

2009 Study Plan for the Lower Sandusky River

Sandusky, and Seneca Counties, Ohio

Ohio Environmental Protection Agency
Division of Surface Water
50 W. Town Street, Suite 700
Columbus, OH 43215

Ecological Assessment Section
4675 Homer Ohio Lane
Groveport, OH 43125

Northwest District Office
347 North Dunbridge Road
Bowling Green, OH 43402

July 9, 2009

CONTACTS

Assigned Field Staff

- Coordinator / Fish / Habitat: Brian Alsdorf (614) 836-8770
- Chemical and Sediment: Brent Kuenzli (419) 373-3005
- Nonpoint: Katie McKibben (419) 373-3013
- *Stormwater: Lynette Hablitzel (419) 373-3009*
- *NPDES: Mary Beth Cohen (Seneca) 419-373-3014*
Andrew Gall (Huron) (419) 373-3003
- TMDL Leader: Alex Smaili (419) 373-3004
- Modeling: Keith Orr (614) 644-2885
Eric Saas (614) 644-2890
- Macroinvertebrates: Chuck McKnight (614) 836-8784

ODNR Wildlife Officers

District 2: 419-424-5000

- Sandusky Co: Brian Bury (419) 429-8393
- Seneca Co: Jim Davis (419) 429-8394

County Sheriff Offices

- Sandusky Co: (419) 332-2613 (Dial 911 for emergency help)
- Seneca Co: (419) 447-3456 (Dial 911 for emergency help)

Hospitals

- Magruder Hospital, 615 Fulton Street, Port Clinton, Ohio 43452 (419) 734-3131
- St. Vincents, 2213 Cherry Street, Toledo, Ohio 43068 (419) 251-3232
- University of Toledo, 3000 Arlington Avenue, Toledo, Ohio 43614 (419) 383-4000
- St. Charles Mercy Hospital, 2600 Navarre Avenue, Oregon, Ohio 43616 (419) 696-7200
- Fostoria Community Hospital, 501 Van Buren Street, Fostoria, Ohio 44830 (419) 436-6640
- Blanchard Valley Hospital, 1900 South Main Street, Findlay, Ohio 45840, (419) 423-4500
- Memorial Hospital, 715 S. Taft Avenue, Fremont, Ohio 43420 (419) 332-7321
- Fisher-Titus Medical Center, 272 Benedict Avenue, Norwalk, Ohio 44857 (419) 668-8101
- Mercy Hospital of Tiffin, 45 St. Lawrence Drive, Tiffin, Ohio 44883 (419) 455-7000
- Bellevue Hospital, 1400 W. Main Street, Bellevue, Ohio 44811 (419) 483-4040

INTRODUCTION

During the 2009 field season (June through October) chemical, physical, and biological sampling will be conducted in the Lower Sandusky River basin to assess and characterize water quality conditions. The study area is a Total Maximum Daily Load (TMDL) basin, so the survey will incorporate a study design and some assessment techniques which are more comprehensive than a targeted sampling strategy alone would entail. The sampling will include sites on the Sandusky River mainstem, Wolf Creek and Muddy Creek along with sites on selected tributaries.

The Lower Sandusky River study area has not been entirely assessed by Ohio EPA. Longitudinal sampling on portions of the Sandusky River was conducted in 1988 and 1990. The sampling effort is structured to characterize point source and nonpoint source impacts, including those from unsewered communities and agricultural activities. Table 1 contains a list of NPDES facilities in the basin. Sampling locations and types of sampling scheduled for the study area are listed in Table 2. Sample locations with geographical coordinates are included in Table 3.

Sampling Objectives:

- Monitor and assess the chemical, physical, and biological integrity of the water bodies within the Lower Sandusky River study area.
- Assess physical habitat influences on stream biotic integrity.
- Determine recreational water quality.
- Evaluate the appropriateness of existing use designations and assign uses to undesignated streams.
- Characterize the amount of aquatic resource degradation attributable to various land uses, including agricultural practices and urbanization.
- Determine any aquatic impacts from known potential sources, including point source dischargers, and from unsewered communities.

SAMPLING ACTIVITIES

Chemical/Physical Water and Sediment

Chemical sampling locations within the study area are listed in Tables 2&3. Conventional chemical/physical water quality samples will be collected 5 times at each designated location. Sediment samples will be collected at 7 locations. Datasondes® will be deployed at 6 locations. Chemical parameters to be tested are listed in Table 4. Surface water sampling will occur across a variety of flow conditions, from lower flows to moderate and higher flows. Additional sampling of organics will be conducted at 9 sites.

Bacteriological Sampling

Water samples will be collected at 15 chemistry sites for bacteriological analyses to determine the attainment status of the Primary Contact recreational use. Testing will include *Escherichia coli* (E. coli) bacteria. Each site will be sampled at least 5 times, while sentinel sites may have 5-10 bacteriological samples.

Macroinvertebrate and Fish Assemblages

Macroinvertebrate sampling methods will be used as listed in Table 2. Fish assemblages will be sampled as listed in Table 2. QHEI scores will be calculated on the habitat at all fish sampling locations.

QUALITY ASSURANCE/SAMPLING METHODS

Ohio EPA Manuals

All biological, chemical, EPA laboratory, data processing, and data analysis methods and procedures adhere to those specified in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio EPA 2006), Biological Criteria for the Protection of Aquatic Life, Volumes II – III (Ohio Environmental Protection Agency 1987, 1989a, 1989b), The Qualitative Habitat Evaluation Index (QHEI); Rationale, Methods, and Application (Rankin 1989) for habitat assessment, Ohio EPA Sediment Sampling Guide and Methodologies (Ohio EPA 2001), and Ohio EPA Fish Collection Guidance Manual (Ohio EPA 2004).

Use Attainment

Attainment/non-attainment of aquatic life uses will be determined by using biological criteria codified in Ohio Administrative Code (OAC) 3745-1-07, Table 7-17. Numerical biological criteria are based on multimetric biological indices including the Index of Biotic Integrity (IBI) and modified Index of Well-Being (MIwb), indices measuring the response of the fish community, and the Invertebrate Community Index (ICI), which indicates the response of the macroinvertebrate community.

Performance expectations for the basic aquatic life uses (Warmwater Habitat [WWH], Exceptional Warmwater Habitat [EWH], and Modified Warmwater Habitat [MWH]) were developed using the regional reference site approach (Hughes et al. 1986; Omernik 1987). This fits the practical definition of biological integrity as the biological performance of the natural habitats within a region (Karr and Dudley 1981). Attainment of an aquatic life use is FULL if all three indices (or those available) meet the applicable criteria, PARTIAL if at least one of the indices did not attain and performance did not fall below the fair category, and NON if all indices either fail to attain or any index indicates poor or very poor performance. The results will be compared to WWH biocriteria for the Huron Erie Plain (HELP) ecoregion.

Recreational use attainment will be determined using fecal coliform bacteria and *E. coli* bacteria. Both types of organisms are indicator organisms for the potential presence of pathogens in surface water resulting from the presence of untreated human or animal wastes, and they are the basis for recreational use water quality criteria in Rule 3745-1-07 of the Ohio Administrative Code (OAC).

Stream Habitat Evaluation

Physical habitat is evaluated using the Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA for streams and rivers in Ohio (Rankin 1989). Various attributes of the available habitat are scored based on their overall importance to the establishment of viable, diverse aquatic faunas. Evaluations of type and quality of substrate, amount of instream cover, channel morphology, extent of riparian canopy, pool and riffle development and quality, and stream gradient are among the metrics used to evaluate the characteristics of a stream segment, not just the characteristics of a single sampling site. As such, individual sites may have much poorer physical habitat due to a localized disturbance yet still support aquatic communities closely resembling those sampled at adjacent sites with better habitat, provided water quality conditions are similar. QHEI scores from hundreds of segments around the state have indicated that values higher than 60 were generally conducive to the establishment of warmwater faunas while those which scored in excess of 75-80 often typify habitat conditions which have the ability to support exceptional faunas.

Biological Community Assessment

Macroinvertebrates will be collected from artificial substrates and from the natural habitats. Quantitative sampling will be conducted at reference sites and at sites with drainage areas in excess of 20 mi². Qualitative sampling will be conducted in headwater sites with drainages smaller than 20 mi². The artificial substrate collection provides quantitative data and consists of a composite sample of 5 modified Hester-Dendy (HD) multiple-plate samplers colonized for six weeks. At the time of the artificial substrate collection, a qualitative multihabitat composite sample is also collected. This sampling effort consists of an inventory of all observed macroinvertebrate taxa from the natural habitats at each site with no attempt to quantify populations other than notations on the predominance of specific taxa or taxa groups within major macrohabitat types (e.g., riffle, run, pool, margin). Fish will be sampled at each sampling location with pulsed DC current. Two passes will be conducted at sites larger than 20 mi² and at reference sites.

Detailed biological sampling protocols are documented in the Ohio EPA manual Biological Criteria for the Protection of Aquatic Life, Volume III (1989).

Sediment

Fine grained multi-incremental sediment samples will be collected in the upper 4 inches of bottom material using either decontaminated stainless steel scoops or Ekman dredges. Collected sediment will be placed into appropriate containers, placed on ice (to maintain 4°C) and shipped to the Ohio EPA lab. Sampling and decontamination protocols will follow those listed in the Ohio EPA Sediment Sampling Guide and Methodologies, November, 2001.

Surface Water

Surface water grab samples will be collected from the upper 12 inches of river water into appropriate containers. Collected water will be preserved using appropriate methods, as outlined in Parts II and III of the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio EPA 2006) and shipped overnight via courier to the Ohio EPA lab for analysis. Field measurements of dissolved oxygen, pH, temperature, and conductivity will be made using YSI 556MPS meters along with all grab samples for surface water chemistry. Datasonde® continuous recorders will be placed at select locations to evaluate diurnal measurements of dissolved oxygen, pH, temperature, and conductivity.

Bacteria

Water samples will be collected into appropriate containers, cooled to 4°C, and transported to the contract lab, Jones & Henry in Northwood, Ohio, within 6 hours of sample collection. All samples will be analyzed for *E. coli* bacteria using U.S.EPA approved methods (STORET Parameter Code 31648).

Field Quality Control Samples

Ten percent of the sediment, water, and bacteria samples will be submitted to the lab as field duplicates. One Datasonde® recorder site will have two instruments placed in the river as field duplicates. Field blanks will occur at a minimum of 5 percent of the water samples. Field instruments will be calibrated daily, using manufacturer guidelines and requirements noted in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio EPA 2006). Matrix spike duplicates will be collected for organic water samples at a minimum of 5 percent.

Table 1. Facilities regulated by the National Pollution Discharge Elimination System in the Lower Sandusky River study area.

Facility Name	NPDES Number	Outfall	Flow Rate (MGD)	Treatment	Receiving Stream	River Mile
Carmeuse Lime, Inc	2IN00051	001	0.10	sedimentation	Wander Ck	2.65
		002	0.58	sedimentation	Wander Ck	1.85
		003	0.50	sedimentation	Wander Ck	1.85
Atlas Ind Inc	2IS00017	001	0.0046	strom water	Houck Ditch	1.88
Bettsville WWTP (Burgoon)	2PA00072	001	0.175	activated sludge, ex-airation, UV	Wolf Ck	5.35
BP Prodcnts, Tiffin	2IN00209	001	0.001	strom water	E. Br. E. Br. Wolf Ck	
Church & Dwight Co.	2IE00011	001	0.0781	EQ pond, RO, boiler blowdown	Sandusky River Indian Ck	26.28 ~5.8
		002	0.08	stromwater		
Farmland Foods Inc.	2IH00006	001	0.05	activated sludge, chl-dechl	John Smith Ditch	6.78
Fostoria Ethanol LLC	2IF00026	001	0.185	non-contact cooling	trib to Muskullunge Ck	~25.0
Hammer-Heinsman STP	2PG00011	001	0.030	activated sludge, ex-airation, chl-dechl	Wolf Ck	22.73
Hopewell Estates MHP	2PY00006	001	0.016	ex-airation, chl, tertiary pond	Harrison Ck	4.04
Meadowbrook Park	2PR00142	001	0.000945	ex-aeration package plant	E. Br. Wolf Ck	1.97
		002	0.000875	ex-aeration package plant	E. Br. Wolf Ck	1.58
Adam's Acres Sub.	2PG00082	001	0.035	ex-aeration, sand filter, chl-dechl	Muskullunge Ck	8.88
Apollo MHP	2PY00062	001	0.015	aeration, clarification, sand filter chl-dechl	L. Muddy Ck	3.9
Carmeuse Lime, Inc Millerville	2IJ00032	001	0.41	sedimentation sedimentation	Muddy Ck Roas Walby Ditch	25.57 0.48
		005	1.4			
Culligan Water Conditioning	2IN00084	001	0.002	backwash water	Minnow Ck	~2.0

Facility Name	NPDES Number	Outfall	Flow Rate (MGD)	Treatment	Receiving Stream	River Mile
Fremont WPCF	2PD00007	001	7.6	primary sed., activated sludge,	Sandusky River	13.85
		002		con.-sand filter		
		003		bypass		
		004		secondary bypass	Sandusky River	~15.8
		005		CSO	Sandusky River	~15.7
		006		CSO	Sandusky River	~15.32
		007		CSO	Sandusky River	~15.05
		008		CSO	Sandusky River	
		009		CSO	Sandusky River	~14.82
		010		CSO	Sandusky River	
		011		CSO	Sandusky River	~16.00
		012		CSO	Sandusky River	~16.00
		013		CSO	Sandusky River	
		015		CSO	Sandusky River	~14.8
		016		CSO	Sandusky River	~14.82
		017		CSO	Sandusky River	~14.48
				CSO		
Heinz Co.	2IN00009	001	0.68	cooling water	Sandusky River	14.16
Helena Migrant Head Start	2PT00032	001	0.004	package plant w/chl-dechl	trib to Muddy Ck	
Lindsey WWTP	2PA00024	001 602	0.215	ex-aeration, sand filters, chl-dechl bypass	Muddy Ck	15.05
Westwood Acres Sub.	2PG00023	001	0.02	ex-aeration, sec-clairifier, sand filter, chl-dechl	trib to Muskullunge Ck	2.95
New Riegel Café	2IH00032	001	0.00075	settling, activated sludge, sand filter, chl	trib to E. Br Wolf Ck	6.18
New Reigel School	2PT00035	001	0.01	flow eq, ex-aeration, act. sludge, sand filter, chl-dechl	trib to E.Br. Wolf Ck	
Pelton MHP	2PY00032	001	0.001875	package plant	Keckler Ditch	1.41
Snakesters	2PR00114	001	0.00245	ex-aeration, sand filter, chl-dechl	E. Br. Wolf Ck	
ThyssenKrupp Atlas Inc	2IN00211	001		oil/water separator (contaminated ground water)	trib to Wolf Ck	~1.2
Webster Industries Inc	2IS00035	001	0.01	non-contact cooling	Houck Ditch	1.88
		004	0.098	non-contact cooling		

Table 2. Lower Sandusky River study area sampling sites.

STATION	STREAM	RM	DA	Location	Sampling	Issue	USGS_Quad	County
U03G01	SANDUSKY R	65.01	655.0	S OF MCCUTCHEVILLE @ CO. RD. 16	MT,F2	Large river evaluation	McCutchenvillel	SENECA
U03G02	SANDUSKY R	52.58	772.0	@ WALNUT GROVE CAMPGROUND	MT,F2	Large river evaluation	Tiffin South	SENECA
500830	SANDUSKY R	47.75	774.0	@ SCOTT BRIDGE RD DST MEXICO	MT,F2	Large river evaluation	Tiffin South	SENECA
500940	SANDUSKY R	42.92	960.0	UPST. TIFFIN @ U.S. RT. 224	MT,F2	Large river evaluation	Tiffin South	SENECA
U04S28	SANDUSKY R	41.84	964.0	AT TIFFIN @ ELLA ST.	MT,F2	Large river evaluation	Tiffin South	SENECA
500920	SANDUSKY R	38.90	1008.0	UPST. TIFFIN WWTP, ADJ. WATER ST.	MT,F2	Large river evaluation	Tiffin North	SENECA
U04S26	SANDUSKY R	38.50	1028.0	DST TIFFIN WWTP , ADJ. CENTER RD.	MT,F2	Large river evaluation	Tiffin North	SENECA
U04S25	SANDUSKY R	31.95	1046.0	AT FORT SENECA @ TWP. RD. 143	B,C,MT,F2,S	Spatial	Tiffin North	SENECA
U04T01	SANDUSKY R	26.94	1067.0	AT OLD FORT @ CO. RD. 51	B,C,MT,F2,	Spatial	Tiffin North	SENECA
U04Q06	SANDUSKY R	23.00	1073.0	UPST. FREMONT, UPST. WOLF CREEK	B,C,MT,F2,S	Ust. Fremont, Ust. Wolf Creek	Fremont West	SANDUSKY
500820	SANDUSKY R	20.25	1251.00	@ RICE RD UPST FREMONT	B,Cmp,MT,F2,PO4,D	Sentinel, Ust. Fremont	Fremont West	SANDUSKY
U04T02	SANDUSKY R	18.05	1255.0	JUST UPST. BALLVILLE DAM	Cm,MT,F2	Impounded (Ballville Dam)	Fremont West	SANDUSKY
U04S23	SANDUSKY R	17.70	1255.0	AT FREMONT @ TIFFIN RD.	Cmo,MT,F2	Dst. Ballville Dam impacts?	Fremont West	SANDUSKY
U04W11	SANDUSKY R	15.40	1260.0	AT FREMONT @ STATE ST.	B,Cmo,MT,F2	Ust. Fremont WWTP	Fremont East	SANDUSKY
U04E01	FREMONT WWTP	13.85	1264.0	AT OUTFALL	C	Effluent sample	Fremont East	SANDUSKY
201316	SANDUSKY R	13.7	1264.0	AT U.S. RT. 20 (via CR 53)	D	Datasonde only, dst. Fremont WWTP	Fremont East	SANDUSKY
U04S17	SANDUSKY R	4.70	1330.0	UPST. WIGHTMANS GROVE (FISHER RD.)	B,C,MT,F2	Lake influenced	Wightmans Grove	SANDUSKY
300671	BARK CREEK	3.20	10.0	AT KELLEY RD. (CR 245)	Cm,M,F	Spatial	Wightmans Grove	SANDUSKY
300675	MUSKELLUNGE CREEK	24.44	2.3	AT TWP. RD. 84	Cm,M,F	Dst. ETOH production facility	Bascom	SENECA
300674	MUSKELLUNGE CREEK	16.70	17.7	AT ST. RT. 635	C,M,F	Spatial	Helena	SANDUSKY
201332	MUSKELLUNGE CREEK	5.40	37.0	NEAR FREMONT @ SPIELDENNER RD.	B,Cmp,MT,F2,PO4,,D	Sentinel	Fremont West	SANDUSKY
U04P08	MUSKELLUNGE CREEK	1.23	44.0	NEAR FREMONT @ FANGBONER RD.	C,MT,F2	Spatial	Wightmans Grove	SANDUSKY
500950	INDIAN CREEK	0.62	11.2	S OF FREMONT @ HURDICK RD.	B,C,M,F	Dwight and Church (baking soda) in headwaters	Fremont West	SANDUSKY
201336	WOLF CREEK	13.60	27.0	0.2 MI. UPST. CO. RD. 592	C,MT,F2	Spatial	Bascom	SENECA
U04S40	WOLF CREEK	5.15	66.5	AT BETTSVILLE @ ST. RT. 12	Cm,MT,F2	Spatial	Bascom	SENECA
U04P04	WOLF CREEK	0.04	158.0	NEAR FREMONT @ ST. RT. 53	C,MT,F2	Spatial	Fremont West	SANDUSKY
U04G09	PLUM RUN	0.79	10.1	E OF FOSTORIA @ ST. RT. 635	C,M,F	Spatial	Bascom	SENECA
U04G11	HARRISON CREEK	0.38	13.1	E OF FOSTORIA @ CO. RD. 592	C,M,F	Spatial	Bascom	SENECA

STATION	STREAM	RM	DA	Location	Sampling	Issue	USGS_Quad	County
U04G07	WOLF CREEK	1.58	71.8	AT TOWNSHIP LINE RD (CR 118)	B,Cmp,MT,F2,PO4,D	Sentinel	Fremont West	SANDUSKY
300673	E. BR. WOLF CREEK	19.65	19.0	@ MEADOWBROOK PARK	C,M,F	Dst. 2 package plants and Bascom unsewered area	Bascom	SENECA
U04G15	E. BR. WOLF CREEK	13.63	33.0	@ TWP. RD. 132	B,C,MT,F2	Spatial	Tiffin North	SENECA
201338	E. BR. WOLF CREEK	9.00	68.0	SW OF FORT SENECA @ TWP. RD. 150	B,Cmp,MT,F2,PO4,D	Sentinel	Tiffin North	SENECA
U04P03	E. BR. WOLF CREEK	0.86	83.0	NEAR BETTSVILLE @ GILMORE RD.	C,MT,F2	Spatial	Fremont West	SANDUSKY
U04G16	SNUFF CREEK	0.33	4.7	@ TWP. RD. 71	C,M,F	Hog farm ust. @ Twp. Rd.123	Tiffin North	SENECA
U04G13	E. BR. OF EAST BRANCH OF WOLF CREEK	3.52	6.8	@ CO. RD. 26	C,M,F	Constrution site (dormitories)	Tiffin South	SENECA
300682	E. BR. OF EAST BRANCH OF WOLF CREEK	1.48	19.7	@ CR 48 (TWP. RD 118)	C,M,F	Spatial	Tiffin North	SENECA
U04G14	M. BR. OF EAST BRANCH OF WOLF CREEK	0.46	11.3	CO. RD. 26	B,C,M,F	Spatial	Tiffin South	SENECA
U04Q10	SUGAR CREEK	3.11	9.4	NEAR TIFFIN @ TWP. RD. 76	Co,M,F,S	Dst. 1980s Toluene spill	Watson	SENECA
U04Q08	SUGAR CREEK	1.05	13.0	NEAR TIFFIN @ TWP. RD. 148	M,F,S	Spatial	Watson	SENECA
U04Q11	SPICER CREEK	0.80	12.3	N OF TIFFIN @ CO. RD. 33	C,M,F	Spatial	Tiffin North	SENECA
U04S07	MUDDY CREEK	29.36	33.0	UPST. MILLERSVILLE @ CO. RD. 58	C,MT,F2	Spatial	Helena	SANDUSKY
201410	MUDDY CREEK	21.10	44.0	W OF FREMONT, DST. TWP. RD. 55	B,C,MT,F2,S	Spatial	Fremont West	SANDUSKY
U04S05	MUDDY CREEK	18.68	63.0	UPST. LINDSEY @ CO. RD. 90	C,MT,F2	Spatial	Lindsey	SANDUSKY
U04S01	MUDDY CREEK	9.79	74.0	DST. LINDSEY @ CO. RD. 153	B,Cmp,MT,F2,PO4,D	Sentinel	Lindsey	SANDUSKY
U04Q13	MUDDY CREEK	1.23	110.0	@ EAST SIDE OF ST. RT. 53	Co,MT,F2,S	Historical landfill site	Wightmans Grove	SANDUSKY
300677	L. MUDDY CREEK	7.55	12.4	@ BOOKTOWN RD.	C,MT,F2	Spatial	Lindsey	SANDUSKY
300676	L. MUDDY CREEK	2.50	25.0	@ KLINE RD.	C,MT,F2	Spatial	Wightmans Grove	SANDUSKY
300679	S. BR. MUDDY CREEK	0.99	21.9	@ ANDERSON RD.	C,MT,F2	Spatial	Helena	SANDUSKY
300680	GRIES DITCH	4.72	9.3	@U.S. RT. 6	C,M,F	Spatial	Helena	SANDUSKY
U04Q16	GRIES DITCH	0.90	16.3	W OF FREMONT @ STAFF RD.	B,C,M,F,S	Livestock (sheep)	Helena	SANDUSKY
300678	FISHING CREEK	0.20	7.0	@ WEICKERT RD.	C,M,F	Spatial	Wightmans Grove	SANDUSKY
300681	E. BR. WOLF CREEK TRIB (18.60)	0.04	8.2	@ TWP. RD. 112	C,M,F	Spatial	New Riegel	SENECA
U03G01	SANDUSKY R	65.01	655.0	S OF MCCUTCHENVILLE @ CO. RD. 16	MT,F2	Large river evaluation	McCutchenvillel	SENECA
U03G02	SANDUSKY R	52.58	772.0	@ WALNUT GROVE CAMPGROUND	MT,F2	Large river evaluation	Tiffin South	SENECA
500830	SANDUSKY R	47.75	774.0	@ SCOTT BRIDGE RD DST MEXICO	MT,F2	Large river evaluation	Tiffin South	SENECA
500940	SANDUSKY R	42.92	960.0	UPST. TIFFIN @ U.S. RT. 224	MT,F2	Large river evaluation	Tiffin South	SENECA

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500920	SANDUSKY R	38.90	1008.0	UPST. TIFFIN WWTP, ADJ. WATER ST.	MT,F2	Large river evaluation	Tiffin North	SENECA
U04S26	SANDUSKY R	38.50	1028.0	DST TIFFIN WWTP , ADJ. CENTER RD.	MT,F2	Large river evaluation	Tiffin North	SENECA
U04S25	SANDUSKY R	31.95	1046.0	AT FORT SENECA @ TWP. RD. 143	B,C,MT,F2,S	Spatial	Tiffin North	SENECA
U04T01	SANDUSKY R	26.94	1067.0	AT OLD FORT @ CO. RD. 51	B,C,MT,F2,	Spatial	Tiffin North	SENECA
U04Q06	SANDUSKY R	23.00	1073.0	UPST. FREMONT, UPST. WOLF CREEK	B,C,MT,F2,S	Ust. Fremont, Ust. Wolf Creek	Fremont West	SANDUSKY
500820	SANDUSKY R	20.25	1251.0	@ RICE RD UPST FREMONT	B,Cmp,MT,F2,PO4,D	Sentinel, Ust. Fremont	Fremont West	SANDUSKY
U04T02	SANDUSKY R	18.05	1255.0	JUST UPST. BALLVILLE DAM	Cm,MT,F2	Impounded (Ballville Dam)	Fremont West	SANDUSKY
U04W11	SANDUSKY R	15.40	1260.0	AT FREMONT @ STATE ST.	B,Cmo,MT,F2	Ust. Fremont WWTP	Fremont West	SANDUSKY
U04S17	SANDUSKY R	4.70	1330.0	UPST. WIGHTMANS GROVE (FISHER RD.)	B,C,MT,F2	Lake influenced	Fremont East	SANDUSKY
300671	BARK CREEK	3.20	10.0	AT KELLEY RD. (CR 245)	Cm,M,F	Spatial	Fremont East	SANDUSKY
300675	MUSKELLUNGE CREEK	24.44	2.3	AT TWP. RD. 84	Cm,M,F	Dst. ETOH production facility	Fremont East	SANDUSKY
300674	MUSKELLUNGE CREEK	16.70	17.7	AT ST. RT. 635	C,M,F	Spatial	Wightmans Grove	SANDUSKY
201332	MUSKELLUNGE CREEK	5.40	37.0	NEAR FREMONT @ SPIELDENNER RD.	B,Cmp,MT,F2,PO4,,D	Sentinel	Wightmans Grove	SANDUSKY
U04P08	MUSKELLUNGE CREEK	1.23	44.0	NEAR FREMONT @ FANGBONER RD.	C,MT,F2	Spatial	Bascom	SENECA
500950	INDIAN CREEK	0.62	11.2	S OF FREMONT @ HURDICK RD.	B,C,M,F	Dwight and Church (baking soda) in headwaters	Helena	SANDUSKY
201336	WOLF CREEK	13.60	27.0	0.2 MI. UPST. CO. RD. 592	C,MT,F2	Spatial	Fremont West	SANDUSKY
U04S40	WOLF CREEK	5.15	66.5	AT BETTSVILLE @ ST. RT. 12	Cm,MT,F2	Spatial	Wightmans Grove	SANDUSKY
U04P04	WOLF CREEK	0.04	158.0	NEAR FREMONT @ ST. RT. 53	C,MT,F2	Spatial	Fremont West	SANDUSKY
U04G09	PLUM RUN	0.79	10.1	E OF FOSTORIA @ ST. RT. 635	C,M,F	Spatial	Bascom	SENECA
U04G11	HARRISON CREEK	0.38	13.1	E OF FOSTORIA @ CO. RD. 592	C,M,F	Spatial	Bascom	SENECA
U04G07	WOLF CREEK	1.58	71.8	AT TOWNSHIP LINE RD (CR 118)	B,Cmp,MT,F2,PO4,D	Sentinel	Fremont West	SANDUSKY
300673	E. BR. WOLF CREEK	19.65	19.0	@ MEADOWBROOK PARK	C,M,F	Dst. 2 package plants and Bascom unsewered area	Bascom	SENECA
U04G15	E. BR. WOLF CREEK	13.63	33.0	@ TWP. RD. 132	B,C,MT,F2	Spatial	Bascom	SENECA
201338	E. BR. WOLF CREEK	9.00	68.0	SW OF FORT SENECA @ TWP. RD. 150	B,Cmp,MT,F2,PO4,D	Sentinel	Fremont West	SANDUSKY
U04P03	E. BR. WOLF CREEK	0.86	83.0	NEAR BETTSVILLE @ GILMORE RD.	C,MT,F2	Spatial	Bascom	SENECA
U04G13	E. BR. OF EAST BRANCH OF WOLF CREEK	3.52	6.8	@ CO. RD. 26	C,M,F	Construction site (dormitories)	Tiffin North	SENECA

STATION	STREAM	RM	DA	Location	Sampling	Issue	USGS_Quad	County
300682	E. BR. OF EAST BRANCH OF WOLF CREEK	1.48	19.7	@ CR 48 (TWP. RD 118)	C,M,F	Spatial	Tiffin North	SENECA
U04G14	M. BR. OF EAST BRANCH OF WOLF CREEK	0.46	11.3	CO. RD. 26	B,C,M,F	Spatial	Fremont West	SANDUSKY
U04Q10	SUGAR CREEK	3.11	9.4	NEAR TIFFIN @ TWP. RD. 76	Co,M,F,S	Dst. 1980s Toluene spill	Tiffin North	SENECA
U04Q08	SUGAR CREEK	1.05	13.0	NEAR TIFFIN @ TWP. RD. 148	M,F,S	Spatial	Tiffin South	SENECA
U04Q11	SPICER CREEK	0.80	12.3	N OF TIFFIN @ CO. RD. 33	C,M,F	Spatial	Tiffin North	SENECA
U04S07	MUDDY CREEK	29.36	33.0	UPST. MILLERSVILLE @ CO. RD. 58	C,MT,F2	Spatial	Tiffin South	SENECA
201410	MUDDY CREEK	21.10	44.0	W OF FREMONT, DST. TWP. RD. 55	B,C,MT,F2,S	Spatial	Watson	SENECA
U04S05	MUDDY CREEK	18.68	63.0	UPST. LINDSEY @ CO. RD. 90	C,MT,F2	Spatial	Watson	SENECA
U04S01	MUDDY CREEK	9.79	74.0	DST. LINDSEY @ CO. RD. 153	B,Cmp,MT,F2,PO4,D	Sentinel	Tiffin North	SENECA
U04Q13	MUDDY CREEK	1.23	110.0	@ EAST SIDE OF ST. RT. 53	Co,MT,F2,S	Historical landfill site	Helena	SANDUSKY
300677	L. MUDDY CREEK	7.55	12.4	@ BOOKTOWN RD.	C,MT,F2	Spatial	Fremont West	SANDUSKY
300676	L. MUDDY CREEK	2.50	25.0	@ KLINE RD.	C,MT,F2	Spatial	Lindsey	SANDUSKY
300679	S. BR. MUDDY CREEK	0.99	21.9	@ ANDERSON RD.	C,MT,F2	Spatial	Lindsey	SANDUSKY
300680	GRIES DITCH	4.72	9.3	@U.S. RT. 6	C,M,F	Spatial	Wightmans Grove	SANDUSKY
U04Q16	GRIES DITCH	0.90	16.3	W OF FREMONT @ STAFF RD.	B,C,M,F,S	Livestock (sheep)	Lindsey	SANDUSKY
300678	FISHING CREEK	0.20	7.0	@ WEICKERT RD.	C,M,F	Spatial	Wightmans Grove	SANDUSKY
300681	E. BR. WOLF CREEK TRIB (18.60)	0.04	8.2	@ TWP. RD. 112	C,M,F	Spatial	Helena	SANDUSKY

B –E-Coli bacteria

C – Inorganic water chemistry, no metals.

Co – C and 624-625 organics (organics collected twice)

Cm – C and metals

Cp – C and 525 new age herbicides (collected twice)

D- Datasonde

F – Single pass fish site

F2 – Two-pass fish site (for reference sites, or drainage area 20 sq. miles or greater)

M – Macroinvertebrate qualitative site

MT – Macroinvertebrate quantitative site (for reference sites, or drainage area 20 sq. miles or greater)

PO4 – Orthophosphates

Type	Number of Sites
Total	52
Water chemistry	44
Bacteria	15
Fish	1 Pass 18 2 Pass 32
Macroinvertebrate	Qual 18 Quant 32
Sediment	7
Datasonde©	6

S – Sediment metals/8270 BNAs/8081

Table 3. Lower Sandusky River site locations in alphabetical order by stream, with latitude and longitude.

STATION	STREAM	RM	DA	Location	Issue	Sampling	POINT_X	POINT_Y	USGS_Quad
300671	BARK CREEK	3.20	10.0	AT KELLEY RD. (CR 245)	Spatial	Cm,M,F	-83.070374	41.38134	Wightmans Grove
U04G13	E. BR. OF EAST BRANCH OF WOLF CREEK	3.52	6.8	@ CO. RD. 26	Construction site (dormitories)	C,M,F	-83.21782	41.11773	Tiffin South
300682	E. BR. OF EAST BRANCH OF WOLF CREEK	1.48	19.7	@ CR 48 (TWP. RD 118)	Spatial	C,M,F	-83.2112150	41.13827	Tiffin North
300673	E. BR. WOLF CREEK	19.65	19.0	@ MEADOWBROOK PARK	Dst. 2 package plants and Bascom unsewered area	C,M,F	-83.27446	41.13072	Bascom
U04G15	E. BR. WOLF CREEK	13.63	33.0	@ TWP. RD. 132	Spatial	B,C,MT,F2	-83.20642	41.15272	Tiffin North
201338	E. BR. WOLF CREEK	9.00	68.0	SW OF FORT SENECA @ TWP. RD. 150	Sentinel	B,Cmp,MT,F2,PO4,D	-83.18380	41.19684	Tiffin North
U04P03	E. BR. WOLF CREEK	0.86	83.0	NEAR BETTSVILLE @ GILMORE RD.	Spatial	C,MT,F2	-83.18430	41.26117	Fremont West
300681	E. BR. WOLF CREEK TRIB (18.60)	0.04	8.2	@ TWP. RD. 112	Spatial	C,M,F	-83.25960	41.12330	New Riegel
300678	FISHING CREEK	0.20	7.0	@ WEICKERT RD.	Spatial	C,M,F	-83.0966673	41.43743	Wightmans Grove
U04E01	FREMONT WWTP OUTFALL	13.85	1264.0	FREMONT WWTP OUTFALL TO SANDUSKY R	Effluent sample	C	-83.104619	41.36195	Fremont East
300680	GRIES DITCH	4.72	9.3	@U.S. RT. 6	Spatial	C,M,F	-83.30920	41.34110	Helena
U04Q16	GRIES DITCH	0.90	16.3	W OF FREMONT @ STAFF RD.	Livestock (sheep)	B,C,M,F,S	-83.25742	41.36315	Helena
U04G11	HARRISON CREEK	0.38	13.1	E OF FOSTORIA @ CO. RD. 592	Spatial	C,M,F	-83.32352	41.18152	Bascom
500950	INDIAN CREEK	0.62	11.2	S OF FREMONT @ HURDICK RD.	Dwight and Church (baking soda) in headwaters	B,C,M,F	-83.15822	41.29145	Fremont West
300677	L. MUDDY CREEK	7.55	12.4	@ BOOKTOWN RD.	Spatial	C,MT,F2	-83.15775	41.40031	Lindsey
300676	L. MUDDY CREEK	2.50	25.0	@ KLINE RD.	Spatial	C,MT,F2	-83.08690	41.43840	Wightmans Grove
U04G14	M. BR. OF EAST BRANCH OF WOLF CREEK	0.46	11.3	CO. RD. 26	Spatial	B,C,M,F	-83.22143	41.11854	Tiffin South
U04S07	MUDDY CREEK	29.36	33.0	UPST. MILLERSVILLE @ CO. RD. 58	Spatial	C,MT,F2	-83.31072	41.29035	Helena
201410	MUDDY CREEK	21.10	44.0	W OF FREMONT, DST.	Spatial	B,C,MT,F2,S	-83.24412	41.36445	Fremont West

STATION	STREAM	RM	DA	Location	Issue	Sampling	POINT_X	POINT_Y	USGS_Quad
				TWP. RD. 55					
U04S05	MUDDY CREEK	18.68	63.0	UPST. LINDSEY @ CO. RD. 90	Spatial	C,MT,F2	-83.24520	41.39037	Lindsey
U04S01	MUDDY CREEK	9.79	74.0	DST. LINDSEY @ CO. RD. 153	Sentinel	B,Cmp,MT,F2,PO4,D	-83.15354	41.45003	Lindsey
U04Q13	MUDDY CREEK	1.23	110.0	@ EAST SIDE OF ST. RT. 53	Historical landfill site	Co,MT,F2,S	-83.05454	41.45194	Wightmans Grove
300675	MUSKELLUNGE CREEK	24.44	2.3	AT TWP. RD. 84	Dst. ETOH production facility	Cm,M,F	-83.367927	41.19607	Bascom
300674	MUSKELLUNGE CREEK	16.70	17.7	AT ST. RT. 635	Spatial	C,M,F	-83.28330	41.27350	Helena
201332	MUSKELLUNGE CREEK	5.40	37.0	NEAR FREMONT @ SPIELDENNER RD.	Sentinel	B,Cmp,MT,F2,PO4,,D	-83.15962	41.35695	Fremont West
U04P08	MUSKELLUNGE CREEK	1.23	44.0	NEAR FREMONT @ FANGBONER RD.	Spatial	C,MT,F2	-83.12162	41.39065	Wightmans Grove
U04G09	PLUM RUN	0.79	10.1	E OF FOSTORIA @ ST. RT. 635	Spatial	C,M,F	-83.28452	41.20812	Bascom
300679	S. BR. MUDDY CREEK	0.99	21.9	@ ANDERSON RD.	Spatial	C,MT,F2	-83.36100	41.25730	Helena
U03G01	SANDUSKY R	65.01	655.0	S OF MCCUTCHENVILLE @ CO. RD. 16	Large river evaluation	MT,F2	-83.26872	40.96476	McCutchenvillel
U03G02	SANDUSKY R	52.58	772.0	@ WALNUT GROVE CAMPGROUND	Large river evaluation	MT,F2	-83.200119	41.01546	Tiffin South
500830	SANDUSKY R	47.75	774.0	@ SCOTT BRIDGE RD DST MEXICO	Large river evaluation	MT,F2	-83.19492	41.04426	Tiffin South
500940	SANDUSKY R	42.92	960.0	UPST. TIFFIN @ U.S. RT. 224	Large river evaluation	MT,F2	-83.19882	41.09566	Tiffin South
U04S28	SANDUSKY R	41.84	964.0	AT TIFFIN @ ELLA ST.	Large river evaluation	MT,F2	-83.18662	41.10396	Tiffin South
500920	SANDUSKY R	38.90	1008.0	UPST. TIFFIN WWTP, ADJ. WATER ST.	Large river evaluation	MT,F2	-83.16330	41.13560	Tiffin North
U04S26	SANDUSKY R	38.50	1028.0	DST TIFFIN WWTP , ADJ. CENTER RD.	Large river evaluation	MT,F2	-83.15842	41.14276	Tiffin North
U04S25	SANDUSKY R	31.95	1046.0	AT FORT SENECA @ TWP. RD. 143	Spatial	B,C,MT,F2,S	-83.16432	41.20695	Tiffin North

STATION	STREAM	RM	DA	Location	Issue	Sampling	POINT_X	POINT_Y	USGS_Quad
U04T01	SANDUSKY R	26.94	1067.0	AT OLD FORT @ CO. RD. 51	Spatial	B,C,MT,F2,	-83.145519	41.23925	Tiffin North
U04Q06	SANDUSKY R	23.00	1073.0	UPST. FREMONT, UPST. WOLF CREEK @ RICE RD UPST FREMONT	Ust. Fremont, Ust. Wolf Creek	B,C,MT,F2,S	-83.16477	41.27807	Fremont West
500820	SANDUSKY R	20.25	1251.00	JUST UPST. BALLVILLE DAM	Sentinel, Ust. Fremont	B,Cmp,MT,F2,PO4,D	-83.15795	41.30845	Fremont West
U04T02	SANDUSKY R	18.05	1255.0	AT FREMONT @ TIFFIN RD.	Impounded (Ballville Dam)	Cm,MT,F2	-83.13662	41.32605	Fremont West
U04S23	SANDUSKY R	17.70	1255.0	AT FREMONT @ STATE ST.	Dst. Ballvile Dam impacts?	Cmo,MT,F2	-83.13022	41.32695	Fremont West
U04W11	SANDUSKY R	15.40	1260.0	AT U.S. RT. 20 (via CR 53)	Ust. Fremont WWTP	B,Cmo,MT,F2	-83.11186	41.34689	Fremont East
201316	SANDUSKY R	13.70	1264.0		Datasonde only, dst. Fremont WWTP, sieche ?	D	-83.10682	41.36675	Fremont East
U04S17	SANDUSKY R	4.70	1330.0	UPST. WIGHTMANS GROVE (FISHER RD.)	Lake influenced	B,C,MT,F2	-83.06070	41.42953	Wightmans Grove
U04G16	SNUFF CREEK	0.33	4.7	@ TWP. RD. 71	Hog farm ust. @ Twp. Rd.123	C,M,F	-83.19716	41.19075	Tiffin North
U04Q11	SPICER CREEK	0.80	12.3	N OF TIFFIN @ CO. RD. 33	Spatial	C,M,F	-83.14420	41.18310	Tiffin North
U04Q10	SUGAR CREEK	3.11	9.4	NEAR TIFFIN @ TWP. RD. 76	Dst. 1980s Toluene spill	Co,M,F,S	-83.09318	41.19337	Watson
U04Q08	SUGAR CREEK	1.05	13.0	NEAR TIFFIN @ TWP. RD. 148	Spatial	M,F,S	-83.12382	41.19585	Watson
201336	WOLF CREEK	13.60	27.0	0.2 MI. UPST. CO. RD. 592	Spatial	C,MT,F2	-83.33075	41.17897	Bascom
U04S40	WOLF CREEK	5.15	66.5	AT BETTSVILLE @ ST. RT. 12	Spatial	Cm,MT,F2	-83.3370	41.14680	Bascom
U04G07	WOLF CREEK	1.58	71.8	AT TOWNSHIP LINE RD (CR 118)	Sentinel	B,Cmp,MT,F2,PO4,D	-83.18800	41.2701	Fremont West
U04P04	WOLF CREEK	0.04	158.0	NEAR FREMONT @ ST. RT. 53	Spatial	C,MT,F2	-83.16886	41.28012	Fremont West

Table 4. List of chemical/physical water quality parameters to be analyzed/measured in surface water, sediment, and fish tissue from the Lower Sandusky River sampling locations. Not all sites will be samples for all parameters. Water samples will be collected 5 times (organics once), sediment once. Bacteria samples will be collected 5 times during the recreation season (5– 10 times at sentinel sites). Select sampling locations will be monitored for dissolved oxygen, pH, temperature, and conductivity using Datasonde© continuous recorders (Table 2).

Parameters	Test Method	Water	Sediment	Fish Tissue
Cbod, 20 day	?	X		
SOLIDS, DISSOLVED (TDS)	USEPA 160.1	X		
SOLIDS, SUSPENDED (TSS)	USEPA 160.2	X		
AMMONIA	USEPA 350.1	X		
TKN	USEPA 351.2	X		
NITRATE-NITRITE	USEPA 353.1	X		
Nitrite	USEPA 354.1	X		
Chloride	USEPA 325.1	X		
COD	USEPA 410.4	X		
TOTAL PHOSPHORUS	USEPA 365.4	X		
ORTHOPHOSPHATE, Dissolved	?	X		
GLYPHOSATE	USEPA 547	X		
ICP 1 (Al,Ba,Ca, Fe, Mg, Mn, Na, Ni, K, Sr, Zn, Hardness)	USEPA 200.7	X		
ICP 3 (Al,Ba,Ca,Fe,Mg,Mn,Na,K,Sr,Zn)	USEPA 200.7		X	
ICPMS 1 (As,Cd,Cr,Cu,Ni,Pb,Se)	USEPA 200.9, SM 3113B	X		X
ICPMS 2 (As,Cd,Cr,Cu,Ni,Pb,Se)	USEPA 200.9, SM 3113B		X	
MERCURY, TOTAL	USEPA 245.1,7470A,7471A	X	X	X (245.1)
pH – grab	YSI 556MPS meter	X – field		
Conductivity – grab	YSI 556MPS meter/ USEPA 120.1	X – field / lab		
Dissolved Oxygen – grab	YSI 556MPS meter	X – field		
Temperature – grab	YSI 556MPS meter	X – field		
VOCs	USEPA 624/USEPA 8260	X	X	
Herbicides	USEPA 525.2	X		
SVOCs (BNAS)	USEPA 625/ USEPA 8270C	X	X	
Pesticides/PCBs/ Chlordane	USEPA 608/ USEPA 8081A, 8082	X (PCBs only)	X (PCBs only)	X (OEPA 590.1)
E.coli	USEPA 1103.1/ 640.1	X		
Percent Solids	SM 2540G		X	X

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<http://www.epa.state.oh.us/dsw/bioassess/BioCriteriaProtAqLife.html>

Appendix A

Hospital Directions and Maps

Magruder Hospital

From Perry Street (St Rte 163):

Turn south on Fulton Street (a sign for Magruder Hospital is located on north side of intersection). Magruder Hospital is 6 blocks south on the east side of the street.

From the South:

Take SR 53 north into Port Clinton. After the stoplight, turn right onto Lay Drive. At the stop sign, turn left onto 6th Street. Follow 6th Street to Magruder.

From Rt 2 Eastbound:

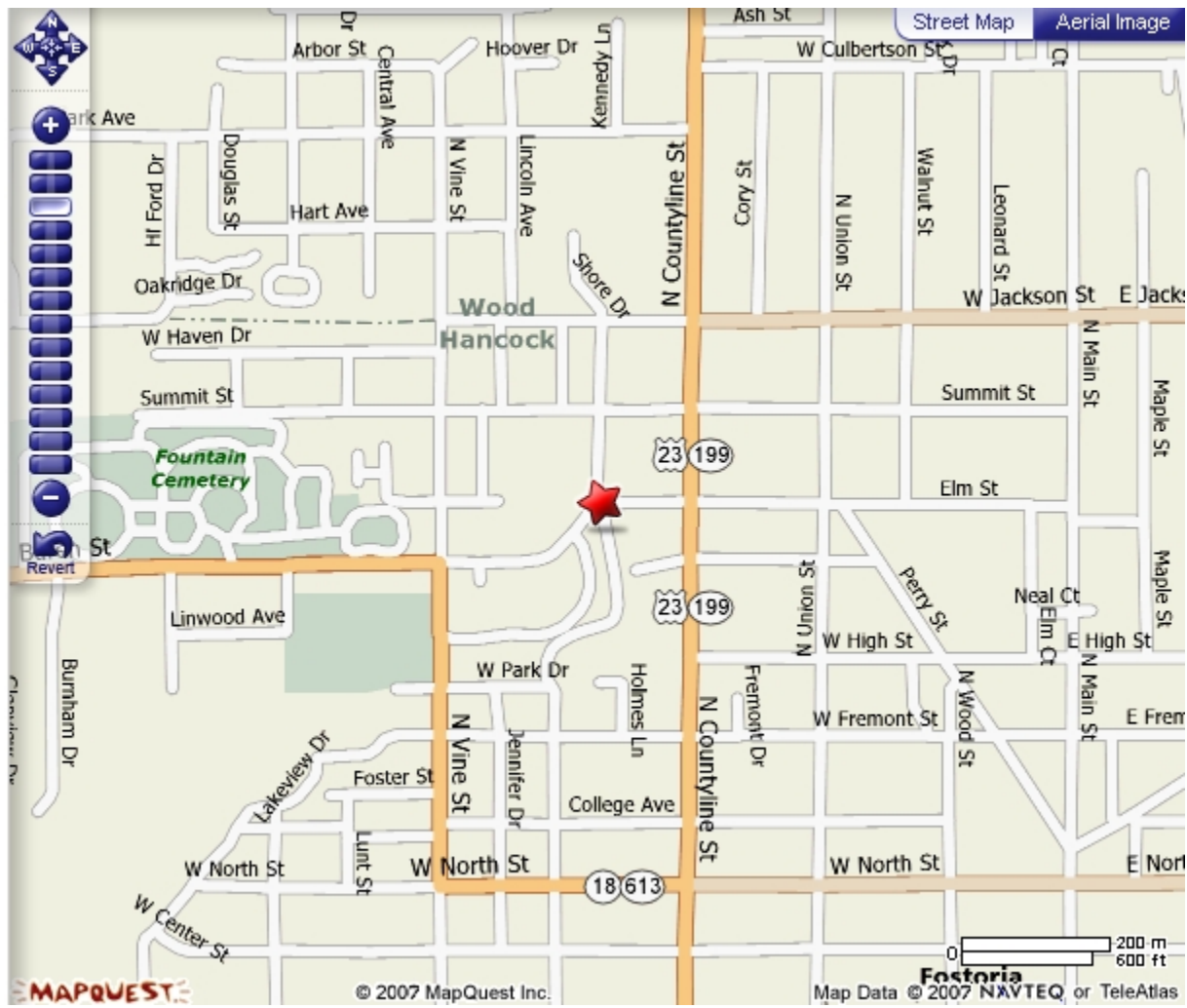
Exit at 53 South and turn north toward Port Clinton. After the stoplight, turn right onto Lay Drive. At the stop sign, turn left onto 6th Street. Follow 6th Street to Magruder.

From Rt 2 Westbound

Exit at SR 163, exit 121. Stay to the left on the exit ramp. Follow Perry Street to the Fulton Street intersection. A sign for Magruder Hospital will be on the north (right hand) side of the intersection. Turn south onto Fulton Street. Magruder Hospital is 6 blocks down on the east side of the street.



South on US 23. Right on Elm Street (613). Elm Street becomes Van Buren Street.



Memorial Hospital

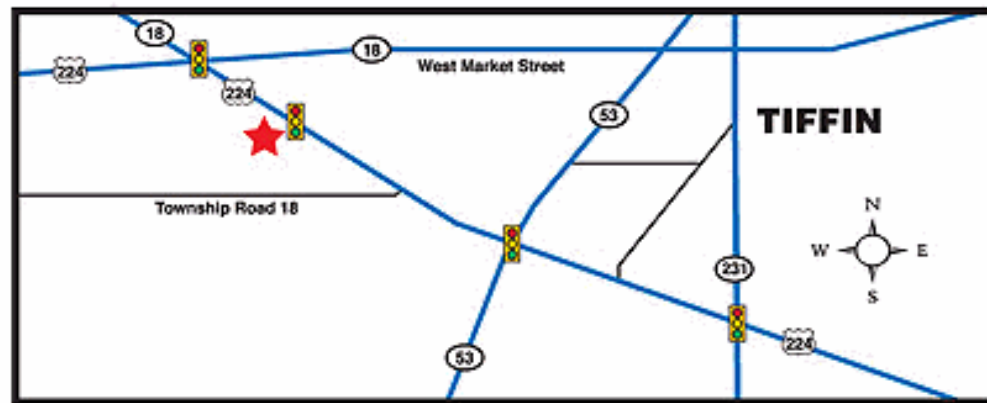
Driving directions:

23 South to US-20 East. Take the OH-53 S/US 6 West exit towards Tiffin. Turn right at Oh/53N/US 6. Turn Left at Hayes Avenue. Turn Right at 3rd Ave. Turn Left at Glen Springs Drive. Glen Springs Drive turns right and becomes S. Taft Avenue.



Mercy Hospital of Tiffin

Directions



[MapQuest Directions To This Location](#)

[Campus Map](#)

From the North: Toledo

Take 180/190 East - Ohio Turnpike toward Cleveland
Exit at State Route 53, South
Follow State Route 53 signs through Fremont, Fort Seneca into Tiffin
Follow State Route 53 through Tiffin
At intersection of US Highway 224 & State Route 53, turn right
At first stop light, turn left onto St. Lawrence Drive

From the South: Upper Sandusky

Take US 23 North
Exit at South Route 53, North
Follow State Route 53 to Tiffin
At intersection of State Route 53 & US 224, turn left
At first stop light, turn left onto Lawrence Drive

From the West: Findlay

Take US Highway 224 East into Tiffin
At intersection of US Highway 224 & State Route 18, turn right & follow US Highway 224
At first top light, turn right onto St. Lawrence Drive

From the East: Willard

Take US Highway 224 West to Tiffin
At first stop light, after State Route 53 intersection, turn left onto St. Lawrence Drive