INTRODUCTION

The U.S. Army Corps of Engineers (USACE), Huntington District (District), is preparing a Dam Safety Modification Report (DSMR) in accordance with Engineer Regulation (ER 1110-2-1156) for the Zoar Levee and Diversion Dam (Project), located upstream of Dover Dam, in Tuscarawas County, Ohio on the Tuscarawas River. Zoar Levee and Diversion Dam is an appurtenant structure to Dover Dam. Zoar Levee and Diversion Dam was built in the 1930's to protect Zoar Village, based on its historical significance and heritage tourism value, from having to be acquired for flowage easement to store flood waters upstream of Dover Dam.

The DSMR is being prepared as a result of two successive storm events that occurred in 2005 and 2008 which loaded the exterior of Zoar Levee with water being impounded on the Tuscarawas River by Dover Dam. During these two events, significant under seepage and piping was observed to be causing progression toward failure. Flood-fighting was required during both events, culminating with the need for emergency action in 2008 in the form of a seepage berm to prevent catastrophic failure.

Following the 2008 event, the project was rated as a Dam Safety Action Classification (DSAC) I project, as progression toward failure had been confirmed to be taking place under normal operations. The USACE DSAC ratings range from DSAC V, Normal (adequately safe), to DSAC I, Urgent and Compelling (unsafe).

In addition, the Zoar Diversion Dam (ZDD) has experienced seepage issues in the past requiring significant repairs. The ZDD was built to help reduce interior flooding from Goose Run, which prior to the construction of Zoar Levee, flowed through Zoar Village to its confluence with the Tuscarawas River.The ZDD is included with Zoar Levee in the DSAC I rating.

The District has also initiated an Environmental Impact Statement (EIS) with the DSMS, as the study has the potential to result in impacts to significant historic properties, most notably Zoar Village. Specifically, Section 2033 of the Water Resources Development Act of 2007 requires that non-structural alternatives, or ways to address the risk that do not rehabilitate the levee, must be considered equally with rehabilitative alternatives. ER 1110-2-1156 requires that removal of Zoar Levee & Diversion Dam be studied as a potential alternative. As the project protects a relatively small area, a non-structural alternative, like breaching the levee and purchasing property behind the levee might be feasible. However, this type of alternative will also significantly impact the residents of Zoar Village and adversely affect many historic properties. The EIS is being prepared to help the District carefully consider the impacts and costs of various alternatives.

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PROJECT BACKGROUND:

- Zoar Levee & Diversion Dam is part of the Muskingum Flood Control Project in Ohio, which was constructed by U.S. Army Corps of Engineers (USACE) for the Muskingum Watershed Conservancy District (MWCD) between 1934 and 1937 (Figures 1 and 2).
- MWCD owned & operated the Muskingum System until the Flood Control Act of 1939 transferred ownership of dams to the federal government.
- Zoar Levee is appurtenant to Dover Dam, located upstream of Dover Dam on the Tuscarawas River (Figure 3).
- The Dover Dam is a dry dam and retains pools only during storm events.
- The Federal Government maintains a flowage easement upstream of Dover Dam to elevation 916 feet above mean sea level (EL. 916' AMSL).
- Zoar Levee begins to provide flood benefits to the Village of Zoar when Dover Dam is retaining a pool above El. 890' AMSL (a 3-year event) (Figure 4).
- Zoar Levee original crest height of EL. 919' AMSL corresponds to Dover Dam's flowage easement (EL. 916') + 3' of freeboard. The current crest elevation, following 1951 work, is EL 928.5' AMSL. The levee is generally divided into two sections, the Ball Field side on the west side of Route 212 and the Rock Knoll on the east side of Route 212 (Figures 5).
- Zoar Diversion Dam retains internal runoff from Goose Run, which flows into Zoar Village from the landward side of Zoar Levee where it is pumped outside the levee (Figures 5-6).
- Zoar Diversion Channel is an auxiliary spillway for Zoar Diversion Dam (Figures 5-6).
- Extant evidence indicates that investments made to construction and maintain Zoar Levee & Diversion Dam was based primarily on the unique historical significance of Zoar Village (Figures 5-6).

SUMMARY OF DAM SAFETY ISSUES WITH PROJECT:

- 1947 Dover Dam pool EL 902.7 and under seepage noted with Zoar Levee
- 1948 added 14 relief wells and 13 piezometers on interior toe of Zoar Levee
- 1950-51 added a pump station, with 2 pumps, each with 15,000 gpm capacity
- 1950-51 levy crest raised from EL. 919 to El. 928.5 to provide protection to Zoar Village from a Standard Project Flood while Dover Dam's reservoir was at spillway capacity.
- 1990s Goose Run impoundment behind Diversion Dam was drained as result of a Limited Embankment Analysis on Zoar Diversion Dam.
- 1993 seepage blanket & relief wells installed downstream of Diversion Dam.
- 1994-1995 relief wells 11-13 replaced at Zoar Levee and 5 additional piezometers added.
- 2005 Dover Dam pool of record EL 907.3 resulted in significant under seepage on Zoar Levee. Sand bag rings and a filter fabric were added to the landward toe of the levee. SPRA concluded Zoar Levee was a DSAC II.

- 2008 Dover Dam pool EL 905.4 and Zoar Levee's performance worsened significantly. Installed a $1.26 million emergency filter blanket. Project reclassified as a DSAC 1, as progression toward failure had been confirmed.
- 2008-Present: IRRMs implemented. Evaluation and surveillance pools established. Stockpiled granular materials. Properly abandoned old relief wells. Constructed a toe drain and interior collection system. Installed additional piezometers. Added a new generator to the pump station. Installed a third pump and automated all pumps.

WHAT DOES THE PROJECT PROTECT / WHAT IS AT RISK?

- Zoar Levee shields approximately 98 buildings or structures from Dover Dam's pool.
- 2000 census ~ 193 people in the Village.
- Zoar Village was established in 1817 by a group of German separatists called Zoarites.
- Zoar Village is a historic property with national level significance.
- USACE considered the historical significance when it originally constructed the Project.
- In the 1960s, the Ohio General Assembly appropriated $300,000 to purchase, preserve, restore and interpret significant buildings in Zoar. The Ohio Historical Society and Zoar Community Association operate historic tours and tourist events in the Village.
- Zoar Village was placed in the National Register of Historic Places (NRHP) in 1969.
- Zoar Village was placed on the 11 Most Endangered Historic Places List by the National Trust for Historic Preservation in June of 2012.

DAM SAFETY MODIFICATION REPORT:

- Engineering Regulation (ER) 1110-2-1156 sets the U.S. Army Corps of Engineers (USACE) policy for Dam Safety.
- Chapter 9 of ER 1110-2-1156 sets forth the process for Dam Safety Modification Studies, which are required before permanently modifying a structure for dam safety reasons.
- Based on Section 2033 of the Water Resources Development Act of 2007, Chapter 9 of ER 1110-2-1156 requires that USACE seek the best way to manage risk to the public from dam safety issues and does not direct us to look for the best alternative for rehabilitating the structure. Therefore, non-structural risk measures must receive equal consideration in alternative development process to structural risk measures.
- USACE has initiated the six (6) step Dam Safety Modification Report (DSMR) in accordance with Chapter 9 of ER-1110-2-1156. .

ENVIRONMENTAL IMPACT STATEMENT:

- USACE must by law, regulation and policy fully consider the impacts any viable alternative will have to the human environment, including but not limited to cultural, historical, natural, social, and community impacts. The following are a summary of the two of the most pertinent laws for the Zoar Levee & Diversion Dam DSMR.

  - National Environmental Policy Act (NEPA) requires that we consider all reasonable alternatives and look for ways to avoid, minimize or mitigate for effects to significant resources, including historical and cultural properties.
  - Section 106 of National Historic Preservation Act (NHPA) requires Federal Agencies to take into account effects to historic properties. This process is set forth by 36 CFR 800
- To consider these impacts, an Environmental Impact Statement (EIS) is being prepared with the DSMR.
  - 24 May 2011, USACE held public scoping meeting to initiate an EIS under the NEPA.
  - USACE Holds Section 106 of the NHPA Consulting Party Meetings Regularly. Consulting Parties include, but are not limited to: (1) local, state and national historic preservation groups; (2) Zoar Community Association; (3) Ohio Historical Society, and (4) the President's Advisory Council on Historic Preservation. The National Park Service and National Trust for Historic Preservation also participating as interested parties. Regular meetings will be held throughout the study.
- In addition, USACE continues regular coordination with the public and stakeholders:
  - Feb & March 2011, USACE meet with the Local, State, and Federal representatives to inform them of the study.
  - 21 March 2011, the DSMR was initiated with the public information meeting held to discuss the study process.
  - Starting March 2011, USACE maintaining regular public office hours (now monthly).
  - Starting August 2011, USACE has established a Community Advisory Committee made up of local leaders and interested parties and meets with them on a monthly basis during the study process.
  - 15 November 2011, USACE held a public meeting to discuss potential studies within and around Zoar Village in support of the DSMR.
  - Public meetings are scheduled at milestone intervals throughout the study
  - A public hearing will be held to announce the recommended risk management plan
  - The Draft EIS and Record of Decision (ROD) will be made available for public and agency comment and review.

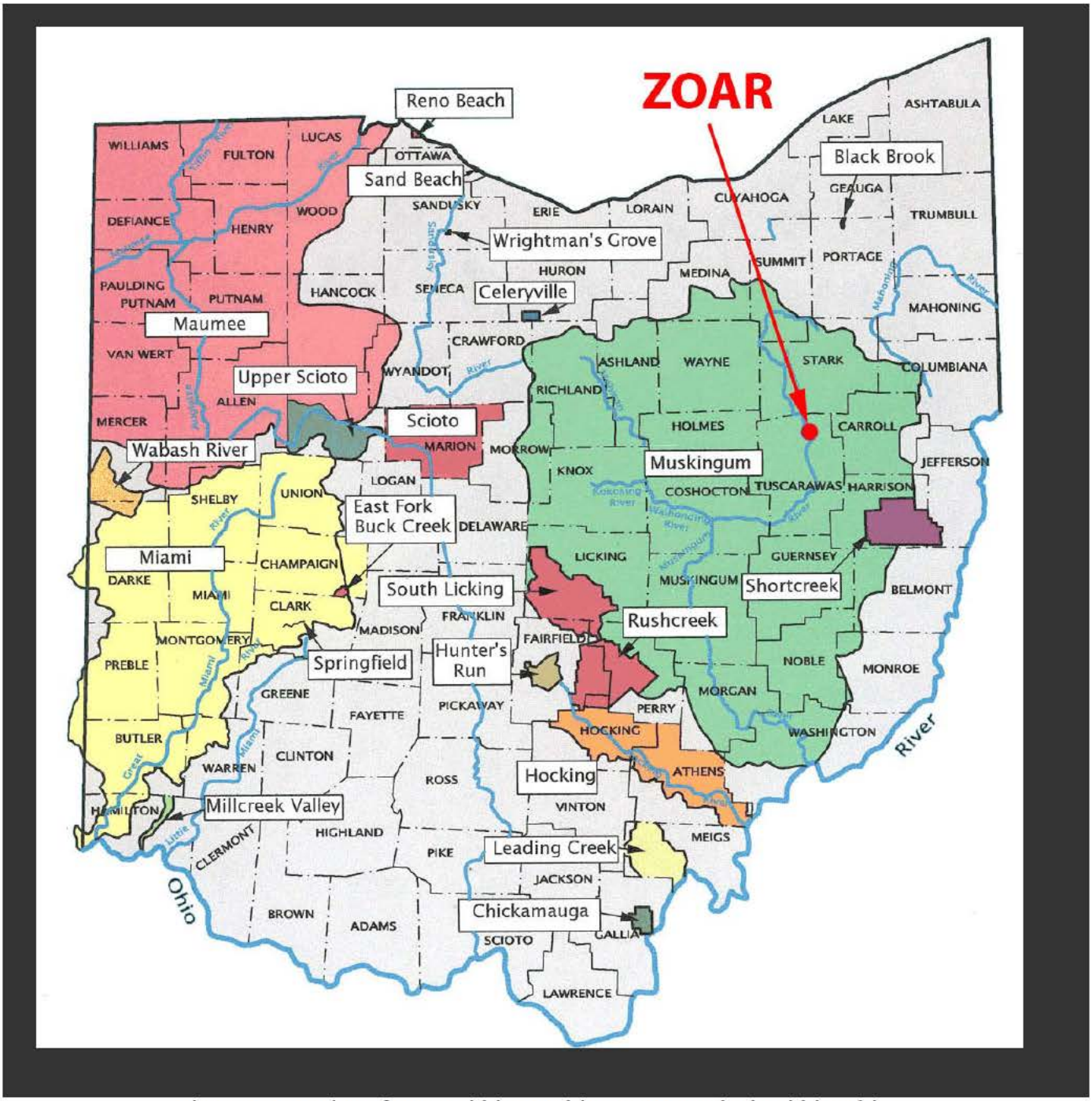

Figure 1. Location of Zoar within Muskingum Watershed, within Ohio.

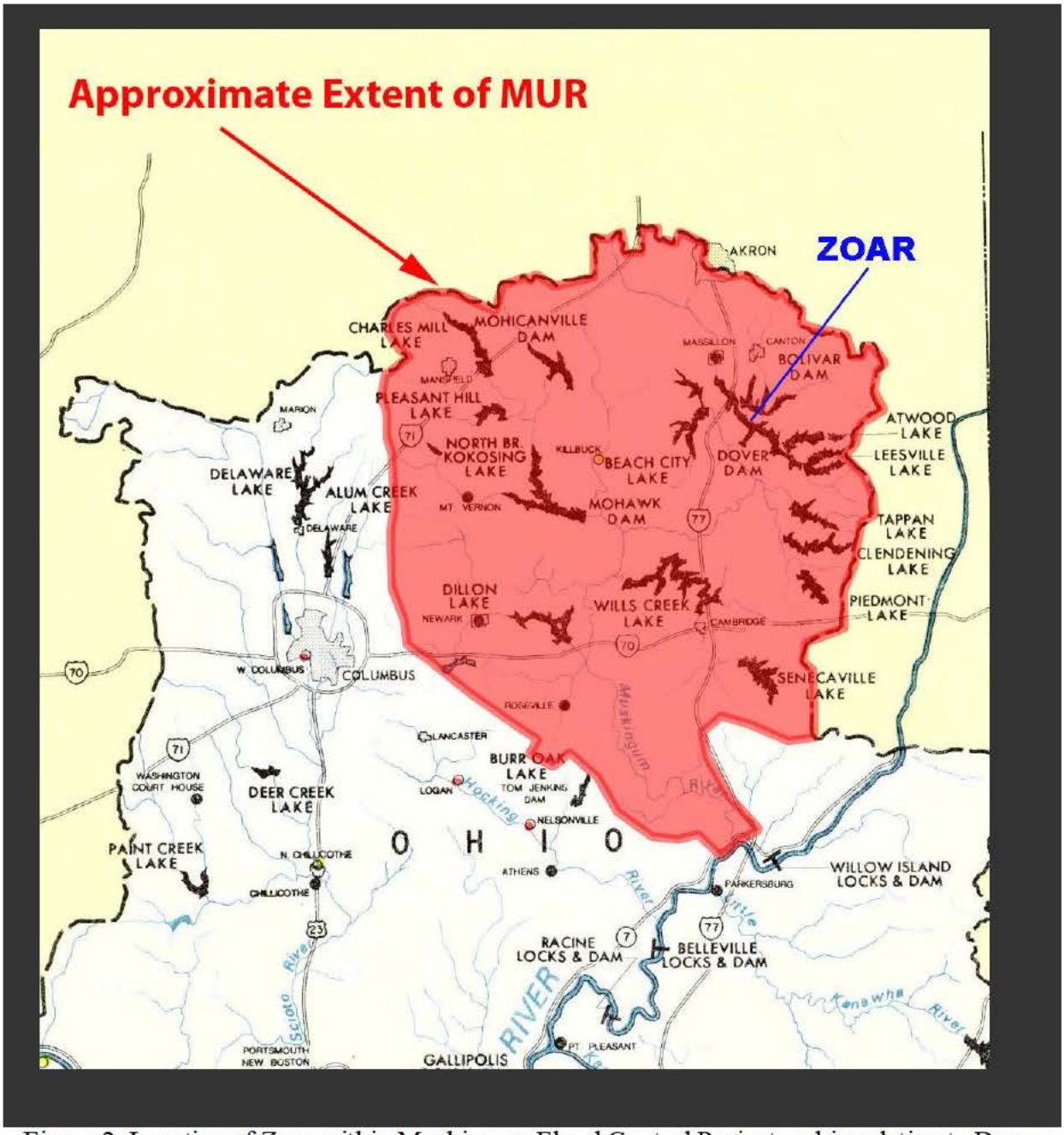

Figure 2. Location of Zoar within Muskingum Flood Control Project and in relation to Dover Dam.

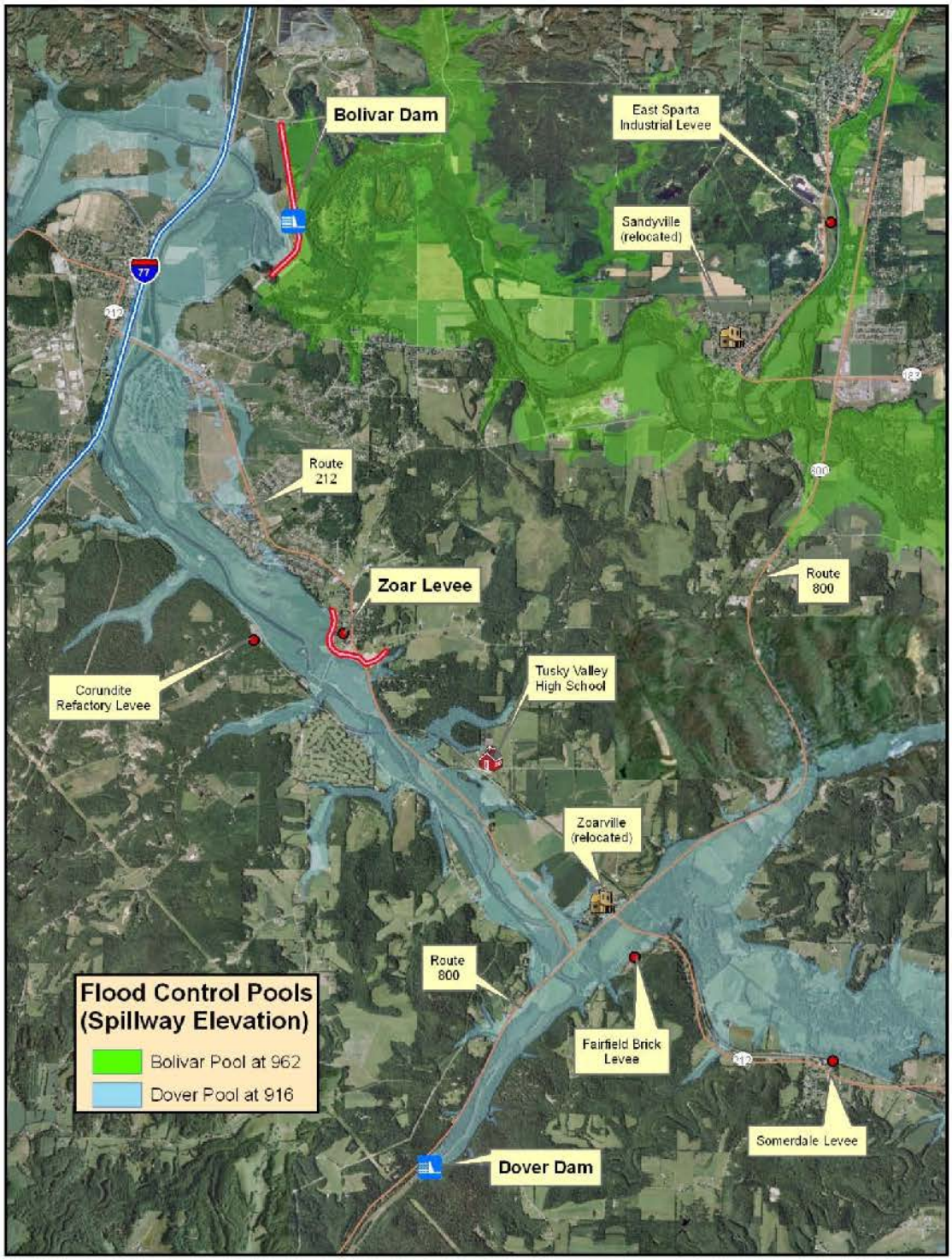

Figure 3. Relation of Zoar Levee to Dover and Bolivar Dam's along the Tuscarawas River. The area shaded blue shows Dover Dam's flowage easement. The area shaded green shows Bolivar Dam's flowage easement.

Figure 4. Aerial Photograph of Village of Zoar showing relationship to Zoar Levee & Diversion Dam, including the pump station and diversion channel. Also charted are those areas inundated by Dover Dam's spillway crest, including those areas that would be included in the flowage easement, if Zoar Levee and Diversion Dam were not included. This information is overlaid onto the National Register Historic District Boundaries for the Zoar Village State Memorial.

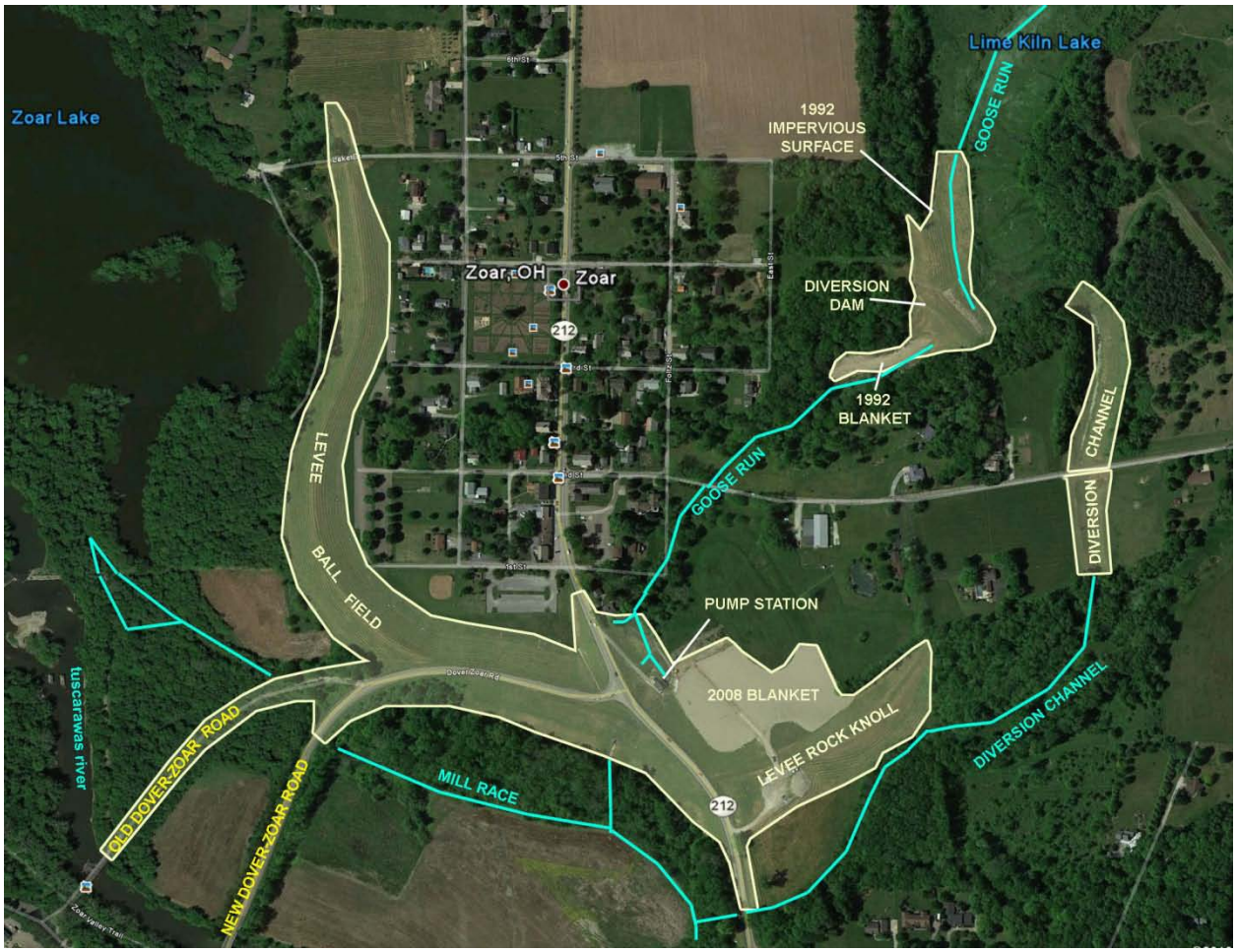

Figure 5. Aerial showing components.