DRAFT
7/31/08

RAPID WATERSHED ASSESSMENT - DATA PROFILE
SANDUSKY WATERSHED

Rapid watershed assessments provide initial estimates of where conservation investments will best address the concerns of landowners, conservation districts, and other community organizations and stakeholders. These assessments help landowners and local leaders set priorities and determine the best actions to achieve their goals.

This assessment for the Sandusky Watershed was completed by NRCS with input from our conservation partners and other local entities.

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Introduction

The Sandusky hydrologic unit (subbasin) is made up of the Sandusky River Watershed plus direct drainage to Lake Erie and Sandusky Bay. It is located in Ottawa, Sandusky, Erie, Wood, Seneca, Huron, Wyandot, Crawford, Richland, Marion, Hancock, and Hardin Counties in northwest Ohio. The subbasin is delineated by the United States Geological Survey as an 8-digit hydrologic unit number 04100011. The 1,165,438-acre (1,821 square mile) subbasin is predominated by the Sandusky River watershed which contains 1420 square miles and drains into Sandusky Bay and finally into the western basin of Lake Erie. Over 65 percent of the subbasin is cropland and over 80.1 percent has a 2 percent slope or less. The largest city in the subbasin is Sandusky, population 27,844 (2000 census), located in Erie County. The total population in the Sandusky subbasin is estimated at 224,392 (2000 census).

Figure 1 - Watershed Map

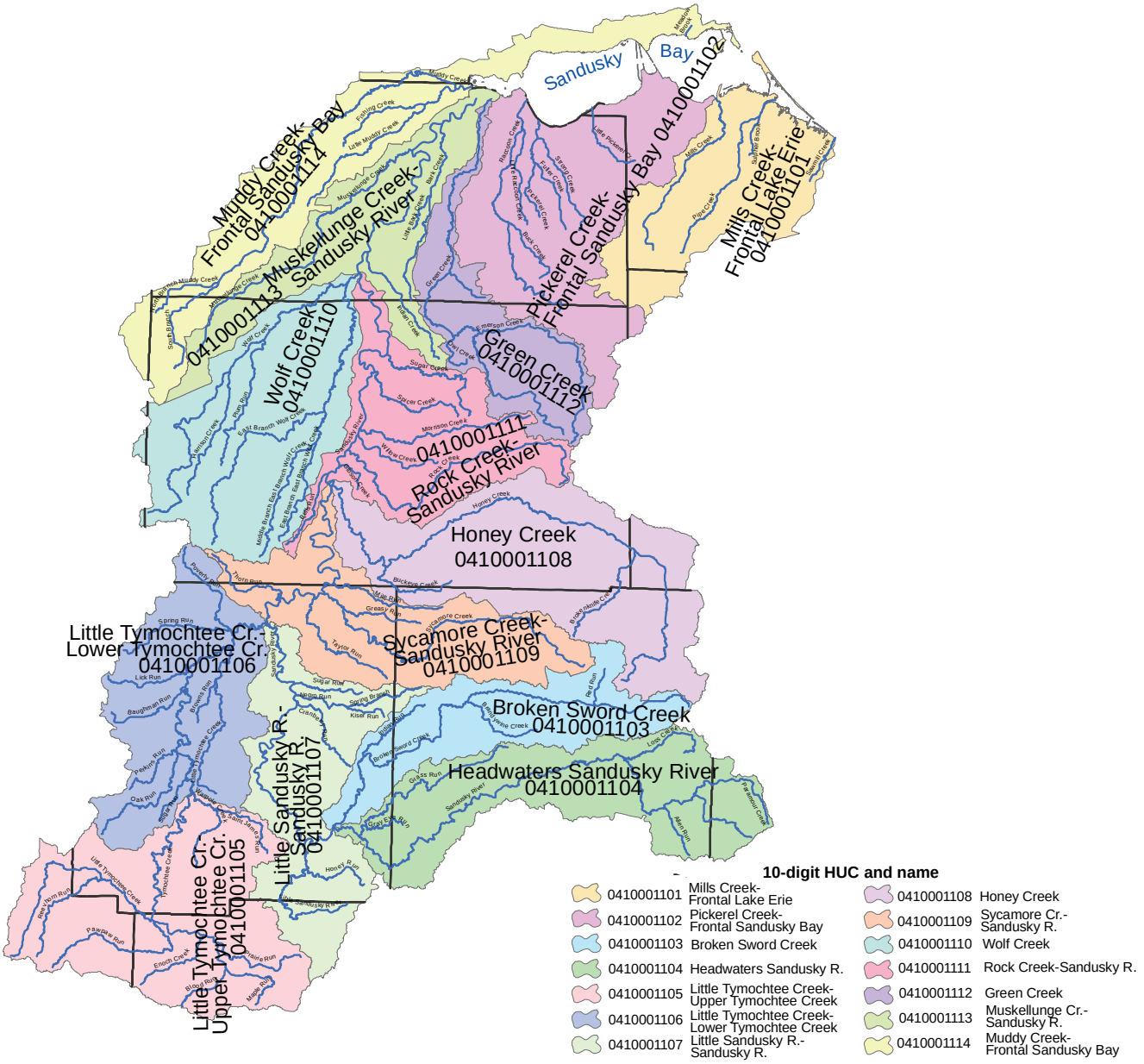


Table 1 - Counties Located In The Sandusky Watershed

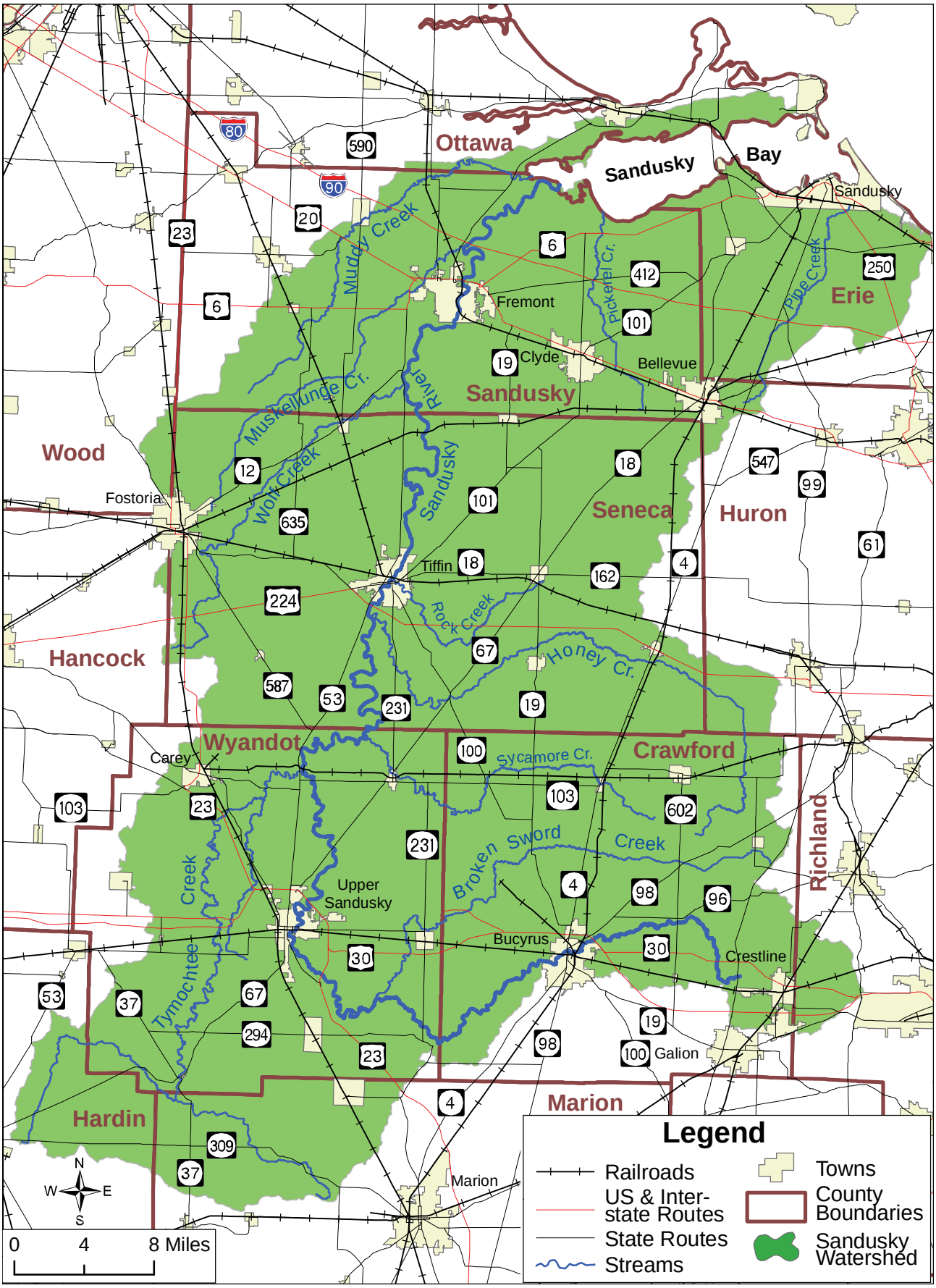
County	Acres	Acres in Watershed	% of Watershed Area	% of County in Watershed
Crawford	257,762	193,778	16.6%	75.2%
Erie	162,439	75,312	6.5%	46.4%
Hancock	341,639	1,009	0.1%	0.3%
Hardin	301,266	28,262	2.4%	9.4%
Huron	316,619	16,033	1.4%	5.1%
Marion	258,651	51,400	4.4%	19.9%
Ottawa	161,987	17,986	1.5%	11.1%
Richland	320,076	10,966	0.9%	3.4%
Sandusky	263,818	202,182	17.3%	76.6%
Seneca	353,501	331,968	28.5%	93.9%
Wood	397,289	4,182	0.4%	1.1%
Wyandot	260,909	232,359	19.9%	89.1%
Totals		1,165,438	100.0%	

Table 2 - 2000 Census Data Summary for the Sandusky Watershed

Summary	Number
Total Population	224,392
Total Households	87,547
Total Families	60,960
Total Housing Units	94,578
Average Household Size	2.51
Average Family Size	3.01
Median Household Income	$38,743
Average Household Income	$46,663
Per Capita Income	$18,535
Population by Race	**Number**
Total	224,392
Population Reporting One Race	221,304
White	207,262
Black or African American	9,678
American Indian or Alaska Native	409
Asian	802
Native Hawaiian or Other Pacific Islander	25
Some Other Race	3,128
Population Reporting Two or More Races	3,088
Total Hispanic Population	7,761

Source: U.S. Census Bureau, Census 2000 Summary File 1 and 3 through ESRI Business Analyst Online, http://bao.esri.com/esribis

Figure 2 - Sandusky Watershed Map



Physical Information

Physical Description

The Sandusky River Watershed extends across the Major Land Resource Areas (MLRA) 99, 111, and 139. This includes the Erie-Huron Lake Plain of the Lake States Fruit, Truck Crop, and Dairy Region and the Indiana-Ohio Till Plain of the Central Feed Grains and Livestock Region and the Lake Erie Glaciated Plateau of the Northeastern Forage and Forest Region.

The MLRA 99 typically is nearly level glacial lake plain with a few scattered ridges of sandy soils that represent past shorelines and moraines. Local relief typically varies less than 10 feet, except for the beach ridges and low moraines that can rise almost 30 feet above the landscape level. The MLRA 111 is a landscape characterized by a gently undulating glacial Wisconsinan till plain, and most areas are dominated by ground moraines that are broken in places by lake plains, outwash plains, flood plains, and many recessional moraines. The ground moraines and lake plains in front of the recessional moraines are flat to undulating. The MLRA 139 is a small northern portion of the watershed directly feeding into Sandusky Bay. Most of this MLRA is a gently rolling to strongly rolling, dissected glaciated plateau. The narrow-band along Lake Erie is fairly flat. Local relief is about 7 to 50 feet.

The entire land area of the Sandusky Watershed was surveyed using the Public Land Survey System (PLSS), and consequently cropland, pastureland and forested areas typically are rectangular in shape. Agriculture typically consists of cash grain farming of corn, soybeans and wheat production, forage (grass-legume hay, tall fescue pasture, and alfalfa hay), and livestock production.

The Sandusky Bay is a key feature of the watershed. While providing shipping port access, recreational access, spawning grounds, and sport fishing, little research has been done to fully describe the bay's condition and health. The Sandusky watershed discharges 275 billion gallons of water and 250,000 tons of sediment into the Bay annually.

The watershed's bedrock geology consists of late Devonian shale and sandstone with Shale units dominating closer to the surface along Lake Erie. Surficial materials include glacial deposits of till, glaciolacustrine sediments, and outwash from Wisconsin and older glacial periods. There are about 890 karst features that have been identified in the Sandusky Watershed where surface runoff can rapidly enter ground water supplies through fractures in the limestone. These occur primarily in northeastern Seneca County, southeastern Sandusky County, western Erie County, and northwestern Huron County.

The following cities and villages are situated entirely or partially in the Sandusky Watershed: Sandusky, Castalia, Greensprings, Bettsville, Fremont, Clyde, Bellevue, Fostoria, Tiffin, Republic, Bloomville, Attica, Carey, New Riegel, Sycamore, Chatfield, New Washington, Upper Sandusky, Nevada, Bucyrus, Harpster, Moral, and Crestline.

Prior to historical settlement, the watershed was densely wooded with prairie openings on the till plains to the south and marshes along the lake plain. Many of these coastal wetlands are presently diked to maintain a consistent water level to promote waterfowl populations for hunting. Currently the watershed consists of approximately1.3 percent herbaceous wetlands and 3.4 percent wooded wetlands.

Karst Features

The sedimentary rock underlying the Sandusky Watershed comprised of limestone and dolomite is subject to the development of karst features such as sink holes.

There are about 890 karst features that have been identified in the Sandusky Watershed where surface runoff can rapidly enter ground water supplies through fractures in the limestone. These occur primarily in northeastern Seneca County, southeastern Sandusky County, western Erie County, and northwestern Huron County.

Figure 3 - Karst Features in the Sandusky Watershed

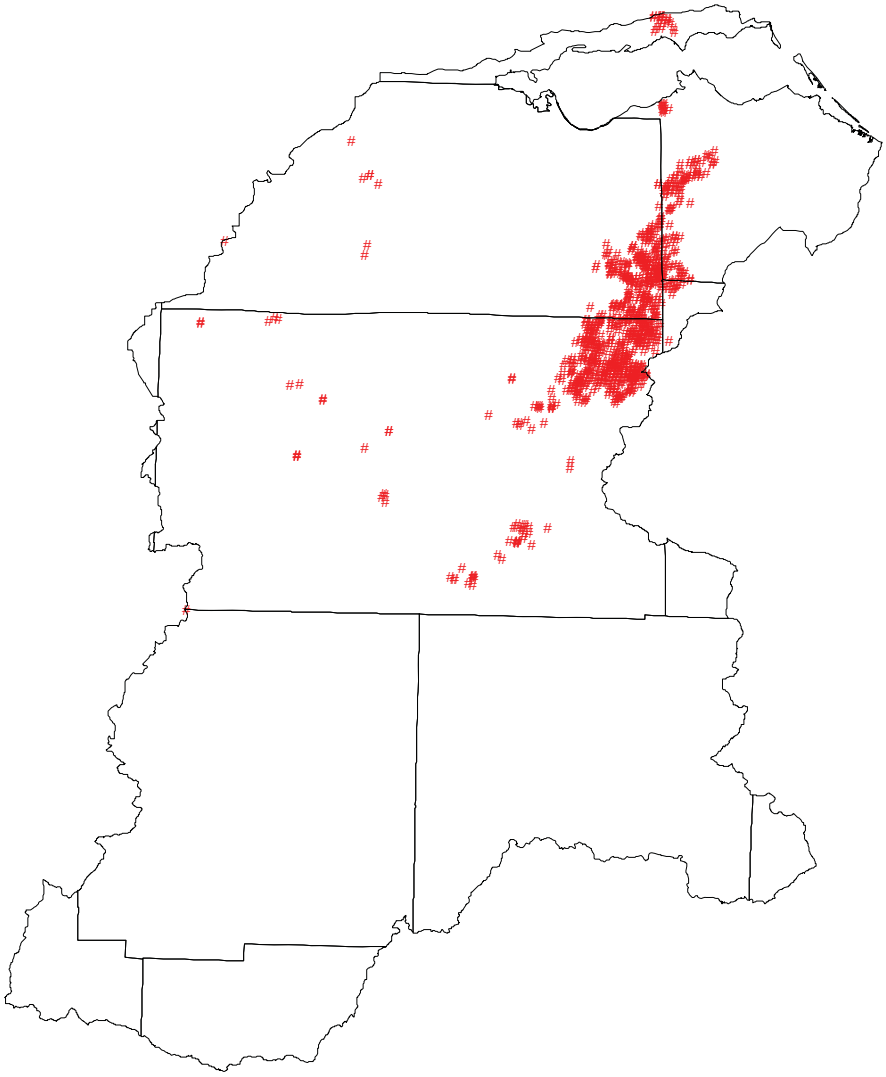


Figure 4 - 10-Meter Digital Elevation Model for the Sandusky Watershed

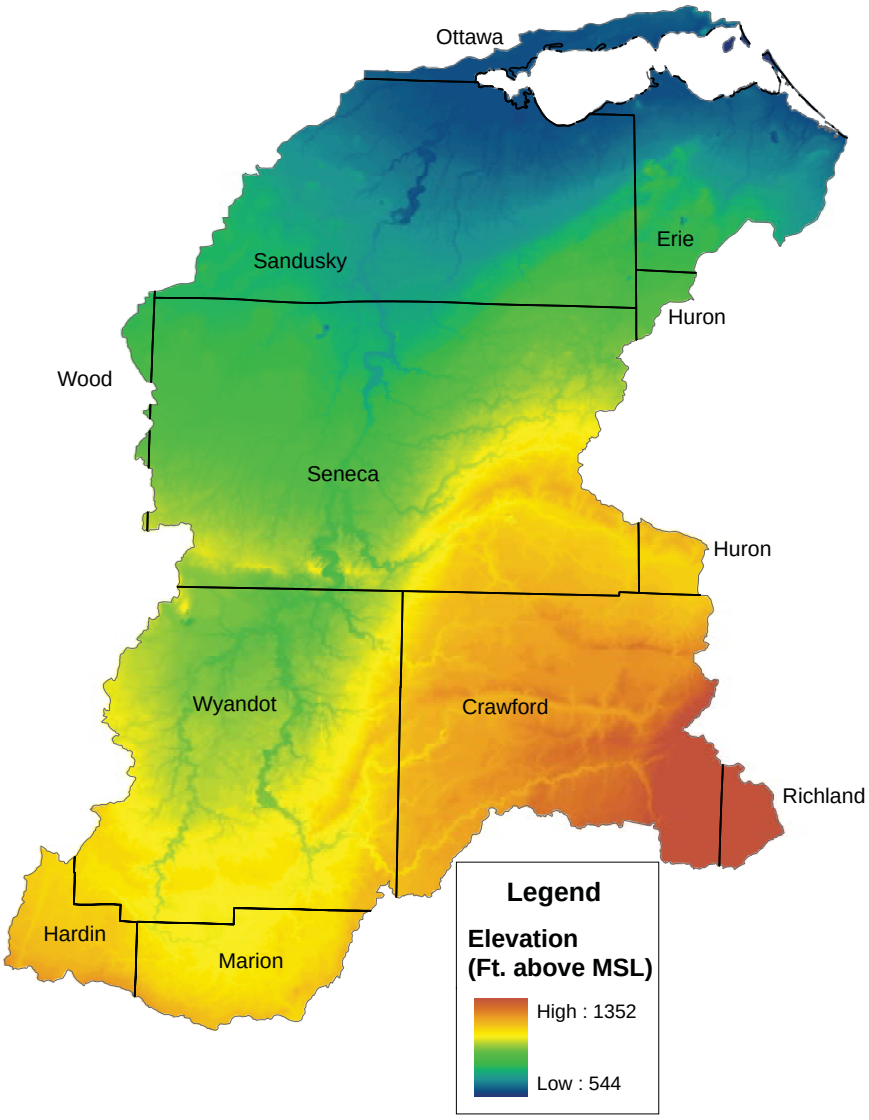


Table 3 - Sandusky Watershed Slope

Class	Area (Sq.Mi.)	Percent of Watershed
0-1%	1174.4	64.4
>1-2%	286.8	15.7
>2-4%	207.6	11.4
>4-6%	78.6	4.3
>6-8%	36.0	2.0
>8-10%	18.3	1.0
>10%	22.8	1.3
Total	1824.7	100.0

Land Use and Land Cover

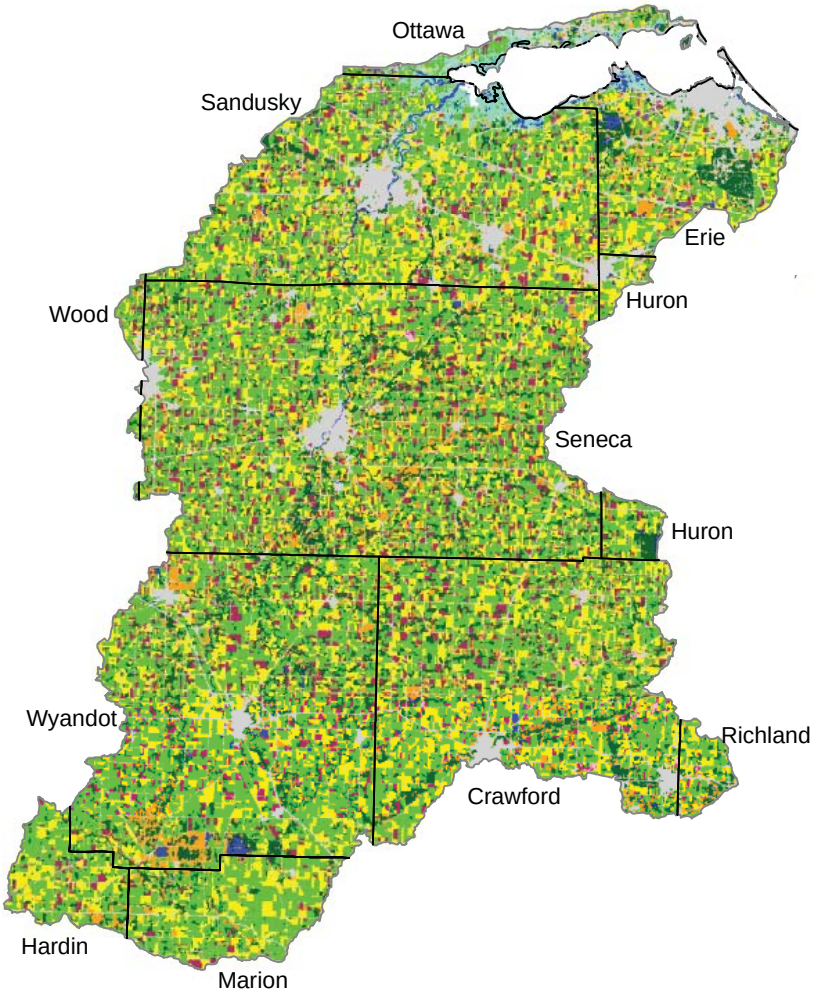
Information and Trends

According to the USDA-NRCS National Resources Inventory (NRI), from 1982 to 1997, there was an increase of about 16,200 acres of urban/built-up land, representing about 1.3 percent of the Sandusky Watershed with a slight corresponding decline in pastureland and cropland acreage.

In 1997, according to the NRI, the watershed was 71 percent cropland, 1.5 percent pastureland, 8.6 percent forestland, 5.2 percent minor cover/uses, 1.4 percent rural transportation, 4.1 percent water, 2 percent Conservation Reserve Program (CRP), and about 6 percent urban/built-up land.

In 2006, there were about: a) 756,290 acres of cropland; b) 11,500 acres of fallow cropland/CRP; c) 72,540 acres of pasture/non-ag/range/ waste/farmstead; d) 156,290 acres of urban land; e) 14,990 acres of wetlands; and f) 136,500 acres of woodland. (Source: USDA NASS Landcover Data, 2006)

Figure 5. Land Use Map



	Landuse	Area (acres)	Area (%)
	Corn	248,430	21.3%
	Soybeans	406,210	34.9%
	Winter Wheat	97,980	8.4%
	Alfalfa	3,670	0.3%
	Idle Cropland / Fallow / CRP	11,550	1.0%
	Pasture, Non-ag, Range, Waste, Farmstead	72,540	6.2%
	Woodland	136,500	11.7%
	Urban	156,290	13.4%
	Water	9,070	0.8%
	Wetlands	14,990	1.3%
	Other	8,170	0.7%
	Total =	1,165,400	

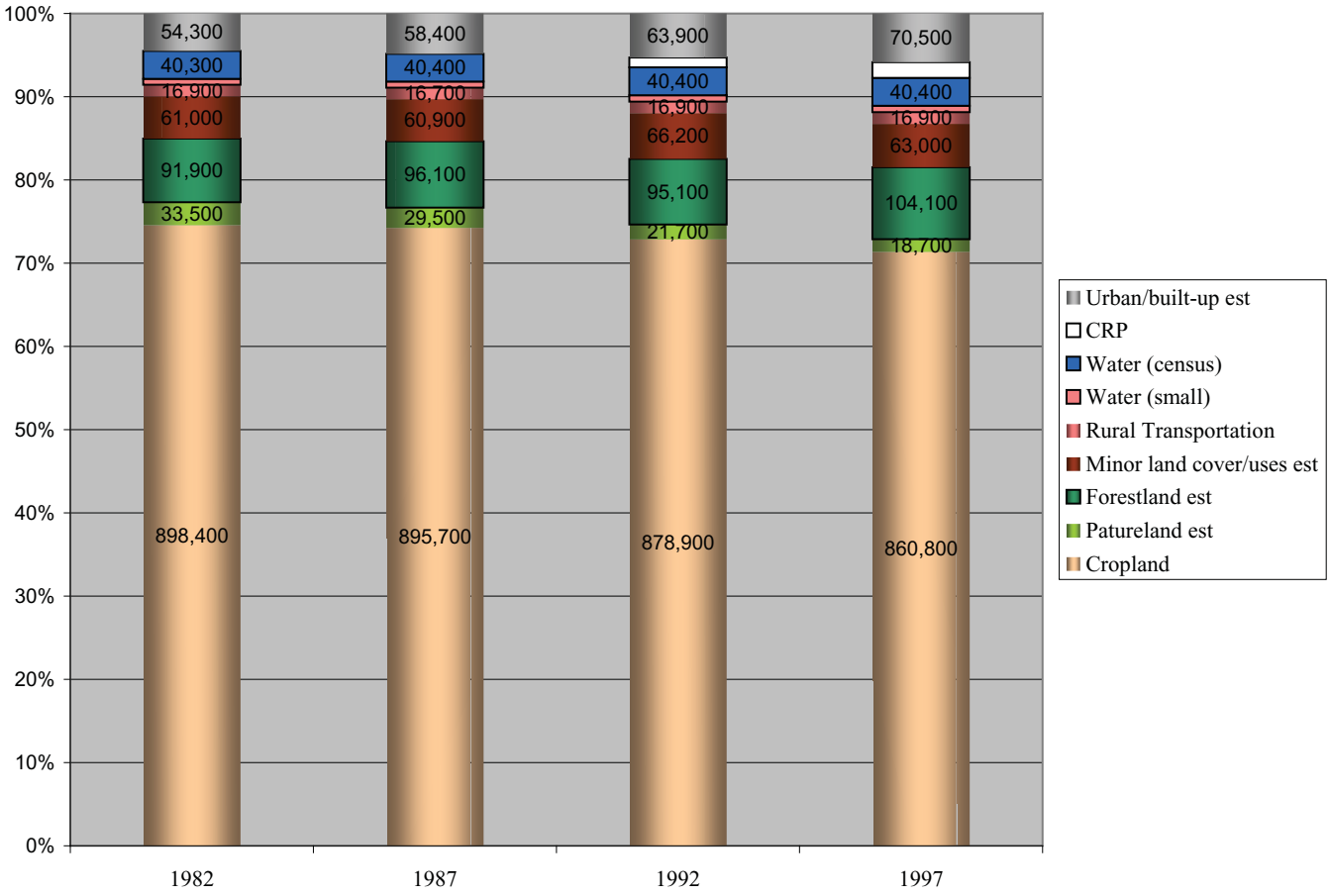
2006 Landcover data from USDA NASS

Table 4 - Cropland and Crop Types in the Watershed

	Cropland	Corn	Bean	Wheat	Hay
Watershed (Ac.)	758,630	248,430	406,210	97,980	3,670
% of Cropland		32.7%	53.5%	12.9%	0.5%

Source: 2006 Landuse / Landcover from NASS

Figure 6 - Broad Land Use
1982 - 1997



A View of the Sandusky Watershed

Other counties located in the Sandusky Watershed:

Hardin County
Huron County
Marion County
Seneca County
Richland County
Wyandot County

Figure 7 - Average Annual Precipitation

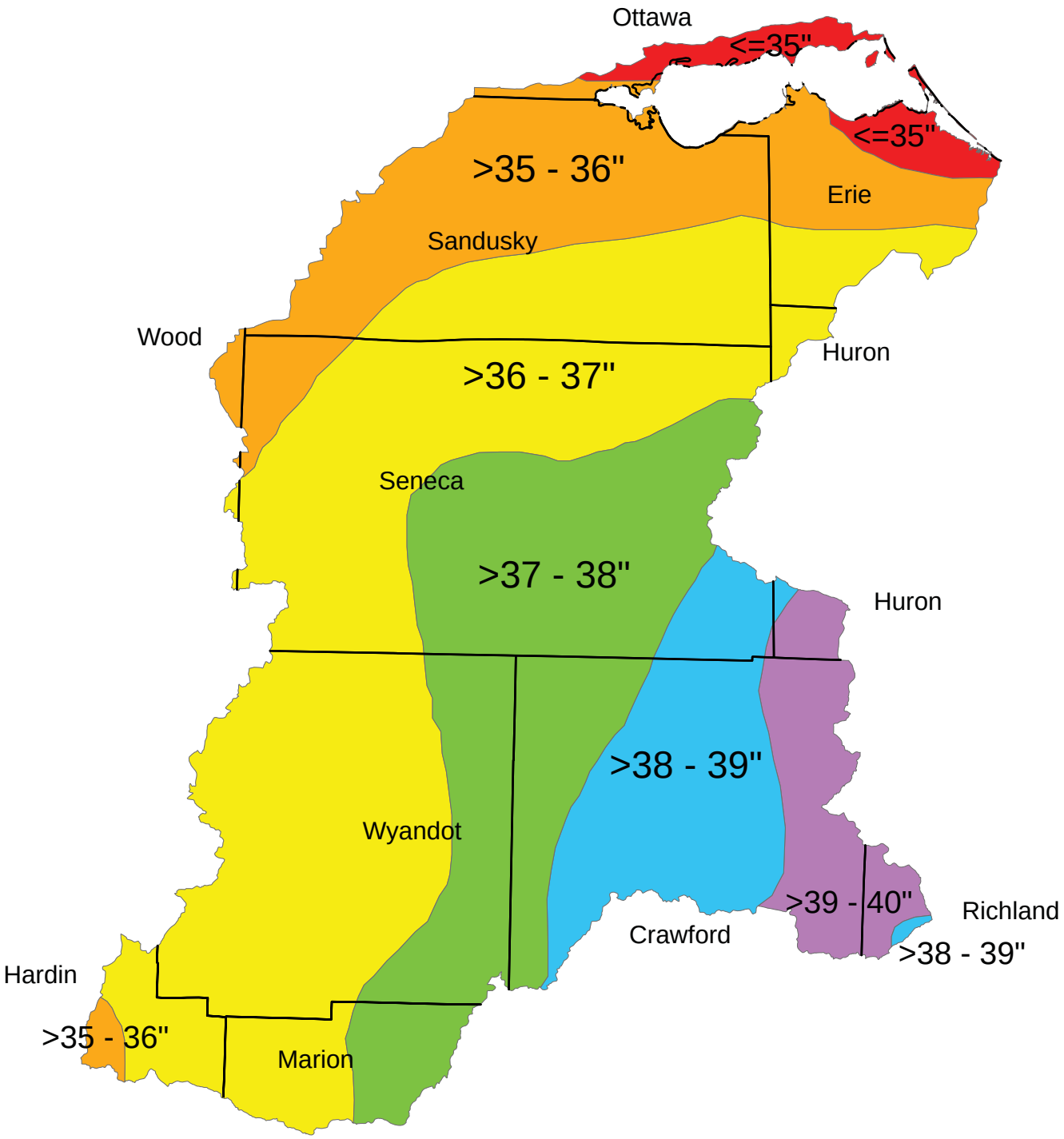
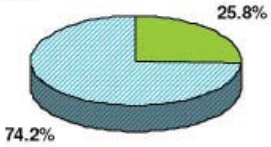


Figure 8 - Water Withdrawal in the Sandusky Watershed

Water Withdrawal in the Sandusky Basin

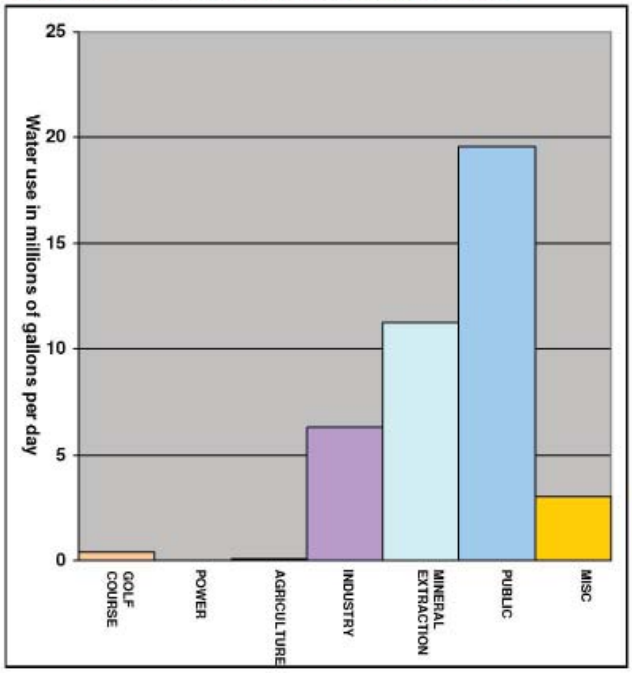
Total fresh-water withdrawal and source of water in 2005

Source	Water use, in million gallons per day	Percent of total use
Surface Water	30.09	74.2%
Ground Water	10.49	25.8%
Total	40.58	100.0%

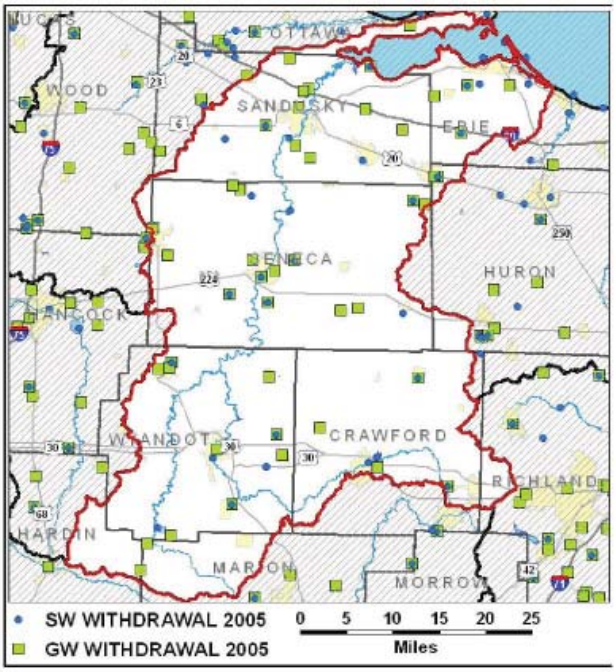


Ground Water Surface Water

Total fresh-water withdrawal by category in 2005



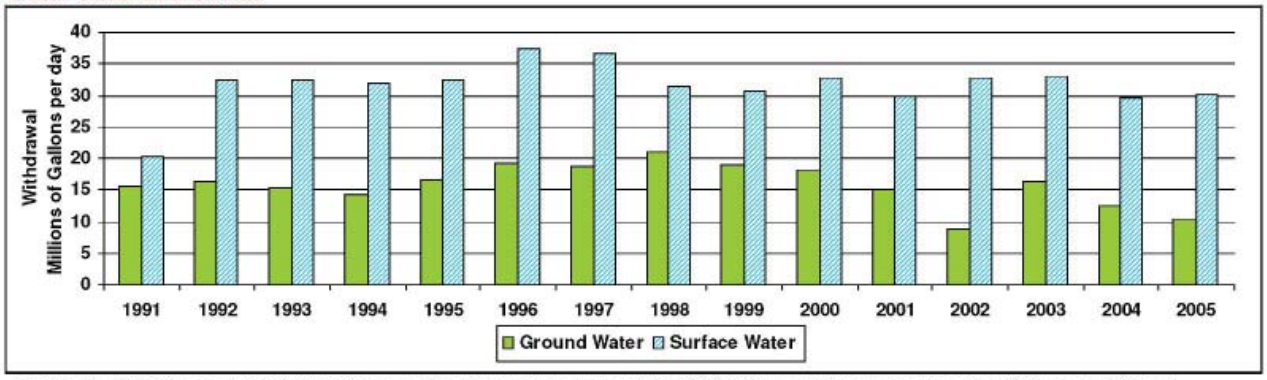
Location of facilities withdrawing water in 2005



Total fresh-water withdrawal by category in 2005 in millions of gallons per day

	Golf Course	Power	Agriculture	Industry	Mineral Extraction	Public	Misc	Total
Surface Water	0.20	0.00	0.03	5.84	3.30	18.07	2.65	30.09
Ground Water	0.18	0.00	0.07	0.43	7.99	1.46	0.36	10.49
Total	0.38	0.00	0.11	6.27	11.29	19.53	3.01	40.58
Percent Total	0.9%	0.0%	0.3%	15.4%	27.8%	48.1%	7.4%	100.0%

Water withdrawal trends



Provided by Ohio Department of Natural Resources (http://www.dnr.state.oh.us/tabid/4035/Default.aspx) in cooperation with U.S. Geological Survey (http://oh.water.usgs.gov/) and Natural Resources Conservation Service (www.oh.nrcs.usda.gov/). Indiana data provided by Indiana DNR (http://www.in.gov/dnr/water/water_availability/SWWF/index.html). See (www.dnr.state.oh.us/tabid/18805/Default.aspx) for explanation of data.

Figure 9 - Stream Orders for the Sandusky Watershed

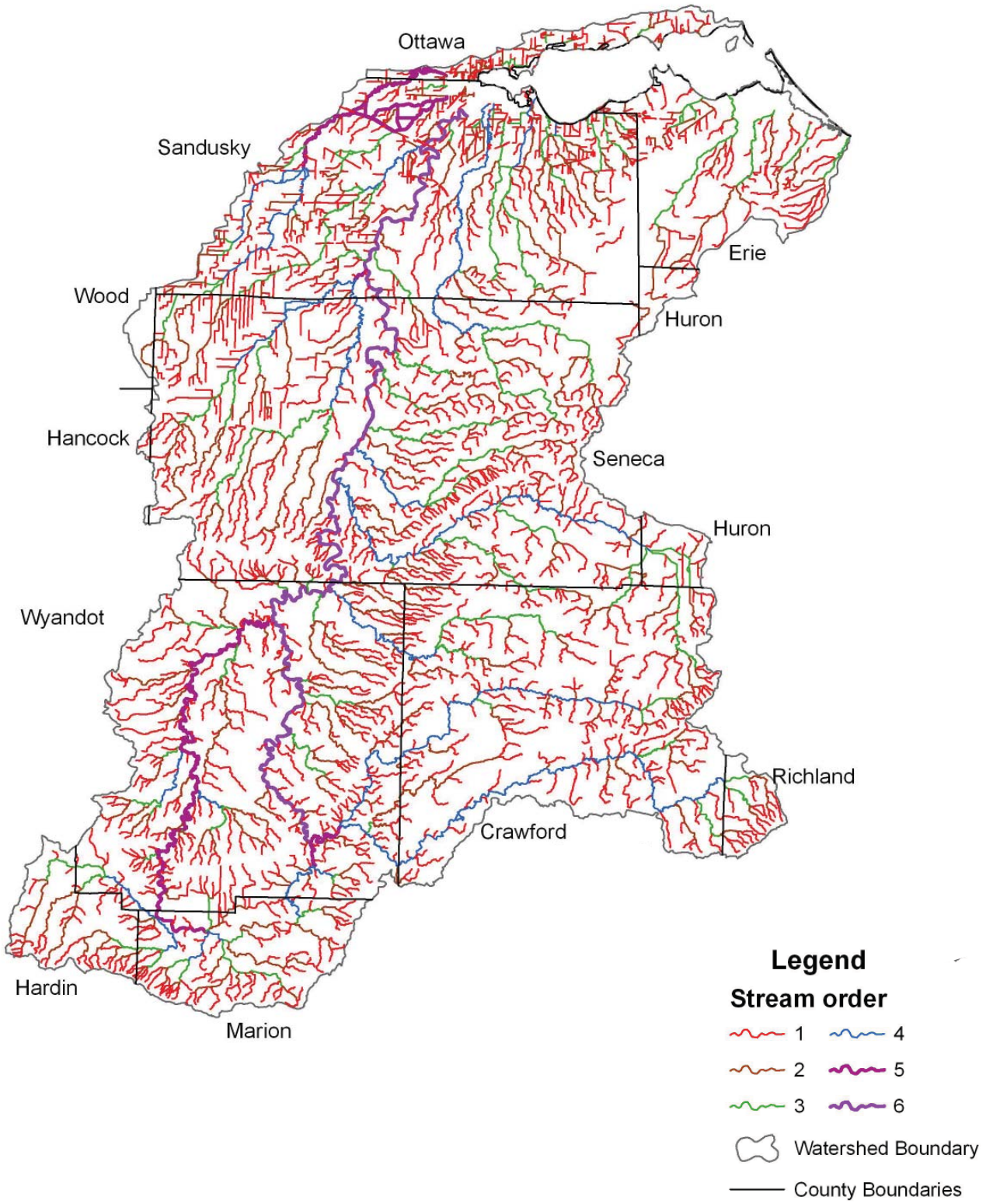


Table 5 - Stream Miles By Order

	Acres of Standing Water (Lakes/ Ponds)	Total Miles of Streams	Total Miles 1st Order Streams	Total Miles 2nd Order Streams	Total Miles 3rd Order Streams	Total Miles 4th Order Streams	Total Miles 5th Order Streams	Total Miles 6th Order Streams
Total Sandusky WS	3761.7[1]	3346.6	1791.3	731.0	376.2	262.6	95.7	89.7
Crawford Co. Portion	478.2	467.4	277.0	83.4	43.8	63.1	N/A	N/A
Erie Co. Portion	854.2	182.4	104.7	44.7	32.6	0.4	N/A	N/A
Hancock Co. Portion	0.0	1.8	1.8	N/A	N/A	N/A	N/A	N/A
Hardin Co. Portion	9.4	68.9	38.7	24.3	5.9	N/A	N/A	N/A
Huron Co. Portion	84.3	36.4	17.1	9.1	9.6	0.6	N/A	N/A
Marion Co. Portion	53.1	156.5	85.6	34.4	19.9	12.0	4.6	N/A
Ottawa Co. Portion	183.5	74.1	44.7	18.2	5.8	N/A	5.4	N/A
Richland Co. Portion	14.9	36.3	24.1	7.3	4.9	N/A	N/A	N/A
Sandusky Co. Portion	236.0	695.6	318.6	165.1	92.8	63.9	33.6	21.5
Seneca Co. Portion	419.5	942.8	527.2	190.3	116.2	76.9	N/A	32.3
Wood Co. Portion	0.0	2.6	N/A	2.6	N/A	N/A	N/A	N/A
Wyandot Co. Portion	1428.7	681.8	351.9	151.6	44.6	45.8	52.1	35.8

[1] 0.05 Acres and larger, and does not include Sandusky Bay backwater in the Sandusky River.

Available Common Land Unit (CLU) data was used to get an estimate of the amount of cropland riparian area that is protected by Conservation Reserve Program (CRP) buffer practices. Additionally, the total amount of protected riparian area was estimated by adding naturally protective land uses (e.g. woods, wetlands, farmsteads, and urban) from the National Agricultural Statistics Service 2006 landuse layer to cropland from the CLU layer that was protected by CRP practices. (Note: This buffer is half as wide as the buffer used for soil management concern on the next page.)

Table 6 - Riparian Zone Protected and Unprotected

Acres Within 60 Feet of Stream Buffer on Both Sides (120 ft. total)	
% Total Cropland Acres in Riparian Zone Protected By CRP	18.9%
% Total Cropland Acres In Riparian Zone Unprotected	81.1%
% of Total Acres In Riparian Zone That Are Protected	66.0%
% of Total Acres in Riparian Zone That Need Protection	34.0%

Figure 10 - Riparian Zone Analysis Map

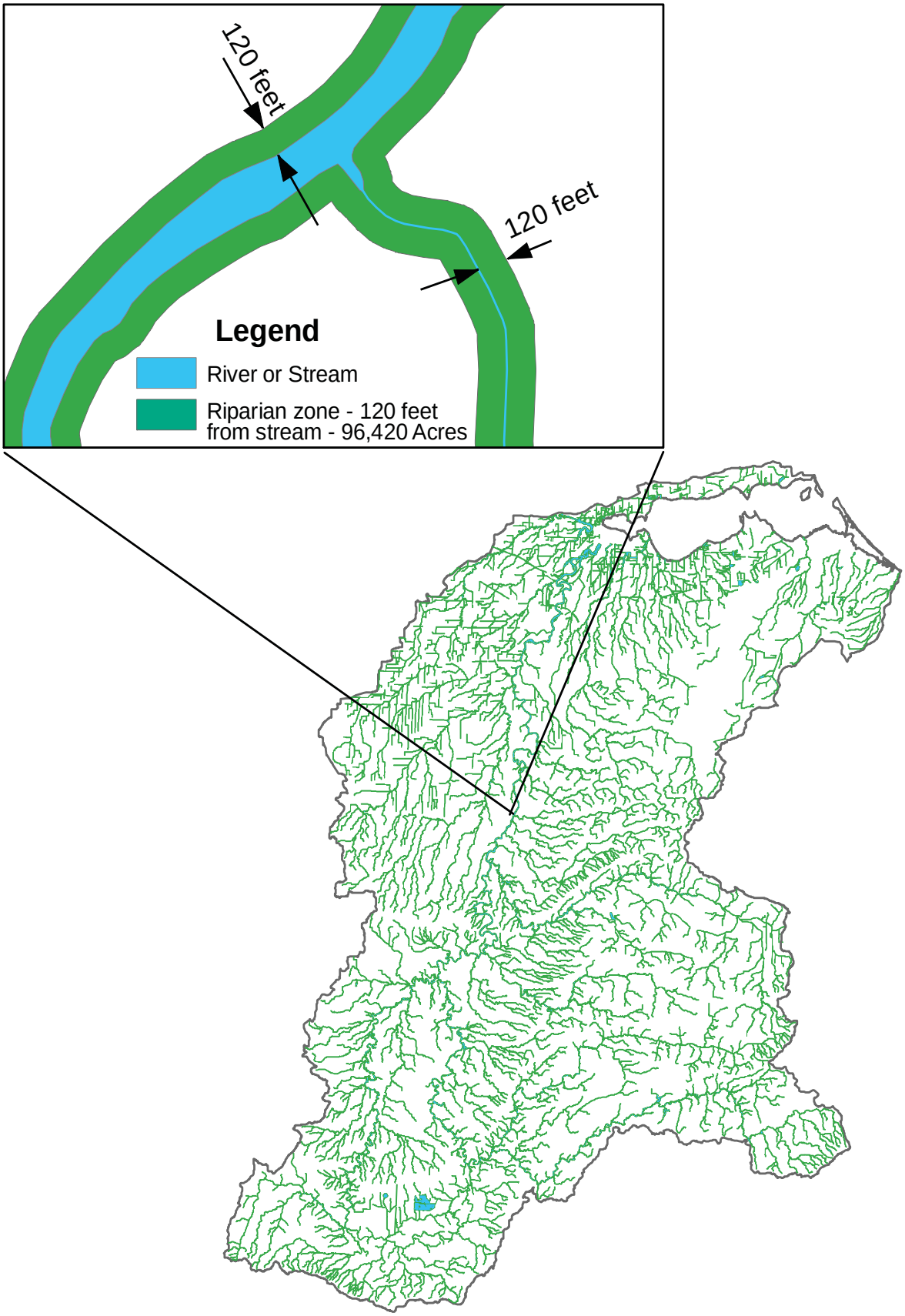
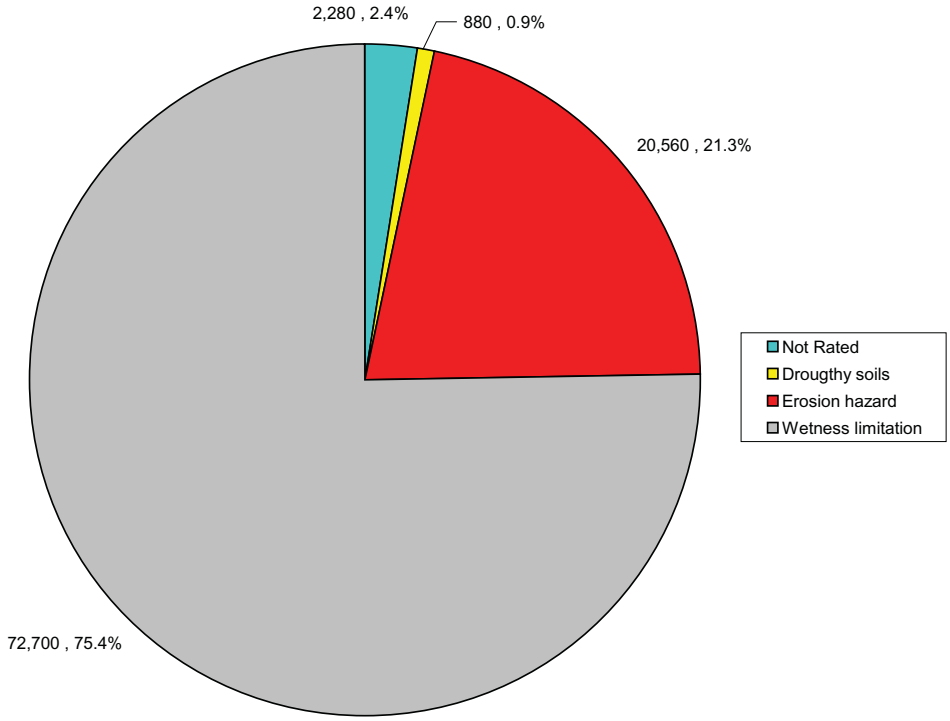


Figure 11 - Primary Soil Management Concern within 120 feet of Streams (Acres and Percentage)



Water Quality Assessment Data

The Upper Sandusky River Total Maximum Daily Load (TMDL) report was approved by U.S. EPA Region 5 on September 29, 2004. TMDLs identify and evaluate water quality problems in impaired water bodies and propose solutions to bring those waters into attainment.

The TMDL report addresses water quality problems that were identified on the 2002 and 2004 Section 303(d) lists. *Organic and nutrient enrichment, siltation, low dissolved oxygen, habitat and flow alterations, and pathogens were identified as the primary causes of impairment.* The following table displays watershed assessment scores, impairments by assessment units, and corresponding NRCS Field Office Technical Guide conservation practices which will have a beneficial effect on these impairments.

Table 7 - Sandusky Watershed Water Quality Assessment Data
(Data from OEPA TMDL Report – August 2004)

Unit	Attainment Status			Conservation Practices Benefiting Impairments If Applied to Watershed					
HUC 11 Assessment Unit	Watershed Score*	Causes of Impairment	Included in TMDL Report ?	Conservation Tillage	Conservation Buffers +	Nutrient Management	Animal Waste Utilization	Cons Cover/Tree Planting ++	Drainage Water Mgt
Bucyrus 020	32	Organic Enrichment/ D.O.	Yes	***	***	***	***	***	***
		Nutrients	Yes	***	***	***	***	***	***
		Sedimentation	Yes	***	***			***	
		Habitat Alteration	Yes		***			***	***
		Pathogens	Yes		***	***	***	***	***
		Flow Alteration	Not Included	***	***			***	***
Broken Sword Creek 030	71	Nutrients	Yes	***	***	***	***	***	***
		Sedimentation	Yes	***	***			***	
		Habitat Alteration	Yes		***			***	***
		Flow Alteration	Not Included	***	***			***	***
Upper Sandusky 040	52	Organic Enrichment/D.O.	Yes	***	***	***	***	***	***
		Nutrients	Yes	***	***	***	***	***	***
		Sedimentation	Yes	***	***			***	
		Habitat Alteration	Yes		***			***	***
		Pathogens	Yes		***	***	***	***	***
		Flow Alteration	Not Included	***	***			***	***

Upper Tymochtee Creek 050	**13**	Organic Enrichment/ D.O.	Yes	***	***	***	***	***	***
		Nutrients	Yes	***	***	***	***	***	***
		Sedimentation	Yes	***	***			***	
		Habitat Alteration	Yes		***			***	***
		Pathogens	Yes		***	***	***	***	***
		Ammonia	Yes		***	***	***	***	***
		Flow Alteration	Not Included	***	***			***	***
Lower Tymochtee Creek 060	**27**	Organic Enrichment/ D.O.	Yes	***	***	***	***	***	***
		Nutrients	Yes	***	***	***	***	***	***
		Sedimentation	Yes	***	***			***	
		Habitat Alteration	Yes		***			***	***
		Ammonia	Yes		***	***	***	***	***
		Flow Alteration	Not Included	***	***			***	***
Mexico 070	**56**	Sedimentation	Yes	***	***			***	
		Habitat Alteration	Yes		***			***	***
		Flow Alteration	Not Included	***	***			***	***
Honey Creek 080	**62**	Organic Enrichment/ D.O.	Yes	***	***	***	***	***	***
		Nutrients	Yes	***	***	***	***	***	***
		Sedimentation	Yes	***	***			***	
		Habitat Alteration	Yes		***			***	***
		Flow Alteration	Not Included	***	***			***	***
Tiffin 090	**50**	Organic Enrichment/ D.O.	Yes	***	***	***	***	***	***
		Nutrients	Yes	***	***	***	***	***	***
		Sedimentation	Yes	***	***			***	
		Habitat Alteration	Yes		***			***	***
		Pathogens	Yes		***	***	***	***	***
		Flow Alteration	Not Included	***	***			***	***
Large River	**84**	Sedimentation	Yes	***	***			***	
		Habitat Alteration	Yes		***			***	***
		Flow Alteration	Not Included	***	***			***	***

Severe Basin Wide Impairment (Scores 0-39)	**Impairment Justifying Basin Wide Effort (Scores 40-79)**	**Score Indicative of Localized Water Quality Issues (Scores 80-90)**

*** Denotes a conservation practice which will have a positive effect on the impairment identified.
+ Note: Conservation Buffers = Filter strips, Riparian Forest Plantings, Wetland Restoration, Field Windbreaks
++ Note: Conservation Cover = Cover Crops, CRP Plantings, Riparian Tree Plantings, Windbreaks
* Watershed assessment unit score is average grade of aquatic life use status. A max assessment unit score of 100 is possible if all monitored sites meet designated aquatic life uses. The method of calculation is presented in Ohio EPA 2002 Integrated Water Quality Monitoring and Assessment Report.

This table prepared from Ohio EPA Sandusky Watershed TMDL Data of August '04 and NRCS Field Office Technical Guide Conservation Effects

Beneficial uses assessed for this report were aquatic life and recreation. The primary causes of aquatic life impairment were *organic enrichment/low dissolved oxygen, phosphorus, sedimentation, habitat alteration, and flow alteration*. The primary cause of recreation use impairment was *pathogens*. In addition, *nitrates* were identified as a concern for surface water supplies of drinking water. Also, a *sport fish consumption advisory* is in effect for the entire length of the Sandusky River because of PCB and mercury levels detected in tissue samples collected in 1997.

Sedimentation was identified as a major cause of impairment. Habitat quality in the Upper Sandusky River was excellent at most mainstem sites, but below target in the tributaries as drainage area decreased. Most of the habitat problems were related to agriculture as more than 80 percent of the watershed is devoted to agriculture.

Phosphorous concentrations were measured in the upper Sandusky River watershed during summer of 2001. Most results were well above target values. A goal of 25 percent total P load reduction was recommended. The report projected that a goal of 25 percent was achievable through implementation of a combination of conservation land management practices and would result in attainment of aquatic life water quality standards when combined with habitat and flow improvements. The following table shows the recommended phosphorous TMDL's for the Sandusky watershed (by assessment unit).

Table 8 - TMDL's and Total Phosphorous Allocations for the Sandusky River Watershed.
(Source of data Ohio EPA Sandusky River Watershed TMDL Report)

Assessment Unit by 11-Digit Watershed (04100011-0xx)	Existing Conditions			Percent Reduction		TMDL
	NPS	PS	Total	NPS	PS	
Total Phosphorus(kg/day)						
Sandusky-Bucyrus (-020)	120	22	142	25	50	101
Broken Sword Creek (-030)	83	0.3	83.3	25	25	63
Sandusky-Upper Sandusky (-040)	106	7.9	114	25	34	85
Upper Tymochtee (-050)	150	0.015	150	25	20	112
Lower Tymochtee (-060)	114	5.5	120	25	60	89
Sandusky-Mexico (-070)	106	0.3	106.3	25	0	80
Honey Creek (-080)	157	4.1	161	25	65	119
Sandusky-Tiffin (-090)	102	15.1	117	25	0*	92

* The % point source reduction applies to phosphorous loads from the main outfall, not to CSO discharges

Nutrient Loadings To Lake Erie And Sandusky Bay

The TMDL report analyzed the stream conditions in the watershed, but did not take into account any needs for nutrient or sediment reductions in loadings to Sandusky Bay and/or Lake Erie. Long term monitoring has shown a decline in sediment and phosphorous loadings from the watershed as conservation practices have been applied to the land. Suspended solids and particulate phosphorus loads have declined over the last 30 years, mostly as a consequence of conservation tillage increases.

Table 9 - Percent Change Per Decade (since 1975) in Average Concentrations in Two Lake Erie Watersheds.

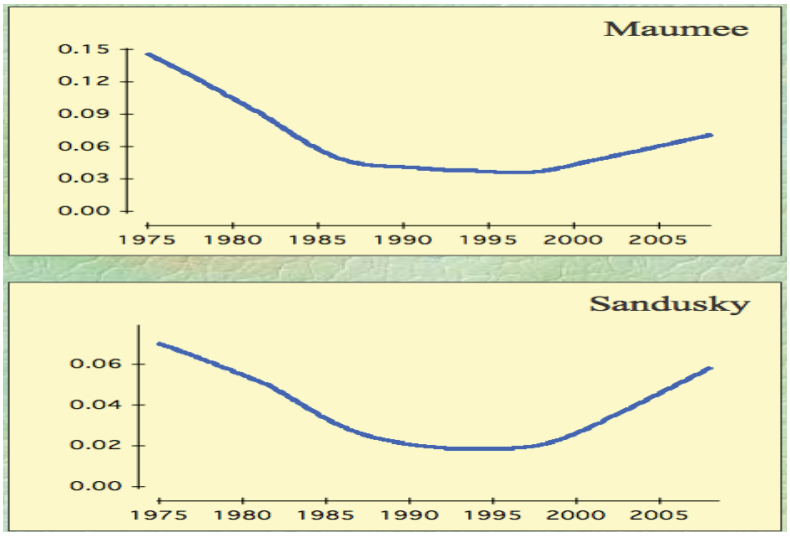
	Maumee	Sandusky
Flow	4.6	4.9
Suspended Solids	-18	-11
Particulate Phosphorous	-14	-10
Dissolved Reactive Phosphorous*	-58, 151	-64, 273

* For DRP, percent decrease per decade prior to 1995 is shown, followed by percent increase since 1995.

Source: P. Richards – Heidelberg College National Center for Water Quality Research

However in recent years, gage data has documented a resurgence and increase in soluble phosphorus loadings to the Lake, (shown in the Figure below) which has been accompanied by an increase in harmful algal blooms.

Figure 12 - Trends in Average Daily Concentrations of Dissolved Reactive P Leaving Sandusky Watershed.



Source: P. Richards – Heidelberg College National Center for Water Quality Research

The State of Ohio currently has a phosphorous task force meeting to develop recommendations for ways to reduce phosphorous runoff from this and other watersheds. The outcome of that report is expected to include a call for further and renewed vigilance for phosphorous reduction to Lake Erie, and the need for additional conservation and nutrient management practices in this watershed.

Table 10 - Major Water Bodies in the Watershed

Name/Location	Acres	Elev(ft.)	Type	Uses
Bucyrus Reservoir (#1)	42.0	1004	Dam on stream	Municipal Water, Recreation
Bucyrus Reservoir (#2)	31.0	991	Dam on stream	Municipal Water, Recreation
Bucyrus Reservoir (#3) Riley Res.	30.4	1036	Upground	Municipal Water, Recreation
Bucyrus Reservoir (#4) Outhwaite Res.	150.0	1014	Upground	Municipal Water, Recreation
City of Bellevue Reservoir (#1)	9.9	761	Upground	Municipal Water
City of Bellevue Reservoir (#3)	14.2	758	Upground	Municipal Water
City of Bellevue Reservoir (#4)	31.8	774	Upground	Municipal Water
City of Clyde Beaver Cr. Upground Reservoir	102.2	748	Upground	Municipal Water, Recreation
City of Clyde Raccoon Cr. Upground Reservoir	34.1	709	Upground	Municipal Water, Recreation
Ellis Lake aka Ma-chri-ka-ba Lake or Walton Lake	36.8	--	Dam on stream	Recreation
Killdeer Plains Wildlife Area (several ponds)	654.0	--	--	Recreation
Killdeer Upground Reservoir	253.9	--	Upground	Recreation
Upper Sandusky Reservoirs (two)	135.0	--	Dam on stream	Municipal Water, Recreation

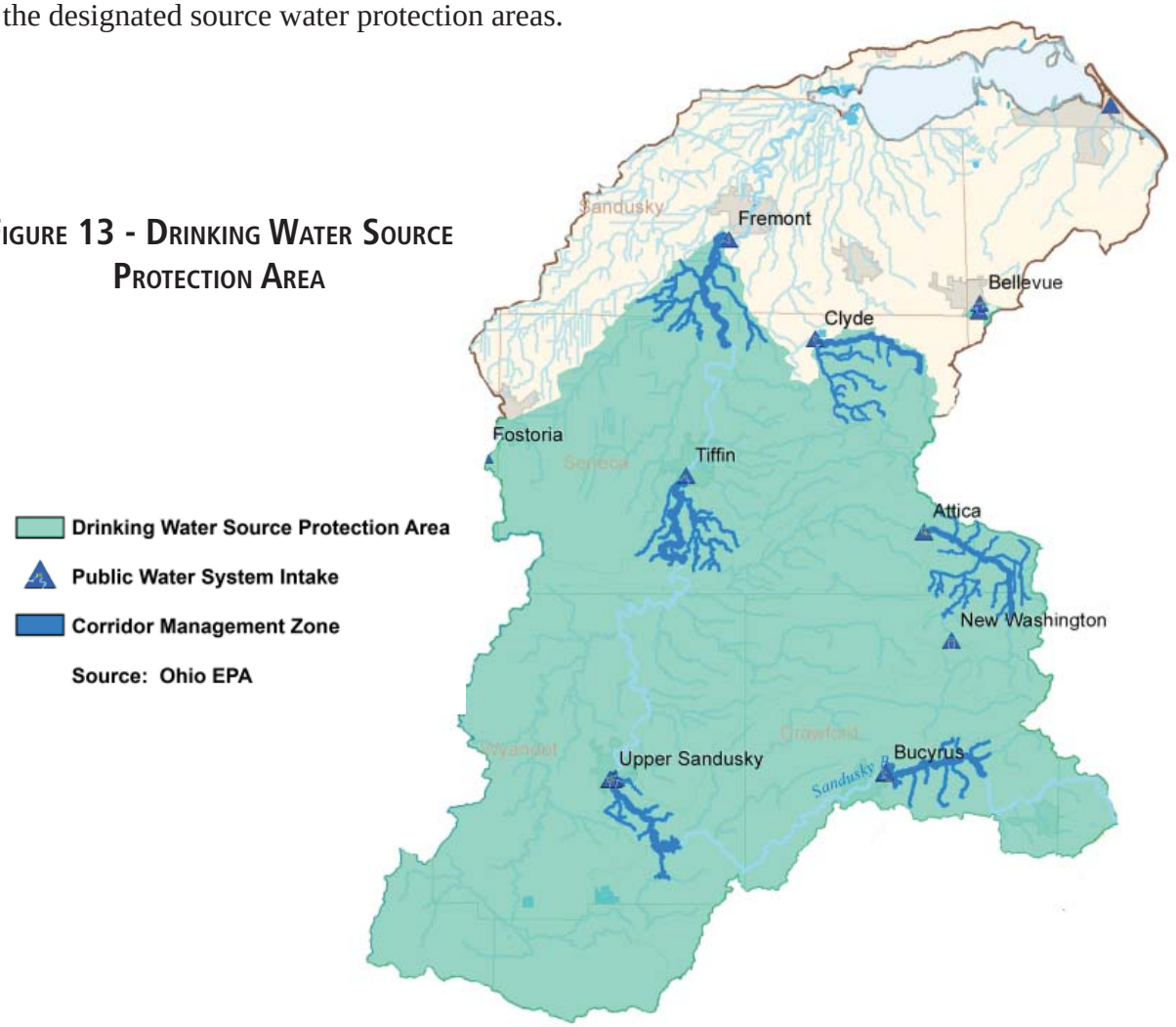
Drinking Water Source Protection Area

The Source Water Assessment and Protection Program in Ohio helps public water suppliers protect drinking water sources, such as streams and underground aquifers, from contamination, in keeping with the federal Safe Drinking Water Act amendments of 1986 and 1996. A number of communities in the Sandusky subbasin are in the process of developing plans for their watersheds and aquifers, including Bucyrus, Fremont, Clyde and Bellevue. The City of Tiffin, through the Ohio American Water Company has an Ohio EPA endorsed plan. These efforts consist of both an assessment (including protection area delineation; identifying the potential contaminant sources in that area; and determining the susceptibility of the aquifer or surface water) and a plan for protection. Possible threats to the surface water source include agricultural runoff (pesticide/fertilizer storage and application, animal feedlots), transportation spills, home construction runoff, oil/gas production activities, unsewered areas, wastewater treatment discharges, landfills, and commercial sources.

The map below shows Drinking Water Source Assessment Areas for Public Water Systems using surface water in the Sandusky subbasin. The areas shaded in blue are stream corridor management zones which are typically upstream from points of water intake.

Conservation Management Practices such as nutrient management, pest management, conservation buffers and filters, conservation tillage, and animal waste utilization can have a beneficial effect on water quality in the designated source water protection areas.

Figure 13 - Drinking Water Source Protection Area



Sandusky Scenic River

The Sandusky State Scenic River was the second river in Ohio to be designated as such in 1970. It flows 130 miles from its source in Crawford County to the Muddy Creek/Sandusky Bays. It is the longest of Ohio's rivers that are within the Lake Erie basin. The river is 'L' shaped, flowing to the west before heading north.

There are several scenic river access sites that are open to the public for canoeing, fishing and hunting. The river also boasts the largest inland population of the Bald Eagle in the state. The Sandusky is the only river in the state to have all 6 species of the Redhorse Sucker. The designated section is 66 miles long. Starting at Harrison Smith Park in Upper Sandusky, the river flows through the northern portion of Wyandot County, into Seneca County and Sandusky County, and finally the designated section ends at Roger Young Park in Fremont.

St. Johns Dam had impounded 8.5 miles of the Sandusky River, which extended 1 mile upstream of the confluence of Sycamore Creek. The impounded waters were deemed impaired by the Ohio EPA. The dam was removed on November 17, 2003, putting to rest the controversy of whether to repair or remove it. In less than two years from the removal, the former impounded area was reclassified as warmwater habitat by OEPA, with the section from Mexico Bridge to Hecks Bridge classified as exceptional warmwater habitat. This area also has four new riffles that were previously underwater. The river recovered on its own. Based on the macroinvertebrate sampling, 6 of the 7 sampling sites are now exceptional warmwater habitat, with the seventh site classified as warmwater habitat. There was no engineering done on the part of the scenic rivers program to assist with the recovery. Upstream flooding has been minimized since the river is now lower, and there is more freeboard in the channel to allow for additional water to be held between the banks. Fishing has also improved. The St. Johns Bridge Scenic River Area is the newest public access site on the river. It is located in the area of where the dam stood for all those years, a tribute to the rapid recovery of the river system, and to those who enjoy this fine river.

Canoeing and fishing are popular recreational activities in the Sandusky State Scenic River.

Sandusky Bay

The Sandusky Bay is a key feature of the Sandusky River watershed. While providing shipping port access, recreational boating, fish spawning grounds, and sport fishing, little research has been done to fully describe the Bay's condition and health. In contrast, extensive studies have been completed in the Sandusky River and its tributaries describing the watershed's potential loading of nutrients and pollutants into the Bay.

According to Ohio's Coastal Atlas, the Sandusky River watershed discharges 275 billion gallons of water and 250,000 tons of sediment into the Bay annually. The water and sediment carry approximately 453.5 metric tons of total phosphorus and 5,608 metric tons of nitrogen as nitrate. Peaks in phosphorus loads have been associated with urbanized areas in the watershed, but the bulk of the phosphorus and nitrogen loading has been attributed to non-point source pollution in this predominantly agricultural watershed.

Water from the Sandusky River moves through Muddy Creek Bay on its path into Sandusky Bay. The surrounding lands around Muddy Creek Bay are part of the natural estuarine and wetland habitat area with remarkable populations of water foul, fish, and Bald Eagles. The area historically was home to an extensive wet prairie system composed of wild rice and other waterfowl supporting foods. As the watershed became more affected by agricultural production and urban development, levels of sediment and turbidity impacted the quality of these natural habitats. The decline of the coastal habitats has lead to a reduction in many wildlife populations.

Sediment dredging creates the main shipping channel across the Sandusky Bay. The dredged channel extends along the shore at the City of Sandusky, turns north along the railroad coal loading dock, then heads east across the lower Bay toward Cedar Pont, and into Lake Erie. This channel is authorized by the Army Corps of Engineers to be dredged at between 21-26 feet in depth. The shoaling that occurs soon after the dredging keeps the actual depth shallower and with lower lake levels, shallower still. Approximately 240,000 cubic yards of material must be dredged every year to maintain the designed channel.

Historically the Sandusky Bay was a significant freshwater fish supply for the United States providing over ten million pounds annually. The Bay also supplied natural ice prior to the advent of electric refrigeration to the region's ice houses. In addition the bay's shipping port has supported a substantial coal export in connection with the Norfolk Southern Corporation's dock and rail system. The coal export on the west side of the Bay continues to ship more than 4.8 million tons of coal annually constituting approximately 97 percent of all commercial traffic through the Bay. Other commodities moved through the Bay include salt, sand, and gravel.

Sandusky Bay has been the gateway to the Lake Erie Islands. As a long standing recreational playground since the mid 1800's, the Lake Erie Islands have drawn substantial numbers of tourists for boating, fishing, and swimming as well as supporting wineries, quarries, and agriculture. The islands have had international draw for the summer seasons and housed some families for many generations as permanent islanders. Multiple ferries connect the mainland to the islands leaving from the Bay and other surrounding ports.

Located at the eastern edge of Sandusky Bay, Cedar Point was home to the lighthouse for the local fishermen and hunters in the nineteenth century. Upon the arrival of the rail road system, Cedar Point quickly developed into an entertainment and recreational area housing venues like bath houses, a dance hall, bowling alleys, picnic areas, and roller coasters. Through the beginning of the 20th century more and more rides, hotels and entertainment attractions were added, drawing visitors from across the lake and Ohio cities. In the 1950's a portion of the area along Cedar Point was set aside as a bird sanctuary that would eventually become Sheldon's Marsh State Nature Preserve. The park's attractions continue to grow and draw millions of visitors to the shores of the Bay and Lake Erie.

The latest research in the Sandusky Watershed is shedding light on the Bay's role in the watershed and the life cycles of its wildlife. Currently walleye are known to stay in or close to the Bay to spawn. Research on walleye and sucker populations has supported the removal of the Ballville Dam near the City of Fremont. Studies in the river indicate the dam is preventing both upward and downward fish population movement, limiting spawning habitat. The dam removal will certainly change the future of the fish populations in the watershed for years to come.

Soil Resource Information

Soil Resources

The soils of the Sandusky watershed formed in many different kinds of parent materials including glacial till, lacustrine and beach deposits, glacial outwash, recent alluvium, material weathered from bedrock and organic soil material.

There are 654 different soil types occurring in the watershed, each with its separate soil management concerns, crop productivity and capability for different land uses. The soils are dominantly nearly level, very poorly drained and somewhat poorly drained mineral soils formed in deposits of lacustrine material or glacial till but also include acreages of sandy soils on beach ridges and flats, organic soils in depressional areas and sloping erosive soils on short side slopes along valleys and narrow bands of end moraines.

Nearly level and gently sloping areas of somewhat poorly drained Blount soils comprise about 17 percent of the watershed. Very poorly drained Hoytville and Pewamo soils each make up about six percent of the watershed. These soils need artificial drainage for grain crop production due to wetness limitations.

Soil management concerns for most of the soils of the Sandusky Watershed include: a) seasonal wetness and the need for artificial drainage on about 780,000 acres of land; b) a hazard of soil erosion by water on about 316,000 acres of land; c) a hazard of soil erosion by wind on about 32,000 acres; d) a hazard of droughtiness due to a restricted root zone on about 38,000 acres; e) and a hazard of soil subsidence on about 1,000 acres of organic soils.

Land Capability System

Land capability classification shows, in a general way, the suitability and management concerns of soils for most kinds of field crops. In general, the soils here are grouped at two levels, capability class and subclass. Capability classes, the broadest groups, are designated by numbers 1 through 8 indicating progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1: soils having few limitations for use; Class 2: soils having moderate limitations;
Class 3: soils having severe limitations; Class 4: soils having very severe limitations;
Class 5: soils having severe limitations for use other than a hazard of erosion; and Class 6 and 7: soils having very severe limitations making them generally unsuitable for cultivation.

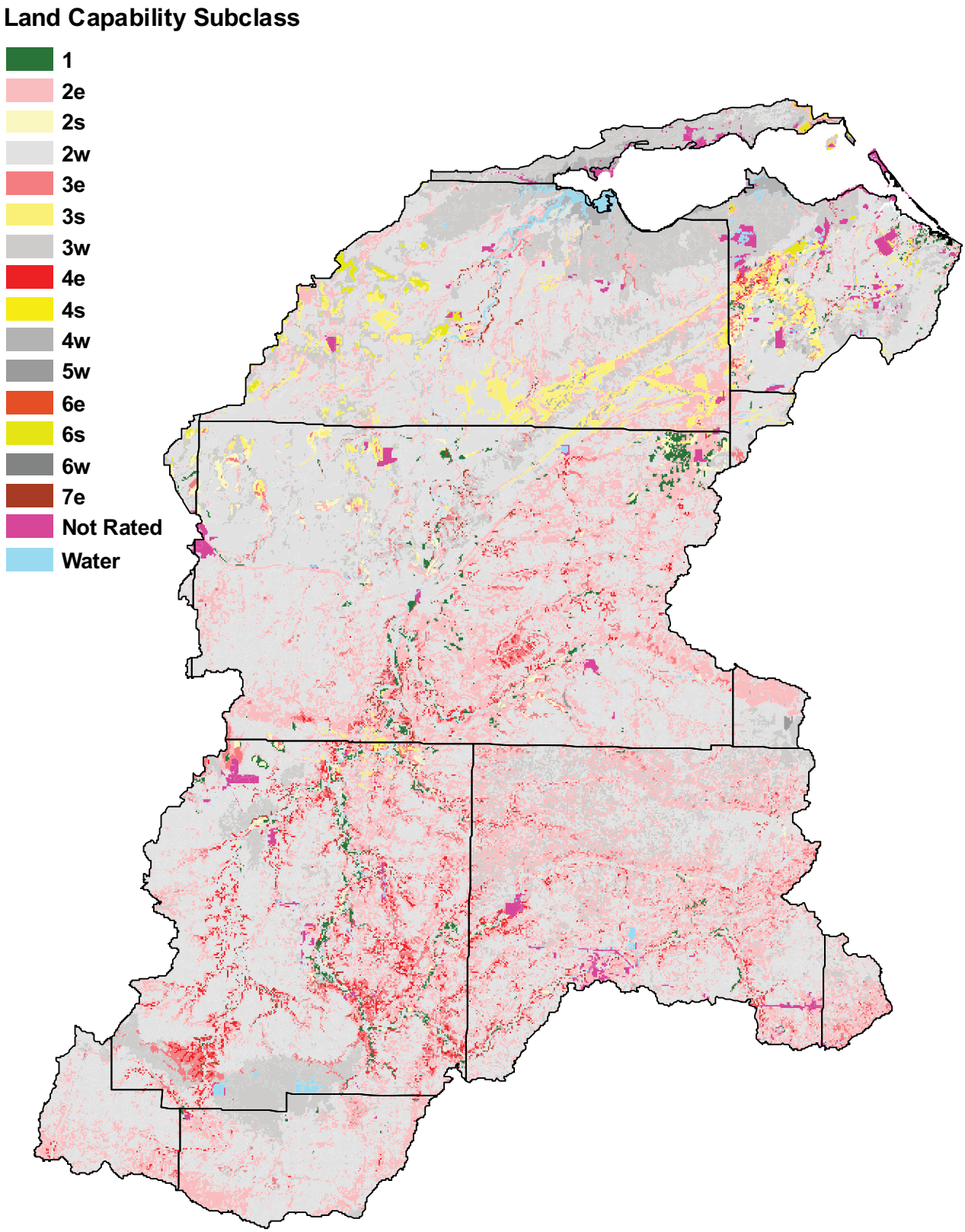
Capability subclasses are soil groups within one class and are designated by adding a lower case letter e, w, or s to the class number denoting a hazard of erosion, wetness, or a restricted root zone respectively.

In general, there are about 10,700 acres of Class 1 soils (having no significant limitations); 876,000 acres of Class 2 soils; 220,000 acres of Class 3 soils; 27,000 acres of Class 4 soils; 400 acres of Class 5 soils; 3,700 acres of Class 6 soils; and 6,000 acres of Class 7 soils.

Table 11 - Land Capability Subclasses

Land Capability Subclass	Acres
1	10,687
2e	250,641
2s	7,716
2w	617,880
3e	41,244
3s	25,938
3w	152,791
4e	18,382
4s	388
4w	8,390
5w	433
6e	16
6s	3,622
6w	44
7e	6,062
Not Rated	14,876
Water	7,964
Grand Total	1,167,075

Figure 14 - Land Capability Subclasses



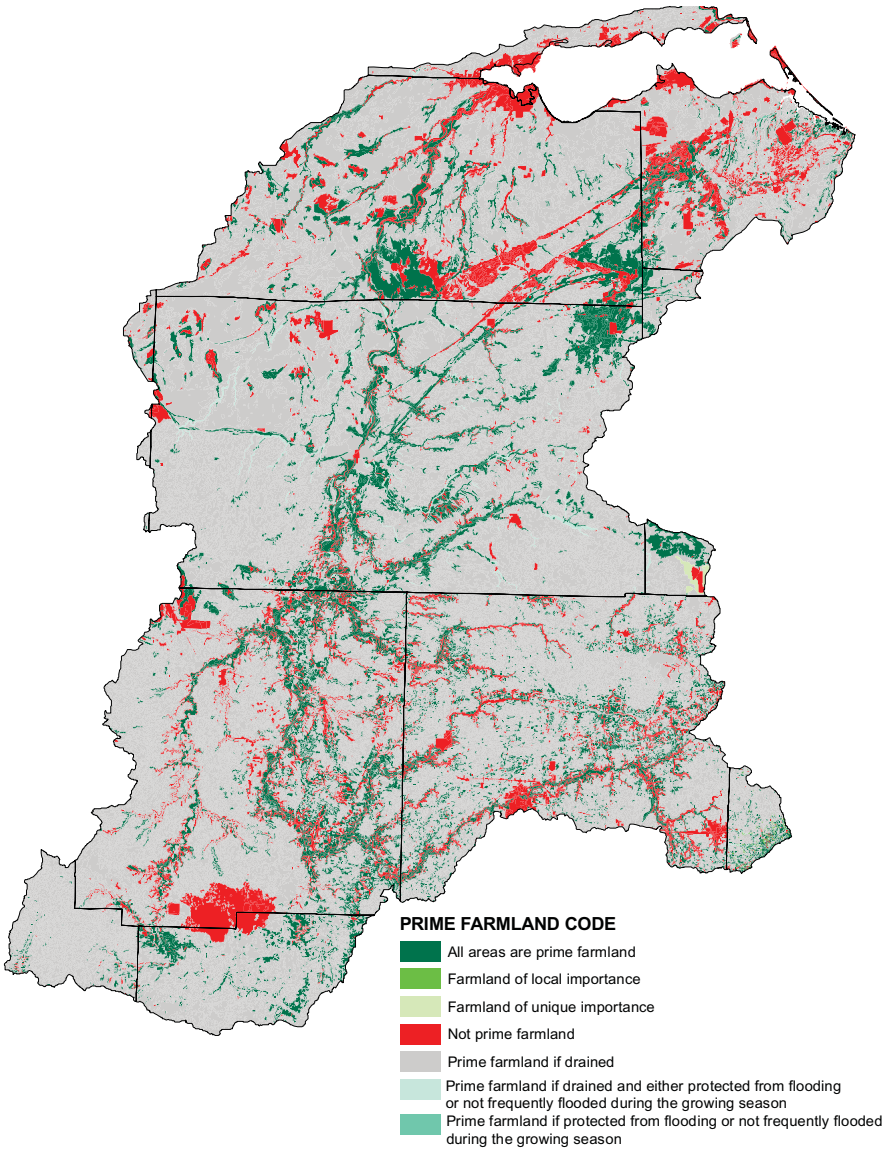
Prime Farmland Classification

Prime farmland is one of several kinds of important farmland defined by the USDA.

In the watershed, about 884,000 acres are listed as "prime farmland if drained," including areas of Blount, Hoytville, Mermill, Pewamo, Bennington, Haskins, Millgrove, Toledo, Colwood, and Del Rey soils; 158,000 acres are listed as "all areas are prime farmland" including areas of nearly level and gently sloping areas of Glynwood, Tuscola, Shinrock, Seward, Rossburg, Oshtemo Milton and Mentor soils; 6,000 acres listed as "prime if protected from flooding or not frequently flooded during the growing season" including frequently flooded areas of Genesee, Sloan, Wabasha, Shoals, and Holly soils.

In the Sandusky Watershed, about 117,000 acres are listed "not prime farmland," including Carlisle, Castalia, Channahon, Elnora, Granby, Ritchey, Seward, Sloan, Spinks, Tedrow, and Toledo ponded soils along with sloping to steep areas of Alexandria, Cardington, Chili, and Glynwood soils; 357 acres in Richland County have been designated "farmland of local importance" including some areas of Cardington and Rittman soils; and 870 acres of Carlisle and Linwood soils have been designated "farmland of unique importance" in Crawford and Huron Counties.

Figure 15 - Prime Farmland



Hydric Soil Distribution

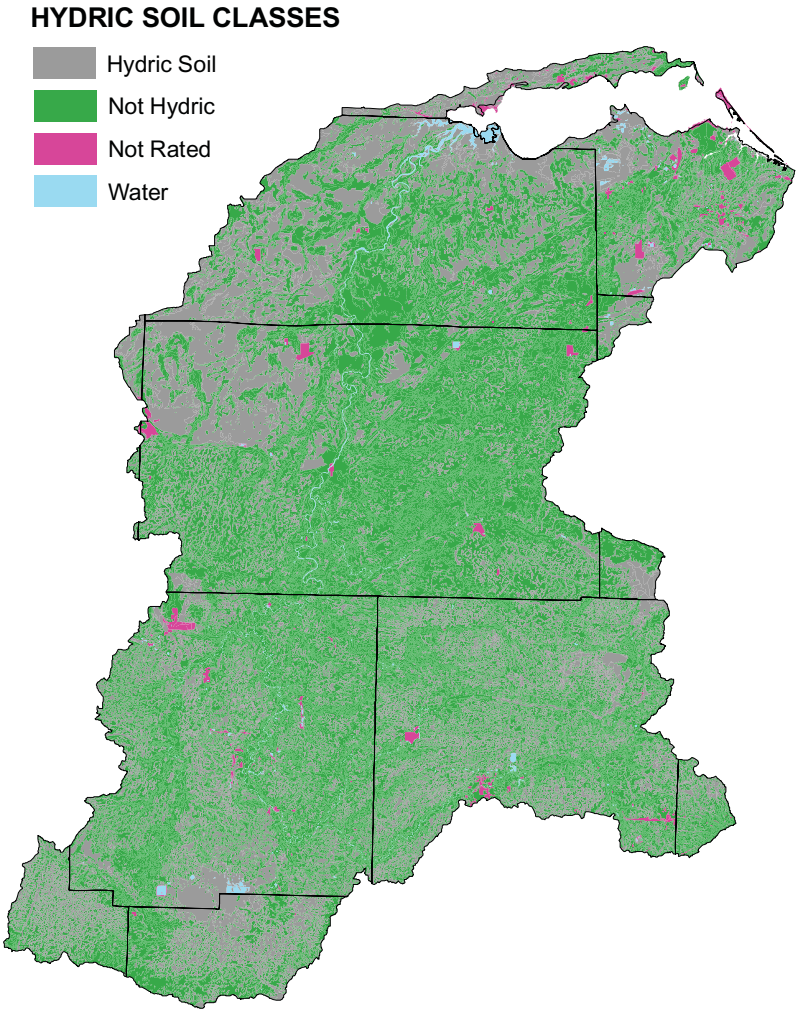
Hydric soils are those soils that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part of the soil and support the growth and regeneration of hydrophytic, or water-loving, vegetation.

In the Sandusky Watershed, hydric soils occur in on expansive flats and depressional areas and comprise about 34 percent of the watershed.

Of the 654 different soil types occurring in the watershed, 158 soil types are hydric soils occupying about 402,700 acres of the watershed. Hoytville silty clay loam, Lenawee silty clay loam, Pewamo silty clay loam, Pandora silt loam and Toledo silty clay are the most extensive hydric soils and occupy 69,000 acres, 25,000 acres, 53,000 acres, 24,000 and 26,000 acres respectively. Other extensive hydric soils include Milford silty clay loam and Luray silty clay loam

Many of these soils are well suited to artificial drainage for cropland.

Figure 16 - Hydric Soil



Soil Loss

Average soil erosion rates by water on cultivated and non-cultivated cropland in the Sandusky River Watershed has declined from about 3.1 T/Ac/Year in 1982 to about 1.9 T/Ac/Year in 1997.

Using land capability classes, average annual soil erosion rates on cropland for 1997 and 1982 were estimated from NRI as follows:

Table 12 - Average Annual Soil Erosion Rates on Cropland

Land Capability Subclass	1997	1982
	Soil Erosion Rate (T/Ac/Year)	
1	1.5	1.6
2e	2.9	4.9
2s	0.7	1.2
2w	1.2	2.0
3e	5.5	8.6
3s	1.3	1.7
3w	1.1	1.7
4e	8.5	14.1
4w	0.9	0.9
5w	1.4	Not Estimated

Figure 17 - 1997 Cropland Soil Loss by Land Capability Subclass (Tons/Year and Percentage)

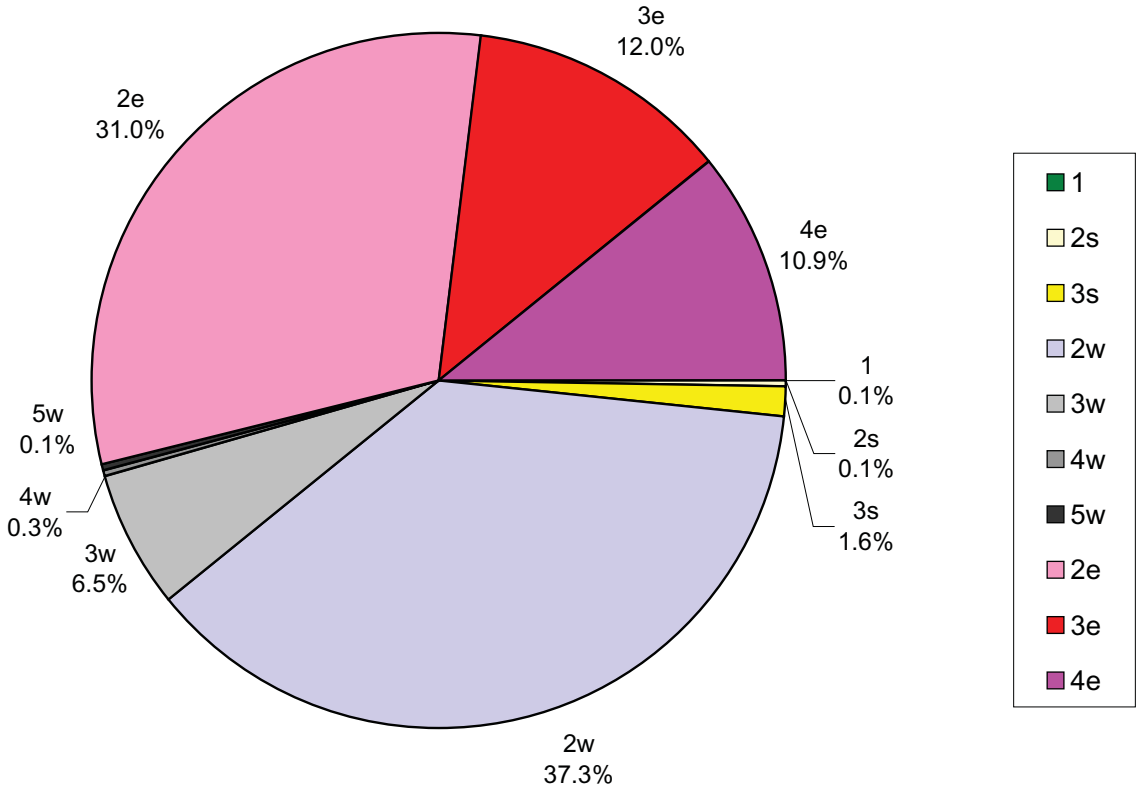


Table 13 - Estimated 1997 Gross Soil Loss from Cropland by Land Capability Subclass

Land Capability Subclass	Annual Gross Soil Loss (Tons/Year)	Percent of Total
1	1,800	0.1%
2s	2,100	0.1%
3s	25,400	1.6%
2w	609,900	37.3%
3w	106,700	6.5%
4w	4,800	0.3%
5w	1,400	0.1%
2e	507,600	31.0%
3e	196,900	12.0%
4e	179,000	10.9%
Total	1,635,600	100.0%

(No estimates for 4s, 6e, 7e, or 7s cropland)

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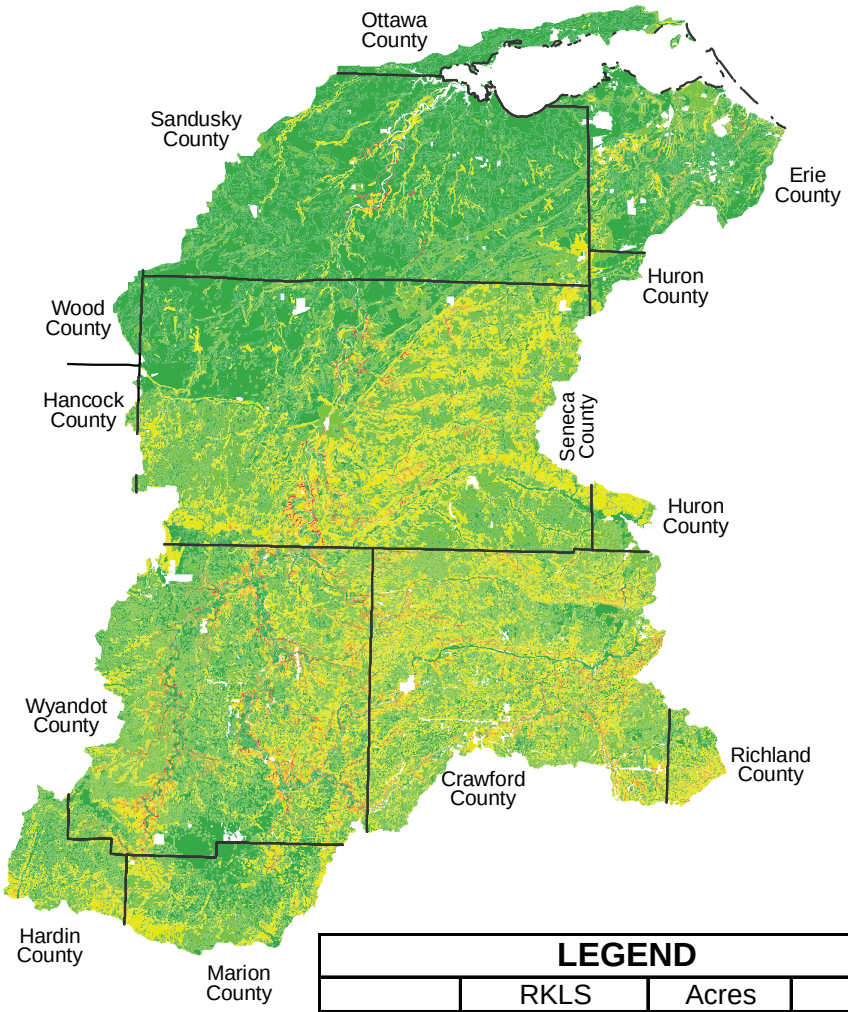
Analysis of Soil Erosion Potential Within the Watershed

The flat nature of this watershed often masks differences in soil erosion potential when typical highly erodible land measurements are used. For this reason, soil erosion potential was calculated for each map unit in the watershed by multiplying the Rainfall Factor (R) times the Soil Erodibility Factor (K) times the Length Slope Factor (LS). These resulting values were grouped by ranges. The higher the resulting RKLS value, the greater the potential for the soil to erode.

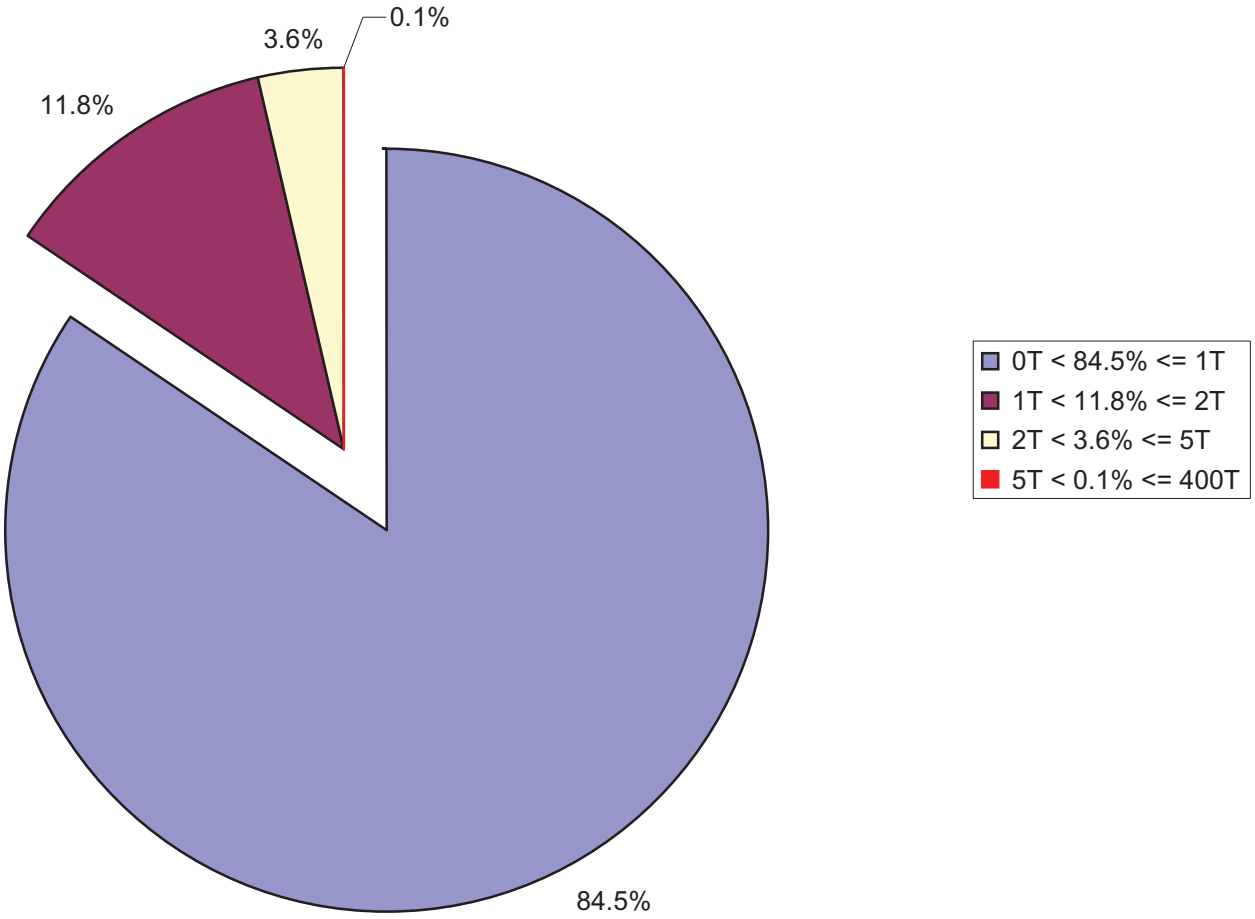
Figure 18 depicts areas within each range. Areas that are yellow, orange or red show highest inherent potential for the soil to erode. This analysis does not account for any management or treatment practice in place that will affect the actual rates of erosion. It only measures potential.

Figure 18 - Soil Erosion Potential (R x K x LS)



LEGEND			
	RKLS	Acres	%
	<= 5.5	503,980	43.2%
	5.6 to 12.2	346,070	29.7%
	12.3 to 37.4	251,690	21.6%
	37.5 to 175	30,520	2.6%
	175.1 to 600	5,050	0.4%
	Not rated	28,130	2.4%
	Total =	1,165,440	100.0%

Figure 19 - 1997 Cultivated Cropland Soil Erosion Rates as a Multiple of "T"



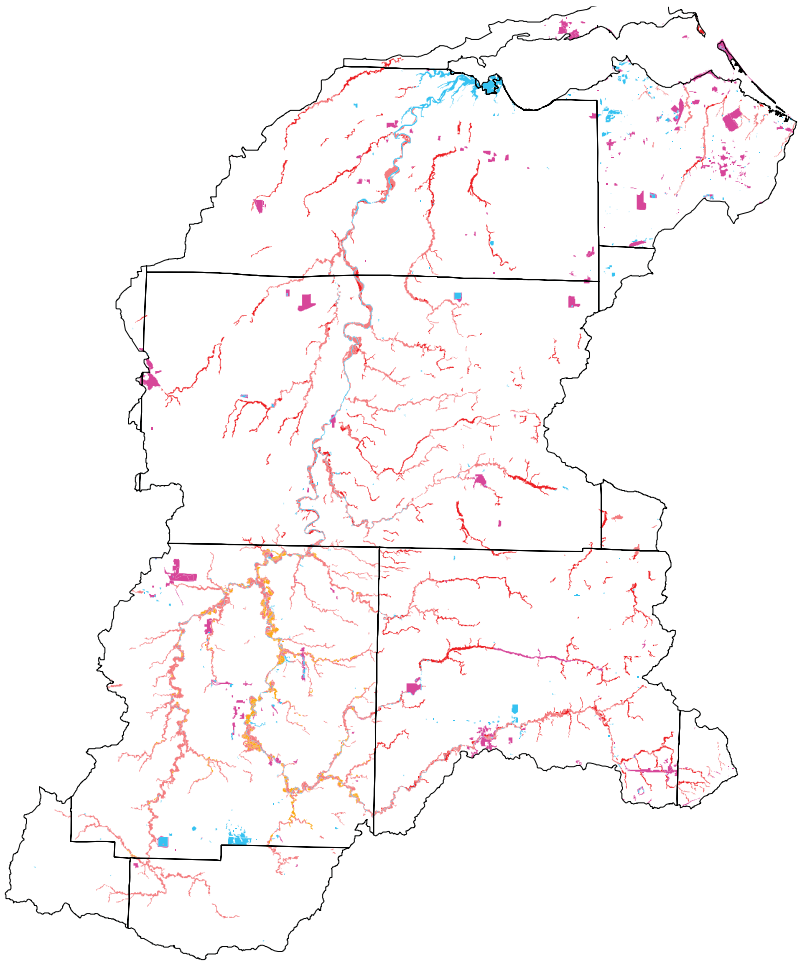
Ephemeral Gully Erosion

Sheet Erosion

Flood Plain Soils

Soils formed in recent alluvium on naturally occurring flood plains comprise about 45,760 acres or about 3.9 percent of the Sandusky Watershed. These soils are on relatively narrow flood plains along streams that commonly occur at the base of sloping to very steep uplands. These soils formed in recent deposits of alluvium that were deposited by stream bank overflow. These soils may flood frequently (usually about once per year), occasionally (usually about once every other year) and some soils may only flood rarely. Soil maps identify alluvial soils by soil map unit name and they interpret the flooding frequency and are landform based.

Figure 20 - Flood Prone Soils



FLOODING FREQUENCY

- Frequent
- Occasional
- Rare
- Water
- None
- Not Rated

Table 14 - Flood Prone Soils Data

	Acres
Frequently Flooded	14,670
Occasionally Flooded	27,970
Rarely Flooded	3,100

Flooding in the Sandusky Watershed

Historical flooding on the Sandusky River is recorded by stream gages in the watershed. There are 5 active stream gages in the hydrologic unit (as seen in the table below) besides 7 discontinued gages. For the 81 years of record available for the USGS gage 04198000 (Sandusky River near Fremont) there were 24 years where the annual peak stage was at or above the flood stage of 10.0 ft. The highest 10 stages of those 24 are given in the table below.

Table 15 - Sandusky Watershed Gage Runoff Data

USGS Gage	Area Sq. Mi.	Years of Gage Record (#)	Period of Record	Peak Q per unit area (cfs/S.M.)	Mean Annual Runoff (WS in.)	Max. Annual Runoff (WS in.)	Min. Annual Runoff (WS in.)
04197170 Rock Creek at Tiffin	34.6	24	1983-2006	76.3	12.19	19.62	4.55
04196000 Sandusky River near Bucyrus	88.8	54	1926-2006[1]	152.0	13.68	22.18	3.12
04197100 Honey Creek at Melmore	149.0	46	1961-2006	29.5	12.39	20.56	4.38
04196800 Tymochtee Creek at Crawford	229.0	47	1961-2007	29.3	11.61	22.38	4.28
04198000 Sandusky River near Fremont	1251.0	81	1924-2006[2]	29.2	11.40	23.51	2.99

[1] missing years 1936-38, 1952-58, 1960-63, 1982-86, and 1988-95
[2] missing years 1937-38

Table 16 - Sandusky River Near Fremont Highest Annual Peak Stages

Date	Q (cfs)	Stage(ft.)
3/16/1978	36,500	13.57
2/4/1984	32,700	12.63
2/10/1959	28,000	15.20
1/15/1930	27,300	11.10
2/24/1985	26,700	11.08
6/14/1981	25,200	10.61
6/2/1997	24,800	10.59
12/31/1990	24,000	10.34
3/4/1979	23,600	10.16
2/15/1950	22,900	9.87

Crawford County Flooding, August 21, 2007

Ottawa County Flooding, June 21, 2006

Karst Area Flooding, Spring 2008

Drainage is a big concern for landowners and farmers in the Sandusky River Watershed. The dominant wet soils require subsurface and surface drainage systems to maximize crop production. In the spring of 2008, drainage problems were compounded when ground water in the karst area around Bellevue, Ohio, flowed out of the sink holes that typically provide drainage for the area. Fields looked like lakes, houses were sandbagged, and sump pumps were running around the clock. Flooding started in early March and did not recede until May. The flooding impacted about 150 Bellevue residences. Unlike typical storm event related flooding, this flooding originated from high groundwater tables due to year long excessive rainfall.

WIND EROSION

There are about 32,200 acres in the Sandusky watershed comprised of soils subject to a severe wind erosion hazard. These soils primarily have sandy surface layers and occur on glacial beach ridges and deltas and nearshore bars on lake plains. They are subject to blowing and wind erosion if left bare during the winter and spring months. Areas of organic soils, such as Carlisle muck, are also subject to severe wind erosion in the Sandusky Watershed.

FIGURE 21 -SOILS SUBJECT TO SEVERE WIND EROSION

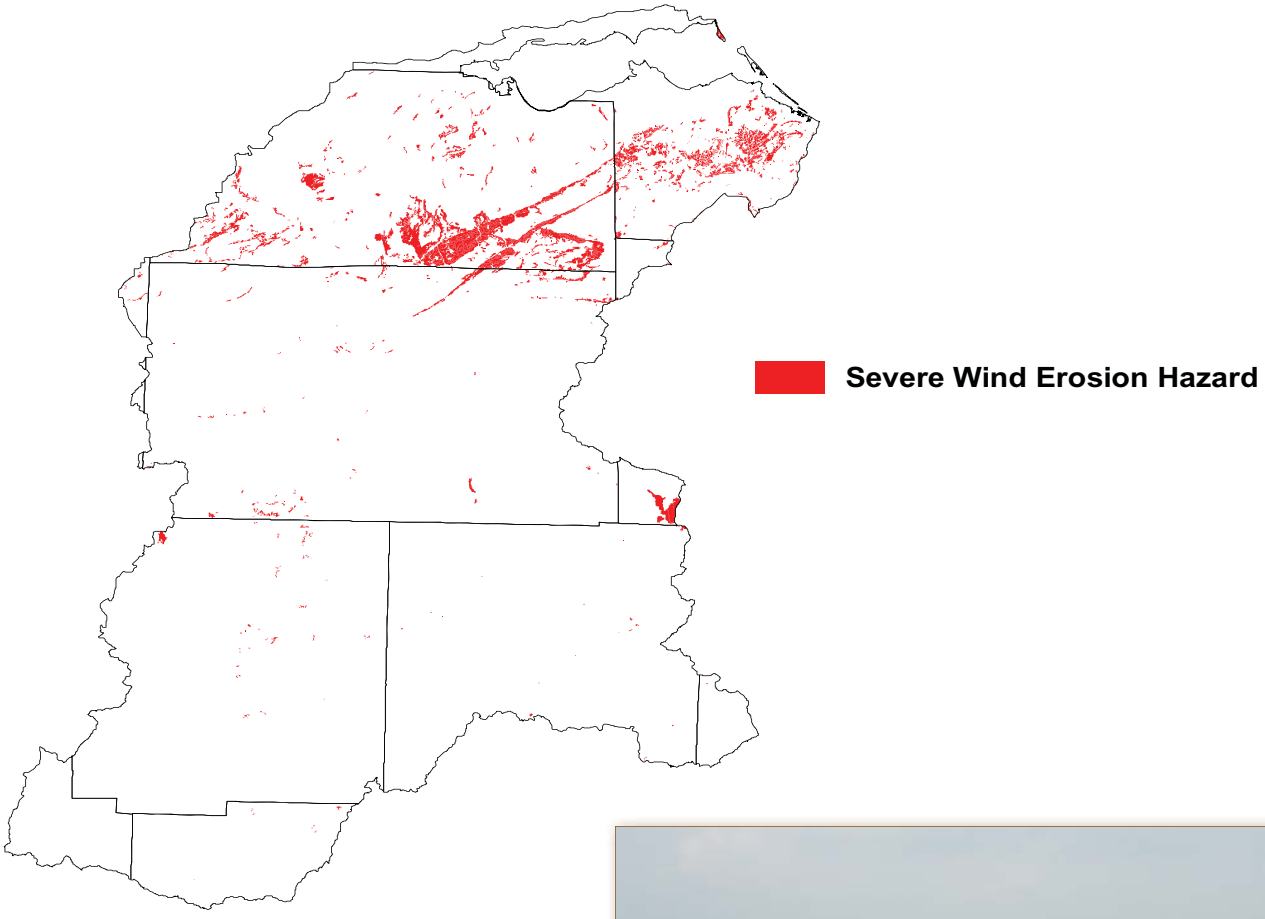


TABLE 17 - AIR RESOURCE CONCERNS TABLE

Soils Subject to Wind Erosion (acres)	
Organic Soils	Mineral Soils
1,760	30,440

New Crawford County Field Windbreak in the Sandusky Watershed.

Plant and Animal Resources

Livestock Resources Information

Most of the livestock in the watershed is raised in confinement operations with the high percentage of cropland in the watershed. Pasture is a minor land use. Dairy/Beef, Swine, and Poultry are all significant components of the livestock industry in this watershed. In recent years considerable and steady growth in confinement hog operations has occurred and continues to occur. Horses for pleasure are a livestock component of this watershed. Grassed based intensive grazing operations are sprouting as new enterprises in the watershed. At the present time, these operations are small and moderate, but in recent years interest has been increasing.

Dairy/Beef produces the most manure on a dry tonnage basis, but swine manure is the largest quantity when liquids from storage and handling are factored in. The bulk of the livestock waste generated in the watershed is utilized via application to cropland. Waste is handled in both the liquid and solid form, but liquid manure is the predominate form in which manure is applied.

There are estimated to be 1622 livestock operations in this watershed and 650 are estimated to have (or be following) a recent current/sufficient Comprehensive Nutrient Management Plan (or be following the 633 Waste Utilization Standard). The remaining 968 producers need a new or revised CNMP plan or partial CNMP planning assistance. There is ample land in the watershed to utilize the livestock waste generated. The waste generated is estimated to supply eight percent of the total phosphorous needs for the crops grown in this watershed.

Table 18 - Livestock Operations Data

Sandusky Watershed Livestock Operations Data	Number
Total Number of Confined Livestock State Permitted Operations in the Watershed	4
Estimated Number of Non Permitted Confined Livestock Operations in the Watershed	1,618
Number of Non Permitted Facilities in the Watershed with Recent Comprehensive Nutrient Management Plans or following 633 Waste Utilization Standard	650
Estimated Number of New Comprehensive Nutrient Management Plans (CNMP's) that may be needed in the Watershed	968

Table 19 - Estimated Livestock Animal Units, Manure Production, and Nutrient Production

County and Watershed Totals	AU	AU	AU	AU	Manure Production(Tons/ Yr.)			Nutrient Production (1000 Lbs./Yr.)		
	Dairies	Beef	Swine	Poultry	Dairy/Beef	Swine	Poultry	N	P2O5	K2O
Crawford	2,674	4,934	6,359	4	75,051	78,442	45	1,705	1,164	1,247
Erie	1,114	1,184	300	2	24,348	3,703	18	287	149	215
Hancock	2,897	1,645	2,661	1	51,913	32,824	18	916	579	676
Hardin	13,436	3,289	7,369	17,550	219,468	90,898	208,409	7,496	6,279	5,001
Huron	7,800	2,763	1,542	11	126,541	19,021	116	1,488	772	1,116
Marion	5,728	263	3,521	1	82,856	43,429	12	1,352	830	1,000
Ottawa	1,114	263	423	5	17,032	5,218	54	234	133	174
Richland	13,594	6,842	2,224	250	236,636	27,438	2,972	2,739	1,416	2,050
Sandusky	1,114	4,211	696	6	48,384	8,585	71	586	310	439
Seneca	1,114	7,039	4,285	2	70,853	52,855	14	1,349	875	992
Wood	2,229	1,908	819	5,601	45,038	10,100	66,505	1,913	1,692	1,244
Wyandot	3,789	1,908	6,673	11,257	65,956	82,313	133,677	4,361	3,944	2,856
Sandusky WS	11,159	16,766	12,804	61	284,911	157,943	723	4,769	2,960	3,522

Note: Poultry estimates err on the low side because yearly statistics do not report them. Some poultry data is taken from the 2002Census of Agriculture but there as well the data may be unreported where it would disclose individual farm numbers.

	Nutrients/Cropland Acre (Lbs/Ac/Yr)		
Sandusky W/S	N	P2O5	K2O
Produced by animals in the watershed	6.3	3.9	4.7
Needed for crop production in the watershed	67.2	47.5	77.0

Wildlife and Endangered Species

Wildlife habitat in much of the watershed is influenced by the predominance of land devoted to intensive cropping. In these areas, virtually all native vegetation has been removed. Most of the agricultural land provides marginal habitat for common edge or disturbance adapted species; lack of winter cover or food for resident species is severely limiting. Permanent cover in the form of woodland, wetlands or grasslands is limited (approximately 14 percent), fragmented and subject to a variety of disturbances. Originally this area had extensive marshes near Lake Erie and widespread wet woods in the rest of the watershed; now, the amount of wetland is approximately 5-10 percent of the watershed. Many large, diked and managed wetlands are found around Sandusky Bay; these provide significant habitat for waterfowl, shorebirds and other wetland-dependent species. Increasing presence of invasive plant species is a management concern in these wetlands. Within the rural areas of the watershed, woodlands occur mostly as small isolated woodlots or narrow riparian borders. At one time, scattered wet prairies occurred in the watershed; now, very few large grassland areas (CRP, old field, pasture) exist and most are subject to disturbance such as mowing which negatively impacts wildlife use. There are increasing amounts of narrow grass borders in cropland areas, but these are still very minimal in terms of benefits to wildlife. Within the urban areas, significant wildlife habitat is limited to a few parks or natural areas.

Habitat quality in streams and rivers in the watershed is negatively impacted by excess sediments, nutrients, stream modification and lack of permanent riparian cover in both rural and urban areas. Smaller tributaries and headwaters are the most severely impacted. The main stem of the Sandusky River does support some significant habitat for fish and other aquatic species. The planned removal of the Ballville Dam near Fremont is expected to extend spawning for walleye and other species for an additional 20 miles up the Sandusky River.

In the majority of the watershed, the presence of unique plant communities and threatened or endangered species is minimal. Some of the privately and publicly owned areas in the northern part of the watershed do provide significant habitat for some listed species.

Table 19 primarily reflects the limited fish and wildlife habitat associated with most of the rural and urban areas. Table 20, listing some of the rare and endangered species, only includes those species which are Federally listed as well as those listed as Endangered by the state of Ohio.

Table 20 - Habitat Reference Information

	Availability and Condition of Wildlife Habitat				
	Much Less Than Typical State Watershed	**Less Than Typical State Watershed**	**Comparable to Typical State Watershed**	**Better Than Typical State Watershed**	**Much Better Than Typical State Watershed**
Stream Habitat	N/A	Condition degraded in many places	N/A	N/A	N/A
Grassland Habitat	Limited extent Low quality	N/A	N/A	N/A	N/A
Wetland Habitat	N/A	N/A	Some large marshes around Sandusky Bay	N/A	N/A
Forest Habitat	Limited extent Low quality	N/A	N/A	N/A	N/A

These designations were based on information from OEPA Water Quality reports, Ohio Division of Wildlife Comprehensive Wildlife Plan, qualitative review of land cover information using broad wildlife habitat models and expert opinion

Table 21 - Rare or Endangered Species Information

Rare or Endangered Plant Species Reported from Watershed	Rare or Endangered Animal Species Reported from Watershed
Rare or Endangered Plant Species Reported from Watershed	Rare or Endangered Animal Species Reported from Watershed
Western Hair Rock Cress Arabis hirsuta	Black Tern Chlidonias niger
Northern Fox Sedge Carex alopecoidea	Common Tern Sterna hirundo
Garber's Sedge Carex garberi	Northern Harrier Circus cyaneus
Small White Lady's Slipper Cypripedium candidum	Loggerhead Shrike Lanius ludovicianus
Engelmann's Spike-rush Eleocharis engelmannii	King Rail Rallus elegans
Caribbean Spike-rush Eleocharis geniculata	Bald Eagle Haliaeetus leucocephalus
Ovate Spike-rush Eleocharis ovata	Eastern Plains Garter Snake Thamnophis radix radix
Canada St. John's-wort Hypericum canadense	Lake Erie Watersnake Nerodia sipedon insularum
Least St. John's-wort Hypericum gymnanthum	Easter Massassauga Sistrurus catenatus
Diffuse Rush Juncus diffusissimus	Western Banded Killifish Fundulus diaphanus menona
Tall Cinquefoil Potentilla arguta	Northern Riffleshell Epioblasma torulosa rangiana
Bushy Cinquefoil Potentilla paradoxa	Rayed Bean Villosa fabalis
Smooth Rose Rosa blanda	Plains Clubtail Gomphus externus
Michaux's Blue-eyed Grass Sisyrinchium mucronatum	Blazing Star Stem Borer Papaipema beeriana
Bushy Aster Aster dumosus	Spartina Borer Moth Spartiniphaga inops
Northern Bog Violet Viola nephrophylla	

Conservation Systems and Practice Application Data

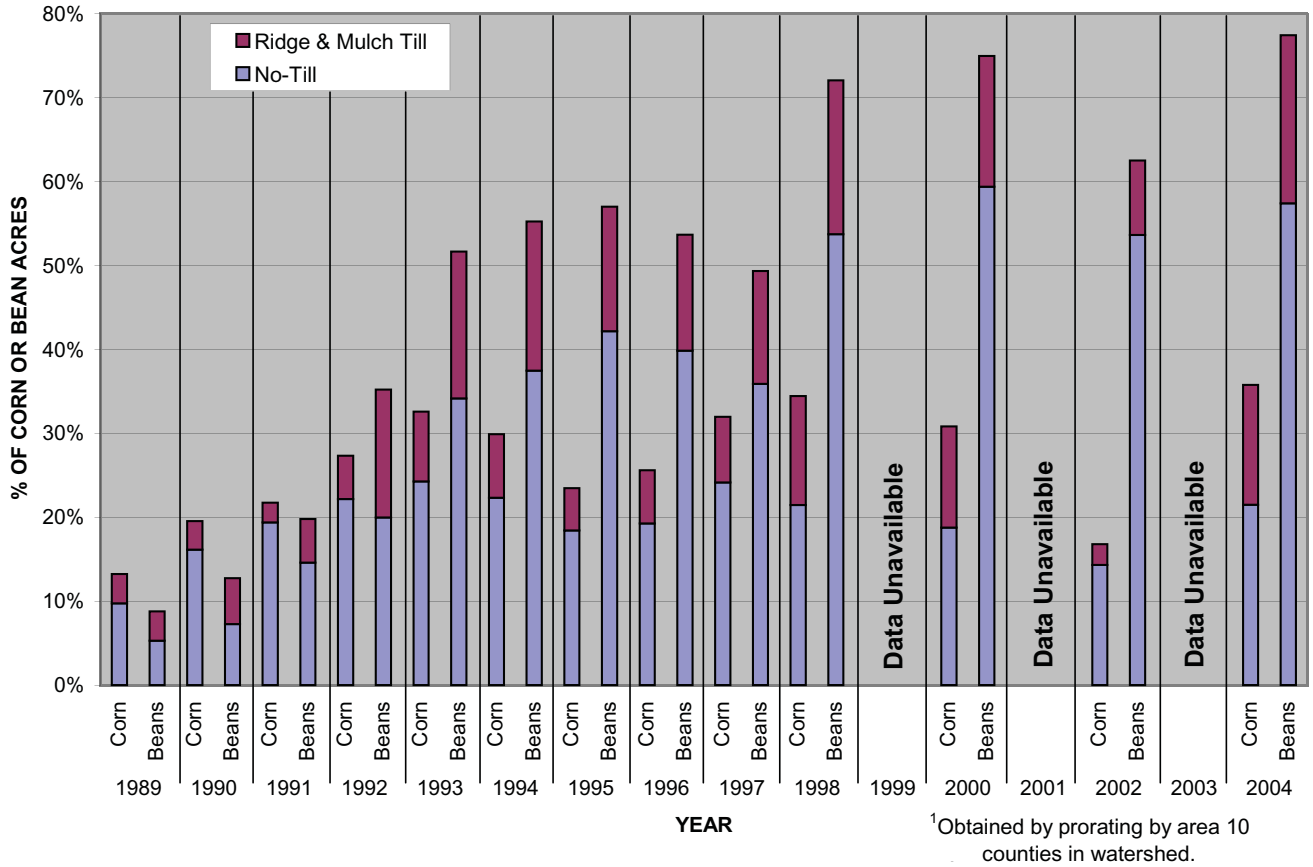
The following table was produced using NRCS' Performance Results System (PRS) and shows the application of key conservation practices and systems plus the number of conservation system acres applied by Farm Bill Program. PRS is used to track, analyze and report NRCS conservation accomplishments. For more information on these and other reports visit: http://ias.sc.egov.usda.gov/PRSHOME/.

Table 22 - NRCS Conservation Progress Performance Measures

	FY01	FY02	FY03	FY04	FY05	FY06	Total
Total Conservation Systems Planned (acres)	20,749	20,558	26,760	N/A	14,397	32,032	114,496
Total Conservation Systems Applied (acres)	19,438	19,713	17,072	N/A	13,742	16,857	86,822
Conservation Practices							
Erosion Control Total Soil Saved (tons/year)	50,406	107,384	16,308	N/A	22,900	42,881	239,879
Filterstrips (393) (acres)	61	15	58	23	14	82	230
Grassed Waterways (412) (acres)	5	18	24	5	10	31	88
Prescirbed Grazing (528 and 528A) (acres)	0	56	0	0	235	104	395
Residue Management (329A-C) (acres)	10,220	6,831	3,589	4,728	8,913	12,124	41,677
Riparian Forest Buffers (391) (acres)	121	67	96	73	1,270	323	1,877
Tree and Schrub Estabilishment (612) (ac)	137	62	40	39	73	22	334
Total Nutrient Management (acres)	17,035	27,615	12,516	4,752	8,514	9,527	75,207
Total Waste Management (313) (numbers)	0	0	0	1	4	8	12
Total Wetlands Created, Restored, or Enhanced (ac)	57	85	71	27	48	72	333
Total Wildlife Habitat (644 - 645)	1,727	843	636	503	1,097	1,238	5,541
Acres Enrolled in Farm Bill Programs							
Conservation Reserve Program	16,396	12,731	11,057	N/A	2,826	1,178	44,188
Environmental Quality Incentives Program	2,827	1,630	0	N/A	3,166	5,783	13,406
Farmland Protection Program	0	0	0	N/A	0	0	0
Wetlands Reserve Program	106	204	0	N/A	11	38	359
Wildlife Habitat Incentive Program	0	0	15	N/A	0	102	117

Performance Results System (PRS) data was extracted (at the Hydrologic Unit Code level) for conservation systems and practices for six years (starting in fiscal year 2001). Information at the hydrologic unit code level was not available where N/A is listed. For more information on these and other performance reports visit: http://ias.sc.egov.usda.gov/PRSHOME/.

Figure 22 - Conservation Tillage Trends



Corn and soybeans planted in crop residue.

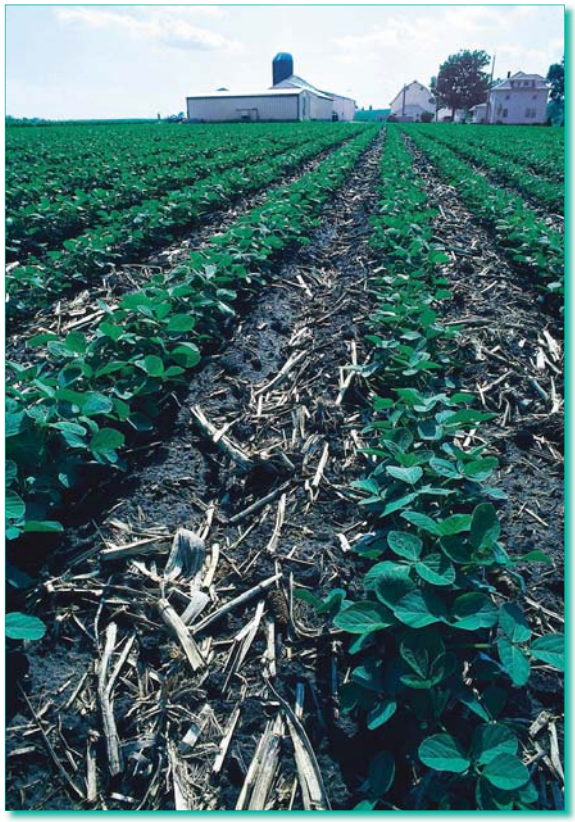


Table 23 - Agricultural Census Data and Economic Information

USDA Census of Agriculture - 2002	Total County Data										Watershed Data[1]
	Crawford	Erie	Hardin	Huron	Marion	Ottawa	Richland	Sandusky	Seneca	Wyandot	
Farms (number)	693	392	842	865	520	517	1,086	1,185	607	3,291	802
Land in farms (acres)	234,204	94,681	246,393	228,346	205,605	114,430	158,653	280,449	201,146	906,469	196,152
Average size of farm (acres)	338	242	293	264	395	221	146	237	331	281	245
Harvested cropland (acres)	207,911	77,277	207,482	181,438	183,317	95,452	101,580	234,949	171,793	776,672	171,915
Market value of crop products sold ($1,000)	$38,696	$29,354	$34,277	$53,294	$35,377	$21,988	$19,739	$43,627	$25,738	$157,441	$45,393
Market value of livestock, poultry & products ($1000)	$30,159	$3,252	$61,272	$13,102	$12,226	$1,918	$26,615	$11,972	$46,407	$91,049	$5,651
Vegetables harvested for sale (farms)	10	34	11	33	6	29	44	15	5	83	42
Vegetables harvested for sale (acres)	69	521	--	3,939	43	1,569	293	1,161	--	3,824	2,673
National Agricultural Statistics Service - 2006											
Wheat Winter - Harvested (acres)	25,900	8,800	21,400	22,400	14,000	15,600	8,300	42,900	27,900	114,022	22,700
Corn For Grain - Harvested (acres)	74,300	29,400	76,000	62,800	49,800	19,400	24,800	77,000	61,900	264,277	57,600
Soybeans - Harvested (acres)	107,600	36,400	115,500	92,600	106,000	51,200	42,100	117,400	97,900	402,528	83,000
Dry Hay - Harvested (acres)	3,800	3,000	6,000	6,900	4,400	5,100	16,300	4,800	3,600	20,927	7,900
NRCS Conservation Program Financial Assistance											
1996 Farm Bill (includes EQIP & WRP)	$164,539	$405,708	$725,337	$662,747	$771,656	$827,297	$41,949	$234,362	$198,574	$1,378,477	$419,513
Environmental Quality Incentives Program ('02-'08)	$880,341	$789,579	$982,715	$3,049,446	$710,514	$262,868	$1,053,113	$1,250,453	$309,582	$3,391,464	$600,901
Conservation Security Program ('04-'06)	$0	$2,930,762	$559,067	$11,288,817	$0	$0	$0	$191,160	$0	$2,162,404	$0
Wetland Reserve Program ('02-'07)	$0	$14,136	$1,700,382	$0	$1,381,100	$451,030	$0	$0	$179,000	$1,004,082	$462,000
Wildlife Habitat Incentives Program ('02-'07)	$0	$0	$13,000	$4,527	$29,145	$77,004	$29,165	$2,192	$0	$36,531	$23,073
Farm & Ranch Lands Protection Program	$0	$0	$0	$0	$112,738	$0	$0	$92,981	$0	$194,979	$111,250
Grassland Reserve Program	$0	$0	$0	$0	$13,431	$0	$0	$0	$0	$2,669	$0
Total 1996-2008 NRCS Administered Program Dollars	$1,044,880	$4,140,185	$3,980,501	$15,005,537	$3,018,584	$1,618,199	$1,124,227	$1,771,148	$687,156	$8,170,607	$1,616,737

[1]Prorated by county area in watershed

Watershed Projects and Planning Information

Table 24 - Local Watershed Related Organizations Identified in the Watershed

Organization Name	Description/Purpose/Benefits	Contact Information	Type of Group (Govt., NGO, partnerships)
Black Swamp Conservancy	The mission of the Conservancy is to encourage conservation and protection of natural and agricultural lands in Northwest Ohio for the benefit of future generations.	**Website:** www.blackswamp.org **Email:** bsc@blackswamp.org	Non-profit
Friends of Minnow Creek	To protect and enhance the entire Minnow Creek Watershed ground and surface water resource base through education, implementation of BMP's and low impact practices and maintaining Minnow Creek.	**Contact Address:** 1000 South St. Fremont, Ohio 43420 **Contact Phone:** 419-332-3618	NGO
Friends of Pipe Creek	Educate the public and develop partnerships; promote sustainable development, preservation, and restoration of the area's water quality, biological health and natural beauty through active watershed stewardship and best use land practices.	**Website:** www.firelandstributaries.org/fopcw **Email:** bhohman@erie-county-ohio.net	Partnership
Firelands Coastal Tributaries	The Firelands Coastal Tributaries (FCT) Watershed Program is a diverse group of government agencies, non-profit groups and local residents working together to enhance, restore, and protect our local streams.	**Website:** www.firelandstributaries.org **Email:** bhohman@erie-county-ohio.net	Partnership
National Center for Water Quality Research	The NCWQR supports the sustainable use of our nation's water resources and the protection of human health and ecological integrity as they are affected by the quality of these resources.	**Website:** www.heidelberg.edu/WQL **Email:** ncwqr@heidelberg.edu	Institution for Higher Education
ODNR, Scenic Rivers Program	State program to protect Ohio's remaining high quality streams for future generations.	**Website:** http://www.dnr.state.oh.us/tabid/985/default.aspx	State Government
Sandusky River Watershed Coalition	Provide leadership for the conservation and enhancement of the Sandusky River watershed and its natural resources through community-based planning, education and action.	**Website:** www.sanduskyriver.org **Email:** cabrookes@wsos.org	Partnership
Soil and Water Conservation Districts for each county in the Watershed	Conservation Districts are locally organized self-governing bodies chartered by the State. Through voluntary action and cooperation of landowners (and other stake holders), the District works to conserve land, water, forest, wildlife and other related resources for the benefit of all.	**Website:** http://www.nacdnet.org/about/districts/websites/	State and Local Government
Western Lake Erie Waterkeeper Association	To preserve, protect, and improve the watershed, waters, and fish of Western Lake Erie, the Great Lakes' warmest, shallowest, most biologically productive area, and to increase public awareness through collaboration, education and advocacy.	**Website:** http://www.westernlakeerie.org **Email:** sandylakeerie@aol.com	Non-profit

Source: http://ohiowatersheds.osu.edu/

Table 25 - List of Relevant Published Watershed Plans, Studies, Reports

Name	Description
Sandusky River Watershed Resource Inventory	By the Sandusky River Watershed Coalition, David Baker, Lead Author and Complier. Available at http://www.sanduskyriver.org/watershed/index.php?page=Resource+Inventory
The Upper Sandusky River Watershed TMDL	Total Maximum Daily Load Report by the Ohio Environmental Protection Agency, 2004. Available at http://www.epa.state.oh.us/dsw/tmdl/SanduskyRiverUpperTMDL.html
FEMA Flood Insurance Rate Maps (FIRM's) and Flood Insurance Studies (FIS).	Available for most Ohio villages and cities and unincorporated areas in Ohio on the flood map link at the website: www.fema.gov/hazard/flood/index.shtm Paper and digital copies of maps are issued by FEMA. The maps show areas subject to flooding
Groundwater Pollution Potential County Maps and Reports	Prepared using the DRASTIC system using existing data to rank areas with respect to relative vulnerability to contamination. Available for all counties in the Sandusky hydrologic unit except Hardin. Available at http://ohiodnr.com/water/gwppmaps/default/tabid/3541/Default.aspx
Ground Water Resources County Maps	Available at http://ohiodnr.com/water/Home/gwrmaps/default/tabid/3629/Default.aspx
Drinking Water Source Protection Plans/Reports	Public Water Systems within watershed counties with Drinking Water Source Protection Plans. Program administered by Ohio EPA. Website: http://www.epa.state.oh.us/ddagw/pdu/swap_securelogin.html

Summary and Observations of Watershed Resource Concerns

- The Sandusky hydrologic unit is largely flat with 80 percent of the land less than or equal to 2 percent slope.
- Sixty-five percent of the watershed is cropland and 86 percent of the cropland was corn and soybeans in 2006.
- From 1982 to 1997, urban land in the watershed increased by 30 percent.
- There are 3,347 miles of streams in the hydrologic unit. Approximately 54 percent of these are first order streams (headwaters of the watershed.)
- There are approximately 96,420 acres (about 8 percent) of land in the watershed within 120 feet of a stream. In the riparian buffer half as wide (60 feet wide on each side), there is an estimated 19 percent of cropland protected by Conservation Reserve Program (CRP) practices and cultivated cropland needing protection makes up approximately 34 percent of all land area in this zone.
- 13.6 percent of this watershed is prime farmland without improvement and an additional 76 percent is prime when drained. The 10 counties partially in the watershed have a combined market value of agricultural products of $560 million. Prorating the value by the percent of area in the watershed gives total watershed receipts of $248 million.
- This watershed has 35 percent hydric soils.
- This watershed has an active and organized watershed group (Sandusky River Watershed Coalition) that is online at http://www.sanduskyriver.org/watershed/. Their resource inventory indicates that agricultural runoff predominates loading of nutrients to Lake Erie while wastewater treatment plant effluent predominates in organic enrichment/Low DO in the streams.
- Ohio EPA has a completed TMDL for the Upper Sandusky River. It is available at http://www.epa.state.oh.us/dsw/tmdl/SanduskyRiverUpperTMDL.html. All watershed assessment units were impaired compared to their designated aquatic life and recreational uses. The major sources of impairment were identified as organic and nutrient enrichment, siltation, low dissolved oxygen, habitat and flow alterations, and pathogens. TMDLs were calculated for total phosphorus, sediment, and pathogens.
- Conservation practices of conservation tillage, conservation buffers, nutrient management, animal waste utilization, conservation cover and tree planting and drainage water management provide techniques to retard impairments, restore environmental health and meet the designated aquatic and recreational uses.
- Recent increasing trends of dissolved phosphorus loadings to Sandusky Bay and Lake Erie have been detected from river monitored data. There is renewed concern to limit phosphorus delivery to the Bay and Lake and offset the algal blooms and low dissolved oxygen.
- Ground water and surface water are both important water sources in the watershed. Among large water users (having capacity to withdrawal over 100,000 gallons/day) surface water accounted for 74 percent of the source waters and ground water 26 percent in 2005.
- Agriculture is a minor user of withdrawn water in the watershed compared to other users.

Next Steps

Part two of the assessment process is a matrix to summarize the conservation practices and systems needed for this watershed, the amounts, and the estimated costs of implementation. This matrix is a companion document that is published separately from this data profile. Based on this assessment the following conservation practices are significant practices that are needed and important in protecting the resources of this watershed. Also included is a listing of the USDA Farm Bill Incentive Programs which provide financial incentives for landowners to install these needed practices.

Needed Conservation Practices

Comprehensive Nutrient Management Plans
Conservation Tillage
Cover Crops
Drainage Water Management
Erosion Control Structures
Field Borders
Field Windbreaks
Filter Strips
Grass waterways
Nutrient Management
Pasture and Hayland Plantings
Riparian Forest Buffers
Tree Plantings
Upland Wildlife Habitat Management
Wetland Wildlife Habitat Management
Wetland Restoration or Creation

Applicable USDA Farm Bill Programs

Conservation Reserve Program (CRP and CREP)
Conservation Security Program (CSP)
Environmental Quality Incentive Program (EQIP)
Farm and Ranchland Preservation Program (FRPP)
Grazing Lands Conservation Initiative (GLCI)
Resource Conservation and Development (RC&D) Program
Wetland Reserve Program (WRP)
Wildlife Habitat Incentive Programs (WHIP)

References and Citations

1. Sandusky River Watershed 10-Meter Digital Elevation Model
Source: Ohio EPA and USGS Ohio Water Science Center derived 10-meter DEM from 7 ½ minute hypsography DLGs.

2. Sandusky River Watershed Average Annual Precipitation
Source: PRISM (Parameter-elevation Regressions on Independent Slopes Model) climate mapping system, 800-meter grid precipitation normals for 1971-2000, http://www.prism.oregonstate.edu/products/matrix.phtml?vartype=tmax&view=maps Last visited on 5/14/07.

3. Sandusky River Watershed Stream Orders
Source: Stream order from National Hydrography Dataset (NHD) high-resolution streams layer, http://nhd.usgs.gov, as calculated by Arcview extension streamorder.avx.

4. Sandusky River Watershed Soil Erosion Potential
Source: Data Source for LS values taken from typical values for SSURGO map units contained in Field Office Technical Guide, Section II, Cropland Interpretations.

5. The Livestock Estimate was prepared from county agricultural statistics data and a procedure developed in consultation with Ohio State University Extension and others. Reported livestock county numbers were prorated on a per acre basis to each of the county 8 digit HUC units. The resulting numbers were then evaluated and adjusted if needed by local NRCS field offices and NRCS/SWCD staff based on local knowledge of where the livestock was located within the county. Standard book values were then applied to estimate the manure production for each type of livestock based on common storage and application systems for that type of livestock. The results were totaled to provide an estimate of manure and nutrient production for the watershed.

Users are cautioned that this is an estimate only for comparison purposes. There are limitations in the input data. One difficulty is that agricultural statistics data is not reported when there are few producers in a county because of confidentially restrictions. These data is missing or unavailable in some cases for some operations.

This analysis also makes no allowances for movement of manure into or out of the watershed by operations which border the watershed boundaries, or by operators which farm land in more than one watershed. There is no available data to quantify the extent of that. Nevertheless, this analysis is a general estimate of the capacity of the watershed to properly utilize the nutrients produced within the watershed and the general need for export of waste out of the watershed, or the importation of commercial fertilizer.