Sandusky River – Tiffin Watershed Action Plan

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Sandusky River - Tiffin Watershed Action Plan Endorsement

The Sandusky River Watershed Coalition would like to recognize the involvement and support of the numerous organizations and individuals who have taken part in the development of this community-based watershed action plan.

We, the undersigned, support and agree to pursue implementation of this Watershed Action Plan and agree to seek the necessary resources to improve the over all water quality in the Sandusky River-Tiffin sub watershed* and the Sandusky River Watershed.

Sandusky Co. Commissioners	Sandusky Co. Engineer	Sandusky Co. Farm Bureau
Sandusky Co. Farm Service Agency	Sandusky Co Health Dept.	Sandusky Co. NRCS
Sandusky Co. OSU Extension	Sandusky Regional Planning Comm.	Sandusky Co. Soil & Water Cons. Dist.
Seneca Co. Commissioners	Seneca Co. Engineer	Seneca Co. Farm Bureau
Seneca Co. Farm Service Agency	Seneca Co Health Dept.	Seneca Co. NRCS
Seneca Co. OSU Extension	Seneca Regional Planning Comm.	Seneca Co. Soil & Water Cons. Dist.
Ohio Department of Natural Resources	Ohio Environmental Protection Agency	Sandusky River Watershed Coalition
National Center for Water Quality Research	City of Tiffin	WSOS Community Action Commission, Inc.

Pleasant Township Board of Township Trustees	Ohio- American Water Company	Village of Republic
	City of Sandusky	

*The Sandusky River-Tiffin Sub watershed will be referred to as *SR-Tiffin* within this text.

Preface

The development of the Sandusky River – Tiffin (SR-Tiffin) Watershed Action Plan began in the fall of 2005 with funding from the Coastal Management Assistance Grant Program, through Ohio DNR. The Sandusky River Watershed Coalition, recipient of the funding, began the effort with the development of the first five chapters of text. This text provides an extensive look at the background conditions which are currently at play in the SR-Tiffin watershed. Upon completion of the initial draft of these chapters, a three month effort to collect public input was begun.

The public input effort began with the planning for a public meeting on April 20, 2006. Partners in the watershed were made aware of the meeting, which was held at Sentinel Vocational Center in Tiffin, OH. Press releases were sent to every newspaper in Seneca and Sandusky Counties to inform the public of the event as well.

Following the public meeting, a second effort was made to gather additional input. This effort was focused at agencies within Seneca County, through a visit and presentation to the Seneca Regional Planning Commission. The handouts which were available at the public meeting were also provided to the SRPC members, including the maps which are included at the end of this text. The SRPC members were also informed of, and invited to take part in the third public input opportunity.

The third opportunity for public input was a web-based survey administered from May 8, 2006 – June 10, 2006. Postcards were sent out to 400 local residents and agencies, requesting their input. Paper copies of the survey, along with postage paid return envelopes were made available to those without web access. Results of the public input sessions, as well as the handouts made available, are located in the Appendix of this text.

Public input was concluded on June 10. During the public comment period, work was done to draft the final chapters of the text. The initial draft was presented to the Steering Committee of the Sandusky River Watershed Coalition on June 15, 2006 via email. The Steering Committee was, through this effort, provided the first opportunity to read through the plan and to provide comments on its content, as well as requests for changes, which could be made before the public comment period.

Following the initial review by the State Area Assistance Team, expanded stakeholder involvement was sought. On March 9, 2007, a meeting of potential stakeholders that were missing from the original plan were invited to discuss and comment on the current plan. The addition of six endorsements to the plan were received from that meeting or subsequent one-on-one meetings with those who could not attend the March 9th meeting. Additional cooperation in the implementation of the plan has been received due to these meetings.

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All maps were developed using a GIS system and readily available data sources.

LIST OF ACRONYMS USED

Army COE	Army Corp of Engineers
AESA	Agricultural Environmental Self-Assessment
BMP	Best Management Practice
CMM	Coastal Management Measure
CMZ	Corridor Management Zone
CNPCP	Coastal Nonpoint Pollution Control Program
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CWA	Clean Water Act
CZARA	Coastal Zone Act Reauthorization Amendments
CZMA	Coastal Zone Management Act
EMZ	Emergency Management Zone
EWH	Exceptional Warmwater Habitat
FSA	Farm Service Agency
GIS	Geographic Information System
HD	Health Departments
HSTS	Home Sewage Treatment System
HUC	Hydrological Unit Code
IBI	Index of Biological Integrity
ICI	Invertebrate Community Index
LaMP	Lakewide Management Plan

LEQI	Lake Erie Quality Index
LRW	Limited Resource Water
MIwb	Modified Index of Well Being
MWH	Modified Warmwater Habitat
NASS	National Agricultural Statistics Service
NCWQR	National Center for Water Quality Research (Water Quality Laboratory)
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resource Conservation Service
OAC	Ohio Administrative Code
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
ORDAC	Ohio Rural Drainage Advisory Committee
PDWS	Public Drinking Water Supply
QHEI	Qualitative Habitat Evaluation Index
RIMP	Resource Inventory and Management Plan
RM	River Mile
SDWA	Safe Drinking Water Act
SRPC	Seneca County Regional Planning Commission
SRW	Sandusky River Watershed
SRWC	Sandusky River Watershed Coalition
STS	Sewage Treatment System
SWAP	Source Water Assessment Program
SWCD	Soil and Water Conservation District
SWPP	Source Water Protection Plan
TMDL	Total Maximum Daily Load
TSD	Technical Service Document
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WAP	Watershed Action Plan
WPCC	Water Pollution Control Center
WRP	Wetlands Reserve Program
WWH	Warmwater Habitat

Acknowledgements

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Much of the introductory and background text is from the Honey Creek WAP, thanks to Tim Loftus, Dave Baker, and the NCWQR. The previously endorsed Honey Creek WAP serves as the roadmap for the planning efforts across the Sandusky River Watershed. Its format is liberally borrowed throughout the course of this text. The desire to complete plans on a consistent and efficient basis has been the driving force for this template-based process of planning. Care has been taken to make all changes as necessary to adapt the information to the Sandusky River-Tiffin watershed while making additions as necessary. However, it is important to recognize the source of much of the content that follows in this plan.

A thank you is also in order for the Steering Committee of Sandusky River Watershed Coalition for hours of dedication and service as they work to improve our local water resources for the benefit of our community.

Thank you to WSOS Community Action Commission, Inc. for the time and effort put into administering the grant for this project and all future grants for the implementation identified in this plan.

Executive Summary – Sandusky River – Tiffin WAP

Watershed Action Plans (WAP's) are developed with the goal of positively impacting land-use practices and other implementation strategies, with the intent of improving water quality such as to meet use attainment goals as set forth by the Ohio Environmental Protection Agency. The Sandusky River Watershed Coalition has prepared the Sandusky River – Tiffin (SR-Tiffin) WAP to (1) identify the causes of water quality impairments within the watershed, (2) guide the implementation of voluntary best management practices (BMP's), and (3) minimize the impacts of sources of water quality impairments for the benefit of both the local community and downstream receiving waters.

The Clean Water Act and US Environmental Protection Agency regulations for protecting public health require that a Total Maximum Daily Load (TMDL) be developed for any waters found to be impaired for their designated use(s). Such waters are placed on the Section 303(d) list of impaired waterbodies in the US. A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. In essence, a TMDL offers a quantitative approach for developing a restoration strategy for watersheds that fail to meet full attainment of biological and chemical water quality standards (WQS). The goal of a TMDL, therefore, is full attainment of WQS and ultimately, removal of waterbodies from the Section 303(d) list.

The SR-Tiffin WAP is based on the findings and recommendations of the "Total Maximum Daily Loads for the Upper Sandusky River Watershed" report that was developed by the Ohio Environmental Protection Agency, Division of Surface Water and released in "Final Report" form on August 10, 2004. This TMDL Report addresses the results from a detailed assessment conducted by Ohio EPA in 2001 of chemical, physical, and biological conditions in order to determine if streams and rivers in the Upper Sandusky study area were attaining their designated uses. Results of the 2001 field study are reported in the "Biological and Water Quality Study of the Sandusky River and Selected Tributaries" published in 2003.

The first three chapters of the SR-Tiffin WAP provide introductory and background information on a variety of fundamental concepts. Chapter 1 introduces several aspects that concern "watershed management". Chapter 2 discusses federal, state, and regional policies that serve as a context for the multiple water resource issues that are relevant to the citizenry of the SR-Tiffin Watershed and for highlighting the importance of implementing watershed management. Chapter 3 offers an inventory of physical and social resources found throughout the SR-Tiffin Watershed.

Chapters 4 and 5 bring focus to several important water resource concepts including "Designated Uses" and "Use Attainment". Designated uses that are relevant to SR-Tiffin include Aquatic Life Support, Public Drinking Water Supply, and Primary Contact Recreation. Parts of the SR-Tiffin Watershed are in full aquatic life support use attainment. Other parts of the watershed are either in partial or non-attainment. Thus, the overall watershed assessment score based upon the aquatic life support designated use is 50 out of 100. As a result, the SR-Tiffin Watershed is deemed impaired for the aquatic life support use designation.

The method that Ohio EPA will use to evaluate attainment of recreation uses is currently under development. Ohio EPA is also developing an assessment methodology for the public drinking water supply use designation. This methodology will eventually be relevant as the surface water of SR-Tiffin yields flow to one public water supply lying within the watershed, the City of Tiffin; and also contributes to the source water of one city supply located downstream, the City of Fremont.

Causes of water quality impairment, identified by the Ohio EPA and addressed in Chapter 6, include:

1. habitat and flow alteration
2. sedimentation
3. phosphorus
4. organic enrichment and low dissolved oxygen
5. ammonia
6. nitrate
7. pathogens
8. contaminated sediment
9. sport fish consumption advisories

The Sandusky River – Tiffin offers a strategy for meeting TMDLs developed for phosphorus reductions, aquatic life habitat improvements, and sedimentation reduction. Chapter 6, "Plan for Watershed Restoration Activities," frames the implementation strategy. The WAP addresses the following water resource related problems and needs in the Sandusky River – Tiffin Watershed:

1. Problem 1 – High rates of sediment and nutrient export that impact downstream receiving waters, including Sandusky Bay and Lake Erie.
2. Problem 2 – Impaired biological communities within the streams of the SR-Tiffin Watershed due to habitat and flow alterations.
3. Problem 3 – Impaired biological communities within the streams of the SR-Tiffin Watershed due to high nutrient loads.
4. Local management effort – Household Sewage Treatment Systems.
5. Special management effort – Coastal Nonpoint Pollution Control Program.
6. Local management effort – Educational Programs.
7. Local management effort – Fundraising Programs.
8. Sandusky River – Main Stem

Each of the above issues is addressed in detail in Chapter 6. A summary of the activities recommended for implementation can be found in Chapter 6 in Table 6.13. The plan focuses on two main goals:

1. Improvement of watershed score to a goal of 80 of 100 as an interim step in improving water quality.
2. Full attainment of all designated uses by all stream segments within the watershed.

Targeting of these practices has been outlined to occur in the following order:

1. Full attainment at all sites over 30mi^2 is the first target goal for this WAP. The weight given to stations of larger drainage areas when determining watershed scores is a part of the reasoning for this approach, as it will allow for a more rapid increase of the watershed score during future assessments.
2. Full attainment of progressively smaller streams in an attempt to continue to raise the watershed score towards an ultimate goal of 100. Reaching a score of 100 is not likely, and will require at least one revision of this plan to better address issues with an even higher level of detail.

Implementation of the recommended BMP's based on the targeting as summarized in Table 6.13 will result in the attainment of additional designated uses, and ultimately, the increase of the watershed score. A portion of Table 6.13 has been reproduced below, listing all of the recommended practices as well as targeting information where applicable.

Task Description/Objectives	**Resources Required: Who, How – Current Programs, New Programs**	**Time Frame, Project Status by color (in progress, planning, concept, ongoing)****
1. Cropland BMP's		
1a. Residue Management – no till, strip till, and mulch till on an additional 12,136 acres (An increase from 55% to 80% conservation tillage).	**Who:** NRCS, SWCD, OSU-E and Producers **How/Current:** EQIP (low funding priority) **How/New:** additional multi-county staff to promote practices, field demonstrations, cost share payments of $15/acre to promote practice for first-time users, and 20% cost share on equipment purchases for non-replacement conservation tillage and planting equipment.	2007-2012
1b. Cover and Green Manure Crops for an additional 9,216 acres of cropland throughout the watershed.	Who: NRCS, SWCD, OSU-E and Producers How/Current: EQIP (low funding priority) How/New: additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP, grant to fund at the rate of at least $15 per acre. Model project – Upper Broken Sword Cover Crop Project, funding through National Fish and Wildlife Foundation.	2007-2012
1c. Field Border establishment protecting 6,144 acres of cropland	Who: FSA, NRCS, SWCD, OSU-E and Landowners How/Current: CRP How/New: additional multi-county staff person to work with farmers and promote benefits of BMP	2007-2012

	implementation in the context of the WAP, grant to fund conservation easements at a rate of $3,000/acre.	
1d. Conservation Crop Rotation to include an additional 800 acres of wheat and 200 acres of hay	Who: SWCD, NRCS, OSU-E and Producers How/Current: Communication effort to promote benefits of inter-seeding and double-cropping. How/New: additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP, grant to fund at a rate of at least $15 per acre	2007-2012
1e. Nutrient Management – new Nutrient Management Plans on 10,000.	Who: NRCS, SWCD, OSU-E, Producers and Farm Service Dealers How/Current: EQIP, communication effort to promote benefits of precision agriculture. How/New: additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP.	2007-2012
1f. Waste management, manure – target four existing animal feeding operations, and 90% of new or expanding operations have CNMP's developed.	Who: NRCS, SWCD, OSU-E and Producers How/Current: EQIP, communication effort by manure management specialist. How/New: Grant to fund at average rate of $20,000 per operation.	2007-2012
1g. Water and Sediment Control Basin to collect runoff from 500 new acres.	Who: SWCD, NRCS, OSU-E and Landowners How/Current: None. How/New: Grant to fund at cost of $10,000	2008-2012
1h. Implementation of two livestock exclusion and alternative watering facilities. Implementation of 4 grazing plans, conversion of 200 acres of cropland to permanent management intensive grazing systems.	Who: Seneca SWCD, NRCS and Producers How/Current: How/New: EPA SS 319 to fund at 60% cost share.	2007-2009
1i. Tile main replacement, four demonstrations.	Who: Seneca SWCD and Landowners How/Current: Landowner funding How/New: Unknown source of cost share dollars to fund at 30% (or higher) cost share.	2007-2010
1j. Waterway Repair – fifteen redline waterways	Who: Seneca SWCD and Landowners How/Current: None How/New: GLBP Soil Erosion and Sediment Control, or other sources to fund at 50% cost share.	2007-2012
1k. N Buydown Program – payments to reduce N application rates.	Who: Seneca SWCD, Producers and Farm Service Dealers How/Current: None How/New: Conservation Innovation Grant	2007-2010

1l. Soil Testing	Who: Seneca SWCD, Farm Service Dealers and Producers How/Current: Producer covers cost. How/New: 25% cost share for increased density and frequency of soil tests.	2007-2010
Task Description/Objectives	**Resources Required: Who, How – Current Programs, New Programs**	**Time Frame, Project Status by color (in progress, planning, concept, ongoing)**
2. Streamside BMP's		
2a. Filter Strip – establish on an additional 20% of streams; emphasis on first and second order streams.	Who: FSA, NRCS, SWCD, OSU-E, Pheasants Forever and Landowners How/Current: CRP, Lake Erie CREP, conservation easements. How/New: additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP	2007-2012
2b. Riparian Forest Buffer – contribute to 20% overall increase as listed above, but with emphasis on third order streams and urban residential areas.	Who: FSA, NRCS, SWCD, OSU-E, ODNR-Ohio Scenic Rivers Program and Landowners How/Current: CRP, Lake Erie CREP, WRP, Clean Ohio Fund, conservation easements. How/New: additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP. Urban specialist to work with urban landowners to promote riparian protection.	2007-2012
2c Wetland Development or Restoration on 500 new acres, to include reconnecting streams with floodplains.	Who: FSA, NRCS, SWCD, OSU-E, Landowners How/Current: CRP, Lake Erie CREP, WRP, Clean Ohio Fund, conservation easements. How/New: additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP. Partnership with DU and other conservation agencies.	2007-2012
2d. Livestock Restriction (access to streams) at 10 sites.	Who: NRCS, SWCD, OSU-E and Producers How/Current: EQIP, communication effort to promote rotational grazing. How/New: additional multi-county staff to work with farmers and promote benefits of BMP implementation in the context of the WAP, grant to	2007-2012

	fund at rate of $5,000 per site.	
2e. Riparian conservation contracts/easements.	Who: Black Swamp Conservancy, SRWC ODNR-Ohio Scenic Rivers Program and Landowners How/Current: Tax credits. How/New: ?	2007-2012
Task Description/Objectives	**Resources Required: Who, How – Current Programs, New Programs**	**Time Frame, Project Status by color (in progress, planning, concept, ongoing)**
3. Point Source Controls		
3a. Reduce point source loads at waste water treatment plants.	Who: Ohio EPA, City of Tiffin WPCC and Village of Republic Administrator How/Current: NPDES How/New: ?	2007-2012
2b. Reduce point source loads from point sources in SR-Tiffin watershed	Who: Ohio EPA, City of Tiffin Engineer & WPCC and Village of Republic Administrator How/Current: NPDES How/New: ?	2007-2012
Task Description/Objectives	**Resources Required: Who, How – Current Programs, New Programs**	**Time Frame, Project Status by color (in progress, planning, concept, ongoing)**
4. Residential/Urban BMP's		
4a. Demonstration of urban stormwater control practices (e.g. rain garden, rain barrel, impervious surfaces). Can be tied into Phase II requirements for Tiffin.	Who: City of Tiffin WPCC, SRWC, Heidelberg College, and NCWQR How/Current: none How/New: SS 319 Grant, Lake Erie Protection Fund, National Science Foundation Grant	2008-2010
4b. Alternative HSTS technology demonstrations	Who: Seneca & Sandusky HD's How/Current: none How/New: Foundation or other funding source to cost share on installation of new system types.	2008-2010
4c. Educational campaign on landscaping and yard maintenance in urban areas –	Who: Seneca SWCD, Seneca HD, City of Tiffin WPCC, SRWC How/Current: none	2007-2009

focus on streamside properties.	How/New: LEPF, Private Foundations.	
4d. Improved implementation of BMP's during construction of new structures.	Who: City of Tiffin Engineers Office How/Current: Enforcement of City, State, and Federal Regulations. How/New: Enforcement of City of Tiffin Storm Water Management Plan, stemming from EPA Phase II and assessment of construction related pollution.	2008-2010
4e. Development of GIS data layer with HSTS and drinking water well information	Who: County HD, SRWC How/Current: HD staff time, non priority project vs. enforcement. How/New: LEPF	2007-2008
4f. General Public education program – media and print program to educate landowners on how to reduce impacts on water quality.	Who: SRWC, City of Tiffin WPCC How/Current: Education Committee How/New: Funding for watershed video, Storm Water Management Plan Education and Outreach	2007-2009
4g. Conduct a Storm Drain Stenciling Program to identify drains as direct runoff to local waters.	Who: City of Tiffin WPCC, Boy Scout Troop #444, Village of Republic How/Current: City of Tiffin WPCC Budget How/New: ?	2007-2026
Task Description/Objectives	**Resources Required: Who, How – Current Programs, New Programs**	**Time Frame, Project Status by color (in progress, planning, concept, ongoing)**
5. Instream BMP's		
5a. Alternative Ditch Design Demonstration Project	Who: SRWC, Seneca SWCD How/Current: none How/New: EPA SS 319, LEPF	2008-2012
5b. Study of potential Fish passage structure implementation/dam removal	Who: City of Tiffin, SRWC, ODNR-Ohio Scenic Rivers Program, Army COE How/Current: none How/New: Army COE funding, EPA SS 319	2010-2015
5c. Study socio-economic effects of removal of Bacon's Dam	Who: City of Tiffin, SRWC, ODNR-Ohio Scenic Rivers Program, Landowner, Pioneer Mill Restaurant patrons How/Current: 319 Funding How/New: Army COE funding	2010-2015
5d. Stream signage/navigation project	Who: SRWC – Education Committee How/Current: LEPF, Div. of Watercraft	2010-2015

	How/New: ?	
6. Data Collection		
6a. Collection of additional data in urban areas.	Who: Ohio EPA, SRWC, ODNR-Ohio Scenic Rivers Program and Volunteer Monitors How/Current: Ohio Scenic Rivers Program on-going and historic monitoring How/New: TMDL quality assessment of sites on tributary streams within City of Tiffin	2007-2009
6b. Collection of data on Spicer Creek and Sugar Creek	Who: Ohio EPA, SRWC and Volunteer Monitors How/Current: None How/New: TMDL quality assessment of sites on these streams.	2007-2009
6c. Collection of data on streams and ditches not sampled for in TMDL monitoring	Who: Ohio EPA, SRWC, Volunteer Monitors How Current: None How New: ?	2007-2009

It is important to note that the watershed plan addresses both the small tributary streams within the watershed, as well as the main stem of the Sandusky River from Honey Creek to Wolf Creek. The main stem of the Sandusky River currently meets all designated uses, and as a large river unit, is analyzed on its own.

Successful implementation of the WAP will require, above all else, willing landowners with a desire to participate in practices meant to improve water quality. Furthermore, additional staff and funding will be necessary for increased implementation of currently available programs, as well as implementation of new concepts. Cooperation from state and federal agencies will also be critical, as these agencies have the ability to control the rules which impact the feasibility of implementation of many practices. Allowing landowners, especially on agricultural lands, to participate in programs while protecting these landowners, both through insurance programs as well as through the maintenance of their cropping history, will be critical to the adoption of new agricultural BMP's. In rural residential and urban areas, the support of local government will be critical to getting landowners to buy into new practices and ideas.

The WAP closes with Chapter 7, Monitoring and Evaluation, and recommends evaluation activities to include:

1. Chemical Water Quality Monitoring
2. Biological Water Quality Monitoring
3. Tracking BMP adoption and implementation

CHAPTER 1
INTRODUCTION

What is a watershed?

A watershed is most often topographically defined and includes an area of land that contributes surface runoff to a single and common point along a river; typically its mouth. The outlet for a watershed can be another river, lake, wetland, or the ocean. Watersheds are variable in size and can range from a small area within one's back yard to that of the Mississippi-Atchafalaya River Basin, the largest river basin in North America, draining an area of 3.2 million square kilometers, or about 41% of the lower 48 United States. Thus, watersheds at the smallest scale are typically nested hierarchically within larger watersheds. The SR-Tiffin Watershed map (Map 1) illustrates this concept for SR-Tiffin as it is shown nested within the larger Sandusky Basin. The Sandusky Basin lies within the still larger Lake Erie basin incorporating parts of five states and the Canadian Province of Ontario. SR-Tiffin can also be subdivided into smaller sub watersheds. Map 1 illustrates this later concept by differentiating between the six Hydrologic Unit Code – 14 (HUC – 14) sub watersheds that collectively comprise the SR-Tiffin Watershed.

What is watershed management?

Watershed management is an adaptive process of collaborative decision-making that is typically driven from either the bottom up, by local concern for the sustainable use of a highly valued natural resource, and/or from the top down, by federal and state laws that are designed to safeguard a resource. Watershed management can be comprehensive in scope, but at a minimum seeks to maintain or restore the chemical, biological, and physical integrity of water resources while safeguarding the economic good of the local communities involved. This socio-political process is concerned with matters of water quality and water quantity and the impact of both on public health and well being.

The watershed provides a planner with a hydrologic area of study, an appropriate physical context for implementing land use planning and ecosystem management, and an area that lends itself better to understanding the relationships between natural and manmade phenomena and water quality. The watershed as a planning and management unit is also beneficial to promoting inter-agency coordination and data availability. The watershed can serve to focus alignment of policies and strategies for surface and groundwater resources management. The alignment of state water resource programs by watershed and need for both intra- and interagency cooperation, have been identified as an issue of strategic importance. Thus, achieving environmental objectives regarding Ohio's surface and groundwater requires addressing the strategic need for watershed management.

What is a watershed action plan?

A watershed action plan (WAP) provides for an accounting of natural resource management objectives, including problems and concerns, and activities that watershed residents will pursue to address their objectives. A WAP is the product of a dynamic process of engagement by the watershed citizenry and other interested parties and serves as a guide for the local implementation of conservation efforts (i.e. watershed management). Figure 1.1 illustrates "Implementing the Watershed Approach" as adopted by the Ohio Environmental Protection Agency (OEPA, 1997).

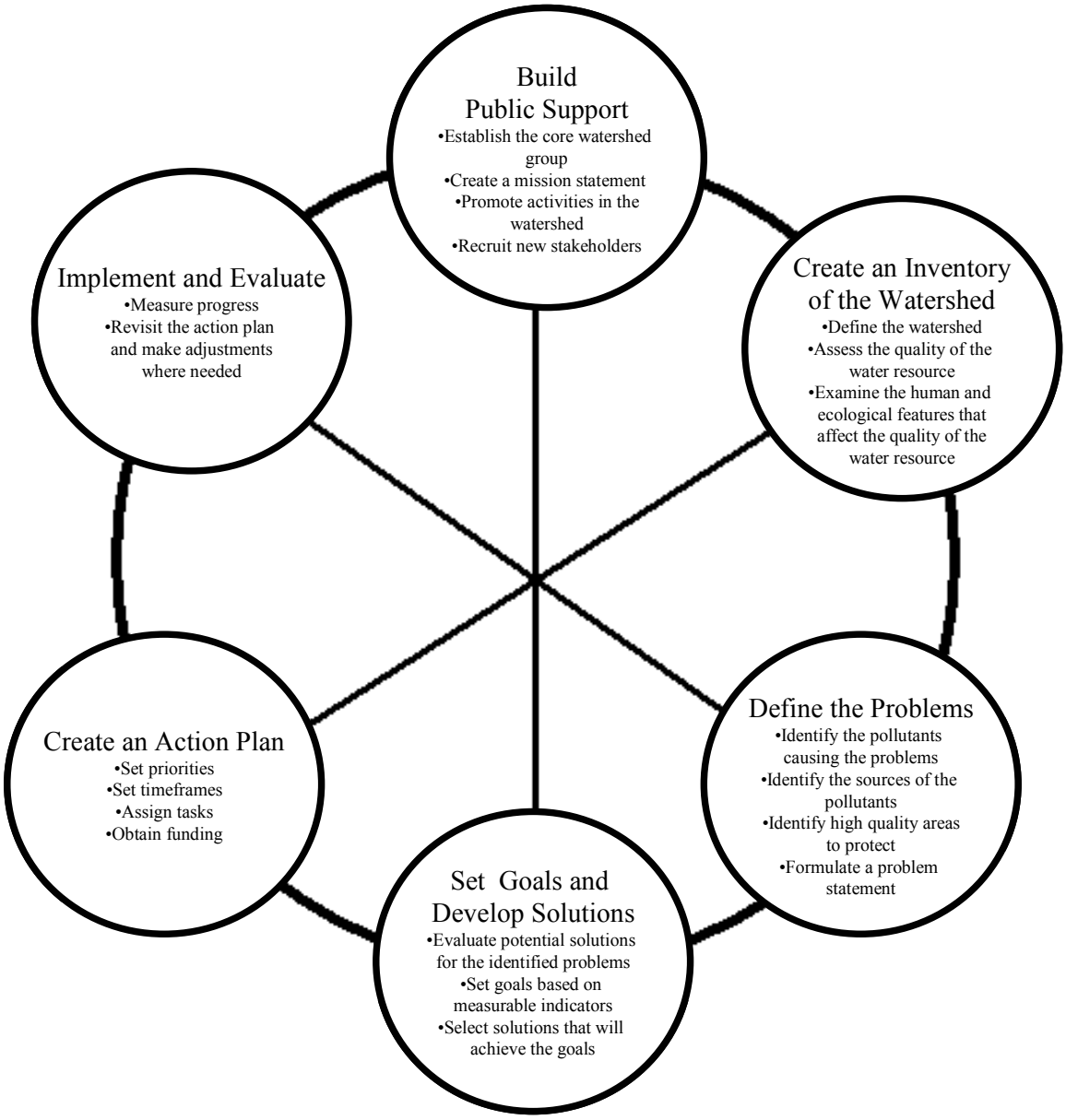


Figure 1.1 Implementing the Watershed Approach (OEPA, 1997)

The Sandusky River – Tiffin Watershed

The Sandusky River – Tiffin Watershed is the name given to the 116.7 square mile watershed that drains much of central Seneca County. Map 1 depicts the location of the watershed within Seneca County. The watershed includes the City of Tiffin and the Village of Republic. The watershed is identified by a unique hydrological unit code, 04100011-090. A detailed inventory of the watershed will be presented in Chapter 3.

Purpose of the SR-Tiffin Watershed Action Plan

The general purpose behind development and implementation of a WAP is to achieve environmental objectives, including public health, regarding Ohio's surface and ground water resources. Watershed action plans guide implementation strategies that are designed to produce water quality improvements in accord with the common water quality goal: a statewide average watershed assessment score of 80 by the year 2010. Since each watershed is unique, a WAP that is specific to an individual watershed is necessary for achieving local goals and objectives. Local participation and approval are also necessary in order to fully account for the local nature of issues and for both the planning process and resulting WAP to possess legitimacy among the watershed residents.

The SR-Tiffin WAP is based on the findings and recommendations of the "Total Maximum Daily Loads for the Upper Sandusky River Watershed" report that was developed by the Ohio EPA, Division of Surface Water, and released in "Final Report" form on August 10, 2004. This TMDL report addresses the results from a detailed field assessment conducted by the Ohio EPA in 2001 of chemical, physical, and biological conditions in order to determine if streams and rivers in the Upper Sandusky study area were attaining their designated uses. Results of the 2001 field study are reported in the "Biological and Water Quality Study of the Sandusky River and Selected Tributaries" published in 2003.

SR-Tiffin Watershed Public Participation

At the outset of the SR-Tiffin Watershed planning process, the Sandusky River Watershed Coalition made a conscious effort to reevaluate its methods of attaining public input regarding the planning process. Watershed planning is a dynamic process, and those lessons learned from the development of the Honey Creek Watershed Action Plan were applied to the development of this plan. In an attempt to test alternative methods of public involvement, the Coalition has decided to attempt alternative methods of outreach and consensus building. Details regarding the outreach efforts and their effectiveness will be related in Chapter 5 and Appendix 3.

Regulated entities within the watershed, municipal wastewater treatment plants and public water suppliers, have been invited to participate in the watershed action planning process. The City of Tiffin has produced source water assessment plan. The City of Tiffin and the Village of Republic public water suppliers, and others from across the watershed, were invited to a meeting in

2004, hosted by the Coalition and Ohio EPA, and were encouraged to develop source water protection plans with the potential for funding support from Section 319 grant money. To date, none of the public water suppliers have taken the initiative to develop a source water protection plan. Such plans may still be developed some day as either a component of the WAPs or as complementary stand-alone documents. In either event, the Coalition will continue to communicate with these regulated entities to take advantage of any opportunities for collaboration and strengthening partnerships.

Sandusky River Watershed Coalition

The Sandusky River Watershed Coalition, referred to hereafter as the Coalition, is a community-based organization that strives to promote local involvement in resource stewardship and development of watershed action plans as guidance for such stewardship. Founded in 1997, the Coalition is a venue through which a large number of local organizations, government agencies, and private citizens can coordinate activities and share information. A full-time watershed coordinator was hired in 2001 to facilitate achievement of Coalition objectives. This staff was one of the first year recipients of the Ohio Department of Natural Resources' Watershed Coordinator Grants. Continued support for the watershed coordinator's position depends on the ability of the Coalition to secure additional funding.

The Coalition is organized around a membership that includes both individuals and organizations. Membership dues are paid each year through either a cash donation or a time commitment. A complete list of members can be found in Table 1.1 or on the Coalition's website, www.sanduskyriver.org . From the membership, representatives are elected to two-year terms on a steering committee. The steering committee includes representatives from select counties within the watershed as well as at-large members. In addition, six subcommittees exist within the Coalition. These working groups each elect a chair every two years as well. The chair serves on the steering committee. Ex-officio members of the steering committee consist of government personnel who are not in a position to cast a vote and others who are included as seen fit by the steering committee. Monthly public meetings are held by the steering committee to guide Coalition activities. The Coalition is governed by a set of by-laws that are also available for review on the web at http://www.sanduskyriver.org/watershed/index.php?page=Committees/Steering+Committee/ . Scroll down to the bottom of this webpage and click on "By-Laws.doc".

Table 1.1 Steering Committee of the Sandusky River Watershed Coalition

Seat	Election Year	Most Recent or Current Representative*
Crawford County	Odd Years	Don Fishpaw, Crawford Co. SWCD
Erie County	Odd Years	Breann Hohman, Firelands

		Coastal Tributaries Watershed Coordinator
Hardin/Marion County	Even Years	James Naus, Resident Farmer
Sandusky County	Even Years	Joe Perry, Sandusky Co. SWCD
Seneca County	Even Years	James Bailey, Resident
Wyandot County	Odd Years	Phil Herring, Resident Farmer
At-Large #1	Even Years	Chris Schimpf, Resident Farmer
At-Large #2	Even Years	Paul Harrison, SRPC
At-Large #3	Odd Years	Holly Gates, Seneca Co. Farm Bureau
At-Large #4	Odd Years	John Crumrine, Seneca Co resident
Agriculture Committee	Odd Years	Tia Rice, Seneca Co. SWCD
Education Committee	Odd Years	Bob Vargo, ODNR DNAP
Development Committee	Even Years	James Bailey, Resident
Stream Flow & Habitat Committee	Even Years	Dave Baker, Heidelberg College NCWQR
Wastewater Committee	Even Years	Kate Siefert, Crawford Co Health Dept.
Water Supply Committee	Odd Years	Stu Smith, Ground Water Science
Ex-officio	None specified	Multiple individuals

*Provided as general information on the diversity of the steering committee.

In February 2000, the Coalition published the *Sandusky River Watershed Resource Inventory*. Following the completion of this document, the Coalition developed and published a management plan. The management plan was merged with the inventory to produce the *Sandusky River Watershed Resource Inventory and Management Plan,* or RIMP. The RIMP focused on the entire 1,884 square mile Sandusky watershed, including the Sandusky Bay basin, and was distributed in November, 2001 after a series of meetings were strategically held throughout the entire Sandusky Basin. During this time of outreach, a concerted effort was made to engage the diversity of interests and other stakeholders to participate in the planning process and ultimate stewardship of Sandusky Basin resources.

The eleven-chapter RIMP provides a considerable amount of information for a large-scale watershed, but lacks the detail necessary for implementing specific measures focused on sub watersheds. The RIMP was also produced prior to an important update, Appendix 8 Update, to state guidance for developing local WAPs. To enable development of WAPs on a more localized scale, the Coalition began the process of sub watershed planning in 2003, focusing first on the Honey Creek and Broken Sword watersheds. This process received initial funding through a Lake Erie Protection Fund grant awarded to the NCWQR in January, 2004. Funding requests for additional planning efforts have been directed to both private foundations as well as government agencies since

the awarding of the initial planning grant. The completion of each new WAP is dependent on both local acceptance and state endorsement. Furthermore, continued support for the watershed coordinator's position depends on the ability of the Coalition and its partners to secure additional funding that aims to fulfill the Coalition's mission.

Mission Statement: We are a diverse group of individuals and organizations that provides leadership for the conservation and enhancement of the Sandusky River watershed and its natural resources through community-based planning, education, and action.

CHAPTER 2
POLICY ENVIRONMENT

Two significant federal acts of legislation are at the heart of multi-institutional efforts to implement a watershed approach for protecting or improving our nation's waters:

1) the Federal Water Pollution Control Act Amendments of 1972 (aka, the Clean Water Act; Public Law 92-500), and
2) the Safe Drinking Water Act of 1974 (Public Law 93-523).

Additionally, a third piece of legislation is significant for SR-Tiffin, all other assessment units within the Sandusky Basin, and other watersheds that lie within a coastal zone: the Coastal Zone Management Act, signed into law in 1972. All three federal laws have been amended at least once since their enactment in the 1970's. In communion with federal law, several state laws and programs are also relevant to watershed planning and will be addressed below along with regional and local initiatives that have some bearing on land use activities within SR-Tiffin.

Clean Water Act (CWA)

Programs of importance that are products of the CWA include the Total Maximum Daily Load (TMDL) program, Section 319 nonpoint source management programs, and a permit system called the National Pollutant Discharge Elimination System (NPDES) that includes the Storm Water Program to name just a few that have relevance to SR-Tiffin.

The TMDL program, section 303(d) of the CWA, is a regulatory mechanism for reducing both nonpoint source and point source pollution in watersheds throughout the country. A TMDL is essentially a pollutant budget for restoring impaired water bodies (e.g. streams, lakes) in order that they may fully attain their designated use(s). Regulations that the US Environmental Protection Agency (USEPA) set forth in 1985 and amended in 1992 remain in effect for the TMDL program.

The State of Ohio, much like all other states, is compelled by law to assess the quality of state waters relative to their designated use(s), identify waters that are impaired for one or more of their designated uses, and develop a TMDL for remedial action where appropriate. The "Total Maximum Daily Loads for the Upper Sandusky River – Final Report" is a product of this program, has been developed by the Ohio Environmental Protection Agency (OEPA), and has relevance to residents of SR-Tiffin. The SR-Tiffin WAP presented here intends to incorporate that data and present a strategy for addressing identified impairments. Additional details of the TMDL for SR-Tiffin are presented below.

When the CWA was reauthorized by the Water Quality Act of 1987, new emphasis was placed on the importance of controlling nonpoint sources of pollution. Section 319 of the CWA compels states to identify waters that are

threatened by nonpoint sources of pollution and develop programs to reduce and eliminate this type of "poison runoff". The State of Ohio is updating their nonpoint source pollution program as discussed below.

Section 319 also serves as a significant source of federal funding, channeled through the states, for programs (e.g. BMP adoptions) that are designed to reduce nonpoint source pollution. There is reason to believe that a state-endorsed WAP will be a requirement for eligibility to this source of funding support. Pollution reduction strategies outlined in Chapter 5 should be designed in such a way as to facilitate the application for and approval of future Section 319 grants.

The NPDES Storm Water Program has been implemented in two phases. Phase II, whose Final Rule was published in the Federal Register on 8 December 1999 (64 FR 68722), expands the Phase I program by extending pollution control expectations to smaller municipal separate storm sewer systems (MS4s) and operators of small (i.e. 1-5 acres) construction sites. Cities including Tiffin, Bucyrus, and Fremont, all within the Sandusky Basin, are expected to be designated MS4s under Phase II. Their final notification of their status should be received from OEPA in 2006.

Expectations for pollution control center on implementation of programs and practices to control polluted storm water runoff through the use of NPDES permits. The Phase II program approach attempts, among other matters, to facilitate and promote watershed planning and to implement the storm water program on a watershed basis (USEPA, 2000). Storm water management, therefore, will play an increasing important role in both the planning and implementation of watershed action plans that aim to remediate impaired waterbodies.

Safe Drinking Water Act (SDWA)

The SDWA created a federal program to monitor and improve the safety of the nation's drinking water supply. The SDWA authorizes the USEPA to set and implement drinking water standards to protect against both naturally occurring and man-made contaminants in public drinking water. The roots of Ohio's Source Water Protection Plan, a program to assist public water suppliers with protecting their sources of drinking water (streams and aquifers) from contamination, can be traced back to the SDWA.

Ohio's Source Water Protection Program addresses public water systems only and features two phases. The first phase is an assessment phase that involves delineating the area in need of protection, identifying the potential contaminant sources in that area, and determining the susceptibility of the source(s) of drinking water. The Ohio EPA reports that this phase was better than 99% complete for Ohio's community public water systems by January 2004. The second phase, just getting underway, involves developing and implementing a local drinking water source protection plan. This second phase is to be led by the public water system owner/operator with assistance from others including local watershed groups. It makes sense for these source water protection plans to be integrated into watershed action plans as both strive to protect the vital

water resources necessary for human health, ecosystem health, and a healthy economy.

In the SR-Tiffin watershed, both the Village of Republic and the City of Tiffin draw on surface water as a raw source of drinking water. Water quality criteria established in Ohio Administrative Code for a public water supply apply within 500 yards of an intake. Both the Village of Republic and the City of Tiffin have each completed a drinking water source assessment and are now encouraged to develop local protection plans. Coalition efforts at developing a SR-Tiffin WAP will be of great benefit to protection of drinking water sources and will work with both municipalities as appropriate to protect this critical water resource.

Coastal Zone Management Act (CZMA)

The Coastal Zone Management Act of 1972 (Public Law 92-583) established a voluntary national program within the Department of Commerce to encourage coastal states, including Ohio, to both develop and implement coastal zone management plans. This policy represents a unique federal-state partnership and was devised for purposes of conserving the high-value coastal zone resources for present and future generations.

As part of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA), Congress created a stand-alone provision to recognize the impacts of nonpoint source pollution on coastal water quality. Named after its placement within these amendments, Section 6217 requires that states and territories with approved coastal management programs develop a Coastal Nonpoint Pollution Control Program (CNPCP). The Ohio CNPCP is administered by the Ohio Department of Natural Resources (ODNR) Division of Soil and Water Conservation.

The CNPCP must be submitted to USEPA and the National Oceanic and Atmospheric Administration (NOAA) for approval and be implemented through changes to both the existing state coastal management program and the new nonpoint source management program that stems from Section 319 of the CWA. Within these state programs, management measures must be specified for restoring and protecting coastal waters from specific categories of nonpoint source pollution.

Management measures are defined in Section 6217 of the CZARA as "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives." Watershed action plans developed for the Ohio Lake Erie Basin, such as presented here for SR-Tiffin, must describe how the relevant management measures of the Ohio CNPCP will be implemented within the specific watershed if a watershed inventory or identified water quality impairments indicate applicability. Management measures must also be addressed in order for the State of Ohio to gain approval for its Coastal Nonpoint Source Pollution Control

Program. Details regarding the relevant management measures are offered in Chapter 6 – Plan for Restoration Activities.

Ohio Nonpoint Source Management Plan

The State of Ohio's new Nonpoint Source (NPS) Management Plan 2005 – 2010 was approved by the USEPA on August 29, 2006. The last comprehensive Ohio NPS Management Plan approved by the USEPA was produced in 1988 and guided by the CWA Amendments of 1987. Updates prior to this earlier plan were developed and appended in 1993 and 1998.

Ohio's Nonpoint Source Management Plan as accepted focuses on five main sections being: Targets, Planning, Solutions, Funding and Quick Links.

The development and implementation of watershed action plans is a key ingredient of state NPS management plan and include all five priorities of the management plan with a localized focus on the planning and implementation efforts. Watershed action plans are to provide science-based, community-led, and sustainable efforts. Throughout the SR-Tiffin WAP the focus of the Ohio Nonpoint Source Management Plan will be defined in greater detail.

Lake Erie Protection & Restoration Plan

While neither a law nor regulatory mechanism, the Lake Erie Protection & Restoration Plan is nonetheless the State of Ohio's blueprint for Lake Erie's future and guidance document for achieving the goals and objectives set forth in a companion piece, the Lake Erie Quality Index (LEQI) < http://www.epa.state.oh.us/oleo/reports/leqi/leqi2004/leqiz.htm >. As noted above, SR-Tiffin is situated within the Lake Erie Watershed. Land use activities within SR-Tiffin, therefore, have a direct impact on Lake Erie.

Having released the Second Progress Report in September, 2004, the Lake Erie Protection & Restoration Plan proposes the implementation of 84 strategic actions for improving the environment, recreational opportunities, and economy of the Lake Erie Watershed. These strategies are grouped under ten areas that address water quality, pollution sources, habitat, biology, coastal recreation, boating, fishing, beaches, tourism, and shipping. While many of these areas are not directly relevant to life in the SR-Tiffin Watershed, some are. Several of the strategies having to do with water quality, pollution sources, habitat, and biology will have an impact on State views and expectations of land use activities within SR-Tiffin and the other sub watersheds of the Sandusky Basin.

For example, one of the strategies found under the Pollution Sources category states, "Increase from 52% to 80% the percentage of agricultural acreage in the Lake Erie Watershed under conservation tillage practices by 2010." This is one of four strategic actions that are designed to meet the strategic objective of reducing agricultural sediment loading from the Lake Erie Watershed by 67%. Thus, conservation tillage, establishing buffers along 80% of Lake Erie watershed ditches, streams, and tributaries, and other Protection and Restoration Plan actions will be achieved by local and related efforts that seek to reduce sediment and phosphorus loadings to SR-Tiffin.

Another strategic action of the Lake Erie Protection & Restoration Plan calls for reforesting riparian corridors and marginal agricultural acreage, floodplains, and wetlands using a variety of existing programs. This action is compatible with the need to reestablish and reconnect riparian corridors in SR-Tiffin. There are other examples where goals of the SR-Tiffin WAP and the Protection and Restoration Plan are complementary. Recommendations in this WAP that address the requirements of improving water quality in SR-Tiffin will, therefore, satisfy other State initiatives such as the Lake Erie Protection & Restoration Plan. To learn more about the Lake Erie Protection & Restoration Plan, please visit their website:
http://www.epa.state.oh.us/oleo/reports/lepr/lepr2/secondreport.html

Lake Erie Lakewide Management Plan (LaMP)

The Lake Erie Lakewide Management Plan (LaMP) provides a structure for the people of the United States and Canada to address environmental and natural resource concerns, coordinate research activities, pool resources, and make joint commitments to improving the environmental quality of our shared resource: Lake Erie (Lake Erie LaMP Work Group, 2004). An excerpt from this binational effort clarifies why the Lake Erie LaMP, updated yearly, is important to the residents of SR-Tiffin:

> The environmental integrity of Lake Erie is dependent not only on various characteristics and stressors within the lake itself, but also on actions implemented throughout the Lake Erie watershed and beyond. Urban sprawl, shoreline development, climate change, the introduction of exotic species, the exploitation and destruction of natural lands and resources, the dominant agricultural and industrial practices within the lake basin, and long-range transport of contaminants from outside the basin all impact the health of Lake Erie.

The Lake Erie LaMP identified land use practices as the dominant management category affecting the Lake Erie ecosystem. For agricultural land use, the Lake Erie LaMP calls for continuing reductions in the use of conventional tillage, agricultural chemicals and fertilizers. Specific watershed targets are to be established for securing, protecting, and restoring natural lands. Phosphorus exports from non-point sources, including agricultural land use, is to be very strongly reduced for purposes of favoring recovery and maintenance of healthy aquatic communities in the immediate receiving waters such as Sandusky Bay. Sewage treatment plants may be expected to improve upon their previously achieved phosphorus load reductions.

The Upper Sandusky TMDL calls for sewage or wastewater treatment plants in Attica, New Washington, and Bloomville to reduce phosphorus concentrations that are currently elevated and identified as one cause of aquatic life impairment within the Sandusky River Watershed. Thus, pollutant reductions

from both point and non-point sources will simultaneously achieve local and regional initiatives that are complementary to one and another.

To learn more about the Lake Erie LaMP, readers are encouraged to visit this website: http://www.epa.gov/glnpo/lakeerie/2004update/index.html

Balanced Growth Task Force

The Balanced Growth Task Force of the Ohio Lake Erie Commission has produced a strategy to protect and restore Lake Erie and its watersheds for purposes of achieving long-term economic competitiveness, ecological health, and quality of life. The planning framework produced by the Task Force recommends a voluntary, incentive-based program for balanced growth in the Ohio Lake Erie basin. This framework reflects the ten guiding principles that are outlined in the Lake Erie Protection and Restoration Plan discussed above.

Throughout the Balanced Growth planning framework, a watershed approach is promoted for planning and decision-making. Furthermore, this framework includes active roles for both local and state governments in supporting local watershed planning partnerships. The essence of the Balanced Growth framework is fully compatible with watershed action plans developed at the scale of SR-Tiffin. The Balanced Growth framework offers reason to believe that new incentives for implementing locally produced watershed action plans could be enjoyed by those groups with such plans.

This new strategy gives residents of the SR-Tiffin watershed more reason to "go with the flow" and produce a meaningful action plan that will lead to greater conservation and improved quality of life. In 2005, the Coalition submitted a request to the Lake Erie Commission to develop a Watershed Balanced Growth Plan for the SR-Tiffin Watershed, however this application was not funded. To learn more about Balanced Growth in the Ohio Lake Erie Watershed, please visit the following website: http://www.epa.state.oh.us/oleo/bgi/BGIPF.pdf

Seneca Regional Planning Commission

The Seneca Regional Planning Commission released the Seneca County Comprehensive Plan Update 2001 in November of that year, referred to hereafter as the Seneca Plan. The Seneca Plan offers a vision for land use that accommodates growth and development where adequate infrastructure currently exists and protects farmland on land parcels most remote from urbanized areas and related activities. Among the thirteen future land use categories offered by the Seneca Plan, a Critical Resource category, representing 6.1% of Seneca County (21,440 acres, 5,651 of which is in the SR-Tiffin Watershed) may lend support for SR-Tiffin WAP implementation activities proposed below in Chapter 6.

The Critical Resource category of land use is defined as the 100-year floodplains throughout Seneca County. Additionally, this category includes 120-foot buffers along county streams. The Seneca Regional Planning Commission "strongly" discourages development within land areas identified as Critical Resource. While this is an important recommendation, much remains to be considered and implemented regarding current land use activities within these

Critical Resource areas and the impact of land use on the ecological integrity of rivers and streams including water quality.

The Seneca Plan offers a wealth of data, maps, and information regarding Seneca County. The Seneca Plan is both comprehensive, in the sense that it encompasses the entire county, and general insofar as it lays out a vision for the location, extent, and types of future land use. Chapter 9 of the Seneca Plan, Strategic Implementation, recommends conservation of sensitive environmental or natural areas that should lend support to the SR-Tiffin WAP. In turn, the SR-Tiffin WAP will bring a much-needed focus to a plan for conservation that emphasizes water resources protection and remediation of water quality impairments. Proponents of both plans should be able to agree that restoring the ecological integrity of SR-Tiffin will also enhance public health along with the economic viability of the region.

A similar comprehensive plan exists for Sandusky County, and will be taken into consideration when decisions are made regarding the limited number of acres within Sandusky County.

Ohio Household Sewage Treatment Regulations

Effective May 6, 2005 Substitute House Bill 231 (125th General Assembly) Chapter 3718 of the Ohio Revised Code became law required the Public Health Council to adopt new rules governing household sewage treatment systems and small flow on-site sewage treatment systems (not more than 1,000 gallons of sewage per day).

In May 2006 according to this law and as revised in Chapter 3701-29 of the Ohio Administrative Code (OAC), the Council adopted new sewage treatment system (STS) rules which became effective January 1, 2007.

The new regulations give the Ohio Department of Health statutory authority to provide oversight, support and review of the new STS rules.

The new regulations affect new and replacement systems permitted after January 1, 2007. Several system design options are available and tailored to the site based on both soil and site conditions, with options for sites with perched seasonal high water tables.

The OAC 3701-29 provides rules for NPDES permit requirements to address future discharges from a limited number of new and replacement HSTS that may be needed on sites where treatment in the soil is not feasible. The STS rules provide a means of compliance to the Clean Water Act requirements for household system discharges.

The STS rules include requirements for the operation and maintenance of HSTS as well as the management of STS residuals and the collection, transportation, disposal and land application of domestic septage.

The new STS rules will be comprehensively reviewed in three years in order to identify and resolve issues or challenges presented by the current rule language. Immediate concerns will be addressed prior to this comprehensive review period.

CHAPTER 3
SR-TIFFIN WATERSHED INVENTORY

Much of the information that might constitute a watershed inventory for SR-Tiffin is available in "The Sandusky River Watershed: Resource Inventory & Management Plan" (SRWC, 2001). The reader is referred to this document as a secondary source of important information on the watershed, its uses, and the impairments facing it.

Land Use

First, it is important to note that the SR-Tiffin sub watershed, comprised of six 14-digit sub watersheds shown in Map 1-A, encompasses the drainage area downstream from the confluence of Honey Creek (RM 43.70) to upstream from the confluence of Wolf Creek (RM 22.73), excluding the main stem. The Sandusky River main stem within this stretch will also be discussed within this plan. It is critical to note that the main stem of the Sandusky River is classified as a "Large River," with drainage of over 500 mi^2. The data from the main stem is being addressed along with the data from the tributaries as a rule that will be followed in future planning efforts. This is being completed for two main reasons. First, the complexity of drainage near the confluence of tributaries and the main stem will make implementation work with landowners almost impossible if the main stem is treated separately from its tributaries. Second, the main stem must be included in planning documents, and the best way to systematically deal with main stem impairments is in small sections, in reference with the tributaries across that section. Otherwise, one or two additional plans would need developed just for the 130-mile main stem. Where appropriate, main stem data will be separated from tributary data, to eliminate any impact the main stem may have on overall assessment scores and implementation targeting. It is the goal of this plan to include the main stem of the Sandusky River in the analysis and implementation process of this plan, without allowing the vast scale and water quality differences present in the main stem to impact the efforts undertaken on the tributary streams. The City of Tiffin, which empties much of its water into the main stem, will be of concern to this plan, and recommendations for the city will have the most direct impact on the main stem.

Land use in SR-Tiffin, Hydrological Unit Code (HUC) 04100011-090, is illustrated in Map 2, SR-Tiffin Watershed: Land Use / Land Cover. Table 3.1, on the following page, quantifies land use as distributed among the six HUC-14 sub watersheds that comprise the SR-Tiffin Watershed. The SR-Tiffin watershed drains 116.7 mi^2 or 74,690 acres. The predominant land use is agriculture (79.9%), with an emphasis on row-crop production, namely soybeans, corn, and wheat on systematically drained soils. Wooded lands account for 16.2% of the land area, and are predominately highly fragmented woodlots, isolated within the systematic county road and agricultural uses. The other land uses are urban (2.3%), wetlands (0.7%), shrub (0.6%), water (0.4%), and barren (0.1%). Table 3.2 compares the SR-Tiffin land use / land cover to that of the Sandusky River Watershed as a whole. It is important to note the different sources of data and their implications. The first column, was taken from the Sandusky River Watershed RIMP, as was the data on the Sandusky River. The middle column, labeled "SR-Tiffin (SRWC)" is based on a GIS analysis of the Land use/Land cover data

obtained from ODNR. This data, a tif. file, was transformed into a shape file, which was then analyzed based on the land use associated with the created polygons. The slight variability in the numbers is likely due to the manipulation of the data, but it is instructive to note the similarities between the two sets of numbers for the SR-Tiffin. The "SRWC" data will be used for all spatial analysis completed as a part of this WAP, and its accuracy can be determined based on its relative closeness to the figures reported in the RIMP, which are assumed as accurate.

Table 3.1 Percent Land Use / Land Cover for 14 digit HUC's*

	Morrison Creek	Sugar Creek	Sandusky (Morrison to Wolf)
Woody Wetlands	0.40%	0.19%	1.04%
Water	0.02%	0.01%	2.68%
Wetlands	0.06%	0.00%	0.61%
Evergreen Forest	0.03%	0.07%	0.08%
Commercial/Industrial/Transportation	0.31%	0.00%	0.13%
Low Intensity Residential	0.79%	0.00%	0.35%
High Intensity Residential	0.04%	0.00%	0.04%
Deciduous Forest	9.65%	0.00%	0.01%
Urban Grasses	0.16%	18.26%	7.91%
Pasture/Hay	20.16%	14.67%	12.92%
Row Crops	**68.36%**	**66.78%**	**74.24%**

	Sandusky (Honey to Morrison)	Spicer Creek	Rock Creek
Woody Wetlands	0.28%	0.79%	0.36%
Water	1.37%	0.01%	0.02%
Wetlands	0.08%	0.07%	0.02%
Evergreen Forest	0.10%	0.04%	0.05%
Commercial/Industrial/Transportation	2.75%	0.00%	0.32%
Low Intensity Residential	14.34%	0.04%	1.63%
High Intensity Residential	2.53%	0.00%	0.19%
Deciduous Forest	0.00%	0.00%	0.01%
Urban Grasses	6.16%	14.98%	12.72%
Pasture/Hay	20.25%	15.63%	17.85%
Row Crops	**52.11%**	**68.43%**	**66.83%**

*greatest land use in bold.

Table 3.2 Land Use by Percent, SR-Tiffin and Sandusky River

Land Use	SR-Tiffin (RIMP)	SR-Tiffin (SRWC)	Sandusky River
Agriculture	79.9%	83.57%	84.0%
Wooded	16.2%	11.44%	12.6%
Urban	2.3%	3.61%	1.2%
Wetlands	0.7%	0.63%	1.1%
Shrub	0.6%	-	0.5%
Water	0.4%	0.64%	0.4%
Barren	0.1%	-	0.3%

Riparian Land Use. Another statistic of interest is the comparison of land use across the watershed versus land use in the vicinities closest to a stream. Table 3.3 provides a summary of land use across the watershed, land use within 300 feet of a stream, and land use within 1 foot of a stream. It is important to notice the 25% decrease in row crops and the more than 600% increase in wetlands that occurs. The one concern regarding this data is the 1300% increase in water as a land use. The data was derived with the use of a 1-foot buffer that was used to clip the land use polygons. The presence of polygons on the land use layer, which were greater than 2 feet wide, created the water land use. This increase is only a change of just over 7%, which could likely be distributed to each of the other land uses based on their current proportions. This process would have the largest impact on row crops, increasing their land use to 44.18%. This still allows for a 22% decrease in row crops within 1 foot of the stream, and a 16% decrease within 300 feet of the stream. In combination with the 100% increase in forests within 300 feet of the stream, it is apparent that there is a tendency for forestlands to exist near streams within the watershed. The riparian land use alongside the stream channels in the SR-Tiffin Watershed is shown in both Map 5 and Map 6. It should be noted that grassed buffers along streams would be classified as agricultural land based on interpretations of satellite imagery. From the standpoint of stream habitat, wooded riparian corridors are preferred.

Table 3.3 Watershed Land Use By Proximity To Streams

Land Use	Watershed	300 ft. Buffer	1 ft. Buffer
Residential	3.15%	2.14%	1.63%
Commercial/Industrial/Transportation	0.56%	0.59%	0.54%
Forest	11.44%	22.99%	29.61%
Wetlands	0.63%	1.38%	3.86%
Water	0.63%	3.57%	8.35%
Row Crops	66.41%	50.28%	41.02%
Pasture/Hay	17.18%	19.05%	14.99%

County Stream and Ditch Maintenance Programs: An important feature of the stream network within the SR-Tiffin Watershed is that many miles of streams are under

county maintenance programs designed to assure that the streams provide adequate outlets for tile drains and conveyance of flood waters away from cropland. In some cases, what are now streams did not exist as such prior to the onset of agricultural drainage programs. Ditches were constructed to provide outlets for tile drainage and surface drainage. Maintenance can involve removal of brush and trees from stream banks, dipping out of sediments that accumulate in the stream channels, and planting of grasses on stream banks and streamside buffers. Other streams have been straightened and "ditched." In some instances levees are used to separate the stream from its floodplain.

Within the SR-Tiffin Watershed, there are about 15.08 miles of streams that are under county maintenance programs. The locations of these streams are shown in Map 4, County Maintained Ditches. For the county maintained ditches, watershed landowners are assessed fees to cover the costs of the maintenance programs. In addition to county maintained ditches, individual landowners are permitted to maintain ditches on their own. According to a recent survey of Soil and Water Conservation Districts, approximately 50% of the total streams under one form of maintenance or another, are maintained by private landowners. In essence, the stream miles as depicted in Map 4, are only half of the total miles impacted by maintenance activities, and the total maintained mileage should be considered close to 30 miles (ONDR, DSWC Survey '05).

The utility of this map also includes its use as guide for learning about nature's capacity for recreating a two-stage design after some period of time following a typical ditch maintenance routine. Alternately, this map will point towards places where a more structurally-engineered approach for creating a two-stage ditch may be pursued. Further details regarding channelization is available throughout this document, including a section which addresses the Coastal Management Measures.

Watershed Hydrography

Stream Drainage Network. The stream drainage network is illustrated in Map 3 titled, SR-Tiffin Watershed: Stream Order. This map is based on the Stream Reach 3 Files as provided by the OEPA and used in their Upper Sandusky TMDL study. In Map 3, the stream segments are color coded by stream order, using the Strahler-Horton stream order classification system (Strahler, 1952; Horton, 1945). In this system first order streams are those small streams with no tributaries. Where two first order tributaries join, a second order stream is formed. To form a third order stream, two second order tributaries must join and to form a fourth order tributary, two third order tributaries must join. Merging of a smaller or low order stream with a larger or high order stream does not change the stream order of the larger stream.

The stream order system provides a simple way to characterize the size and position of streams in a drainage network. In general, there are many more miles of low order streams than of high order streams in a drainage network. For SR-Tiffin, 54.45% of the stream miles (84.39 miles) are 1st Order streams. Each progressively larger order of streams comprises a progressively smaller percentage of the total miles of streams.

Table 3.4 – Stream length by stream order in the SR-Tiffin Watershed

Stream Order	Length (miles)	Percent of Miles
1st Order	84.39	54.45%
2nd Order	38.28	24.70%
3rd Order	16.89	16.89%
4th Order	3.97	3.97%
Total	155.00	100%

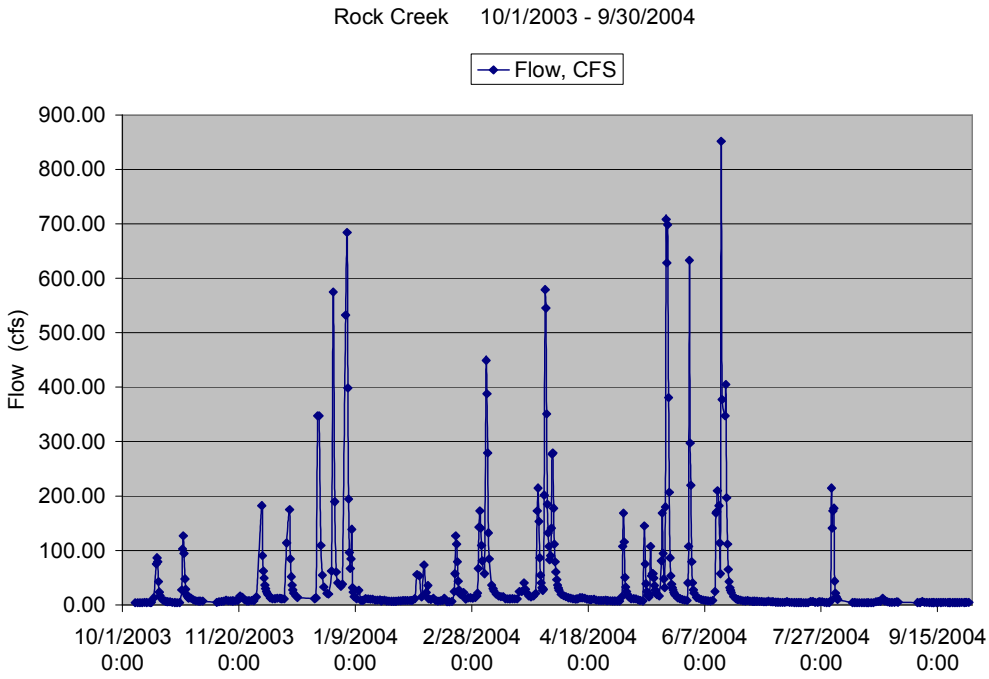
Information for the major tributaries of SR-Tiffin is shown in Table 3.5. These data are taken for the ODNR's Gazetteer of Ohio Streams (ODNR, 1960). Similar data are provided for the other tributaries of the Sandusky River drainage network in Table 3.3 of the RIMP.

Table 3.5 – Major Tributaries of SR-Tiffin as reported in the 1960 Gazetteer of Ohio Streams (ODNR 1960).

Stream Name	Length	Elevation (source)	Elevation (mouth)	Avg. Fall (ft/mile)	Drains (sq. miles)
Sugar Creek	**10.4**	**805**	**648**	**15.1**	**13.5**
Spicer Creek	**6.1**	**777**	**660**	**19.2**	**12.6**
Morrison Creek	**11**	**836**	**703**	**12.2**	**20.3**
Willow Creek	**5**	**805**	**708**	**19.4**	**5.66**
Rock Creek	**19.6**	**888**	**722**	**8.5**	**34.8**
East Branch Rock Creek	**6.1**	**920**	**807**	**18.5**	**8.2**
Armstrong & Beighly Ditch	**5.2**	**888**	**855**	**6.4**	**11.4**
Carpenter Ditch	**3**	**940**	**869**	**23.6**	**3.02**
Gibson Creek	**1.9**	**765**	**724**	**21.6**	**3.35**
Bells Run	**3.1**	**786**	**727**	**19**	**3.84**

Streamflow Characteristics. The stream flow within the SR-Tiffin watershed are documented by the USGS stream gage on the campus of Heidelberg College, which monitors Rock Creek in Tiffin. The gage is located at 0.05 mi downstream from the bridge on Rebecca Street, with a drainage area of 34.6mi^2. This gage has collected data continuously since June 1983. The discharge rates for Rock Creek for 2004 are shown in Figure 3.1. The summary of statistics for water years 1984-2004 is reproduced in Table 3.6.

Figure 3.1 – Stream Flow for Rock Creek, Water Year 2004.



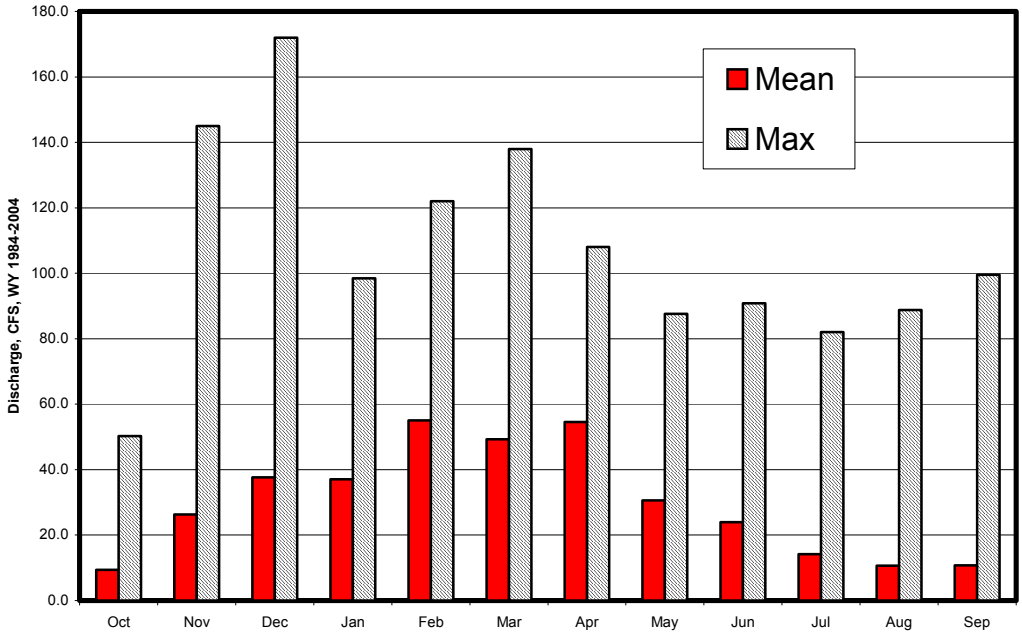
(Source: NCWQR – Ohio Tributary Loading Data).

Table 3.6 – Summary of statistics for USGS Stream Gage 04197170 (Rock Creek at Heidelberg College, Ohio) for water years 1984-2004. (Water Resources Data, Ohio, Water Year 2004, Volume 2, online at http://water.usgs.gov/pubs/wdr/2004/wdr-oh-04/WDR-OH-04-2.pdf)

Summary Statistics	2003 Calendar Year	2004 Water Year	Water Years 1984-2004
Annual Total	10707.1	12562.20	
Annual Mean	29.3	34.3	29.8
Highest Annual Mean			48.2 1984
Lowest Annual Mean			11.6 1988
Highest Daily Mean	580 Apr 5	628 Jan 5	1590 Aug 26 1998
Lowest Daily Mean	.80 Feb 19	0.85 Sep 28	0.32 Jul 29 1988
Annual Seven-Day Minimum	.82 Feb 15	0.93 Sep 24	0.37 Sep 11 2001
Maximum Peak Flow		873 Jun 14	2640 Aug 26 1998
Maximum Peak Stage		6.63 Jun 14	8.96 Aug 26 1998
Instantaneous Low Flow		0.75 Sep 26	0.32 Jul 29 1988
Annual Runoff (CFSM)	.848	0.99	0.86
Annual runoff (Inches)	11.51	13.51	11.70
10 Percent Exceeds	67	83	57
50 Percent Exceeds	7.6	9.2	6.2
90 Percent Exceeds	2.5	2.0	1.4

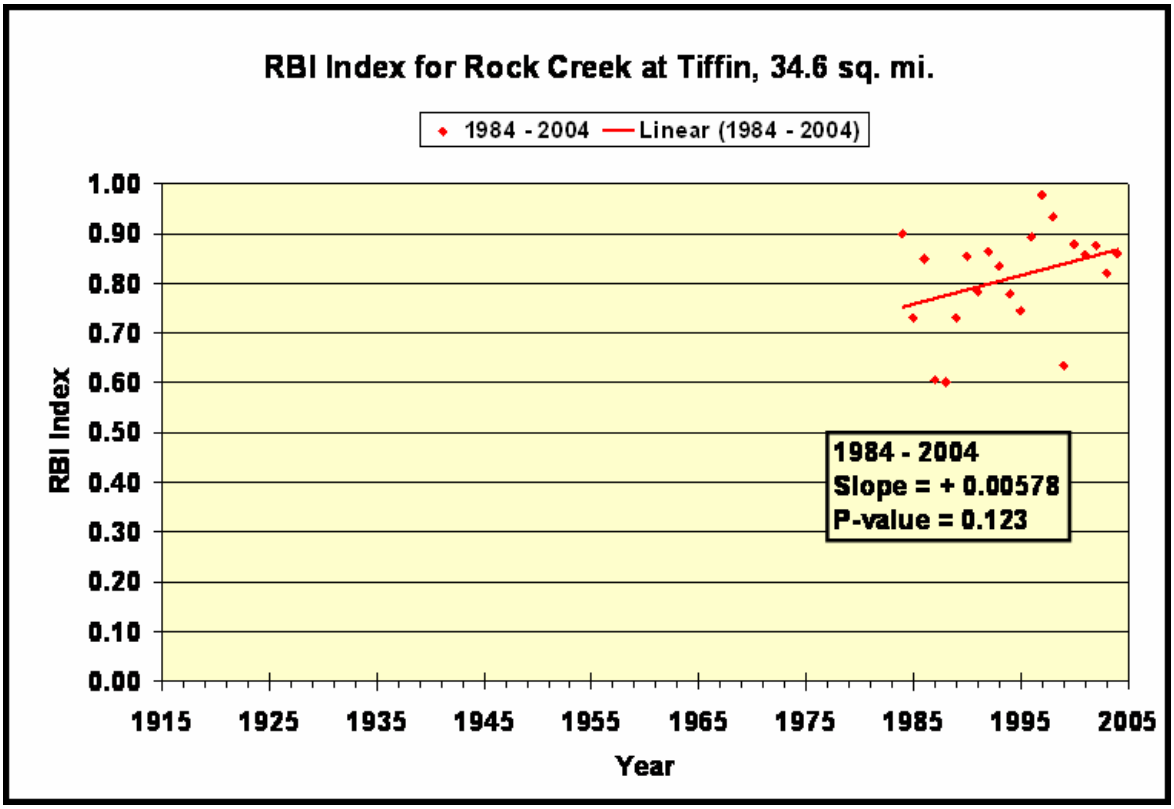
Seasonal Aspects of Discharge. The seasonal pattern of discharge for SR-Tiffin is shown in Figure 3.2, where average monthly discharges are plotted. December, May, and March are the months with the highest average discharges while August, July, and September have the lowest discharges. The pattern of variability in average monthly discharge differs from the pattern of annual monthly precipitation (Figure 3.3, RIMP). In the Sandusky Watershed, June, July and August are the months with highest precipitation while October, January and February are the months with the lowest precipitation.

Figure 3.2 – Average monthly discharge from Rock Creek at Heidelberg College Campus, Tiffin gaging station for the 1984-2004 water years.



Stream Flashiness. Flashiness is a measure of how quickly stream flows change during runoff events, relative to the total discharge of the stream. Flashy streams are those that, relative to other streams in their size range, have high peak flows during runoff events and low base flows. Staff of the NCWQR have developed a flashiness index and applied it to numerous Midwestern streams (Baker et al., 2004). Low base flows have been identified by Ohio EPA as a problem for the SR-Tiffin watershed. During their 2001 sampling period, it was reported that "intermittent or nearly intermittent conditions occurred during dry weather and were encountered even though the sites drained areas up to 17.7 mi^2" (2001 Sandusky River TSD). High stream flashiness is typically detrimental to aquatic biota and the fact that flashiness is impacting aquatic life in SR-Tiffin is a concern.

Figure 3.3 Stream Flashiness – RB Index, Rock Creek, 1984-2004 (from Baker, et al, Flashiness Trends in Rural Streams, Poster)



Other Stream and Floodplain Attributes. Currently, there is a paucity of data for several physical attributes of SR-Tiffin streams and floodplains. In time, as resources are organized around additional data collection and analysis efforts, this WAP will be updated to include information on the following attributes:

* Channel and floodplain condition, including miles of natural versus engineered/maintained channel, floodplain connectivity (longitudinal) and connectedness (lateral), streambank condition, extent and location of levees or other structures that isolate the river from its floodplain, riparian habitat, oxbow cutoffs
* extent and location of streams bordering conservation easements
* inventory of wetlands and opportunities (e.g. location, extent) for wetland restoration

Regarding the last item, the Coalition will ask Ohio EPA 401 Water Quality Certification Section for assistance on deploying the Ohio Rapid Assessment Method for wetlands.

Ecoregional Location.

The SR-Tiffin Watershed is situated exclusively within the Eastern Corn Belt Plains (Level III), Clayey, High Lime Till Plains (Level IV) Ecoregion of the conterminous United States. The Ohio EPA uses water quality criteria for the Eastern Cornbelt Plains Ecoregion to evaluate biological conditions for the entire SR-Tiffin Watershed.

Table 3.7 – Ecoregional Biocriteria: Eastern Corn Belt plains (ECBP) (Upper Sandusky River TMDL – OEPA 2004).

INDEX-Site Type	LWR	MWH channel modified	MWH impounded	WWH	EWH
IBI Headwater – Wading/Boat	18/18	24.24	-/30	40/42	50
MIwb Wading/Boat	4.0/4.0	6.2/5.8	-/6.6	8.3/8.5	9.4/9.6
ICI	8	22	-	36	46

Table 3.8 – Ecoregion Location, Use Designation, and Aquatic Life Use Attainment of the SR-Tiffin Watershed. (After: Upper Sandusky River TMDL – OEPA 2004).

River Mile	Location	Ecoregion	Use Designation	IBI	MIwb	ICI	QHEI	Attainment Status
0.1/0.2	Bells Run	ECBP	WWH	22*	NA	F*	54.5	NON
0.3/0.4	Gibson Creek	ECBP	WWH	32*	NA	MG	46.0	Partial
8.4/8.3	Rock Creek	ECBP	WWH	32*	NA	F*	49.0	NON
4.0/4.0	Rock Creek	ECBP	WWH	38^{ns}	8.1^{ns}	50	76.0	Full
---/4.2	East Branch Rock Creek	ECBP	WWH	---	NA	F*	---	(NON)
0.1/0.1	East Branch Rock Creek	ECBP	WWH	32*	NA	F*	57.5	NON
3.0/3.0	Willow Creek	ECBP	WWH	22*	NA	MG	35	NON
---/11.4	Morrison Creek	ECBP	MWH	---	---	P*	---	(NON)
9.4/9.4	Morrison Creek	ECBP	MWH	32	NA	P*	24	Partial
2.4/2.4	Morrison Creek	ECBP	WWH	34*	NA	MG	55.0	Partial

Soils

Soils in the eastern portion of the SR-Tiffin watershed are generally of Blount-Pandora association. According to the *Soil Survey of Seneca County, Ohio*, they are "nearly level and gently sloping, somewhat poorly drained and poorly drained soils formed in moderately fine textured glacial till." There are also Glynwood-Pandora-Blount association soils. These soils are at time more sloping, and better drained than the Blount-Pandora association. These are both deep soils on till plains.

The northern portion of the watershed is more varied. Those soils along the Sandusky River and the last miles of Rock and Morrison Creeks are Chagrin-Shoals-Ross association. They are "nearly level, well drained and somewhat poorly drained soils formed in medium textured and moderately fine textured alluvium." They are deep soils on flood plains and terraces, and in upland depressions.

The remainder of the northern watershed is split among several associations that are classified as "deep soils on beach ridges, terraces, lake plains, outwash plains, and end moraines." These include Kibbie-Digby association, Hoytville-Nappanee association, and Gallman-Digby-Haney association.

A map of hydric soils in the watershed has also been provided (Map 8). Approximately 11.5% of the soils in the watershed are hydric. There are several large tracks that are apparent in the northern third of the map. The utilization of these areas may be important for potential wetlands projects.

Table 3.9 Soils – Hydrologic Groups, Hydric Soils, and Soil Types

Hydrologic Soil Groups		Hydric Soils		Soil Types*	
A	0.3%	Yes	11.5%	BoA	24%
B	19.8%	No	88.5%	BoB	19%
C	64.2%			Pa	5%
D	6.8%			DmA	5%
A/D	0.02%			GxB2	4%
B/D	8.5%			KbA	4%
C/D	0.4%			Ht	3%
				NpA	3%

*Only the most common soil types are represented.

Hydrological Soil Groups. Hydrologic Soil Groups, illustrates the pattern of hydrologic soil groups throughout SR-Tiffin. Table 3.5 supports the hydrologic soil groups map by quantifying the distribution of soil groups. Hydrologic soil groups are useful for estimating surface runoff from precipitation. Soils that do not feature year-round vegetative protection (i.e. working agricultural fields) are assigned to one of four groups, A – D, that are grouped on the basis of their intake capacity of water when the soils are completely wet and continue to receive precipitation from long-duration storms.

Group A soils feature a high infiltration rate (i.e. low runoff potential), but are only 0.03% of the soils in the SR-Tiffin Watershed. A total of 19.8% of the watershed soils

are in Group B. These moderately well drained soils are located along floodplains of the lower reaches of the watershed's creeks and the main stem of the Sandusky River. 64.2% of the soils are in Group C, while another 6.8% are in drainage class D. Both of these soil groups have slow infiltration rates and are subject to surface runoff. As well, this distribution of soil types is consistent with those in the Honey Creek Watershed to the south.

Certain Group D soils in the watershed respond favorably to tile drainage. Thus 8.5% assume Group B characteristic with tile drainage. A minimal amount of the soils assume Group A or Group C characteristics, 0.02% and 0.4% respectively (A/D and B/D). Without tile drainage, fully 80% of the soils are in hydrologic soil Group C or D.

Identifying the location of soils that are most prone to surface runoff will assist with efforts to target adoption of BMPs as stakeholders move forward with implementing the SR-Tiffin WAP. While local knowledge will play a key role in efforts to target BMPs, spatial analysis of a combination of soil attributes (e.g. hydrologic group, slope, drainage, and the soil's physical properties) and/or other physical features of the landscape can also be employed to inform these efforts. The expertise necessary for such analyses, employing the use of a Geographic Information System (GIS), will be enabled with additional funding to support such activities.

Climate

SR-Tiffin, like most of Ohio, is situated in a humid continental climate zone that features cold winters and hot summers. Average low/high temperatures in Tiffin, Ohio during the years 1971-2000 ranged from 16.7 – 31.9 degrees Fahrenheit (F) in January and from 62.6 – 84.3 degrees F in July. The mean annual temperature during this period was 50 degrees F. Precipitation is near evenly distributed throughout the year. For the same period, the annual average at Tiffin was 37.08 inches (in); June was the wettest month (4.18 in) and February was the driest (2.00 in) (NOAA, 2002).

Geology

The SR-Tiffin watershed traverses the boundary of the ice-sourced bedrock landscape of northwest Ohio and the water-eroded bedrock landscape of central Ohio. Traveling from southeast to northwest, the watershed consists of Devonian Columbus and Delaware Limestones, Silurian Tymochtee and "Monroe" Dolostones, Silurian Greenfield Dolostone, and Silurian Niagaran-aged Lockport Dolostone.

The watershed flows from a Till Plains to Lake Plains environment as water moves to the north. The Till Plains to the south and east of Tiffin are characterized by extensive flat to very gently rolling plains and heavy till soils. The areas north of Tiffin are Lake Plains, formed by the recession of glacial lakes. The extremely flat lands are dotted with remnants of ancient beach ridges (Baker 2001 RIMP).

Political Geography and Demographics

Population and related demographics data is not accurately tracked on a watershed basis. To best estimate the population of the watershed, each township's population was considered to have an even distribution. The percentage of the land in the watershed within the township was used as a means of extrapolating a best

estimate for the watershed population. All figures are based on this method of reasoning.

SR-Tiffin drains land in two counties.

1. Seneca (98.3%)
2. Sandusky(1.7%)

SR-Tiffin is located in a predominately rural landscape (79.9%) in northwest Ohio. The majority of the population is white (96.71%) with "other", including multiple races (1.53%) second and black (1.09%) third. The 2000 US Census lists the median age of residents at 37.6. Of the 10,924 housing units in the watershed, 6.09% are listed as vacant.

Table 3.10 – Political units and other entities within SR-Tiffin Watershed

County	Township	Locality	School District*	Other Planning Organizations
Seneca				Seneca Regional Planning Commission
	Adams		Clyde-Green Springs LSD	
	Bloom		Buckeye Central LSD	
	Clinton		Tiffin CSD	
		Tiffin	Tiffin CSD	
	Eden		Mohawk LSD	
	Hopewell		Hopewell Loudon LSD	
	Pleasant		Old Fort LSD	
	Reed		Seneca East LSD	
	Scipio		Seneca East LSD	
		Republic	Seneca East LSD	
	Seneca		New Riegel LSD	
Sandusky				Sandusky Regional Planning Commission
	Ballville		Fremont CSD	

*each school district is listed at least once. Multiple districts may overlap within a given township, in which case the predominant district serving the watershed was listed.

Table 3.11 – SR-Tiffin Watershed population by county, municipality, and township (estimated).

Seneca County	Population					Sandusky County	Population
Adams Twp.	186		Scipio Twp.	1,525		Ballville Twp.	358
Bloom Twp.	134		Seneca Twp.	89		Total (Sandusky)	358
Clinton Twp.	3,432		Tiffin City	18,135			
Eden Twp.	392		Republic	614		Estimated total population for SR-Tiffin Watershed	25,568
Hopewell Twp.	80		Total (Seneca)	25,210			
Pleasant Twp.	1,053						
Reed Twp.	184						

Table 3.11 estimates the watershed's population at 25,568 residents. Of those, 18,135 are residents of the city of Tiffin (70.9%), which drains directly into the Sandusky River. The remaining 7,433 residents are distributed across the rural landscape of the watershed. The largest single population outside of Tiffin is in Republic, with 614 residents. The remainder of the watershed has an average of 62 residents per square mile, compared with an average of 277 people per square mile across Ohio. Table 3.12 shows the population for the counties in the watershed from 1900-2004. Population data for 2004 as reported by the US Census bureau, shows slight growth in both counties, with populations returning to 1990 levels. Peak populations for both counties were present in the 1980's.

Table 3.12 – Population data for the watershed counties from 1900-2004.

County	1900	1910	1920	1930	1940	1950
Sandusky	34,311	35,171	37,109	39,731	41,014	46,114
Seneca	41,163	42,421	43,176	47,941	48,499	52,978
	1960	1970	1980	1990	2000	2004
Sandusky	56,486	60,983	63,267	61,963	61,792	61,984
Seneca	59,326	60,696	61,901	59,733	58,683	57,789

Agricultural Resources

As with population data, agricultural data are not tracked by watershed. County specific data for Sandusky and Seneca counties can be found at:

1. Sandusky County –
   http://www.nass.usda.gov/census/census02/profiles/oh/cp39143.PDF
   http://nass.usda.gov/oh/profile03/sand-scioto.pdf
2. Seneca County –
   http://www.nass.usda.gov/census/census02/profiles/oh/cp39147.PDF
   http://nass.usda.gov/oh/profile03/seneca-shelby.pdf

Table 3.13 provides a summary of relevant data from the above sources.

Table 3.13 – Agricultural Statistics, Sandusky and Seneca Counties

	Sandusky	Seneca
Number of Farms	**802 (-8%)***	**1,185 (-10%)***
Land in Farms	**196,152 (-4%)***	**280,449 (-6%)***
Average Farm Size	**245 ac (+5%)***	**237 ac (+5%)***
Avg. Production/Farm	**$63,647 (-16%)***	**$46,919 (-26%) ***
Government Payments	**$3,085,000 (+31%)***	**$3,721,000 (+6%)***
Gov't. Payments/Farm	**$7,397 (+52%)***	**$5,354 (+21%)***
Farm Land In Cropland	**92%**	**90%**

***percent change is from 1997-2002.**

The following can be extrapolated from the 2003 data:

1. Soybeans are the dominant crop in the watershed (Seneca 46.7%, Sandusky 47.7%),
2. The majority of farms had sales under $50,000 (Seneca 78%, Sandusky 72%) in 2002,
3. The biggest portion of sales for livestock in 2002 came from hogs and pigs,
4. The number of farms has decreased while the size of the average farm has increased,
5. The average age of the principal operator for farms is 53,
6. Forty percent of the principal operators do not consider farming their primary occupation,
7. Over 94% of principal operators are male, over 99% are white.

Figure 3.4 – Farms By Size, Sandusky & Seneca County, 2002

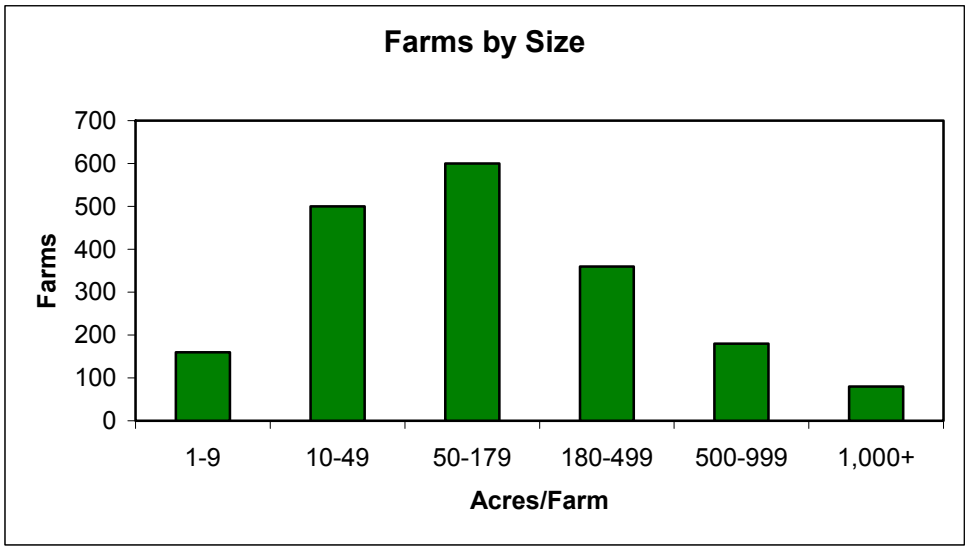


Table 3.14 below quantifies agricultural land uses by area within each county. It should be noted that the area within Sandusky County that drains to the SR-Tiffin watershed is almost exclusively agricultural in use. Wolf Creek Park, which is located at the very most northern tip of the watershed, on the east bank of the Sandusky River, is

also within this watershed, and is the largest single exception to the dominant land use pattern.

Table 3.14 – Agricultural Land Uses by Area & County in the SR-Tiffin Watershed*.

	Sandusky Co.	Seneca Co.	Percent of Total Land Area
Total area, acres	266,240	348,800	-
Number of farms	800	1,190	-
Land in farms, acres	199,000	286,000	78.9%
Soybean, acres	81,600	113,000	31.6%
Corn, acres	59,800	79,400	22.6%
Wheat, acres	20,800	42,100	10.2%
Oats, acres	0	1,600	0.3%
Hay, acres	8,400	5,900	2.3%
Produce, acres	340	0	0.1%
CRP, acres	2,808	8,015	1.8%
Other farm, acres	25,252	35,985	10.0%
Non-farmland, acres	67,240	62,800	21.1%

*All data from 2002 statistics as cited above, except CRP acreage. Conservation Reserve Program acreage as of Sept. 2004, reported by USDA Farm Service Agency http://www.fsa.usda.gov/dafp/cepd/29th/Table1F.pdf.

Livestock, especially hogs and pigs, are an important part of the local agricultural economy. In Sandusky County, livestock accounted for 9.2% of cash receipts in 2002. In Seneca County the importance is even greater at 20.8%. However, livestock, and associated manure can be a major source of water quality problems. Liquid manure applications can enter tile drainage systems and be quickly delivered to local streams. Fish kills have been observed in the Sandusky River watershed, and were likely caused by manure applications. Poor manure management can also lead to phosphorus loading in streams. Where livestock have direct access to stream channels, there is particular concern about the potential impacts. Proper management of livestock and manure will help protect water quality and the reputation of the local industry. Practices that help producers properly manage manure will be discussed in the following chapters. Below is an estimate of the number of livestock present in the SR-Tiffin watershed. These figures were extrapolated using countywide statistics for Seneca County, and assumed an even distribution of livestock facilities. The watershed within Sandusky County was the subject of a windshield survey and only one livestock operation was visible.

Table 3.15 – Estimate of livestock in SR-Tiffin Watershed

Type of Livestock	Estimated population, based on 2003 Ohio Agricultural Statistics for Seneca County
Cattle & Calves	2,255
Sheep & Lambs	760
Hogs & Pigs	4,146
Layers (20 wks. and older)	234
Pheasants	158
Total	7,553

Rock Creek Crop and Tillage Survey

A survey of the entire watershed's agricultural practices is not financially feasible at this time. In the fall of 2005, the NCWQR completed a survey of crop rotation and conservation tillage in the Rock Creek watershed. The survey was conducted by driving all roads within the 22,000 acre watershed, and recording the cover and tillage present every 0.3 miles. Preliminary results from the survey are listed below in Table 3.16, along with the results as provided by GIS analysis of the watershed.

Table 3.16 – Rock Creek Crop and Tillage, Survey vs. GIS Results

	Windshield Survey of Rock Creek	GIS Data for Rock Creek
Woody Wetlands	---	0.36%
Water	---	0.02%
Wetlands	---	0.02%
Evergreen Forest	---	0.05%
Commercial/Industrial/Transportation	---	0.32%
Low Intensity Residential	---	1.63%
High Intensity Residential	---	0.19%
Deciduous Forest	---	0.01%
Urban Grasses	---	12.72%
Pasture/Hay	3%	17.85%
Conservation Reserve Program	8%	---
Row Crops	**81%**	**66.83%**
Other	8%	**---**

Of the cropland observed by the NCWQR, 51% was planted to soybeans; 29%, corn; 15%, wheat; and 4%, to hay in rotation with other crops. Regarding tillage, 16% of fields were conventionally tilled; 2% were mulch tilled (50% or more residue); and 51% were as of yet untilled. There was a 67% increase in wheat acres over the previous year as well.

A follow-up tillage and land use survey was completed in May 2006. The results are detailed below in Table 3.17. The survey was complete by documenting tillage

practices at 0.3 mile intervals on all roads within the watershed. The survey was completed over a two day period in late May, allowing for optimal visibility of tillage practices, as well as emerged crops. The statistic of greatest concern is the 92% rate of conventional tillage for corn. Cover crops and conservation tillage practices are necessary to help control the impacts of this more aggressive tillage practice, and opportunities to impact this high percentage need explored.

Table 3.17 – Land Use and Tillage Survey – Rock Creek – May 2006

Land Use - Rock Creek - May 2006						
Soybeans	Corn	Wheat	Hay	CRP	Pasture	Other
36%	23%	15%	4%	9%	3%	10%
Tillage Practices - Rock Creek - May 2006						
		Prior Crop				
Soybean Tillage	Total Tillage	Corn	Soybeans	Wheat		
Mulch Till	21%	94%	3%	3%		
No Till	55%	82%	12%	6%		
Conventional Tillage	24%					
Corn Tillage	Total Tillage					
Mulch Till	7%					
No Till	1%					
Conventional Tillage	92%					

Conservation Cropping and Tillage Systems in Seneca County

The use of conservation cropping systems will be important to future water quality improvements in the SR-Tiffin watershed. Based on research by the NCWQR, there are several benefits that could be expected from the use of conservation practices in Seneca County. Table 3.17 provides an overview of erosion rates for a Blount silt loam soil, with a slope of 3% and a length of 200 feet. The rates were determined using the RUSLE program.

Table 3.18 – Erosion Rates for Blount silt loam soil

Tillage Practices	Erosion Rates
1920's Conventional Spring Tillage	2.2 tons/acre/year
1960's Conventional Fall Tillage	3.8 tons/acre/year
2004 Conventional Fall Tillage	5.0 tons/acre/year
2004 Conventional Corn/No-till Beans, Wheat	3.2 tons/acre/year

The above calculations were applied to a 600 acre watershed, having an average slope of 2%, a length of 6000 feet, and Hydrologic Group B soils. Runoff calculations were then made for a 10 year storm (3.6 inches in 24 hours):

Table 3.19 - Impacts of conservation practices on a 10 year storm.

	RCN	CFS	Runoff	T/C Hrs
1920's	75	286	1.37	1.82
1960's	79	385	1.64	1.62
2004 – CV	80	414	1.72	1.57
2004 – NT	77	333	1.51	1.72

The impacts of tillage and other conservation practices as outlined above are critical when considering these practices for implementation programs.

Cultural Resources

The cultural resources of the SR-Tiffin watershed are more varied than many of the Upper Sandusky River sub watersheds. The location of the City of Tiffin within the watershed is the primary reason for this. Table 3.20 contains information on cultural resources within the watershed.

State Route 53, which runs through the western edge of the watershed, is a major route of travel residents of southern Ohio, especially Columbus and the surrounding counties, as they head north to Lake Erie. This has some impact on the watershed, including the presence of several marine and outdoors supply stores, which supply products not readily used in most of the Sandusky River watershed. The influence of Lake Erie and Sandusky Bay on the flow of traffic and tourist dollars through the region is important. The Sandusky River offers a complimentary experience to Lake Erie vacationers, and the use of the River for fishing, hunting, canoeing, and other activities is important to the local economy and culture.

In 2004 the Coalition produced a Recreational Resources Map for the Sandusky River Watershed. The map was funded through the Lake Erie Protection Fund, ODNR Scenic Rivers Program, and other contributions. In addition, an interactive map was published on the Coalition's website, which includes short descriptions and contact information for many local recreational resources. The map is limited to nature-based recreation, and does not include all of the resources listed below. Future updates and printings of the map are expected in the coming years. For additional information on local cultural and recreational resources, contact the Sandusky County Convention & Visitors Bureau, http://www.sanduskycounty.org/, or the Seneca County Convention & Visitors Bureau, http://www.senecacounty.com/visitor/.

Table 3.20 – Cultural Resources in the SR-Tiffin Watershed

Resource	Location	County	Type	Contact Information
Hedges Boyer Park	Summit St, Tiffin	Seneca	City Park	419-448-5408
Nature Trails	E. Davis St at Sandusky River, Tiffin	Seneca	City Park	419-448-5408
Schekelhoff Nature	North Water Street, Tiffin	Seneca	City Park	419-448-5408

Preserve				
Kernan Park	Huss St. at Sandusky River, Tiffin	Seneca	City Park	419-448-5408
PM Gillmor Community Park	East off St. Rt. 53, Fort Seneca	Seneca	Community Park	
P.M. Gillmor Park	Co. Rd. 51 at the Sandusky River, Old Fort	Seneca	Community Park	
Community Park	Republic	Seneca	Community Park	
Steyer Nature Preserve	Abbott's Bridge	Seneca	County Park	http://www.senecacounty.com/parks/
Miller Conservation Farm	TR-138, East of St Rte. 101	Seneca	SWCD Educational Facility	419-447-7073
Abbott's Bridge Scenic River Access	TR 152 & CR 33	Seneca	Scenic Rivers	www.ohiodnr.com/dnap
Sandusky State Scenic River	Sandusky River	Seneca, Sandusky	Scenic Rivers	www.ohiodnr.com/dnap and www.dnr.state.oh.us/watercraft/boat/rivers/sandusky.html
Wolf Creek Park	St Rte. 53, north of Seneca Co. line	Sandusky	County Park	http://www.scpd-parks.org/
Seneca Co. Museum	28 Clay St, Tiffin	Seneca	Museum	419-447-5955
Tiffin Glass Museum & Glass Shoppe	25-27 S Washington St, Tiffin	Seneca	Museum	www.tiffinglass.org
Franciscan Earth Literacy Center	194 St. Francis Ave., Tiffin	Seneca	Environmental Education	www.earthliteracy.org
Ritz Theatre	30 S Washington, Tiffin	Seneca	Historic Theatre	www.ritztheatre.org
Clinton Heights Golf Course	2760 E T Rd 122, Tiffin	Seneca	Golf Course	419-447-8863
Clinton Lake Campground	4990 E TR 122, Republic	Seneca	Outdoor Rec. Facility	419-585-3331
Tiffin Community YMCA	180 Summit Street, Tiffin	Seneca	Full Facility YMCA	419-447-8711

Seneca Co. Fairgrounds	Hopewell Ave., Tiffin	Seneca	Fairgrounds	419-447-7888
Tiffin-Seneca Heritage Festival	Downtown Tiffin	Seneca	Festival	419-447-5609
Towne & Country	SR 53 North, Tiffin	Seneca	Golf Course	

Biological Resources

The *Sandusky River Watershed Resource Inventory and Management Plan,* or RIMP, updated most recently in December, 2002, devotes an entire chapter to the biological resources of the Sandusky River Watershed. The RIMP features ten tables of lists of species found within this larger basin including threatened and endangered species at both state and national levels. Many of these species are very likely to be found within SR-Tiffin, but a biological inventory restricted to the SR-Tiffin Watershed has not been conducted to date. Thus, the reader is referred to the RIMP for a complete list of biological resources found in the Sandusky River Watershed.

The recovery of bald eagles in Ohio is particularly noteworthy. Eighty-eight nesting pairs of eagles were reported in 2003; up from four nesting pairs in 1979. Many eagle nests have been counted along the Sandusky River, and the portion of the river from Honey Creek to Wolf Creek is home to many adult and juvenile birds. A stream corridor survey in the fall of 2005 produced a count of at least 11 different bald eagles of various ages within this stretch of the river, or 1 eagle every 2.7 river miles. The increase in eagles over the past twenty-five years is indicative of progress made in pollution reduction, but there is still concern for elevated levels of contaminants such as DDT and PCBs in some eagles.

The bald eagle is one of three key indicator species used to assess the biological health of Lake Erie as documented in the State of the Lake Report, 2004: Lake Erie Quality Index (LEQI). For more information on the LEQI, including additional discussion of bald eagles, the reader is referred to the following website: http://www.epa.state.oh.us/oleo/reports/leqi/leqi2004/pdf/2004lakeeriequalityindex.pdf

Finally, the Ohio Environmental Protection Agency published the Biological and Water Quality Study of the Sandusky River and Selected Tributaries, 2001: Seneca, Wyandot, and Crawford Counties, Ohio in May, 2003. This report includes information specific to the SR-Tiffin watershed.

National Pollutant Discharge Elimination System Permits

Point Source Pollution is not addressed in this plan as it is under the jurisdiction of the Ohio EPA National Pollutant Discharge Elimination System (NPDES) Permit regulations. These permits regulate the amount of discharged waste water while maintaining water quality standards of the water course it is entering. The permitting process considers other factors such as combined sewer overflows, pretreatment and sludge disposal.

By reducing the permitted discharge levels from the total pollutant found within a ditch, stream or river provides a more accurate nonpoint source contribution of a particular pollutant.

Point Sources that can be identified within the Sandusky River – Tiffin sub-watershed are listed in Table 3.21

Table 3.21 National Pollutant Discharge Elimination System Permits

Permit Holder	Permit Number
City of Tiffin Water Pollution Control Center	**2PD00025**
Hammer-Heinsman STP	**2PG00011**
National Machinery LLC	**2IS00009**
Ohio-American Water Company -Tiffin Facility	**2IW00235**
Republic WWTP	**2PA00087**
Seneca County Facilities	**2PG00088**
Sentinel Vocational Center	**2PT00017**
Webster Manufacturing Company	**2IS00035**

CHAPTER 4
WATER RESOURCES

Introduction

To understand the general approaches to water resource protection used in Ohio and elsewhere, familiarity with the following set of terms and ideas is essential:

- **Use Designations**
- **Use Attainment/Use Impairment**
- **Water Quality Data (Chemical, Physical, Biological)**
- **Water Quality Standards/Criteria**
- **Causes and Sources of Impairments**
- **Remedial Measures/Watershed Action Plan**

Use designations identify the particular uses of water resources that the state deems worthy of protection. Ohio recognizes three such general areas of water use - aquatic life habitat, recreation, and water supply. Within each of these uses, subcategories exist that more specifically identify applicable uses for a particular stream segment or lake. For example, warmwater habitat is a particular aquatic life use designation applicable to most Ohio streams.

Use attainment indicates whether or not water quality (chemical, physical, or biological) is acceptable to support the designated uses. Stream segments or lakes can be in full, partial, or non-attainment of a particular use, such as warmwater habitat. Where the water quality of a stream segment fails to reach full attainment, that segment is said to have a "**use impairment"**. Thus a **water quality problem** is referred to, in the terminology of the Ohio EPA, as a **"use impairment"**.

Water quality data are either quantitative or qualitative measurements of the chemical, physical or biological characteristics of a stream segment that are used to determine whether or not a particular use is impaired. One of the measurements to determine whether a stream segment meets the warmwater habitat use designation is a fish community index called the Index of Biological Integrity (IBI).

Water quality standards are particular values of water quality data used to determine whether or not a given use is impaired. The term "**criteria**" is often used interchangeably with water quality standard. The water quality standard for the IBI index for streams in this area having the warmwater use designation is 40 out of a maximum possible score of 60. To be in full attainment, the IBI index of such a stream must be 40 or higher.

Where stream segments are impaired relative to a particular use, i.e., applicable standards are not met, attempts are made to identify the particular **causes and sources of impairment**. For example, excessive nutrient concentrations derived from failed septic tanks may be a cause and source of impairment to the fish community, resulting in IBI values that fall below the standard.

Remedial measures are those actions which can address the causes and/or sources of impairment such that, when implemented, result in water quality

improvements. A **watershed action plan (WAP)** identifies the appropriate remedial measures for a watershed and sets forth a plan to achieve their implementation.

Use Designations in Ohio: An Overview

As noted above, Ohio recognizes three use designations for streams and rivers -- aquatic life habitat, water supply, and recreation. Each of the above three categories is subdivided into various levels of use, as shown in Sidebar 4.1 (Adapted from Sidebar 5.1 of the RIMP). The aquatic life use designations of exceptional warmwater habitat (EWH), warmwater habitat (WWH), modified warmwater habitat (MWH) and limited resource water (LRW) are particularly important, since OEPA relies heavily on the biological integrity of streams in their water resource assessments. These categories are described in more detail in Sidebar 4.2, which is reproduced from the OEPA Guide to Developing Local Watershed Action Plans in Ohio. Although designated uses of stream segments in the Upper Sandusky TMDL area do not include segments designated as exceptional warmwater habitat, a description of that category is included since many segments of the Sandusky River mainstem do meet the standards for that category.

Ideally, the aquatic life use designations are based on field investigations by the OEPA that include determination of the Qualitative Habitat Evaluation Index (QHEI). For some stream segments, use designations were set in connection with published state water quality standards of 1978 and 1985 without the benefit of biological field investigations.

More background on use designations and their pre-TMDL status in the Sandusky Watershed are presented in Chapter 5 of the SRW RIMP.

Post-TMDL Use Designations in the SR-Tiffin Watershed.

The 2001 Sandusky River TSD document provides a listing of current and proposed use designations of stream segments in the Upper Sandusky TMDL area (OEPA, 2003, Table 1C). The SR-Tiffin portion of that table is shown as Table 4.1.

Table 4.1 – Waterbody Use Designations for the SR-Tiffin Watershed (Based on Table 1C of the 2001 Sandusky River TSD (OEPA, 2003)). See Sidebar 4.1 for abbreviations of use designations.

Water Body Segment	Use Designations												
		Aquatic Life Habitat						Water Supply			Recreation		
	SRW	WWH	EWH	MWH	SSH	CWH	LRW	PWS	AWS	IWS	BW	PCR	SCR
Sandusky River													
- at RMs 18.05, 42.12, 82.9, 83.15, and 115.45		+						o	+	+		+	
-RM 42.0 to RM 19.0	+	+							+	+		+	
-RM 45.0-RM 42.0 (Ella St. Dam)	+			"+					+	+		+	
-RM 47.8 (upstream from Tiffin) to RM 45.0	+	+							+	+		+	
- U.S. 30 N (RM 82.1) in upper Sandusky to RM 115.43	*	+							+	+		+	
-Beechgrove Rd. (RM 115.43) to U.S. Rte. 30 N		+							+	+		+	
-all other segments		*							*	*		*	
Morrison Creek – headwaters to RM 7.9 (CR 43)				'+					*+	*+			*+
- all other segments		*+							*+	*+		*+	
Willow Creek				"+					*+	*+		*+	
Unnamed tributary (Willow Creek RM 0.88)							o						o
Rock Creek		*+							*+	*+		*+	
East Branch		*+							*+	*+		*+	
Armstrong & Beighly ditch		*							*	*		*	
Carpenter Ditch		*							*	*		*	
Gibson Creek		*+							*+	*+		*+	
Bells Run		*+							*+	*+		*+	

* Designations based on the 1978 and 1985 water quality standards.
\+ Designations based on pre-TMDL OEPA biological field assessments.
** Designations based on 1978 and 1985 standards for which results of a biological field assessment are now available (2001 TSD study).
"+ New recommendations based on the findings of this 2001 TSD study.
o Designated uses based on results other than OEPA biological data.

A majority of the stream miles within the watershed have not been provided with use designations as of yet. Rather than assume that those undesignated streams are to be treated as WWH streams, the coalition views them simply as undesignated at this time. Many of these streams are under maintenance (Map 7) and thus would be classed as MWH. The topic of use designations for headwater streams is currently under investigation by the OEPA (http://www.epa.state.oh.us/dsw/wqs/headwaters/index.html). The Coalition chooses to await clarification of use designations for headwater streams before initiating specific programs for these streams. In any case, their use attainment status is unknown.

It is also important to note that some streams in this watershed were not sampled nor were they included in the TMDL report. For these streams, any information that is readily available will be used to assist in the development of this plan.

Map 8 titled Sandusky River Tiffin Watershed: Aquatic Life Support, shows aquatic life use designations for SR-Tiffin, as listed in Table 4.1. The map also shows the stream segments that do not have current use designations. Since use designation is a prerequisite to determination of use attainment, maps of use attainment can be no more detailed than those of use designation.

Table 4.1 also notes that one site on the Sandusky River is a public water supply. This area serves as a portion of the supply used for the City of Tiffin. According to the *Drinking Water Source Assessment for the Ohio-American Water Company, Tiffin District*, this source supplies water to 18,135 residents within the city. The Sandusky River is the primary source of drinking water; however, it is mixed with water from five public wells that draw from bedrock at a depth of 250-350 feet. The well field has a fully endorsed Wellhead Protection Plan. The total capacity of the city's treatment system is 3.43 million gallons per day, and current use is at 2.146 million gallons. A low head dam is present in the Sandusky River at river mile 42.1, which serves the city's water supply.

Sidebar 4.1 Designated Uses for Water Resources in Ohio

Aquatic Life Habitat Use Designations

In assessing the quality of Ohio's streams and rivers, the Ohio EPA relies heavily on whether or not a stream segment is achieving its aquatic life habitat use designation. The aquatic habitat use designations used by the Ohio EPA are:

- **Exceptional Warmwater Habitat (EWH)**
- **Warmwater Habitat (WWH)**
- **Modified Warmwater Habitat (MWH)**
- **Limited Resource Water (LRW)**
- **Seasonal Salmonid Habitats (SSH)**
- **Coldwater Habitat (CH)**

The vast majority of streams and rivers in Ohio are designated as Warmwater Habitat. Waters classified as Warmwater Habitat should be "capable of supporting and maintaining a balanced, integrated, adaptive community of aquatic organisms". This is the principal restoration target for water resources management in Ohio. Descriptions of the other aquatic life habitat use designations are available at the Ohio EPA web site (http://chagrin.epa.state.oh.us/watershed/aquatdef.htm).

Water Supply Use Designations

The Ohio EPA specifies the following three water supply use designations:

- **Public Water Supplies** - these are waters that with conventional treatment will be suitable for human intake and meet federal regulations for drinking water. Criteria associated with this use designation apply within 500 yards of surface water intakes for human consumption
- **Agricultural Supplies** - these waters are suitable for irrigation and livestock watering without treatment.
- **Industrial Supplies** - these waters are suitable for commercial and industrial uses with or without treatment.

Recreation Use Designations

In Ohio, Recreational Use Designations are in effect during the recreation season - May 1-October 15. There are three subdivisions of recreational use.

- **Bathing Waters** - these waters are suitable for swimming where a lifeguard and/or bathhouse facilities are present, and include any additional similar areas where the water quality is approved by the Director of the Ohio EPA.
- **Primary Contact Recreation** - these waters are suitable for full-body contact recreation such as swimming, canoeing and scuba diving with minimal threat to public health as a result of water quality.
- **Secondary Contact Recreation** - these waters 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.

State Resource Waters Use Designation

State Resource Waters are water bodies that lie within park systems, wetlands, wildlife areas, wild, scenic and recreational rivers and publicly owned lakes and waters of exceptional recreational or ecological significance.

Sidebar 4.2. Aquatic Life Use Designations (applicable to the Upper Sandusky TMDL area)

Exceptional Warmwater Habitat (EWH) is the most biologically productive environment. These waters support unusual and exceptional assemblages of aquatic organisms, which are characterized by a high diversity of species, particularly those that are highly intolerant and/or rare, threatened, endangered or special status. This use represents a protection goal for water resource management efforts dealing with Ohio's best water resources. The standards for ammonia and dissolved oxygen are more stringent than in the other use designations.

Warmwater Habitat (WWH) defines the typical warmwater assemblage of aquatic organisms for Ohio's rivers and streams. It is the principal restoration target for the majority of water resource management efforts in Ohio. Criteria (standards) vary by ecoregion and site type.

Modified Warmwater Habitat (MWH) applies to stream with extensive and irretrievable physical habitatmodifications. The biological criteria for warmwater habitat are not attainable. The activities contributing to the modified warmwater habitat designation have been sanctioned and permitted by state or federal law.
the representative aquatic assemblages are generally composed of species that are tolerant to low dissolved oxygen, silt, nutrient enrichment and poor habitat quality. The ammonia and dissolved oxygen standards are less stringent than warmwater habitat. There are three subcategories:

- **Modified Warmwater Habitat - A** for those streams affected by acidic mine runoff;
- **Modified Warmwater Habitat - C** for those streams heavily channelized; and
- **Modified Warmwater Habitat - I** for those streams extensively impounded.

The biocriteria are set separately for each subcategory.

Limited Resource Water (LRW) applies to streams that have drainage areas of less than three square miles and either may lack water on a recurring annual basis, or have been irretrievable altered to the extent that noappreciable assemblage of aquatic life can be supported; no formal biological criteria are established for thisdesignation.

Additional "Uses" of Land and Water Resources

Agricultural Drainage Uses: An essential reality of the stream networks of the Sandusky Watershed, is that they not only serve as aquatic life habitat, but that they also serve as pathways of agricultural drainage that are essential to productive agriculture in the watershed. Many streams now referred to as headwater streams did not exist prior to agricultural drainage programs. Often ditches were dug to drain wetlands, and subsequently deepened and maintained to provide outlets for tile drainage. In other cases, streams that obviously existed prior to the onset of agricultural drainage programs have been highly modified, either as part of drainage practices themselves, or as a consequence of agricultural land use in general.

A major concern of landowners in the watershed is that efforts to achieve designated aquatic life uses in the headwater streams that drain their cropland will interfere with the drainage functions of those streams. The Coalition hopes that clarification of use designations for headwater streams in agricultural landscapes will emerge as part of OEPA's Headwater Initiative. While the MWH and LRW use designations do provide some relief to the concerns of farmers, even these designations could be a source of problems relative to agricultural drainage provided by headwater streams.

Leaving aside for the moment the issue of aquatic life use designation, it is instructive to acknowledge one basic ecological principle that applies to both man-

altered and natural streams: water, nutrients, and energy are exported to downstream areas. Drainage ditches, therefore, whether modifications of natural streams or relatively new features of the landscape that have been created for purposes of conveyance, cannot be considered separate from the natural stream network. Such modifications of or additions to the natural stream network have a significant impact on water resources both locally and downstream (Karr and Dudley, 1981).

Pollutant Export Issues

Although there is no official use designation stating that watersheds should not export pollutants in quantities detrimental to downstream receiving waters, the necessity of reducing pollutant export from watersheds has long been recognized. Pollutant export from the Rock Creek Watershed has been monitored by the NCWQR since 1982 through detailed studies at the USGS Stream Gaging Station at Tiffin. More than 12,000 water samples have been analyzed from that site for sediments and nutrients. The annual loads of suspended sediments and various nutrients exported from the watershed for each of the 10 years between 1994 and 2003 is shown in Table 4.2.

The data in Table 4.2 indicate that there are wide fluctuations in both flow and loads in Rock Creek. The lowest discharge observed was 22 million cubic yards in 1998, while the highest was 53 million cubic yards in 1996. Total phosphorus ranged from 1,416 short tons in 1998 to 21,048 short tons in 1996. The annual variations in discharge and in nutrient and sediment export are primarily associated with variations in the frequency, magnitude and seasonal distribution of rainfall events which initiate runoff, erosion and tile flow leading to nutrient and sediment transport to and through Rock Creek and its tributaries.

Table 4.2 – Annual discharge and export of suspended sediments (SS), total phosphorus (TP), Soluble Reactive phosphorus (SRP), Nitrate plus nitrite nitrogen (N), and chloride from the Rock Creek Watershed at the Rock Creek USGS stream gaging station as measured by the NCWQR. Units: discharge in million cubic yards, annual loads in short tons.

Water Year	Discharge	SS	TP	SRP	Nitrate	Chloride
1994	29	7,351	12	0.5	95	597
1995	41	13,372	21	1.0	153	798
1996	53	21,048	30	1.4	171	763
1997	44	10,212	16	2.0	98	609
1998	22	1,416	4	0.8	63	621
1999	31	4,470	9	1.9	111	671
2000	27	1,764	6	1.8	86	810
2001	42	12,040	19	1.7	118	819
2002	29	8,136	12	1.9	152	716
2003	41	7,693	15	3.0	133	874
Average	**36**	**8,750**	**14**	**1.6**	**118**	**728**

The average annual discharge and export of nutrients and sediments at the NCWQR network of tributary monitoring stations is shown in Table 4.3. Note that the period of record does vary among several of the stations so that the average annual discharges do not represent comparable time periods for all of the streams. The data presented in Table 4.3 clearly indicate that export amounts tend to increase as watershed area increases. The Maumee River has the largest export of suspended solids, total phosphorus and nitrate, while the Scioto River has the largest export of soluble reactive phosphorus and the Cuyahoga has the largest export of chloride.

Table 4.3 – Average annual discharge and sediment and nutrient loads for the indicated water years. Units: drainage area is square miles, discharge in million cubic yards, and sediment and nutrient loads in short tons.

River	Water Years	Drainage Area	Dis - charge	SS	TP	SRP	Nitrate	Chloride
Raisin	94-03	1,042	888	73,746	143	21.0	3,555	28,046
Maumee	94-03	6,330	6,290	879,506	1,972	336.4	34,261	153,398
Sandusky	94-03	1,253	1,229	193,524	400	49.3	7,026	29,589
Honey Cr	94-03	149	143	17,683	47	7.4	756	2,754
Rock Cr.	**94-03**	**35**	**33**	**7,788**	**13**	**1.2**	**113**	**639**
Vermilion	01-03	262	216	30,966	50	7.8	728	6,425
Cuyahoga	94-03	708	1,069	206,129	244	34.5	1,609	126,157
Grand	94-03	686	1,043	104,921	106	8.0	512	31,462
Muskingum	96-03	7,420	-	673,047	1,402	233.3	13,927	269,715
Scioto	97-03	3,854	4,242	406,795	1,157	420.0	15,735	153,965
Great Miami	97-03	2,685	3,316	314,086	1,045	418.1	12,953	127,312

To directly compare runoff and nutrient and sediment export among watersheds of various sizes, unit area export rates are calculated. This calculation involves dividing the total export (annual or average annual) by the total watershed area, resulting in units of tons per square mile. Conversion factors are then used to produce more understandable units such as pounds per acre. Table 4.4 contains the average annual unit area export rates for the same rivers shown in Table 4.3. In the case of discharge, dividing the volume of discharge by the area gives units of length, which are then converted to inches.

Note that the unit area runoff in inches for Rock Creek is similar to that of other northwestern Ohio streams. Runoff does increase in the Eastern Ohio streams (Cuyahoga and Grand), due primarily to snow-belt effects associated with Lake Erie. The Cuyahoga River has the highest unit area sediment export. The high rate for the Cuyahoga is likely due to naturally high erosion rates on the steep slopes of the Cuyahoga Valley. High bank erosion of previously filled flood plains and construction site erosion may also be playing a role in the high sediment export rate from the Cuyahoga watershed.

Unit area suspended sediment export from the Rock Creek Watershed is higher than average for the Sandusky River Watershed as a whole (717 lbs/acre versus 483 lbs/acre). The same holds true for total phosphorus (1.21 lbs/acre versus 1.00 lbs/acre).

The unit area export of soluble reactive phosphorus from Rock Creek (0.11 lbs/acre) is similar to that of the Sandusky Watershed as a whole (0.12). The unit area export of Nitrate is lower for Rock Creek (10.4 lbs/acre) versus the whole of the Sandusky River (17.5 lbs/acres) and its neighboring sub watershed, Honey Creek (15.9 lbs./acre). The lowest export rates of nutrients come from the Grand River, which is a primarily forested watershed in eastern Ohio.

The unit area export rates of total phosphorus from the agricultural watersheds of Northwestern Ohio are among the highest to be observed from Midwestern agricultural watersheds (Baker and Richards, 2002). These high rates of phosphorus export are related to the high clay content of area soils and the high average soil test values for phosphorus. Northwestern Ohio also has high nitrate export rates relative to other Midwestern agricultural areas. The high nitrate export rates in this area are associated with the extensive use of tile drainage in this region. Adoption of various agricultural BMPs in northwestern Ohio has reduced sediment and phosphorus export during the period from 1976 to 1995, but nitrate export has increased during this same time period. (Richards and Baker, 2002).

Table 4.4 Average annual unit area discharges and unit area loads for indicated water years for tributaries monitored by the NCWQR. (Unpublished data, NCWQR)

River	Year	Discharge, inches	SS, lbs/acre	TP, lbs/acre	SRP, lbs/acre	Nitrate, lbs/acre	Chloride, lbs/acre
Raisin	94-03	9.92	221	0.43	0.06	10.7	84
Maumee	94-03	11.56	435	0.98	0.17	16.9	76
Sandusky	94-03	11.40	483	1.00	0.12	17.5	74
Honey Cr.	94-03	11.18	371	0.98	0.15	15.9	58
Rock Cr.	**94-03**	**11.23**	**717**	**1.21**	**0.11**	**10.4**	**59**
Vermilion	01-03	9.58	370	0.60	0.09	8.7	77
Cuyahoga	94-03	17.56	911	1.08	0.15	7.1	557
Grand	94-03	17.67	478	0.49	0.04	2.3	143
Muskingum	96-03	-	284	0.59	0.10	5.9	114
Scioto	97-03	12.80	330	0.94	0.34	12.8	125
Great Miami	97-03	14.36	366	1.22	0.49	15.1	148

Chapter 5
AQUATIC LIFE USE ATTAINMENT – SANDUSKY RIVER – TIFFIN WATERSHED

Use Attainment

This section is divided into sections describing the use attainment for each of the following three use designations assigned to segments of SR-Tiffin:

- Aquatic life use
- Recreation use
- Public water supply use

Aquatic Life Use Attainment

To understand the basis for biological use attainment analyses by the OEPA, additional background information is needed beyond the general concepts introduced in the previous chapter. Much of the information presented below is taken from the OEPA Guide to Developing Local Watershed Action plans in Ohio (OEPA, 1997), the Sandusky River TSD (OEPA, 2003), the TMDL (OEPA, 2004b), and the RIMP (SRWC, 2001).

Biological Community Measurements: As part of the Upper Sandusky TMDL study, the Ohio EPA conducted detailed studies of the biological communities within the drainage network of the SR-Tiffin Watershed. The locations of the sampling stations are shown on Map 12. The numbering of the stations is based on the watershed area upstream from the sampling site, with the largest area having the lowest number (1) and smallest area having the highest number (14).

The TMDL study plan called for fish studies at 12 stations, quantitative macro invertebrate studies at 4 sites and qualitative macro invertebrate studies at 9 sites. Fish collections were completed at 12 stations, quantitative macro invertebrate studies at 4 sites and qualitative macro invertebrate studies at 12 sites. The 12 stations that are of consequence for the majority of the text that follows are numbered 3 through 14. Sites 1 and 2 had qualitative ICI scores available only. Ohio EPA staff noted low water levels during the sampling period at these stations (TMDL 2004).

The OEPA utilizes standardized electro fishing techniques to study fish communities. These techniques are described in the OEPA User's Manual for Biological Field Assessment (OEPA, 1987). Quantitative macro invertebrate studies involve the placement of artificial substrates in riffle environments of streams. Following a colonization period, the artificial substrates are collected and the macro invertebrate communities evaluated relative to species composition and frequency. The qualitative macro invertebrate studies involve the use of nets to collect representative species present in the stream. The macro invertebrate methods are also described in the OEPA User's Manual for Biological Field Assessment (OEPA, 1987).

Biological Indices: The fish and macro invertebrate data from the above studies are used to calculate the following three indices, as described in the OEPA Guide and presented below:

- **Index of Biological Integrity (IBI)** - The index of biological integrity is a measure of fish species diversity and species populations. The index is a number that reflects total native species composition, indicator species composition, pollutant intolerant and tolerant species composition, and fish condition. Combined, the higher the calculation, the healthier the aquatic ecosystem; conversely, the lower the index, the poorer the health of the aquatic ecosystem. The highest score is 60.
- **Modified Index of Well Being (MIwb)** - the modified index of well being factors out 13 pollutant tolerant species of fish and includes fish mass in the final analysis. Thus, if the IBI and the MIwb are examined together, an even clearer picture of the health of the biological community emerges. For example, if a high IBI is coupled with a low MIwb, it could tell us that while there is a variety of species and a good number of individuals of each species (high IBI) individual members of these species are smaller than what is expected. This might indicate that while fish are numerous, they are not maturing fully. In turn, this information could be useful in determining which pollution source is impacting the biological community. The highest value of the MIwb is 12. The MIwb is not applied to stream segments with drainage areas less than 20 square miles.
- **Invertebrate Community Index (ICI)** - the invertebrate community index is based on measurements of the macro invertebrate communities living in a stream or river. It is particularly useful in evaluating stream health because: (1) there are a wide variety of macro invertebrate taxa, which are known to be pollutant intolerant; and (2) there are a number of macro invertebrate taxa, which are known to be pollutant tolerant. Like the IBI, the ICI scale is 0 - 60 with higher scores representing healthier macro invertebrate communities and therefore more biologically diverse communities.

Biological Standards: In Ohio, numerical standards for the above indices have been incorporated into the state's pollution control laws. The minimum standards vary depending on the use designation and location (ecoregion) in the state. All of the watersheds within the Upper Sandusky TMDL study area are located in the Eastern Corn Belt Ecoregion (see Figure 2.3 in the OEPA Guide or Figure 5.2 in the RIMP). For streams in this ecoregion the standards for the three indices are shown in Figure 5.1 for each of the aquatic life use designations in the watershed. The standards are shown in tabular fashion in Table 5.5.

The figure illustrates how the standards become more stringent as the designation moves from lower to higher uses. The "bar" for acceptable quality is lifted as the use designation shifts from LRW to EWH for all three indices. As shown in Figure 5.1 and in Table 5.1, index values slightly below the standard are considered to be non-significant departures from the standard, and hence are deemed marginally acceptable. Where index values fall below those deemed marginally acceptable, stream segments are unacceptable relative to that index.

In Figure 5.1, each graph has a horizontal axis of drainage area at the sampling station. This is included on the graph because, as will be seen in subsequent sections of this chapter, index values tend to shift with drainage area, although biological standards are constant.

Reference Sites: The particular values of the standards shown above are based on biological measurements of reference streams in each ecoregion of the state. The reference stream segments are selected such that they have minimal pollutant impacts and optimal habitat characteristics for that ecoregion. The standards used for WWH general represent the 25th percentile of all of the index values for the reference sites. Thus, if the scores at all of the reference sites for a particular ecoregion were ranked from the highest to the lowest, the score 25% up from the lowest score is selected as the standard. Separate sets of reference sites are selected for MWH use designations. By using ecoregional reference sites, OEPA assures that local streams are evaluated relative to similar streams, in terms of soils, geology, and native vegetation. Two ecoregional WWH reference sites are located in the Upper Sandusky TMDL study area, as are five MWH reference sites.

Figure 5.1 Relationship between use designations and aquatic life standards for three biological indices. Standards are for streams in the Eastern Cornbelt Ecoregion.

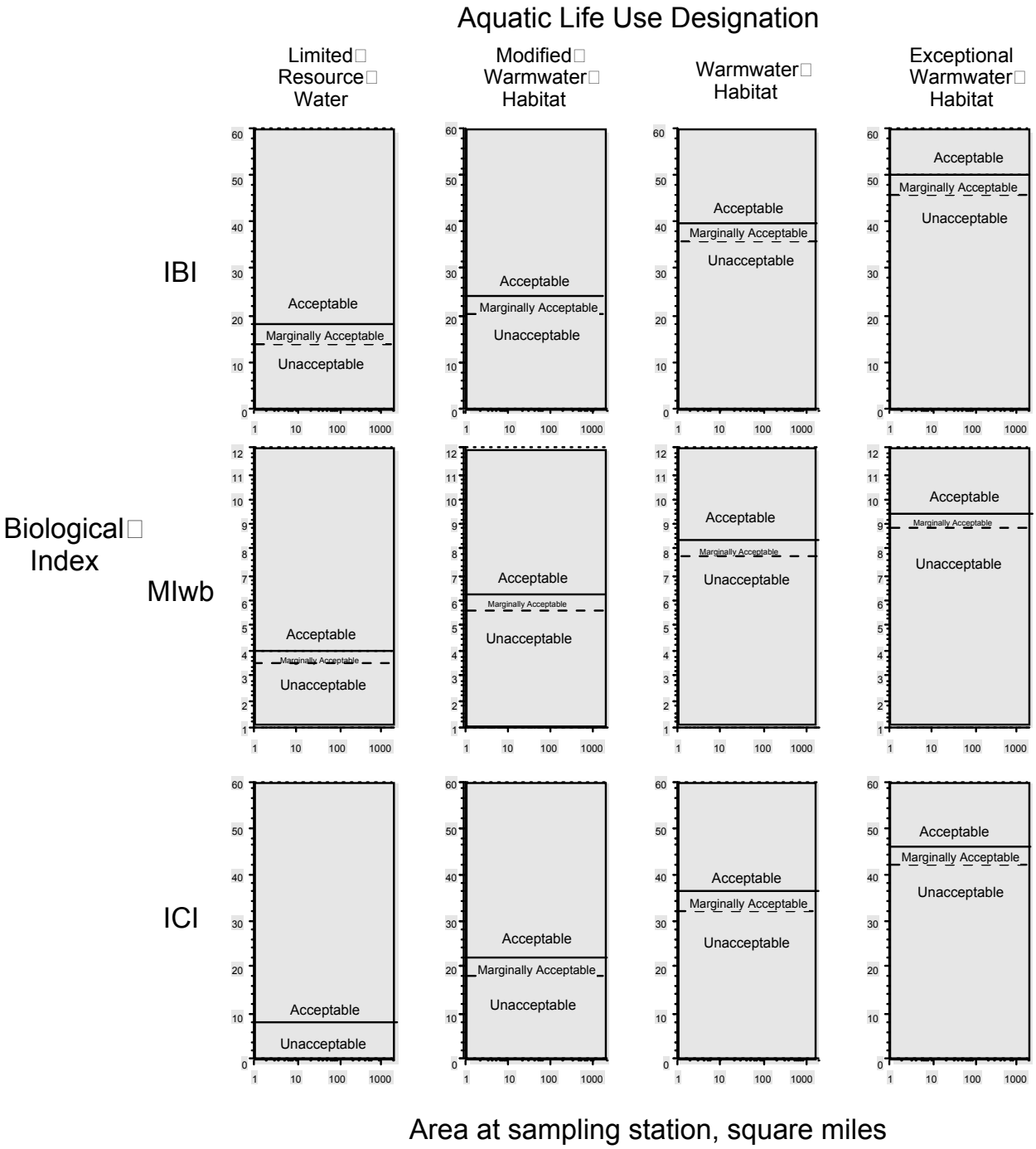


Table 5.1 Water quality standards (biocriteria) for streams and rivers in the Eastern Corn Belt Plains ecoregion.

Index - Site Type	LRW	MWH Channel modified	MWH impounded	WWH	EWH
IBI Headwater - Wading/Boat	18/18	24/24	-/30	40/42	50
MIwb Wading/Boat	4.0/4.0	6.2/5.8	-/6.6	8.3/8.5	9.4/9.6
ICI	8	22	-	36	46

Table 5.2 Narrative evaluations for the three biological indices used in Ohio's biological assessments. The ranges for exceptional, very good, poor and very poor are applied statewide, regardless of ecoregion. The values for good, marginally good, and fair, as listed in the table, apply to streams in the Eastern Corn Belt Plains ecoregion.

IBI			MIwb		ICI	Narrative Evaluation
Headwater	Wading	Boat	Wading	Boat	All	
50-60	50-60	48-60	≥ 9.4	≥ 9.6	46-60	Exceptional
46-49	46-49	44-47	8.9-9.3	9.1-9.5	42-44	Very Good
40-45	40-45	42-43	8.3-8.8	8.5-9.0	36-40	Good
36-39	36-39	38-41	7.8-8.2	8.0-8.4	32-34	Marginally Good
28-35	28-35	26-37	5.9-7.7	6.4-7.9	14-30	Fair
18-27	18-27	16-25	4.5-5.8	5.0-6.3	2-12	Poor
12-17	12-17	12-15	0-4.4	0-4.9	<2	Very Poor

Degrees of Use Attainment for Ohio Streams and Rivers: The OEPA has developed a standard set of terms to describe the degree to which biological use attainment is being met. These are as follows:

- **Fully Attaining** - All indices meet standards.
- **Fully Attaining but threatened** - All indices meet standards, but land use activities in the watershed pose an immediate threat to maintaining water quality at this level.
- **Partially Attaining** - One of two or two of three indices do not meet criteria and are not in the poor or very poor category.
- **Non-attaining -** None of the indices meet standards or one organism group indicates a severe toxic impact (poor or very poor category) even if the other organism groups indicate attainment.

Application of the above evaluations requires information on what index scores the OEPA views as poor or very poor. These, as well as other narrative criteria, are shown in Table 5.2.

Results of Biological Studies in the Sandusky River - Tiffin Watershed

Biological Index Values and Attainment at Individual Sampling Stations: The results of the 2001 biological sampling program for stations in the SR-Tiffin Watershed are shown in Table 5.3 and Map 12. Table 5.3 combines information from the TSD, the TMDL study plan, and the TMDL. For each station the table includes information on the name of the stream, the sampling location, the river mile of the sampling location, the drainage area at the sampling location, the biological index scores, the QHEI (an index of habitat quality), the use designation at the sampling site, and the attainment status. The station numbers on Map12 link the sampling locations on the watershed maps to tabular information regarding specific stations.

Any index value that falls outside of the acceptable range for that use designation is marked with an asterisk, while any value falling in the poor or very poor range is also underlined.

Table 5.3 Summary of biological studies completed in the SR-Tiffin Watershed during the 2001 Upper Sandusky TMDL studies.

Station #	Name of stream	Location of sampling site	River Mile	Area	IBI	MIwb	ICI[a]	QHEI	Use Desig.	Attainment Status[b]
14	Morrison Creek	State Route 18	11.4				P*		MWH	**(NON)**
13	East Branch Rock Creek	State Route 67	4.2			NA	F*		WWH	**(NON)**
12	Gibson Creek	Sycamore Street	0.3	3.3	32*	NA	MG	46.0	WWH	Partial
11	Willow Creek	Twp Rd 15, Morrison Rd.	3.0	3.7	22*	NA	MG	35.0	MWH	**NON**
10	Bells Run	State Route 53	0.1	3.8	22*	NA	F*	54.5	WWH	**NON**
9	East Branch Rock Creek	At mouth	0.1	8.2	32*	NA	F*	57.5	WWH	**NON**
8	Morrison Creek	Twp Rd. 175, Coffman Rd.	9.4	10.4	32	NA	P*	34.0	MWH	Partial
7	Rock Creek	County Road 16	8.4	15.9	32*	NA	F*	49.0	WWH	**NON**
6	Morrison Creek	Twp Rd. 15, Morrison Rd.	2.4	17.7	34*	NA	MG	55.0	WWH	Partial
5	Rock Creek	Twp Rd. 201, Old Attica Rd.	4.0	31.0	38[ns]	8.1[ns]	50	76.0	WWH	Full
4	Sandusky River	U.S. Route 224	43.0	957.0	46	7.3	NA	57.0	MWH◆	Full
3	Sandusky River	Ella Street	41.8	962.0	57	10.1	42	76.0	WWH	Full
2	Sandusky River	Upstream Tiffin WWTP	38.9	1008.0	54	10.7	50	87.0	WWH	Full
1	Sandusky River	County Road 38	36.4	1031.0	50	9.9	36	84.5	WWH	Full

◆ Recommended.
* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.
ns Not significant departure from biocriterion (≤4 IBI or ICI units; ≤0.5 MIwb units).a Narrative evaluation used in lieu of ICI (E=Exceptional; G=Good; MG=Margionally Good; F=Fair; P=Poor).
b Use attainment status based on one organism group is parenthetically expressed.
NA Not applicable. The MIwb is not applicable to headwater sites.

For the watershed as a whole, 35% (5) of the stations were in full attainment of the use designation, 21% (3) were in partial attainment, and 42% (6) were in non-attainment. Map 12 displays aquatic life support use attainment for each station. It is important to note the impacts of the main stem of the Sandusky River on these figures. Table 5.4 provides the attainment status percentages for the main stem and the remaining streams within the watershed.

Table 5.4 Use attainment evaluation for Sandusky River Main Stem in SR-Tiffin watershed versus tributary streams.

Attainment Status	SR-Tiffin Watershed	Sandusky River	Tributary Streams
Full Attainment	35%	100%	10%
Partial Attainment	21%	0%	30%
Non Attainment	42%	0%	60%

The impact of the main stem on the overall watershed scores is important to consider. As stated previously, this text will deal with the entire watershed, including the main stem. The implementation plan will separate the main stem from the tributary streams, and important data such as that above will be discussed. The attainment of the main stem distorts the picture of the watershed's overall health, with only 10% of tributary streams in full attainment. The size of the watershed represented and the weight of the station will be considered later in this text, and will be important to determining the true health of the watershed.

For the IBI fish index, 6 of 14 stations were in the unacceptable range (all 6 were from tributary streams); for the MIwb fish index, 5 of 5 stations were in the acceptable range (4 of these were on the main stem, the tributary streams were almost exclusively "NA"); for the quantitative ICI, 0 of 4 stations were in the unacceptable range; and for the qualitative ICI, 2 of 9 were in the poor or very poor range.

Indices in Relation to Watershed Area: Within the Upper Sandusky TMDL area, and most of Ohio, there is a distinct relationship between the size of the drainage area upstream from a sampling station and the values of its biological indices. These relationships within SR-Tiffin and the Upper Sandusky TMDL area are shown in Figure 5.2. In this case the drainage areas are broken down into four categories: headwater streams (< 20 square miles), wadeable streams (≥ 20 - <200 square miles), small rivers (≥ 200 - <500 square miles) and large rivers (≥500 square miles).

For the Upper Sandusky TMDL data set as a whole, there is a clear decrease in each index as the drainage area above sampling stations decreases. This is confirmed in Table 5.5, Figure 5.2, and Figure 5.3, where the average index value is shown for each size range. It is noteworthy that, for the Sandusky River TMDL area, the average scores for the IBI and the ICI for the stations in the large river category meet the criteria for exceptional warmwater habitat (EWH) while the average scores for the headwater and wadeable streams fail to meet the criteria for warmwater habitat. These relationships will be reflected in the management strategies set forth to reach the attainment goals for the SR-Tiffin Watershed.

Table 5.5 Biological index values in relation to drainage area of sampling stations for the Upper Sandusky TMDL area and the SR-Tiffin Watershed.

Index/Station	Parameter	Headwater Streams	Wadeable Streams	Small Rivers	Large Rivers
		≤ 20 sq. mi.	≤ 200 - >20	≤ 500 - >200	> 500 sq. mi.
IBI, Sandusky	Mean	30.3	35.3	42.5	50.9
	Std. Deviat.	±7.52	±7.00	±6.41	±4.48
	N	82	39	8	9
IBI, SR-Tiffin	Mean	29.4	38.0	-	51.8
	Std. Deviat.	±5.1	-		±4.8
	N	7	1		4
MIwb, Sand.	Mean	-	7.18	8.19	9.19
	Std. Deviat.		±1.34	±1.26	±1.24
	N		38	8	9
MIwb, SR-Tif.	Mean	-	8.1	-	9.5
	Std. Deviat.		-		±1.5
	N		1		4
ICI, Sandusky	Mean	29.0	38.9	46.6	46.6
	Std. Deviat.	±9.43	±7.67	±4.93	±5.85
	N	97	39	8	7
ICI, SR-Tiffin	Mean	-	50	-	42.7
	Std. Deviat.		-		±7.0
	N		1		3

Figure 5.2. Biological Index Values in relation to drainage area.

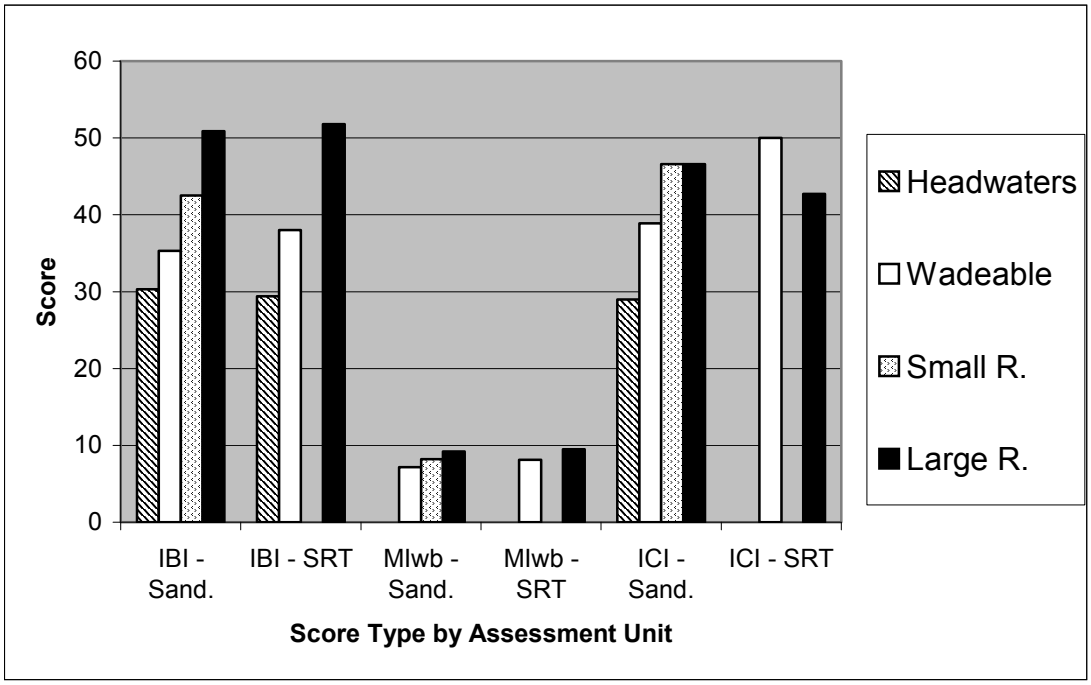
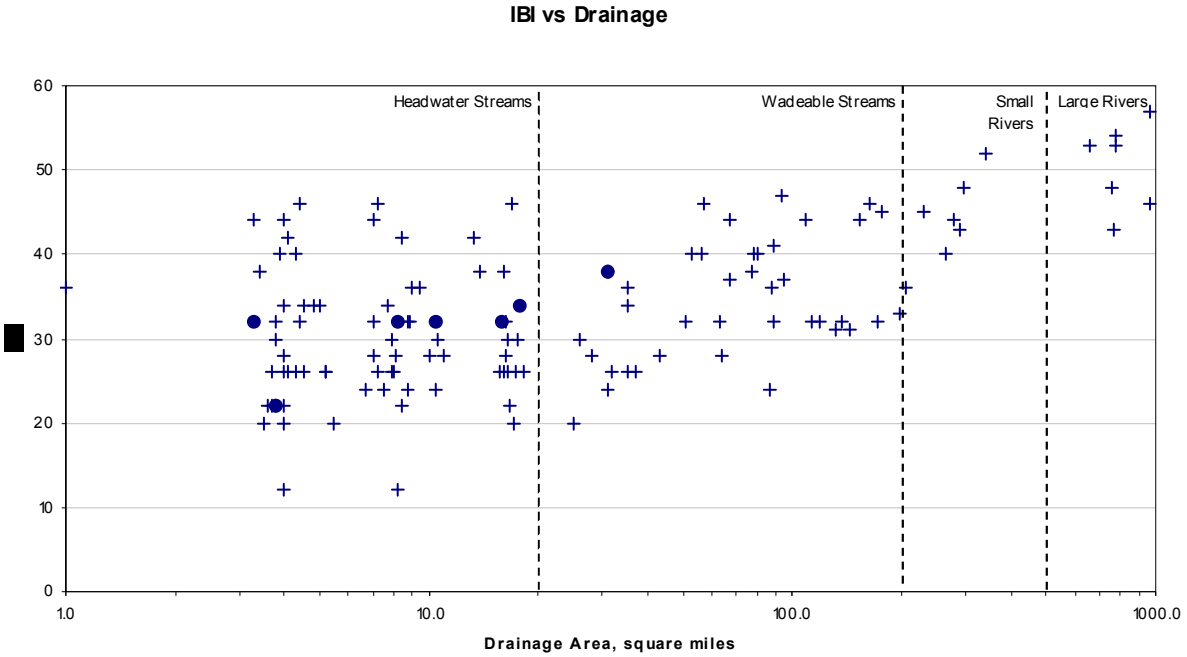
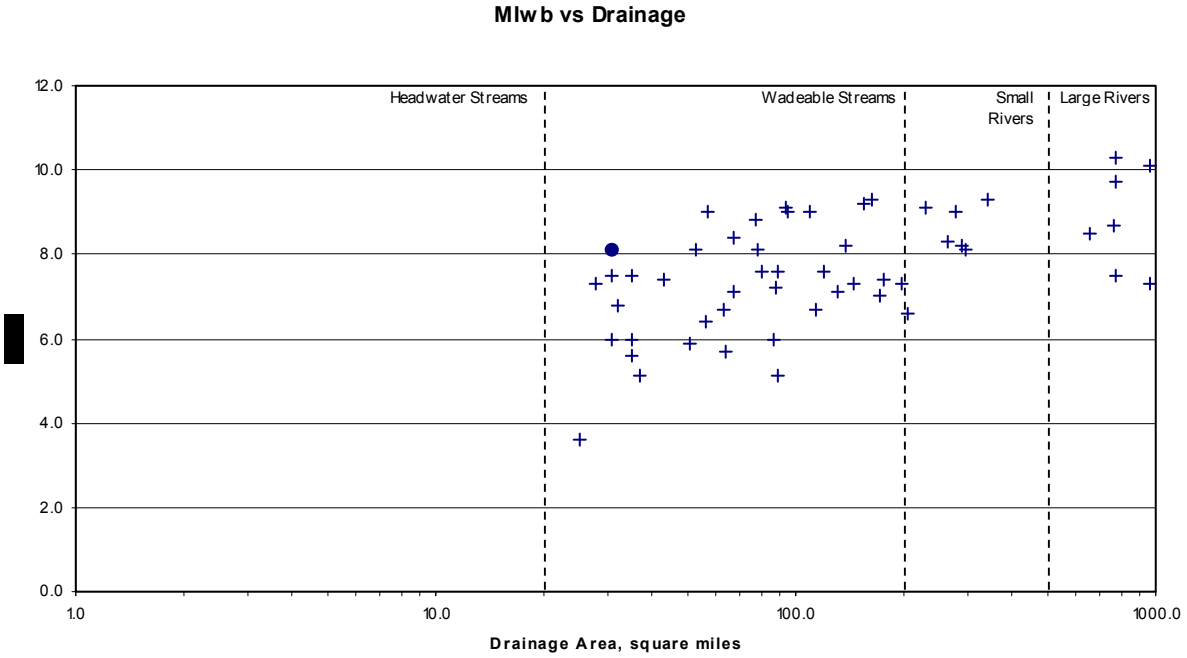
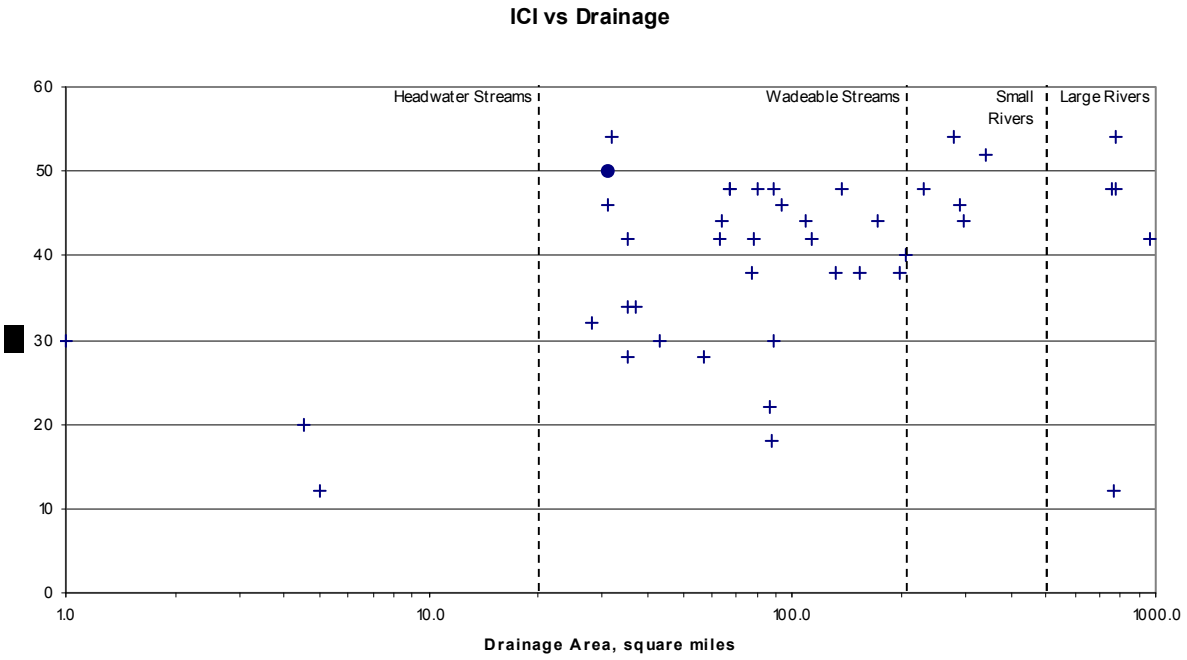
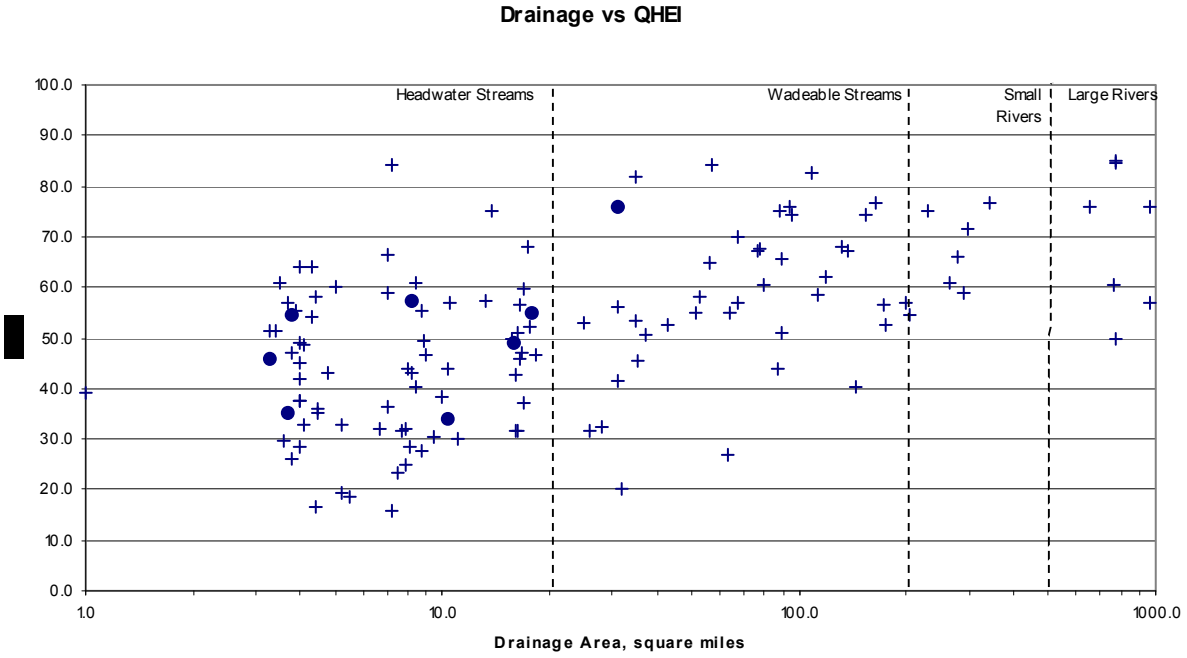


Figure 5.3 IBI, ICI, MIwb, and QHEI in relation to drainage, square miles









• SR-Tiffin scores, + Upper Sandusky River Watershed scores, from TMDL data

Attainment in Relation to Use Designation: In Table 5.6, the percentage of stations falling into the three attainment categories are shown in relation to use designation for the SR-Tiffin stations as well as for the Sandusky TMDL area as a whole. In the SR-Tiffin watershed, 7 stations were classified as WWH. Of these 14% were in full attainment, 29% were in partial attainment and 57% were in non-attainment.

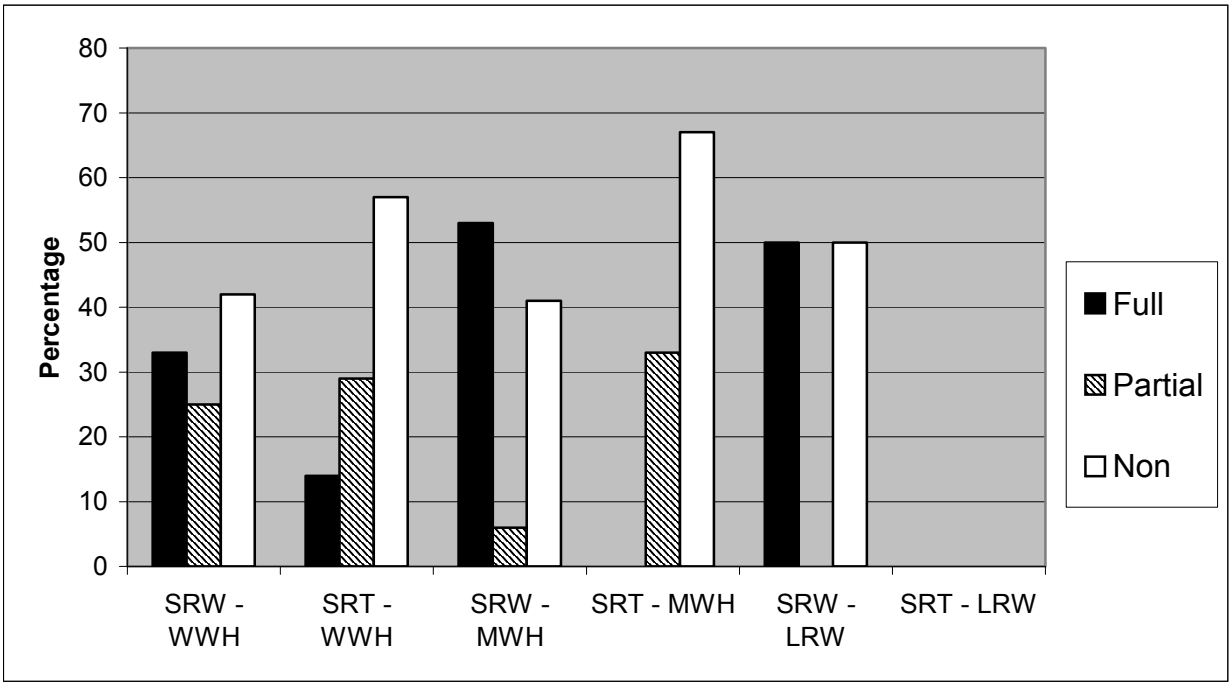
In the watershed, 3 stations were classified as MWH. Of these, 33% were in partial attainment and 67% were in non-attainment. There are no LRW in the SR-Tiffin watershed.

For the Upper Sandusky TMDL study area, 109 stations were classified as WWH. Of these, 33% were in full attainment, 25% in partial attainment and 42 % on non-attainment. For WWH stations, SR-Tiffin had a higher percentage of stations in full attainment than the Upper Sandusky TMDL study area as a whole. There were 32 stations classified as MWH in the Upper Sandusky TMDL area and the percentages in the various attainment categories were similar for both SR-Tiffin and the entire Upper Sandusky area. This information is also represented in Figure 5.4, where SRW is the entire Sandusky River Watershed and SRT is the SR-Tiffin watershed. The graph excludes all large river scores. It should be noted that the sites in Full attainment drop for both WWH and MWH in the SR-Tiffin watershed. In the case of the WWH, this drop is made up for almost exclusively in non-attainment sites. For MWH, the drop in full attainment is split between partial and non-attainment sites. The failure of any of the MWH segments to come into full attainment is an issue of importance.

Table 5.6 Use attainment in relation to use designation for the SR-Tiffin Watershed and for the entire Upper Sandusky TMDL Area.

SR-Tiffin (tributaries) Use Attainment by Use Designation (Watershed Score = 50)				
Use Designation	**Full Attainment**	**Partial Attainment**	**Non attainment**	**Total #**
WWH	1 (14%)	2 (29%)	4 (57%)	7
MWH	0 (0%)	1 (33%)	2 (67%)	3
LRW	-	-	-	-
Total	1 (10%)	3 (30%)	6 (60%)	10
SR-Tiffin Main Stem Sites (all are Large Rivers) (Ave Watershed Score=NA)				
Use Designation	**Full Attainment**	**Partial Attainment**	**Non attainment**	**Total #**
WWH	3 (100%)	-	-	3
MWH	1 (100%)	-	-	1
LRW	-	-	-	-
Total	4 (100%)	-	-	4
All Sandusky Sub watershed Sites (excludes Large Rivers) (Ave Watershed Score=44)				
Use Designation	**Full Attainment**	**Partial Attainment**	**Non attainment**	**Total #**
WWH	36 (33%)	27 (25%)	46 (42%)	109
MWH	17 (53%)	2 (6%)	13 (41%)	32
LRW	3 (50%)	-	3 (50%)	6
Total	56 (38%)	29 (20%)	62(42%)	147

Figure 5.4. Percentage in attainment, Sandusky River Watershed versus SR-Tiffin Watershed (excluding all large river scores).



Watershed Scores: In order to both evaluate and compare biological use attainment in streams the OEPA has developed a watershed scoring system. The calculation of the watershed score is illustrated in Figure 5.5, using the SR-Tiffin watershed as an example. The monitoring stations within a watershed are divided into the four size ranges shown in column I. For the smallest three size ranges, the percentage of the stations in full attainment is calculated. In Figure 5.5, the formula as presented in the Upper Sandusky TMDL is provided, along with the calculations for the SR-Tiffin watershed. It is important to note that the entire watershed score of 50, came from one single station. Future assessments of this watershed may not include this particular station, so use of this information to target practices only near the stations which would increase the watershed score, or attainment at those sites, would be misguided. Rather, these sites should serve as a guidance that illustrates the problems that face the entire watershed, and which would likely be experienced at nearly every potential future sampling station.

Figure 5.5. Calculation of the watershed score.

Data Group 1	Data Group 2	Data Group 3	
≤5 mi.^{2}	>5mi.^{2} to ≤20mi.^{2}	>20mi.^{2} to ≤50mi.^{2}	Spatial Score

[(a/b + a/b)/2 + (a/b)]/2 x 100 = c

where:
a= number of sites in full attainment
b= number of sites in data group
c= spatial attainment score for assessment unit

[(0/5 + 0/4)/2 + (1/1)]/2 x 100 = c

[(0 + 0)/2 + 1]/2 x 100 = c

[0 + 1]/2 x 100 = 50

It should be noted that in the calculation of sub watershed scores, full attainment at a site with MWH (or LWR) designation has equal weight as full attainment at a site with WWW designation.

In 2000, the average watershed score in Ohio was 47. The OEPA has set an average watershed score of 80 as the target for 2010 (OEPA, 2004c). The scores of the sub watersheds of the Sandusky River, based upon the TMDL data, are shown in Figure 5.7. None of the sub watersheds in the Upper Sandusky TMDL study area meet the OEPA target score of 80. The SR-Tiffin Watershed has an average watershed score (50) when compared with the other watersheds the TMDL study area (Figure 5.7).

Table 5.7. Ranked watershed scores for the Upper Sandusky River watershed.

Sub watershed	11 digit # 04100011-	Watershed Score	Percent WWH	Avg. IBI	Avg. MIwb	Avg. ICI	Avg. QHEI
Broken Sword Creek	030	71	43	31	8	43	46
Honey Creek	080	64	58	36	7	37	51
Sandusky River - Mexico	070	56	78	33	8	41	49
Sandusky River - Upper Sandusky	040	52	89	29	5	34	47
Sandusky River - Tiffin (Partial)	090	50[5]	73[5]	31[4]	8[1]	50[1]	51[1]
Sandusky River- Bucyrus	020	32	92	33	4	21	49
Lower Tymochtee Creek	060	27	93	28	6	-	42
Upper Tymochtee Creek	050	13	60	30	7	39	47
Average		**45.6**	**45.6**				

*Superscript number for SR-Tiffin is the rank for the watershed versus the other Upper Sandusky watersheds.

In Figure 5.7, the average IBI, MIwb, ICI, and QHEI scores are also shown for each 11-digit watershed in the Upper Sandusky TMDL area.

Watershed scores are also strongly impacted by the way sampling stations cluster within the size categories used to calculate the watershed score. In the case of SR-Tiffin (Figure 5.5), only one of the stations fell in the 20-50 square mile size category. That category is automatically assigned 25% of the total score. That single station, which was in full attainment of WWH use designation, contributed all 50 points to the total watershed score. In general, the 20 - 50 square mile size category is under-represented in the data sets, resulting in a small number of stations having a disproportionate impact on watershed scores. This problem was identified in the SRWC comments on the draft TMDL and acknowledged by OEPA in their responses. However, solutions have yet to be developed.

For the reasons mentioned above, the utility of watershed scores will be evaluated on a watershed by watershed basis in the preparation of watershed management plans by the SRWC.

Attainment by 14-digit Watersheds:

In Figure 5.8, the results of the biological sampling program are arranged by the six 14-digit watersheds located in the SR-Tiffin Watershed. Even though the Upper Sandusky TMDL study has provided a greatly improved data set upon which evaluations of biological use attainment can be based, the density of collection sites provides very limited data upon which to evaluate water quality at the 14-digit watershed level. Care must be exercised in interpreting the data for the following reasons:

- Some of the sub watersheds have very limited sampling (2 of 6 14-digit watersheds in the SR-Tiffin Watershed contain only 0 sampling station).
- Only 3 sampling stations are present on Morrison Creek.
- The 3 stations listed for the Sandusky River Honey Creek to Morrison Creek are for 3 different streams, each of which drains to the Sandusky River, and each of which has only 1 sampling station.
- The distribution of drainage area sizes at sampling stations differs greatly among 14-digit watersheds. Thus 14-digit watersheds located along downstream reaches of major tributaries contain sites with much larger drainage areas, as much as 31 square miles, versus those at upstream sites or on smaller tributaries, as little as 3.3 square miles.

IBI Scores for each of the tributaries to the Sandusky River Honey Creek to Morrison Creek watershed, are significant departures from ecoregion biocriterion. Two of the three IBI and three of the four ICI scores for Rock Creek are significant departures from ecoregion biocriterion as well. The ICI scores for two of the sites in the Morrison Creek watershed are considered poor. It is again important to note that the entirety of the watershed score derives from the one site in full attainment in the Rock Creek watershed (site #10).

Table 5.8. Biological study results by 14-digit watersheds within the Sandusky River - Tiffin Watershed**

Map #	14 Digit HUC	Name of Stream	Location of Sampling	River Mile	Drainage Area	IBI	MIwb	ICI	QHEI	Use Designation	Use Attainment
12	**010**	Gibson Creek	Sycamore	0.3	3.3	32*	NA	MG	46.0	WWH	Partial
11	**010**	Willow Creek	TR 15, Morrison Rd.	3.0	3.7	22*	NA	MG	35	MWH	**NON**
10	**010**	Bells Run	SR 53	0.1	3.8	22*	NA	F*	54.5	WWH	**NON**
13	**020**	East Branch Rock Creek	At mouth	0.1	8.2	32*	NA	F*	57.5	WWH	**NON**
9	**020**	East Branch Rock Creek	SR 67	4.2		---	NA	F*	---	WWH	**(NON)**
7	**020**	Rock Creek	CR 16	8.4	15.9	32*	NA	F*	49.0	WWH	**NON**
5	**020**	Rock Creek	TR 201, Old Attica Road	4.0	31.0	38^{ns}	8.1	50	76.0	WWH	Full
14	**030**	Morrison Creek	SR 18	11.4		---	---	P*	---	MWH	**(NON)**
8	**030**	Morrison Creek	TR 175, Coffman Rd.	9.4	10.4	32	NA	P*	34	MWH	Partial
6	**030**	Morrison Creek	TR 15, Morrison Rd.	2.4	17.7	34*	NA	MG	55.0	WWH	Partial

** The sampling station data for the Sandusky River's main stem has not been included in this chart.

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.

ns Not significant departure from biocriterion (≤4 IBI or ICI units; ≤0.5 MIwb units).a Narrative evaluation used in lieu of ICI (E=Exceptional; G=Good; MG=Margionally Good; F=Fair; P=Poor).

b Use attainment status based on one organism group is parenthetically expressed.

NA Not applicable. The MIwb is not applicable to headwater sites.

Recreation Use Attainment

Recreation beneficial use designation

To meet the Clean Water Act's charge to establish swimmable/fishable waters requires that recreation be designated a beneficial use. Recreation use designations apply during the recreation season only, defined as the period from May 1 to October 15, and include three subcategories of use: bathing waters, primary contact, and secondary contact. Almost all the SR-Tiffin watershed has been given the primary contact recreation (PCR) designation (OAC 3745-1-12). This designation refers to waters suitable for full-body recreation such as swimming or canoeing. The water generally has at least a 1 meter depth over an area of at lest 100 square feet to meet this designation. Secondary Contact Recreation (SCR) is the designation for waters that are too small and shallow to allow primary contact. Only 2 sites in the watershed have the SCR designation: Morrison Creek – headwaters to river mile 7.9 and Unnamed tributary to Willow Creek, river mile 0.88.

Assessment method for recreation use attainment

Ohio EPA's newly developed method for assessing attainment of recreation uses is described in the Ohio 2004 Integrated Water Quality Monitoring and Assessment Report (OEPA, 2004a). Fecal coliform is used as an indicator organism for the presence of pathogens. The Water Quality Criterion (Table 7-13, OAC 3745-1-07) states that the geometric mean fecal coliform content, based on no less than five samples within a thirty-day period, shall not exceed 1000 CFU (colony forming units) per 100mL and fecal coliform content shall not exceed 2000 CFU per 100mL in more than 10% of the samples taken during any thirty-day period.

In the Ohio 2004 Integrated Report, the pool of raw data for fecal coliform was not large enough to allow direct comparison of the geometric mean to the water quality criterion. Therefore, waters were designated impaired when the 75^{th} percentile exceeded 1000 or the 90^{th} percentile exceeded 2000 CFU per 100 mL. A minimum of three sampling locations and 15 measurements within a given assessment unit were required to assess attainment.

Fecal coliform data and the watershed's recreational use attainment

An OEPA study conducted in 2001 in the SR-Tiffin watershed reported a geometric mean of 830 CFU/100mL and a 90^{th} percentile of 4163 CFU/100mL. The Ohio 2004 Integrated Report (Appendix D.2.) provides the following data: for pooled data taken from 21 ambient sites with 34 ambient sampling records, the geometric mean was 155 CFU/100mL, the 75^{th} percentile was 635 CFU/100mL, and the 90^{th} percentile was 1200 CFU/100mL. On the basis of these data the OEPA has determined that the SR-Tiffin watershed assessment unit is considered impaired for the primary contact recreation use designation. (OEPA, 2004a).

Data measured in the 2001 OEPA study is broken down by site in Figure 5.9.

Table 5.9 OEPA Biological and Water Quality Study 2001.

Site (Each site had 5 sets of samples collected at 2-week intervals)	River Mile	Fecal Coliform (CFU/100 mL)	Applicable statewide water quality criteria (3745-1-07)
Morrison Creek	9.34	1100	Recreation OMZM*
	2.36	6000	Recreation OMZA
	2.36	1400	Recreation OMZM
Rock Creek	8.31	1900	Recreation OMZA
	3.96	1100	Recreation OMZA
E. Br. Rock Creek	0.47	3800	Recreation OMZM

*OMZM: Outside Mixing Zone Maximum, OMZA: Outside Mixing Zone Average

Several sites were mentioned as problem locations for recreational uses in the 2001 Sandusky River TSD (OEPA, 2003).

> "Extremely elevated levels of bacteria were documented in the Sandusky River below the City of Tiffin. The source was overflows from combined sewers that were activated during a rainstorm. The Tiffin City Council approved a phased plan for separating combined sewers in January, 2002. Another problem spot in Tiffin is Honey Creek near its confluence with the Sandusky River."…"Other areas where failed septic systems were a concern are…the Village of Republic in Seneca County." (OEPA 2003, p.26)

The impacts of the Honey Creek Subdivision on Honey Creek, and thus on the Sandusky River, are dealt with in the Honey Creek Watershed Action Plan. The City of Tiffin's CSO's and the Village of Republic will be dealt with in Chapter 6 of this plan.

Potential causes and sources of impairment

The similarity of land use across the watershed provides the potential for additional impairments due to septic system failure, livestock related impacts, and other common land use issues. The potential for future degradation of PCR use as it exists should be guarded against when and where feasible. With this goal in mind, potential causes and sources of impairment are examined here.

The TMDL Report for the Upper Sandusky River, prepared by the OEPA Division of Surface Water, includes recreation in its assessment of beneficial uses. The report identifies pathogens as the primary cause of recreation use impairment. Sources include combined sewer overflows, agricultural sources (manure), and septic systems.

Bacteria and other pathogens are a human health issue for recreational use attainment, because people can be exposed to these organisms while wading, swimming, and fishing. Measurement of fecal coliform, a bacterium ubiquitous in fecal matter, serves as an indicator of the presence of fecal contamination from human and/or animal sources. Where such contamination exists, serious disease-causing organisms may be present. Diseases that can be caused by exposure to bacterial pathogens include diarrhea, urinary tract infections, typhoid fever, gastroenteritis, and

dysentery. Viral pathogens include polio, hepatitis A, and encephalitis. Other water-borne pathogens that cause concern are cryptosporidium and giardia.

Municipal wastewater treatment facilities are required to disinfect the effluent they discharge into public water bodies during the recreation season (May 1-Oct. 15). However, combined sewer overflows can cause untreated sewage to bypass the treatment plant and enter into streams, bringing dangerous levels of pathogens with it. Combined sewer overflows may occur in sewer systems that carry both sanitary waste and storm water. During a heavy rain, the sewage may be diverted directly to the stream to prevent flooding of the treatment system.

Another source of pathogens is livestock production. Manure can enter streams from pasture land, direct access of livestock to the stream, feedlot runoff, and manure disposal by land application. Artificial tile drainage systems can carry contaminants from liquid manure application.

Drainage from poorly designed, failed, or unmaintained septic systems can contribute pathogens to water resources. Cross connecting septic systems to storm sewers in housing developments and small towns can facilitate pollution of receiving streams. In some instances septic systems have been known to be connected to agricultural tile drainage systems.

In waterways where hydrological modification has isolated the channel from the landscape, sediments can become concentrated. Since pathogens can attach to suspended or bed load sediments, these pathogens may also become more concentrated.

Public Water Supply Use Attainment

Two communities have public water supplies that take water from the surface waters of the SR-Tiffin Watershed: Tiffin and Republic. Tiffin pumps water from the Sandusky River within the city limits. This water is mixed with water from a well field located along the Sandusky River as well. The well field consists of five public water supply wells completed in bedrock at 250-350 feet deep. The City of Tiffin has a fully endorsed Wellhead Protection Plan for the well field.

Water quality criteria for public water supplies

Waters located within five hundred yards of a drinking water intake are given the use designation of “public water supply” (OAC 3745-1-07). OEPA water quality criteria for the protection of human health fall under two sub-categories: drinking and non-drinking (OAC 3745-1-33). The “drinking” human health criteria apply to all water bodies located within five hundred yards of drinking water in the system has ample capacity for the community at this time. The drinking water supply is susceptible to contamination as it is in the karst formations. This is the biggest concern facing the water supply at this time.

A drinking water source assessment has been conducted for Tiffin’s water treatment facilities under the Source Water Assessment Program (SWAP) required by the Safe Drinking Water Act and the results are reported below (Drinking Water Source Assessment Reports).

Drinking Water Source Assessment for the City of Tiffin

The Tiffin public water system serves 18,135 people through 8,200 service connections and produces an average of 2.146 million gallons per day. The Drinking Water Source Protection Area (approximately 957 square miles) includes the drainage area upstream of the plant intake and is subdivided into a Corridor Management Zone (CMZ) and Emergency Management Zone (EMZ). The CMZ extends from the intake to 10 miles upstream and includes the area 1000 feet to each side of the stream. It also includes any tributaries along this section of the mainstem with an expanse 500 feet wide on each side. The EMZ is a semicircle that extends 500 feet upstream and 100 feet downstream of the intake.

The land uses for the protection area are 70.9% row crops, 17.2% pasture/hay, 9.6% deciduous forest, and several other uses at less than 1% (includes residential, wetlands, forest, and others).

The assessment report gives compliance monitoring results for finished water. The system had no health-based or maximum contaminant level (MCL) violations. It should be noted that an OEPA Pesticide Special Study detected nitrate and several pesticides (alachlor, atrazine, metolachlor, simazine, and cyanazine)in the finished water, suggesting impact from local land use activities (OEPA, 1999).

The following excerpt from the Source Assessment provides information on biological and chemical monitoring in the Sandusky River and its tributaries:

> The segment of the Sandusky River that is within the Tiffin corridor management zone is assigned the Warmwater Habitat (WWH) use designation. However, the impounded area (upstream of) the Ella St. Dam is effected by heavy siltation, limited habitat and lack of discernable flow, so has been recommended to be assigned the impounded Modified Warmwater Habitat (MWH) use. The impounded area upstream of the Ella St. Dam is also designated as a Public Water Supply (PWS). This impounded segment is in full attainment of the recommended MWH use, but the water quality standard criteria for iron and manganese in a PWS zone were exceeded in most samples. The rest of the Sandusky River that is within the corridor management zone is in full attainment of the WWH use designation, and water quality is fairly good. There were some higher than normal temperatures, partly due to the nature of the impoundments, but good dissolved oxygen levels were maintained. Results of analyses for organic priority pollutants upstream and downstream of the Tiffin landfill were all below detectable levels. Low levels of atrazine were detected at both sites, but the results are estimated values.
> Gibson Creek (tributary to the Sandusky River at RM 41.92) is only in partial attainment of the WWH use designation based on biological sampling. No water quality data is available for Gibson Creek, but it appears to be impaired by nutrient enrichment and/or organic loading. (Source Water Assessment, 5)

A review of regulated facilities found 44 potential contaminant sources in the drinking water source protection area. Eighteen of these are in the corridor

management zone none are within the emergency management zone. The Sandusky River or its tributaries are crossed 1,461 times by roads/streets and 84 times by rail. There are 2.4 roads miles within 100 feet of a stream, creating 41 stream crossings within the corridor management zone. A total of 1,379 oil/gas wells are located in the protection area, 32 of these are within the corridor management zone. There is one gas line crossing the Sandusky River within the corridor management zone.

Recommended protective strategies include:

"Controlling agricultural runoff and runoff from cattle grazing pastures, with particular attention to sources of pesticides, nitrates, phosphorus, and microorganisms such as fecal coliform bacteria. This can be accomplished via educational efforts." (Source Water Assessment, 6)

Partnership between the City of Tiffin and the Sandusky River Watershed Coalition is also listed as a protective strategy. The City of Tiffin is currently a member of the Sandusky River Watershed Coalition.

Benefits of Ohio's Source Water Assessment and Protection Program for the SR-Tiffin Watershed

Public water treatment systems have an excellent record of providing safe drinking water to Ohio. However, should treatment fail for any reason, public health can be put at risk. The experience of the City of Milwaukee in 1993 gives evidence of this risk. When the city's public water supply became contaminated with cryptosporidium from animal wastes, 69 people died and 4,400 were hospitalized among the 850,000 residents in this system. By protecting the source water used by a water treatment plant, we can lessen the risks associated with failures in the treatment systems.

Other concerns for safeguarding source waters include the toxic substances on the OEPA human health water quality criteria list mentioned above. Some toxic substances are not removed by standard water treatment processes or are not removed in a consistent manner. When a treatment plant employs activated charcoal to remove organics, for example, the efficiency of the charcoal bed can change with time. If the bed is not maintained properly, organics may pass through to the finished drinking water. Improving the quality of the source water lowers the risk to human health from ineffective or failed treatment processes. An added potential benefit of source water protection may be reduced treatment costs for the municipalities within the watershed.

Sandusky River – Main Stem (RM43.70-22.73)

The main stem of the Sandusky River from Honey Creek to Wolf Creek is considered a Large River by OEPA. The main stem of the Sandusky is addressed individually within the TMDL for the Upper Sandusky River Watershed. The development of a WAP for the main stem alone is not a process that lends itself well to either the public involvement or implementation phases. To address this issue, the main stem of the Sandusky River will be dealt with as multiple units, divided by the individual14-digit HUC's. The main stem from Honey Creek to Wolf Creek has been discussed at length throughout this text. Included below is information as derived from the TMDL for the main stem of the Sandusky River.

> Two impounded areas failed to meet the WWH use. The Ella St. dam (RM 42.0) exists to supply drinking water for the City of Tiffin. The St. Johns dam (RM 50.2) allows for small boat recreation, but severely impairs the attainment of the designated WWH use….Since the Ella St. dam is necessary and its removal in not a possibility, an impounded Modified Warmwater Habitat use (MWH) is appropriate. Biological communities in the impounded reach met this use…Very few water quality problems were documented in the assessment unit, however, urban storm water is a concern as a source of recreational impairment. A storm on July 24, 2001 apparently produced enough rain to activate combined sewer overflows (CSOs) in Tiffin and elevated bacteria counts were subsequently documented. The associated ammonia and phosphorus concentrations were also higher. Pesticide scans indicated that insecticides used on crops were a concern in several areas. The compound dieldrin was detected in both the Ella St. and St. Johns dam pools on the Sandusky River. The level at both sites exceeded toxicity guidelines.

As noted above, the City of Tiffin has adopted a plan for addressing the CSOs within the city. The final implementation of this plan will eliminate the impacts of CSOs on the Sandusky River. A complete Storm Water Management Plan has also been developed by the City of Tiffin to address six areas of minimum controls as required in the Ohio EPA Storm Water Phase II Program. The St. Johns dam has been removed since the completion of the TMDL, and the impounded area has shown significant recovery. The presence of riffle structures, benthic macro-invertebrates, and other indicators have been tracked by OEPA, the NCWQR, The Ohio State University, and other researchers. The continued monitoring of the recovery of the once impounded area will continue for 5 years after the dam's removal.

The presence of pesticides is likely due to the agricultural land uses found throughout the watershed. The reduction of pesticide levels should occur upon the completion and implementation of watershed action plans for the entire upstream area. The aquatic life found within the Sandusky River, the abundant habitat, and the proliferation of the Bald Eagle are all indicators of the overall health of the Sandusky River's main stem. The improvement of water quality within the tributaries, and the implementation of many management practices, will have beneficial impacts on the Sandusky River. The replacement of failed septic systems is one activity that should be given special attention along the Sandusky River. Partnership with local county health departments will allow the Coalition to address this need.

Ground Water

Throughout Ohio ground water is an important resource for both public and private drinking water supplies, irrigated agriculture and more. The Ohio EPA is the designated state ground water quality management agency for addressing and preventing ground water pollution and other water quality problems (OEPA, 2000). The Ohio DNR, Division of Water, conducts ground water mapping and research, develops

water supply studies, ensures the safety of existing dams, regulates construction of new dams, dikes, and levees, provides technical assistance services, and much more.

The Ohio DNR, Division of Water, has produced county ground water resource maps for all Ohio counties. They are intended to aid in the development of reliable ground water supplies throughout the state. For example, ground water resource maps show the expected yield to a drilled well at any location within the county along with other types of data (ODNR, date unknown). Given that the SR-Tiffin Watershed is predominantly rural, there is an important reliance among watershed residents on ground water made available via private wells. Maps for the two counties with land area in SR-Tiffin can be accessed from the following website: http://www.dnr.state.oh.us/water/gwrmaps/

Ground water pollution potential maps have been developed by the Ohio DNR, Division of Water, for most counties in Ohio using the DRASTIC mapping system. The DRASTIC system consists of two major elements: the designation of map able units, termed hydrogeologic settings, and the superposition of a relative rating system for pollution potential. The DRASTIC index values vary from 23 to 230. The higher the DRASTIC index, the greater the vulnerability to contamination (ODNR, date unknown).

Ground water pollution potential analysis in Seneca County resulted in a map that illustrates ten hydrogeologic settings with varying vulnerability to ground water contamination. The map for Seneca County illustrates ground water pollution indexes ranging from 98 to 217 (ODNR, 1994). High vulnerability in portions of Seneca County reflects the presence of karst geology. Map 14 illustrates the location of the karst region in relation to the SR-Tiffin Watershed.

The Sandusky River Watershed Coalition implemented an educational-outreach program in 2003 directed to local public water suppliers and landowners. Program topics included ground water pollution, high pollution potential in karst geology areas, and action plans for public water suppliers to implement.

Chapter 6
PLAN FOR WATERSHED RESTORATION ACTIVITIES

This Action Plan will address the following water resource related problems and needs in the Sandusky River – Tiffin Watershed:

1. **Problem 1 – High rates of sediment and nutrient export that impact downstream receiving waters, including Sandusky Bay and Lake Erie.**
2. **Problem 2 – Impaired biological communities within the streams of the SR-Tiffin Watershed due to habitat and flow alterations.**
3. **Problem 3 – Impaired biological communities within the streams of the SR-Tiffin Watershed due to high nutrient loads.**
4. **Local management effort – Household Sewage Treatment Systems.**
5. **Special management effort – Coastal Nonpoint Pollution Control Program.**
6. **Local management effort – Educational Programs.**
7. **Local management effort – Fundraising Programs.**
8. **Sandusky River – Main Stem**

This chapter will deal with each of these issues, and will lead to the development of action items.

Agricultural Programs to Reduce Water Resource Impairments: An Overview

Agriculture dominates land use in the Sandusky River Watershed. Consequently, many, but certainly not all, of the causes and sources of water quality problems are associated with agricultural land uses. Numerous discussions on agricultural pollution abatement issues have taken place within the Sandusky River Watershed Coalition and its committees, as well as between the Coalition's Steering Committee and various agricultural groups, including individual Soil and Water Conservation Districts and area agricultural service center staff. A listing of some of these meetings is shown in the Appendix 1. These meetings provided the Steering Committee with a good overview of the concerns and needs of Soil and Water Districts relative to future efforts for reducing water resources problems in the Sandusky Watershed.

The Coalition's Agricultural Subcommittee has also solicited input from the Crawford, Seneca, and Wyandot Soil and Water Districts regarding BMPs they considered appropriate for future grant applications. Their recommendations, as summarized by the Agricultural Subcommittee, are presented in Sidebar 6.1. Subsequently, NCWQR staff developed a set of "Guiding Principles for Watershed Action Plan Development Relative to Agricultural Nonpoint Pollution." These guiding principals attempt to summarize and integrate a variety of diverse messages coming from various Coalition constituencies. These guiding principles have been endorsed by the Coalition's Steering Committee and are shown in Sidebar 6.2.

Sidebar 6.1 Sandusky River Watershed Coalition
Agricultural Subcommittee
Recommendations for watershed BMPs, 12/18/04

(These recommendations are based on input from the Crawford, Seneca and Wyandot SWCD's)

1. Repair broken tile mains in connection with the development of water retention areas and/or controlled drainage. Broken tile mains are often sites of serious erosion and sediment delivery to streams.
2. Increase participation in filter strip programs by increased marketing of existing programs (CRP, CREP) and/or by increasing rental rate payments (from private sources) so that payments would exceed the value of the average crop on non flooding soils.
3. Use selective logjam removal to alleviate local flooding problems, focusing on large, complete blockage logjams. Allow smaller logjams to remain for stream habitat enhancement.
4. Use rotation incentive payments so that farmers can incorporate small grains, hay or cover crops into their rotations. Target to fields next to water courses; extend the rotation to at least three years; must be green (i.e. growing) during the winter. Cost share must cover seed costs, labor and chemical burn down in spring. Cover crops can be used in this category or as stand alone measures.
5. Innovative equipment - variable rate equipment, manure equipment, yield monitors, etc.. Aid to producers for conservation equipment purchase often opens doors for participation in additional conservation programs.

Some Specific BMPs to Promote

1. Filter strips, target all ditches
2. Tillage/planting equipment (non inversion
3. and no-till
4. Tile blow-out repairs
5. Manure storage
6. Manure spreading equipment
7. Composters
8. Nutrient and pest management
9. Cover crops
10. Waterways and structures
11. Repair old tile mains
12. Natural channel design (demo)
13. Incentive for continuous no-till (tier levels?)
14. Promote 3-4 year rotations (not just a corn/soybean rotation)
15. Reduce use of triazine products (Atrazine)
16. Carbon sequestration (This is an outcome of a BMP such as tree planting rather than a BMP in and of itself.)
17. Windbreaks
18. Reduce nitrate delivery via tile (What BMP will achieve this goal?)
19. Filter strip payments/incentives to tenants farmers
20. Buydowns - GPS, yield monitors, mapping systems, geo-referencing equipment
21. Record keeping software- GIS info software
22. Conservation tillage equipment for corn production
23. Log jam removal
24. Field buffers (around whole fields, not just next to streams)

Sidebar 6.2 Guiding Principles for Watershed Action Plan Development Relative to Agricultural Nonpoint Pollution

1. Plan components must hold promise for meeting water quality objectives:
   - Reduce aquatic life impairments within the rivers and streams of the watershed.
   - Reduce the export of pollutants that impair downstream water uses (drinking water supplies, downstream flooding, Sandusky Bay and Lake Erie.

2. Plan components must be deemed appropriate to watershed farmers and landowners:
   - Must be economically viable to individual farmers.
   - Must recognize the importance of drainage to profitable crop production in this region.
   - Must recognize the diversity of crop and livestock production settings within the watersheds (large versus small operations; owner-operators versus renters; site specificity of BMPs).
   - Should hold promise for providing long-term solutions to problems.

3. Where appropriate, the plan components should be targeted to site specific sources and causes of site-specific impairments.

4. Solving drainage problems, such as removal of problem causing log jams or repair of broken tile mains, may be an integral part of improving aquatic habitats in streams.

5. Priority for restoration of woody riparian corridors and/or in-stream habitat will be given to larger streams over smaller streams. We do not expect high quality aquatic communities in man-made drainage ditches where, prior to land clearing, natural streams were absent.

6. Many water quality problems represent the cumulative impacts of multiple upstream sources. For these problems, remedial measures may require widespread adoption throughout the watershed. For example, grassed buffer strips on many miles of small streams and ditches may be needed to help reduce sediment and nutrient inputs to streams and subsequent export.

7. Plans will address non-agricultural sources of impairments (point sources, septic tanks, urban nonpoint sources) as well as agricultural sources.

8. Where either the agricultural or environmental efficacy of practices is uncertain, the plan will suggest demonstration projects for evaluation of those practices. Farmers/land owners willing to participate in the demonstrations will be essential for evaluation of these innovative practices. Farmers/landowners participating in demonstration projects will receive extra incentives or protections related to any added risks they encounter.

9. Educational materials and programs will play an integral part in the Watershed Action Plans including their development and their implementation.

PROBLEM 1. High rates of sediment and nutrient export that impact downstream receiving waters, including Sandusky Bay and Lake Erie.

Background. As shown in Table 4.4, the unit area export (lb/acre/year) of sediment and phosphorus for Rock Creek are high in comparison with other northwest Ohio watersheds. As a general rule, the export rates for northwest Ohio are high relative to other Ohio and Michigan watersheds. These high rates of export contribute to water quality problems in Sandusky Bay and Lake Erie. Nitrate export rates for Rock Creek are only 60% that of the Sandusky River Watershed, 10.4 lbs/acre as compared with 17.2 lbs per acre. As such, nitrate reductions are not a priority when considered in light of the sediment and phosphorus rates for Rock Creek, 148% and 121% greater than Sandusky River export rates respectively. Due to nitrate concerns within the City of Fremont, nitrates cannot be ignored, but are less of a local priority.

About 90% of the total phosphorus export from Rock Creek is in the form of particulate phosphorus that is attached to sediment particles, especially the clay-sized fractions. Consequently, much of the effort to reduce phosphorus export is associated with reducing erosion and d sediment export from the watershed. Other control measures for phosphorus focus on reducing the phosphorus content of sediment through fertilizer and manure programs, addressing failing septic systems, and addressing CSO issues in Tiffin. The sources of phosphorus in Rock Creek are expected to be representative of those in the other tributaries that make up the SR-Tiffin watershed. The TMDL reports a 21% deviation from the phosphorus target for headwater streams in the SR-Tiffin watershed, as related to point sources. The TMDL calls for a straight 25% reduction of P from nonpoint sources. The wadeable streams meet phosphorus goals.

Sources of Phosphorus in the Sandusky River – Tiffin Watershed. Table 6.1 below quantifies the sources of phosphorus in the SR-Tiffin Watershed.

Table 6.1 Phosphorus in the SR-Tiffin Watershed (TMDL Table 20)

Phosphorus Source	kg/year	Percent
Point Sources	5512	12.87%
CSO's	141	0.33%
Unregulated nonpoint sources	35270	82.37%
Stormwater (urban)	372	0.87%
Home sewage treatment systems	260	0.61%
Background/ground water	1227	2.87%
Air Deposition	39	0.09%
Total	**42821**	**100%**

Goals for reductions in phosphorus export. The TMDL study calls for the following reductions in phosphorus loading:

Table 6.2 Phosphorus load reduction goals.

Phosphorus Source	Percent Reduction	Reduction, lbs/year
Point Sources	0%	0
Nonpoint Sources*	25%	20,562
NPS Margin of Safety (5%)	5%	4,720

*The TMDL lists a goal of 0% from the main WWTP outfall. A goal of 100% reduction in the CSO loads is expected, and is quantified as the reduction in lbs/year for nonpoint sources, 310 lbs/year.

The impacts of point sources are experienced during low flow and medium flow conditions. A reduction of point sources within this watershed is not recommended by the TMDL (Table 19).

Tools to Reduce Phosphorus Exports: A wide variety of tools are available for the reduction of phosphorus exports. Due to the tendency for phosphorus to attach itself to soil particles, many of these practices will also focus on reducing erosion. The following is a partial list of tools:

- No till
- Strip till
- Conservation tillage
- Buffer strips
- Phosphorus application
  - Soil testing
  - Grid sampling
- Rotations that include wheat, hay, and year-round cover
- Better manure practices
- Subsurface drainage
- Programs to increase BMP implementation
- Buffer strips around roadside culverts and catch basins
- Grassed waterways
- Cover crops
- Property line filter strips and field borders.
- Reconnect streams to floodplains.

Management Plan for Load Reduction: The calculations for load reductions can be found in Table 6.3. The tabular summary for the practices can be found at the end of the chapter in Table 6.13. Efforts to reduce phosphorus and sediment export from the SR-Tiffin Watershed will focus on two features of the landscape -- cropland areas and streamside areas. Programs focused on croplands will include efforts to reduce erosion and runoff through increased use of various conservation tillage procedures, including no-till, strip till, reduced till and other forms of vertical tillage (“AerWay systems”). These procedures reduce raindrop impact on bare soil, which initiates soil erosion. They also increase infiltration, thereby reducing sheet flow and rill erosion which transport eroded particles off the fields. Cropland programs will also include advancing fertilizer and manure management on croplands through soil testing and precision application. Grants will be sought to aid farmers in equipment purchases related to both tillage improvements and precision fertilizer (and pesticide) application. Other cropland programs will focus on increasing the use of winter cover crops and diversifying crop rotations to minimize the use of corn-soybean rotations and soybean-soybean-corn rotations. More varied cropping rotations, as recommended here, will reduce help erosion and soil compaction problems.

Streamside BMPs will include establishment of buffer strips along headwater streams and establishment of woody riparian corridors along wadeable streams, and where possible, also along headwater streams. While it is preferable to provide details of a targeted approach to implementing streamside BMPs (i.e. provide specific locations and/or names of targeted streams), insufficient data will limit our ability to do so at this time (any possible targeting is included in the section that follows). It is the intention of the Coalition to generate additional necessary data, conduct additional landscape-scale analyses, and adopt a targeted approach to include an outreach plan to landowners in support of this aspect of the SR-Tiffin WAP.

These buffers trap portions of the sediment and nutrients that otherwise would move from cropland to streams. In addition, buffers, where they replace cropland, can also reduce erosion at certain positions on the landscape with potentially high sediment delivery to streams. Both of these effects reduce sediment and phosphorus loading to streams. Where runoff moves from fields to streams via grassed waterways or other concentrated flow pathways (gullies and tile main blow-outs), streamside buffers have minimal impact in reducing pollutant loading to streams. In these cases, consideration will be given to the establishment of wetland areas adjacent to streams where the output from grassed waterways and tile mains could undergo temporary storage, allowing sediment deposition and nutrient uptake and transformation. Area soil conservation staff and farmers have suggested that establishment of buffers (grass or woody) at the margins of fields could also be effective in reducing erosion and in trapping sediment and pollutants. Such field borders could also concentrate farm implement traffic and thereby minimize compaction under the cropland. An additional streamside BMP includes reconnecting the stream channel to the floodplain. This could occur in selected areas where previous channelization has occurred. Reconnecting streams and their floodplains would reduce sediment export through flood plain deposition, reduce peak discharges at downstream locations, and provide for nutrient uptake and transformations.

In short, restoring full floodplain functions would yield important ecosystem services that would help to achieve the desired water quality improvements. Targeting for load reductions will occur broadly throughout the SR-Tiffin Watershed. As noted earlier in Chapter 3, about 80% of the soils in the watershed are in soil drainage classes C and D. As such they have slow infiltration rates and a high tendency for runoff. Although extensive use of tile drainage has improved the infiltration on about 9% of these soils, the soils nevertheless tend to seal at the soil surface during heavy rains, and consequently yield considerable surface runoff. The use of distributed parameter models to attempt to target specific fields for BMP application is beyond the scope of these studies. Instead we will rely of the local knowledge of SWCD and NRCS staff and of the farming community to prioritize practices to those areas having high erosion rates and high delivery of eroded materials to streams. Work under way by the National Center for Water Quality Research will result in a watershed model for Rock Creek, which will be available to assist in the targeting of some practices. The development of this model and its full implementation is not expected until 2007. This product will be utilized as funds allow to assist with the targeting of practices throughout the implementation process. The various maps in this document are expected to support a common sense targeting based on local expertise. The input provided by local staff has

been incorporated into the text of this document, and will assist in targeting along with the eventual use of the NCWQR model. Point sources are a minor contributor to phosphorus export from the watershed, and although their reductions have been touched on in this section, they will be more fully addressed in relation to their impacts on stream biota during low flow periods.

Targeting of Practices. The need for reductions in phosphorus will require participation in best management practices by landowners from across the watersheds. The sediment scores for much of the watershed are meeting or exceeding TMDL targets, 10 for MWH and 12.5 for WWH. Gibson Creek, Rock Creek, and Morrison Creek each have stations that do not meet substrate goals. As well, the WWH stream segments deviate from goals by 6%. Targeting of practices in the upstream portion of Morrison Creek, which is a MWH, should have beneficial impacts on the WWH section downstream. As noted in the TMDL, nearly all of the nutrient issues within the assessment unit occur during moist or wet times. The majority of practices will need to deal with high flow solutions. Low flow impacts, such as septic systems, will be dealt with later, and do have localized impacts on water quality. Further targeting will be noted in Table 6.13

USDA Conservation Effects Assessment Project (CEAP) for Rock Creek Watershed.

In the near future, completion of work on the USDA CEAP grant awarded to the National Center for Water Quality Research at Heidelberg College will be of great assistance in guiding and evaluating agricultural Best Management Practice (BMP) use outlined within this action plan. The grant focuses research efforts within Rock Creek, one of the 14 digit watersheds within the Sandusky River – Tiffin watershed action planning unit. The goals of this research are to demonstrate the water quality benefits of agricultural BMP's at the watershed level and to evaluate the influence on water quality of the types of practices, the timing of their application and their location within the watershed. Two broad research objectives are to conduct statistical trend analyses relating water quality to agricultural BMP adoption within Rock Creek and to develop, calibrate and validate an Annual Agricultural Nonpoint Source model for the watershed. The model will be extremely useful in helping direct the selection, location and timing of agricultural BMP's that will most effectively improve water quality. In addition, CEAP survey research will explore social and economic factors that act to either encourage or inhibit conservation practice adoption. Combining these results with the nonpoint source model will provide valuable direction in formulating future work to enhance water quality.

Phosphorus Reduction Calculations – SR-Tiffin Watershed (Table 6.3)							
BMP	***Watershed***	***% Cropland***	***Cropland***	***Opportunity***	***Opportunity***	***P Reduction***	***P Reduction***
	Acres	***Acres***	***Acres***	***% Increase***	***Acres***	***Factor (lbs/ac)***	***(lbs)***
residue	74688	65	48547.2	25	12136.8	0.82	**9952.18**
management		*see Table 3.14*		*assumes 55% of cropland receives this BMP now*			
	Avg. SS Export per Yr (short tons)	***SS Reduction Goal from buffers (%)***	***SS Load Reduction per Year (short tons)***	***Ratio of SS to PP***	***PP Reduction (short tons)***		
filter strip / riparian							
forest buffer	8750	15.0	1312.5	465 to 1	2.8		**5645.16**
	see Table 4.2		*assumes 4.5 ton / ac SS load reduction*				
	New Acreage Goal	***1/10th Reduction SS Yield (short tons)***	***Convert SS to PP (divide by 465)***	***Convert to lbs. (X 2000)***			
cover and green manure crop	9216	921.6	1.98	3963.87			**3963.87**
	translates into 13% of total cropland						
	Implementation Goal (acres)	***Expected Reduction in P / ac (lbs)***					
field borders	6144	0.4					**3200.00**
	5% of cropland with field borders						
	Implementation Goal (acres)	***Expected Reduction in P (lbs)***					
conservation crop rotation							
wheat	800	912					
hay	200	258					**1170**
	Implementation Goal (acres)	***Unit Area Load - TP lbs / acre***	***Expected Reduction of P delivery (%)***	***P Reduction (lbs)***			
nutrient management							
CCA plan	8000	0.98	10	784			
CNMP plan	2000	0.98	30	588			**1372**
		assumes 1 ton sediment reduction /ac draining to wetland			**Total P reduction (lbs)**		**25303.21**

Problem 2. Impaired Biological Communities within the streams of the SR-Tiffin Watershed

Background. The biological communities in the SR-Tiffin Watershed failed to meet standards for their designated uses at 9 out of 14 sites analyzed in the TMDL study (see Chapter 4). Six sites had low scores for invertebrates, six has low fish scores. Smaller streams were more likely to be impaired than larger streams. The watershed score for the SR-Tiffin Watershed, as calculated by the OEPA, is 50 out of a possible score of 100, with the entire score originating from one site on Rock Creek (see Chapter 5, Table 5.3).

Causes and Sources of Biological Impairments in the SR-Tiffin Watershed: The primary causes and sources of biological impairments in the watershed are summarized in Table 6.4.

Table 6.4 Summary of causes and sources of biological impairments in the SR-Tiffin Watershed.

	Causes of Biological Impairments	Sources of Impairments
1.	Elevated phosphorus concentrations during low flow periods. These conditions lead to excessive algal growth that causes large day-night fluctuations in oxygen concentrations. This issue is of limited concern within the SR-Tiffin unit, as most P issues are associated with high flow conditions.	Failed septic tanks, improper manure handling.
2.	Poor stream habitat, as reflected by low scores for the Qualitative Habitat Evaluation Index (QHEI), The QHEI Index includes assessments of the following seven stream habitat parameters: • substrate quality • instream cover • channel morphology • riparian zone and bank erosion • pool quality • riffle quality • gradient	Sheet and gully erosion from croplands, stream- bank erosion, construction site erosion. Farm animal access to streams. Channelization for agricultural drainage. Log- jam removal for drainage enhancements. Separation of stream channels from flood plains. Natural limitations of streams associated with low stream gradients, available substrates, etc.
3.	Altered stream flow regimes - • lowered base flows • higher peak flows	Extensive use of tile drainage for cropland, soil compaction, wetland drainage, channelization, separation of stream channels from floodplains, increase in impervious areas associated with urbanization, dam construction.
4.	Excessive temperature fluctuations	Removal of woody riparian corridors, low base flow in streams. Widened stream channels.
5.	Organic loading resulting in low dissolved oxygen and siltation	Septic tanks, poor sewage treatment, livestock wastes, manure spills, CSO's, urban residential stormwater.
6.	Accidental spills	Fertilizer and manure handling facilities, transportation accidents.

Elevated phosphorus concentrations - While there are no specific standards for phosphorus concentrations in streams, the OEPA has set phosphorus concentrations guidelines for streams of various sizes and use designations. These guidelines are shown in Table 6.5. The guidelines suggest that higher phosphorus concentrations are expected and allowed in MWH than is WWH streams. The phosphorus data for the Sandusky TMDL do not meet those expectations. In fact the median phosphorus concentration for Sandusky MWH streams was 0.08 mg/liter for headwater streams and 0.06 for wadeable streams. Both median values met the targets for WWH streams and were actually lower than the corresponding medians for WWH streams (0.10 mg/L for headwater and 0.12 mg/L for wadeable). Because of generally low phosphorus concentrations in Sandusky MWH streams, we are comparing all concentrations to the WWH target values.

Table 6.5 Phosphorus concentration guidelines to support biological use attainment

Watershed Size	Statewide Criteria Total Phosphorus Conc. (mg/L)	
	WWH	MWH
Headwaters (H) - drainage area < 20 sq mi	0.08	0.34
Wadeable (W) - drainage area 20 - 200 sq mi	0.10	0.28
Small Rivers (SR) - Drainage area > 200 sq mi	0.17	0.25

In Table 6.6 the phosphorus concentrations observed in the SR-Tiffin Watershed as part of the TMDL study are shown in relation to the WWH use designation. Station #6 in Morrison Creek and station #7 in Rock Creek exceeded the TP standards the most frequently.

Table 6.6. Total phosphorus concentrations at SR-Tiffin watershed stations observed during the 2001 TMDL study.

Station Number	Area (mi^2)	Date	Phosphorus (mg/l)	TP Standard (mg/L)
#1 Sandusky River at RM 36.50-C.R. 38	1031	61401	0.08	0.17
	1031	62801	<0.05	0.17
	1031	71201	0.06	0.17
	1031	72601	0.15	0.17
	1031	80901	0.13	0.17
#2 Sandusky River at RM 38.90-Adjacent Water St.	1008	61401	0.05	0.17
	1008	62801	0.08	0.17
	1008	71201	<0.05	0.17
	1008	72601	0.12	0.17
	1008	80901	0.1	0.17

#3 Sandusky River at RM 41.84- Ella St.	962	61401	0.06	0.17
	962	62801	0.05	0.17
	962	71201	<0.05	0.17
	962	72601	0.12	0.17
	962	80901	0.12	0.17
#4 Sandusky River at RM 42.92- U.S. 224	957	61401		0.17
	957	62801		0.17
	957	71201	<0.05	0.17
	957	72601	0.12	0.17
	957	80901	0.09	0.17
#5 Rock Creek at RM 4.0x- T.R. 201	31	61401	0.06	0.10
	31	62801	0.42	0.10
	31	71201	<0.05	0.10
	31	72601	0.06	0.10
	31	80901	0.07	0.10
#6 Morrison Creek at RM 2.4x- T.R. 15	17.7	61401	0.1	0.08
	17.7	62801	0.14	0.08
	17.7	71201	0.2	0.08
	17.7	72601	0.16	0.08
	17.7	80901	0.91	0.08
#7 Rock Creek at RM 8.3x- C.R. 16	15.9	61401	0.07	0.08
	15.9	62801	0.09	0.08
	15.9	71201	0.12	0.08
	15.9	72601	0.18	0.08
	15.9	80901	0.21	0.08
#8 Morrison Creek at RM 9.4x- T.R. 175	10.4	61401	0.08	0.08
	10.4	62801	0.09	0.08
	10.4	71201	<0.05	0.08
	10.4	72601	0.28	0.08
	10.4	80901	0.24	0.08
#9 East Branch Rock Creek at RM 0.4x- C.R. 16	8.2	61401	0.1	0.08
	8.2	62801	0.05	0.08
	8.2	71201	0.08	0.08
	8.2	72601	0.09	0.08
	8.2	80901		0.08

Aquatic Habitat conditions in the SR-Tiffin Watershed. The Ohio EPA uses the Qualitative Habitat Evaluation Index (QHEI) to assess habitat conditions in the streams where they conduct

biological surveys. Procedures for determining the QHEI are described by E.T. Rankin (Rankin, 1989). The QHEI score is the sum of seven separate factors. These include the substrate conditions, the instream cover, the channel conditions, the riparian conditions, the pool development, the riffle development and the stream gradient. As part of the TMDL, the OEPA has set target values for the QHEI score and the substrate score for various use designations. These target values are shown in Table 6.7.

The QHEI score, as well as the scores of each of the seven factors contributing to the QHEI score are shown in Table 6.8 for those stations where QHEI determinations were completed in the TMDL study. This table also includes the biological index data for each station, a summary of the phosphorus concentration results, and summaries of additional comments included in the TMDL text regarding causes of impairments at specific stations. An asterisk is used to indicate those values that do not meet standards or target values for specific parameters. For components of the QHEI that have no target value, the maximum possible score is shown. If all factors had their maximum score the QHEI would total 100 at that station. The highest QHEI score observed in the SR-Tiffin watershed was 76, a value that occurred at station #5 on Rock Creek. The detail provided in Table 6.8 supports targeting of specific measures related to individual habitat or chemical problems for individual stations.

Although siltation and embeddedness are included in the determination of the substrate scores, they are so important to stream biota that OEPA staff takes special note of these conditions in assessing causes of impairment. These concerns were noted for ALL assessment unit streams during the TMDL process. The use of substrate scores also played a role in providing a "yes" answer for embeddedness. As well, the Upper Sandusky River TSD stated that a high ICI score paired with low fish scores (ICI, MIwb) could point to habitat impairments as the ICI uses artificial structures for assessment purposes. These scores were also taken into account when determining where to target sedimentation and embeddedness reduction practices.

Table 6.7. Target values for QHEI scores and substrate subscores, by use designation, included in the TMDL study.

Aquatic Life Use Designation	QHEI Score	Substrate Score
WWH	60	12.5
MWH	45	10
LRW	30	8

Table 6.8 Summary of boil. indices, use attainment, QHEI scores, and other possible causes of. impairment at TMDL sampling stations

Stat-ion #	Name of stream	Location Of sampling site	Use Desig.	River Mile	Drainage Area	Attainment Status	IBI	Mlwb	ICI	Elevated Phos-phorus (#/5>0.1)	QHEI/ Target (MWH 45, WWH 60)	Substrate/ Target (MWH 10, WWH 12.5)	Cover (Max 20)	Channel (Max 20)	Riparian (Max 10)	Pool (Max 12)
10	Bells Run	SR 53	WWH	0.1	3.8	**NON**	22*	NA	F*	-	54.5*	12.5	10.0	*11.0*	8.0	5.0
13	E. Br. Rock Creek	SR 67	WWH	4.2	-	**(NON)**		NA	F*	-	-	-	-	-	-	-
9	E. Br. Rock Creek	At mouth	WWH	0.1	8.2	**NON**	32*	NA	F*	1	57.5*	15.0	10.0	14.0	6.5	*2.0*
12	Gibson Creek	Sycamore Street	WWH	0.3	3.3	Partial	32*	NA	MG	-	46*	8.5*	*7.0*	*9.5*	*5.0*	4.0
14	Morrison Creek	State Route 18	MWH	11.4	-	**(NON)**			P*	-	-	-	-	-	-	-
8	Morrison Creek	Twp Rd. 175, Coffman Rd.	MWH	9.4	10.4	Partial	32	NA	P*	2	34*	9.5*	*1.0*	*6.0*	*3.5*	4.0
6	Morrison Creek	Twp Rd. 15, Morrison	WWH	2.4	17.7	Partial	34*	NA	MG	5	55*	10.5*	8.0	13.5	8.0	4.0
7	Rock Creek	CR 16	WWH	8.4	15.9	**NON**	32*	NA	F*	3	49*	11*	*7.0*	14.0	*6.0*	*1.0*
5	Rock Creek	Twp Rd. 201, Old Attica Rd.	WWH	4.0	31.0	Full	38^{ns}	8.1$_{ns}$	50	1	76.0	15.5	13.0	17.5	8.0	9.0
11	Willow Creek	Twp Rd 15, Morrison Rd.	MWH	3.0	3.7	**NON**	22*	NA	MG	-	35*	12.0	*5.0*	*5.0*	*3.0*	4.0
4	Sandusky R.	U.S. 224	MWH	43.0	957.0	Full	46	7.3	NA	1	57.0	11.0	14.0	*11.5*	6.5	8.0
3	Sandusky R.	Ella St.	WWH	41.8	962.0	Full	57	10.1	42	2	76.0	15.0	12.0	17.0	*6.0*	9.0
2	Sandusky R.	Upstream Tiffin WWTP	WWH	38.9	1008.0	Full	54	10.7	50	1	87.0	17.0	18.0	19.0	7.0	11.0
1	Sandusky R.	CR 38	WWH	36.4	1031.0	Full	50	9.9	36	2	84.5	16.0	16.0	19.5	7.0	11.0

Station #	Name of stream	Location of sampling site	Use Desig.	Riffle (Max 8)	Gradient (Max 10)	DO (X/5<4.0)	Siltation	Embedded-ness	Hydromodification / Habitat Modification	Enrichment / Low DO	Other Notes (from TSD, TMDL)
10	Bells Run	SR 53	WWH	*0.0*	*8.00*	-	Yes	Yes			
13	E. Br. Rock Creek	SR 67	WWH	-		-		Yes	Low water		
9	E. Br. Rock Creek	At mouth	WWH	*0.0*	10.00	1	Yes	Yes			
12	Gibson Creek	Sycamore Street	WWH	2.0	10.00	-	Yes	Yes			
14	Morrison Creek	State Route 18	MWH	-		-		Yes	Habitat modification		Bacteria
8	Morrison Creek	Twp Rd. 175, Coffman Rd.	MWH	*0.0*	10.00	2	Yes	Yes	Habitat modification	Yes	Bacteria
6	Morrison Creek	Twp Rd. 15, Morrison	WWH	1.0	10.00	1	Yes	Yes		Yes	Phosphorus, Bacteria
7	Rock Creek	CR 16	WWH	*0.0*	10.00	3	Yes	Yes		Yes	
5	Rock Creek	Twp Rd. 201, Old Attica Rd.	WWH	3.0	10.00	0					
11	Willow Creek	Twp Rd 15, Morrison Rd.	MWH	*0.0*	*6.00*	-	Yes	Yes	Habitat modification		
4	Sandusky R.	U.S. 224	MWH	*0.0*	*6.00*	0					
3	Sandusky R.	Ella St.	WWH	7.0	10.00	0					
2	Sandusky R.	Upstream Tiffin WWTP	WWH	7.0	*8.00*	0					
1	Sandusky R.	CR 38	WWH	7.0	*8.00*	0					

- Records in red with * are below standard/target goal. Records in green and *italics* are below median value for HUC unit, except riffle, which is the average score. Median and average scores do not include Sandusky River main stem scores.

Altered Stream Flow Regimes. The clearing of forested lands for agricultural production greatly increases the peak discharges during runoff events. Subsequent installation of tile drainage, construction of ditches to receive the tile outlets, and channelization of natural streams further contribute to peak runoff events and, at the same time, diminish base flow in streams by lowering the water table and decreasing groundwater recharge. Consequently, the flow regimes that supported the pre-settlement aquatic fauna of the SR-Tiffin Watershed have been greatly altered. Higher peak flows and lower base flows increase the flashiness of streams. Measurements of stream flashiness at the Rock Creek gaging station confirm these measurements during the past 25 years and are shown in Figure 3.3 (Baker et al. 2004). One consequence of the increased flashiness is simply the absence of flowing water in streams where, given their drainage areas, continuous flows would be expected in this climate. Several stations (#9, #13, station upstream of #5, and an abandoned site on Armstrong-Beighley Ditch) were deemed too dry to complete all sampling. "Little was to be gained in sampling those areas where a puddle of water was present" (TSD 2001). It is important to note the presence of sink holes within the channel of the upper reaches of Rock Creek. These sink holes are a part of the karst terrain of northeast Seneca County. Their presence may have historically impacted water levels on Rock Creek, and may limit the ability of any management activities to restore sufficient flows to these reaches. Additional work will need to be completed to determine the full extent of the impact of these sink holes.

Altered flow regimes interact with other habitat factors, such as streambed substrate quality (i.e. siltation and embeddedness). Higher peak flows can accelerate bank erosion, which further contributes to siltation of streams. Channelization often separates stream channels from their floodplains as does construction of levies or berms, resulting in increased sediment delivery to downstream receiving waters. While Table 6.8 does provide some evidence to support targeting of practices, it is important to note that the TSD and TMDL point to the overwhelming dominant, agricultural land use activities as the major source of water quality impacts within the watershed. Many of the flow regime and related impacts are due not to specific land uses at specific locations, but to the sum total of the land uses from across a given watershed. Addressing the prevailing issues on a large scale through locally acceptable practices will be a key to successful recovery of aquatic biota.

Goals for Biological Communities in the SR-Tiffin Watershed: The following goals have been adopted by the Coalition for biological communities in the SR-Tiffin Watershed:

Priority 1. Improve the watershed score to at least 80 out of 100 by 2010.

Priority 2. Long-term Goal - all streams should meet their aquatic life use designations

(This is consistent with the federal Clean Water Act and the TMDL program and would result in a watershed score of 100)

Restoration Strategies.

For Priority 1. All stations on stream segments over 30mi^2 are in full attainment. There is only one station in this category within the assessment unit. The remaining stations are all less than 20mi^2. For the purposes of this priority, the stations have been divided into those less than 5mi^2 (stations 10, 11, 12, 13, 14) and those greater than 5mi^2 (stations 6, 7, 8, 9), as is done

when calculating the watershed score. Table 6.9 is a calculation of the impact of various scenarios on the watershed score. Each station in full attainment that is less than 5mi^2 is worth 5 points to the watershed score, each station from 5mi^2 to 20mi^2 is worth 6.25 points. The lone station over 20mi^2 is worth 50 points.

Table 6.9. Stations in full attainment by drainage area and resultant watershed score.

Under 5mi^2	Over 5mi^2 under 20mi^2	Over 20mi^2	Resultant Watershed Score
1	0	1	55
3	0	1	65
0	1	1	56.25
0	4	1	75
1	1	1	61.25
1	3	1	73.75
2	4	1	85
3	4	1	90

For Priority 2. The second and longer-term priority will be to bring all streams within the watershed into compliance with their designated uses. At present, 9 of 10 stream segments fail to meet designated uses.

Management Plan for Priority 1 Programs. *Narrative strategy***.** Efforts to improve in stream water quality within the assessment unit will require the implementation of a suite of practices throughout the watershed. Keeping in mind the willingness of landowners to adopt certain practices, the implementation of various practices will be targeted as much as possible. An example of this targeting will occur in those areas under 5mi^2, which will not be a priority for woody riparian corridors. Landowners are more accepting of woody corridors along larger streams. The streams from 5-20mi^2 will be the primary target for implementing new woody riparian plantings. There will be many areas where this practice will not be accepted, but the implementation of this practice where acceptable will be important for improving QHEI and related scores. In areas of 5mi^2 or less, filter strips will be encouraged to help reduce the sediment load and control water temperatures. A priority focus on the larger watershed areas will be implemented as these sites tend to have the higher potential for meeting water quality goals in the short-term, and thus can have the most impact on improving the watershed score by 2010.

Management Plan for Priority 1 Programs. *Tabular Summary.* To implement the plan described above, the specific tasks described in Table 6.13 will be undertaken.

Management Plan for Priority 2 Programs. *Narrative Strategy***.** Efforts to restore the headwater streams in the SR-Tiffin Watershed will initially be linked to the cropland and streamside BMPs associated with the basin wide programs to reduce sediment and phosphorus loading to Lake Erie. By reducing sediment loading into streams, the substrate component of

the QHEI should improve. Part of this improvement will derive from the tendency of streams to develop natural channels relative to the sediment loading and flow regime characteristics of the area. The reductions in delivery of eroded soils from cropland will lengthen the time between channel maintenance activities related to maintenance of tile outlets. Thus the streams will have more time develop "natural" channels, even where the channels are confined to drainage ditches and previously channelized natural streams.

BMPs aimed at restoring more natural flow regimes within stream systems of the SR-Tiffin will also contribute to restoration of headwater streams. By reducing peak flows, channel erosion will be reduced, while increasing base flows will improve substrate and riffle-pool conditions. The effectiveness of various BMPs in restoring flow regimes in tiled cropland remains to be seen and likely will be the subject of demonstration project proposals.

Instream BMPs within headwater streams will include selective logjam removal on an as-needed basis. Where channel maintenance activities are needed, demonstration projects of two-stage ditch installation or natural channel design features will be considered.

It should be noted that most of the headwater streams in the watershed have not received specific use designations by the OEPA. The OEPA is undertaking a "Headwater Initiative" to better clarify management options for various types of headwater streams. Part of the Headwater Initiative is based on the concept that the headwater streams constitute significant limiting factors to use designation and use attainment for downstream, larger rivers. That condition does not seem to apply to the Sandusky River, and possibly other agricultural river systems in Ohio. In the case of the Sandusky River, the mainstem of the river, as well as the lower portions of its major tributaries generally meet WWH standards and even EWH standards, while headwater streams frequently fail to meet MWH and WWH standards. In the watershed scoring system used by the OEPA, headwater streams account for only 25% of the watershed score, even though they comprise about 85-90% of the stream miles.

Management Plan for Priority 2 Program: *Tabular Summary.* The specific plans for meeting priority 2 goals are shown in Table 6.13. Successful implementation of the strategies presented here will require, above all else, willing landowners. As set forth in the strategy tables, an additional staff person will be required for outreach and educational efforts directed towards the agricultural community and in support of Coalition efforts to implement the WAP and achieve water quality goals.

Problem 3 – Impaired biological communities within the streams of the SR-Tiffin Watershed due to high nutrient loads.

Background: The majority of nutrient loading impacts will be addressed through the practices aimed at loading to Lake Erie and Sandusky Bay. However, ambient water quality impacts may still be of concern in localized areas. Addressing the impacts of nutrients on low flow conditions will be essential for meeting all water quality goals.

Causes & Sources: Table 6.1 and Table 6.2 outlined phosphorus sources and reduction goals for the watershed. The majority of the reductions during high flow conditions will come from agricultural sources, as they are the primary source of impairment. Low flow sources, including failing septic tanks, residential yard care, and spills will be addressed as a part of this priority. In many instances, the impacts of

these sources may occur either at random, only during specific seasons, or only in localized areas. Finding and addressing these issues will be a challenge in some areas. An example of such targeting includes Morrison Creek, which suffers from high bacteria levels. A target area outside of the SR-Tiffin watershed is "Hillbilly Haven", which was identified by the Seneca County GHD as a target area for septic replacement. Impacts to streams in areas such as this may not be readily apparent as they may occur in very localized areas and during very limited times, but will be addressed when local desire and support is sufficient.

Goals: Elimination of low flow impairments within the SR-Tiffin watershed.

Management Plan for Program: *Narrative Strategy***.** The development of an inventory of priority areas for educational outreach will need developed to properly implement this plan. An example of such would be education of streamside landowners within the Bells Run watershed. The watershed is small, and the population could all be reached with the same message in a very short timeframe. Focusing on individual streams and localized problems will be key to the success of this program. Additional targeting will be a priority for the SRWC to help address this issue, and grants will be sought to help implement this targeting and implementation.

Management Plan for Problem 3 Program: *Tabular Summary.* The projects required to implement this plan are included in Table 6.13.

Household Sewage Treatment Systems

Household sewage treatment system (HSTS) plans have been revised and approved for each of the two counties in the SR-Tiffin Watershed based on revisions to the Ohio Administrative Code (OAC) effective January 1, 2007. These plans address both new and replacement systems permitted after January 1, 2007 to install systems suited to both soil and site conditions of the lot. The new OAC regulations provide options for soils with perched seasonal high water tables which are addressed as variance options on a county by county basis. HSTS plans are available for review at each of the two county health departments. The SR-Tiffin WAP intends to work in tandem with these plans as an important component of improving water quality and public health within the watershed.

According to the Seneca County HSTS Plan, 7,900 homes in the county (~85%) are between 20-30 years old. The HSTS's for these homes are nearing the end of their useful life and will need to be replaced in the next 5-15 years. The Seneca County General Health District estimates that approximately ten percent of the systems in the county are currently failing (~920 systems). The county averages forty to fifty replacements each year.

The Sandusky County General Health District estimates that based on the number of household sewage treatment systems in Sandusky County that are fifty (50) to one hundred (100) years old, are discharging off-lot, are installed in unsuitable soils, and have little or no maintenance, the majority of household sewage treatment systems are creating public health nuisances, impacting water quality, and degrading the

environment. They estimate that fifty-six (56%) percent or 5,500 home sewage treatment systems in Sandusky County are malfunctioning. Fewer than two dozen homes are located within the Sandusky County portion of the watershed.

A chart of critical areas that have been identified for HSTS replacement is featured in Table 6.10.

Table 6.10. HSTS areas of concern within SR-Tiffin Watershed, and other sanitary concerns.

Area	County	Issue	Action Needed
City of Tiffin	Seneca	39 combined sewer overflows.	Eliminate all 39 CSO's.
Village of Republic	Seneca	Morrison and E. Br. Rock Creek are impacted by failing HSTS	Replace HSTS where sewers are not present, work with Village to ensure sewer system is being utilized by all eligible homes.
Brace & Bon Air Ave.	Seneca	60 homes and small businesses – public health concern	Tie-in to city sewers at Market St.
Harley & Huron St.	Seneca	Similar to Brace & Bon Air issue	Tie-in to city sewers.
Scattered HSTS	Seneca	Failing HSTS in very rural locations that cause limited, localized impacts to streams	Due to lot sizes and the scattered nature of these homes, replacement HSTS are the only viable solution.
Morrison, Rock, and E. Br. Rock Ck	Seneca	Field assessment of HSTS needs completed.	Complete field assessments.

Ohio's Coastal Nonpoint Pollution Control Program: Management Measures

Introduction. Ohio's Coastal Zone Management Program requires that watershed action plans explicitly address specific management measures. We have done so in Table 6.11. Some of these management measures are addressed elsewhere in the SR-Tiffin WAP. For example, the preceding section on HSTS is also addressed under management measure 5.6.2 in the table. Additional comments on the various management measures of the CNPCP are contained within Appendix 3 of this document.

Table 6.11 – Actions Necessary to Address the Coastal Management Measures

Management Measure	Agencies (Lead Agency listed first)	Strategy	Cost*	Timeline	Target Area	Guidance Document/BMP Manual
5.3.1 – New Development	Regional Planning Commissions (Seneca Co, Sandusky Co., City of Tiffin Engineers office) in partnership with SRWC	Review planning document to determine coverage of CMM. Address any gaps with individual Regional Planning Commissions.	$3,000 for staff to review county plans (per commission). $5,000 for staff to research or develop new language to cover any omissions (per commission). $5,000 for staff to work with Commissions on changes to planning documents, and to request adoption of recommended changes (per commission). Total: $13,000 per county/commission within the watershed.	2007-2010	Full SR-Tiffin watershed, focus on areas near Tiffin, where develop is most likely to occur.	To be determined based on needs within a given community – will vary between rural and urban areas. Example: Seneca Comprehensive Plan (and other similar plans currently adopted or in development by regional planning entities). Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
5.3.2 – Watershed Protection	SRWC, Sandusky State Scenic Rivers Program, City of Tiffin Water Pollution Control Center, SWCD's, Village o	Development of watershed action plans at 11-digit HUC level. Watershed wide education and implementation program,	$40,000 for staff and related expenses per watershed plan. $10,000 per year for staff and $5,000 per year for other costs for watershed wide education and	2007-2015	Sandusky River Watershed (04100011)	Guide to developing watershed action plans in Ohio. Appendix 8 update. SR-Tiffin Watershed Action Plan – as model for future planning documents.

	Republic Administrator, OSS Joint Solid Waste District, Izaack Walton League, Pheasants Forever, individuals and all other stakeholders.	including watershed festival and Clean Sweep, river clean-up events. Implementation of water quality projects.	information program. Unknown total cost for implementation of water quality projects. $20,000 per year for staff to update plans as necessary. Total: $440,000 for remaining watershed plans, $15,000 per year for education, $20,000 per year for upkeep of all 14 plans in Sandusky River Basin.			Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
5.3.3 – Site Development	SRWC in partnership with Coastal Management staff, ODOT staff, county engineers and City if Tiffin Water Pollution Control Center and associated staff	Review County Engineer and City of Tiffin practices, educate engineers on use of ODOT manual, work with partners to establish strategy for adoption of manual.	$15,000 – for two conferences and a workshop for engineers. $3,000 – for education of County Engineers Association of Ohio through workshop with ODOT and ODNR participation. $30,000 – for staff time to work with partners on development of new policies. $8,000 – for staff time to work towards adoption of new policies. $3,000 – for public	2007-2010	Full SR-Tiffin watershed, focus on areas near Tiffin, where develop is most likely to occur.	ODOT Manual(s) (cited in main text) and other materials to be determined as deemed necessary. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/

			outreach regarding new standards and the impacts on water quality. Total: $59,000			
5.5.1 – Existing Development	Regional Planning Commissions (for each county and City of Tiffin WPCC) in partnership with SRWC	Review city/county planning documents to determine coverage of CMM. Address any gaps with individual Commissions. Incorporated areas without planning commissions (Republic will be asked to adopt same language as adopted by planning commissions).	To be completed with CMM 5.3.1, New Development no additional costs expected.	2007-2010	Full SR-Tiffin watershed, prioritized near population centers – Tiffin, Republic.	To be determined based on needs within a given community – will vary between rural and urban areas. Example: Seneca Regional Plan (and other similar plans currently adopted or in development by regional planning entities). Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
5.6.1 – New On-Site Disposal Systems	County health departments (Seneca and Sandusky) in partnership with SRWC Each county will	Review changes as mandated by new HSTS rules (effective January 2007). Determine shortcomings of	$2,000 – for staff to review new laws as they relate to CMM. $5,000 – for staff to work with ODNR and local health departments to develop	2007-2008	Full SR-Tiffin watershed (except sewered areas), focus on rural	To be determined based on new state regulations and necessary changes. HSTS plans for the 2 counties in watershed will also be used.

	take lead in its own county, as the current status and the needs for changes to their codes will vary.	rules and language necessary to meet CMM. Implement changes to county HSTS plans to meet CMM.	language to address shortcomings of HSTS rules. $5,000 – for staff to work with partners to request adoption of new rules. (Also note cost for development of GIS layer for each county, as outlined in 5.6.2, Operating Onsite Systems) Total: $12,000		areas, away from sewers, where low density makes new sewers unlikely. Additional targeting will be based on GIS maps when created.	Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
5.6.2 – Operating HSTS	County health (Seneca, Crawford, Wyandot, and Huron Counties) departments in partnership with SRWC.	Regular (every 5 years) inspection program for each home sewage treatment system in watershed by county health department or approved contractor.	$50 per home per year for implementation of project. $15,000 for staff time to work with HD's to draft language and request adoption by county health boards. $15,000 per county to develop GIS layer of septic systems. Upkeep of systems can be tracked using the GIS layer. Total: $30,000 to develop, $50 per home per year to maintain.	2007-2008	Full SR-Tiffin watershed (except sewered areas), additional targeting will be possible with development of GIS layer for each county.	To be determined based on new state regulations and necessary changes. HSTS plans & HC WAP include strategies for implementation in targeted areas. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
5.8.1 –	SRWC in	Develop a	$30,000 – for staff to	2007-2012	Full SR-	ODOT Manual(s)

Planning, Siting, and Developing Local Roads and Highways	partnership with Coastal Nonpoint Source Coordinator, ODOT Staff, and county engineers.	guidebook for distribution to county engineers to adopt which would satisfy the management measure.	develop the guidebook. $6,000 – for staff to develop trainings for county engineers at which guidebook would be presented. $10,000 – for staff to implement trainings (3 sessions across Lake Erie basin in Ohio). Total: $46,000		Tiffin watershed, focus on areas near City of Tiffin, where develop density is most likely to increase.	(cited in main text) and other materials to be determined as deemed necessary. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
5.8.2 – Local Bridges	SRWC in partnership with Coastal NPS Coordinator, ODOT Staff, and county engineers.	Develop a guidebook for distribution to Lake Erie Watershed county engineers to adopt, which would satisfy the management measure.	$30,000 – for staff to develop the guidebook. $6,000 – for staff to develop trainings for county engineers at which guidebook would be presented. $10,000 – for staff to implement trainings (3 sessions across Lake Erie basin in Ohio). Total: $46,000	2007-2012	All locally controlled bridges.	ODOT Manual(s) (cited in main text) and other materials to be determined as deemed necessary. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
5.8.5 – Operation and Maintenance of Roads, Highways, and Bridges	SRWC in partnership with Coastal NPS Coordinator, ODOT Staff, and county engineers.	Develop a guidebook for distribution to county engineers to adopt which would satisfy the management	$30,000 – for staff to develop the guidebook. $6,000 – for staff to develop trainings for county engineers at which guidebook would be presented.	2007-2012	Full SR-Tiffin watershed, focus on areas near City of Tiffin, where	ODOT Manual(s) (cited in main text) and other materials to be determined as deemed necessary. Guidance Specifying Management

		measure.	$10,000 – for staff to implement trainings (3 sessions across Lake Erie basin in Ohio). Total: $46.000		develop density is most likely to increase.	Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
5.8.6 – Runoff Systems for Roads, Highways, and Bridges	SRWC in partnership with Coastal NPS Coordinator, ODOT Staff, and county engineers	Develop a guidebook for distribution to county engineers to adopt which would satisfy the management measure.	$30,000 – for staff to develop the guidebook. $6,000 – for staff to develop trainings for county engineers at which guidebook would be presented. $10,000 – for staff to implement trainings (3 sessions across Lake Erie basin in Ohio). Total: $46,000	2007-2012	Full SR-Tiffin watershed, focus on areas near City of Tiffin, where develop density is most likely to increase.	ODOT Manual(s) (cited in main text) and other materials to be determined as deemed necessary. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
7.4.1 – Operation and Maintenance Program for Existing Modified Channels – Surface Water	Ohio Department of Natural Resources, Division of Soil and Water Conservation is leading ORDAC. SRWC in partnership with state and local Soil and Water Conservation	Participate in Ohio Rural Drainage Advisory Committee. Complete an inventory of channel modification within the watershed. Create inventory of areas for	$5,000 – for staff participation in ORDAC $3,000 – for staff to complete inventory of channelization practices. $5,000 – for staff to work with agencies and landowners to determine potential demonstration sites.	2007-2010	Channelized stream sections – especially county maintained ditches.	To be developed through ORDAC. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/

	Districts and county engineers (Seneca and Sandusky Counties) will provide input as applicable.	potential demonstration projects. Publicize demonstration projects as potential solutions for landowners.	$5,000 – for staff to promote demonstration projects as implemented Total: $18,000			
7.4.2 – Operation and Maintenance Program for Existing Modified Channels – Instream and Riparian Habitat	Ohio Department of Natural Resources, Division of Soil and Water Conservation is leading ORDAC. SRWC in partnership with state and local Soil and Water Conservation Districts and county engineers (Seneca and Sandusky Counties) will provide input as applicable.	Participate in Ohio Rural Drainage Advisory Committee. Complete an inventory of channel modification within the watershed. Create inventory of areas for potential demonstration projects. Publicize demonstration projects as potential solutions for landowners.	$5,000 – for staff participation in ORDAC $3,000 – for staff to complete inventory of channelization practices. $5,000 – for staff to work with agencies and landowners to determine potential demonstration sites. $5,000 – for staff to promote demonstration projects as implemented Total: $18,000	2007-2010	Channelized stream sections – especially county maintained ditches.	To be developed through ORDAC. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/
7.5.3 – Dams	SRWC in partnership with National Center for Water Quality Research	Develop sampling program for upstream and downstream of dam at Ella St. and	$5,000 – for staff to develop monitoring program. $20,000 – annual cost for implementation of	2007-2015	Ella St Dam and Bacon's Dam	Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters,

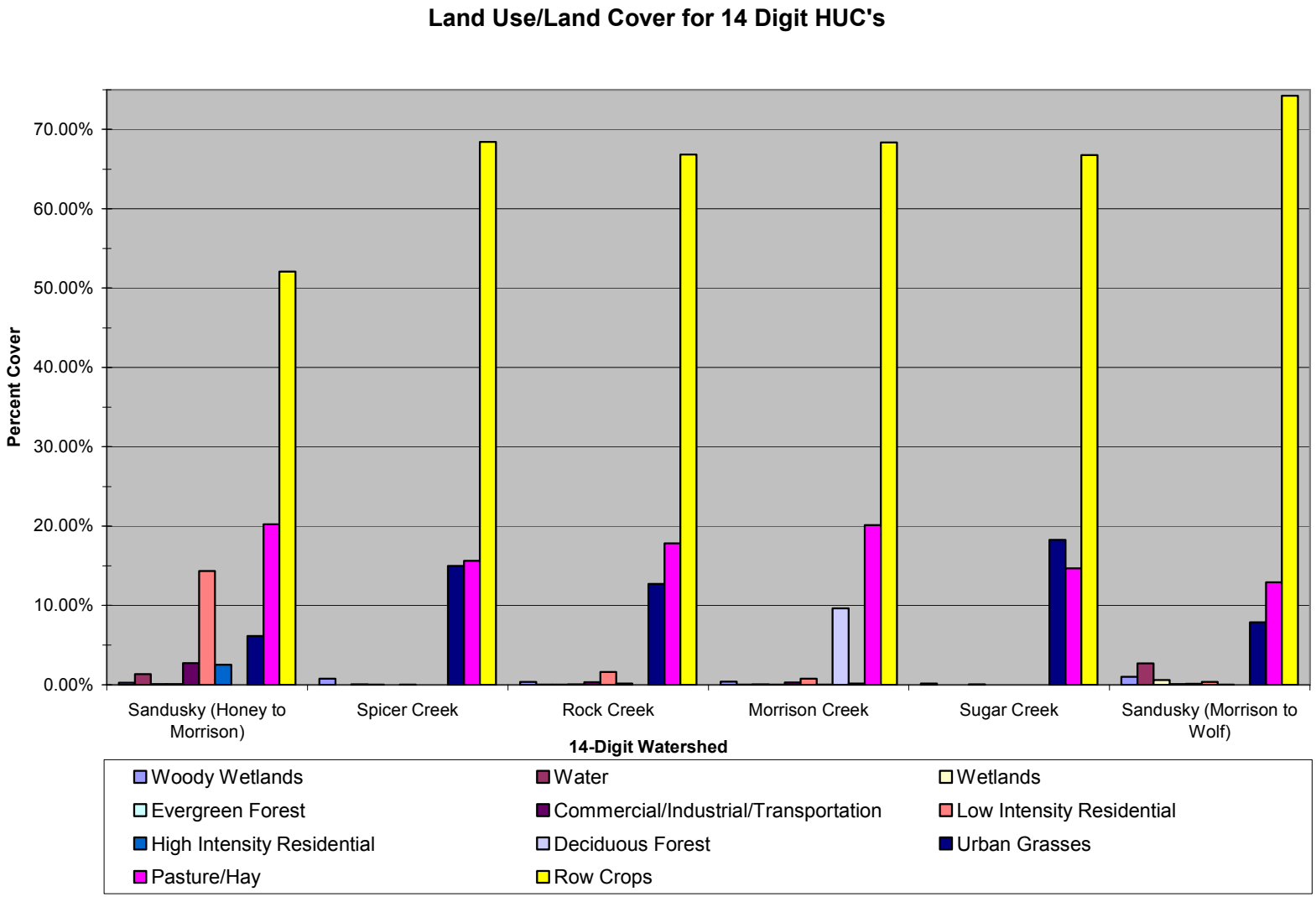
	and ODNR-Ohio Scenic Rivers Program	Bacon's Dam. Secure funding for monitoring program to determine water quality impacts. Solutions will be based on particular problems as they arise.	basic monitoring program. $5,000 – annual cost for staff to analyze and interpret data. Total: $30,000 for first year, $25,000 for each additional year.			USEPA http://www.epa.gov/owow/nps/MMGI/
7.6.1 – Eroding Streambanks and Shorelines	SRWC in partnership with local SWCD's (Seneca, Crawford, Huron, and Wyandot Counties)	Develop an inventory of erosion areas where BMP's could be installed. Develop a list of acceptable local BMP's. Implement BMP's and provide public education opportunities where possible.	$10,000 –to work with SWCD and landowners to develop inventory. $3,000 – for staff to develop list of acceptable BMP's. $5,000 – for staff to implement public education campaign for implemented BMP demonstration sites. Total: $18,000	2007-2010	SR-Tiffin Watershed wide inventory, demonstrations will focus on areas with noted impacts.	ORDAC guidance as developed, and other relevant guidance as determined necessary. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal, Waters, USEPA http://www.epa.gov/owow/nps/MMGI/

*Costs include staff time and associated organizational costs, such as supplies, rent, etc for staff to complete these tasks. Costs do not include actual implementation/installation of any practices, except where explicitly stated. Costs for most practices cannot be estimated at this time, as they will be site and practice specific. Costs are based on 2006 estimates, and should be expected to increase each year.

Rock Creek Headwaters, Sugar Creek, Spicer Creek

The TMDL report did not include data on the upper reaches of Rock Creek, nor any of Sugar Creek or Spicer Creek. Any data that is available has been used in the development of this plan. As additional data becomes available, additional targeting of practices and new water quality goals will be developed for these areas, as well as the rest of the watershed. Figure 6.1 below provides a graphical representation of land use within each of the 14-digit HUC's. The spike in Low-Intensity Residential in the Sandusky River (Honey Creek to Morrison Creek), which includes Willow Creek, shows the importance of urban practices in this area.

Figure 6.1 – Land Use by 14-digit HUC



Sandusky River: Main Stem

The main stem of the Sandusky River has been addressed at times throughout this text as Ohio EPA considers the main stem of the river a separate assessment unit. However, the development and implementation of a plan for just the main stem is not a logical approach. Based on this reasoning, the Coalition has decided to address each section of the main stem with the assessment unit that it flows through. The following 11-digit HUC watershed plans will address main stem issues (04100011 –) 020, 040, 070, 090, and 120.

Within the City of Tiffin, several key issues will need addressed. First, the city has the most CSO events of any city in the watershed. Elimination of the CSO's is a priority for the Coalition, the city, and Ohio EPA. Second, the city became a Phase II community in 2006 with a comprehensive management plan due May 2007. Implementation of the Phase II requirements will have a positive impact on water quality both within the main stem and along the tributaries within Tiffin. Finally, urban land uses will need addressed. This will include practices such as illicit discharges and dumping by residents and industry, over application of fertilizers on private and commercial property, over application of road deicing products and other chemicals to urban roadways, the removal of riparian trees to facilitate a better view of the streams by urban landowners, and other habitat, nutrient, and temperature related impacts. Strategies for addressing these issues are outlined in Table 6.13.

The Sandusky River leaves the City of Tiffin to the north. River Road follows the Sandusky through the rest of the SR-Tiffin watershed. ODNR and the Seneca County Park District replaced Abbott's Bridge in northern Seneca County. While the bridge was closed, this site suffered from regular illegal dumping. Future monitoring of dumping at this site will be important to curtail this habit as a new park facility is opened at this site. As well, homeowners on the east side of River Road have in many instances taken over ownership of the small area west of the road, between the road and the river. Removal of riparian vegetation, the planting of lawns and landscaping, and the use of chemical fertilizers in this area all have a negative impact on the river. Education of these streamside landowners will be important for preservation of water quality in this section of the stream.

Finally, sampling sites along the Sandusky River main stem, yielded results that met Full Attainment of WWH designation. These results were, according to the mapping provide in the TMDL, applied to the main stem, as well as to the various tributaries, upstream from the mouth to the first sampling station. This is most apparent on Rock Creek (3.3 miles), Willow Creek (3 mi), Morrison Ck (2 mi), and Gibson Run (0.3 mi). These segments likely need assessed individually, and due to urban impacts, may not meet use designations. This information is important to implementation projects in the urban areas, and masks the potential impact of the urban areas on these small streams.

Education & Public Outreach

The Education Standing Committee of the SRWC is active in pursuing funding to support K-12 related projects that will benefit the community as a whole and will help improve the understanding that students have of water quality issues. The committee has taken the lead on educating the adult public on watershed related issues as well. Recent and current projects include the printing of a recreational-resources map with funding from the Lake Erie Protection Fund, the development of a watershed video project concept in cooperation with WBGU-PBS, and an examination of signage needs for the Sandusky River. In addition, the SRWC has received a grant from the Ohio Environmental Education Fund to implement a farmer self evaluation developed by the Ohio Farm Bureau. This program has been targeted to the Honey Creek watershed and eastern portion of the SR-Tiffin watershed during its first year. Implementation for the final 2 years of the grant will be opened up to other areas across the Sandusky River Watershed. The SRWC has also cooperated in a successful grant program by area schools to incorporate water quality monitoring into their curriculum. This project is being implemented by the NOECA in Sandusky, Ohio.

The Coalition has recently completed a strategic planning process as well. The goal of the strategic plan is to focus the SRWC's resources on the most appropriate activities in the coming years. Part of this activity included the development of a method for producing more concise and effective implementation procedures. This includes assigning responsibility for tasks to specific organizations and individuals. Specific activities beyond the generalities contained in this plan should be the responsibility of the above-mentioned standing committees, as outlined during our strategic planning process. Table 6.11 features the core educational outreach activities.

Table 6.12. Core educational outreach activities of the SRWC.

Activity	Location	Schedule
Semi-Annual Membership Meetings	Rotates between counties.	Spring and Fall
Monthly Steering Committee Meetings	Seneca Co. Ag. Service Center	First Monday of each month, at least 8 meetings per year.
Fair Booths	County Fairs	Summers
Riverfest	Lowe-Volk Park	Annually in late May
Subcommittee Meetings	Varies	Recommended to meet quarterly.
Watershed Newsletter	Via Mail	Quarterly, 1 month before Membership Meetings.
Press Releases	All watershed outlets	As necessary, average 1 or more

		per month.
Website	www.sanduskyriver.org	On-going

The SRWC in cooperation with the City of Tiffin are working together on educational efforts for the City of Tiffin's Storm Water Management Plan (SWMP) which will be submitted in May 2007 to Ohio EPA as part of their Phase II Storm Water program.
Plans currently include providing newsletter articles for the yearly newsletter as well as future educational programming on topics such as lawn care, how to dispose of hazardous materials, and storm water drain stenciling.

Fundraising Plan

The SRWC has reorganized the Development Standing Committee for purposes of sustaining the organization in general and watershed coordinator position in particular. In the past, the Coordinator was responsible for Membership and Fundraising activities and since the restructuring is overseeing these events while being guided by the committee. An annual membership drive is held, and includes requests made to individuals, organizations, businesses, and governments. During its initial years, the SRWC averaged approximately $6,000 per year in donations. From November 2003-June 2005 the SRWC has raised approximately $18,000 in cash donations from the community. This is equal to 50% of our annual goal, and is an area in need of volunteer support. The reorganized Development Standing Committee has been working to expand the membership database as a starting point for expanded fundraising efforts. Once the membership database has been established the committee will investigate other forms of fundraising.

All other income for the Coalition will need to be raised through successful grant applications. Partnering agencies such as National Center for Water Quality Research, Seneca Soil and Water Conservation District, as well as the Coalition are continually seeking grant opportunities for activities that need to be completed in the Sandusky River Watershed from sources including but not limited to USEPA, Ohio EPA, ODNR, local government and private foundations. Seeking this funding will be a primary objective of the SRWC for the foreseeable future.

Outside organizations including Land Stewardship Project of Minnesota and the Great Lakes Commission have been actively involved with the Coalition on grants their organizations are pursuing to utilize within the Sandusky River Watershed specifically the SR-Tiffin sub watershed.

Table 6.13 – Tabular Summary – SR-Tiffin Implementation Plan*

Task Description/Objectives	Resources Required: Who, How – Current Programs, New Programs	Time Frame, Project Status by color (in progress, planning, concept, ongoing)**	Targeting	Performance Indicator(s)
1. Cropland BMP's				
1a. Residue Management – no till, strip till, and mulch till on an additional 12,136 acres (An increase from 55% to 80% conservation tillage).	**Who:** NRCS, SWCD, OSU-E and Producers **How/Current:** EQIP (low funding priority) **How/New:** additional multi-county staff to promote practices, field demonstrations, cost share payments of $15/acre to promote practice for first-time users, and 20% cost share on equipment purchases for non-replacement conservation tillage and planting equipment.	2007-2012	Areas that drain to 1st and 2nd order streams focusing on FSA defined HEL fields. Morrison Creek.	Increase in residue management as reflected in annual tillage surveys within the watershed. Improved substrate scores. Reduction in P.
1b. Cover and Green Manure Crops for an additional 9,216 acres of cropland throughout the watershed.	Who: NRCS, SWCD, OSU-E and Producers How/Current: EQIP (low funding priority) How/New: additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP, grant to fund at the rate of at least $15 per acre. Model project –	2007-2012	Areas that drain to 1st and 2nd order streams focusing on FSA defined HEL fields.	Increase in cover crops as reflected in annual tillage surveys; track acres of subsidies for establishment of cover crops. Reduction in P.

	Upper Broken Sword Cover Crop Project, funding through National Fish and Wildlife Foundation.			
1c. Field Border establishment protecting 6,144 acres of cropland	Who: FSA, NRCS, SWCD, OSU-E and Landowners How/Current: CRP How/New: additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP, grant to fund conservation easements at a rate of $3,000/acre.	2007-2012	Large fields/tracts without borders, fence rows, or other changes in vegetation.	7.5 ac of field borders – average field size of 60ac with a 50' wide border surrounding the field. Reduction in erosion to streams and P.
1d. Conservation Crop Rotation to include an additional 800 acres of wheat and 200 acres of hay	Who: SWCD, NRCS, OSU-E and Producers How/Current: Communication effort to promote benefits of interseeding and double-cropping. How/New: additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP, grant to fund at a rate of at least $15 per acre	2007-2012	Areas where surveys/available data indicate limited use of rotations.	Increase wheat and hay acreage as documented in crop history reports, or implementation of grant program for new acreage.
1e. Nutrient Management – new Nutrient Management Plans on 10,000.	Who: NRCS, SWCD, OSU-E, Producers and Farm Service Dealers How/Current: EQIP, communication effort to promote benefits of precision agriculture. How/New: additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP.	2007-2012		Track new CNMP plans and impacted acreage.

1f. Waste management, manure – target four existing animal feeding operations, and 90% of new or expanding operations have CNMP's developed.	Who: NRCS, SWCD, OSU-E and Producers How/Current: EQIP, communication effort by manure management specialist. How/New: Grant to fund at average rate of $20,000 per operation.	2007-2012		Track number of new CNMP plans developed and implemented.
1g. Water and Sediment Control Basin to collect runoff from 500 new acres.	Who: SWCD, NRCS, OSU-E and Landowners How/Current: None. How/New: Grant to fund at cost of $10,000	2008-2012		Target ten most severe cases of gulley erosion, possibly in conjunction with tile-main blowouts.
1h. Implementation of two livestock exclusion and alternative watering facilities. Implementation of 4 grazing plans, conversion of 200 acres of cropland to permanent management intensive grazing systems.	Who: Seneca SWCD, NRCS and Producers How/Current: How/New: EPA SS 319 to fund at 60% cost share.	2007-2009	One exclusion project in Scipio Twp, one in either Clinton or Pleasant Twp. to promote visibility to local producers. 4 grazing plans implemented where accepted by landowners.	Implementation of two projects with press coverage and educational events. Reduced streambank erosion, economic benefits to producers, implementation of additional projects across watershed.
1i. Tile main replacement, four demonstrations.	Who: Seneca SWCD and Landowners How/Current: Landowner funding How/New: Unknown source of cost share dollars to fund at 30% (or higher) cost share.	2007-2010	One each in Rock, Morrison, Spicer, and Sugar Creek Watersheds.	Replacement tied to implementation of filter strips and other BMP's as a suite of practices. Reduced N, P, erosion.
1j. Waterway Repair – fifteen redline waterways	Who: Seneca SWCD and Landowners How/Current: None	2007-2012		Repair of 15 waterways.

	How/New: GLBP Soil Erosion and Sediment Control, or other sources to fund at 50% cost share.			
1k. N Buydown Program – payments to reduce N application rates.	Who: Seneca SWCD, Producers and Farm Service Dealers How/Current: None How/New: Conservation Innovation Grant	2007-2010	1st and 2nd order streams, upstream of water supplies.	Implementation of project and adoption of lowered N rates by producers.
1l. Soil Testing	Who: Seneca SWCD, Producers and Farm Service Dealers. How/Current: Producer covers cost. How/New: 25% cost share for increased density and frequency of soil tests.	2007-2010	Fields within 1000' of streams	Increased testing rates based on coop records.
Task Description/Objectives	**Resources Required: Who, How – Current Programs, New Programs**	**Time Frame, Project Status by color (in progress, planning, concept, ongoing)**	**Targeting**	**Performance Indicator(s)**
2. Streamside BMP's				
2a. Filter Strip – establish on an additional 20% of streams; emphasis on first and second order streams.	Who: FSA, NRCS, SWCD, OSU-E, Pheasants Forever and Landowners How/Current: CRP, Lake Erie CREP, conservation easements. How/New: additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the	2007-2012	Sloping crop land adjacent to 1st and 2nd order streams, including drainage ditches.	Miles of filter strips established along streams. Improved biological attainment scores.

	WAP			
2b. Riparian Forest Buffer – contribute to 20% overall increase as listed above, but with emphasis on third order streams and urban residential areas.	Who: FSA, NRCS, SWCD, OSU-E, ODNR-Ohio Scenic Rivers Program and Landowners How/Current: CRP, Lake Erie CREP, WRP, Clean Ohio Fund, conservation easements. How/New: additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP. Urban specialist to work with urban landowners to promote riparian protection.	2007-2012	3rd and 4th order streams	Miles of riparian tree buffers established.
2c Wetland Development or Restoration on 500 new acres, to include reconnecting streams with floodplains.	Who: FSA, NRCS, SWCD, OSU-E and Landowners How/Current: CRP, Lake Erie CREP, WRP, Clean Ohio Fund, conservation easements. How/New: additional multi-county staff person to work with farmers and promote benefits of BMP implementation in the context of the WAP. Partnership with DU and other conservation agencies.	2007-2012	Areas with hydric soils, historic wetlands, and streamside areas.	Acres of wetlands/active floodplain restored.
2d. Livestock Restriction (access to streams) at 10 sites.	Who: NRCS, SWCD, OSU-E and Producers How/Current: EQIP, communication effort to promote rotational grazing. How/New: additional multi-county staff to work with farmers and promote benefits of BMP implementation in the context of the WAP, grant to fund at	2007-2012		Implementation at 10 new sites.

	rate of $5,000 per site.			
2e. Riparian conservation contracts/easements.	Who: Black Swamp Conservancy, SRWC, ODNR-Ohio Scenic Rivers Program and Landowners How/Current: Tax credits. How/New: ?	2007-2012	Streamside, especially where current riparian areas need preserved.	Implementation of contracts to provide permanent protection for streamside vegetation and floodplain access by streams.
Task Description/Objectives	**Resources Required: Who, How – Current Programs, New Programs**	**Time Frame, Project Status by color (in progress, planning, concept, ongoing)**	**Targeting**	**Performance Indicator(s)**
3. Point Source Controls				
3a. Reduce point source loads at waste water treatment plants.	Who: Ohio EPA, City of Tiffin WPCC, and Village of Republic Administrator How/Current: NPDES How/New: City of Tiffin Storm Water Management Plan	2007-2012	City of Tiffin Water Pollution Control Center, Village of Republic	Track NPDES permits. Reduction in point source loads.
3b. Reduce point source loads from point sources in SR-Tiffin watershed	Who: Ohio EPA, City of Tiffin Engineer & WPCC, Village of Republic Administrator How/Current: NPDES How/New: ?	2007-2012	Throughout watershed	Track NPDES permits. Reduction in point source loads.
Task Description/Objectives	**Resources Required: Who, How – Current Programs, New Programs**	**Time Frame, Project Status by**		**Performance Indicator(s)**

		color (in progress, planning, concept, ongoing)		
4. Residential/Urban BMP's				
4a. Demonstration of urban storm water control practices (e.g. rain garden, rain barrel, impervious surfaces). Can be tied into Phase II requirements for Tiffin.	Who: City of Tiffin WPCC, SRWC, Heidelberg College and NCWQR How/Current: none How/New: SS 319 Grant, Lake Erie Protection Fund, National Science Foundation Grant.	2008-2010	City of Tiffin	Implementation of variety of demonstration projects, with press coverage and educational outreach. Adoption of practices by landowners. Reduction in urban runoff and associated pollutant loads.
4b. Alternative HSTS technology demonstrations	Who: Seneca & Sandusky HD's How/Current: none How/New: Foundation or other funding source to cost share on installation of new system types.	2008-2010	Rural areas where sewers are not likely to reach. Morrison Creek	Implementation of variety of demonstration projects, with press coverage and educational outreach. Reduction of P and fecal coliform in streams.
4c. Educational campaign on landscaping and yard	Who: Seneca SWCD, Seneca HD, City of Tiffin WPCC, SRWC	2007-2009	City of Tiffin	Workshops hosted for residents.

maintenance in urban areas – focus on streamside properties.	How/Current: none How/New: Lake Erie Protection Fund, Private Foundations.			Use of soil tests by homeowners to determine application rates. Number of citizens/households consulted. Reduction in P and N in runoff.
4d. Improved implementation of BMP's during construction of new structures.	Who: City of Tiffin Engineer Office How/Current: Enforcement of City, State, and Federal Regulations. How/New: City of Tiffin Storm Water Management Plan	2008-2010	City of Tiffin	Adoption and implementation of ordinances to prevent pollution from construction sites. Reduction in erosion to streams.
4e. Development of GIS data layer with HSTS and drinking water well information	Who: County HD, SRWC How/Current: HD staff time, non priority project vs. enforcement. How/New: LEPF	2007-2008		Development and use of GIS layer. Increased efficiency in targeting HSTS replacements.
4f. Landowner education program – media and print program to educate landowners on how to reduce impacts on water quality.	Who: SRWC, City of Tiffin WPCC How/Current: Education Committee How/New: Funding for watershed video, National Machinery Foundation, City of Tiffin Storm Water Management Plan Education and Outreach	2007-2009		Completion of watershed video project, including air on PBS, showing of executive summary video at local organizational meetings, and use of curriculum in schools.

4g. Conduct a Storm Drain Stenciling Program to identify drains as direct runoff to local waters.	Who: City of Tiffin WPCC, Boy Scout Troop #444, Village of Republic and SRWC How/Current: City of Tiffin WPCC Budget How/New: ?	2007-2026	City of Tiffin and Village of Republic	Completion of all Storm Water Drains being Stenciled
Task Description/Objectives	**Resources Required: Who, How – Current Programs, New Programs**	**Time Frame, Project Status by color (in progress, planning, concept, ongoing)**		**Performance Indicator(s)**
5. Instream BMP's				
5a. Alternative Ditch Design Demonstration Project	Who: SRWC, Seneca SWCD How/Current: none How/New: EPA SS 319, LEPF	2008-2012	County maintained ditch.	Implementation of demonstration project and dissemination of economic and environmental information. Meet use designation, full attainment at site.
5b. Fish passage structure implementation/dam removal	Who: City of Tiffin, SRWC, ODNR-Ohio Scenic Rivers Program, Army COE How/Current: none How/New: Army COE funding, EPA	2010-2015	Bacon's Dam, Ella St. Dam	Implementation of fish passage structures or removal of dams to restore river

	SS 319			system.
5c.Study socio-economic effects of removal of Bacon's Dam	Who: SRWC, City of Tiffin and ODNR-Ohio Scenic Rivers Program How/Current: 319 Funding How/New: Army COE funding	2010-2015	Bacon's Dam	Removal of dam.
5d. Stream signage/navigation project	Who: SRWC – Education Committee How/Current: LEPF, Div. of Watercraft How/New:	2010-2015	Main Stem of Sandusky River	Implement signage as navigational aid to recreational users of Sandusky River.
6. Data Collection				
6a. Collection of additional data in urban areas.	Who: Ohio EPA, SRWC, ODNR-Ohio Scenic Rivers Program and Volunteer Monitors How/Current: Ohio Scenic Rivers Program on-going and historic monitoring How/New: TMDL quality assessment of sites on tributary streams within City of Tiffin	2007-2009	City of Tiffin	Development of use attainment maps reflecting data from last 0.5 mi of tributary streams.
6b. Collection of data on Spicer Creek and Sugar Creek	Who: Ohio EPA, SRWC and Volunteer Monitors How/Current: None How/New: TMDL quality assessment of sites on these streams.	2007-2009	Sugar Creek Spicer Creek	Development of use attainment maps reflecting data from these streams.

Notes:
*Funding levels are based on 2006 estimates, and may increase or decrease each year. The first agency listed as the "Who" is considered the lead agency. This table includes some information which can be found in the CMM table, but does not repeat all practices from all CMM.

** Explanation of project status:

in progress – currently has ample funding, project is being implemented. Projects may return back to ongoing status if upon completion it is determined that additional implementation is necessary to meet water quality goals.
planning – some amount of planning has been completed, project is priority for funding.
concept – some amount of planning has been done, project needs additional development to help target and refine project implementation plan – this planning would likely need to occur once funding was identified.
ongoing – project has, or has historically had funding, but additional funds will be necessary for further implementation.

Chapter 7
MONITORING AND EVALUATION

Monitoring Summary

To evaluate progress in addressing the problems described in Chapter 5, chemical and biological monitoring will be required. The NCWQR has been monitoring the water quality of Rock Creek since 1984 with the analysis of thousands of samples. The samples are taken by automatic sampler near the Heidelberg Campus. A USGS gaging station at this same location produces a continuous record of discharge. Samples for nutrient and sediment analysis are taken daily during low flow and three times per day during runoff events. Samples for pesticide analysis follow a seasonal schedule. During the growing season samples are taken twice per week during low flow and three times per day during runoff events. For the rest of the year samples are taken every two weeks.

This monitoring program is essential to assessing achievement of the problems outlined throughout this WAP. Given that this water quality monitoring program is currently subsidized by the NCWQR, funding for continued monitoring will be sought through grant writing and proposals submitted to appropriate entities.

The OEPA last conducted a biological assessment in 2001. Since their goal is to repeat this assessment every 5-10 years, the SR-Tiffin Watershed could come up for assessment again as early as 2006. It is more likely, however, that the next assessment will be conducted some time between 2007 and 2011, if not later. Such assessments produce the biological indices that determine the watershed score.

Achieving the goals set forth in this watershed action plan will depend on the implementation of the BMPs that comprise the specific strategies proposed here. Performance indicators set forth in the task tables of Chapter 6 form the basis for evaluating this implementation. The Watershed Coalition will devise specific plans to track these indicators.

Table 7.1. Evaluation of SR-Tiffin WAP implementation and efficacy.

Evaluation Activity	Who	How	Time Frame
Chemical Water Quality Monitoring	NCWQR	Apply for funding; $35,000 / year	1 January 2007 – December 2011.
Biological Water Quality Monitoring	Ohio EPA, DSW	State funded 5-year Basin Approach	2007-2010
Track BMP Implementation	USDA NRCS, SWCD's, Coalition, others	Variety of existing and new techniques and reporting devices	1 January 2007 – 31 December 2015.

Plan Update/ Revision

Strategy to keep the plan in front of the general public and responsible officials. The goal of the Sandusky River Watershed Coalition is to create stronger interest and involvement of citizens in each of the sub watershed assessment units (e.g. Honey

Creek) that comprise the larger Sandusky Basin. These groups will participate in and be largely responsible for keeping the watershed action plan active and current within the local community. Until such local groups or subchapters of the Coalition are established, the SRWC will be responsible for the visibility and promotion of the WAP's. This will occur through several methods, as outlined in the following sections.

Distribution list for the plan. The stakeholders in the planning process, as outlined in at the beginning of this text (pg. i) will each receive an electronic copy of this text. They will also have the opportunity to formally endorse the WAP as they see fit. The SRWC is committed to providing an opportunity for any group in the watershed to meet with SRWC staff and partners to discuss the WAP. These local organizations will also be advised that their participation on a local advisory board for the SR-Tiffin WAP will help assure rapid implementation of the plan. An ideal outcome of this process will have one representative from each of the HUC-11 sub watersheds participate on the SRWC Steering Committee as a voting member.

On-going information/education component. This will be the main responsibility of the local sub watershed group as listed under the first section (in addition to implementation activities as a part of the SRWC). Until this group is organized, the SRWC is committed to doing everything within its power to raise awareness and create interest among the watershed residents about the SR-Tiffin WAP as well as to promote implementation of the plan. When updates to the plan are necessary, the local planning partners will again be called upon to take part in a revision process. The plan should be revisited every three years or as necessary, which ever comes first, and revised accordingly. The NCWQR will continue to seek funding to do water quality monitoring in the Sandusky River Watershed. The SRWC will use water quality information produced by the NCWQR to monitor progress and evaluate the need for revisions and updates to the WAP. Surface-water monitoring by the NCWQR is contingent upon available funding.

REFERENCES

American FactFinder,2000, http://factfinder.census.gov/home/saff/main.html?_lang=en.

Baker, D.B., R.P. Richards, T.T. Loftus, and J.K. Kramer. 2004. A New Flashiness Index: Characteristics and Applications to Midwestern Rivers and Streams. *Journal of the American Water Resources Association* 40(2): 503-522.

Baker, D.B. and R.P. Richards. 2002. Relationships between changing phosphorus budgets and riverine phosphorus export in northwestern Ohio watersheds. *Journal of Environmental Quality* 31: 96-108.

Horton, R.E. 1945. Erosional developments of streams and their drainage basins: Hydrophysical approach to quantitative morphology. *Geological Society American Bulletin* 56: 275-370.

Karr, James R. and Daniel R. Dudley. 1981. Ecological perspectives on water quality goals. Environmental Management 5(1): 55-68.

Lake Erie LaMP Work Group. 2004. Lake Erie Lakewide Management Plan (Updated April 2004). Prepared under the direction of the Lake Erie LaMP Management Committee. Environment Canada and the U.S. Environmental Protection Agency are the federal co-leads for the Lake Erie LaMP. Available via http://www.epa.gov/glnpo/lakeerie/2004update/index.html

Loftus, Timothy T. and R. Peter Richards. 2005. *Water Use for Irrigation Agriculture in Ohio's Lake Erie Basin*. Report to the Coastal Zone Management Program.

National Oceanic and Atmospheric Administration. 2002. *Climatological Data Annual Summary: Ohio 2002,* Vol.107(13). National Climatic Data Center, Asheville, NC.

Natural Resources Conservation Service. Date Unknown. Soil Data Mart. http://soildatamart.nrcs.usda.gov/

Ohio Department of Health Bureau of Environmental Health. 2007. Sewage Treatment System Rules Fact Sheet. Columbus, Ohio.

Ohio Department of Natural Resources, Division of Soil and Water Conservation. Survey of Ohio Drainage, 2005. Unpublished, distributed through Ohio Rural Drainage Advisory Committee, 2006.

Ohio Department of Natural Resources. 1960. *Gazetteer of Ohio Streams*. http://www.dnr.state.oh.us/water/pubs/pdfs/GAZETTEER_OF_OHIO_STREAMS.pdf.

Ohio Department of Natural Resources. 1992 (reprint date). *Geologic Map of Ohio.* Original compilation by J.A. Bownocker (State Geologist of Ohio, 1906-1928), 1920. Map last revised in 1947.

Ohio Department of Natural Resources. 1994. Ground Water Pollution Potential of Seneca County, Ohio by Kelly C. Smith and John Voytek. Ground Water Pollution Potential Report No. 9. Division of Water, Water Resources Section. Columbus, OH.

Ohio Department of Natural Resources. 1996. Rainwater and Land Development. Division of Soil and Water Conservation. Columbus, OH.

Ohio Department of Natural Resources. 2003. Ground Water Pollution Potential of Crawford County, Ohio by Michael P. Angle and Chris Russell. Ground Water Pollution Potential Report No. 61. Division of Water, Water Resources Section. Columbus, OH.

Ohio Department of Natural Resources. 2005. ODNR, Division of Soil and Water Conservation Home Page (Updates!!) http://www.dnr.ohio.gov/soilandwater/ accessed 23 June 2005

Ohio Department of Natural Resources. Date unknown. Ground Water Resource Maps for Ohio. Division of Water. http://www.dnr.state.oh.us/water/gwrmaps/ accessed 21 June 2005.

Ohio Department of Natural Resources. Date unknown. How to read and use ground water pollution potential maps. Division of Water. http://www.dnr.state.oh.us/water/gwppmaps/How_to_read_ppmaps.htm accessed 21 June 2005.

Ohio Department of Transportation. 2000. Handbook for Sediment and Erosion Control. Office of Construction Administration. Columbus, OH. (available via http://www.dot.state.oh.us/construction/OCA/Manuals/Docs/Erosion/Erosion%20Control.pdf)

Ohio Department of Transportation. 2005. Maintenance Administration Manual, Volume Two. March 2005. Columbus, OH.

Ohio Environmental Council. 2004. Testimony of Jack Shaner, Public Affairs Coordinator, Ohio Environmental Council, before the Ohio House Energy & Environment Committee: Substitute House Bill 231 – Household Sewage Septic Systems. April 24, 2004.

Ohio Environmental Protection Agency. 1987. *Biological criteria for the protection of aquatic life: Volume II. User's Manual for Biological Field Assessment of Ohio Surface Waters.* Division of Water Quality Monitoring and Assessment, Surface Water Section, Columbus, Ohio.

Ohio Environmental Protection Agency. 1997. *A Guide to Developing Local Watershed Action Plans in Ohio*. Division of Surface Water, Columbus, Ohio.

Ohio Environmental Protection Agency. 1999. *OEPA Pesticide Special Study May 1995 through March 1999.* Division of Drinking and Ground Waters. http://www.epa.state.oh.us/ddagw/pestspst.html.

Ohio Environmental Protection Agency. 2000. Ohio's Ground Water Quality: 2000 305(b) Report. Division of Drinking and Ground Waters. Columbus, OH.

Ohio Environmental Protection Agency. 2003. *Biological and Water Quality Study of the Sandusky River and Selected Tributaries 2001, Seneca, Wyandot, and Crawford Counties.* OEPA Technical Report EAS/2003-4-6. Division of Surface Water, Ecological Assessment Section, Columbus, Ohio.

Ohio Environmental Protection Agency, 2003. *Drinking Water Source Assessment for the Ohio-American Water Company Tiffin District.* Division of Surface Water, Division of Drinking and Ground Waters, Northwest District Office.

Ohio Environmental Protection Agency. 2004a. *Ohio 2004 Integrated Water Quality Monitoring and Assessment Report.* Draft for Public Comment. Division of Surface Water, Columbus, Ohio.

Ohio Environmental Protection Agency. 2004b. *Total Maximum Daily Loads for the Upper Sandusky River –Final Report.* Division of Surface Water, Columbus, Ohio.

Ohio Environmental Protection Agency. 2004c. Ohio NPS Management Plan 2005-2010. Division of Surface Water, http://www.epa.state.oh.us/dsw/nps/NPSMP/

Ohio Environmental Protection Agency. 2007. Getting the Point about Nonpoint – Ohio Nonpoint Source Pollution Management Plan 2005-2010. Division of Surface Water, http://www.epa.state.oh.us/dsw/nps/NPSMP/ referenced March 27, 2007

Ohio Environmental Protection Agency. 2005. *Public Drinking Water Supply-Beneficial Use Development of Ohio's Assessment Methodology Project Summary*. Division of Drinking and Ground Waters, bulletin dated January, 2005.

Ohio Environmental Protection Agency. 2006. *Individual Ohio NPDES Permits (individual and Municipal Discharge,* http://epa.state.oh.us/dsw/permits/individual.html. referenced April 16, 2007.

Ohio Lake Erie Commission. 2004. *Lake Erie Protection and Restoration Plan*. http://www.epa.state.oh.us/oleo/reports/lepr/lepr2/secondreport.html.

Ohio Legislative Service Commission. 2004. Sub. H.B. 231, 125th General Assembly. Available via http://www.lsc.state.oh.us/analyses125/04-hb231-125.pdf

Rankin, E.T. 1989. *The qualitative habitat evaluation index (QHEI): rationale, methods, and application.* Div. Water Qual. Plan . and Assess., Ecol. Assess, Sect. OEPA, Columbus, Ohio.

Rankin, E.T., R. Miltner, C. Yoder, and D. Mishne. 1999. *Association Between Nutrients, Habitat, and the Aquatic Biota in Ohio Rivers and Streams.* Ohio EPA Technical Bulletin, DSW/MAS/1999-1-1, January 7, 1999.

Richards, R. Peter. 2001. Reports from the Ohio Tributary Monitoring Program, 1: Program Description. NCWQR Technical Report Series.

Richards, R.P. and D.B. Baker. 2002. Trends in water quality in LEASEQ rivers and streams, 1975-1995. *Journal of Environmental Quality* 31: 90-96.

Sandusky River Watershed Coalition. 2001. *Sandusky River Watershed Resource Inventory and Management Plan*. Fremont, Ohio.

Seneca Regional Planning Commission. 2001. *Seneca County Comprehensive Plan Update 2001*. Tiffin, Ohio.

State of Ohio. 2003. *Ohio Administrative Code.* Chapter 3745-1. "Water Quality Standards." http://www.epa.state.oh.us/dsw/rules/3745-1.html.

Strahler, A.N. 1952. Hypsometric (area-altitude) analysis of erosional topography. *Bulletin of the Geological Society of America* 63: 1117-1142.

United States Department of Agriculture. 1980. *Seneca County Soil Survey*. Soil Conservation Service.

United States Environmental Protection Agency. 2000. Storm Water Phase II Final Rule: An Overview. USEPA Office of Water. EPA 833-F-00-001, January 2000, Fact Sheet 1.0.

United States Environmental Protection Agency. Undated document. Memorandum *To:* State Water Division Directors, EPA Regional Water Division Directors, *From:* Charles Sutfin, Director, Assessment and Watershed Protection Division, U.S. E.P.A. *Subject:* Policy Clarification on Overlap of 6217 Coastal Nonpoint Programs with Phase I and II Storm Water Regulations.

All websites accessed Summer 2005 – Spring 2007.

APPENDIX 1

Public Input Summary

Primary Opportunities for Public Input

Public Input Opportunity	Date Held	Advertisement	Location	Attendance	Notes
Public Meeting	April 20, 2006	Press release to all local papers, SRWC website.	Sentinel Career Center, Tiffin.	6 individuals attended.	A 1:30 discussion was held. Handouts from the meeting are included in this Appendix. Maps of the watershed were distributed.
Seneca Regional Planning Commission	May 3, 2006	None.	SRPC Conference Room	Approx. 20 local officials and representatives.	SRPC was provided same handouts as were available at the public meeting. Representatives from townships, commissioners, and city government were present, and asked to comment.
Online Survey	May 8, 2006 – June 10, 2006	Postcards mailed to 400 landowners and local officials/agencies. Front page article in Advertise-Tribune on June 7, 2006.	Survey was online, residents could call to request a paper copy of the survey, with return postage paid.	Received 20 complete surveys, analyzed data from 26 total surveys with at least partial completion, including 4 requests for paper copies of survey.	Questions and results are included in this Appendix. Local officials received this survey as a second opportunity for input.
SRWC Steering Committee Comment Period	June 15, 2006 – July 7, 2006	Distributed to SC via email.	WAP Draft released online for SC review and comment.		Opportunity for Steering Committee and related entities to provide comments prior

					to public release.
Public Comment Period	July 11, 2006 – August 11, 2006	Press release, radio release, comment session held in room off lobby of Tiffin Seneca Public Library	Tiffin Seneca Public Library – kickoff meeting on July 11. Email and postal mail notices sent to over 50 individuals and organizations requesting comments.	Over 105 patrons visited the library during the comment session meeting held July 11. Only 2 residents stopped to offer comments.	Only 3 comments were received. Requests for we blinks, etc were received from several interested parties – none of whom submitted comments.

Other Sources of Public Input

Steering Committee meetings with local Soil and Water Conservations Districts and NRCS District Staff

To explore areas of mutual concern and interest, the Steering Committee of the Sandusky River Watershed Coalition met with the Supervisors and staff of the Soil and Water Conservation Districts in counties of the Sandusky River Watershed. These were generally very productive meetings. The dates of these meetings are listed below:

Crawford SWCD - July 1, 2003
Seneca SWCD - November 13, 2003
Erie SWCD - December 17, 2003
Wyandot SWCD - March 11, 2004
Sandusky SWCD - April 8, 2004

Agricultural Environmental Self Assessment Program (AESA)

The Agriculture Committee of the SRWC received a $46,000 grant in 2005 from the Ohio Environmental Protection Agency's Ohio Environmental Education Fund. As a part of this process, farmers from the Republic took part in the self-assessment. The input from these individuals during the self-assessment sessions has been taken into account during the drafting of this plan. As well, the input received from a post-

assessment survey of the farmers has been used to help develop this plan. The survey results from the AESA program are available from the SRWC upon request.

Press Release for April 20 Public Meeting

FOR IMMEDIATE RELEASE April 6, 2006

Chris Riddle Watershed Coordinator
419-334-5016, cmriddle@wsos.org Sandusky River Watershed Coalition

A public meeting has been scheduled by the Sandusky River Watershed Coalition as part of a watershed planning process. The meeting will be held on April 20 from 7:00 to 9:00 pm in the Cafeteria at Sentinel Career Center, 793 E. Twp Road 201, Tiffin. Residents of select watersheds are asked to attend the meeting to provide input on ways to improve water quality in their streams. The meeting will focus on the Sandusky River Tributaries, including Bells Run, Rock Creek, Morrison Creek, Gibson Creek, Willow Creek, Sugar Creek, and Spicer Creek. Information on water quality problems based on available data will be provided at the meeting, participants are asked to provide input on problems they see in the area, as well as solutions to these problems.

Water quality impacts in these watersheds include rural residential, agricultural, and urban sources. Water quality data suggests that while the main stem of the Sandusky River through this stretch is in relatively good condition, there are several problems that need addressed in the tributary streams. Landowners will eventually be asked to participate in grant funded programs that will help implement the solutions outlined in the watershed plan that is being developed. The public meeting on April 20 will provide local input regarding acceptable solutions.

For additional information on the watershed planning process, the Sandusky River Watershed Coalition, or to see a detailed map of the watersheds listed above, visit www.sanduskyriver.org. The Sandusky River Watershed Coalition can also be reached at 419-334-5016 or by emailing cmriddle@wsos.org. The SRWC is a non-profit organization dedicated to improving water quality for the benefit of all local citizens, and is administered by WSOS Community Action Commission, Inc. This project is funded by the Ohio Department of Natural Resources, Coastal Zone Management Assistance Grants. Details at www.dnr.state.oh.us/coastal.

(Map from release excluded to save space. Press release map was taken from Map 1.)

Handouts for April 20 Public Meeting

Sandusky River – Tiffin Tributaries – Public Input Meeting – April 20, 2006

Ohio EPA's Goals:

- Increase stream flows during dry times of the year.
- Reduce P by 25% from unregulated sources of runoff.
- Reduce bacteria in Morrison Creek, and other localized areas.
- Improve stream habitat, both in streamside areas and in the streams themselves.
- Improve the watershed score by having 80% of streams meeting their attainment goals.

Discussion Questions:

1. Ohio EPA has set a series of goals. What do you think about these goals? Can they be obtained? If so, what types of practices would you like to see used to reach these goals? If you feel they can't be reached, why? (15 minutes)

2. From your own experience as a landowner and resident, what are your biggest concerns about water quality and water quantity? How can we address these issues? (15 minutes)

3. There are many good things about the streams that we may want to preserve/protect in this area. What resources do you see our local streams providing? Examples may include swimming, fishing, wildlife habitat, drinking water, waste removal, etc. What needs protected, and what is worth protecting? What do you see as acceptable amounts of protection, and how do we get there? (15 minutes)

4. You have considered EPA's goals, your own goals, and ways for addressing each. From these, which are the most important to you? List the top five (or so) goals you would like to see accomplished over the next 3-5 years. (15 minutes)

Presentation For April 20 Public Meeting

Watershed Action Planning
for:
Sandusky River
(Tiffin Tributaries)

20 April 2006

Sandusky River Watershed Coalition

Mission Statement

To provide leadership for the conservation and enhancement of the Sandusky River Watershed and its natural resources through community-based planning, education, and action.

Why Are We Here?

To get your input on water quality and quantity problems that need fixed, water resources that need protected, and to determine priorities for action as well as acceptable methods for reaching our goals.

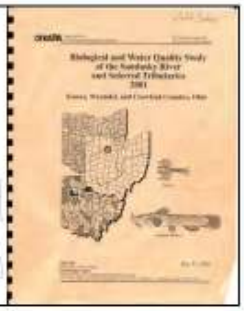
How Will We Do This?

For the next 20 minutes we will share information with you regarding water quality in the watershed.

This information is based on Ohio EPA's studies of the area.

We will not go into full detail on the specifics – more information is available in the handouts or through further discussion.

The Ohio EPA Intensive Study of the Upper Sandusky River and its tributaries



And then…

Once you have heard from us, it will be your turn to talk.

We will work for about an hour on getting your input.

Tonight is not the end of public input.

Surveys will be sent to some local residents.

Our website will continue to have information on public involvement. www.sanduskyriver.org

There will be a public comment period before the plan is submitted for state review.

1

Good Housekeeping

- This project is funded through the Coastal Management Assistance Grant Program
- www.dnr.state.oh.us/coastal

Assistance in developing the plan is also being provided by the Water Quality Laboratory at Heidelberg College

What is a watershed action plan?

* A written document:
  - inventory of social, physical, and biological resources
  - description of stream network and floodplain
  - assessment of riparian corridor
  - listing of causes and sources of water quality impairments
  - statement of impairment reduction goals
  - strategy of implementing site-specific BMPs
  - evaluation plan
  - plan for updates and revision
* Locally developed and acceptable to watershed residents.
* Must show promise for meeting state water quality standards; hence – state endorsable!

Getting Started: The Watershed

What are the issues???

- Is there a problem with the health of biological communities?
- Is there an impact on recreational use of the streams?
- Is there a problem for public and private water supplies?
- Is there an impact on Lake Erie?
- Does this affect me???

Setting the Standard

Not all streams are the same – so, they are not all judged by the same criteria. Streams of the same type are judged against one another to determine their quality.

WWH - Warmwater Habitat

Designation for streams that should support typical warmwater assemblages of aquatic organisms for Ohio's streams and rivers. This is Ohio's principle restoration target.

MWH - Modified Warmwater Habitat (channel modified)

Applies to streams with extensive and irretrievable physical habitat modifications. The activities contributing to the modifications have been sanctioned by state and federal law.

2

Use Attainment

Each stream then assessed to determine if its quality is good enough to meet its designated use. The bar is higher for warm water streams than for modified warm water streams.

Full Attainment

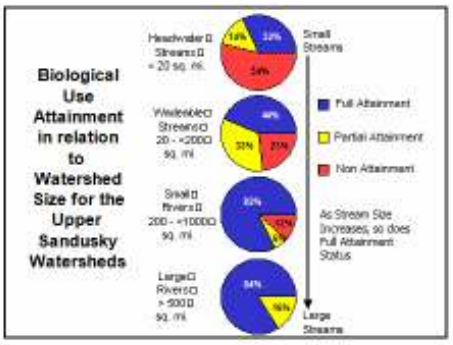
All indices meet standards.

Partial Attainment

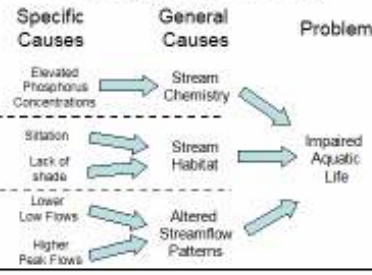
One of two or two of three indices do not meet standards and are not in the "very poor" category.

Non Attainment

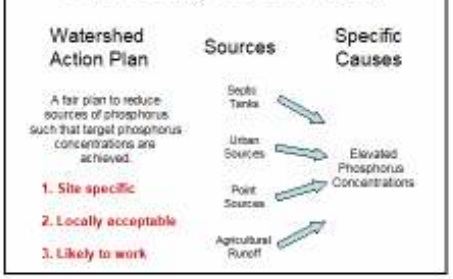
None of the indices meet standards or one organism group indicates a severe toxic impact (poor or very poor category) even if the other organism groups indicate attainment



Finding The Source(s)



Addressing the Source(s)



3

Phosphorus as an example…

Phosphorus Source	kg/year	Percent
Point Sources	5512	12.87%
CSO's	141	0.33%
Unregulated nonpoint sources	35270	82.37%
Stormwater (urban)	372	0.87%
Home sewage treatment systems	260	0.61%
Background/ground water	1227	2.87%
Air Deposition	39	0.09%
Total	**42821**	**100%**

The TMDL calls for a 25% reduction in nonpoint source phosphorus.

Unregulated nonpoint sources contribute 35270 kg/yr, or 77,757 lbs/year.

A 25% reduction is 19,439 lbs/year.

Reduction in P

The watershed is 116.7 sq miles, and is about 83% agriculture.

This translates to about 62,000 acres of agricultural land.

A reduction of 20,000 lbs of P per year on 62,000 acres of land translates to 0.32 pounds of P per acre per year.

What are EPA's Goals?

- Increase stream flows during dry times of the year.
- Reduce P by 25% from nonpoint across the watershed, 21% from point in headwater streams.
- Reduce bacteria in Morrison Creek.
- Improve stream habitat, both in riparian areas and in the streams themselves.
- Improve the watershed score by having 80% of streams meeting their attainment goals.

Something to keep in mind

- We are not here to point fingers at others for "their" problems. We are all in this together, and we will only see improvements if we decide to work together.
- This is your chance to tell us how to help you improve your community. We can help find the dollars to pay for the costs, we need guidance on where the dollars are most needed.

Something to keep in mind

- Most streams in the urban areas are meeting their use designations. This does not mean they are without problems. Don't forget to include suggestions for how to improve these areas.
- In agricultural areas, don't forget about the impacts of rural residential properties.
- Streams that have not been assessed we know little about. Even those that have been studied need more data collected.

Something to keep in mind

- You don't have to focus on the data – your knowledge and concerns are more important.
- You are the experts regarding land use and the impacts that you see – this is YOUR community.
- Don't sweat the details – look at the big picture, and focus on the issues that you see in your daily life. Be prepared to offer suggestions for how to address these issues.

We Need Your Input On:

- What water quality problems do you want to see addressed?
- What resources do you want to see preserved and promoted?
- What practices will help us address EPA's goals?
- How do you want each of these done?

It is important to note that:

- The Watershed Action Plan will have to address certain EPA requirements.
- Public input is part of what EPA requires – they want your opinions.
- Not all goals in the plan need to be for EPA – local concerns are equally as important, if not more important than EPA concerns, and may have nothing to do with EPA's data.

Its Your Turn to Talk

You have listened to us talk to you for long enough. Now it is your turn to talk.

5

Web Survey Postcard

Postcard was mailed to nearly 400 residents and agencies (about 20 agencies). Approximately 25 postcards were returned due to bad addresses. Recipients had over 30 days to complete the survey online. Paper copies of the survey, including a return postage paid envelope, were available upon request. Five requests were received for paper copies.

Water Quality Survey
Your Input is Needed

Landowners in Seneca, Eden, Bloom, Scipio, Reed, Clinton, Pleasant, Adams, and Ballville Townships... we need your input.

The SRWC is developing a plan for improving water quality in local streams. As a landowner, your help is needed. Please visit our website and complete the online survey. It is completely anonymous, and will only take 10 minutes to complete. If you do not have web access contact us via the methods on the right and we will send you a paper copy and a postage paid envelope.

To take the survey log on to:
www.sanduskyriver.org
THANK YOU FOR YOUR HELP!

Watershed includes:Bells Run, Gibson Run, Willow Creek, Morrison Creek, Rock Creek, Sugar Creek, Spicer Creek, and other direct tributaries to the Sandusky River near Tiffin.

Sandusky River—Tiffin

The plan will focus on the above drainage area.

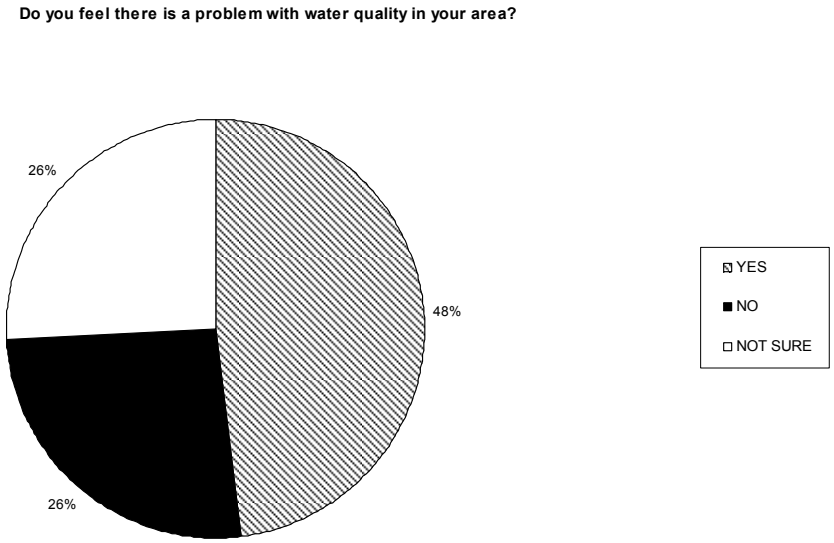
Sandusky River Watershed Coalition

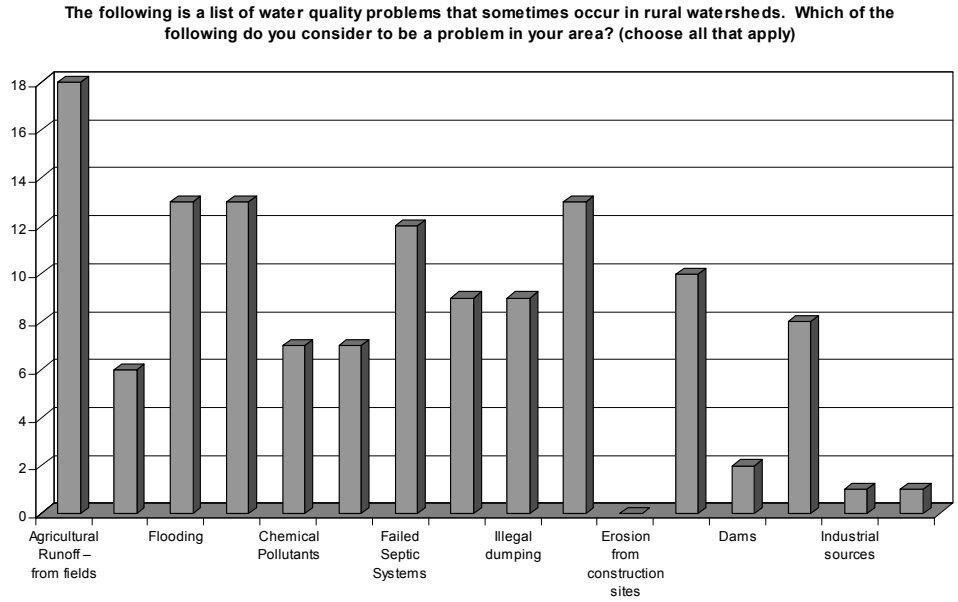
219 S. Front Street
PO Box 590
Fremont, OH 43420

Phone: 419-334-5016
Fax: 419-334-5125
E-mail: cmriddle@wsos.org

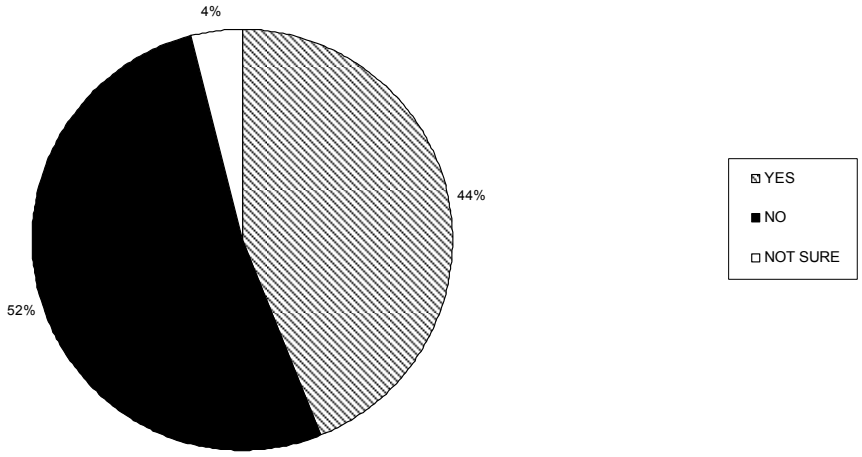
Web Survey Results

Survey was administered from May 8, 2006 through June 10, 2006. Four individuals requested and received paper copies of the survey.

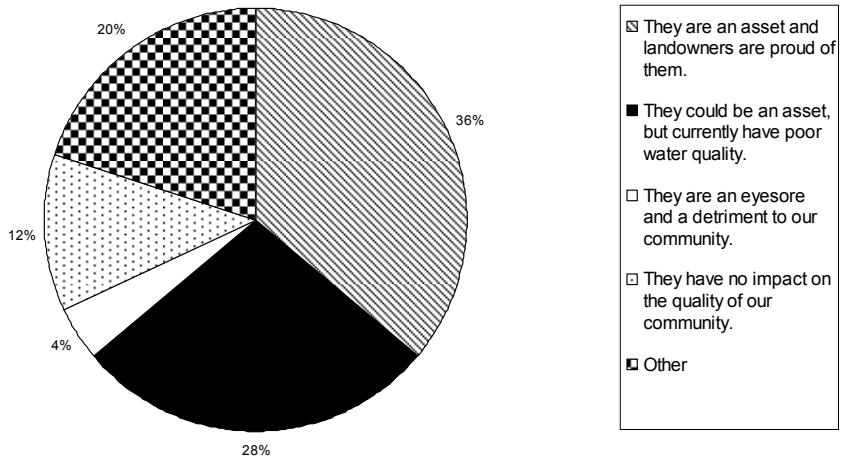




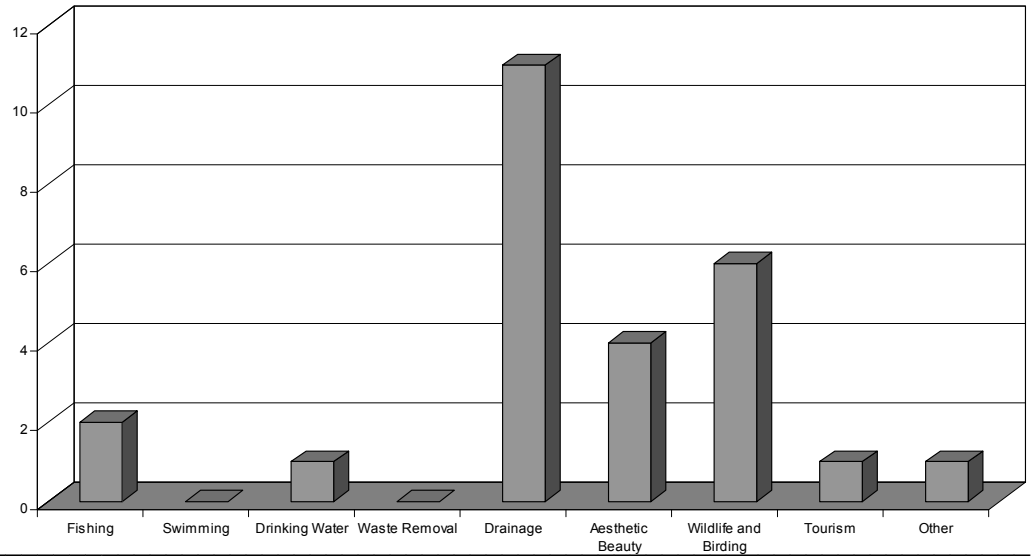
Is there a problem with flooding in your area?



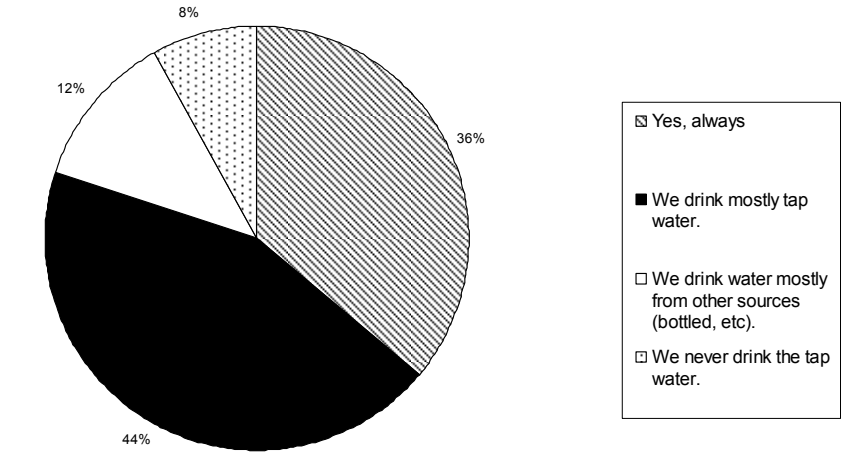
What best describes the streams in your area?



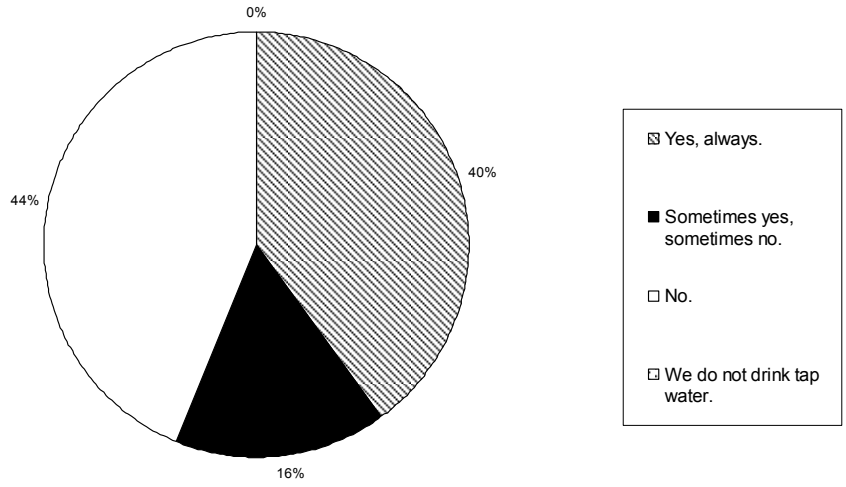
What do you consider the most beneficial use of our local streams?



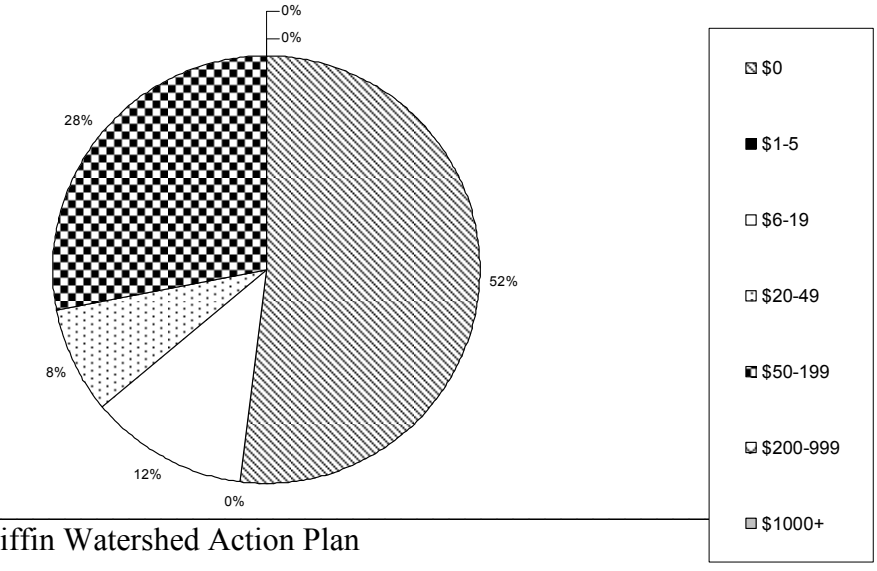
Do you drink tap water in your home?



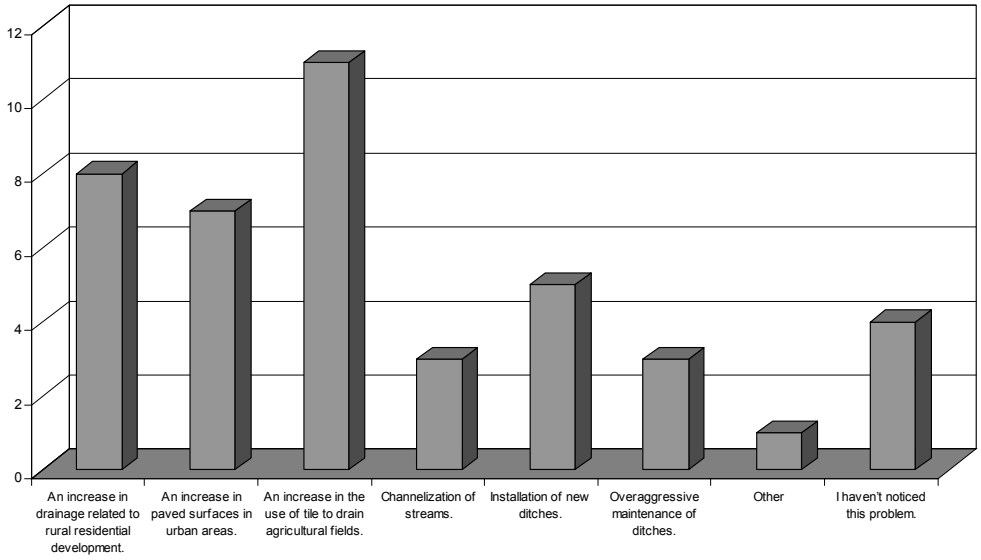
Do you filter your tap water in your home?



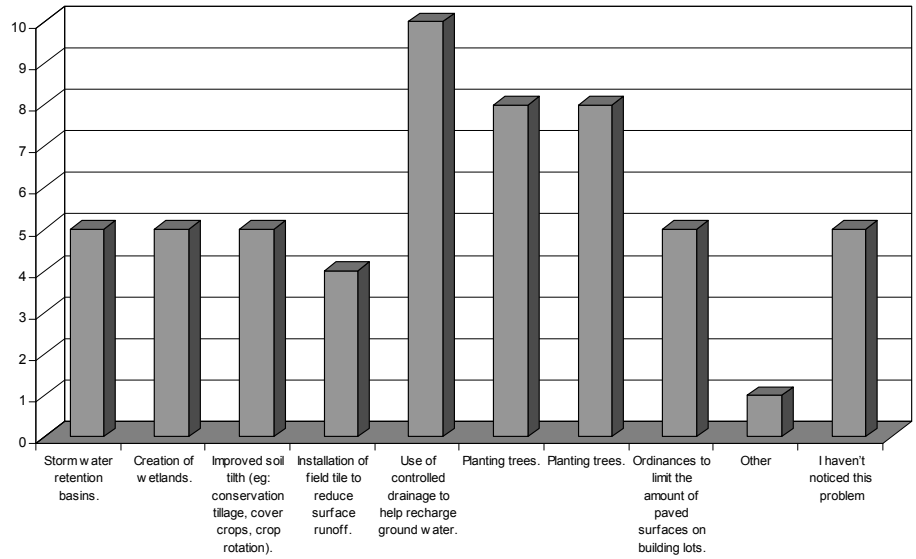
Do you filter your tap water in your home?



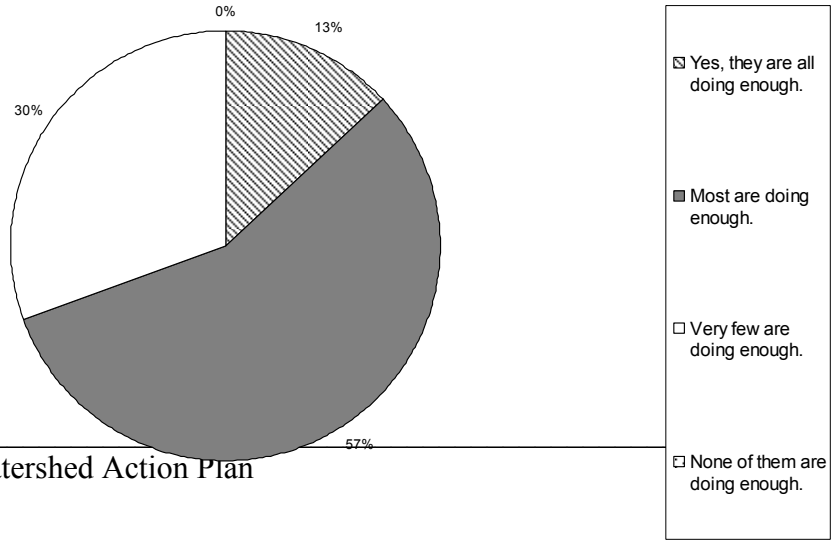
Which of the following do you feel might be causing (flashiness in streams)? (Choose all that apply)



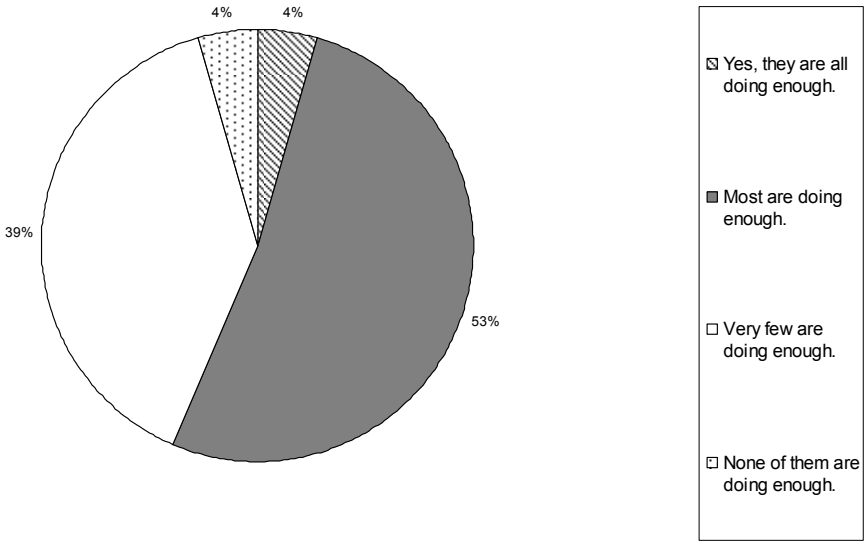
If you feel flashiness is a problem, which of the following practices would you like to see implemented in the watershed as potential solutions? (choose all that apply)



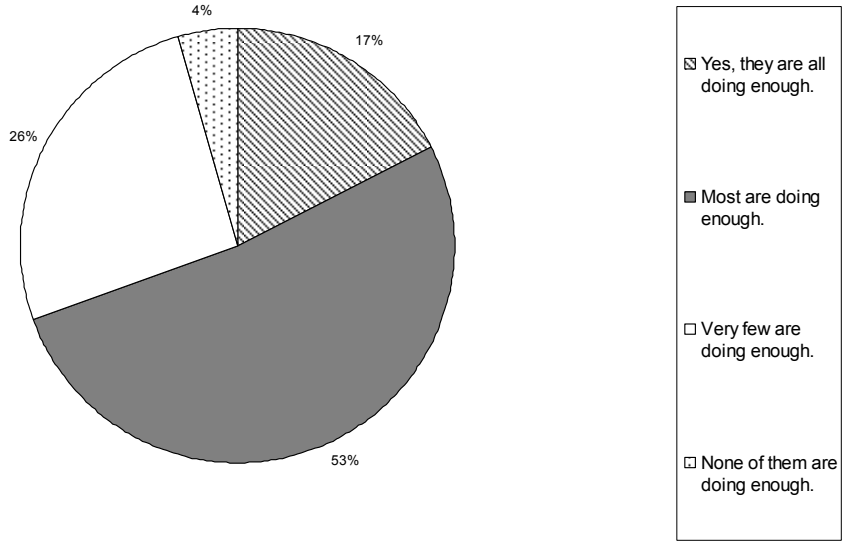
Do you feel that farmers are doing enough to limit how much water pollution they cause?



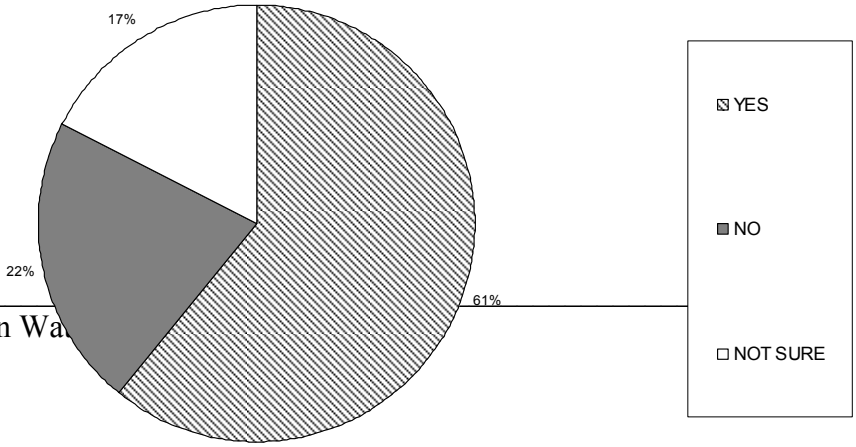
Do you feel industries are doing enough to limit how much water pollution they cause?



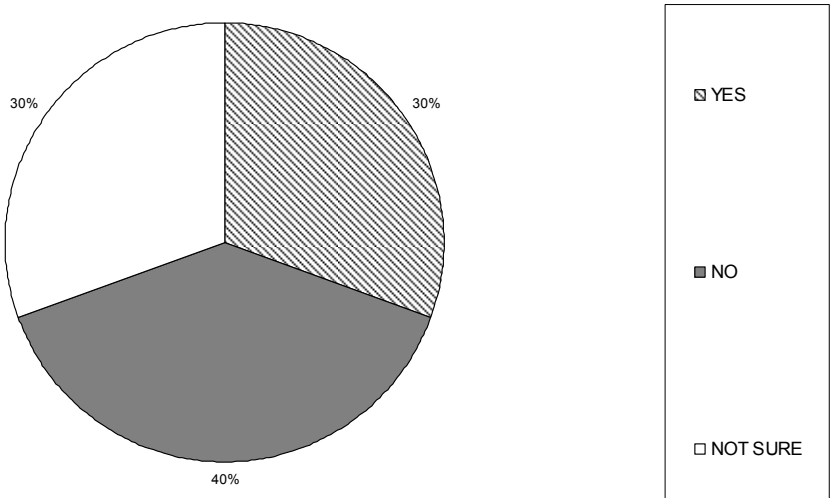
Do you feel local government is doing enough to limit water pollution in local streams?



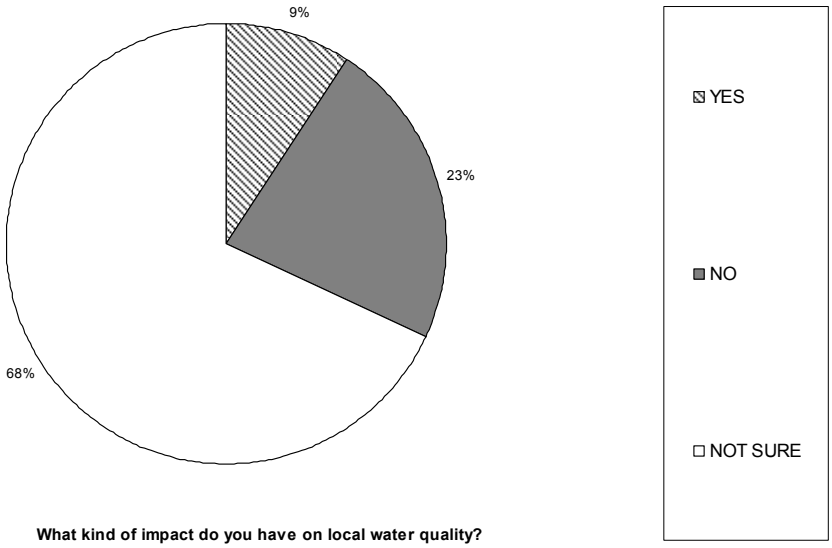
Do you feel work needs to be done to improve the quality of local streams?



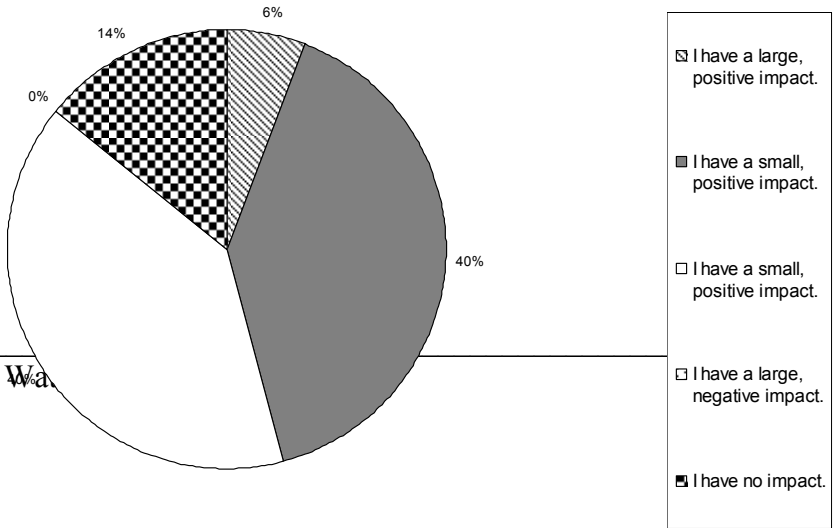
Does your next door neighbor create pollution that impacts local streams?



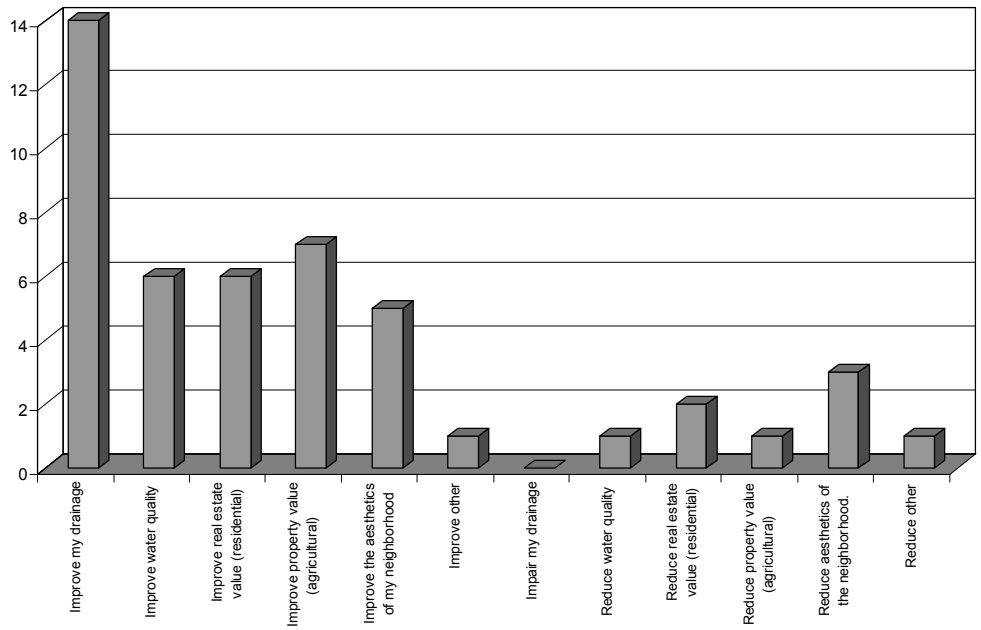
Would that same neighbor pay $5 per year to support cleaner water in your community?



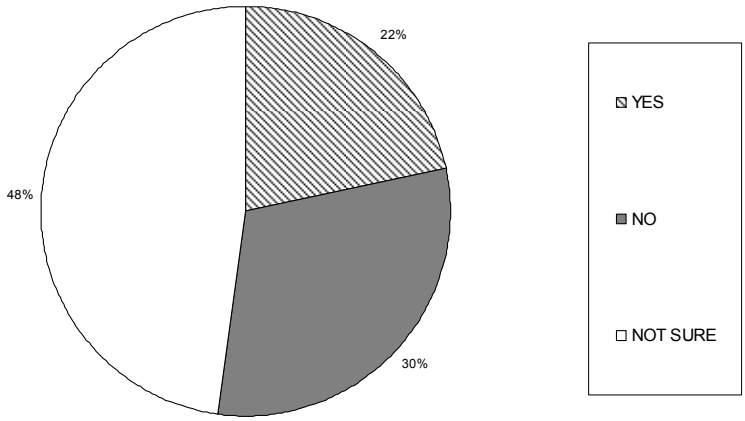
What kind of impact do you have on local water quality?



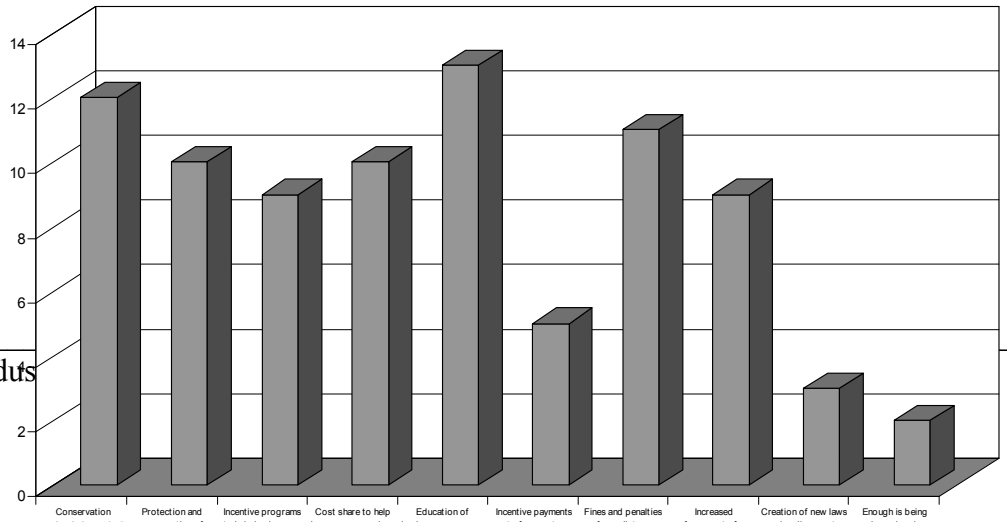
Putting a watercourse on ditch maintenance will most likely... (choose all that apply)



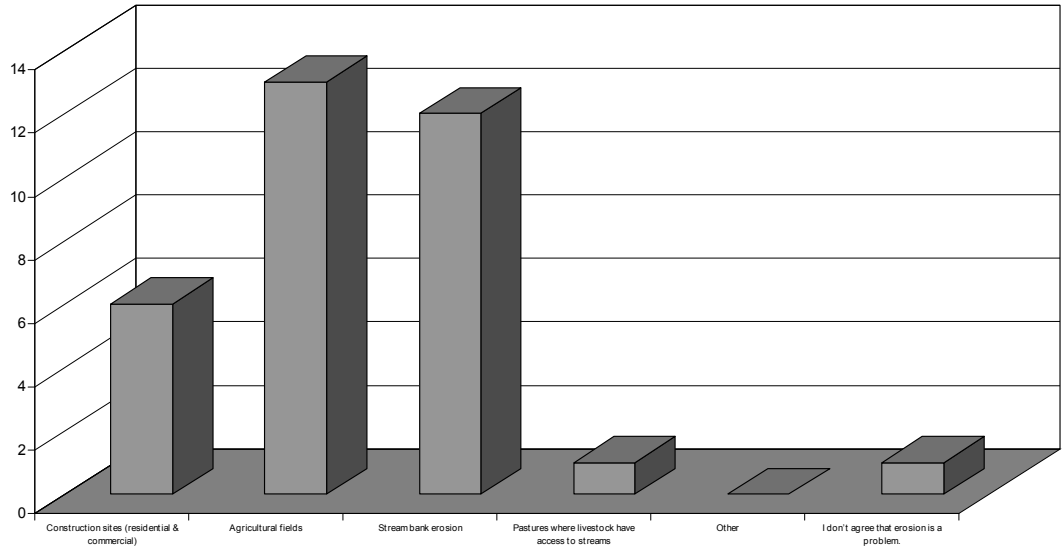
Do you feel enough is being done to protect local streams and the quality of water in them?



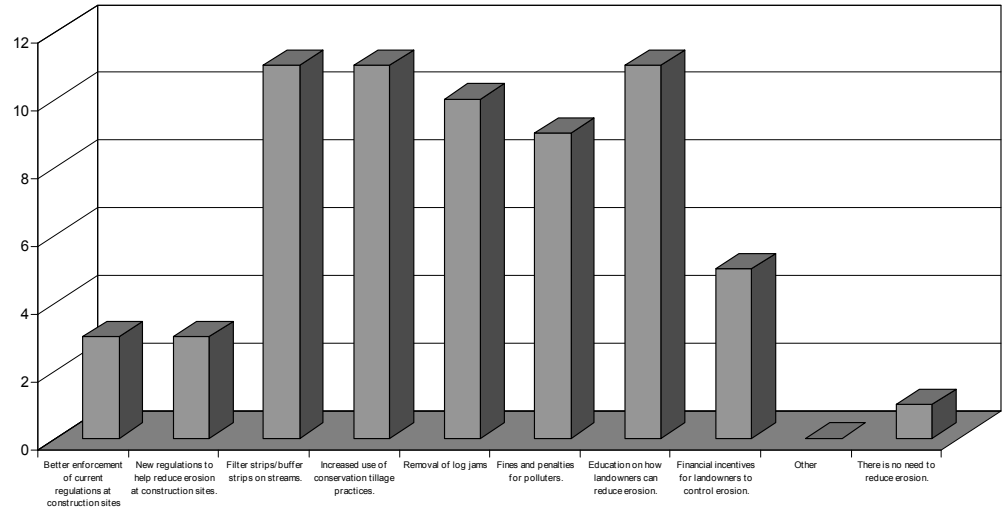
Which of the following approaches would you like to see used to protect local streams? (choose all that apply)



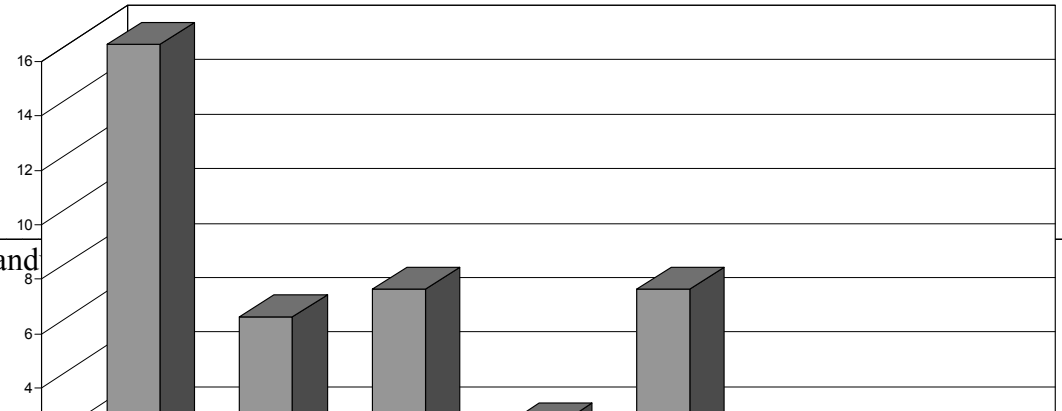
Ohio EPA listed sediment caused by erosion as the number one cause of pollution in your watershed. Which of the following do you feel are the most significant sources of this erosion? (choose all that apply)



Which of the following potential solutions would you like to see implemented to reduce erosion in this watershed? (choose all that apply)

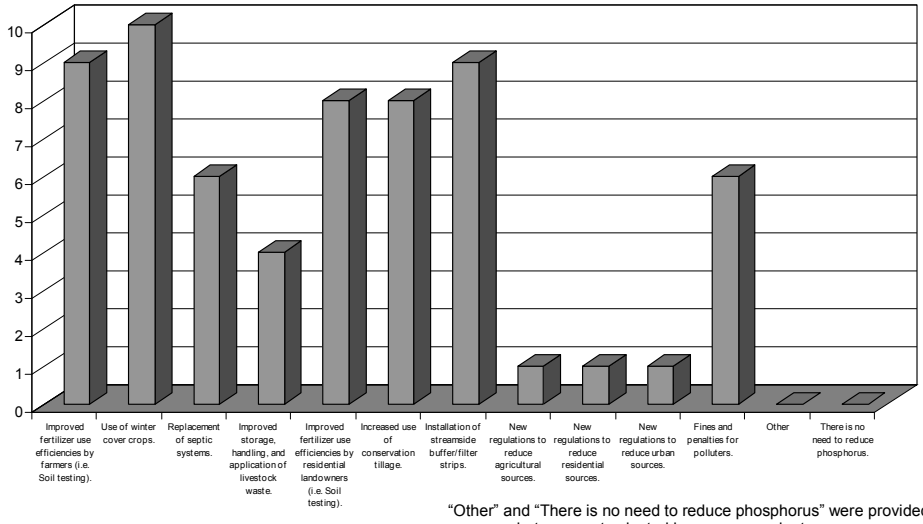


A goal of reducing phosphorus levels in streams has been suggested by Ohio EPA. Which of the following do you feel are the most significant sources of this phosphorus? (choose all that apply)



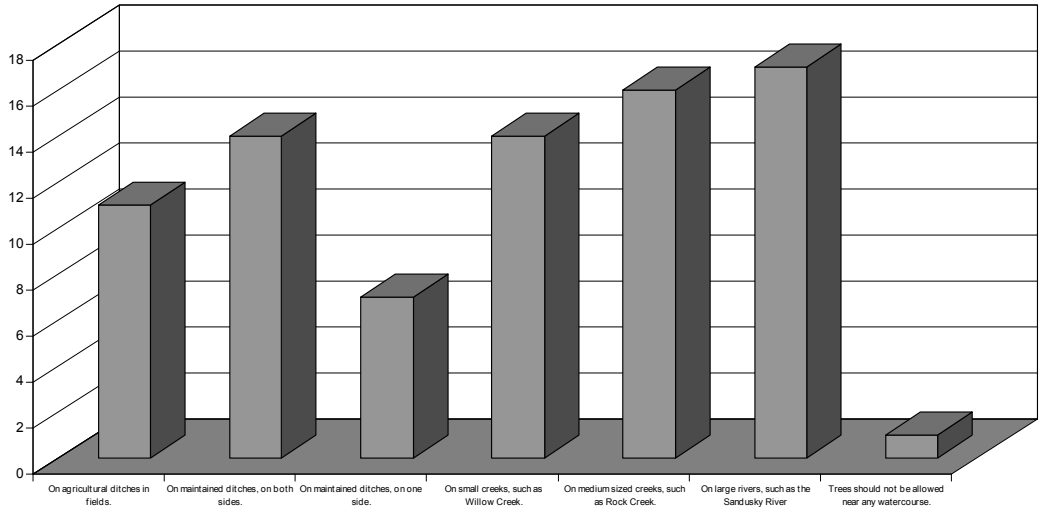
Sand

Which of the following practices would you like to see implemented in this watershed to reduce phosphorus in streams? (choose all that apply)

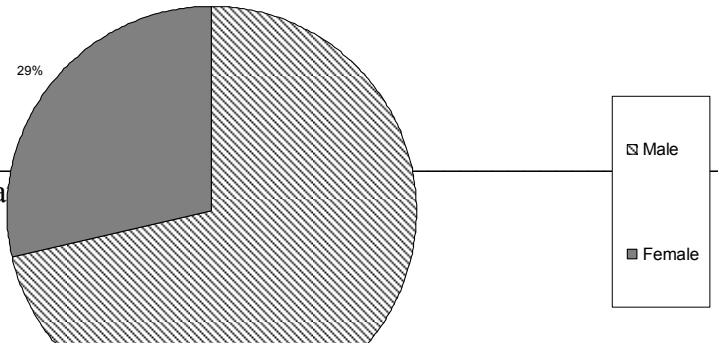


"Other" and "There is no need to reduce phosphorus" were provided as answers, but were not selected by any respondent.

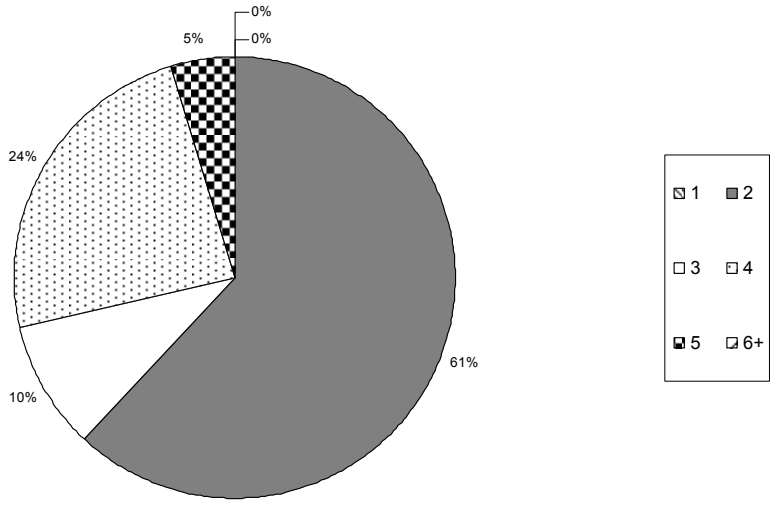
Where do you feel it is acceptable to have trees? (choose all that apply)



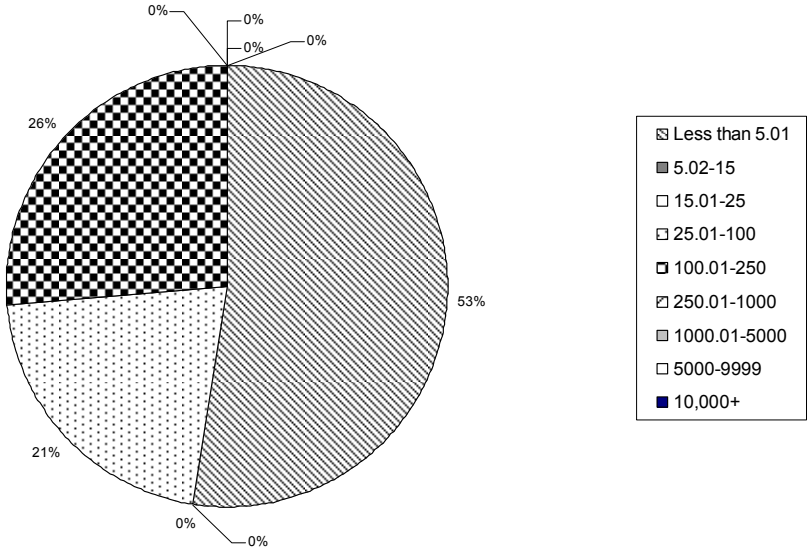
What sex are you?



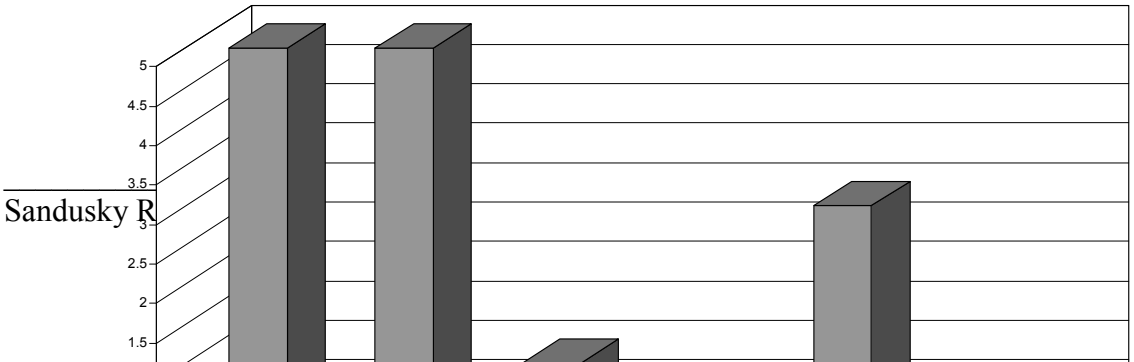
How many people live in your home?



How many acres of land do you own, rent, farm, or have a controlling interest in?



Which of the following best describes you?



Web survey –fill-in questions.
This section includes answers that required text, and the responses associated with the answer “other” where provided. All questions with the option “other” provided a space for the respondent to provide a text answer.

Question: What do you consider the top 3 problems (with water quality)?
Answers:

- Streambank erosion.
- Failed septic systems, erosion from construction sites, erosion from agricultural fields.
- Agricultural runoff, illegal dumping, low water levels.
- None.
- Runoff, flooding, erosion due to improper tilling.
- Erosion, flooding, dumping.
- Tiffin CSO’s, urban runoff, failed septic.
- Erosion.
- Chemical runoff into stream, illegal dumping, failed septic systems.
- Ag runoff from fields, failed septic systems, log jams/ditch cleaning.
- Septic system failures, loss of riparian corridor, channelization.
- Ag. runoff from fields, streambank erosion, and flooding.
- Chemical pollutants, in my opinion is the worst problem. My father and I were "organic" style farmers, and avoid chemical applications on our farms. Also, we have wells, and the water table has lowered considerably in the past 40 years.
- Flooding.
- Illegal dumping.
- Not sure.
- Ag runoff from fields, flooding, erosion from fields.
- Streambank erosion, erosion from fields, agriculture runoff.
- Urban Runoff, erosion from fields, flooding.
- Flooding & Erosion
- Agricultural Runoff, Illegal dumping and low water levels
- Pollution, pollution and pollution.

- Along Rock Creek within the city of Tiffin-appears improper sewer separation; erosion; poor vegetation
- Failed Septic systems, Agricultural Runoff, Flooding
- Agricultural runoff from fields. Agricultural runoff from livestock. Streambank erosion.
- flooding, erosion from fields, low water levels

Question: What best describes the streams in your area?
Answer: Other:

- overall not bad they need cleaned
- littered with trash and brush..... no cleanup programs
- People don't recognize their importance.
- Residential landowners view the river and streams as an asset. Farmers, in general, seem to think that the river is there just for their use.

Question: Which of the following do you feel might be causing (flashiness)? (choose all that apply)
Answer: Other:

- Increased development.

Question: If you feel flashiness is a problem, which of the following practices would you like to see implemented in the watershed as potential solutions? (choose all that apply)
Answer: Other:

- Limit channelization.

Question: What is your occupation?
Answers:

- attorney
- Township Superintendent
- Retired
- Health care provider
- Graphic Designer
- factory worker
- Village Administrator
- Sales
- Health District
- Retired government worker, part time law enforcement officer.
- Retired carpenter
- Retired
- ag. equipment sales
- laborer
- Business Mgr.
- Retired
- None
- Sales
- College professor

- Professional

Question: Please provide any comments that you may have regarding this survey, water quality in your watershed, or water related issues in general.
Answers:

- Opposed to county ditch maintenance because of the removal of all trees
- Cut down on pollution of watershed.
- I didn't realize there was a problem besides the occasional flooding of Rt.224
- wish my water was better for consumption/cooking/laundering/
- The waterways are cleaner than they used to be, but still need work.
- a clean stream is a happy stream
- None
- I just hope you are not looking for more funding. There are other ways to resolve such problems like enforcement of current regulations.
- My main concern is that little or nothing is done to facilitate stream cleanup programs in my area.
- we need something done about the 224 bridge over the Sandusky river. as the ice breaks up it dams up behind and it floods us.
- not bad, could be better.
- None
- Lets get back to working with nature, instead of trying to control her. Remember that we don't own the earth, we just have use of it for the time we are here.
- Keep up the good work
- In our area during peak periods the river banks are insufficient to carry the load and hundreds of acres of farmland are flooded
- My primary concern of late has been the quality of Gibson Run in the south end of Tiffin. The normal flow is mostly spring water and it rarely goes dry even in extreme drought. It is named after General William Harvey Gibson. His Sycamore street residence and the subdivision he created - through which the stream runs - are both named Springdale. I'm convinced the water rises due to the underground sand formations in the south part of Tiffin and just beyond. Lake Mohawk may also be the recipient of some of this spring water. To illustrate, and VERY SIMILARLY on a much larger scale, there is a large sand formation running generally from Green Springs to Castalia. At the southern end of this formation near Green Springs there are at least two large springs - one of which feeds Beaver creek AND turns it into a trout stream! At the northern end of the formation are at least four massive springs: 1) Castalia's Blue Hole. 2) Rockwell trout stream. 3) and 4) At least two very large springs which rise under the waters of Sandusky Bay near Whites Landing. Gibson Run does not produce much volume, but if it had a little more flow, it would also potentially be a trout stream. In 2005 there was a hatch of smallmouth bass near Sycamore St. I've been concerned that: A) A little more pollution than normal has appeared. I

have not been able to locate the source. B) Development south of Tiffin over the sand formation could be very detrimental to the continued flow of spring water. Detention basins and/or wetlands could be beneficial. Thank you for your interest.

- Biggest concern is the improper sewer separation-large quantities of 'suds' on Rock Creek. Also the erosion has increased greatly since many trees have been taken out & only weeds & a few wild flowers left in many spots.
- Interested in seeing results and actual facts.
- It'll be tough to change agricultural practices under current Ohio property laws. The most significant change may need to happen in that area. For example, currently property rights extend to the middle of the watercourse and include the streambed, which gives these property owners the right to do nearly anything with riparian zones, the river bottom, the water flowing over the bottom, the water entering feeder streams etc. A change in this one area--say, defining the property line to a high water mark, as many states do--would allow much greater and more responsible control over activities that affect water quality.
- Much of the flooding is caused by channelization upstream. The less interference with nature, the better.

NOTE: The order of the text results was rearranged to protect the anonymity of the respondents.

Comments Received During Public Comment Period – 07/11/06 - 08/11/06

- A comment was received requesting the addition of the development of navigational signage for recreational river use to the list of projects.
- A comment was received requesting the addition of the removal of Bacon's Dam to the list of projects.
- A comment was received requesting the inclusion of wheat and other small grains as BMP's where appropriate.
- At the request of the watershed coordinator, a series of comments and suggestions were received from Mark Fritz, Crawford, Sandusky, Seneca, and Wyandot SWCD Manure Management Specialist, regarding manure management and related issues. His suggestions were incorporated into the action plan.

Potential Stakeholder Meeting held March 9, 2007

Stakeholders whose interests were not documented in the First Draft were invited to an Focus Group discussion held March 9, 2007 at the Clinton Township House. Those invited included the municipal and township government officials, local farm service dealers, and private water supply provider. Eleven officials were present.

An updated version of the Power Point WAP overview provided above was presented. A list of questions and a copy of the draft implementation plan was also

shared with the group and a focus group discussion was held. From the focus group discussion there were comments and concerns shared and debated.

Face to face meetings were held with those who could not attend the March 9th meeting. The same presentation and hand-outs were shared. Several additional comments and concerns were shared.

Those comments and concerns are as follows:

- one slide in the presentation showed that through the City of Tiffin, the Sandusky River is in full attainment; yet there are requirements for the City to spend 50 million dollars to fix CSO's. What is the thinking of Ohio EPA here?
- Has soil quality declined with continued erosion of soil into Lake Erie?
- Can we really meet attainment requirement s for small streams where flows are typically small to start with?
- Protecting or preserving area along the river would be an important step in permanent improvements.
- Continued losses of nitrogen from agriculture is a factor that impacts the operation and costs of doing business at the Tiffin water treatment facility.
- Why is there a need to remove the Bacon Dam?
- Eutrophication and sedimentation into Lake Mohawk is an issue within the watershed.
- Storm water runoff issues need emphasis.
- The emphasis should be to maintain point source reductions per NPDES permits.
- City of Tiffin ordinances currently address storm water runoff concerns.
- There may be a need for volunteer monitoring on smaller streams or unmonitored ones to better clarify problems.
- A county wide set back provision along streams might be developed with help from Regional Planning. The intent would be to minimize many of the water quality impacts associated with proximity to the stream.
- Why can farmers and producers not follow the township, county and state right-of-ways to provide a natural buffer between the field and road drainage to reduce non-point source pollution that occurs in runoff.
- With the corn market raising and the talk of increased corn acreage in response there is an increased concern of nitrate levels in our surface water.
- An increase in pH levels has been noted from the increase of Phosphorus in the last six years and they are year round not just seasonal.

Appendix 2

State Review of
Sandusky River - Tiffin Draft Watershed Action Plan
and
Coalition Responses to the State Review

Contents will be added when available.

10 November 2006

Sandusky River Watershed Coalition
Deb Martin, Director
Great Lakes RCAP,WSOS CAC, Inc.
P.O. Box 590, 219 S. Front St.
Fremont, OH 43420
(419) 334-5117

Dear Sandusky River Watershed Coalition,

Thank you for submitting a copy of the Sandusky River -Tiffin Watershed Action Plan covering HUC 04100011- 090 as part of the review for state endorsement. We sincerely appreciate your ongoing efforts to meet the challenges and demands of this watershed project. In addition, we wish to thank the National Center for Water Quality Research at Heidelberg College, along with all the other partners who have contributed to the watershed planning effort.

Comments from your Area Assistance Team are compiled and enclosed for the watershed action plan that was submitted in September 2006. Please share our comments with the watershed group leadership as appropriate. The Sandusky River-Tiffin Watershed Action Plan has a full endorsement pending status. Once the specific plan comments contained in this letter are incorporated into the plan, the plan can receive full endorsement. Please refer to attachment one (State Endorsement Process) for a complete definition.

We recognize that this watershed planning effort has been, and is an ongoing process. Therefore, to maintain compliance with the watershed coordinator grant agreement, it is essential that when new data is made available, such as total maximum daily limits (TMDLs) or work is completed on new sub watersheds, this plan will be updated to include the components outlined in state guidance and refined to reflect the achievements and lessons learned as implementation proceeds.

Once again, we want to commend you and all your partners for the high level of teamwork and persistence that has resulted in a plan that is truly user friendly. Your efforts show that successful watershed plan development and implementation is achieved only with strong local stakeholders and partners working toward consensus on specific, focused actions necessary to improve and protect Ohio's cherished water resources.

Please let us know within 30 days of receipt of this letter whether you intend to address the comments or wish to discuss them further. It is the State's intention to continue to be a very strong stakeholder and supporter of your efforts to protect and improve water resource quality in the Sandusky River-Tiffin watershed

Ohio truly appreciates your efforts thus far, and we look forward to working with you in the future. If you have any questions, please contact Matt Adkins, ODNR, DSWC (419) 609 4102 or Katie McKibben Ohio EPA, DSW (419) 373-3013.

Sincerely,

Matt Adkins
ODNR, Division of Soil & Water Conservation

Katie McKibben
Ohio EPA, Division of Surface Water

Enclosure

cc: Russ Gibson, Ohio EPA-DSW, Greg Nageotte, ODNR-DSWC

The following comments have been provided by:

Katie McKibben, OEPA-DSW, Bowling Green
Aaron Lantz, ODNR – DSWC, Columbus
Matt Adkins, ODNR-DSWC, Sandusky
Dana Oleskiewicz, OSU Extension, Wooster

Katie's comments:
General:

- The plan is well developed, cohesive, and easy to navigate. It follows a similar format and layout that is in the Sandusky-Honey Creek Plan, which received full state endorsement in April 2006.
- Chapter 2. Policy Environment is an excellent background for any watershed plan. There is also a relevant discussion in Chapter 4. Water Resources from the perspective of agricultural drainage and water quality goals.
- The maps for the general geography and other spatial characteristics of the watershed are very useful and detailed.
- The resource inventory in this WAP is meant to update and complement the previous Resource Inventory & Management Plan (RIMP) developed in 2000. There is a general statement that refers the reader of 2006 Sandusky -Tiffin plan to the RIMP for more detailed inventory information. The exception to this is information on channel morphology that was not available in 2000, nor was it provided by way of the TMDL assessment in 2001.
- Appendix 1. Public Input Summary is a good model of public involvement strategy that other watershed groups and plan reviewers may want to see. They even included a copy of the power point presentation and discussion question aids that were used in public meetings for the WAP.

Section III. Watershed Inventory – A
Soils maps – contact Aaron Lantz for assistance on creating a basic soil associations maps for the watershed. I noted the maps with hydric soils, but nothing with basic soils or location of HEL soils.

Section III. Watershed Inventory – E
A list of NPDES permitted facilities can be found with a map in the RIMP, but it would be a useful reference for the implementing team to transfer that list to Chapter 3 of the WAP.

Aaron's comments:

- You did a great job with the inventory and stressing the importance of soils in watershed management.
- Reference Digital soils information in your plan (I know you used it). You could reference the Soil Data Mart in your reference section.

Suggestion:
The Implementation section In the Target column (in your table) you could use soils to further target or prioritize areas for BMPs. I am referring to when you are targeting 1st and 2nd order streams.

Matt's comments:
General :

- The plan mentions the funding source as ODNR on page ii (preface) and xi (acknowledgements). However, as a Coastal Management Assistance Grant project the plan must include the following statement on the cover page and/or acknowledgements page.

  This [report/video/Internet site] was prepared by [Subrecipient] under award NA05NOS4191090 from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce through the Ohio Department of Natural Resources, Office of Coastal Management. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration,

Department of Commerce, Ohio Department of Natural Resources, or the Office of Coastal Management. For more information, contact Yetty Alley at the Office of Coastal Management (419) 626-7986.

- Check for cut and paste errors from the Honey Creek WAP. For Example: page 10 that refers to Chapter 5- Implementation Plan for Improving Water Quality, Page xii refers to the Honey Creek WAP.
- Update the cover page with current contact information.
- Add Acronyms on page x SRPC, AESE, ORDAC
- Check for page number errors. For example page ii public input appendix page v has incorrect page number for public input results. For example Coastal NPS Implementation plan starts on page 141.
- Please update page 10 to reflect the current status of the Ohio Nonpoint Program and Plan. For more information, contact Greg Nageotte, ODNR, DSWC at 614 265 6619.
- The Sandusky River –Tiffin Watershed Action Plan has organized the inventory, water resources, aquatic life use attainment and plan for restoration activities primarily on the 11 digit HUC scale. Where possible provide additional information on the 14 digit scale. For example, list and provide a summary of each of the 14 digit watersheds within the Sandusky River- Tiffin Watershed.

Watershed Maps (1-15)

There are several improvements that could be made to increase the readability and usefulness of the maps. There are many options to remedy these problems. I have provided suggestions below:

- Include source data in plan or on maps.
- Provide definitions in the legends (example map 7 and 14 SRT and Roman Numerals).
- The colored lines in legends are hard to see (example map 11).
- Change color or increase width of lines (example map 11).
- The land use maps are hard to read due to 11 digit HUC scale and color scheme (example map 10 and 15).
- 14 Digit HUC Scale may increase usefulness and readability of maps.
- Reduce the use of yellow and increase contrast of colors.
- The background color and legend colors need increased contrast (example map 5).
- The city of Tiffin boundary is filled with color over the data layers (example 7,10,14).

Coastal NPS Management Measures

- New OSDS- Please update the text that relates to the new HSTS law and rules to reflect the current status of the legislation and rules on page 143.
- Add the City of Tiffin and Republic to the endorsement page.
- Phase II areas are exempt from specific management measures. However the City of Tiffin and other urbanized areas are not exempt from watershed protection and site development management measures. Include a strategy for implementation of these management measures in the City of Tiffin. Page 142-143.
- Include a lead agency for the City of Tiffin and town of Republic for Coastal NPS implementation strategies in table 6.11 page 84-95
- Text for the Bacon Street dam is missing on page 149. Include an implementation strategy for the town of Republic waste water treatment ~~dam~~ plant on page 92.
- Please identify or explain the strategies mentioned on page 149 for eroding streambanks and shorelines.

Dana's Comments:

Strengths:

-very comprehensive, easy to follow, and user friendly

-nice introduction and background information

-data presented in sub watersheds, strong watershed inventory, with designated uses outlined

-scientific information is thorough

-Coalition structure explained, as is the public involvement process
-nice use of font colors to denote timeline and project status
-good agency and governmental involvement
-comprehensive list of partners involved
-use of public meetings in developing solutions
-evaluation is a component in goals/objectives (as indicators)
-who is going to do what by when and how is nicely presented in the implementation plan tables!

Weaknesses:
-load reduction not quantified in tables
-appears to be an environmental government work plan (i.e. SWCD, NRCS, & OSU)
-stakeholder involvement is not diverse (what about other community entities? Municipalities, schools, civic groups, libraries, nonprofits, etc.)
-SWCD, NRCS, OSU listed as the lead on objectives and action items, and simultaneously which dilutes effectiveness (it is like saying all the partners are going to do all tasks within the same timeframe – why bother stating it – where is the assignments and prioritizing?)
-public (broader stakeholders) only involved in voicing concerns and problems, not implementing solutions
-minimal reference to educational outreach and fundraising for continuing efforts

Suggestions:

1) Develop a broader list of stakeholders and invite them to participate.
2) Allow for opportunities (i.e. in workgroups) where all stakeholders can provide input into solutions and then take a lead on actions.
3) Use the implementation strategies table as a starting point, but broaden it according to the contributions made by the diverse stakeholders (more solutions by more people).

Consider the development of an educational strategy and a fundraising plan as a component of the plan.

Coalition Responses to Comments from the State Review Team

In response to comments received by the State Review Team, a meeting was held January 8, 2007 between the State Review Team, numerous Coalition members and the Watershed Coordinator to discuss the direction of the plan in response to the comments. Numerous changes have been made to the plan to strengthen areas of weakness reflected in the comments and as a result of the numerous meetings with additional stakeholders.

To facilitate the final review of this WAP, a copy of the comments has been inserted with the specific revision or response made to the specific comment received. The responses to the comments appear in Red Type following each comment received by each State Review Team member.

The following comments have been provided by:

Katie McKibben, OEPA-DSW, Bowling Green
Aaron Lantz, ODNR – DSWC, Columbus
Matt Adkins, ODNR-DSWC, Sandusky
Dana Oleskiewicz, OSU Extension, Wooster

Katie's comments:

Section III. Watershed Inventory – A
Soils maps – contact Aaron Lantz for assistance on creating a basic soil associations maps for the watershed. I noted the maps with hydric soils, but nothing with basic soils or location of HEL soils. – HEL map has been added as Map no. 16, but no basic soils map was added. After discussion with Aaron Lantz the value of such map was questioned since it would not provide any additional targeting of programs like the HEL map can provide.

Section III. Watershed Inventory – E
A list of NPDES permitted facilities can be found with a map in the RIMP, but it would be a useful reference for the implementing team to transfer that list to Chapter 3 of the WAP. – Added a section at the end of Chapter 3 discussing what the NPDES permit provides and how it can be relevant to the plan followed with Table 3.21 which shows the NPDES permit holders and permit number.

Aaron's comments:

- Reference Digital soils information in your plan (I know you used it). You could reference the Soil Data Mart in your reference section. Soil Data Mart added as reference within the Reference Section of the WAP

Suggestion:
The Implementation section In the Target column (in your table) you could use soils to further target or prioritize areas for BMPs. I am referring to when you are targeting 1st and 2nd order streams. – Sections 1a., 1b., and 2a. in the Implementation Plan were reviewed and additional targeting of HEL lands were added to the target area of the 1st and 2nd order streams.

Matt's comments:
General :

- The plan mentions the funding source as ODNR on page ii (preface) and xi (acknowledgements). However, as a Coastal Management Assistance Grant project the plan must include the following statement on the cover page and/or acknowledgements page.

  This [report/video/Internet site] was prepared by [Subrecipient] under award NA05NOS4191090 from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce through the Ohio Department of Natural Resources, Office of Coastal Management. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration, Department of Commerce, Ohio Department of Natural Resources, or the Office of Coastal Management. For more information, contact Yetty Alley at the Office of Coastal Management (419) 626-7986. – Added to the cover page as well as the introductory paragraph of the Acknowledgements page.
- Check for cut and paste errors from the Honey Creek WAP. For Example: page 10 that refers to Chapter 5- Implementation Plan for Improving Water Quality, Page xii refers to the Honey Creek WAP. – entire document double checked and completed
- Update the cover page with current contact information. - completed
- Add Acronyms on page x SRPC, AESE, ORDAC – Addition of many acronyms used within the plan and that have been added during revisions will now be found in the List of Acronyms.
- Check for page number errors. For example page ii public input appendix page v has incorrect page number for public input results. For example Coastal NPS Implementation plan starts on page 141. – Document completely renumbered and Table of Contents reflects all changes.
- Please update page 10 to reflect the current status of the Ohio Nonpoint Program and Plan. For more information, contact Greg Nageotte, ODNR, DSWC at 614 265 6619. This section has been revised to meet the current approved plan.
- The Sandusky River –Tiffin Watershed Action Plan has organized the inventory, water resources, aquatic life use attainment and plan for restoration activities primarily on the 11 digit HUC scale. Where possible provide additional information on the 14 digit scale. For example, list and provide a summary of each of the 14 digit watersheds within the Sandusky River- Tiffin Watershed. – A map has been provided showing each of the 14-digit HUC within the Sandusky River-Tiffin and has been referenced in Chapter 3. Within many of the tables and figures the information has been provided on a 14-digit HUC scale.

Watershed Maps (1-15)

There are several improvements that could be made to increase the readability and usefulness of the maps. There are many options to remedy these problems. I have provided suggestions below:

- Include source data in plan or on maps. – Added to the reference section of the plan.
- Provide definitions in the legends (example map 7 and 14 SRT and Roman Numerals). – Defined the Stream Order in Map 3, provided clarification of explanation to Map 7 and Roman numerals in Map 14 were defined.
- The colored lines in legends are hard to see (example map 11). Background color was changed to show use designation more clearly.
- Change color or increase width of lines (example map 11).- Again Background color was changed to bring out the stream use Designation more clearly.
- The land use maps are hard to read due to 11 digit HUC scale and color scheme (example map 10 and 15). Changed color schemes in attempt to increase visibility of land use maps.
- 14 Digit HUC Scale may increase usefulness and readability of maps. – To increase the read ability of the maps the roads of the watershed have been removed to make the maps less cluttered by information that provides usefulness of the map. To determine which map should be available in the 14 digit scale was difficult.
- Reduce the use of yellow and increase contrast of colors. Changed background color to bring out the yellow since it was used to define specific layers.
- The background color and legend colors need increased contrast (example map 5). Background color in several maps has been changed to increase the contract.

- The city of Tiffin boundary is filled with color over the data layers (example 7,10,14). City of Tiffin and Village of Republic filled color has been removed from the maps in which it affected the mapped items visibility.

Coastal NPS Management Measures

- New OSDS- Please update the text that relates to the new HSTS law and rules to reflect the current status of the legislation and rules on page 143. Changed the HSTS section to reflect the new Ohio Administrative Code.
- Add the City of Tiffin and Republic to the endorsement page. City of Tiffin, Village of Republic, City of Sandusky, Pleasant Township Board of Trustees, Ohio-American Water Company and WSOS Community Action Commission, Inc. have all been added endorsements.
- Phase II areas are exempt from specific management measures. However the City of Tiffin and other urbanized areas are not exempt from watershed protection and site development management measures. Include a strategy for implementation of these management measures in the City of Tiffin. Page 142-143. City of Tiffin Storm Water Management Plan objectives have been added into the Implementation plan accordingly.
- Include a lead agency for the City of Tiffin and town of Republic for Coastal NPS implementation strategies in table 6.11 page 84-95 Within this section City of Tiffin Water Pollution Control Center and City engineer have been added. Often times mention of City of Tiffin is added in parenthesis' following Regional Planning this is due to the fact that the City of Tiffin is represented on the Seneca County Regional Planning.
- Text for the Bacon Street dam is missing on page 149. Include an implementation strategy for the town of Republic waste water treatment ~~dam~~ plant on page 92. Text for the Ella Street dam and Bacon Dam have been updated. In regards to the Republic waste water treatment plant it was found in researching this issue that Coastal Management Measures do not apply to dams that are guided by NPDES permits which is the case in this situation. This information was referred to in the text as well as adding reference to the Emergency Action Plan the Village has developed.
- Please identify or explain the strategies mentioned on page 149 for eroding streambanks and shorelines. Included in Referencing of Tables 6.11and 6.13.

Dana's Comments:

Suggestions:

1. Develop a broader list of stakeholders and invite them to participate. – Focus Group Meeting for Stakeholders was held on March 9. Additional meetings with City of Sandusky, Village of Republic and Ohio-American Water Company were completed. Additional endorsements were received by all listed above as well as Pleasant Township Board of Trustees, City of Tiffin and WSOS Community Action Commission, Inc.
2. Allow for opportunities (i.e. in workgroups) where all stakeholders can provide input into solutions and then take a lead on actions. – In the footnotes of the Implementation Plan you will note that the first agency listed is the lead agency with the others being partners in that action. By being partners allows for input into the solutions.
3. Use the implementation strategies table as a starting point, but broaden it according to the contributions made by the diverse stakeholders (more solutions by more people). – With the addition of additional stakeholders those participating in the implementation of the plan have increased in many of the various areas of the plan.
4. Consider the development of an educational strategy and a fundraising plan as a component of the plan. – Fundraising is addressed in the Implementation Plan as the

How/Current and How/New. Also the text that addressed the Fundraising has been updated to include changes in structure of the Steering Committee standing committees.

Additional Text Provided

In Chapter 6, a section titled USDA Conservation Effects Assessment Project (CEAP) for Rock Creek Watershed was added to the plan. This grant has provided additional assistance in guiding and evaluating BMP's needed to obtain the goals of phosphorus reduction in the watershed. It also demonstrates the involvement of one of the many partners and their commitment to the Coalition.

APPENDIX 3

Draft Implementation Plans for Satisfying Coastal Management Measures

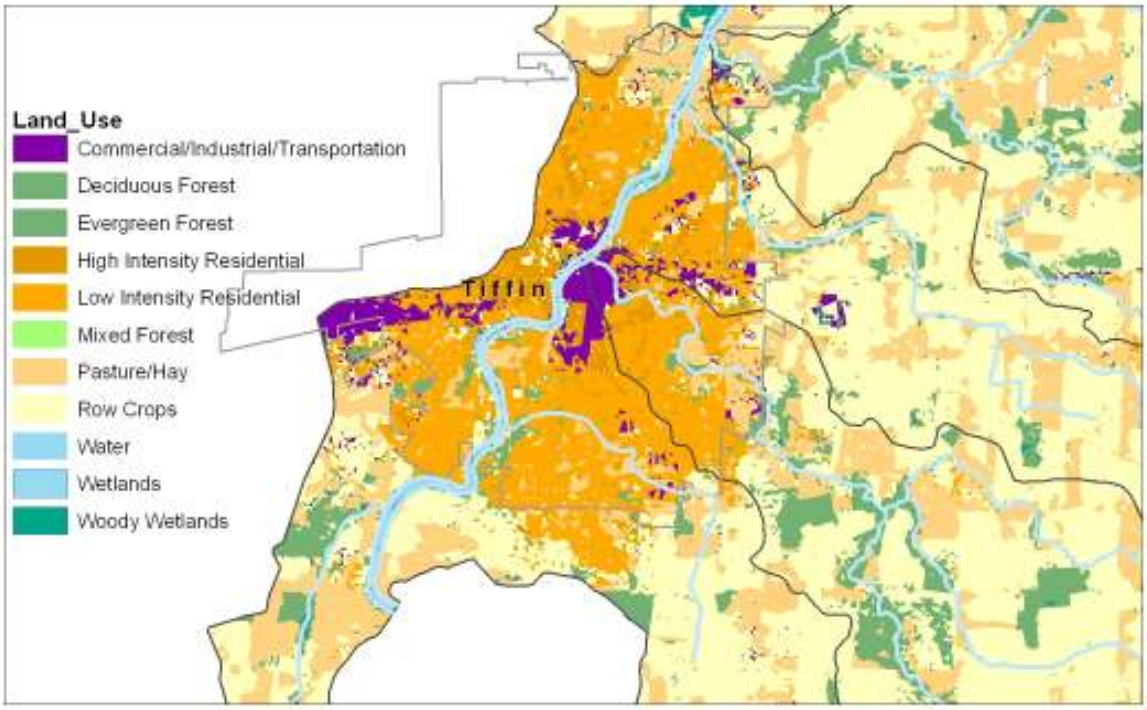
The following text and Table 6.11 provide information necessary for addressing the Coastal Management Measures as they apply to the SR-Tiffin watershed.

Irrigation Water Management. The Farm Bureau is addressing this issue at the state level. Consequently, it is no longer necessary for the Coalition to address this issue within the SR-Tiffin WAP. However, it should be noted that irrigation agriculture was not implicated in the identification of contributing factors to water quality impairments in Honey Creek (OEPA 2004b). Furthermore, in a study of water use for irrigation agriculture in Ohio's Lake Erie Basin, Loftus and Richards (2005) did not find irrigation agriculture to be present at a level that would require a reporting of usage withdrawals to the State of Ohio. There is no reason to suspect, therefore, that irrigation agriculture is problematic in the SR-Tiffin Watershed. Based upon the weight of this evidence, it appears that this management measure is not applicable to the SR-Tiffin Watershed.

Water withdrawals from streams for use in private ponds were noted by EPA field staff as a concern. Withdrawals during low water events, especially the dry summer months when pond levels are low, were the most common concern, as this practice lowers stream levels even further. Education targeted to streamside landowners regarding the negative impacts this practice may have on their ponds will be important for helping to curtail this activity by rural residential landowners.

New Development Management Measure (Urban). Urban land use represents between two to four percent (2%-4%) of the SR-Tiffin Watershed, as noted in Table 3.2 above. The population in Seneca County has been declining since 1980, Sandusky County meanwhile has been holding relatively steady over the past 30 years. For the majority of the watershed, urban land use is not a concern. Within the City of Tiffin, urban uses are impacting water quality. Figure A shows current land use in and around the City of Tiffin. According to Ohio EPA, Tiffin is currently an Appendix 7 community, and will receive Phase II designation in 2006. Phase II designation exempts an area from the CMM, as activities become required rather than voluntary. The SRWC plans to become involved in Tiffin's efforts to meet Phase II requirements, as outlined in Table 6.13.

Figure A. Land Use – City of Tiffin and Surround Areas within SR-Tiffin Watershed



Watershed Protection Management Measure (Urban). See *New Development Management Measure.*

Site Development. See *New Development Management Measure.*

Existing Development Management. See *New Development Management Measure.*

New On-Site Disposal Systems. New county health department household sewage treatment system plans include guidance to meet the requirements of this management measure. This management measure also finds support in Sub. H.B. 231 (125th G.A.) discussed above in Chapter 2. Readers are encouraged to visit the Coalition's website and navigate to the Wastewater Committee's webpage to learn more including information about the home sewage treatment replacement program available here: http://www.sanduskyriver.org/watershed/index.php?page=Committees/Waste+Water/Home+Sewage+Treatment+Systems/

Copies of household sewage treatment system plans are available from your local county health department, and are kept on file by the Coalition in its offices. Contact information for local health departments can be found on the "Links" page of the Coalition's website. Updates on state rules and Sub. H.B. 231 can be found on the Ohio Department of Health's website www.odh.ohio.gov.

Operating On-Site Disposal Systems. Regular inspection and maintenance of home sewage treatment systems is critical to proper operation and treatment of sewage. To comply with the Coastal Management Measures, it will be necessary for a professional to inspect each system in the watershed on a regular schedule. Current funding levels do not allow for such a process to take place. To remedy this situation, additional funding would be required from federal, state, and/or local sources or through the payment of annual maintenance fees by the homeowners. One of two potential strategies could be employed with these funds. The first is a regular, fixed interval schedule of inspections, which could be completed on a 5-10 year basis. A second method is for inspections to occur at the time of sale for homes with sewage treatment systems. During the interim, it is the goal of the Coalition to continue to educate homeowners on the maintenance of their systems as the only feasible method for addressing this issue.

An estimated cost for a fixed-interval maintenance program with annual inspections is $100 per system per year. Less frequent inspections of systems would allow for a reduced fee. In addition, there is the potential to increase annual fees through a conglomeration of homeowners. These increased fees would be used to cover anything from basic maintenance to full replacement of failing systems, depending on the need. Spreading these payments out though an annual payment scheme would reduce the burden on a homeowner who is often unprepared to handle the cost of replacing a failing system.

In addition, the Coalition is working with local health departments to explore the potential use of GIS technology for tracking onsite systems. The goal of the project would be to create a GIS layer for each watershed county, which would include all relevant information regarding HSTS systems. This layer would be based on the county auditor's parcel layer. Using this layer, the health departments can quickly locate and target areas in need of HSTS replacements.

Operation and Maintenance of Home Sewage Treatment Systems – A Sample Plan

There are a variety of potential methods for implementing an operation and maintenance program for rural home sewage treatment systems, as indicated in the body of this text. Below is a detailed example of how one such method could be implemented, if funded. This is not to suggest the below as either the best nor as the only method of implementation. The final decision on implementation is a matter that must be resolved by the Ohio Department of Health in cooperation with county health departments and any potential funding or legislative sources.

A basic service would include annual inspections and as-needed pumping of treatment systems. To implement such a system, and annual fee of $100 per homeowner would be assessed by the agency responsible for the maintenance; in this scenario a private contractor, whom is registered with the county health department, will assume this role.

The contractor will be responsible for conducting a general inspection of the system in compliance with any ODH or county health department regulations that may be in place. The contractor would maintain documentation of this inspection for 5 years. As well, when the system is in need of pumping (approximately every 3-5 years), the

contractor will be responsible for contacting the appropriate entity as well as scheduling and paying for the pumping. The annual fee paid to the contractor by the homeowner would cover this payment. In the case where a system is determined failing, or in need of repair or replacement, the contractor would notify both the homeowner and the county health department. Follow-up on the repair or replacement would still be under the authority of the county health department.

Planning, Siting, and Developing Roads and Highways (Local Ohio).
Bridges (Local Ohio).
Operation and Maintenance of Roads, Highways, and Bridges
Runoff Systems for Roads, Highways, and Bridges.

Management measures, as relating to *Runoff Systems for Roads, Highways, and Bridges; Operation and Maintenance of Roads, Highways, and Bridges; Bridges (local only);* and *Planning, Siting, and Developing Roads and Highways (local only),* all require the participation and cooperation of local county engineers. To facilitate this process, the Sandusky River Watershed Coalition submitted a letter to each of the county engineers within the Honey Creek Watershed in August of 2005, requesting their participation with this process. Follow-up phone calls were made, but without success in reaching the engineers. After consultation with ODNR Coastal Management staff, a second letter and a detailed survey were submitted to the county engineers in December 2005. This second letter and the follow-up phone calls were met with mixed results. The Seneca County Engineer has refused to participate in the process, and has submitted documentation to this effect to the Coalition. Based on this experience, the Coalition has determined a course of action for addressing this management measure across the entire Sandusky River Watershed, including the SR-Tiffin.

At this time, a strategy has been developed for a multi-phased effort to produce the necessary results within these counties. It is the opinion of the Coalition that additional, outside assistance from the Ohio Department of Transportation and the ODNR Division of Soil and Water Conservation will be a necessary part of this process. The current stance of the county engineers is symptomatic of a larger issue, which is the need for continued investment in the watershed planning process, including education and public outreach.

Step 1: An educational program must be put in place to educate county engineers on the importance of watershed planning, and their participation in the process. This would include education on the goals and impacts of watershed plans, the role of the Coastal Management Measures, and participation by ODOT representatives. One part of this process is currently underway. In June 2006, the NCWQR will host a Sandusky River Symposium, to discuss all issues relating to the management of the Sandusky River Watershed. Local officials, including County Commissioners and County Engineers, will be invited to this event. To help facilitate the involvement of county engineers from across the Lake Erie Watershed, it is critical that their peers, namely ODOT officials, become involved in this education process. Work with the County Engineers Association within Ohio would be one method for developing a dialogue among Lake Erie Watershed counties regarding the Coastal Management Measures and watershed planning. The goal of this step is to develop an understanding of

watershed planning and the importance of participation within the ranks of county engineers. This step is critical both to the development of detailed plans for addressing water quality and to the implementation of water quality objectives in the years to come.

Step 2: An inventory of current practices would need to be completed across the watershed. This process has been begun, but a lack of willingness to participate has made completion impossible at this time. Once engineers are educated regarding the advantages of and the need for participation, further action can be taken to develop an inventory. From this inventory, a list of new policies and procedures can be developed that, if implemented, would address all coastal management measures. Ideally the county engineers would each adapt a series of policies similar to those developed by ODOT.

Step 3: Implementation of the new policies would begin immediately upon their adoption. Those actions that could be taken immediately to improve management would be adopted first. Issues regarding the design and maintenance of roadways and bridges could not all be implemented at once due to the costs involved. Rather, a strategy would be developed in each county to address issues as maintenance and replacement of various roadways and bridges occurred. A 15 to 20 year implementation plan would likely be the best place to start this process. Regular review and revision of this plan would be necessary based on the amount of progress that is made towards determined objectives.

A budget for this process is expected as follows:

Step 1: Education

- Education of County Engineers through two watershed conferences and a workshop - $15,000
- Education of County Engineers Association of Ohio through a two-day workshop with ODOT and ODNR participation - $3,000

Step 2: Policy Adoption

- Development of new policies and procedures - $30,000
    - Cost includes legal review and staff time for the development of new policies.
- Adoption of new policies -$8,000
    - Cost is for $3,000 in public outreach in each county to gain political and popular support for new policies, as well as to educate the local residents on the benefits of new policies and approaches.

Step 3: Implementation of Policies

- Implementation costs will vary county to county, and will not be available until new policies have been developed and a full inventory has been conducted in each county.

(Note the Coalitions responses to the following three Coastal Nonpoint Pollution Control Management Measures grouped into a single response.)

Channelization and Channel Modification Management Measures.
Physical and Chemical Characteristics of Surface Waters.
Instream and Riparian Habitat.

Currently, the only inventory of channelization that exists in the SR-Tiffin Watershed is one of county ditch maintenance practices. These areas are noted on Map 4. Based on a recent ODNR survey of SWCD's from across the state, it can be safely assumed that county maintenance is only about 50% of the total miles under maintenance. The remaining miles are maintained by private landowners. To comply with the Coastal Management Measures, the Coalition will work with the local Soil and Water Conservation Districts to review the schedule of maintenance for these ditches as a first step. From this schedule, the Coalition will work with the Districts and landowners to explore funding opportunities that would allow the implementation of new technologies aimed at improving the physical and chemical characteristics of these streams. The implementation of these practices is dependent on multiple factors, not least of which is the buy-in of local landowners. Without their support, alternative practices will not be able to move forward.

A more complete inventory of channelization must be completed for the remainder of the SR-Tiffin Watershed (this inventory would include only streams, namely blue line streams as listed on topographic maps, that have been channelized, not drainage ditches that have been created by man). The Coalition would propose to complete this through the use aerial photos and expert analysis of stream channels. ODNR Division of Soil and Water Conservation staff will be an essential resource when developing a complete inventory. The cost for an inventory of SR-Tiffin is estimated at nearly $10,000. Once this information is gathered, the Coalition will work to provide educational materials to landowners about the potential for alternative practices on their properties. Again, the limiting factor for implementation will be first and foremost, the willingness of landowners to participate. The other major limiting factor is funding. To develop a two-stage channel, estimated costs are as high as $50 per lineal foot. To return to a natural channel design, estimates are as high as $100 per lineal foot. The SR-Tiffin Watershed has 155 miles of streams. It is likely that a majority of the miles have been impacted by some form of channelization.

The Coalition is currently participating in the Rural Drainage Advisory Council, organized by the ODNR Division of Soil and Water Conservation. The watershed coordinator along with multiple Steering Committee members who are representing their soil and water conservation districts, are involved with the process. It is important to note that the Coalition is in support of efforts to continue to meet our drainage needs in an environmentally sensitive way, and proper planning and installation of drainage practices by trained professionals is a part of the solution to rural drainage needs. As well, it should be recognized that drainage within rural areas is a concern due to the age and condition of many of the tile mains that so many landowner rely on. Maintaining a functioning drainage network while minimizing environmental impact is critical to keeping landowners on board with various Coalition projects, while still addressing water quality issues within the watershed.

Dams. There are three dams of consequence in the watershed. One dam is located in the SR-Tiffin watershed assessment unit, the other two are located on the main stem of the Sandusky River, and are discussed here for simplicity's sake. The dam located within the assessment unit is the Republic WWT Lagoon Dam. This dam is next to a tributary to Morrison Creek. The stream is MWH and is in partial attainment

in this segment. The dam does not have a direct impact on stream quality at this point. The releases from the WWT lagoon are the biggest concern at this location. These releases are regularly monitored and regulated under NPDES permit regulations. Maintaining the structural integrity of the dam will be important for water quality. A breech of the dam provides the largest potential for water quality impacts and is addressed in the Village of Republic's Waste Water Treatment Emergency Action Plan written by Poggemeyer Design Group and is on file in the Village of Republic Administrator's Office.

The second dam, the Ella Street Dam, is used as part of the water supply for the City of Tiffin. The city relies mainly on groundwater, but also uses water from the Sandusky River for its drinking source. The dam, like most dams, does have a negative impact on water quality at that site. There is no room on either side of the dam for management measures to be implemented as is apparent from the photo below, Figure B. Ohio American Water Company owns this dam. Bacon's Dam, the third dam, is privately owned (Figure C).

Figure B. Ella Street Dam, City of Tiffin, Aerial Photo 2002

Ella Street Dam is located on the southern edge of Tiffin. The original purpose of the dam was for milling. In the late 1800's, the dam was purchased and utilized for the local water works and as flood control for the Mechanicsburg area, just downstream which is the current site of the Tiffin Middle School. To this day the dam provides water to the Mill Race leading into the Ohio-American Water Company Treatment Plant that supplies the water for the City of Tiffin.

Figure C. Bacon's Dam, City of Tiffin, Aerial Photo 2002

Bacon's Dam is located on the northern edge. The dam was originally used for milling purposes, but is no longer functional as such. The area upstream of the dam includes businesses and homes. The area downstream begins approximately two miles of flat, regularly low water levels with a bedrock substrate.

Water quality downstream of each dam is meeting all criteria. The Coalition will offer its assistance to the owners of each dam. When the dams are due for regularly scheduled maintenance the Coalition will work to implement new management practices that can improve upstream and downstream water quality even more. While the Sandusky River is meeting all use designations, additional improvements would always be welcomed.

Eroding Streambanks and Shorelines. Similar to the "Instream and Riparian Habitat Restoration Management Measure" discussed above, the Coalition does not currently possess adequate data or information to quantify the extent of eroding streambanks. There are no shorelines within the watershed. Funding will be pursued to inventory streambank condition and other physical attributes of the stream network as pointed out in Chapter 3. In the meantime, strategies outlined in Table 6.11 Management Measure 7.6.1 and in Table 6.13 Section 2 Streamside BMP's will be implemented, some of which will help to stabilize eroding streambanks.

Channelization and Channel Modification – A Sample Plan

There are a variety of potential methods for implementing a channelization and channel modification retrofitting program for streams in the watershed, as indicated in the body of this text. Below is a detailed example of how one such method could be

implemented, if funded. This is not to suggest the below as either the best nor as the only method of implementation. The final decision on implementation is a matter that must be resolved by the Sandusky River Watershed Coalition, the county Soil and Water Conservation Districts, the State of Ohio Division of Soil and Water Conservation, the Ohio Environmental Protection Agency, and most importantly, but individual landowners. As a voluntary action, the buy-in of landowners is the most important part of the collaboration that is required to address this issue.

The following text outlines two strategies. The first is for the completion of an inventory of channelization in the watershed. The second is a strategy for implementing a demonstration project that would show both a two-stage ditch as well as natural channel design. These examples are broad estimates, as specific costs will depend upon many variables that cannot be calculated at this time. A variability of as much as 30% in the final cost is not impossible.

Development of an Inventory of Channelized Streams

Activity	Cost
Review of aerial photos (intern staff 300 hrs @ $10). - Gather photos – 2 weeks (60hrs) - Organize photos – 1 week (30 hrs) - Initial review – 2 week (60 hrs) - Field truth – 1 week (30 hrs) - Full review of photos – 3 weeks (90 hrs)	$3,000
Review of topographic maps & other sources of data (intern staff 100 hrs @ $10) - Gather topographic maps – 10 hrs - Research other potential records – 20 hrs - Initial review of data – 20 hrs - Truth versus aerial photos – 30 hrs - Additional review – 20 hrs	$1,000
Supervisory Staff (100 hrs @ $22). - Train intern – 20 hrs - Assist with initial review – 20 hrs - Field truth – 30 hrs - Assist with full review – 10 hrs - Develop GIS layer – 20 hrs	$2,200
Supervisor Benefits (29%)	$650
Travel Costs (500 miles at $.485)	$250
Copy, phone, computer, and related office costs	$1,000
Final map development and printing costs	$900

Fiscal Administration Costs (10%)	$1,000
Total Cost	$10,000

Demonstration Project – Two Stage Ditch and Natural Channel

Site Development Costs (two stage ditch, 3,000 feet @ $50/foot) $150,000
- Engineering, planning, and construction.

Site Development Costs (natural channel, 3,000 feet @ $100/foot) $300,000
- Engineering, planning, and construction.

Project Director (600 hrs @ $22 (200hrs per year or 10% time)) $17,028
- Project management
- Communications
- Reporting
- Management of contractors and partners
- Fringes @ 29%

Property Costs (82 acres (300' buffers) @ $5,000/acre) $410,000
- Easement - $3,500 per acre
- Legal fees - $1,000 per acre
- Surveyor fees - $500 per acre

Public Outreach (Field Days) (6 days, 2 per year @ $500 ea.) $3,000

Monitoring Program (Based on USGS stream gauge figures) $60,000
- For 2 years of monitoring.

Travel Costs (2,000 miles at $.485)	$970
Office Costs (phone, computer, copies, postage, etc.)	$3,000
Fiscal Administration Costs (10%)	$94,400
Total Project Cost (3 year program)	$1,038,398

Outline of Cost Estimates for Large-Scale Implementation

The following scenario is taken from the Honey Creek WAP for illustrative purposes only. Honey Creek drains 179 square miles, or 156% of the SR-Tiffin's watershed. Simple math can assist with the re-projection of these numbers to any watershed with similar issues. Exact lengths of stream in need of repair vary from watershed to

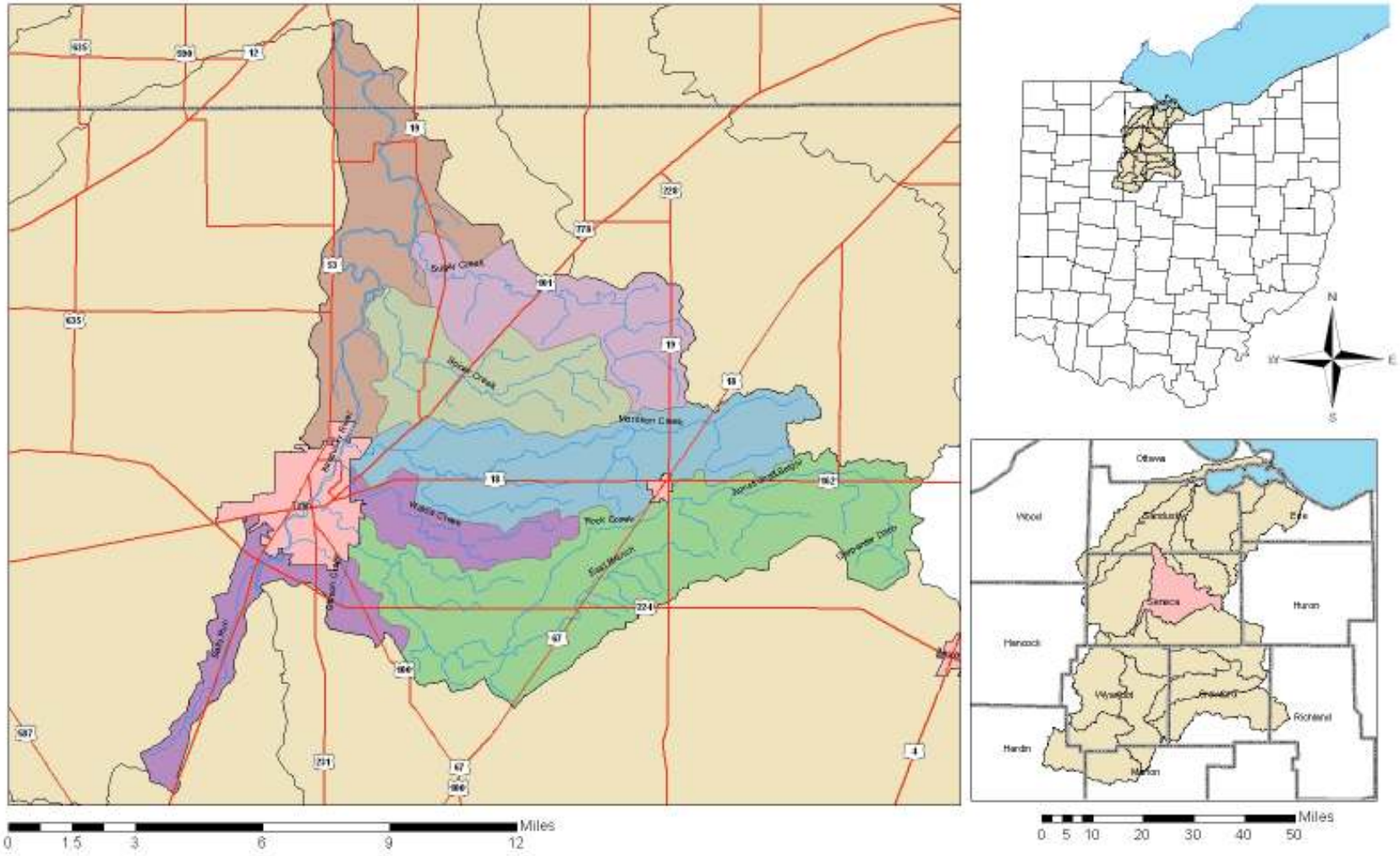
watershed. The benefit gained from reproducing this scenario for each watershed is now worth the cost of the labor to do so. This example shall serve as an example and methodology by which this same information can be calculated for any watershed.

To restore even 20% of the total stream miles to a natural design, a fraction of what is likely needed, at $75 per lineal foot, the project would cost $19,166,400. It is also likely that easements would need to be purchased along these streams to permanently protect the newly designed channels. Permanent easements are unpopular in the watershed, but could be purchased if sufficient funds are made available. Based on local land values and discussions with landowners, these easements, in floodplain areas, could run in excess of $3,000-$5,000 per acre. This combination of expenses should provide a scenario conducive to natural channel design and the permanent protection of riparian areas in Honey Creek. Providing a minimal 100' wide buffer on 20% of the channel in Honey Creek would require the purchase of 5,754 acres into easements. At $3,000 an acre, this brings the total project cost to at least $36,428,400.

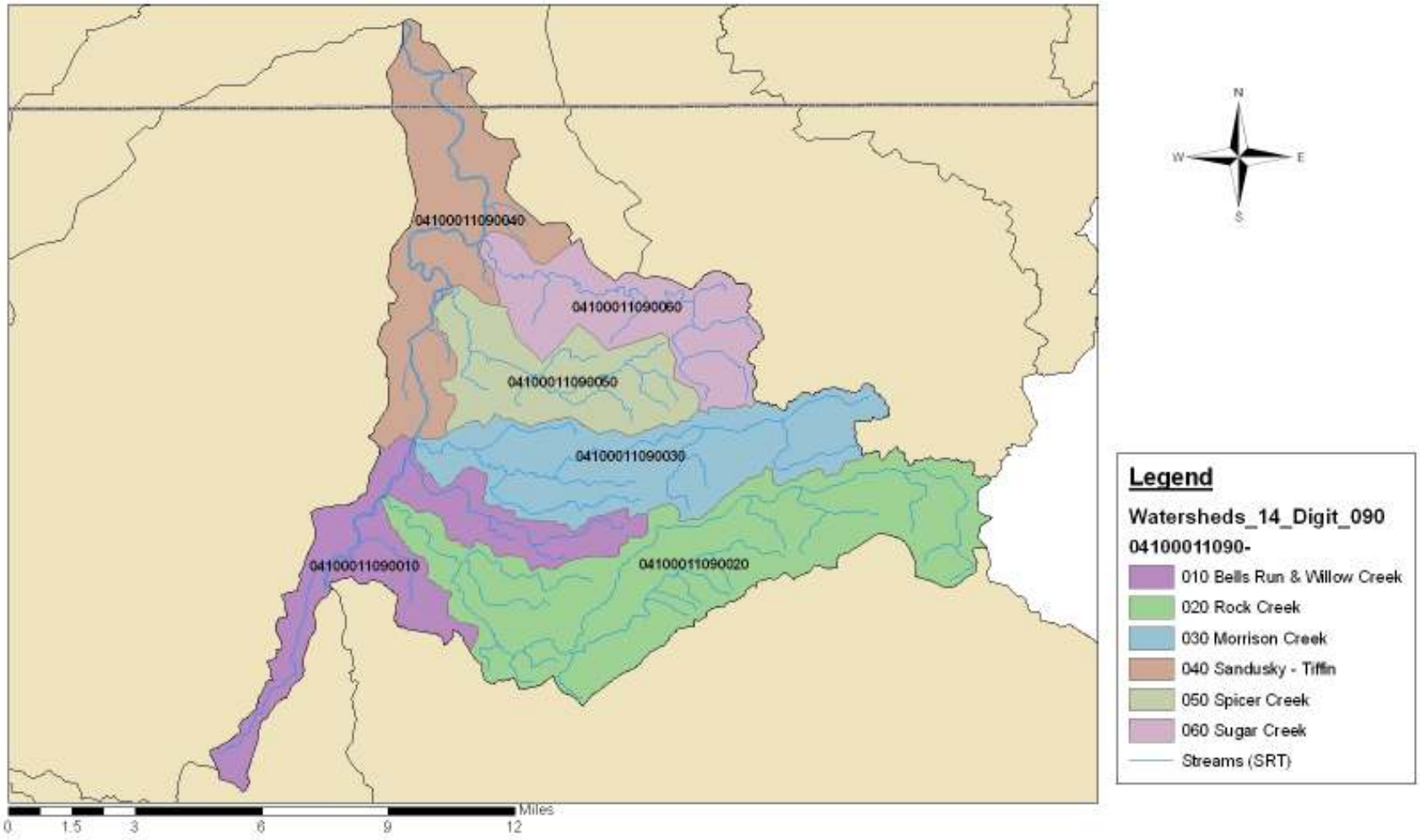
Realistically, active restoration is not an affordable option for many landowners. This is especially true when considering that many landowners have been paying to maintain straight channels for many years. Thus our likely best approach is to provide setbacks from stream channels, and to allow nature to do the majority of the work. Small projects could be completed to help direct the recovery process of streams. These could be completed for perhaps $10-$50 per lineal foot, depending on the amount of work to be completed). However, it is important to note that setbacks from streams are socially and politically difficult to promote in the watershed. It is likely that per acre payments would be required to provide for the setbacks. A large investment has been made in drainage in the watershed. This investment has opened up immense tracts of land to agriculture use and residential development. Natural channel design and/or setbacks would be perceived as contrary to the actions taken for several generations in the watershed, and would be difficult to promote successfully.

One additional issue to consider is that of the use of levees in the watershed. Levees have been constructed along the main stem of Honey Creek in eastern Seneca County. These levees have served to open up land to agriculture and development for more than a generation. The lands which are in residential development are likely permanently lost. Those lands in agriculture could be regained as floodplains. To do so would require the destruction of the current levees, and the construction of new levees further from the stream. The new levees would be necessary to protect additional acres of farm ground and infrastructure during the highest of peak flows. The land that is used for floodplains would have to be purchased from the landowners. If this land is for sale, then current market value could be paid. Otherwise, it is likely the landowner sees a value in the land, such as a yearly income from crops, and that loss of income should be considered in any payments made for these lands. Partnerships with the Black Swamp Conservancy and other such organizations may provide opportunities for some lands to be entered into permanent easements, but for many local landowners, the tax incentives alone are not enough compensation for these grounds.

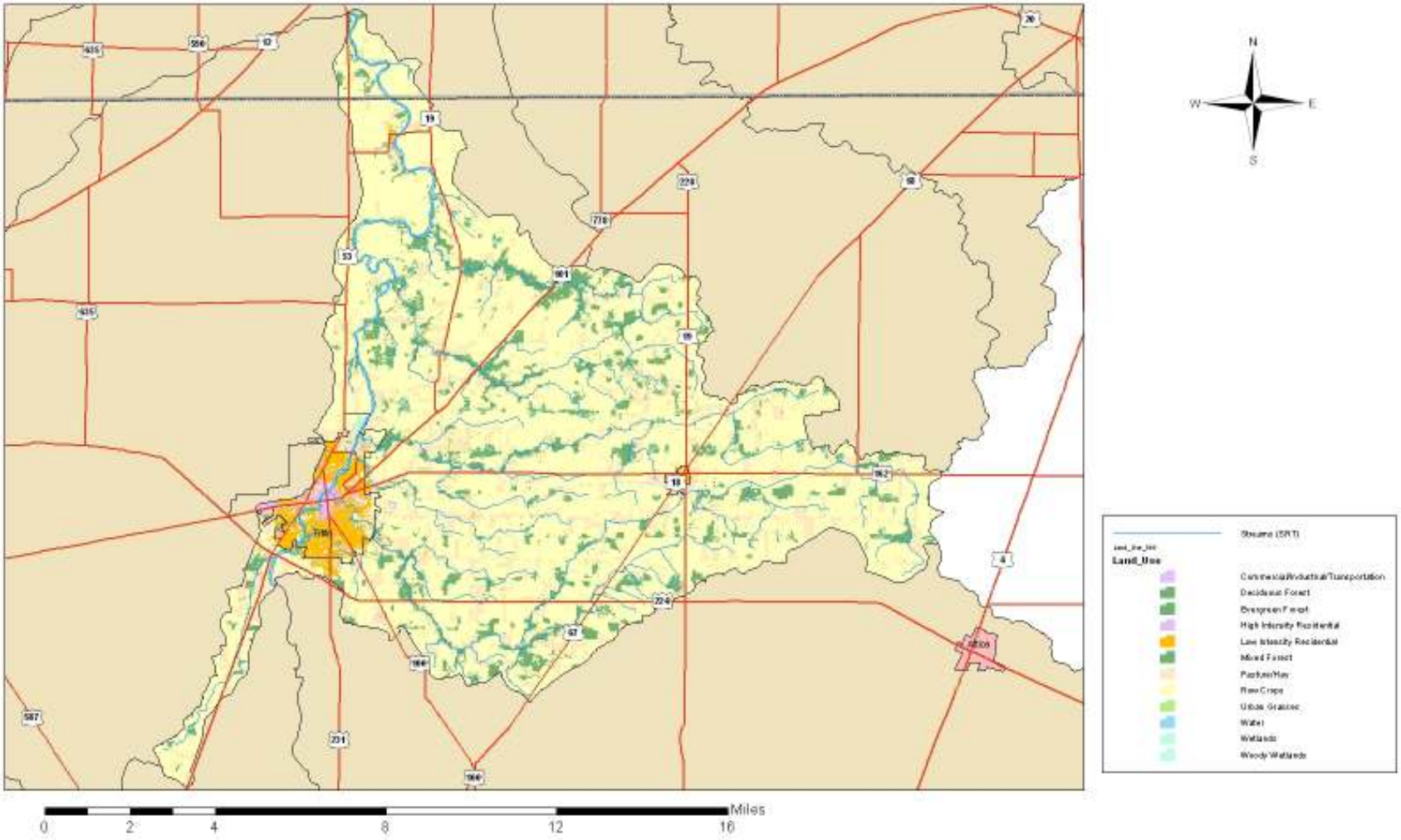
1. Location of Sandusky River - Tiffin Watershed



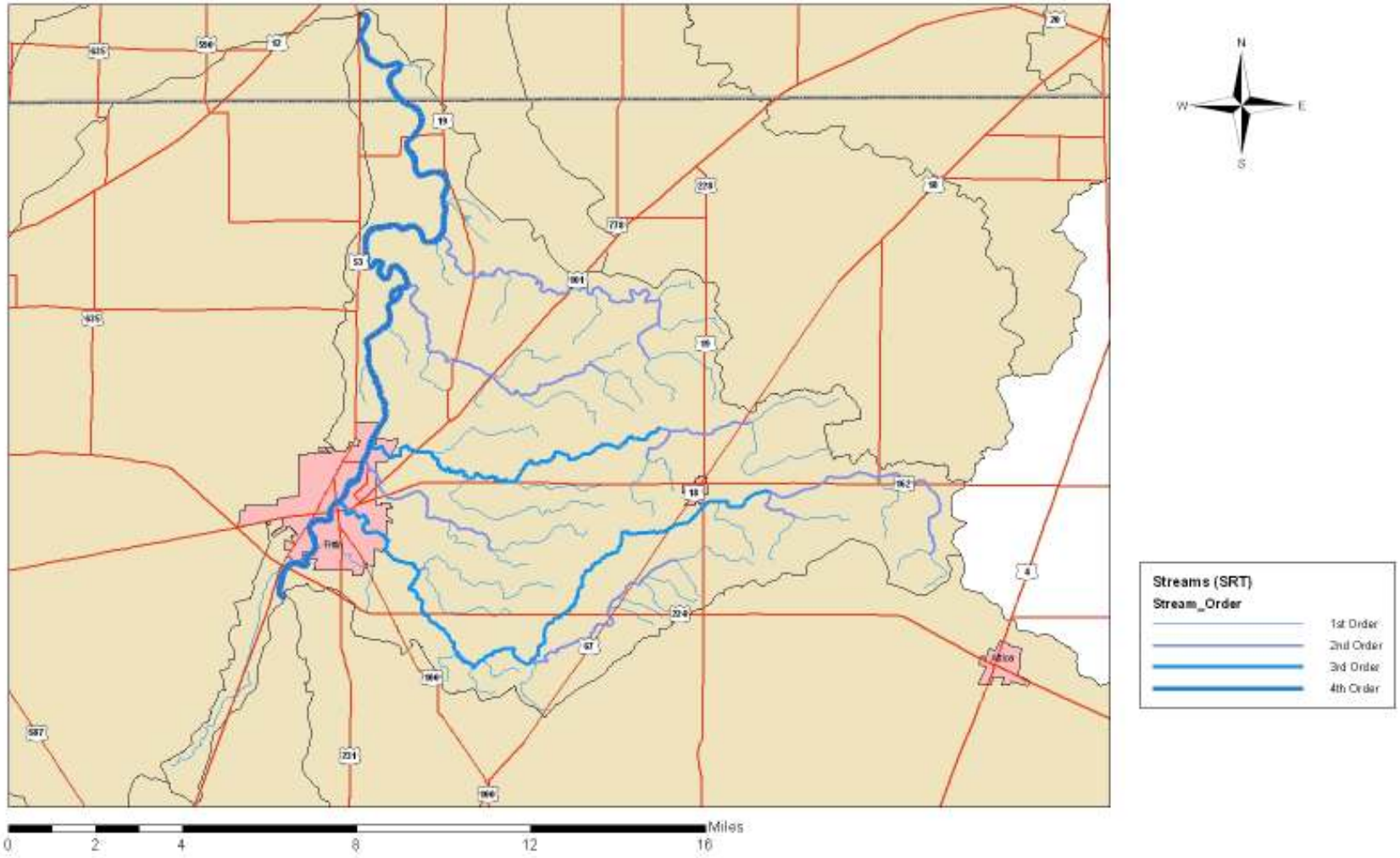
1-A. 14-Digit HUC Watersheds in the Sandusky River - Tiffin



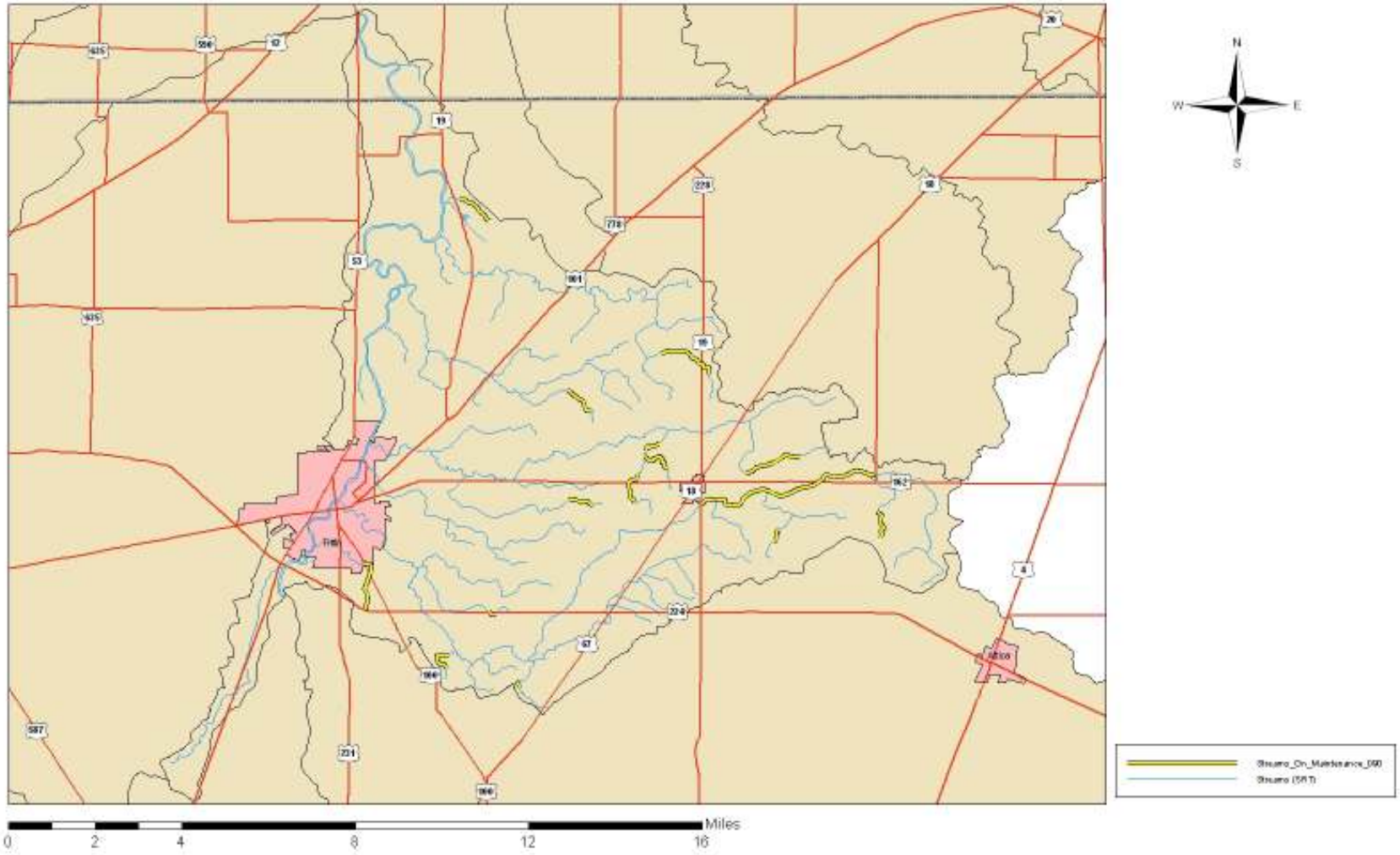
2. Land Use / Land Cover



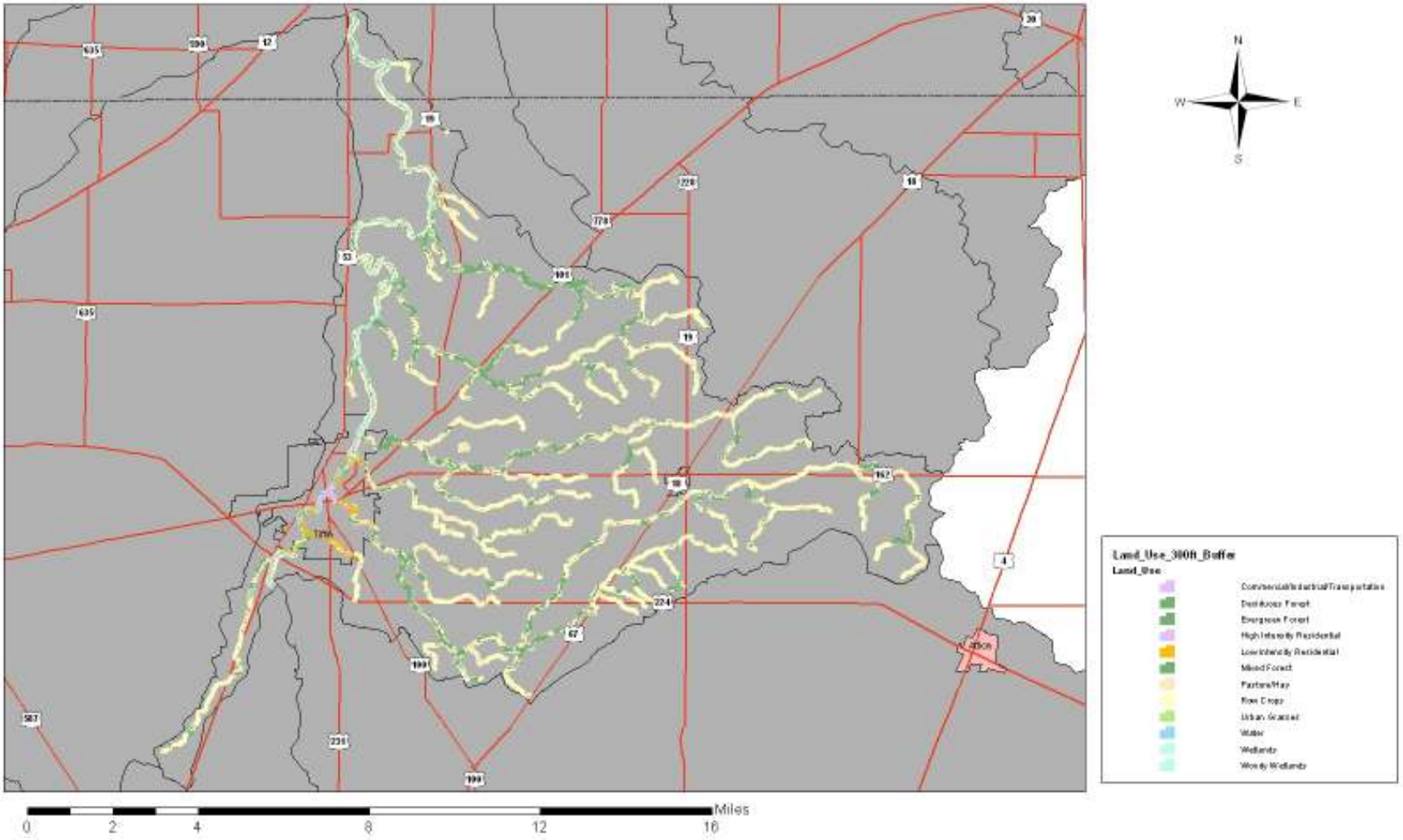
3. Stream Order



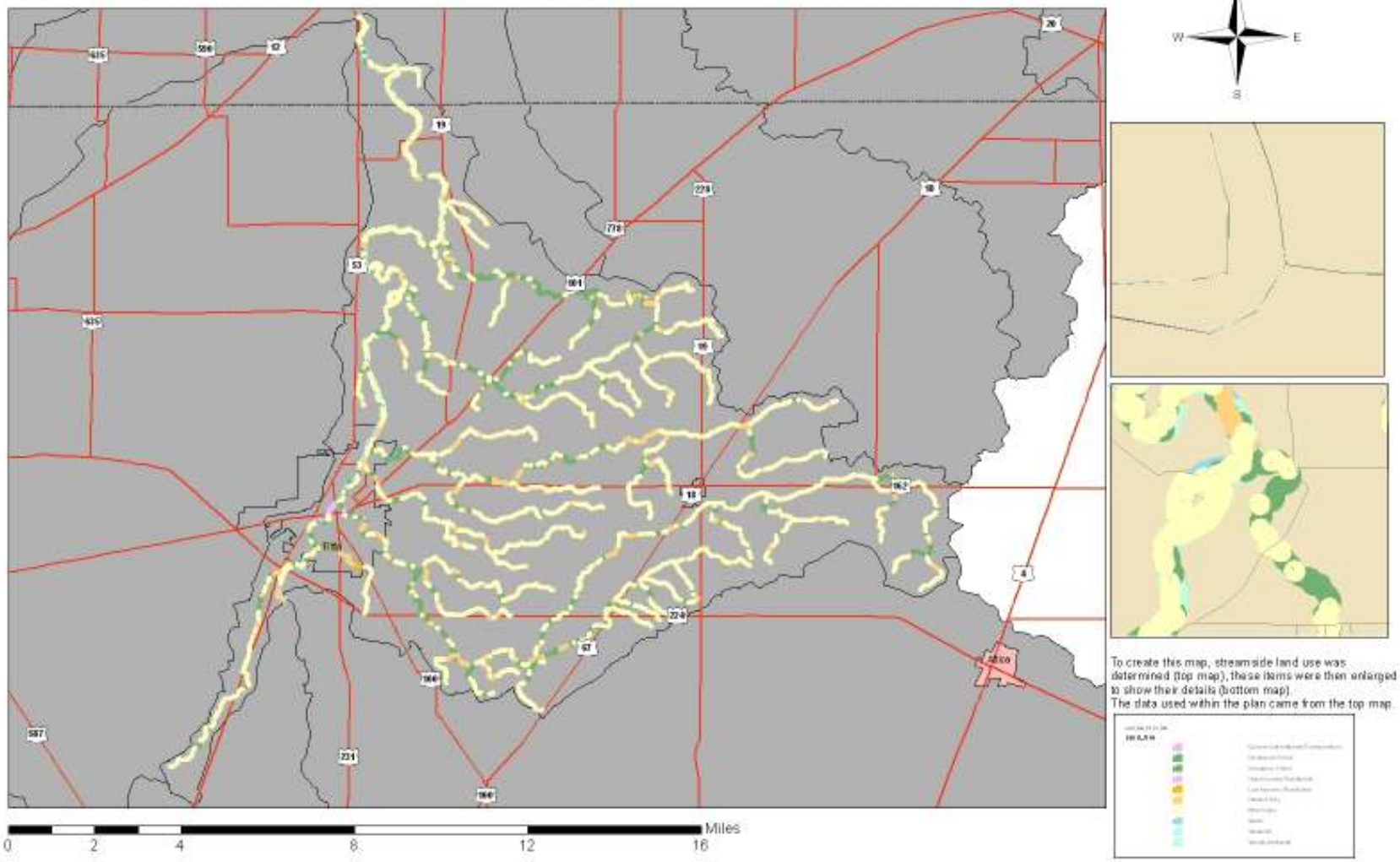
4. Watercourses on County Maintainance



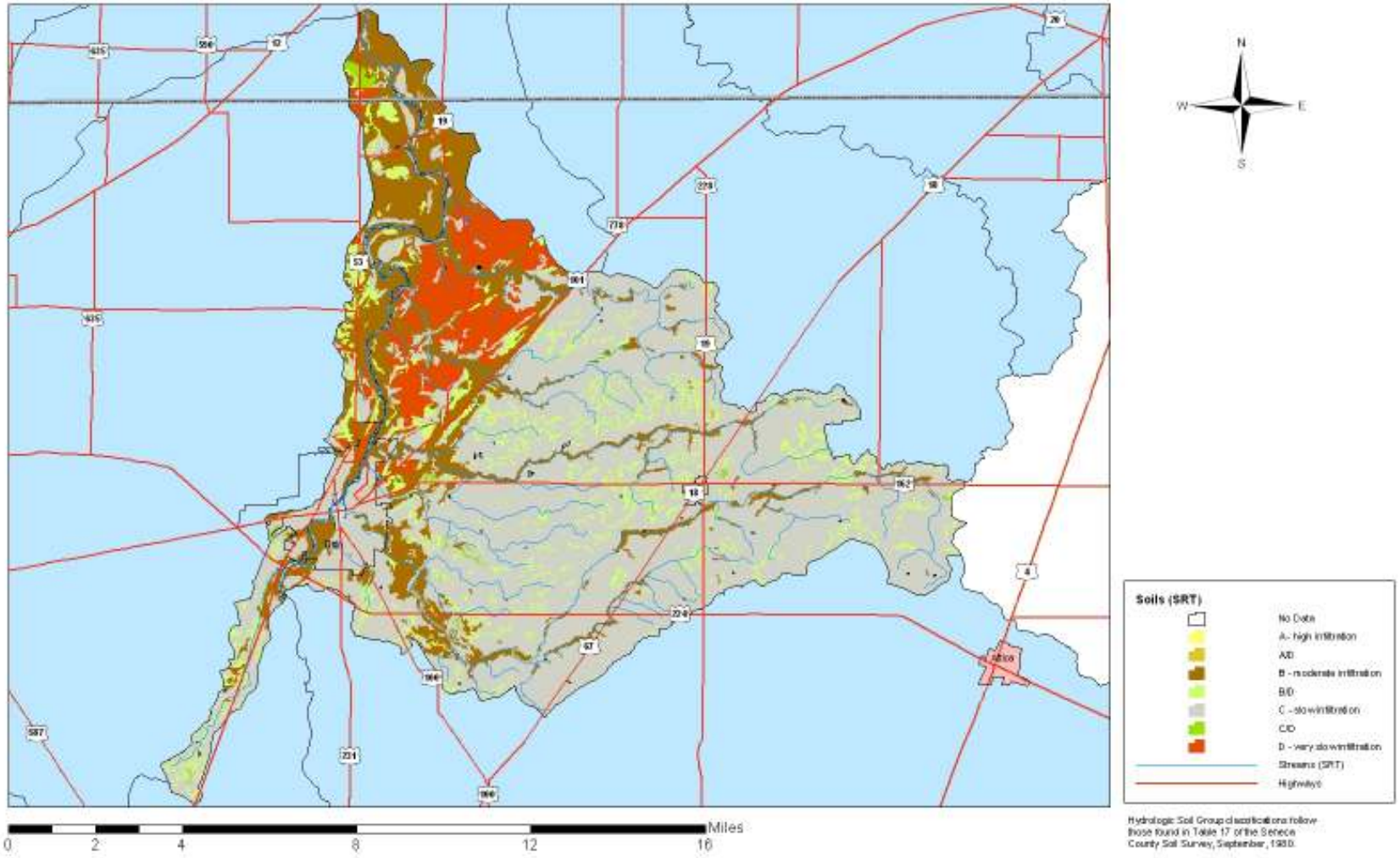
5. Land Use/Land Cover - Within 300' of Streams



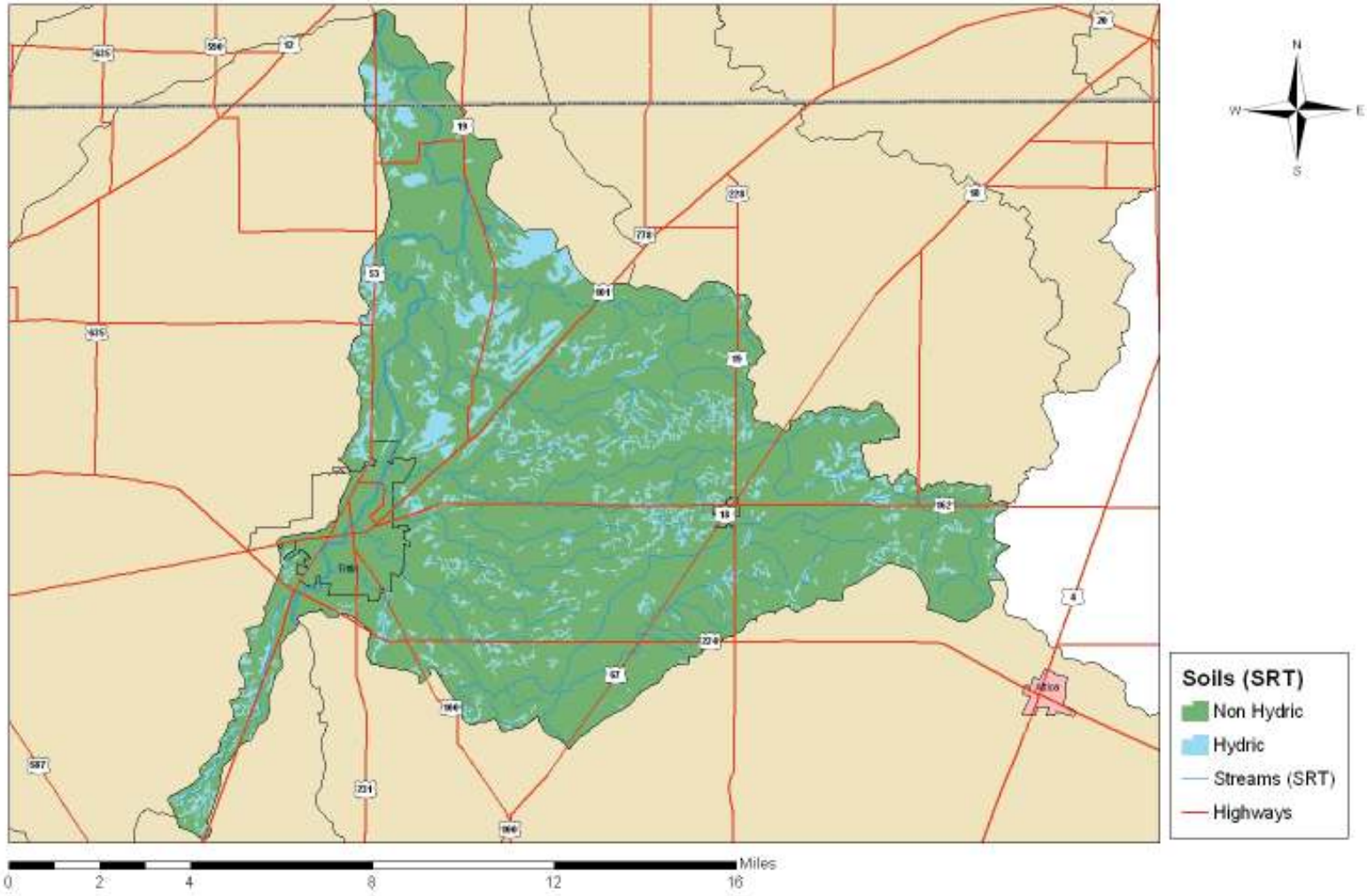
6. Land Use/Land Cover - Streamside



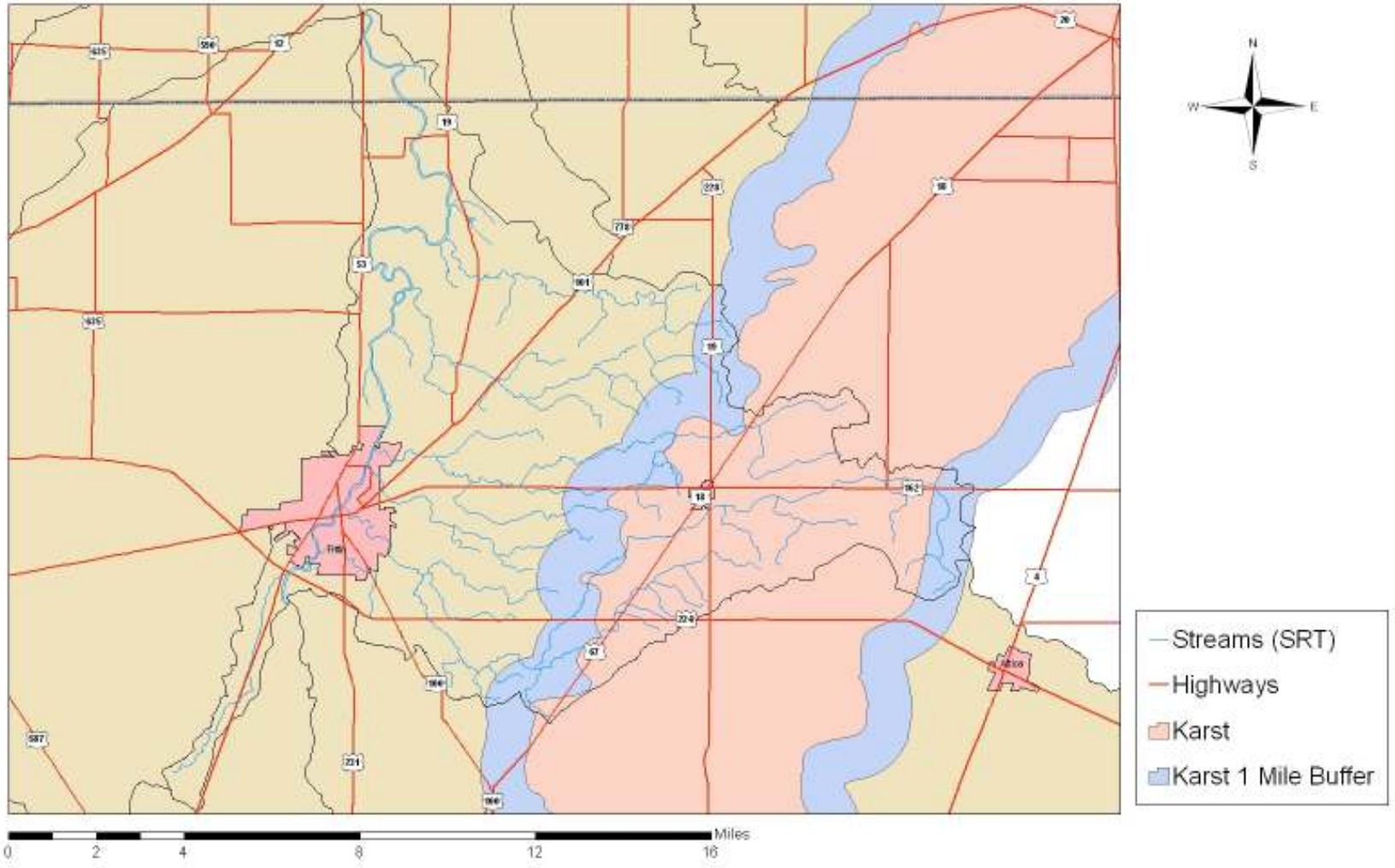
7. Hydrologic Soil Groups



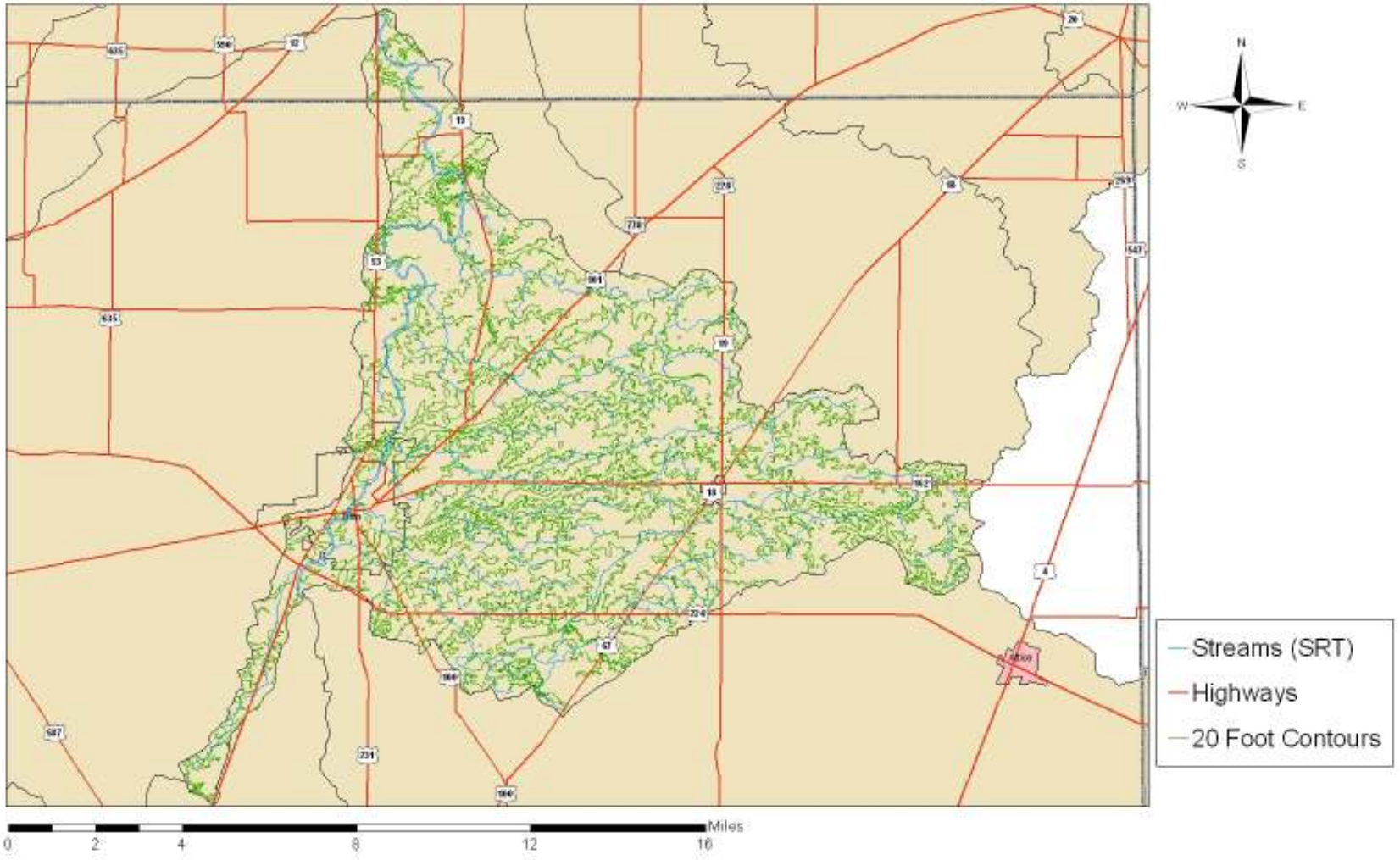
8. Hydric Soils



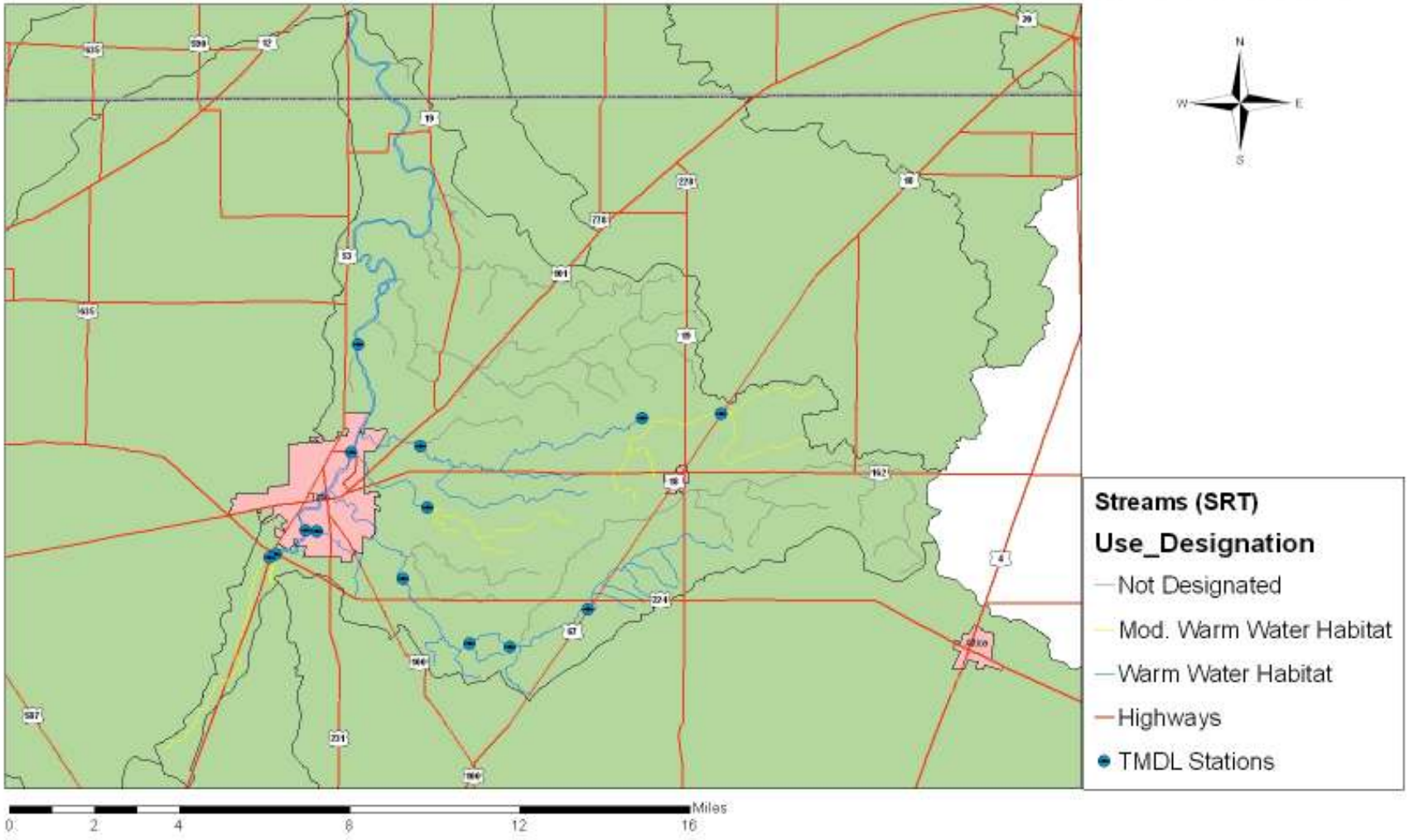
9. Karst Area


N
W
E
S
Streams (SRT)
Highways
Karst
Karst 1 Mile Buffer
Miles
0
2
4
8
12
16

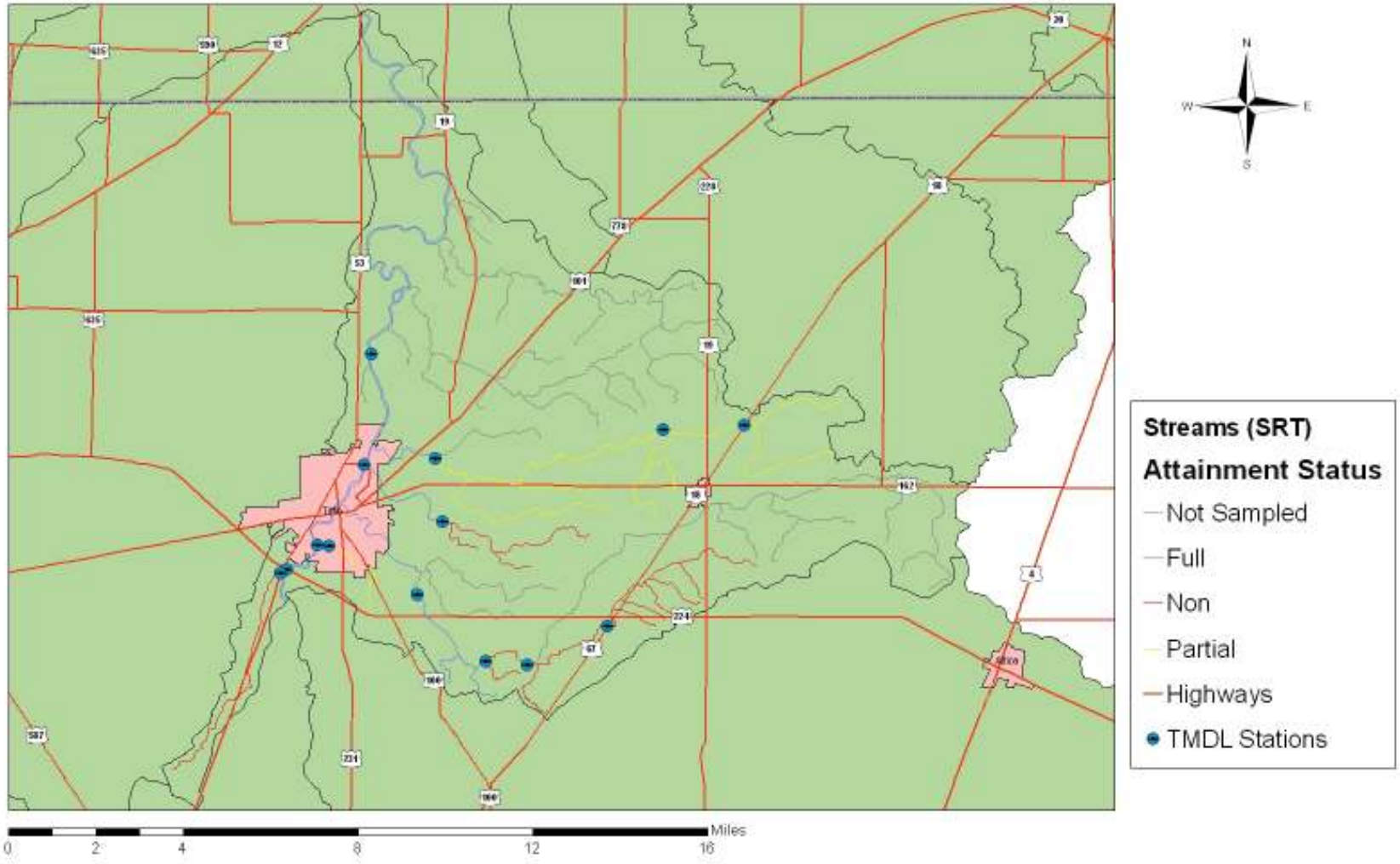
10. Twenty Foot Contour Lines



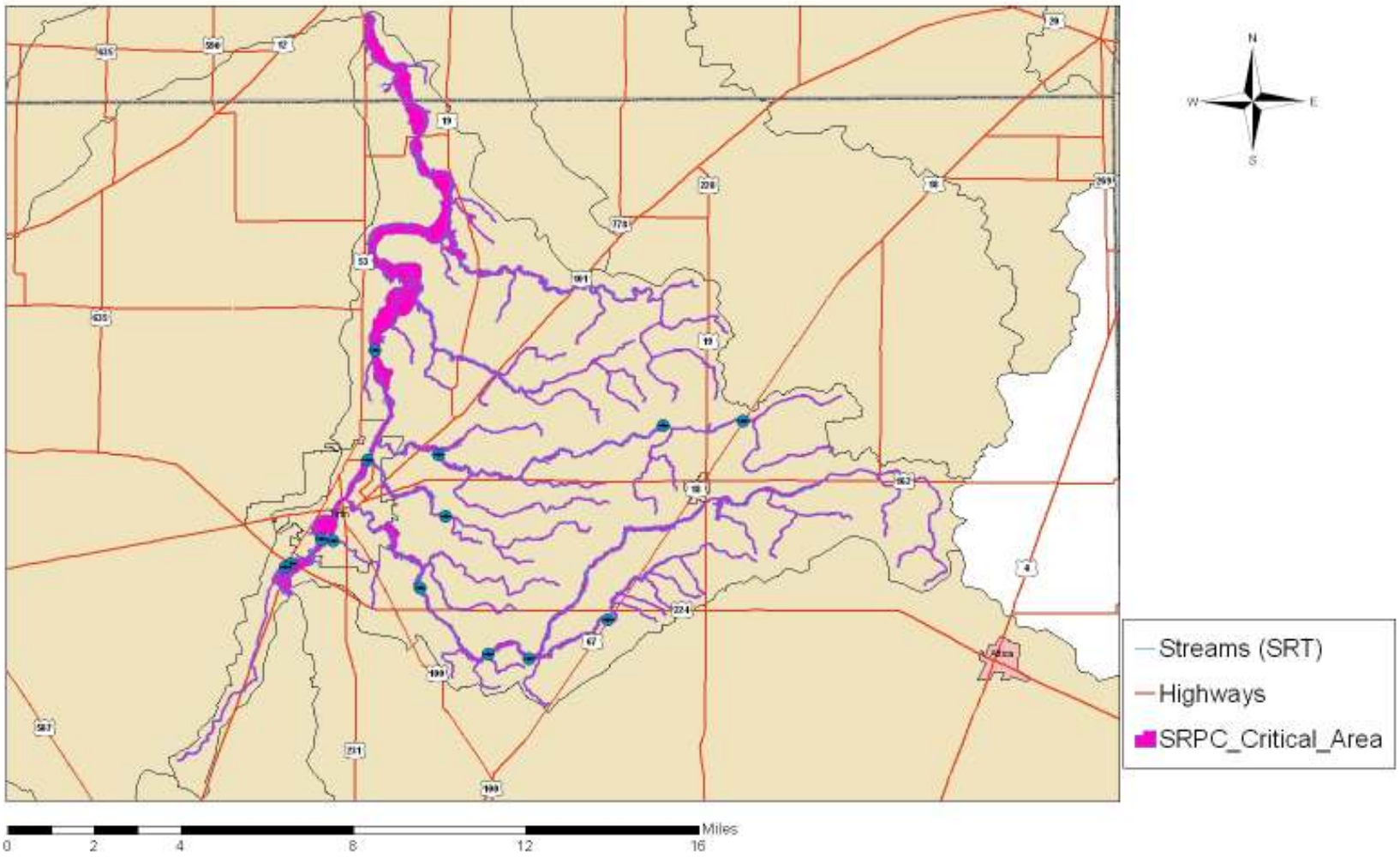
11. Stream Use Designations and Sampling Stations



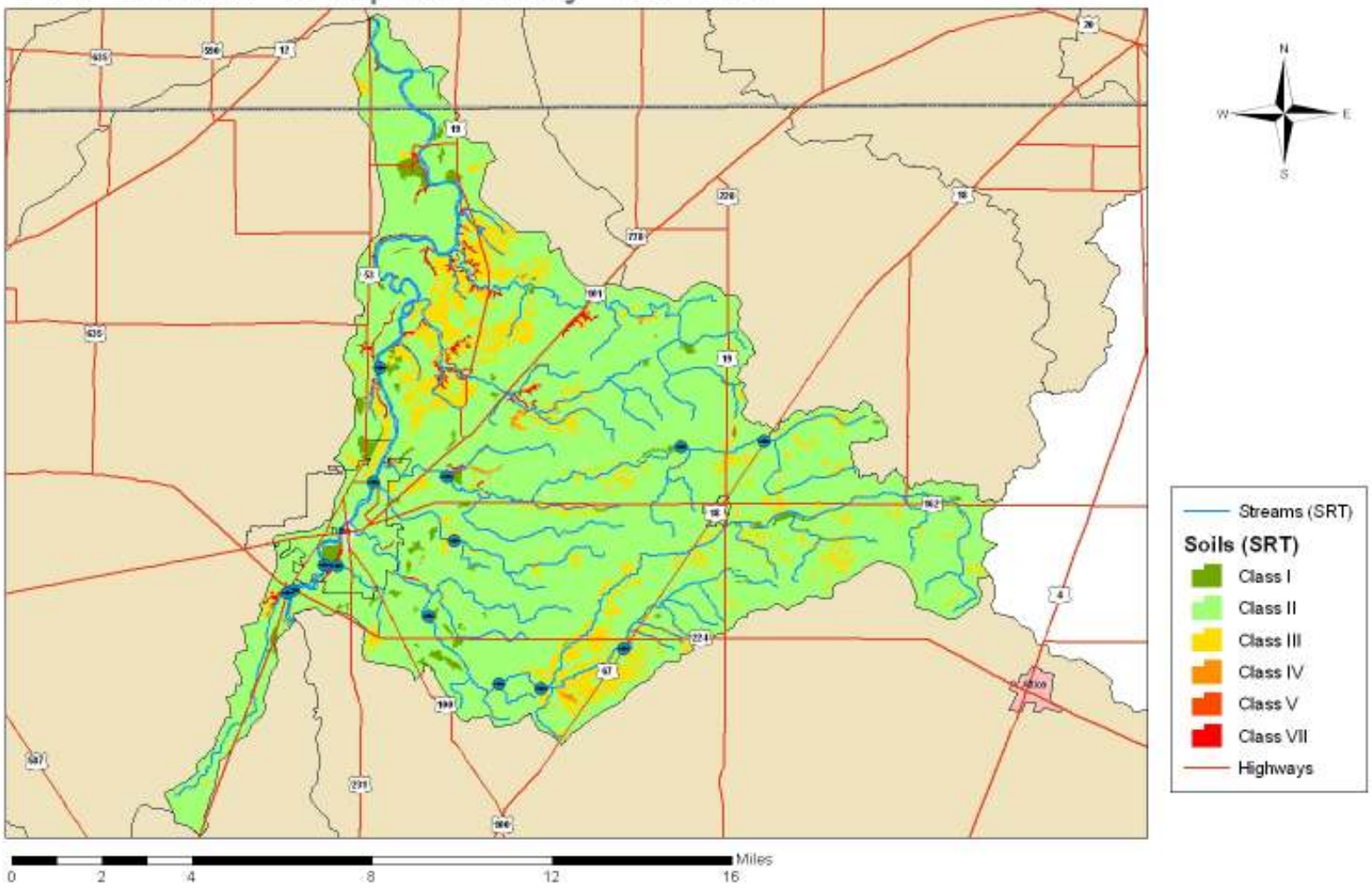
12. Use Attainment and Sampling Station Locations



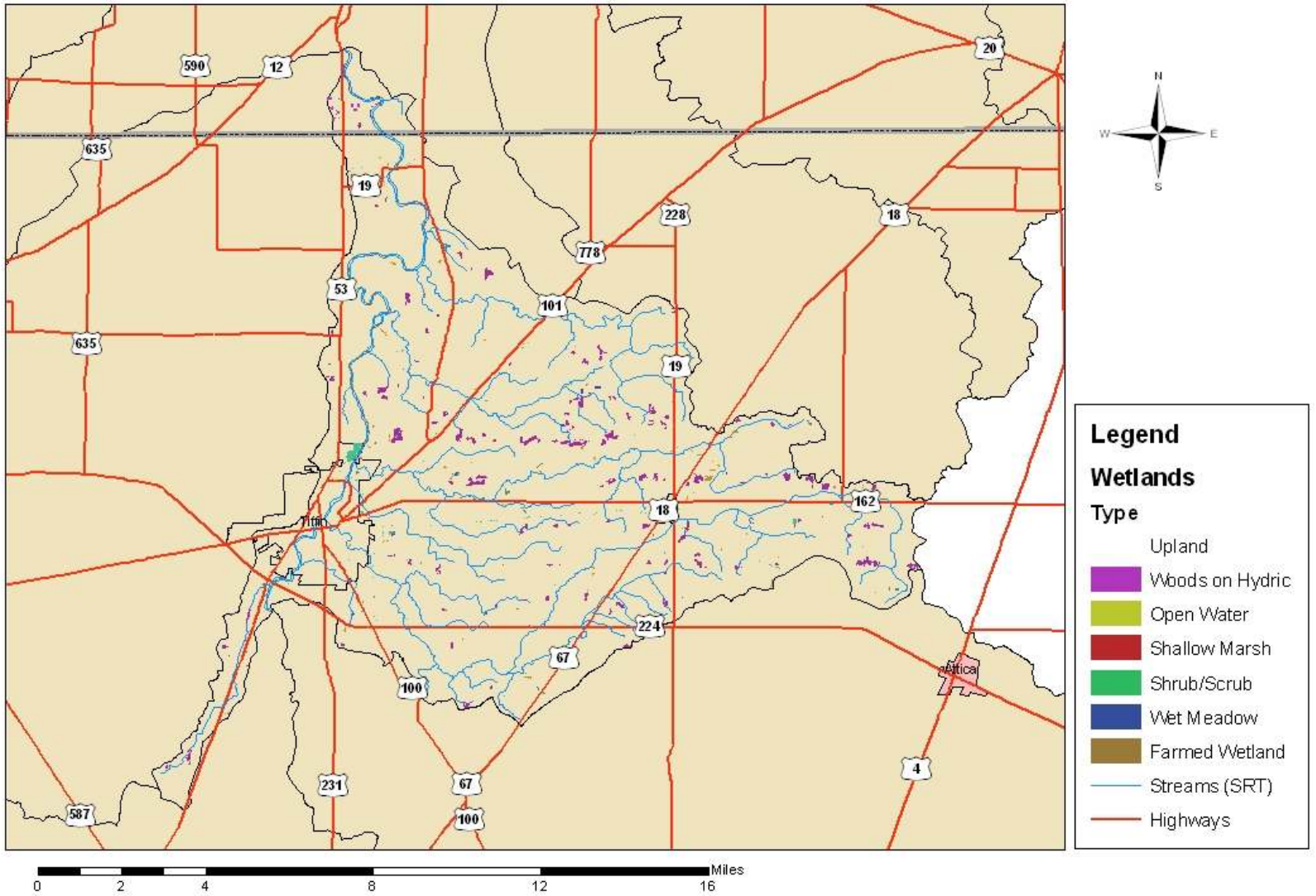
13. Seneca Regional Planning Commission Critical Areas



14. Land Capability Class



15. Wetlands - Ohio Wetlands Inventory



Highly Erodible Land