TERRESTRIAL & AQUATIC HABITAT BASELINE STUDY, IN SUPPORT OF ZOAR LEVEE & DIVERSION DAM, DAM SAFETY MODIFICATION STUDY, LAWERENCE TOWNSHIP, TUSCARAWAS COUNTY, OHIO

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February 2013

Zoar Environmental Baseline Study

Executive Summary

In support of the Zoar Levee and Diversion Dam, Dam Safety Modification Study (DSMS), field investigations were conducted in June 2012 to determine the location and extent of ecologically significant habitats and of Waters of the United States, including wetlands, streams, and open water within the Zoar Baseline Study Area. Areas identified as potential waters and areas that exhibited all three indicators of potential jurisdictional wetlands were noted. Identification of potential wetlands required characterization of plant community types, identification of hydric soils, and hydrologic indicators for each community type. Stream channels were identified based upon the presence of an Ordinary High Water Mark, along with a defined bed and bank. For ecologically significant habitats, the study area was qualitatively assessed for unique habitats and the potential presence of threatened or endangered species.

For this study, a baseline study area was defined by Huntington for the DSMS to encompass the incorporated boundary of Zoar Village, the current National Register of Historic Places boundary for the Zoar State Memorial Site, the limits of elevation 916 feet above mean sea level (AMSL) behind Zoar Levee and Diversion Dam (which corresponds to the flowage easement maintained for Dover Dam), plus some extra area. Field investigations were conducted for all locations in which access was obtained within the study area. As a result of limited access and the potential for changing conditions, additional and more detailed investigations may be necessary during the DSMS to completely inventory the environmental conditions within the Study Area.

Wetlands

Twelve wetlands were found within the Study Area. These include wetlands 1, 2, Goose Run Impoundment wetland, Pump Station wetland, Government Property wetland, Subdivision wetland, Floodplain Field wetland, Between Roadways wetland, Canal wetland, Zoar Wetland and Arboretum, and Diversion Channel Wetland.

Wetland 1 is a 1.37 acre depressional wetland situated northeast of town and southwest of the Goose Run Impoundment. This forested depressional wetland has an undulating ground surface and is mostly surrounded by a berm.

Wetland 2 is a 3.56 acre consistently inundated wetland located northwest of the Goose Run Impoundment. The wetland is a large depression which was historically used as a barrow area for construction projects associated with the Zoar Levee. This depressional wetland contains a small mudflat area and a larger open water area; encircling this is scrub/shrub with mature trees on the top of the scarp surrounding the depression.

Goose Run Impoundment wetland is within the Goose Run Impoundment area encompassing a total of 22.8 acres. The Diversion Dam impounds temporary pools in this area in response to flashy storm events. Boundaries of this wetland extend outside of the Study Area. This wetland can best be described as a wetland/upland complex because of its heterogeneity and the interspersion of upland habitat. Vegetation is dominated by the invasive reed canary grass.

The Pump Station wetland is located south of 2nd Street and east of Route 212. Goose Run empties into this wetland/pond before being pumped under Route 212 and the Zoar Levee. A 2008 emergency gravel seepage blanket against the interior toe of the Rock Knoll of the levee lies adjacent to this wetland to the southeast. This wetland was estimated (by aerial photography) to be approximately 0.18 acres. The wetland boundary may extend onto properties where access was not obtained. It is an open water constructed wetland that contains both aquatic and emergent habitats.

Government Property wetland is located within a reach artificially excavated during construction of the Zoar Levee & Diversion Dam. The majority of this wetland is forested with other areas of emergent vegetation. In total, 8.76 acres of this naturalized wetland are located within the Study Area and assessments show that it has the potential for high quality habitat.

Subdivision wetland is located south of the Government Property Wetland and north of Michael Lane. This riverine wetland is estimated (by aerial photography) to be approximately 3 acres. Wetland boundaries extended out of the study area and also onto properties with restricted access.

Floodplain Field wetland is south of town along the Tuscarawas River floodplain and encompasses approximately 37 acres. It consists of multiple habitats including forest, emergent, scrub/shrub, and agricultural. The wetland is bisected by the remains of a Mill Race constructed by the Zoarites connecting the Tuscarawas River to Goose Run.

Between Roadways wetland is located between the old and new alignments of Dover Zoar road, southwest of Zoar Levee. Construction of artificial barriers, such as Dover Zoar Road and Zoar Levee have changed the hydrology and likely disconnected this wetland from others nearby, including the Floodplain Field wetland complex. In total, this wetland consists of 2.25 acres of forested habitat.

Canal wetland is located on the right descending bank of the Tuscarawas River, bounded by County Highway 111 to the southwest and the Tuscarawas River to the northeast. This area has been highly altered by human activity, yet assessments show the wetland has the potential for high quality habitat. Within the Study Area, the Canal Wetland encompasses 16.69 forested acres; but the actual wetland boundaries likely extend beyond the Study Area.

The Zoar Wetland and Arboretum is located west of Zoar Levee on the bottomland/floodplain of the Tuscarawas River. The Zoar Wetland and Arboretum in the study area measures 244.70 acres. Within the Zoar Wetland and Arboretum is Zoar Lake which is an impounded unnamed tributary of the Tuscarawas River. The complexity, variety, and quality of the various ecosystems within the Zoar Wetland and Arboretum add to importance of the area for conservation, education, and recreation. Although not nesting at Zoar Lake, bald eagles nesting at near-by Beach City Dam frequent this body of water.

The Diversion Channel artificially drains Lime Kiln Lake from the southeast corner and is narrowly channelized for approximately 310 ft until it enters the unnamed tributary on

government property. This area functions mainly as a wetland due to consistent water inputs from seeps and sheet-flow. Because the channel was excavated from upland soils, it is a non-jurisdictional wetland.

The Outflow Wetland is located on the left descending bank of Goose Run approximately 40 meters downstream of the Diversion Dam outflow. It is also adjacent to Reach 1 of Goose Run. It is approximately 0.2 acres in size and is likely the result of Goose Run inundation during storm events. This wetland has not been fully assessed.

Streams

Six streams were delineated within the Study Area including Unnamed Tributary 1, 2, 3, 4, Unnamed Secondary Tributary to Tributary 1, and Goose Run.

Unnamed Tributary 1 flows through the Government Property Wetland with an undefined bed and bank. At the end of this wetland is the eastern portion of the Zoar levee, which confines the unnamed tributary, resulting in a defined bed and bank. The unnamed tributary flows for approximately 325 ft before entering Goose Run.

Unnamed Secondary Tributary to Unnamed Tributary 1 flows through Subdivision Wetland and to the unnamed tributary that drains the Diversion Channel. Only a small portion of the stream was accessible for this assessment.

Unnamed Tributary 2 flows through the Canal Wetland and is parallel and east of the towpath. This stream begins outside of the Zoar Study Area.

Goose Run watershed drains a large portion of the Study Area and has a total drainage of approximately 2.4 square miles. Within the Study Area, Goose Run flows from the northeast through the Goose Run Impoundment and continues through the Diversion Dam. Downstream of the Dam, the stream is channelized for approximately 400 feet before entering a forested area for 1200 feet and continuing on to the ponding area for the Zoar pumping station. From the ponding area, Goose Run flows under the Levee through culverts or can be pumped over the levee during times when Dover Dam is retaining a pool. South of the Levee, Goose Run exits the culverts and flows through the forested portion of the Floodplain Field wetland and then an additional 1100 feet to the Tuscarawas River.

Unnamed Tributary 3 flows through the northwest portions of the Goose Run Impoundment into Goose Run on its right descending bank. This stream begins outside of the Zoar Study Area and flows through the Goose Run Impoundment wetland.

Unnamed Tributary 4 flows through the northeast portions of the Goose Run Impoundment into Goose Run on its left descending bank. This stream begins outside of the Zoar Study Area and flows through the Goose Run Impoundment wetland.

Significant Ecological Habitats

There were no ecologically significant habitats found within the study area. Besides the wetland habitats described below, the only other natural habitats were three open fields and a few parcels of upland forests. The open fields were dominated by a variety of grasses, with small rodents and the typical variety of birds present. The upland forests were all second growth, unmanaged forests, with no notable species or specimens. Wildlife observed throughout the study area included the usual range of deer, snakes, frogs, and birds.

Conclusions

Overall, the Zoar Baseline Study Area has an abundance of good quality wetlands. Eleven wetlands consisting of approximately 340 acres were recorded within the Study Area. Several of these wetlands extend beyond the study boundaries, and more possible wetlands may be present within the study boundaries on properties with restricted access. These wetlands were primarily riverine wetlands, with only 2 being depressional wetlands. Streams within the study area have been heavily altered and channelized, and were generally considered in poor or fair quality. Artificial channels were historically excavated for canal and mill races, some more recently for agricultural drainage ditches.

No ecologically significant terrestrial habitats were located within the Zoar Study Area during this assessment.

This report is meant to serve as a planning tool for decision making during the alternative formulation process. A more detailed delineation of wetlands and streams may be required if an alternative has the potential to impact any of the wetlands or streams described in this report. Additional assessments may also be necessary if alternatives have the potential to impact properties within the Study Area that were not accessible during this assessment.

I. PURPOSE AND NEED

The U.S. Army Corps of Engineers, Nashville District (Nashville) was tasked by the U.S. Army Corps of Engineers, Huntington District (Huntington) to perform a Terrestrial and Aquatic Habitat Baseline Study to aid in the development of the total Baseline Condition being assembled in support of Zoar Levee and Diversion Dam, Dam Safety Modification Study (DSMS), Tuscarawas County, Ohio (Figure 1). The Dam Safety Modification Study is being conducted by U.S. Army Corps of Engineers, Huntington District (Huntington) to identify a long-term risk management plan to address seepage and stability issues associated with Zoar Levee and Diversion Dam.

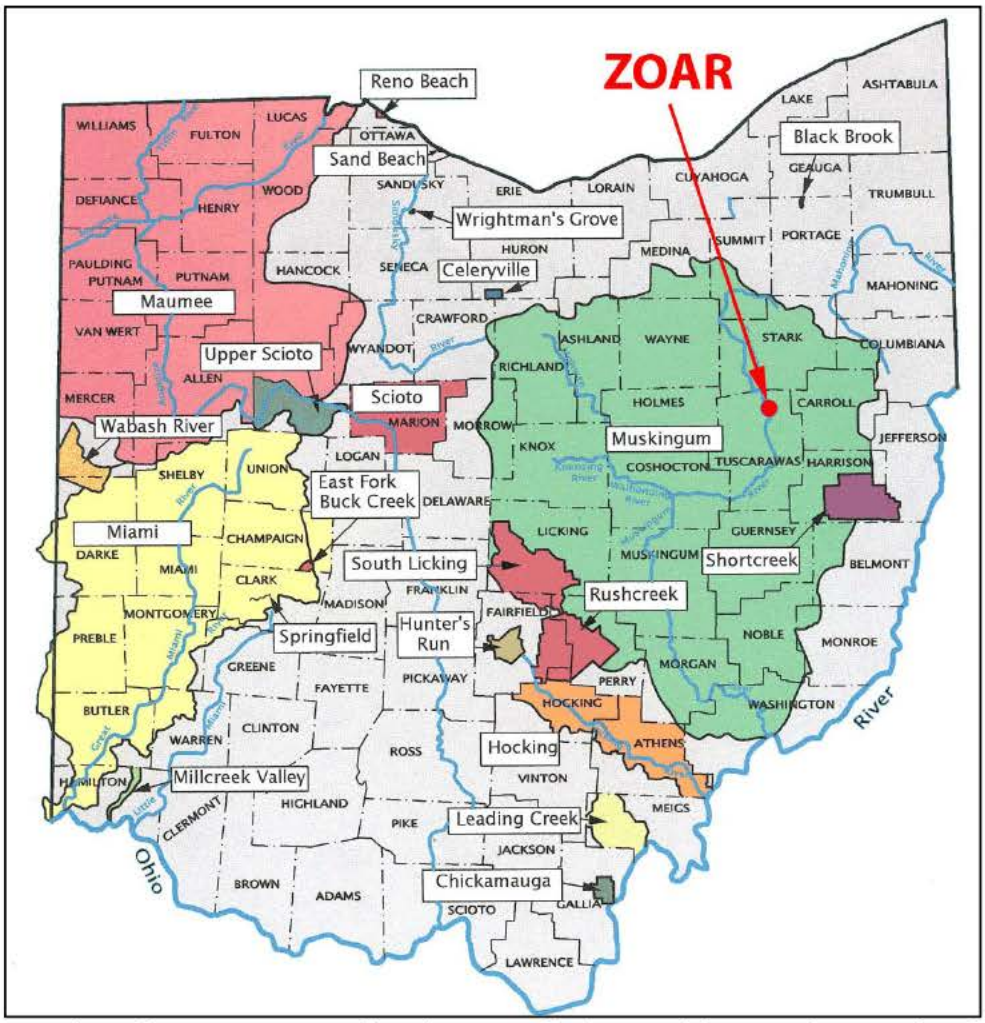

Figure 1. Location of Zoar Levee & Diversion Dam in the Muskingum River Basin within State of Ohio.

Zoar Levee and Diversion Dam are part of the Muskingum River Basin System (Figure 1). The Muskingum River Basin is the site of Ohio's first multiple purpose water management and land conservation river basin project. Zoar Levee and Diversion Dam were constructed to help protect Zoar Village from water being impounded by Dover Dam, located 4 miles downstream on the Tuscarawas River (Figure 2). Without Zoar Levee and Diversion Dam, all portions of

Zoar Village located at or below elevation 916 feet (ft) above mean sea level (amsl) would have been evacuated at the time of Dover Dam's construction in the mid 1930s. Elevation 916 ft is Dover Dam's spillway and the flowage easement the federal government maintains upstream of Dover Dam.

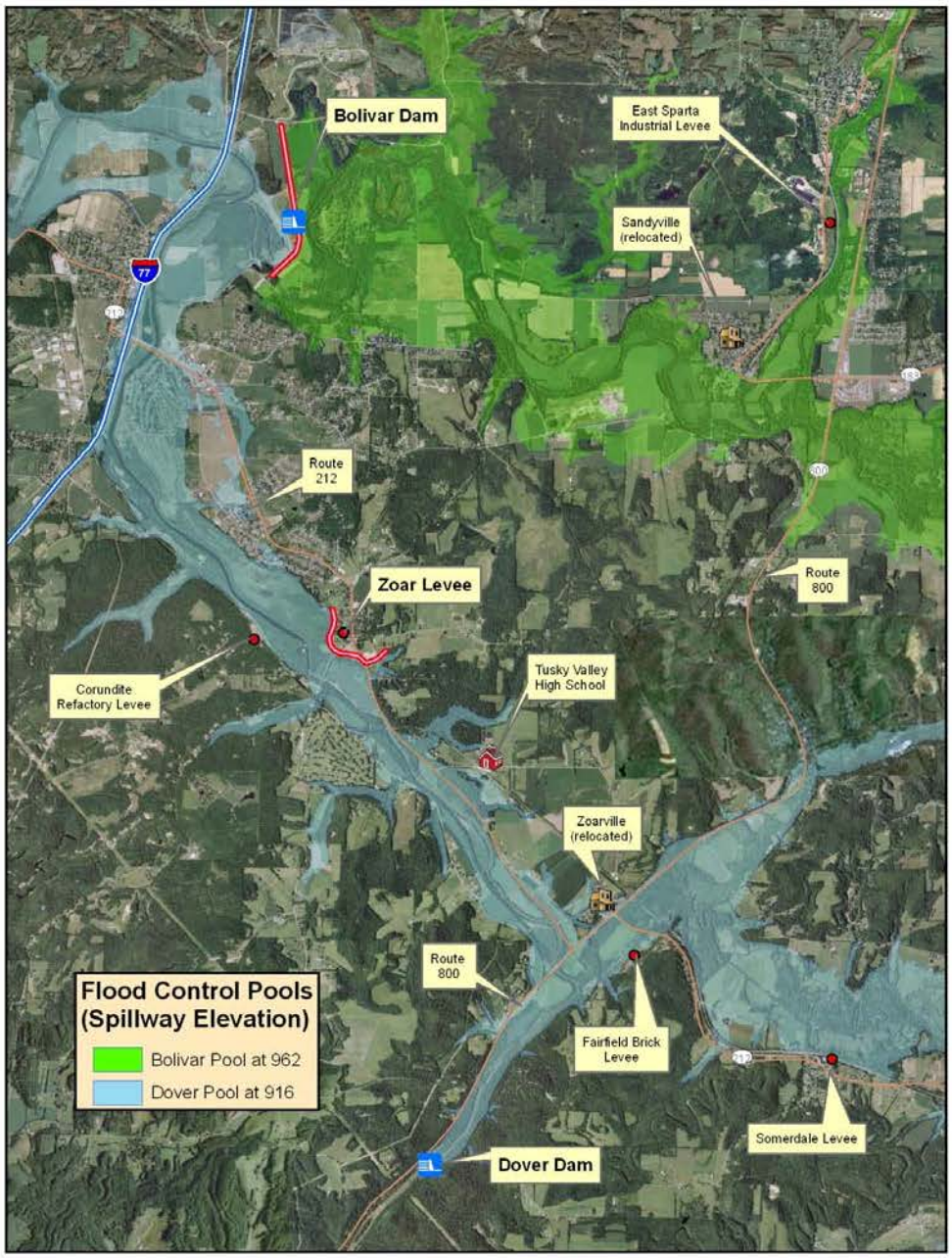

Figure 2: Zoar Levee & Diversion Dam in Relation to Dover Dam and flowage easement**.** Also charted is Bolivar Dam and its flowage easement located upstream of Zoar Levee & Diversion Dam.

For this study, a baseline study area (Figure 3) was defined by Huntington for the DSMS to encompass the incorporated boundary of Zoar Village, the current National Register of Historic

Places boundary for the Zoar State Memorial Site, the limits of elevation 916 feet above mean sea level (AMSL) behind Zoar Levee and Diversion Dam (which corresponds to the flowage easement maintained for Dover Dam), plus some extra area. The purpose of the study area is to allow Huntington to gather baseline data on a number of lines of inquiry, including but not limited to community impacts, historic properties, terrestrial and aquatic habitats, economics, and hazardous, toxic, and radioactive waste (HTRW) over a large area to allow for consideration of potential effects to a wide range of significant resources during the formulation, evaluation and comparison of alternatives. The area labeled as a "Real Estate Exclusion Area" was those portions of Zoar Village where rights of entry were not sought by the federal government for this study, as it was determined that terrestrial and aquatic baseline data could be achieved from publically accessible rights-of-way (e.g. public roads).

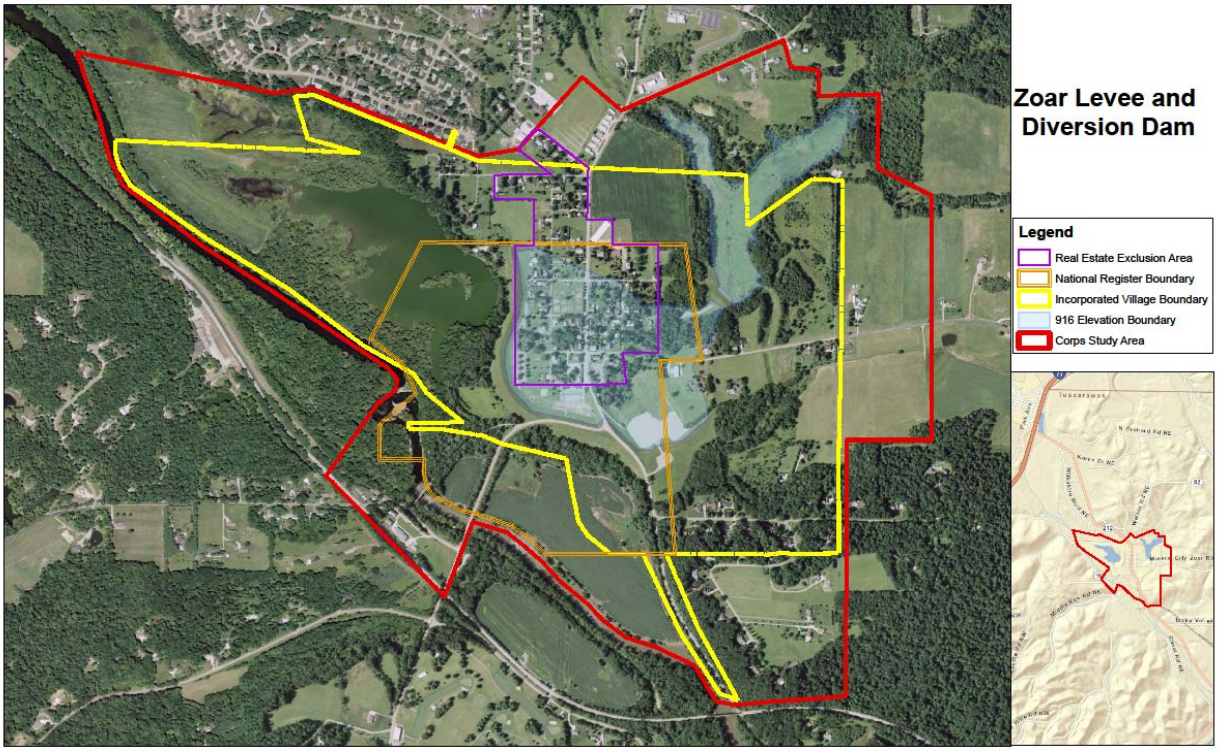

Figure 3: Baseline Planning Assessment Study Area.

The purpose of this study was to define significant terrestrial and aquatic habitat within the study area to aid Huntington consider effects to any significant ecological resources as it formulates, evaluates and compares potential risk management alternatives. Specifically, this data shall aid Huntington it attempting to identify alternatives that can avoid or minimize affects when possible and when not, ensures appropriate mitigation features are identified and included in the recommended alternative. This baseline data shall also aid Huntington District in identifying the need to consult about and comply with specific environmental resource laws, including, but not limited to the U.S. Fish & Wildlife Coordination Act and the Clean Water act for any specific alternative.

Potential Waters of the U.S., including wetlands, located within the study area (Figure 2) (where access was obtained) were identified using the *1987 Wetland Delineation Manual* (Environmental Laboratory, 1987) by the U.S. Army Corps of Engineers (USACE) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountain and Piedmont Region (Version 2), April 2012*. Impacts to waters of the United States are regulated by the USACE and the United States Environmental Protection Agency (USEPA) through Section 404 of the Clean Water Act (33 U.S.C. 1344). In addition, prior to federal authorization for impacts to waters of the United States, certification must first be obtained from the State as defined in Section 401 of the Clean Water Act (33 U.S.C. 1341).

For ecologically significant habitats, the study area was qualitatively assessed for unique habitats and the potential presence of threatened or endangered species.

A field investigation was conducted for all locations in which access was obtained within the study area to identify wetlands, extant streams, and ecologically significant habitats that could be impacted by a wide range of potential risk management alternatives. This information is being gathered to help Huntington District develop baseline data concerning significant environment constraint potentials to support evaluation and comparison of alternatives. The results of the review are summarized in this report after a brief history of Zoar Village and a timeline of flood risk management measures put into place and now being revisited.

II. BRIEF HISTORY OF ZOAR VILLAGE

Zoar Village is an example of an unique community with noteworthy historical significance on a national level, located in east central Ohio, along the Tuscarawas River in Tuscarawas County, about 70 miles south of Cleveland, Ohio (Figure 1). Zoar Village was established in 1817 by a group of German separatists called Zoarites, seeking a new home where they could freely practice their religion without oppression. The Society of Separatists of Zoar existed from 1817 to 1898, and at its height included over 300 members and held up to 12,000 acres of land surrounding Zoar Village. Although founded primarily as a religious community, the separatists introduced a communal system of living and work to pay their debts for land and guarantee their economic and social security.

Much of Zoar Village was documented in 1936 by the Historic American Building Survey (HABS). This study concluded that Zoar Village was "the most successful communist experiment ever conducted in the United States" (HABS 1936). In the 1960s, the Ohio General Assembly appropriated $300,000 to purchase significant buildings in Zoar Village to preserve, restore, and interpret them. The Ohio Historical Society (OHS) now manages several buildings in the Zoar Village as a State Memorial Site. In 1967, the Zoar Community Association (ZCA) was founded to ensure the preservation of Zoar Village and the surrounding areas and to assist in the maintenance of the economic vitality of the Zoar Village area. The Zoar Village State Memorial Historic District was placed on the National Register of Historic Places (NRHP) in 1969 (Pratt, 1969) for its association with the 19th Century German separatist movement and for its outstanding examples of nineteenth century architecture. The NRHP boundary was increased in 1975 (Darbee and Pratt, 1975); as currently listed, its period of significance extends from 1817

to 1898. The Historic District measures 176.7 total acres, 54 acres of which is located behind Zoar Levee within elevation 916 ft (Figure 4).

Today, Zoar Village stands remarkably intact with numerous buildings from period of significance still standing and it continues to be a heritage tourist assessment as a result of its unique history, the quality of surviving historical integrity, and an active and thriving community. Zoar Village is also listed as an important component of the Ohio & Erie Canal National Heritage Corridor. For more information concerning Zoar Village or the Ohio & Erie Canal National Heritage Corridor, please visit http://www.zca.org/home.html, http://ohsweb.ohiohistory.org/places/ne10/index.shtml, or www.ohioeriecanal.org.

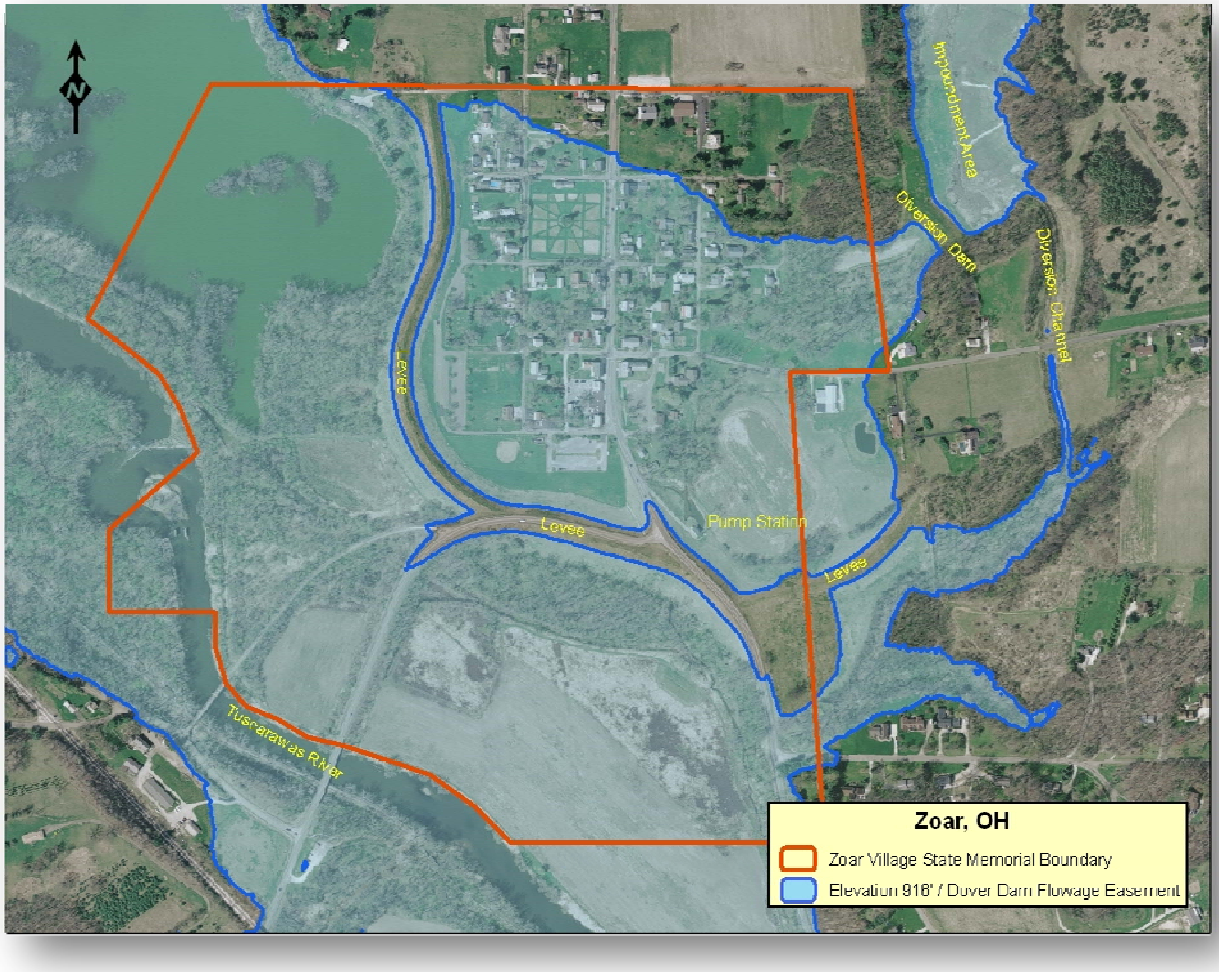

Figure 4: Current 1975 NRHP Boundary for Zoar Village State Memorial Historic District in relation to elevation 916 ft.

III. BRIEF HISTORY OF ZOAR LEVEE & DIVERSION DAM

In response to the State of Ohio's Flood of 1913, which killed over 400 people and destroyed over 20,000 homes, several studies were conducted to find the best way to manage water resources in the Muskingum River Basin. Zoar Levee and Diversion Dam is part of the Muskingum River Basin System (Figure 1). The Muskingum River Basin is the site of Ohio's first multiple purpose water management and land conservation river basin project. The Muskingum Watershed Conservancy District (MWCD) was created on 3 June 1933 for the purpose of development of this project. The initial plan called for 14 flood control reservoirs. In 1933, the Public Works Administration (PWA) awarded a grant of $22,090,000.00 to the USACE to construct the proposed plan. In 1934, the Federal Government executed a contract with the MWCD to allow the USACE to conduct investigations and draft a final plan. This official plan for the basin was approved by the MWCD on 19 November 1934. Construction of the project began in 1935 and the completed system was turned over to the MWCD in 1938. The Flood Control Act of 1939 returned the dams to the federal government and flood control operations back to USACE. Today Huntington manages these projects.

Zoar Levee is an appurtenant structure to the Dover Dam (Figure 2) which is a dry dam retaining a pool only during events to attenuate downstream flooding in coordination with other Muskingum Basin projects. Zoar Levee (Figure 5) provides flood damage reduction benefits to Zoar Village and provides protection from flooding when Dover Dam is retaining a pool above elevation 890 ft (a 3-year flood event). As such the original crest elevation of the Zoar Levee was designed to correspond to the spillway elevation of Dover Dam of 916 ft, with an additional 3 feet of freeboard for a resulting crest elevation of 919 ft. The current crest elevation, following additional work in, is 928.5 ft. The Federal Government still maintains flowage easement upstream of Dover Dam to elevation 916 ft. Without Zoar Levee and Diversion Dam, all portions of Zoar Village located at or below elevation 916 ft amsl would have been evacuated at the time of Dover Dam's construction. The Diversion Dam (Figure 5) is located on Goose Run, about 1,000 ft upstream of Zoar Levee and was built to work in conjunction with the levee. The Diversion Dam is a retention structure for runoff in the Goose Run watershed, which flows into a ponding area for the Zoar Levee pump station (Figure 5). The Diversion Channel (Figure 5) is an auxiliary spillway for the Zoar Diversion Dam.

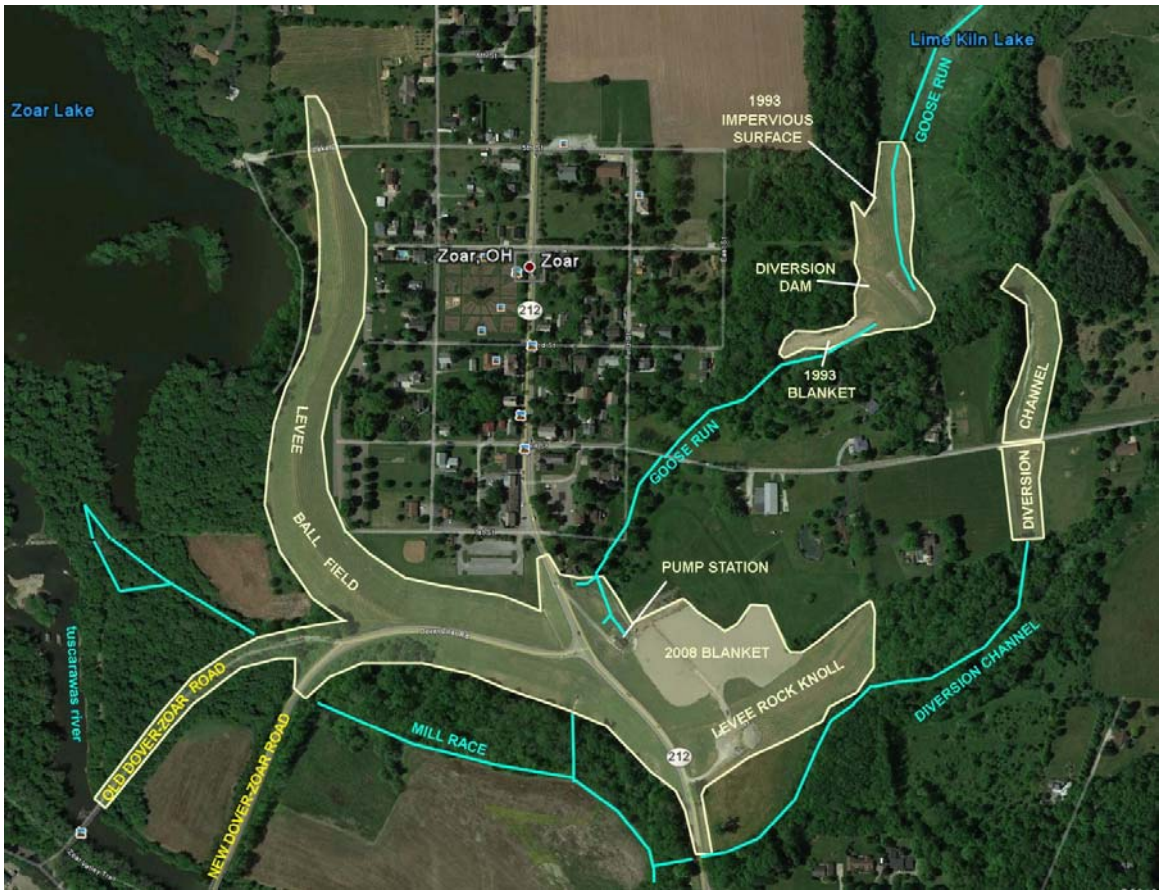

Figure 5. Aerial Photograph Displaying Components of Zoar Levee & Diversion Dam.

Original documentation concerning the decision to construct the levee verses remove the town from Dover Dam's flowage easement indicates that the MWCD and USACE considered the historical significance of the community when it originally constructed the levee.

IV. SUMMARY OF DAM SAFETY ISSUES WITH THE PROJECT

In the 1990's Huntington conducted Embankment Re-Analysis of Zoar Diversion Dam which resulted in the installation of an upstream seepage control measure and downstream seepage berm and collection system. It was also determined that Zoar Diversion Dam was not suitable for maintaining a permanent impoundment due to safety issues.

In January of 2005, a record high water event resulted in Dover Dam's impoundment reaching a record pool of elevation 907.4. Widespread small "pin" boils were noted and was more concentrated seepage. In response, Huntington installed rings of sand bags around the seeps and attempted to place a small granular filter berm to reduce the movement of soil particles. A Screening Portfolio Risk Assessment (SPRA) of Zoar Levee and Diversion Dam assigned Zoar Levee a DSAC II classification, citing "extensive seepage and small boils" and rating both the levee and Diversion Dam as "Probably Inadequate" for seepage and piping under "Normal" loading conditions.

In 2008, another significant Dover Dam pool loaded Zoar Levee for a month and peaked three feet below the 2005 pool, at 904.6 feet. The levee's performance worsened significantly, with large concentrated seepage or boils appearing at several locations within the interior of the levee.

Early during the 2008 event, large concentrated seepage locations were sand-bagged. As the pool elevation increased during the next two weeks the number of boils, the size of boils, and the total quantity of seepage across the area increased significantly. Boils repeatedly expanded and collapsed sandbag rings. Without having the benefit to be able to interpret whether the seepage was flowing solely through bedrock or dangerously along the bedrock/soil contact, the changing locations and increasing seepage quantities were considered as just cause to declare an emergency. Under an emergency situation, it was decided to install a $1.26 million seepage berm with 37,000 tons of granular material.

This event resulted in Zoar Levee and Diversion Dam being reclassified as a DSAC 1 project, as progression toward failure was believed to be potentially occurring.

V. CURRENT DAM SAFETY MODIFICATION STUDY

To find a long-term plan to reduce risk to Zoar Village, Huntington is currently preparing a DSMR for the Zoar Levee and Diversion Dam in accordance with Draft ER 1110-2-1156. This Engineer Regulation (ER) is the result of Section 2033 of the Water Resources Development Act (WRDA) of 2007, which among other things, required USACE to adopt a risk analysis approach to project cost estimates for water resource projects and ensure that the benefits and costs associated with structural and nonstructural alternatives are evaluated in an equitable manner.

A DSMR is required to justify modifying a USACE project to address risk associated with Dam Safety to meet tolerable risk guidelines with the goal being to find the best risk management plan. The objective of the DSMR is to identify and recommend an alternative risk management plan.

VI. SCOPE OF WORK

Nashville was scoped to complete four subtasks.

a) Conduct a jurisdictional evaluation for waters of the U.S. including wetlands for the study area. The jurisdictional evaluation was completed by a qualified scientist using the *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region, July 2011 (ERDC/EL TR-10-9).* This evaluation determined if wetlands, watercourses or bodies of water were present in the study area, and if found, obtained their accurate size, shape, and location. Nashville also evaluated the quality of each water body using current Ohio Environmental Protection Agency protocols (ORAM or HHEI/QHEI). This evaluation included photographs documenting site conditions and vegetation during fieldwork. Additionally, the following background documentation was reviewed: National Wetland Inventory (NWI) Map, Flood Insurance Rate Maps (FIRM) Floodplain Maps, Aerial Photography, U.S.

Geological Survey (USGS) Topographic Map, and Tuscarawas County Soil Surveys. Nashville also examined aquatic resources for suitable habitat of federal and state protected species.

b) Qualitatively determine the presence of ecologically significant habitat. Initially, it was thought that this assessment would require a significant portion of the report. However, it was determined that the extent of anthropogenic disturbance resulted in a lack of any high quality or ecologically significant habitats. As a result, this task was minimized accordingly.

c) Combine all results of these studies into the following technical report and incorporated all relevant geographic data on GIS layers using ArcView 9.2.

VII. STUDY AREA DESCRIPTION

The following provides brief physical description of the Study Area, including information the physiographic, hydraulic, pedologic, and built environment.

The Study Area is located within the unglaciated Muskingum-Pittsburg Plateau region of the Allegheny (Kanawha) Plateaus section of the Appalachian Plateaus physiographic province. Muskingum-Pittsburg Plateau is described as a moderately high to high relief (300 ft – 600 ft) dissected plateau having broad major valleys that contain outwash terraces and tributaries with lacustrine terraces, medium-grained bedrock sequences. Elevation within the Study Area ranges from between 860 to 1,063 AMSL.

Bedrock geology for the area is generally Mississippian and Pennsylvanian-age siltstones, shales, sandstones, and economically important coals and claystones, with Wisconsian-age sand, gravel, and lacustrine silt and silt-loam colluviums. Bedrock geology specifically for the study area is jointed and fractured sandstone and limestone with interbeds of shale (Kays et al., 2009). Glacial outwash and lake deposits occurred in the floodplains and other low lying areas that existed below the glacial margin; these deposits generally consist of gradational layers of clays, silts, sands, and gravels. Regionally, these sands and gravels are good groundwater resources with many natural springs.

Major landforms in the Study Area include fluvial channels (e.g. Tuscarawas River / Goose Run), alluvial floodplains, wet and dry artificial impoundments (e.g. Zoar Lake, Goose Run Impoundment), glacial outwash terraces, and anthropogenic modifications (e.g. Ohio & Erie Canalway, Zoar Levee & Diversion Dam, Zoar Diversion Channel).

The study area is located within Ohio Soil Region 11 (Coshocton-Westmoreland-Berks Region) (ODNR-DSWR 2012) and contains soils belonging to the Wheeling-Chili-Tioga soil association This soil association is described as consisting of “deep, nearly level to strongly sloping, well drained soils formed in loamy material, glacial outwash, and alluvium; on outwash terraces and floodplains” (USDA-SCS 1986:10). Twenty-three separate soil units, exhibiting a wide range of characteristics, are found within the study area. Thirteen distinct soil series, including two soil

series that develop on land that has been surface mined, and two man-made soil units, are represented. The soils found in the study area generally fall into one of three broad categories: well drained soils that people may have found attractive for long-term habitation and use; poorly drained soils that people would find unsuitable for long-term use, but which may have been used for short-term or specialized activities; or soils that have been heavily disturbed by large scale construction or industrial activities. Additional details on the soil series and the specific soil units found within the study area are discussed below. A soil map for the vicinity of the study area is shown in **Error! Reference source not found.** The following provides brief description of each soil series represented.

Coshocton Series soils are moderately well drained soils originating in colluvium and residuum from siltstone, sandstone, or shale bedrock, hence the presence of channery in the soil. These soils are found on ridge tops and hillsides in the uplands (USDA-SCS 1986:89). These ridge top locations and well draining nature made these areas attractive for longer term human occupations. One such relatively level area of Coshocton silt loam, 3 to 8 percent slopes (CpB), occurs on the upland landform that encompasses the housing development on Michael Lane, in the far southeastern part of the study area. Two small areas of Coshocton-Guernsey silt loams, 8 to 15 percent slopes (CsC), are located in the east central part of the study area adjacent to the Bethesda soils found in this area. Another small area of this soil type is found in the far northeastern corner of the study area. A narrow strip of Coshocton-Guernsey silt loams, 15 to 25 percent slopes (CsD), underlies the railroad bed from its intersection with Dover-Zoar Road, northwest to just south of Ebert Road. A very small area of Coshocton-Guernsey very stony silt loams, 8 to 15 percent slopes (CtC), is located in the far southeastern corner of the study area.

Fitchville Series soils are somewhat poorly drained soils originating in sediments deposited in former lakes that are now slack water terraces (USDA-SCS 1986:91). Long-term human occupation of land with poorly drained soils is unlikely, although short-term or specialized activities may have taken place at such locations, or around the edges of such areas. A large area of Fitchville silt loam, 0 to 3 percent slopes (FcA), abuts Zoar Lake on the lake's northern and western sides. Another, smaller area of this soil is located in the center of the study area and encompasses the location of the Zoar Pump Station and points immediately north of the Zoar Pump Station, on the presently undeveloped north side of 2nd Street.

Hazelton Series soils are well drained soils originating in colluvium and residuum from sandstone bedrock, hence the presence of channery in the soil. These soils are found on ridge tops and hillsides in the uplands (USDA-SCS 1986:93). These ridge top locations and well draining nature made these areas attractive for longer term human occupations. Narrow bands of Hazelton channery loam, 8 to 15 percent slopes (HeC), and Hazelton channery loam, 25 to 40 percent slopes (HeE), can be found in the southeastern part of the study area surrounding a level upland landform that encompasses the housing development at Michael Lane.

Linwood Series soils are very poorly drained soils originating in organic deposits with recent alluvium in the surface layer. Linwood soils are found in depressions on glacial outwash plains (USDA-SCS 1986:95). Long-term human occupation of land with poorly drained soils is unlikely, although short-term or specialized activities may have taken place at such locations, or

around the edges of such areas. A narrow band of Linwood mucky silt loam, ponded (Ln), is found in the far northwestern part of the study area, south of Hess Mill Road.

Morristown Series soils are well-drained soils that occur in areas that have been surface mined, and often later cultivated, if top soil is replaced or the area is reclaimed. As a result of this history, Morristown soils have a shallow top soil horizon that transitions immediately to the soil horizon arising from the bedrock (C horizon) (USDA-SCS 1986:96). Because these soils have been mined and possibly reclaimed, there is very little to no chance that archeological remains pre-dating the time of mining will be preserved. An area of Morristown loam, 0 to 8 percent slopes (MrB), is located in the east central portion of the study area, east of Goose Run Impoundment, adjacent to the study area boundary.

Nolan Series soils are well drained soils originating in alluvium on floodplains. Nolan soils are found on floodplains (USDA-SCS 1986:96). Because these soils are well drained, there is a greater probability that humans found level areas having these soils attractive for longer-term habitation. A narrow band of Nolan silt loam, occasionally flooded (No), is located in the south-southwest part of the study area along the Tuscarawas River, southeast of Dover-Zoar Road.

Orville Series soils are somewhat poorly drained soils originating in alluvium on floodplains. Orrville soils are found on floodplains (USDA-SCS 1986:97). Long-term human occupation of land with poorly drained soils is unlikely, although short-term or specialized activities may have taken place at such locations, or around the edges of such areas. Large areas of Orrville silt loam, occasionally flooded (Or), are found within the southern one-half of the study area along the Tuscarawas River. A small area of this same soil is found in the southeastern portion of the study area along what appears to be a small stream. Two additional, very small areas of this soil are found in the north central and northeastern parts of the study area: one is at the north end of the western branch of the Goose Run Impoundment, the other at the northeast end of the eastern branch of the Goose Run Impoundment.

Plainfield Series soils are excessively drained soils originating in sandy outwash deposits. These soils are found on glacial outwash terraces and stream terraces (USDA-SCS 1986:97). Because these soils are well drained, there is a greater probability that humans found level areas having these soils attractive for longer-term habitation. A large area of Plainfield loamy sand, 3 to 8 percent slopes (PwB), is found in the east central and southeastern portion of the study area; this area of Plainfield soil is roughly bounded by State Route 212 on the west, Hickory Lane on the south, the study area boundary and other soil types on the east, and Township Highway 387 on the north.

Sparta Series soils are excessively drained soils originating in sandy outwash deposits. These soils are found on glacial outwash terraces and stream terraces (USDA-SCS 1986:100). Because these soils are well drained, there is a greater probability that humans found level areas having these soils attractive for longer-term habitation. A small area of Sparta loamy fine sand, 0 to 3 percent slopes (SpA), is found at the south end of Zoar Lake, on either side of the old road bed of First Street west of the Zoar Levee.

Wheeling Series soils are well drained soils originating in loamy material and the underlying glacial outwash. These soils are found on outwash terraces (USDA-SCS 1986:103). Because

these soils are well drained, there is a greater probability that humans found level areas having these soils attractive for longer-term habitation. Wheeling loam, 0 to 3 percent slopes (WrA), is found on the northwest side of the study area at the northwest end of Zoar Lake, and on both sides of SR 212, just north of the y-intersection at SR 212 and County Highway 82, on the north side of town. A small area of Wheeling Urban land complex, nearly level (WsA), is located in the northern portion of the study area in association with the housing along Hess Mill Road.

Pits, Gravel, symbolized by the letter combination Pt, are areas that have been surface mined for sand and gravel that is later used in construction. The pits typically occur on outwash terraces and in areas that have Chili, Conotton, or Wheeling soils underlain by glacial outwash (USDA-SCS 1986:48). Areas that have been surface mined are not favorable for the preservation of archeological remains because of the removal of the natural top soil. A comparatively small area of pits is mapped in the far northeastern portion of the study area, overlapping a borrow area for construction of the Zoar Levee, as depicted on the 1935 as-built drawings. The mapped pits area encompasses approximately one-third of the borrow area.

Udorthents soils are areas of cut and fill typically occurring in construction areas along highways and other large public works such as dams and levees, and in urban areas (USDA-SCS 1986:54). Areas where cutting and filling has taken place are not usually favorable for the preservation of archeological remains because of the disturbance to the natural top soil. There are two comparatively small areas of Udorthents, hilly (Ua), in the southern part of the study area: one is such area is located at the southern tip of Zoar Lake, and the other area is located on the south side of the river, west of Dover-Zoar Road and north of County Highway 111. A much larger Udorthents area is located east and south of Goose Run Impoundment (a.k.a. Lime Kiln Lake), on the north side of 2nd Street (Township Highway 387). According to the 1935 as-built drawings, only three-quarters of this area mapped as Udorthents was used as a borrow area for the construction of the Zoar Levee.

The Study area lies within Ohio's largest watershed, the Muskingum River Basin, covering more than 8,000 square miles or approximately 20% of the state. The Tuscarawas River is the largest hydrologic features in the Study Area. The Tuscarawas River rises in Stark County, Ohio, above the Portage Lakes region lying near Akron and North Canton. From its source, it flows north westerly into Summit County, then westerly to Barberton, where it turns south to its junction

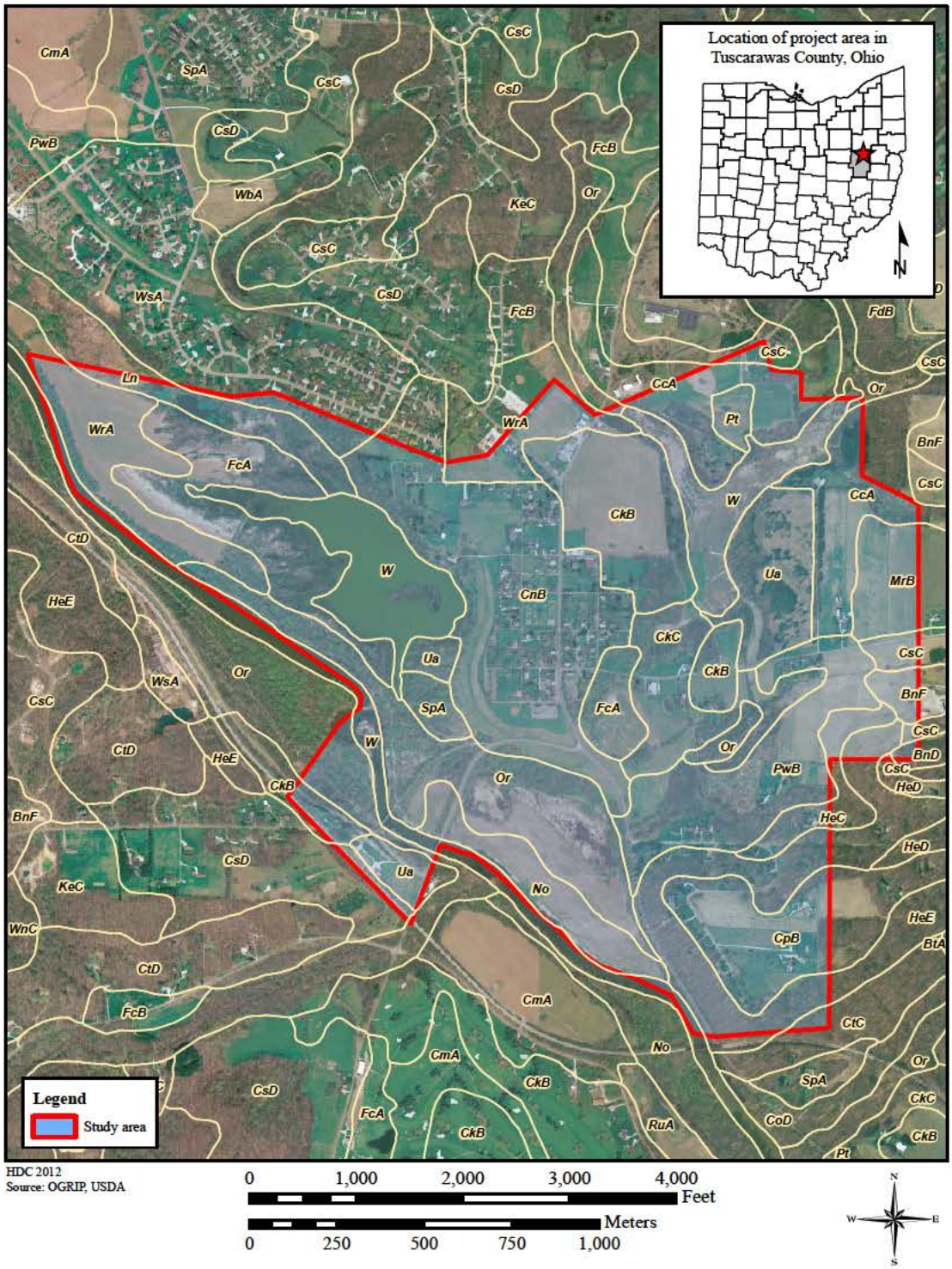

Figure 6. Soils Map for Study Area

with Chippewa Creek, then southeasterly passing through Massillon, Bolivar and Zoar, to the mouth of Conotton Creek, then southwesterly to Dover and the mouth of Sugar Creek, then southerly to New Philadelphia, then southwesterly to the mouth of Stillwater Creek, then southwesterly to Newcomerstown, and finally westerly to its junction with the Walhonding River. The Tuscarawas River joins the Walhonding River near Coshocton, Ohio and together they form the Muskingum River.

There is one named tributary to the Tuscarawas River within the Study Area, Goose Run. The Goose Run basin is approximately 2.5 square-miles. There are three unnamed tributaries of Goose Run. Other hydrologic features include an unmanned tributary to the Tuscarawas River, located along its right descending bank, and five man-made features. The man-made features include: 1) the Zoar Diversion Channel, which intercepts the feeders to Goose Run; 2) Zoar Pump Station Ponding Area, which was constructed in the 1950s at the point where Goose Run intercepts Zoar Levee; 3) Zoar Lake, which impounded another feeder of the Tuscarawas River in the early twentieth century; 4) the ruins of the Ohio & Erie Canal; and 5) the ruins of a nineteenth century mill race.

Other reported hydrologic features within the Study Area include several natural springs. Some springs can be observed today within the Goose Run Impoundment, the Zoar Diversion Channel and along Fourth Street in Zoar Village. It is suspected other exists.

Large scale anthropogenic activity has occurred within the Study Area, starting in 1817 with the settlement of Zoar Village. During the nineteenth century many continued modifications were made to the study area. Tens of homes, industrial, recreational, and commercial buildings were constructed. Large portions of the study area located along bottomlands of the Tuscarawas River were improved and plowed for agriculture. A stone dike or levee was built along the left descending bank of the Tuscarawas River. Starting in the 1830's the Ohio & Erie Canal was constructed, and canal feeder locks and mill races were constructed that bisect the Study Area today. A low head timber-cribbed stone dam was constructed across the Tuscarawas River to help feed mill races and allow canal boats to cross it. Many springs were also tapped and piped to building to aid in producing, among other things, dairy products. A railroad also bisected the study area in the late nineteenth century and crossed the Tuscarawas River.

Many improvements were also made during the early twentieth century. The Ohio & Erie Canal bed in the study area was altered to create a fish hatchery. The dam across the Tuscarawas River was improved to facilitate construction of a hydroelectric power plant. Zoar Lake was impounded by a concrete dam and stone dike to provide a recreational lake. A small lake was created in the current location of the Goose Run Impoundment for lime kilns and a never-constructed brewery.

In the 1930's major alterations were made to the Study Area with construction of Dover Dam, approximately four miles downstream. While, large portions of the study area had to be evacuated for impoundment required for this dam, Zoar Levee and Diversion Dam, including the Diversion Channel were constructed at this time. The construction of these flood control features greatly altered the topographic, physiographic and hydrologic nature of the Study Area. This

project was improved in the 1950s, when the levee was raised approximately 9.5 feet and a pump station was added where Goose Run intercepts the levee.

Development following the 1930's flood control project has been limited to those areas outside of Dover's flowage easement and has largely been limited to residential housing. Major exceptions, include the improvement and re-routing of Dover-Zoar Road across Zoar Levee and the Tuscarawas River. However, recently, the Ohio & Erie Canal toe path has been improved for a recreational trail.

VIII. INVESTIGATIVE METHODOLOGY

Field investigations were conducted in June 2012 to determine the location and extent of ecologically significant habitats and of Waters of the United States, including wetlands, streams, and open water areas. Areas identified as potential waters and areas that exhibited all three indicators of potential jurisdictional wetlands were noted. Identification of potential wetlands required characterization of plant community types, identification of hydric soils, and hydrologic indicators for each community type. Stream channels were identified based upon the presence of an Ordinary High Water Mark, along with a defined bed and bank.

For ecologically significant habitats, the study area was qualitatively assessed for unique habitats and the potential presence of threatened or endangered species. Because of historical and ongoing anthropogenic impacts, this assessment quickly resulted in the finding that no ecologically significant habitats exist within the study area. As such, this report is focused on the field investigations for Waters of the United States.

According to the Federal Register (1980;1982), wetlands are defined as *Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.* Under normal site conditions, all three indicators of jurisdictional wetlands, including the presence of hydrophytic macrophytes, hydric soils, and certain hydrologic indicators, must be identified to meet the criteria for a jurisdictional wetland (Environmental Laboratory, 1987).

For all potential wetland areas, dominant species in the tree, sapling / shrub, woody vine, and herbaceous layers were determined for all jurisdictional areas in accordance with the 1987 Wetland Delineation Manual. Recorded vegetative data consisted of herbs with the greatest percentage of aerial cover within 5 ft of the plot center. Within a 30 ft radius of the plot center, saplings and shrubs with the greatest height, trees with the largest relative basal area, and woody vines with the greatest number of stems were recorded. Species within each of these layers were listed on data forms. Characteristics of each community type (upland and wetland) were recorded on data forms and sample points were chosen to represent both an identified potential wetland and its surrounding upland community. These data points were recorded with a Global Positioning System (GPS) hand held unit. Boundaries of areas in which all three wetland criteria

were met were identified and measured in the field. Points at which dominant vegetation species changed from wetland to upland, where soils changed from hydric to non-hydric, or where indicators of wetland hydrology were no longer observed were marked in the field and recorded using GPS. These points were then utilized to generate the delineation maps in the various appendices.

Dominance was determined for each stratum individually and dominant species included those that consisted of 50 percent of the total dominance measure for a stratum, plus any additional species comprising 20 percent or more of the total dominance measure of a stratum. Hydrophytic vegetation was determined to be present when more than 50 percent of the dominants in a sample area were listed as facultative (FAC), facultative wetland (FACW), or obligate wetland (OBL) plants according to Reed (1988).

Soil data were collected by extracting a 20 inch deep soil test pit (where possible) to determine the soil series or phase. Soil matrix and mottle colors were identified using a Munsell Soil Color Chart (Macbeth, Revised 1992). Evidence of any other hydric soil characteristics and evidence of the presence of wetland hydrology were also recorded. The study area is located within the Major Land Resource Area 124 within Land Resource Region N, definitions of which were both referenced when characterizing soil profiles.

U.S. Fish and Wildlife Service (USFWS) has developed a geospatial National Wetlands Inventory (NWI) which shows topographical maps that categorize wetlands and deepwater habitats throughout the United States. The wetlands investigated throughout the study area were checked for inclusion in the NWI. Often, the actual limits of the wetlands differ from those reported in the NWI, as this tool is not meant to define the limits of jurisdiction for Waters of the U.S. Flood Insurance Rate Maps (FIRM) Floodplain Maps, developed by the Federal Emergency Management Agency (FEMA), were also referenced.

V. SITE DESCRIPTIONS

Ecologically Significant Habitats

There were no ecologically significant habitats found within the study area. Besides the wetland habitats described below, the only other natural habitats were three open fields and a few parcels of upland forests. The open fields were dominated by a variety of grasses, with small rodents and the typical variety of birds present. The upland forests were all second growth, unmanaged forests, with no notable species or specimens. Wildlife observed throughout the study area included the usual range of deer, snakes, frogs, and birds. Species were noted on original field forms.

Waters of the United States

Twelve wetlands consisting of approximately 354 acres were recorded within the study area (Figure 7). Several of these wetlands extend beyond the study boundaries, and more wetlands may be present within the study boundaries on properties with restricted access. All wetland and stream boundaries that abut the Zoar study area should be considered arbitrary as no attempt was

made to continue the assessments outside of this area. Dominant vegetation within the wetland areas, hydric soil conditions, and wetland hydrologic indicators found at each site are described below based on the delineation forms that are located in each respective site Appendix. Map of delineated wetland, topographic map, soils map, NWI maps, photographs, and field data sheets can also be found in the respective site Appendix.

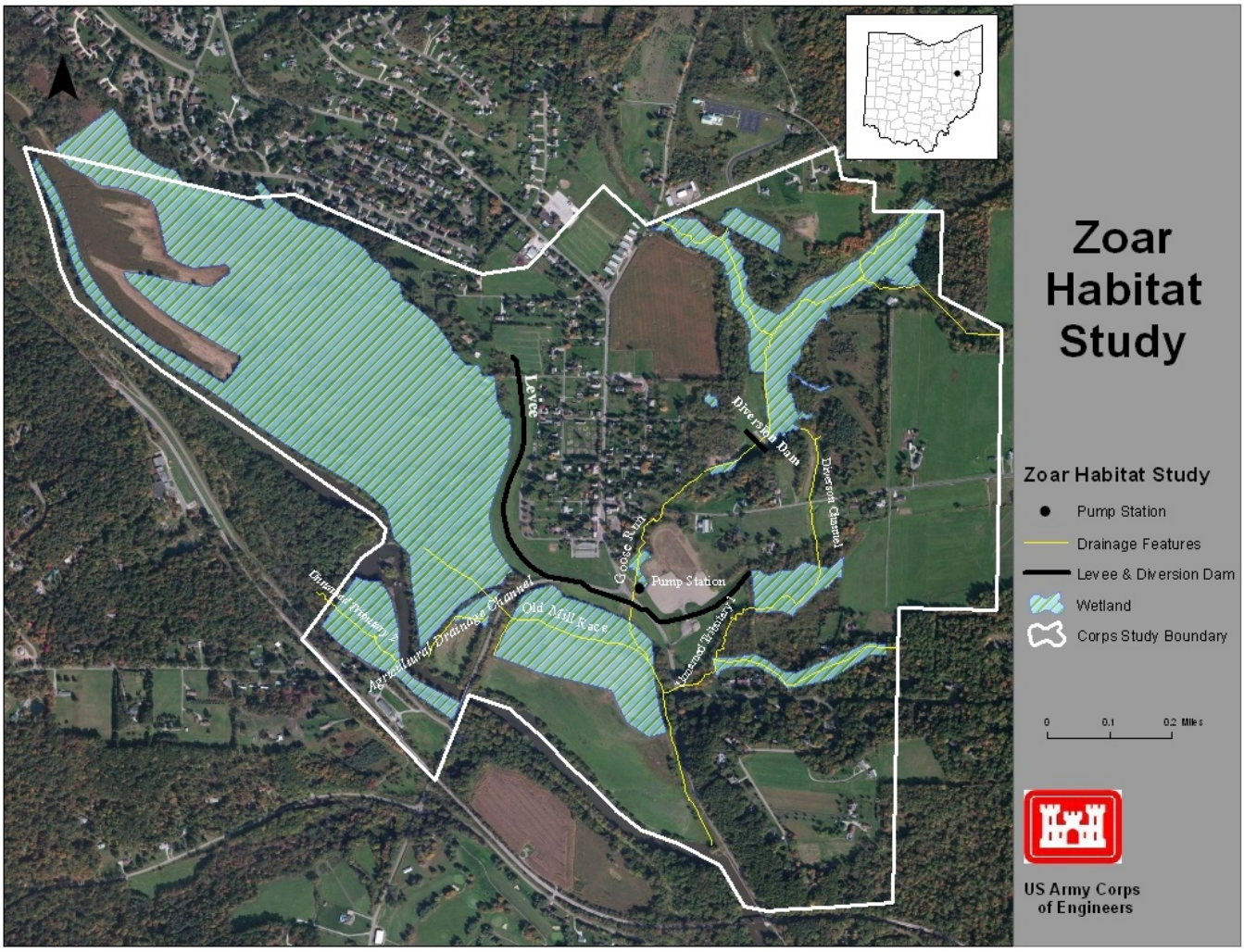

Figure 7. Zoar Habitat Study map showing delineated waters.

Wetlands

Wetland 1

The Wetland 1 (elevation 920 ft amsl) is located west of Goose Run Impoundment (Lime Kiln Lake), south of 5th Street, and East of East Street. This wetland is a depressional wetland, most likely created by the extensive earth moving that has occurred in this plot of forest. The wetland is not listed on the NWI, nor is it mapped as any specific zone on the FIRM maps. The 1912 and 1944 United States Geologic Survey (USGS) 15 minute quadrangle Canal Dover (quad) maps

and the 1961, 1994, and 2010 USGS 7.5 minute topographic quadrangle Dover (quad) maps do not depict this area in detail. This wetland is visible on aerial photography as saturated.

A wetland was identified which encompasses 1.37 acres (Figure 8), a small portion of this is forested area.

Wetland 1 is a small depression in a forested plot. This forested depression wetland has an undulating ground surface and is mostly surrounded by a berm. The berm is tallest on the west side at 4 to 5 ft, and it is barely visible on the northeast side. No apparent drainage enters this wetland. Drift deposits and drainage patterns were observed as the indicators of wetland hydrologic conditions. Hydrophytic vegetation includes American elm, green ash, clear weed, silver maple, yellow marsh marigold, Clayton's bedstraw, false nettle, and swamp smartweed; poison ivy was a dominant plant in this forest. Large woody debris and standing dead trees were present within the wetland, however, were not present along the forest edge. Soils were identified as hydric with low-chroma colors and redoximorphic ped features. Map of delineated wetland, topographic map, soils map, photographs, and delineation forms can be found Appendix 1.

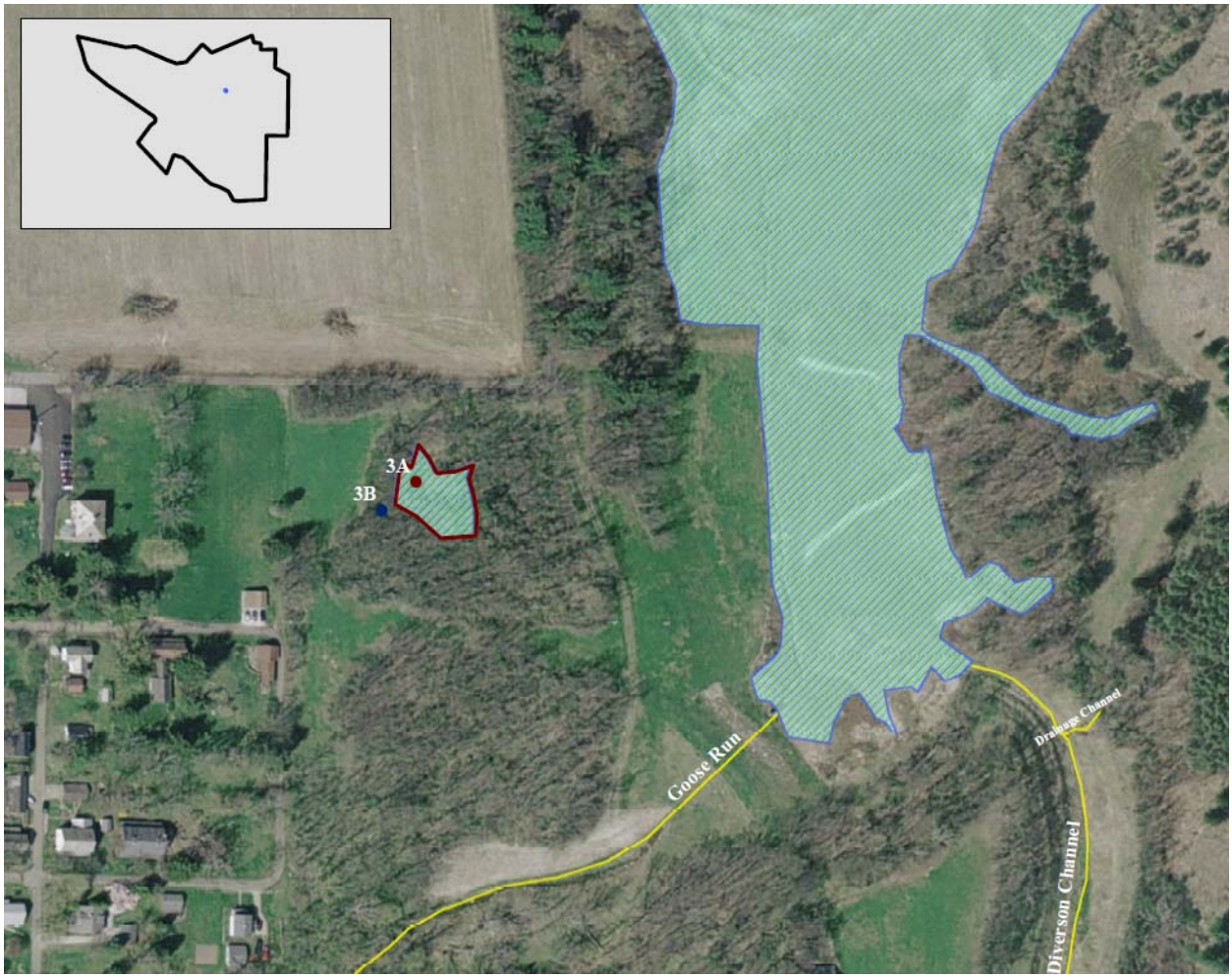

Figure 8. Aerial map showing Wetland 1 outlined in red with vegetation plots 3A and 3B.

Wetland 2

The Wetland 2 (elevation 920 ft amsl) is located northwest of Goose Run Impoundment. This wetland is connected hydraulically to the Goose Run Impoundment under the property owner's driveway. Although a culvert could not be located during the survey, there was flow coming from under the driveway. The wetland is listed on the NWI as a palustrine, unconsolidated bottom, intermittently exposed wetland (PUBG). It is also listed as Zone A on the FIRM maps, meaning a special flood hazard area subject to inundation by the 1% annual chance flood, but has no base flood elevation determined. The 1912 and the 1944 quad maps do not depict this area in detail. The 1961, 1994, and 2010 quad maps depict this wetland as a lake, This wetland is also continually visible on aerial photography as inundated.

A wetland was identified which encompasses 3.56 acres, the entire depression (Figure 9). The NWI map only depicts 0.36 acres as wetland. Wetland 2 is a large depression which was historically used as a barrow area for construction projects associated with the Zoar Levee. This depressional wetland contains a small mudflat area and a larger open water area; encircling this is scrub/shrub with mature trees on the top of the scarp surrounding the depression. No apparent drainage enters this wetland, except for a possible subterranean connection to a neighboring depression (. Saturated soils, standing water, and water marks were observed as the primary indicators of wetland hydrologic conditions. Aquatic vegetation dominates this wetland with duckweed, water plantain, swamp smartweed, broadleaf cattail, and common spikerush. Soils were identified as hydric with low-chroma colors with very high organic matter content. Map of delineated wetland, topographic map, soils map, NWI map, photographs, and delineation forms can be found Appendix 2.

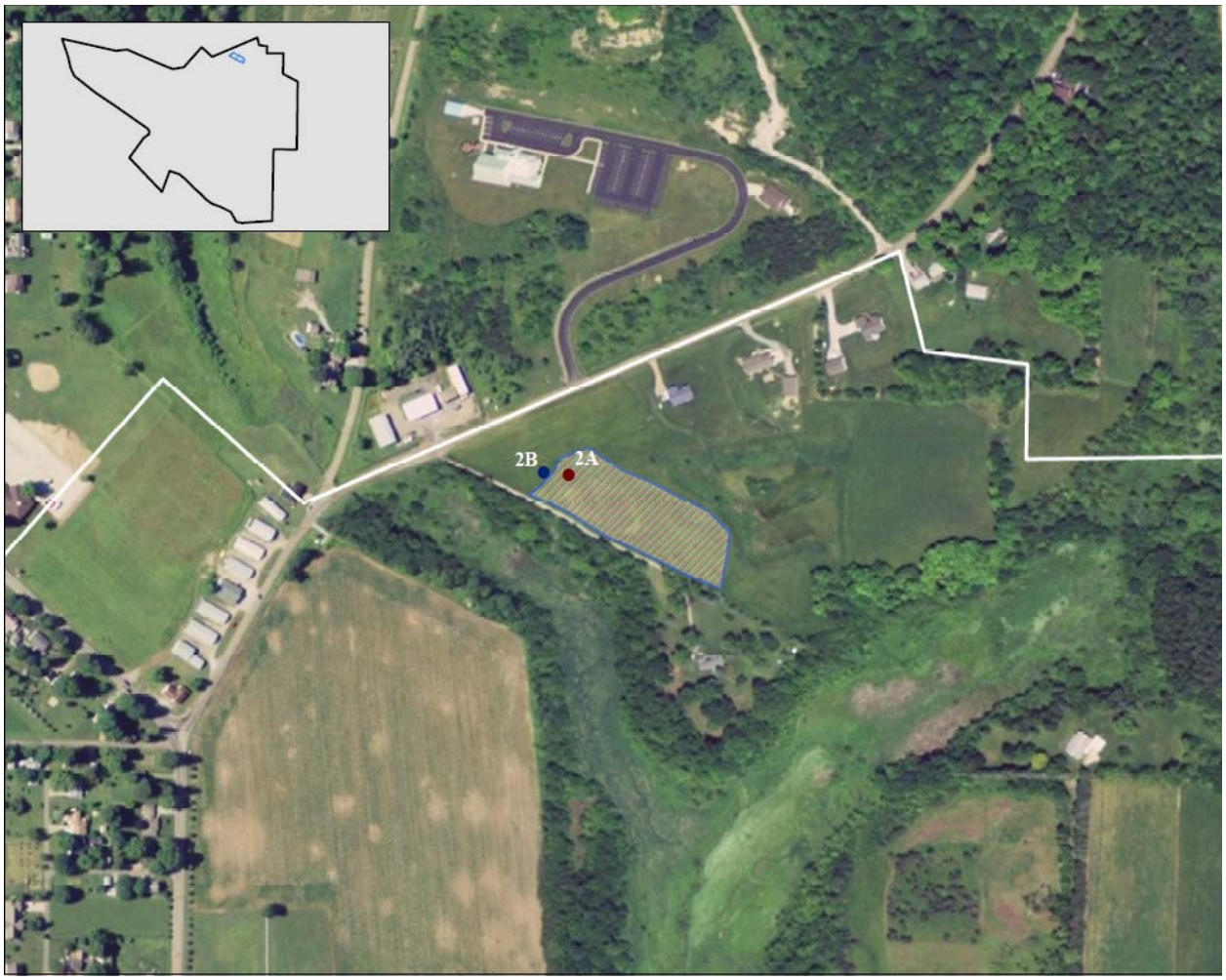

Figure 9. Aerial map showing Wetland 2 outlined in blue with vegetation plots 2A and 2B.

Goose Run Impoundment (Lime Kiln Lake) Wetland

Goose Run Impoundment (elevation 915 ft amsl) is located northeast of Zoar Village proper and is surrounded by private land. Goose Run Impoundment Wetland is listed on the NWI as a palustrine, emergent, persistent, seasonally flooded wetland (PEM1C). It is also listed as Zone A on the FIRM maps, meaning a special flood hazard area subject to inundation by the 1% annual chance flood, but has no base flood elevation determined. The 1912 and 1944 quad maps depict this area, as the un-impounded Goose Run. However, the 1944 quad is clearly mistaken, as Goose Run was impounded at this time by the Zoar Diversion Dam. The 1961, 1994, and 2010 quad maps depict the Goose Run Impoundment Wetland as Lime Kiln Lake. This colloquial name actually referred to small lake that was impounded in the early twentieth century prior to the construction of the Zoar Diversion Dam. As previously mentioned, the Goose Run Impoundment located behind the Diversion Dam was drained in 1992 and this area has not retained a permanent pool of water since. However, temporary pools of water have built up behind the Diversion Dam due to flashy storm events. These typically drain with 24 hours of impoundment. Goose Run and bifurcated upland input channels bisect the wetland.

The Goose Run Impoundment encompasses 22.8 acres, or the entire extent of the Goose Run Impoundment, which was elevation 916 feet above mean sea level. It is believed that the boundaries for this wetland extend beyond the Study Area. Based upon the USFWS NWI maps, the entire wetland most likely encompasses 26.5 acres. This wetland can be best described as a wetland/upland complex because of the heterogeneity of the habitat.

Goose Run Impoundment Wetland is dominated by emergent vegetation with reed canary grass present almost everywhere, but only dominant near Plot 1A (Figure 10). Other emergent vegetation consists of broadleaf cattail, numerous sedges, and numerous rushes. The forested portions of this wetland were primarily the three areas of springs; these were dominated by skunk cabbage, poison ivy, silver maples, and American elms. These skunk cabbage areas are fed by numerous springs along the hillside. Shrubby areas were dominated by elderberry, multiflora rose, and blackberry. Soils were identified as hydric with gleyed or low-chroma colors and were very mucky (high amounts of decomposing organic matter). Saturated soils, drainage patterns, high water table, and hydrogen sulfide odor were observed as the primary and secondary indicators of wetland hydrologic conditions. Map of delineated wetland, topographic map, soils map, NWI map, photographs, and delineation forms can be found in Appendix 3.

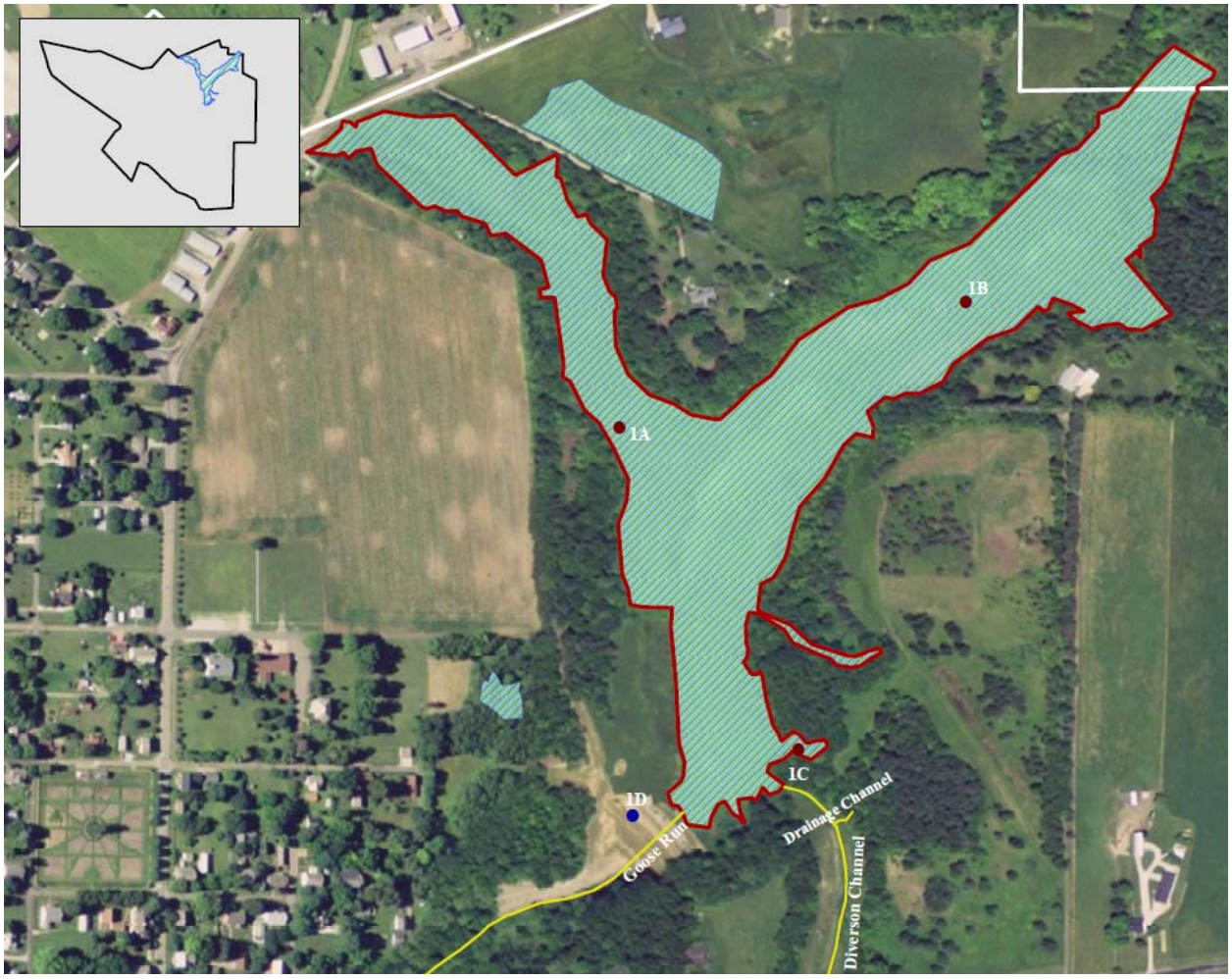

Figure 10. Aerial map showing Goose Run Impoundment outlined in red with vegetation plots 1A, 1B, 1C, and 1D.

Pump Station Wetland

The Pump Station Wetland (elevation 900 ft amsl) is located south of 2nd Street and east of Route 212. Goose Run empties into this wetland before being pumped under Route 212 and the levee. A 2008 emergency gravel seepage blanket against the interior toe of the Rock Knoll of the levee lies adjacent to this wetland to the southeast. The wetland is listed on the NWI as a palustrine, emergent, persistent, seasonally flooded wetland (PEM1C). This area is listed as Zone AE on the FIRM maps, meaning a special flood hazard area subject to inundation by the 1% annual chance flood, with base flood elevation determined. The 1912 and 1944 quad maps depict this area as the confluence of the unnamed tributary with Goose Run. This tributary was rerouted into the Diversion Channel during the construction of Zoar Levee. The 1961, 1994, and 2010 quad maps depict this area as a part of a larger depression that includes the race track area. This open water wetland is clearly visible on aerial photography.

This wetland was estimated (by aerial photography) to be approximately 0.18 acres (Figure 11). The wetland boundary may extend onto properties where access was not obtained. NWI map depicts this wetland as 0.33 acres. Vegetation within this wetland had been mowed only a few days after this data was recorded.

The Pump Station wetland is an open water constructed wetland that contains both aquatic and emergent habitats. Standing water and true aquatic plants were observed as the primary indicators of wetland hydrologic conditions. Hydrophytic vegetation includes broadleaf cattail, numerous sedges and rushes, sensitive fern, floating leaf pondweed, curly leaf pondweed, watermilfoil, and broadleaf arrowhead. Soils were not investigated due to depth of standing water. Map of wetland site, topographic map, soils map, NWI map, photographs, and a delineation form can be found Appendix 4.

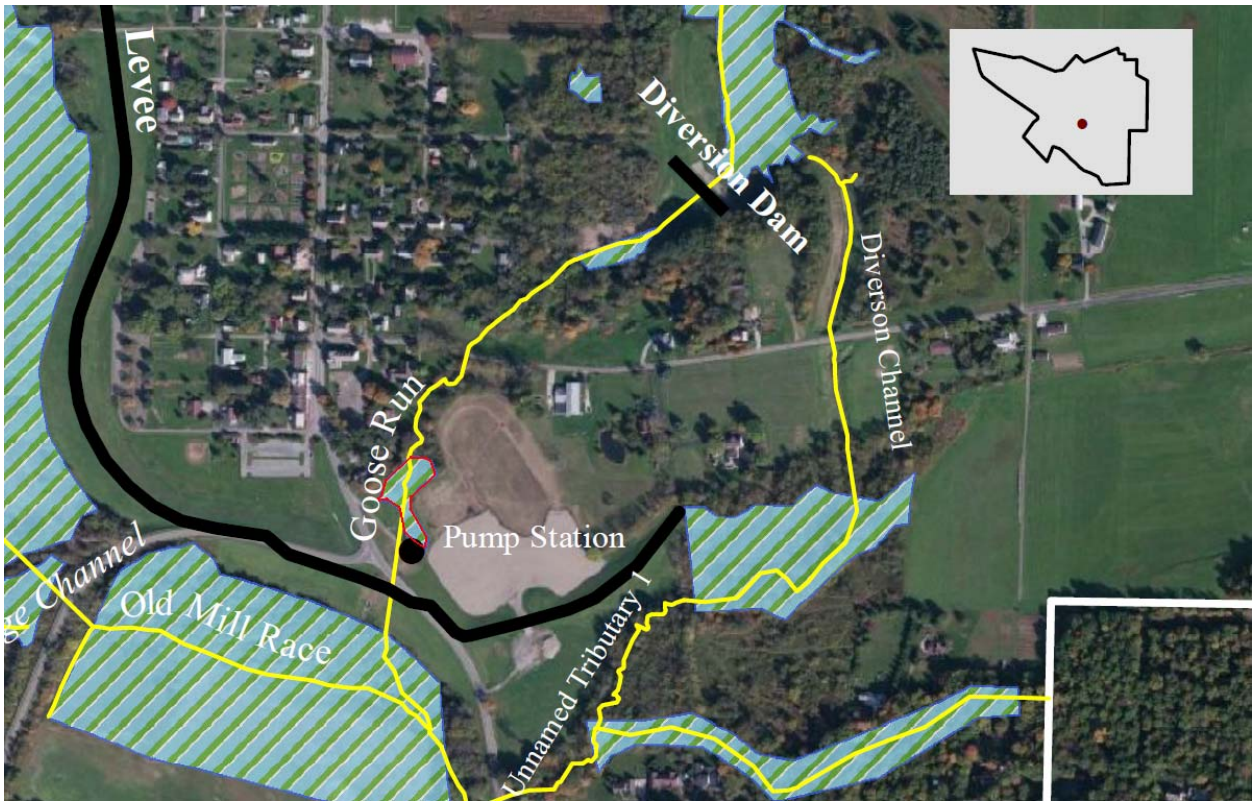

Figure 11. Aerial map showing the Pump Station Wetland noted as a red dot.

Government Property Wetland

The Government Property Wetland (elevation 900 ft amsl) is located within a reach artificially excavated during construction of the Zoar Levee & Diversion Dam. This area was excavated to connect an unnamed drainage that once flowed to Goose Run that was cut off by the levee and another unnamed tributary of Goose Run to provide a continuous outlet for the Zoar Diversion Channel. Unlike the trapezoidal portion of the Zoar Diversion Channel, this reach has since naturalized. Today, these two linked tributaries have formed a small stream bed.

The wetland is listed on the NWI as a lacustrine, littoral, unconsolidated bottom, saturated, artificially flooded, diked/impounded wetland (L2UBKh). The area is listed as Zone A on the FIRM maps, meaning a special flood hazard area subject to inundation by the 1% annual chance flood, but has no base flood elevation determined, and Zone AE that has base flood elevations determined. The 1912 and 1944 quad maps do not depict this area in detail. The 1961, 1994, and 2010 quad maps depict this wetland as land subject to inundation. This wetland is visible on aerial photography as forested with areas of emergent vegetation. A utility line corridor has been cut through the vegetation on the eastern side of this wetland.

A wetland was identified which encompasses 8.76 acres (Figure 12), however it may extend beyond study boundaries. NWI map depicts this wetland as part of the much larger L2UBKh wetland along the Tuscarawas River. This wetland has the potential for high quality.

As previously mentioned, the Government Property wetland is a riverine wetland that exists along the outflow of the diversion channel. This wetland contains both a forested area and an

emergent vegetation area. Saturated soils, standing water, and drainage patterns were observed as the indicators of wetland hydrologic conditions, although the actual channel of this unnamed tributary was not well defined. Hydrophytic vegetation of the forested portion of this wetland included American elm, green ash, skunk cabbage, Clayton's bedstraw, green bulrush, jewel weed, broadleaf arrowhead, and swamp agrimony. Aquatic and emergent vegetation dominates another portion of this wetland including broadleaf cattail, common rush, sensitive fern, fox sedge, skunk cabbage, jewel weed, broadleaf arrowhead, and rice cutgrass. Soils were identified as hydric with low-chroma colors and very high organic matter content (mucky). Map of delineated wetland, topographic map, soils map, NWI map, photographs, and delineation forms, can be found Appendix 5.

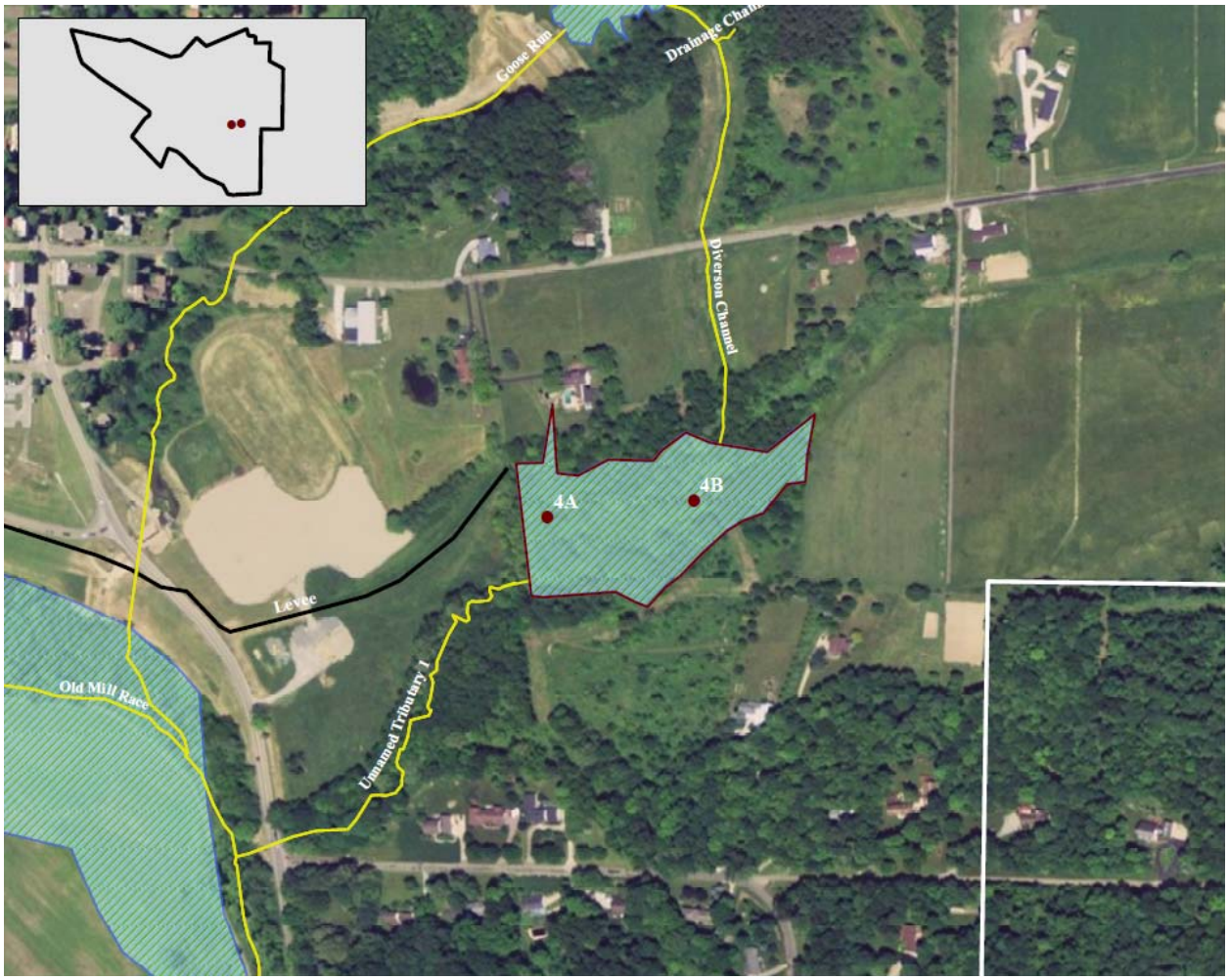

Figure 12. Aerial map showing Government Property Wetland outlined in red with vegetation plots 4A and 4B.

Subdivision Wetland

The Subdivision Wetland (elevation 900 to 920 ft amsl) is located south of the Government Property Wetland and north of Michael Lane; it lies along an unnamed secondary tributary to the unnamed tributary. This riverine wetland lies along several parcels (parcels 55 to 62, and east of parcel 62), many with restricted access, and was not fully delineated. The wetland is listed on the NWI as a lacustrine, littoral, unconsolidated bottom, saturated, artificially flooded,

diked/impounded wetland (L2UBKh). This area is listed as Zone AE on the FIRM maps, meaning a special flood hazard area subject to inundation by the 1% annual chance flood, with base flood elevation determined. The 1912 and 1944 quad maps depict this area as a tributary to Goose Run. The 1961, 1994, and 2010 quad maps depict this area as an unnamed tributary to the Diversion Channel and the wetland as forested land subject to inundation. This wetland is visible on aerial photography as forested.

This wetland was estimated (by aerial photography) to be approximately 3 acres. Wetland boundaries extended out of the study area and also onto properties with restricted access. NWI map depicts this wetland as part of the much larger L2UBKh wetland along the Tuscarawas River.

Subdivision Wetland is a riverine wetland that lies along an unnamed secondary tributary. Surface water and true aquatic plants were observed as the primary indicators of wetland hydrologic conditions. Hydrophytic vegetation included American elm, green ash, swamp white oak, red maple, skunk cabbage, jewel weed, and clear weed. Soils were identified as hydric with low-chroma colors, redoximorphic ped features, and very high organic matter content (mucky). Topographic map, soils map, NWI map, photographs, and a delineation form can be found Appendix 6.

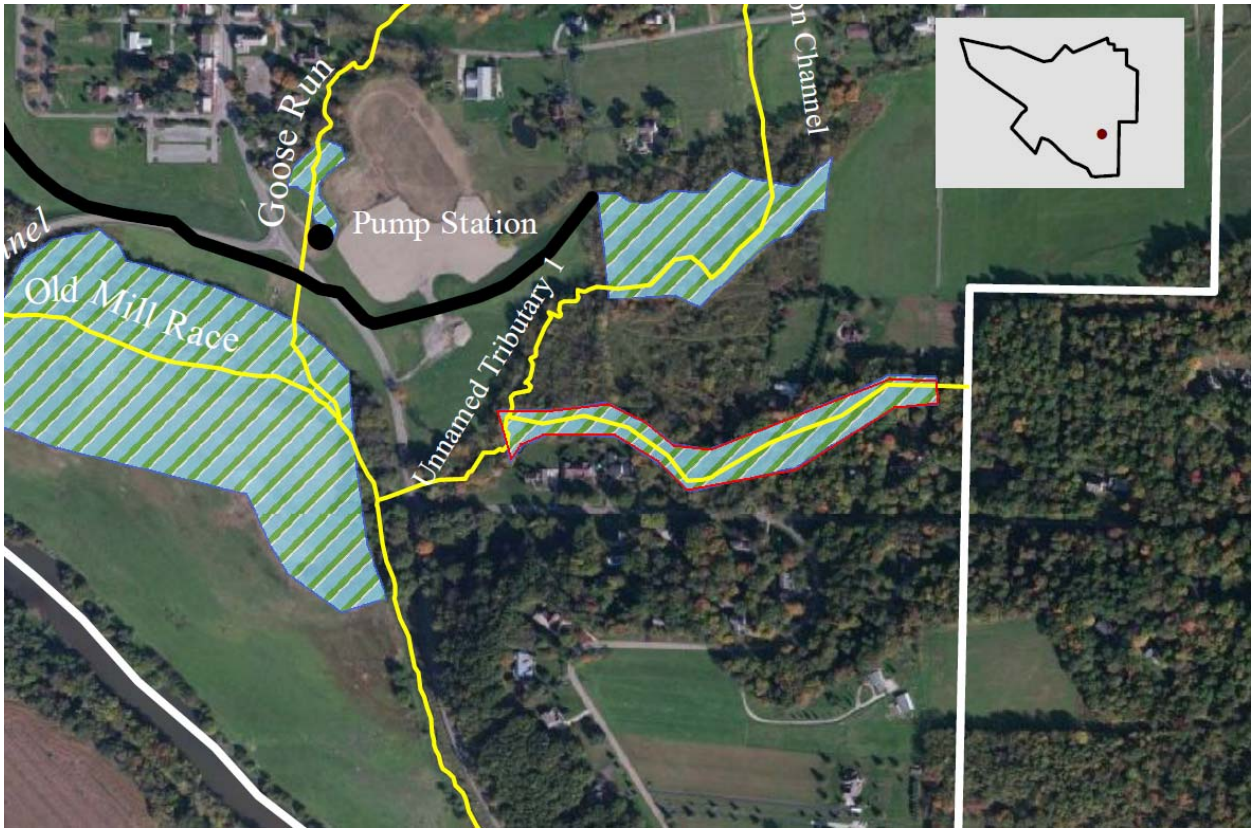

Figure 13. Aerial map showing Subdivision Wetland outlined in red.

Floodplain Field Wetland

Floodplain Field Wetland (elevation 880 ft amsl) is south of town along the Tuscarawas River Floodplain. The entire floodplain landform is mapped as a complex of habitats on the NWI including:

- lacustrine, littoral, unconsolidated bottom, saturated, artificially flooded, diked/impounded wetland (L2UBKh) for most of the field;
- the northwestern corner is mapped as a palustrine, emergent, persistent, seasonally flooded wetland (PEM1C); and
- the northern boundary along the levee is mapped as palustrine, forested, broad-leaf deciduous, seasonally flooded wetland (PFO1C).

Goose Run enters the floodplain after emerging from under the levee. The Zoar Diversion Channel enters this floodplain along the eastern boundary through a culvert under Route 212. The Zoarites had constructed a Mill Race extending the Tuscarawas River to Goose Run. Portions of this Old Mill Race are still present. However, very few segments still retain a properly defined bed and bank and were, therefore, only recorded as drainage patterns within a wetland. A drainage ditch runs along the western edge of the agricultural field from the western most end of the Old Mill Race south to the Tuscarawas River.

This area is listed as Zone AE on the FIRM maps, meaning a special flood hazard area subject to inundation by the 1% annual chance flood, with base flood elevation determined. This east-west channel most likely was created for the mill race that used to run along the northern portion of this field. The 1912 quad map does depict two structures on the eastern edge of this floodplain that most likely were associated with the mill(s). The 1961, 1994, and 2010 quad maps depict this area as land subject to inundation. The 2010 topographic map has re-drawn the contour lines, depicting a depression along the western boundary of this landform. The complexity of this wetland is clearly visible on aerial photography; and, according to the farmer who now works this land, planting is more difficult due to this hydrology. USACE personnel have noted that large portions of this area have been planted every year except 2005, 2008, and 2011.

The wetland encompasses 36.79 acres (Figure 14). To the south by southwest, is an agricultural field that if not cultivated, might also be categorized as a wetland.

The Floodplain Field Wetland complex is described by its distinctive habitats. The forested portion, PFO1C, along the northern edge contains the old mill race as well as Goose Run. Hydrophytic vegetation includes black willow, American sycamore, button bush, reed canary grass, yellow pond lily, floating leaf pondweed, and broadleaf arrowhead, with poison ivy dominant in every vegetation stratum. The Old Mill Race no longer has flow but does retain water, the depth of which varied up to ten inches; portions of the stone walls of the mill race are still present under a thick layer of poison ivy. The emergent wetland, PEM1C, in the northwest corner, had not been cleared or cultivated in at least eight years based upon aerial photography. This area was dominated by hydrophytic vegetation including reed canary grass, broadfruit bur-reed, swamp milkweed, broadleaf cattail, green bulrush, American water plantain, and rice cutgrass. Similar vegetation spread east along the southern edge of the mill race; however, this area has been regularly cut and cultivated. A shrub/scrub area was also present in this floodplain complex, a black willow sapling stand approximately 10 to 15 ft tall with low chroma soils. The

remainder of the floodplain landform was planted in corn. Overall this wetland complex had standing water, flowing water, saturated soils, mud cracks, and drainage patterns as the primary and secondary indicators of wetland hydrologic conditions. Maps of the Floodplain Field Wetland complex, topographic map, soils map, NWI map, photographs, and delineation forms can be found Appendix 7.

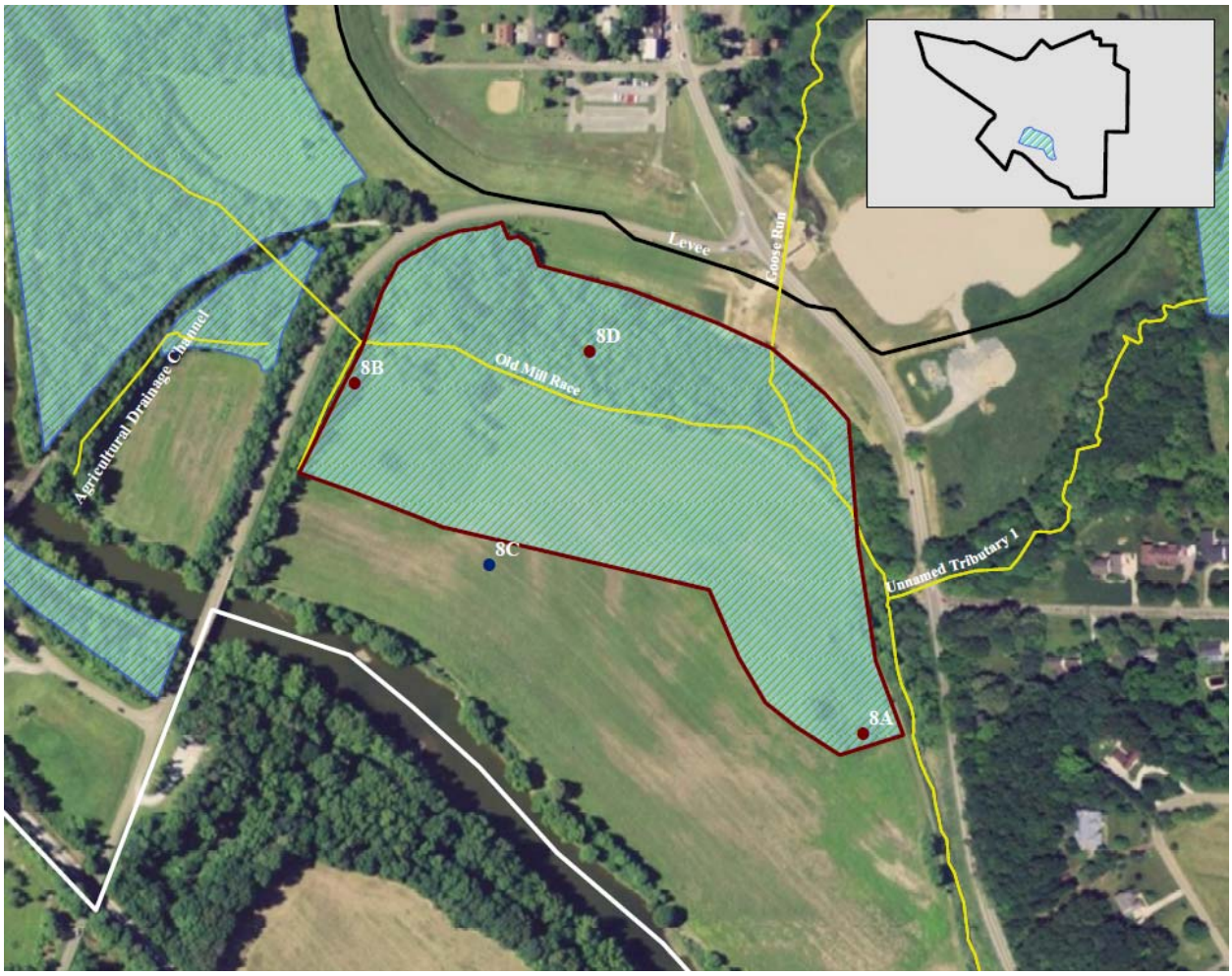

Figure 14. Aerial map showing Floodplain Field Wetland outlined in red with vegetation plots 8A, 8B, 8C, and 8d.

Between Roadways Wetland

The wetland located between two roadways (elevation 880 ft amsl) is located between the old and new alignments of Dover Zoar road, southwest of Zoar Levee. Construction of artificial barriers, such as Dover Zoar Road and Zoar Levee have changed the hydrology and likely disconnected this wetland from others nearby, including the Floodplain Field Wetland complex. The wetland is listed on the NWI as palustrine, forested, broad-leaf deciduous, seasonally flooded wetland (PFO1C), while the remainder of the field is listed as a lacustrine, littoral, unconsolidated bottom, saturated, artificially flooded, diked/impounded wetland (L2UBKh). This area is listed as Zone AE on the FIRM maps, meaning a special flood hazard area subject to inundation by the 1% annual chance flood, with base flood elevation determined. The 1912 and 1944quad maps depict this area as continuous with the rest of the floodplain to the south. The

1961, 1994, and 2010 quad maps depict the Old Mill Race as crossing at the north end of the wetland and connecting to both adjacent fields. This forested wetland is visible on leaf-off aerial photography.

While the NWI map depicts this wetland as 1.05 acres, The Between Roadways Wetland actually encompasses 2.25 acres (Figure 15). An agricultural field lies from the south to southwest corner that, if not cultivated, might also be categorized as a wetland.

This forested wetland is dominated by hydrophytic vegetation including silver maple, American elm, green ash, button bush, water knotweed, swamp dock, jewel weed, Canadian anemone, and poison ivy. Saturation was observed as the primary indicator of wetland hydrologic conditions. Portions of the Old Mill Race channel are vaguely present; however, no culvert could be located joining it to the section of the Old Mill Race in the neighboring Floodplain Field Wetland. The wetland is separated from the adjacent agricultural field by an east-west drainage ditch that joins another drainage ditch running south along the western edge of the agricultural field. Soils were identified as hydric with low-chroma colors and very high organic matter content. A map of the delineated Between Roadways Wetland, topographic map, soils map, NWI map, photographs, and delineation forms can be found Appendix 8.

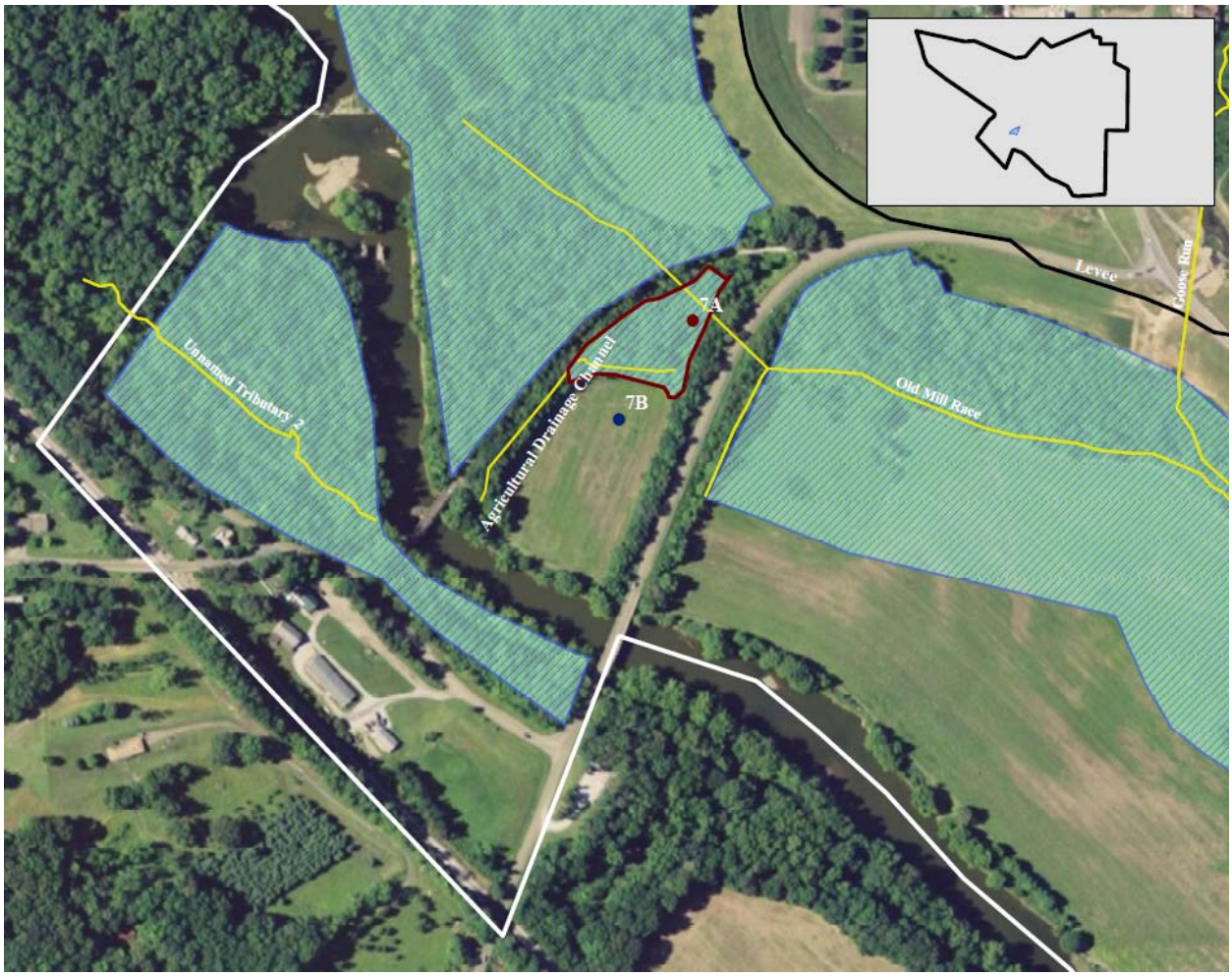

Figure 15. Aerial map showing Between Roadways Wetland outlined in red with vegetation plots 7A and 7B.

Canal Wetland

The Canal Wetland is located on the right descending bank of the Tuscarawas River, bounded by County Highway 111 to the southwest and the Tuscarawas River to the northeast. This area has been highly altered by human activity. Highway 111 marks the western boundary, just east of which is the Ohio & Erie Canal. Remnants of the Ohio & Erie Canal bed create most of the wetland; portions of the canal have been segregated and impounded by an early 20th century fish hatchery. The Ohio & Erie Canal towpath is an artificially elevated trail located above natural ground surface and runs parallel to the canal on its riverside. Running parallel to, and east of, the towpath is unnamed tributary 2 to the Tuscarawas River. Perpendicular to these features is a nineteenth century truss bridge and remnants of a Lake Erie Railroad bridge. These two artificially elevated features run northeast-southwest and cross the Tuscarawas River. The wetland is listed on the NWI as a lacustrine, littoral, unconsolidated bottom, saturated, artificially flooded, diked/impounded wetland (L2UBKh). This area is listed as Zone AE on the FIRM maps, meaning a special flood hazard area subject to inundation by the 1% annual chance flood, with base flood elevation determined. The 1912 and 1944 quad maps depict the canal, railroad, and the truss bridge. The 1961, 1994, and 2010 quad maps depict these features as land subject to inundation. This forested wetland is visible on leaf-off aerial photography.

Within the Study Area, the Canal Wetland encompasses 16.69 acres (Figure 16); but the actual wetland boundaries likely extend beyond the Study Area. NWI map depicts this wetland as part of the much larger L2UBKh wetland along the Tuscarawas River. This wetland has the potential for high quality.

This forested wetland is dominated by hydrophytic vegetation including silver maple, red maple, American sycamore, black willow, black elderberry, creeping jenny, jewel weed, rough bedstraw, fox sedge, reed canary grass, skunk cabbage, clear weed, yellow marsh marigold, glade mallow, duck weed, true forget-me-not, and poison ivy. Surface water, saturation, and high water table were observed as the primary indicators of wetland hydrologic conditions. Soils were identified as hydric with low-chroma colors and very high organic matter content (mucky loam). Map of delineated wetland, topographic map, soils map, NWI map, photographs, and delineation forms can be found Appendix 9.

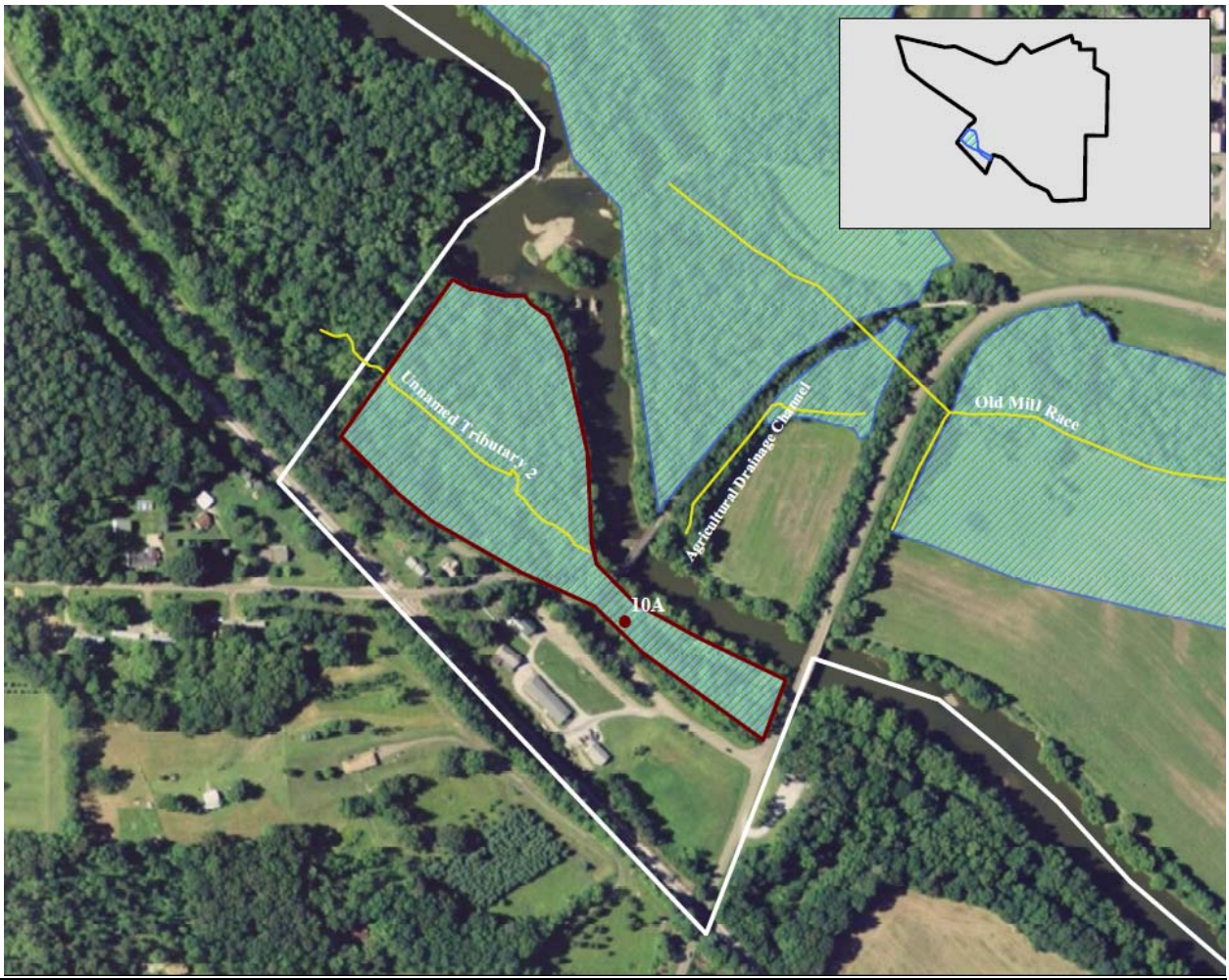

Figure 16. Aerial map showing Canal Wetland outlined in red and vegetation plot 10A.

Zoar Wetland and Arboretum

The Zoar Wetland (elevation 900 to 880 ft amsl) is located west of Zoar Levee on the bottomland/ floodplain of the Tuscarawas River. Large portions of this resource is owned by Earth Action Partnership and functions as an educational public park for conservation and the enjoyment of residents and visitors. Within the Zoar Wetland and Arboretum is Zoar Lake. Zoar Lake is an impounded unnamed tributary. It was impounded in the early 20th century by a concrete dam and stone berm to create a recreational lake. A former oxbow of the Tuscarawas River, this area has been reported to have been seasonally inundated and generally wet prior to the lake impoundment. This entire area is mapped as a complex of habitats on the NWI including:

- lacustrine, littoral, unconsolidated bottom, saturated, artificially flooded, diked/impounded wetland (L2UBKh) for the agricultural field and riparian zone;
- the northwestern portion is mapped as a palustrine, scrub-shrub, broad-leaved deciduous/emergent, persistent, seasonally flooded wetland (PSS1/EM1C);
- a small centrally located area is mapped as a palustrine, emergent, persistent, semi-permanently flooded wetland (PEM1F);
- another central area adjacent to Zoar Lake is mapped as a palustrine, scrub-shrub, broad-leaved deciduous, seasonally flooded wetland (PSS1C);
- the lake itself is mapped as a lacustrine, limnetic, unconsolidated bottom, permanently flooded wetland (L1UBH); and
- the southern-most area in this wetland complex, adjacent to the Tuscarawas River, containing the remains of Lake Erie Railroad and the Old Mill Race is mapped as a palustrine, forested, broad-leaf deciduous/emergent, persistent, seasonally flooded wetland (PFO1/EM1C).

This area is listed as Zone AE on the FIRM maps, meaning a special flood hazard area subject to inundation by the 1% annual chance flood, with base flood elevation determined. The 1912 quad map does not depict Zoar Lake, but does depict a small stream running along the eastern edge of the floodplain, most likely originating from the numerous springs present along the hillside. Historically, the lake was artificially filled with soil by local residents in an attempt at cultivation; however, this was short lived and was not fruitful. The 1944 quad map depicts this area as an unforested lake. The 1961, 1994, and 2010 quad maps depict this area as a forested lake on land subject to inundation. The southernmost portion of this wetland has seen the most human disturbance, including the remains of the 1st Street, now a walking trail; the artificially excavated Old Mill Race; and structural remains of a mill/powerhouse, dam, bridge, and railroad. At the southern boundary of this wetland lies a culvert, under the original Dover Zoar Road, connecting this portion of the Old Mill Race to that in the neighboring field, called the Between the Roadways wetland. The complexity of this wetland is clearly visible on aerial photography.

The Zoar Wetland and Arboretum in the study area measures 244.70 acres (Figure 17). However, this resource extends beyond the Study Area. This wetland is very diverse and of high quality. Although mapped on the Ohio Department of Natural Resources Biodiversity Database, it is not recorded as a High Quality Wetland (correspondence letter in Appendix 10). The complexity, variety, and quality of the various ecosystems within the Zoar Wetland and Arboretum add to importance of the area for conservation, education, and recreation. Although not nesting at Zoar Lake, bald eagles nesting at near-by Beach City Dam frequent this body of water.

Zoar Wetland and Arboretum contains numerous hydrophytic vegetation strata including: aquatic, emergent, scrub/shrub, forested, and open water. Aquatic vegetation recorded at sampling points is duck weed, although numerous others were noted throughout the wetland including water milfoil, floating leaf pondweed, and yellow pond lily. Hydrophytic emergent vegetation recorded at sampling points includes reed canary grass, broadfruit bur-reed, narrowleaf cattail, Allegheny monkey flower, creeping jenny, Canadian anemone, small spike false nettle, swamp dock, yellow marsh marigold, and swamp buttercup. The scrub/shrub stratum of hydrophytic vegetation is represented at the sampling points by black elderberry and button bush; others such as spice bush were also observed. Examples of hydrophytic trees recorded at sampling points include silver maple, red maple, American sycamore, black willow, green ash, and box elder. Overall this wetland complex had standing water, saturated soils, high water table, mudcracks, and drainage patterns as the primary and secondary indicators of wetland hydrologic conditions. Among the several water sources, at least two springs were identified as feeding into this vast wetland. Maps of the delineated Zoar Wetland and Arboretum Wetland, topographic map, soils map, NWI map, photographs, and delineation forms can be found Appendix 10.

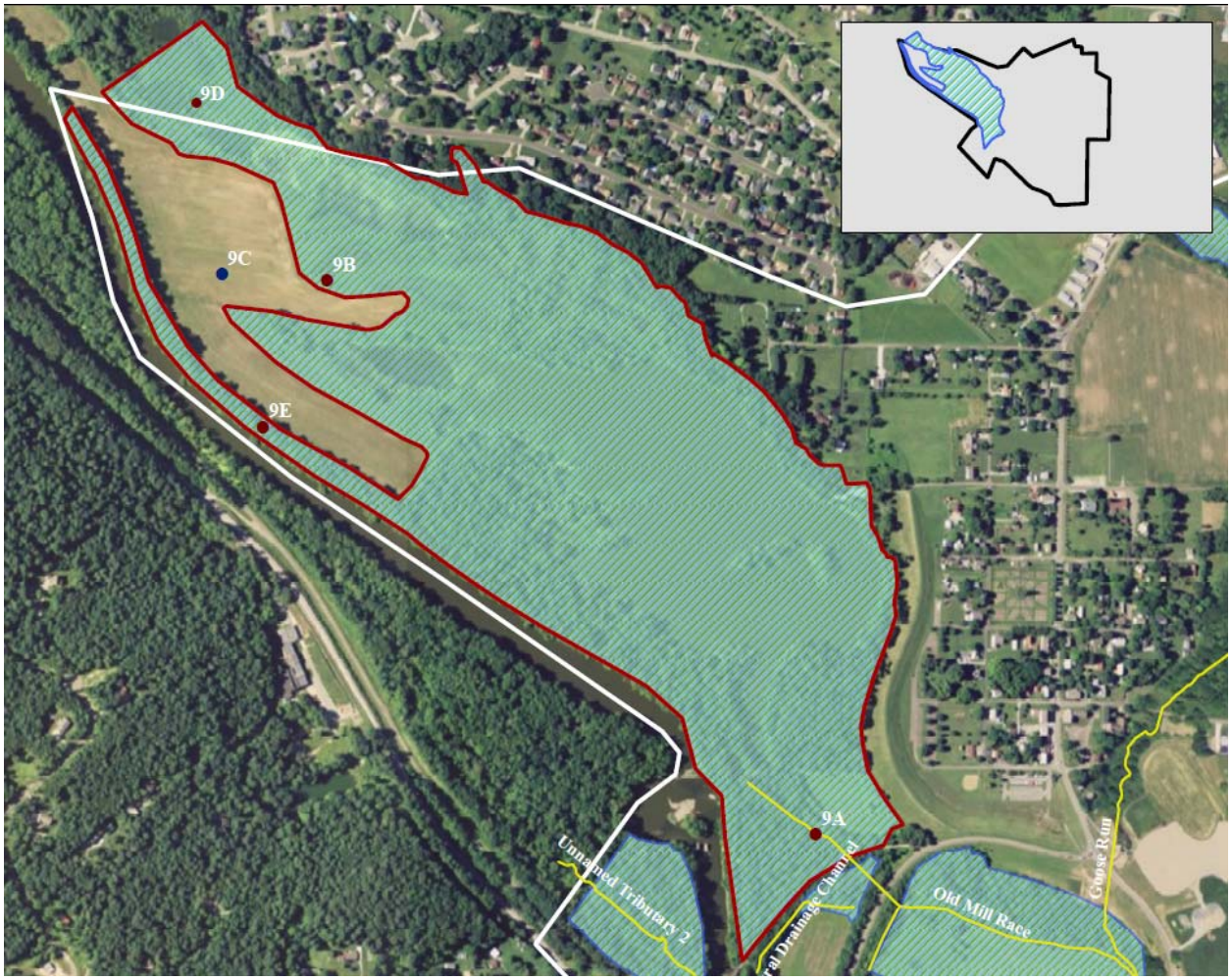

Figure 17. Aerial map showing Zoar Wetland and Arboretum outlined in red with vegetation plots 9A, 9B, 9C, 9D, and 9E.

Diversion Channel Wetland

The Diversion Channel artificially drains Goose Run Impoundment'southeast corner and is channelized for approximately 310 ft until it enters the unnamed tributary on government property. This area functions mainly as a wetland due to consistent water inputs from seeps and sheet-flow. Because the channel was excavated from upland soils, it is a non-jurisdictional wetland. Cattail and duckweed dominate the vegetation. Documentation of the Diversion Channel Wetland can be found in Appendix 11.

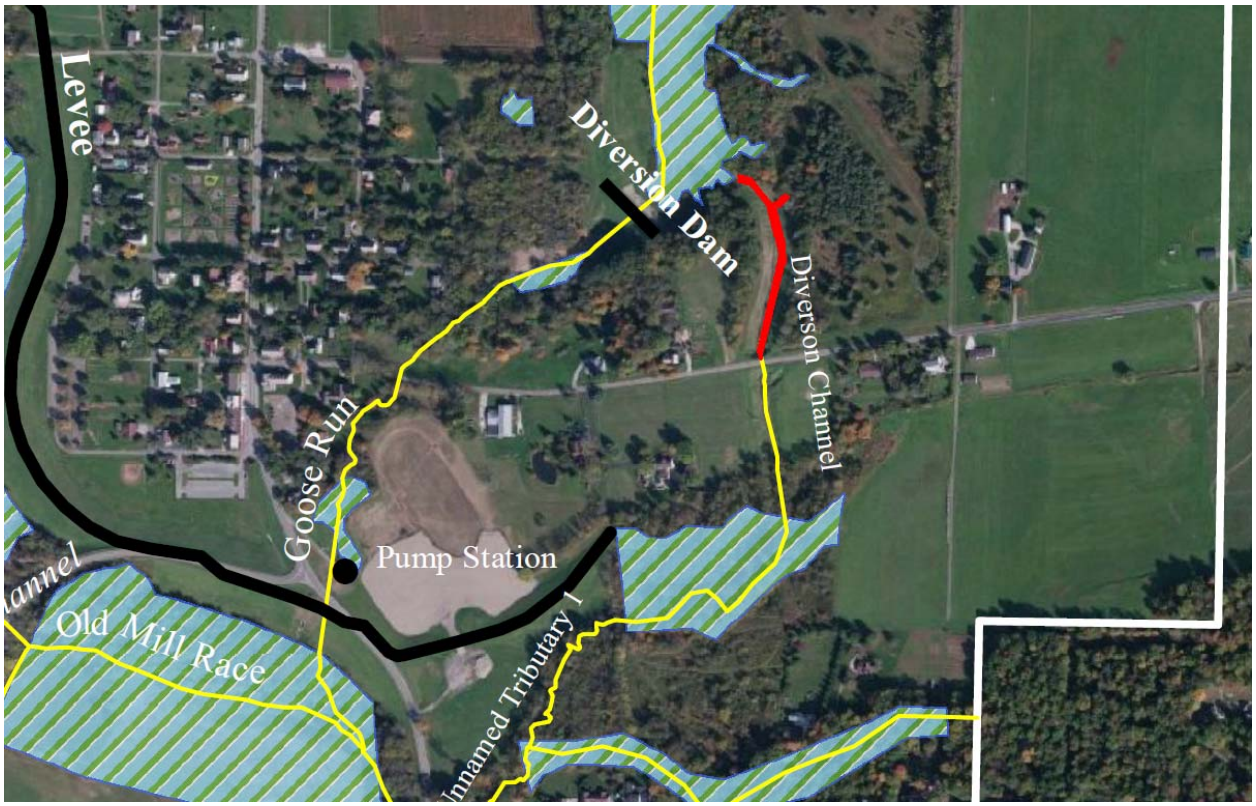

Figure 18. Aerial map showing the Diversion Channel Wetland outlined in red.

Outflow Wetland

The Outflow Wetland is located on the left descending bank of Goose Run approximately 40 meters downstream of the Diversion Dam outflow (Figure 19). It is also adjacent to Reach 1 of Goose Run. It is approximately 0.2 acres in size and is likely the result of Goose Run inundation during storm events. This wetland has not been fully assessed.

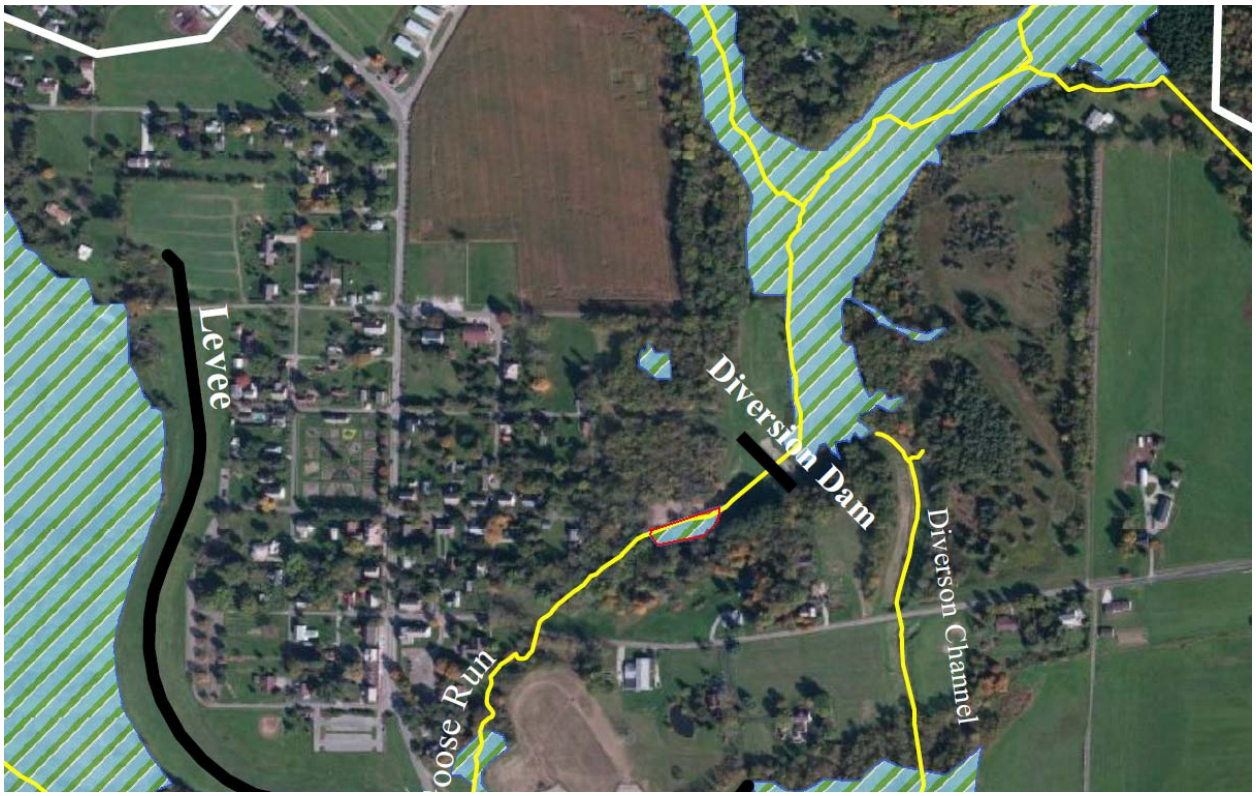

Figure 19. Aerial map showing Diversion Outflow Wetland outlined in red.

Streams

Unnamed Tributary 1

This unnamed tributary flows through the Government Property Wetland with an undefined bed and bank. At the end of this wetland is the eastern portion of the Zoar levee, which confines the unnamed tributary, resulting in a defined bed and bank. The unnamed tributary flows for approximately 325 ft before entering Goose Run. Field forms and photographs are included in Appendix 12.

Unnamed Secondary Tributary to Unnamed Tributary 1

This stream flows through Subdivision Wetland and to the unnamed tributary that drains the Diversion Channel. Only a small portion of the stream was accessible for this assessment. Field forms and photographs are included in Appendix 12.

Unnamed Tributary 2

Unnamed Tributary 2 flows through the Canal Wetland and is parallel and east of the towpath. This stream begins outside of the Zoar Study Area. Field forms and photographs are included in Appendix 12.

Goose Run

Goose Run Watershed, less than 1,500 acres (about 2.4 square miles), drains a large portion of the Study Area. Historically, Goose Run has been impounded twice, once in the early twentieth century to create Lime Kiln Lake and again in the 1930s by the Zoar Diversion Dam. The Zoar

Diversion Dam held a permanent impoundment behind it until 1992, when it was drained. Currently, Goose Run flows freely through the Diversion Dam and on to the levee. The section between the Diversion Dam and the levee is approximately 1,500 ft long. It then flows under the levee, via a single concrete culvert, and continues for another 2,300 ft to the Tuscarawas River, totaling 4,200 ft in length below the Diversion Dam. Field forms and photographs are included in Appendix 12.

Reach 1 of Goose Run begins at the Diversion Dam and extends approximately 400 ft; this section is channelized.

Reach 2 is about 1,200 ft long and extends from the end of Reach 1 to the ponding area for the Zoar Pump Station. This reach is mostly forested, except for 125 ft that is maintained lawn near the crossing of Second Street in Zoar Village.

Reach 3 is approximately 350 ft long series of culverts underneath Zoar Levee. This reach can be temporally closed when Dover Dam is retaining pools against Zoar Levee. During these events, Goose Run is pumped up and thru the levee crest by three pumps and exits riverward via flap gates.

Reach 4 begins at the exterior toe of Zoar Levee and runs through the forested portion of the Floodplain Field Wetland for approximately 1,200 ft; it had a silt substrate with the only gravel/cobble present at the confluence of the unnamed tributary, entering via culvert under Route 212.

Reach 5 begins at the wetland and runs to the Tuscarawas River for approximately 1,100 ft; it had a silt substrate with practically no instream cover.

Reach 6 is located within the Goose Run Impoundment. Through the entirety of the impoundment and the wetland, Goose Run maintains definitive bed and bank. Two small unnamed tributaries support the flow of Goose Run within the wetland and the impoundment.

Unknown Tributary 3

Unnamed Tributary 3 flows through the northwest portions of the Goose Run Impoundment into Goose Run on its right descending bank. This stream begins outside of the Zoar Study Area and flows through the Goose Run Impoundment Wetland. No assessment has been completed for this stream. Field forms and photographs are included in Appendix 12.

Unknown Tributary 4

Unnamed Tributary 4 flows through the northeast portions of the Goose Run Impoundment into Goose Run on its left descending bank. This stream begins outside of the Zoar Study Area and flows through the Goose Run Impoundment Wetland. No assessment has been completed for this stream. Field forms and photographs are included in Appendix 12.

VI. CONCLUSIONS:

No ecologically significant terrestrial habitats were located within the Zoar Study Area during this assessment.

A routine evaluation for Waters of the United States, including wetlands**,** was also conducted in support of a Baseline Condition for Zoar Levee and Diversion Dam, Dam Safety Modification Study, Tuscarawas County, Ohio.

Overall the Zoar study area has an abundance of good quality wetlands. Twelve wetlands consisting of approximately 340 acres were recorded within the Study Area. Several of these wetlands extend beyond the study boundaries, and more possible wetlands may be present within the study boundaries on properties with restricted access. These wetlands were primarily riverine wetlands, with only 2 being depressional wetlands. Streams within the study area have been heavily altered and channelized, and were generally considered in poor or fair quality. Artificial channels were historically excavated for canal and mill races, some more recently for agricultural drainage ditches.

This report is meant to serve as a planning tool for decision making during the alternative formulation process. A more detailed delineation of wetlands and streams may be required if an alternative has the potential to impact any of the wetlands or streams described in this report. Additional assessments may also be necessary if alternatives have the potential to impact properties within the Study Area that were not accessible during this assessment.