Maumee RAP

PARTNERING FOR CLEAN STREAMS

Swan Creek Watershed Plan of Action

April 2001

TMACOG

TOLEDO METROPOLITAN AREA COUNCIL OF GOVERNMENTS

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Introduction

The Swan Creek Plan of Action is a watershed plan to guide future restoration and preservation efforts on the Swan Creek and its tributaries. The document takes a comprehensive look at the watershed, breaking it into prioritized categories which describe the water quality impairments and make recommendations to address those issues.

The Maumee RAPs Swan Creek Action Group received a Lake Erie Protection Fund grant in 1997 to develop this plan in addition to establishing a bacterial monitoring program, conducting a floodplain study and holding educational events for watershed residents. The goal of the action group is to fully restore the beneficial uses of the Swan Creek, creating a safe environment for area habitat as well as for fishing, swimming and other forms of recreation. If the recommendations set forth in this document are implemented, the Swan Creek Action Group should achieve this goal.

Description of Watershed

The land area, or the watershed, that Swan Creek drains is 205 square miles. Its headwaters rise in Henry, Fulton and western Lucas Counties. Over 200 miles of creeks and ditches drain the watershed. Swan Creek itself is only about 40 miles long. The major streams that feed Swan Creek are Ai Creek, Blue Creek and Blystone Ditch.

The majority of the Swan Creek watershed is located within the Maumee Area of Concern. The Maumee RAP is a cooperative effort of citizens, businesses, and industry working together with governments to restore the areas waters to "fishable and swimmable" conditions. The Maumee RAP began in October of 1987 and is a public-private partnership coordinated between the Ohio EPA and the Toledo Metropolitan Area Council of Governments. The organization is focused on the implementation of projects to improve the water quality of the region.

The Swan Creek watershed can be divided into three major reaches, or parts, based on the dominant stream characteristics within each reach. In the upstream reach from river mile 19 in Monclova Township to the headwaters, or source, the channel is stable. The banks are low (15 to 25 feet) with indistinct valleys and floodplains. This reach is primarily in agricultural use.

The middle reach is the area that lies between river miles 19 and 6. Here the creek is actively eroding its channel. The banks are high (35 to 45 feet or more) and unstable and are intermixed with detached floodplains. Bedrock in the channel at river mile 19 prevents the extension of this erosion upstream. The major problems are urbanization with the filling in of the floodplains and destruction of wetland areas. The water quality is *fair* but does not meet the goals of the Clean Water Act. The cause of quality impairment is ill-functioning septic tank systems, storm runoff, agricultural runoff, and the erosive forces of the stream itself.

The land use in the middle reach is primarily residential and is one of the fastest developing areas in Northwest Ohio. Land areas included are Monclova and Springfield Townships in Lucas County and the western edge of the City of Toledo. Tributaries to Swan Creek which have extensive floodplain lands are Wolf Creek, Blystone Ditch, Stone Ditch, Cairl Creek, Drennan Ditch and Heilman Ditch. These floodplains, or bottom lands as they are sometimes called, have been mapped. The elevation of the 100-year base flood has been detailed in the 1983 Flood Insurance Rate Maps developed under the Federal Emergency Management Agency. Such maps also describe the base flood elevations and the flood hazard factors.

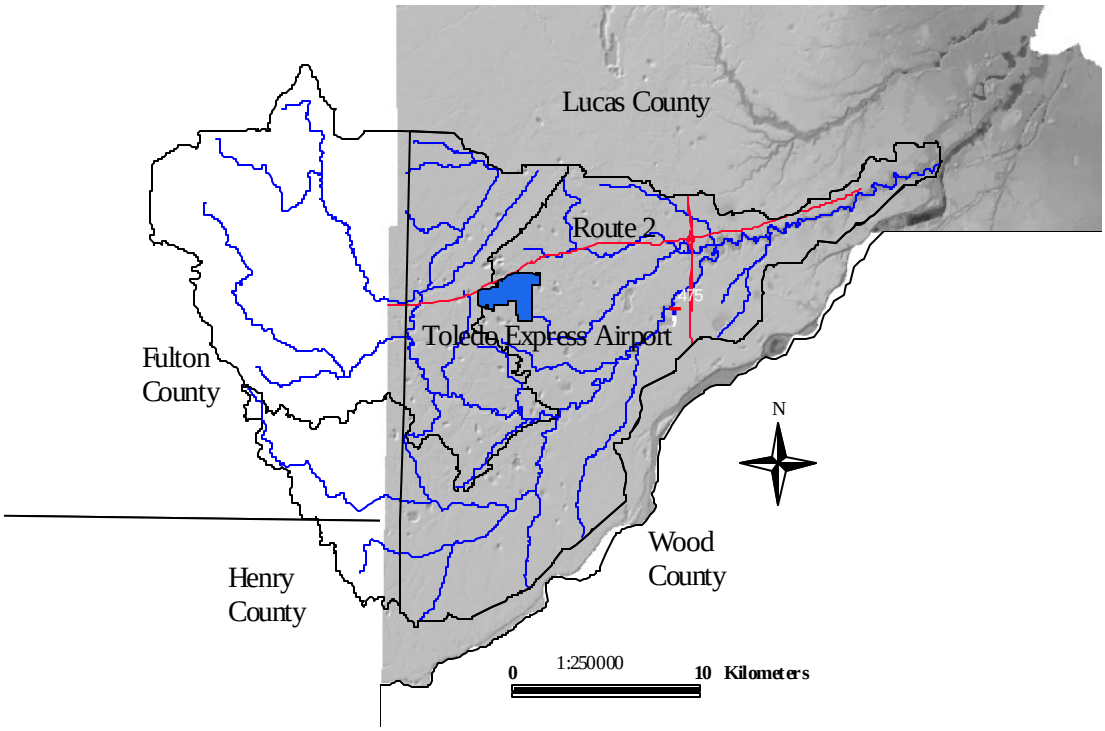


Figure 1. Swan Creek watershed as it drains from Fulton and Henry Counties into Lucas County and the Maumee River. I-475, Route 2 and Toledo Express Airport noted as location information.

Swan Creek Watershed

The lower reach, from river mile 6 (CSX Railroad Bridge) to the mouth in downtown Toledo, is actively silting in its channel. The banks are as high as 35 to 45 feet and are intermixed with floodplain areas. This lower reach is under the seiche effect from the Maumee River and Lake Erie. The level of Lake Erie prevents the lower reach from naturally deepening itself. The major problem is extremely poor water quality, due to storm runoff, hydromodification and urban development.

The lower reach is highly urbanized with little vacant land left to build upon. The land use is residential, commercial and industrial. Within this reach are two major open space areas. The first is Highland Park between South Avenue and the creek, with the second being Sterling Field. This playing field is within

an ox bow, or bend, in the creek and lies between two major streets, Hawley and Collingwood.

This lower reach is neither swimmable nor fishable according to public health standards. Contributing to the pollution are the combined sewer overflows, industrial discharges to the sanitary sewer system, storm sewers contaminated by careless residents, and urban storm water runoff which carries fertilizers from lawns and street debris. All of this can and does reach the creek, degrading water quality.

From Champion Street (river mile 3.9) to the mouth the water quality is rated as *poor*. The worst areas are from Hawley Street (river mile 2.6) to Collingwood Boulevard (river mile 1.2) with zinc, lead, arsenic, nickel and chromium found in the water and the bottom sediments. Creosote has been found in sediments at Hawley Street.

Fish tissue sampling conducted on carp taken at St. Clair Street in 1986 showed 5.9 parts per million (ppm) of PCBs from the body composite. The U.S. Food and Drug Administration Health Standards for PCBs in fish is 2.0 ppm for the edible portion. Polychlorinated biphenyls (PCBs) are highly stable man-made organic substances and are acutely toxic to organisms. PCBs are banned today as they are carcinogenic.

Problems and Priorities

Overall, the Swan Creek watershed is on the rebound. Many of its water quality impacts have been reduced or eliminated. Within the Maumee Area of Concern, the Swan Creek is the closest stream to having its beneficial uses fully restored. This document is designed to provide guidance for the continued restoration and protection of the watershed. Implementation of the Swan Creek Action Plan will take time and cooperation between the Maumee RAP and its partners, but will dramatically improve its water quality and habitat, and should remove the public health and safety risks associated with fish consumption and bodily contact.

The chapters of the Swan Creek Plan of Action are arranged in a priority order. Topics have been organized in a "Highest Priority", "High Priority" and "Moderate Priority" structure. Those items with the highest priority will have the largest effect in restoring the beneficial uses of the watershed and thus should be addressed first. Each component is important to water quality and the efforts to address them should not be diminished based on their ranking within this document.

Highest Priority

- Wetlands and Floodplains
- Home Sewage Disposal
- Land Use and Zoning
- Agricultural Runoff

High Priority

- Contaminated Stream Sediments
- Package Plants

Moderate Priority

- Atmospheric Deposition
- Combined Sewer Overflows
- Dumps, Landfills and Uncontrolled Waste Sites
- Water Treatment Plant Sludge

Highest Priority Objectives

Wetlands and Floodplains

Description of Problem

Wetlands and floodplains are vital components of the Swan Creek watershed. Floodplains are necessary to help control and prevent flood events resulting from heavy rainfalls. Wetlands provide natural storage of water but also offer the added benefit of filtering out sediment and chemical pollutants. Development within floodplains and the filling in of wetlands have proved detrimental to the Swan Creek watershed. Flood events have been more dramatic due to the lack of natural flood storage and water quality has worsened with fewer wetlands to remove contaminants.

The report *Flooding and Erosion Related to Urbanization: Swan Creek Watershed* (1973) stated that an additional 1000 acres of floodplains were needed below river mile 19 on the Swan Creek to control flooding. Undoubtedly, the number of acres needed has risen since then due to the overall loss of floodplains and the increase in impervious surface area to produce runoff.

Conflicting ideas of appropriate land use and high land costs have caused destruction of many wetland areas in the Swan Creek watershed. Yet, according to the *Ohio Coastal Resource Management Plan* (1989), each acre of wetland yearly performs $3,850 in services, such as a reduction in nearshore sediment, nutrient, and contaminant loadings, as well as protection against shore erosion for the public, at essentially no current cost.

Moist habitats were once viewed as worthless and considered wastelands. Their conversion to other uses were historically encouraged. However, the trend in recent decades has altered this perception. In spite of this increased awareness, there still is pressure to convert wetlands to cropland, commercial development sites, and other uses.

The Clean Water Act, Section 404, defines wetlands as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include swamp forests, wet prairies and marshes and are generally found within the boundary of the 100-year floodplain.

RAP Recommendations

The Maumee RAP recommends the following:

- *Preserve wetlands as natural habitats with sufficient management to maximize wildlife usage and native plant communities*.
  The RAP recommends that wetlands currently owned and managed by governmental entities and the private sector should be preserved as natural habitats but should receive sufficient management action to maximize wildlife usage and native plant communities.

- *Jurisdictions should adopt wetland legislation following federal guidelines and definitions outlined in Section 404 of the Clean Water Act.*

Counties, cities, villages and townships should adopt their own legislation following the federal definitions and guidelines as outlined in Section 404 of the Clean Water Act. Model ordinances from across the United States should be reviewed to determine the applicability and effectiveness of those approaches for use within the Swan Creek watershed.

- *A policy of "no net loss" should be strictly followed when development takes place in a wetland.*
  The loss of wetlands to real estate development (residential, commercial or otherwise) should be discouraged by governmental agencies involved in the permit review process. Should development activities adversely affect wetlands, the Ohio EPA policy of "no net loss" should be followed. Mitigation projects should be required which actually replace lost acreage with high quality, man-made wetland areas in equal or greater amounts than were eliminated during the development activity.

- *Comprehensive floodplain/wetland maps and plans should be developed, prohibiting development within identified areas.*
  Building on the *National Wetlands Inventory Maps*, the United States Fish and Wildlife Service (USFWS) and local governments should prepare a comprehensive plan and maps which identify wetlands and floodplains, followed by adoption of prohibition on development within identified areas. The planning process must include a review of existing floodplain and zoning legislation, with maps being made available to the general public to monitor the disposition of these areas. Comprehensive plans should be reviewed every five years, but the initial process should be open to a wide array of interested parties.

- *A Coastal Wetlands Preservation Program should be established at the state level.*
  A Coastal Wetlands Preservation Program should be established at the state level and should be supported with a special revenue Wetlands Preservation Fund in the State budget. Identified coastal wetlands should be valued as prime agricultural land for tax purposes. Responsibility for such program should be within ODNR in order to carry forward new improvements to create, restore or preserve coastal wetlands.

- *Additional floodplain/wetland education programs should be established.*
- Educational programs need to be initiated by the Maumee RAP and by all governmental entities on the need and importance of these wetland and floodplain protection programs.

Home Sewage Disposal

Description of Problem

The Swan Creek watershed has many home sewage disposal systems located in the rural portions of Fulton and Lucas Counties outside of the Toledo City limits. These on-site systems can be an effective method of wastewater treatment when operated correctly with the continuous care of the property owner. Improperly maintained, failing or inadequate systems will negatively effect ground and surface water quality.

On-site disposal systems were designed to operate in mainly rural areas where centralized sewers are not available. Most on-site sewage disposal units installed today consist of a septic tank followed by a soil absorption system. Formerly, some home sewage systems that were installed were a subsurface sand filter or aeration system which has an off-lot discharge. These types of systems are not as popular since they have a discharge that can cause water pollution.

An on-site sewage system consists of two stages. The first stage is the septic tank and its primary purpose is to protect the soil absorption system from becoming clogged by solids in the wastewater. Wastewater is discharged directly into the septic tank where the solids and other material such as greases and oils are retained. The tank must be pumped regularly, approximately every two to three years, to remove the accumulated solids. If this is not done, the solids will accumulate to fill the tank and will wash out into the second stage (soil absorption or leach field).

The leach field is attached to the septic tank and consists of a series of distribution pipes arranged in a grid pattern. The leach field will provide a natural treatment of the wastewater and dispose of this treated water through groundwater recharge. The septic tank effluent flows to the drainfield, and percolates through the soil. The soil acts as a biological filter to remove most harmful substances including pollutants and pathogens without causing odor or creating public health issues.

The cause of failure of an on-site system can include improper maintenance by the homeowner or improper installation of a system or the installation of a home septic system in an area with a seasonal high water table or soil types that are not conducive to soil absorption. Areas subject to a high water table, especially during the winter and early spring, do not allow the effluent to percolate to lower subsoils. Poor soil types include areas with shallow bedrock, sandy soils, or clay soils. Shallow bedrock does not allow for proper seepage, some sandy soils are highly permeable and will allow percolation of effluent to occur too quickly while tight clay soils will not allow the water to drain away and is easily overloaded.

Failing home sewage systems pose a problem to the watershed by introducing potentially harmful bacterial into the ecosystem. E.coli and fecal coliform bacteria are common in the waste of warm-blooded animals, including humans, and can cause serious illness to individuals coming into contact with polluted waters. Illnesses commonly related bacterial contact are flu-like symptoms, but in severe cases, can result in the death of young children and the elderly. Historically, bacterial testing has been regularly conducted within the Toledo City Limits but nothing has been regularly available in the

suburban and rural portions of Swan Creek.

Recognizing that no bacterial data was available outside of the City of Toledo, the Maumee RAP Swan Creek Action Group established the StreamKeeper bacterial testing program in 1998 focusing on suburban and rural portions of Swan Creek and its tributaries. The results of monthly testing for two years showed bacterial levels consistently exceeding the Ohio EPA standards for primary and secondary contact at most sites. Appendix A lists the data results of the study.

Since the conclusion of sampling, the Fulton County and Toledo-Lucas County Health Departments have been working with the Maumee RAP to identify these sources. Dye testing of home septic systems within the watershed is ongoing.

RAP Recommendations

The Maumee RAP recommends the following:

- *Local health departments should establish a renewable operation permit and routine inspection program.*
- That local health departments establish a renewable operation permit and routine inspection program for septic systems. Such programs should require a single-page inspection and inventory sheet to be filed by septage haulers with computerization by the local health department for ease of record keeping. This change would systematically begin to set time limits for operation permits which are now non-expiring and transferable.

- *A pump-out/inspection inventory should be established.*
- A pump-out/inspection inventory would allow building a data base for those systems that precede modern records as records for on-site systems installed before 1959 are incomplete. The complaint forms should be redesigned to take advantage of the inventory opportunity that complaint inspections provide. Cross-reference with pump-out records would allow "sample" monitoring of the accuracy of septage hauler's inventory reports.

- *All records should be reassessed to determine if additional data could be provided.*
- All forms, drawings, and other records should be reassessed to determine if additional data, useful in long-term management efforts, could be provided.

- *A schedule of all fees should be reevaluated annually.*
- A schedule of all fees should be reevaluated annually to ensure that they accurately reflect the resources each activity involves and to account for inflationary factors. Income from on-site systems currently is limited to registration fees for installers, septage haulers and permit application charges. The permit application fee needs particular attention. The lack of resources limits the capacity of local health departments to routinely gather data needed for detailed assessment of current activities such as public education, operation and maintenance, and septage disposal.

- *Additional bacterial testing programs should be conducted to detect contamination*

sources.

- Additional StreamKeeper-like watershed testing should be conducted to further narrow down the sources of bacterial contamination. Additional monthly testing is needed to further solidify the existing data sets. Sample collection, testing and analysis can be funded through local and federal grant sources.

- *Health departments should be encouraged to continue dye testing septic systems in the watershed.*
- The Fulton and Lucas County Health Departments should be encouraged to continue dye testing home septic systems throughout the watershed. Funding for such efforts should be sought through budgetary increases, permits, grants, or other forms of local or federal assistance. Staffing should also be increased to conduct the additional testing. Interns from local universities can assist in this effort, however, they would be unable to follow up with any enforcement related issues due to health department regulations.

- *Annual inspection of all on-site household wastewater systems should be initiated.*
- An annual inspection of all on-site household wastewater disposal systems including on-lot and off-lot systems should be initiated. While local Boards of Health could establish such renewal and inspection fees, the collection of such fees could become a burden to local health departments. Therefore, state enabling legislation could establish that it be collected on the tax duplicate as an assessment through the required establishment of operation and maintenance districts.

- *Develop and distribute a homeowner education program.*
- Develop and distribute a homeowner education program, since most homeowners have little to no knowledge of how their system operates. It would include information on having
- septic tanks regularly pumped by an approved operator, not overloading the system, and minimizing the amount of solids that are disposed of in a septic tank system.

Land Use and Zoning

Description of Problem

Land use in the Swan Creek watershed has changed rapidly over the past few decades. In 1970, the watershed was primarily rural/agricultural outside of the City of Toledo but rapid growth in the 1980's and 1990's has consumed farmland and transformed the landscape. Swan Creek can still be considered a rural watershed in the general sense but suburban features, such as strip malls, residential subdivisions and fire hydrants are becoming increasingly more visible.

Commercial development along State Route 2 (Airport Highway), residential development in Monclova, Springfield, and Spencer Townships, and the extension of water service to Delta in Fulton County have begun suburbanizing large portions of the Swan Creek watershed. This development has resulted in channelization of waterways, loss of natural floodways, habitat alteration, loss of open space and the facilitation of further development. Based upon the profitability of such development, this growth is expected to continue.

Between 1988 and 1995, nearly 20% of farmland (over 16,000 acres) has been lost, corresponding with a similar increase in residential and commercial land uses during the same period (Swan Creek Hydrologic Study, 2000). While the shifts in land use are economically beneficial to the region, the increase in impervious surface area (roads, parking lots, buildings, etc.) produces addition storm water draining into Swan Creek and its tributaries. This increase, along with the modification and destruction of floodplains due to development, are result in more dramatic flood events during heavy storms. The *Combined Sewer Overflow* chapter discusses the Swan Creek North and South Tunnel Systems installed by the City of Toledo. These were designed to contain excess storm water and reduce the potential of combined sewer overflow events as a result of the amplified flood volumes. Additional storm water measures may be necessary in the future if impervious surface area continues to increase.

In 2000, the Maumee RAP's Swan Creek Action Group and Bowling Green State University conducted the Swan Creek Hydrologic Study to model the effects of land use changes on the watershed. This dynamic study analyzes the flooding impacts resulting from increases in total impervious surface area and changing land usage on individual parcels. It is hoped that jurisdictions will use this information to determine the implications of development on the hydrologic system before approving final plans. See Appendix B for an example and abstract of the study.

Currently, there are few zoning regulations in place to reduce the impacts of increased impervious surface area or to prohibit to modification of floodplains. For instance, regulations within the City of Toledo will grant a variance in non-floodway flood hazard areas if the water surface of the base flood is increased no more than one-half foot in any reach or for the cumulative effect of several reaches (Toledo Municipal Code 1169.10 (b), 1987 replacement). Alterations to floodways often result in increased downstream flood velocities and, subsequently, greater flood levels in areas with narrower channels or obstructions.

RAP Recommendations

The Maumee RAP recommends the following:

- *Developers and/or jurisdictions should conduct a runoff analysis using the models contained in the Swan Creek Hydrological Study.*
  The Maumee RAP recommends that developers and/or jurisdictions conduct a runoff analysis of development sites prior to plan approval using models contained in the Swan Creek Hydrologic Study. These models assess the impact of land use changes on the watershed due to additional impervious surface area. Development plans producing excessive surface runoff should be redesigned using alternative storm water management strategies to reduce impacts.

- *Overlay zoning districts protecting floodways should be created adjacent to waterways.*
  Overlay zoning districts protecting floodways should be implemented adjacent to Swan Creek waterways. These districts can be enacted without changing the base zoning. Overlay districts should buffer waterways by specifying development criteria to minimize the impact of newly created impervious surface area, restrict or prohibit the modification of floodways and development within them, and help preserve open space and habitat throughout the watershed. These districts should be developed across jurisdictional boundaries for comprehensive watershed protection.

- *Developers should be encouraged to use alternative storm water management techniques.*
  Developers should be encouraged to use alternative storm water management techniques such as permeable surfaces and additional open space to relieve the burden of runoff on the watershed. These best available techniques should be incorporated into development plans throughout the watershed.

- *Jurisdictions within the watershed should agree upon and a consistent set of zoning and land use standards protecting water quality.*
  Jurisdictions within the watershed should agree upon a consistent set of zoning and land use standards which consider environmental impacts as well as engineering and safety guidelines. These standards should encourage open space preservation in areas that will have a large impact on water quality.

- *The Maumee River Regional Storm Water Coalition's (MRRSWC) Regional Storm Water Standards should be adopted and followed by jurisdictions within the watershed.*
  The Maumee River Storm Water Coalition developed a set of regional storm water standards to set policy and implement a consistent set of design standards. All jurisdictions within the Swan Creek Watershed should adopt and follow these design standards.

Agricultural Runoff

Description of Problem

Agricultural runoff has always been a concern and a persistent issue within the Swan Creek watershed and the Maumee Area of Concern. Agricultural runoff is caused by precipitation which erodes soils and carries nutrients, pesticides, and herbicides away from their point of origin and to the nearest stream, ditch or watershed. During large storms, the runoff to surface water and infiltration to ground water increases as does the rate of pollutant movement (or transport).

Agricultural runoff has historically been a large source of pollutants in the Maumee River watershed and the Swan Creek is no exception. Mitsch (1990) reported that approximately 31% of the watershed (40,087 acres) is agricultural land which is susceptible to erosion by wind and water, carrying sediment and nutrient loading into the Swan Creek. As a major tributary to the Maumee River, these materials are deposited into the River, Maumee Bay and Lake Erie impacting water quality and the overall health of the Lake.

A significant source of nonpoint source pollution comes from the application of excessive agricultural chemicals to farm fields. Fertilizers and herbicides, such as nitrogen, are applied to fields to enhance crop health. However, only limited concentrations of these chemicals are needed to be effective. Excess chemicals/compounds will remain in the soil where, they may degrade or adhere to soil particles. If attached to the soil, they will move with it to nearby waterway.

Nitrate is a fertilizer compound often found in surface waters adjacent to croplands and pastures. It is derived from manufactured fertilizers, natural decomposition, and legume crops. Nitrate is easily transported to water sources when it is added to the soil at rates exceeding what the natural environment removes. It is considered toxic at levels above 10mg/L. Accumulation of nitrate and other compounds in lakes, for example, may accelerate eutrophication resulting in a reduction in the dissolved oxygen killing many animal species.

RAP Recommendations

The Maumee RAP recommends the following:

- *Jurisdictions should strongly encourage the use of conservation and no-till farming.*
  Jurisdictions within the Swan Creek watershed continue to strongly encourage the use of conservation and no-till farming practices. Landowners should leave at least 30% crop residue on the field to effectively hold soil on the land and reduce erosion.

- *Landowners should buffer their stream banks by enrolling in CRP, CREP or other conservation programs.*
  Landowners should compliment conservation and no-till practices by enrolling in grassed filter strip programs such as the Conservation Reserve Program (CRP), the Conservation Reserve Enhancement Program (CREP) or other local programs to install buffers along streambanks. These grass buffers will trap sediment and other pollutants before they reach area waterways. The buffers

should be at least 20' wide with additional footage encouraged to increase the effectiveness of the buffer. Forested buffer strips should be installed to provide filtration, deposition, plant uptake, anaerobic denitrification and other natural processes to further remove sediment and nutrients from runoff and subsurface flows.

The Maumee RAP supports and encourages the programs established by the Agricultural Runoff Action Group, the Portage River Basin Council, the Lake Erie Buffer Team and the Ohio Department of Natural Resources to decrease sediment and chemical loadings throughout the Maumee Area of Concern and Northwest Ohio to protect and preserve waterways.

- *Stream banks should be stabilized (vegetative means preferred) to protect against scour and erosion with naturally stable channels protected and/or restored to secure the greatest range of beneficial stream functions.*
  Banks of streams should be stabilized and protected against scour and erosion by vegetative or structural means to reduce sediment loads and pollution. Vegetative (bioengineering) means are preferred and should be encouraged over structural (riprap) methods to protect stream banks. In order to ensure the long-term stability of such activities, analysis of channel form and shape should be undertaken and incorporated into specific project design.

- *Measures should be taken to further reduce phosphorus and nitrate levels.*
  Phosphorus levels, though lower, are still a concern throughout the Great Lakes. Any land having a Bray P-1 Phosphorus level in excess of 60 pounds per acre for row crop and small grain rotation and 90 pounds per acre for specialty crop and forages in rotation, should have no additional phosphorus fertilizer applied until soil test levels are reduced below this level by crop removal. An exception is for starter row fertilizer. Bray P-1 is the most accepted measure for agricultural phosphorus use recommendations.

  To control nitrate levels, the Maumee RAP encourages the application of nitrogen as close as possible to the time the crop will utilize the nitrogen, using split applications, as necessary. Fall application of nitrogen is discouraged. Grass or legume cover crops should be planted in the fall to tie up excess nitrogen and other nutrients. This provides a recycling of nutrients until the next crop season.

- *Livestock should be excluded from streams and stream banks.*
  Livestock should be excluded from streams and stream banks to prevent soil compaction and loss of vegetation. In addition, livestock exclusion from streams will prevent manure deposition, and thus bacterial contamination, to the stream.

High Priority Objectives

Contaminated Stream Sediments

Description of Problem

Historically, the sediments in lower Swan Creek have been contaminated by the unregulated disposal of chemicals from industrial facilities and other pollutants from sources such as combined sewer overflows. According to the *Biologial and Water Quality of the Lower Maumee River Mainstem and Major Tributaries* (Ohio EPA, 1989), the upstream area of Swan Creek was impaired from the impact of CSO discharges. The overall biological performance was fair and typical of impacts associated with siltation and nutrient enrichment from agricultural runoff. However, the pollution impacts increased in severity downstream. Sediment, water quality, and biological community results all reflected a complex impact caused by oxygen demanding wastes from CSOs and other pollutants (i.e. creosote) from intermittent industrial releases.

Then in 1993 Ohio EPA conducted fish and macroinvertebrate sampling which considered the upstream area of Swan Creek in Lucas County to be in full or partial attainment of its warmwater habitat use designation. However, the downstream areas were still in non-attainment.

The *Maumee RAP Recommendations Report* (1991) noted the need for sediment and water quality sampling throughout the Maumee Area of Concern. During the mid- to late1990s Ohio EPA conducting several sediment sampling events in the Swan Creek watershed to achieve this goal. Based on the sediment core and grab samples taken in 1995-96 and 1997, it was determined that the sediments in the lower Swan Creek contained high levels of lead, nickel, zinc, polychlorinated biphenols (PCBs), and polynuclear aromatic hydrocarbons (PAHs).

Sampling seems to indicate an improvement in sediment and water conditions in some stream segments, which can be attributed to the elimination or reduction of various pollution sources or remediation activities found in other sections of this report (i.e. Combined Sewer Overflows, Dumps, Landfills and Uncontrolled Waste Sites).

RAP Recommendations

The Maumee RAP recommends the following:

- *Sampling should be conducted throughout the watershed to determine the present sediment conditions, based on source reduction and /or elimination.*
  Sediment, water quality and biological community sampling should be conducted throughout the watershed to determine the present sediment conditions, based on source reduction and/or elimination. Available data should be reviewed to determine the most appropriate sampling plan needed to confirm suspected improvements.

- *The City of Toledo should maintain its schedule to abate all combined sewer overflows.*
  It is also recommended that the City of Toledo maintain its schedule for abatement of all combined sewer overflows on the Swan Creek to eliminate another potential source of contamination. Complete separation of storm and sanitary sewers would improve overall water quality and give the waterways the natural ability to reduce sediment contamination.

Package Plants

Description of Problem

A package plant is a small, semi-portable prefabricated wastewater treatment system that services an apartment complex, trailer park, camp, or self-contained business that is not connected to a city sewer system and is not on a site appropriate for a septic system (Water Environment Federation, 2001).

Package plants function through a process known as extended aeration. Extended aeration is a biological treatment process that grows a culture of aerobic micro-organisms (activated sludge) to digest the organic matter in sewage. An extended aeration plant has an aeration chamber where activated sludge and raw sewage are mixed with air to promote digestion. The plant has a settling chamber as well. Clear, treated water flows over a weir and out of the plant; activated sludge settles to the bottom and is pumped back to the aeration tank (TMACOG, 2001).

Extended aeration plants, as they have been designed over the last forty years, come in numerous variations depending on design requirements at the time. Common features include:

- Trash trap - a septic tank upstream of the plant to remove settleable and floatable solids
- Chlorination - disinfects treated wastewater; usually a plastic tube that feeds slow-dissolving chlorine tablets as needed.
- Dechlorination - Removes residual chlorine from effluent after disinfection is done. Mechanically, a dechlorinator is similar to a chlorinator. These devices came into common use in the late 1990s.
- Filter - a sand bed that filters remaining solids out of treated effluent
- Some larger extended aeration plants have an aerobic sludge digestion/sludge holding tank

Package plants, if improperly maintained, will frequently discharge untreated, or incompletely-treated sewage. The common problems are:

1. Lack of operator attention of both operation and maintenance.
2. Lack of operator expertise.
3. Lack of enforcement by Ohio EPA and /or local Health Department.
4. The package plant is too large or too small to treat the wastewater effectively.

It is the responsibility of Ohio EPA to issue permits for package plants. Users intending to install a package plant must submit an anti-degradation application and demonstrate that there are no other available means of sewage treatment for that particular site. Plants receiving permits are intended to be temporary treatment facilities and will be taken out of operation when public sewers become available.

Results of water samples taken during the Maumee RAP's Swan Creek StreamKeeper Study show high bacteria counts within most of the Swan Creek watershed. Improperly maintained or failed home septic systems are believed to be the primary source of bacterial contamination. However, improperly maintained package plants operating within the watershed are another suspected pollutant source.

RAP Recommendations

The Maumee RAP recommends the following:

- *Extend sanitary sewer service to areas of high package plant concentration.* Continued efforts to extend sanitary sewer service to areas of high package plant concentrations.

- *Training and/or certification of personnel to run plants should be mandatory.* It is recommend that training of personnel to run these plants be *mandatory*. Ohio EPA regulations require all discharges have an NPDES permit. In the past, Ohio EPA targeted discharges over 25,000 gpd for NPDES permits. Currently, Ohio EPA is putting all package plants under permit but has not yet reached every plant. Package plants with known problems have been approached first to bring the plant into compliance. When a package plant is under an NPDES permit, the plant must be under the supervision of a Class I Operator, collect and analyze effluent samples, and fill out Monthly Operating Reports (OEPA, 2001).

- *Package plants should require more monitoring and be more frequently inspected.* NPDES permits require monitoring according to the size of the plant. More monitoring is required with larger plants. Facility information is updated each time a permit is renewed. Changes in ownership require a formal notification to Ohio EPA. Also, the package plant is upgraded, along with the permit, whenever a major change occurs at the facility that the package plant services.

  More frequent plant inspection by Ohio EPA and/or Health Departments is needed. Package plants under present the inspection system can cause local nuisance, health, and water quality problems. Making sure that existing plants are well operated is difficult, but necessary.

- *Additional bacterial testing programs should be conducted to detect contamination sources.* Additional bacterial testing should be conducted by the Maumee RAP and/or its partners to pin-point sources of contamination. Further study would expedite the removal of bacterial sources and minimize the public health risk of primary and secondary contact of Swan Creek waters.

Moderate Priority Objectives

Atmospheric Deposition

Description of Problem

Atmospheric deposition is caused when pollutants released into the air are carried by wind patterns away from their place of origin and are deposited. These pollutants come from man-made sources such as the burning of fossil fuels, industrial processes, cars and other forms of transportation, fertilizer, and the volatilization of animal wastes. Air deposition can also come from natural sources of emissions. For example, up to 25 percent of the mercury emitted worldwide is released naturally as part of the global mercury cycle. Depending on weather conditions, and the chemical and physical properties of the pollutants, pollution can be carried significant distances from its source and can undergo physical and chemical changes as it travels. Some of these chemical changes include the formation of new pollutants such as ozone, which is formed from nitrogen oxides (NOx) and hydrocarbons.

Atmospheric deposition occurs when pollutants in the air fall on the land or water. Pollution deposited in snow, fog, or rain is called *wet deposition*, while the deposition of pollutants as dry particles or gases is called *dry deposition*. Air pollution can be deposited into water bodies either directly from the air onto the surface of the water, or through *indirect deposition*, where the pollutants settle on the land and are then carried into a water body by runoff or through natural processes such as the movement of groundwater through the soil.

Any chemical that is emitted into the air can become an air deposition problem. Some of the common ones include different forms of nitrogen (in high concentrations), mercury, copper, polychlorinated biphenols (PCBs), polynuclear aromatic hydrocarbons (PAHs), lead, polycyclic organic matter (POM), dioxins, furans, toxaphene, hexachlorobenzene, hexachlorocyclohexane, and diazanon. Even chemicals that are no longer in use in the U.S. (such as PCBs) can be deposited because they are emitted from incinerators that burn contaminated garbage from contaminated sites, or blown in from other countries.

Pollutants that persist in the environment for many months or years, and which accumulate in plants, fish, and wildlife are called "persistent bioaccumulative pollutants." Persistent means that the pollutant does not break down or become non-toxic easily (or at all) in the environment. Bioaccumulative means that the pollutant concentrates in the bodies of animals, including humans, that ingest contaminated food on a regular basis. One of the most common persistent bioaccumulative pollutants is mercury. Others include metals such as lead and cadmium; pesticides such as chlordane, DDT, dieldrin, lindane and toxaphene; and industrial pollutants such as PCBs, dioxins, and furans. The tendency of these substances to linger in the environment and to build up in plant and animal tissues poses the greatest risk to human health and the environment. People and other animals generally receive the highest doses of these pollutants when they eat contaminated foods, especially contaminated fish.

RAP Recommendations

The Maumee RAP recommends the following:

- *More research should be conducted to determine the effects of atmospheric deposition on the watershed.*
  More research should be done to determine the extent to which atmospheric deposition is affecting the watershed. Very little data is available to document the impacts of atmospheric deposition and the course of action necessary to minimize its effects.

- *Northwest Ohio should generally reduce emission levels to maintain compliance with air quality standards.*
  It is generally recommended that Northwest Ohio reduce its emissions levels to improve air quality, thereby maintaining compliance with National Ambient Air Quality Standards (NAAQS) and providing a healthy environment for residents with asthma and other breathing disorders. These reductions should come from stationary, mobile and area sources.

Combined Sewer Overflows

Description of Problem

Early sewers in the Swan Creek watershed were built primarily for the drainage of storm or surface water removal. As a part of the Great Black Swamp, these drainage systems were a necessity if any type of development was to take place. An extensive system of storm water sewers was constructed in Toledo as a result.

Over time, the supply of public water to residents added another component to the equation, sanitary waste removal. The method regarded as the most cost effective to the region was to tie the sanitary sewers together with the storm sewers. Since these sewers collected both storm and sanitary flow the term "combined sewer" was adopted. Around 1920 the Ohio Department of Health required cities to collect these separate discharge points and convey them to a central discharge point through interceptor sewers.

During dry weather all discharge is conveyed to a wastewater treatment plant. When a storm occurs these combined sewers will surcharge the interceptor system. Relief points were established to prevent the flows during storm events from overloading the interceptor sewers and the treatment plant. These relief points are mechanical devices called "regulators".

The regulators control the amount of flow from the combined sewers to the interceptor sewers. A float mechanism causes a gate to close if the water level rises in the combined sewer. This action isolates the combined sewer from the main interceptor. The excess flow in the combined sewer then overflows a weir and discharges directly to the stream. Hence the term "combined sewer overflow (CSO)".

This method proved to be satisfactory until environmental concerns began to focus on the conditions of receiving streams. Combined sewer overflows are but one of many contributors that impact water quality. CSOs are a source of biological oxygen demand, oil, grease, fecal coliform and E. coli bacteria, settleable solids, floatable materials and other pollutants which effect the stream aesthetics and their usages (Maumee RAP Recommendations Report, 1991.)

There are two jurisdictions in the Swan Creek watershed that still need to address CSOs: Toledo and Swanton. Toledo's CSO system on Swan Creek historically contained as many as 10 permitted overflows.

The Village of Swanton wastewater treatment plant is a trickling filter plant with tertiary treatment provided by sand filters. The plant has a design capacity of 0.92 mgd and discharges effluent to AI Creek which eventually joins Swan Creek. This effluent is disinfected with chlorine prior to discharge. The plant is in compliance with its NPDES permit throughout most of the year, but does have some problems with meeting ammonia limits. Due to combined sewers within the collection system, infiltration and inflow can cause occasional loading problems at the plant. Thirteen overflows currently exist within the collection system. Their NPDES permit contains a requirement for the Village of Swanton to develop and submit a long term control plan for their combined sewer system. The Village will also be

required to submit a combined sewer system operational plan to minimize impacts of CSO discharges.

RAP Recommendations

The Maumee RAP recommends the following:

- *All combined sewer overflows within the watershed should be abated.* City of Toledo should adhere to the abatement schedule for agreed upon by the City and US EPA. The Village of Swanton should eliminate all CSOs.

Dumps, Landfills And Uncontrolled Waste Sites

Description of Problem

Old landfills, dumps and uncontrolled waste sites have been identified as a significant source of contamination to the waters of the Maumee Area of Concern. The majority of these sites are located in the Ottawa River watershed; many of which have been capped or cleaned up. The continued clean up of these sites throughout the Maumee Area of Concern is an important element in the restoration of water quality, sediment quality and biological communities in some stream segments.

The Ohio EPA Division of Emergency and Remedial Response (DERR) is charged with the discovery, prioritization, and oversight of remediation of uncontrolled, unregulated, or abandoned waste sites. Many of these sites are old landfills, municipal or industrial dumps, or dumping areas which were used by the public without official operation or sanction.

Cleanup of landfills, dumps and uncontrolled waste sites can be addressed in many ways. Involuntary or required actions can legally require a potentially responsible party and/or property owner to clean up a site through enforcement actions or consent orders issue by local, state and/or federal regulatory agencies. Ohio EPA's Remedial Response Program utilizes all applicable state and federal standards to require clean up of contaminated land, air, or water. This activities are usually for long-term clean up efforts and often involves the potentially responsible parties (PRP's), regulatory agencies, and the pubic involvement of private citizens or organizations.

Ohio EPA's Voluntary Action Program (VAP) encourages voluntary clean up by the responsible party and/or the current property owner. All property in Ohio is eligible for this program provided it is not covered by a specific government program and/or currently under other orders to be cleaned up. VAP differs from other programs in that it is voluntary and relies upon private parties to investigate and clean up contaminated properties. The program allows clean up to be tailored to the future use of the property and utilizes institutional controls such as deed restrictions to meet clean up standards. VAP benefits the property owner by limiting their legal responsibility for future clean up. Ohio EPA performs audits of approximately 25 percent of all properties in the program to ensure compliance with all state rules and regulations (Ohio EPA, 2001).

See Appendix C for information on the name, location, use, contaminant, and status of dumps, landfills or uncontrolled waste sites within the Swan Creek watershed

RAP Recommendations

The Maumee RAP recommends the following:

- *The Voluntary Action Program (VAP) is a recommended means of remediation.* The Maumee RAP recommends the Voluntary Action Program (VAP) as a means of remediating sites designated as needing further action or clean up. Cooperation with VAP benefits the property owner by allowing the owner to tailor the clean up to the future uses of the

property. By cleaning up sites voluntarily, costs are reduced compared to the costs associated with enforcement. However, an opportunity for public input and involvement in this process would be beneficial.

- *Identified sites should be fully secured and contained to reduce or eliminate leachate.* It is recommended that the sites identified in the Swan Creek watershed be fully secured and contained to reduce or eliminate leachate from these locations. Contaminated leachate can runoff into streams and into the water table, affecting the overall water quality of the watershed. Enforcement actions should be taken on sites that do not quality for the VAP program.

Wastewater Treatment Plant Sludge

Description of Problem

Sewage sludge is the material removed during the treatment of domestic wastewater. It is primarily composed of human waste, but also contains chemicals that are discharged by commercial and industrial facilities and household hazardous wastes. When treated and processed, sewage sludge becomes biosolids. Biosolids contain various amounts of nitrogen, phosphorus and potassium and can either be applied to land, incinerated, or buried in a landfill.

Land application of sewage sludge generated by domestic sewage treatment is performed in an environmentally safe and cost-effective manner in many communities. Land application involves taking advantage of the fertilizing and soil conditioning properties of sewage sludge by spreading the sewage sludge on the soil surface, incorporating or injecting the sewage sludge into soil, or spraying the sewage sludge. Because sewage sludge disposal practices (e.g., landfilling) are becoming less available and more costly, and because of the increasing desire to beneficially reuse waste residuals whenever possible, land application is increasingly chosen as a sewage sludge use or disposal practice (OEPA, 1995).

The topic of sludge disposal has been debated recently. Advocates of sludge application to farm fields state that, if properly treated, it can safely add needed nutrients to the land and produce greater crop yields. Opponents say that metals and toxins found in sludge can be absorbed by plants and insects, and consequently can be passed to birds, farm animals and ultimately to humans. In December 1999, the US EPA issued a proposed rule revising the standards for the use and disposal of biosolids. The proposed rule would require facilities which prepare biosolids for land application to test the biosolids for dioxins (chemical contaminants), and also to perform periodic monitoring to determine the level of dioxins.

In Ohio, nearly 50 percent of sludge is reused on the land. Local companies, such as N-Viro International, provide this type waste management technology. N-Viro produces class A sludge for nutrient management. Lucas County reuses sludge from the Maumee River Wastewater Treatment Plant and has been applying it to area fields successfully for many years.

RAP Recommendations

The Maumee RAP recommends the following:

- *Class A and B sludge should be reused via land application.*
  Comparing the three alternatives for sludge disposal (incineration, land application and burial), the Maumee RAP recommends that class A and B sludge be reused via land application. All disposal methods can potentially release metals and dioxins into the environment but land application provides the greatest benefit.

- *Research should continue on the long term safety of accumulated sludge applied to land.*
  The Maumee RAP recommends that research be conducted on the long term safety of accumulated sludge applied to land.

Appendices

Appendix A

Appendix A

Swan Creek StreamKeeper Bacteria Results

	Site	**Jun-98**		**Jul-98**		**Aug-98**		**Sep-98**	
	(per 1.0 ml)	*E coli*	Fecal	*E coli*	Fecal	*E coli*	Fecal	*E coli*	Fecal col.
1	**LS 1**	8	440	8	320	12	585	4	215
2	**LS 2**	13	360	8	320	4	625	3	230
3	**LS 3**	9	460	6	230	6	480	2	215
4	**LS 4**	24	760	2	160	8	475	3	195
5	**LS 5**	38	440	3	120	10	280	2	215
6	**LS 6**	23	480	5	180	14	435	2	290
7	**LS 7**	12	520	4	220	4	230	3	210
8	**LS 8**	7	380	6	240	2	200	8	220
9	**LS 9**	8	420	1	200	3	250	7	175
10	**LS 10**	1	720	4	360	12	665	16	40
11	**LS 11**	10	520	2	105	38	825	6	61
12	**FS 1**	21	540	18	720	16	1315	14	375
13	**FS 2**	41	476	32	880	8	1135	11	710
14	**LA 1**	19	460	11	1200	700	2600	132	380
15	**LA 2**	22	480	0	440	13	470	0	30
16	**FA 1**	42	640	19	115	64	795	25	370
17	**FA 2**	52	1120	25	920	10	530	13	225
18	**FA 3**	41	1120	21	860	9	870	10	335
19	**FA 4**	11	700	6	560	6	415	0	260
20	**LW 1**	6	460	10	800	4	505	5	375
21	**LW 2**	9	340	17	480	6	545	7	380
22	**LW 3**	4	300	8	500	6	645	5	210
23	**LW 4**	13	440	20	600	22	660	7	590
24	**LW 5**	10	380	5	360	18	690	13	530
25	**LD 1**	1	148	4	160	3	385	2	140
26	**LD 2**	1	188	1	200	0	420	1	50
27	**LB 1**	28	600	33	800	8	525	12	365
28	**LB 2**	18	560	30	420	14	470	7	445
29	**LB 3**	12	420	5	720	4	505	8	535
30	**LH 1**	-	-	23	580	14	510	12	585
31	**LH2**	-	-	40	640	13	570	11	635
32	**FF 1**	11	560	21	960	26	1110	14	5600
33	**FF 2**	42	840	1	1300	13	565	11	215
	Mean	18	525	22	505	33	645	11	467
	Median	12	476	8	440	10	530	7	260
	High	52	1120	40	1300	700	2600	132	5600
	Low	1	148	0	105	0	200	0	30

	Site	Oct-98		Nov-98		Dec-98		Jan-99	
	(per 1.0	*E coli*	Fecal	*E coli*	Fecal	*E coli*	Fecal	*E coli*	Fecal col.
1	**LS 1**	3	90	0	41	0	14	N/A	N/A
2	**LS 2**	6	120	1	39	1	19	N/A	N/A
3	**LS 3**	2	180	3	45	1	27	N/A	N/A
4	**LS 4**	1	80	2	98	1	18	N/A	N/A
5	**LS 5**	3	140	8	240	0	13	N/A	N/A
6	**LS 6**	5	400	17	380	1	32	N/A	N/A
7	**LS 7**	4	80	12	300	0	44	N/A	N/A
8	**LS 8**	1	120	3	320	2	96	N/A	N/A
9	**LS 9**	7	80	5	240	3	64	N/A	N/A
10	**LS 10**	4	112	4	108	3	46	N/A	N/A
11	**LS 11**	1	110	1	38	0	30	N/A	N/A
12	**FS 1**	5	240	11	260	0	53	N/A	N/A
13	**FS 2**	3	180	8	180	0	37	N/A	N/A
14	**LA 1**	50	340	9	300	8	120	N/A	N/A
15	**LA 2**	0	60	26	640	15	240	N/A	N/A
16	**FA 1**	25	410	5	160	2	56	N/A	N/A
17	**FA 2**	5	210	2	120	1	40	N/A	N/A
18	**FA 3**	4	300	18	180	2	84	N/A	N/A
19	**FA 4**	3	120	1	160	1	28	N/A	N/A
20	**LW 1**	1	160	1	27	3	60	N/A	N/A
21	**LW 2**	4	210	2	31	3	72	N/A	N/A
22	**LW 3**	3	180	5	80	5	100	N/A	N/A
23	**LW 4**	7	400	5	81	2	76	N/A	N/A
24	**LW 5**	4	300	14	180	6	52	N/A	N/A
25	**LD 1**	3	100	2	49	0	32	N/A	N/A
26	**LD 2**	1	80	1	27	0	21	N/A	N/A
27	**LB 1**	8	280	1	45	3	88	N/A	N/A
28	**LB 2**	4	440	2	70	1	120	N/A	N/A
29	**LB 3**	11	120	0	65	2	84	N/A	N/A
30	**LH 1**	-	-	12	840	0	164	N/A	N/A
31	**LH2**	4	660	6	320	0	200	N/A	N/A
32	**FF 1**	36	400	45	300	13	180	N/A	N/A
33	**FF 2**	3	500	9	160	7	72	N/A	N/A
34	**FF3**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
35	**FD1**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Mean	7	225	7	186	3	72	N/A	N/A
	Median	4	180	5	160	1	56	N/A	N/A
	High	50	660	45	840	15	240	N/A	N/A
	Low	0	60	0	27	0	13	N/A	N/A

	Site	Feb-99		Mar-99		Apr-99		May-99	
	(per 1.0	*E coli*	Fecal	*E coli*	Fecal col.	*E coli*	Fecal	*E coli*	Fecal col.
1	**LS 1**	1	60	1	40	4	172	2	24
2	**LS 2**	0	120	0	12	12	108	3	40
3	**LS 3**	1	124	0	42	6	172	3	28
4	**LS 4**	0	45	0	30	9	88	0	36
5	**LS 5**	0	33	1	25	23	136	1	100
6	**LS 6**	1	21	0	19	10	160	1	80
7	**LS 7**	N/A	N/A	0	21	N/A	N/A	2	60
8	**LS 8**	N/A	N/A	0	21	N/A	N/A	2	56
9	**LS 9**	N/A	N/A	0	26	N/A	N/A	0	15
10	**LS 10**	3	56	0	48	6	84	1	76
11	**LS 11**	2	47	0	56	7	140	1	60
12	**FS 1**	0	41	4	163	N/A	N/A	2	40
13	**FS 2**	2	84	1	86	N/A	N/A	12	60
14	**LA 1**	0	124	2	82	12	200	3	160
15	**LA 2**	0	33	0	13	13	180	0	56
16	**FA 1**	0	280	3	42	3	180	6	160
17	**FA 2**	3	64	0	65	3	280	2	120
18	**FA 3**	8	96	N/A	N/A	23	152	3	156
19	**FA 4**	0	15	0	43	2	200	3	140
20	**LW 1**	0	47	2	100	N/A	N/A	3	80
21	**LW 2**	1	72	2	103	N/A	N/A	6	72
22	**LW 3**	0	18	1	200	N/A	N/A	3	66
23	**LW 4**	6	80	0	108	3	42	1	40
24	**LW 5**	2	104	1	67	3	28	N/A	N/A
25	**LD 1**	1	44	0	72	12	96	2	25
26	**LD 2**	0	22	0	33	19	160	0	33
27	**LB 1**	1	37	3	40	7	104	5	104
28	**LB 2**	1	25	0	52	3	84	3	92
29	**LB 3**	0	31	2	73	4	172	4	80
30	**LH 1**	N/A	N/A	1	400	2	44	20	100
31	**LH2**	N/A	N/A	5	360	4	200	5	200
32	**FF 1**	22	288	5	900	N/A	N/A	2	76
33	**FF 2**	3	900	4	820	N/A	N/A	1	32
34	**FF3**	N/A	N/A	N/A	N/A	N/A	N/A	6	60
35	**FD1**	N/A	N/A	N/A	N/A	N/A	N/A	TNTC	TNTC
	Mean	2	104	1	130	8	138	3	77
	Median	1	51.5	0.5	54	6	152	2	69
	High	22	900	5	900	23	280	TNTC	TNTC
	Low	0	15	0	12	2	28	0	15

	Site	Jun-99		Jul-99		Aug-99		Sep-99	
	(per 1.0	*E coli*	Fecal col.	*E coli*	Fecal col.	*E coli*	Fecal col.	*E coli*	Fecal
1	**LS 1**	5	132	11	180	1	100	1	60
2	**LS 2**	4	80	4	196	0	90	0	52
3	**LS 3**	8	176	4	160	5	120	1	36
4	**LS 4**	2	200	3	84	1	110	0	56
5	**LS 5**	4	160	8	220	6	180	2	84
6	**LS 6**	7	210	10	196	10	220	0	176
7	**LS 7**	3	180	15	100	11	180	2	76
8	**LS 8**	1	80	13	60	5	90	0	30
9	**LS 9**	2	132	6	84	3	88	1	96
10	**LS 10**	1	120	14	220	0	124	1	45
11	**LS 11**	N/A	N/A	7	120	1	160	0	15
12	**FS 1**	10	210	2	100	0	210	0	200
13	**FS 2**	15	180	1	400	1	300	1	TNTC
14	**LA 1**	N/A	N/A	3	160	0	40	1	200
15	**LA 2**	N/A	N/A	0	76	1	100	3	240
16	**FA 1**	18	310	3	90	N/A	N/A	N/A	N/A
17	**FA 2**	15	176	0	160	N/A	N/A	N/A	N/A
18	**FA 3**	23	420	0	132	0	320	16	TNTC
19	**FA 4**	8	360	N/A	N/A	N/A	N/A	N/A	N/A
20	**LW 1**	4	600	5	190	9	200	3	200
21	**LW 2**	5	320	10	150	8	180	5	160
22	**LW 3**	8	380	7	180	10	220	7	110
23	**LW 4**	10	240	N/A	N/A	4	160	10	164
24	**LW 5**	3	480	N/A	N/A	20	280	13	196
25	**LD 1**	3	176	N/A	N/A	1	160	0	72
26	**LD 2**	1	80	N/A	N/A	0	140	0	84
27	**LB 1**	8	76	10	300	33	200	N/A	N/A
28	**LB 2**	6	96	5	420	17	260	1	60
29	**LB 3**	6	52	6	160	28	180	8	120
30	**LH 1**	N/A	N/A	N/A	N/A	0	TNTC	8	160
31	**LH2**	N/A	N/A	N/A	N/A	2	320	13	320
32	**FF 1**	7	300	3	120	0	TNTC	0	200
33	**FF 2**	1	96	2	96	8	TNTC	1	TNTC
34	**FF3**	12	420	0	200	1	48	1	220
35	**FD1**	7	520	0	108	0	TNTC	10	TNTC
	Mean	7	215	6	167	6	175	3	124
	Median	5.5	178	5	160	2.5	180	1	103
	High	23	600	15	420	33	320	TNTC	TNTC
	Low	1	52	0	60	0	40	0	15

	Site	Oct-99		Nov-99		Dec-99		Jan-00	
	(per 1.0	*E coli*	Fecal col.	*E coli*	Fecal	*E coli*	Fecal	*E coli*	Fecal
1	**LS 1**	N/A	N/A	0	20	2	80	0	30
2	**LS 2**	N/A	N/A	0	48	0	64	0	44
3	**LS 3**	0	110	0	60	0	40	0	40
4	**LS 4**	2	176	0	96	0	15	0	56
5	**LS 5**	1	260	0	52	1	32		
6	**LS 6**	0	300	0	35	0	25		
7	**LS 7**	0	180	1	56	N/A	N/A		
8	**LS 8**	0	80	1	45	N/A	N/A		
9	**LS 9**	2	64	0	30	N/A	N/A		
10	**LS 10**	0	96	4	124	0	120		
11	**LS 11**	0	120	0	60	0	84		
12	**FS 1**	12	300	1	240	N/A	N/A		
13	**FS 2**	2	260	2	400	N/A	N/A		
14	**LA 1**	0	72	0	88	3	180		
15	**LA 2**	0	60	3	120	0	64	0	27
16	**FA 1**	N/A	N/A	20	96	N/A	N/A		
17	**FA 2**	N/A	N/A	2	300	N/A	N/A		
18	**FA 3**	0	180	3	160	N/A	N/A		
19	**FA 4**	0	210	0	140	N/A	N/A		
20	**LW 1**	2	120	0	140	2	30	0	80
21	**LW 2**	1	100	0	48	0	52	0	160
22	**LW 3**	0	80	0	76	1	48	0	120
23	**LW 4**	0	240	0	120	N/A	N/A	0	60
24	**LW 5**	0	200	1	160	N/A	N/A	0	29
25	**LD 1**								
26	**LD 2**								
27	**LB 1**	0	160	N/A	N/A	0	72	0	100
28	**LB 2**	2	280	N/A	N/A	1	80	0	160
29	**LB 3**	0	260	N/A	N/A	0	320	0	120
30	**LH 1**	N/A	N/A	N/A	N/A	N/A	N/A	1	80
31	**LH2**	N/A	N/A	N/A	N/A	N/A	N/A	0	96
32	**FF 1**	7	76	28	220	N/A	N/A		
33	**FF 2**	1	90	17	180	N/A	N/A		
34	**FF3**	0	120	1	88	N/A	N/A		
35	**FD1**	0	TNTC	0	TNTC	N/A	N/A		
	Mean	1	163	3	120	1	82	0	80
	Median	0	160	0	96	0	64	0	80
	High	12	300	28	400	3	320	1	160
	Low	0	60	0	20	0	15	0	27

	Site	Feb-00		Mar-00		Apr-00		May-00	
	(per 1.0	*E coli*	Fecal	*E coli*	Fecal col.	*E coli*	Fecal col.	*E coli*	Fecal col.
1	**LS 1**			0	18	1	74	12	740
2	**LS 2**			1	28	1	59	13	660
3	**LS 3**			0	18	1	56		
4	**LS 4**			0	16	0	60		
5	**LS 5**			0	23	0	85		
6	**LS 6**			0	25	0	84		
7	**LS 7**								
8	**LS 8**								
9	**LS 9**								
10	**LS 10**			0	58	0	92	1	720
11	**LS 11**			1	43	0	28	3	720
12	**FS 1**								
13	**FS 2**								
14	**LA 1**			0	50	1	151	5	460
15	**LA 2**			0	11	1	66	4	960
16	**FA 1**								
17	**FA 2**								
18	**FA 3**								
19	**FA 4**								
20	**LW 1**			1	100	11	140		
21	**LW 2**			0	77	3	108		
22	**LW 3**			2	89	1	121		
23	**LW 4**								
24	**LW 5**								
25	**LD 1**								
26	**LD 2**								
27	**LB 1**			2	50	1	70	5	500
28	**LB 2**			0	75	2	101	5	500
29	**LB 3**			3	56	2	74	2	300
30	**LH 1**			1	63			0	460
31	**LH2**			1	31			2	620
32	**FF 1**								
33	**FF 2**								
34	**FF3**								
35	**FD1**								
	Mean			1	46	2	86		
	Median			0	46.5	1	79		
	High			3	100	11	151		
	Low			0	11	0	28		

SITE NUMBER	SITE LOCATION
	Swan Creek - Lucas County
LS 1	Garden Rd., East of Holland-Sylvania Rd.
LS 2	Salisbury Rd., West of Manley Rd.
LS 3	Maumee-Western Rd., West of Coder Rd.
LS 4	Monclova Rd., East of Albon Rd.
LS 5	Keener Rd., North of Stitt Rd.
LS 6	Stitt Rd., West of Bucher Rd.
LS 7	Weckerly Rd., West of Eber Rd.
LS 8	Whitehouse-Spencer, North of Winslow
LS 9	Berkey-Southern (Rt. 295), South of Obee
LS 10	Monclova Rd., East of Rt. 64
LS 11	Waterville-Swanton (Rt. 64), South of Swanton Reservoir
	A I Creek - Lucas County
LA 1	Airport Hwy. (Rt 20A), East of Scott
LA 2	Fulton-Lucas, North of Airport Highway
	Wolf Creek - Lucas County
LW 1	Holland-Sylvania, South of Airport Hwy.
LW 2	Airport Hwy., West of Spring Valley Rd.
LW 3	Holloway Rd. South of Progress
LW 4	Airport Hwy., near Gunn Rd.
LW 5	Albon Rd., North of Angola
	Drennan Ditch - Lucas County
LD 1	Angola Rd., East of Courtway
LD 2	King Rd., North of Angola Rd.
	Blue Creek - Lucas County
LB 1	Heller, South of Waterville-Neapolis
LB 2	Waterville-Neapolis, West of Schadel
LB 3	Fulton-Lucas, South of Hite
	Heilman Ditch - Lucas County
LH 1	Heilman Ditch in Toledo at Glendale
LH 2	Heilman Ditch in Toledo at Cass near Eastedge Dr.
	Swan Creek - Fulton County
FS 1	CR 5-2, North of Airport Hwy., on East side of road.
FS 2	CR-H, West of CR-5-2, on the North side of road
	Fewless Creek - Fulton County
FF 1	CR-5-2, North of CR-F, on East side of Road 5-2
FF 2	CR-H, West of CR-6-2 on the South side of Road H
	A I Creek - Fulton County
FA 1	CR-J, West of St, Rte. 64, on the North side of Road J
FA 2	CR-K, between CR-3 and St. Rte. 64, on the North side of the Road
FA 3	CR-4, North of CR-L, on the East Side of the Road
FA 4	CR-L, East of CR-5, on the South side of the road.

Ohio EPA Bacterial Standards

Bathing Waters

Fecal coliform - geometric mean fecal coliform content, based on not less than five samples within a thirty-day period, shall not exceed 200 per 100 ml and fecal coliform content shall not exceed 400 per 100 ml in more than ten per cent of the samples taken during any thirty-day period.

E. coli - geometric mean E. coli content, based on not less than five samples within a thirty-day period, shall not exceed 126 per 100 ml and E. coli content shall not exceed 235 per 100 ml in more than ten per cent of the samples taken during any thirty-day period.

Primary Contact

Fecal coliform - geometric mean fecal coliform content, based on not less than five samples within a thirty-day period, shall not exceed 1,000 per 100 ml and fecal coliform content shall not exceed 2,000 per 100 ml in more than ten per cent of the samples taken during any thirty-day period.

E. coli - geometric mean E. coli content, based on not less than five samples within a thirty-day period, shall not exceed 126 per 100 ml and E. coli content shall not exceed 298 per 100 ml in more than ten per cent of the samples taken during any thirty-day period.

Secondary Contact

Fecal coliform - shall not exceed 5,000 per 100 ml in more than ten per cent of the samples taken during any thirty-day period.

E. coli - shall not exceed 576 per 100 ml in more than ten per cent of the samples taken during any thirty-day period.

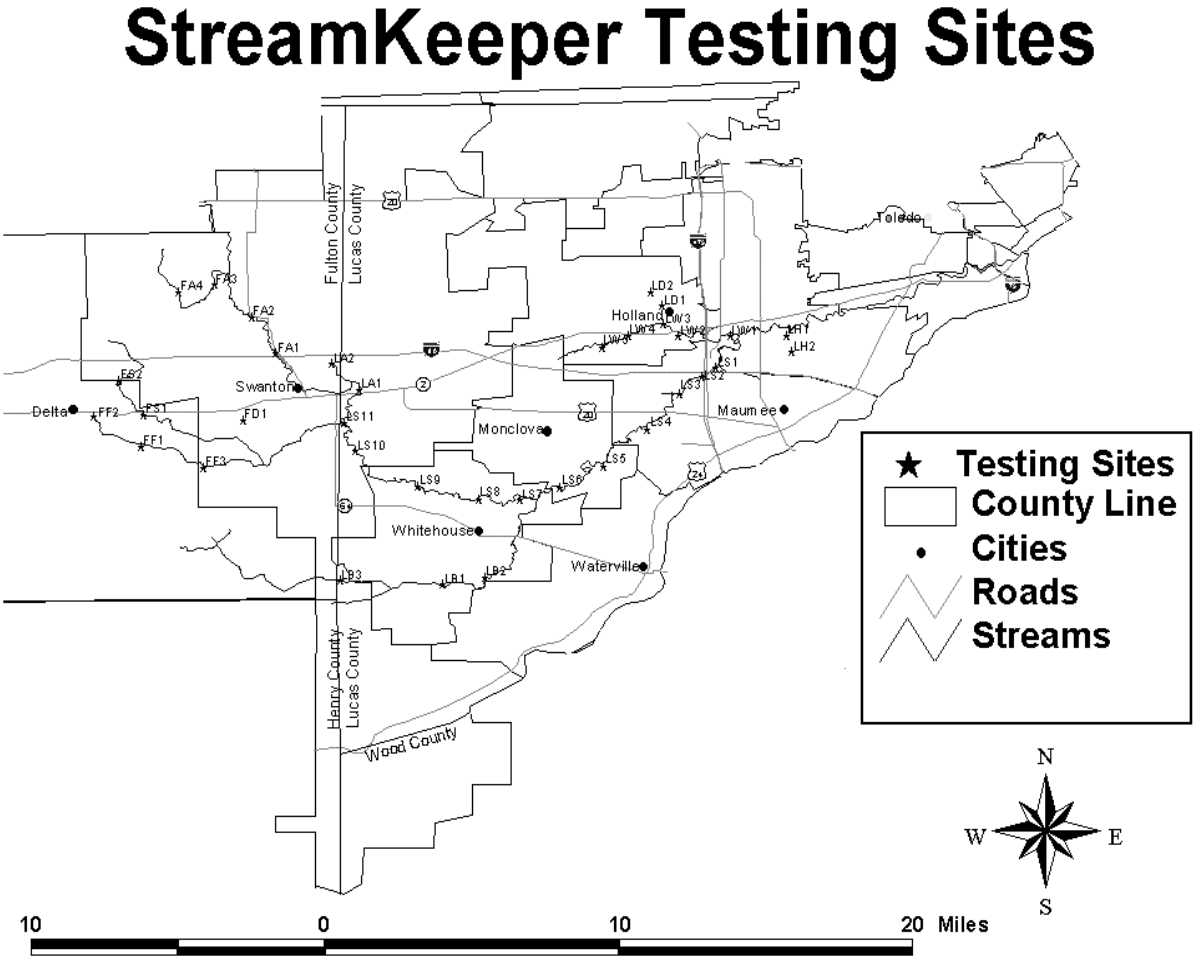
Definitions

"Bathing waters" - these are waters that, during the recreation season, are suitable for swimming where a lifeguard and/or bathhouse facilities are present, and include any additional such areas where the water quality is approved by the director. Water bodies assigned the bathing waters use designation are not necessarily indicated in rules 3745-1-08 to 3745-1-30 of the Administrative Code but include local areas of those water bodies meeting this definition.

"Primary contact" - these are waters that, during the recreation season, are suitable for full-body contact recreation such as, but not limited to, swimming, canoeing, and scuba diving with minimal threat to public health as a result of water quality. In addition to those water body segments designated in rules 3745-1-08 to 3745-1-32 of the Administrative Code, all lakes and reservoirs, except upground storage reservoirs and those lakes and reservoirs meeting the definition of bathing waters, are designated primary contact recreation.

"Secondary contact" - these are waters that, during the recreation season, are suitable for partial body contact recreation such as, but not limited to, wading with minimal threat to public health as a result of water quality.

	EPA Standard (100ml)	StreamKeeper Equivalent (1ml)
Bathing Waters – Fecal Coliform	200	2
Bathing Waters – E. coli	126	1
Primary Contact – Fecal Coliform	1,000	10
Primary Contact – E. coli	126	1
Secondary Contact – Fecal Coliform	5,000	50
Secondary Contact – E. coli	576	6



Appendix B

Appendix B

Swan Creek Hydrologic and Land Use Study

Effects of Urbanization on the Hydrology of the Swan Creek Watershed

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Bowling Green State University

Abstract:
Over the past three decades, the Swan Creek Watershed in Lucas County, Ohio has experienced urbanization extending from Toledo to its suburbs. Swan Creek and its tributaries feed into the Maumee river and eventually discharge into Lake Erie. The increase of urbanization has caused problems to the local hydrology. The transformation of rural land to impervious surfaces yields additional rainfall run-off, which in turn increases the incidence of flooding in the Swan Creek Basin. The goal of this project is to determine the effects of increased urbanization on the hydrology of Swan Creek Watershed.

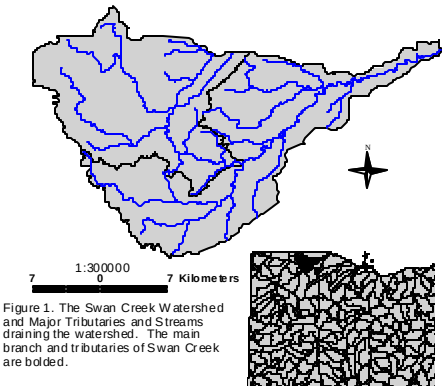
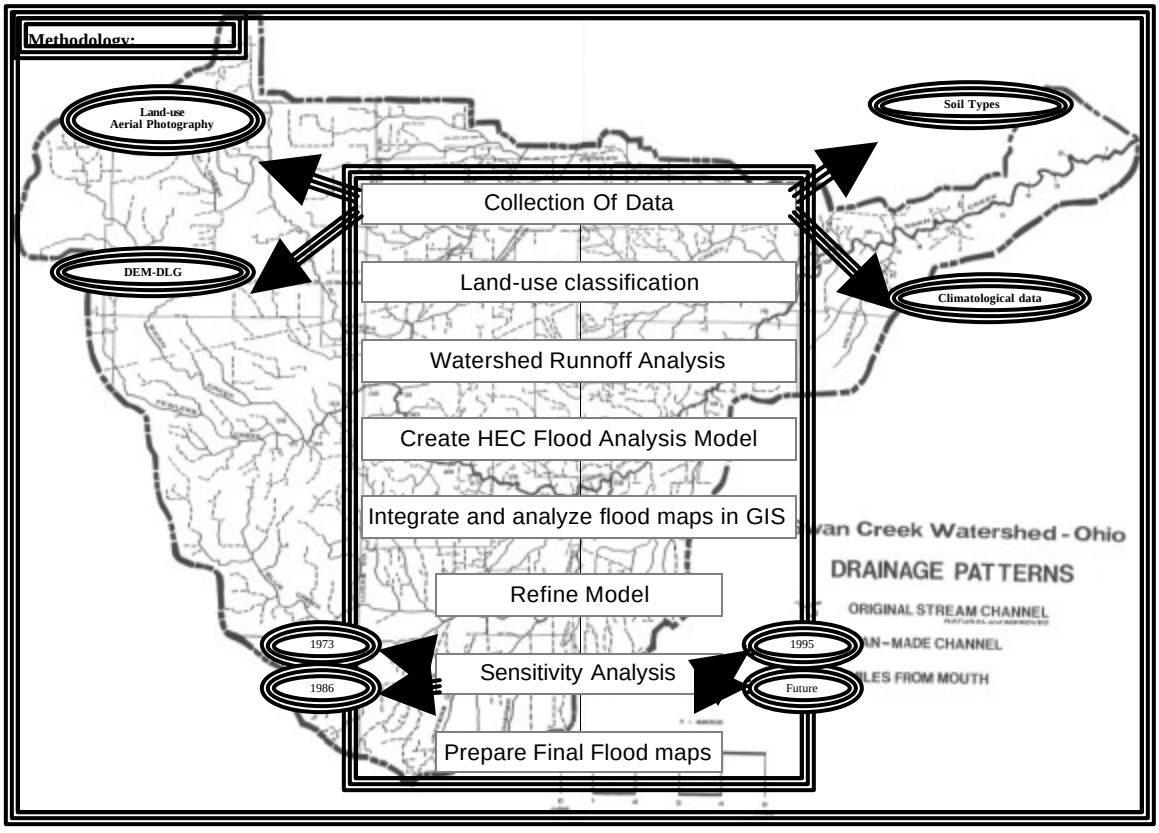


Figure 1. The Swan Creek Watershed and Major Tributaries and Streams draining the watershed. The main branch and tributaries of Swan Creek are bolded.



Appendix C

Appendix C

This data was provided by Ohio EPA Division of Emergency and Remedial Response. Some sites may flow to multiple waterways due to drainage tiles, manmade ditches, etc.

Swan Creek Watershed Dumps, Landfills & Uncontrolled Waste Sites		
Site Name/ Site Location	*Facility Operational/ Contaminant Description*	*Site Status*
Columbia Gas A.K.A. Toledo Coal Gas Plant A.K.A. Toledo Gas Light and Coke Company 328 South Erie Street	The former Toledo Coal Gas Plant was a manufacturing facility for coal products as early as 1865. The manufacturing process ceased prior to 1947.	The site was investigated as part of the Ohio EPA Maumee Area of Concern Phase III Site Assessments in 1997. The site was recommended for additional investigatory activities.
Penn Central Transport A.K.A. Stanley Diesel Shop 435 Emerald Ave.	Information does not appear to exist with respect to the actual existence or operation of this facility.	The current status of the property is undetermined.
Webstrand Corporation Corner of Hamilton and Collingwood Boulevard	The former Webstrand Corporation facility has been historically operated as a manufacturer of automotive instruments, engineering and battery research, storage of finished can inventory. The potential contaminants of concern include organic solvents and metals.	The site was evaluated as a Preliminary Assessment and determined to be a low priority for additional investigation.
Bethel Lutheran Church 1853 South Ave.	Prior to the construction of the Bethel Lutheran Church in 1953, the property was reportedly used as a dump. The Dump accepted typical household/municipal refuse and demolition debris.	The site was investigated as part of the Ohio EPA Maumee Area of Concern Phase III Site Assessments in 1997. The site was designated as no further remedial action planned.

Swan Creek Watershed Dumps, Landfills & Uncontrolled Waste Sites		
Louie Street at Swan Creek Dump Louie Street at Swan Creek	The former Louie Street at Swan Creek Dump was operated between 1920 and 1955. The Dump accepted typical household/municipal refuse.	The site was investigated as part of the Ohio EPA Maumee Area of Concern Phase III Site Assessments in 1997. The site was designated as no further remedial action planned.
Swan Crk. at Western Dump 1401-1463 Western Ave.	The Swan Creek at Western Dump operated until approximately 1930. The Dump accepted typical household/municipal refuse and commercial wastes. Potential contaminants of concern include organic constituents and metals.	The site was investigated as part of the Ohio EPA Maumee Area of Concern Phase III Site Assessments in 1997. The site was designated as no further remedial action planned.
Western Avenue Dump	Information does not appear to exist with respect to the actual existence or operation of this suspected landfill. This Dump is believed to be the 1401 to 1463 Western Avenue to Swan Creek site.	The site was investigated as part of the Ohio EPA Maumee Area of Concern Phase III Site Assessments in 1997. The site was designated as no further remedial action planned.
Swan Creek at Chester Street Dump Swan Creek at Chester Street	The Swan Creek at Chester Street Dump operated from approximately 1920 until 1955. The Dump accepted typical household/municipal refuse and commercial wastes. Potential contaminants of concern include organic constituents and metals.	The site was investigated as part of the Ohio EPA Maumee Area of Concern Phase III Site Assessments in 1997. The site was designated as no further remedial action planned.

Swan Creek Watershed Dumps, Landfills & Uncontrolled Waste Sites		
NL Industries Bearings Division A.K.A. Bunting, Brass, and Bronze A.K.A. Eagle-Picher Bearings Co. 715 Spencer Street	Based on information obtained via a Preliminary Assessment, the former NL Industries facility operated a brass foundry that manufactured brass and bronze machine parts. Lead bearings were also manufactured. The potential contaminant of concern appears to be metals, more specifically lead.	The current status of the property is undetermined.
Champion Spark Plug 900 Upton Ave.	The potential contaminants of concerns appeared to be cutting oils, benzene, toluene, ethyl benzene, and xylenes, petroleum hydrocarbons, and mineral spirits. The contamination was result of historic leaks for underground storage tanks. The contaminant pathway was identified as ground water.	The Champion Spark Plug facility was the subject of a voluntary remediation that included removal of the underground storage tanks, removal of contaminated soils and disposal of the underground storage tank contents. Ohio EPA provided Aoversight@ without the benefit of an Administrative Order until division policy shift in 1990.
Swan Creek at Champion Street Dump Swan Creek at Champion Street	The former Swan Creek at Champion Street Dump operated from 1945 until 1950. The Dump accepted typical household/municipal refuse.	The site was investigated as part of the Ohio EPA Maumee Area of Concern Phase III Site Assessments in 1997. The site was designated as no further remedial action planned.

Swan Creek Watershed Dumps, Landfills & Uncontrolled Waste Sites		
Jennison-Wright Corporation Broadway Ave. (east of Toledo Zoo)	The former Jennison-Wright facility operated as a wood treatment facility until 1990. Potential contaminants of concern include polynuclear aromatic hydrocarbons, benzene, toluene, ethyl benzene and xylenes.	The site is under Administrative Order on Consent between the potentially responsible parties and the State of Ohio to perform a remedial investigation/Feasibility Study. The Feasibility Study indicates contaminant impact of soils and groundwater and recommends measures to address contamination.
Scott Park	Information does not appear to exist with respect to the actual existence or operation of this suspected dump.	The current status of the property is undetermined.
Plaskon 2829 Glendale Ave.	The former Plaskon facility manufactured plasticizers, resins, and various molding compounds between 1947 and 1979. Potential contaminants of concern include methylene chloride, acids, alcohols, xylenes, toluene, and oils.	The former owner/operator of the facility implemented a voluntary groundwater remediation system (i.e., "pump and treat") in addition to the removal of product storage tanks.
Allied Auto of Toledo Unable to determine an address	Information does not appear to exist with respect to the actual existence or operation of this facility.	The current status of the property is undetermined.
Arlington Ave.	Information does not appear to exist with respect to the actual existence or operation of this suspected dump.	The current status of the property is undetermined.
Swan Creek Landfill Glendale Ave. (east of Reynolds Road)	Information does not appear to exist with respect to the actual existence or operation of this suspected landfill.	The site was investigated as part of the Ohio EPA Maumee Area of Concern Phase III Site Assessments in 1997. The site was designated as no further remedial action planned.

Swan Creek Watershed Dumps, Landfills & Uncontrolled Waste Sites		
Detroit Lead Battery Recyclers 5715 Angola Road	The facility was originally constructed as a brass foundry operation. In December of 1980, the facility was purchased and operated as a battery recycling facility until 1983. The potential contaminant of concern appears to be metals, more specifically lead.	The site has been remediated under Administrative Order on Consent between the potentially responsible parties and U.S.EPA.
Holland Village Dump Northwest Corner of Front Street and Conrail Right-of-Way	Minimal information exists with respect to the operational history of the former Holland Village Dump. The Dump accepted typical household/municipal refuse until 1958.	The site was investigated as part of the Ohio EPA Maumee Area of Concern Phase III Site Assessments in 1997. The site was designated as no further remedial action planned.
Angola Road Landfill 7717 Angola Road (Angola Road Mobile Home Park)	The Angola Road Landfill was an active repository for wastes between sometime in the 1950's until the early 1960's. The landfill accepted typical household/municipal refuse.	The site was investigated as part of the Ohio EPA Maumee Area of Concern Phase III Site Assessments in 1997. The site was recommended for a site inspection upon completion of the Division of Surface Water Corrective Action (compliance with an existing NPDES permit) to determine if further action is warranted.
Spencer Township Dump Between Frankfort Road and the Tributary 340 Eber Road	The Spencer Township Dump began accepting waste in the early 1950's and ceased operations in the late 1960's. The Dump reportedly accepted all waste types including commercial/industrial.	The site was investigated as part of the Ohio EPA Maumee Area of Concern Phase III Site Assessments in 1997. The site was designated as no further remedial action planned.

Swan Creek Watershed Dumps, Landfills & Uncontrolled Waste Sites		
International Mineral and Chemical Unable to determine an address	Information does not appear to exist with respect to the actual existence or operation of this suspected dump.	The current status of the property is undetermined.
Frankfort Auto Parts 229 South Schwamberger Road	The former Frankfort Auto Parts was discovered via a complaint regarding abandoned and deteriorating drums. The operational history of the auto parts junk yard is unknown. Organic solvents were determined as the potential constituent of concern.	The former Frankfort Auto Parts site was the subject of U.S. EPA removal action. Approximately 150 55-gallon drums of various hazardous substances, etc., and contaminated surface soils removed for appropriate disposal.
Griswold Landfill 10745 Old State Line Road	The Griswold site was used as a disposal site for household wastes, appliances, construction debris, tires, drums of various solvents, etc. for an undetermined number of years. The potential constituents of concern appear to be metals contamination and organic solvents.	The former Griswold site was the subject of U.S. EPA removal action. Numerous drums of paint waste, etc. and piles of aluminum smelting (i.e., "dross") were removed for appropriate disposal. Ohio EPA post-removal investigations determined that the site did not pose a significant threat to human health and the environment.
Bush Drum Site Unable to determine an address	Information does not appear to exist with respect to the actual existence or operation of this suspected dump.	The current status of the property is undetermined.

Swan Creek Watershed Dumps, Landfills & Uncontrolled Waste Sites		
American Can Company 10444 Waterville-Swanton Road	The American Can Company manufactures two piece aluminum and steel cans. The facility utilized a lagoon as a holding basin for effluent generated during the manufacturing process. The lagoon was used for a period of approximately one year and permanently removed in 1992. The potential contaminant of concern appears to be metals.	The site was investigated as part of the Ohio EPA Maumee Area of Concern Phase III Site Assessments in 1997. The site was designated as no further remedial action planned.
Springfield-Monclova Township Dump A.K.A. Reed Road Landfill Reed Road approximately 2 mile West of Berkey-Southern Road (State Route 295)	The former Springfield-Monclova Township Dump operated as a solid waste landfill between 1950 and 1970.	The site was investigated as part of the Ohio EPA Maumee Area of Concern Phase III Site Assessments in 1997. The site was designated as no further remedial action planned.
Irwin Road Dump 809 South Irwin Road	Minimal information exists with respect to the operational history of the former Irwin Road Dump. The 5 acres dump accepted typical household/municipal refuse until sometime in the 1970's.	The site was investigated as part of the Ohio EPA Maumee Area of Concern Phase III Site Assessments in 1997. The site was designated as no further remedial action planned.
Swanton Township Dump North of Neapolis-Waterville Road and Manore Road Intersection	The Swanton Township Dump operated from the mid 1950's until the late 1960's. The Dump accepted typical household/municipal refuse.	The site was investigated as part of the Ohio EPA Maumee Area of Concern Phase III Site Assessments in 1997. The site was designated as no further remedial action planned.

Swan Creek Watershed Dumps, Landfills & Uncontrolled Waste Sites		
Swanton Township Dump North of Monclova Road, East of Southern Road, South of Route 295, and West of Spencer Street	Information does not appear to exist with respect to the actual existence or operation of this suspected landfill.	The current status of the property is undetermined.
Providence Township Dump 7349 and 7421 Manore Road	The Providence Township Dump reportedly operated from the early 1960's until the early 1970's. The Dump accepted typical household/municipal refuse.	The site was investigated as part of the Ohio EPA Maumee Area of Concern Phase III Site Assessments in 1997. The site was designated as no further remedial action planned.
Providence Township Dump Between Schadel Road and Hertzfeld Road	Information does not appear to exist with respect to the actual existence or operation of this suspected landfill.	The current status of the property is undetermined.

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