Stormwater Infrastructure Evaluation

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Fluid thinking®

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1 – Executive Summary

The Village of Archbold engaged Jones & Henry Engineers and their team to provide a stormwater infrastructure evaluation and plan to update the Village's stormwater strategy.

Jones & Henry's Team included:

- Jones & Henry – Project Management, Storm Sewer Modeling, Capacity and Condition Analysis, and Strategy Development.
- Hoff Consulting – Rules & Regulations, Public/Stakeholder Engagement, and Strategy Development.
- EDGE – Green Infrastructure/Low-Impact Development, and Strategy Development.

The goals of this study are to:

- Reduce localized flooding.
- Improve water quality.
- Identify stormwater infrastructure capacity and shortcomings through the development of a stormwater system model.
- Identify problems with the condition of the Village's stormwater infrastructure.
- Provide recommendations to correct deficiencies noted.
- Develop recommendations for new rules and regulations to comply with current and forthcoming state and federal regulations, and to address current and future Village needs related to stormwater management.
- Get stakeholder buy-in by engaging the community in a series of public stakeholder meetings to educate the public on the need for change and to invite the public to provide feedback to the Village.
- Explore Green/Low-Impact Development solutions for stormwater management, and provide examples on how such strategies could be used in Archbold.
- Provide an implementation plan for the recommended improvements, rules and regulations, and low-impact development solutions.

The Village drains to Flat Run and Brush Creek. Each of these waterways is tributary to the Tiffin River and ultimately the Maumee River and Lake Erie. The Village's stormwater infrastructure has largely been installed since 1966. Past practice in the Village has been largely based on conveyance (move stormwater to the receiving stream as quickly as possible). More recent stormwater strategies have

focused on reducing runoff rates to pre-development conditions and additions of features intended to mimic natural drainage features reducing runoff rates and improving water quality.

Findings of our study of the existing stormwater infrastructure indicate:

- The condition of the Village's stormwater infrastructure is good. No significant condition-related issues were identified.
- The storm sewer pipe network is appropriately sized for the design conditions.
- Localized flooding issues appear to be related to the hydraulic capacity during runoff events (and the resulting water level) of Flat Run and Brush Creek, not storm sewer capacity.
- The following localized issues were noted during our investigation:
  - Quail Hollow/North Pointe Estates Flooding (Flat Run).
  - Cambridge Estates (Woodland Oaks 3)/Woodland Oaks 2 Flooding (Surface Drainage).
  - Basement Backups on Christine Drive and Monterey Court (Sanitary Sewer).
  - Fairlawn Retirement Community Flooding (Private Site Storm Water Management).
  - County Road 24 Flooding at Bridge/Culvert and Sunoco (Brush Creek).
  - General increases in flows to Brush Creek and resulting creek water levels from unrestricted storm flows primarily due to industrial development.

Several changes to the rules and regulations for the Village were recommended including:

- Revised Storm Sewer Design Standards.
- Implementing Formal Stormwater Detention Standards.
- Requiring Stream Setbacks & Buffers/Conservation Easements.
- Encouraging Low-Impact Design.

Developing an Asset Management Plan was also recommended which would include:

- Asset Inventory.
- Condition Assessment and Prioritization.
- Improvement Planning and Implementation.
- Tracking, Review, and Updates to the Plan.

Refinements to the Village's Stormwater O&M Program were also recommended, including:

- Annual inspection of all existing storm sewer outfalls.
- Annual cleaning and inspection of catch basins (CBs) and curb inlets (CIs) within the Central Business District.
- Annual cleaning and inspection of at least 20% of the remaining stormwater collection system, including all CBs and CIs.
- Continuation of current street sweeping program for all streets and municipal facilities. Village personnel currently sweep all streets once every three weeks in the Spring and Summer and each street twice per week in the Fall.
- Coordination with local businesses, schools, and institutions for semi-annual sweeping of parking lots and CB cleaning.

Three stakeholder meetings were held, and the presentations and attendance lists from these meetings are included in the Appendix of this report.

Green/Low-Impact Development (LID) strategies for handling stormwater were reviewed with the Village and case studies showing how these concepts could be applied were developed for:

- The Flat Run watershed.
- Existing Commercial and Industrial Sites.
- Village Park and School Lands.
- Brush Creek Conservation Development and "Greenway Corridor".

LID has the potential to add value to developable land in the Village and provide reductions in runoff and improvement of water quality of the receiving streams locally and regionally. This meshes well with the Village's desire to attract additional population to the Village.

Funding sources for stormwater improvements that impact water quality regionally are currently plentiful and available from a large number of state and federal sources. A full listing of these sources, along with local and other funding options, is provided in Section 9 of this report.

We recommend working with The Nature Conservancy (TNC) to obtain and coordinate funding for stormwater projects that have regional implications and/or include LID elements.

Funding for Village 'hard' stormwater infrastructure improvements, such as pipe replacement or pipe cleaning, will need to be funded by the Village. To establish a fund for such improvements, the Village should develop a source of funds that can be used for these needs. Development of a stormwater utility or additions to existing user fees could be explored.

Recommendations of this study are:

- Early Action Items – We recommend the following actions are initiated in 2023:
  - Implement updated stormwater rules and regulations including updated design standards, detention requirements, stream setback and conservation easements, and incentives for use of LID techniques. (The Village has now adopted updated stormwater regulations as of March 20, 2323.)
  - Maintain contact with ODOT, with respect to the State Route 66 culvert replacement, with the goal of keeping the new culvert hydraulically similar to the existing culvert.
  - Begin the development of a stormwater management plan including asset management and O&M.
  - Start design of the Cambridge Estates/Woodland Oaks stormwater diversion, and coordinate with TNC on available grants and funding.
  - Start the design of the Flat Run stormwater impoundment/constructed wetlands on Village land south of Sauder Village, continue to coordinate with Pete Carr with Fulton County Soil and Water to obtain Ohio EPA grant.
  - Engage TNC to assist in funding land acquisition for the Brush Creek Conservation Corridor concept.
  - Begin the Ditch Petition process with Fulton County for ditch cleaning efforts in Flat Run and Brush Creek. Promote efforts with TNC to improve conditions along both streams. These two items should further reduce water levels in Flat Run and Brush Creek during run-off events.
  - Explore funding availability for other LID projects on Village-owned Park and School lands.
  - Explore methods to establish a Village funding source for on-going stormwater 'hard' infrastructure improvements.
- Long-Term Items – We anticipate these efforts starting in 2024 or 2025 and continuing on:
  - Implement funding mechanism for Village stormwater management.
  - Continue to develop Brush Creek Conservation Corridor, and promote the vision of this corridor to attract development and promote the recreational and water quality benefits to the community and region. Consider formalizing an arrangement with TNC to assist in this effort.
  - Update the Village's stormwater system GIS with information from the annual inspections.

- Develop Stormwater Infrastructure Capital Improvement Plan based on inspection and funding development.
- Utilize LID concepts in Village development work to promote the concepts and serve as an educational tool to the community.
- Monitor ODOT culvert replacement projects in and around the Village on Brush Creek and Flat Run. Advise ODOT of potential adverse effects to the Village storm drainage conditions that could result from ODOT work.

2 – Introduction

An important initial piece of the strategic initiatives identified in the 2021 Archbold Comprehensive Plan was a comprehensive evaluation of the Village's stormwater infrastructure. This Study has been undertaken to perform that evaluation, address future stormwater needs, and develop recommendations on changes to rules and regulations concerning stormwater for the Village.

The Village of Archbold is located near the southwestern corner of Fulton County in the Tiffin River basin and is, thus, also tributary to the Maumee River and Lake Erie, as shown in Figure 1. The Village is served by a separate storm sewer system that discharges into two local stream systems, Flat Run and Brush Creek, as shown in Figure 2.

The Village's storm sewer system was mostly constructed after 1966, as the Village experienced a great deal of residential and industrial growth. Although the storm sewer system has experienced few problems over those decades, some drainage issues have occurred that are primarily related to the local streams. These have included overland flow impacting residential development, basement flooding due to stream backwater surcharging storm sewers, and flooding of some County Roads.

The regulatory landscape has also changed in the intervening years. The Clean Water Act and its attendant regulations were not in place in 1966, and stormwater discharges are currently viewed in a much different light. The Village realizes that its stormwater practices must evolve to adapt to current and forthcoming regulations and water-quality standards.

The Village also wishes to be a partner with residents, business owners, developers, farm owners, and neighboring governments as it develops strategies to address its stormwater discharges, drainage concerns, and water quality.

3 – Study Goals

This study was undertaken to accomplish the following goals:

- Identify the condition and capacity of the Village's current stormwater facilities, and provide recommendations to correct deficiencies by developing a capital improvement plan that will provide the Village with an appropriate level of service with the goals of reducing flooding and improving stormwater quality.

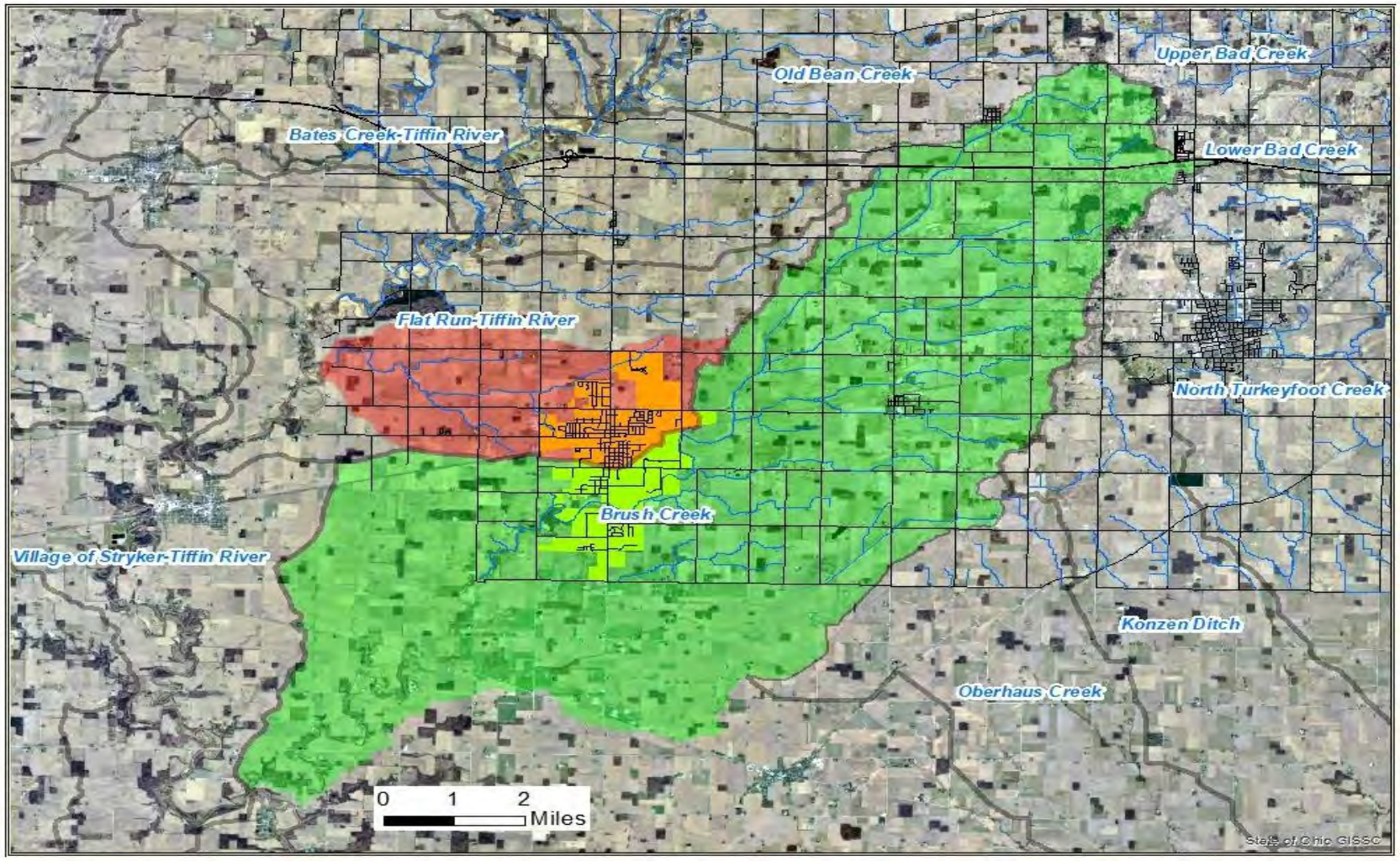

Figure 1 – Vicinity Map

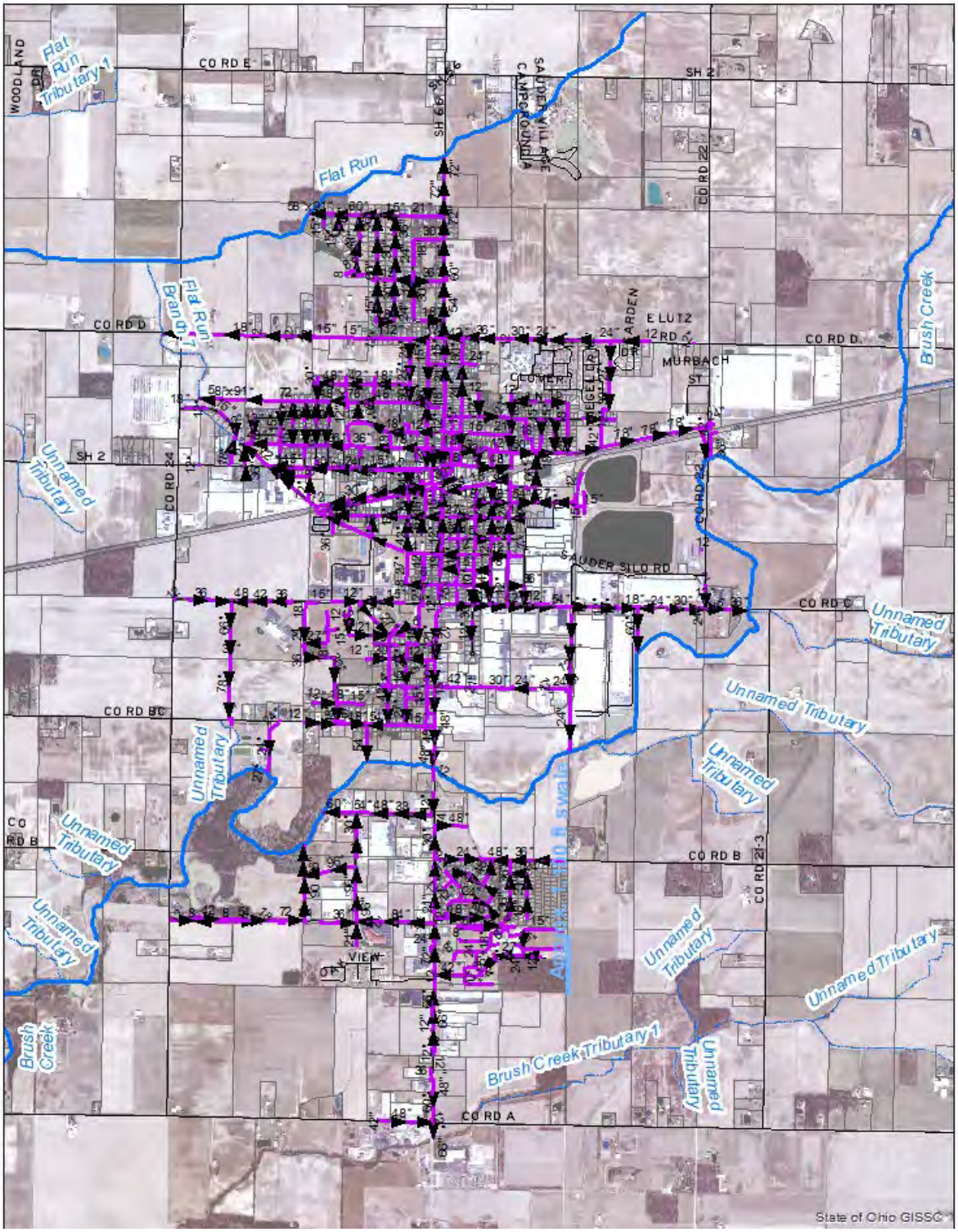

Figure 2 – Storm Sewer System

- Provide recommendations on rules and regulations that respect the desire for continued development, and incorporate common-sense best practices for the improvement of stormwater management and quality. These recommendations will include practical green and low-impact development policies that combine private and public efforts to improve the quality of the built environment in the Village.

- Conduct outreach meetings for Village officials and stakeholders from outside the Village. Buy-in from the Village and other stakeholder groups will be important in gaining trust and developing a sense of partnership.

- This document will serve as a Stormwater Master Plan for the Village and document:
  - Why change is needed?
  - What is being proposed?
  - Identification of early-action projects that will have the greatest impact on current issues.
  - Identification of longer-term projects that will enhance the Village's stormwater infrastructure.
  - Identify and prioritize future operations, maintenance, and asset management activities for the Village to undertake.
  - How the community will be impacted and enhanced?
  - Anticipated costs and sources of funding.
  - Approximate timing for implementation.

4 – Historical Information

Watershed Summary

The Flat Run and Brush Creek watersheds drain areas of 9.7 and 66.6 square miles, respectively. The watersheds are primarily agricultural land and a few woodlots outside of the Village of Archbold. Both flow southwesterly toward the Tiffin River, and both basins are fairly flat.

Flat Run passes through the north part of Archbold at Sauder Village and drains about 1.8 square miles of the Village. There are only two main discharge points from the Village's storm sewer system directly to the main branch of Flat Run, at State Route 66 and at the northwest corner of the Quail Hollow Subdivision.

Branch 7 of Flat Run (referred to on FEMA maps as Flat Run Tributary 2) begins just north of the ConAgra plant and flows northwesterly to Flat Run with its confluence located just west of County Road 24.

Branch 7 alone drains about 0.8 square miles of Archbold, including not only most of the area north of the Norfolk-Southern Railroad tracks, but also Archbold High School and parts of downtown south of the tracks.

Brush Creek meanders through the Village, roughly bisecting it. Brush Creek is a larger stream with a more well-defined floodplain, but some areas of the floodplain have been filled in the past, most notably at the Village's Wastewater Treatment Plant and just west of State Route 66. There is also a large wetland "pond" located south of Sauder Woodworking along the south bank of Brush Creek just north of County Road B.

Both of these streams and their major branches were the subject of petitioned county ditch project improvements undertaken by Fulton County in the 1950s. These projects included dredging the banks and bottom of the channels to a trapezoidal cross-section shape, and cleanout of culverts and farm crossings. The streams are not on "permanent maintenance", as the projects were completed prior to revisions in Ohio's Ditch Laws a few years later. However, it appears that some parts of the streams have been maintained to some degree by the adjacent property owners.

The historical development of the Archbold area is shown in the following images, which depict land use in 1913, 1971, 1995, and 2019, respectively.

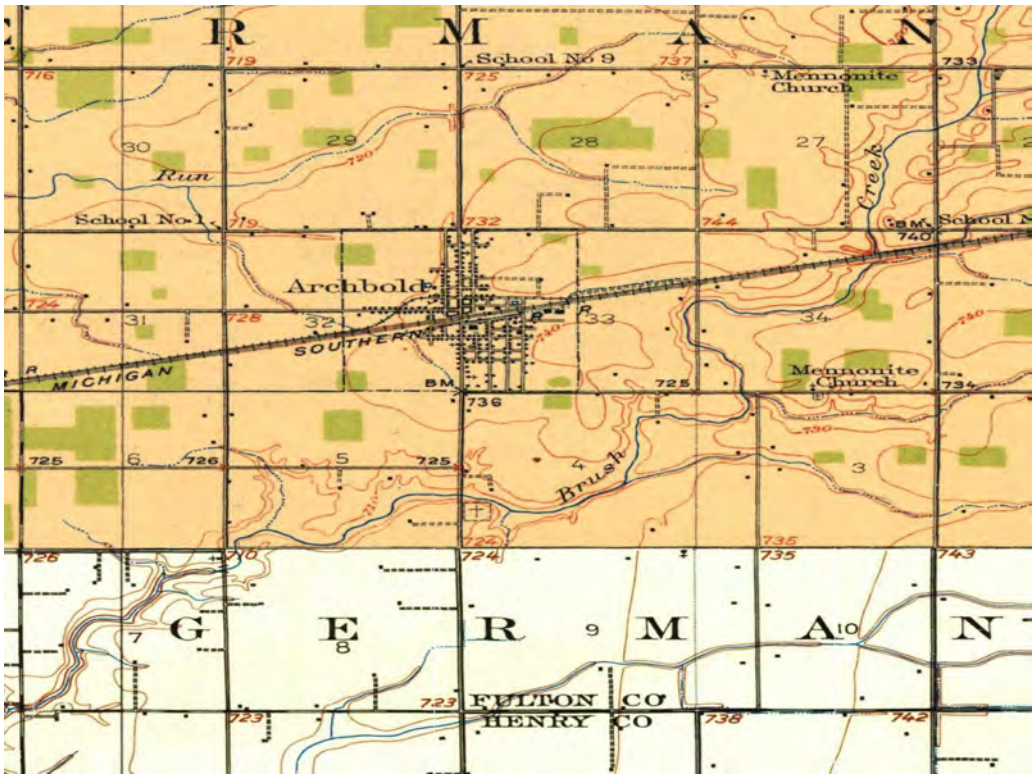

Figure 3 – USGS Mapping, 1:63,000 scale, 1913

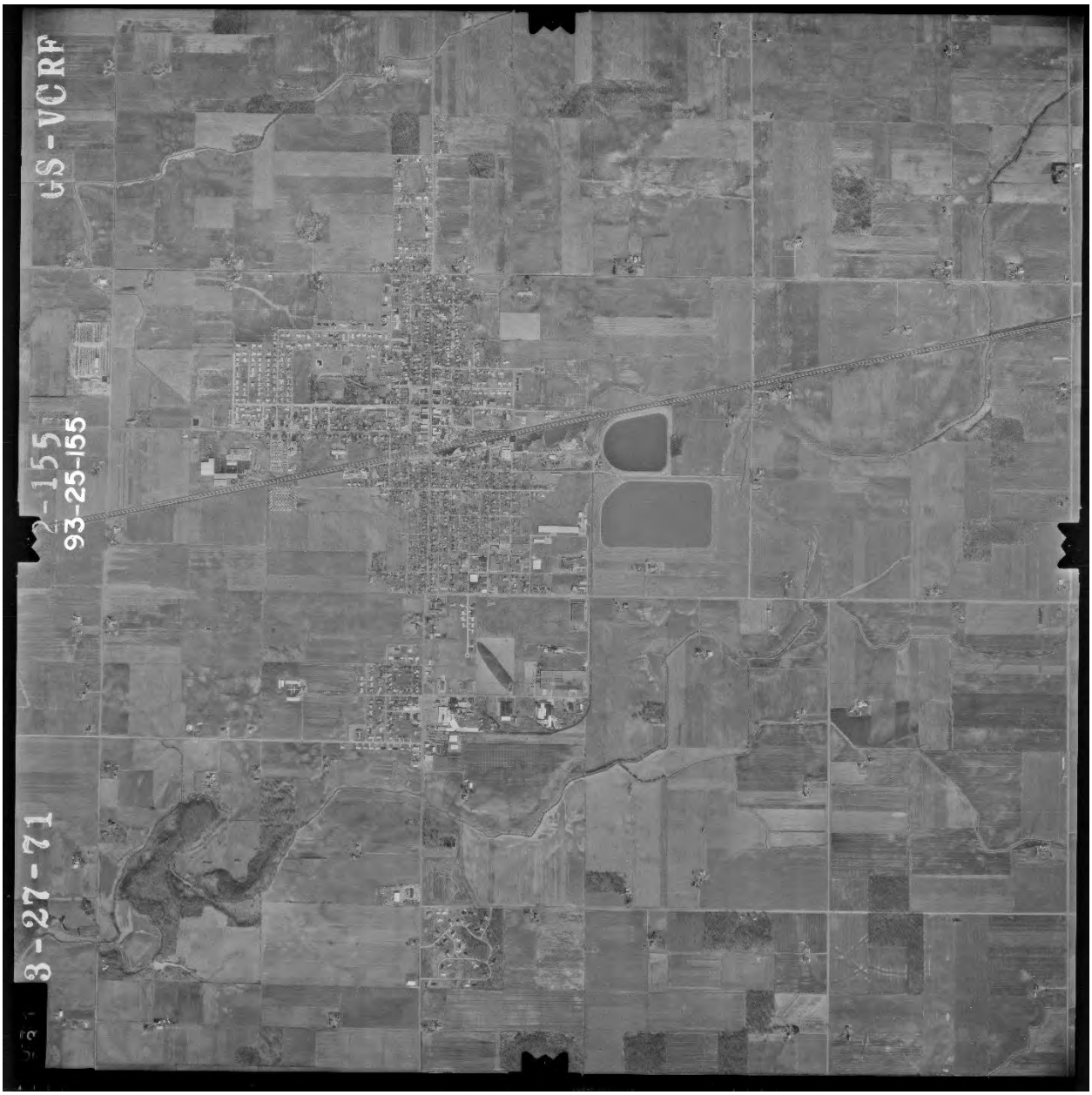

Figure 4 – Aerial Imagery, Village of Archbold, 1971

Figure 5 – USGS Imagery, 1995

Figure 6 – Fulton County Imagery, 2019

The slow development of the Village to the north and south over the past century is clearly seen, particularly the residential development north of County Road D, the expansion of the Sauder Woodworking facilities near the Village reservoirs, the construction of Sauder Village, and the industrial and commercial growth south of Brush Creek.

Information Sources

A comprehensive search was undertaken for information on the Village's storm sewer system and the two stream networks. The following is a summary of information obtained and used in this Study:

- GIS data from the Village, including storm sewer pipes, catch basins, and manholes.
- GIS data from Fulton County, including parcels, roadways, ditches, ground contours, and aerial photographs.
- GIS data from the State of Ohio, including aerial imagery and ground elevation datasets.
- Storm sewer record drawings from the Village of Archbold.
- Bridge and culvert drawings from the Fulton County Engineer and Ohio Department of Transportation.
- The 1966 Storm Sewer Study for Archbold prepared by Jones & Henry Engineers.
- Cleanout plans for both streams from the Fulton County Engineer's office.
- The 2016 Stormwater Management Study prepared for Sauder Village.
- Hydrologic and hydraulic models from the FEMA Flood Insurance Study for Fulton County.
- Nine-Element Non-Point Source Implementation Strategy reports for the Brush Creek and Flat Run Watersheds from the Fulton Soil & Water Conservation District.
- Site plans for several commercial properties.

5 – Capacity and Condition of Existing Drainage System

The current drainage system for the Village and its surrounding area consists of two primary components: the piped separate storm sewers located mostly within the Village, and the major open channel systems consisting of the Flat Run and Brush Creek stream channels and their tributaries. A small area in the extreme southern portion of the Village drains into a ditch that flows into Henry County.

Although there are some privately-owned storm sewers that serve individual properties within the Village, this study is focused on the storm sewers that are owned and operated by the Village. This system covers virtually the entire developed area of the Village and is shown on Figure 7.

The storm sewer system was constructed mostly after 1966, when Jones & Henry prepared its Storm Sewerage Report for the Village. The design of the storm sewers was based on pipes flowing full for a 5-year frequency storm and the hydraulic grade line (HGL) being kept below ground elevations for a 10-

year frequency storm. The layout of the Village's system over the next few decades mostly followed the recommendations in Jones & Henry's report.

More recent portions of the storm sewer system in Industrial Park areas followed a slightly different design, sizing the storm sewers to convey a 10-year frequency storm when flowing full and keeping the HGL below grade for a 25-year frequency storm. The Village does not currently have an official requirement for new developments to provide any stormwater detention to reduce the peak rate of runoff entering the public storm sewers; however, a few private detention basins at commercial and industrial sites have been constructed in recent years.

Virtually all of the storm sewers discharge into either the Flat Run or Brush Creek stream systems, except for the small southerly area that drains into the Henry County ditch. The drainage areas of Flat Run and Brush Creek are shown on Figure 8. Flat Run drains the northern part of the Village, and as its name implies, has a very flat grade and no well-defined floodplain. Only a short reach of Flat Run in and near Sauder Village lies within the Village of Archbold. The stream is historically considered a Fulton County Ditch but was last petitioned and "cleaned out" in 1956 and is not on "permanent maintenance" by the County Engineer. The land immediately adjacent to the stream channel is primarily agricultural. Some private farm crossings have been constructed across the stream channel; the most notable of which is a driveway bridge at the extreme west end of Quail Run, and a long farm culvert downstream of State Route 66. Most of the crossings on major roadways are large elliptical corrugated metal pipe (CMP) culverts.

Brush Creek is a larger stream that flows through the central part of the Village and drains most of the Village's central and southern areas. Brush Creek has a more well-defined floodplain than Flat Run, and there is only limited development near its banks. Most of the land adjacent to the stream is agricultural outside the Village and open space inside the Village. Roadway crossings on this stream are bridges as opposed to culverts. There is one small low-head dam on the stream at the Village's Water Treatment Plant, but this appears to present only a minor obstruction to flow.

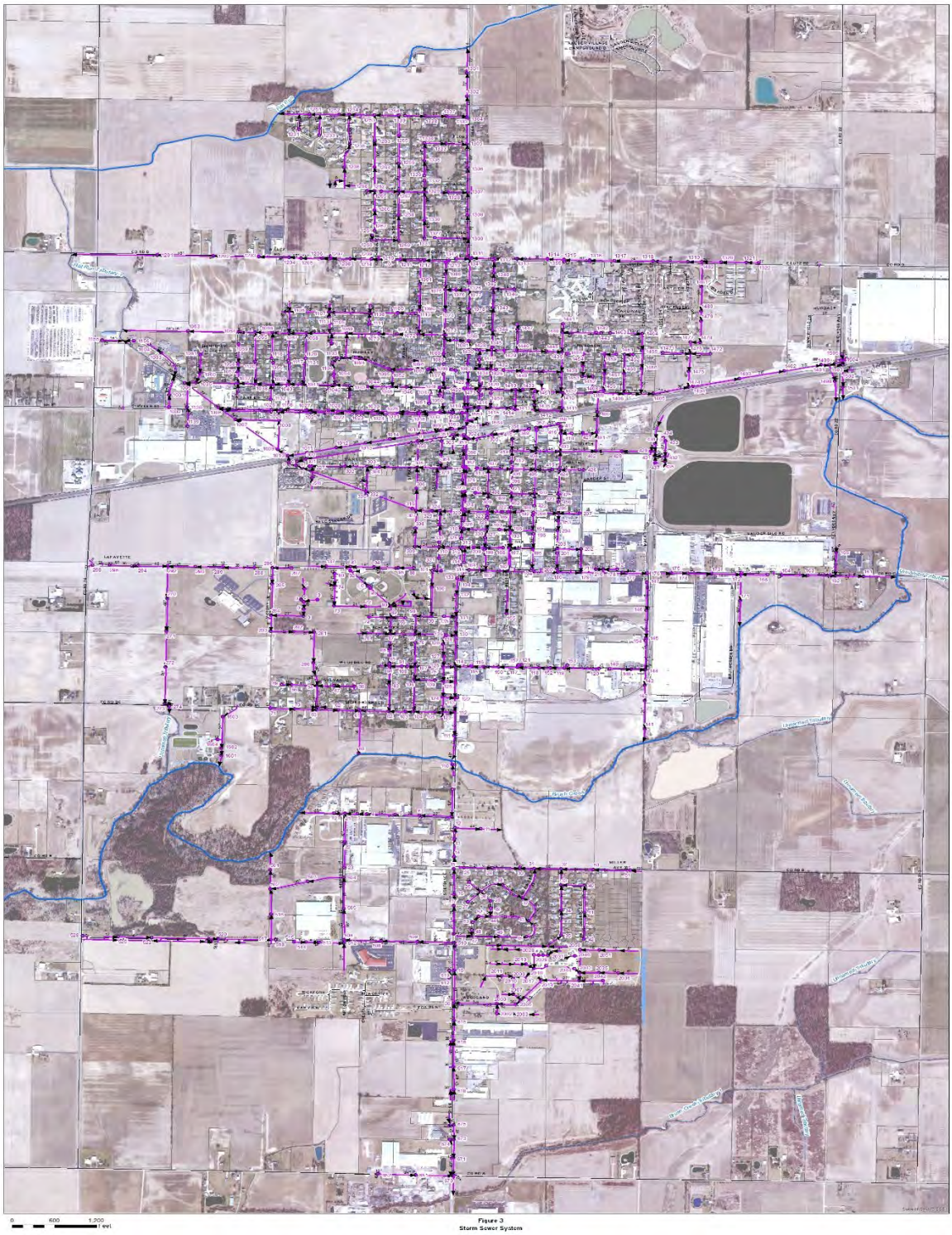

Figure 7 – Storm Sewer System

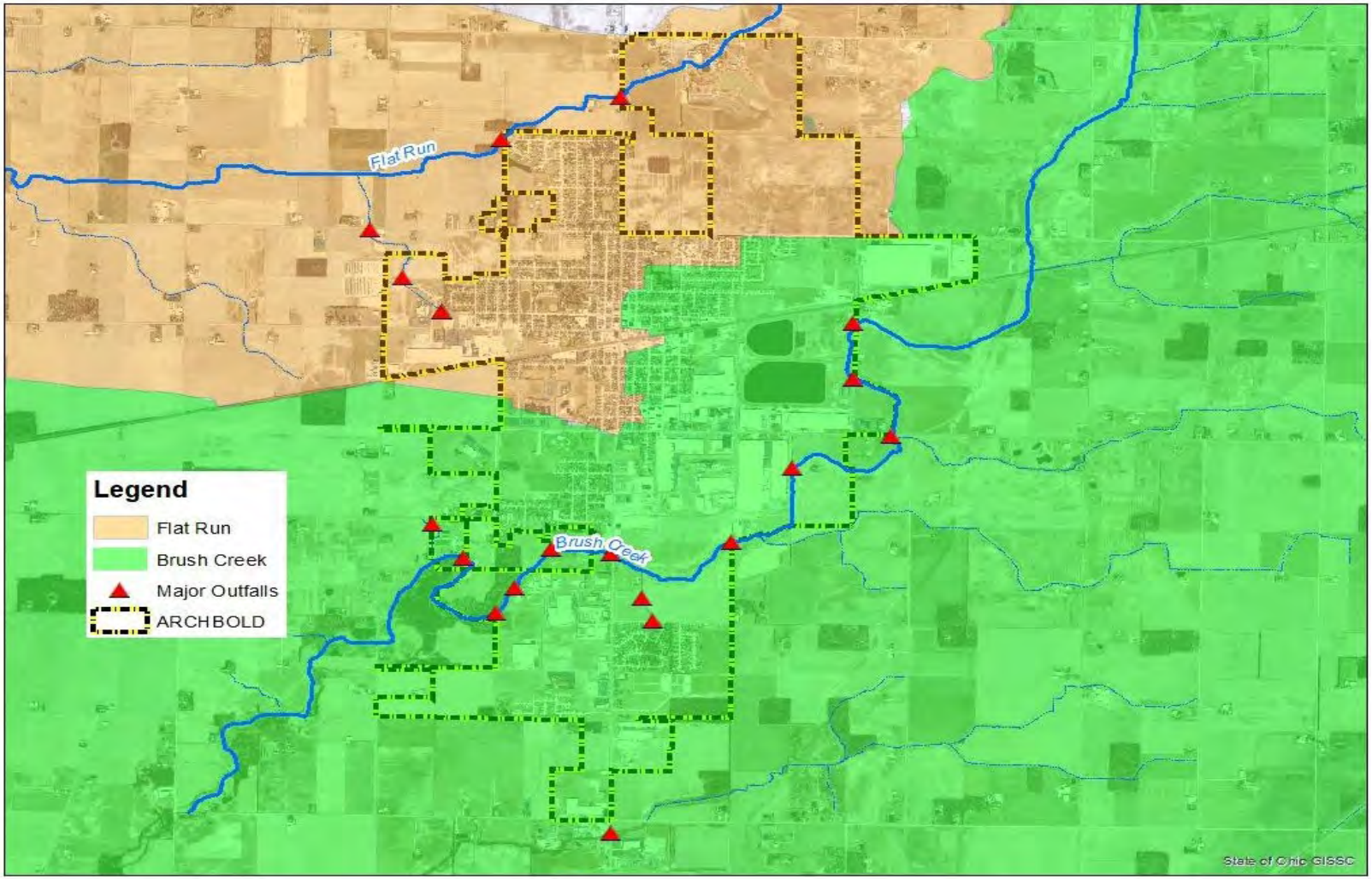

Figure 8 – Outfalls by Drainage Basin

Known Drainage Issues

Discussions with the Village and other stakeholders indicated that there were some current issues with storm drainage in and near the Village involving both the storm sewers and the stream systems.

Quail Hollow/North Point Estates Flooding

Flooding of basements along Quail Run in the Quail Hollow Subdivision was reported during recent heavy storms. In one case, the problem was attributed to failure of sump pumps due to a blackout during the storm. The sump pumps discharge into the storm sewer on Quail Run, which in turn, discharges into Flat Run

Cambridge Estates (Woodland Oaks 3) / Woodland Oaks 2 Flooding

Some street flooding was reported in the residential area along Rosewood and Dogwood Courts between Miller Avenue and Woodland Park. Village personnel felt this was likely caused by runoff from farm fields east of these two streets flowing overland westward into the subdivision, overloading the storm sewers on these streets.

Basement Backups on Christine Drive and Monterey Court

Basement backups in these areas have been reported during wet weather. It appears that these backups were related to sanitary sewer conditions. Recent improvements at the Village's wastewater treatment plant appear to have improved conditions. However, this area should continue to be monitored.

Fairlawn Retirement Community Flooding

Flooding has been reported in this community located along County Road D. It appears that the stormwater issues on this site are related to the private onsite stormwater infrastructure and that improvements to the Village system will not likely impact this private system enough to alleviate onsite stormwater issues.

County Road 24 Flooding at Bridge/Culvert and Sunoco near Brush Creek

Generally speaking, runoff to the Brush Creek watershed has increase substantially because of increased runoff from unrestricted stormwater flows from developed land. This increase in runoff causes Brush Creek water levels to rise quickly during storm events which has caused nuisance flooding at times.

System Modeling

Storm Sewers

The public storm sewer system was modeled using SewerGEMS with its storm sewer module. This included modeling runoff from catchments using the Rational Method and modeling the hydraulics of the pipes using Manning's equation. The geometry was imported from the Village's GIS shapefiles of its storm sewer pipes and manholes and was supplemented with information obtained from the Village's

record drawings of its storm sewer system. The model generally included pipes larger than 15 inches in diameter. The modeled system is shown in Figure 7.

Subareas at key locations in the Village's system were determined using ground contours and the pipe network. Runoff coefficients and times of concentration for each subarea were estimated from aerial photography and soils data.

Stream Channels

The Brush Creek and Flat Run stream channels in the vicinity of the Village were modeled using HEC-RAS software. The model geometry was developed from HEC-RAS and HEC-2 models obtained from FEMA, and was updated based on rough field measurements and some bridge and culvert drawings obtained from ODOT and the Fulton County Engineer.

The peak flows used in the Brush Creek model were taken from the FEMA Flood Insurance Study for Fulton County, which were based on the NRCS curve number method. The peak flood flows for Flat Run were calculated using HEC-HMS and employed the NRCS curve number method for consistency.

Design Storms

The design storms used for the storm sewers were the 5- and 10-year storms. The design storm for the stream channels was the 25-year storm, although the 5-, 10-, and 100-year flood profiles were also calculated.

Overview of Results

The results for the storm sewer models showed that the existing sewers appeared to not have significant capacity issues for the design storms. The problem areas were confined to the storm sewers in Rosewood and Dogwood Courts and the storm sewer on Quail Run.

The storm sewers on Rosewood and Dogwood Court showed the HGL exceeding the manhole rim elevations for a 10-year storm, as shown on Figure 9. There is an area of farm field to the east of Dogwood Court of about 22.1 acres that flows overland and into the storm sewers on Dogwood and Rosewood Courts, as shown on Figure 10. Diverting this runoff away from these storm sewers would allow them to convey a 10-year storm without the HGL exceeding the manhole rims.

For the Quail Run storm sewer, the large elliptical pipe can convey a 10-year storm without the HGL exceeding the manhole rim elevations, as shown on Figure 11, but the HGL is within a few feet of the rim elevations, and is thus higher than the basement elevations of the homes on Quail Run. Therefore, if the sump pumps in these basements fail, there is no way to move water from the foundation drains into the storm sewer by gravity unless the HGL in the storm sewer is reduced a few feet.

The HGL in the storm sewer is controlled to a large degree by the elevation of the water in Flat Run. To try to reduce the flood elevation in Flat Run, we evaluated building a detention basin alongside the north side of the Flat Run channel just upstream of the outlet of the Quail Run storm sewer, as shown in Figure 12. The water in Flat Run would overflow a weir built along the north bank of Flat Run and enter a

large detention basin, which would reduce the peak flow, and thus the flood elevation, on Flat Run downstream.

Unfortunately, this alternative alone was not able to reduce the peak flow and flood elevation enough to solve the problem on the Quail Run storm sewer. The HGL on the storm sewer could only be reduced by approximately 2 feet. There was simply not enough depth available between the flood elevation of Flat Run and the channel bottom of Flat Run to "push" enough water into the detention basin, even with the basin covering an area over 30 acres.

It should be noted that the largest portion of the Flat Run watershed, see Figure 8, lies outside the Village. So, a more comprehensive solution to the water level in Flat Run will require reaching outside the Village and partnering with Fulton County to improve drainage conditions for this waterway. This will be a long-term cooperative effort.

Although a complete solution to Flat Run does not appear feasible with the area controlled by the Village, any reduction in flows to this waterway will help reduce water levels and therefore flooding in this area. A constructed wetland has been proposed for this purpose in the Green and Low Impact Development section of this report.

Residents in this area should be encouraged to either direct their stormwater sump pump discharges to grade or to install backflow prevention devices on the stormwater sump pump discharges. These changes will reduce the probability of stormwater backing up from the storm sewer into basements.

The flood profiles for the studied reaches of Flat Run and Brush Creek are shown on Figures 13 and 14. Storm sewer HGL profiles and tabular data are included in Appendix A.

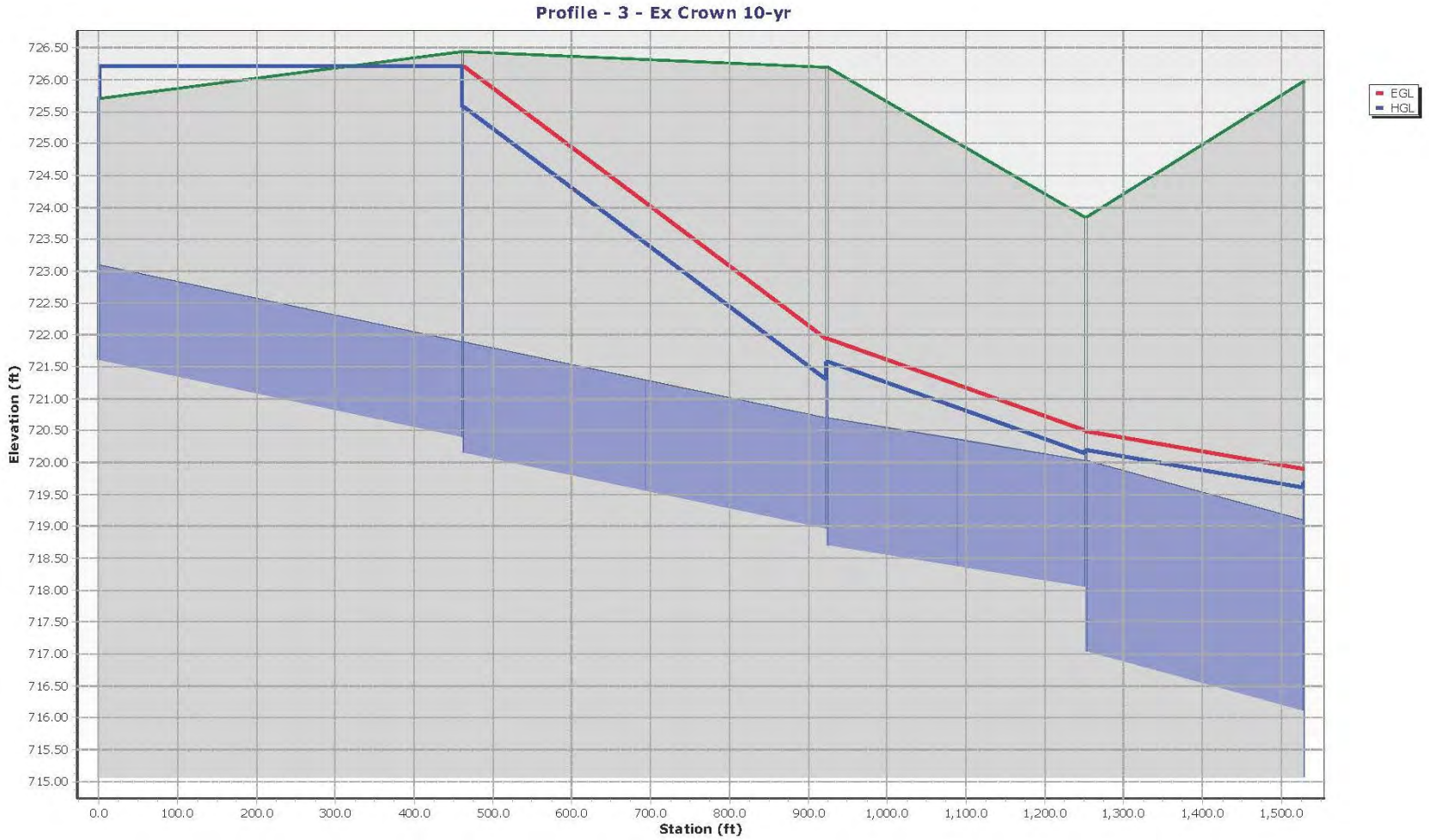

Figure 9 – Dogwood Court Hydraulic Profile

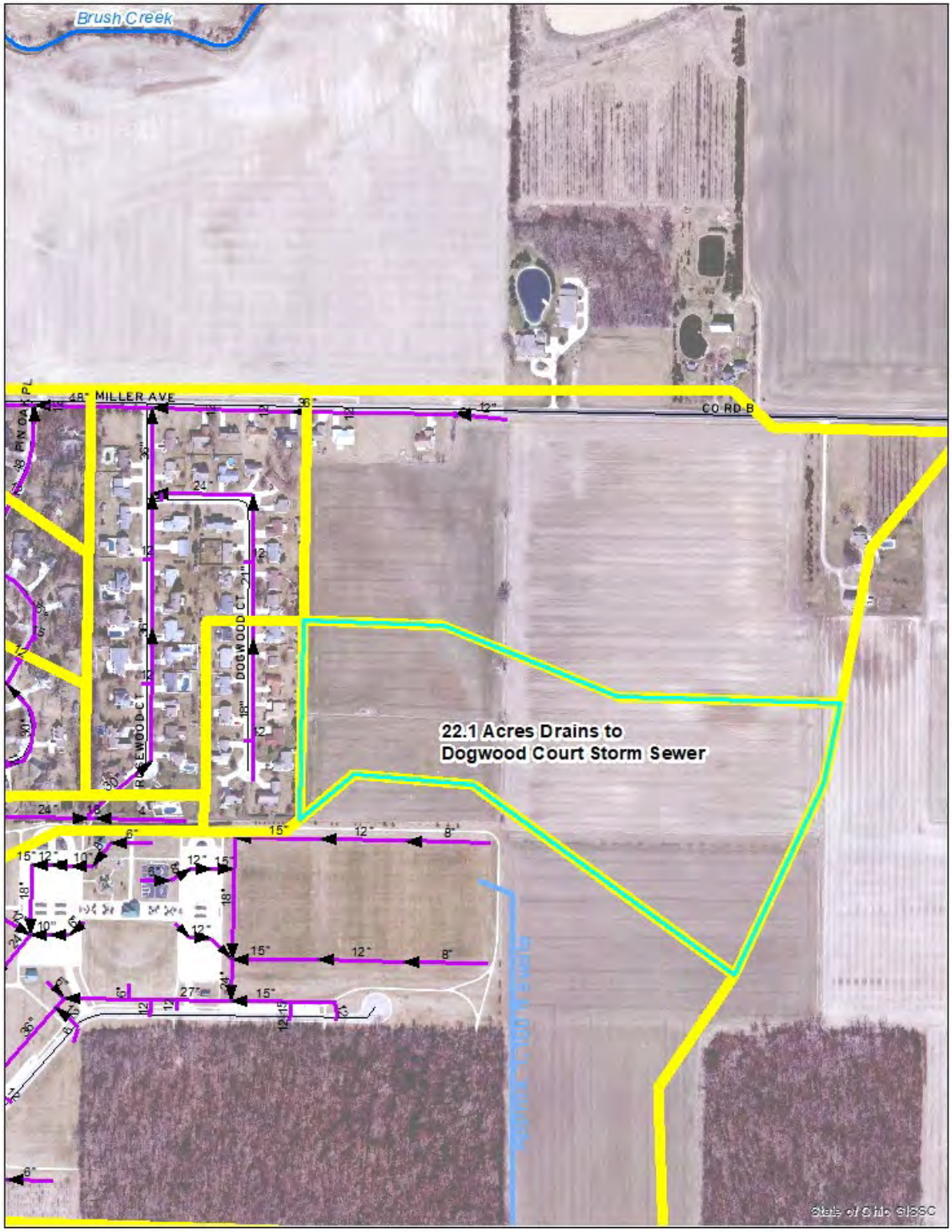

Figure 10 – Off-Site Drainage to Dogwood Court

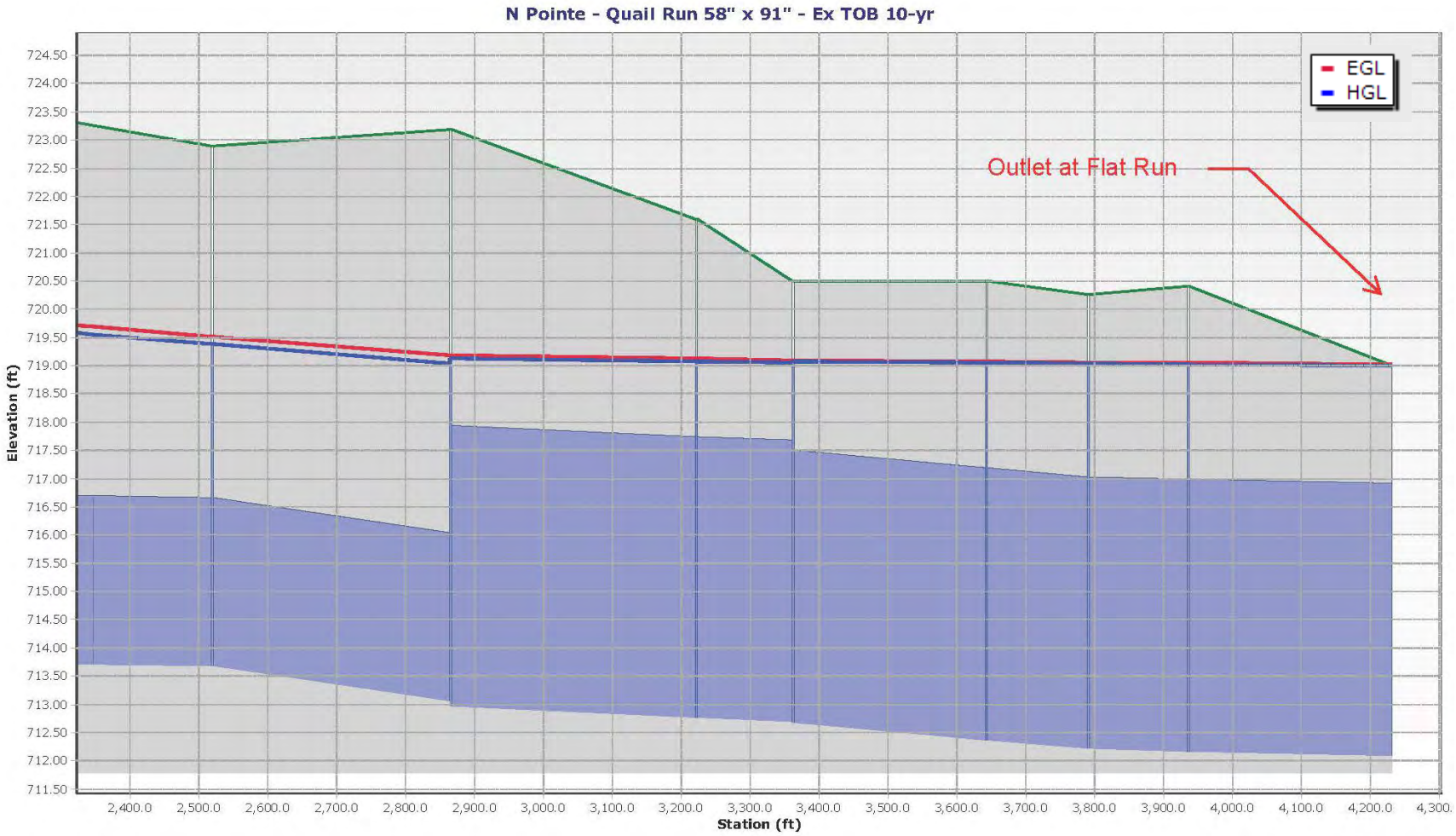

Figure 11 – Quail Run Storm Sewer Hydraulic Profile

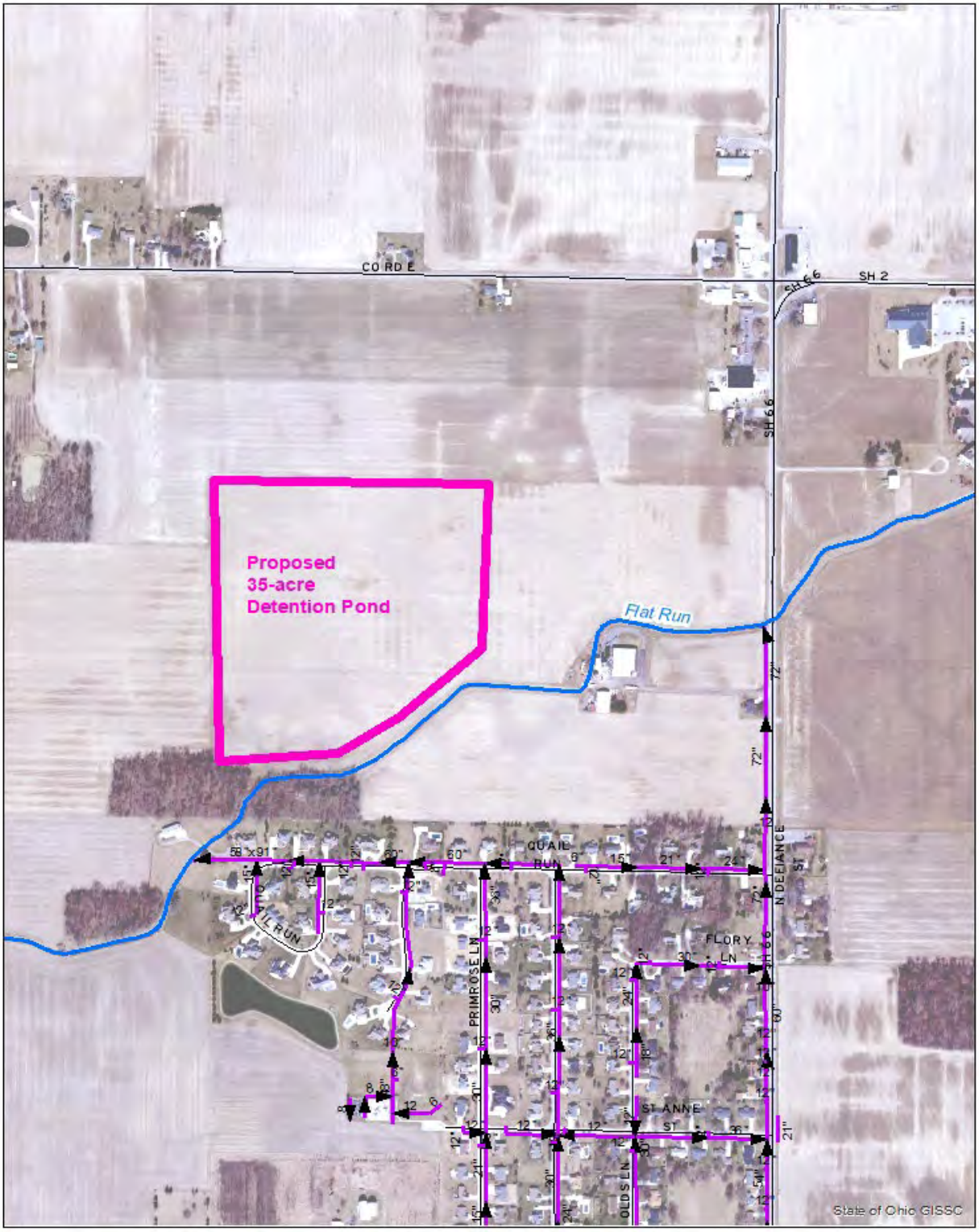

Figure 12 – Quail Run Detention Pond

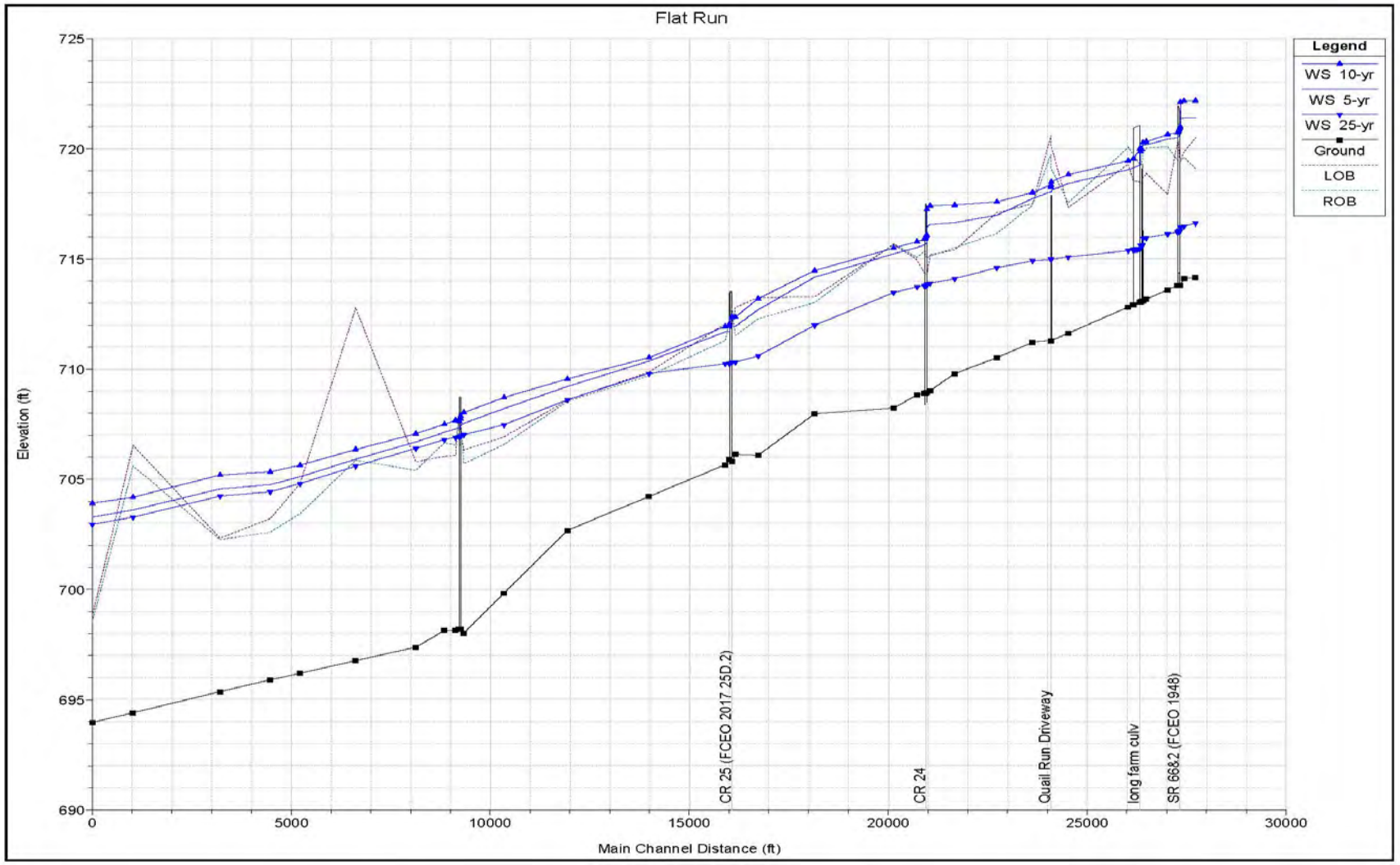

Figure 13 – Flat Run Hydraulic Profile

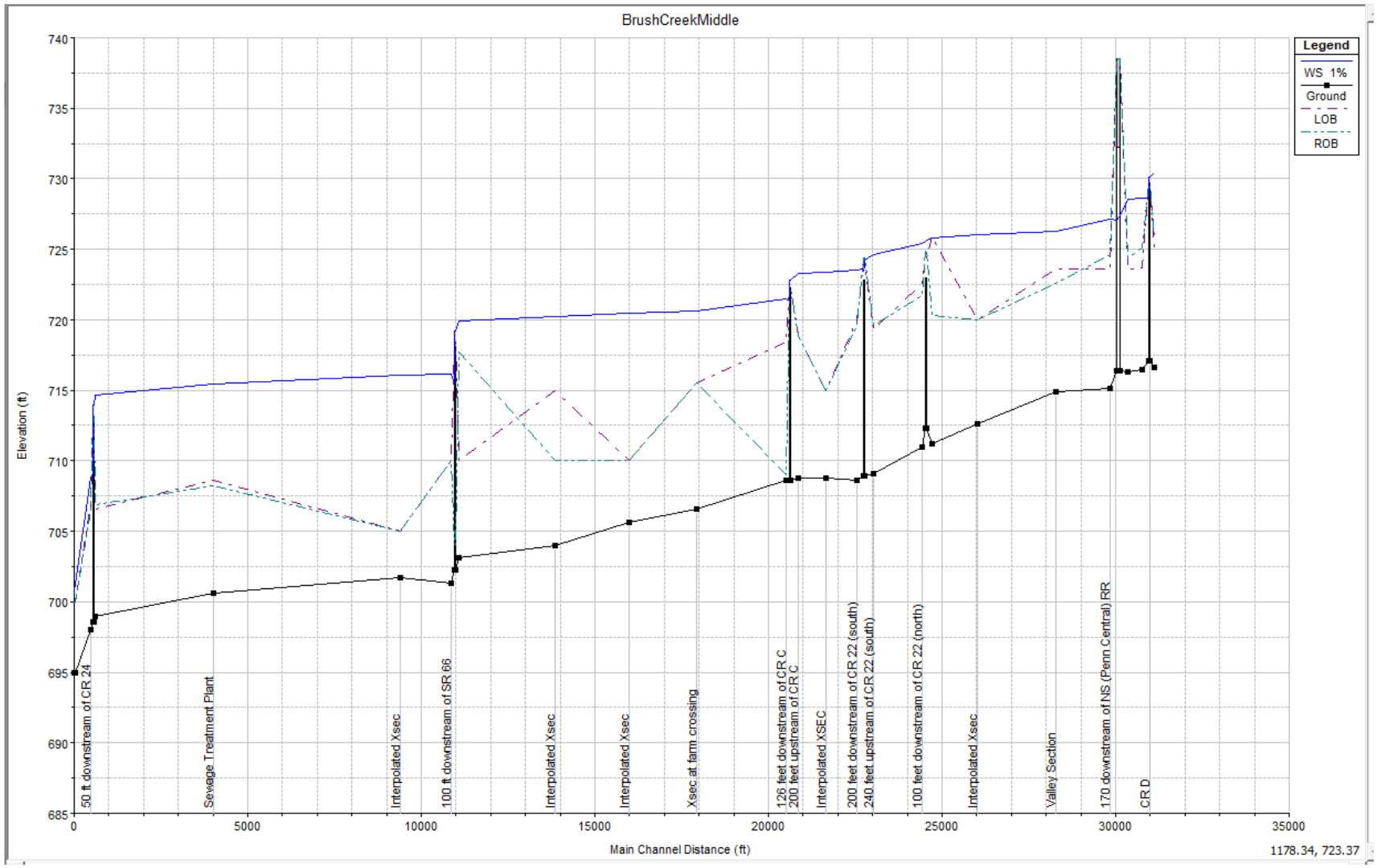

Figure 14 – Brush Creek Hydraulic Profile

6 – Rules and Regulations

Past approaches to stormwater management within communities throughout Northwest Ohio and the Midwest Region have historically focused on providing conveyance capacity to move the runoff away as quickly as possible. With the proliferation of impervious surfaces (e.g., roofs and pavements) due to development and enhanced drainage through man-made and modified drainageways, enclosed storm sewers and agricultural tiling, the capacity of local receiving streams are becoming overwhelmed more rapidly during and immediately after significant runoff events. This runoff is also contributing to degradation of water quality by carrying pollutants and sediment to the receiving streams. Understanding the potential negative impacts due to stormwater runoff, federal, state, and local regulations have been promulgated. Additional, more stringent rules related to water quality impacts due to stormwater are anticipated, with focus on nutrient reductions within the Lake Erie and Maumee River Watersheds.

Current Local Standards

The Village of Archbold has historically focused on providing capacity to carry stormwater discharges directly to receiving streams. Traditional design methodologies common throughout the region have been utilized. The basic storm sewer designs are based upon conveyance of a 5-year, peak-intensity, rainfall runoff within the proposed storm sewers and a check to ensure the hydraulic grade line (HGL) of storm flow resulting from runoff of a 10-year, peak-intensity will remain at or just below the ground surface. Runoff from proposed sites are generally unrestricted and stormwater discharges to local receiving streams are rapid and concentrated to individual outfalls.

The Village has not adopted local stormwater detention/retention requirements and are currently in the process of developing new Subdivision and Engineering Regulations to reflect current practices to include stormwater detention/retention volumes based upon a comparison of pre-development runoff to post-development conditions. The Village adopted stormwater regulations on March 20, 2023, which are included in Appendix C.

Chapter 150, Flood Damage Prevention of the Archbold Code of Ordinances adopted in 1998 and amended in 2011, established the Village Administrator with the responsibility to review applications for development within flood hazard areas of the Village, as defined by the Federal Emergency Management Agency (FEMA) flood mapping. This section of local code generally prohibits fill to be placed within the defined floodway of a stream, unless otherwise approved through FEMA. Filling within a floodplain is limited to a cumulative total of not greater than one foot rise in the base flood elevation. The Village may elect to further amend this section of code to provide more stringent requirements for allowable rise in the base flood elevation.

The Village requires compliance with applicable State and Federal Rules discussed in the following section and may elect to adopt local standards that are more stringent than the minimum levels mandated.

State and Federal Standards

Ohio EPA Small Municipal Separated Storm Sewer Systems (MS4) Program

The Ohio EPA has issued a general stormwater discharge permit for communities of fewer than 100,000 residents. The Ohio EPA is currently focusing on engagement with communities with populations larger than 10,000 and is working through the process to eventually enforce these rules on all communities throughout the State. The Ohio EPA is also focused on communities located within watersheds that have an approved Total Maximum Daily Loading (TMDL). Currently, the upper Maumee River Basin does not have an approved TMDL, but approval of the TMDL is on the near horizon and will cause Fulton County and the Village of Archbold to meet the full requirements of the Small MS4 Program. Additional information related to the Maumee River TMDL may be found at https://epa.ohio.gov/divisions-and-offices/surface-water/reports-data/maumee-river-watershed.

The stormwater general permit requires the development and implementation of a Stormwater Management Plan (SWMP), that defines the best management practices (BMPs) the Small MS4 has selected to address the six minimum control measures in the permit, why those particular BMPs were selected, and defined performance standards for BMP implementation. The six minimum control measures within the general stormwater permit are:

1. Public Education and Outreach
2. Public Participation and Involvement
3. Illicit Discharge Detection and Elimination
4. Construction Site Runoff Control
5. Post-Construction Runoff Control
6. Pollution Prevention/Good Housekeeping for Municipal Operations

Once the TMDL for the upper Maumee River watershed is accepted, the Village will be required to prepare a SWMP and file for formal coverage under the Permit. In the interim, the Construction Stormwater Management requirement for individual projects is required.

Construction Stormwater Management

As identified within the Small MS4 Program above, the State of Ohio requires that projects with predicted land disturbance in excess of 1.0 acre are required to develop a Stormwater Pollution Prevention Plan (SWP3), providing construction and post-construction BMPs conforming to the Ohio Department of Natural Resources (ODNR) Rainwater & Land Management Manual. Further, if an individual construction project is part of a larger program or a phased development, the SWP3 shall incorporate the entirety of the completed program or phases.

Such BMPs reduce the opportunity for sediment and nutrients to reach receiving streams. However, the volume of detention that is created is nominally less than typical detention/retention requirements. The Village has the authority to adopt local standards that are more stringent than those required by the State of Ohio and may reduce the area of disturbance triggering the requirement for an SWP3.

Federal Requirements

The Clean Water Act (CWA) passed in 1972 is the overarching regulation controlling the release of potential contaminants to surface waters throughout the United States. Several sections of the CWA are relevant to stormwater management.

Stormwater NPDES Permits

The U.S. EPA, through the CWA, established a National Pollutant Discharge Elimination System (NPDES) permit program to regulate point sources of discharge of sediment and nutrients to receiving streams. The NPDES Permits are issued for individual wastewater treatment plants (WWTPs) such as the Village of Archbold's, as well as general permits for stormwater throughout the State of Ohio. This section of the CWA defined MS4s and established the requirements for the TMDLs noted above.

CWA Sections 401 and 404

Section 404 of the CWA regulates placement of fill into wetlands, lakes, and streams deemed as "waters of the State." Section 404 is intended to aid in minimizing adverse impacts to wetlands and other waters. If impacts cannot be avoided, to compensate for such loss through mitigation and restoration. Within Ohio, Section 404 is jointly implemented by Ohio EPA and the U.S. Army Corps of Engineers (USACE). USACE issues Section 404 Permits and monitors compliance with the issued permits, and the Ohio EPA provides water quality certifications in accordance with CWA Section 401.

Additionally, Sub-Section 404(m) of the CWA authorizes review of all applications submitted to the USACE by the U.S. Fish & Wildlife Service (USFWS) for potential impacts to protected and endangered species. Further reviews and screening of permit applications may be required through various additional agencies authorized under the National Environmental Policy Act (NEPA) and/or National Historical Preservation Act (NHPA).

The Village of Archbold and private entities seeking to construct new stormwater outfalls are required to file for a permit through the USACE prior to commencing construction.

Federal Emergency Management Agency (FEMA)

FEMA provides guidance and review for proposed fill within a floodplain and floodway. As noted above, the Village adopted local regulations to provide eligibility for participation in the National Flood Insurance Program, or NFIP, for local residents and businesses. FEMA has established mapping based upon estimates of topography and local hydrology to define base flood elevations and special flood hazard areas (SFHA) that are prone to flooding. Proposed developments that result in modifications to local floodplains and floodways require engineering analysis and issuance of a local floodplain

development permit. Modifications that may result in changes in a floodplain or floodway within the SFHA require filing for review by FEMA prior to issuing a local floodplain permit.

Anticipated Regulations/Standards

It is anticipated that further regulations and standards will be promulgated following completion of the TMDL for the Upper Maumee River. General reductions in the allowable discharge of nutrients, including phosphorous, will likely result in more rigorous implementation and monitoring of Stormwater Management Plans within MS4 communities such as Archbold. State and Federal requirements may also begin to limit the rate of discharge to reduce downstream flooding and erosion.

Peer Communities' Standards Review

Review of local standards developed by similar communities throughout Northwest Ohio provides insight and guidance for creation of local standards to ensure that the Village is not placed at a competitive disadvantage for proposed residential and commercial development. The following page provides a tabular presentation of local stormwater regulations adopted by nearby communities.

Table 1
Peer Community Standards Summary Table

	City of Bowling Green	City of Bryan	City of Defiance	City of Findlay	City of Lima	City of Napoleon	City of Perrysburg	Village of Pioneer	City of Wauseon
Conveyance Standard	5-Year Storm Conveyance / 10-Year HGL Check	5-Year Storm Conveyance / 10-Year HGL Check	5-Year Storm Conveyance / 10-Year HGL Check	5-Year Storm Conveyance / 10-Year HGL Check	10-Year Storm Conveyance	5-Year Storm Conveyance / 10-Year HGL Check	5-Year Storm Conveyance / 10-Year HGL Check	10-Year Storm Conveyance	12-Inch minimum pipe size with 2.0 FPS (min.) velocity
Detention Required	Yes (see Notes)	No (see Notes)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Allowable Pre-Development Runoff (Qpre)	2-Year Runoff (C= 0.10 & i=2.3"/hr)	--	2-Year Runoff	5-Year Runoff (see Notes)	2-Year Runoff	2-Year Runoff	2-Year Runoff (C= 0.10 & i=2.2"/hr)	5-Year Runoff	(see Notes)
Post-Development Storage Required	25-Year Runoff	--	Critical Storm	100-Year Runoff	(see Notes)	Critical Storm	100-Year Runoff	25-Year Runoff	(see Notes)
Ownership	Private	--	Private	Private	Private	Private	Private	Private	Private
Storm Taps Provided	No	No	No	No	No	Yes (see Notes)	No (see Notes)	Yes (see Notes)	No
SWP3 Required	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Allowable Flood Rise	1.0 Feet	1.0 Feet	1.0 Feet	0.10 Feet (see Notes)	1.0-Feet	1.0 Feet	1.0-Feet	1.0 Feet	1.0 Feet
NOTES:	Considerations for reduction of detention provided for redevelopment of lands.	Draft regulations in process (2-yr, 50-yr Method proposed)	Storage volume calculated by design engineer and reviewed by City based upon "Critical Storm Method". City allows use of SWMM modeling as well.	Allowable pre-development runoff may be reduced based upon system capacity. Reduced 1% ACE rise required for floodplains.	Detention volume for sites <10-ac. based upon 10-Year runoff; Sites >10-ac. based upon 100-Year runoff	Storage volume calculated based upon "Critical Storm Method". Storm taps for footer tiles and sump pumps.	Downspouts are to be discharged onto surface.	Storm taps provided, but no definition of allowable connections.	Detention volume calculations by design engineer to limit post-development runoff not exceeding pre-development runoff

Level of Service

Levels of service (LOS) for stormwater management are generally based upon an assessment of the acceptable levels of risk as determined from community to community. Potential and acceptable risks are identified through local review of best practices to meet economic, social, and environmental goals and ultimately define and prioritize strategies to meet these goals.

Examples of varying strategies for LOS for regional communities can be found by examining Table 1 presented above. The City of Findlay has adopted a more stringent requirement to limit the allowable rise in base flood elevation to only 0.1 feet from the FEMA standard of up to 1.0 feet, reflective of the general concern due to periodic flooding on the Blanchard River and the low-lying areas within the central business district. Similarly, the Cities of Bowling Green, Lima, and Perrysburg that tend to discharge to smaller receiving streams and local drainageways have adopted detention requirements based upon a 2-year pre-development runoff that simulate former agricultural lands surrounding each community.

For the Village of Archbold, it is recommended that the proposed modifications to the local stormwater requirements meet the following strategic goals for LOS:

- Maintain Public Safety and Welfare
- Flood Damage Avoidance, including Basement Backups
- Natural Resource Protection and Preservation
- Create Economic and Recreational Opportunity
- Fiscal Responsibility

The means to meet the above goals will be created through continued efforts of asset management, including enhanced cleaning and inspections, and revisions to the local design standards and regulations.

Recommended Regulations

It is recommended that the Village of Archbold develop and refine revised stormwater management standards to include the following:

- Revised Storm Sewer Design Standards
  - Maintain the current 5-year storm conveyance and 10-year HGL check.
  - Provide defined equations and tables for rainfall intensity curves as adopted by ODOT.
  - Provide defined runoff coefficients for various land uses.
  - When practical, match crowns of pipes when changing pipe sizes to reduce increases in HGL.

- Limit storm taps/service connections to allow footer tiles connected through sump pumps only and require backflow devices on all connections to minimize stormwater backups during surcharge events. Downspouts should be discharged to the surface.

➢ Implement Formal Stormwater Detention Standards

- Develop a standardized workbook to calculate required storage volumes.
- Base minimum detention for all new sites and developments upon a 2-year pre-development condition and a 50-year post-development condition at full build-out.
- Require detention on all re-developed sites based upon the incremental increase in impervious areas.

➢ Stream Setbacks and Buffers/Conservation Easements

- Require 50-foot minimum setbacks from receiving streams for all buildings.
- Require 25-foot minimum setbacks from receiving streams for all proposed pavements.
- Encourage conservation easements along receiving streams as additional open space for planned developments.

➢ Encourage Low-Impact Design

- Encourage incorporation of LID solutions, such as permeable pavements, rain gardens, etc., in site planning and developments.
- Provide incentives for LID by allowing tradeoffs for detention requirements and/or offering development and financial incentives. Incentives could include the following:
  - o <u>Stormwater Fee Discount</u>
    - ❖ Require a stormwater fee that is based on impervious surface area. If property owners reduce need for service by reducing impervious area and the volume of runoff discharged from the property, the Village reduces the fee.
  - o <u>Development Incentives</u>
    - ❖ Offered to developers during the process of applying for development permits. Examples include zoning upgrades, expedited permitting, reduced stormwater requirements, and increases in floor area ratios.

- Grants
  - ❖ Provide direct funding to property owners and/or community groups for implementing a range of green infrastructure projects and practices.
- Rebates and Installation Financing
  - ❖ Provide funding, tax credits, or reimbursements to property owners who install specific practices. Often focused on practices needed in certain areas or neighborhoods.
- Awards and Recognition Programs
  - ❖ Provide marketing opportunities and public outreach for exemplary projects. May include monetary awards.

The updated Stormwater Regulations adopted March 20, 2323, are included in Appendix C, and include many of the recommendations above.

Asset Management

Asset Management is an overarching framework of understanding the infrastructure within a community to provide basis for informed decisions in planning, maintenance, and capital improvement programs. In essence, Asset Management is intended to allow communities to operate in a proactive rather than reactive manner to ensure systemwide capacity and reliability. Asset Management programs consist of four common steps:

1. Asset Inventory
2. Condition Assessment and Prioritization
3. Improvement Planning and Implementation
4. Tracking, Review, and Updates

Asset Inventory

The Village has created and maintains a local geographic information system (GIS) mapping of the stormwater system, including pipes, manholes, and inlets, as well as streets and drainageways. Continued updates to the GIS data and mapping with condition and performance information will aid the Village in creating priorities for future maintenance and capital improvement programs.

Condition Assessment and Prioritization

The modeling and reviews completed in development of this analysis and report, as well as anecdotal information accumulated through resident feedback and Village inspections, aid in determining current condition of assets contained within the GIS system. If not already included within the GIS system, the Village should establish a scoring and rating system for the various elements within the GIS. The rating system should be based upon a combination of the condition and criticality of the various system components. Prioritization for further inspection and assessments and/or replacement is then determined through the rankings based on scores derived for the assets and provides the initial sequences for Improvement Planning and Implementation.

Improvement Planning and Implementation

Developing a long-range strategy to maintain a desired level of service for the community requires extensive planning to coordinate maintenance and capital programs and budgets, as well as identifying funding opportunities. Strategies and implementation may include on-going operations and maintenance (O&M) and inspections to monitor the condition of the assets to (and including) replacement, when required.

Tracking, Review, and Updates

As system-wide O&M, inspections, and replacements occur, the efforts should be documented within the GIS and condition scoring to maintain an up-to-date Asset Inventory and Prioritization for continuation of the overall Asset Management Programs.

Stormwater Operation and Maintenance (O&M)

As identified above, the Phase II MS4 requirements will soon be formally enforced on the Village of Archbold. The Village has been proactive in creating basic O&M programs for storm system cleaning and street sweeping. To aid communities in improving the water quality from stormwater discharges, the U.S. EPA has identified several BMPs for stormwater pollution prevention and good housekeeping that may be found at https://www.epa.gov/npdes/national-menu-best-management-practices-bmps-stormwater-pollution-prevention-and-good. Based upon our understanding of the Village's current staffing and equipment availability, we suggest consideration for implementation of the following:

- Annual inspection of all existing storm sewer outfalls.
- Annual cleaning and inspection of catch basins (CBs) and curb inlets (CIs) within the Central Business District.
- Annual cleaning and inspection of at least 20% of the remaining stormwater collection system, including all CBs and CIs.
- Continuation of the Village's current street sweeping program for all streets and municipal facilities. Village personnel currently sweep all streets once every three weeks in the Spring and Summer and each street twice per week in the Fall.

- Coordination with local businesses, schools, and institutions for semi-annual sweeping of parking lots and CB cleaning.

7 – Stakeholder Outreach

Village administration and staff identified that stormwater detention/retention systems have not been required within residential subdivisions and commercial/industrial sites. The purpose of the Stakeholder Engagement was to aid in educating the community members about the positive benefits of modern stormwater management programs for the Village and surrounding areas and obtain feedback for proposed modifications to the Village's approach to stormwater management.

A project Stakeholder group, consisting of representatives of several local businesses, property owners, and governmental agencies, was invited to attend two Stakeholder Meetings held at the Archbold High School on June 15, 2022 and October 19, 2022, respectively. A full list of Stakeholders invited to the meetings, the individual slide decks presented, and a copy of the Frequently Asked Questions (FAQs) developed for the meetings are included in Appendix "D". Additional individual meetings to review individual case studies for specific properties were held with the potentially-affected Stakeholders. These case studies were presented publicly at the second Stakeholder Meeting.

The first Stakeholder Meeting provided an overview of the overall scope of work, project schedule, program goals, and intended outcomes. The presentation also provided an overview of current practices and potential modifications to local policies. The second Stakeholder Meeting reviewed the overarching information provided in the first presentation and provided the findings from data acquisition and review throughout the Village. Initial concepts for planned detention requirements and opportunities for integration of LID and capital improvements were also presented. The third Stakeholder Meeting presented the study's findings and recommendations, Early Action items for 2023 and Long-Term items for 2024 to 25 and beyond, and information on Funding Sources and Educational Opportunities. The Stakeholder Meetings were generally well-attended with over 25 individuals from the community and project team in attendance.

8 – Green and Low-Impact Development

According to the U.S. EPA, the term Green and Low-Impact Development (LID) refers to systems and practices that use or mimic natural processes that result in the infiltration, evapotranspiration, or use of stormwater in order to protect water quality and associated aquatic habitat. Our water ecosystems are very sensitive to manmade changes. Alterations to our water, such as pollutants and even water temperature, can adversely affect thousands of plant species and animals that make up the ecosystem itself. The alteration of natural drainage infrastructure has a negative effect on the environment.

LID is an approach to land development (or re-development) that works with nature to manage stormwater as close to its source as possible. LID employs principles such as preserving and recreating natural landscape features, minimizing effective imperviousness to create functional and appealing site drainage that treats stormwater as a resource rather than a waste product. (Source: EPA)

How Does LID Affect Archbold?

FIGURE 15: BUCKEYE: ARCHBOLD FLOODING

Low-Impact Development (LID) can have a direct effect on a community. Natural infiltration of stormwater generated by precipitation events like rain and snow can slow and reduce the total amount of runoff, or surface movement of water. Increased runoff can cause localized flooding in streets, businesses, and basements if not collected by either man-made structures or water bodies. Collected stormwater is traditionally directed through a large pipe network and exited into a water body, such as a creek, river, or basin. The movement of this constructed water system increases the runoff rate due to the speed at which water is moving. As the runoff rate and the runoff total increases, the waterbodies that collect stormwater have a higher potential for large-scale flooding. Flooding can cause water pollution and a number or other major issues that affect people and our environment.

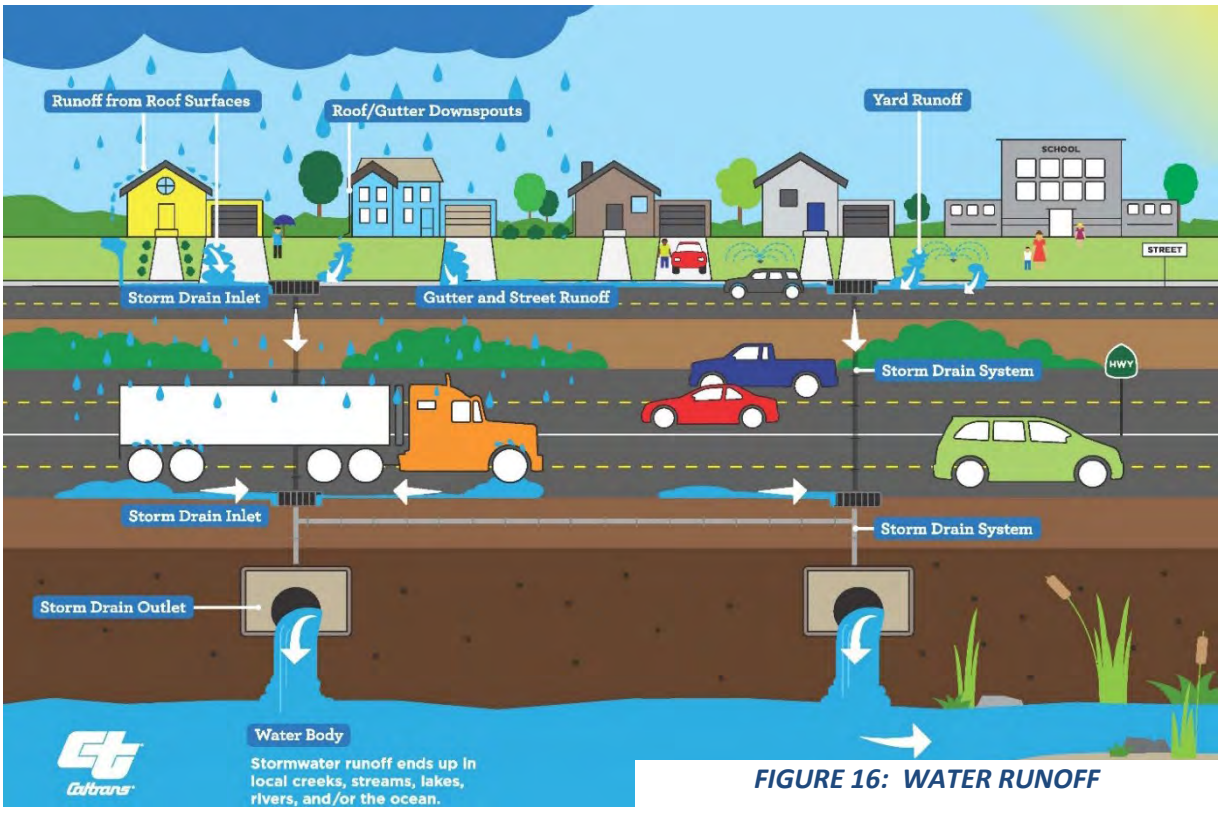

FIGURE 16: WATER RUNOFF

How Does LID Affect Ohio?

The Village of Archbold is part of the Lake Erie Watershed. More specifically, the Maumee River watershed, which has many tributaries reaching across Indiana, Michigan, and Ohio. Among these numerous creeks and streams, are Flat Run and Brush Creek, which both meander to the Tiffin River, which feeds into the Maumee River, Lake Erie, and eventually, the Atlantic Ocean via the St. Lawrence River.

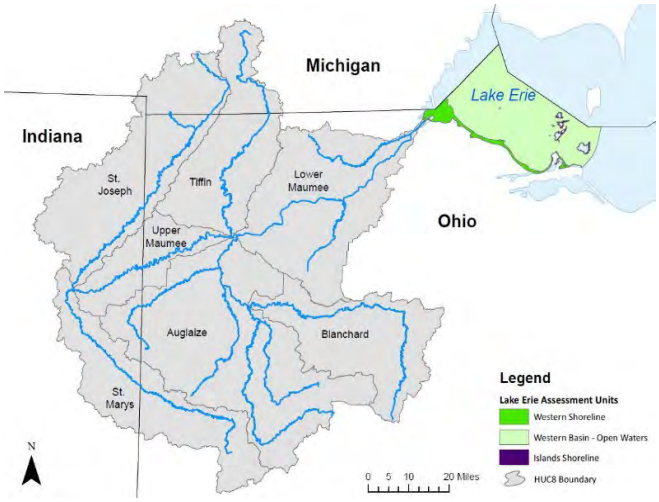

FIGURE 17: OHIO EPA: MAUMEE RIVER WATERSHED

Man-made Impacts that are placed upon our natural water systems carry heavy burdens for all living things, including people. Despite the Village of Archbold's footprint and population size in comparison to other municipalities and cities within the Maumee River Watershed, the decisions made on the systems and practices for stormwater management within the Village directly affect anything downstream. Cities on the Maumee River like Toledo and Defiance, Ohio take on the full brunt of poor water quality partially generated by decisions in cities like Lima, Findlay, and Fort Wayne. Each community plays a critical role in protecting our natural resources.

FIGURE 18: INTERNATION BUSINESS TIMES: BLUE-GREEN ALGAE IN LAKE ERIE

The National Center for Coastal Ocean Science is one of many Federal and State agencies that tracks Blue-Green Algae blooms in Lake Erie, which is just one of many health hazards effecting the Great Lakes.

"Western Lake Erie has been plagued by an increase of HABs (harmful algal blooms) intensity over the past decade. These blooms consist of cyanobacteria or blue-green algae, which are capable of producing toxins that pose a risk to human and animal health, foul coastlines, and impact communities and businesses that depend on the lake." (NOAA)

In August of 2014, the City of Toledo issued urgent warnings not to drink or to use their tap water after Blue-Green algae had entered the residential water supply. The life-threatening toxins left over half a million people without water for over 3 days.

This major health crisis urged agencies across the country to develop and fund sources that could mitigate the annual bloom and provide a healthier environment. Scientists all agreed that this was a statewide issue, not just local to coastal towns and cities.

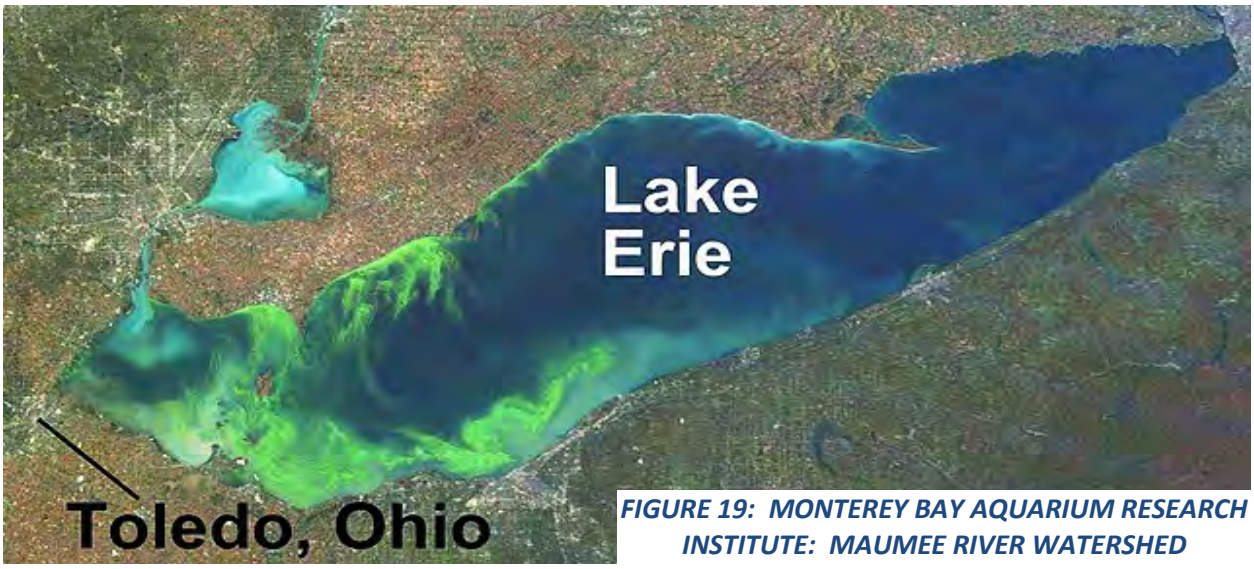

FIGURE 19: MONTEREY BAY AQUARIUM RESEARCH INSTITUTE: MAUMEE RIVER WATERSHED

In response to that moment many small municipalities, private businesses, and landowners in Northwest Ohio have researched development and conservation practices that would help Lake Erie, and the contributing watersheds, become safer water sources for the people, plants, and animals that rely on it.

By implementing Low Impact Development strategies, runoff totals and rates can be reduced, and localized and large-scale flooding events can be lessened. Pollutants can be screened and inflated water temperatures that culture harmful bacteria and algae can be lowered. Locally, if separate members of the community participate as part of a larger team, water quality can be increased, which has an immediate impact on flora and fauna in the community and communities that depend on Archbold downstream.

FIGURE 20: NATURALIZED ADAPTIVE RIPARIAN ZONE: GRAND JUNCTION, IN

Developing With Low Impact

Development typically takes place on a large- or small-scale stage. LID can require different types of measures depending on how site specific the plan is. A regional plan may look at how land use affects a tributary. However, a site plan may be more inclined to solve stormwater issues before it exits into a tributary. All plans have same overall goals. Positively Manage Stormwater on-site as such that it does not become an ecological burden downstream.

Large-Scale Planning and Development

Planning at a large scale is typically viewed through a regional lens. Master Plans and Comprehensive Plans are both regional, as they dissect land use and direct landowners on how to best develop. Outer edges of a plan are typically open space land uses like agriculture or light residential. Closer to the core, the denser the land use becomes.

Large-Scale Planning will often focus on the undeveloped, open space, where future development may take place. Areas like agricultural fields and woodland sites on the edges of a city are often prime for development. Whether it is for residential, commercial, or industrial development, stormwater should be a high priority for discussion. Planning for large scale development should consider existing conditions. Soil Type, topography, Plant Infrastructure, Habitat, and Ecosystems are all things that effect stormwater drainage on an undeveloped site. Altering these natural systems will also alter the quality or surrounding water systems above and below ground.

Preservation and Conservation of existing land is an increasingly important strategy for ensuring open space in critical natural environments. These areas often provide the natural filtration and detention of stormwater, working as a biological buffer between development and water systems. Some of these may be referred to as Greenways, or Riparian Zones. They primarily benefit the natural environment, but also provide passive recreational opportunities like trails, boardwalks, and educational interest.

FIGURE 21: LARGE-SCALE PLANNING FOR CONSERVATION

Large Impact, Low-Scale Planning in Archbold

Archbold has a strong economy for its size relative to other surrounding communities. Much of the labor is commuting from other areas of Northwest Ohio, increasing demand for various housing stock. Developers often take advantage of these situations to purchase multiple acres of available open space with plans to make a profit through a means of residential, commercial, or industrial development. Municipalities can prepare regulations and ordinances to ensure that the natural environment is protected on the developed property and all neighboring properties.

In addition, municipalities and property owners can take it upon themselves to acquire existing land and preserve it in the best interest of the community. In some cases, non-profit organizations, local, state, or federal agencies can mobilize to utilize or preserve critical ecosystems and habitats in the best interest of the region. The goals and objectives of these specific agencies may vary, but the preservation of land almost always benefits stormwater management and the overall health of the regional water systems.

Land Engineering

Most Ohioans may recognize the Northwest corner of the state as relatively flat and agriculture based. From a stormwater standpoint, there are pros and cons to this type of landform. From an agricultural perspective, drainage is a relatively slow process, allowing for crops to soak up precipitation over longer periods of time, keeping soil moist. From a development standpoint, it can be a major concern when heavy rain events occur. Drainage paths are less delineated, and surface flooding can occur quickly. Drainage ways are often shallow, and overflow at critical points, especially in populated areas.

However, municipalities can take advantage of some of these flat areas to help control stormwater drainage. Many areas across Northwest Ohio have built tall man-made embankments called “dikes” to prevent surface flow of water during major rain events. They are engineered to control the rate and amount of water that enters a water system, like a ditch, creek, stream, or river. Dikes are designed to hold a specific amount of water back, often creating a wetland, which has many environmental benefits.

In addition, it helps protect developed lands downstream. Sauder Village is a perfect case study of a positive impact resulting from Low Impact Design and Planning. As a result of numerous damaging flood events, Sauder Village hired a consulting firm to come up with a plan to mitigate the issue. In 2018, they implemented phase one of their plan by building an engineered, 2-dike water control system on the eastern edge of their property to intercept surface drainage into the Village. The impact was immediate. Not only did the flooding significantly reduce, but the standing water behind the dike created a wetland that attracted a diversity of flora and fauna. Sauder Village is now planning to create an educational trail system along the extents of the wetland area as an enhancement to a once underutilized, agricultural field.

FIGURE 22: AERIAL: SAUDER VILLAGE ENGINEERED DIKES

Quail Hollow Subdivision – Archbold, Ohio

Flat Run is one of two main tributaries of the Tiffin River that flow through Archbold. Originating among agricultural fields of the Northeast corner of the Village limits, it takes on stormwater from the Northern sector of the Village, flowing east to west, exiting the Village limits at the Northwest corner of the Quail Hollow Subdivision.

Properties within this neighborhood have had numerous flooding issues since the development of the subdivision in the mid-90s. Most of the issues have been related to basement flooding from storm system backups due to major rain events. With most of the issues happening within close proximity to Flat Run, it is believed that high levels of the hydraulic grade line (varying water elevation) of Flat Run is the major contributor. Exit points for local stormwater systems often fall below high water in Flat Run, which has a shallow profile.

One of the ways that the Village of Archbold may be able to combat the situation, would be to consider land engineering upstream from the critical flooding areas to improve water concentration time downstream in Quail Hollow. The Village controls a large property east of State Route 66, bordering East Lutz Road. A shallow swale directs surface drainage north through the middle of the property into Flat Run, which flows directly through Sauder Village.

By developing a water detention system similar to the examples from Sauder Village, the Village of Archbold could contain over 25 acre-feet of stormwater that currently outlets into Flat Run without control. By reducing the overall volume and rate of water entering the system, localized flooding downstream would be reduced.

It is important to consider that areas outside of the Village limits may negatively impact the hydraulic levels of Flat Run. Due to the shallow nature of waterway, impediments such as vegetated overgrowth or fallen trees may restrict the flow of water enough for water to backup into the Quail Hollow Area. The Village of Archbold should consider partnering with neighboring communities and county districts to address areas outside of the Village limits.

FIGURE 23 PLAN: QUAIL RUN DRIVE IN QUAIL HOLLOW

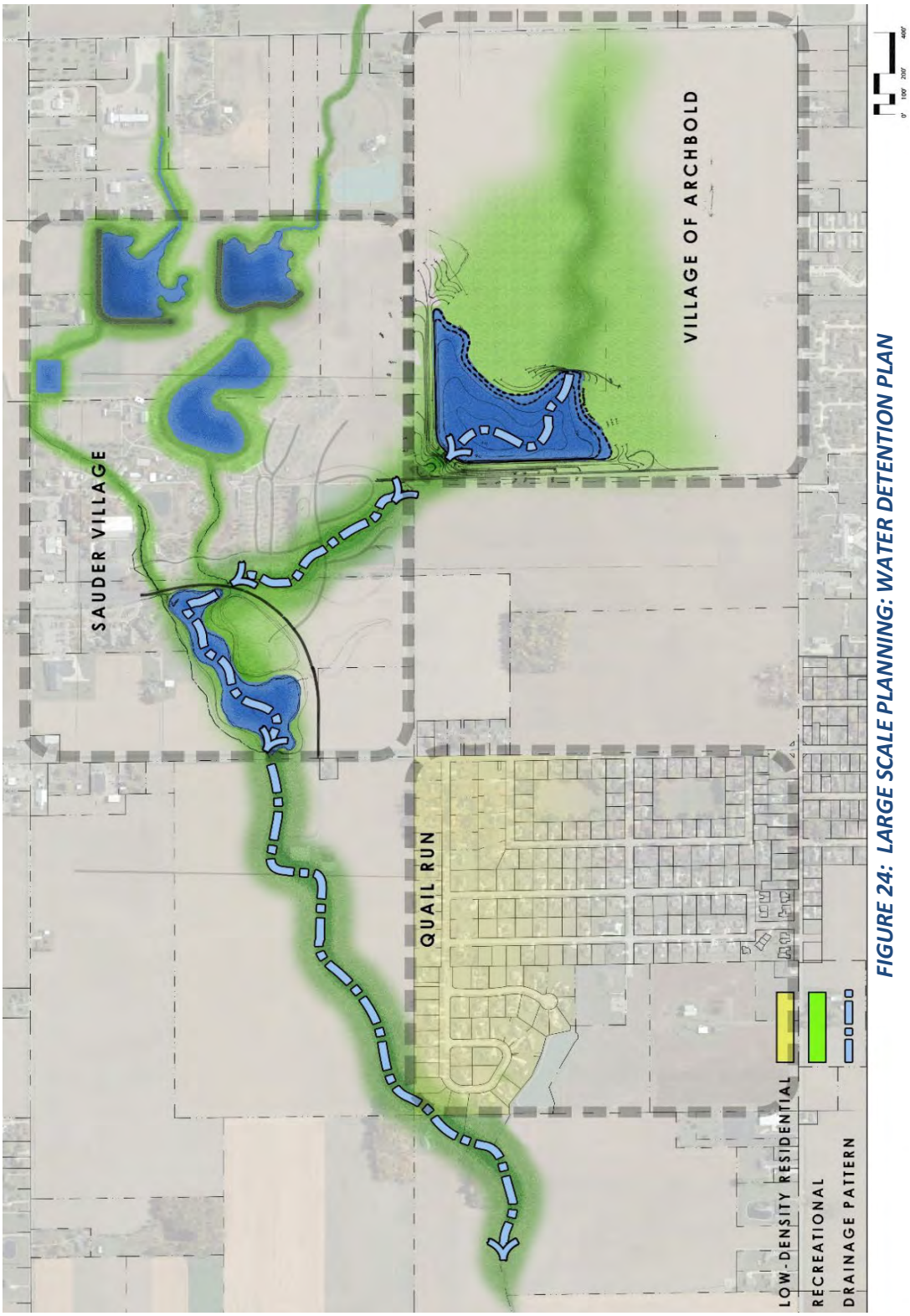

FIGURE 24: LARGE SCALE PLANNING: WATER DETENTION PLAN

Brush Creek Corridor Study

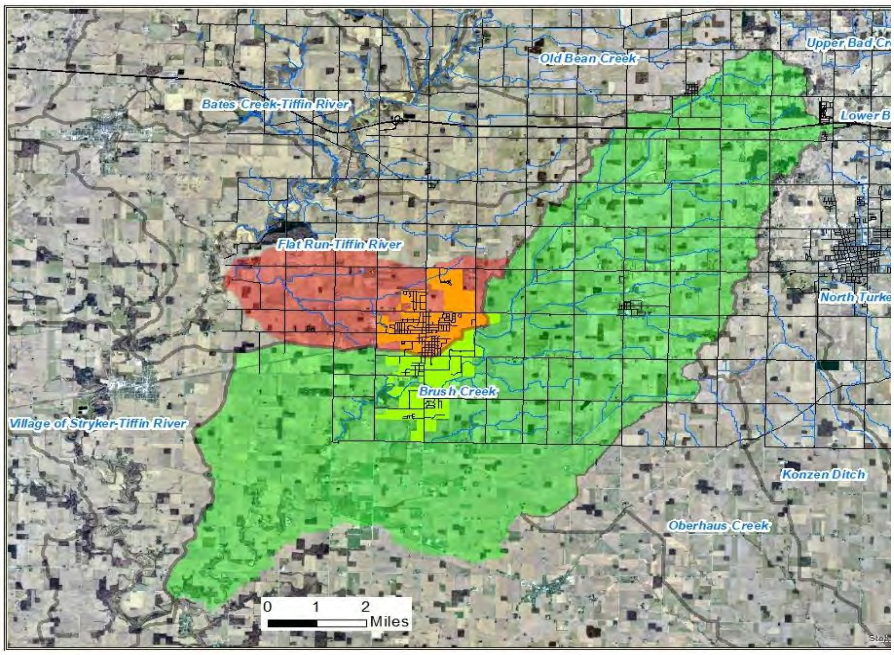

FIGURE 25 PLAN: FLAT RUN/BRUSH CREEK WATERSHED

Brush Creek is the larger of the two waterways meandering through the Village of Archbold. Originating in the north Wauseon region, the Creek enters the Village limits, crossing County Road 22 (Clyde's Way) south of the Norfolk-Southern Railway. It continues in a southern direction, east of Sauder Woodworking facilities, then bending on a westward direction, crossing State Route 66 south of Downtown, and eventually exiting the Village limits at County Road 24, south of County Road B, north of Nolan Parkway. Brush Creek receives drainage from a substantial amount of acreage throughout Fulton County via a convergence of smaller tributaries and agricultural drainage ditches.

Brush Creek is the main natural feature within the Village of Archbold. It is the prime source for public water access and supports many habitats and localized ecosystems within the Village.

The Brush Creek Corridor, and surrounding area, is prime for development, due to the open space that fronts the corridor, the woodlands that it temporarily meanders through, and adjacent desirable land uses, such as Parks and Recreation, nearby schools, existing utility infrastructure, and arterial roads that provide immediate access to Downtown Archbold and surrounding industry.

Unregulated, the Brush Creek Corridor has the potential to be negatively impacted by development. Once built upon, the opportunity to protect and restore riparian corridors greatly diminishes. Often, the disturbed corridor can affect drainage in the area, causing stormwater issues like flooding in developed areas that could have been avoided by LID.

Planning for Future Development

By partnering with local business owners and private property owners, the Village of Archbold may have a unique opportunity to explore a long-term plan for preservation and conservation along the Brush Creek Riparian Corridor and still provide a tactical strategy for private development that benefit new business and homeowners, as well as the public.

FIGURE 26: LARGE SCALE PLANNING: BRUSH CREEK CORRIDOR

Benefits of the Brush Creek Corridor Plan

Acquiring land for conservation purposes along the Brush Creek Corridor would open up multiple opportunities on a local and regional scale. If acquired by the Village of Archbold, these preserved lands along the Creek could be developed for passive recreation, despite being under conservation regulations. This provides opportunities to trail systems, non-motorized pathways, educational centers, and Creek access points for the public.

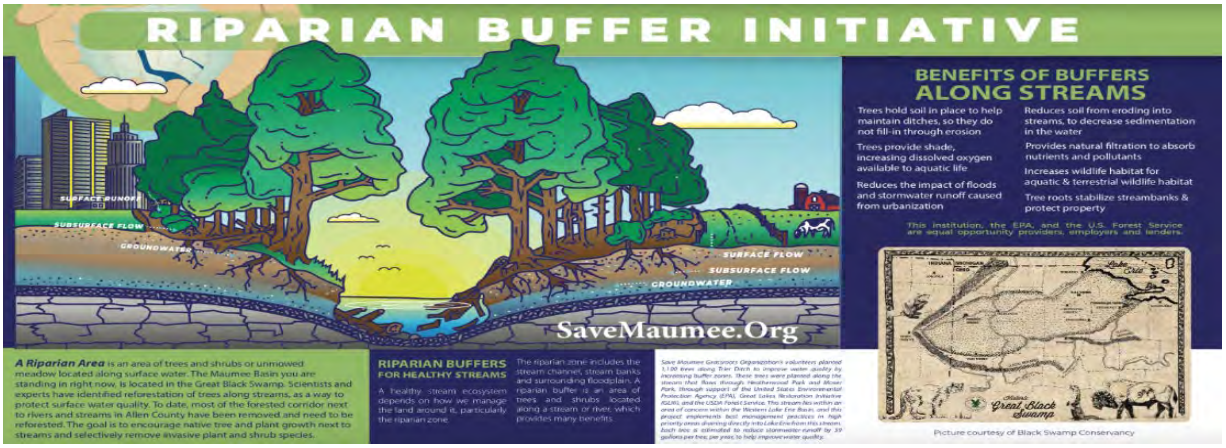

FIGURE 27: SAVEMAUMEE.ORG – RIPARIAN BUFFER INITIATIVE

FIGURE 28: LARGE-SCALE PLANNING: BRUSH CREEK CORRIDOR

Environmental Values

There is major potential to return areas to natural wetlands, as they were hundreds of years ago using land engineering techniques such as two-stage dikes, that would temporarily retain standing water when creek levels rise to critical hydraulic levels. This in turn, provides a major expansion for targeted biodiversity, enhancing the ecosystem, and environment. Positive effects from a protected riparian corridor would result in improved water quality locally and downstream. It would also provide important infiltration and drainage rate improvement, resulting in less localized flooding, while giving relief for downstream communities.

FIGURE 29: CITY OF DALLAS: RIPARIAN CORRIDOR

Economic Value

Areas outside of the riparian corridor would also receive substantial value. Existing property owners would see a bump in housing value, due to the proximity and access to natural features, trails, and pathway networks. Undeveloped land surrounding the area Brush Creek Corridor would see an increased value for development. Existing businesses at the south end of Downtown would receive increased attention and value. Overall, the Village of Archbold would benefit economically from increased activity on a regional level. The Village of Archbold will also be able to improve a number of existing stormwater issues relating to Brush Creek and the increases in runoff it has seen through development in the Village.

FIGURE 30: TRAIL LINK – KING COUNTY, WASHINGTON. GREEN RIVER TRAIL: RIPARIAN CORRIDOR

Woodland Oaks 2, and Cambridge Estates Subdivisions

Residents of the Woodland Oaks Subdivision, off of Miller Avenue, continue to feel the effects of heavy rain events. In contrast to Quail Hollow, Woodland Oaks receives surface runoff from neighboring agricultural fields, causing standing water. Increasingly concerning, an additional subdivision (Cambridge Estates) has been platted east of Woodland Oaks. Although this area has not been slated for development, future decisions to move forward with residential plans would only exacerbate the current flooding issues. An Increase of disturbed land would decrease infiltration and cause more problems.

An important piece of the Brush Creek Corridor Plan would be the construction of a drainage swale to collect runoff from the neighboring agricultural fields to the east. With the open space that is available, the proposed drainage swale could become a natural aesthetic asset to future development. Rather than a traditional ditch, the swale could utilize the current open space to meander slightly as is flows north, providing alcoves for picnic areas, winding pathways, and vegetation. Other communities across the country have discovered the benefits of combining hydraulic engineering with public engagement.

FIGURE 31: BRUSH CREEK CORRIDOR: CAMBRIDGE ESTATES STORMWATER DRAINAGE

County Road 24 Bridge

Riparian Corridor development could also resolve issues on Brush Creek downstream. The County Road 24 Bridge has become a bottleneck point for heavy flows moving through Brush Creek. In some cases, water has overtopped the roadway north of the bridge, which is a major hazard for unsuspecting drivers. It is not known if the bridge itself has been overtopped, since the structure has been replaced.

The conservation of land adjacent to Brush Creek will significantly reduce runoff totals and runoff rates due to increased natural vegetation that will increase infiltration and act as a physical buffer, as stormwater is released to the Creek. As the Riparian Corridor Plan develops, the benefits increase, creek levels decrease, and localized flooding becomes less frequent.

FIGURE 32: BRUSH CREEK CORRIDOR: BECK/MILLER PROPERTY STORMWATER DRAINAGE

Small-Scale, Low-Impact Design

Planning that is more site specific is very typical of small-scale design. Contextually, design at this level gets to the heart of Low-Impact Design, which is exploring stormwater solutions at the source to benefit the site in question and eliminate the burden of stormwater issues outside of the development zone. Quite simply, a post-construction site should meet stormwater metrics at pre-development.

For new development, there are numerous ways to accomplish these stormwater design standards, ranging from high to low costs, disturbance, and levels of engineering. Each site has its own unique pre-development and post-development characteristics that will guide the Village to certain solutions. Large industrial developments may require stormwater solutions that minimalize site disturbance, while some residential developments may benefit from a large detention pond that provides aesthetic value for the neighborhood.

FIGURE 33: TATA AND HOWARD: SMALL SCALE LID

For developed sites, such as residential neighborhoods, commercial businesses, or industrial business, improving stormwater management becomes much more challenging, though not impossible. In most cases, the property owner will have to re-develop a portion of their developed property in an effort to mitigate a stormwater issue. The most cost- and time-efficient opportunities arise during a required maintenance of a facility, where re-development construction was already required, such as the replacement of an existing parking lot. While construction is underway on a parking lot, it is also a logical time to consider stormwater management upgrades that will mitigate the runoff from an impervious surface.

Small Scale LID – Case Study – Existing Industrial Facility

The following Case Studies analyze Industrial, Commercial, Institutional, Parks and Recreational opportunities to implement Low Impact Design solutions. Each site introduced is complemented with engineered and biological strategies to improve stormwater management.

Existing Industrial Facility

The Village of Archbold has a very healthy industrial economy for a rural municipality. Like most industrial sites, manufacturing space is essential for efficient product production. The building footprint on the site is impervious, in that, precipitation that falls directly onto the top of the building and is not infiltrating into the ground that the building is standing upon. Instead, water cascades down a roof and is transported to a different location. This increases runoff rate. The site also has less capacity for infiltration, so surface water will often drain to other properties during major rain events. This increases runoff totals, unless stormwater management practices are implemented.

Unfortunately, Archbold has many facilities that include an oversized impervious footprint for their property size. Some of these sites are contributing to higher runoff rates and totals that are negatively affecting nearby water sources. Brush Creek is heavily impacted by some of these examples.

Fortunately, there are mitigation strategies that can still be implemented despite the pre-existence of the industrial facilities on site. This example involves an existing Industrial manufacturing facility that bears a heavy building footprint on site. Currently, the entire site drains into a matrix of stormwater structures and is piped to a nearby creek via a 60-inch stormwater line. The system successfully drains the site without disturbing other properties. However, the majority of the precipitation that lands on this site has no chance of natural infiltration. The runoff rate is very high, which affects the Creek's hydraulic level during major rain events, and everywhere downstream from the pipe outlet point.

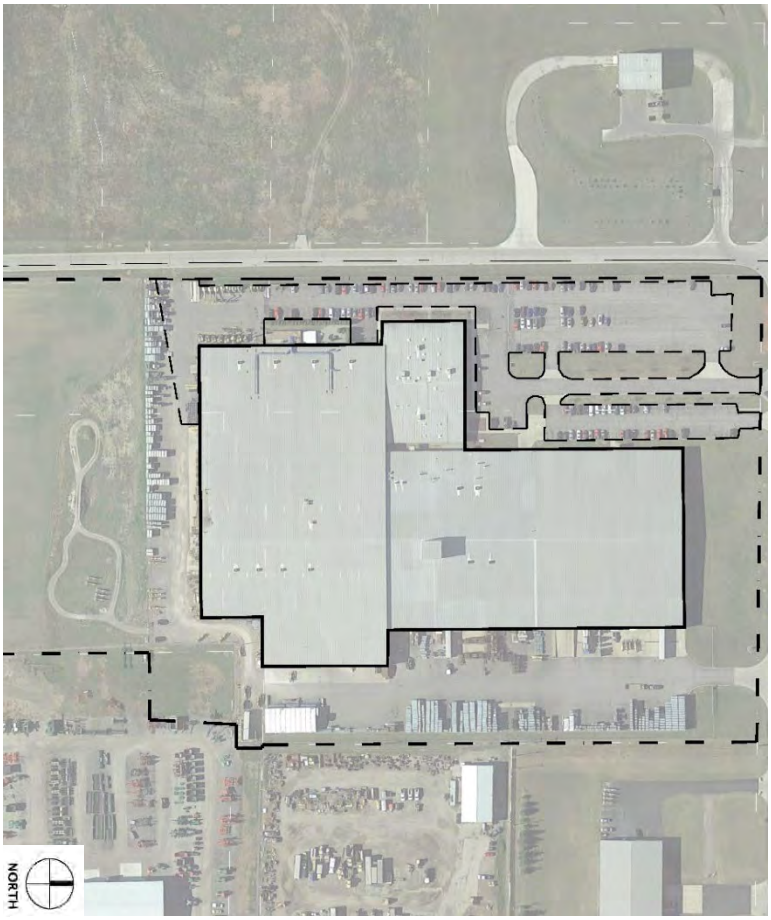

FIGURE 34: EXISTING INDUSTRIAL COMPLEX

Small Scale LID – Case Study – Existing Commercial Facility

Existing Commercial Facility

Archbold has a very concentrated downtown area and there aren't many gaps between buildings. However, like all municipalities, from villages to large cities, the farther you get away from the central business district, or downtown, the larger the voids become between these buildings. These gaps are often poorly optimized, setbacks vary, buildings have less aesthetic value or curb appeal, parking lots are oversized, and the walkability is diminished.

Some of these characteristics among the commercial properties located outside the downtown fabric become more harmful from a stormwater management perspective. Oversized parking lots with no trees are built for ease of access. Parking is established in front of the building to showcase availability, instead of providing pedestrian access closer to the road. Properties are often established with the goal of providing one service, rather than multiple services, such as residential loft space. In contrast to the industrial development example used prior, commercial properties tend to have a rather open slate for future re-development utilizing LID practices. In fact, most of the solutions are the same, but they can be utilized in a manner that it helps the public utilize the commercial space more effectively.

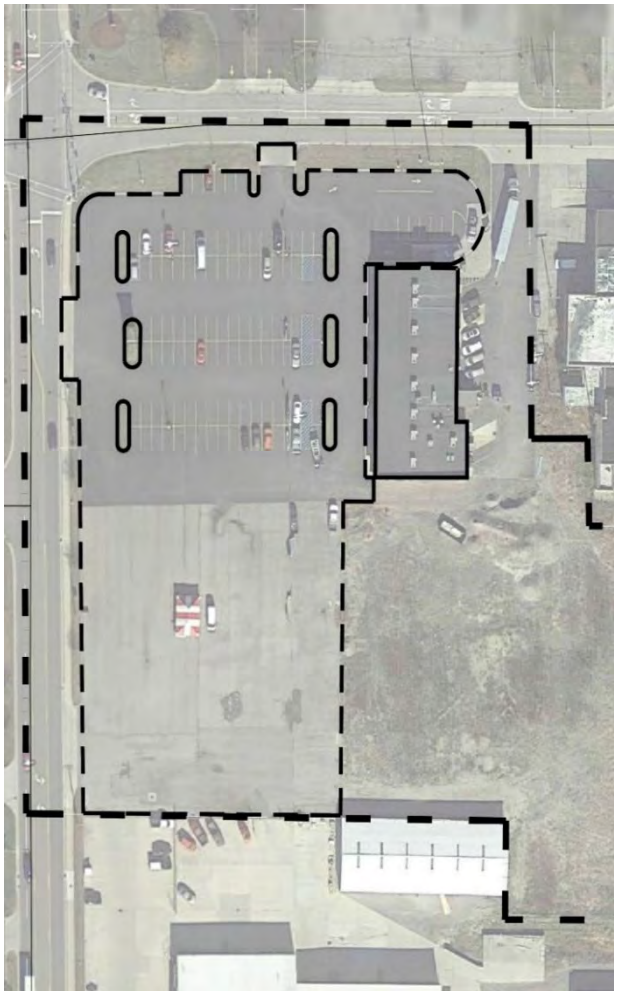

FIGURE 35: EXISTING COMMERCIAL PROPERTY

This existing commercial property is currently operating as a "single-fast", casual restaurant. It has a very large parking lot, with zero landscape islands or trees. It has a very large setback from the right-of-way to major arterial road, just outside of downtown, and no designated pedestrian access. It is nearly 100% impervious and drains directly to the Village's stormwater system.

Unlike the Industrial property, this commercial example has a larger parking footprint than the building. Nevertheless, they both prevent water from naturally filtering in the place that it lands. Both sites successfully remove stormwater from the site efficiently through a network of stormwater utilities. Unfortunately, this commercial example may generate more ecological concerns, due to the darkness of the pavement. The parking area on this site will likely generate warmer runoff than the industrial property, which encumbers most of its runoff collected from a light-colored, cooler, steel roof.

Small Scale LID – Case Study – Detention Basin (Biological)

The following pages provide two engineered and two biological strategies to improve stormwater management on their respective sites.

Detention Basin (Biological)

When a commercial or industrial property has ample open space, a detention basin is a very typical application for stormwater management. Precipitation that falls on impervious surfaces on site are collected and channeled to the basin. Water will naturally filter into ground over time. It will also help separate any harmful pollutants and sediments from the water. The detention basin will have an overflow control pipe to prevent the basins from overflowing during major rain events and filtered water would re-enter the existing stormwater system on site. This will reduce runoff rates dramatically for the site.

- INTERCEPT PARKING RUNOFF
- FILTER WATER
- OVERFLOW SYSTEM
- REQUIRES OPEN SPACE

FIGURE 36: DETENTION BASIN

FIGURE 37: DETENTION BASIN IMPLEMENTATION EXAMPLE - INDUSTRIAL

FIGURE 38: DETENTION BASIN IMPLEMENTATION EXAMPLE - COMMERCIAL

Small Scale LID – Case Study – Underground Storage

Underground Storage

As industrial and commercial facilities grow or change over time, sometimes traffic circulation and parking constraints require costly redevelopment of parking areas and driveways. It also provides a unique opportunity to explore other options for stormwater management, including underground storage. Once constructed, this stormwater management system can be completely paved over. It would provide the highest water storage option and remain minimally invasive, preserving space to maximize site efficiency.

- INTERCEPT PARKING RUNOFF
- FILTER WATER
- REQUIRES RECONSTRUCTION OF OTHER UTILITIES

FIGURE 39: UNDERGROUND STORAGE

FIGURE 40: UNDERGROUND DETENTION BASIN IMPLEMENTATION EXAMPLE - INDUSTRIAL

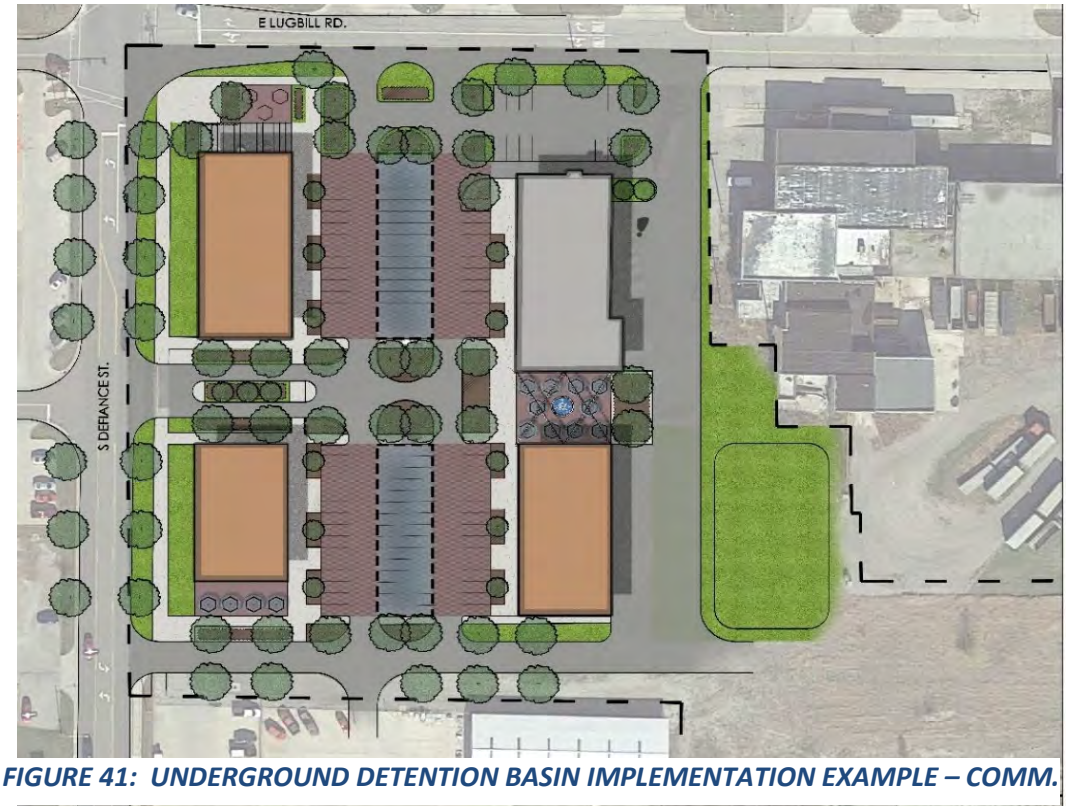

FIGURE 41: UNDERGROUND DETENTION BASIN IMPLEMENTATION EXAMPLE – COMM.

Small Scale LID – Case Study – Pervious Pavement

Pervious Pavement

Another option for stormwater management is to replace existing pavement with pervious pavers. This application is typically more cost effective than underground storage because it requires less engineering. Although it provides less storage, it turns a large portion of previously impervious area into pervious. It certainly helps with stormwater management and provides aesthetic value to a parking lot. It is important to note the pervious pavement can clog with everyday debris (dirt, leaf matter, etc.) and requires professional vacuum cleaning services to efficiently filter water through the paver.

- INTERCEPT PARKING RUNOFF
- FILTER WATER
- REQUIRES RECONSTRUCTION OF OTHER FACILITIES

FIGURE 42: PERVIOUS PAVEMENT

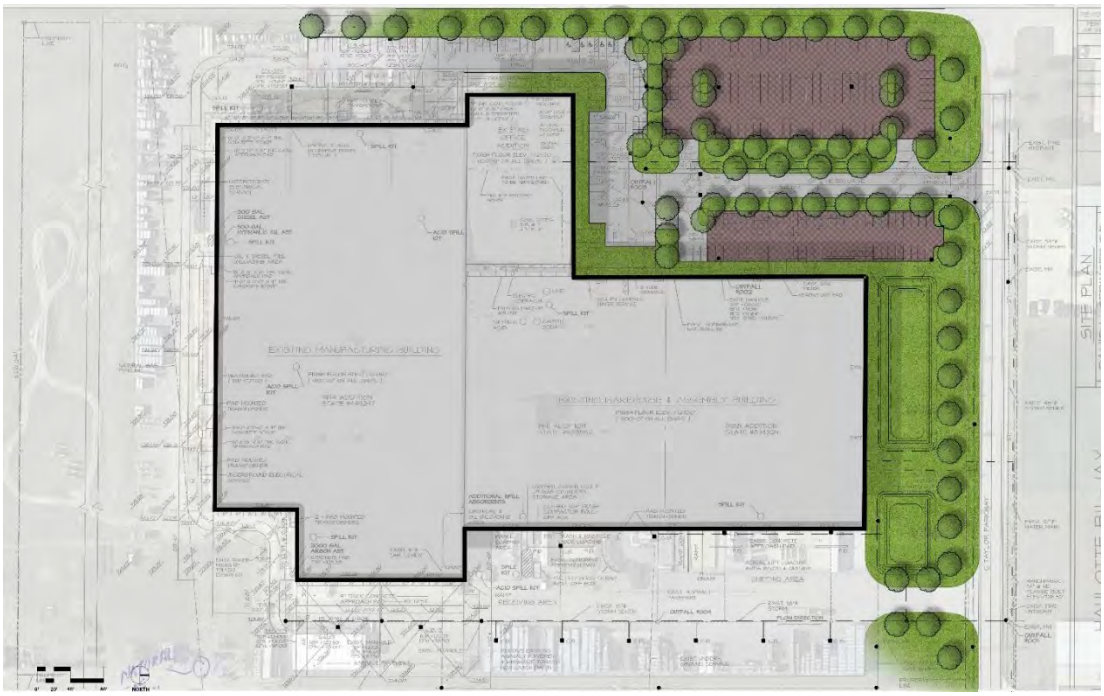

FIGURE 43: PERVIOUS PAVEMENT IMPLEMENTATION EXAMPLE - INDUSTRIAL

FIGURE 44: PERVIOUS PAVEMENT IMPLEMENTATION EXAMPLE - COMMERCIAL

Small Scale LID – Case Study – Shade Trees

Shade Trees

Shade tree canopy provides excellent cover from the sun in parking lots. In addition, they reduce the temperature on pavement, which is reflected into the surrounding environment. When precipitation lands on hot pavement, the water is warmed up as it surface drains. Heated water affects the surrounding water systems and has a major effect on the health of aquatic species. Shade trees are great for intercepting precipitation before it lands on an impervious surface, reducing runoff rates. Planting trees is quite cost-effective and has a profound effect on stormwater management.

- INTERCEPT PRECIPITATION
- REDUCE HEAT ISLAND AFFECT
- PROVIDES SHADE
- AESTHETIC VALUE

FIGURE 46: PARKING LOT TREE IMPLEMENTATION EXAMPLE - INDUSTRIAL

FIGURE 45: PARKING WITH PLANTED TREES

FIGURE 47: PARKING LOT TREE IMPLEMENTATION EXAMPLE - INDUSTRIAL

Small Scale LID – Institutions – Case Study

Utilizing Village-owned, public facilities for stormwater management can provide instant returns on stormwater performance, due to the amount of space that is available. Additionally, upgrades to public land can lead to public education, and increased momentum for future stormwater management planning as common practice for development within the Village.

Many schools have turned stormwater management upgrades into part of the scientific curriculum. Whether it is a garden area, naturalize upland meadows, or wetland areas, opportunities for learning about unique food systems, natural environments, ecosystems, plants, or animals is all at their front door. It ties directly into many classrooms and programs for all ages.

FIGURE 48: GARRISON ELEMENTARY, WASHINGTON D.C.

FIGURE 49: THE LEARNING GARDEN LOS ANGELES, CA

FIGURE 50: MORRILL ELEMENTARY CHICAGO, IL

Small Scale LID – Institutions – Case Study – Archbold Elementary/High School Complex

The Archbold Elementary/High School facility is 60 acres in size and includes the entire athletic complex for the high school. This requires a lot of impervious building and parking space. The athletic fields require a lot of open lawn space. Despite all of those facilities, there is still ample open space on site. Unfortunately, virtually all of the remaining open space is mowed.

Although stormwater can infiltrate through open lawn space, it isn't as productive as natural vegetation such as meadow grass. Lawn also doesn't filter pollutants as well or provide habitat. There is still a lot of potential left on the table. In addition, the mowed grass requires weekly maintenance. This requires time and money spent by the school system on an annual basis. Reducing lawn areas and providing some naturalized buffers and zones could be very beneficial for everyone.

There is also plenty of space available for detention ponds to be strategically placed on site. The school complex doesn't have a lot of flooding issues beyond infrequent ponding in low-lawn areas; however, it would be beneficial from a water quality perspective to locate small detention ponds or bioswales near buildings to filter runoff generated from buildings. This would allow sediments and pollutants to settle, cleaner water to naturally filtrate.

Of course, any of these stormwater improvements would provide an education component describing its function and benefit to the school and the surrounding water systems.

FIGURE 51: ARCHBOLD H.S./ELEMENTARY COMPLEX - STORMWATER IMPROVEMENTS

Small Scale LID – Parks and Recreation – Case Study

Parks and recreation facilities are similar to public institutions, because they typically offer large open spaces, and there are generally less hoops to jump through in order to improve stormwater management.

Small parks that offer playground facilities are often overlooked for opportunity. However, the open space adjacent to the playground might be the perfect space for an urban garden, or pollinator habitat with an educational component. Both options provide great nutrient uptake, and reduce time taken for Village Maintenance staff to mow the entire park.

Some communities tap into prescribed utility areas to establish recreational opportunities, like trails and trail heads. Utility corridors and easements also offer preserved land that can be utilized for vegetated buffers, like greenways that provides filtration areas for sheet drainage, reducing runoff rates, while providing localized habitats.

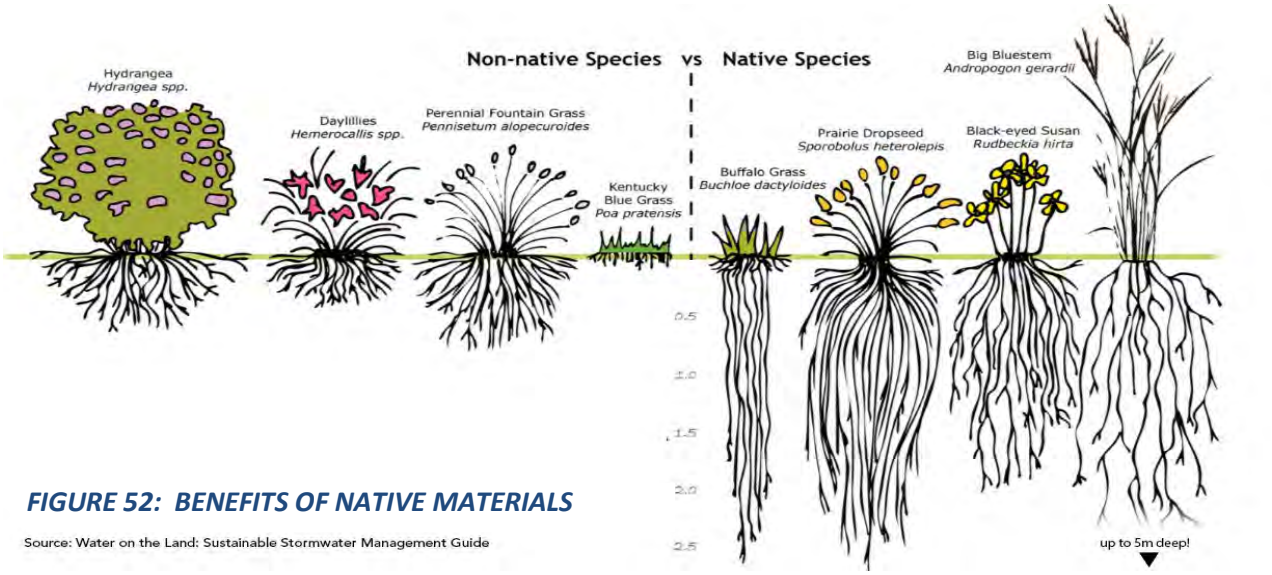

FIGURE 52: BENEFITS OF NATIVE MATERIALS

Source: Water on the Land: Sustainable Stormwater Management Guide

FIGURE 53: CYNWYD HERITAGE TRAIL, PA

Small Scale LID – Parks and Rec – Case Study – Woodland Park

This is an example of a recreational park that focuses on athletic fields. Many of these are often mowed from end to end based on convenience. Some of the fields require fertilizers that help grass grow healthy but can also surface drain harmful chemicals into our water systems. If there are areas outside of the athletic zone, Park staff should strongly consider a naturalized buffer zone like meadow grass, bioswales, or rain gardens strategically placed to collect runoff that can be filtered before reaching our water systems.

Additionally, strategically placed detention ponds, bioswales, and raingardens would be beneficial from a water quality perspective to filter runoff generated from adjacent parking lots. This would allow sediments and pollutants to settle and transfer cleaner water to naturally filtrate. It would reduce total runoff, and lower runoff rates during major rain events.

Finally, the expansion of naturalized area would allow for a pleasant transition into the southern woodland area, and provide interest for the walkable trail around the complex.

FIGURE 54: NATURALIZED EDGE TO ATHLETIC FIELDS

FIGURE 55: WOODLAND PARK ATHLETIC COMPLEX – STORMWATER IMPROVEMENTS

Small Scale LID – Roadway BMPs

Roadway design can often provide unique opportunities to include stormwater management. Most roadways are engineered to collect surface runoff. This provides safety for drivers, but also ensures that toxins and chemicals often left behind by vehicles do not spread into public space or other properties. Engineering practices for road construction evolved to consider many of the BMPs that are promoted by Low-Impact Design. Biological options, like Rain Gardens and Bio-Swales, are great for naturally slowing water runoff, and filtering harmful sediments while providing aesthetic value. Other engineered options may include spring berms or rip-rap in swales, or catch basin filtration systems that collects sediments from runoff before entering the stormwater system. There are applications for all roadway types, from highways, arterials, all the way down to the local neighborhood streets.

Figure 56 – Curbside Bio-Swales

Figure 57 – Curbside Rain Gardens

Figure 58 – Rip-Rap Check Dams in Roadside Swales

Figure 59 – Catch Basin Filtration

9 – Funding Options

The Village will need to find a way to implement funding for stormwater-related activities and infrastructure improvements as part of a sustainable stormwater program.

The construction, operation, and maintenance of a municipal separate storm sewer system can involve significant expense, especially when regulatory requirements (existing and pending stormwater regulations), flooding concerns, water quality issues (including total maximum daily loads, or TMDLs), population growth, and industrial expansion are factored in.

State and Federal Programs

Federal and state funding for local stormwater management takes many forms including technical support, facility construction, cooperative programs, and grants and loans. Local governments make use

of federal and state government funding for various purposes including stormwater management, flood control, and water quality protection.

Funding sources for stormwater improvements that impact water quality regionally are currently plentiful and available from a variety of state and federal sources including:

Grants and Loans

OEPA Financial Assistance Programs

- Water Pollution Control Loan Fund
- Nonpoint Source Program
- Ohio Environmental Education Fund

OPWC State Capital Improvement Program

- Grants/Loans/Credit Enhancement
- Infrastructure Improvements
- Local Match

Clean Ohio Conservation Fund

- Open Space
- Riparian Corridors
- Grants

Ohio Department of Natural Resources

- Urban Streams Program
- Nonpoint Source Pollution Educational Grants
- Watershed Coordinator

Lake Erie Protection Fund

- Water Quality/Resource Protection
- Research Grants
- Implementation Grants

ODOT Transportation Enhancement Program

- Environmental Transportation Enhancements
- Up to 80% of Construction
- MPO/ODOT

Ohio Department of Development

- Business Development (412) Account
- Urban and Rural Initiative Program
- Rural Industrial Park Loan Program

Community Development Block Grants

- Formula Allocation Program
- Infrastructure Improvements
- 51% Low to Moderate Income

Federal Emergency Management Agency

- Hazard Mitigation
- Disaster Recovery
- Grants

Great Lakes Commission

- Urban Erosion Control
- Storm Water Phase II Implementation
- Grants

Natural Resources Conservation Service

- Small Watershed Program
- Watershed Protection/Flood Prevention
- 250,000 Acres or Less

US Army Corps of Engineers Water Resources Program

- Reconnaissance Phase – 100%
- Feasibility Study - 50%
- Design, Construction, O&M – Varies

Land and Water Conservation Fund

- Non-Profit Partnering
- Grant Writing
- Conservation/Preservation
- Agriculture
- Wetlands/Critical Ecosystems

ODNR – Coastal Management Grants

Not necessarily 100% focused on true Coastlines. Watershed Grants for Planning and Land Acquisition purposes have been granted.

https://gis.ohiodnr.gov/MapViewer/?config=Grants

- Education
- Planning
- Research/Monitoring
- Design
- Construction
- Acquisition

ODNR Nature Works

- Recreational Infrastructure
- Facilities
- Land Acquisition

- Planning
- NRAC
- H2Ohio

We recommend working with TNC to obtain and coordinate funding for stormwater projects that have regional implications and/or include LID elements. Other funding sources can be accessed when they fit a particular project need; again, working with TNC or Maumee Valley Planning could help in matching the right funding source to the project.

One of the more compelling options for conservation is the ability of funding sources to pay for property that will be dedicated (at least in part) to conservation. This allows property owners to be compensated for their land without having to develop the property completely.

Local Funding

Funding for Village 'hard' stormwater infrastructure improvements, such as pipe replacement or pipe cleaning, will need to be funded by the Village. To establish a fund for such improvements, the Village should develop a source of funds that can be used for these needs. Development of a stormwater utility or additions to existing user fees could be explored. The following are some examples of local funding options that could be explored.

Property Taxes/General Fund

Many communities have funded stormwater management from property taxes paid into their general funds. However, there is great competition for municipal general fund dollars from other worthy municipal programs. Stormwater management improvements typically have a low priority, unless the Village is re-acting to a recent major storm or regulatory action. The total cost of stormwater management is not readily apparent, because these costs are often spread among several general fund departmental budgets. As stormwater management costs increase, general fund budgets are often not increased to meet those needs. The sources of general revenues have little, if any, association with the origin of stormwater management demands and costs. For example, property taxes are usually calculated based on the economic value of land and improvements, which have little direct relationship with stormwater runoff quantity or quality.

Because general revenues are derived primarily from taxes, tax-exempt properties do not support the cost, even though it can be shown that many of them, such as governmental properties, schools, colleges, and universities are major contributors of stormwater runoff.

Sewer/Water Utilities

Some communities include stormwater management costs as line items within their water or sanitary sewer enterprise system budgets. Water and sanitary sewer utilities charge customers user fees for services rendered. Many of these, base their user fees on metered water flow. This is not typically equitable, because a property's metered water flow is not proportional to stormwater runoff generated

by the property. For example, a shopping center typically generates a significant amount of stormwater runoff (primarily from the impervious area of its buildings and parking lots) but may use a relatively small amount of potable water.

Stormwater Utility

A user fee funded stormwater utility includes a sustainable funding mechanism dedicated to recover a portion of, or all, the costs of stormwater infrastructure regulatory compliance, planning, maintenance, capital improvements, and repair and replacement. Stormwater user fees are charged to taxpaying and tax-exempt properties and are based on property area. User fee funded stormwater utilities address the short-comings and inequities of funding stormwater management by property taxes or water/sanitary user fees.

A user fee funded stormwater utility operates similarly to an electric or water utility. The utility is administered and funded separately from the revenues in the City's general fund, ensuring a dedicated revenue source that can only be used to recover stormwater management program expenses.

Regulatory Purpose

Communities must meet the federal and state regulatory requirements to manage stormwater. Stormwater user fees provide property owners access to (and reimburse the community for) the services the community provides to manage the community's stormwater runoff which consists of the sum of the stormwater runoff from all property within the community's legal boundaries. All fees collected are deposited in the community's dedicated stormwater enterprise fund. That fund is restricted in purpose, and none of the revenue generated from the user fees may be used to pay for any other community expenses.

Proportionate to the Necessary Cost of Service

Services to manage stormwater runoff can include, but are not limited to, street sweeping, leaf pickup, and catch basin cleaning. The total cost of services provided to manage stormwater runoff is allocated per property based on the relative amount of runoff generated by each property's area. Thus, the user charge reflects the amount of stormwater runoff generated per property and consequently, the relative amount of stormwater services used by a property owner. For example, a ten-acre shopping center generates significantly more stormwater runoff than a coffee shop, and the cost to provide stormwater service for the shopping center is significantly more than what is required for the coffee shop. The area-based user fee charged to these properties takes this into account.

Voluntarily Refuse or Limit Use of Service

A user fee funded stormwater utility charge can be designed to allow property owners to voluntarily refuse or limit the use of the stormwater service by offering credits to those property owners who adopt approved stormwater best management practices such as rain gardens or on-site stormwater storage. Adopting these practices can reduce a stormwater utility bill by as much as 100% in some communities.

The following are resources available for assistance in developing a stormwater utility:

Storm Water Utilities & Districts Enabling Legislation

- O.R.C. §6117(HB 549)
- O.R.C. §6119
- Ohio Constitution

Common Elements And Approaches To Developing A Stormwater Utility Are Listed Below

Storm Water Utilities & Districts Seven Key Elements

- Operation and Maintenance Practices
- Storm Water Management Policies
- Planning and Design Activities
- Capital Improvements
- Educational Activities
- Program Administration
- Implementation of Funding Mechanisms

Storm Water Utilities & Districts Stakeholder Approach

- Formation of Work Groups
- Work Group Meetings
- Draft Plan
- Stakeholder Review/Comments
- Final Plan
- Public Meetings/Hearings

Special Assessments

If a stormwater construction project benefits only a portion of a village, it can be funded by fees assessed only to those properties within that area, which is called a special assessment district. Special assessments can be used to fund capital improvement and operation of stormwater systems. The assessment concept is predicated on apportioning costs based on the direct and special benefits received.

Bonding for Capital Improvements

Bonding is a common practice to fund and spread the cost of major capital improvement projects out over a number of years. Bonds are not a revenue source, but rather a method of borrowing money to fund expenditures. Debt service of bonds is commonly derived from general revenues, service fees, or special assessments. Two types of bonding are available, revenue bonding and general obligation bonding. General obligation bonding incurs a debt that has first standing with regard to public assets and is backed by the "full faith and credit" of the issuing agency. Revenue bonding is supported and ensured only by specified revenues, such as service fees or assessments.

System Development Charges

System development charges, also known as connection fees or tie-in charges, are one-time fees commonly charged to new properties connecting to a water or sanitary sewer system. The objective is to buy into the infrastructure that has already been built for them, to pay their fair share of the infrastructure expansion necessary to serve them, or a combination of both. The amount of the new customer's system development charge is typically calculated on the basis of the potential water demand that the new customer will place on the system. Stormwater system development charges can also be developed. However, the amount of a customer's stormwater charge is typically tied to the area of the customer's property.

Impact Fees

Impact fees have been adopted by government entities for a variety of public infrastructure components. They are based on the cost of mitigating development impacts of individual developments by building public off-site improvements where impacts cannot be solved on site.

Developer Extension/Latecomer Fee

Under the developer extension/latecomer fee concept, the initial developer is later compensated for providing the facilities by fees applied to subsequent developers that tap into or make use of the improvements. This fee is not a revenue mechanism, rather a means of apportioning capital costs among several properties as they are developed.

Plan Review, Development Inspections, and Special User Fees

Fees for the performance of regulatory activities may be collected. This category of fees is related to special services provided to a limited group, as opposed to user fees that are generally applicable to utility customers. Such fees apportion the costs only among those who require the service or cause the need for the regulatory measure. Special fees may have other applications, such as a cost recovery mechanism that assigns certain expenses to a specific group. For example, the inspection of a private detention system which may be ignored by property owners. Inspections may be necessary to ensure that systems are maintained and not altered from their approved design. Placing the cost of such inspections on the specific property owners through special fees relieves the general taxpayers or utility ratepayers of the expense. Special fees typically provide only small additional amounts of revenue.

10 – Recommendations and Implementation Plan

This section provides recommendations to the Village to change their stormwater management strategy and to develop improved rules and regulations and move forward with projects that will have immediate impact on the Village's stormwater hot spots.

Capital Projects

Fortunately for the Village, their existing system of stormwater infrastructure is in good condition and of adequate capacity. The majority of the system is less than 60 years old. The system probably has at least 20 years of service before major repairs or replacements are required due to age. So, we do not see any large-scale capital improvements that will need to be made to the pipe infrastructure based on condition or capacity concerns.

We are recommending capital projects related to flooding issues in the Cambridge Estates/Woodland Oaks subdivisions. This project is highlighted as one of the Green/LID case studies in the report and involves diverting overland flow from agricultural land east of the development to the north. This project ties in with the larger Brush Creek corridor vision. The cost for this improvement is estimated at $100,000 to $150,000.

The other capital improvement project we are recommending is the development of a constructed wetland/detention area on Village-owned property south of Sauder Village. This project would reduce the amount of runoff in Flat Run and help to reduce flooding occurrence in the Quail Hollow and North Pointe Estates subdivisions. As noted in the report, this project is not a complete solution to the Flat Run flooding problem, but it would still be a positive step for this area. The cost for this improvement is estimated at $140,000 to $200,000.

Both of these projects are LID projects and may be eligible for state and federal funding. The Village should work to obtain funds to reduce the impact on the Village.

Capacity, Management, and Operations & Maintenance (CMOM)

The Village should implement a more regular inspection and cleaning program for its stormwater infrastructure.

We estimate that the costs to implement these recommendations will be $100,000 to $150,000 annually. The results of these inspections will also allow the Village to define a long-term capital improvement program to repair or replace its stormwater infrastructure over time.

Once stormwater funding is in place development of a replacement fund for stormwater infrastructure should be considered.

Implementation Schedule

Early Action

➢ We recommend the following actions are initiated in 2023:

- Implement updated stormwater rules and regulations including updated design standards, detention requirements, stream setback and conservation easements, and incentives for use of LID techniques.
  - Information sessions for Contractors and Developers who typically work with the Village could be offered to educate them on the new requirements.
- Maintain contact with ODOT with respect to the State Route 66 culvert replacement with the goal of keeping the new culvert hydraulically similar to the existing culvert.
- Begin the development of a stormwater management plan including asset management and O&M.
- Start design of the Cambridge Estates/Woodland Oaks stormwater diversion and coordinate with TNC on available grants and funding.
- Start the design of the stormwater impoundment/constructed wetlands on Village land south of Sauder Village, continue to coordinate with Pete Carr with Fulton County Soil and Water to obtain Ohio EPA grant.
- Engage TNC to assist in funding land acquisition for the Brush Creek Conservation Corridor concept.
- Explore funding availability for other LID projects on Village-owned Park and School lands.
- Consider inclusion of Roadway BMPs when planning street reconstruction projects or new street construction.
- Explore methods to establish a Village-funding source for on-going stormwater ‘hard’ infrastructure improvements.

Long-Term

➢ We anticipate these efforts starting in 2024 or 2025 and continuing on:

- Implement funding mechanism for Village stormwater management.
- Continue to develop Brush Creek Conservation Corridor, and promote the vision of this corridor to attract development and promote the recreational and water quality

benefits to the community and region. Consider formalizing an arrangement with TNC to assist in this effort.

- Update the Village's stormwater system GIS with information from the annual inspections.
- Develop stormwater infrastructure capital improvement plan based on inspection and funding development.
- Continue discussions with Fulton County to gain support for ditch cleaning efforts in Flat Run. Promote efforts with TNC to improve conditions along Flat Run. Both of these items should further reduce water levels in Flat Run during runoff events.
- Utilize LID concepts in Village-development work to promote the concepts and serve as an educational tool to the community.
- Monitor ODOT culvert replacement projects in and around the Village on Brush Creek and Flat Run. Advise ODOT of potential adverse effects to the Village storm drainage conditions that could result from ODOT work.

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APPENDICES A, B, and C

Information included in Appendices A, B, and C is available by Contacting the Village of Archbold Engineering Division

APPENDIX D

STAKEHOLDER MEETING INFORMATION

1

Agenda

1. Introductions & Sign-In
2. Study Goals and Project Scope
3. Stakeholder Engagement
4. Current Issues ~ “Stormwater 101”
5. Past Village Efforts
6. Current and Anticipated Regulations
7. Levels of Service
8. Typical & Nonstandard/Green Options
9. Open Discussion
10. Project Schedule
11. Next Stakeholder Meeting

2

Project Goals and Scope

- Goals
  - reduce localized flooding
  - improve water quality
  - develop buy-in/partnership with stakeholders
- Identify the condition and capacity of the Village's current stormwater facilities
- Provide recommendations to correct deficiencies
- Develop a capital improvement plan that will provide the Village with an appropriate level of service

3

Project Goals and Scope

- Provide recommendations on local rules and regulations
  - Respect the desire for continued development
  - Incorporate common-sense best practices for the improvement of stormwater management and water quality
  - Include practical green and low-impact development policies & solutions
- Conduct outreach meetings for Village officials and stakeholders
- Develop summary report to document:
  - Project findings
  - Early action projects that will have the greatest immediate impact
  - Longer-term projects to ensure continued service and enhance the overall community
  - Operations and maintenance & asset management activities
  - Anticipated costs & timing for implementation

4

Project Stakeholders

- Village of Archbold
- Archbold Schools
- Fulton County Engineer
- Fulton County Soil & Water
- Fulton County Plan Commission
- German Township
- Local Designers
- Local Landowners
- TMACOG
- Local Businesses/Employers
  - Arrow Tru-Line
  - Bil-Jax / Haulotte
  - CONAGRA
  - Miller Bros.
  - Sauder Village
  - Sauder Woodworking
  - Tri-Flo

5

Stakeholder Engagement

- Local “sounding board” for concepts and ideas
- Provide feedback
- Offer input for storm water management opportunities
- Assist in change management within the community

6

"Stormwater 101"

- Why is stormwater management important?
  - ✓Safety
  - ✓Reduce property damage
  - ✓Improve the environment
  - ✓Less cost for community
- Common Terms
  - Storm frequency & intensity
  - Hydraulic Grade Line (HGL)
  - Impervious surface or area
  - Infiltration & runoff
  - Stormwater detention (dry) & retention (wet) ponds
  - Rate vs. Volume
  - Floodplain & Floodway

7

"Stormwater 101" ~ Example Calculation

Pre-Development (2.5 ac. open field)

$Q_{pre} = c_{pre}IA$

$Q_{pre} = (0.20) \times (3.23"/hr) \times (2.5 ac.)$

$Q_{pre} = 1.62$ CFS or 725 GPM

Requires a 12" pipe @ 0.25% slope

Post-Development (apartments)

$Q_{post} = c_{post}IA$

$Q_{post} = (0.70) \times (3.23"/hr) \times (2.5 ac.)$

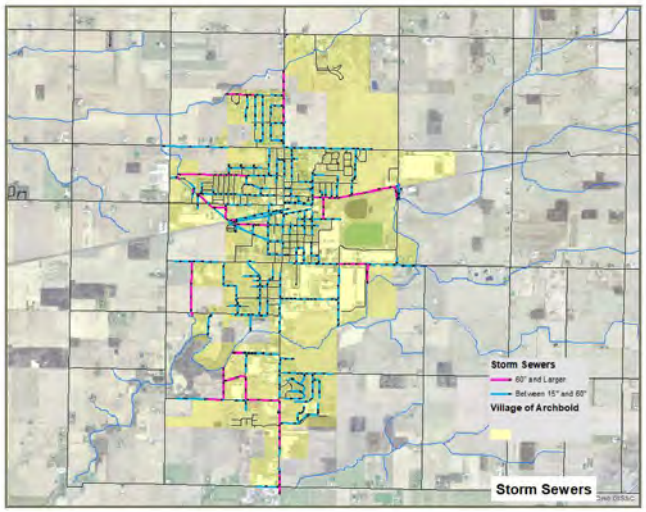
$Q_{post} = 5.67$ CFS or 2,545 GPM

Requires a 24" pipe @ 0.10% slope

Qpost / Qpre = 350% increase in runoff

8

Past Village Efforts



9

Ohio & Federal Regulations

- Current
  - Ohio EPA MS4 Program
  - Construction Stormwater Management / ODNR Rainwater & Land Development Manual
  - Others: USACE, USFWS, FEMA, 401/404 CWA, etc.
- Anticipated
  - Volume & Rate of Runoff Control
  - Water Quality Enhancements

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Levels of Service

Time (min.)	Frequency (Years) / "i" (in./hour)					
	2	5	10	25	50	100
20.00	2.66	3.23	3.67	4.23	4.61	5.05
21.00	2.58	3.14	3.58	4.12	4.49	4.93
22.00	2.51	3.06	3.49	4.02	4.38	4.82
23.00	2.44	2.98	3.40	3.92	4.28	4.71
24.00	2.38	2.91	3.32	3.83	4.18	4.61
25.00	2.32	2.84	3.24	3.75	4.08	4.51
26.00	2.26	2.77	3.17	3.66	4.00	4.42
27.00	2.21	2.71	3.10	3.59	3.91	4.33
28.00	2.16	2.65	3.03	3.51	3.83	4.24
29.00	2.11	2.59	2.97	3.44	3.75	4.16
30.00	2.06	2.53	2.91	3.37	3.68	4.08
35.00	1.86	2.29	2.64	3.07	3.36	3.74
40.00	1.70	2.10	2.42	2.82	3.09	3.45
45.00	1.56	1.93	2.23	2.61	2.87	3.21
50.00	1.45	1.80	2.08	2.44	2.68	3.01
60.00	1.26	1.58	1.82	2.15	2.38	2.67
70.00	1.12	1.41	1.63	1.93	2.14	2.41
75.00	1.07	1.33	1.55	1.84	2.04	2.30
80.00	1.02	1.27	1.48	1.75	1.95	2.20
90.00	0.93	1.16	1.35	1.61	1.80	2.03
100.00	0.85	1.07	1.25	1.49	1.67	1.88
120.00	0.74	0.93	1.08	1.30	1.47	1.65

Current Storm Sewer Design Standard:

Contain 5-YR runoff within pipe & allow 10-YR runoff to surcharge to just below the surface.

Should this standard be more conservative to allow for increased frequency of more severe storms?

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Conventional Solutions

- Enlarging Pipe Sizes
- Relief Sewers
- Dry Detention & Wet Detention Basins
- Stream Channel Dredging/Enlarging/Lining
- Culvert/Bridge Replacement
- "Hard" Erosion Control

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Green Initiatives – Planning & Neighborhood Design

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Green Initiatives – L.I.D. (Low Impact Design) – Site / Parking

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Green Initiatives – L.I.D. (Low Impact Design) – Site / Parking

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Open Discussion

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Project Schedule

• Kickoff Meeting	March 2022
• Data Gathering & Analysis	March – August 2022
• Rule and Regulations Review	May – June 2022
• Stakeholder Meeting 1	June 2022
• Identify Options for Stormwater Management Facilities	June – August 2022
• Funding Option Assessment	July – September 2022
• Report Development	August – October 2022
• Stakeholder Meeting 2	September – October 2022
• Finalize Report	January 2023
• Stakeholder Meeting 3	January 2023
• Submit Final Report	January 2023

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Future Stakeholder Meetings

Meeting #2 – September or October 2022

- Present findings & anticipated changes to local requirements
- Provide examples of best practices
- Offer near-term and long-term opportunities & strategies
- Estimate runoff volume/rate & water quality improvement

Meeting #3 – January 2023

- After report submitted to Village
- Present findings & recommendations
- Discuss program implementation timeline
- Funding opportunities
- Educational opportunities
- Updated local design standards & rules
- Community-wide GI & LID opportunities

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Thank You!!
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Village of Archbold
Storm Water Infrastructure Evaluation
Stakeholder Frequently Asked Questions (FAQs)

Why is the Village evaluating its storm water systems?

The last study of the Village's storm water system was completed in 1966. The rules and regulations governing storm water management have advanced greatly since the report was completed, including efforts to reduce the amount of sediment and floatable debris captured and discharged to local creeks and waterways. In addition, portions of the Village have experienced basement backups and localized surface flooding during and immediately following significant rainfall events.

This new study will:

- ✓ Assess the condition and capacity of the existing storm water systems and provide recommendations for improvement (where necessary).
- ✓ Provide recommendations for local rules.
- ✓ Identify funding sources to aid in completing capital programs.

Who are the members of the Stakeholder Group?

Several local landowners, developers and business leaders were contacted, along with representatives of Archbold Schools, Fulton County, German Township and local/regional planning organizations.

What is the purpose of the Stakeholder Group?

The Stakeholder Group will serve as a "sounding board" for discussion during the development of the overall Storm Water Infrastructure Evaluation report, including suggested enhancements to the Village's approach to storm water management. Additional support will also be provided by the Stakeholder Group externally by offering insight and directing questions to the project team as information is passed to the community at-large.

Where does our local storm water runoff go?

Some rainfall that hits the Village infiltrates into the local soils, with the excess runoff that cannot infiltrate flowing off-site. Most of the properties within the Village of Archbold are served by underground storm sewers. The remaining lands are drained by surface swales and ditches. All of these storm sewers and drainageways outlet into the local streams of Flat Run and Brush Creek and ultimately pass into the Tiffin River, Maumee River and Lake Erie.

Why is storm water management important for our community?

The risks associated with storm water (e.g. – street and property flooding, basement backups, erosion) have risen due to the increased frequency and intensity of storms within our region. These safety and property damage risks are compounded as additional development occurs, creating more runoff from sites. Water quality for flows discharging to the receiving streams is also a concern and has become a regulated item through the Ohio EPA. As a municipality, the Village is required to comply and support the enforcement of such mandates. Effective storm water management can ultimately save the Village money long-term and, when enhancing water quality, can also open additional opportunity for outside grants and low-interest loan programs to reduce costs for capital projects.

What is the difference between a floodway and a floodplain?

The "floodway" of a stream is generally defined as the limits of the stream channel itself and adjacent areas above the streambank required to carry a flood. The "floodplain" consists of the floodway and further adjacent lands below the

high water level during a flood event. While not a perfect description, a "floodway" generally contains rapidly moving water, while an inundated "floodplain" will be relatively still.

What is a 100-year storm event?

The term "100-year storm" is a misnomer and can be confusing. The correct terminology is a "1% annual chance exceedance event," or 1% ACE event. This refers to the statistical probability of such a highly intense rainfall/runoff event happening in a single year. A 1% ACE event has a 1% statistical probability of occurring in any given year, based upon meteorological and streamflow data accumulated for our region dating back to the late 1800's. A 1% ACE storm or flooding event could possibly occur multiple times in one year or may not occur at all. Similarly, a "5-year storm" would be a 20% ACE event and has a 20% probability of occurring. A "10-year storm" is a 10% ACE event and has a 10% probability of occurring.

Can a 100-year (1% ACE) flood event occur in the Village when the local rainfall is not significant?

Yes. The watersheds contributing to the local streams are significantly larger than the Village itself. A major rain event upstream of the Village may cause the streams to swell to an elevation creating flood conditions within the Village. Such an increase in the water levels will limit the capacity of the Village's collection system to transport local runoff.

How are storm sewers and drainageways sized to carry runoff from a site?

Storm runoff from an existing or proposed site is usually estimated through the "Rational Method", a relatively simple calculation that will vary significantly based upon the individual site's amount of vegetated cover, the estimated intensity of a rainfall event and the area of the site.

The Rational Method formula is Q = cIA, where:

"Q" is the calculated runoff in cubic feet per second (CFS)
"c" is a runoff constant varying from 0.10 for vegetated sandy soils to 0.95 for hard surfaces
"I" is the estimated rainfall intensity in inches per hour (IN/HR) for a defined rainfall frequency
"A" is the area of a site or catchment in acres (AC)

Once the estimated runoff is calculated, further calculations are completed to determine the pipe and/or open channel size and slope required to carry the discharge. Most enclosed storm sewer systems are designed to carry the runoff from a 5-year storm within the pipe and preventing surface flooding for the 10-year storm.

How will this study impact existing businesses and developments?

Previously established businesses and developments within the Village of Archbold were not required to detain storm water runoff when they were developed. The anticipated rules that may be enacted locally may not require such storm water management facilities to be constructed for the existing sites. However, the same sites must continue to conform to all applicable federal and state requirements and, at a minimum, the Village of Archbold will support enforcement of such existing mandates. Additional local requirements that may be recommended as part of this evaluation will be directed toward improving the community through encouraging conservation and drainage solutions that maintain current runoff rates and mimic natural systems when site modifications and expansions occur. Please note that any site disturbance impacting an area of 1.0 acres or more are currently subject to the OEPA construction storm water program and require implementation of construction and post-construction best management practices (BMPs) , regardless of local rules and standards that may be developed.

How will this study impact existing homes and subdivisions?

Past residential developments within the Village of Archbold were not required to detain storm water runoff even though the rate and volume of runoff increased due to the construction of streets, walks, drives and roofs. Similar to the commercial and industrial sites noted above, future land use modifications affecting 1.0 acres or more will be subject to the OEPA construction storm water program, regardless of local rules and standards that may be developed. Additional local requirements that may be recommended as part of this evaluation will be directed toward improving the community through encouraging conservation and drainage solutions that maintain current runoff rates and mimic natural systems when new residential developments occur.

Will there be opportunity for additional community input?

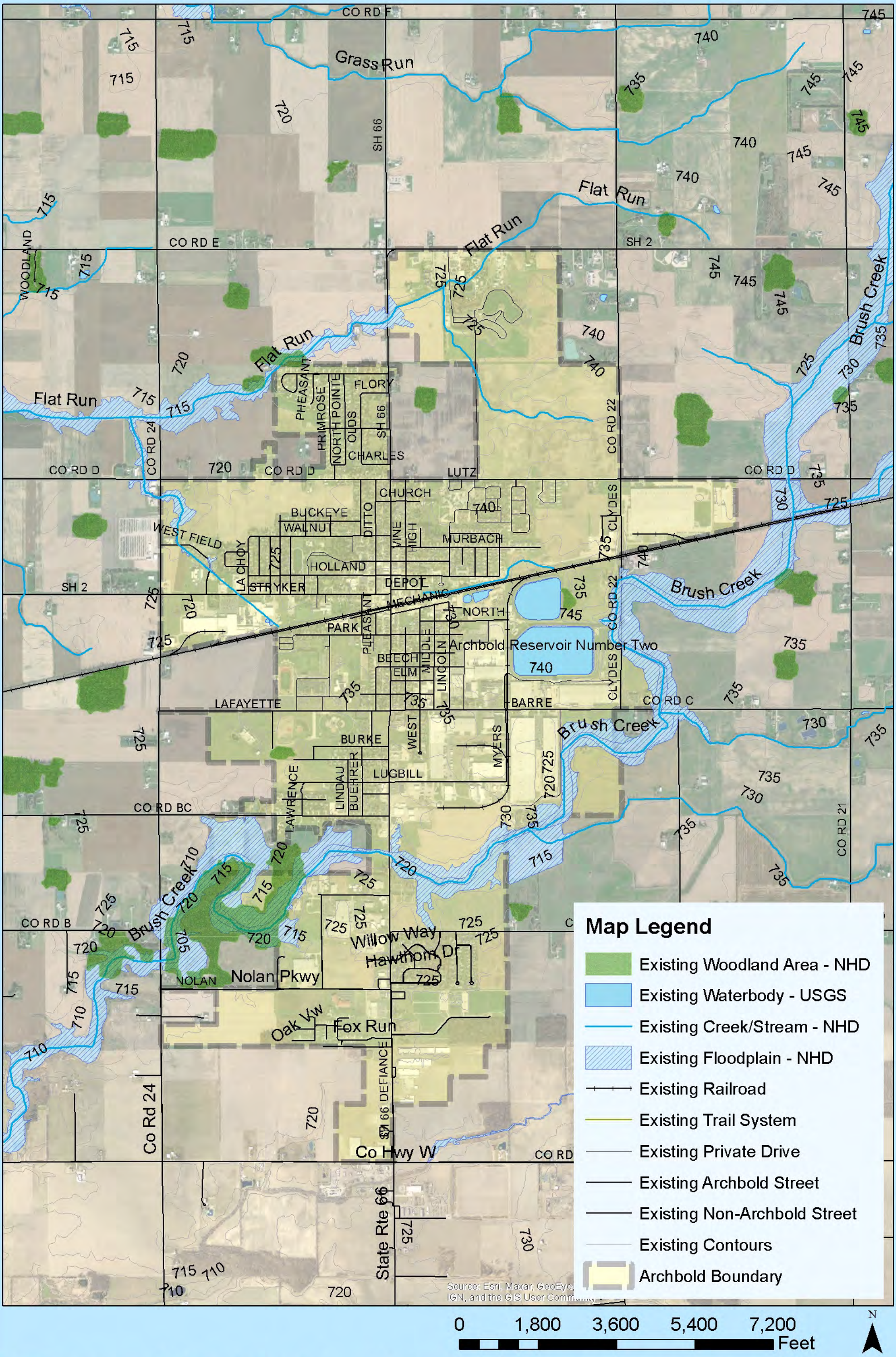
Yes. The findings of the study will be presented to Village Council and proposed revisions to local rules will be discussed with the Plan Commission and Council prior to formal enactment. These meetings are public forums and will provide opportunity for the local community to be engaged.

What are the next steps in this process?

The project consulting team will continue to accumulate and assess available information. Two (2) additional stakeholder meetings will occur during the evaluation and report development.

Additional common words and phrases utilized in storm water management include:

- Hydraulic Grade Line (HGL) – The water surface elevation or profile of water flowing within a pipe or open channel.
- Impervious Surface or Area – Generally solid or highly compacted surfaces that do not permit water to be absorbed rapidly. Examples include concrete, asphalt and rooftops.
- Infiltration – Absorption of water into soil.
- Runoff Coefficient (c) – An approximate relation of the rate of runoff to the amount of rainfall that occurs over a defined area. Runoff coefficients may range from 0.10 (sandy, vegetated areas) to 0.95 (fully impervious surfaces).
- Runoff Rate – A measurement or approximation of the discharge/runoff from a site typically expressed in cubic feet per second (CFS).
- Storm Frequency – The statistical likelihood that a rainfall event of a given intensity may occur during any year. A 5-YR storm frequency has a 20% chance of occurring, a 10-YR storm has a 10% chance, a 100-YR storm has a 1% chance and so on. Each incremental increase in the return frequency relates to higher peak intensity storm.
- Storm Intensity or Peak Intensity – A measurement of the rate of rainfall presented in inches per hour (IN/HR) for a defined duration of time.



Village of Archbold - General Hydrology Basemap

Village of Archbold
Storm Water Infrastructure Evaluation
Stakeholder Meeting #1
June 15, 2022 ~ Archbold High School Lecture Hall
SIGN-IN SHEET

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Jonathan Black	Archbold	419 446-2109	JWB@Archbold.com
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BRAD MILLER	MILLER BROS CONST.	419-466-4706	bradmiller@mcholdings.com
Wendell Beck	Land owner	419-967-0699	
Chris Collis	Sauder Village	419-630-8876	Chris.Collis@Sauderville ORG

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Storm Water Infrastructure Evaluation
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SIGN-IN SHEET

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Village of Archbold
Storm Water Infrastructure Evaluation
Stakeholder Meeting #1
June 15, 2022 ~ Archbold High School Lecture Hall
SIGN-IN SHEET

Name	Representing	Phone	Email
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Kevin Frey	Frey + Sons	419-367-3739	Kevin@freyandsons.net

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Agenda

1. Introductions & Sign-In
2. Project Goals and Scope
3. Project Stakeholders
4. General Study Findings
5. Current and Anticipated Rules & Regulations
6. Best Practices
7. Case Studies
   - Flat Run
   - Existing Commercial/Industrial Sites
   - Park & School Lands
   - Brush Creek Conservation Development & “Greenway” Corridor
8. Project Schedule
9. Future Stakeholder Meeting
10. Open Discussion

2

Project Goals and Scope

- Goals
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  - improve water quality
  - develop buy-in/partnership with stakeholders
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- Local Landowners
- TMACOG
- *The Nature Conservancy*
- Local Businesses/Employers
  - Arrow Tru-Line
  - Bil-Jax / Haulotte
  - CONAGRA
  - Miller Bros.
  - Sauder Village
  - Sauder Woodworking
  - Tri-Flo

5

Stakeholder Engagement

- Local “sounding board” for concepts and ideas
- Provide feedback
- Offer input for storm water management opportunities
- Assist in change management within the community.

Some of the concepts presented within this study may run counter to past practices of the Village but are representative of current thinking about stormwater management.

6

General Study Findings

- Storm Sewer Capacity
- Flat Run & Quail Hollow/North Pointe Estates Flooding
- Cambridge Estates (Woodland Oaks 3)/Woodland Oaks 2 Flooding
- Basement Backups on Christine Drive & Monterey Court
- Fairlawn Retirement Community Flooding
- Brush Creek Flooding ~ Co. Rd. 24 Bridge & Sunoco Site
- Brush Creek Significant Developed Industrial Site Contributions

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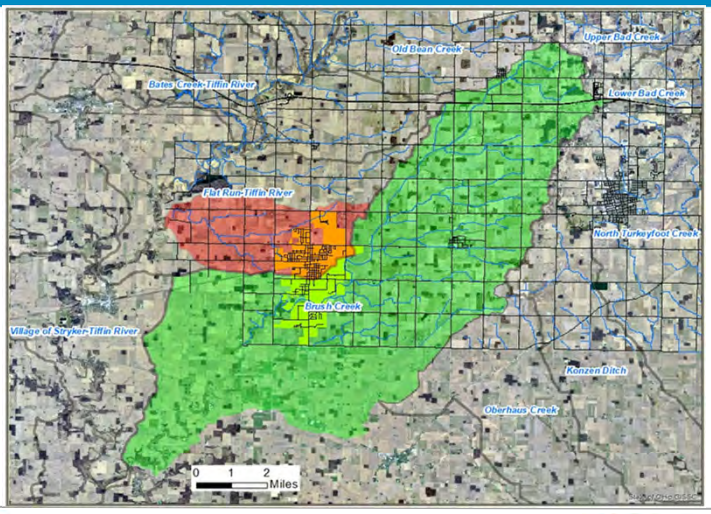
Watershed Map



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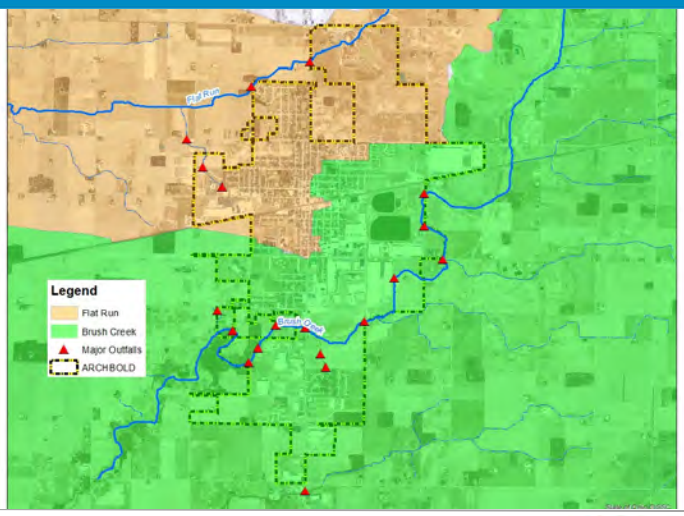
8

Watershed Map



9

Ohio & Federal Regulations

- Current
  - Ohio EPA Municipal Separated Sanitary Sewer System (MS4) Program
  - Construction Stormwater Management / ODNR Rainwater & Land Development Manual
  - Others: USACE, USFWS, FEMA, 401/404 CWA, etc.
- Anticipated
  - Volume & Rate of Runoff Control
  - Water Quality Enhancements ~ Suspended Solids & Nutrients

10

Levels of Service

- Strategic Goals
  - Maintain Public Safety & Welfare
  - Flood Damage Avoidance & Reduction
  - Natural Resource Protection & Preservation
  - Create Economic Opportunity
  - Fiscal Responsibility
- Tactical Implementation
  - Asset Management to Define Priorities
  - Enhanced Cleaning & Maintenance
  - Refine & Re-Examine Design Standards & Local Regulations

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Local Rules

- Current Standards
  - 5-year storm within pipe; 10-year Hydraulic Grade Line (HGL) below surface
  - No local stormwater detention requirements are currently adopted ~ Construction and Post-Construction BMP's Required and Some Voluntary Detention has been done
- Anticipated
  - Formal Stormwater Detention Standards
  - Revised Storm Sewer Design Standards
  - Stream Setbacks & Buffers / Conservation Easements
  - Low Impact Design Encouraged ~ Zoning Code Incentives
  - Targeted Downspout & Sump Pump Disconnection
  - Stormwater Fees

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Local Rules ~ Regional Communities

Community	Storm Sewer Design	Detention Required	Downspout Connections
Bowling Green	5-yr / 10-yr	Yes (2-yr Pre- vs. 25-yr Post-Development)	--
Bryan	5-yr / 10-yr	No (Draft in Process)	--
Defiance	5-yr / 10-yr	Yes (Design May Vary)	
Findlay	5-yr / 10-yr	Yes (5-yr Pre- vs. 100-yr Post-Development)	--
Lima	10-yr	Yes (2-yr Pre- vs. 10-yr Post-Development if <10 acres) ***	--
Napoleon	5-yr / 10-yr	Yes (Critical Storm Method)	No
Perrysburg	5-yr / 10-yr	Yes (2-yr Pre- vs. 100-yr Post-Development)	No
Pioneer	10-yr	Yes (5-yr Pre- vs. 25-yr Post-Development)	--
Wauseon	5-yr / 10-yr	Yes (Design May Vary)	--

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"Stormwater 101" ~ Example Calculation (5-Yr./20-min.)

Pre-Development (2.5 ac. open field)

$Q_{pre} = c_{pre}IA$

$Q_{pre} = (0.20) \times (3.23"/hr) \times (2.5 ac.)$

$Q_{pre} = 1.62$ CFS or 725 GPM

Requires a 12" pipe @ 0.25% slope

Post-Development (apartments)

$Q_{post} = c_{post}IA$

$Q_{post} = (0.70) \times (3.23"/hr) \times (2.5 ac.)$

$Q_{post} = 5.67$ CFS or 2,545 GPM

Requires a 24" pipe @ 0.10% slope

Qpost / Qpre = 350% increase in runoff

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Detention Example

- 2-year (50% ACE) Pre-Development vs. 100-Year (1% ACE) Post-Development
- Reduces peak discharge by 76% for 5-year (20% ACE) & 80% for 10-year (10% ACE)
- Additional storage may be required for Construction BMPs

STORMWATER DETENTION DESIGN - 2-Year Pre/100-Year Post Storm Method

LOT AREA (SQ. FT.)	109,250	Notes:	2.51	AC
PAVMT AREA (SQ. FT.)	50,500	WT. C = Cw =	0.7	- perv = 0.20
WET POND AREA (SQ. FT.)	6,000			- imperv = 0.95
BUILDING AREA (SQ. FT.)	17,000	ALLOW C =	0.2	
TOTAL IMPERVIOUS (SQ. FT.)	73,500	ALLOW I =	2.66	- 2yr, 20 min
NET PERVIOUS (SQ. FT.)	35,750	Q ALLOW (cfs) =	*1.33*	

DETENTION VOLUME CALCULATION

tc (min)	i100 in./hr.	CwA (A=Ac)	Qin Q100	Qout= Qallow	Qin-Qout	xtcx60 (cu. ft.)	xtcx60 (ac. ft.)
10.00	6.73	1.76	11.82	1.33	10.48	6,288.65	0.15
15.00	5.76	1.76	10.11	1.33	8.78	7,900.31	0.19
20.00	5.05	1.76	8.87	1.33	7.53	9,037.95	0.21
30.00	4.08	1.76	7.16	1.33	5.83	10,491.61	0.25
40.00	3.45	1.76	6.06	1.33	4.72	11,334.31	0.27
50.00	3.01	1.76	5.28	1.33	3.95	11,850.46	0.28
60.00	2.67	1.76	4.69	1.33	3.35	12,071.67	0.28
70.00	***2.41***	***1.76***	***4.23***	***1.33***	***2.90***	***12,166.48***	***0.28***
80.00	2.20	1.76	3.86	1.33	2.53	12,134.88	0.28
90.00	2.03	1.76	3.56	1.33	2.23	12,040.07	0.28
100.00	1.88	1.76	3.30	1.33	1.97	11,797.80	0.28
110.00	1.76	1.76	3.09	1.33	1.76	11,587.12	0.27
120.00	1.65	1.76	2.90	1.33	1.56	11,250.04	0.26
130.00	1.56	1.76	2.73	1.33	1.40	10,892.33	0.26
140.00	1.47	1.76	2.59	1.33	1.25	10,515.96	0.25
150.00	1.40	1.76	2.46	1.33	1.12	10,110.93	0.24

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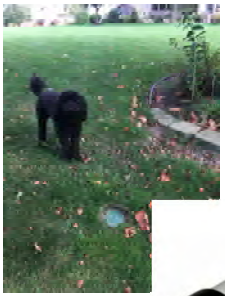
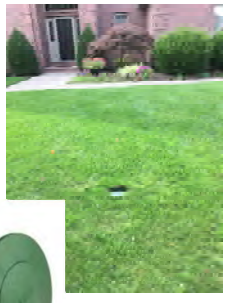
Examples

Rain Gardens/Bioswales ~ Defiance

Downspout Disconnections & Pop-Ups





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Examples

Permeable Pavers

Conservation Easement / Constructed Wetland

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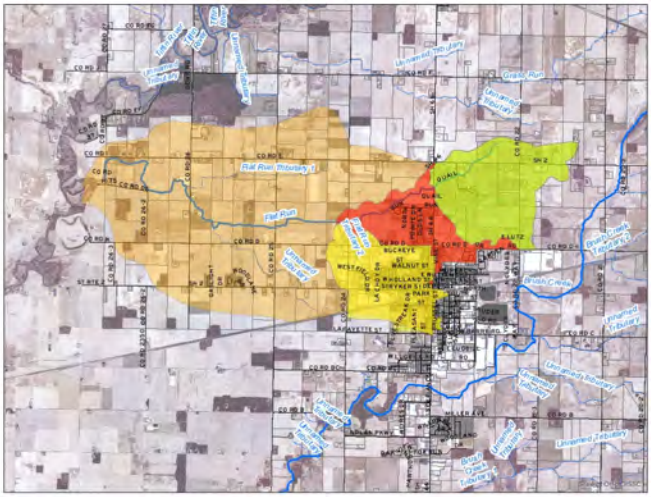
Flat Run Drainage Issues



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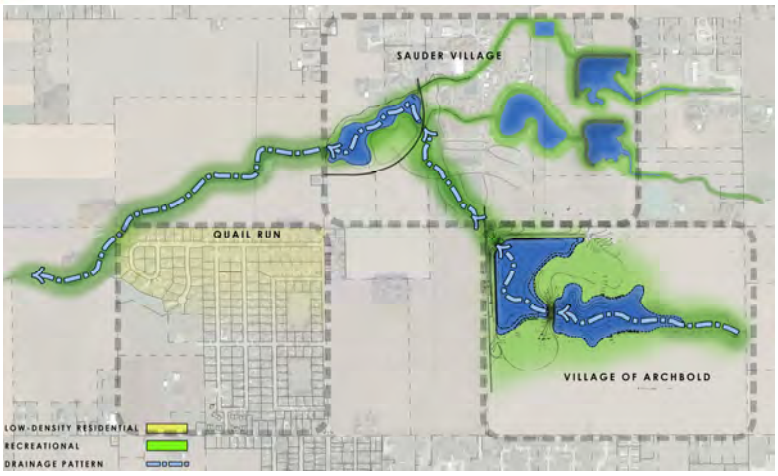
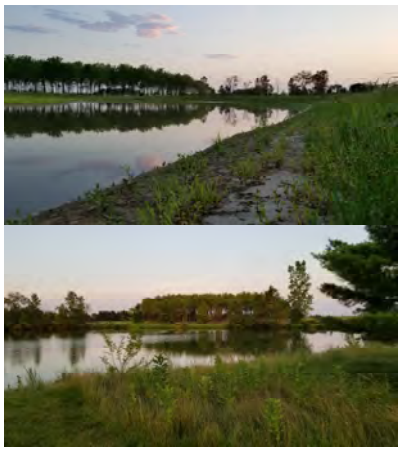
Case Studies ~ Flat Run Drainage Area





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Case Studies ~ Existing Commercial/Industrial Sites

Existing Industrial Site

- RECONFIGURED PARKING LOT
- STORMWATER IMPROVEMENTS
  - DETENTION BASINS
    - Stormwater Impact: High
    - Cost Impact: Medium

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Case Studies ~ Existing Commercial/Industrial Sites

Existing Industrial Site

- RECONFIGURED PARKING LOT
- STORMWATER IMPROVEMENTS
  - UNDERGROUND DETENTION BELOW PARKING LOT (Saves Surface area)
    - Stormwater Impact: High
    - Cost Impact: High

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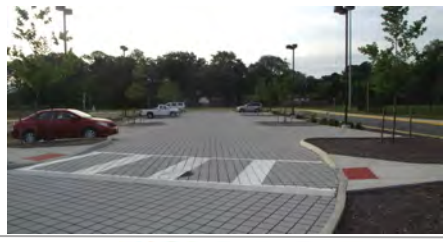
Case Studies ~ Existing Commercial/Industrial Sites

Existing Industrial Site

- RECONFIGURED PARKING LOT
- STORMWATER IMPROVEMENTS
  - PERVIOUS PAVERS
    - Stormwater Impact: Medium
    - Cost Impact: High



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Case Studies ~ Existing Commercial/Industrial Sites

Existing Industrial Site

- RECONFIGURED PARKING LOT
- SHADE TREE PLANTINGS
  - Intercept/Slow Runoff:
  - Reduced Heat-Island affect:
  - Stormwater Impact: Medium/Low
  - Cost Impact: Low

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Case Studies ~ Existing Commercial/Industrial Sites

Existing Commercial Site

- RECONFIGURED PARKING LOT
- STORMWATER IMPROVEMENTS
  - DETENTION BASINS
    - Stormwater Impact: High
    - Cost Impact: Medium

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Case Studies ~ Existing Commercial/Industrial Sites

Existing Commercial Site

- RECONFIGURED PARKING LOT
- STORMWATER IMPROVEMENTS
  - UNDERGROUND DETENTION BELOW PARKING LOT (Saves Surface area)
    - Stormwater Impact: High
    - Cost Impact: High

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Case Studies ~ Existing Commercial/Industrial Sites

Existing Commercial Site

- RECONFIGURED PARKING LOT
- STORMWATER IMPROVEMENTS
  - PERVIOUS PAVERS
    - Stormwater Impact: Medium
    - Cost Impact: High

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Case Studies ~ Existing Commercial/Industrial Sites

Existing Commercial Site

- RECONFIGURED PARKING LOT
- SHADE TREE PLANTINGS
  - Intercept/Slow Runoff:
  - Reduced Heat-Island affect:
  - Stormwater Impact: Medium/Low
  - Cost Impact: Medium/Low

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Case Studies ~ Park & School Lands

ARCHBOLD HIGH SCHOOL

- STORMWATER IMPROVEMENTS
  - DETENTION BASINS
    - Stormwater Impact: High
    - Cost Impact: Medium
  - SHADE TREE PLANTINGS
    - Intercept/Slow Runoff:
    - Reduced Heat Island affect:
    - Stormwater Impact: Medium/Low
    - Cost Impact: Medium/Low
  - FLAT RUN WATERSHED

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Case Studies ~ Park & School Lands

WOODLAND PARK

- STORMWATER IMPROVEMENTS
  - DETENTION BASINS
    - Stormwater Impact: High
    - Cost Impact: Medium
  - SHADE TREE PLANTINGS
    - Intercept/Slow Runoff:
    - Reduced Heat Island affect:
    - Stormwater Impact: Medium/Low
    - Cost Impact: Medium/Low
  - MEADOW GRASS PLANTINGS
    - Reduced Maintenance/Mowing
    - Stormwater Impact: Medium/Low
    - Cost Impact: Low

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Case Studies ~ Brush Creek Conservation Development

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Case Studies ~ Brush Creek Conservation Development

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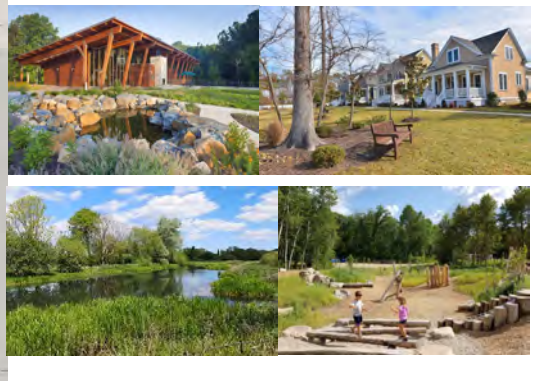
Case Studies ~ Brush Creek Conservation Development



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Case Studies ~ Brush Creek Conservation Development

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Project Schedule

• Kickoff Meeting	March 2022
• Data Gathering & Analysis	March – August 2022
• Rule and Regulations Review	May – June 2022
• Stakeholder Meeting 1	June 2022
• Identify Options for Stormwater Management Facilities	June – August 2022
• Funding Option Assessment	July – September 2022
• Report Development	August – October 2022
• Stakeholder Meeting 2	September – October 2022
• Finalize Report	February 2023
• Stakeholder Meeting 3	February 2023
• Submit Final Report	February 2023

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Future Stakeholder Meeting

Meeting #3 – February 2023

- After report submitted to Village
- Present findings & recommendations
- Discuss program implementation timeline
- Funding opportunities
- Educational opportunities
- Updated local design standards & rules
- Community-wide GI & LID opportunities

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Open Discussion

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Thank You!!
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Village of Archbold
Storm Water Infrastructure Evaluation
Stakeholder Frequently Asked Questions (FAQs)

Why is the Village evaluating its storm water systems?

The last study of the Village's storm water system was completed in 1966. The rules and regulations governing storm water management have advanced greatly since the report was completed, including efforts to reduce the amount of sediment and floatable debris captured and discharged to local creeks and waterways. In addition, portions of the Village have experienced basement backups and localized surface flooding during and immediately following significant rainfall events.

This new study will:

- ✓ Assess the condition and capacity of the existing storm water systems and provide recommendations for improvement (where necessary).
- ✓ Provide recommendations for local rules.
- ✓ Identify funding sources to aid in completing capital programs.

Who are the members of the Stakeholder Group?

Several local landowners, developers and business leaders were contacted, along with representatives of Archbold Schools, Fulton County, German Township and local/regional planning organizations.

What is the purpose of the Stakeholder Group?

The Stakeholder Group will serve as a "sounding board" for discussion during the development of the overall Storm Water Infrastructure Evaluation report, including suggested enhancements to the Village's approach to storm water management. Additional support will also be provided by the Stakeholder Group externally by offering insight and directing questions to the project team as information is passed to the community at-large.

Where does our local storm water runoff go?

Some rainfall that hits the Village infiltrates into the local soils, with the excess runoff that cannot infiltrate flowing off-site. Most of the properties within the Village of Archbold are served by underground storm sewers. The remaining lands are drained by surface swales and ditches. All of these storm sewers and drainageways outlet into the local streams of Flat Run and Brush Creek and ultimately pass into the Tiffin River, Maumee River and Lake Erie.

Why is storm water management important for our community?

The risks associated with storm water (e.g. – street and property flooding, basement backups, erosion) have risen due to the increased frequency and intensity of storms within our region. These safety and property damage risks are compounded as additional development occurs, creating more runoff from sites. Water quality for flows discharging to the receiving streams is also a concern and has become a regulated item through the Ohio EPA. As a municipality, the Village is required to comply and support the enforcement of such mandates. Effective storm water management can ultimately save the Village money long-term and, when enhancing water quality, can also open additional opportunity for outside grants and low-interest loan programs to reduce costs for capital projects.

What is the difference between a floodway and a floodplain?

The "floodway" of a stream is generally defined as the limits of the stream channel itself and adjacent areas above the streambank required to carry a flood. The "floodplain" consists of the floodway and further adjacent lands below the

high water level during a flood event. While not a perfect description, a "floodway" generally contains rapidly moving water, while an inundated "floodplain" will be relatively still.

What is a 100-year storm event?

The term "100-year storm" is a misnomer and can be confusing. The correct terminology is a "1% annual chance exceedance event," or 1% ACE event. This refers to the statistical probability of such a highly intense rainfall/runoff event happening in a single year. A 1% ACE event has a 1% statistical probability of occurring in any given year, based upon meteorological and streamflow data accumulated for our region dating back to the late 1800's. A 1% ACE storm or flooding event could possibly occur multiple times in one year or may not occur at all. Similarly, a "5-year storm" would be a 20% ACE event and has a 20% probability of occurring. A "10-year storm" is a 10% ACE event and has a 10% probability of occurring.

Can a 100-year (1% ACE) flood event occur in the Village when the local rainfall is not significant?

Yes. The watersheds contributing to the local streams are significantly larger than the Village itself. A major rain event upstream of the Village may cause the streams to swell to an elevation creating flood conditions within the Village. Such an increase in the water levels will limit the capacity of the Village's collection system to transport local runoff.

How are storm sewers and drainageways sized to carry runoff from a site?

Storm runoff from an existing or proposed site is usually estimated through the "Rational Method", a relatively simple calculation that will vary significantly based upon the individual site's amount of vegetated cover, the estimated intensity of a rainfall event and the area of the site.

The Rational Method formula is Q = cIA, where:

"Q" is the calculated runoff in cubic feet per second (CFS)
"c" is a runoff constant varying from 0.10 for vegetated sandy soils to 0.95 for hard surfaces
"I" is the estimated rainfall intensity in inches per hour (IN/HR) for a defined rainfall frequency
"A" is the area of a site or catchment in acres (AC)

Once the estimated runoff is calculated, further calculations are completed to determine the pipe and/or open channel size and slope required to carry the discharge. Most enclosed storm sewer systems are designed to carry the runoff from a 5-year storm within the pipe and preventing surface flooding for the 10-year storm.

How will this study impact existing businesses and developments?

Previously established businesses and developments within the Village of Archbold were not required to detain storm water runoff when they were developed. The anticipated rules that may be enacted locally may not require such storm water management facilities to be constructed for the existing sites. However, the same sites must continue to conform to all applicable federal and state requirements and, at a minimum, the Village of Archbold will support enforcement of such existing mandates. Additional local requirements that may be recommended as part of this evaluation will be directed toward improving the community through encouraging conservation and drainage solutions that maintain current runoff rates and mimic natural systems when site modifications and expansions occur. Please note that any site disturbance impacting an area of 1.0 acres or more are currently subject to the OEPA construction storm water program and require implementation of construction and post-construction best management practices (BMPs) , regardless of local rules and standards that may be developed.

How will this study impact existing homes and subdivisions?

Past residential developments within the Village of Archbold were not required to detain storm water runoff even though the rate and volume of runoff increased due to the construction of streets, walks, drives and roofs. Similar to the commercial and industrial sites noted above, future land use modifications affecting 1.0 acres or more will be subject to the OEPA construction storm water program, regardless of local rules and standards that may be developed. Additional local requirements that may be recommended as part of this evaluation will be directed toward improving the community through encouraging conservation and drainage solutions that maintain current runoff rates and mimic natural systems when new residential developments occur.

Will there be opportunity for additional community input?

Yes. The findings of the study will be presented to Village Council and proposed revisions to local rules will be discussed with the Planning Commission and Council prior to formal enactment. These meetings are public forums and will provide opportunity for the local community to be engaged.

What are the next steps in this process?

The project consulting team will continue to accumulate and assess available information. One (1) additional stakeholder meeting will occur following completion of the evaluations and draft report development.

Additional common words and phrases utilized in storm water management include:

- Hydraulic Grade Line (HGL) – The water surface elevation or profile of water flowing within a pipe or open channel.
- Impervious Surface or Area – Generally solid or highly compacted surfaces that do not permit water to be absorbed rapidly. Examples include concrete, asphalt and rooftops.
- Infiltration – Absorption of water into soil.
- Runoff Coefficient (c) – An approximate relation of the rate of runoff to the amount of rainfall that occurs over a defined area. Runoff coefficients may range from 0.10 (sandy, vegetated areas) to 0.95 (fully impervious surfaces).
- Runoff Rate – A measurement or approximation of the discharge/runoff from a site typically expressed in cubic feet per second (CFS).
- Storm Frequency – The statistical likelihood that a rainfall event of a given intensity may occur during any year. A 5-YR storm frequency has a 20% chance of occurring, a 10-YR storm has a 10% chance, a 100-YR storm has a 1% chance and so on. Each incremental increase in the return frequency relates to higher peak intensity storm.
- Storm Intensity or Peak Intensity – A measurement of the rate of rainfall presented in inches per hour (IN/HR) for a defined duration of time.

Village of Archbold
Storm Water Infrastructure Evaluation
Stakeholder Meeting #2 Sign-In Sheet

NAME	REPRESENTING	PHONE	EMAIL
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Chris Hauser	" "	(419) 473-9611	chauser@jheng.com
TIM [illegible]	EDGE	419.255.5335	TP[illegible]EDGEUS.com
Brock Beck	Engineering	419-446-2109	bbeck@archbold.com
Christy Shadbolt	Regional Planning	419.337.9214	ChristyShadbolt@fultoncountyoh.com
Jake Wyse	Village of Archbold street dept.	419-572-1105	archst@archbold.com
DAVE DAVIS	Archbold Fire Dept	419-445-9506	ddavis@archbold.com

Village of Archbold
Storm Water Infrastructure Evaluation
Stakeholder Meeting #2 Sign-In Sheet

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David Geringer	David L Geringer P.E.	419-446-2118	dgeringer@rtecexpress.net
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Nick Filipovich	Arrow Tru-Line	419. 551-0182	nfilipovich@arrowtruline.com
Wendell Bark			

Village of Archbold
Storm Water Infrastructure Evaluation
Stakeholder Meeting #2 Sign-In Sheet

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Bonnie Beck		567-444-4744	

Village of Archbold
Storm Water Infrastructure Evaluation
Stakeholder Meeting #2 Sign-In Sheet

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~~BRAD STORT~~	VILLAGE OF ARCHBOLD	419.572-1493	
JASON MARTZ	Village of Archbold	419.572.1098	archst@archbold.com
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Jen Kidder	Village of Archbold	1119572-1093	jenkidder@archbold.com

Village of Archbold
Storm Water Infrastructure Evaluation
Stakeholder Meeting #2 Sign-In Sheet

NAME	REPRESENTING	PHONE	EMAIL
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Mike Weaver	USDA, NRCS and Fulton Soil+Water		
Ashlee Decker	The Nature Conservancy	419-455-4192	ashlee.decker@tnc.org
Lisa Bratton	Fairlawn Retirement Community	567-444-5065	lbratton@fairlawnarchbold.com
Donna Dettling	Village of Archbold	419-445-4726	ddettling@archbold.com
Karla Ball	Archbold Village Council	419.551.7122	kball@archbold.com

Village of Archbold
Storm Water Infrastructure Evaluation
Stakeholder Meeting #2 Sign-In Sheet

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JAYSON SELGO	ARCHBOLD SCHOOLS		
Chris Collis	Sauder Village		chris.collis@SauderVillage.org

Project Stakeholder Meeting No. 3

Archbold Stormwater Infrastructure Evaluation

March 7, 2023

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Agenda

1. Introductions & Sign-In
2. Project Goals and Scope
3. Project Stakeholders
4. Stakeholder Engagement
5. Federal, State and Local Rules
6. Study Findings
7. Study Recommendations
8. Funding Opportunities
9. Educational Opportunities
10. Project Schedule
11. Open Discussion

Project Goals and Scope

- Goals
  - Reduce Localized Flooding
  - Improve Water Quality
  - Develop Buy-In/Partnership with Stakeholders
- Identify the Condition and Capacity of the Village's Stormwater Facilities
- Provide Recommendations to Correct Deficiencies
- Develop a Capital Improvement Plan that will Provide the Village with an Appropriate Level of Service

Project Goals and Scope

- Provide Recommendations on Local Rules and Regulations
  - Respect the Desire for Continued Development
  - Incorporate Common-Sense Best Practices for the Improvement of Stormwater Management and Water Quality
  - Include Practical Green and Low-Impact Development Policies & Solutions
- Conduct Outreach Meetings for Village Officials and Stakeholders
- Develop Summary Report to Document:
  - Project Findings
  - Early Action Projects that will have the Greatest Immediate Impact
  - Longer-Term Projects to Ensure Continued Service and Enhance the Overall Community
  - Operations and Maintenance & Asset Management Activities
  - Anticipated Costs & Timing for Implementation

Project Stakeholders

- Village of Archbold
- Archbold Schools
- Fulton County Engineer
- Fulton County Soil & Water
- Fulton County Plan Commission
- German Township
- Local Designers
- Local Landowners
- TMACOG
- *The Nature Conservancy*

- Local Businesses/Employers
  - Arrow Tru-Line
  - Bil-Jax / Haulotte
  - CONAGRA
  - Miller Bros.
  - Sauder Village
  - Sauder Woodworking
  - Tri-Flo

Stakeholder Engagement

- Local “Sounding Board” for Concepts and Ideas
- Provide Feedback
- Offer Input for Storm Water Management Opportunities
- Assist in Change Management within the Community

Some of the concepts presented within this study may run counter to past practices of the Village but are representative of current thinking about stormwater management.

State of Ohio & Federal Regulations

- Current Regulations
  - Ohio EPA Municipal Separated Sanitary Sewer System (MS4) Program
  - General Construction Stormwater Management Permit (SWP3 Plans)
  - Clean Water Act (CWA) & NPDES Program
  - Others: USACE, USFWS, FEMA

- Anticipated Revisions Due to Maumee River TMDL
  - Volume & Rate of Runoff Control
  - Water Quality Improvements ~ Suspended Solids & Nutrients
  - Enhanced Enforcement

Local Rules ~ What are your Neighbors Doing?

Community	Storm Sewer Design	Detention Required	Downspout Connections
Bowling Green	5-yr / 10-yr	Yes (2-yr Pre- vs. 25-yr Post-Development)	--
Bryan	5-yr / 10-yr	No (Draft in Process)	--
Defiance	5-yr / 10-yr	Yes (Design May Vary)	
Findlay	5-yr / 10-yr	Yes (5-yr Pre- vs. 100-yr Post-Development)	--
Lima	10-yr	Yes (2-yr Pre- vs. 10-yr Post-Development if <10 acres)	--
Napoleon	5-yr / 10-yr	Yes (Critical Storm Method)	No
Perrysburg	5-yr / 10-yr	Yes (2-yr Pre- vs. 100-yr Post-Development)	No
Pioneer	10-yr	Yes (5-yr Pre- vs. 25-yr Post-Development)	--
Wauseon	5-yr / 10-yr	Yes (Design May Vary)	--

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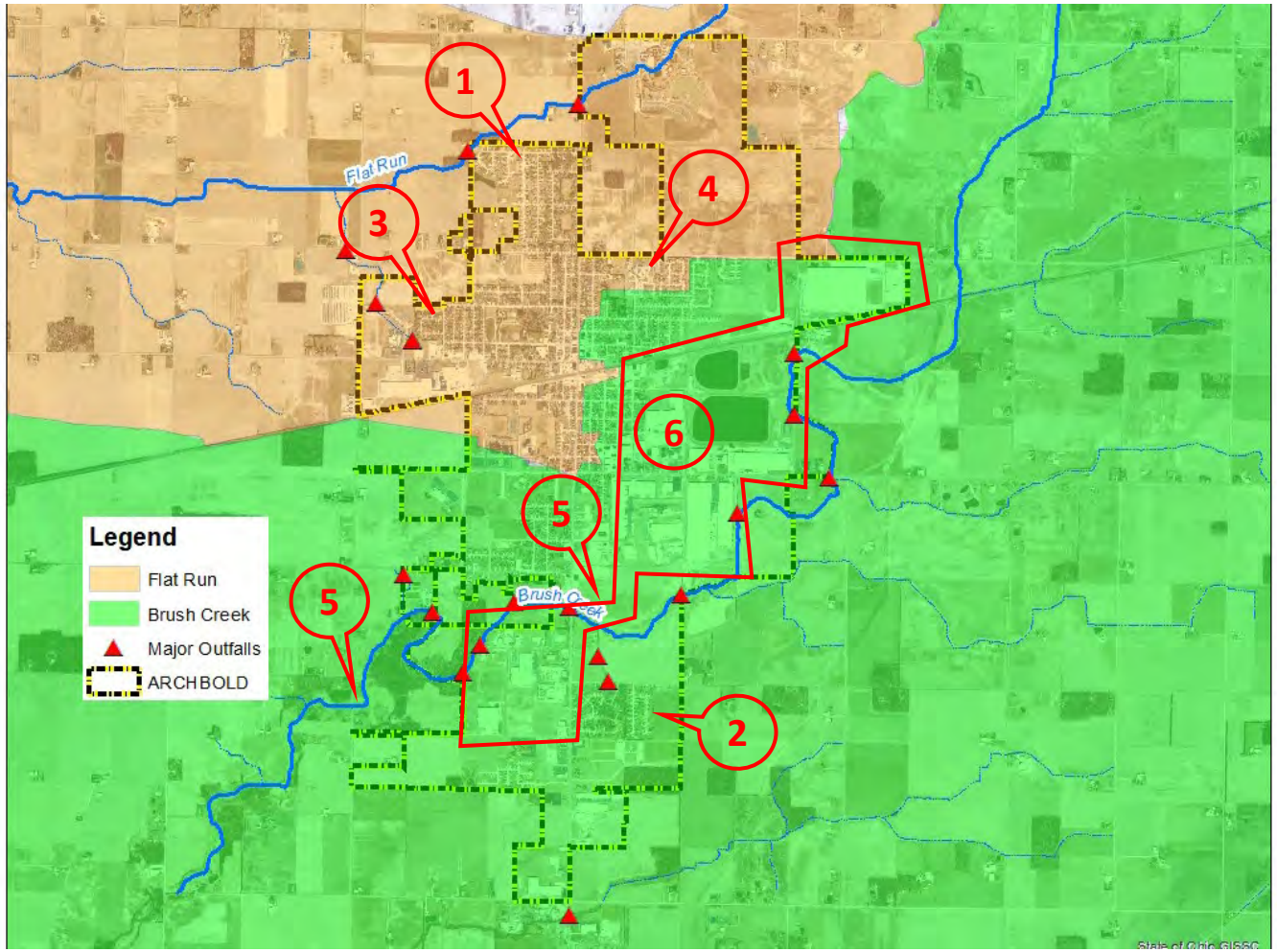
Study Findings



- Storm Sewer Capacity Generally Adequate

1. Flat Run & Quail Hollow/North Pointe Estates Flooding
2. Cambridge Estates (Woodland Oaks 3 /Woodland Oaks 2) Flooding
3. Basement Backups on Christine Drive & Monterey Court
4. Fairlawn Retirement Community Flooding
5. Brush Creek Flooding ~ Co. Rd. 24 Bridge & Sunoco Site
6. Brush Creek Significant Developed Industrial Site Contributions

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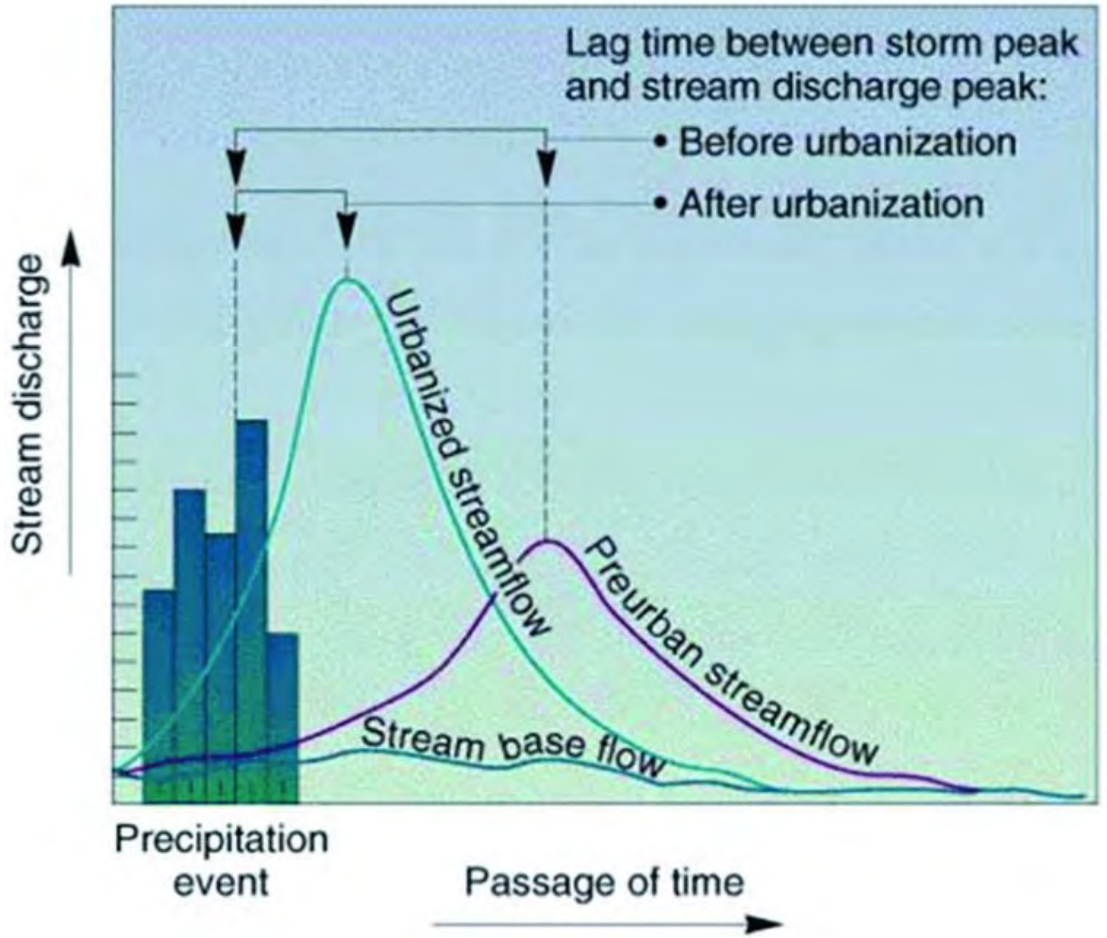
Study Recommendations – Early Action 2023



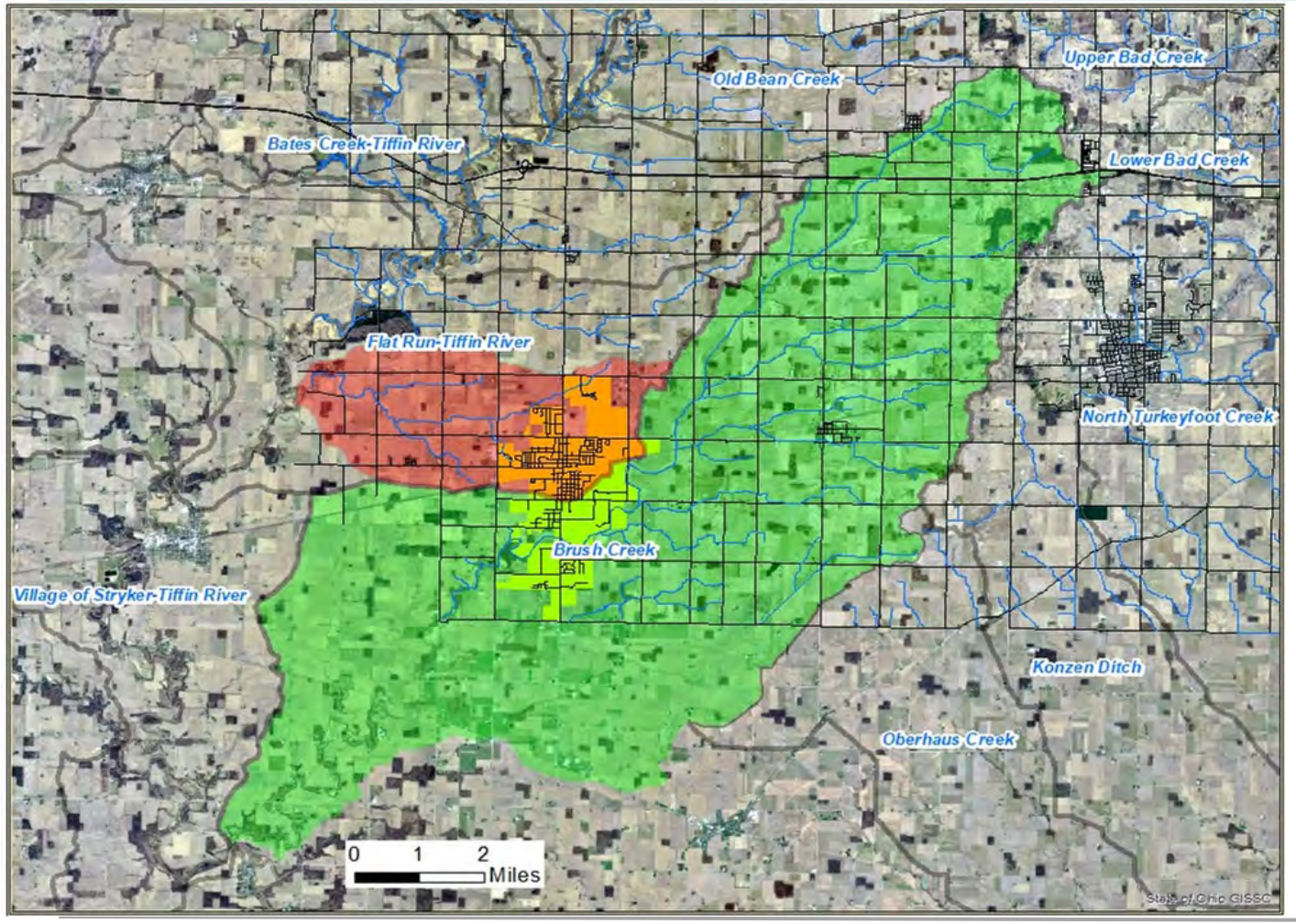
- Update Stormwater Rules & Regulations
  - Updated Design Standards
  - Detention Requirements
  - Stream Setback & Conservation Easements
  - Low Impact Development (LID) Incentives
- Why? - Put a Lid on Flow Increases to Flat Run and Brush Creek, Keep List of Issues from Growing

Study Recommendations – Early Action 2023

- Refine Village's Asset Management and Maintenance Program
  - Continue Street Sweeping
  - Annual Catch Basin & Outfall Inspection/Cleaning
  - Clean/ TV Inspect Storm Sewers on 10 Year Intervals
- Why? - Keep Your Facilities in Good Condition

- Begin Screening and Developing Methods for the Village to Fund Stormwater Infrastructure Improvements
- Why? – A Lot of Alternatives are Available, Funds Will be Needed, Not Too Soon to Start Discussions

Early Action – Flat Run and Brush Creek Watersheds



- Need to Consider Entire Watershed
  - Start the Ditch Petition Process with Fulton County
  - Coordinate with German Township and Trustees
- Why?
  - A Large Part of Flat Run and Brush Creek's Watersheds are Outside Archbold
  - Regional Cooperation will be Needed to Improve Drainage Conditions on these Waterways
  - Different Issues/Solutions in Each Watershed
  - **Places Flat Run and Brush Creek on Permanent Maintenance Plan**

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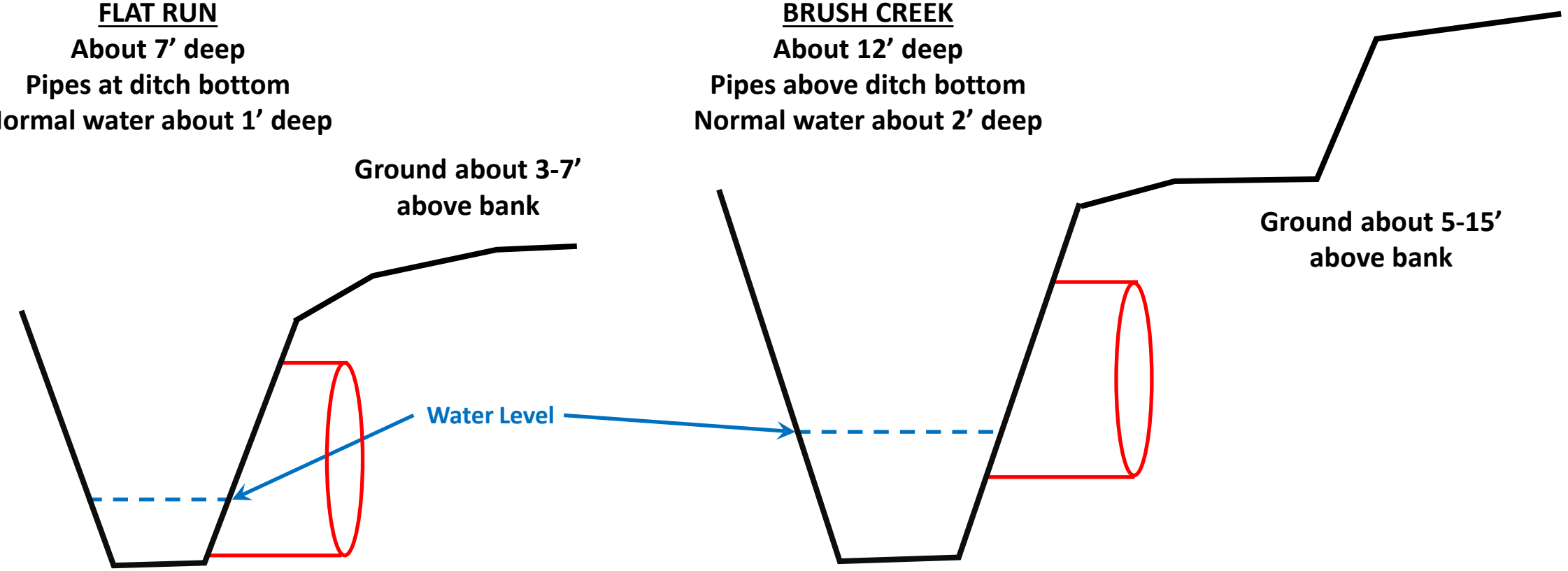
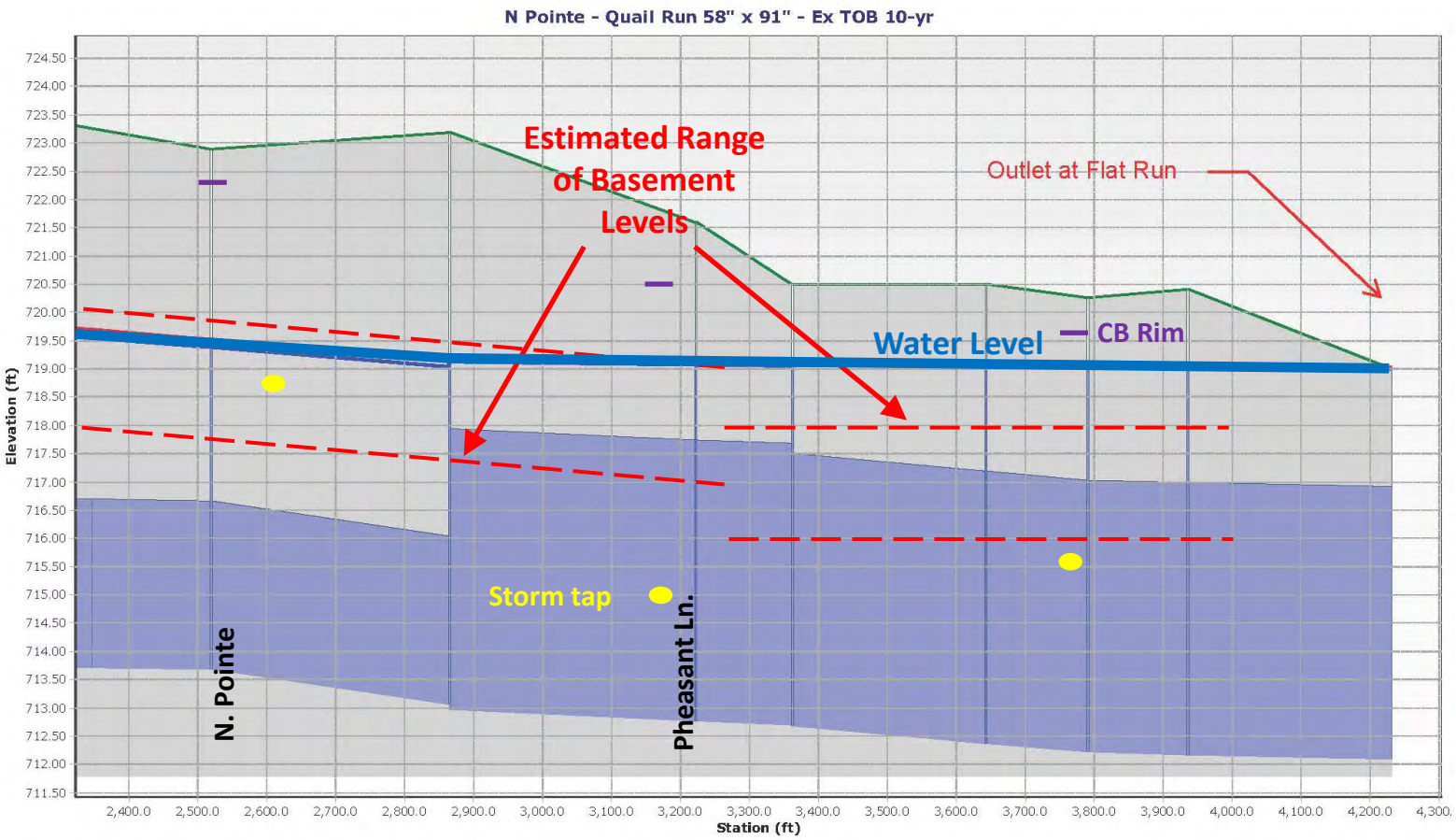
Early Action - Flat Run and Brush Creek Watersheds

FLAT RUN
About 7’ deep
Pipes at ditch bottom
Normal water about 1’ deep

BRUSH CREEK
About 12’ deep
Pipes above ditch bottom
Normal water about 2’ deep

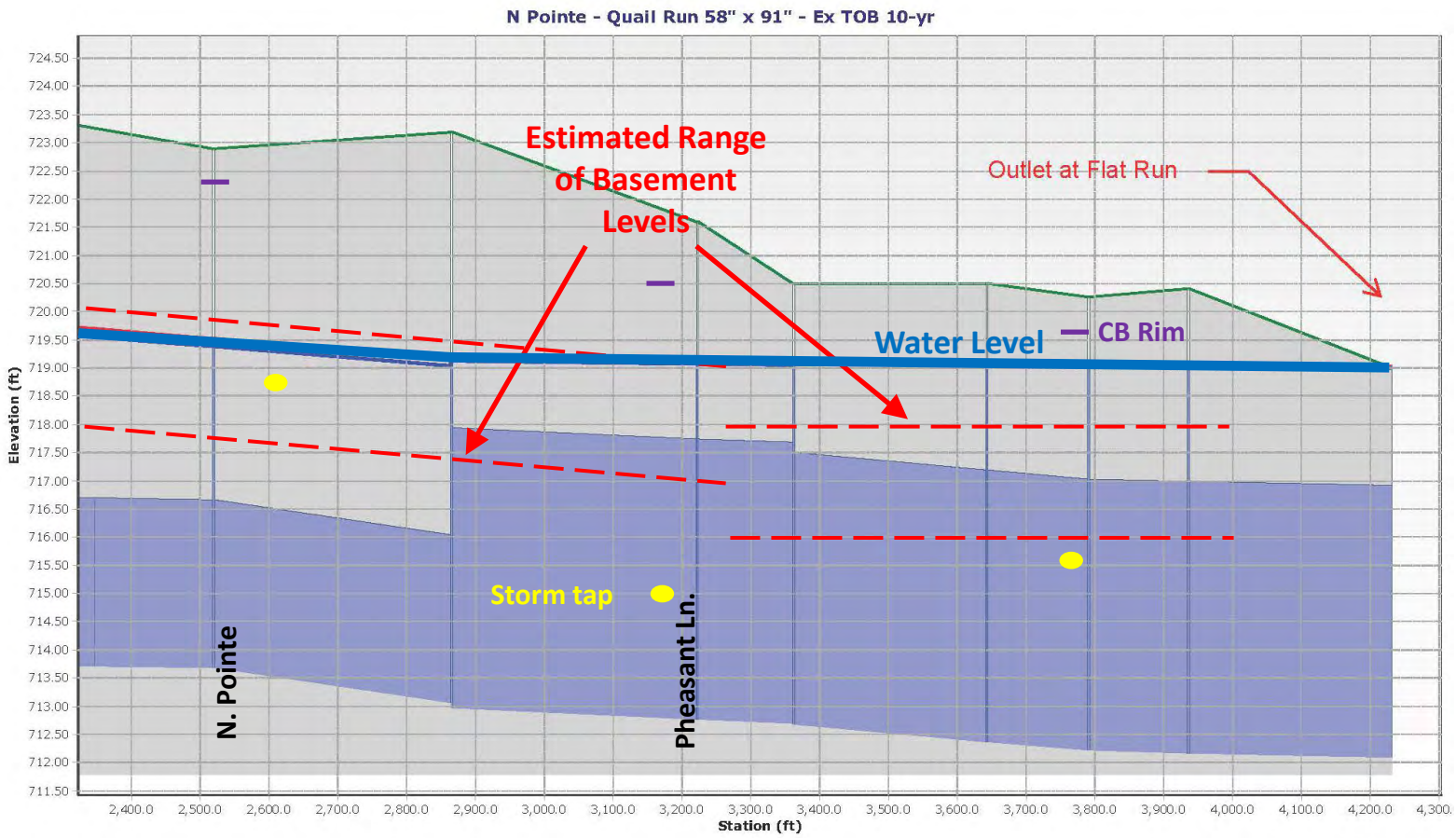


Early Action - Quail Hollow/North Pointe Estates –Flat Run



- The Quail Run Storm Sewer System Reflects the Water Level in Flat Run
- The Storm Sewer Has Adequate Capacity
  - During Rain Events Sewer Water Levels can be Near the Ground Surface
  - Higher than the Basement Elevations of the Homes on Quail Run

Early Action - Quail Hollow/North Pointe Estates –Flat Run



- A Detention Basin Alongside Flat Run was Evaluated
  - The Basin Reduced Water Levels in Flat Run by About 2 Feet.
  - Unfortunately, Basements Will Still be Impacted
- Not Enough Depth Available Between Flat Run Flood Level and its Channel Bottom to "Push" Enough Water into the Basin

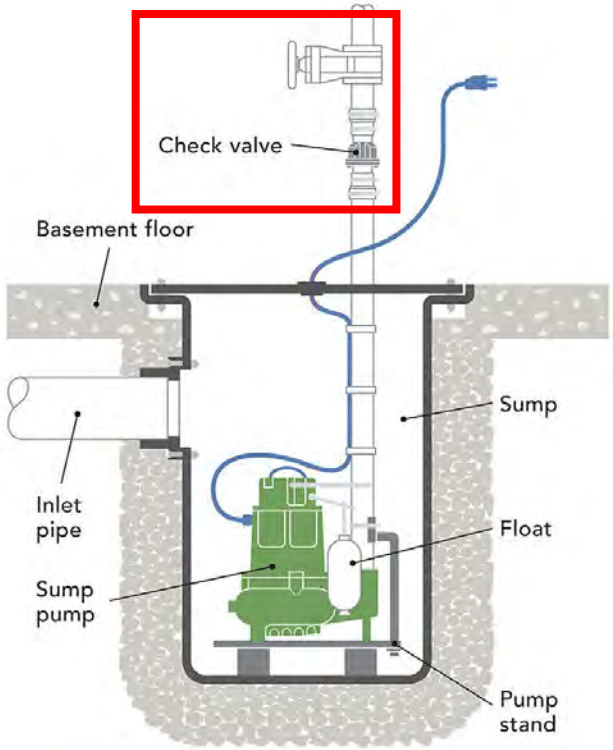
Early Action - Quail Hollow/North Pointe Estates –Flat Run

Can Anything be Done??

YES

Study Recommendations – Early Action 2023

Sump Pump Connections



Targeted Downspout Disconnections

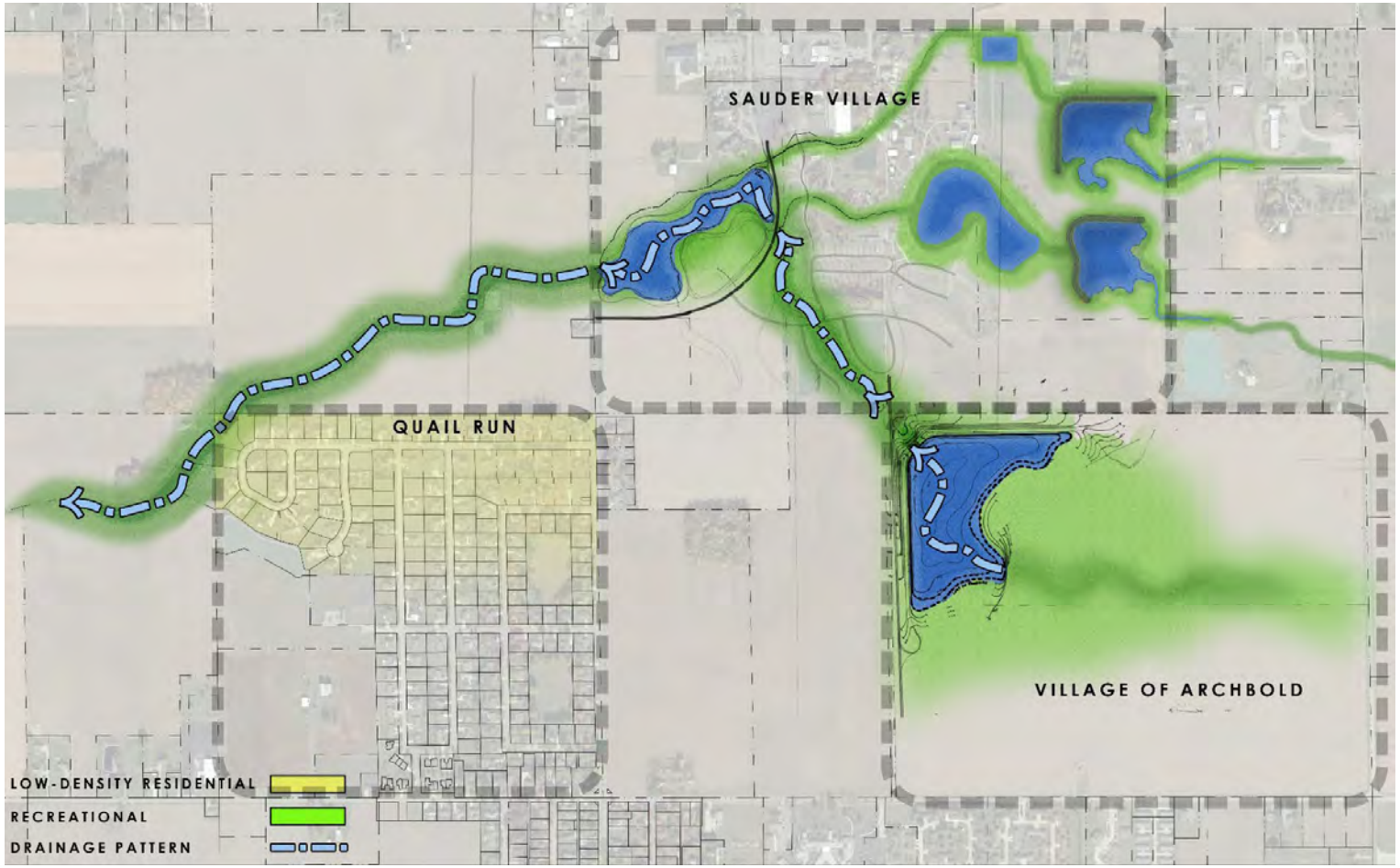
Yard “Pop-Ups”

Study Recommendations – Early Action 2023

Rain Gardens/Bioswales

These Actions Can Be Applied At Many Different Locations in the Village

Early Action - Quail Hollow/North Pointe Estates – Wetland/Detention Flat Run Watershed



- Start the Design of the Stormwater Detention/Wetland
- Coordinate SR66 Culvert Sizing with ODOT
- Seek Funding
- Why?
  - Helps With Identified Issue
  - Not a Complete Solution

Early Action - Cambridge Estates/Woodland Oaks Diversion

- Start the Design of the Stormwater Diversion
- Seek Funding

- Why?
  - Addresses Identified Issue
  - Provides Start to Brush Creek Corridor Concept

Early Action - Brush Creek Conservation Corridor

- Engage The Nature Conservancy (TNC) in Further Development of the Conservation Corridor and Funding for Land Acquisition
- Why?
  - Secures Land for Conservation
  - Concept Should Lead to Interest in Development within Village
  - Concept Provides for Detention of Water in Brush Creek Watershed
  - Concept Will Provide Opportunity for Water Quality Improvements

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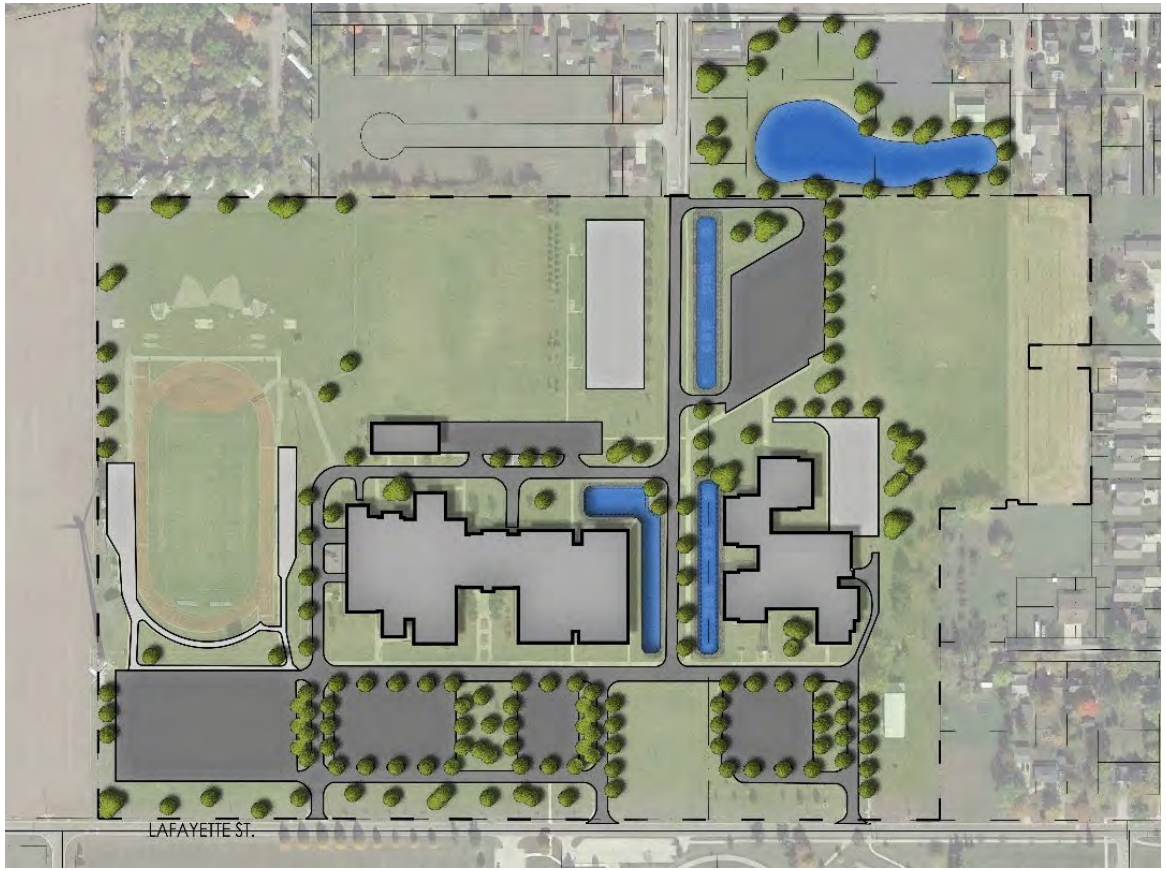
Early Action - LID Project Archbold Schools



- Explore funding to develop Low Impact Development (LID) projects on Village School Lands
- Why?
  - Shows Village Buy In – Lead By Example
  - Educational Opportunities
  - Reduction in Flows to Brush Creek and Flat Run Are Helpful

Early Action - LID Project Woodland Park

- Explore funding to develop Low Impact Development (LID) projects on Village Park Lands
- Woodland Park Shown as Example – Can be Applied to Other Village Parks
- Why?
  - Shows Village Buy In – Lead By Example
  - Educational Opportunities
  - Opportunities to Reduce Mowing and Other Maintenance Efforts

Study Recommendations Summary – Early Action 2023

- Update Stormwater Rules & Regulations
- Refine Village's Asset Management and Maintenance Program
- Start the Design of the Cambridge Estates/Woodland Oaks Stormwater Diversion, Seek Funding (Capital Project)
- Start the Design of the Stormwater Detention/Wetland for Quail Hollow/North Pointe Estates/Flat Run, Seek Funding (Capital Project)
- Start Ditch Petition Process with Fulton County for Brush Creek and Flat Run

Study Recommendations Summary – Early Action 2023

- Engage The Nature Conservancy (TNC) to Assist with Further Development of the Brush Creek Conservation Corridor Concept and Funding for Land Acquisition

- Explore Funding to Develop Low Impact Development (LID) Projects on Village Owned Park and School Lands

Study Recommendations – Long Term 2024/25 and Ongoing

- Implement Funding Mechanism for Village Stormwater Program
- Continue to Develop & Promote Brush Creek Conservation Corridor
- Update the Village's Stormwater System GIS
- Develop Stormwater Infrastructure Capital Improvement Plan

Study Recommendations – Long Term 2024/25 and Ongoing

- Continue Flat Run and Brush Creek Ditch Improvement Efforts
- Utilize LID Concepts in Village-Development Work
- Monitor ODOT and County Culvert Replacement Projects

Funding Opportunities

- Variety of State and Federal Funding Sources are Available for Stormwater Management
  - Maumee Valley Planning Organization or The Nature Conservancy can Assist in Navigating Funding Sources
  - Many of the Funding Sources Favor Conservation Activities

- The Village Will Need to Decide how to Fund Village Hard Infrastructure Stormwater Maintenance, Operations, and Improvements

Educational Opportunities

- Consider Holding Education Sessions or Developing Educational Materials for Contractors & Developers
- Add Informational Kiosks at Village Park and Schools to Promote Stormwater Management and Low Impact Development
- Promote Brush Creek Conservation Corridor as a Method to Increase Property Values and Enhance Life Within the Village of Archbold
- Village Presentations to Civic Groups

Project Schedule

• Kickoff Meeting	March 2022
• Data Gathering & Analysis	March – August 2022
• Rule and Regulations Review	May – June 2022
• Stakeholder Meeting 1	June 2022
• Identify Options for Stormwater Management Facilities	June – August 2022
• Funding Option Assessment	July – September 2022
• Report Development	August – October 2022
• Stakeholder Meeting 2	September – October 2022
• Finalize Report	February 2023
• Stakeholder Meeting 3	March 2023
• Submit Final Report	March 2023

Closing Remarks

- Village Comments
- Final Report to be posted on Village Website

Open Discussion

Thank You!!

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Village of Archbold
Storm Water Infrastructure Evaluation
Stakeholder Meeting #3 Sign-In Sheet

NAME	REPRESENTING	PHONE	EMAIL
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Ashlee Decker	TNC	419-455-4192	ashlee.decker@tnc.org
Dave Gerdinge		419-446-2118	

Village of Archbold
Storm Water Infrastructure Evaluation
Stakeholder Meeting #3 Sign-In Sheet

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Village of Archbold
Storm Water Infrastructure Evaluation
Stakeholder Meeting #3 Sign-In Sheet

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Jake Wyse	Archbold Street	419-446-2241	" "
Ben Disbro	Archbold Eng. Department	419-446-2109	bdisbro@archbold.com
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Chris Cullis	Sauder Village	419-630-8876	Chris.Cullis@SauderVillage.org

Village of Archbold
Storm Water Infrastructure Evaluation
Stakeholder Meeting #3 Sign-In Sheet

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