DAM SAFETY ASSURANCE PROGRAM
EVALUATION REPORT AND
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX H
ENGINEERING APPENDIX

DOVER DAM, OH
TUSCARAWAS RIVER

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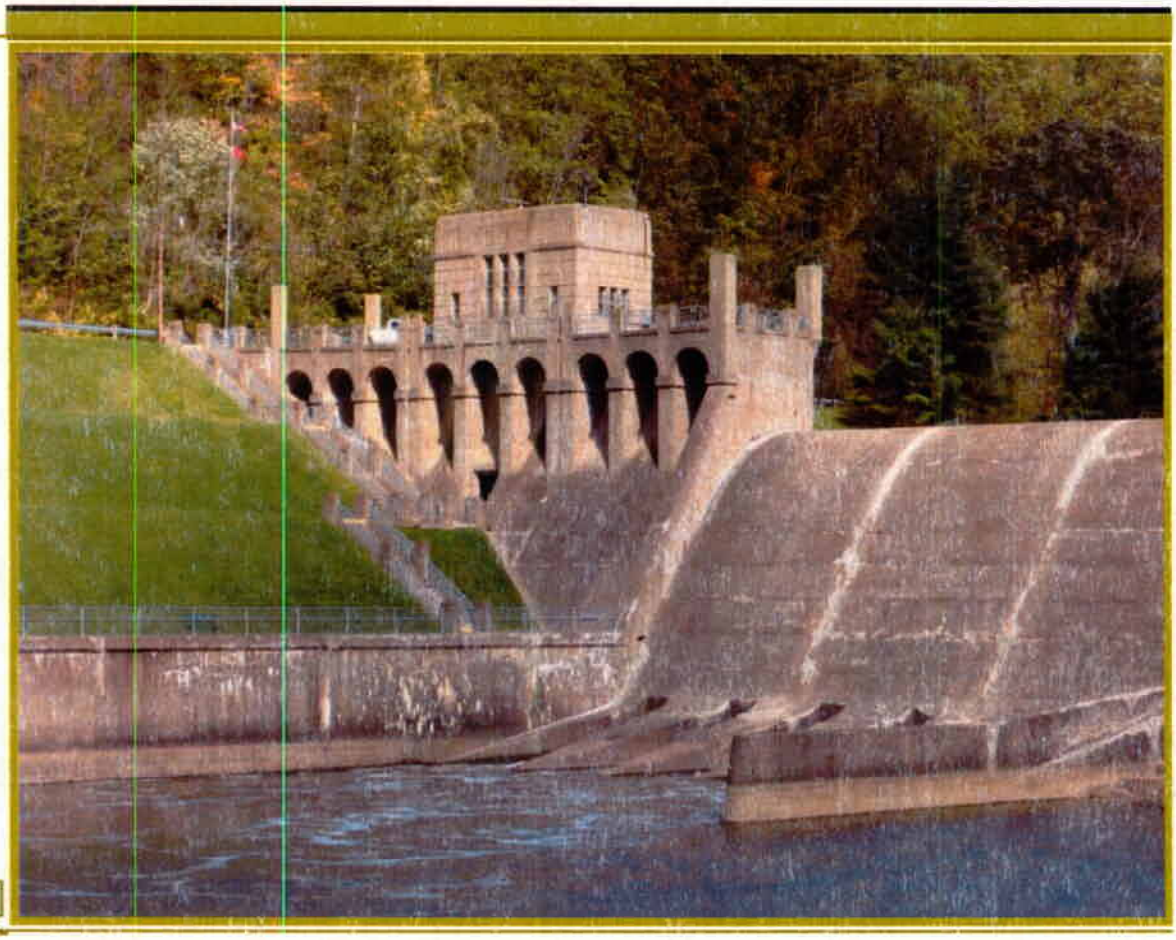
This Appendix contains the following documents in support of the Evaluation Report/Environmental Impact Statement.

NATIONAL REGISTER ASSESSMENT OF DOVER DAM

TUS-986-5
Dover, Tuscarawas County, Ohio
Contract DACW59-02-D-0001, Delivery Order CG01



Submitted by
Hardlines Design Company
4608 Indianola Avenue
Columbus, Ohio 43214

Submitted to
U.S. Army Corps of Engineers
Huntington District
502 Eighth Street
Huntington, West Virginia 25701

DRAFT
October 31, 2006

NATIONAL REGISTER ASSESSMENT OF DOVER DAM

TUS-986-5
Dover, Tuscarawas County, Ohio

Submitted to
U.S. Army Corps of Engineers, Huntington District
502 Eighth Street
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October 31, 2006

ABSTRACT

Hardlines Design Company (HDC) was contracted in August 2006 to complete a National Register of Historic Places (NRHP) inventory and evaluation of Dover Dam (TUS-986-5), located at Dover, Ohio, on the Tuscarawas River in Tuscarawas County. HDC completed the work under Contract No. DACW59-02-D-0001, Delivery Order CG01.

The dam was constructed starting in the late 1930s as part of the New Deal's ambitious public works program to provide jobs for unemployed Americans, hydroelectric facilities for the nation's electrical power needs, and water recreation facilities. The dam is a good example of a large-scale concrete gravity dam of the 1930s–1940s era; this type and scale of dam is not all that common in Ohio. The dam was also part of the long and significant history of the development of the Muskingum Watershed. Maintenance records from the U.S. Army Corps of Engineers show that the dam has had few alterations and has an excellent level of integrity for the period of its original construction. This report is being completed because the dam does not meet current safety standards, and its alteration is planned for the near future.

HDC finds that the dam is eligible for the National Register of Historic Places (NRHP) under Criteria A and C. Under Criterion A, the dam has associations with the New Deal relief efforts and with the history of the improvement of the Muskingum Watershed. Under Criterion C, it is a good example of a 1930s-1940s–era concrete gravity dam of large scale. Such dams are engineering landmarks in the state of Ohio, and relatively few well-preserved large-scale dams of this type exist in the state. Also, Dover Dam has a very high level of material integrity—the dam has had no major changes since construction was completed,

only routine repairs and maintenance. Finally, the dam is a good example of the Art Deco architectural style applied to an engineering structure.

ACKNOWLEDGMENTS

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PROJECT OVERVIEW

Scope of Project

HDC was contracted by the U.S. Army Corps of Engineers, Huntington District (Huntington District), in August 2006 to complete an eligibility evaluation for the National Register of Historic Places (NRHP) for Dover Dam (TUS-986-5) near Dover, Tuscarawas County, Ohio, on the Tuscarawas River (Figure 1 and Figure 2). The dam is located in a wooded area of Fairfield Township, about 3.5 miles north of the city of Dover. The work was completed under contract DACW59-02-D-0001, Delivery Order CG01.

The dam is a poured, reinforced concrete structure and includes north and south abutments and a central spillway. The dam is no longer considered safe, and the U.S. Army Corps of Engineers has evaluated it as deficient. If the dam is to remain in place, alterations must be made, but before any changes are made, the dam must be evaluated to see if it has the integrity and the historical and/or engineering significance to be eligible for listing in the NRHP. Since the dam was built from 1935–1938, it is over 50 years old, which is the cutoff point for NRHP eligibility under the standard criteria of A, B, C, and D.

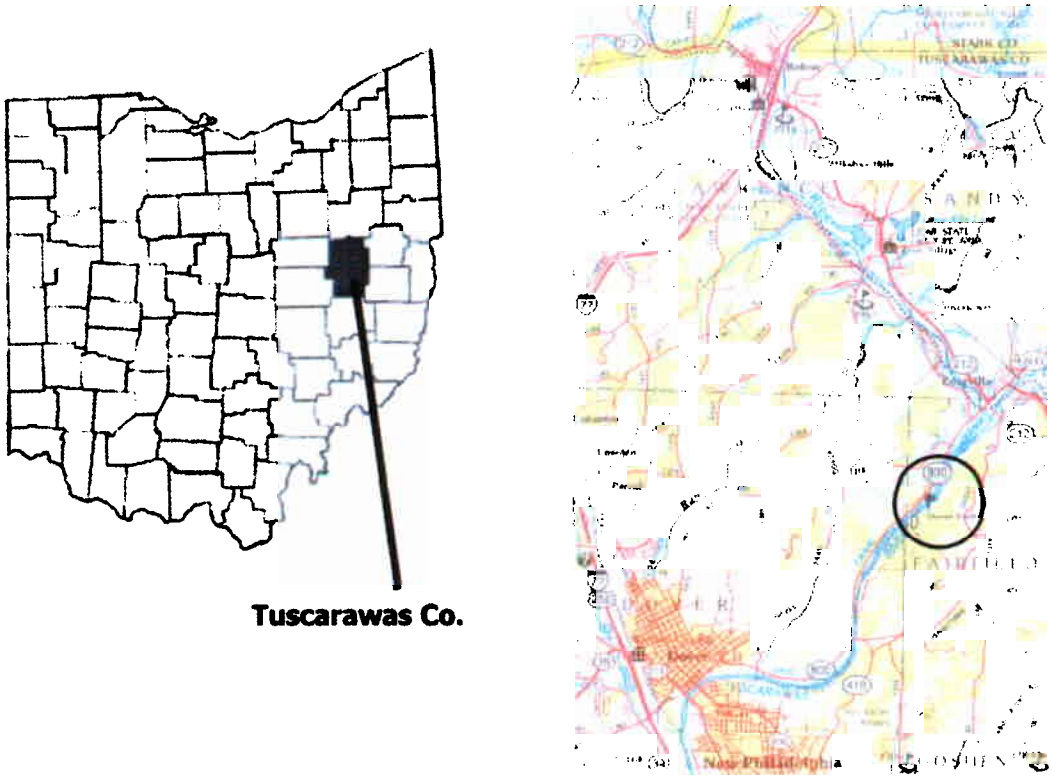


Figure 1. Location map showing Dover Dam in relation to Dover, New Philadelphia, and nearby roadways

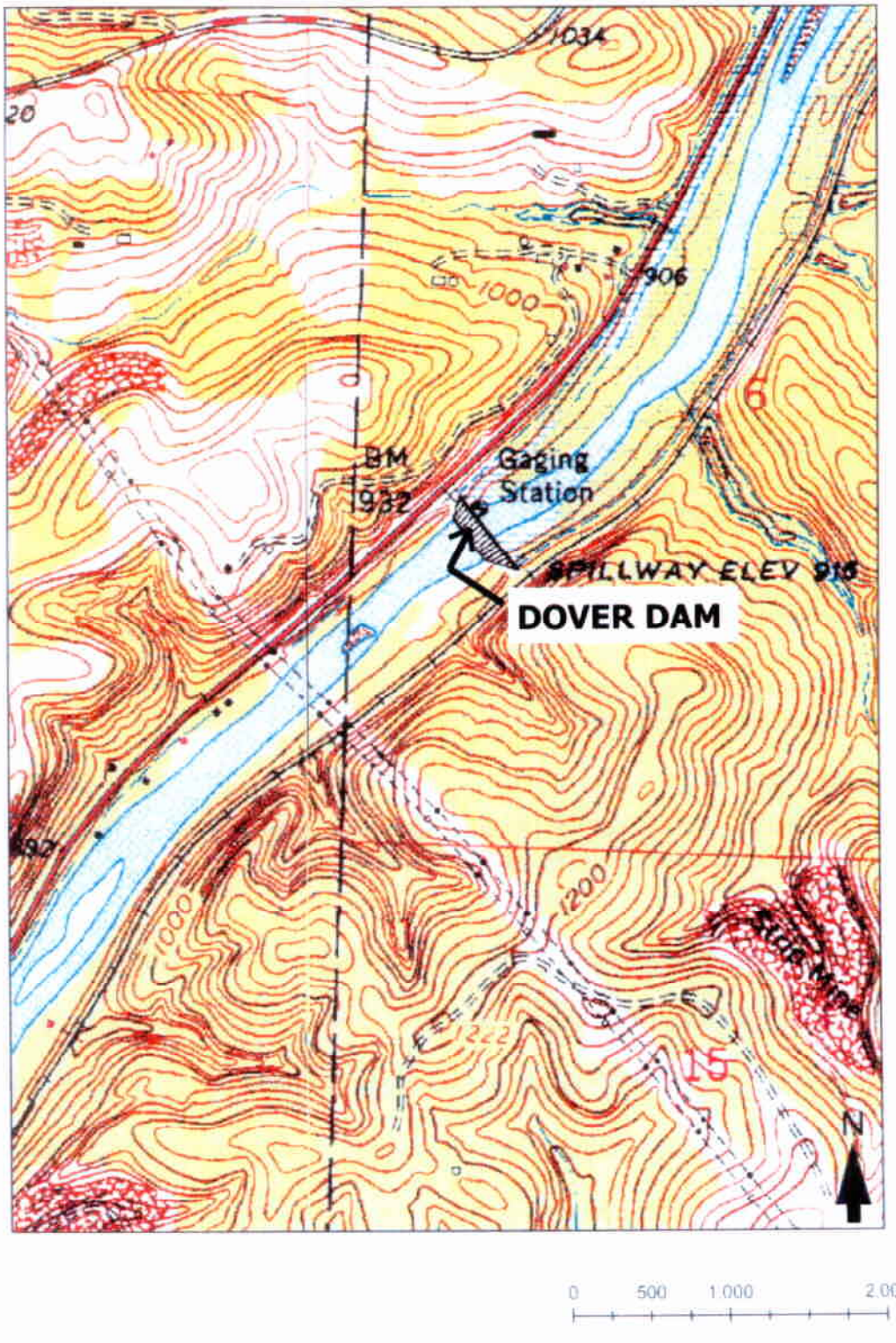


Figure 2. Current USGS map of the project site, with the location of Dover Dam marked

RESEARCH AND FIELD METHODS

Research Methods

Sources Reviewed

HDC historians reviewed the following sources for this report:

The Ohio Historic Preservation Office (OHPO):

- NRHP files
- Determination of Eligibility files
- Eligibility survey report files
- Ohio Historic Inventory (OHI) inventory files
- Online resource mapping

Materials provided by the Huntington District:

- Maintenance reports and summaries
- Construction drawings

Other sources:

- Secondary histories of the Huntington District and the Muskingum Watershed
- Secondary sources on dams in the United States

OHPO files were searched for any existing documentation of the dam and to determine if the dam is within an NRHP district and if it had an existing OHI form. Review of cultural resource records held by OHPO indicated that Dover Dam is not listed in the NRHP and is not within an NRHP historic district that is listed in or eligible for the NRHP. No past determinations of NRHP eligibility were found for the dam. The dam has not been recorded on an OHI form, so HDC completed a new form and obtained a new OHI number.

Field Methods

The field team for HDC completed its field survey at Dover Dam on October 13, 2006, which involved examining and documenting the dam. Specifically, the field team examined the dam for integrity and significant engineering features, noted significant features of the structure, and took high-quality digital photographs. The HDC field team completed a full OHI form since a form for the building had not previously been completed.

The field team also coordinated with the Huntington District to research records on the history of the dam, including construction drawings and maintenance records.

NRHP Eligibility Methods

The property was evaluated, physically and through intensive literary research, for its eligibility for inclusion in the National Register of Historic Places (NRHP). To be eligible for the NRHP, a property must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and the property must meet one of the four criteria listed below:

A) Be associated with events that have made significant contributions to the broad patterns of our history

B) Be associated with the lives of persons significant in our past

C) Embody the distinctive characteristics of type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction

D) Yield, or be likely to yield, information important in prehistory or history

Given the architectural nature of the resource, the criteria considered for the property were A, B, and C. At times, historians cite Criterion D for standing buildings and structures if the resource appears able to provide additional significant historical information. This use of Criterion D was not appropriate for the Dover Dam.

HISTORIC CONTEXT

Tuscarawas County, and Fairfield Township, Ohio

Tuscarawas County

Little was known about Tuscarawas County in the first half of the eighteenth century, as only a few explorers had ventured into the area. In 1750, Christopher Gist of the Ohio Land Company did some exploration of the Tuscarawas Valley, and in 1761, missionaries from the Renewed Church of the United Brethren, also known as Moravians, set up missionary activities in the area (Wikipedia:Tuscarawas County 2006). One source reported that the Moravian settlers brought with them 71 head of cattle (Warner, Beers & Co. 1884:400). In 1760, Major Robert Rogers, a New Hampshire native, visited the Delaware Indians at Tuscarora near Sandy Creek (Warner, Beers & Co. 1884:252), and in 1764, Colonel Henry Bouquet set up an army camp near the present site of Bolivar, Ohio (Warner, Beers & Co. 1884:256).

In 1772, David Zeisberger established the village of Schonbrunn near what is now New Philadelphia. A second settlement, Gnadenhutten, was set up later during that same year at a different location (Wikipedia:Tuscarawas County 2006). The Continental Army set up Fort Laurens near Bolivar in 1778 (Warner, Beers & Co. 1884:258). The fort was abandoned in 1779 and was not used again (Warner, Beers & Co. 1884:262).

After the Revolutionary War, the land was part of the U.S. Military District. An ordnance was passed in 1785 to survey a series of six-mile square townships in the area (Warner, Beers & Co. 1884:325). Washington County was established in 1788 in the Ohio Territory, with

Marietta as the county seat. Muskingum County was founded in 1804, and Tuscarawas County was created four years later in 1808 from a portion of Muskingum County. Tuscarawas County would lose land when other counties were formed within it—Coshocton County in 1810, Harrison County in 1813, Holmes County in 1824, and Carroll County in 1832 (Warner, Beers & Co. 1884:353–354).

Tuscarawas County was at first divided into only four townships: Lawrence, Goshen, Salem, and Oxford (Fairfield County was created later, in 1817). New Philadelphia was set up as the county seat in 1808, and a log jail was built that year, with a brick courthouse built between 1818 and 1825 (Warner, Beers & Co. 1884:355). Early agriculture in the county consisted of corn, wheat, oats, and tobacco (Warner, Beers & Co. 1884:400). A stretch of the Ohio and Erie Canal was built through the county from 1825–1830, which was operated by the State of Ohio through 1861. The Steubenville and Indiana Railroad decided to build its main line through Uhlrichsville in 1851, with a branch line into New Philadelphia. The main line of the railroad was completed in 1855.The Cleveland and Pittsburgh Railroad built a Tuscarawas branch starting in 1852, with trains servicing New Philadelphia beginning in 1854. Additional railroad lines were added through the county in the 1860s and 1870s (Warner, Beers & Co. 1884:388–397).

By the 1880s, wheat and corn production were major agricultural staples of the area, with significant production of rye, buckwheat, barley, potatoes, flax, and hay (Warner, Beers & Co. 1884:388–397).

Technological progress came about in New Philadelphia at the end of the nineteenth century. The city got its initial contingent of electric lights in 1889, and an electric railway was

installed between Dover and New Philadelphia from 1899–1900. The first clay, brick, and tile plant was started in the area in 1883 in the Uhlrichsville area, and it was set up to manufacture sewer pipe. By the early twentieth century, the clay industry had become an important economic force in the area and served as a major employer; the industry reached its peak in the1920s, with 14 plants and about 1,500 employees. Coal mining was also an economic mainstay of the county for much of the twentieth century, with the Beaver Coal Company operating a large mine near Dover Dam (Tuscarawas County Genealogical Society 1988:3–8).

One of the most important events in the county during the first few decades of the twentieth century was the March 1913 flood, in which the Tuscarawas River rose 37 inches above previous records. The flood destroyed bridges, idled factories, and forced many residents out of their homes (Tuscarawas County Genealogical Society 1988:3). The flooding eventually led local leaders to promote flood control in the area, with the eventual formation of the Muskingum Watershed Conservation District in 1933 (Jenkins 1976:41-42).

Also in the 1930s, the clay industry began a long process of consolidation that would continue for decades. By 1988, only two clay industry plants remained in the county (Tuscarawas County Genealogical Society 1988:3). As of the 2000 census, the county had a population of 90,914 (Wikipedia:Tuscarawas County 2006).

Fairfield Township

Dover Dam is located in Fairfield Township, which was formed in 1817. Early settlers in the area were Gideon Jennings, Aaron Reeves, John McCreary, and Abel Williams, with all arriving in the area before 1807 (Warner, Beers & Co. 1884:546). Rev. J. B. Finley, a

traveling preacher, brought Methodism to the area in 1809. The Furnace United Brethren Church was built in the western portion of the township, around 1850. The wood frame St. Matthews Evangelical Lutheran Church was built in 1837 and enlarged in 1872–1873. Other congregations included the German Baptists, also known as Dunkards. The Village of Fairfield was laid out by Samuel and Worthington Slutts in 1854, with 30 lots. The town was sited on the Tuscarawas Branch of the Cleveland and Pittsburgh Railroad, but it never grew to a large size. It was later referred to as Zoar Station (Warner, Beers & Co. 1884:546–547).

Zoar

Another major element in the history of Fairfield Township was the establishment of the small settlement of Zoar, which was founded by a group of Germans from the Wurttemberg area who had separated from the Lutheran Church and had been persecuted. Led by Joseph Bimeler, the group came to the United States around 1817. The group landed in Philadelphia and were assisted by the Quakers. Later in 1817, several of the society's members traveled to eastern Ohio and purchased land. The settlers began to construct buildings, and the full contingent of the 200 members of the group arrived at Zoar in the spring of 1818.

In April 1819, after some difficulties, the group officially founded the Society of Separatists of Zoar and reorganized as a commune where goods were shared and each person donated their property to the society (Ohio History Central 2005). The Zoar community prospered after becoming a commune. The group was largely self-sufficient and sold any surplus goods and agricultural products in the surrounding community. Industries included a flour mill, textiles, a tin shop, a cooper, a wagon maker, and two iron foundries. The group also contracted to build a seven-mile portion of the Ohio and Erie Canal, which crossed through the Zoarite lands.

After the death of Bimeler in 1853, the commitment to the society's founding principles began to decline, and as the nineteenth century progressed, the society itself began to wane. In 1898, members of the society dissolved the organization, and the Zoarite property was divided among the remaining members (Ohio History Central 2005). The early to mid-Nineteenth century rise and late-century decline of the Zoarites resembles that of several other communal settlements in this region of the United States, including the Union Village Shakers of Warren County, Ohio, and the Harmonists of western Pennsylvania.

The Muskingum Watershed Conservancy District

The origins of Dover Dam go back to the devastating flood of 1913 and the subsequent Conservancy Act of Ohio, passed in 1914. (Advanced Technology 2001:Sec. 3, 1). Several local civic organizations in Tuscarawas County also promoted the improvement of water resources in the area. Action on this issue began to gain momentum at the end of the 1920s. A group of industrialists in New Philadelphia and Dover formed an informal group to study flood protection and possible transportation on the Tuscarawas River (Jenkins 1976:23–31). In 1928, civic leaders in Zanesville (a city particularly hard hit by the 1913 flood), spearheaded formation of the Muskingum-Tuscarawas Improvement Association (Johnson 1977:161). The association commissioned a study entitled "Report on Water Resources of the Muskingum Drainage Area," which was produced by the Dayton Morgan Engineering Company in 1931. This report recommended construction of reservoirs, levees, and channel walls, and the proposed construction program in the plan called for four large reservoirs and other improvements at a cost of $53 million. According to the report, canalization of the Tuscarawas River between Dover and New Philadelphia was considered economically unfeasible (Jenkins 1976:23-31). In 1932, the U.S. Army Corps of Engineers, Huntington

District, also completed a report on the Muskingum Basin that reached very similar conclusions (Johnson 1977:161).

Community activity to form a water management district in the area continued to build momentum through the early 1930s. By May 1933, several civic organizations in Tuscarawas County and in Zanesville and Newark filed petitions to create a water management district. On June 3, 1933, a court decree came down that established the Muskingum Watershed Conservancy District (Jenkins 1976:41–42), which was created largely to facilitate execution of a reservoir plan for the area. The district board of directors held its first meeting on June 13, 1933. At about the same time, Congress passed two sections of the National Industry Recovery Act, with Title II of the act creating a Federal Emergency Administration of Public Works. This organization would be essential in completing dams and flood control reservoirs in the Muskingum Basin, including Dover Dam (Jenkins 1976:46). On August 9, 1933, the Conservancy District's board of directors approved a document titled "General Plan for Flood Protection and Water Conservation for the Muskingum Watershed Conservancy District," and two days later, the directors applied to the Administrator of Public Works in Washington, D.C., through the Ohio State Advisory Board, for a grant of $41,640,000. The board stated that construction associated with the flood protection plan would provide employment for 8,000 people, with $20 million expended on wages. (Jenkins 1976:53).

On December 28, 1933, the Federal Emergency Administration of Public Works approved funding for $22,590,000 for construction of 14 reservoirs in the watershed. This action was the only grant given to a local water management project under the National Industrial Recovery Act (Jenkins 1976:58). An agreement was signed between the Muskingum Watershed Conservancy District and the Public Works Administration on March 29, 1934.

The U.S. Army Corps of Engineers immediately began surveys and foundation investigations for the 14 dams proposed for the reservoir system. At first, the Huntington District of the Corps was in charge of constructing the dams and reservoirs (Jenkins 1976:64). However, due to the size of the undertaking, the Chief of Engineers established a new engineer district at Zanesville in February 1934, with Colonel Joseph D. Arthur appointed as District Engineer (Johnson 1977:163). The Zanesville District acted quickly to prepare an official plan outlining the dam sites, surveying 39 potential reservoir sites, testing materials, completing hydrological studies, and testing models for outlet structures and spillways (Jenkins 1976:67).

The official plan for the sites of the 14 dams was approved by the Conservancy District on October 6, 1934. Work began on the Tappan and Charles Mill dam sites in the first week of 1935, and by summer 1935, work on the other 12 dams was underway (Johnson 1977:163). In the end, 14 dams were built for the Muskingum basin from 1935–1938. In addition to the concrete gravity dam at Dover, 13 earthfill gravity dams were built: the Mohawk, Pleasant Hill, Charles Mill, and Mohicanville dams on the Walhonding River system; the Wills Creek and Senecaville dams on smaller streams in the area east of Zanesville; and the Bolivar, Atwood, Leesville, Beach City, Tappan, Clendening, and Piedmont dams on the Tuscarawas River basin (Johnson 1977:164).

The Planning and Construction of Dover Dam

Dover Dam is the key reservoir in the Tuscarawas River basin. Two sites for the dam were considered initially, the existing site and a second proposed site about one mile downstream of the existing site. The current site was chosen because it required lower construction costs

and had better foundation conditions. Dover Reservoir was designed to have a conservation pool of 1,000 acre-feet and a flood control pool of 203,000 acre-feet, or the capacity to hold 4.9 inches of runoff. Initially, a number of different dam types were considered, including earth-fill, concrete buttress, multiple arch, and several combination types, but all were eliminated because of potential difficulties involving foundations and materials. However, the narrow gorge location of the dam site and the rock foundations below the site led to the selection of a concrete gravity design for Dover Dam, making it the only dam of this type in the 14 pre-World War II dams of the Muskingum Watershed Conservancy District. The Dover Dam site required a concrete gravity dam with a spillway in the middle of the river since the steep, boxy character of the canyon did not allow for a side-channel spillway (Advanced Technology 2001:Sec. 3, 3). In February of 1935, construction drawings for a concrete gravity dam were drawn up by the U.S. Army Corps of Engineers, Huntington District.

After the site for Dover Dam was finalized, a construction contract was awarded to Bates and Rogers Construction Company of Chicago, and a notice to proceed was issued on June 5, 1935. The dam was constructed in two stages using two cofferdams. The first cofferdam extended from the north shore of the river and included the first 11 concrete monoliths of the dam. This section of the dam was sufficiently completed by August 1936 that the upstream and downstream shore connections of the cofferdam were pulled so that water flowed through this portion of the dam. The second cofferdam was then constructed, allowing for the construction of the remainder of the spillway and the south abutment monoliths. The target completion date for the dam was originally May 5, 1937, but due to several change orders

and the need to address a fault that was found in the rock beneath the dam, the completion date was extended to November 29, 1937 (Advanced Technology 2001:Sec. 3, 4).

In July 1938, Dover Dam, along with the 13 earthfill gravity dams in the Muskingum Basin system, was originally turned over to the Muskingum Watershed Conservancy District for operation. However, with the Conservancy eager for another agency to take on the financial burden of operating the dams, Congress passed a bill to turn control of the system back over to the Corps of Engineers. Since the Zanesville District had been eliminated in June 1938, responsibility for maintaining the 14 Muskingum Basin dams was shifted to the Huntington District in August 1939 (Johnson 1977:166).

Since its completion, the U.S. Army Corps of Engineers has used the dam as a flood control facility. Although the dam was originally designed to maintain a permanent lake, problems with pollution and silt led the Corps to decide in 1941 to instead use the dam as a dry reservoir (Advanced Technology 2001:Sec. 2 2–3). The dam's current use is therefore limited to impounding water during high flow conditions to prevent flooding.

Concrete Gravity Dams in Ohio

Poured concrete has been used to construct dams in Ohio since the early twentieth century. One of the early examples of a reinforced concrete dam in Ohio was the Girard Dam (formerly Liberty Lake Dam), built in 1916. However, although both Girard Dam and Dover Dam are built of reinforced concrete, Girard dam is not a concrete gravity dam; instead, it has a buttress-type design, based on design principles developed by Nils F. Ambursen, an engineer and Norwegian immigrant (Hampton 1999:10).

A database of dams maintained by the Ohio Department of Natural Resources (ODNR) revealed only one additional pre-World War II concrete gravity reservoir dam similar in scale to Dover Dam—the O'Shaughnessy Reservoir Dam in Delaware County, Ohio. O'Shaughnessy was completed in 1925, with a maximum height of 91'3", and is a combination of concrete gravity and earthfill gravity construction. According to the database, the only other large concrete gravity dams remotely close in date to Dover Dam are Highland County's Rocky Fork Lake Dam (1952) and Franklin County's Hoover Dam (1956) (Ohio Department of Natural Resources 2006:1).

RESOURCE EVALUATION

This section includes a brief description of Dover Dam (TUS-986-5), followed by a discussion of the resource under the NRHP eligibility criteria. This dam is recommended as eligible for the NRHP under Criteria A and C.

Description

Overview

Dover Dam (Photo 1–Photo 3) was built as part of the ambitious public works campaign of the New Deal and is associated with the 1930s federal flood control program for the Ohio Valley and the surrounding area, as well as the history of the Muskingum Watershed Conservancy District. The dam is located on the Tuscarawas River at Dover; the area immediately surrounding the dam is grass lawn, while the overall area is wooded. State Route 800 runs a north-south course immediately to the northwest of the dam's north abutment, and there is a picnic and recreation facility on the south bank of the river southwest of the dam. Dover Dam is a concrete gravity dam that stretches across a fairly narrow canyon area characterized by limestone and silt shale. The structure reaches 83' tall at its highest point, and the dam's crest is 824' long. The entire dam is constructed of poured, reinforced concrete and consists of four major components: the north abutment, a central spillway, the south abutment, and a stilling basin below the spillway.

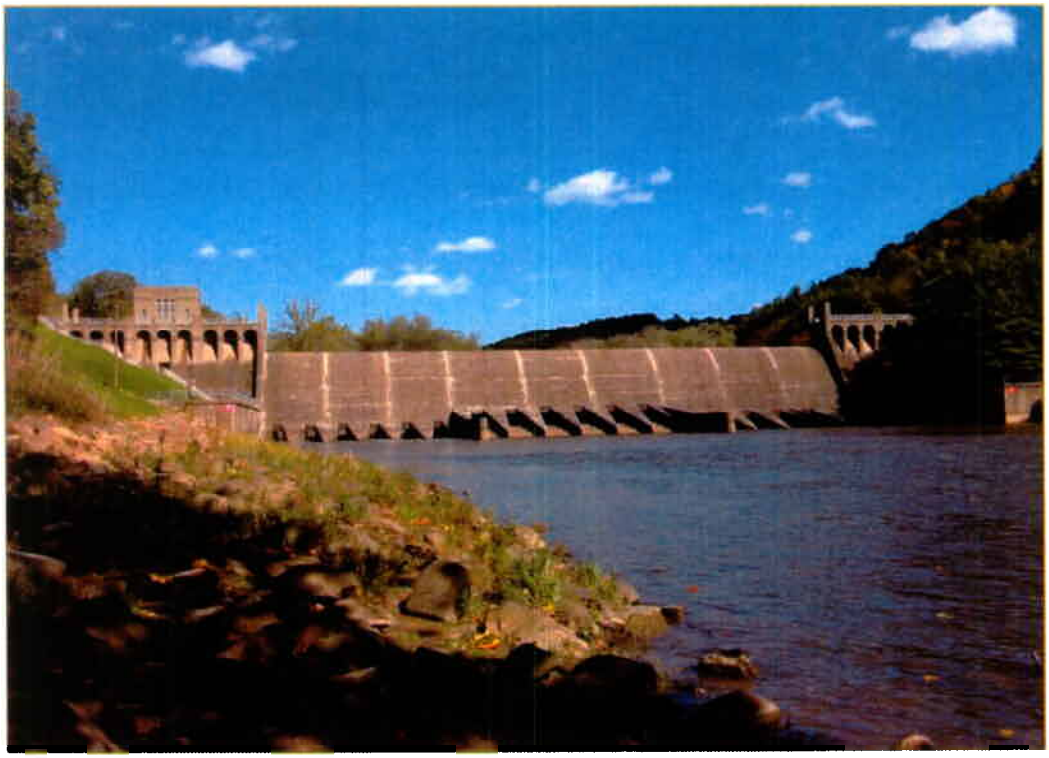


Photo 1. West face of dam, looking east

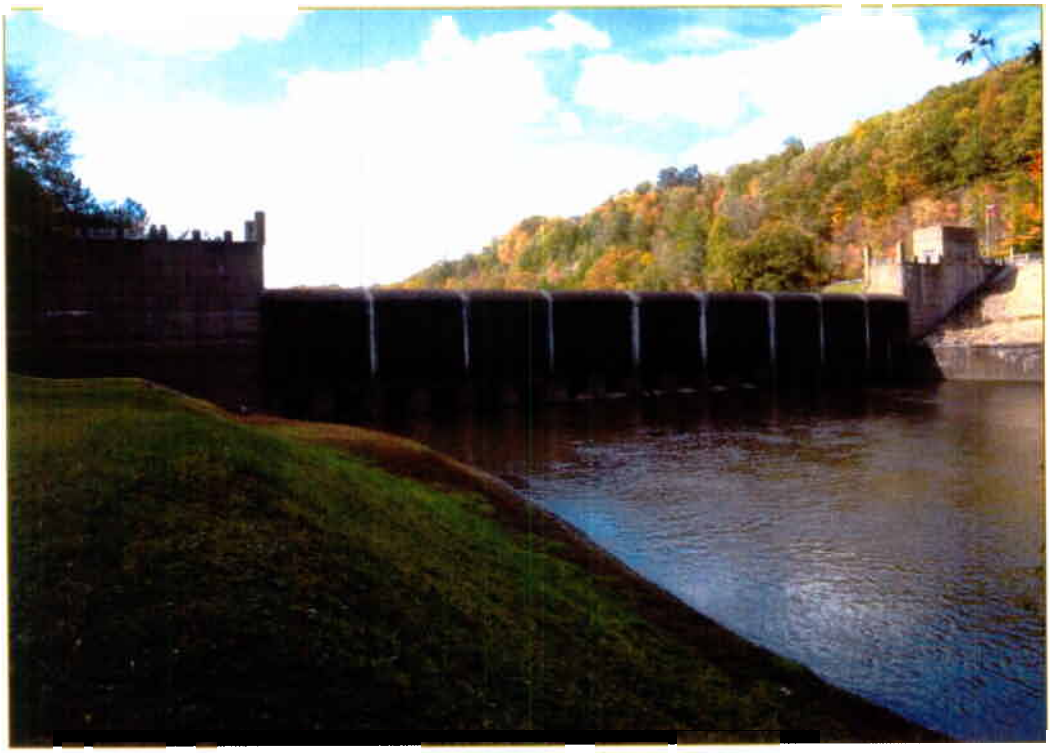


Photo 2. East face of dam, looking west

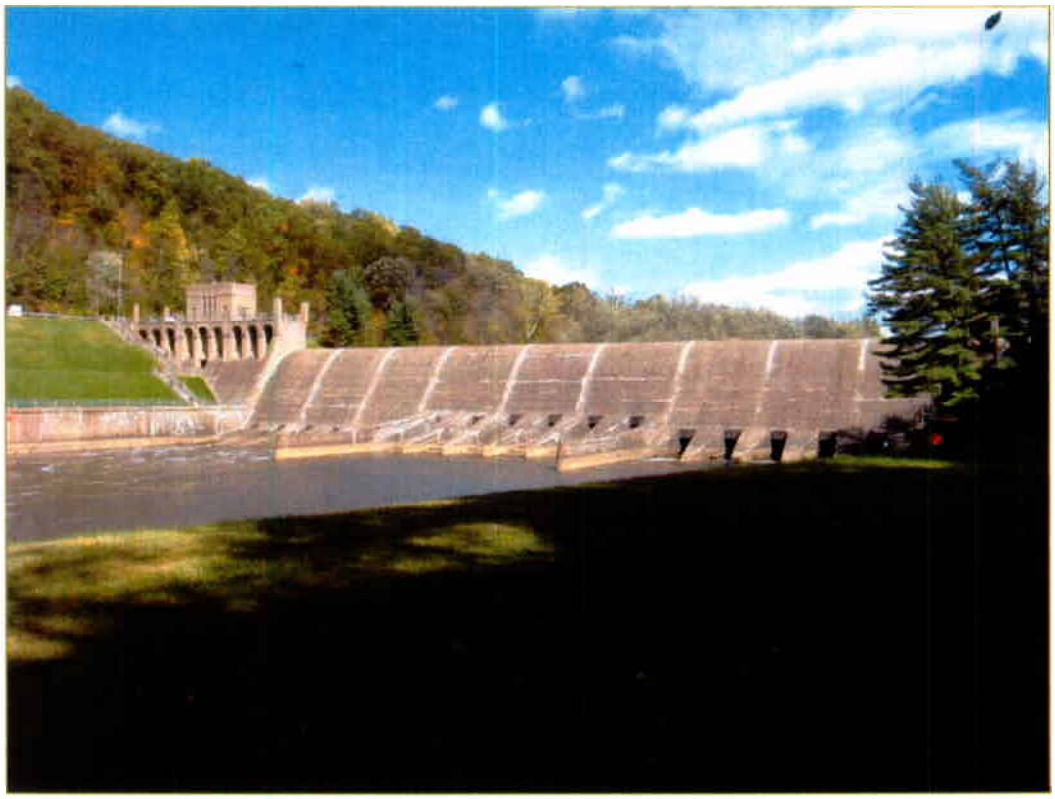


Photo 3. West face of dam, looking northeast

North Abutment

The bulk of the north abutment of the dam (Photo 4) is composed of a series of five large 36'-long concrete monoliths, numbered during construction as monoliths 1–6. The abutment's west wall is decorated with an arcade of nine concrete arches on square posts. The top of this portion of the dam is flat, with Art Deco concrete and steel handrails. A large obelisk-like concrete upright with vertical linear decoration is positioned at the two downstream corners of the abutment, and a flat-roofed concrete operating house sits atop this section. The control house (Photo 5, Photo 6)) features horizontal recessed bands, a stepped top, and a set of triple windows on the downstream wall. The center frieze of the downstream wall contains three recessed concrete panels with shield motifs. The north wall of the control house has a modern steel overhead door, above which is a concrete panel with an inscription of "Dover Dam 1935" in Roman lettering. A long staircase on the downstream side of the

north abutment leads down to a platform that overlooks the stilling basin. The handrail for these steps has the same design as the handrail on the roof of the main north abutment. The entire length of the north abutment is 192', and it is 25'6" wide.

Photo 4. North abutment and operating house, looking north

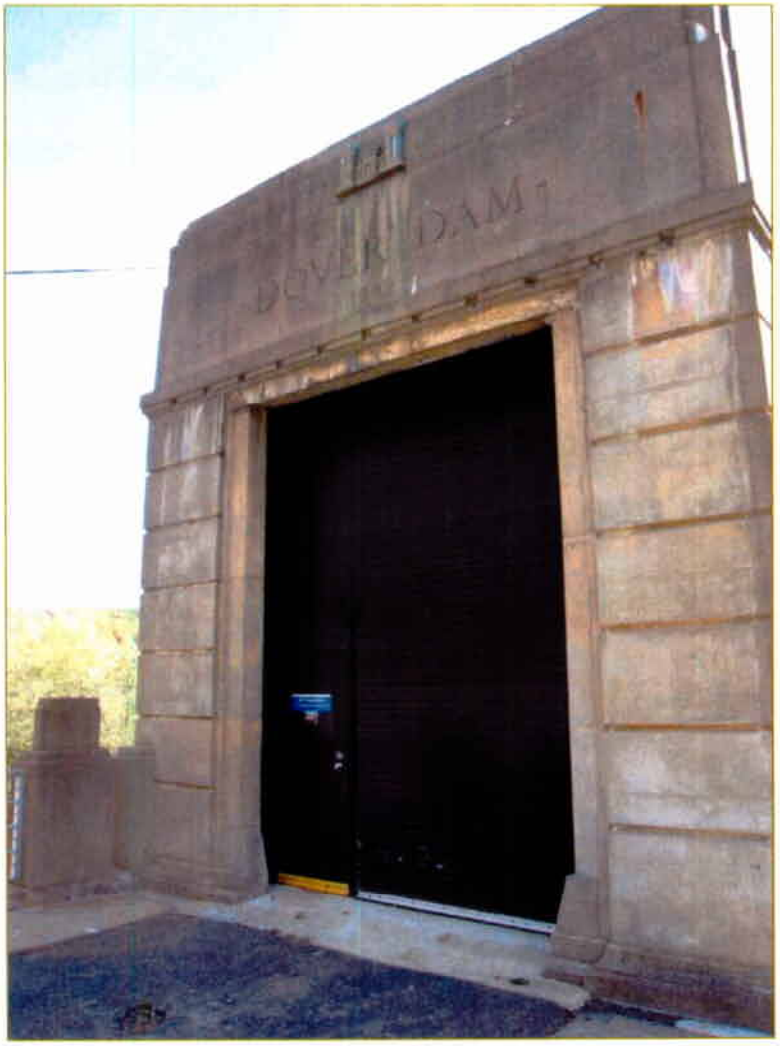


Photo 5. Operating house, north wall, looking southeast

Photo 6. Interior of operating house, looking southeast

Central Spillway

The central portion of the dam is a 338'-long uncontrolled ogee spillway with a total width of about 100' (Photo 7–Photo 9). The spillway features 18 gated sluices controlled by slide gates that operate by hydraulic cylinders (Advanced Technology 2001:Sec. 2 2–3). The sluices are split up into groups of six, with 7'-by-7' gates on the six north sluices and the six middle sluices, while the six sluices to the south have 5' by 10' gates. Inside the spillway is a barrel-vaulted operating gallery (Photo 10), which is essentially a tunnel through the middle of the solid concrete mass of the spillway. The operating gallery holds the gate machinery for the sluice gates and allows access to this equipment.

Photo 7. Spillway, looking north

Photo 8. Spillway, looking northwest along axis of dam

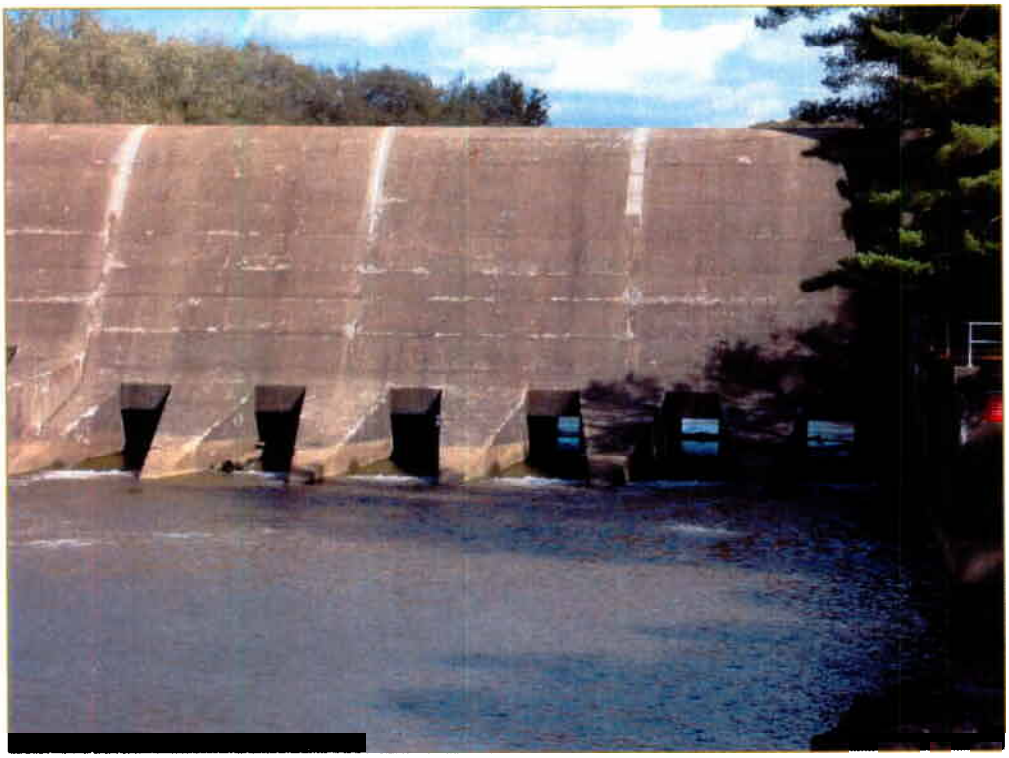


Photo 9. Detail of south portion of spillway, looking northeast

Photo 10. Operating gallery, looking southeast

South Abutment

The south abutment is similar to the north abutment and is 274' long and 25'6" wide (Photo 11, Photo 12). The bulk of the abutment is composed of eight massive concrete monoliths numbered 16–23 during construction. Like the north abutment, the south is decorated with an arched arcade on the west (downstream) side, but with a total of 18 arches. The top of the

abutment has a flat walkway area, metal and concrete railings, and a concrete entrance house with a flat roof.

Photo 11. South abutment, looking northeast

Photo 12. Upper deck of south abutment, looking northwest

Stilling Basin

Immediately downstream of the spillway is a concrete stilling basin that is designed to slow the velocity of the water as it leaves the spillway. The stilling basin extends about 100' downstream and has a concrete base and four low concrete walls that separate the basin into three sections, corresponding to the three groups of sluice gates in the spillway. A series of concrete baffles, two rows in the north portion of the spillway and three rows in the central and south parts, slows the speed of the water as it passes through the basin.

Decorative Features

The dam exhibits many characteristics of the Art Deco style and seems to reflect a design mode common to 1930s federal government buildings and structures in which Neoclassical elements were combined with Art Deco features (Photo 13). Neoclassical elements of Dover Dam include the massive arched arcades of the two abutments, while Art Deco features include stepped-back forms on several parts of the dam: operating and entrance houses, the concrete portions of the railings on both abutments, and the geometrical design of the metal railings on top of the two abutments and along the concrete exterior stairs on the west side of the north abutment (Photo 14).

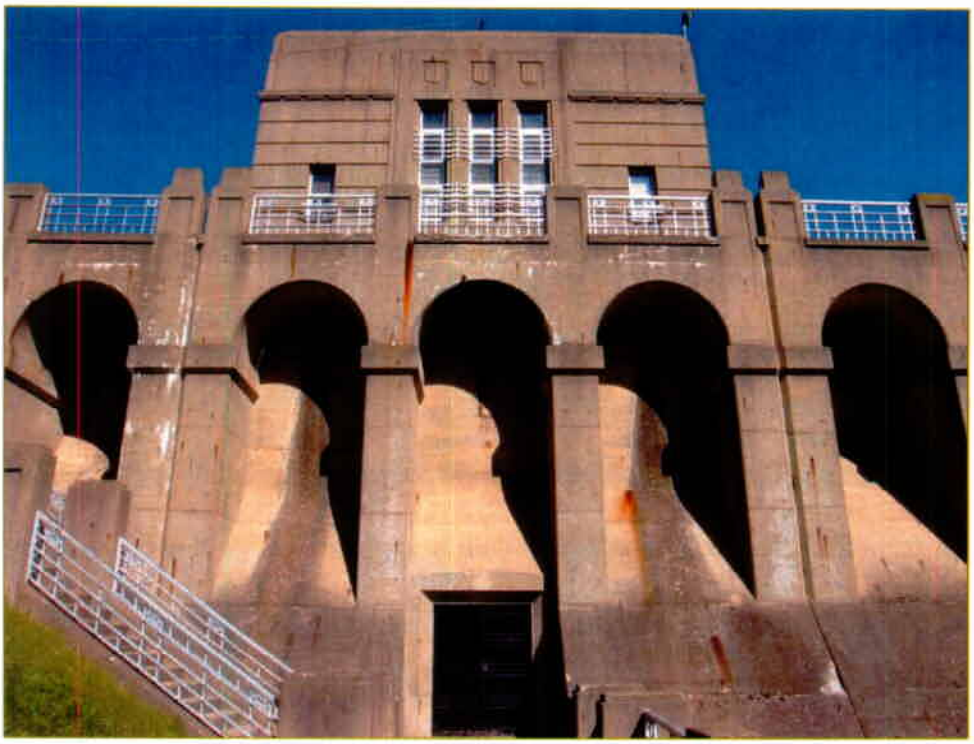


Photo 13. North abutment and operating house, looking northeast

Photo 14. Art Deco railings on south abutment, looking southwest

NRHP Eligibility

Criterion A Significance

Dover Dam is associated with the Muskingum Watershed Conservancy District, an important organization charged with managing the water resources of the Muskingum Basin from 1933 onward. The dam is also part of the massive federal flood control program of the 1930s that led to the construction of numerous federal reservoir dams in Ohio and Pennsylvania, and that eventually led to dramatic reductions in the frequency and severity of flooding along the Ohio River and other locations. Finally, the dam is associated with the ambitious public works program of Roosevelt's New Deal, which sought to provide jobs for the unemployed while providing facilities that enhanced recreational opportunities and achieved important practical objectives such as flood control.

Dover Dam is recommended as eligible for the NRHP under Criterion A.

Criterion B Significance

No evidence was found indicating that the dam has significant associations with any persons of historical importance. Eligibility associated with Criterion B significance does not appear to be appropriate for this resource.

Criterion C Significance

Dover Dam is one of the most intact examples of a concrete gravity dam of the 1930s that remains in Ohio. As such, it represents a type of engineering resource that is important for its scale and prominence, and that is not very common within Ohio. Locally, the dam is the only one of the 14 pre-1950 Muskingum Basin dams that was built of poured concrete; the remaining 13 dams are all earthenfill dams. The dam's aesthetic features also make it a good

example of Art Deco design fused with some Neoclassical Revival elements, a style that was often used for federal projects of the 1930s era and that effectively reflects the aesthetics of that period.

Dover Dam is recommended as eligible for the NRHP under Criterion C.

Criterion D Significance

Archaeological survey was not part of this project. The Dover Dam structure itself does not appear to have the potential to reveal significant additional historical information. Criterion D does not appear to be appropriate for this resource.

Summary of NRHP Evaluation

Recommendation	**Eligible for the NRHP under Criteria A and C**
Integrity	Dam has excellent material integrity and good integrity of setting.
Criterion A	**Recommended as eligible.** High historical significance in association with the New Deal, flood control, the Muskingum Watershed Conservancy District.
Criterion B	No association with important historical persons, not significant in this area.
Criterion C	**Recommended as eligible.** High significance as one of Ohio's best large-scale examples of a concrete masonry gravity dam of the 1930s. This is a major dam type that is not very common throughout the state. The dam is also good example of Federal government Art Deco design applied to a public works structure.
Criterion D	No potential to yield further information. Not significant in this area.

SUMMARY OF NRHP ELIGIBILITY

HDC found that Dover Dam is a fixed crest concrete gravity dam built from 1935 to 1938. The U.S. Army Corps of Engineers, Huntington District, designed the dam and oversaw its construction by Bates and Rogers Construction Company of Chicago.

HDC concludes that Dover Dam is eligible for the National Register of Historic Places (NRHP) under Criteria A and C:

Under Criterion A, the dam is associated with New Deal public works programs, the ambitious federal flood control programs of the 1930s-1940s, and the history of the Muskingum Watershed Conservancy District.

Under Criterion B, the dam was not found to be associated with any persons of historical importance. Eligibility under Criterion B does not appear to be appropriate for this resource.

Under Criterion C, the dam is a good large-scale example of a 1930s–1940s poured concrete gravity dam, which is a major dam construction type. There are relatively few dams of this type, vintage, and scale in Ohio that survive with such a high level of integrity. The aesthetic features of the dam also make it a good example of the Art Deco style.

REFERENCES

Advanced Technology Systems, Inc.

2001 *Water Control Manual for Dover Lake*. U.S. Army Corps of Engineers, Huntington District Contract No. DACW-69-00-D-0006. On file at U.S. Army Corps of Engineers, Huntington District, Muskingum Area Office.

Advisory Council for Historic Preservation (ACHP)

1998 *How to Apply the National Register Criteria for Evaluation*. Government Printing Office, Washington D.C.

Hampton, Roy A.

1999 *Inventory, Evaluation and Documentation of Lower Girard Dam, Liberty Township, Trumbull County, Ohio.* Prepared by Hardlines Design and Delineation for U.S. Army Corps of Engineers, Pittsburgh District, Contract No. DACW59-98-M-0025. On file at Hardlines Design Company, Columbus, Ohio.

Jackson, Donald C.

1988 *Great American Bridges and Dams*. Preservation Press, Washington, D.C.

Jenkins, Hal

1976 *A Valley Renewed: The History of the Muskingum Watershed Conservancy District*. Kent State University Press.

Johnson, Leland

1977 *Men Mountains, and Rivers, an Illustrated History of the Huntington District, U.S. Army Corps of Engineers 1754–1974*. Washington D.C.: U.S. Government Printing Office.

Ohio Department of Natural Resources

2006 Printout of Dams Database for Concrete Gravity Dams. Database maintained at Ohio Department of Natural Resources, Columbus, Ohio. Printout on file at Hardlines Design Company, Columbus, Ohio.

Ohio History Central: An Online Encyclopedia of Ohio History

2005 *Zoar*. www.ohiohistorycentral.org/entry.php?rec=829

Tuscarawas County Genealogical Society

1988 *History of Tuscarawas County, Ohio*. Dallas: Taylor Publishing.

U.S. Army Corps of Engineers, Huntington District

1935 *As-Built Construction Drawings of Dover Dam.* Elevations, Plans, Sections, and Details. On file at U.S. Army Corps of Engineers, Huntington District, Muskingum Area Office.

1999 *General Drawings of Dover Dam.* Elevations, Plans, and Sections. On file at U.S. Army Corps of Engineers, Huntington District, Muskingum Area Office.

2006 *History of Remedial Measures as of January 2006, Dover Dam.* On file at U.S. Army Corps of Engineers, Huntington District.

Warner Beers and Company

1884 *History of Tuscarawas County, Ohio*. Warner, Beers and Company.

Wikipedia

2006 *Tuscarawas County*. http://en.wikipedia.org/wiki/Tuscarawas_County

APPENDIX A.
OHI Form

OHIO HISTORIC INVENTORY

Ohio Historic Preservation Office
1985 Velma Avenue
Columbus, Ohio
614/297-2470

OHIO HISTORICAL SOCIETY SINCE 1885

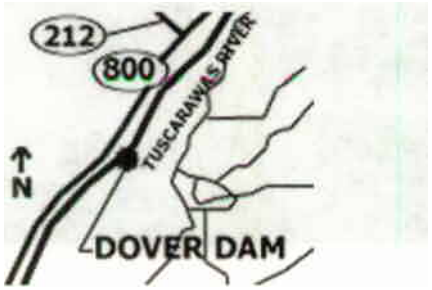
1. No. TUS-986-5
2. County Tuscarawas
4. Present Name(s) Dover Dam ☐ Coded
3. Location of Negatives No negatives-digital
5. Historic or other Name(s) Dover Dam
Roll No. 1 Picture No.(s) 1-3

6. Specific Address or Location
East of State Route 800, on Tuscarawas River, 3.5 miles north of Dover

6a. Lot, Section or VMD Number
N/A - Federal property

7. City or Village If Rural, Township & Vicinity
Fairfield Township, Zoarville vicinity

8. Site Plan with North Arrow



9. U.T.M. Reference
Quadrangle Name Dover
17 | 4 6 5 0 5 5 | 4 4 8 9 5 1 5
Zone | Easting | Northing

10. SITE: Site ☐ Structure ■ Building ☐ Object ☐

11. On National Register? Yes ☐ No ■
12. N.R. Potential? Yes ■ No ☐
13. Part of Estab. Hist. Dist? Yes ☐ No ■
14. District Potential? Yes ☐ No ■

15. Name of Established District (N.R. or Local)
N/A

16. Thematic Association(s)
Government, Flood control

17. Date(s) or Period 1935-1938
17b. Alteration Date(s) c. 1975

18. Style or Design Art Deco ■ High Style ☐ Element

18a. Style of Addition or Element(s)
Neoclassical Revival

19. Architect or Engineer
U.S. Army Corps of Engineers, Huntington District

19a. Design Sources
Unknown

20. Contractor or Builder
Bates and Rogers Construction Company, Chicago,

21. Building Type or Plan
Concrete gravity dam with central spillway

22. Original Use, if apparent
Flood control dam

23. Present Use
Flood control dam

24. Ownership: Public ■ Private ☐

25. Owner's Name & Address, if known
U.S. Army Corps of Engineers, Huntington District , 502 Eighth St. Huntington, WV 25701

26. Property Acreage approx. 50

27. Other Surveys in Which Included
N/A

28. No. of Stories N/A

29. Basement? Yes ☐ No ■

30. Foundation Material
Poured concrete

31. Wall Construction
Reinforced concrete

32. Roof Type & Material
Concrete

33. No. of Bays
Front 46 Side 1

34. Exterior Wall Material(s)
poured concrete

35. Plan Shape Irregular

36. Changes (Explain in #42) Addition ☐ Altered ■ Moved ☐

37. Window Types
☐ 6 over 6 ☐ 2 over 2 1 over 1 ☐
☐ 4 over 4 ■ Other

38. Building Dimensions 824' X 200'

39. Endangered? By What? Yes ■ No ☐
Alteration to improve safety

40. Chimney Placement
None

41. Distance from and Frontage on Road
d-0', f-300'

42. Description of Important Interior and Exterior Features (Continue on reverse if necessary)
Reinforced concrete gravity dam 83' tall, approximately 200' wide and crest is 824' long. Dam is composed of a 192' wide north abutment, a 338' wide central spillway, a 274' long south abutment, and a stilling basin that sits below the spillway. The entire dam is composed of a series of 21 solid concrete monoliths. The north abutment is decorated on the downstream (east) side with an arcade of nine round-arched openings. The north abutment also features a flat concrete deck on top with Art Deco concrete and metal railings and a concrete operating house with shield motif decorations and a stepped top. (continued)

43. History and Significance (Continue on reverse if necessary)
The origins of the dam go back to concerns about flood control in the Muskingum Basin that were brought up after the devastating 1913 flood. After significant community action in the 1920s, the Muskingum Watershed Conservancy District was founded in 1933 to manage the water resources of the Muskingum basin, including the Tuscarawas River. At the same time, the foundation of the New Deal's Federal Emergency Administration of Public Works opened the door to the possibility of Federal funding for flood control projects (continued)

44. Description of Environment and Outbuildings (See #52)
Immediate area around dam is planted in grass; overall area is wooded. No outbuildings observed.

45. Sources of Information
Huntington District, Construction Drawings of Dover Dam, 1935.
Hardlines Design Company, National Register Assessment of Dover Dam, October 31, 2006. Submitted to U.S. Army Corps of Engineers, Huntington District.
Johnson, Leland, *Men, Mountains, and Rivers: An Illustrated History of the Huntington District U.S. Army Corps of Engineers*, U.S. Government Printing Office, 1977.

46. Prepared by
Roy Hampton/Heather Kenney

47. Organization
Hardlines Design Company

48. Date Recorded in Field
October 13, 2006

49. Revised by
50a. Date Revised
50b. Reviewed by

1. No. TUS-986-5
2. County Tuscarawas
4,5. Present or Historic Name Dover Dam
6. Specific Address or Location East of State Route 800, on Tuscarawas River,

51. Condition of Property

- ■ Excellent
- □ Good/Fair
- □ Deteriorated
- □ Ruin
- □ Destroyed/Burned Date _____

52. Historic Outbuildings and Dependencies

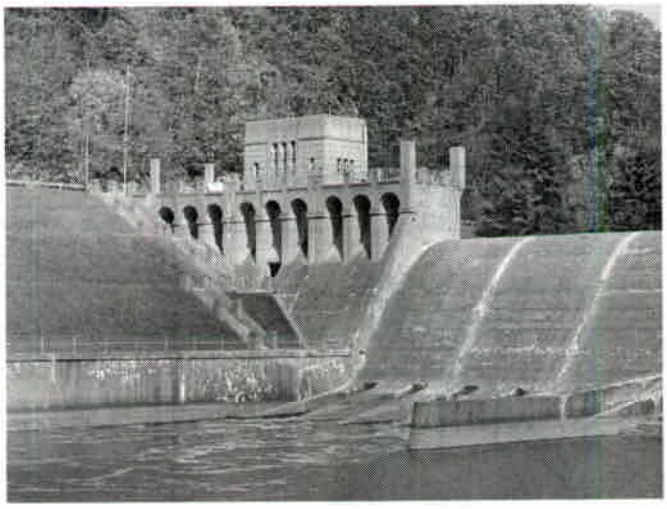
Barn Type(s)

Corn Crib or Shed □	Smoke House □	Privy □
Summer Kitchen □	Spring House □	Garage □
Silo □	Ice House □	
Designed landscape features □		

53. Affiliated OAI Site Number(s)

Archeological Feature:	Observed	Expected on Basis of Archival Research
Well	_____	_____
Privy	_____	_____
Cistern	_____	_____
Foundation	_____	_____
Structural Rubble	_____	_____
Formal Trash Dump	_____	_____
Other _____	_____	_____

54. Farmstead Plan



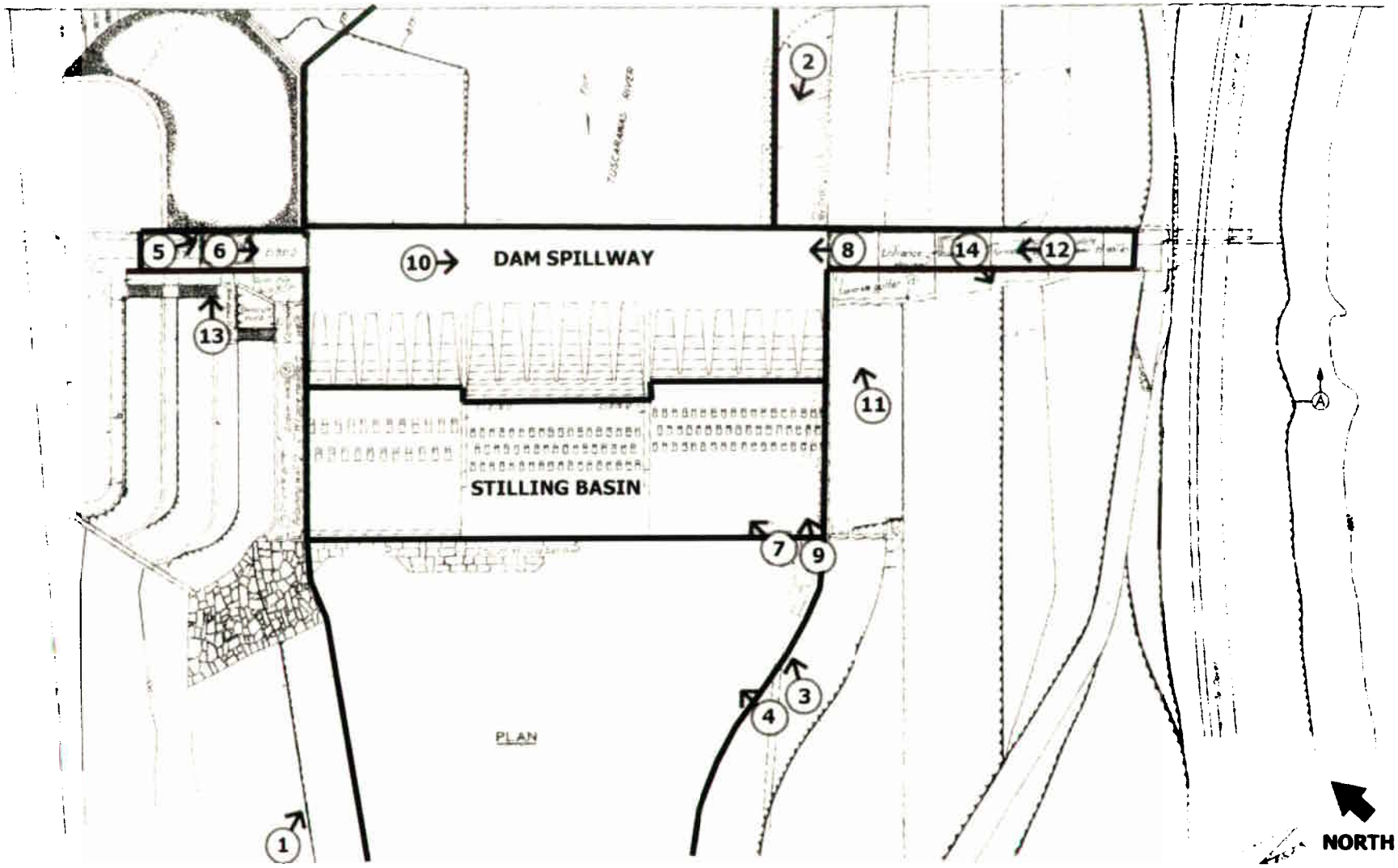
42. (Cont'd)

The central spillway is a 338' wide uncontrolled spillway constructed of reinforced concrete and is ogee-shaped. The spillway has a total of 18 gated sluices that are controlled by a series of slide gates that are operated by hydraulic cylinders. Twelve of the sluices measure 5' x 10', while the remaining six measure 7' x 7'. The cylinders and other pieces of gate equipment are accessed via the operating gallery, a barrel vaulted tunnel that runs through the center of the spillway. The south abutment is adorned on the downstream face with an arched arcade with eighteen openings, and features a concrete deck with Art Deco railings similar to those on the north abutment. A concrete entrance house sits on top of the south abutment deck. A 100' stilling basin with concrete floor, concrete baffles, and four wing walls is positioned on the downstream side of the dam. Few alterations have been made to the exterior of the dam other than concrete patching, removal of a small number of original lighting fixtures, and the replacement of the north garage door of the operating house.

43. (Cont'd)

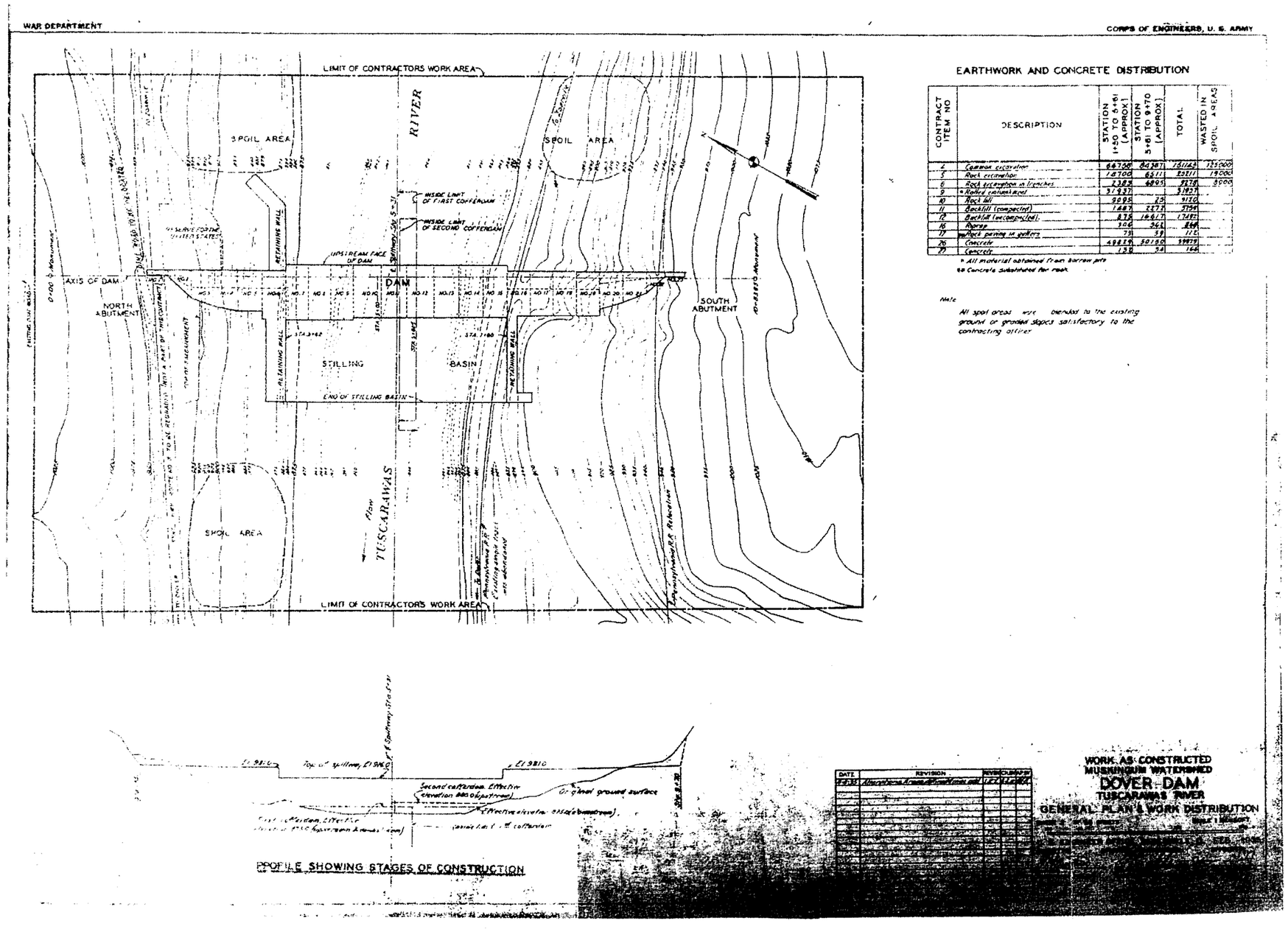
in the area. In 1933, federal funding was approved for a flood control reservoir system for the Muskingum Basin. The system was to have fourteen reservoir dams to impound water for flood control. The U.S. Army Corps of Engineers, Huntington District, drew up plans for the dams, including Dover Dam, which was to be the only concrete gravity dam of the fourteen planned; the other thirteen were to be earth fill gravity dams. Construction of the dams was such a large undertaking that a new U.S. Engineer's Office at Zanesville, Ohio, was established to oversee completion of the project. A construction contract for Dover Dam was awarded to Bates and Rogers Construction Company of Chicago, and the notice to proceed was issued on June 5, 1935. The dam was built in two major sections using two cofferdams. The first (north) section of the dam was completed in August 1936. The target overall completion date for the dam was May 5, 1937. However, due to the discovery of a fault in the rock underneath the dam, a change order was issued that resulted in additional work and extension of the completion date to November 29, 1937. Once the dam was completed the operation of it was briefly turned over to the Muskingum Watershed Conservancy District, then to the U.S. Army Corps of Engineers, Huntington District. The dam was also planned to maintain a permanent reservoir lake, but after the lake was filled, it was found that the water was being polluted by a local industrial concern and that there were severe problems with sedimentation. In 1941, the Huntington District decided not to maintain a permanent lake at Dover Dam. The dam now only impounds water during high water conditions to prevent flooding. The dam continues to be maintained and operated by the Huntington District. Dover Dam is now considered deficient by modern standards and alteration of the dam is planned for the future to improve its safety.

APPENDIX B.
Photo Key

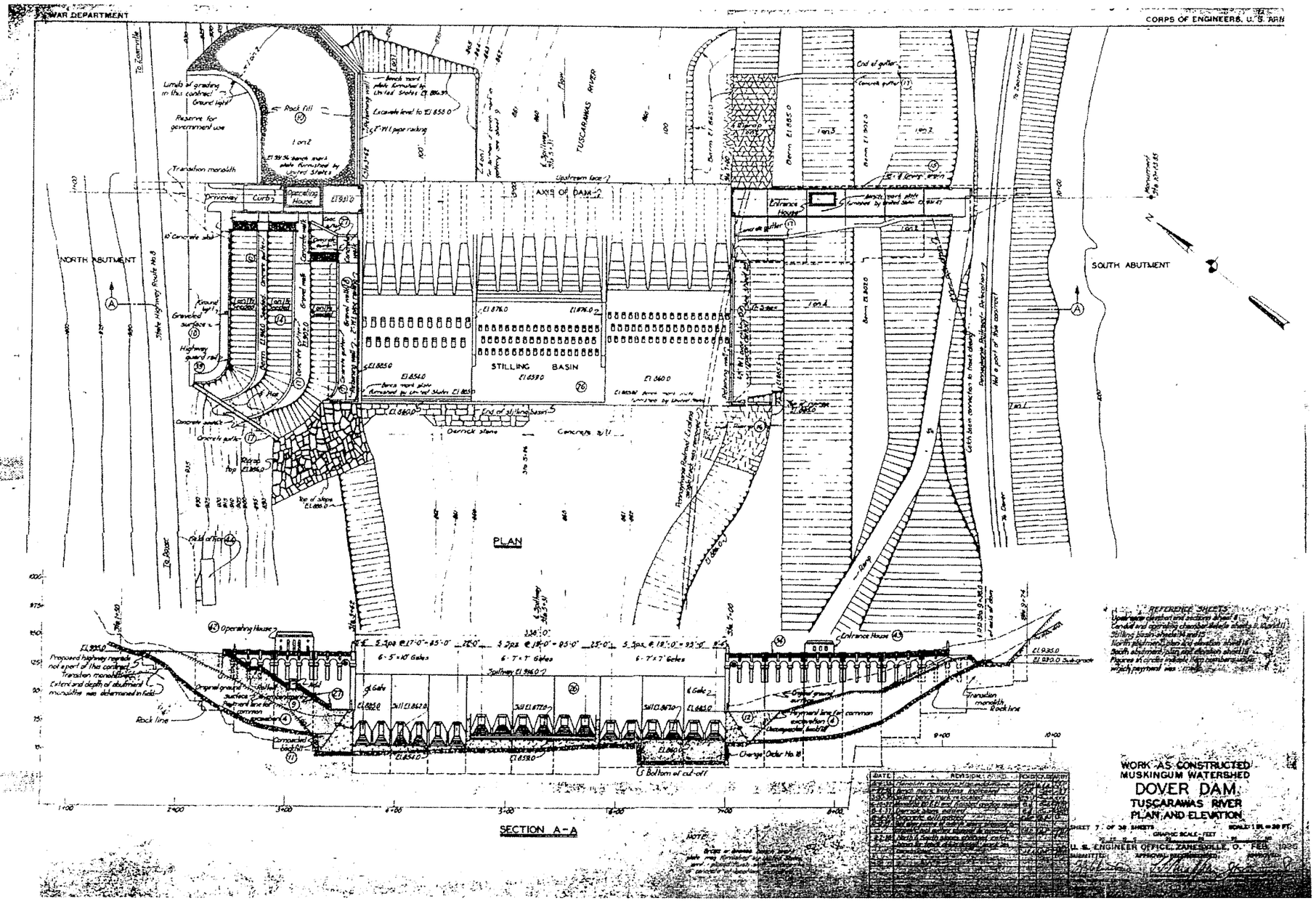


Key to field photographs

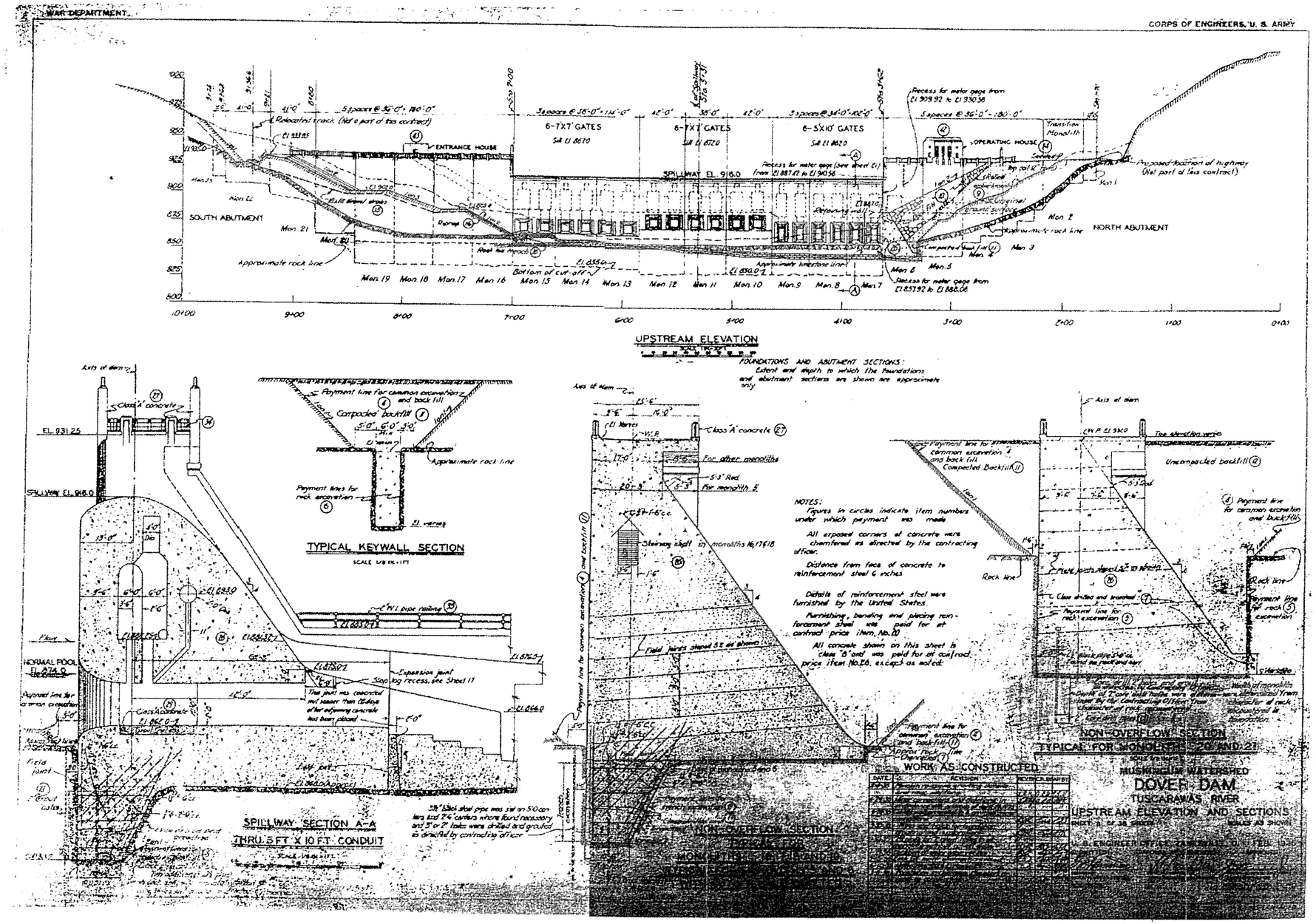
APPENDIX C.
Copies of Original Construction Drawings (1935)



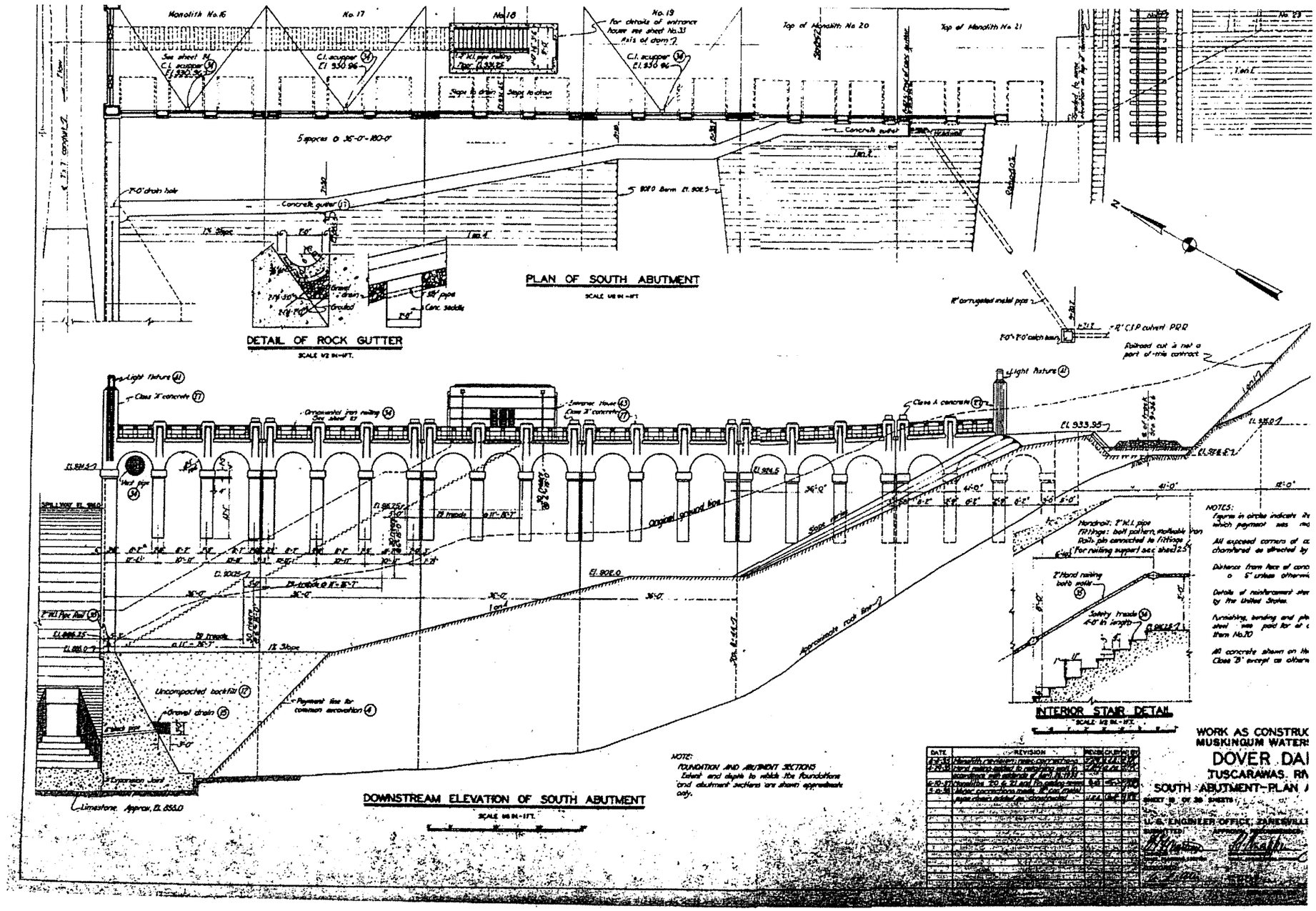
Drawing 1. General plan and work distribution



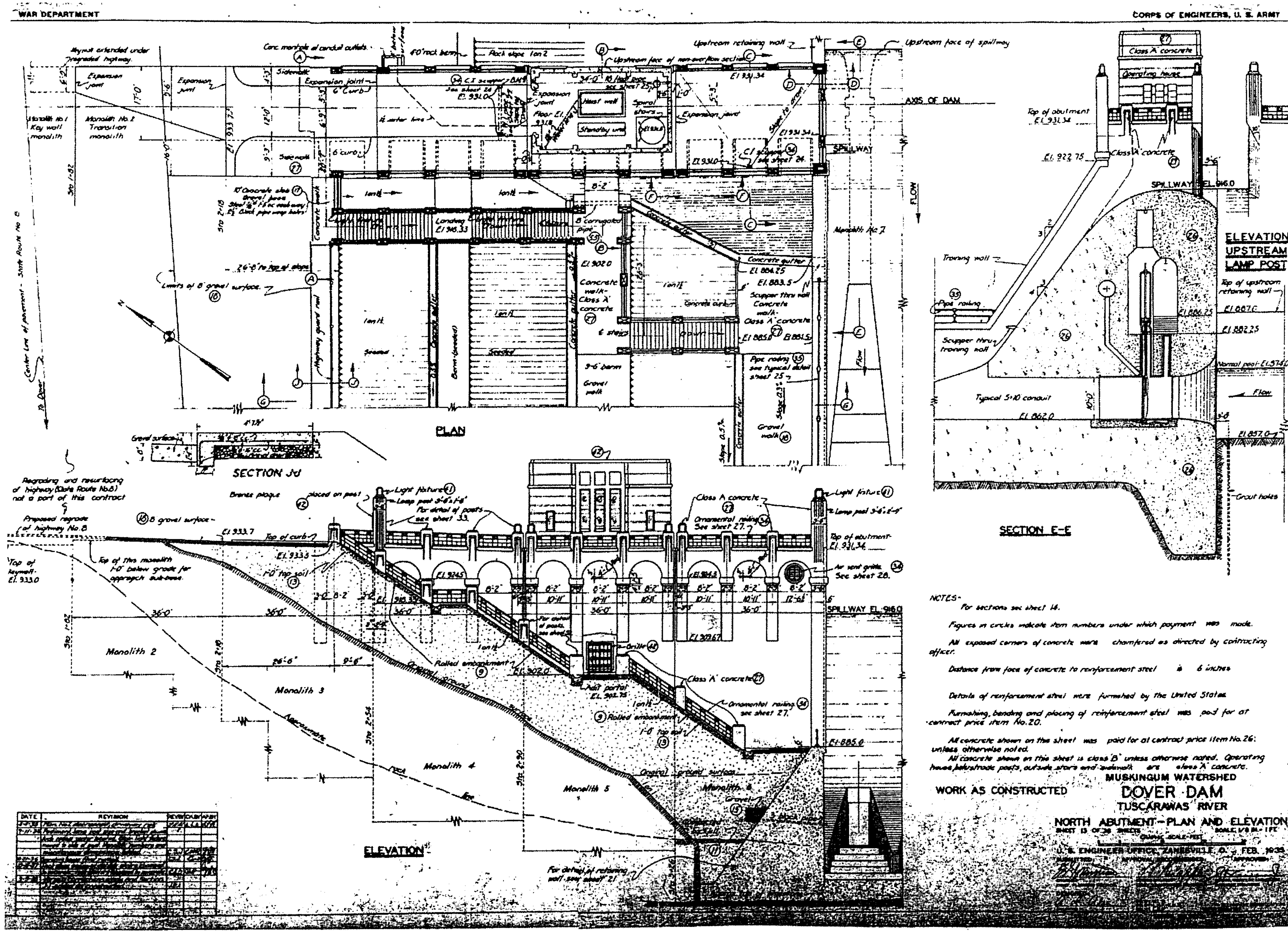
Drawing 2. Plan and elevation



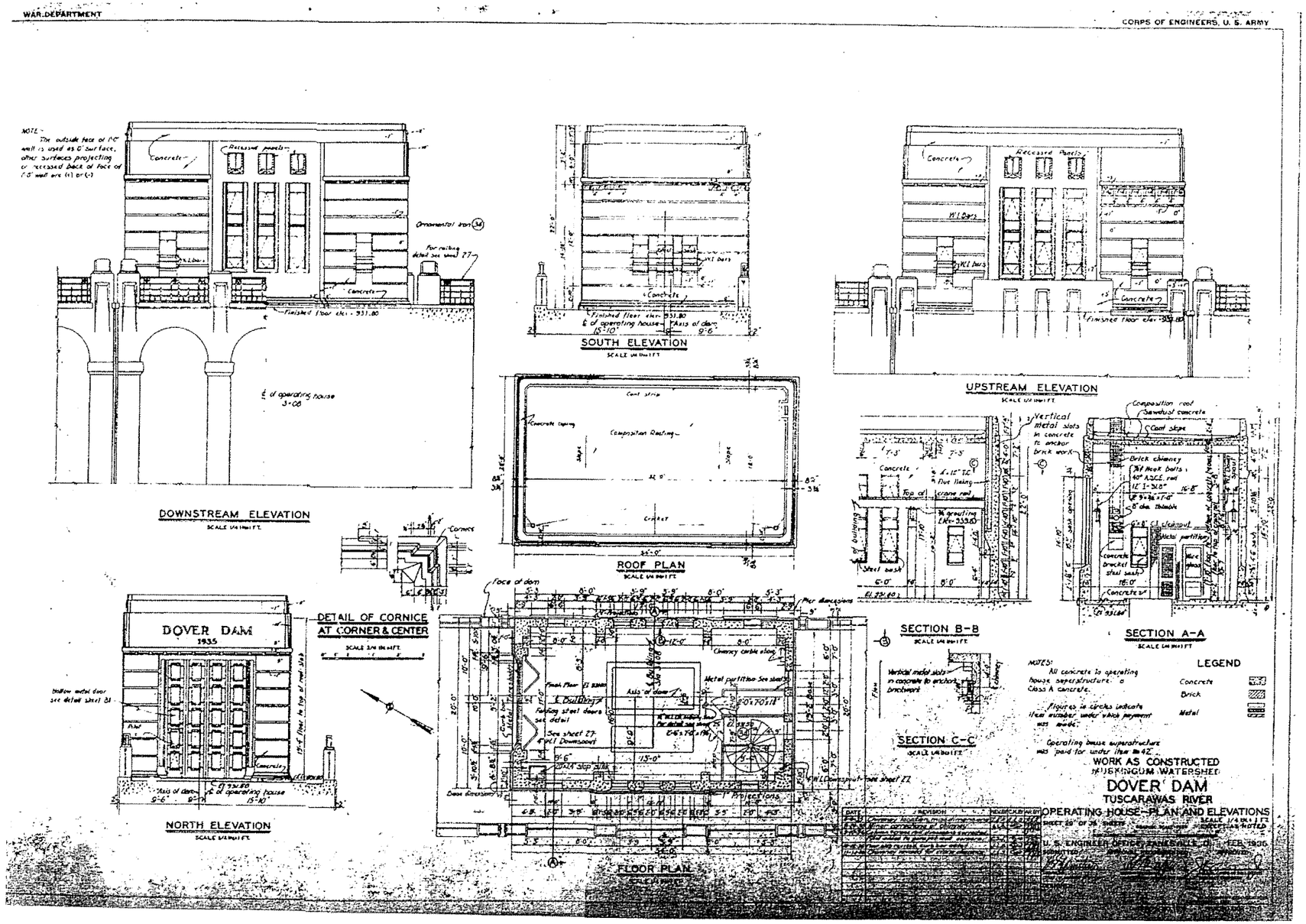
Drawing 3. Upstream elevation and sections



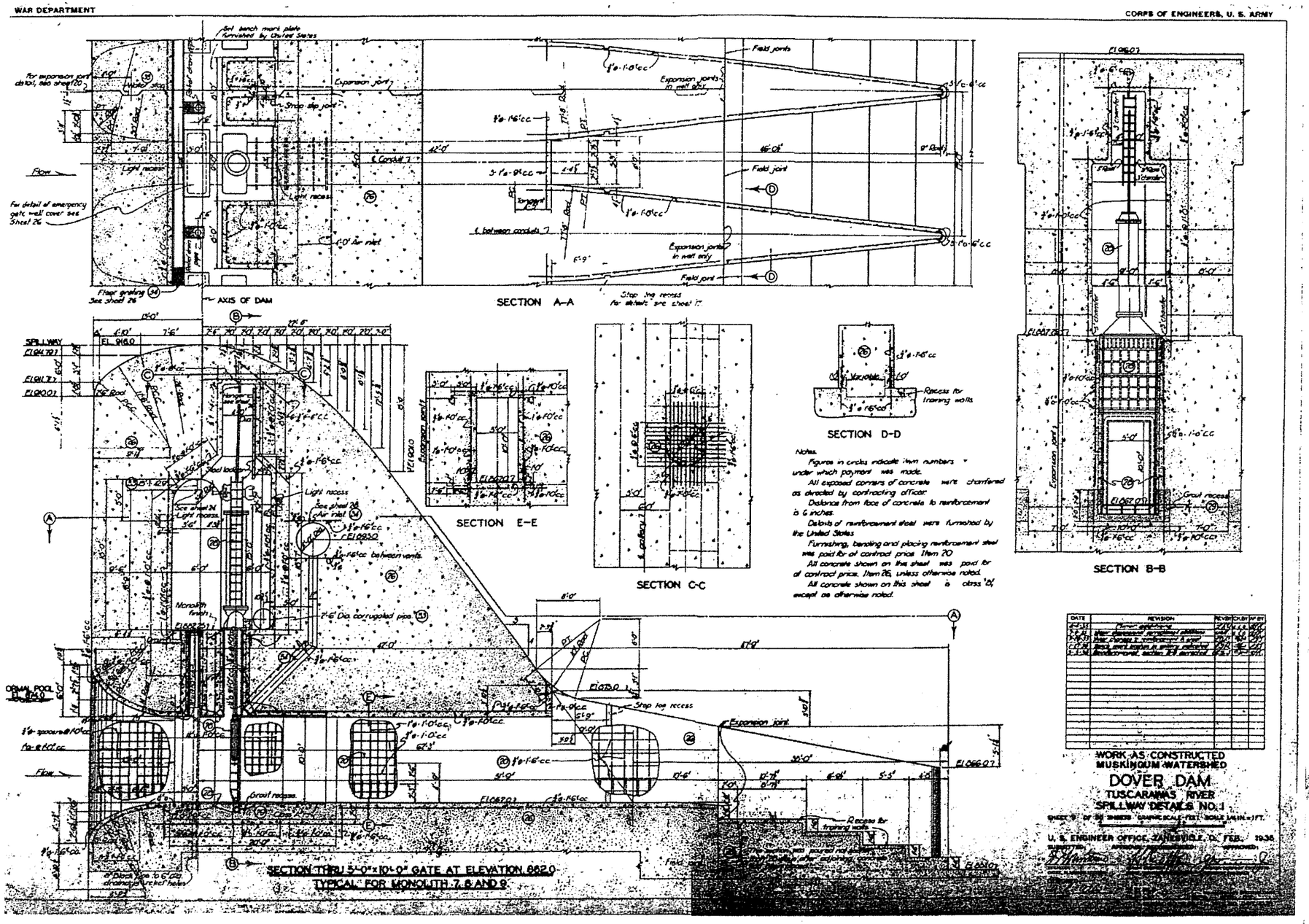
Drawing 4. South abutment - plan and elevation



Drawing 5. North abutment - plan and elevation



Drawing 6. Operating house - plan and elevations



Drawing 7. Spillway details no. 1

OHIO HISTORIC INVENTORY

Ohio Historic Preservation Office
1985 Velma Avenue
Columbus, Ohio
614/297-2470

OHIO HISTORICAL SOCIETY SINCE 1885

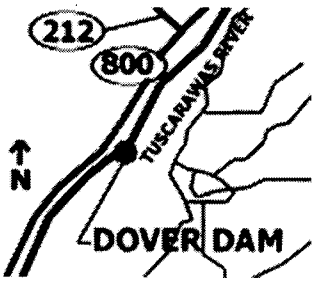
1. No. TUS-986-5
2. County Tuscarawas
4. Present Name(s) Dover Dam ☐ Coded
3. Location of Negatives No negatives-digital
5. Historic or other Name(s) Dover Dam
Roll No. 1 Picture No.(s) 1-3

6. Specific Address or Location
East of State Route 800, on Tuscarawas River, 3.5 miles north of Dover

6a. Lot, Section or VMD Number
N/A - Federal property

7. City or Village If Rural, Township & Vicinity
Fairfield Township, Zoarville vicinity

8. Site Plan with North Arrow



9. U.T.M. Reference
Quadrangle Name Dover
17 | 4 6 5 0 5 5 (Easting) | 4 4 8 9 5 1 5 (Northing)

10. SITE: Site ☐ Building ☐ Structure ■ Object ☐

11. On National Register? Yes ☐ No ■
12. N.R. Potential? Yes ■ No ☐
13. Part of Estab. Hist. Dist? Yes ☐ No ■
14. District Potential? Yes ☐ No ■

15. Name of Established District (N.R. or Local)
N/A

16. Thematic Association(s)
Government, Flood control

17. Date(s) or Period
1935-1938

17b. Alteration Date(s)
c. 1975

18. Style or Design
Art Deco
■ High Style ☐ Element

18a. Style of Addition or Element(s)
Neoclassical Revival

19. Architect or Engineer
U.S. Army Corps of Engineers, Huntington District

19a. Design Sources
Unknown

20. Contractor or Builder
Bates and Rogers Construction Company, Chicago,

21. Building Type or Plan
Concrete gravity dam with central spillway

22. Original Use, if apparent
Flood control dam

23. Present Use
Flood control dam

24. Ownership
Public ■ Private ☐

25. Owner's Name & Address, if known
U.S. Army Corps of Engineers, Huntington District , 502 Eighth St. Huntington, WV 25701

26. Property Acreage approx. 50

27. Other Surveys in Which Included
N/A

28. No. of Stories N/A

29. Basement? Yes ☐ No ■

30. Foundation Material
Poured concrete

31. Wall Construction
Reinforced concrete

32. Roof Type & Material
Concrete

33. No. of Bays
Front 46 Side 1

34. Exterior Wall Material(s)
poured concrete

35. Plan Shape Irregular

36. Changes (Explain in #42)
Addition ☐ Altered ■ Moved ☐

37. Window Types
☐ 6 over 6 ☐ 2 over 2 1 over 1
☐ 4 over 4 ■ Other ☐

38. Building Dimensions 824' X 200'

39. Endangered? By What? Yes ■ No ☐
Alteration to improve safety

40. Chimney Placement
None

41. Distance from and Frontage on Road
d-0', f-300'

42. Description of Important Interior and Exterior Features (Continue on reverse if necessary)
Reinforced concrete gravity dam 83' tall, approximately 200' wide and crest is 824' long. Dam is composed of a 192' wide north abutment, a 338' wide central spillway, a 274' long south abutment, and a stilling basin that sits below the spillway. The entire dam is composed of a series of 21 solid concrete monoliths. The north abutment is decorated on the downstream (east) side with an arcade of nine round-arched openings. The north abutment also features a flat concrete deck on top with Art Deco concrete and metal railings and a concrete operating house with shield motif decorations and a stepped top. (continued)

43. History and Significance (Continue on reverse if necessary)
The origins of the dam go back to concerns about flood control in the Muskingum Basin that were brought up after the devastating 1913 flood. After significant community action in the 1920s, the Muskingum Watershed Conservancy District was founded in 1933 to manage the water resources of the Muskingum basin, including the Tuscarawas River. At the same time, the foundation of the New Deal's Federal Emergency Administration of Public Works opened the door to the possibility of Federal funding for flood control projects (continued)

44. Description of Environment and Outbuildings (See #52)
Immediate area around dam is planted in grass; overall area is wooded. No outbuildings observed.

45. Sources of Information
Huntington District, Construction Drawings of Dover Dam, 1935.
Hardlines Design Company, National Register Assessment of Dover Dam, October 31, 2006. Submitted to U.S. Army Corps of Engineers, Huntington District.
Johnson, Leland, *Men, Mountains, and Rivers: An Illustrated History of the Huntington District U.S. Army Corps of Engineers*, U.S. Government Printing Office, 1977.

46. Prepared by
Roy Hampton/Heather Kenney

47. Organization
Hardlines Design Company

48. Date Recorded in Field
October 13, 2006

49. Revised by | 50a. Date Revised

50b. Reviewed by

1. No. TUS-986-5
2. County Tuscarawas
4,5. Present or Historic Name Dover Dam
6. Specific Address or Location East of State Route 800, on Tuscarawas River.

51. Condition of Property

- ■ Excellent
- □ Good/Fair
- □ Deteriorated
- □ Ruin
- □ Destroyed/Burned Date _____

52. Historic Outbuildings and Dependencies

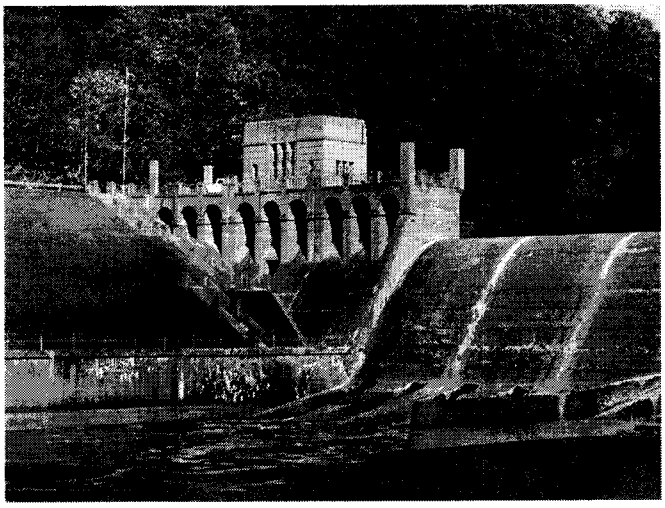
Barn Type(s)

Corn Crib or Shed □ Smoke House □ Privy □
Summer Kitchen □ Spring House □ Garage □
Silo □ Ice House □
Designed landscape features □

53. Affiliated OAI Site Number(s)

Archeological Feature:	Observed	Expected on Basis of Archival Research
Well	_____	_____
Privy	_____	_____
Cistern	_____	_____
Foundation	_____	_____
Structural Rubble	_____	_____
Formal Trash Dump	_____	_____
Other _____	_____	_____

54. Farmstead Plan



42. (Cont'd)

The central spillway is a 338' wide uncontrolled spillway constructed of reinforced concrete and is ogee-shaped. The spillway has a total of 18 gated sluices that are controlled by a series of slide gates that are operated by hydraulic cylinders. Twelve of the sluices measure 5' x 10', while the remaining six measure 7' x 7'. The cylinders and other pieces of gate equipment are accessed via the operating gallery, a barrel vaulted tunnel that runs through the center of the spillway. The south abutment is adorned on the downstream face with an arched arcade with eighteen openings, and features a concrete deck with Art Deco railings similar to those on the north abutment. A concrete entrance house sits on top of the south abutment deck. A 100' stilling basin with concrete floor, concrete baffles, and four wing walls is positioned on the downstream side of the dam. Few alterations have been made to the exterior of the dam other than concrete patching, removal of a small number of original lighting fixtures, and the replacement of the north garage door of the operating house.

43. (Cont'd)

in the area. In 1933, federal funding was approved for a flood control reservoir system for the Muskingum Basin. The system was to have fourteen reservoir dams to impound water for flood control. The U.S. Army Corps of Engineers, Huntington District, drew up plans for the dams, including Dover Dam, which was to be the only concrete gravity dam of the fourteen planned; the other thirteen were to be earth fill gravity dams. Construction of the dams was such a large undertaking that a new U.S. Engineer's Office at Zanesville, Ohio, was established to oversee completion of the project. A construction contract for Dover Dam was awarded to Bates and Rogers Construction Company of Chicago, and the notice to proceed was issued on June 5, 1935. The dam was built in two major sections using two cofferdams. The first (north) section of the dam was completed in August 1936. The target overall completion date for the dam was May 5, 1937. However, due to the discovery of a fault in the rock underneath the dam, a change order was issued that resulted in additional work and extension of the completion date to November 29, 1937. Once the dam was completed the operation of it was briefly turned over to the Muskingum Watershed Conservancy District, then to the U.S. Army Corps of Engineers, Huntington District. The dam was also planned to maintain a permanent reservoir lake, but after the lake was filled, it was found that the water was being polluted by a local industrial concern and that there were severe problems with sedimentation. In 1941, the Huntington District decided not to maintain a permanent lake at Dover Dam. The dam now only impounds water during high water conditions to prevent flooding. The dam continues to be maintained and operated by the Huntington District. Dover Dam is now considered deficient by modern standards and alteration of the dam is planned for the future to improve its safety.

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
November 15, 2006

Colonel Dana Hurst
District Engineer
Huntington District, Corps of Engineers
502 Eighth Street
Huntington, WV 25701-2070

Attn: Jonathan J. Aya-ay, Planning Section

Dear Colonel Hurst:

This is in response to your request for our Planning Aid Letter regarding the Dover Dam Safety Assurance Project, Dover, Tuscarawas County, Ohio. Your staff has indicated that currently, the Dover Dam on the Tuscarawas River (Figure 1) does not conform to the Corps' current design standards for high hazard dams. We understand that you intend to complete planning, design, and construction of Dam Safety Assurance measures to meet these design standards to better guarantee the safety of the public. Some of the Preliminary Alternatives that you examined include:

a) constructing a new dam,
b) raising the existing dam height,
c) constructing an auxiliary spillway (varying capacities),
d) modifying the existing spillway,
e) constructing a stilling basin downstream of the existing dam, and
f) anchoring the existing structure to prevent sliding.

BACKGROUND

The Corps evaluates structures such as Dover Dam periodically throughout their lives. These evaluations are important for identifying trends in the aging process of the structure, as well as offering an opportunity to consider developments in the design and weather forecasting sciences. Concerns for the stability of the dam have grown over the life of Dover Dam. Since the construction of the project in the 1930's, the maximum pool recorded was 907.4 feet mean sea level (msl) or 8.6 feet below the spillway crest in January 2005. No significant problems have been encountered with the dam; however, inflow is very carefully monitored to ensure the safety of the public downstream of the dam.

The Corps will continue to manage stability concerns in the event of extreme flooding. However, recent flood events have highlighted the need to address on-going concerns and renew consideration of potential low-frequency extreme flood events. The National Weather Service has published details of procedures and methods that are used to develop generalized estimates of Probable Maximum Precipitation (PMP), the greatest rainfall rates for specified durations that are theoretically possible for regions throughout the United States. These rainfall estimates are considered extreme, with a very low probability of occurrence. However, the worst-case storms associated with the PMP events, retain some probability of occurrence. These PMP events are used to develop flood scenarios and guide design criteria for structures such as Dover Dam. The Corps has determined the dam may not safely accommodate flooding during these theoretical Probable Maximum Flood (PMF) events.

In the event of a PMF, the pool behind Dover is estimated to reach or exceed elevation 940.5 feet msl. For context, the project will be completely overtopped at elevations above 931 feet msl, the current spillway elevation is 916 msl and the project was designed for flood waters reaching only 936.8 msl. The concrete gravity dam is also believed to be unstable against sliding under these conditions due to known faulting and uncertain foundation bedrock quality.

ADVANCED ALTERNATIVES

Consideration of public and agency comments during the scoping period and a more detailed study of initial alternatives have revealed two action alternatives that best meet project purposes. These action alternatives along with the No Action alternative will be carried forward for detailed consideration. They are briefly described below:

1.) Raise and anchor dam to accommodate 100% Probable Maximum Flood (PMF).
This alternative includes raising the existing dam approximately 9 feet to accommodate the 100% PMF. This alternative would include anchoring of the existing dam with steel cable.

2.) Allow overtopping and Anchor dam to accommodate 100% PMF.
This alternative includes modification of the current non-overflow sections to be able to withstand flow during extreme flood events up to the 100% PMF event. This alternative would also include anchoring of the existing dam.

The Huntington District has determined that an Environmental Impact Statement (EIS) for the project is warranted to comply with the National Environmental Policy Act (NEPA). We will assist the District in assessing existing baseline fish and wildlife habitat conditions, identification of fish and wildlife concerns and opportunities, evaluating the selected and alternative plans, and developing environmental mitigation measures for the project

On August 3, 2006, Service biologists attended a briefing meeting with Corps staff who are working on the Dover Dam project. The Corps staff provided background material regarding its flood control system within the Muskingum River Basin and the proposals considered to bring a number of deficient dams to current safety standards in this watershed. Also discussed were examples of other dams within the Huntington District that were upgraded to today's standards.

FISH AND WILDLIFE RESOURCES

Ohio EPA provided the Service with macroinvertebrate and fish survey data from the Tuscarawas River in the vicinity of Dove Dam (Appendix A). Also, included are tables of information on the Invertebrate Community Index (ICI), the Index of Biotic Integrity (IBI) for the fish community, and finally a table for the Qualitative Habitat Evaluation Index (QHEI). Overall, it appears that the Tuscarawas River has had modest improvements, since the 1995 collections. The fish species list indicates a diverse fishery resources that we believe will continue to improve as sources of pollution continue to be abated and if the riparian vegetation is left intact. Figure 2 shows fishing and kayaking activities on the Dover Dam tailwater area.

On September 1, 2006, a Service biologist made an on-site review of the proposed project area to characterize the Tuscarawas River down and upstream from the Dover Dam, its riparian habitat, and to photograph the above areas (Figures 3 and 4). Results of the vegetation survey is included in Table 1. Based on this survey, we consider the riparian vegetation to be stable, with good species diversity. The riparian corridor provides food, cover, and nesting habitat for a variety of wildlife species.

Upstream Access Road:
On September 21, 2006, a Service biologist attended an on-site meeting with your staff, as well as Regulatory Branch staff, to review the proposed access roads from Old Zoarville Road to the Dover Dam. The proposal includes separate ingress and egress roads on beds that were used as a railroad prior to construction of the dam (Figure 5) and the more recent railroad bed built on a higher elevation. At some locations the remains of railroad ties still exist on this bed. Even with separate access roads, some widening of the existing roadway would be necessary at some segments, at least.

The entire proposed access-road area is forested, except for the narrow railroad beds. Some of the forest is wetland. At this time wetland delineation has not been done, although Regulatory staff indicated areas that are, or would, in all probability be wetlands. We understand that wetland delineation will be done after detailed plans of the selected plan are complete. We consider the upland and wetland forests and some palustrine emergent wetland to be high quality habitat for many species of birds, mammals, and herpetiles. This area is used by many species of resident and migratory birds, with focus on riparian birds, such as kingfishers. White-tailed deer are abundant in this area, along with many furbearer species. One of the most important features of wildlife habitat area along Tuscarawas River from the Old Zoarville Road to the Dam is the fact that it is not fragmented.

Downstream Access Road (**Preferred**):
Shortly after our September 21 meeting, your office evaluated the above proposed access road. In part due to wetland impacts associated with the above road, the Corps staff decided to look at the downstream access alternative. This alternative would begin at the first downstream bridge and would follow an existing road and railroad bed along the left bank to the dam site. On October 25, 2006, a Service biologist and Corps staff walked the new proposed access road. Its

length is similar to the proposed upstream access road. Overall, smaller woody vegetation (Figure 6) and virtually no wetlands would be impacted with this new preferred access alternative. Therefore, the Service supports utilizing the downstream access route.

The Corps maintains a kiosk at the Dover Dam parking lot that addresses the natural resources in the area. It has posters of fish species in the Tuscarawas River, and reptile species that can be found in the area.

IMPACTS TO FISH AND WILDLIFE RESOURCES

Modification or securing the existing dam will result in severe impacts for the area immediately at and around the dam (Figure 1). The only potential impact to fish and wildlife resources would be a temporary impact to the water quality and aquatic biota passing the structure. We recommend that that impact be minimized by using non-erodible materials to the maximum extent possible, securing erodible materials, and minimizing the time duration for the project.

Some impacts would occur to riparian habitat surrounding the staging areas for construction. At this time these areas include the lawn and parking area on the right bank tailwater area and the corresponding left bank tailwater area. An additional area (acreage undetermined at this time) would be cleared during construction of the access road from the railroad bed to the left bank staging area. May require clearing along the left bank, since it does not include a paved parking area.

On September 1, a biologist made a vegetation survey of the right downstream bank, primarily. Not all plants species were identified; however, Table 1 provides an adequate characterization of the riparian vegetation in the tailwater area. This diverse vegetation provides excellent cover and nesting habitat, and is a food source for an array of wildlife species. Appendix A includes tables on the aquatic biota of Tuscarawas River in the vicinity of the dam, and notes on water quality indices, based on macroinvertebrate and fish data collected by Ohio EPA staff.

We realize that efforts to secure the Dover Dam for future years will result in impacts to both aquatic and terrestrial habitats. However, we believe those impacts can be minimized by using the prior cleared areas along both riverbanks (in the Dover Dam tailwater area of Tuscarawas River) as staging areas for construction materials, minimizing the size of the access road, such that pull-off areas be used at appropriate intervals that minimize impacts to adjacent wetland and forest habitats. We recommend that the Corps and its contractors fully utilize and enforce the use of best management practices (BMP) during the construction period, which we hope can be expedited, since cooperative weather is frequently a matter of luck. Some common BMP's that we recommend include, but are not limited to, the following:

1. Stream and/or wetland setbacks
2. Water quality ponds
3. Water bar or riffle
4. Sediment trap and silt fence
5. Mulching and seeding
6. Tree and natural area preservation

Note: Native species must be used in planting and seeding activities.

ENDANGERED SPECIES COMMENTS

The proposed project lies within the range of the **Indiana bat** (*Myotis sodalis*), a Federally-listed endangered species. Since first listed as endangered in 1967, its population has declined by nearly 60%. Several factors have contributed to the decline of the Indiana bat; these include the loss and degradation of suitable hibernacula, human disturbance during hibernation, pesticides, and the loss and degradation of forested habitat, particularly stands of large, mature trees. Fragmentation of forest habitat may also contribute to declines.

Summer habitat requirements for the species are not well defined, but the following are considered important:

(1) dead or live trees and snags with peeling or exfoliating bark, split tree trunks and/or branches, or cavities, which may be used as maternity roost areas;
(2) live trees (such as shagbark hickory and oaks) which have exfoliating bark;
(3) stream corridors, riparian areas, and upland woodlots which provide forage sites.

Should the proposed site contain trees or associated habitats exhibiting any of the characteristics listed above, we recommend that the habitat and surrounding trees be saved wherever possible. If the trees must be cut, further coordination with this office is requested to determine if surveys are warranted. Any survey should be designed and conducted in coordination with the Endangered Species Coordinator for this office.

Based on our biologist's survey of the riparian habitat along the right bank of the tailwater area, very little, if any, potential Indiana bat habitat was observed. Some potential Indiana bat habitat was observed along the proposed access road, although it did not appear to be prime habitat. The Corps of Engineers should contact the U.S. Fish and Wildlife Service again after detailed access plans have been made. At this time we believe seasonal cutting of unavoidable trees would be sufficient to comply with our guidance.

The project area also 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.

Finally, the proposed project lies within the range of the **clubshell mussel** (*Pleurobema clava*), a Federally-listed endangered species, based on historic records for Tuscarawas County. The clubshell inhabits areas with sand or gravel substrate and also prefers areas with riffles and runs. Should the proposed project directly or indirectly impact any of the habitat types described above, we recommend that a survey be conducted to determine the presence or probable absence

of mussels in anticipated impact zone of the proposed site. If a mussel bed is found, further coordination with the Service would be required.

In a 1996 survey, white heelsplitter (*Lasmigona complanata*) was found at Dover Dam. At the next survey site downstream from the dam, giant floater (*Pyganodon grandis*), fat mucket (*Lampsilis siliquoidea*), and white heelsplitter were found.

SUMMARY OF RECOMMENDATIONS

1. We do not believe there is significant difference in impacts to the area's fish and wildlife resources from either of the two action alternatives. Raising the height of the dam would result in more use of the access road; however, the road would have to be prepared for use with either alternative. Pull-outs should be used to allow trucks to pass safely, while minimizing impacts associated with access road widening.

2. We anticipate minimal impacts to wetland habitats with use of the downstream access road. Any impacts should be mitigated in accordance with provisions of the Clean Water Act, as administered by the Corps of engineers and Ohio EPA. We recommend that wetland mitigation (or other mitigation, such as planting of native trees, shrubs, and forbs on disturbed project areas) occur on Corps property in the vicinity of the project.

3. After a decision is made regarding the access road and detailed plans are finalized, an assessment of potential Indiana bat habitat should be made. At this time we anticipate that seasonal cutting of unavoidable trees would be sufficient to address avoidance of impacts to this species.

4. The construction period should be carefully planned to minimize impacts associated with construction. We recommend strict adherence to best management practices (see above list of common BMP's) during and following construction to reduce impacts to fish and wildlife resources.

5. We understand that the placement of limestone riprap is proposed in a 25-foot reach of the stream immediately off the stilling basin. We believe this material may provide benefits for the fishery resources. This should be coordinated with the Service and Ohio Department of Natural Resources. Prior to placement of this material, the existing substrate should be assessed for its potential to harbor a mussel community. If warranted, a presence/absence mussel survey should be done in this area.

6. As is the case throughout most of Ohio, invasive exotic plant species are becoming an increasing problem, and the Dover Dam area is no exception. We recommend that invasive plants, such as bush honeysuckle and Japanese knotweed, be removed from the project area, including along the access road, and replaced with native species of value to fish and wildlife.

7. Figure 7 shows tailings from past coal mining in the area. We recommend that this area be restored by removing these materials and planting the area with a variety of native woody plants, as mitigation for losses of shrub and tree habitat along the access road.

This list of recommendations is not exhaustive, relative to implementation of either BMP's or mitigation measures; however, it is a good starting point for initiation of an environmentally sound project. We offer our continued recommendations during your planning process, as warranted.

These comments have been prepared under the authority 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 are 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 me or anyone at this office for Ken Lammers' phone number and/or email address.

Sincerely,

Mary Knapp

Mary Knapp, Ph.D.
Supervisor

cc: ODNR, Div. of Wildlife, SCEA Unit, Columbus, OH
ODNR, Div. of Real Estate and Land Management, Columbus, OH
Ohio EPA, 401/Wetland Section, Columbus, OH

Table 1. Species of vegetation observed in the riparian corridor (right bank) downstream from the Dover Dam near Dover, Tuscarawas County, Ohio, on September 1, 2006.

TREES

White Pine	*Pinus strobus*
E. Hemlock	*Tsuga canadensis*
E. Cottonwood	*Populus deltoides*
E. Sycamore	*Platanus occidentalis*
Box-elder*	*Acer negundo*
Elm	*Ulmus* spp.
N. Hackberry*	*Celtis occidentalis*
Tree of Heaven	*Ailantus altissima*
Honey Locust	*Gleditsia triacanthos*
Black Willow	*Salix nigra*
Silver Maple	*Acer saccharium*
Sugar Maple	*Acer saccharum*
White Ash	*Fraxinus americana*
Green Ash	*Fraxinus pennsylvanica*
Basswood	*Tilia americana*
Redbud	*Cercis canadensis*
Flo. Dogwood	*Cornus florida*
White Oak	*Quercus alba*
Chestnut Oak	*Quercus prinus*
N. Red Oak	*Quercus rubra*
Bitternut Hickory	*Carya cordiformis*
Hawthorn	*Crataegus* sp.
Black Cherry	*Prunus serotina*
American Beech	*Fagus grandifolia*
Tulip Poplar	*Liriodendron tulipifera*
Sassafras	*Sassafras albidum*

Table 1 (continued)

SHRUBS

Bush Honeysuckle	*Lonicera* sp.
Common Elderberry	*Sambucus canadensis*
Silky Dogwood	*Cornus amomum*
Multiflora Rose	*Rosa multiflora*
Black Raspberry	*Rubus occidentalis*
Staghorn Sumac	*Rhus Typhina*
Spicebush	*Lindera benzoin*
Blackberry	*Rubus allegheniensis*
Black Raspberry	*R. occidentalis*
Bladdernut	*Staphylea trifilia*

VINES

Riverbank Grape	*Vitis riparia*
Virginia creeper	*Parthenocissus quinquefolia*
Poison Ivy	*Toxicondendron radicans*
Common Dodder	*Cuscuta gronovii*
Greenbrier	*Smilax rotundifolia*
B. Nightshade	*Solanum dulcamara*
Japanese Honeysuckle	*Lonicera japonica*

NON-WOODY PLANTS

Common Dandelion	*Taraxacum officinale*
Evening Primrose	*Oenothera* sp.
Goldenrod	*Solidado* sp.
Japanese Knotweed	*Polygonum cuspidatum*
Common Plantain	*Plantago major*
English Plantain	*Plantago lanceolata*
White Clover	*Trifolium repens*
Moth Mullein	*Verbascum blattaria*
Cocklebur	Xanthium chinense
Garlic Mustard	*Alliaria officinalis*
Tall Meadow-rue	*Thalictrum polygamum*
Giant Ragweed	*Ambrosia trifida*
Swamp Milkweed	*Asclepias incarnate*
False Nettle	*Boehmeria cylindrical*
White Snakeroot	*Eupatorium rugosum*
Eastern Waterleaf	*Hydrophyllum virginianum*
Spotted Jewelweed	*Hypericum capensis*
Pale Jewelweed	*H. pallida*
Bird's-Foot Trefoil	*Lotus corniculatus*
F. Solomon's Seal	*Smilacina racemosa*
S. Sweet Cicely	*Osmorhiza longistylis*
Common Sorrel	*Oxalis dillenii*
Reed Canary Grass	*Phalaris arundinacea*
Clearweed	*Pilea pumila*
Broad-leaved Dock	*Rumex obtusifolius*
Stinging Nettle*	*Urtica dioica*
Blue Vervain	*Verbena hastate*
Tall Ironweed	*Vemonia gigantean*
Wild Geranium	*Geranium maculatum*
Wingstem	*Actinomeris alternifolia*

** Additional plant species observed upstream from Dover Dam on 21SEP06.*

FIGURES FOR DOVER DAM PLANNING AID LETTER

November 2006

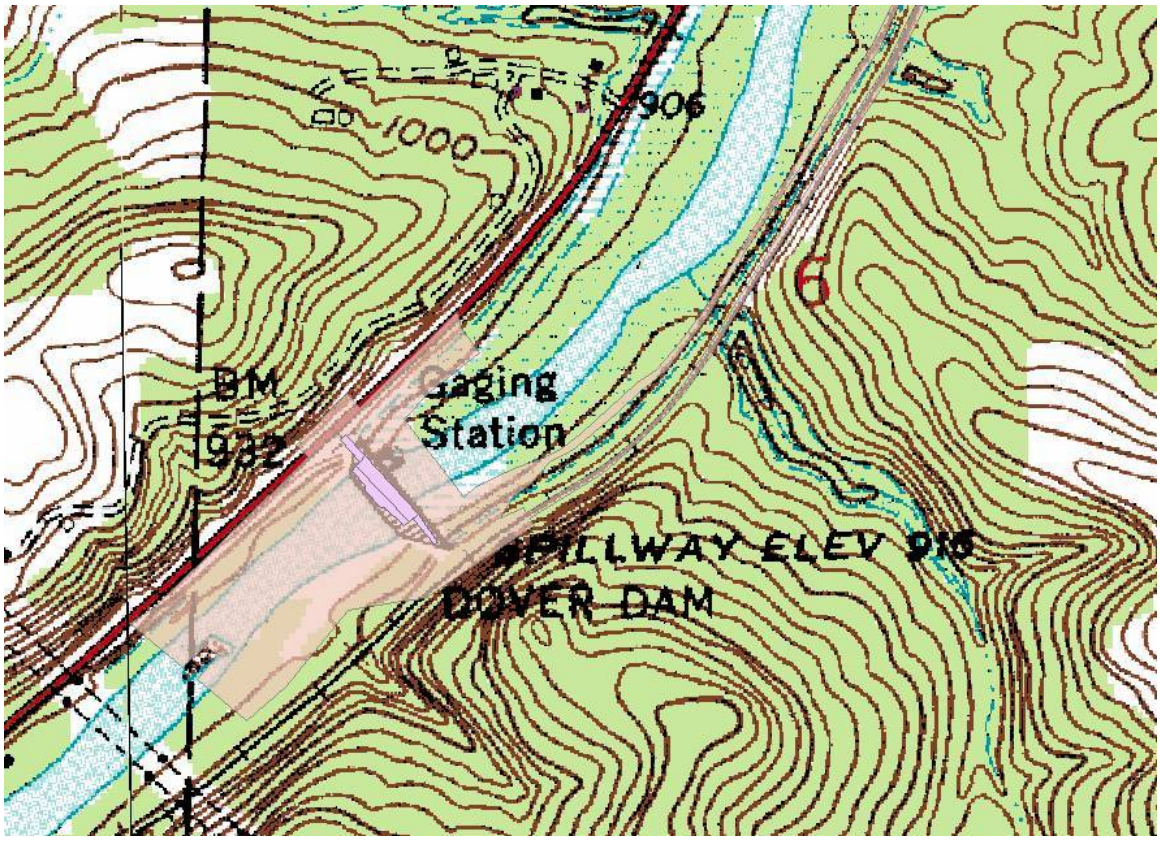


Figure 1. USGS topographic map showing direct impact area around Dover Dam.

Figure 2. Recreation (fishing and kayaking) on the Dover Dam tailwater area.

Figure 3. Tuscarawas River downstream from Dover Dam.

Figure 4. Tuscarawas River upstream from Dover Dam.

Figure 5. Typical view of old railroad bed along the upstream access road.

Figure 6. Typical view of old access road downstream from Dover Dam (preferred access).

Figure 7. Coal mine tailings along the proposed downstream access road.

APPENDIX A

Tables of Ohio EPA aquatic resource data for the Tuscarawas River in the vicinity of Dover Dam, Tuscarawas County, Ohio.

Ohio EPA/DSW Ecological Assessment Section – Macroinvertebrate Collection

Invertebrate Community Index (ICI) scores for sites on the Tuscarawas River near Dover Dam

Species List – Fish, River Mile 63.10, Tuscarawas River

Species List – Fish, River Mile 61.90, Tuscarawas River

Index of Biotic Integrity (IBI) scores for sites on the Tuscarawas River near Dover Dam

Qualitative Habitat Evaluation Index (QHEI) scores for sites on the Tuscarawas River near Dover Dam

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Collection Date: 08/24/2005 River Code: 17-500 RM: 63.20 Site: Tuscarawas River

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	221 +
03600	*Oligochaeta*	8 +
04664	*Helobdella stagnalis*	+
05800	*Caecidotea sp*	+
06810	*Gammarus fasciatus*	417 +
08250	*Orconectes (Procericambarus) rusticus*	+
08601	*Hydrachnidia*	32 +
11130	*Baetis intercalaris*	416 +
13000	*Leucrocuta sp*	78 +
13510	*Maccaffertium exiguum*	17
13550	*Maccaffertium mexicanum integrum*	192
13570	*Maccaffertium terminatum*	200 +
16700	*Tricorythodes sp*	270 +
24900	*Gomphus sp*	+
45400	*Trichocorixa sp*	+
48410	*Corydalus cornutus*	+
51300	*Neureclipsis sp*	1
52200	*Cheumatopsyche sp*	886 +
52430	*Ceratopsyche morosa group*	79 +
52520	*Hydropsyche bidens*	82 +
52550	*Hydropsyche frisoni*	+
52560	*Hydropsyche orris*	420 +
52570	*Hydropsyche simulans*	5 +
53800	*Hydroptila sp*	1
68601	*Ancyronyx variegata*	9 +
68901	*Macronychus glabratus*	19 +
69400	*Stenelmis sp*	+
77750	*Hayesomyia senata or Thienemannimyia norena*	220 +
80410	*Cricotopus (C.) sp*	24
81825	*Rheocricotopus (Psilocricotopus) robacki*	24
82141	*Thienemanniella xena*	8
82220	*Tvetenia discoloripes group*	+
84450	*Polypedilum (Uresipedilum) flavum*	147 +
84540	*Polypedilum (Tripodura) scalaenum group*	49
84700	*Stenochironomus sp*	24
85625	*Rheotanytarsus sp*	1343 +
87540	*Hemerodromia sp*	82
97601	*Corbicula fluminea*	13 +
98600	*Sphaerium sp*	+
99240	*Lasmigona complanata*	+
99860	*Lampsilis radiata luteola*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 29 Total Taxa: 41
No. Qualitative Taxa: 31 ICI: **46**
Number of Organisms: 5287 Qual EPT: 10

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Collection Date: 06/20/1995 River Code: 17-500 RM: 68.70 A Site: Tuscarawas River at Twp. rd. 387, dst. Zoar

Taxa Code	Taxa	Quant/Qual
03600	*Oligochaeta*	+
06810	*Gammarus fasciatus*	+
08200	*Orconectes sp*	+
22300	*Argia sp*	+
77500	*Conchapelopia sp*	+
77750	*Hayesomyia senata or Thienemannimyia norena*	+
79085	*Telopelopia okoboji*	+
80204	*Brillia flavifrons group*	+
84470	*Polypedilum (P.) illinoense*	+
97601	*Corbicula fluminea*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 10
No. Qualitative Taxa: 10 ICI:
Number of Organisms: 0 Qual EPT: 0

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Collection Date: 08/02/1995 River Code: 17-500 RM: 68.70 B Site: Tuscarawas River at Twp. rd. 387, dst. Zoar

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	8 +
03600	*Oligochaeta*	10 +
05800	*Caecidotea sp*	+
06810	*Gammarus fasciatus*	27 +
08250	*Orconectes (Procericambarus) rusticus*	+
11130	*Baetis intercalaris*	2
13400	*Stenacron sp*	1
13550	*Maccaffertium mexicanum integrum*	72 +
13570	*Maccaffertium terminatum*	535 +
16700	*Tricorythodes sp*	117 +
17200	*Caenis sp*	+
25620	*Stylurus spiniceps*	+
48410	*Corydalus cornutus*	1
52200	*Cheumatopsyche sp*	181 +
52430	*Ceratopsyche morosa group*	250 +
52530	*Hydropsyche depravata group*	2
52540	*Hydropsyche dicantha*	88 +
52560	*Hydropsyche orris*	14 +
52570	*Hydropsyche simulans*	1
52801	*Potamyia flava*	9
53501	*Hydroptilidae*	1
68130	*Helichus sp*	+
68601	*Ancyronyx variegata*	3
68901	*Macronychus glabratus*	8 +
74100	*Simulium sp*	4
77750	*Hayesomyia senata or Thienemannimyia norena*	92 +
79085	*Telopelopia okoboji*	10
80410	*Cricotopus (C.) sp*	10 +
80420	*Cricotopus (C.) bicinctus*	10 +
80430	*Cricotopus (C.) tremulus group*	+
81231	*Nanocladius (N.) crassicornus or N. (N.) "rectinervis"*	5
81825	*Rheocricotopus (Psilocricotopus) robacki*	68
82200	*Tvetenia bavarica group*	5
82220	*Tvetenia discoloripes group*	5
82730	*Chironomus (C.) decorus group*	+
82820	*Cryptochironomus sp*	+
83040	*Dicrotendipes neomodestus*	+
83300	*Glyptotendipes (G.) sp*	19 +
84450	*Polypedilum (Uresipedilum) flavum*	24 +
84470	*Polypedilum (P.) illinoense*	10 +
84480	*Polypedilum (P.) laetum group*	+
84520	*Polypedilum (Tripodura) halterale group*	5
84700	*Stenochironomus sp*	5
85625	*Rheotanytarsus sp*	87
85800	*Tanytarsus sp*	5
87540	*Hemerodromia sp*	2

No. Quantitative Taxa: 36 Total Taxa: 46
No. Qualitative Taxa: 27 ICI: **42**
Number of Organisms: 1696 Qual EPT: 8

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Collection Date: 06/20/1995 River Code: 17-500 RM: 64.90 A Site: Tuscarawas River

Taxa Code	Taxa	Quant/Qual
03360	*Plumatella sp*	+
03600	*Oligochaeta*	+
06810	*Gammarus fasciatus*	+
08200	*Orconectes sp*	+
22300	*Argia sp*	+
24900	*Gomphus sp*	+
52560	*Hydropsyche orris*	+
77500	*Conchapelopia sp*	+
82820	*Cryptochironomus sp*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 9
No. Qualitative Taxa: 9 ICI:
Number of Organisms: 0 Qual EPT: 1

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Collection Date: 08/02/1995 River Code: 17-500 RM: 64.90 B Site: Tuscarawas River

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+
03360	*Plumatella sp*	+
06810	*Gammarus fasciatus*	+
08260	*Orconectes (Crokerinus) sanbornii sanbornii*	+
13400	*Stenacron sp*	+
13550	*Maccaffertium mexicanum integrum*	+
13570	*Maccaffertium terminatum*	+
16700	*Tricorythodes sp*	+
23909	*Boyeria vinosa*	+
45100	*Palmacorixa sp*	+
48210	*Chauliodes pectinicornis*	+
52200	*Cheumatopsyche sp*	+
52430	*Ceratopsyche morosa group*	+
52540	*Hydropsyche dicantha*	+
52560	*Hydropsyche orris*	+
52570	*Hydropsyche simulans*	+
68601	*Ancyronyx variegata*	+
68702	*Dubiraphia bivittata*	+
68901	*Macronychus glabratus*	+
69400	*Stenelmis sp*	+
74100	*Simulium sp*	+
80410	*Cricotopus (C.) sp*	+
80420	*Cricotopus (C.) bicinctus*	+
81250	*Nanocladius (N.) minimus*	+
81825	*Rheocricotopus (Psilocricotopus) robacki*	+
82141	*Thienemanniella xena*	+
82820	*Cryptochironomus sp*	+
84060	*Parachironomus pectinatellae*	+
84450	*Polypedilum (Uresipedilum) flavum*	+
84470	*Polypedilum (P.) illinoense*	+
84700	*Stenochironomus sp*	+
85625	*Rheotanytarsus sp*	+
97601	*Corbicula fluminea*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 33
No. Qualitative Taxa: 33 ICI:
Number of Organisms: 0 Qual EPT: 9

Invertebrate Community Index (ICI) scores for sites on the Tuscarawas River near Dover Dam.

River Mile	Drainage Area (sq mi)	Number of				Percent:					Qual. EPT	Eco-region	ICI
		Total Taxa	Mayfly Taxa	Caddisfly Taxa	Dipteran Taxa	Mayflies	Caddis-flies	Tany-tarsini	Other Dipt/NI	Tolerant Organisms			
Tuscarawas River (17-500)													
Year: 2005													
63.20	1404	29(4)	6(4)	7(6)	9(4)	22.2(6)	27.9(4)	25.4(6)	24.0(4)	0.2(6)	10(2)	4	46
Year: 1995													
68.70 B	1103	36(6)	5(2)	8(6)	17(6)	42.9(6)	32.2(4)	5.4(2)	18.8(4)	1.8(4)	8(2)	4	42

River Code: **17-500**	Stream: **Tuscarawas River**	Sample Date: **1995**
River Mile: **68.70**	Location: at Twp. rd. 387, dst. Zoar Dam	Date Range: 06/20/1995
Time Fished: 2572 sec	Drainage: 1103.0 sq mi	Thru: 08/25/1995
Dist Fished: 1.00 km	Basin: Muskingum River No of Passes: 2	Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Quillback Carpsucker	C	O	M		1	1.00	0.42	0.94	0.66	936.00
Silver Redhorse	R	I	S	M	1	1.00	0.42	0.03	0.02	31.00
Golden Redhorse	R	I	S	M	3	3.00	1.26	0.36	0.25	119.33
Northern Hog Sucker	R	I	S	M	89	89.00	37.39	16.96	12.04	190.54
White Sucker	W	O	S	T	8	8.00	3.36	3.31	2.35	414.00
Common Carp	G	O	M	T	54	54.00	22.69	110.81	78.67	2,051.95
Goldfish	G	O	M	T	1	1.00	0.42	0.14	0.10	136.00
River Chub	N	I	N	I	8	8.00	3.36	0.51	0.36	64.23
Spotfin Shiner	N	I	M		18	18.00	7.56	0.13	0.09	7.09
Sand Shiner	N	I	M	M	1	1.00	0.42	0.00	0.00	3.00
Bluntnose Minnow	N	O	C	T	11	11.00	4.62	0.05	0.04	4.73
Channel Catfish	F		C		1	1.00	0.42	0.63	0.45	634.00
Yellow Bullhead		I	C	T	1	1.00	0.42	0.34	0.24	339.00
Brown Bullhead		I	C	T	1	1.00	0.42	0.24	0.17	242.00
White Crappie	S	I	C		1	1.00	0.42	0.04	0.03	43.00
Rock Bass	S	C	C		13	13.00	5.46	1.29	0.91	98.85
Smallmouth Bass	F	C	C	M	14	14.00	5.88	4.89	3.47	349.29
Largemouth Bass	F	C	C		1	1.00	0.42	0.03	0.02	28.00
Green Sunfish	S	I	C	T	2	2.00	0.84	0.01	0.01	5.00
Bluegill Sunfish	S	I	C	P	1	1.00	0.42	0.04	0.03	41.00
Pumpkinseed Sunfish	S	I	C	P	1	1.00	0.42	0.01	0.01	12.00
Yellow Perch			M		2	2.00	0.84	0.08	0.06	40.50
Greenside Darter	D	I	S	M	4	4.00	1.68	0.02	0.01	3.75
Banded Darter	D	I	S	I	1	1.00	0.42	0.00	0.00	2.00
Mile Total					238	238.00		140.85		
Number of Species					24					
Number of Hybrids					0					

River Code: **17-500**	Stream: **Tuscarawas River**	Sample Date: **1995**
River Mile: **64.10**	Location: 0.3 mi. upst. Dover Dam	Date Range: 06/20/1995
Time Fished: 3353 sec	Drainage: 1403.0 sq mi	Thru: 08/25/1995
Dist Fished: 1.00 km	Basin: Muskingum River No of Passes: 2	Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Quillback Carpsucker	C	O	M		3	3.00	2.26	2.22	1.10	740.67
Silver Redhorse	R	I	S	M	2	2.00	1.50	2.41	1.20	1,202.50
Golden Redhorse	R	I	S	M	2	2.00	1.50	1.24	0.61	617.50
Northern Hog Sucker	R	I	S	M	29	29.00	21.80	4.85	2.41	167.16
White Sucker	W	O	S	T	9	9.00	6.77	3.38	1.68	375.44
Common Carp	G	O	M	T	74	74.00	55.64	184.52	91.71	2,493.45
Spotfin Shiner	N	I	M		3	3.00	2.26	0.03	0.01	8.33
Bluntnose Minnow	N	O	C	T	3	3.00	2.26	0.01	0.00	2.00
Common Carp X Goldfish	G	O		T	1	1.00	0.75	0.32	0.16	320.00
Channel Catfish	F		C		1	1.00	0.75	0.67	0.33	674.00
Rock Bass	S	C	C		1	1.00	0.75	0.15	0.08	153.00
Smallmouth Bass	F	C	C	M	1	1.00	0.75	0.49	0.25	493.00
Yellow Perch			M		2	2.00	1.50	0.05	0.02	24.50
Johnny Darter	D	I	C		1	1.00	0.75	0.00	0.00	2.00
Sauger X Walleye	E	P			1	1.00	0.75	0.87	0.43	870.00
	Mile Total				133	133.00		201.20		
	Number of Species				13					
	Number of Hybrids				2					

River Code: **17-500**	Stream: **Tuscarawas River**	Sample Date: **2004**
River Mile: **63.10**	Location: at power lines, dst. Dover Dam	Date Range: 07/21/2004
Time Fished: 4247 sec	Drainage: 1404.0 sq mi	
Dist Fished: 0.50 km	Basin: Muskingum River No of Passes: 1	Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Bowfin		P	C		5	10.00	1.64	10.73	5.75	1,073.00
Grass Pickerel		P	M	P	2	4.00	0.66	0.08	0.04	20.00
Northern Pike	F	P	M		3	6.00	0.99	3.20	1.71	532.67
Silver Redhorse	R	I	S	M	5	10.00	1.64	12.05	6.46	1,205.00
Golden Redhorse	R	I	S	M	2	4.00	0.66	3.02	1.62	756.00
Northern Hog Sucker	R	I	S	M	46	92.00	15.13	24.30	13.02	264.15
White Sucker	W	O	S	T	7	14.00	2.30	8.91	4.77	636.20
Common Carp	G	O	M	T	25	50.00	8.22	83.41	44.68	1,668.17
River Chub	N	I	N	I	1	2.00	0.33	0.24	0.13	118.00
Spotfin Shiner	N	I	M		28	56.00	9.21	0.50	0.27	8.89
Sand Shiner	N	I	M	M	16	32.00	5.26	0.08	0.04	2.38
Bluntnose Minnow	N	O	C	T	23	46.00	7.57	0.10	0.05	2.14
Channel Catfish	F		C		13	26.00	4.28	17.70	9.48	680.77
Trout-perch		I	M		3	6.00	0.99	0.02	0.01	2.67
White Crappie	S	I	C		5	10.00	1.64	1.58	0.85	158.00
Black Crappie	S	I	C		11	22.00	3.62	2.08	1.11	94.55
Rock Bass	S	C	C		48	96.00	15.79	12.42	6.65	129.38
Smallmouth Bass	F	C	C	M	2	4.00	0.66	0.24	0.13	60.00
Largemouth Bass	F	C	C		5	10.00	1.64	0.47	0.25	46.60
Warmouth Sunfish	S	C	C		3	6.00	0.99	0.16	0.09	26.67
Green Sunfish	S	I	C	T	2	4.00	0.66	0.02	0.01	6.00
Bluegill Sunfish	S	I	C	P	31	62.00	10.20	2.00	1.07	32.26
Redear Sunfish	E	I	C		1	2.00	0.33	0.02	0.01	12.00
Pumpkinseed Sunfish	S	I	C	P	5	10.00	1.64	0.25	0.13	25.00
Yellow Perch			M		8	16.00	2.63	2.72	1.46	170.25
Blackside Darter	D	I	S		1	2.00	0.33	0.01	0.00	3.00
Logperch	D	I	S	M	1	2.00	0.33	0.02	0.01	12.00
Banded Darter	D	I	S	I	1	2.00	0.33	0.01	0.00	3.00
Sauger X Walleye	E	P			1	2.00	0.33	0.34	0.18	172.00
Mile Total					304	608.00		186.67		
Number of Species					28					
Number of Hybrids					1					

River Code: **17-500**	Stream: **Tuscarawas River**	Sample Date: **2005**
River Mile: **61.90**	Location: upst. St. Rt. 416	Date Range: 08/04/2005
Time Fished: 4244 sec	Drainage: 1406.0 sq mi	Thru: 10/04/2005
Dist Fished: 1.00 km	Basin: Muskingum River No of Passes: 2	Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Bowfin		P	C		1	1.00	0.26	1.45	0.77	1,450.00
Northern Pike	F	P	M		2	2.00	0.52	1.76	0.94	880.00
Quillback Carpsucker	C	O	M		3	3.00	0.77	1.79	0.95	595.33
Silver Redhorse	R	I	S	M	20	20.00	5.15	26.54	14.15	1,327.21
Golden Redhorse	R	I	S	M	24	24.00	6.19	13.65	7.28	568.75
Northern Hog Sucker	R	I	S	M	87	87.00	22.42	21.42	11.42	246.15
White Sucker	W	O	S	T	7	7.00	1.80	4.96	2.65	708.86
Smallmouth Redhorse	R	I	S	M	2	2.00	0.52	1.10	0.59	549.50
Common Carp	G	O	M	T	37	37.00	9.54	84.82	45.21	2,292.49
Golden Shiner	N	I	M	T	4	4.00	1.03	0.07	0.04	16.75
Spotfin Shiner	N	I	M		15	15.00	3.87	0.05	0.03	3.47
Sand Shiner	N	I	M	M	31	31.00	7.99	0.04	0.02	1.23
Bluntnose Minnow	N	O	C	T	45	45.00	11.60	0.13	0.07	2.89
Channel Catfish	F		C		21	21.00	5.41	18.54	9.88	883.00
Yellow Bullhead		I	C	T	2	2.00	0.52	0.51	0.27	255.50
White Crappie	S	I	C		1	1.00	0.26	0.17	0.09	171.00
Black Crappie	S	I	C		4	4.00	1.03	0.68	0.36	169.75
Rock Bass	S	C	C		46	46.00	11.86	5.64	3.01	122.63
Smallmouth Bass	F	C	C	M	14	14.00	3.61	3.05	1.62	217.71
Largemouth Bass	F	C	C		2	2.00	0.52	0.61	0.32	304.50
Green Sunfish	S	I	C	T	2	2.00	0.52	0.07	0.04	35.50
Bluegill Sunfish	S	I	C	P	2	2.00	0.52	0.01	0.00	4.00
Green Sf X Bluegill Sf					1	1.00	0.26	0.05	0.03	52.00
Yellow Perch			M		1	1.00	0.26	0.04	0.02	42.00
Logperch	D	I	S	M	3	3.00	0.77	0.03	0.02	11.33
Johnny Darter	D	I	C		1	1.00	0.26	0.00	0.00	2.00
Greenside Darter	D	I	S	M	1	1.00	0.26	0.00	0.00	4.00
Banded Darter	D	I	S	I	6	6.00	1.55	0.01	0.01	2.00
Sauger X Walleye	E	P			1	1.00	0.26	0.39	0.21	388.00
Mottled Sculpin		I	C		2	2.00	0.52	0.01	0.00	4.00
Mile Total					388	388.00		187.60		
Number of Species					28					
Number of Hybrids					2					

Index of Biotic Integrity (IBI) scores for sites on the Tuscarawas River near Dover Dam.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Sunfish species	Sucker species	Intolerant species	Percent of Individuals: Rnd-bodied suckers	Simple Lithophils	Tolerant fishes	Omni-vores	Top carnivores	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(1.0 km)		IBI	Modified Iwb
Tuscarawas River - (17-500)																		
Year: 2005																		
61.90	A	10/04/2005	1406	22(5)	4(5)	5(3)	1(1)	26(3)	32(3)	28(1)	26(3)	17(5)	50(3)	0.0(5)	350(3)		40	9.7
61.90	A	08/04/2005	1406	18(3)	2(3)	5(3)	0(1)	49(5)	51(5)	19(3)	19(3)	17(5)	60(5)	1.7(3)	232(3)		42	8.7
Year: 2004																		
63.10	A	07/21/2004	1404	26(5)	7(5)	4(3)	2(3)	17(1)	21(3)	19(3)	18(3)	23(5)	52(3)	0.8(3)	494(5)		42	10.0
Year: 1995																		
68.70	A	06/20/1995	1103	10(3)	1(1)	2(1)	1(1)	43(5)	46(5)	36(1)	35(1)	10(3)	56(5)	3.5(1)	104(1)	*	28	5.9
68.70	A	08/25/1995	1103	20(3)	5(5)	5(3)	2(3)	37(3)	44(5)	31(1)	30(1)	13(5)	55(5)	10.9(1)	216(3)		38	7.7
64.10	A	06/20/1995	1403	6(1)	0(1)	4(3)	0(1)	8(1)	17(1)	85(1)	90(1)	0(1)	10(1)	17.7(1)	16(1)	*	14	3.8
64.10	A	08/25/1995	1403	11(3)	1(1)	4(3)	0(1)	36(3)	41(3)	53(1)	53(1)	4(1)	40(3)	31.9(1)	76(1)	*	22	5.5

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

Key QHEI Components

River Mile	QHEI	Gradient (ft/mile)	WWH Attributes: No Channelization or Recovered	Boulder/Cobble/Gravel Substrates	Silt Free Substrates	Good/Excellent Substrates	Moderate/High Sinuosity	Extensive/Moderate Cover	Fast Current/Eddies	Low-Normal Overall Embeddedness	Max Depth > 40 cm	Low-Normal Riffle Embeddedness	Total WWH Attributes	MWH Attributes (High Influence): Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse/No Cover	Max Depth < 40 cm (WD, HW)	Total HL MWH Attributes	MWH Attributes (Moderate Influence): Recovering Channel	Heavy/Moderate Silt Cover	Sand Substrates (Boat)	Hardpan Substrate Origin	Fair/Poor Development	Low Sinuosity	Only 1-2 Cover Types	Intermittent and Poor Pools	No Fast Current	High/Mod. Overall Embeddedness	High/Mod. Riffle Embeddedness	No Riffle	Total ML MWH Attributes	(MWH HL+1)/(WWH+1) Ratio	(MWH ML+1)/(WWH+1) Ratio
(17-500) Tuscarawas River																																	
Year: 2005																																	
61.9	**74.5**	1.23	■	■		■		■	■	■	■	■	8						0		•			•							2	0.11	0.33
Year: 2004																																	
63.1	**78.0**	1.23	■	■			■	■	■		■		6						0		•		•					•	•		4	0.14	0.71
Year: 1995																																	
68.7	**80.5**	1.23	■	■		■	■	■		■	■	■	8						0		•						•	•	•		4	0.11	0.56
64.1	**70.5**	1.23	■	■		■					■	■	5				♦		1		•		•	•			•	•	•		6	0.33	1.33