Storm Water Quality Management Plan
Part B
Baseline Characterization Report
327 IAC 15-13-7

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City of Franklin, IN

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Part B Baseline Characterization Report

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Introduction

This report, as required under 327 IAC 15-13-7, is the Storm Water Quality Management Plan (SWQMP) Part B: Baseline Characterization and Report. The report is a result of Rule 13, a new storm water rule implemented under the Clean Water Act Phase II National Pollution Discharge Elimination System Program. The purpose of this report is to create a baseline characterization of the entire MS4 area based on land use, existing structural and non-structural Best Management Practices (BMPs), sensitive waters, and also the condition of receiving streams which were identified in the Notice of Intent (NOI) to IDEM in Part A of the SWQMP. Included in the report is a review of existing data and the collection of new data necessary to adequately describe the condition of the affected waterbodies. The water quality was evaluated using a bioassessment technique, which quantifies the number and kinds of aquatic life present in area streams to measure their ecological health. The MS4 area was characterized in order to draw conclusions about existing water quality issues.

The report is organized into two sections:

1. Summary of Data Collection and Evaluation: Provides a summary of data used to characterize the MS4 area. Includes information on land use, existing BMPs, sensitive waters, and existing stream water quality data.

2. Results of Data Evaluation: Provides results of evaluating the MS4 area and also includes new water quality data used to supplement the existing data. Discusses continued characterization efforts and tasks to be completed prior to submitting Part C of the SWQMP.

Section One
Summary of Data Collection and Evaluation

I. SUMMARY OF GENERAL DATA ON MS4 ENTITY AND SYSTEM

The following describes the MS4 entity in general, providing a context for the evaluation of the water quality data and other data sources in the preparation of this report.

A. City of Franklin

1. Population

According to the U.S. Census Bureau, Census 2000 data, Franklin has a population of 19,463.

2. Population Growth

One of the interesting factors in this program is to evaluate which areas are growing or declining in population. This may provide some guidance for prioritizing programs. The national average for population growth from 1990 to 2000 was 13.15%, and the Indiana State average for population growth from 1990 to 2000 was 9.67%.

Table 1: Percent Growth 1990 - 2000

City	1990 Population	2000 Population	Percent Growth
Franklin	12,097	19,463	60.9%

The data indicates that the City of Franklin has had significant growth in population over the last 10 years. This means that Franklin is approximately 50% ahead the State average for growth since 1990.

3. Receiving Waters

The receiving waters for Franklin are identified in those areas where Franklin's city limits intersect the United States Geological Survey (USGS), Hydrologic Unit Code (HUC)-14 subwatersheds.

Following is a table listing the HUC-14 subwatersheds that are evaluated under this MS4 program:

Table 2: HUC-14 Codes

HUC14 Name	HUC-14
Hurricane Creek (Johnson)	05120204090050
Youngs Creek-Amity Ditch	05120204090070
Youngs Creek - Brewers/Canary Ditches	05120204090030
Youngs Creek - Buckhart Creek	05120204090060
Youngs Creek - Ray Creek	05120204090040

Stormwater can flow into all types of receiving water systems within these five subwatersheds, from very small roadside ditches, to intermittent streams, to large rivers. Each entity regulated under this MS4 program is tasked with developing a working definition of receiving waters to include in their program. The U.S. Department of the Interior Geological Survey, Water Resources Division, in conjunction with the Indiana Department of Natural Resources (IDNR), Division of Water, developed a reference manual entitled "Drainage Areas of Indiana Streams", copyright 1975. This manual defines drainage areas for all streams in Indiana having a drainage area of at least five square miles. For purposes of this MS4 program, Franklin will consider receiving streams that have assigned names in the aforementioned manual.

Consequently, the receiving waters within these areas include the following:

Table 3: Receiving Waters

HUC-8	HUC-11	HUC-14	Assigned Names Receiving Waters
05120204	090	050	Hurricane Creek (Johnson)
05120204	090	070	Youngs Creek-Amity Ditch
05120204	090	030	Youngs Creek - Brewers/Canary Ditches
05120204	090	060	Youngs Creek - Buckhart Creek
05120204	090	040	Youngs Creek - Ray Creek

II. SUMMARY OF BASELINE DATA COLLECTION AND EVALUATION

The City of Franklin used numerous resources to identify, gather, and evaluate data for this Baseline Characterization Report. Some of the entities that were involved with this assessment include:

- City of Franklin
- Johnson County Soil and Water Conservation District
- Purdue University
- Commonwealth Engineers, Inc.
- Commonwealth Biomonitoring, Inc.
- U.S. EPA
- U.S. Department of the Interior
- U.S. Geological Survey
- U.S. Census Bureau
- Indiana Department of Environmental Management
- Indiana Department of Natural Resources
- the general public

III. SUMMARY OF EVALUATION APPROACH

A. Land Use Evaluation

Basic land use information is a simple way to initially characterize the MS4 area. By identifying residential, commercial, industrial, agricultural and open land areas, it is easier for an entity to visualize where to focus the MS4 program. The land use for the City of Franklin was evaluated using Geographic Information System (GIS) mapping. The necessary layers to generate the map were gathered from Purdue University's Center for Advanced Applications in GIS Graphics. The layers used for the mapping were the land use, urbanized areas, HUC-14s, city boundaries, and the USGS topographic maps. The land use map is provided in Appendix A of this report.

A wetlands map is also provided as a means to characterize the MS4 area. Wetlands have natural pollutant-removal capabilities which make them very beneficial to improving water quality. The locations of the wetlands are shown on the aerial photography for Franklin. The wetlands map is provided in Appendix B of this report.

B. Evaluation of Structural and Non-structural BMPs

The identification and assessment of structural and non-structural Best Management Practices (BMPs) is a useful characterization tool. A structural BMP is an actual device or object that is used to control either the quantity or quality of storm water run-off. A non-structural BMP is a program or housekeeping practice that is in place to improve the water quality of streams and storm water run-off. With assistance from Commonwealth Engineers, Inc. (CEI), the City of Franklin conducted field assessments of existing structural BMPs. CEI met with the City and outlined the procedure for assessing the structural BMPs.

A Structural BMP Inventory Sheet was used to document and assess each known BMP in the program area. Each Inventory Sheet required the following information about the BMP: HUC-14, type of BMP, contiguous land use, number of inflow points, type of outlet(s), and recommendations to improve the BMP. The functionality of the BMP was characterized using a numerical rating scale of 1 through 4. A rating of a 1 indicated the BMP was in poor condition. A rating of a 4 indicated the BMP was in good condition. An additional guidance document was developed in order to give the field technician a more objective approach to rating the BMP. The document listed areas of concern for the BMP and then listed typical conditions for each rating. For example, a mowed condition in the embankment area was rated as a 4, but an overgrown condition was rated as a 1. Additional information, if known, included the installation date, drainage area, design volume, size, and availability of maintenance records.

The second page of the Inventory Sheet was a photo log for documenting the structural BMP with digital photography. The first step was to sketch the BMP and any pertinent structures such as inlets and outlets. Flow directions in the BMP were also sketched. The items photographed were deficiencies in the BMPs such as broken trash screens, inlets and outlets, and overall views of the BMP. In order to assist in the orientation of the photographs, the location and direction the photograph was taken was noted on the BMP sketch. A copy of the Structural BMP Inventory Sheet and rating guide is provided in Appendix C.

Aerial photography of the MS4 area was obtained from a GIS website operated by Purdue University. One large index map was printed out along with multiple 200 scale drawings. The location of the BMP was mapped on the aerial photography then transferred to a GIS program which assigned latitude and longitude coordinates to the BMP.

Although all structural BMPs in the MS4 area have the potential to contribute to the improvement of water quality, a distinction was made between the public and private sectors. The private sector includes BMPs owned, operated, or maintained by a private party such as a homeowner or a neighborhood association. The public sector includes BMPs that are owned, operated, or maintained by the City, such as publicly owned golf courses or city parks. The distinction between the public and private sectors was made because the BMPs in the private sector were not included in the inventorying process. The reason for not including the BMPs in the private sector was that the City is not responsible for the privately owned BMPs and, therefore, do not have the authority to monitor their effectiveness.

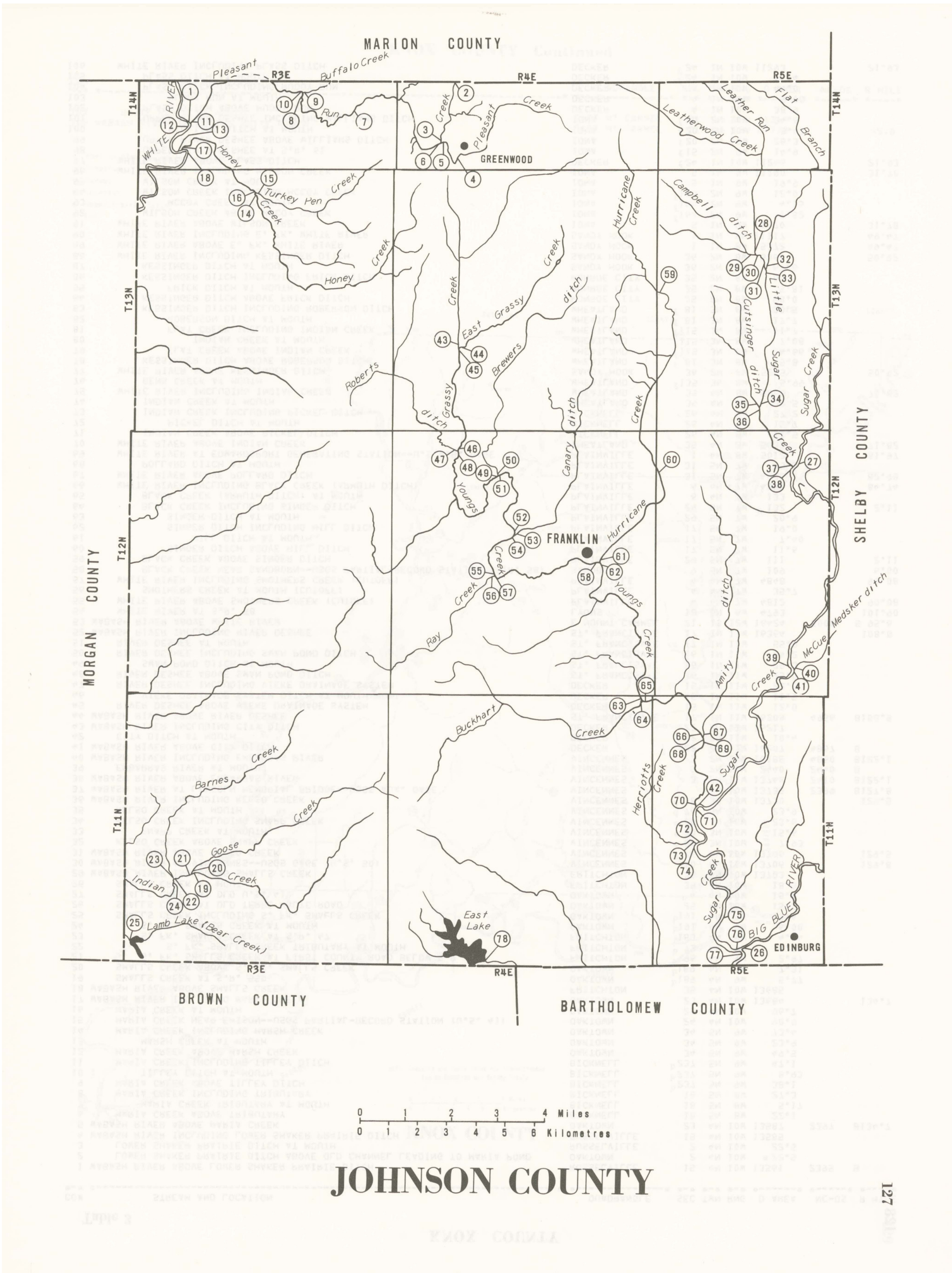
The City of Franklin coordinated the documentation of non-structural BMPs within the program area. The non-structural BMPs were obtained through the use of a form filled out by the MS4 program coordinator or appropriate City personnel. The form required a description of the BMP, the office or department which regulates the BMP, the current state of the BMP, and the MS4 jurisdiction under which the BMP falls. A copy of the form is provided in Appendix D of this report.

D. Identification of Sensitive Waters

The identification of sensitive waters is an important part of the overall Phase II stormwater program. Sensitive areas include public swimming areas, surface drinking water intakes, waters containing threatened or endangered species and their habitat, and outstanding State and National resource waters. The identification of sensitive areas is directly related to the purpose statement of this rule: "public health, existing water uses, and aquatic biota are protected." Identifying sensitive areas is a key first step in protection. Once known, storm water discharges into or near the sensitive areas can receive higher prioritization for control measure implementation to ensure that the sensitive areas are adequately protected.

The following figure depicts all receiving streams being addressed by the City of Franklin under this MS4 program:

Figure 1: Receiving Streams



1. Threatened or Endangered Species

IDNR, Division of Nature Preserves conducted an *Indiana Natural Heritage Data Center* database search for the City of Franklin, Indiana, MS4 receiving streams. This database references endangered, threatened and rare species, high quality natural communities, and significant natural areas. The database returned results for five different species, but two of these are birds, which should be minimally impacted by stormwater discharges. Following are the three endangered species reports:

Table 4: Endangered Species

Type	Species	Common Name	State Classification	Location	Date	Comments
Mollusk	Epioblasma Triquetra	Snuffbox	Endangered	T11NR05E 05	1990	
Reptile	Clonophis Kirtlandii	Kirtland's Snale	Endangered	T12NR04E 23	1950	
Mollusk	Lynx Rufus	Bobcat	Endangered	T11NR04E 08	1992	

A complete copy of the database search results is included as Appendix E to this report.

2. Primary Contact Recreational Areas

Primary contact recreational areas include beaches, swimming areas, boating clubs, diving areas and other formal recreation facilities that use the receiving streams for recreation. There are no known primary contact recreational areas.

3. Drinking Water Sources

Surface drinking water intakes are considered a sensitive area for human health factors. According to the U.S. Environmental Protection Agency's (EPA's) Safe Drinking Water Information System database, there are 37 known public water supply systems in Johnson County. None use surface water as their source of water. A copy of the database search results is included as Appendix F to this report.

4. Outstanding State Resource Waters

The State of Indiana lists a few receiving waters whose existing quality exceeds established standards. These are referred to as Outstanding State Resource Waters. Following is an excerpt from the rules, which clearly do not indicate any such waters in Johnson County.

327 IAC 2-1-2 Maintenance of surface water quality standards
Authority: IC 13-14-8; IC 13-14-9; IC 13-18-3
Affected: IC 13-18-1; IC 13-18-4; IC 13-30-2-1
Sec. 2. The following policies of nondegradation are applicable to all surface waters of the state:
(1) For all waters of the state, existing beneficial uses shall be maintained and protected. No degradation of water quality shall be permitted which would interfere with or become injurious to existing and potential uses.
(2) All waters whose existing quality exceeds the standards established herein as of February 17, 1977, shall be maintained in their present high quality unless and until it is affirmatively demonstrated to the commissioner that limited degradation of such waters is justifiable on the basis of necessary economic or social factors and will not interfere with or become injurious to any beneficial uses made of, or presently possible, in such waters. In making a final determination under this subdivision, the commissioner shall give appropriate consideration to public participation and intergovernmental coordination.
(3) The following waters of high quality, as defined in subdivision (2), are designated by the board to be an outstanding state resource and shall be maintained in their present high quality without degradation:
(A) The Blue River in Washington, Crawford, and Harrison Counties, from river mile 57.0 to river mile 11.5.
(B) The North Fork of Wildcat Creek in Carroll and Tippecanoe Counties, from river mile 43.11 to river mile 4.82.
(C) The South Fork of Wildcat Creek in Tippecanoe County, from river mile 10.21 to river mile 0.00.
(4) Any determination made by the commissioner in accordance with Section 316 of the Clean Water Act concerning alternative thermal effluent limitations will be considered to be consistent with the policies enunciated in this section. *(Water Pollution Control Board; 327 IAC 2-1-2; filed Sep 24, 1987, 3:00 p.m.: 11 IR 579; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1018; errata filed Jul 6, 1990, 5:00 p.m.: 13 IR 2003; filed Jan 14, 1997, 12:00 p.m.: 20 IR 1346)*

327 IAC 2-1.5-19 Limited use waters and outstanding state resource waters
Authority: IC 13-14-8; IC 13-14-9; IC 13-18-3
Affected: IC 13-18-4
Sec. 19 (b) The following waters within the Great Lakes system are designated as an outstanding state resource water:
(1) Cedar Creek in Allen and DeKalb counties, from river mile 13.7 to its confluence with the St. Joseph River.
(2) The Indiana portion of the open waters of Lake Michigan.
(3) All waters incorporated in the Indiana Dunes National Lakeshore.
(Water Pollution Control Board; 327 IAC 2-1.5-19; filed Jan 14, 1997, 12:00 p.m.: 20 IR 1411; errata filed Aug 11, 1997, 4:15 p.m.: 20 IR 3378)

D. Review of Existing / Available Water Quality Data

The City of Franklin conducted research to obtain existing water quality data for the targeted watersheds of this program. This consisted of researching water quality studies that have been previously conducted by other entities. The Indiana Department of Environmental Management (IDEM) suggests contacting their agency, local agencies (if applicable), universities, and local organizations (e.g. environmental or citizen groups).

Commonwealth Engineers submitted query requests to IDEM's Office of Water Quality, Assessment Branch, specifically from the Biological Studies Section. Information regarding macroinvertebrates and fish populations was generated from the *Assessment Information Management System* (AIMS) database. The results from the AIMS database are provided as Appendix G of this report.

One of the results from the AIMS database is a calculation for an "Index of Biological Integrity" or IBI score. The U.S. EPA has developed a "rapid bioassessment" technique which has been shown to generate highly reproducible results that accurately reflect the ecological health of a stream or lake. The process uses recent knowledge of how aquatic animals respond to changes in environmental conditions. In this process, the aquatic community of a study site is compared to that of a reference site known to have high water quality and representing the best conditions possible for that area. The ecological health of the study site is measured by comparing conditions to the reference. The final product of bioassessment is the IBI score. Although there are many different types of IBI measurements and scales, all can be converted to a 0 to 100 scale, where 0 represents the lowest ecological health and 100 represents the highest possible value.

Another one of the results obtained from the AIMS database is a calculation for a "Qualitative Habitat Evaluation Index" or QHEI score. Habitat analysis of a stream or lake is conducted by taking measurements of important waterbody and watershed characteristics, and then assigning numerical values to these characteristics. All assigned values are added together to obtain a QHEI score. As with the IBI, the highest value possible with the habitat assessment technique is 100. Sites with lower habitat values normally have lower IBI values as well.

Finally, Commonwealth Engineers and Commonwealth Biomonitoring reviewed the obtained data. In those areas that were lacking useful information or data, Commonwealth Biomonitoring conducted field studies to supplement the existing information.

Table 5: Existing Data

Sampler	Waterbody	Sample Date	Invert.	Fish	Habitat
IDEM	Young's Creek	July 7, 1993	55		64
		July 7, 1993	55		68
CB		December, 1993	83		71

Biological studies conducted in the Franklin area during the past decade show that Young's Creek has relatively high IBI and habitat values. In most cases, the IBI and habitat scores are similar, indicating good water quality. However, there were at least 3 fish kills in Young's Creek during the 1990's and these had detrimental effects on aquatic life in the stream.

IV. DEFINITION OF MS4 SYSTEM AND WATERS OF THE STATE

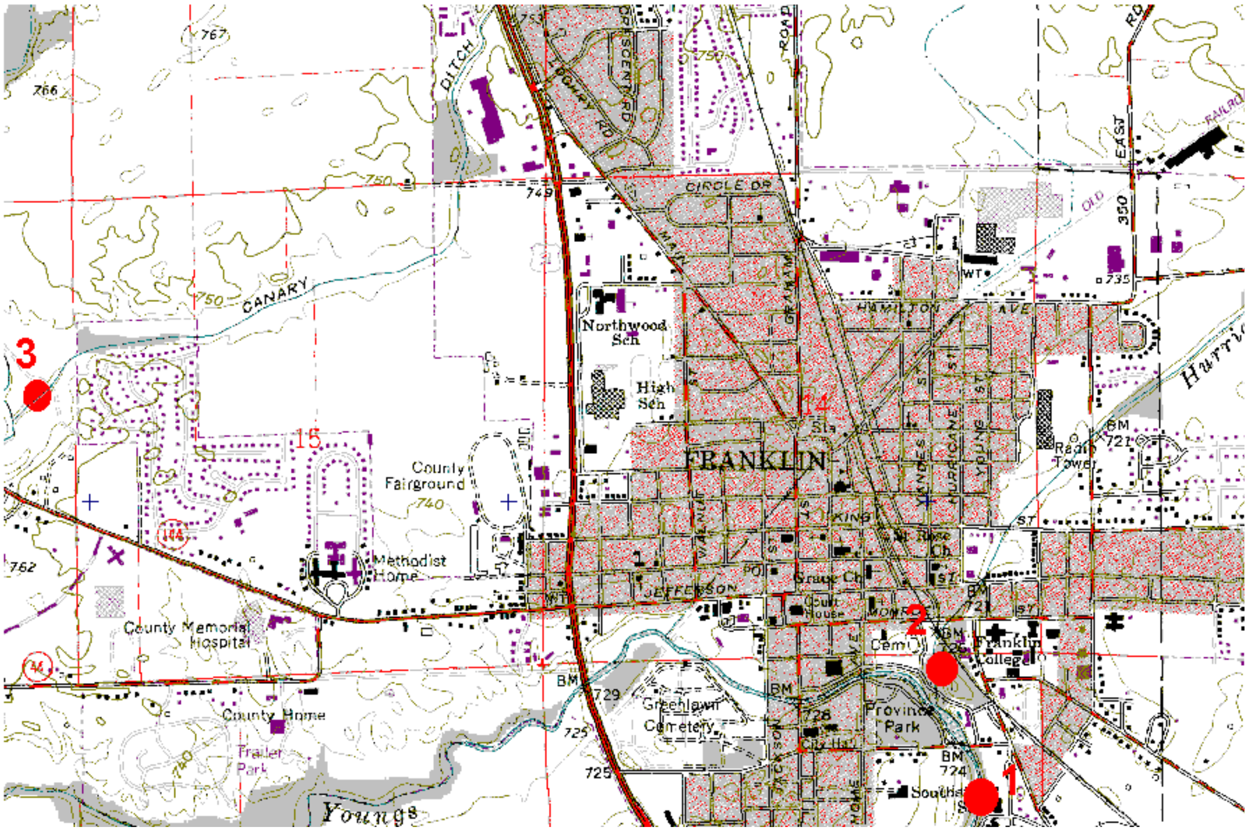
The Franklin MS4 system and storm water utility is defined by its corporate boundary. Waters within the system were limited to named conveyances as described by USGS topographic mapping and their "Drainage Areas of Indiana Stream" atlas compiled in cooperation with IDNR. Ditches that were unnamed and only carried water after a significant rain event were not defined as waters per the City MS4 program. No additional waters were defined subsequent to the City's Part A submittal.

V. REPORT ON NEW DATA

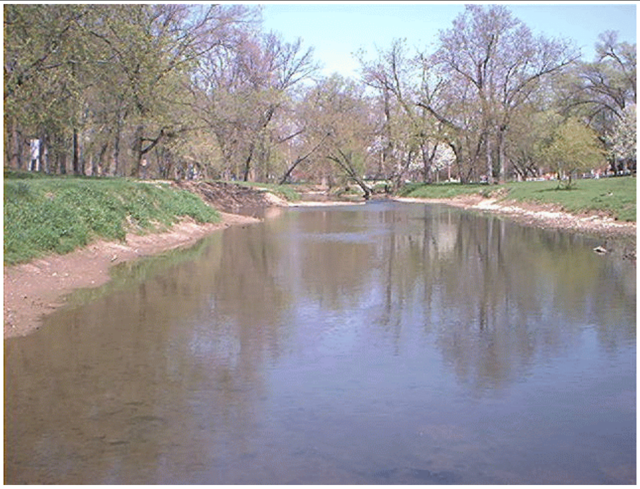
To update information on the biological integrity of streams in the Franklin area, 3 sites were chosen for study:

Site 1: Young's Creek
Site 2: Hurricane Creek
Site 3: Canary Ditch

Figure 2: New Data Sites



Franklin Sampling Sites 1 - 3: Figures 3-5



Site 1 – Young's Creek

Site 2 – Hurricane Ditch

Site 3 – Canary Ditch

Section Two
Results of Data Evaluation

VI. CHARACTERIZATION OF MS4 CONDITIONS

A. Sensitive Areas for Priority Attention

As mentioned earlier in this report, research was conducted regarding threatened or endangered species, primary contact recreational areas, and drinking water sources in the MS4 area. The research found that there are 3 threatened or endangered species in the area, no primary contact recreational areas, and no surface water drinking sources in the MS4 area. Therefore, based on the results of the research, the MS4 area contains some sensitive areas for priority attention.

B. Areas with Potential for Storm Water Quality Problems

Land use data was used to identify areas with potential for storm water quality problems. Although a certain land use category does not ensure impaired water quality, some categories are more prone to lower quality than others. High density residential areas could produce hydrocarbon laden run-off generated from oils and gasoline from automobiles. Trash and other debris could also be found in these areas. Agricultural land could produce run-off containing pesticides from the crops and also large amounts of sediment from the fields. These areas were noted for concern when analyzing the MS4 area for potential storm water quality problems.

C. BMP Evaluation Results

The documentation of the structural and non-structural BMPs in the City of Franklin provided a detailed evaluation of the MS4 conditions. Overall, three structural BMPs were evaluated in the MS4 area. The types of BMPs were:

- 1 vegetated filter strip
- 1 constructed wetland
- 1 creek bank erosion preventative

Of the three structural BMPs, two were assigned a perfect rating of 4 and one was assigned a rating of 3.

In terms of land use categories, two BMPs were located in residential/park and one was located in residential/park/agricultural. The BMPs were located in one HUC-14 area.

The structural BMP evaluation form contained a section dedicated to BMP improvement recommendations. The only recommendation was to reposition riprap. The completed structural BMP sheets, corresponding photographs, and aerial mapping of the BMP location are in Appendix H to this report.

The non-structural BMPs are listed on the form in Appendix I.

D. Potential Sites for Additional BMPs

Concentrate storm water control efforts on Young's Creek. Use BMPs that control excessive sediment inputs. These include street sweeping, construction of swales, and use of storm inlet filters. It is also important to do some stream bank stabilization to prevent excessive bank erosion.

Although problems are not quite as severe there, these same activities could be applied to good effect in the Hurricane Creek watershed. Both Young's Creek and Hurricane Creek flow through a beautiful greenway (Province Park) close to the city center, so efforts to improve water quality and reduce stream bank erosion will be highly visible and easily appreciated.

The Canary Ditch watershed currently has no major water quality problems. New construction in this watershed should take advantage of the best management practices currently available for erosion control.

BMPs that reduce sediment loading and chemicals are listed below.

<u>Street Sweeping</u>

Street sweeping is a BMP that would potentially reduce the sediment load to the two watersheds. A streetsweeping program consists of street cleaning using mechanical vehicles to reduce pollutants in stormwater runoff from street surfaces. Streetsweeping vehicles physically remove solids from impervious surfaces, therefore reducing the availability of solids and associated pollutants for pickup by runoff-generating rainfall.

Certain circumstances may permit a form of street cleaning called "street flushing," a process by which water transported by tanker trucks is used to wash accumulated debris from the street into gutters and stormwater inlets. The primary use of street flushing is in areas serviced by combined sewers, where runoff generated by flushing would be conveyed to a municipal wastewater treatment plant. Most NPDES permits for separate storm drains do not allow street flushing.

Although earlier results of the Nationwide Urban Runoff Program suggested that conventional streetsweeping had a relatively low impact on the improvement of water quality in the Midwest and eastern United States, more recent studies have found vacuum-assisted streetsweeping to be more effective. Streetsweeping using equipment based on vacuum-assisted technologies can significantly reduce pollutant washoff from urban streets. Weekly to bimonthly sweeping programs can achieve reductions of up to 80 percent in annual total suspended solids and associated pollutants.

Vegetated Swales

A vegetated swale is a broad, shallow channel with a dense stand of vegetation covering the side slopes and bottom. Swales can be natural or manmade, and are designed to trap particulate pollutants, promote infiltration, and reduce the flow velocity of storm water runoff. Vegetated swales can serve as part of a storm water drainage system and can replace curbs, gutters and storm sewer systems. Therefore, swales are best suited for residential, industrial, and commercial areas with low flow and smaller populations.

Vegetated swales can be installed wherever the local climate and soils allow the establishment and maintenance of a dense vegetative cover. The feasibility of installing a vegetated swale at a particular site depends on the area, slope, and perviousness of the contributing watershed, as well as the dimensions, slope, and vegetation in the swale system. While swales are generally used as a stand-alone storm water BMP, they are most effective when used in conjunction with other BMPs, such as wet ponds, infiltration strips, wetlands, etc. Although vegetated swales have been widely used as storm water BMPs, there are also certain aspects of vegetated swales that have yet to be quantified. Some of the issues being investigated are whether their pollutant removal rates decline with age, what effect the slope has on the filtration capacity of vegetation, the benefits of check dams, and the degree to which design factors can enhance the effectiveness of pollutant removal.

Sediment Filters and Sediment Chambers

Sediment filters are a class of sediment-trapping devices typically used to remove pollutants, primarily particulates, from storm water runoff. Sediment filters have four basic components: inflow regulation, pretreatment, a filter bed, and an outflow mechanism.

Sediment chambers are only one component of a sediment filter system.

Inflow regulation refers to the diversion of storm water runoff into the sediment-trapping device. After runoff enters the filter system, it enters a pretreatment sedimentation chamber. This chamber, used as a preliminary settling area for large debris and sediments, usually consists of nothing more than a wet detention basin. As water reaches a predetermined level, it flows over a weir into a filter bed of some filter medium. The filter medium is typically sand, but it can consist of sand, soil, gravel, peat, compost, or a combination of these materials. The purpose of the filter bed is to remove smaller sediments and other pollutants from the storm water as it percolates through the filter medium. Finally, treated flow exits the sediment filter system via an outflow mechanism to return to the storm water conveyance system.

Sediment filters may be a good alternative for smaller construction sites where the use of a wet pond is being considered as a sediment-trapping device. Their applicability is wide ranging, and they can be used in urban areas with large amounts of highly impervious area. Because confined sand filters are man-made soil systems, they can be applied to most development sites and have few constraining factors. However, for all sediment filter systems, the drainage area to be serviced should be no more than 10 acres.

<u>Vegetated Buffers</u>

Vegetated buffers are areas of either natural or established vegetation that are maintained to protect the water quality of neighboring areas. Buffer zones reduce the velocity of storm water runoff, provide an area for the runoff to permeate the soil, contribute to ground water recharge, and act as filters to catch sediment. The reduction in velocity also helps to prevent soil erosion.

Vegetated buffers can be used in any area that is able to support vegetation but they are most effective and beneficial on floodplains, near wetlands, along streambanks, and on steep, unstable slopes. They are also effective in separating land use areas that are not compatible and in protecting wetlands or waterbodies by displacing activities that might be potential sources of non-point source pollution.

Vegetated buffers require plant growth before they can be effective, and land on which to plant the vegetation must be available. If the cost of the land is very high, buffer zones might not be cost-effective. Although vegetated buffers help to protect water quality, they usually do not effectively counteract concentrated storm water flows to neighboring or downstream wetlands.

Several researchers have measured greater than 90 percent reductions in sediment and nitrate concentrations. Buffer/filter strips do a reasonably good job of removing phosphorus attached to sediment, but are relatively ineffective in removing dissolved phosphorus.

Catch Basins/Catch Basin Inserts

A catch basin (also known as a storm drain inlet or a curb inlet) is an inlet to the storm drain system that typically includes a grate or curb inlet and a sump to capture sediment, debris, and associated pollutants. They are also used in CSO watersheds to capture floatables and settle some solids. Catch basins act as pretreatment for other treatment practices by capturing large sediments. The performance of catch basins at removing sediment and other pollutants depends on the design of the catch basin (e.g., the size of the sump) and maintenance procedures to retain the storage available in the sump to capture sediment.

Catch basin efficiency can be improved using inserts, which can be designed to remove oil and grease, trash, debris, and sediment. Some inserts are designed to drop directly into existing catch basins, while others may require extensive retrofit construction.

Catch basins are used in drainage systems throughout the United States. However, many catch basins are not ideally designed for sediment and pollutant capture. Ideal application of catch basins is as pretreatment to another storm water management practice. Retrofitting existing catch basins may help to improve their performance substantially. A simple retrofit option is to ensure that all catch basins have a hooded outlet to prevent floatable materials, such as trash and debris, from entering the storm drain system. Catch basin inserts for both new development and retrofits at existing sites may be preferred when available land is limited, as in urbanized areas.

VII. CHARACTERIZATION OF WATER QUALITY DATA

A. Key Observations on Water Quality

Aquatic Community

Because they are considered to be more sensitive to local conditions and respond relatively rapidly to change, benthic (bottom-dwelling) organisms were considered to be the primary tool to document the biological condition of the streams. The U.S. EPA's "rapid bioassessment" technique, as described earlier in the report, was used to generate the IBI score for each site. The maximum value, which correlates to maximum ecological health, is 100.

Table 6: Index of Biological Integrity (IBI) Score

Site #	Site Description	IBI Score
1	Young's Creek	30
2	Hurricane Creek	13
3	Canary Ditch	40

Habitat Evaluation

The aquatic habitat at each study site was evaluated according to the method described by Ohio EPA. This method's results assigns values to various habitat parameters (e.g. substrate quality, riparian vegetation, channel morphology, etc.) and results in a numerical score for each site. Higher scores indicate higher aquatic habitat value. The maximum value for habitat using this assessment technique is 100.

Table 7: Qualitative Habitat Evaluation Index (QHEI) Score

	Site #		
Habitat Parameters	**1**	**2**	**3**
Substrate	10	8	8
Cover	6	2	2
Channel	12	8	7
Riparian	5	5	4
Pool/Riffle	11	7	7
Gradient	10	8	8
Drainage Area	11	8	7
Total	**65**	**46**	**43**

Sample Collection (Macroinvertebrates)

Macroinvertebrate samples in this study were collected on April 16, 2004. Samples were collected by kicknet in riffle areas where current speed approached 30 cm/sec. All samples were preserved in the field with 70% ethanol.

Laboratory Analysis (Macroinvertebrates)

In the laboratory, a 100 organism subsample was prepared from each site by evenly distributing the animals collected in a white, gridded pan. Grids were randomly selected and all organisms within grids were removed until 100 organisms had been selected from the entire sample. Each animal was identified to the lowest practical taxon (usually genus or species).

Data Analysis (Macroinvertebrates)

Following identification of the animals in the sample, ten "metrics" are calculated for each site. These metrics are based on knowledge about the sensitivity of each species to changes in environmental conditions and how the benthic communities of non-impacted ("reference") streams are usually organized. For example, mayflies and caddisflies are aquatic insects which are known to be more sensitive than most other benthic animals to degradation of environmental conditions. A larger proportion of these animals in a sample receives a higher score. The sum of all ten metrics provides an individual "biotic score" for each site.

The metrics used in this study were adapted from Ohio EPA. Because Ohio EPA uses a larger sample size in its macroinvertebrate protocol, some of the metrics were modified to more closely correspond to a 100 organism sample. In addition, since a separate qualitative sample was not taken, the U.S. EPA metric “% Dominant Taxon” was substituted for the “EPT Qualitative Taxa” metric used in Ohio. The following scoring values were used in this study:

Table 8: Scoring Values for Metrics Adapted from Ohio EPA and U.S. EPA RBA Protocol III

Data Category	6 points	4 points	2 points	0 points
# of Genera	>20	14 - 20	7 - 13	<7
# Mayfly Taxa	> 6	4 - 6	2 - 4	<2
# Caddisfly Taxa	> 4	3 - 4	1 - 2	0
# Diptera Taxa	>12	8 - 12	4 - 7	<4
% Tanytarsini	>25	11 - 25	1 - 10	0
% Mayflies	>25	11 - 25	1 - 10	0
% Caddisflies	>20	11 - 19	1 - 10	0
% Tolerant Species	0-10	11 - 20	21 - 30	>30
% non-Tanytarsids & non-insects	<25	25 - 45	46 - 65	>65
% Dominant Taxon	<20	21-29	30-39	>40

Aquatic Habitat Analysis

When the EPA habitat scoring technique was used, the following aquatic habitat values were obtained for each site in the study:

Table 9: Rapid Bioassessment Results for Macroinvertebrates

Macroinvertebrates	Site # 1	Site # 2	Site # 3
Chironomidae (Midges)			
Orthocladius obumbratus	58	52	5
Cricotopus bicinctus	7	10	13
C. trifascia			13
Parametriocnemus spp.	3		
Chaetochadius spp.	3	13	13
Ablabesmyia mallochi	3	7	3
Microtendipes caelum			3
Omisus spp.			10
Cryptochironomus fulvus			3
Endochironomus spp.			3
Polypedilum convictum	3		
Simuliidae (Blackflies)			
Simulium spp.	2	1	1
Tipulidae (Craneflies)			
Antocha spp.		1	

Ephemeroptera (Mayflies)			
Stenacron interpunctatum	3		
Stenonema femoratum	1		
Caenis spp.	1		11
Trichoptera (Caddisflies)			
Cheumatopsyche sp.	5		6
Hydroptilidae			1
Plecoptera (Stoneflies)			
Taeniopteryx spp.		1	
Coleoptera (Beetles)			
Stenelmis larvae	11	11	11
Berosus spp.			1
Isopoda (Aquatic Sow Bugs)			
Lirceus spp.		2	
Pelecypoda			
Corbicula fluminea		2	2
Sphaeridae			1
Total	**100**	**100**	**100**

Table 10: Data Analysis for Macroinvertebrates

Data Category	Site # 1	Site # 2	Site # 3
# of Genera	12	10	16
Mayfly Taxa	3	0	1
Caddisfly Taxa	1	0	2
Diptera Taxa	7	6	10
% Tanytarsini	0	0	0
% Mayflies	5	0	11
% Caddisflies	6	0	6
% Tolerant Species	10	17	29
% non-Tanytarsid midges & non-insects	77	86	69
% Dominant Taxon	58	52	13

Table 11: Scoring

Data Category	Site # 1	Site # 2	Site # 3
# of Genera	2	2	4
# Mayfly Taxa	2	0	0
# Caddisfly Taxa	2	0	2
# Diptera Taxa	2	2	4
% Tanytarsini	0	0	0
% Mayflies	2	0	4
% Caddisflies	2	0	2
% Tolerant Species	6	4	2
% non-Tanytarsid midges & non-insects	0	0	0
% Dominant Taxon	0	0	6
Score	18	8	24
Standardized Score	**30**	**13**	**40**

B. Conclusions from Data Analysis

<u>Aquatic Habitat</u>

Aquatic habitat index values ranged from 43 to 65. According to this scoring scheme, Canary Ditch and Hurricane Creek have generally "poor" aquatic habitat. In contrast, the habitat value of Young's Creek was relatively good.

<u>Macroinvertebrate Communities</u>

The most commonly collected species were tolerant midge larvae, especially *Orthocladius obumbratus*. Intolerant forms such as mayflies and caddisflies were rare or absent.

The normalized biotic index scores ranged from 13 to 40, which means that all sites were impacted compared to regional "reference" sites. It is interesting to note that the site with the lowest habitat score (Canary Ditch) had the highest biotic index score.

<u>Diagnosis</u>

One of the most useful aspects of biological monitoring is that we can use information on the way aquatic animals respond to different types of stress to diagnose a problem. For example, degraded biotic integrity can often be directly related to degraded habitat. Aquatic life cannot thrive where habitat is lacking and often the biotic index scores closely match the habitat scores. Sometimes, however, the biotic index scores are much lower than the habitat scores. Where this occurs, degraded water quality is usually present.

Despite having low habitat value, Canary Ditch had the highest biotic index score of the three sites examined. Its biotic index score closely matched its habitat score, indicating that water quality was generally adequate.

In contrast, Young's Creek had a biotic index score 35 points lower than its habitat score. This site had seriously degraded water quality. Excessive sediment inputs was probably the major problem, since the sediment-tolerant midge species *Orthocladius obumbratus* was by far the most common animal present.

Hurricane Creek also had some serious water quality problems, since its biotic index score was 30 points lower than its habitat score. Again, excessive sediment loading was probably the primary problem.

Stream bank erosion was severe on both Hurricane Creek and Young's Creek. Much of the excessive sediment inputs could be corrected by stabilizing the stream banks. A bioengineering technique involving establishment of a healthy stream bank plant community is recommended.

VIII. STRATEGY FOR CONTINUED CHARACTERIZATION EFFORTS

The initial testing of the MS4 waterways was completed in order to determine a baseline characterization. The goal of the testing program is to develop an assortment of structural and non-structural BMPs, along with maintaining the current BMPs, in order to reduce pollution in the waterways. Once these measures are in use, testing will continue to monitor the effectiveness on the water quality. However, the desired increase in water quality will not take place immediately. Therefore, testing will begin approximately three years after the implementation of the BMP program, allowing the watershed time to reflect the changes of the program.

IX. TASKS PRIOR TO SUBMITTAL OF STORM WATER QUALITY MANAGEMENT PLAN (SWQMP) – PART C

The main task to be completed before the submittal of the SWQMP is to create a storm water utility. The storm water utility will be responsible for implementing the SWQMP, maintaining records, enforcing ordinances, and other tasks dealing with the storm water in the MS4 area. If a new storm water utility is not a feasible solution, the existing sewer utility will be modified to incorporate the tasks of the MS4 program. A result of either creating a new utility or modifying the sewer utility is determining the source of funds to support it.

Part C of the MS4 program requires the implementation of six minimum control measures (MCMs). The MCMs are to be used to monitor the effectiveness of the program. The six minimum control measures are:

1. Public education and outreach
2. Public participation and involvement
3. Illicit discharge detection and elimination
4. Construction site storm water run-off control
5. Post-construction storm water run-off control
6. Pollution prevention/good housekeeping for municipal operations

Each of the six MCMs require certain tasks to be completed before implementation.

1. Public education and outreach

   Local government agencies such as the Soil and Water Conservation District, IDNR, and IDEM need to be identified to determine who will be able to participate in the public education programs. A few roles these agencies may play in the public education process are developing pamphlet materials for distribution and holding public meetings.

2. Public participation and involvement

   Similar to the public education and outreach MCM, local government agencies will need to be identified for coordinating public involvement events such as storm drain stenciling and stream cleaning.

3. Illicit discharge detection and involvement

   The City of Franklin will be responsible for both detecting and eliminating illicit discharges. One task will be to either revise current ordinances or develop new ordinances to provide a means for enforcing the illicit discharges. Another task will be to identify both City personnel and local government agencies to enforce the program. Detection equipment to be used in the illicit discharge control program will also need to be identified.

4. Construction site storm water run-off control

   The City of Franklin will be responsible for enforcing a construction site storm water run-off control program. Similar to the illicit discharge program, current ordinances will need to be revised and new ordinances will need to be developed in order to provide the City personnel with a means for enforcing the program. Local government agencies which will enforce the program will need to be identified.

5. Post-construction storm water run-off control

   A program will be implemented to monitor and ensure post construction run-off from new developments in meeting water quality standards. Current ordinances will need to be revised and new ordinances will need to be developed in order to provide the City personnel with a means for enforcing the program.

6. Pollution prevention/good housekeeping for municipal operations

   A program will be implemented to prevent pollution from municipal operations in the City of Franklin. Current ordinances will need to be revised and new ordinances will need to be developed in order to provide the City personnel or local government agencies with a means for enforcing the program.

Conclusion

This report has outlined the methods and data used for characterizing the MS4 area, along with drawing conclusions from the data. Part C of the SWQMP is due in January, 2005 and the report has listed several tasks that need to be completed before its submittal. The City of Franklin should continue to maintain existing structural and non-structural BMPs, with the focus being on an improvement of water quality in the receiving streams.