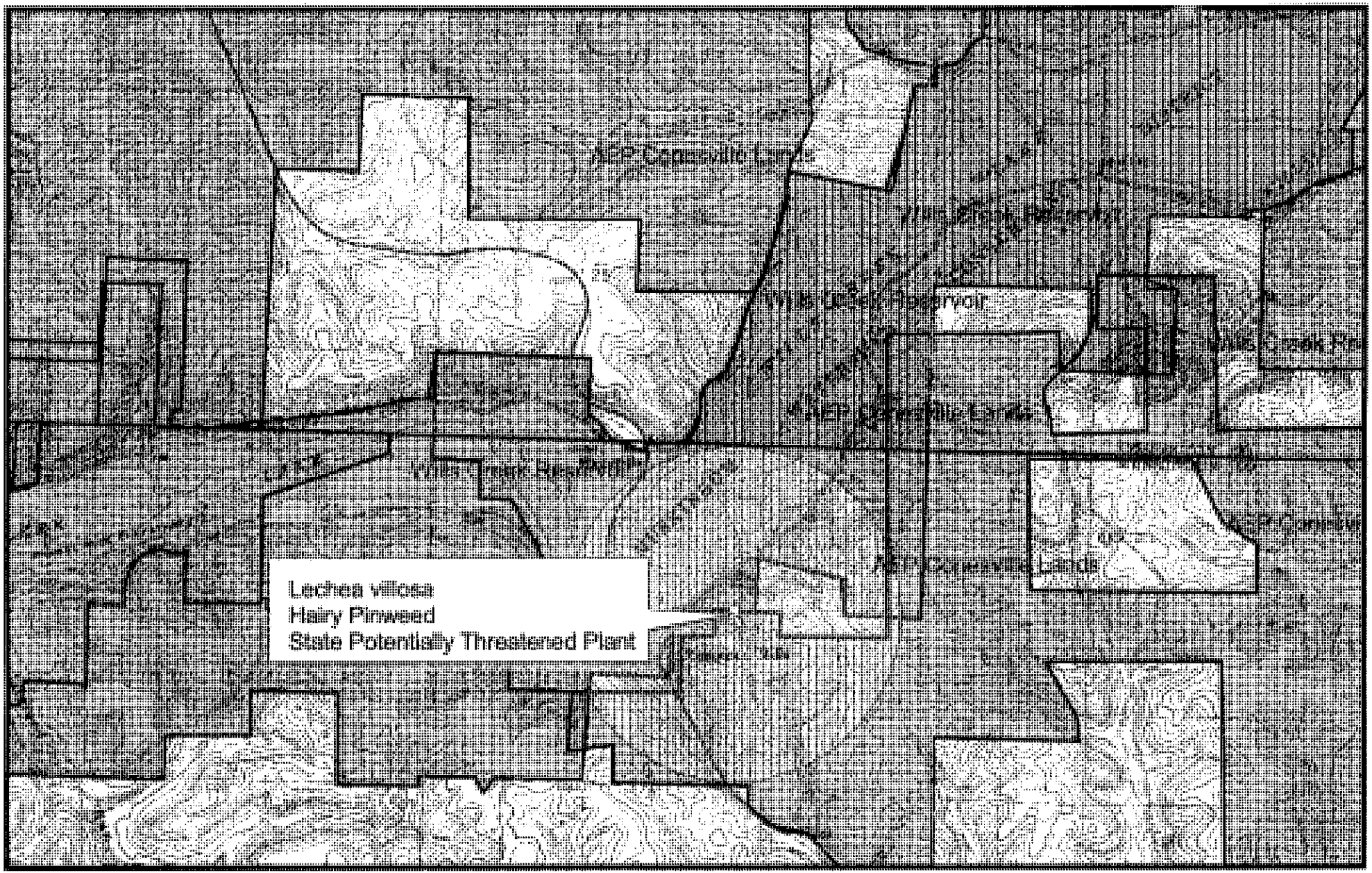
Sincerely,

Marleen Kromer

Marleen Kromer
Natural Heritage Data Management Section

Wills Creek Lake - MM280

August 6, 2003



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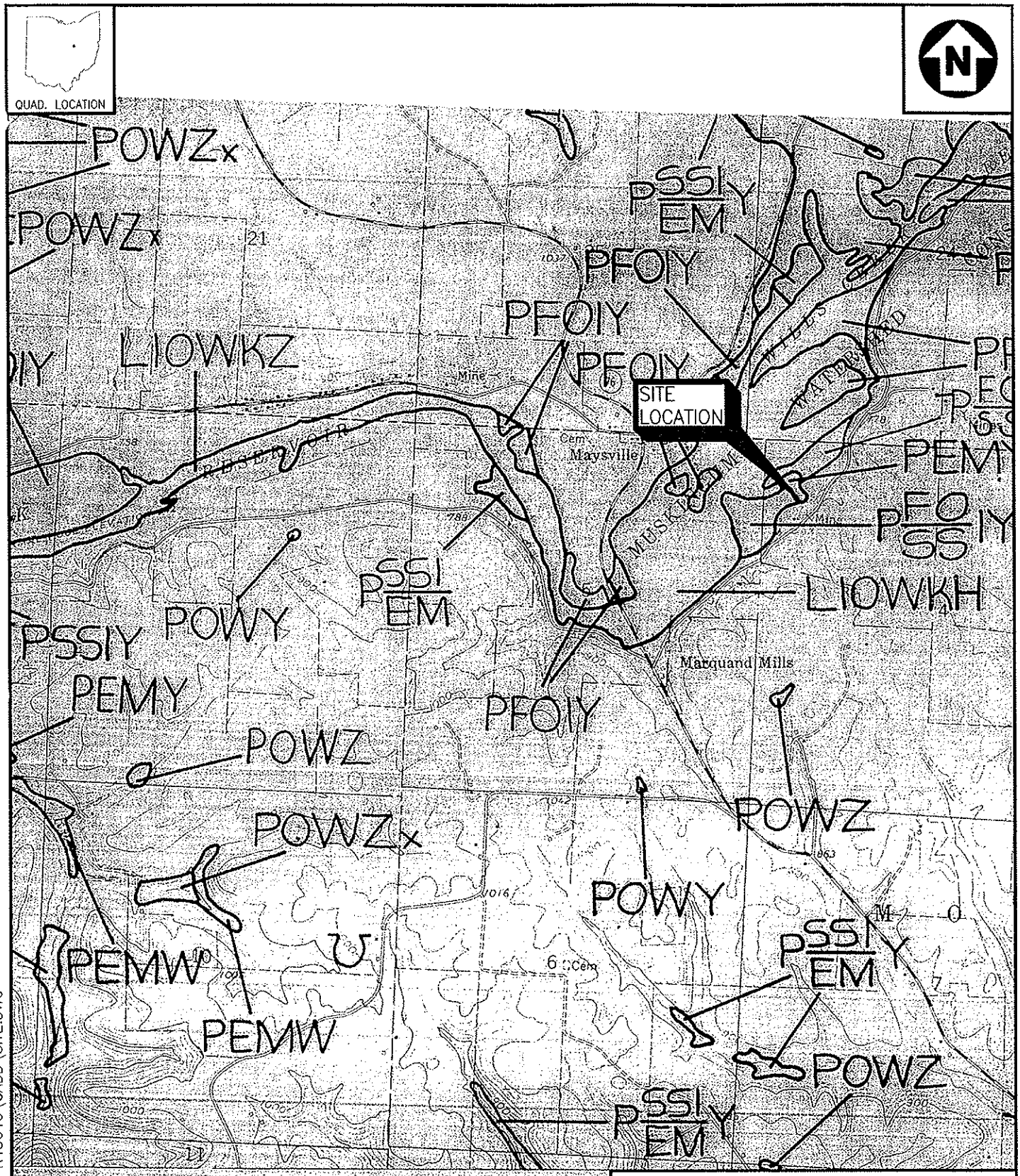
Ohio Division of Natural Areas and Preserves

APPENDIX C

WETLAND MAPS



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WILLS CREEK LAKE MM280
U.S. ARMY CORPS OF ENGINEERS
MARQUAND MILLS, OHIO

NWI MAP

BURGESS AND NIPLE, INC.
ENGINEERS & ARCHITECTS

SCALE: 1"=2000'
DATE: MARCH 2007

Mason Mine 280, Section 1135 Environmental Restoration Project
Area Affected by Acid Mine Drainage

APPENDIX D
HERPETOLOGICAL SURVEY

Thomas K. Pauley, Ph.D.
Biologist
5421 West Pea Ridge Road
Huntington, West Virginia 25705
Telephone - (304) 736-7687 FAX - (304) 736-1424

November 3, 2003

Mr. George D. Biemel, PE
Project Manager
Burgess and Niple, Inc.
5085 Reed Road
Columbus, Ohio 43220

Dear George,

Please find enclosed our report on the herpetological survey conducted at Wills Creek MM280 with the additions you and Julie A. Carpenter suggested (letter dated 23 October 2003). I have returned the text with changes and an additional table (#5). I hope we have addressed your requests. If you have any questions, please contact me and we will attempt to clarify it any way we can.

Again, we appreciate the opportunity to work on this project with you.

Sincerely,

Tom Pauley

Thomas K. Pauley, Ph.D.

Muskingum and Coshocton counties, Ohio.

Submitted to: Burgess & Niple

5085 Reed Road

Columbus, OH 43220

Submitted by: Drs. Thomas K. Pauley and Mark B. Watson

Introduction

Worldwide decline of some amphibian species have been reported for several years (Alexander 2000; Barinaga 1990; Bradford 1991; Blaustein and Wake 1990; Blaustein , et al. 1994; Blaustein and Kiesecker 2002; Carey et al. 2001; Halliday 2001; Milstein 1990; Pechmann, et al. 1991; Phillips 1990; Stebbins and Cohen 1995; Wyman, 1990; Wake 1991). Various reasons have been suggested for these declines including low soil and water pH values. Development of eggs, larvae, and froglets/toadlets can be negatively affected by acid precipitation (Sadinski and Dunson, 1992; Wyman and Jancola, 1992; Grant and Licht, 1993), pesticides (Johnson 1980; Vardia, et al., 1984; Licht, 1985), and heavy metals (Ireland, 1977 and Birge et al., 1979). Low pH values have also been shown to adversely alter distribution and density (Beebee and Griffin, 1977; Saber and Dunson, 1978; Strijbosch, 1979; Dale et al., 1985; Freda and Dunson, 1986; Leuven et al., 1986), sperm motility (Schlichter, 1981), embryonic survival (Pough and Wilson, 1977; Tome and Pough, 1982; Pierce, et al., 1984), and embryonic development (Gosner and Black, 1957; Pough and Wilson, 1977; Cooke, 1981; Dunson and Connell, 1982; Freda and Dunson, 1986; Cummins, 1986) of amphibians.

The biological value of amphibians to an ecosystem may exceed that of other vertebrates. Many species of amphibians emerge in great numbers from winter refugia early in the spring when food sources are limited for many predators. Amphibians are top predators in headwater streams and primary consumers (tadpoles) in pond ecosystems (Dunson, 1982). Predatory salamander larvae

are important in determining types and amounts of zooplankton and insects (Dodson, 1970; Dodson and Dodson, 1971), and tadpoles are important in determining types and amounts of phytoplankton, magnitude of nutrient cycling, and levels of primary production (Seale, 1980).

Dunson et al. (1992) described characteristics that make salamanders excellent indicators of changes in the environment. These include: (1) some species have complex life cycles with aquatic and terrestrial stages which expose them to environmental pollutants; (2) some species show keen competition for vital resources which can quickly demonstrate how different species react to pollutants; (3) they have permeable skin, gills, and eggs that are susceptible to pollutants in the environment; (4) poikilothermy makes them vulnerable to environmental fluctuations; (5) many species hibernate or estivate in soils that may expose them to toxic conditions; and (6) salamanders are important in terrestrial and aquatic food webs in northeastern deciduous forests.

Amphibians are particularly sensitive to environmental pollutants such as AMD because of their permeable integument, gelatinous eggs, and gilled larvae. These physical characteristics allow the absorption of chemicals from soil and water. As a result, many areas with AMD can only support amphibians that are tolerant of media with low pH values. Amphibians native to the Wills Creek area cannot tolerate pH values below 4.0 (Pierce 1985).

Qualitative herpetological surveys were conducted in the proximate vicinity of the proposed action at Mason Mine 280 (MM280). Ten sites with varying habitats were inventoried to assess potential amphibians and reptiles present. Two "reference sites" were chosen upstream of the MM280 adit. These sites showed no obvious signs of acid mine drainage (AMD).

Methods

Ground searches for amphibians and reptiles were conducted by turning cover objects and visually scanning the surface of the forest floor. Amphibian larvae were inventoried by sampling with "D"-framed nets and commercial minnow traps. Aquatic turtles were sampled with 3 types of traps (hoop, catfish, and box) and by searching for basking turtles with binoculars (8X40) and a spotting scope (10X20-60).

Traps included a mini-hoop net (20 in. in diameter and 4.5 ft. in length), a hoop net (3 ft. in diameter and 6 ft. in length), and a wire-box trap (30 X 30 X 50 cm) baited with canned fish. Two fyke nets were set for aquatic salamander species, this net is a hoop with 5 cm opening and 4.5 m lead baited with canned fish and canned dog or cat food. Commercial minnow hoop traps (also known as activity traps) were set for larval amphibians. Traps were set for two nights and one day (approximately 36 hours). Locations (coordinates) were all trap types were used are provided in Table 1.

Results and Discussion

General area description

Wills Creek Lake is surrounded by many abandoned and partially reclaimed strip mines and deep mines. Upland areas were predominantly mesic mixed-hardwoods. Bottomland areas were mainly flood tolerant hardwoods, including sycamore (*Platanus occidentalis*), silver maple (*Acer saccharinum*), and box-elder (*Acer negumbo*). Most of the bottomland we observed had been previously inundated with water as evidenced by the large amount of flood debris. AMD is present in many tributaries. The lake is subject to fluctuations in water levels and is heavily impacted by siltation. At the times of the survey, water levels were up into vegetation surrounding the lake. Inventories were conducted June 9-11, 2003.

We used 2 reference sites and 8 studies sites to sample for amphibians and reptiles. Locations and descriptions of each site are provided below and coordinates for each site are found in Table 2. Trap sites were located in the first reference site (Site Number 1) and in the impact site (Site Number 6).

Survey sites

Site #1 was located approximately 1.6 km northeast of MM280 (Figure 1) and in an approximately 8.5 ha embayment (Figure 2). This site was upstream of the AMD outflow from MM280 and was considered the first reference site. The perimeter of the embayment was lined with willow (*Salix* sp.) and silver maple saplings. Aquatic vegetation (pond weed, *Potamogeton* sp.) was found in several locations. Average pH in this embayment (n=6) was 7.9. Inventory dates: June 9, 2003 and June 10, 2003.

Site #2 was located approximately 200 m northeast of MM280 (Figure 1 and 3). This area contained an approximately 0.1 ha permanent pond, possibly used for sediment control. The edges of the pond were lined with mostly cattails (*Typha latifolia*). Inventory dates: June 9, 2003 and June 11, 2003.

Site #3 was located approximately 270 m south of MM280 and contained a seep and roadside ditch (Figures 1 and 4). Inventory dates: June 9, 2003.

Site #4 was located approximately 330 m southwest of MM 280, this site contained a small borrow pit or rock quarry (Figures 1 and 5). Inventory dates: June 9, 2003.

Site #5 was a wooded hillside approximately 80m south of MM280 (Figure 1). This area contained a mesic mixed deciduous forest (Figure 6). Inventory dates: June 9, 2003.

Site #6 was the study site and adjacent surrounding floodplain forest (Figure1 and 7). The outflow from the mine showed large amounts of precipitates. The areas adjacent to the flowing water were barren of vegetation. Inventory dates: June 9, 2003 and June 10, 2003.

Site #7 was located along the roadside 1.1 km north of the study site (Figure 1). This area was characterized by early succession hardwoods and exotic shrub species (Figure 8). Inventory dates: June 10, 2003.

Site #8 was a roadside ditch located 430 m north of the study site (Figures 1 and 9). Inventory dates: June 10, 2003.

Site #9 was considered a second reference site 2.3 km north of the study site along a section of floodplain forest (Figure 1). Inventory dates: June 10, 2003.

Site #10 was 2.2 km north of the study site just downstream of the old bridge (Figure 1). Inventory dates: June 10, 2003.

Species observed

Amphibians, reptiles and birds observed at each Wills Creek study site are listed in Table 3. Examples of amphibians and reptiles observed are shown in Figure 10. Bird studies were not part of the contract, but were listed in case they could be of use. A list of common and scientific names of the observed and potential amphibian and reptile species is found in Table 4. Species richness observed and expected at each site is listed in Table 5. Species richness is a measure of the diversity of animals observed. Species richness observed in each site was below that potentially expected if the site were not impaired. At this time there is no standard amphibian biotic index to determine if a site has been influenced by AMD. A comparison can be made by comparing a non impacted site with one that has been impacted, since amphibians do not tolerate AMD well. It appears in this case that the entire drainage area is impacted by AMD as well as silt.

Habitat characteristics such as orange colored water (pyrite) and mineral deposits or precipitates and thick black silt in embayments and streams as well as piles of mine debris indicate the presence AMD in the entire study area. Because this was a short-term qualitative and not quantitative study, no statistically relevant conclusion could be drawn from the results.

It is our opinion, that the number and diversity of amphibians observed in the MM280 were limited by impacts of AMD and previous mining activity in the area. AMD prevents the successful reproduction of many amphibian species. This is a prevalent problem for those that breed or inhabit streams, ponds or wetlands impacted by AMD. Few species were found in reference or study site, meaning the relative abundance of species observed in both areas was low. This suggests both sites were influenced by mining activity. Since the survey was conducted mid-summer, many early breeding anurans were not calling and therefore more difficult to find. If successful breeding occurred for these early species, their larvae should have been persistent in the pools and roadside ditches examined. No anuran larvae were captured or observed during the day or night in reference or MM280 sites at a time of year when they should be present. The absence of larvae suggests that successful reproduction is not occurring. These observations combined with habitat characteristics described above supports our opinion that the area was impacted by AMD.

Treatment of the AMD should bring positive benefits for the amphibian and reptile communities in the MM280 area. Adult anurans were found in several sites so that recruitment and reestablishment of amphibians to the embayment should proceed. As amphibians are a primary food source for many animals including birds, reptiles, mammals and fishes, increasing their numbers will add to the health of this ecosystem. Amphibian species found in the study sites are those usually observed in disturbed habitats. Studies have shown that some species of anurans (*Rana clamitans melanota, Hyla chrysoscelis*, and *Pseudacris c. crucifer*) are pioneer species and will inhabit newly constructed ponds or

disturbed habitats (Pauley 1993a; Cromer et al. 2001; DiMauro 2001). Turtle species observed are those found in many streams impacted by sediment, AMD, and other pollutants.

Several studies have shown that amphibians and reptiles can re-colonize old surface mines and deep mines if AMD is neutralized. Additional studies have shown that amphibians colonize silt ponds constructed on surface mine benches (Myers and Klimsira 1963; Turner and Fowler 1981; Fowler, et al. 1985; Pauley 1993b). For example, Pauley (1993b) found 9 species of salamanders, 2 toads, 7 frogs, 1 turtle, 3 lizards, and 10 snakes on old surface mines in the New River Gorge in West Virginia. Species observed included Eastern Red-spotted Newts, Northern Dusky Salamanders, Seal Salamanders, Allegheny Mountain Dusky Salamanders, Red-backed Salamanders, Northern Slimy Salamanders, Four-toed Salamanders, Long-tailed Salamander Midland Mud Salamanders, Eastern American Toads, Fowler's Toads, Northern Spring Peepers, Mountain Chorus Frogs, Cope's Gray Treefrogs Northern Green Frogs, Pickerel Frogs, Northern Leopard Frogs, Wood Frogs, Eastern Box Turtles, Northern Fence-Lizards, Five-lined Skinks, Broad-headed Skinks, Common Watersnakes, Northern Black Racers, Eastern Wormsnakes, Northern Ring-necked Snakes, Black Ratsnakes, Northern Red-bellied Snakes, Eastern Gartersnakes, Eastern Milksnake, Northern Copperheads, and Timber Rattlesnakes.

In addition, amphibians and reptiles have been found to use abandoned coalmine shafts (Saugey, et al.; Pauley 1993b). Pauley (1993b) Red-spotted Newts, Northern Dusky Salamanders, Seal Salamanders, Allegheny Mountain Dusky Salamanders, Black-bellied Salamanders, Wehrle's Salamanders, Cumberland Plateau Salamanders, Northern Slimy Salamanders, Spring Salamanders, Southern Two-lined Salamanders, Long-tailed Salamanders, Cave Salamanders, Eastern American Toads, Northern Spring Peepers, Mountain Chorus Frogs, Cope's Gray Treefrogs, Northern Green Frogs, Northern Fence

Lizards, Five-lined Skinks, Northern Ring-necked Snakes, and Northern Black Racers in abandoned coalmine shafts in New River Gorge in West Virginia.

Literature Cited

Alexander, M.A. and J.K. Eischeid. 2001. Climate variability in regions of amphibian declines. Conservation Biology 15(4):930-942.

Barinaga, M. 1990. Where have all the froggies gone? Science 247:1033-1034.

Beebee, T. J. C. and J. R. Griffin. 1977. A preliminary investigation into natterjack toad (*Bufo calamita*) breeding site characteristics in Great Britain. J. Zool. 181:341-350.

Birge, W. J., J. A. Black, and A. G. Westerman. 1979. Evaluation of aquatic pollutants using fish and amphibian eggs as bioassay organisms. In: Animals as monitors of environmental pollutants. Edited by S. W. Neilson, G. Migaki, and D. G. Scarpelli. National Academy of Science, Washington, D.C. pp. 108-118.

Blaustein, A.R. and D.B. Wake. 1990. Declining amphibian populations: a global phenomenon? Trends in Ecology and Evolution 5:203-204.

Blaustein, A.R., D.B. Wake, and W.P. Sousa. 1994. Amphibians declines: judging stability, persistence, and susceptibility of populations to local and global extinctions. Conservation Biology 8:60-71.

Blaustein, A.R. and J.M. Kiesecker. 2002. Complexity in conservation: lessons from the global decline of amphibian populations. Ecology Letters 5(4): 597.

Bradford, D.F. 1991. Mass mortality and extinction in a high-elevation population of *Rana muscosa*. Journal of Herpetology 25:174-177.

Carey, C., W.R. Heyer, J. Wilkinson, R.A. Alford, J.W. Arntzen, T. Halliday, L. Hungerford, K.R. Lips, E.M. Middleton, S.A. Orchard, and A.S. Rand. 2001. Amphibian declines and environmental change: Use of remote-sensing data to identify environmental correlates. Conservation Biology 15(4):903-913.

Cooke, A. S. 1981. Tadpoles as indicators of harmful levels of pollution in the field. Environ. Pollut. Ser. A. 25:123-133.

Cromer, R.B., J.D. Lanham, and H.H. Hanlin. 2001. Herpetofaunal responses to gap and skidder-rut wetland creation in a southern bottomland hardwood forest. Forest Science 48(2):407-413.

Cummins, C.P. 1986. Effects of aluminum and low pH on growth and development in *Rana temporaria* tadpoles. Oecologia 69:248-252.

Dale, J. M., B. Freedman, and J. Kerekes. 1985. Acidity and associated water chemistry of amphibian habitats in Nova Scotia. Can. J. Zool. 63:97-105.

DiMauro, D. and M.L. Hunter, Jr. 2001. Reproduction of amphibians in natural and anthropogenic temporary pools in managed forests. Forest Science 48(2):397-406.

Dodson, S. I. 1970. Complementary feeding niches sustained by size-selective predation. Limnol. Oceanogr. 15:131-137.

Dodson, W. I. and V. E. Dodson. 1971. The diet of *Ambystoma tigrinum* larvae from western Colorado. Copeia 1971:614-624.

Dunson, W. A. 1982. The effect of acid rain on amphibians in temporary forest ponds. A proposal to the U. S. Fish and Wildlife Service. 13 pp.

Dunson, W. A. and J. Connell. 1982. Specific inhibition of hatching in amphibian embryos by low pH. J. Herpetol. 16:314-316.

Dunson, W. A., R. L. Wyman, and E. S. Corbett. 1992. A symposium on amphibian declines and habitat acidification. J. Herpetol. 26(4):349-352.

Fowler, D.K., D.M. Hill, L.J. Fowler. 1985. Colonization of coal surface mine sediment ponds in southern Appalachia by aquatic organisms and breeding amphibians. In: Water Management on mined lands. Eds. R.P. G. Brooks, J.B. Hill, F.J. Brenner, and S. Carpets. Proceedings of a conference. The Pennsylvania State University, State College, PA. Pp 261-280.

Freda, J. V. and W. A. Dunson. 1986. Effects of low pH and other chemical variables on the local distribution of amphibians. Copeia 1986:454-466.

Gosner, K. L. and I. H. Black. 1957. The effects of acidity on the development and hatching of New Jersey frogs. Ecology 38(2):256-262.

Grant, K. P. and L. E. Licht. 1993. Acid tolerance of anuran embryos and larvae from central Ontario. J. Herpetol. 27:1-6.

Halliday, T. 2001. The wider implications of amphibian population declines. Oryx 35(3): 181-182.

Ireland, M. P. 1977. Lead retention in toads, *Xenopus laevis* fed increasing levels of lead-contaminated earthworms. Environ. Pollut. 12:85-92.

Johnson, C. R. 1980. The effects of five organophosphorus insecticides on thermal stress in tadpoles of the Pacific treefrog, *Hyla regilla*. Zool. J. Linn. Soc. 69:143-147.

Leuven, R. S. E., C. den-Hartog, M. M. C. Christiaans, and W. H. C. Helijligers. 1986. Effects of water acidification on the distribution and the reproductive success of amphibians. Experientia 42:495-503.

Licht, L. E. 1985. Uptake of 14C DDT by wood frog embryos after short term exposure. Comp. Biochem. Physiol. C,81:117-119.

Milstein, M. 1990. Unlikely harbingers. Natl. Parks 64:18-24.

Myers, C.W. and W.D. Klimsira. 1963. Amphibians and reptiles of an ecologically disturbed (strip-mined) area in Southern Illinois. The American Midland Naturalist 70(1): 127-133

Pauley, T.K. 1993a. Study of artificial amphibian ponds in forest clearcuts. Unpublished report to the USDA-FS.

Pauley, T. K. 1993b. Report of the Upland Vertebrates in the New River Gorge National River. Volume I-III. 1,119 pp.

Pechmann, J.H.K., D.E. Scott, R.D. Semlitsch, J.P. Caldwell, L.J. Vitt, and J.W. Gibbons. 1991. Declining amphibian populations in perspective: Natural fluctuations and human impacts. Science 253:892-895.

Phillips, K. 1990. Where have all the frogs and toads gone? BioScience 253:422-424.

Pierce, B.A. 1985. Acid tolerance in amphibians. BioScience 35(4):239-243.

Pierce, B. A., J. B. Hoskins, E. Epstein. 1984. Acid tolerance in Connecticut wood frogs (Rana sylvatica). J. Herpetol. 18 (2):159-167.

Pough, F. H. 1976. Acid precipitation and embryonic mortality of spotted salamanders, *Ambystoma maculatum*. Science 192:68-70.

Saber, P. A. and W. A. Dunson. 1978. Toxicity of bog water to embryonic and larval anuran amphibians. J. Exp. Zool. 204:33-42.

Sadinski, W. J. and W. A. Dunson. 1992. A multilevel study of effects of pH on amphibians of temporary ponds. J. Herpetol. 26:413-422.

Saugey, D.A., G.A. Heidt, D.R. Health. 1988. Utilization of abandoned mine drifts and fracture caves by bats and salamanders: Unique subterranean habitat in the Ouachita Mountains. In: Management of amphibians, reptiles, and small mammals in North America. Eds. R.C. Szaro, K.E. Severson, and D.R. Patton. General Technical Report RM-166. United States Department of Agriculture-Forest Service. Pages 64-71.

Schlichter, L. C. 1981. Low pH affects the fertilization and development of *Rana pipiens* eggs. Can. J. Zool. 59:1693 -1699.

Stebbins, R.C. and N.W. Cohen. 1995. A natural history of amphibians. Princeton University Press. Princeton, NJ. 316 pp.

Strijbosch, H. 1979. Habitat selection of amphibians during their aquatic phase. Oikos 33:363-372.

Tome, M. A. and F. H. Pough. 1982. Responses of amphibians to acid precipitation. In: Johnson, R. E. (ed.), Acid rain and Fisheries, Proc. Int. Symp. Acid Precipitation and fishery impacts in Northeastern North America. Am. Fish. Soc., Bethesda, Maryland. pp. 245-253.

Vardia, H.K., P. Sambasiva, and V. S. Durve. 1984. Sensitivity of toad larvae to 2,4-D and endosulfan pesticides. Arch. Hydrobiol. 100:395-400.

Wake, D. 1991. Declining amphibian populations. Science 253:860.

Wyman, R. L. 1990. What's happening to the amphibians? Conserv. Biol. 4:350-352.

Wyman, R. L. and J. Jancola. 1992. Degree and scale of terrestrial acidification and amphibian community structure. J. Herpetol. 26:392-401.

Table 1. Location of aquatic turtle and minnow traps at Will Creek Lake

Northing	Easting	Type	Notes	pH
4446492	433692	Hoop		8.40
4446584	433523	Catfish		7.60
4446647	433657	Catfish		8.00
4446504	433526	Fyke		8.00
4446529	433790	Minnow Trap		0.00
4446451	433544	Minnow Trap		7.80
4446387	433552	Minnow Trap		8.00
4444978	432620	Minnow Trap	in grass	5.10
4444999	432619	Box		5.10
4445007	432622	Catfish	next to log	nd
4444997	432597	Catfish	under button bush at mouth	7.30
4445004	432578	Fyke	at mouth	7.30
4444964	432561	Hoop	in willows	6.70
4444964	432561	Minnow Trap	in willows	6.70
4444998	432600	Minnow Trap		7.20
4446477	433500	Hydro lab	Channel out of control	7.27
4444995	432572	Hydro lab	Downstream of outflow	7.23
4445013	432678	Hydro lab	in AMD embayment	5.6
4446421	433462	Hydro Lab	River channel out of control	7.27

* Hydro lab are water quality readings by B. Passmore

Table 2. Locations of Survey sites at Wills Creek Lake

Northing*	Easting*	Site Number	Description
433612	4446369	Site #1	Reference Site
433001	4445058	Site #2	Permanent Pond with cattails
432653	4444755	Site #3	Seep and Roadside ditch
432620	4444685	Site #4	Borrow pit and Rock quarry
432735	4444822	Site # 5	Wooded Hillside
432824	4444863	Site #6	Study Site
433235	4445994	Site #7	Along roadside
433066	4445290	Site #8	Roadside ditch
434218	4446642	Site #9	Second Reference site
434336	4446724	Site #10	

*UTM Zone 17, NAD 83

Table 3. Amphibians, reptiles, and birds observed at Wills Creek Lake

Location	Amphibians and Reptiles	Birds
Site #1	*Rana clamitans melanota*	Great Blue Heron
	Chelydra s. serpentina	Acadian Flycatcher
	Chrysemys picta marginata	Common Yellowthroat
		Indigo Bunting
		House Wren
		Yellow-billed Cuckoo
		Red-tailed Hawk
		Tufted Titmouse
		Red-eyed Vireo
		Prothonotary Warbler
		Turkey Vulture
		Song Sparrow
		Swainson's Warbler
		Downy Woodpecker
		Hairy Woodpecker
		Red-headed Woodpecker
		Red-bellied Woodpecker
		Gray Catbird
		Wood Thrush
		Eastern Wood-Pewee
		Blue-gray Gnatcatcher
		Mourning Dove
		Red-winged Blackbird
		American Redstart
		Yellow-throated Warbler
		Blue Jay
		Baltimore Oriole
Site #2	*Rana clamitans melanota*	Gray Catbird
	Hyla chrysoscelis	Eastern Wood-Pewee
		Eastern Towhee
		Eastern Phoebe
		Swamp Sparrow
		Northern Flicker
Site #3	none	None
Site #4	*Diadophis punctatus edwardsii*	
Site #5	*Plethodon glutinosus*	None

Location	Amphibians and Reptiles	Birds
Site #6	*Rana clamitans melanota*	Scarlet Tanager
	Hyla chrysoscelis	Whip-poor-will
	Plethodon glutinosus	Northern Cardinal
	Chrysemys picta marginata	Carolina Chickadee
	Apalone s. spinifera	American Woodcock
Site #7	*Elaphe o. obsoleta*	
Site #8	*Rana clamitans melanota*	
Site #9	*Bufo fowleri*	
	Hyla chrysoscelis	
Site #10	*Bufo fowleri*	
	Hyla chrysoscelis	
	Rana catesbeiana	
	Rana clamitans melanota	

Table 4. Scientific and common names of amphibian and reptile species observed and potential species.

Scientific name	common name
**Bufo fowleri*	Fowler's Toad
Bufo a. americanus	Eastern American Toad
**Hyla chrysoscelis*	Cope's Gray Treefrog
Pseudacris c. crucifer	Northern Spring Peeper
**Rana catesbeiana*	American Bullfrog
**Rana clamitans melanota*	Northern Green Frog
Rana palustris	Pickerel Frog
Rana sylvatica	Wood Frog
Ambystoma jeffersonianum	Jefferson Salamander
Notophthalmus v. viridescens	Red-spotted Newt
Ambystoma maculatum	Spotted Salamander
Plethodon cinereus	Red-backed Salamander
**Plethodon glutinosus*	Northern Slimy Salamander
Plethodon richmondi	Northern Ravine Salamander
Desmognathus fuscus	Northern Dusky Salamander
Eurycea bislineata	Northern Two-lined Salamander
**Diadophis punctatus edwardsii*	Northern Ring-necked Snake
**Elaphe o. obsoleta*	Black Ratsnake
**Chelydra s. serpentina*	Eastern Snapping Turtle
***Terrapene c. Carolina*	Eastern Box Turtle
**Chrysemys picta marginata*	Midland Painted Turtle
**Apalone s. spinifera*	Eastern Spiny Softshell

* Species observed

**Observed and reported by Barry Passmore

Table 5. Species richness of inventory sites.

Location site	Observed	Expected*	Potential Richness
1**	3	5	8
2	2	5	7
3	0	3	3
4	1	0	1
5	1	2	3
6***	6	5	11
7	1	1	2
8	1	1	2
9	2	3	5
10	4	2	6

*Species expected to inhabit the site, but not observed
** Reference site upstream of MM 280
*** MM 280 site

C:\My Documents\Consulting 2003\COE\ wills creek sites map (768x1001x24b jpeg)

Figure 1.

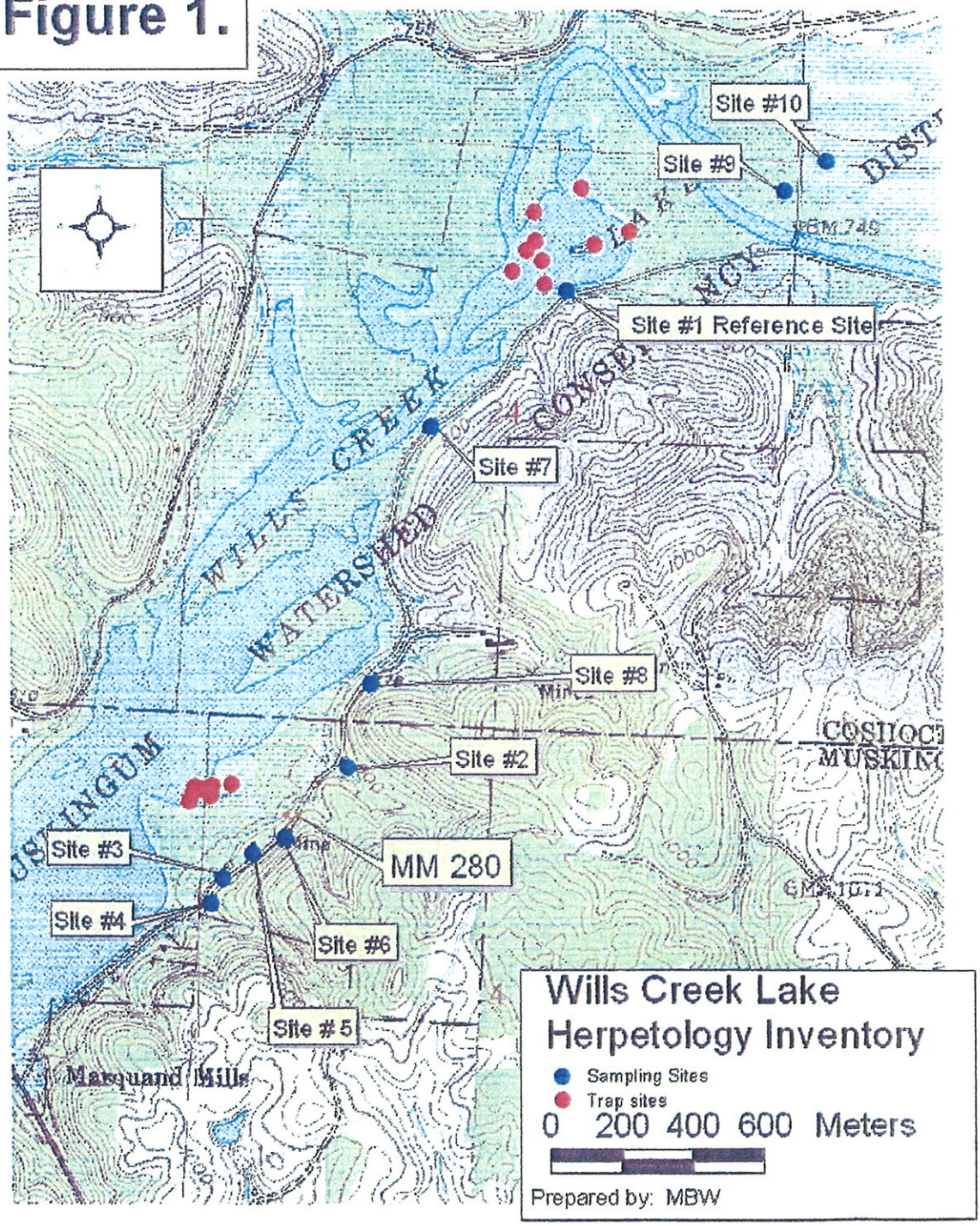


Figure 2. Site #1 View NW showing small island.

Figure 3. Site #2 Small sediment pond lined with vegetation.

Figure 4. Site #3 Roadside ditch with standing water.

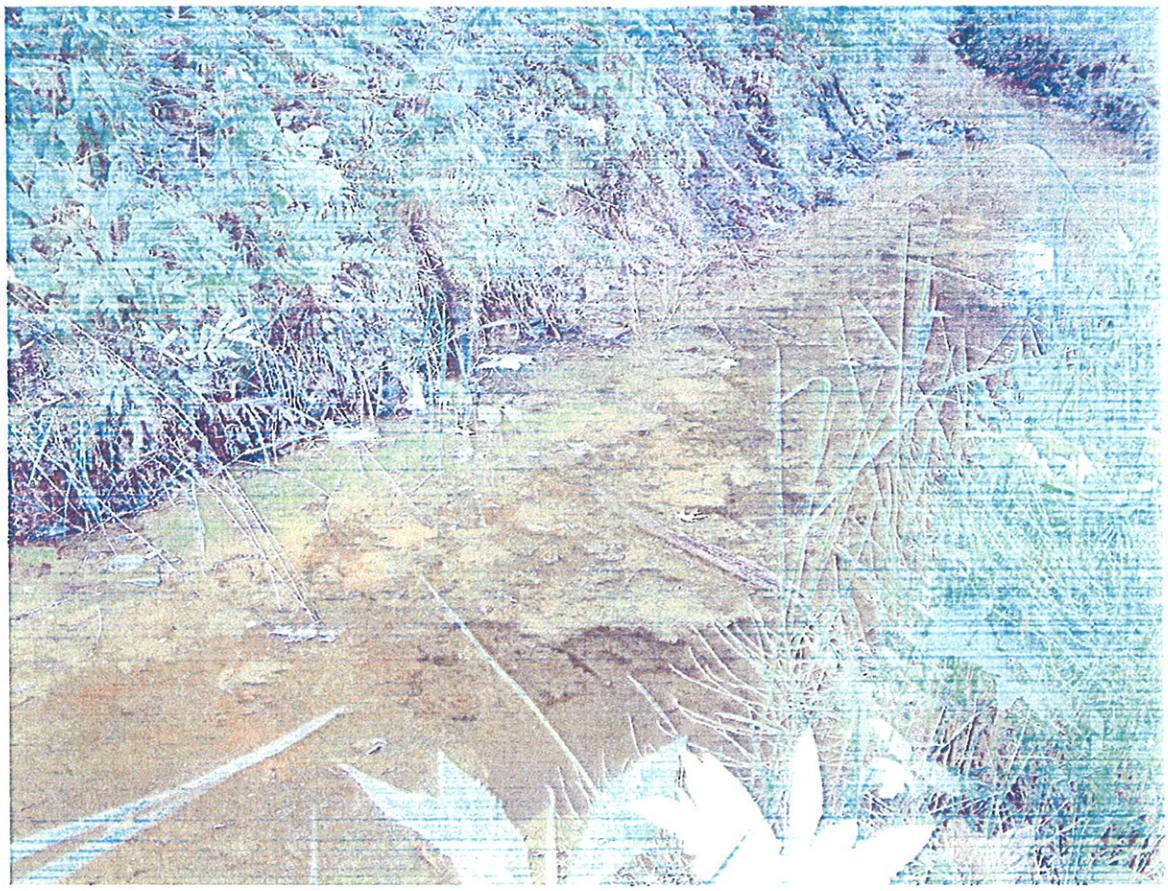


Figure 5. Site #4 Borrow pit

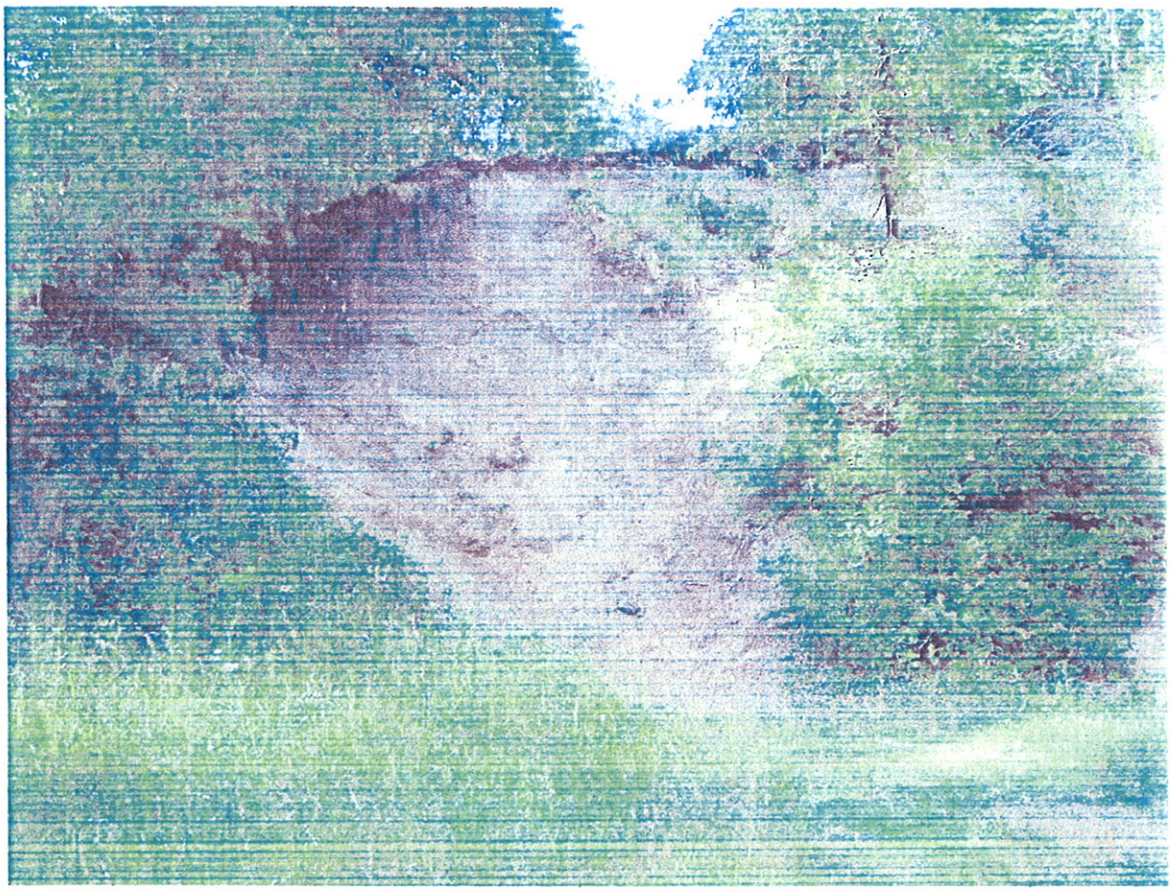


Figure 6. Site #5 Wooded hillside

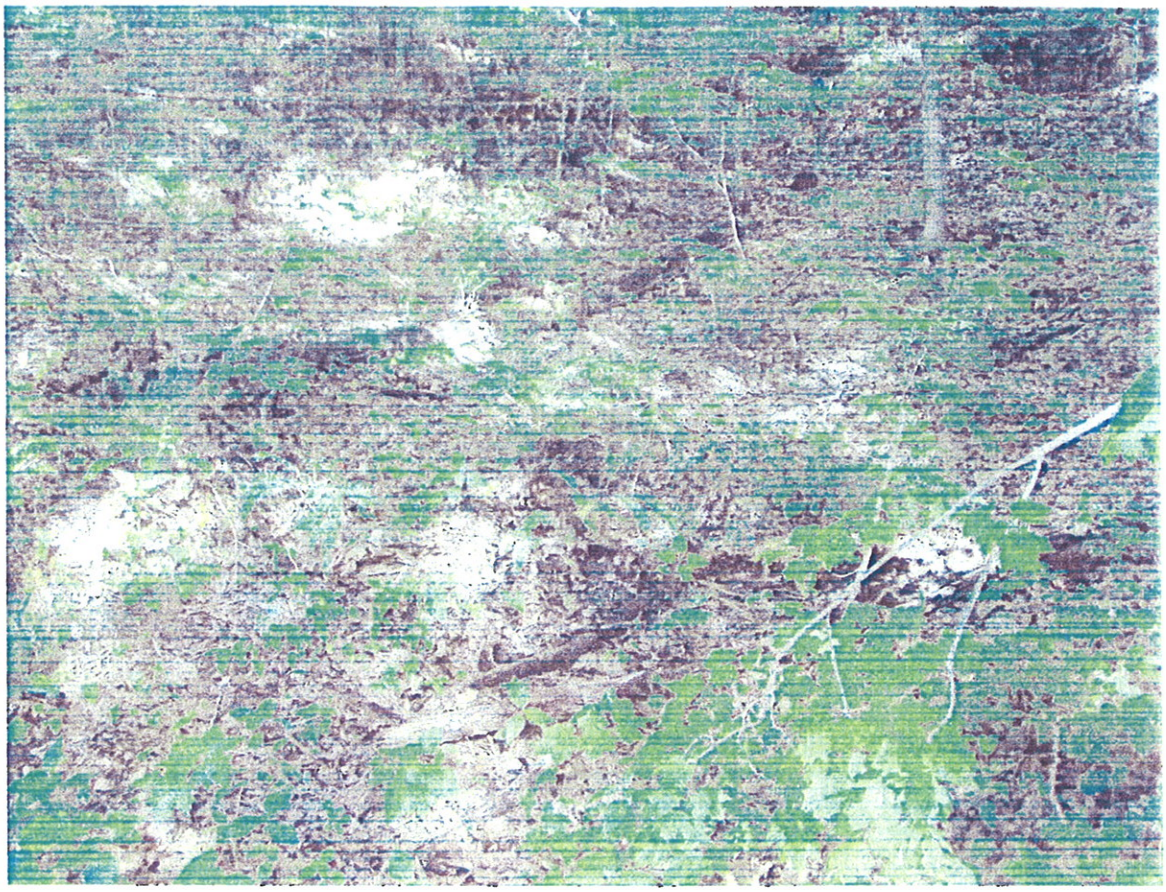


Figure 7. Site #6 NW view showing impacted drainage from MM280.

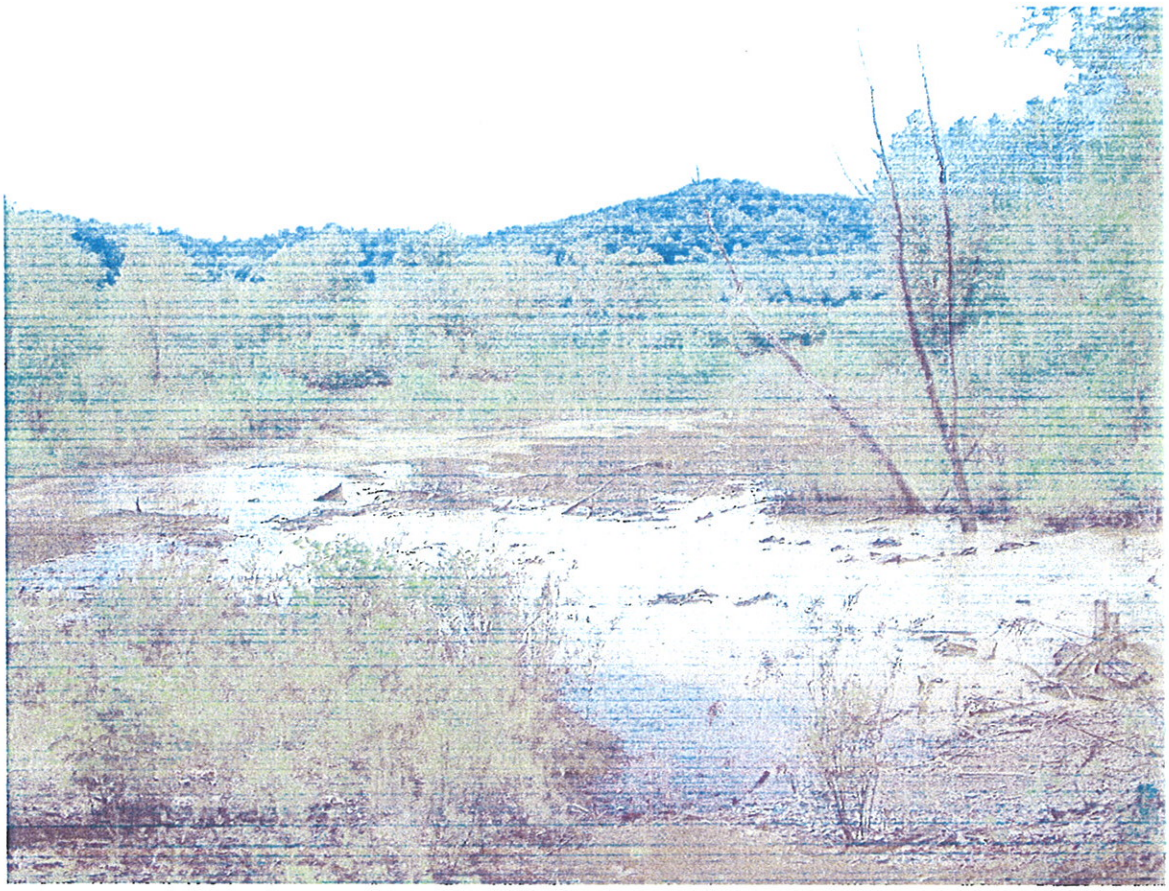


Figure 8. Site #7 Roadside area

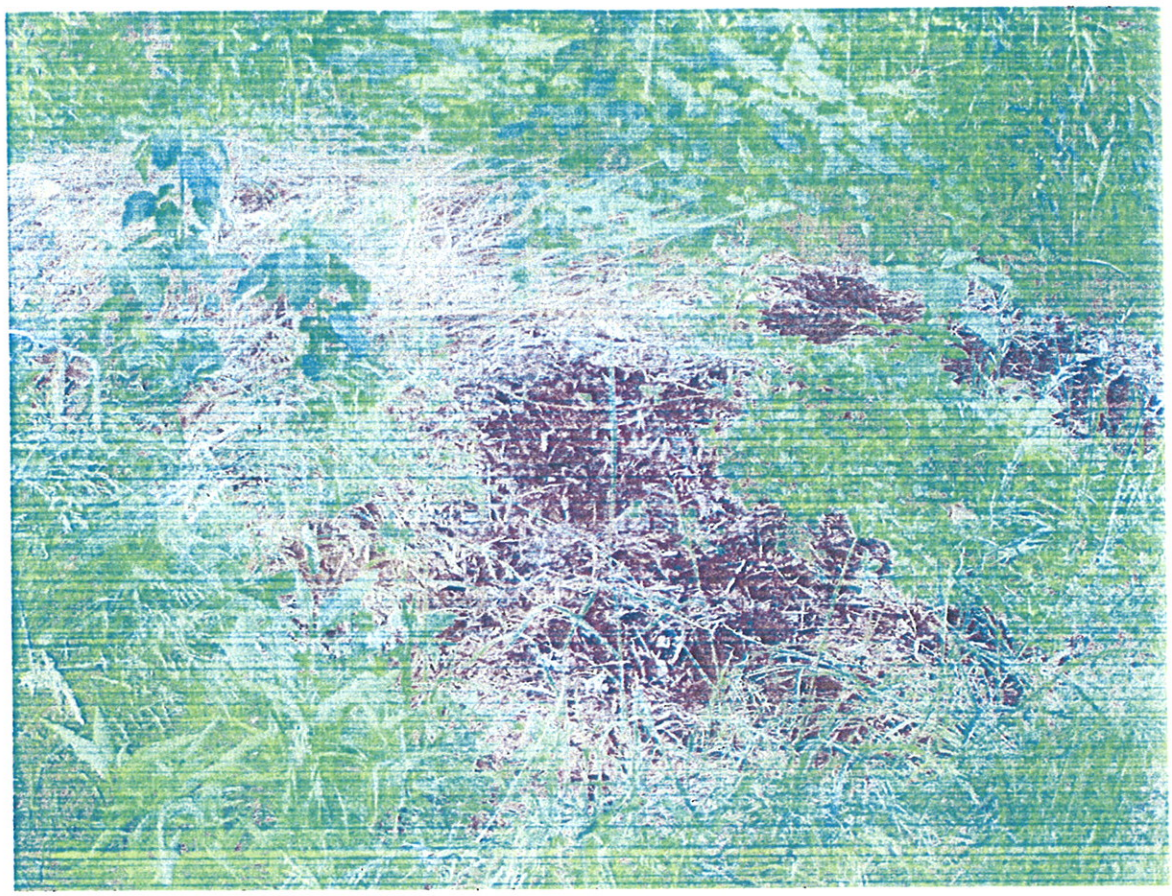


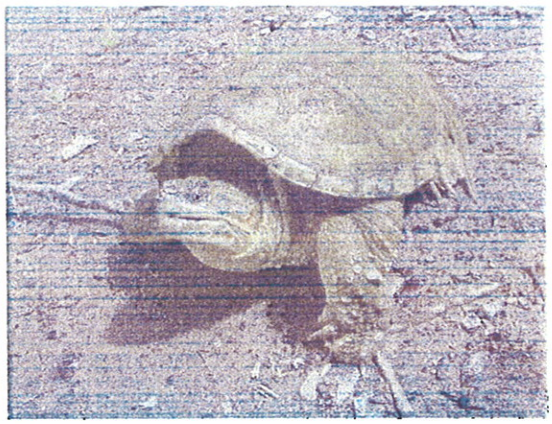
Figure 9. Site #8 Roadside ditch

Figure 10. Pictures of amphibian and reptile species observed.

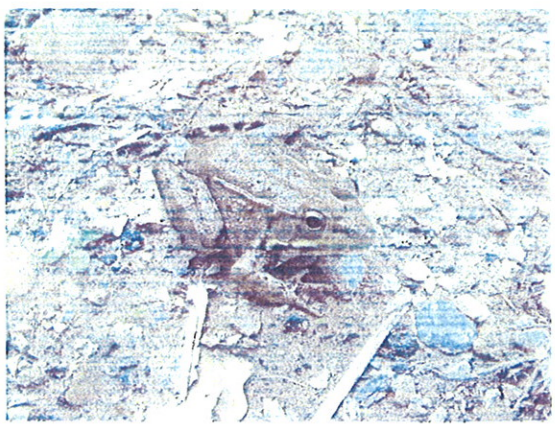
Elaphe o. obsoleta

Chrysemys picta marginata

Apalone s. spinifera

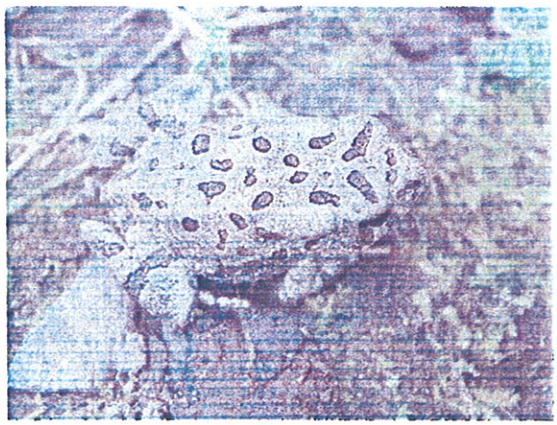
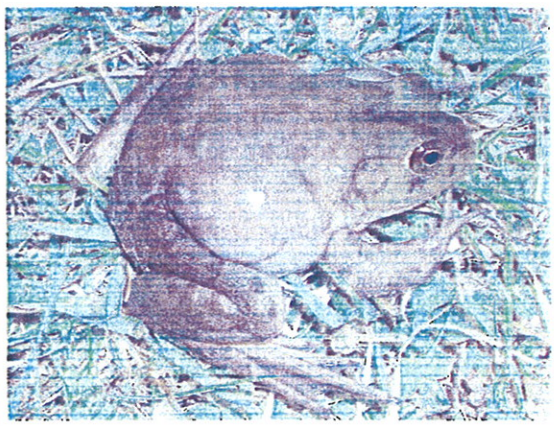
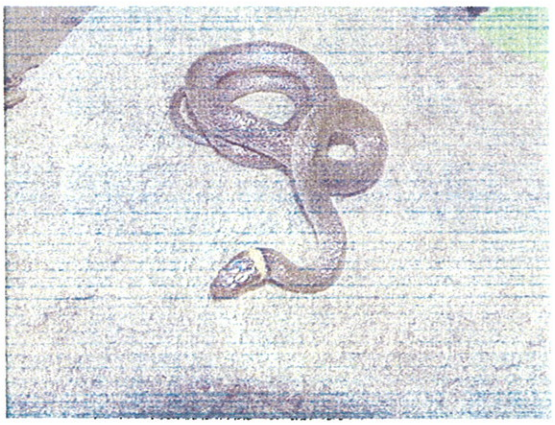
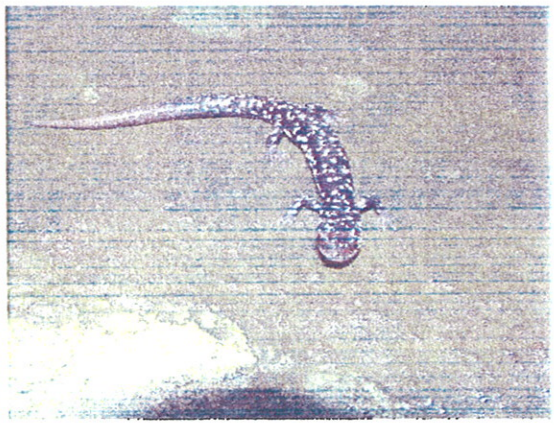


Chelydra s. serpentina



Rana clamitans melanota

Hyla chrysoscelis

	
Bufo fowleri	*Rana catesbeiana*
	
Diadophis punctatus edwardsii	*Plethodon glutinosus*

Wills Creek Inventory Data Sheet

Site type: Inven./hab. **Site #:** 1 **Date:** 9 June 03 **Quad:** Wills Creek, Ohio

Location: Wills Creek Lake

Elevation:_____ **Aspect:**_____ **Start:**_____
End:_____ **# People** 2

G.P.S
N 444 6369 E 0433612

Habitat
Type Lake, Embayment of slow flowing stream

Potential
Species_____

Sample Tech Call

Species:

1. Rana Clamitans melanota **Sex:** (M)/F # 1 **Life stage:** Adult
2. _____ **Sex:** M/F # _____ **Life stage:**_____
3. _____ **Sex:** M/F # _____ **Life stage:**_____
4. _____ **Sex:** M/F # _____ **Life stage:**_____
5. _____ **Sex:** M/F # _____ **Life stage:**_____
6. _____ **Sex:** M/F # _____ **Life stage:**_____
7. _____ **Sex:** M/F # _____ **Life stage:**_____
8. _____ **Sex:** M/F # _____ **Life stage:**_____
9. _____ **Sex:** M/F # _____ **Life stage:**_____
10. _____ **Sex:** M/F # _____ **Life stage:**_____

Water T_____ **pH**_____

Notes:

Great Blue Heron
Acadian Flycatcher
House Wren
Yellow-bellied Cuckoo
Common Yellowthroat
Indigo Bunting
Red-tailed Hawk

Wills Creek Inventory Data Sheet

Site type: Inven./hab. **Site #:** 1 **Date:** 10 June 03 **Quad:** Wills Creek, Ohio

Location: Wills Creek Lake

Elevation:_____ **Aspect:**_____ **Start:**_____
End:_____ **# People** 2

G.P.S
N 444 6369 E 0433612

Habitat Type Embayment

Potential Species_____

Sample Tech Trap (hoop)

Species:

1. Chelydra s. Serpentina **Sex:** M/F # _____ **Life stage:** Adult
2. Chrysemys p. picta marginata **Sex:** M/F # _____ **Life stage:** Adult
3. _____ **Sex:** M/F # _____ **Life stage:**_____
4. _____ **Sex:** M/F # _____ **Life stage:**_____
5. _____ **Sex:** M/F # _____ **Life stage:**_____
6. _____ **Sex:** M/F # _____ **Life stage:**_____
7. _____ **Sex:** M/F # _____ **Life stage:**_____
8. _____ **Sex:** M/F # _____ **Life stage:**_____
9. _____ **Sex:** M/F # _____ **Life stage:**_____
10. _____ **Sex:** M/F # _____ **Life stage:**_____

Water T_____ **pH**_____

Notes: Tufted Titmouse
Baltimore oriole
Red-eyed Vireo
Prothonotary Warbler
Turkey Vulture
gray Catbird
Wood Thrush
Wood Peewee
Swainson's Warbler
Downy Woodpecker
Hairy Woodpecker
Red-bellied woodpecker
American Redstart
Blue-gray Gnatcatcher
Mourning Dove
Red-winged Blackbird
Blue Jays
Common Yellowthroat

Wills Creek Inventory Data Sheet

Site type: Inven./hab. **Site #:** 2 **Date:** 9 June 03 **Quad:** Wills Creek, Ohio

Location: Wills Creek Lake

Elevation:_____ **Aspect:**_____ **Start:**_____
End:_____ **# People** 2

G.P.S
N 444 5094 E 043 2945

Habitat Type Permanent Pond w/ cattails

Potential Species Rana Sylvatica, Rana palustris, Ambystoma maculatum, Ambystoma jeffersonianum, Pseudacris Crucifer

Sample Tech Hand / D-net

Species:

1. Rana Clamitans melanota **Sex:** M/F # 10+ **Life stage:** larval
2. Hyla Chrysoscelis **Sex:** M/F # 10+ **Life stage:** larval
3. Hyla Chrysoscelis **Sex:** M/F # 1 **Life stage:** Adult
4. _____ **Sex:** M/F # _____ **Life stage:**_____
5. _____ **Sex:** M/F # _____ **Life stage:**_____
6. _____ **Sex:** M/F # _____ **Life stage:**_____
7. _____ **Sex:** M/F # _____ **Life stage:**_____
8. _____ **Sex:** M/F # _____ **Life stage:**_____
9. _____ **Sex:** M/F # _____ **Life stage:**_____
10. _____ **Sex:** M/F # _____ **Life stage:**_____

Water T_____ **pH**_____

Notes: Gray Catbird
Wood Peewee
Eastern Towhee

Wills Creek Inventory Data Sheet

Site type: Inven./hab. **Site #:** 2 **Date:** 11 June 03 **Quad:** Will Creek, Rio

Location: Wills Creek Lake

Elevation:_____ **Aspect:**_____ **Start:**_____
End:_____ **# People** 2

G.P.S
N 444 5094 E 0432 945

Habitat
Type Permanent pond w/ cattails

Potential
Species_____

Sample Tech meadow trap

Species:

1. ~~Hyla~~ **Sex:** M/F # _____ **Life stage:**_____
2. Hyla Chrysoscelis **Sex:** M/F # 10+ **Life stage:** larvae
3. _____ **Sex:** M/F # _____ **Life stage:**_____
4. _____ **Sex:** M/F # _____ **Life stage:**_____
5. _____ **Sex:** M/F # _____ **Life stage:**_____
6. _____ **Sex:** M/F # _____ **Life stage:**_____
7. _____ **Sex:** M/F # _____ **Life stage:**_____
8. _____ **Sex:** M/F # _____ **Life stage:**_____
9. _____ **Sex:** M/F # _____ **Life stage:**_____
10. _____ **Sex:** M/F # _____ **Life stage:**_____

Water T_____ **pH**_____

Notes: Eastern Phoebe
Swamp Sparrow
Northern Fleicher

Wills Creek Inventory Data Sheet

Site type: Inven./hab. **Site # :** 3 **Date:** 9 June 03 **Quad:** Wills Creek, Ohio

Location: Wills Creek below

Elevation:_____ **Aspect:**_____ **Start:**_____
End:_____ **# People** 2

G.P.S
N 4444 7~~55~~ E 0432653

Habitat Type Seep, roadside ditch

Potential Species Pseudacris Crucifer

Sample Tech Dip net

Species:

1. Ø **Sex:** M/F # _____ **Life stage:**_____
2. _____ **Sex:** M/F # _____ **Life stage:**_____
3. _____ **Sex:** M/F # _____ **Life stage:**_____
4. _____ **Sex:** M/F # _____ **Life stage:**_____
5. _____ **Sex:** M/F # _____ **Life stage:**_____
6. _____ **Sex:** M/F # _____ **Life stage:**_____
7. _____ **Sex:** M/F # _____ **Life stage:**_____
8. _____ **Sex:** M/F # _____ **Life stage:**_____
9. _____ **Sex:** M/F # _____ **Life stage:**_____
10. _____ **Sex:** M/F # _____ **Life stage:**_____

Water T_____ **pH**_____

Notes:

Wills Creek Inventory Data Sheet

Site type: Inven./hab. **Site #:** 4 **Date:** 9 June 03 **Quad:** Wills Creek, Ohio

Location: Wills Creek Lake

Elevation:_____ **Aspect:**_____ **Start:**_____
End:_____ **# People** 2

G.P.S
N 4444 685 E 0432620

Habitat Type Borrow Pit and Rock Quarry

Potential Species_____

_____

Sample Tech Land

Species:

1. Didelphis virginiana **Sex:** M/F # _____ **Life stage:** Adult
2. edwardsii **Sex:** M/F # 1 **Life stage:**_____
3. _____ **Sex:** M/F # _____ **Life stage:**_____
4. _____ **Sex:** M/F # _____ **Life stage:**_____
5. _____ **Sex:** M/F # _____ **Life stage:**_____
6. _____ **Sex:** M/F # _____ **Life stage:**_____
7. _____ **Sex:** M/F # _____ **Life stage:**_____
8. _____ **Sex:** M/F # _____ **Life stage:**_____
9. _____ **Sex:** M/F # _____ **Life stage:**_____
10. _____ **Sex:** M/F # _____ **Life stage:**_____

Water T_____ **pH**_____

Notes:

Wills Creek Inventory Data Sheet

Site type: Inven./hab. **Site #:** 5 **Date:** 9 June 03 **Quad:** Wills Creek, Ohio

Location: Wills Creek Lake

Elevation:_____ **Aspect:**_____ **Start:**_____
End:_____ **# People** 2

G.P.S
N 4444 822 E 0432735

Habitat Type Wooded Hillside

Potential Species_____

Sample Tech hand

Species:

1. Plethodon glutinosus **Sex:** M/F # 1 **Life stage:** Adult
2. _____ **Sex:** M/F # _____ **Life stage:**_____
3. _____ **Sex:** M/F # _____ **Life stage:**_____
4. _____ **Sex:** M/F # _____ **Life stage:**_____
5. _____ **Sex:** M/F # _____ **Life stage:**_____
6. _____ **Sex:** M/F # _____ **Life stage:**_____
7. _____ **Sex:** M/F # _____ **Life stage:**_____
8. _____ **Sex:** M/F # _____ **Life stage:**_____
9. _____ **Sex:** M/F # _____ **Life stage:**_____
10. _____ **Sex:** M/F # _____ **Life stage:**_____

Water T_____ **pH**_____

Notes:

Wills Creek Inventory Data Sheet

Site type: Inven./hab. **Site #:** 6 **Date:** 9 June 03 **Quad:** Wills Creek, Rio

Location: Wills Creek Lake

Elevation:_____ **Aspect:**_____ **Start:**_____
End:_____ **# People** 2

G.P.S
N 4444 863 E 04 32735

Habitat Type Embayment

Potential Species_____

Sample Tech Hand

Species:

1. Hyla Chrysoscelis **Sex:** M/F # _____ **Life stage:** Adult
2. Rana Clamitans melanota **Sex:** M/F # _____ **Life stage:** Adult
3. Apalone S. spinifera **Sex:** M/F # 1 **Life stage:** Adult
4. _____ **Sex:** M/F # _____ **Life stage:** _____
5. _____ **Sex:** M/F # _____ **Life stage:** _____
6. _____ **Sex:** M/F # _____ **Life stage:** _____
7. _____ **Sex:** M/F # _____ **Life stage:** _____
8. _____ **Sex:** M/F # _____ **Life stage:** _____
9. _____ **Sex:** M/F # _____ **Life stage:** _____
10. _____ **Sex:** M/F # _____ **Life stage:** _____

Water T_____ **pH**_____

Notes: Scarlet Tanager
Whip-poor-will

Wills Creek Inventory Data Sheet

Site type: Inven./hab. **Site #:** 6 **Date:** 10 June 03 **Quad:** Wills Creek, Ohio

Location: Wills Creek Lake

Elevation:_____ **Aspect:**_____ **Start:**_____
End:_____ **# People** 2

G.P.S
N 4444 763 E 0432824

Habitat Type Embayment

Potential Species_____

Sample Tech hand + trap (hoop)

Species:

1. Hyla Chrysoscelis — Sex: M/F # 1 — Life stage: Adult
2. Plethodon glutinosus — Sex: M/F # 1 — Life stage: Adult
3. Chrysemys picta marginata — Sex: M/F # 1 — Life stage: Adult
4. _____ — Sex: M/F # _____ — Life stage: _____
5. _____ — Sex: M/F # _____ — Life stage: _____
6. _____ — Sex: M/F # _____ — Life stage: _____
7. _____ — Sex: M/F # _____ — Life stage: _____
8. _____ — Sex: M/F # _____ — Life stage: _____
9. _____ — Sex: M/F # _____ — Life stage: _____
10. _____ — Sex: M/F # _____ — Life stage: _____

Water T_____ **pH**_____

Notes: Seep w/ Sphagnum moss - too dry for Salamanders
Birds: Northern Cardinal, Carolina Chickadee
American woodcock - ♂ nest display
Trees: Yellow Poplar, White Ash, Red Maple,

Wills Creek Inventory Data Sheet

Site type: Inven./hab. **Site #:** 7 **Date:** 10 June 03 **Quad:** Wills Creek, Ohio

Location: Wills Creek Lake

Elevation:_____ **Aspect:**_____ **Start:**_____
End:_____ **# People** 2

G.P.S
N 444 5994 **E** 0433235

Habitat Type Roadside

Potential Species_____

Sample Tech Bond

Species:

1. Elliptio obsoleta **Sex:** (M)/F # _____ **Life stage:** Adult
2. _____ **Sex:** M/F # _____ **Life stage:**_____
3. _____ **Sex:** M/F # _____ **Life stage:**_____
4. _____ **Sex:** M/F # _____ **Life stage:**_____
5. _____ **Sex:** M/F # _____ **Life stage:**_____
6. _____ **Sex:** M/F # _____ **Life stage:**_____
7. _____ **Sex:** M/F # _____ **Life stage:**_____
8. _____ **Sex:** M/F # _____ **Life stage:**_____
9. _____ **Sex:** M/F # _____ **Life stage:**_____
10. _____ **Sex:** M/F # _____ **Life stage:**_____

Water T_____ **pH**_____

Notes:

Wills Creek Inventory Data Sheet

Site type: Inven./hab. **Site #:** 8 **Date:** 10 June 03 **Quad:** Wills Creek, Ohio

Location: Wills Creek Lake

Elevation:_____ **Aspect:**_____ **Start:**_____
End:_____ **# People** 2

G.P.S
N 4445290 E 0433066

Habitat Type Roadside ditch

Potential Species_____

Sample Tech hand/dip net

Species:

1. Rana Clamitans melanota **Sex:** M/F # 2 **Life stage:** Subadult
2. _____ **Sex:** M/F # _____ **Life stage:**_____
3. _____ **Sex:** M/F # _____ **Life stage:**_____
4. _____ **Sex:** M/F # _____ **Life stage:**_____
5. _____ **Sex:** M/F # _____ **Life stage:**_____
6. _____ **Sex:** M/F # _____ **Life stage:**_____
7. _____ **Sex:** M/F # _____ **Life stage:**_____
8. _____ **Sex:** M/F # _____ **Life stage:**_____
9. _____ **Sex:** M/F # _____ **Life stage:**_____
10. _____ **Sex:** M/F # _____ **Life stage:**_____

Water T_____ **pH**_____

Notes:

Wills Creek Inventory Data Sheet

Site type: Inven./hab. **Site #**: 9 **Date**: 10 June 03 **Quad**: Wills Creek, Ohio

Location: Wills Creek Lake

Elevation:_____ **Aspect**:_____ **Start**:_____
End:_____ **# People** 2

G.P.S
N 444 6420 E 043 4218

Habitat Type Floodplain

Potential Species_____

_____

Sample Tech Calling

Species:

1. Bufo fowleri **Sex**: M/F # 2-3 **Life stage**: Adult
2. Hyla chrysoscelis **Sex**: M/F # 3-4 **Life stage**: Adult
3. _____ **Sex**: M/F # _____ **Life stage**:_____
4. _____ **Sex**: M/F # _____ **Life stage**:_____
5. _____ **Sex**: M/F # _____ **Life stage**:_____
6. _____ **Sex**: M/F # _____ **Life stage**:_____
7. _____ **Sex**: M/F # _____ **Life stage**:_____
8. _____ **Sex**: M/F # _____ **Life stage**:_____
9. _____ **Sex**: M/F # _____ **Life stage**:_____
10. _____ **Sex**: M/F # _____ **Life stage**:_____

Water T_____ **pH**_____

Notes:

Wills Creek Inventory Data Sheet

Site type: Inven./hab. **Site #:** 10 **Date:** 10 June 03 **Quad:** Wills Creek, Ohio

Location: Wills Creek Lake

Elevation:_____ **Aspect:**_____ **Start:**_____
End:_____ **# People** 2

G.P.S
N 444 1724 E 0434336

Habitat Type Embayment and Floodplain

Potential Species_____

Sample Tech hand / call

Species:

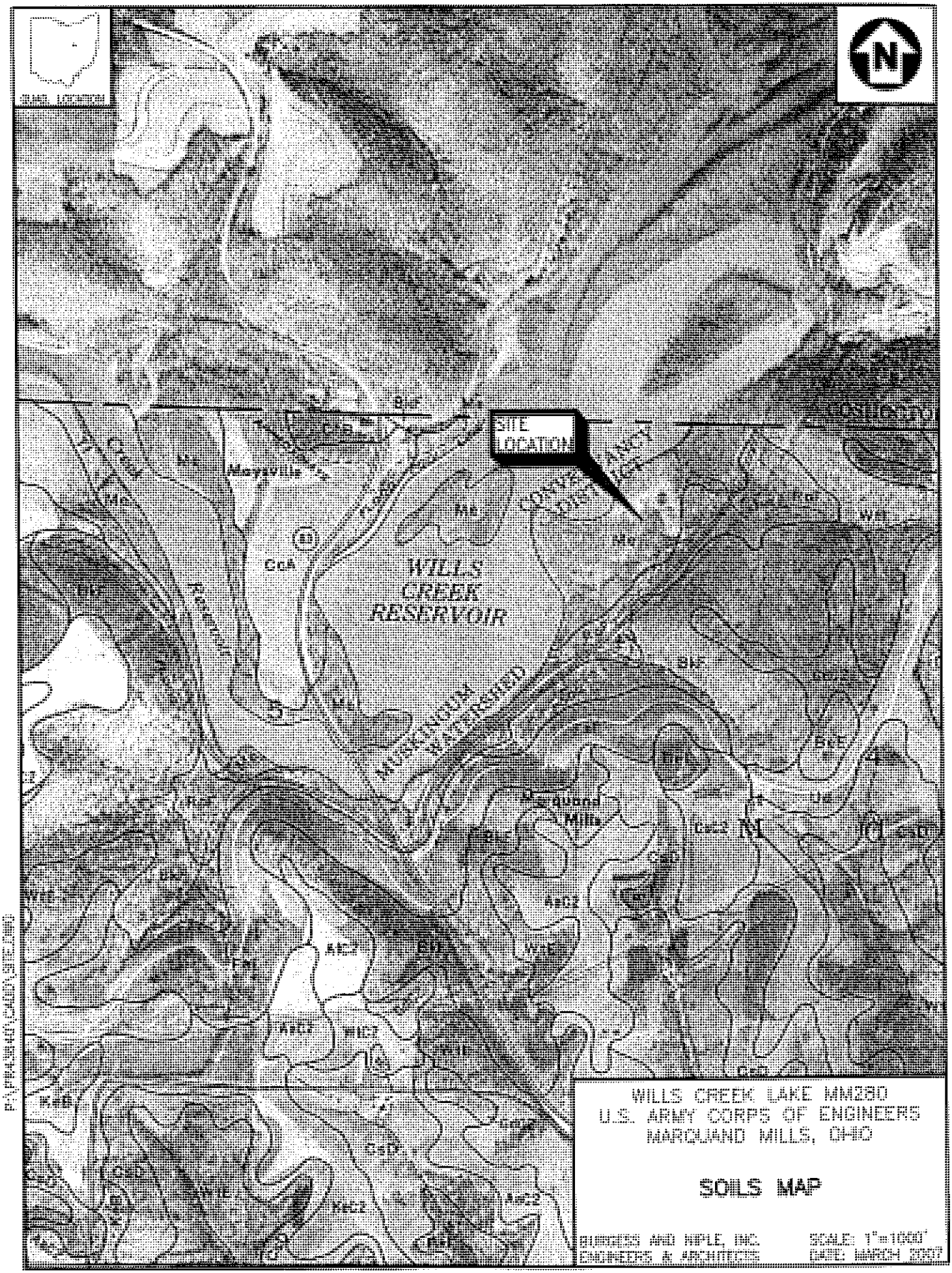
1. Bufo fowleri Sex: M/F # _____ Life stage: Adult
2. Hyla Chrysoscelis Sex: M/F # _____ Life stage: Adult
3. Rana catesbeiana Sex: M/F # _____ Life stage: Adult
4. Rana Clamitans melanota Sex: M/F # _____ Life stage: Adult
5. _____ Sex: M/F # _____ Life stage:_____
6. _____ Sex: M/F # _____ Life stage:_____
7. _____ Sex: M/F # _____ Life stage:_____
8. _____ Sex: M/F # _____ Life stage:_____
9. _____ Sex: M/F # _____ Life stage:_____
10. _____ Sex: M/F # _____ Life stage:_____

Water T_____ **pH**_____

Notes:

APPENDIX E

SOIL SURVEY MAP AND PRIME FARMLAND INFORMATION



WILLS CREEK LAKE MM280
U.S. ARMY CORPS OF ENGINEERS
MARQUAND MILLS, OHIO

SOILS MAP

BURGESS AND NIPLE, INC.
ENGINEERS & ARCHITECTS

SCALE: 1"=1000'
DATE: MARCH 2007

PAPER SIZE (24" x 36")

Prime and other Important Farmlands

Muskingum County, Ohio

Map symbol	Map unit name	Farmland classification
GdC2	Gilpin silt loam, 8 to 15 percent slopes, eroded	Farmland of local importance
Me	Melvin silt loam, frequently flooded	Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

APPENDIX F

2003 MM-280 ESA REPORT

Phase I Environmental Site Assessment

Muskingum Mine 280
Wills Creek Lake
Muskingum County, Ohio

Prepared for:
U.S. Army Corps of Engineers
Huntington District
502 Eighth Street
Huntington, West Virginia

September 2003

PHASE I ENVIRONMENTAL SITE ASSESSMENT

MUSKINGUM MINE 280
WILLS CREEK LAKE
MUSKINGUM COUNTY, OHIO

PREPARED FOR

U.S. ARMY CORPS OF ENGINEERS
HUNTINGTON DISTRICT
502 EIGHTH STREET
HUNTINGTON, WEST VIRGINIA

SEPTEMBER 2003

BURGESS & NIPLE, INC.
Engineers and Architects
5085 Reed Road
Columbus, Ohio 43220

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EXECUTIVE SUMMARY

Burgess & Niple, Inc. (B&N) conducted a Phase I Environmental Site Assessment (ESA) for the Muskingum Mine 280 (MM-280) site located adjacent to Wills Creek Lake along Tyson Road, Township Route (TR) 145, northeast of State Route (SR) 83 in Muskingum County, Ohio. A site inspection of MM-280 was performed by B&N on Tuesday, August 5, 2003 by B&N's Mr. Joseph Christopher. Ms. Jennifer Conroy provided a quality assurance/quality control (QA/QC) check of this Phase I ESA.

The actual site is currently undeveloped; however, historical documents show that the site was used as a coal mining facility (MM-280) as early as 1958 and proceeding until 1965 when the mine was abandoned. A large coal refuse (gob) pile was observed on the site confirming that a coal mining facility was located on this site. This gob pile was identified with a Global Positioning System (GPS) to be centered at N 40° 09' 04.1" by W 081° 47' 27.4". An iron pipe, approximately 5 inches in diameter, was located protruding from the gob pile in a southwesterly direction. This pipe was severed on the southern end as it left the ground. There was no detectable flow of any type observed coming from the pipe during the site visit. A manmade headwall with two exposed drainage pipes is located adjacent to, and northwest of the gob pile. The northeast pipe had no noticeable flow at the time of the site visit. The southwest drainage pipe was continuously emitting water onto the site at a significant rate. This drainage flowed to the northwest down a small streambed, over a manmade weir, and onto a plateau creating what appeared to be a large field of iron sludge deposits. This flow appeared to braid through iron sludge toward Wills Creek Lake.

A historical literature survey of the site indicates a number of structures were, at one time, located on the site. These structures included a scale house and scales, coal-loading tipple, two sheds, and a house. According to a survey completed in 1965, these structures appeared to be supplemental to the historic mining operation that occupied the site. At the time of inspection, the only remnants of those structures appeared to be the foundation of the scale house and some wooden timbers that might have been the structural supports for the loading tipple. In addition, small pockets of dumped trash; i.e., glass bottles, cans, etc., were observed scattered across the site, mainly concentrated on the northwest side of TR 145. These pockets appeared to be isolated and small in nature.

The Environmental Data Resources, Inc. (EDR) database search revealed no small quantity generator (SQG) sites within 0.75 miles of the site or leaking underground storage tanks (LUSTs) within 1.0 mile of the site. There were no underground storage tank (UST) sites within 0.75 mile of the subject site. In addition, EDR reported no orphan facilities in the general vicinity. EDR did report that one Department of Defense (DOD) site is within 1.0 mile of the site. It is believed that the DOD site is the

large impoundment (Wills Creek Lake) located immediately adjacent to the site, which is administered by a DOD entity, the U.S. Army Corps of Engineers (USACE). The size of the impoundment is at least 640 acres in size, which is the criteria to be considered a DOD site.

The Phase I ESA revealed no recognized environmental conditions (RECs) or Business Environmental Risks (BERs) associated with the current use, storage, or disposal of hazardous substances or petroleum products for the subject site except for the following:

- Presence of large-scale Acid Mine Drainage (AMD) and sedimentation as a result of suspected ferric hydroxide precipitation.

- Presence of a large coal refuse pile located on the southwest portion of the site, adjacent to TR 145, and east of Wills Creek Lake.

- The northwest portion of the site is within the 100-year floodplain of Wills Creek Lake. Due to the regulations and restrictions associated with floodplain development, this is considered a BER for the site.

B&N recommends the coal pile refuse be regraded, capped and vegetated. B&N does not recommend any further environmental investigation at this time

1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to report the findings of the Phase I Environmental Site Assessment (ESA) conducted by Burgess & Niple, Inc. (B&N) for the U.S. Army Corps of Engineers (USACE). The Phase I ESA conducted by the B&N was performed in accordance with established USACE policy and the American Society for Testing and Materials (ASTM) E1527-00 Phase I Environmental Property Assessment standard. A site visit for the above referenced site was conducted by B&N on Tuesday, August 5, 2003.

1.2 Special Terms and Conditions

A detailed inspection of the site area, which is henceforth referred to as the "site" or "subject site," was conducted in accordance with the Statement of Work contained within Contract No. DACW69-03-D-0001, Work Order No. 0004 between the USACE-Huntington District and B&N of Columbus, Ohio. A copy of the Statement of Work for this project is included in Appendix A. This report has undergone internal review according to the procedures outlined by B&N in the Quality Control Plan (QCP) prepared for the proposed subject site. Performance of the Phase I ESA for the subject site does not include a detailed inspection of adjacent properties.

1.3 Limitations and Exceptions of Assessment

The Phase I ESA conducted by B&N for the subject site represents the environmental condition of the site as of August 5, 2003. Statements contained within this report do not apply to changes in site use or associated changes in the environmental condition of the site after this date.

Performance of the Phase I ESA for the subject site does not include subsurface investigations, soil or water testing of any kind, or asbestos or lead-based paint testing.

1.4 Limiting Conditions and Methodology Used

The Phase I ESA for the subject site was conducted based on currently accepted engineering practices and guidelines and was prepared using the format and procedures outlined by ASTM in its Practice E1527-00 and USACE policy.

1.5 Quality Assurance/Quality Control (QA/QC) Procedures

A QCP was prepared by B&N for work completed during the Phase I ESA located at Muskingum Mine 280 (MM-280) in Muskingum County, Ohio. The QCP was prepared to outline the standards to be adhered to during all work conducted at the site. All site work was conducted in accordance with the QCP prepared by B&N for this project. All draft documents prepared during the project were subject to internal review within B&N and also external review by the USACE. All review comments were incorporated into final documents submitted to the USACE.

2.0 SITE DESCRIPTION

2.1 Location and Legal Description

The site is located in Muskingum County, approximately 55 miles east of Columbus, Ohio. It is bisected by Tyson Road (Township Route [TR] 145) northeast of State Route (SR) 83, and is approximately 4.0 miles above Wills Creek Lake Dam. A site location map is included in Appendix B.

2.2 Site and Vicinity Characteristics

2.2.1 Local Geology and Soils

According to the *Soil Survey of Muskingum County, Ohio*[1], soils occupying the subject site consist primarily of Melvin silt loam (Me), 0 to 2 percent slopes, Rodman gravelly sandy loam, 25 to 70 percent slopes, and Berks-Westmoreland complex, 40 to 70 percent slopes.

Melvin silt loam (Me) has the characteristics of a deep, nearly level, and poorly drained soil along floodplains. It is mainly found on bottomland along streams. Melvin silt loam has generally a 0 to 2 percent slope. Flooding is brief and mainly occurs during the dormant season, but flashfloods can occur during the growing season. Permeability is moderate in Melvin soil types with a very slow rate of runoff. The available water capacity is very high with a seasonal water table at or near the surface during the spring and winter seasons. Melvin soil type has moderate capacity to store organic nutrients in the surface layer, as well as release plant nutrients. Melvin silt loam is identified as a hydric soil on the County Hydric Soils List for Ohio.

Rodman gravelly sandy loam (RoF) has the characteristics of a deep, steep, and very steep, excessively drained soil located on dissecting hillsides and escarpments on glacial outwash terraces. Rodman gravelly sandy loam soil has generally a 25 to 70 percent slope. In some areas the surface layer is loam or loamy sand with the surface layer and upper part of the subsoil being very strongly acid. Permeability is moderately rapid in the subsoil and very rapid in the underlying material. The runoff rate is rapid and the available water capacity is low. The content of organic material is moderate with the

[1] Steiger, R. 1996. *Soil Survey of Muskingum County, Ohio*. U.S. Department of Agriculture, Soil Conservation Service, in cooperation with the Ohio Department of Natural Resources, Division of Lands and Soils, and the Ohio Agricultural Research and Development Center and Ohio State University Extension.

plant rooting depth being limited by sand and gravel layers at a depth of 20 to 30 inches. The capacity to store and release plant nutrients is low. Due to the severity of the slopes, erosion hazards are very severe.

Berks-Westmoreland complex (BkF) has the characteristics of moderately deep, well drained soil on dissected, very steep hillsides along the larger stream valleys. Areas of the soil type have some of the most rugged terrain in the County. These soil types are made up of approximately 40 percent Berks soil and 35 percent Westmoreland soil. The Berks soil is typically found on the steeper, upper parts of hillsides while Westmoreland soil is found primarily on the less sloping areas. These two soils are so closely intermingled that they are generally classed together since it would be impractical to map them separately. Berks soil has a moderate to moderately rapid permeability rate with the Westmoreland type being moderate. Runoff is very rapid on both soils. The available water capacity is very low in the Berks soil and moderate in the Westmoreland. The content of the organic matter is low in the Berks soil and moderately low in the Westmoreland. The depth of root zone is dependant on the depth of bedrock, which ranges from 2 inches in the Berks soil type to more than 40 inches in the Westmoreland. The capacity to retain and release plant nutrients is low in the Berks soil and moderate in the Westmoreland. Berks-Westmoreland soil type is listed in the County Hydric Soils Supplemental List as a non-hydric soil with hydric components occurring in spring.

A copy of the soils map for the subject site is included in Appendix B.

2.2.2 **Wetlands and Flood Mapping**

National Wetland Inventory (NWI) Maps are compiled by the U.S. Department of the Interior, Fish & Wildlife Service (USFWS). These maps outline existing wetland and deepwater habitat areas on individual U.S. Geological Survey (USGS) topographical maps. NWI maps are prepared by stereoscopic analysis of high altitude aerial photographs. The aerial photographs typically reflect conditions during the specific year and season when they were taken. Because small wetland areas and those obscured by dense forest cover may not be represented on these maps, NWI maps should not be used as the sole method of determining the presence or absence of jurisdictional wetlands on site. The NWI map depicting the site indicates that there is one area of permanently and artificially flooded lacustrine open water habitat with unknown bottom structure (LIOWKH) west of the site (Wills Creek Lake). There are two palustrine areas, which are forested with deciduous broad leaf scrub-shrub type vegetation (PFO/SSIY) on the northeast section and approximate center of the site, respectively. There is one Palustrine area with emergent seasonal vegetation (PEMY) near the center of the site. A copy of this NWI map is included in Appendix B, indicating the location of these wetland areas.

According to the Flood Insurance Rate Map (FIRM) for Muskingum County, Ohio, Panel No. 390425 0075 C, dated June 3, 1988 the northwest portion of the subject site, adjacent to Wills Creek Lake, is located in Flood Zone A, a 100-year flood zone with no base flood elevations determined. The southeastern portion of the site is located in Flood Zone X, areas determined to be outside the 500-year floodplain. A copy of the map is located in Appendix B.

2.2.3 Water Use

Because the site is undeveloped, water is not currently in use.

2.2.4 Site Drainage

Drainage at the site is primarily in a north by northwest direction toward, and into, Wills Creek Lake, which is located adjacent to the site to the north and west. Drainage flow is in the form of overland flow and through underground culvert systems, which extend under TR 145.

2.2.5 Site Utilities

Utilities are not currently in use within the site boundaries.

2.2.6 Wells

No monitoring wells or water wells are known to be located on the subject site.

2.2.7 Vegetation

Vegetation on the proposed project site is in the form of a forested riparian corridor, located on the northwestern edge of the site along Wills Creek Lake. The vegetation on the southeast portion of the site located on the southeast side of TR 145 is primarily forested land.

2.3 Descriptions of Structures, Roads, and Other Site Improvements

TR 145 (Tyson Road) bisects the site and runs northeast along Wills Creek Lake. The site is located in an approximate 0.5 mile stretch beginning approximately 0.5 mile northeast of SR 83. A survey conducted in 1965 indicates that there was, at one time, a coal loading tipple, scale house, sheds, and a house located within the site boundaries. The site inspection revealed remnants of what appeared to be the scale house, but no discernable remnants of the house or sheds were located. However, some possible structural debris, in the form of wooden timbers that could have been the support structure for a loading tipple, was found. These debris pieces were not definitive enough to describe them as the actual tipple debris.

2.4 User-Supplied Information

The Detailed Project Review (DPR) submitted by the USACE conveyed that the USACE would be responsible for preparing a financial analysis and a real estate supplement. The USACE will also be responsible for preparing the Project Cooperative Agreement (PCA).

2.5 Current Uses of the Site

The most common use of this site appears to be flood control, wildlife and fisheries enhancement, and recreation.

2.6 Past Uses of the Site

According to historical aerial photographs, topographical maps, and surveys, the earliest use of the subject site, dating back to at least 1958, appears to have been coal mining. This use persisted until 1965 when the mine was abandoned. A mine survey dated January 16, 1965 clearly depicts an underground mine complex with several structures erected on the subject site.

2.7 Current and Past Uses of Adjoining Properties

Currently, the area adjacent to the site on the west (Wills Creek Lake) is primarily used for flood control, fishing, and recreation. The areas to the east of the site are almost completely forested and appear to be used for public recreational purposes as well as hunting. A house trailer was located

approximately 75 to 100 yards to the southeast side of TR 145 approximately 200 yards from the southern tip of the site. This residence appeared to be used periodically at the time of the on-site survey.

According to a 1962 (Photorevised 1978) Ohio Geological Survey Abandoned Underground Mine map, there are at least three other underground mines adjacent to this site. These include, Cn-161 to the north, Cn-164 to the east, and Mm-125 to the southwest. A copy of the Abandoned Underground Mine map can be found in Appendix B. The areas to the east of the site are almost completely forested and appear to be used for public recreation and hunting. Wills Creek Lake to the west has been used for flood control, fishing, and recreation since it was created in June 1936.

2.8 Site Rendering, Map, or Site Plan

The USGS quadrangle depicting the site is included in Appendix B.

3.0 RECORDS REVIEW

3.1 Environmental Record Sources

An environmental database search was performed for the subject property and vicinity by Environmental Data Resources, Inc. (EDR). Various federal and state environmental databases were searched for sites located within a given radius from the subject property as designated by ASTM E1527-00. Results of the database search are summarized below. A copy of the database report is provided in Appendix C.

3.1.1 National Priority List (NPL)

The NPL, commonly known as the Superfund list, is a list of sites nationwide that are eligible for federal Superfund expenditures based on their Hazard Ranking Score (HRS), state priority status, or certain criteria established jointly by the U.S. Environmental Protection Agency (EPA) and the Agency for Toxic Substances and Disease Registry (ATSDR). The NPL is a subset of the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) list and currently identifies approximately 1,200 sites for priority cleanup under the Superfund program. The agency release date for the NPL is April 30, 2003.

EDR reported no U.S. EPA NPL properties located within 1.5 miles of the subject site. The subject site is not listed on the U.S. EPA NPL.

3.1.2 Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS)

CERCLIS contains a list of sites that are either proposed to be included, or are already listed on the NPL and sites that are in the screening and assessment phase for possible inclusion on the NPL. The U.S. EPA has identified these facilities as having had an actual or a suspected uncontrolled release of hazardous substances, contaminants, or pollutants into the environment. The agency release date for CERCLIS is June 16, 2003.

No Further Remedial Action Planned (NFRAP) sites have been removed from the U.S. EPA's CERCLIS database. These sites include areas where, following an initial investigation, either no contamination was found, contamination was removed quickly without need for the site to be placed on

the NPL, or the contamination was not serious enough to require federal superfund action or NPL consideration.

EDR reported no U.S. EPA CERCLIS properties located within 1.0 mile of the subject site. The subject site is not listed on the U.S. EPA CERCLIS.

3.1.3 Resource Conservation and Recovery Information System (RCRIS)

The EPA's RCRIS program identifies and tracks hazardous waste from the point of generation to the point of disposal. The RCRIS database is a compilation by the U.S. EPA of facilities that report generation, storage, transportation, and treatment or disposal of hazardous waste. Treatment, storage, and disposal (TSD) facilities, and large and small quantity generators of hazardous waste are regulated under the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) are those facilities generating greater than 1,000 kilograms (kg) of hazardous waste or more than 1 kg of acutely hazardous waste per month. Small quantity generators (SQGs) are those handlers that generate 100 to 1,000 kg of hazardous waste or less than 1 kg of acutely hazardous waste during any calendar month. The agency release date for the RCRIS list used in this report is May 9, 2003.

RCRA TSD sites are facilities that treat, store, and/or dispose of hazardous waste. EDR reported no RCRA treatment, storage, or disposal TSD facilities on or within 0.5 mile of the site, and no LQG or SQG facilities on or within 0.25 mile of the site. The subject site is not listed as a RCRA TSD facility.

3.1.4 RCRA Corrective Actions (CORRACTS)

CORRACTS is a database maintained by U.S. EPA for RCRA facilities which are undergoing corrective action. A corrective action order is issued pursuant to RCRA Section 3008(h) when there has been a release of hazardous waste or constituents into the environment from a RCRA facility. The agency release date for CORRACTS list used in this report is March 31, 2003.

No facilities located within 1.5 miles of the subject site were identified by EDR as being listed on CORRACTS. The subject site is not listed on CORRACTS.

3.1.5 Emergency Response Notification System (ERNS)

The U.S. EPA ERNS is a national database used to collect information on reported releases of oil and hazardous substances. ERNS contains information from spill reports made to federal authorities including the EPA. The agency release date for the ERNS list used in this report is December 31, 2002.

EDR reported no facilities located within 0.5 mile of the site are listed on ERNS. The subject site is not listed on ERNS.

3.1.6 Registered Underground Storage Tanks (USTs)

USTs are regulated under Subtitle I of RCRA and must be registered with the state department responsible for administrating the UST program. In the state of Ohio, the responsible state department is the State Fire Marshal's Office, Bureau of Underground Storage Tank Regulations (BUSTR). The agency release date for the list used in this report is June 8, 2003.

EDR reported no registered USTs within 0.75 mile of the subject site. The subject site is not listed as having any USTs.

3.1.7 Leaking Underground Storage Tanks (LUSTs)

LUST records maintained by BUSTR contain an inventory of reported LUST incidents, including suspected releases. The agency release date for the LUST list used in this report is June 8, 2003.

EDR reported there are no LUSTs located within 1.0 mile of the site. The subject site is not listed as having any LUSTs.

3.1.8 State Equivalent CERCLIS List (SCL)

The SCL for Ohio is identified as the Ohio Master Sites List (MSL), which was published by the Ohio EPA and is now discontinued. EDR reported no Ohio MSL facilities located within 1.5 miles of the site. The subject site is not listed on the Ohio EPA MSL.

3.1.9 Solid Waste Landfills (SWLFs)

Records of solid waste facilities/landfills, including both active and inactive facilities in the state of Ohio, are maintained by Ohio EPA. The agency release date for the SWLF list used in this report is April 30, 2003.

EDR identified no SWLFs within 1.0 mile of the site. The subject site is not listed as a SWLF.

3.1.10 Ohio Spills

Ohio Spills is an emergency response database of all incidents, spills, or releases to the environment, which are reported to Ohio EPA. EDR reported that the subject site is not listed on Ohio Spills as having any reported releases.

3.1.11 Federal ASTM Supplemental Records

In a database search of ASTM supplemental records EDR determined that one U.S. Department of Defense site (DOD) was present within 1.0 mile of the site. A DOD site is defined as federally-owned or administered lands, administered by the DOD, that have an area equal to or greater than 640 acres. This site was found to be north and west of the project site and is assumed to be Wills Creek Lake.

3.2 Physical Setting Sources

The subject site is depicted on the USGS 7.5-minute series Wills Creek, Ohio quadrangle. Elevation at the site is approximately 750 feet above mean sea level (amsl). A riparian corridor is represented for the northwestern portion of the site, adjacent to or associated with, Wills Creek Lake. Site drainage is primarily in a north by northwest direction via underground culvert systems and overland flow toward Wills Creek Lake.

3.3 Historical Use Information

3.3.1 Historical Topographical Maps

Historical USGS quadrangle maps were ordered from EDR. The EDR maps are representative of the years 1978 and 1994. A historical Ohio Geological Survey Abandoned Mine quadrangle map from

1962 (photorevised 1978) depicts a number of abandoned underground mine complexes adjacent to the project site. The EDR maps appear to represent similar land uses and situations outlined in other maps and aerial photographs reviewed by B&N as discussed in Section 2.0. A copy of these historical topographical maps can be found in Appendix B.

3.3.2 Aerial Photographs

Aerial photographs spanning the period from 1958 to 2003 were reviewed to help determine past use of the site as well as adjacent site use.

In an aerial photograph from 1958, the subject site appears to be used primarily for coal mining, with forested areas to the south and west. The actual site can be depicted as having very little forest cover, in relation to the surrounding areas. Braided road development and cleared areas indicative of a possible coal loading area are apparent. The large acid mine drainage (AMD) flow can be seen in this photograph and seems to be located toward the northeast just adjacent to TR 145. Adjacent site use is primarily agricultural or residential in nature. During the period from 1958 to 1965, the site appears to still be in use as a coal mining facility. According to a mine survey completed in 1965 there are a number of structures located on the site. These structures can be observed in the 1965 photograph. By 1971 the coal mining facility appears to be abandoned. The structures present in 1965 no longer appear in the photograph. Many of the roads still exist, in part, but they appear to be unused.

Aerial photographs from 1988, 1994, and 2003 show the land has returned to a somewhat forested site. Some remnants of the past facility are evident but they appear to be still unused. The AMD flow to the northeast is still evident. Copies of the aerial photographs obtained for the proposed project site are included in Appendix D.

3.3.3 Sanborn Maps

Sanborn Fire Insurance maps contain information relating to past uses of individual structures, location of fuel or chemical tanks, and storage of other potentially toxic substances. Sanborn maps cover areas that were developed primarily for industrial or manufacturing purposes between the 1880s to the mid-1960s. Due to the site's rural and undeveloped nature, no Sanborn map coverage exists for the site.

3.3.4 Recorded Land Title Records

The DPR states that the USACE will be responsible for a thorough real estate record.

3.4 Additional Record Sources

On August 1, 2003, a formal written request for review of historical databases for any known and likely occurrences of federal or state protected, endangered, and rare species, and their designated habitats were submitted to Ms. Debbie Woischke of the Ohio Department of Natural Resources (ODNR) Division of Natural Areas & Preserves and Ms. Mary Knapp of USFWS.

Ms. Marleen Kromer of the ODNR, submitted a letter dated August 6, 2003 indicating she had reviewed the Natural Heritage maps and files for the project area, including a 1.0-mile radius, northeast of Marquand Mills. The location of one rare plant, Hairy Pinweed (*Lechea villosa*) adjacent to the site was noted. This plant was observed in 1968 in a sandpit 0.5 mile east of SR 76 at Wills Creek Bridge. A copy of Ms. Kromer's letter and associated map can be found in Appendix B. A response from the USFWS has not been received by B&N as of September 24, 2003 completion of this Phase I ESA.

4.0 SITE INSPECTION INFORMATION

The following information was obtained during the site visit on Tuesday, August 5, 2003, and from a follow-up records review subsequent to the site inspection. Photographs taken during the site visit are presented in Appendix E. It should be noted that due to an inoperable date stamp function on the camera, an inaccurate date of January 11, 1994, is indicated. The correct date for the photographs is the actual site visit date of August 5, 2003.

4.1 Hazardous Substance Use, Storage, and Disposal

No hazardous substances were observed to be used, stored, or disposed of on the subject site.

4.2 Hazardous Substance Containers and Unidentified Substance Containers

No hazardous substance containers or unidentified substance containers were observed on the subject site during this investigation.

4.3 Storage Tanks

4.3.1 Aboveground Storage Tanks (ASTs)

No ASTs were observed on the subject site during the site inspection.

4.3.2 Underground Storage Tanks (USTs)

No USTs are known to be located on the subject site. No evidence of USTs was observed during the site inspection.

4.4 Polychlorinated Biphenyls (PCBs)

No PCBs are known to be present on the site. No evidence of PCBs was observed during the site inspection.

4.5 Solid Waste Disposal

No solid waste was being generated at the time of the site inspection.

4.6 Other Conditions of Concern

4.6.1 Raw Materials/Chemical Use, Storage, and Disposal

No raw materials are in use at this site. Chemicals are not currently used, stored, or disposed of on the subject site.

4.6.2 Asbestos-Containing Materials (ACMs)

Due to the undeveloped nature of the site, ACMs are not considered an issue.

4.6.3 Air Emissions

The subject site is not currently a source of regulated air emissions.

4.6.4 Wastewater

No wastewater streams associated with industrial or manufacturing processes are currently generated on or discharged from the subject site. However, significant amounts of suspected AMD, as a result of historic coal mining activities, is evident.

4.6.5 Stormwater Runoff

Stormwater runoff on the subject site is primarily in a northwesterly direction to Wills Creek Lake via underground culverts and overland flow.

4.6.6 Site Reconnaissance

A house trailer was located approximately 75 to 100 yards to the southeast side of TR 145 approximately 200 yards from the southern tip of the site. This residence appeared to be used periodically at the time of the on-site survey.

A large broken iron pipe, approximately 5 inches in diameter was observed on site. This pipe was protruding from the ground in a southerly direction west of TR 145 at the head of the gob pile. This pipe appeared to be empty at the time of the site inspection and is of unknown use and/or historic contents.

5.0 FINDINGS AND CONCLUSIONS

B&N performed a Phase I ESA in conformance with the scope and limitations of ASTM Practice E1527-00 (Phase I ESA Process) for the site identified as MM-280 located in Muskingum County, Ohio. Any exceptions to, or deletions from, this practice are described in Section 1.0 of this report. The Phase I ESA revealed no recognized environmental conditions (RECs) associated with the current use, storage, or disposal of hazardous substances or petroleum products for the property except:

- Presence of large-scale AMD and sedimentation as a result of suspected ferric hydroxide precipitation.

- Presence of a large coal refuse pile located on the southwest portion of the site, adjacent to TR 145, and east of Wills Creek Lake.

- The northwest portion of the site is within the 100-year floodplain of Wills Creek Lake. Due to the regulations and restrictions associated with floodplain development, this is considered a Business Environmental Risk (BER) for the site.

B&N recommends that the coal refuse pile be regraded, capped, and vegetated. No further environmental investigation is recommended at this time.

6.0 SIGNATURES OF ENVIRONMENTAL PROFESSIONALS

The Environmental Professionals who conducted the Phase I ESA and completed this report on the MM280 site located adjacent to Wills Creek Lake in Muskingum County, Ohio are:

Joseph R. Christopher
Environmental Scientist

Signature: Joseph R. Christopher
Date: 9/24/03

Mitchel R. Strain
B&N Project Coordinator

Signature:
Date: 9/26/03

George D. Biemel, PE
B&N Project Director

Signature: George D. Biemel
Date: 10/1/03

Jennifer R. Conroy, PE
B&N Independent QA Review

Signature: Jennifer R. Conroy
Date: 10/1/03

Burgess & Niple, Inc.
5085 Reed Road
Columbus, Ohio 43220

7.0 QUALIFICATIONS OF ENVIRONMENTAL PROFESSIONALS

Mr. Christopher joined B&N in 1998 as an Environmental Scientist in the Environmental Section. Mr. Christopher has an extensive background of over 10 years in environmental chemistry. He has 4 years of experience with the National Research Center for Coal and Energy (NRCCE) located at West Virginia University coupled with 3 years of practical fisheries work in evaluating freshwater impoundment growth rates of Largemouth Bass and sensitive species identification and location in lotic environments. The scope of Mr. Christopher's experience at the NRCCE was to work closely with the office of the National Mine Lands Reclamation Center as an analytical chemist to analyze innovative ways of remediating AMD. Mr. Christopher has a Bachelor of Science degree in Wildlife and Fisheries Management from West Virginia University with an emphasis on freshwater fisheries management.

Mr. Strain joined B&N in 1993 and is an Environmental Scientist and is the Director of the Ecological Section. As a Certified Professional Soil Scientist (CPSS) and Soil Classifier (CPSC), he has 8 years' experience as a Soil Scientist in conducting and managing soil and groundwater investigations. Additional experience includes conducting Phase I site assessments and serving as the site health and safety officer at hazardous materials sites. Mr. Strain has conducted numerous soil and groundwater investigations at underground storage tank facilities. His experience includes various soil and groundwater sampling techniques as well as the design and installation of groundwater monitoring wells. He has also conducted soil vapor surveys using a portable gas chromatograph to assess extent of a contaminant plume. Mr. Strain holds a Bachelor of Science degree in Geology with an emphasis in Environmental Science from the State University of New York and Master of Science degree in Soil Science from the University of New Hampshire.

Mr. Biemel joined B&N in 1976 and is the Director of the Environmental Engineering Section. He has conducted studies of industrial facility wastewater discharge quality for regulatory compliance, assisted in negotiation with regulatory agencies, and performed detailed design of wastewater treatment facilities. Mr. Biemel has written spill prevention, control, and countermeasure plans and stormwater pollution prevention plans; investigated urban and industrial site flooding and developed mitigation alternatives; directed soil and groundwater contamination investigations; prepared Phase I ESA reports; and directed additional assessments. Mr. Biemel is a registered Professional Engineer (PE) in Michigan and Ohio and received a Bachelor of Science degree and a Master of Science degree in Civil Engineering from The Ohio State University.

Ms. Conroy joined B&N in 1989 as an engineer in the Environmental Division. She has provided oversight and professional certifications for RCRA closures, various other soil cleanups, and UST closures, including preparation of reports detailing closure and cleanup activities for submission to appropriate regulatory agencies. She has performed Phase I and II Environmental Site Assessments and Assessment reports, environmental compliance audits, and industrial wastewater studies. She has completed groundwater remediation design, storage tank design, National Pollutant Discharge Elimination System (NPDES) permit applications, Ohio EPA Air Fee Emission Reports, Clean Air Act Title V evaluations, Spill Prevention Control and Countermeasure (SPCC) and Storm water Pollution Prevention (SWPP) Plan preparation and certifications, NPDES storm water sampling, Annual Hazardous Waste Reports and Community Right-to-Know Reports, hazardous waste delisting sampling and quality assurance plan preparation, and the associated negotiations with federal and state agencies. Ms. Conroy holds a Bachelor of Science degree in Civil Engineering and a Master of Science degree in Water Resources/Environmental Engineering from Ohio University.

APPENDIX G

2003 CULTURAL RESOURCE RECONNAISSANCE SURVEY

Contract Publication Series WV03-30

CULTURAL RESOURCES RECONNAISSANCE SURVEY MM280, WILLS CREEK RESERVOIR, MONROE TOWNSHIP, MUSKINGUM COUNTY, AND LINTON TOWNSHIP, COSHOCTON COUNTY, OHIO

By

Michael L. Orr

CULTURAL RESOURCE ANALYSTS, INC.

CULTURAL RESOURCES RECONNAISSANCE SURVEY MM280, WILLS CREEK RESERVOIR, MONROE TOWNSHIP, MUSKINGUM COUNTY, AND LINTON TOWNSHIP, COSHOCTON COUNTY, OHIO

By

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C. Michael Anslinger, RPA
Vice President of Operations – West Virginia
August 8, 2003

Lead Agency: U.S. Army Corps of Engineers, Huntington District

ABSTRACT

On July 23 and 24, 2003, personnel from Cultural Resource Analysts, Inc. conducted a reconnaissance-level pedestrian survey (Cultural Resource Survey MM280) along the southern bank of Wills Creek Reservoir, Monroe Township, Muskingum County, and Linton Township, Coshocton County, Ohio. The reconnaissance was conducted at the request of Ms. Julie Carpenter of Burgess & Niple, Inc.

The project area consists of an approximate 43.0 ac (17.4 ha) tract of nearly level floodplain or terrace and some steep and dissected upland. Elevation ranges from approximately 797 ft (243 m) to 880 ft (268 m) above mean sea level. The land appears to be idle with both forest and barren mine runoff/spoil areas present. Tyson Road provides direct access to the area.

Information obtained by the record search completed at the Ohio Historic Preservation Office and the Ohio Historical Society, indicates that no previously recorded archaeological sites are located within the project area. However, two recorded sites are reported within 2.0 mi (3.2 km) of the project. According to information obtained from historic maps three structures dating from the mid-nineteenth and early to mid-twentieth centuries were present in the project area.

Non-systematic pedestrian survey of the project area located the remains of a domestic structure and a possible outbuilding in the area where a structure is shown of an early twentieth century map. In addition, in the southwestern corner of the project area, domestic refuse and other remains were identified in an upland setting. These remains are not associated with any identified structures shown on historic maps, and appear to date to the mid-twentieth century. No standing structures or above ground prehistoric resources were identified.

Previous mining and related activities, and possibly the impoundment of Wills Creek, have impacted many of the areas having the highest potential for prehistoric and/or historic sites. Extant information is not sufficient to determine the size and period of occupation for the identified resources. Because a subsurface investigation was not completed, no information for the nature, depth, and integrity of associated archaeological deposits was obtained. Based on soil drainage characteristics and the age of project area landforms, the potential for buried sites is low.

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I. INTRODUCTION

On July 23 and 24, 2003, personnel from Cultural Resource Analysts, Inc. (CRAI) conducted a non-systematic reconnaissance-level survey (Cultural Resource Survey MM280) along the southern bank of Wills Creek Reservoir, Monroe Township, Muskingum County, and Linton Township, Coshocton County, Ohio (Figures 1 and 2). The project area incorporated approximately 43.0 ac (17.2 ha) of nearly level alluvial landforms and some dissected upland. CRAI initiated the reconnaissance at the request of Ms. Julie Carpenter of Burgess & Niple, Inc. (B&N). Project personnel consisted of the author and Kristie Martin.

Figure 1: Location of Muskingum and Coshocton Counties, Ohio.

Project tasks to be completed by CRAI were:

1. To perform a records search at the Ohio Historic Preservation Office (OHPO), Ohio Historical Society (OHS), and other repositories as necessary;
2. To complete a non-systematic pedestrian reconnaissance of the project area (Tracts A-C) to assess site potential by areas/landforms, and record locations of any exposed surface sites and historic structures that might be identified; and
3. To provide a technical report that conforms to OHPO guidelines, which will include any figures plotting any identified sites and photographs documenting said sites.

As defined in the Scope, the reconnaissance was not to include any shovel probing or other subsurface investigation, or the collection of any artifacts. In addition, it was stipulated that any identified sites or structures would not be formally recorded through the completion of OHPO standard forms.

II. ENVIRONMENTAL BACKGROUND

Climate

Muskingum and Coshocton counties have a continental climate with cold, snowy winters and warm to very hot, humid summers (USDA-SCS 1996). In winter the average temperature is 30°F (-1.1°C), with the average daily minimum temperature being 21°F (-6.1°C). In summer the average temperature is 71°F (21.7°C), with the average daily maximum temperature being 81°F (27.2°C). The yearly average precipitation is 21 in (53 cm), 60 percent of which occurs between April and September. The average yearly snowfall is 24 in (61 cm) (USDA-SCS 1996).

Physiography, Drainage, and Geology

Muskingum and Coshocton counties (including the project area) are located primarily within the unglaciated Allegheny Plateau physiographic region. The counties are generally characterized by rolling to dissected topography, with the greatest amounts of local relief being in their eastern sections. Smooth, wide ridges, broad valleys, and mild slopes are common features of the landscape (USDA-SCS 1996). Surface elevation ranges from approximately 660 ft (201 m) to 1300 ft (396 m) above mean sea level (msl). Within and adjacent to the project

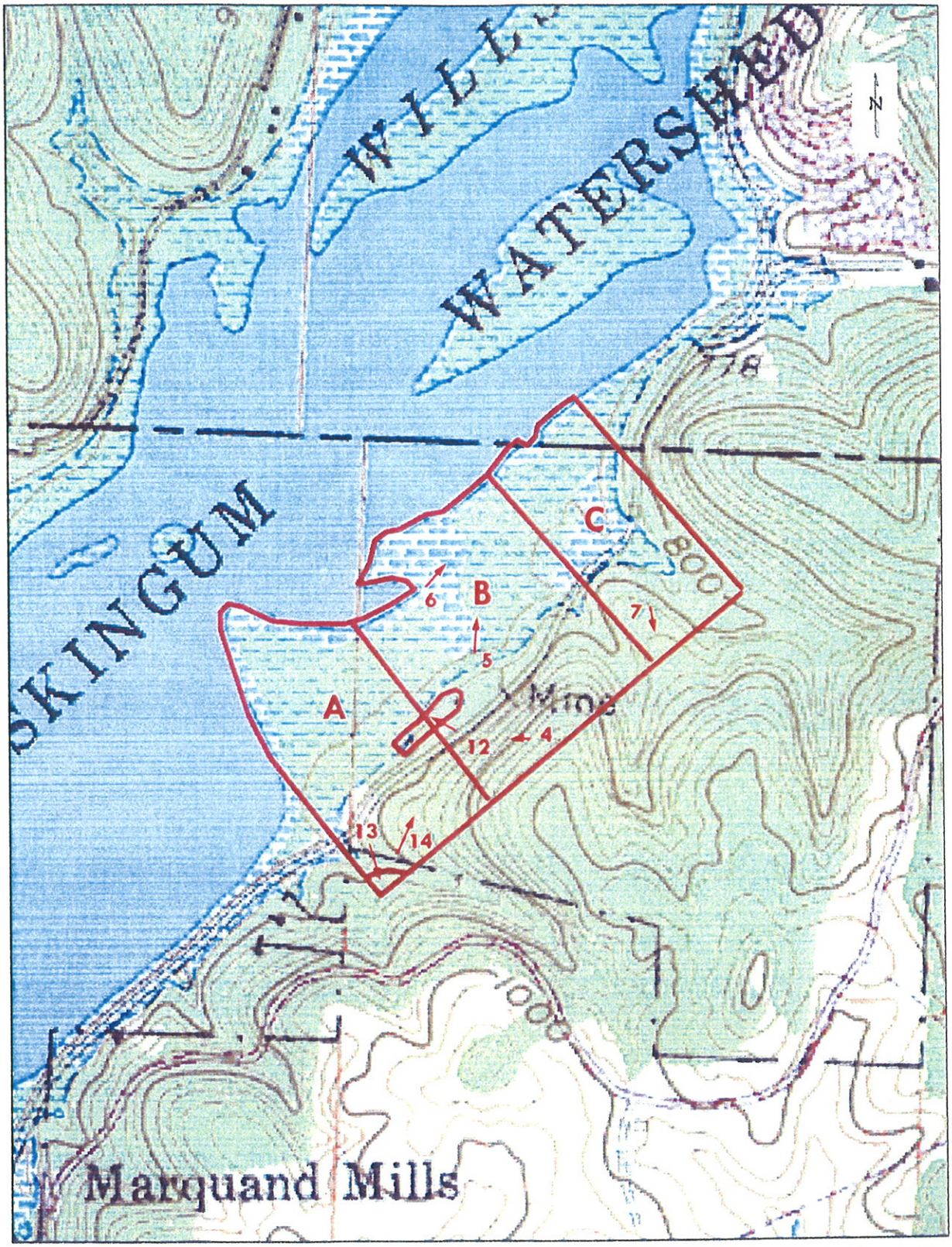


Figure 2: Portion of USGS 7.5' Wills Creek Quadrangle showing project tracts and photo key. Scale: 1"= 667'.

area, elevation ranges from 740 ft (226 m) to 920 ft (280 m) msl.

Major rivers of Coshocton County are the Walhonding, Tuscarawas, and Muskingum. The former two converge from the west and east, respectively, to form the Muskingum at a location approximately 15 mi (24 km) north of the project area. From this location the Muskingum flows south and southeast through Muskingum County. White Eyes, Symmes, and Salt creeks drain much of the area in the vicinity of the project area (USDA-SCS 1996). Primary drainage of the project area is provided by Wills Creek (Figure 2).

Muskingum County is underlaid by sedimentary lithologies dating to the late Mississippian, Pennsylvanian, and early Permian Periods (USDA-SCS 1996). Exposed strata include two formations belonging to the late Mississippian Period: Logan and Maxville Limestones. While the Logan Formation is confined to the northwestern portion of the county, the Maxwell Limestone outcrops in the southwestern parts of the county. Pennsylvania lithologies belong to the Pottsville, Allegheny, Conemaugh, and Monongahela systems. The early Permian is represented by remnant exposures on high knobs in various portions of the county. Exposed strata within the area consist of numerous beds of sandstone, shale, limestone, and coal.

The bedrock of Cochocton County is sedimentary. Two systems are represented—the upper Mississippian and the Pennsylvanian. It Mississippian is confined to the lower slopes in the western one third of the county (Lamborn 1954). The exposed series, mainly the Logan Formation, consists of fine-grained sandstone and siltstone interbedded with shales. However, about 85 percent of the area of the county is associated with the Pennsylvanian System. The series represented are the Allegheny, Pottsville and the lower 170 ft (52 m) of the Conemaugh. The Allegheny Series has outcrops that occur in every township in Coshocton County. The Lower and Middle Kittanning coals are of chief economic importance for coal-mining activities. Outcrops of the Pottsville Series also outcrop in every township in Coshocton County. It consists of the lowest members of the Pennsylvanian System. The western half of the county has large exposures of the Pottsville Series at all elevations, but in the eastern half, the exposures are confined mainly to lower slopes. The Conemaugh Series is the least extensive Pennsylvanian bedrock in Coshocton County. It is mainly confined to the upper slopes of the highest hills in many areas in the southeastern part of the county. It has been almost totally removed in the northeastern townships. The bedrocks of the Conemaugh Series consist almost entirely of sandstones and sandy shales (Hempel and Graham 2001).

Chert/flint is available from primary contexts in Muskingum and Cochocton counties (Stout and Schoenlaub 1945). Specifically, the Pennsylvanian Boggs, Brush Creek, Upper Mercer, and Vanport members contain raw materials used extensively by local and regional prehistoric groups for the manufacture of chipped-stone tools and implements. These deposits outcrop commonly along stream channels, which provided excellent quarry locales for the prehistoric inhabitants of the region.

Soils

Project area soils belong to the Tioga-Nolin-Newark association (USDA-SCS 1996). This association is characterized by deep, well-drained and somewhat poorly drained alluvial soils found along the floodplains of major rivers and their tributaries (USDA-SCS 1996). Three soil units are mapped within the project area: Melvin silt loam, frequently flooded (Me), Rodman gravelly sandy loam, 25-70 percent slopes (RoF), and Berks-Westmoreland complex, 40-70 percent slopes (BkF) (USDA-SCS 1996:Sheet Number 7). The distribution of these soils within the project area is shown in Figure 3.

Melvin silt loam is mapped in the northwestern two-thirds of the project area

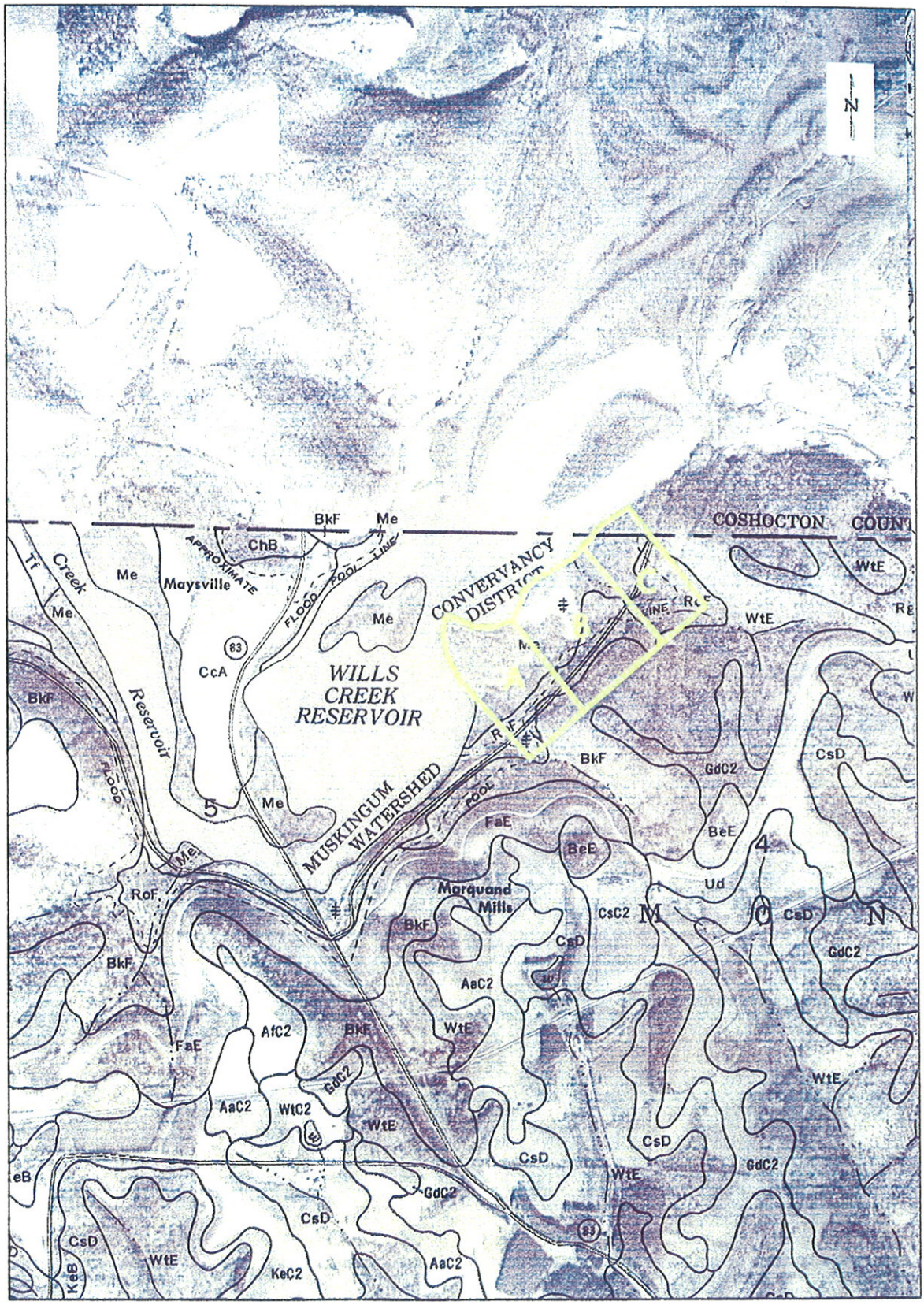


Figure 3: Project area soils (taken from USDA-SCS 1996:Sheet Number 7). Scale: 1"=1300'.

along the bottom area overlooking Wills Creek. This soil is deep, nearly level, and poorly drained (USDA-SCS 1996). An A/Cg/Ab/Cg profile characterizes the Melvin series (USDA-SCS 1996:174-175). Texture is silt loam, and the solum typically extends to about 30 in (76 cm).

Rodman gravelly sandy loam, 25-70 percent slopes is mapped for sideslope in the southeastern one-third of the project area (USDA-SCS 1996). This unit is characterized by deep, steep to very steep, excessively drained soils on dissected hillsides and escarpments on glacial outwash terraces. The typical profile for this mapping unit consists of A/AB/Bw/C horizons (USDA-SCS 1996:180-181). The solum extends to approximately 30 in (76 cm).

Soils of the Berks-Westmoreland complex, 40-70 percent slopes, developed in sediments on very steep and dissected hillsides along larger stream valleys (USDA-SCS 1996:28). They are moderately deep-to-deep and well drained. The typical profile has A/Bw/BC/Cr horizons.

Description of Project Area

Mapping provided to CRAI by B&N for Cultural Resource Survey MM280, indicates that the project area consists of three adjacent tracts defined as Areas A, B, and C, which combined encompass approximately 43.0 ac (17.4 ha) (Figure 2). These tracts occupy an area of terrace/floodplain on the south side of Wills Creek Reservoir and some adjacent upland. Topography ranges from level to steep. Land use consists of a mix of upland forest, scrub, and idle ground along the reservoir that contains mine runoff (Figures 4-7). The latter area is low-lying and wet in places. Elevation in the project area ranges from approximately 797 ft (243 m) to 880 ft (268 m) above msl.

Figure 4: Photograph showing typical wooded portion of the project area, Tract A.

Figure 5: Photograph showing barren coal runoff/waste area, Tract B.

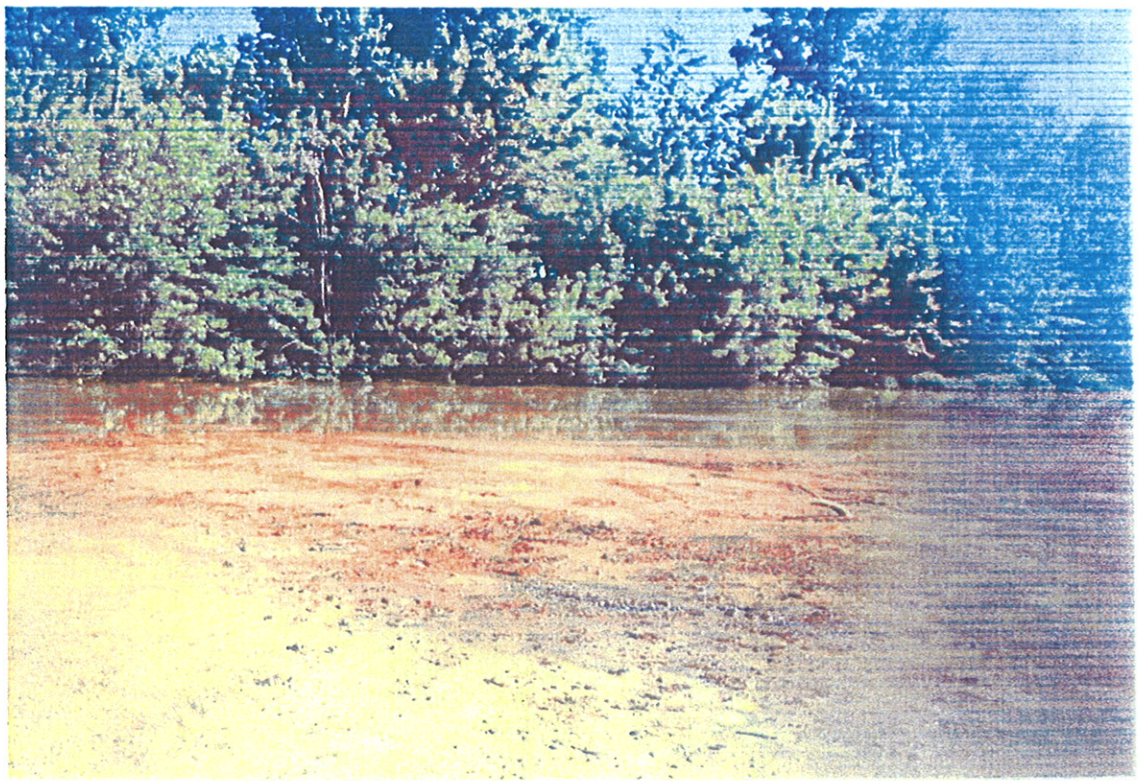


Figure 6: Photograph showing toxic coal runoff area, Tract B.

Figure 7: Photograph showing upland logging access road, Tract C.

III. RECORD SEARCH AND CULTURAL OVERVIEW

Record Search

A search of records maintained by the OHPO and the OHS for the project area was conducted. Information from the literature review provides a background and context for the archaeology and history in the region. For the purpose of this project the background research was limited to areas within 2.0 mi (3.2 km) of the project area. The following resources were examined:

1. *An Archeological Atlas of Ohio* (Mills 1914);
2. Ohio Archaeological Inventory files;
3. Ohio Historic Inventory files;
4. National Register of Historic Places files;
5. Cultural Resource Management reports;
6. 1866 *Atlas of Muskingum County, Ohio* (Beers 1866);
7. 1872 *Atlas of Coshocton County, Ohio* (Lake 1872); and
8. 15' USGS topographic quadrangle.

***An Archeological Atlas of Ohio* (Mills 1914)**: Mills' Atlas shows 119 archaeological sites in Coshocton County and 87 sites in Muskingum County. The Coshocton County sites include mounds (n=62), enclosures (n=21), villages (n=9), burials (n=20), stone graves (n=2), and flint quarries (n=5). The Muskingum County sites include mounds (n=54), enclosures (n=9), villages (n=3), burials (n=3), and flint quarries (n=18). Most of the sites recorded by Mills in Coshocton and Muskingum counties are located along the Muskingum River and its tributaries. None of these sites are within the 2.0 mi (3.2 km) study area radius. Three mounds and an enclosure, however, are located between 2.5 mi (4.0 km) and 4.0 mi (6.4 km) north of the project area in Linton Township, Coshocton County.

Ohio Archaeological Inventory: Eighteen archaeological sites have been recorded on the Wills Creek 7.5" USGS topographic quadrangle. Two of these (33Mu1207 and 33Cs38) are within the 2.0 mi (3.2 km) study radius. Site 33Mu1207 is a Late Woodland/Late Prehistoric site located in the floodplain of Wills Creek, approximately 0.5 mi (0.8 km) northwest of the project area (Brown 2002). Brown (2002) reported the collection of a triangular projectile point and 12 pieces of lithic debris from the cultivated surface. Site 33Cs38 (Portius Site) is located on a terrace of Wills Creek, approximately 1.2 mi (1.9 km) northeast of the project area (Brown 1977, Regional Archaeological Preservation Office). According to the Ohio Archaeological Inventory, a Snyders projectile point (n=1), stemmed points (n=4), a side notched point (n=1), corner notched points (n=3), projectile point fragments (n=3), and lithic debris were collected from the cultivated surface of this site. No report is available for site 33Cs38.

Ohio Historic Inventory: The Ohio Historic Inventory lists five recorded sites in Monroe Township, Muskingum County, and 15 sites in Linton Township, Coshocton County. Only one historic inventory is located within the 2.0 mi (3.2 km) study radius. This site (Cos-156-23) is a coal tipple located 0.3 mi (0.5 km) northeast of the project area, which was reported by Gary Novak, ODNR, Division of Reclamation (1989). No report is available. The site inventory form does not include any additional information.

National Register of Historic Places: No National register sites or structures are located within the 2.0 mi (3.2 km) study radius.

Cultural Resource Management Reports: Only one cultural resource management survey report is on file for the 2.0 mi (3.2 km) study radius. Completed by Brown (2002), the project was conducted for the U.S. Army Corps of Engineers for a proposed borrow area located 0.5 mi (0.8 km) northwest of the project area. This survey resulted in the documentation of site 33Mu1207.

1866 *Atlas of Muskingum County, Ohio* (Beers 1866): The 1866 *Atlas of Muskingum County, Ohio* (Beers 1866) indicates that the project area overlaps the Peter Marquand, Heirs of J. Wisecarver, S. D. Starkey, and Mrs. Miller properties. Two structures appear to be indicated on the Miller property and one structure appears to be indicated on the Wisecarver property (Figure 8). Peter Marquand was the owner of a gristmill south of the community of Maysville, west of the project area. The mill has been inundated by Wills Creek Reservoir. Peter Marquand is a descendent of Charles Marquand, who emigrated from France to Wills Creek in 1810 (Everhart 1882).

1872 *Atlas of Coshocton County, Ohio* (Lake 1872): The northern portion of the project area appears to extend into the Maria Baird property, as shown on the 1872 Atlas of Coshocton County, Ohio (Lake 1872). No structures are indicated within this portion of the Baird property (Figure 9).

15' USGS topographic quadrangle: A house/structure may be present near a road intersection depicted on the 1908 Conesville, Ohio 15' USGS topographic quadrangle. This appears to be the same structure location indicated on the 1866 *Atlas of Muskingum County, Ohio* (Beers 1866). A structure is also located between Wills Creek and the road that runs through the project area (Figure 10).

Cultural Overview

The following discussion provides a brief overview for the culture history of southeastern Ohio. It is not intended to provide a comprehensive discussion. A representative sample of diagnostic hafted bifaces known for the area is presented in Figure 11.

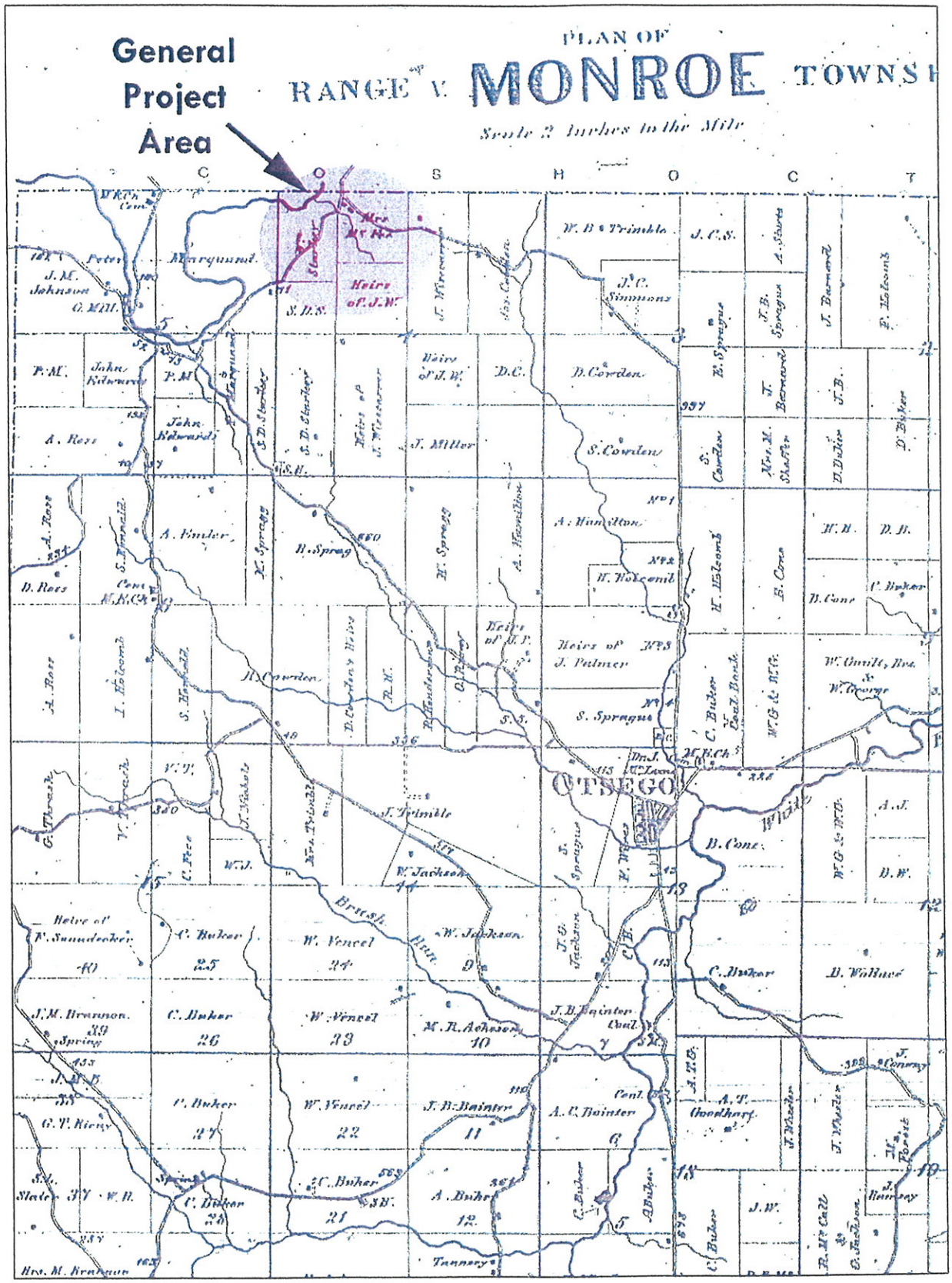


Figure 8: Portion of 1866 *Atlas of Muskingum County, Ohio* showing structures within project area.

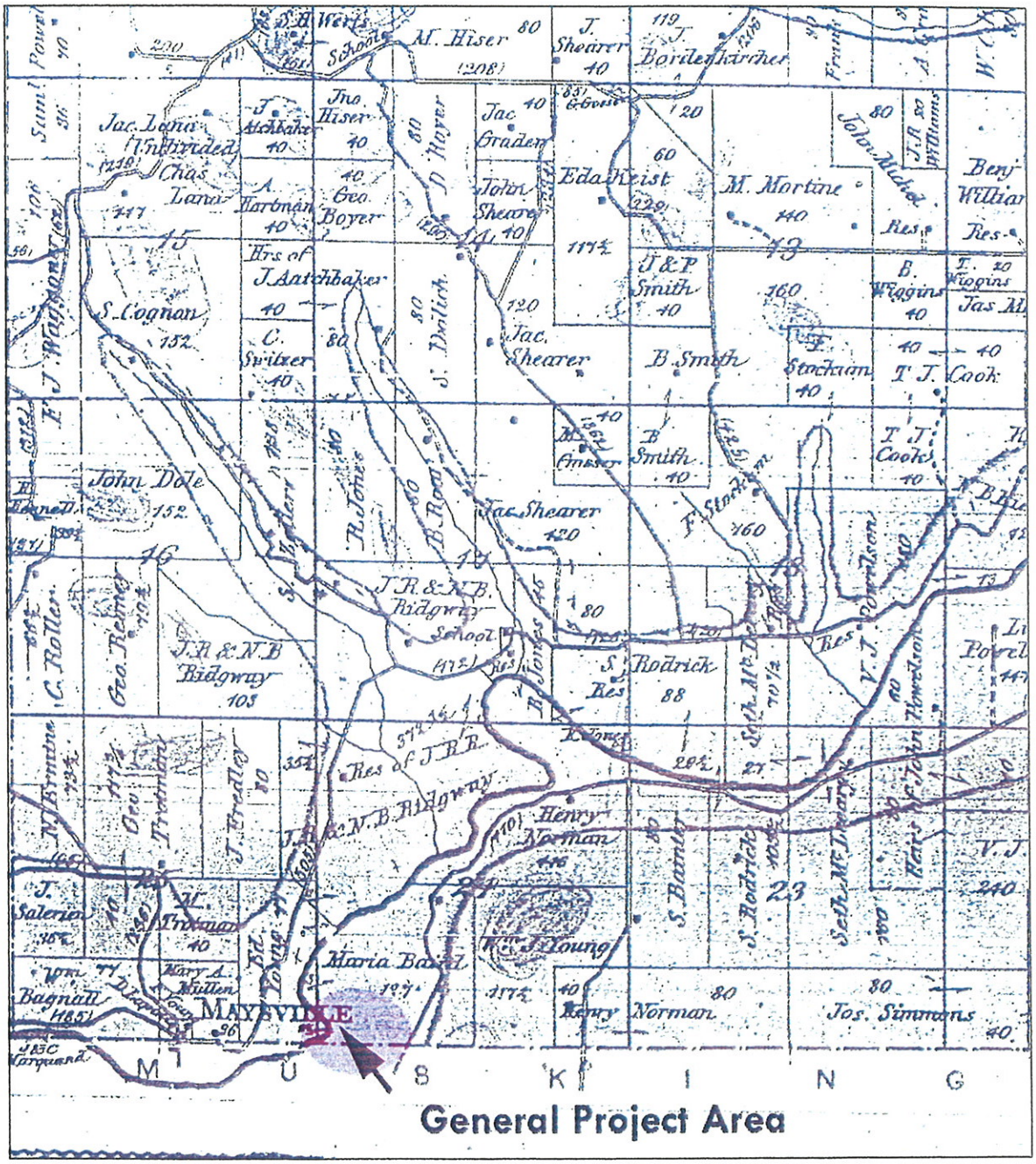


Figure 9: Portion of 1872 *Atlas of Coshocton County, Ohio* showing project area.

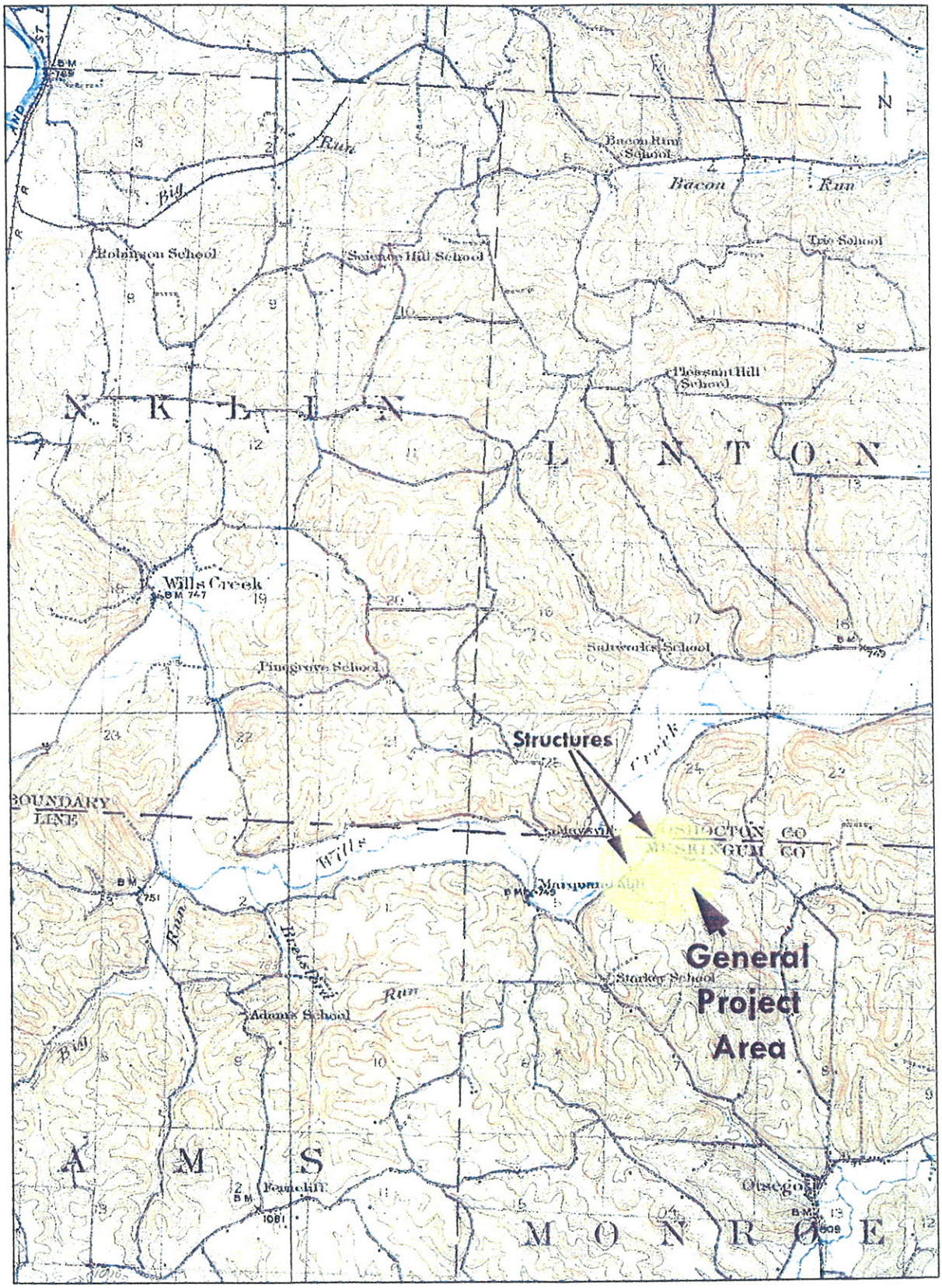


Figure 10: Portion of 1908 15' USGS Conesville, Ohio Quadrangle showing structures within project area.

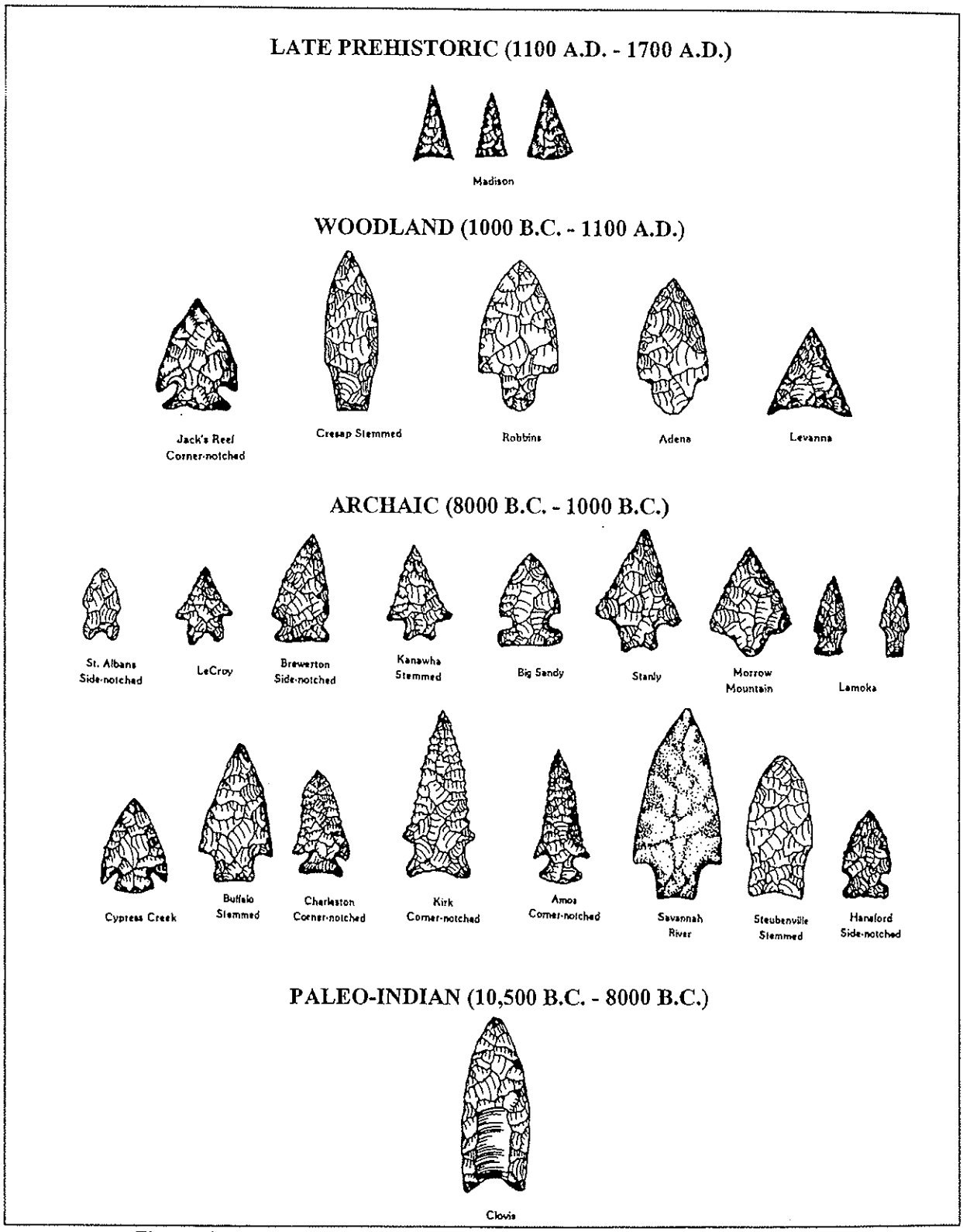


Figure 11: Illustration of diagnostic hafted bifaces by temporal period.

Pre-Clovis (Pre-9500 B.C.)

To date no pre-Clovis sites have been documented for Ohio (Lepper 1999). However, elsewhere in the eastern U.S., including the upper Ohio River Valley, cultural deposits located stratigraphically below Early Paleoindian have been reported (Adovasio et al. 1999; McAvoy and McAvoy 1997). Available uncorrected radiocarbon dates indicate these sites date to the late Pleistocene, at approximately 15,000 to 13,000 B.C. The presence of pre-Clovis sites in the region is not unexpected given the antiquity (ca. 10,550 B.C.) recently accepted for the MV-II occupation at the Monte Verde site in southern Chile (Dillehay 1997, Meltzer et al. 1997:659-663).

Associated artifacts consist of basally thinned trianguloid to lanceolate bifaces, prepared polyhedral cores and prismatic blades. The core and blade industry has been described as having a Eurasiatic, Upper Paleolithic flavor (Adovasio et al. 1999:418). These early populations are characterized as generalized hunter-foragers, rather than specialized hunters.

Paleoindian Period (ca. 9500 to 8000 B.C.)

The earliest cultural period conclusively documented in the Middle Ohio Valley is Paleoindian. However, because of a general lack of dateable contexts, the chronology for the region has relied heavily on cross dating with sites located outside the region (e.g., Great Plains, Northeast). Based on typological evidence and limited radiocarbon assays, there is general consensus that early groups of specialized late Pleistocene hunters occupied the region by approximately 9550 to 9250 B.C.

Large Paleoindian sites, or sites having Paleoindian components, have been identified throughout Ohio, but are most common in the glaciated regions. In the unglaciated Appalachian Plateau, sites tend to be small, often consisting of isolated points.

Important Paleoindian sites for Ohio include Nobles Pond (33St357), Welling (33Co2), Sandy Spring (33Ad30), Paleo Crossing (33Me274) Sheriden Cave, and Mielke (Brose 1994:61-76; Seeman et al. 1994:77-116). In addition, the Burning Tree Mastodon site, discovered near Newark, Ohio, is reported as a possible Early Paleoindian kill/butchering site (Fisher et al. 1994:43-57). However, diagnostic artifacts were not found in association.

Early Paleoindian sites are identified by the presence of highly distinctive Clovis fluted projectile points. Gainey fluted and Cumberland fluted points are believed to date to the Middle Paleoindian period, and unfluted types belong to the Plano Cluster are diagnostic of Late Paleoindian period. Associated lithic types associated with Paleoindian sites include a variety of unifacial tools and bifaces.

Archaic Period (8000 to 1000 B.C.)

The Archaic Period is usually reported as coinciding with the beginning of the Holocene, although this does not hold true for all areas of the eastern U.S. In general, the Archaic represents a period of time during which populations adapted to modern environmental conditions. Based on changes in a variety of cultural dimensions, including adaptive strategies and technology, the period is usually divided into Early (8000 to 6000 BC), Middle (6000 to 3000 B.C.), and Late (3000 to 1000 B.C.) subperiods.

Early Archaic

Environmental conditions during the Early Archaic period were dynamic, as post-Pleistocene floral and faunal communities migrated northward. The archaeological evidence suggests Early Archaic groups consisted of small bands of hunter-gatherers with egalitarian social structures. Sites tend to be small, the assemblages being limited to a restricted range of functional types, many of which were probably multifunctional. Non-utilitarian items are rarely discovered. Larger

sites have been reported, but appear to represent favored locations that witnessed repeated short-term occupations, resulting in palimpset assemblages.

Diagnostic artifacts include point types of the Thebes, Large Side Notched, Kirk Corner Notched, Kirk Stemmed, Rice Lobed, and LeCroy clusters (Justice 1987; Vickery and Liftin 1994). Unifaces are common, as are bifaces and adzes. Thebes and Kirk populations tended to use high quality raw materials for tool manufacture, a trend that carried over from the Paleoindian Period and ended with the bifurcate tradition (Cantin 2000).

Because most sites are plow-disturbed and lack intact features, little subsistence information is available. The general lack of plant processing implements has been used by some to suggest a reliance of fauna, with the most important specie being white-tailed deer. However, where features have been identified, carbonized nutshell is often present.

Few Early Archaic burials have been identified in the eastern U.S., thus the database for burial practices and ceremonialism is impoverished. However, for the latter part of the Early Archaic, three non-habitation sites containing cremations have been identified in southern Indiana (Tomak 1979; Cochran et al. 1995). Bifurcated base points of the Rice Lobed and LeCroy traditions were discovered in association with the cremated remains.

Middle Archaic

In many respects, in Ohio and other parts of the Ohio Valley, less is known about the Middle Archaic than either the Early or Late Archaic Periods (Vickery 1980). A sparse scattering of Stanley Stemmed points, dating to approximately 5950 to 5550 B.C., are present in the state, as are other southern types including Guilford, Morrow Mountain, Eva, Sykes and White Springs.

At least along some of the major drainages and in elevated settings adjacent to Pleistocene lakebeds, and wetlands characterized by lacustrine soils in the southern part of the state, larger, perhaps seasonally occupied sites are expected. Sites of this nature, containing well developed midden stains and large numbers of pit features and perhaps burials, are reported for portions of the Ohio Valley, but appear to be concentrated downriver from Cincinnati.

Late Archaic

The Late Archaic Period appears to represent a time of significant population growth and increasing regionalism. The subsistence base is diffuse, with a wide range of plant and animal species playing an important role. Domestic species (e.g., sumpweed, sunflower, goosefoot) are present in the subsistence base. Changes in adaptive strategies resulted in larger and more intensively occupied sites than witnessed during the preceding periods. Often these sites have heavy midden deposits, large numbers of functionally diverse features (e.g., hearths, earth ovens, refuse pits), including human and dog burials. Artifact assemblages include a wide array of utilitarian and some ceremonial/religious items. Because stone-boiling technology was prevalent, thermally altered rock is a common component of many sites dating to the period.

Identified throughout the state are points common to the Laurentian Tradition of the northeastern U.S., with examples of the Brewerton Cluster being abundant (Vickery 1980; Justice 1987:115-124). Also present are the types belonging to the Table Rock Cluster, the Lamoka Cluster, the Merom Cluster, the Late Archaic Stemmed (e.g., McWhinney Heavy Stemmed) Cluster, the Genesee Cluster, the Susquehanna Cluster, and the Meadowood and Terminal Archaic Barbed Clusters (Justice 1987).

Woodland Period (1000 B.C. to A.D. 900)

Griffin (1978:231) notes that during the Late Archaic there was "... considerable evidence for the long distance movement of

goods." The interregional movement of goods provided a structure for the transmission of information as well. During this period of interregional dynamism, there was a trend towards more sedentary living, increasingly elaborate burial ceremonialism, and possibly stratified social organization. These trends, along with the appearance of fired ceramic vessels, mark the transition between Archaic and Woodland peoples. The Woodland period, like the preceding Archaic period, is divided into three subperiods: Early Woodland (1000 B.C. to 250 B.C.), Middle Woodland (250 B.C. to A.D. 350), and Late Woodland (A.D. 350 to A.D. 900).

Overall, the Woodland period witnessed a continuation and elaboration of cultural practices that began during the Late Archaic. Woodland peoples became increasingly dependent on the cultivation of plant foods, which allowed for a more sedentary lifestyle. Except for the latter part of the Late Woodland, subsistence practices remained similar to the Archaic subsistence patterns, this is to say a combination of hunting, plant food gathering, and fishing in a seasonal round exploitation pattern. It is within the Woodland period that highly visible site types such as mounds and enclosures were constructed in the Mid-Ohio Valley.

Early Woodland

Early Woodland in the Middle Ohio Valley is often viewed as being synonymous with Adena. However, evidence indicates that ceramics are present in the region several hundred years before Adena mound building begins. The settlement and subsistence systems used during this period resulted in small sites having low archaeological visibility; that is, sites typically do not have developed middens or large artifact assemblages. In other words, these Early Woodland peoples probably had a semi-sedentary lifestyle, not unlike earlier Archaic populations. Starchy and oily domesticates were a consistent part of the diet.

Much of what is known about Adena comes from mound and earthwork excavations, rather than habitation sites. Adena burial ceremonialism and ritual have been the focus of numerous studies. The evidence indicates a period of increasing cultural and social complexity, within which certain individuals attained superior status. The presence of artifacts fashioned from exotic raw materials reflects the increasing extent and importance of regional trade networks.

Most Adena mounds and earthworks are located along major river valleys such as the Scioto, Hocking, and Muskinghum, primarily in the central and southern part of the state (Mills 1914). In the Hocking Valley, a significant concentration of mounds, earthworks, and habitation, presumed to be primarily of Adena affiliation, are located in various upland and valley setting at The Plains (Abrams 1992:19-23).

Middle Woodland

Middle Woodland in southern Ohio is typically defined by Hopewell mortuary culture. During this period conical and loaf-shaped burial mounds, geometric earthworks, and enclosures were constructed. Individual mounds often contain the remains of many individuals; some associated with large quantities of "expensive" trade goods (Seeman 1979), indicating persons of high rank or status.

The artifact inventory for the "culture" is large and functionally diverse. Raw materials, many acquired from distant source areas, include obsidian, mica, copper, and conch shell. Craft specialization may have been practiced for the production of some funerary items. Lithic tool manufacture included a core and blade technology, making extensive use of Flint Ridge Flint.

Although Middle Woodland sites have been identified in a variety of landscape positions, there appears to be a tendency toward large valleys. This is viewed by some

as reflecting an increasing reliance of plant cultivation for subsistence.

Late Woodland

In some respects, the Late Woodland represents a marked departure from the preceding Middle Woodland, in that elaborate earthworks and enclosures were no longer constructed. However, small burial mounds and earthen embankments continued to be constructed.

The early Late Woodland is recognized by the presence of Newtown or Newtown-like assemblages. This includes thin cordmarked, grit-tempered jars with sharp, angular shoulders and thickened rims. Associated points belong to the Lowe Cluster (Justice 1987). It has been argued that the first nucleated villages in the Mid-Ohio Valley date to this period, being defined by circular midden stains and partially enclosing ditches and/or low embankments (Seeman and Dancey 2000:583-611). However, Clay and Creasman (1999) disagree, suggesting that the details of the archaeological record do not support the presence of nucleated villages.

The late Late Woodland is represented by Intrusive Mound or Parkline Culture (Seeman and Dancey 2000:583-611). Sites of this period are small and have low archaeological visibility. Burials are often placed in earlier mounds. Associated artifacts include Raccoon Notched, Jack's Reef Pentagonal, and Levanna points. Some ceramics have true collars, which at times are decorated with cordwrapped-stick impressions.

Subsistence was mixed and diverse, with domesticated species of the Eastern Agricultural Complex being common. During the later part of the period, maize cultivation became more important to the subsistence system. However, deer and other mammals remained important to the diet.

Late Prehistoric Period (950 RCYBP to European Contact)

During the Late Prehistoric period, southeastern Ohio was home to people of the Monongahela Culture. This culture shared many traits with Fort Ancient to the west, but showed even less influence from Mississippian Culture. The settlement system includes permanent, multi-year villages that were 0.4 to 0.8 ha (1-2 ac) in size with a circular plan, plaza and stockade (Griffin 1978). Houses were small, circular to oval constructions of pole and bark. Large "pear-shaped" structures possibly used as specialized storage facilities, are also known for some sites in western Pennsylvania. Village size has been estimate to range from 75 to 150 people.

The subsistence economy was diffuse, being based on both natural and domesticated species. Hunting, collecting, and agriculture (or large scale horticulture) were important, with the latter including the production of maize.

Village sites are often located in upland saddle settings and on high terraces along major streams. The upland sites might have been located along trails. Compared to neighboring Fort Ancient, the villages are smaller and less intensively occupied. Nevertheless, villages often contain well-developed middens. Also present are functionally diverse features, including storage and cooking pits.

Burials were placed in pits within the village area, and only rarely are associated with grave goods. The artifact assemblage includes shell temper pottery, triangular points, pottery elbow pipes, celts, pendants, beads, discoidals, and a variety of other items made from bone. The ceramics typically consist of round-based vessels with slightly in-sloping shoulders and vertical to slightly flaring or collared rims and lugs. The exterior surface is usually either plain or cordmarked, with incising sometimes occurring on the rims. Although usually tempered with crushed shell, limestone was sometimes used.

Protohistoric and Historic Aboriginal Period

By the beginning of the sixteenth century A.D., the Ohio River valley was populated by a number of sedentary cultural groups (Schwartz 1967). After A.D. 1680, the cultural fabric of these groups was severely stressed and reshaped in the wake of shifting fur trade patterns (Hunt 1940). The consequence of this change was an increasing displacement of resident aboriginal groups by newly arriving Indian groups (Hunter 1978:588).

History of Muskingum County, Ohio

Located in the east-central portion of Ohio, Muskingum County is bounded by Coshocton County to the north, Perry and Licking Counties to the West, Morgan County to the south, and Guernsey and Noble Counties to the East. Muskingum County covers a total of 650 square miles.

After an approximate 12,000-year period of prehistoric occupation, the first European activities in the Muskingum County region began in the late 18th century. In 1774 Colonel Angus McDonald attacked the Shawnee village of Wakatomaca, located on the Muskingum River below Dresden (Howe 1908).

By 1796 Congress authorized Ebenezer Zane to build a road from what is now Wheeling, West Virginia to Maysville, Kentucky. "Zane's Trace," as it was known, had the distinction of being the first federally subsidized local construction project (Vonada 1991). Congress authorized three sections of land throughout Ohio as Zane's compensation. These land sections were located near the present day cities of Chillicothe, Lancaster, and Zanesville. Of these land sections, Zane gave his brother, John McIntyre, the land section consisting of rolling terrain believed to be the least desirable of the three sections (Howe 1908). In 1799, this land section saw the arrival of early settlers spurred on by the passage of the Northwest Ordinance of 1787 and the platting of the city of Westbourn (Howe 1908). However, the Postmaster-General named the local post office Zanesville, which quickly replaced Westbourne as the city name (Howe 1908).

Muskingum County was organized on March 1, 1804 from land appropriated from Washington and Fairfield Counties. Muskingum is a Delaware Indian word roughly translated as "a town on the riverside" (Howe 1908). At this time, the city of Zanesville was established as the county seat and a land office was established to sell unappropriated military lands (Howe 1908). With the introduction of various industries, Zanesville continued to prosper. Three brick manufacturers opened in 1802 selling clay products, while Samuel Sullivan began to produce whiteware in 1808. By 1810, Zanesville was selected as the state capitol of Ohio.

The population of the county swelled during the period between 1810 and 1812 due to the belief that the legislature would be permanently located in Zanesville (Howe 1908). During this period, most of the military land was sold and many capitol improvements were made within the county (Howe 1908). In 1812 the state capitol was relocated from Zanesville to Chillicothe. However, the wealth of natural resources, such as timber and farmland, enabled the county to continue to prosper (Howe 1908). By 1820 the county population was 17,824 and by 1840 the county population grew to 38,746.

Economic activity was centered on wheat agriculture, coal and clay mining, and ceramic production by the 1840s. Although coal provided a cost-effective fuel for powering steam engines and for the ceramic manufacturing process, coal mining never became a dominant industry within the county. However, 22 pottery manufacturers located within Muskingum County produced cookware, tiles, and other ceramic products. The Muskingum River and a system of canals aided in the transport of both agricultural and manufacturing products. Regular steamboat service was scheduled from Zanesville to Cincinnati and New Orleans during this period (Howe 1908).

By 1880 the economic activities of the county were firmly based on agriculture, clay mining, and ceramic production. American Encaustic Tile employed 1,000 people in Muskingum County in 1892 and by the early 1900s, the Brush-McCoy Company introduced and manufactured art pottery.

Most of the brick manufacturers of Muskingum County had succumbed by 1950 to the rising costs of transportation and the prevalence of concrete block. Contemporary manufacturers, such as Fiori and Hull, have continued to operate producing mostly dinnerware.

In the 1990s economic activity is squarely centered on the service industry. The primary service industries are mostly financial and health services. Other economic activities within the county include the manufacture of wood, lumber, stone, clay and glass products, as well as the agribusiness commodities of cattle and cash grain crops (Vonada 1991; USDA-SCS 1996).

Notable persons from Muskingum County include the novelist Zane Grey whose 80 works have generated 139 million sales (Vonada 1991). Senator John Glenn, from New Lexington, was the first American to orbit the Earth and the first Ohioan to be elected to four consecutive terms in the U.S. Senate. In addition he is the oldest person to go into space.

History of Linton Township, Coshocton County, Ohio

Linton Township lies in the southeast corner of Coshocton County, and is the largest township in the county. It covers an area of 5 mi (8.0 km) N-S by 7.5 mi (12.1 km). Topography of the township is mostly hilly, except for the valleys skirting the streams, which are regarded as flat and very fertile. The principal stream is Wills Creek, which enters the township near the middle of its eastern boundary line and leaves at its extreme southwestern corner (adjacent to the project area). The direct distance from its ingress into the township to its exit is less than 8 mi (12.9 km), but its meanderings upon its flood plain makes its actual length about 20 mi (32.2 km) (CCGS 1985).

Native Americans were very numerous in the vicinity of the township; however, following the Treaty of Greenville in 1794, they had mostly migrated to Wyandotte County, Ohio. The Delaware was the dominant tribe in the area, having taken over the land from the Shawnees. At the advent of the whites the Delaware had several noted chiefs including Killbuck, Netawatwes, and White Eyes, who was probably the most able of them all. Many historians compare him with the great Logan of the Shawnees. There were no known villages within the township, but there were many encampments and scattered inhabitants (CCGS 1985).

James Miskimen first came to this area in 1800, after first visiting a relative at the land office at Chillicothe. He traveled on foot up the Muskingum River to the Mouth of Wills Creek, thence upstream to the North Bend location, where he was much pleased with the area. After a return home to Maryland and a period of working in his father's distillery for five years, he claimed a large tract of land in the north bend of Wills Creek in 1805. He returned home again, married, and in 1806 brought his bride to the north bend (CCGS 1985).

Agriculture was the principal occupation in the area, though ventures such as sawmills, gristmills, tanneries and salt production each contributed to the local economy.

Benjamin Chambers from New York established the first tannery at Plainfield in 1818. Tanning with bark was a slow process often taking as long as 18 months for a single hide. Andrew Ferrier built the first grist mill in the area at Plainfield on Wills Creek in 1809. Prior to that, the nearest was in Zanesville. William McCleary and Judge Fulton operated a salt boiling operation in the area where the Salt Works School was later located (northeast of the project area, across the reservoir, Figure 8). Salt wells had to be sunk to a depth of several hundred feet to

reach veins of salt rich enough to make the operation worthwhile. In the spring, water would rise to the top of the well, while in other seasons it had to be pumped out by hand. The Linton township wells produced an average of a bushel of salt from approximately 60 gal (227 liters) of water, which was rather efficient compared to the 150 gal (568 liters) necessary to produce the same volume in other areas (CCGS 1985).

The township was noted for having the most one room schools of any in the county, which was partially due to its size. Sand Banks, North Bend, Carrs, Linton Mills, Salt Works, Williams Run, Bacon Run, Trio, and Pleasant Hill schools were all operating at one time. The North Bend school was the last in operation and closed in 1932 (CCGS 1985).

Linton was also noted for its contribution to the northern effort in the American Civil War with 115 veterans of the conflict buried within its borders. There are at least six veterans of the War of 1812 interred here, most notably "Fighting Bill Reed", depicted alongside Oliver Hazard Perry in the transfer boat at the Battle of Lake Erie (CCGS 1985).

Religious groups were active in the community since about 1810. Denominations included Methodists, Presbyterians, Catholics, Lutherans, and a short-lived group of United Brethren. The first was a group of eight Methodists, which held service in a log school house donated by Thomas Johnson (CCGS 1985).

IV. FIELD METHODS

Methods used to complete the field reconnaissance are discussed below.

Pedestrian Survey: A non-systematic reconnaissance-level survey was completed for the entire project area (Tracts A-C). The goal was to identify evidence for any above ground resources (e.g., historic foundations, cemeteries, and mounds) that might be present. Although the examination was not conducted systematically, field personnel made an effort to examine a range of areas within each tract, including all those considered to have high site/resource potential.

GPS Receiver: The crew used a Garmin GPSMap 76S Chartplotting receiver to verify location in the field. Project area boundaries were first plotted onto 7.5' Topographic Maps using the *track* function in Maptech Terrain Navigator software. Maps for use with the unit were downloaded from the Garmin MapSource Eastern United States Topographic Maps CD-Rom. The Datum used by both packages of software was set to NAD 1927. The geo-referenced tracks created in Maptech Terrain Navigator were loaded directly onto the unit, and appeared as an overlay on the topographic maps. The unit could then be used in the field as a verification of location with respect to the project boundaries.

Scope Conditions: As set forth in the CRAI's Scope of Work, the reconnaissance did not include 1) shovel probing or other subsurface investigations, 2) the collection of artifacts, and 3) the formal recording of sites or structures through the completion of OHPO standard forms.

V. RESULTS AND INTERPRETATIONS

Information obtained from the records search and field reconnaissance provide a variety of information regarding cultural resources and archaeological site potential of the project area.

Reconnaissance failed to find any evidence for above ground prehistoric sites. No bedrock overhangs that could have been used as rockshelters are present in the project area. Also, no evidence for earth or stone mounds or earthworks was discovered.

Because most soil surfaces were obscured by vegetation or covered by mine waste and water, it was not possible to obtain much direct information for the presence or absence of in-ground sites. However, review of soils

mapping indicates that the majority of the project consists of poorly drained Melvin soil, which corresponds to a generally level alluvial landform that probably represents the flood plain or a terrace of Wills Creek. Wills Creek Reservoir might inundate this area seasonally. Along the Ohio and Kanawha rivers in West Virginia soils of the Melvin series have been documented as having very low archaeological potential for prehistoric surface sites (Maslowski 1985; Maslowski and Hatten 1987).

The higher land mapped as Rodman gravelly sandy loam and Berks-Westmoreland complex probably has higher site potential than the area of Melvin soil. However, in the project area these soils are generally associated with steep to very steep topography, although some relatively level land is also present. Given the lack of evidence for rockshelters, the highest potential for sites might to be associated with intact areas of the outwash terrace adjacent to the north side of Tyson Road.

Based on extant information is seems doubtful that deeply buried sites are present in the project area. The poorly drained Melvin soil probably reflects an area that has been low-lying and at least seasonally wet for many millennium. Poorly drained soils rarely contain buried sites. The late Pleistocene age of the outwash terrace suggests this landform also has little or no potential to contain buried sites, although plow-truncated features could be present.

With respect to historic resources, information obtained from the map study indicates that one or more structures, or portions thereof, were located in the project area. Specifically, the 1866 Atlas of Muskingum County (Beers 1866) (Figure 8) shows two structures located along a lane or access road on the northeast side of a hollow near the Muskingum – Coshocton county-line, which appears to correspond to an area within Tract C. One structure is shown at the same approximate location on the 1908 USGS 15' Conesville Quadrangle (Figure 10). However, during the reconnaissance it was determined that a portion of this area is inundated by a pond, which probably formed when drainage for the hollow to Wills Creek was blocked by the earthen ramp, which carries Tyson Road across the mouth of the hollow. Pedestrian examination of this area failed to find any evidence for the structures.

Another structure shown on the 1908 USGS 15' Conesville Quadrangle is at a location adjacent to the north side of Tyson Road. A structure is located at the same approximate location on the 1962 (photorevised 1985) USGS 7.5' Wills Creek Quadrangle, with an outbuilding being farther southwest. Reconnaissance of this area resulted in the identification of historic debris identified as FS 1.

In addition, historic remains were identified in the southwest corner of Tract A, at a location where no structures were indicated on any of the maps examined for the study. These remains are reported as FS 2.

FS 1

USGS 7.5' Quadrangle: 1962 Wills Creek, Ohio (Photorevised 1985)
UTM Location: Z-17, 4444630N, 432707E
Elevation: 808 ft (246 m) above msl
Size: Unknown
Component: Probably Euro-American
Age: Possibly late 19th to mid-20th century
Closest Named Water: Wills Creek
Topographic Setting: Floodplain/Terrace
Slope: 0-10 percent
SCS Soil Unit: Melvin silt loam (Me)
Project Tracts: A and B

Description: FS 1 was discovered during pedestrian examination of Areas B and C, where a structure is depicted on the 1908 15' Conesville, Ohio, and 1962 7.5' Wills Creek, Ohio, quadrangles (Figures 2 and 10). Several large cut stones, an approximate 10-x-10 ft (3-x-3 m) depression, a concrete-lined well or drain (Figure 12), an 8.0-10.0 ft (2.4 to 3.0 m) tall earthen berm lined with rubber tires, and

Figure 12: Photograph of concrete-lined well/drain at FS 1.

window glass and stoneware sherds were identified.

West of the well or drain was a large depression of unknown function, which measured about 75 ft (23 m) E-W by 20 ft (6 m) N-S. On the west side of the depression were remnants of a concrete pad, window glass, and a brick marked *Coshocton Block*. The latter remains are located in Tract A, in the location marked as an outbuilding on the 1962 topographic map (Figure 2).

FS 2

USGS 7.5' Quadrangle: 1962 Wills Creek, Ohio (Photorevised 1985)
UTM Location: Z-17, 4444401N, 432613E
Elevation: 858 ft (262 m) above msl
Size: Unknown
Component: Probably Euro-American
Age: Probably 20th century
Closest Named Water: Wills Creek
Topographic Setting: Sideslope
Slope: 0-15 percent
SCS Soil Unit: Rodman gravelly sandy loam (RoF) 25-70 percent slopes
Project Tract: A

Description: FS 2 was identified in the southwest corner of Tract A. Identified remains consisted of concrete and terracotta drains or cisterns (Figure 13). A metal box-spring mattress was lying over the concrete feature (Figure 14). There was a small piece of ironstone decorated with decal on the ground surface. No structural elements were noticed in the immediate area. A modern mobile home was located approximately 300 ft (91 m) west of the site, outside the project boundaries.

VI. CONCLUSIONS

Information generated by this study failed to find any evidence for above ground prehistoric sites or historic structures in the project area, and the potential for in-ground and buried sites is considered to be low,

Figure 13: Photograph of terracotta cistern at FS 2.

Figure 14: Photograph of concrete-lined well/drain at FS 2 with remnants of box spring.

especially for the large area mapped as Melvin silt loam along the shore of Wills Creek Reservoir.

The only cultural materials identified by the reconnaissance consisted of debris associated with a historic structure, which based on information from the map study dates from approximately the early to mid-twentieth century. Referenced as FS 1, the nature and integrity of associated archaeological deposits is not known.

FS 2 is located in a forested upland setting. Its location does not correspond to any structures identified during the review of historic maps. Based on this fact and the types of items identified, the remains probably date to the mid-twentieth century, and may not be historic (i.e. 50+ years old).

Examination of an area in Tract C where two structures are shown on a nineteenth century map failed to find any evidence for their presence. However, a portion of this area is inundated.

Finally, the physical integrity of much of the project area has been impacted by mining and the impoundment of Wills Creek Reservoir. Based on extant information the potential for significant cultural resources to be present in the project area is considered low.

REFERENCES

Abrams, E.
1992 Woodland Settlement Patterns in the Southern Hocking River Valley, Southeastern, Ohio. In Cultural Variability in Contexts: Woodland Settlements of the Mid-Ohio Valley. Ed. Mark F. Seeman. MCJA Special Paper No. 7. Kent State University Press: Kent, Ohio.

Adovasio, J.M., D. Pedler, J. Donahue, and R. Stuckenrath
1999 No Vestige of a Beginning nor Prospect for an End: Two Decades of Debate on Meadowcroft Rockshelter. In *Ice Age Peoples of North America: Environments, Origins, and Adaptations of the First Americans*. pp. 416-431. Edited by R. Bonnichsen and K.L. Turnmire. Oregon University Press, Corvallis, Oregon.

Beers, F.
1866 Atlas of Muskingum County, Ohio. Beers, Soule and Company, New York, New York.

Brose, D. S.
1994 Archaeological Investigations at the Paleo Crossing Site, A Paleoindian Occupation in Medina County, Ohio. In *The First Discovery of America: Archaeological Evidence for the Early Inhabitants of the Ohio Area*, edited by W.S. Dancey, pp. 61-76. The Ohio Archaeological Council, Columbus.

Brown, J.
2002 Phase I Archaeological Survey, Borrow Area Wills Creek Lake, Coshocton and Muskingum Counties, Ohio. Submitted to Huntington District, U.S. Army Corps of Engineers. Stark County Regional Planning Commission.

Cantin, M. E.
2000 Comparative Analyses of Thebes and Kirk Lithic Technology and Home Range Implications in Southwestern Indiana. Master's Thesis, Department of Geography, Geology, and Anthropology, Indiana State University, Terre Haute.

Clay, R.B. and S. Creasman
1999 Middle Ohio Valley Late Woodland Nucleated Settlements: 'Where's the Beef?' *West Virginia Archeologist* 51(1&2).

Cochran, D.R., M. Angst, and J.A. Mohow
1995 McCullogh's Run Site (12-B-1036): Four Bifurcate Traditions Cremations from South Central Indiana.

Coshocton County Genealogical Society (CCGS)
1985 A History of Coshocton County, Ohio. CCGS.

Dillehay, T.D.
1997 *Monte Verde: A Late Pleistocene Settlement in Chile: Paleoenvironment and Site Context.* Vol. I. Smithsonian Institution Press, Washington, D.C.

Everhart, J.
1882 History of Muskingum County, Ohio. J. F. Everhart & Co. Columbus, Ohio.

Fisher, D. C., B. T. Lepper, and P. E. Hooge
1994 Evidence for Butchery of the Burning Tree Mastodon. In *The First Discovery of America: Archaeological Evidence for the Early Inhabitants of the Ohio Area*, edited by W. S. Dancey, pp. 43-57. The Ohio Archaeological Council, Columbus.

Griffin, J. B.
1978 The Midlands and Northeastern United States. In *Ancient Native Americans*, edited by J.D. Jennings, pp. 221-280. W.H.

Hempel, J. W. and T. E. Graham
Soil Survey of Coshocton County, Ohio. United States Department of Agriculture, Natural Resources Conservation Service in cooperation with Ohio Department of Natural Resources, Division of Soil and Water Conservation; the Ohio Agricultural Research and Development Center; the Ohio State University Extension; and the Coshocton County Commissioners.

Howe, H.
1908 Historical Collections of Ohio. Published by the State of Ohio, Columbus, Ohio.

Hunt, G.T.
1940 The Wars of the Iroquois: A Study in Intertribal Trade Relations. University of Wisconsin Press, Madison.

Hunter, W.A.
1978 History of the Ohio Valley. In *Handbook of North American Indians*, Vol. 15: Northeast, edited by B.G. Trigger, pp. 588-593. Smithsonian Institution.

Justice, N.D.
1987 Stone Age Spear and Arrow Point of the Midcontinental and Eastern United States. Indiana University Press, Bloomington and Indianapolis.

Lake, D.J.
1872 *Atlas of Coshocton County, Ohio.* C. O. Titus, Philadelphia.

Lamborn, R.E.
1954 Geology of Coshocton County. Ohio Department of Natural Resources, Division of Geological Survey. 4th Series, Bulletin 53.

Lepper, B.T.
1999 Pleistocene Peoples of Midcontinental North America. In *Ice Age Peoples of North America: Environments, Origins, and Adaptations of the First Americans.* pp. 362-394. Edited by R. Bonnichsen and K.L. Turnmire. Oregon University Press, Corvallis, Oregon.

Maslowski, R.F.
1985 Computers, Soils, and Archeological Surveys. Unpublished paper presented at the Annual Meeting of the United State Army Corps of Engineers, Denver Colorado.

Maslowski, R.F. and L.K. Hatten
1987 Relationship of Archeological Sites to SCS Soil Types in West Virginia. Unpublished paper presented at the West Virginia Academy of Science Annual Meeting, West Virginia State College, Institute, West Virginia.

McAvoy, J.M. and L.D. McAvoy
1997 Archaeological Investigations of Site 44Sx202, Cactus Hill, Sussex County, Virginia. Virginia Department of Historic Resources, Research Report Series No. 8.

Meltzer, D.J., D.K. Grayson, G. Ardila, A.W. Barker, D.F. Dincauze, C.V. Haynes, F. Mena, L. Nunez, and D.J. Stanford
1997 On the Pleistocene Antiquity of Monte Verde, Southern Chile. *American Antiquity* 62:659-662.

Mills, W.
1914 *An Archaeological Atlas of Ohio.* Ohio State Archaeological and Historical Society.

Seeman, M.F.
1979 The Hopewell Interaction Sphere: The Evidence for Interregional Trade and Structural Complexity. *Prehistory Research Series* 5(2). Indiana Historical Society, Indianapolis.

Seeman, M. F., G. Summers, E. Dowd, and L. Morris
1994 Fluted Point Characteristics at Three Large Sites: The Implications for Modeling Early Paleoindian Settlement Patterns in Ohio. In *The First Discovery of America: Archaeological Evidence of the Early Inhabitants of the Ohio Area*, edited by W. S. Dancey, pp. 77-93. The Ohio Archaeological Council, Columbus.

Seeman, M.F. and W.S. Dancey
2000 The Late Woodland Period in Southern Ohio: Basic Issues and Prospects. In *Late Woodland Societies: Tradition and Transfromation across the Midcontinent.* (Edited by Thomas E. Emerson, Dale L. McElrath, & Andrew C. Fortier. University of Nebraska Press.

Stout, W. and R.A. Schoenlaub
1945 The Occurrence of Flint in Ohio. State of Ohio Department of Natural Resources, Division of Geological Survey, Fourth Series, Bulletin 46, Columbus.

Tomak, C.H.
1979 Jerger: An Early Archaic Mortuary Site in Southwestern Indiana. Proceedings of the Indiana Academy of Science, 88:62-69. Indianapolis.

United States Department of Agriculture, Soil Conservation Service.
1981 Land Resource Regions and Major Land Resource Areas of the United States. U.S. Department of Agriculture Handbook 296.

United States Department of Agriculture, Soil Conservation Service (USDA-SCS)
1996 Soil Survey of Muskingum County, Ohio. United States Department of Agriculture, Soil Conservation Service in cooperation with Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center.

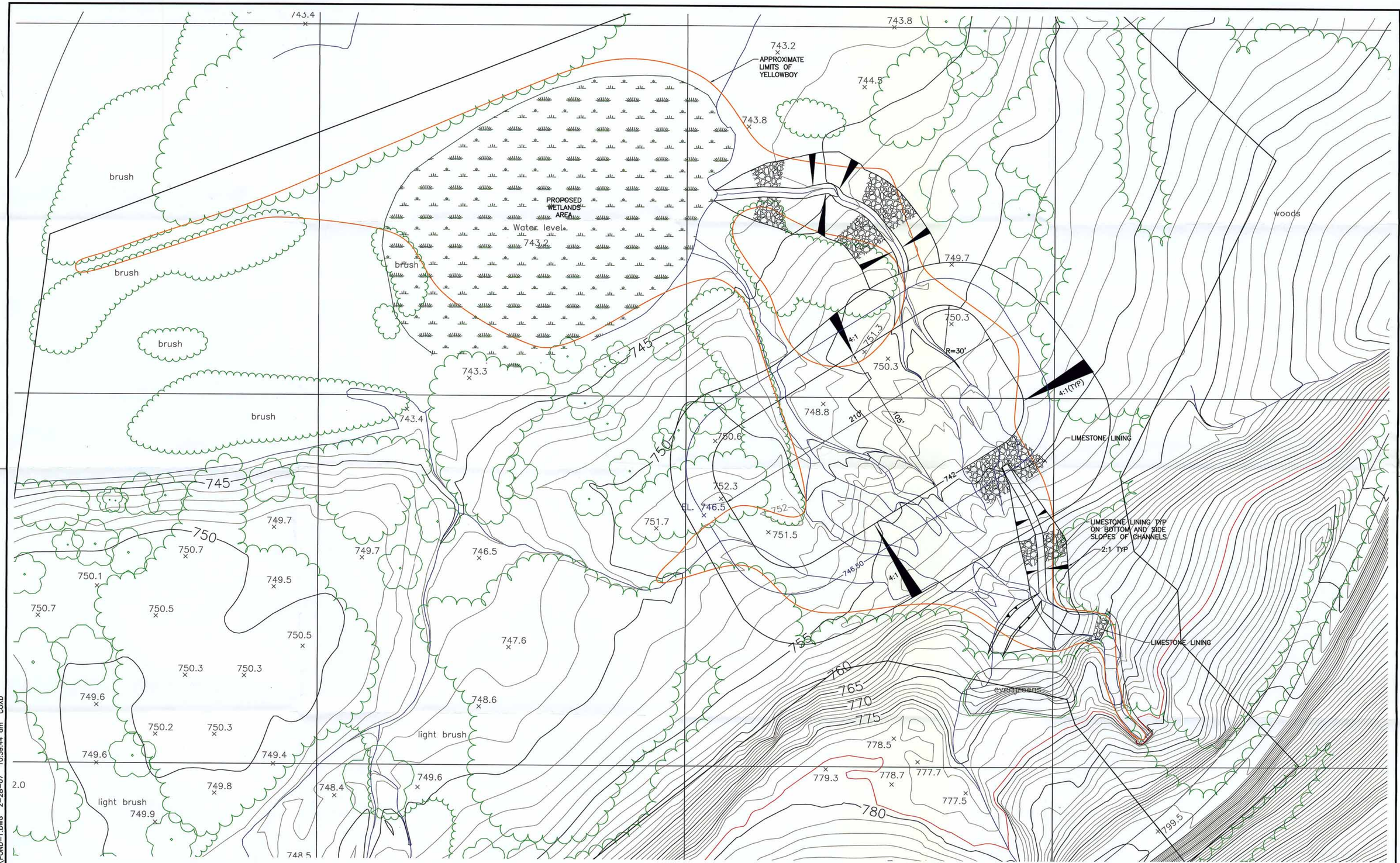
Vickery, K.D.
1980 Preliminary Definition of Archaic Study Units in Southwest Ohio. Prepared for the State Archaeological Preservation Plan Meeting, Columbus.

Vickery, K.D. and J.C. Litfin
1994 A Proposed Revision of the Classification of Midwestern Paleoindian, Early Archaic, and Middle Archaic Projectile Points. In *The First Discovery of America: Archaeological Evidence of the Early Inhabitants of the Ohio Area.* Edited by William S. Dancey. The Ohio Archaeological Council, Inc., Columbus.

Vonada, D.
1991 The Ohio Almanac. Orange Frazer Press, Inc., Wilmington, Ohio.

APPENDIX H

NER PLAN CONCEPTUAL DESIGN DRAWING AND RENDERINGS



NO.	REVISIONS	DATE	BY	CHK.

Burgess & Niple, Inc. COLUMBUS, OH

BURGESS & NIPLE

U.S. ARMY CORPS OF ENGINEERS
HUNTINGTON DISTRICT
MM280 RESTORATION

JOB NO.	43640
DESIGNED BY:	GDB
DRAWN BY:	DSC
CHECKED BY:	GDB
APPROVED BY:	GDB
DATE:	FEB. 2007

SETTLING POND AND POLISHING WETLAND LAYOUT

SCALE: 1"=30'

SHEET NO. 3 OF 3

P:\PR43640\CADD\POND-1.DWG 2-28-07 10:39:44 am COXD

NO.	REVISIONS	DATE	BY	CHK.

Burgess & Niple, Inc. COLUMBUS, OH

BURGESS & NIPLE

U.S. ARMY CORPS OF ENGINEERS
HUNTINGTON DISTRICT
MM280 RESTORATION

JOB NO.	43640
DESIGNED BY:	GDB
DRAWN BY:	DSC
CHECKED BY:	GDB
APPROVED BY:	GDB
DATE:	FEB. 2007

EXISTING SITE TOPOGRAPHY

SCALE: 1"=60'

SHEET NO. 2 OF 4

P:\PR43640\CADD\PLAN-1.DWG 2-15-07 9:04:25 am COXD

Embayment/Constructed Wetland - Before

Embayment/Constructed Wetland - After

Discharge Location - Before

Discharge Location - After

Gob Pile - Before

Gob Pile - After

APPENDIX I

Preliminary Restoration Plan

Section 1135 Preliminary Restoration Plan
Fact Sheet Updated 10 December 2001

1. **Project:** Wills Creek Lake, MM280 Acid Mine Drainage Abatement Project.

Wills Creek Lake in Ohio is one of the original 14 flood control reservoirs planned and constructed by the Corps of Engineers and the Muskingum Water Conservancy District (MWCD).

Wills Creek Lake was completed in June 1936 at a cost of $2,899,900. Authorized purposes served by the Wills Creek Lake project include flood control, recreation, and fish and wildlife enhancement. The year round storage of Wills Creek Lake is 900 surface acres. Operation and maintenance of the reservoir for flood control purposes has been the responsibility of the Corps since construction, while the MWCD has retained responsibility for conservation, recreation, water use, etc. Wills Creek Lake is within Congressional District 18.

2. **Location:** Wills Creek Lake is situated in the Ohio counties of Coshocton, Guernsey and Muskingum. It is located approximately 55 miles east of Columbus, Ohio (see Figure 1). This proposed environmental restoration project is located along the south shoreline approximately 4 miles above the dam (Figure 2).

The MM280 acid mine restoration project is located on Corps flowage easement lands as well as land owned by the Muskingum Water Conservancy District (MWCD), a public corporation created in 1933 for the purpose of developing a plan for flood control, conservation, recreation and water use in the Muskingum River Basin. Operation and maintenance of the 14-reservoir system for flood control purposes in the Muskingum Basin has been the responsibility of the Corps of Engineers since its inception. At Wills Creek, the Corps owns 131 acres in fee and 20,252 acres of flowage easements.

3. **Description:** Environmental restoration measures proposed for the MM280 site at Wills Creek Lake could include the following practices: the construction of a system of tested and fully State-accepted anoxic limestone drains (ALD's) followed by wetland ponds or cells. This system could be employed separately or in combination with measures directed to the mine adit such as hydraulic seals.

The proposed bio-geochemical treatment scheme will be designed to ameliorate the existing degradation of surface water quality at

the Wills Creek project caused by untreated acid mine drainage (AMD). It is expected that environmental restoration will be accomplished via the capture and routing of the pollutants (untreated AMD) to a single collection point, where improvements in baseline water quality will be accomplished during sequential phases of the proposed AMD treatment scheme. The anoxic limestone beds function by promoting the contact of acid mine drainage with limestone gravel under anoxic conditions. The anoxic conditions limit the oxidation of ferrous iron, thereby minimizing the armoring of limestone with ferric hydroxide. ALD's are generally used to treat acid mine drainage before it flows into a constructed wetland finishing area.

Wills Creek Lake in the vicinity of the AMD outfall or discharge exhibits serious decline both in aquatic habitat and aquatic life. The most significant negative water quality effect from the discharge is that of acidification. Secondary impacts also exist and consist of the accumulation of vast amounts of sediment deposits in the lake and embayment surrounding the AMD outfall. The impaired water quality and physical habitat near the discharge combine to greatly reduce the abundance and diversity of the aquatic food chain in the area. The esthetic (visual) impairment to the Wills Creek Lake setting from the AMD plume and sediment delta is excessive on any qualitative scale. Because a much-used lakeshore public access road affords unobstructed view of the environmental degradation, the magnitude of the negative esthetic impacts is much increased. Implementation of the proposed restoration project at MM280 is expected to return this segment of the lake and embayment to a more balanced aquatic environment having a vastly improved esthetic and visual quality - one that is represented by a normal composition of aquatic organisms. Without the proposed environmental restoration project, no improvement in the existing degraded aquatic environment is to be expected.

The ongoing untreated AMD discharges from underground mines into Wills Creek Lake and its tributaries has directly and indirectly depressed the aquatic fauna of the lake, resulting in a fish population, for example, occurring at well below carrying capacity. Improvements to surface water quality and associated fishery habitat are fully anticipated to enhance the opportunities for more successful fish spawning and nesting with tangible benefits to the entire food chain to be expected. Specific sport fish most likely to be benefited from the project include blackbass, catfish, crappie, saugeye and various panfish. As improvements to the lake fishery occur, there will be foodchain benefits to many wildlife species including small mammals, amphibians, reptiles, shore and wading birds and waterfowl.

Regionally, the project occurs within the Muskingum River Basin of east-central Ohio (Figure 1) - where widespread habitat deterioration has occurred through surface and deep mining, deforestation and development. Serious declines in species biodiversity and wildlife habitat continue to occur basinwide, especially to the aquatic habitats and populations. A once-diverse molluscan (bivalve) and native fishery has been significantly impacted, making efforts to restore such habitats and ecosystems within the basin especially worthwhile. Historically, the Muskingum River Basin in Ohio has contained the most diverse and rich aquatic resources in the state.

Alternatives to the proposed bio-geochemical treatment system have been and will continue to be considered. Acid mine drainage originates from underground mine complexes. The best management practices, therefore, must target those sources. Aside from the proposed anoxic limestone drain alternative, alkaline injection may be the only other treatment practice of this category. Most other mine drainage alternatives employ treatment at the point of discharge. Such treatment schemes are generally referred to as conventional treatment systems. However, because of the excessively high costs associated with conventional systems they have not warranted further consideration. All feasible AMD treatment alternatives will be evaluated during preparation of the PMR.

The quantifiable project outputs associated with the MM280 site are expected to include the increase or improvement of approximately 10 acres of generalized warm-water habitat in Wills Creek Lake and approximately 3 acres of wetlands. Improved aquatic habitat amounting to nearly 10 acres can be assessed through use of water quality parameters, both chemical and biological. With-Project conditions will be compared against baseline chemical and biological parameters to measure actual outputs realized. The most significant improvement will be observed and measurable in the embayment and vicinity of the acid mine outfall. With project implementation there can be expected significant reductions in effluent concentrations of heavy metals such as aluminum (Al). An additional 3 acres of wetlands will be constructed on impacted land that ranges from marginal to poor in habitat quality.

4. **CONSISTENCY STATEMENT:** There will be no unacceptable impacts upon authorized project purposes as a result of construction and implementation of the MM280 Ecosystem Restoration Project. This project will improve considerably the fish and wildlife management aspects of the lake.

5. **VIEWS OF SPONSOR:** The Ohio Department of Natural Resources, Division of Mineral Resources Management has re-submitted a

letter (dated 20 June 2001) to the District Engineer expressing their willingness and intent to cost share the project under authority of Section 1135 (b) of the Water Resources Development Act of 1996, as amended. The State of Ohio has long recognized the importance of correcting chronic acid mine drainage responsible for the serious degradation at Wills Creek and other Muskingum Basin projects. As the agency responsible for management of fish and wildlife in Ohio, the Department of Natural Resources, like the Corps, understands that significant habitat and population gains are attainable through the ecosystem restoration project at MM280.

6. VIEWS OF FEDERAL AND OTHER STATE AGENCIES: The environmental restoration project at Wills Creek has the support and endorsement of the U.S. Fish and Wildlife Service, the Office of Surface Mines, and Ohio Division of Wildlife as well as the Muskingum Water Conservancy District.

7. ENVIRONMENTAL COMPLIANCE REQUIREMENTS: The Huntington District will initiate preparation of an Environmental Assessment\FONSI during the DPR phase of study. Full coordination of all proposed restoration strategies will continue with state and Federal agencies throughout the planning and construction phases.

8. COSTS AND BENEFITS: Total project cost for the restoration project at Wills Creek Mason Mine 280 is estimated to be $1,500,000. The table in Section 11 depicts preliminary construction costs including P&S, E&D and S&A.

Implementation of the ecosystem restoration project is expected to result in the environmental restoration of approximately 10 acres of aquatic habitat at Wills Creek Lake, a portion of which is critical littoral zone necessary to fish spawning and benthic insect production. This restoration of aquatic habitat will primarily benefit popular pan and gamefish such as bluegills, crappie, and blackbass. Incidental to the direct benefit to native fish species are the added benefits to related aquatic and semi-aquatic taxonomic groups such as amphibians, reptiles, and small mammals including economically important furbearers (mink, raccoon, muskrat and weasel). Important wading and shorebirds will likewise derive benefit from increased production of fish, aquatic insects, amphibians and reptiles. Waterfowl such as mallards, coots, and blue-winged teal commonly utilize Wills Creek Lake for lengthy periods during spring and fall seasons. A large heron rookery found along the shores of the lake is indicative of the many aquatic species that stand to directly

benefit from restored habitats at this Corps project. As existing shallow, seasonal wetlands within the Wills Creek Lake project area are diminished in size and number due largely to agricultural expansion, the importance of environmental restoration of available aquatic habitats at Wills Creek, especially the littoral zones of the reservoir such as that area at MM280, becomes more paramount. The existing conditions found at the lake embayment at the outfall from the MM280 AMD site are severely degraded. The AMD iron and sediment plume can be observed a considerable distance off shore. As solids settle in the vicinity, further decline in potential available aquatic habitat occurs. The sedimentation and acidification of this small embayment has resulted in the highly degraded baseline condition that exists at MM280. Approximately 4 acres of land (terrestrial wildlife habitat) are similarly degraded below the AMD discharge. Where vegetation once grew, there now exist yellow precipitates and other unsightly sediments. Furthermore, the land will not support the weight of either wildlife or project visitors that might encounter the affected resources. The proposed ecosystem restoration project at MM280 is expected to correct each of the present adverse conditions and result in a greatly improved aquatic and terrestrial habitat on Corps property for wildlife and the public.

Based upon our understanding of existing land (habitat) use and value, we derived HIS values of Future With and Future Without Project Conditions by employing the HEP (Habitat Evaluation Procedures) Methodology of the Fish and Wildlife Service.

Net gain is shown in Table 1. Graphs depicting Future With and Future Without Project Conditions plotted over the 50-year project life appear in Tables 2. A net gain of 324 Habitat Units (HU'S) have been calculated from the above graphs, and the Average Annual Habitat Units (AAHU) for the proposed project are presented in Table 2. Projected benefits and outputs are very preliminary in nature and await better definition and resolution during subsequent planning phases.

A constructed AMD treatment project referred to as the Wills Creek Tipple Project, designed and built by the Ohio Department of Natural Resources, has reclaimed 12 acres of toxic coal refuse while treating AMD with a similar bio-geochemical system. The project was completed in 1994 at Wills Creek Lake. Since that time, monitoring of the influent and effluent waters confirmed the significant treatment capability of anoxic limestone drain\composted wetlands systems. The Tipple Project resulted in elimination of all acidity while the pH increased by two standard units. There has been an observed reduction of iron, manganese, sulfates and total dissolved solids by as much as 99%, 62%, 37% and 38% respectively.

9. **SCHEDULE:** Major milestone dates are as follows:

	START	COMPLETE
PRP	Jul.98	Jan. 99
DPR	May 02	Dec 02
P&S	Feb 03	April 03
Construct:		
Advertise\Award	June 03	July 03
Implement	Aug. 03	Nov. 03

10. **SUPPLEMENTAL INFORMATION:** The Ohio counties surrounding the Wills Creek Lake and flood control project (COE) have been extensively mined (deep and surface) in the past. Many of these practices have severely impacted the mainstem Wills Creek and many tributary streams. Wills Creek, like a number of surface waters within the Muskingum River Basin of east central Ohio, once contained richly diverse fishery and bivalve resources. In fact, the aquatic resources of this basin were renown for their diversity and abundance throughout the state and region. During and following the coal mining, these resources were reduced to a fraction of their prior status. Through implementation of state and Federal environmental standards, the regulatory agencies have attempted to return the Muskingum watershed to near its former condition. Many such efforts have been patchy and have met with limited success.

At Wills Creek, however, focused attention has sought to remedy past environmental abuse primarily through two recent initiatives: (1) formulation of the Wills Creek Watershed Association and, (2) a government "set aside" program and watershed approach on Wills Creek which seeks to target basin-wide mining-induced problems for correction. The AMD discharge from the Mason Mine 280 site is recognized as a very serious contributor of acidity, metals, etc. to the lake, and as such, has received priority attention from the Division of Mineral Resources Management. One such AMD site at the COE lake project - the Wills Creek Tipple - has already been remediated using treatment similar to that proposed for this restoration project. Approval and implementation of the MM280 restoration project will contribute to watershed improvement objectives set by the Watershed Association, the Ohio Division of Reclamation and the State of Ohio.

The project sponsor will probably be providing some technical support as in-kind services. Ohio DNR will furnish technical review and oversight of the design features for the proposed AMD treatment scheme, data collection, and inspection and monitoring functions during and following project construction.

11. **FINANCIAL DATA:** (all costs in thousands of dollars)

	Total	Non-Fed	Fed	2002	2003	2004
DPR	190	-0-	190	130	60	0
P&S	80	-0-	80	-0-	80	0
Construct	1,230	375	855	-0-	1,230	0
TOTALS	1,500	375	1,125	130	1,370	0

Note: Reports and P&S are initially federally financed, with costs distributed as part of the non-Federal share of project costs during implementation.

It must also be noted that work-in-kind may only be credited subsequent to execution of the PCA, at the earliest during the Plans and Specifications phase if the project is approved.

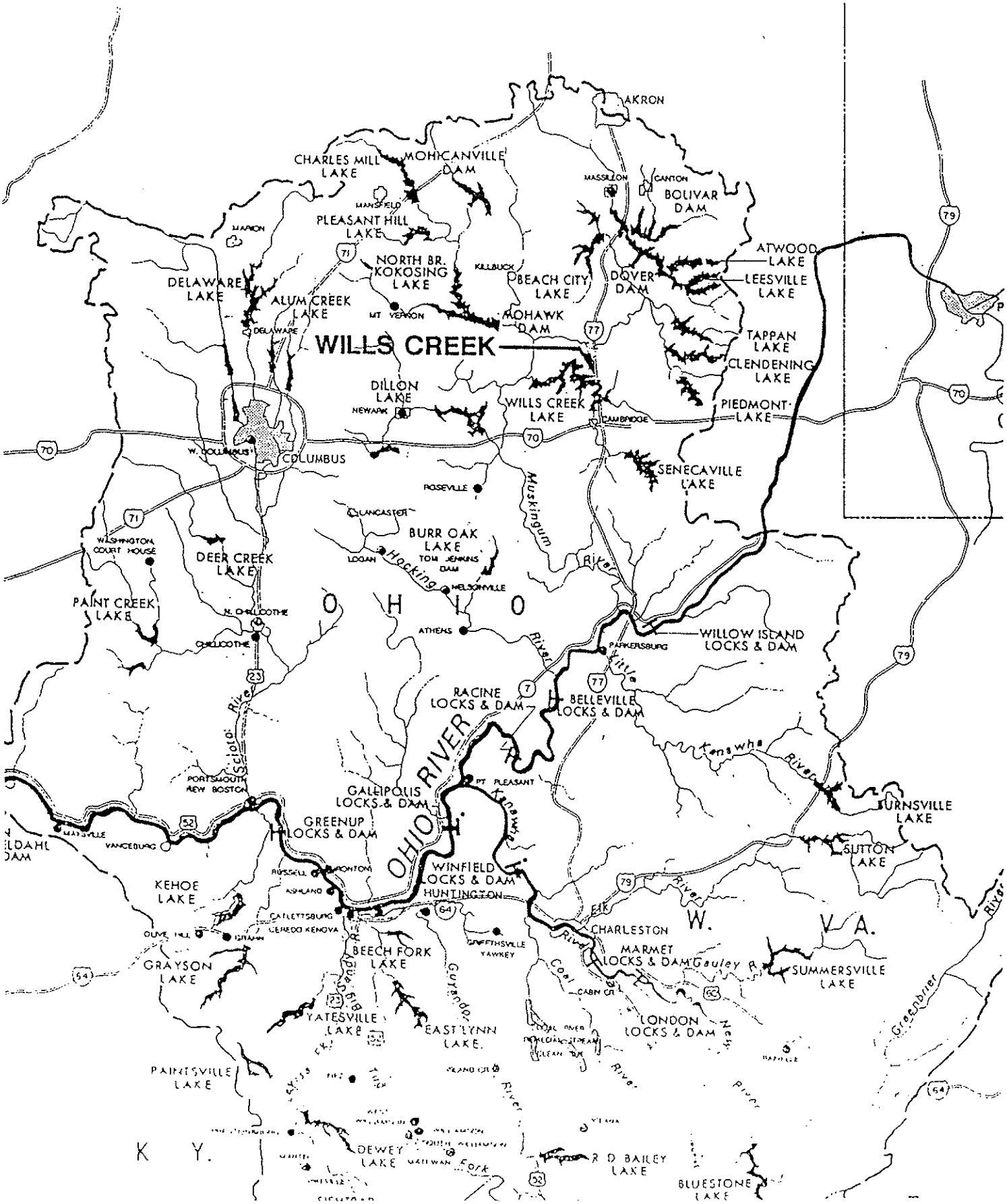
Non-Federal Requirements:

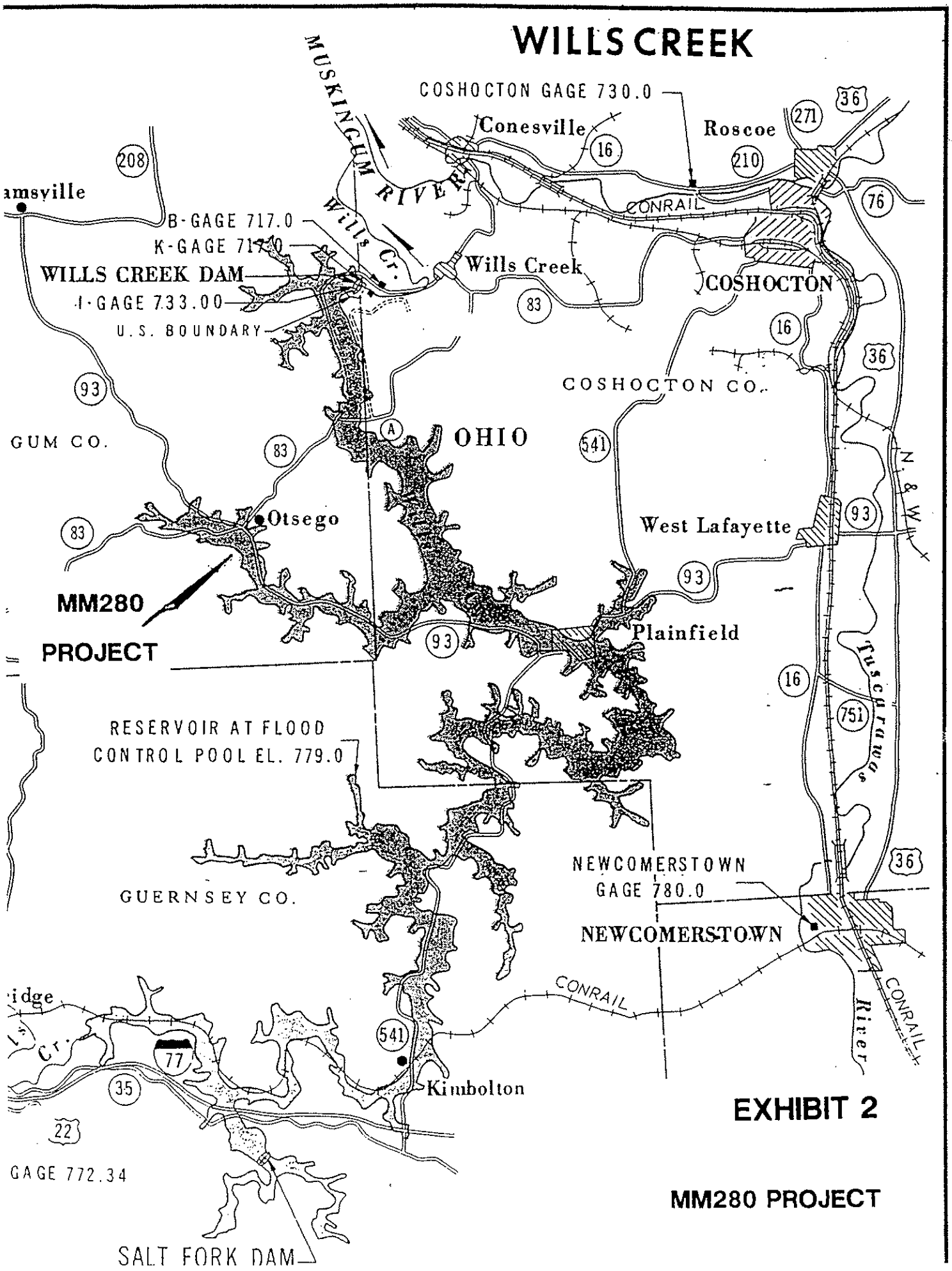
LERRD	NONE
CASH	$375,000
IN-KIND SERVICES	-
OMR&R	700\YR for 20 yrs

12. **FEDERAL ALLOCATIONS TO DATE:**

Preliminary Restoration Plan	10,000.
Update Fact Sheet	2,500.
Detailed Project Report	NONE
Plans and Specifications	NONE
Construction	NONE
TOTALS	12,500.

EXHIBIT 1
WILLS CREEK LAKE




WILLS CREEK
MUSKINGUM RIVER
COSHOCTON GAGE 730.0
Conesville
Roscoe
CONRAIL
B-GAGE 717.0
K-GAGE 717.0
WILLS CREEK DAM
I-GAGE 733.00
U.S. BOUNDARY
Wills Cr.
Wills Creek
COSHOCTON
COSHOCTON CO.
GUM CO.
OHIO
Otsego
West Lafayette
MM280
PROJECT
Plainfield
RESERVOIR AT FLOOD
CONTROL POOL EL. 779.0
Tuscarawas
N. & W.
NEWCOMERSTOWN
GAGE 780.0
NEWCOMERSTOWN
GUERNSEY CO.
CONRAIL
CONRAIL
River
Kimbolton
GAGE 772.34
SALT FORK DAM
EXHIBIT 2
MM280 PROJECT

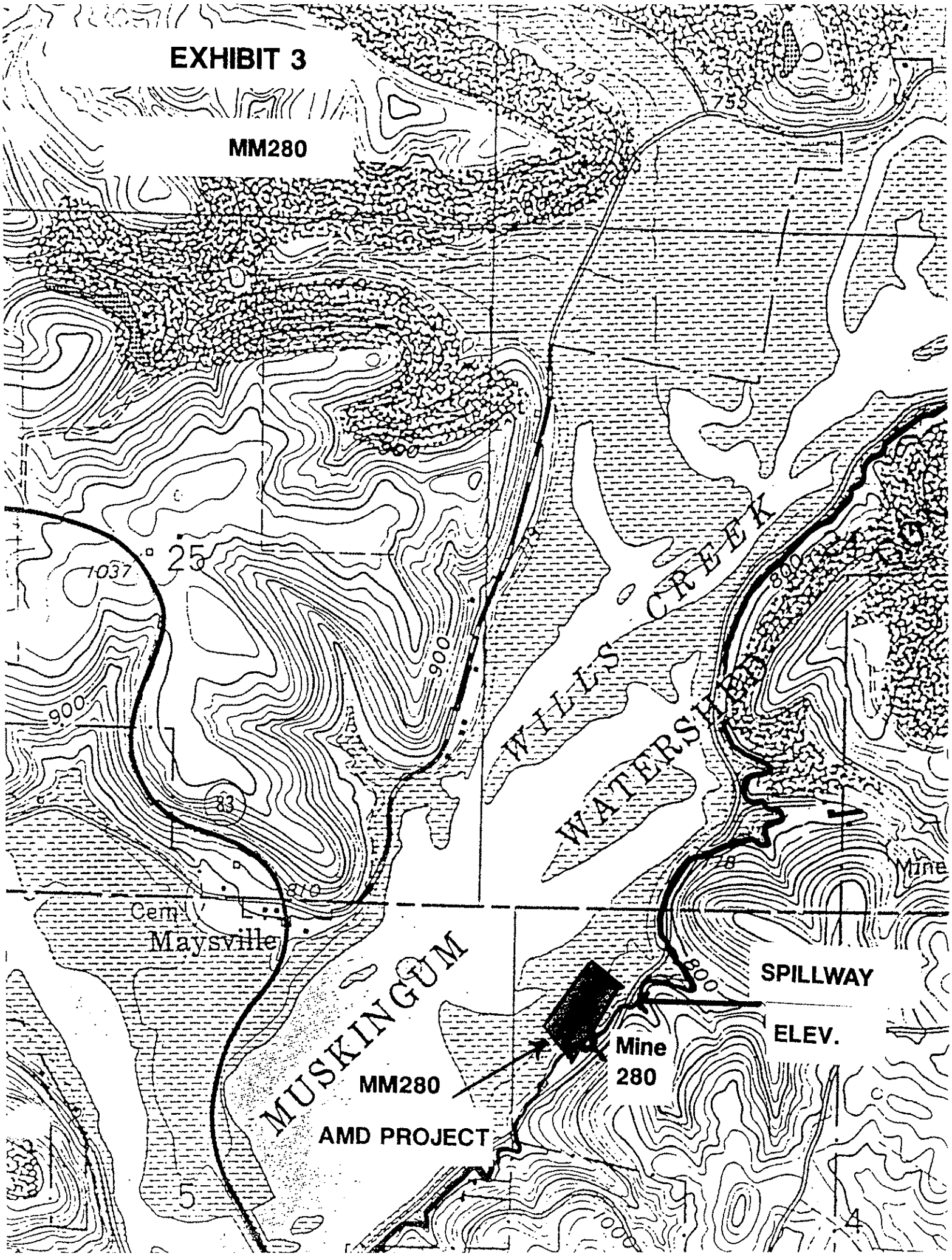


EXHIBIT 3
MM280
25
1037
900
900
WILLS CREEK
WATERSHED
800
Mine
Cem
Maysville
810
MUSKINGUM
800
SPILLWAY
ELEV.
Mine
280
MM280
AMD PROJECT
5
4

TABLE 1

HSI'S AT WILLS CREEK LAKE

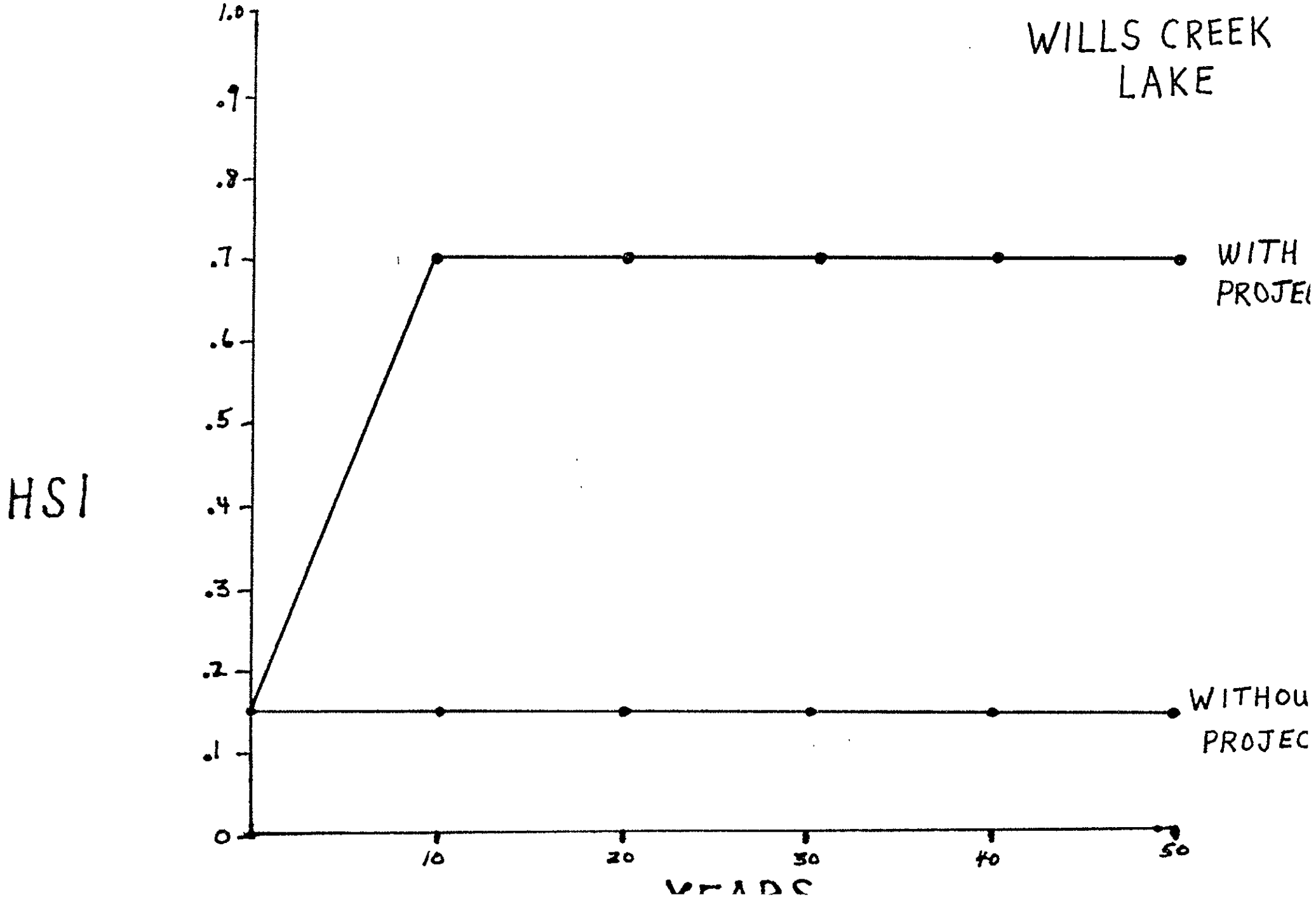
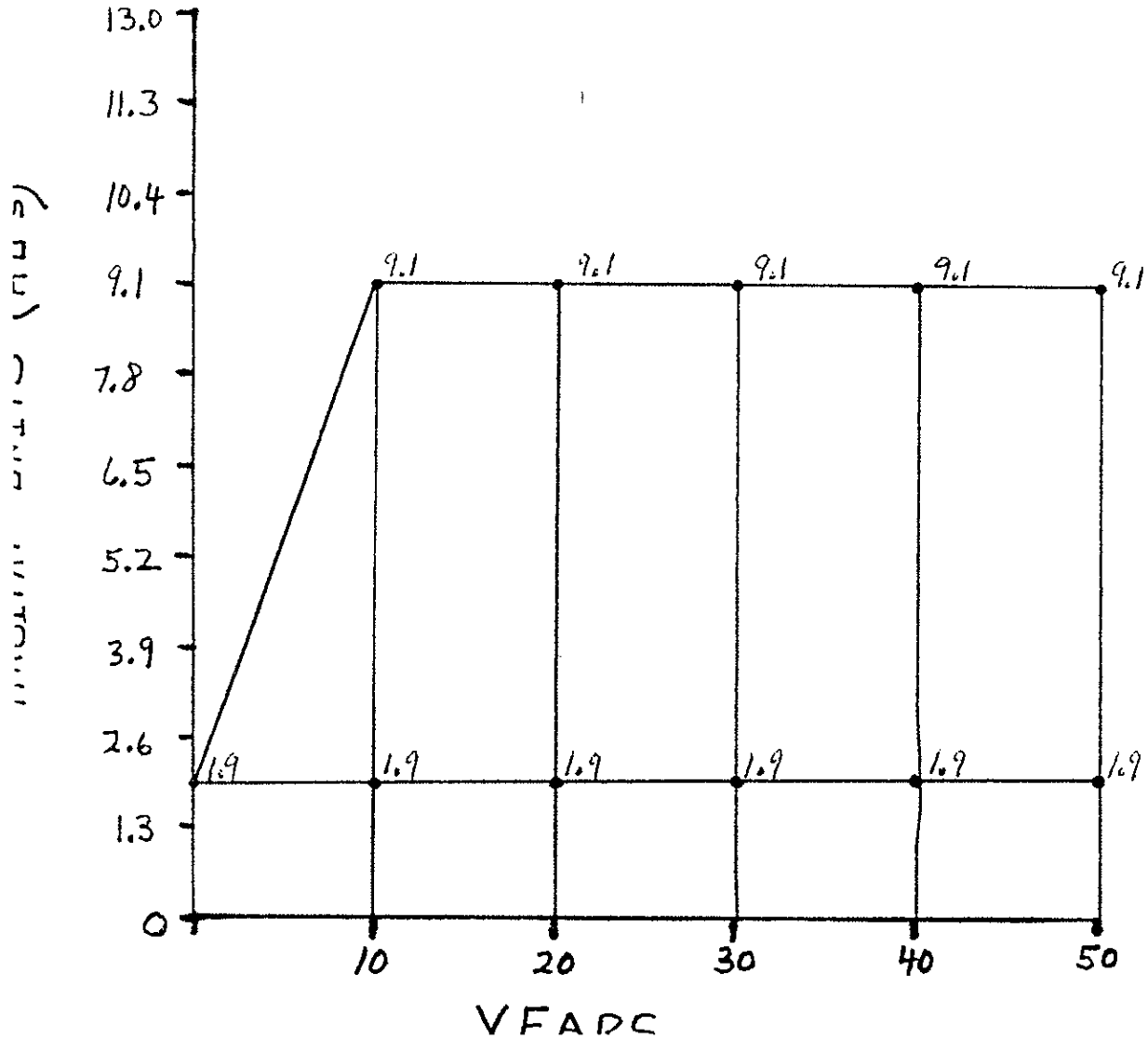


TABLE 2

419 - 95 = 324 JET GAIN

$AAHU = \frac{324}{50} = 6.5$



FUTURE WITH PROJECT

$4(10 \times 9.1) = 364$

$(10 \times 1.9) = 19$

$\frac{1}{2}(10 \times 7.2) = 36$

$= 419$ HU's

FUTURE WITHOUT PROJECT

$5(10 \times 1.9) = 95$ HU's