

2009 Study Plan for the Sandusky Bay tributaries

**Eire, Huron, 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

June 12, 2009

CONTACTS

Assigned Field Staff

- Coordinator / Fish / Habitat: Holly Tucker (614) 836-8777
- Chemical and Sediment: Brent Kuenzli (419) 373-3005
- Nonpoint: Katie McKibben (419) 373-3013
- Stormwater: Lynette Hablitzel (Erie, Huron & Seneca) (419) 373-3009
Patricia Tebbe (Sandusky) (419) 373-3016
- NPDES: Mary Beth Cohen (Sandusky & Seneca) 419-373-3014
Rich Zuzik (Erie) (419) 373-3020
Andrew Gall (Huron) (419) 373-3003
- TMDL Leader: Dan Glomski (419) 373-3023
- Modeling: Keith Orr (614) 644-2885
Eric Saas (614) 644-2890
- Macroinvertebrates: Angela Dripps (614) 836-8798

ODNR Wildlife Officers

District 2: 419-424-5000

- Erie Co: Kevin Good (419) 429-8382
- Huron Co: Jeff Collingwood (419) 429-8387
- Sandusky Co: Brian Bury (419) 429-8393
- Seneca Co: Jim Davis (419) 429-8394

County Sheriff Offices

- Erie Co: (419) 625-7951 (Dial 911 for emergency help)
- Huron Co: (419) 668-6912 (Dial 911 for emergency help)
- 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 Sandusky Bay tributaries 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 community of Clyde is within the study area, and has had a childhood cancer cluster dating back to 2004. The study area was originally part of the lower Sandusky TMDL study area, but has been partitioned off in hopes of being able to provide the public with a complete TSD in spring 2010. The study area includes 3 HUC 10s: 0410001101, 0410001102, and 0410001112.

The Sandusky Bay tributaries have not been assessed since 1995. 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 Sandusky Bay tributaries 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.
- Collect fish samples for the Ohio Sport Fish Tissue Monitoring Program (used to assess chemical contaminant levels in fish).

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 12 locations. Datasondes® will be deployed at 11 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. Public Water Supply intakes will be evaluated at two locations and will be tested for pesticides in addition to the normal suite of parameters. DDAGW will coordinate with NWDO staff for sampling times that occur before the official sampling season begins in June.

In order to receive results from DES in a timely manner and to have the report completed by spring 2010, an attempt will be made to have all sediment samples collected prior to June 2009.

Bacteriological Sampling

Water samples will be collected at all chemistry sites for bacteriological analyses to determine the attainment status of the Primary Contact recreational use of the Raccoon Creek mainstem and associated tributaries. 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.

Fish Tissue

Fish tissue samples will be collected from 4 locations as part of the Ohio Fish Tissue Consumption Monitoring Program. However, because fish may reveal the presence of bioaccumulative toxins, any appropriately sized fish collected during routine fish sampling may be sent for fish tissue analysis. This information will be used to supplement data collected for the Ohio Sport Fish Consumption Advisory Program and to determine if areas of concern are present that warrant further investigation in relation to the cancer cluster in Clyde.

Fillet samples of edible size sport fish will be tested for organochlorinated pesticides, PCBs, mercury, lead, cadmium, arsenic, and selenium. Results will be used in the Ohio Sport Fish Consumption Advisory Program. In order to receive results from DES in a timely manner and to have the report completed by spring 2010, an attempt will be made to have all fish tissue samples collected prior to August 2009. All Raccoon Creek and associated samples will be listed first in the Groveport log book and turned in first to the lab.

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).

Fish Tissue

Tissue fillet samples will be collected from fish of edible size, and species preferred for analysis may include spotted bass, largemouth bass, smallmouth bass, flathead catfish, walleye, saugeye, white bass, common carp, freshwater drum, and channel catfish. When possible, composite samples (by species) will be collected using a minimum of three fish and a minimum of 150 grams of material. At each sampling location, an attempt will be made to collect five fish species for fillet tissue analysis. Fish will be sampled using electrofishing boat methods at the reservoir and wading method at the remainder sites. Sampling locations are listed in Table 2.

Fish used for tissue analysis will be filleted in the field using decontaminated stainless steel fillet knives. Filleted samples will be wrapped in aluminum foil, placed in a sealed plastic bag, and placed on dry ice. Sampling and decontamination protocols will follow those listed in the Ohio EPA Fish Collection Guidance Manual (2004); however, it is not necessary to clean aluminum foil which is used directly from the roll. Fish tissue samples will be stored in chest freezers at the Ohio EPA Groveport Field Facility prior to delivery to DES.

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 Sandusky Bay tributaries study area.

Facility Name	NPDES Number	Outfall	Flow Rate (MGD)	Treatment	Receiving Stream	River Mile
City of Sandusky WWTP	2PF00001	001	22	Final	Sandusky Bay	
		004		CSO	Sandusky Bay	
		005		CSO	Sandusky Bay	
		006		CSO	Sandusky Bay	
		007		CSO	Sandusky Bay	
		008		CSO	Sandusky Bay	
		009		CSO	Sandusky Bay	
		011		CSO	Sandusky Bay	
		013		CSO	Sandusky Bay	
		014		CSO	Sandusky Bay	
		015		CSO	Sandusky Bay	
		016		CSO	Sandusky Bay	
		017		CSO	Sandusky Bay	
		018		CSO	Sandusky Bay	
		019		CSO	Mills Ck	
021	CSO	Taylor Ck				
Wagner Quarries DBA	2IJ00006	001	1.9	sedimentation	Taylor Ditch	1.59
		002	1.9	sedimentation	Hemminger Ditch	
Thakar Aluminum Corp	2IE00007	001	2.1	heat exchanger	Mills Ck	0.22
NASA Plum Brook Station	2IO00002	001	0.006	instream sampler	Kuebler Ditch	1.75
		002	0.04	instream sampler	Ransom Brook	3.55
		003	6	B-2 retention pond	Plum Brook	~5.5
		005	0.0008	package plant	Kuebler Ditch	~2.1
		010	0.033	outlet pipe	Lindsey Ditch	--
		014	0.0009	main sump	Pentolite Ditch	--
016	0.0003	cooling tower	-----	--		
BP Oil Co-Sandusky	2IN00178	001	0.0008	sed. oil/water separator	railroad ditch to Pipe Ck @ 1.3	
Hanson Aggregates Inc.	2IJ00021	001	4.35	settling	Caswell Ditch	5.70
		002	3.17	settling	Pipe Ck	12.20

Facility Name	NPDES Number	Outfall	Flow Rate (MGD)	Treatment	Receiving Stream	River Mile
Sandusky Acq Holdings LLC Okamoto Sandusky Mfg	2IQ00015	001 002			storm sewer storm sewer	-- --
Bellevue WTP	2IW00011	001 002 003	0.03 intermittent	lime sludge lagoon lime sludge lagoon lime sludge lagoon	Snyder's Ditch	4.95
Bellevue WWTP	2PD00037	001	2.4	activated sludge,sec/clair, trick/filter	Snyder's Ditch	3.80
Automotive Components Holdings LLC	2IC00013	001			Schowe Ditch	0.70
Kyklos Bearing Int. Inc.	2IC00011	001	0.00725	storm/w polishing pond	Mills Ck	1.55
Castalia Trout Farm	2IN00049	001 002	3 6	settling settling	Cold Ck Cold Ck	1.79 2.09
Erie Materials Inc.	2IJ00083	001	2.3		Kuebelen Ditch	
Erie Islands WWTP	2PQ0000 1	001	0.15	package plant	Pickerel Ck	1.39
Clyde WTP	3IW00050	001 002 003	0.009 0.009 0.009	lime sludge lagoon lime sludge lagoon lime sludge lagoon	Norris Ditch	12.26
Clyde WWTP	2PD00004	001 010 300	1.9	oxidation, sec/clair, UV, polishing lagoon CSO SSO	Raccoon Ck	11.02
Leafy Oaks RV Park Inc.	2PR00147	001	0.01	package plant/chl-dechl	Westerhouse Ditch	4.7
Club Rog WWTP	2PR00170	001	0.002	package plant	trib to Green Ck	4.65
Green Springs WWTP	2PB00026	001	0.24	aerated lagoons	Flag Run Ck	1.2

Table 2. Sandusky Bay tributaries study area sampling sites, by 10-digit Hydrologic Unit Code (HUC).

STATION	STREAM	RM	DA	Location	Sampling	Issue	USGS_Quad	County
HUC 10 0410001101 Mills Creek - Frontal Lake Erie								
U05P09	Mills Creek	0.07	42.0	Monroe Street	Sp	Sediments	Sandusky	Erie
U05P05	Mills Creek	1.34	39.7	Perkins Avenue	CmbPO4BODpo+,MT,F2,D	Sentinel, Dwnst. Old Ford Plant	Sandusky	Erie
U05S18	Mills Creek	3.70	35.0	Strub Road	Cm,MT,F2	Dwnst. quarry	Sandusky	Erie
U05P07	Mills Creek	5.20	29.0	Bogart Road	Cm,MT,F2	Dwnst. livestock	Castalia	Erie
U05S06	Mills Creek	6.03	29.0	State Route 99	Cm,MT,F2,D	Upst. quarry and livestock	Castalia	Erie
U05S07	Mills Creek	10.40	21.0	Portland Road	Cm,MT,F2,S	Spatial	Bellevue	Erie
U05W37	Caswell Ditch	0.85	3.9	Bogart Road	C,MT,F2	Reference Site	Sandusky	Erie
U05S09	Snyder Ditch	2.46	4.3	Knauss Road	Com,D	Dwnst. Bellevue WWTP	Bellevue	Erie
U05S11	Snyder Ditch	3.85	3.1	Goodrich Road	Cm	Upst. Bellevue WWTP	Bellevue	Huron
U05K13	Snyder Ditch	5.00	1.5	Railroad tracks	Cmp ⁵	PDWS, chem only	Bellevue	Huron
U05K14	Pipe Creek	0.90	28.6	US 6	Sp	Sediment only.	Sandusky	Erie
U05K15	Pipe Creek	2.30	22.8	Columbus Avenue	CmbPO4BODp,MT,F2,D	Sentinel, urban area, bacteria	Sandusky	Erie
U05K16	Pipe Creek	6.60	18.4	Schenk Road	Cm,M,F	Dwnst. NASA	Sandusky	Erie
U05K17	Pipe Creek	8.15	14.7	Patten Tract Road	Cm,M,F	Dwnst. golf course, Upst. NASA,	Kimball	Erie
U05K18	Pipe Creek	10.90	9.4	Harris Road	Cm,M,F	Dwnst. quarry, Upst. golf course	Kimball	Erie
U05K19	Taylor Ditch	0.80	2.9	DeWitt Avenue	Cm	Urban influence of upst. pond and ducks.	Sandusky	Erie
U05K20	Taylor Ditch	2.70	1.5	Bogart Road	Cm	Chem only	Sandusky	Erie
K01K20	Plum Brook	1.00	6.8	Perkins Road	Cm	Chem only, MS4	Sandusky	Erie
K01K21	Sawmill Creek	1.00	13.5	Boos Road	Cbm,M,F	Spatial	Huron	Erie
HUC 10 0410001102 Pickerel Creek-Frontal Sandusky Bay								
300670	Cold Creek*	0.30	3.0	CR 105 (Bardshar Road)	Cb,M,F	Spatial	Castalia	Erie
201385	Little Pickerel Creek	1.25	5.9	Yetter Road	Cb,M,F	Verify CWH	Vickery	Sandusky
	Pickerel Creek	6.26	9.5	Reinicke Rd (TR 233)	C,M,F	Spatial	Clyde	Sandusky
U05S04	Pickerel Creek	3.30	43.7	Twp. Rd. 247	CmbPO4BODp,MT,F2,D	Sentinel	Vickery	Sandusky

				(Whitmore Rd)				
U05K11	Strong Creek	2.00	4.6	Twp. Rd 268	Cb	North of Vickery, bacteria	Vickery	Sandusky
U05K12	Strong Creek	2.90	4.0	Twp. Rd 272	C	Upst. of Vickery, bacteria	Vickery	Sandusky
U05K08	Raccoon Creek	1.1	35.1	Brugger Road	Sp	Sediment only.	Vickery	Sandusky
U05W17	Raccoon Creek	5.45	22.5	Twp. Rd 244 (Karbler Road)	CmbPO4BODpo+,M,F,Sp,FT,D	Sentinel	Vickery	Sandusky
U05W10	Raccoon Creek	10.18	12.2	Twp. Rd. 223	Cmo+,M,F,Sp,FT,D	Spatial, Dwnst. bridge	Clyde	Sandusky
U05W08	Raccoon Creek	10.76	13.3	Adj. Clyde Dump	Cm o+	Chem. only. Characterize leachate from dump.	Clyde	Sandusky
U05W33	Raccoon Creek	11.01	11.6	Clyde WWTP mix zone	Cm o+	Mix zone, chem only	Clyde	Sandusky
U05P04	Raccoon Creek	11.32	11.3	US 20	Cmo+,M,F,Sp	Upst. CSO and WWTP, Dwnst. Whirlpool	Clyde	Sandusky
U05S01	Raccoon Creek	13.60	8.6	Upst. Limerick Road	Cmo+,M,F,Sp	Upstrm. Clyde	Clyde	Sandusky
U05S03	Buck Creek	0.20	4.5	Twp. Rd. 223	Cmo+,M,F,Sp	Historical toxicity	Clyde	Sandusky
U05K05	South Creek	4.00	18.1	Whitmore (TR 247)	Cb,M,F	Spatial	Wightmans Grove	Sandusky
U05G01	South Creek	7.92	7.1	County Road 229	C,M,F	Spatial	Fremont East	Sandusky
U05K06	South Creek	11.30	5.1	1672 CR 236 (Spayd Rd aka Sherman Rd)	Sp	Sediment only. Historical leach dump site.	Fremont East	Sandusky
U05K07	South Creek	11.70	4.9	Limerick Road	Sp	Sediment only. Upstream leach dump site.	Fremont East	Sandusky
U05K09	Raccoon Creek Reservoir	0.00	10.0	Limerick Road	Sp,FT	Sediment and Fish Tissue only.	Clyde	Sandusky
HUC 10 0410001112 Green Creek								
U04K01	Green Creek	5.06	78.3	TR 239 (Balsizer Rd)	CmbPO4BODp,MT,F2,D	Sentinel	Wightmans Grove	Seneca
U04G20	Green Creek	9.08	74.0	County Road 229	C,MT,F2,D	Spatial	Fremont East	Sandusky
U04S10	Green Creek	12.85	71.0	Dewey Road	C,MT,F2	Dwnst. Green Springs, longitudinal coverage	Fremont East	Sandusky
U04G24	Green Creek	18.80	53.0	County Road 34	C,MT,F2	Dwnst. Lowell	Watson	Seneca

U04G25	Beaver Creek	3.48	43.4	State Route 101	CbmPO4BODp ⁵ ,MT,F2	Sentinel,PWS, Chem@RM 2.88, Upst. Lowell	Watson	Seneca
U04K03	Beaver Creek	4.00	20.9	Adjacent State Route 101	C,MT,F2	Dwnst. Leafy Oaks RV	Watson	Seneca
U04K04	Westerhouse Ditch	0.62	16.2	State Route 19	M,F	Upstream MHP, HUC12	Watson	Seneca
U04K06	Albright Ditch	0.60	3.8	State Route 228	C	Upstream MHP, HUC12	Watson	Seneca
U04G26	Emerson Creek	1.83	22.0	Twp Road 179	C,MT,F2	Spatial	Fireside	Seneca
U04K07	Emerson Creek (aka Royer Ditch)	6.85	15.2	Roy Meyers Road	Cm,M,F	Dwnst. sludge Fields,HUC12	Fireside	Seneca
U04K08	Emerson Creek (aka Royer Ditch)	10.10	6.4	County Road 46	Cm,M,F	Upst. sludge Fields, HUC 12	Fireside	Seneca
U04K02	Westerhouse Ditch	3.25	9.6	Snavely Road	Cb,M,F	HUC12	Watson	Seneca
U04K02	Beaver Creek Reservoir	0.00	10.0	Beaver Creek Reservoir	Sp,FT	Sediment and Fish Tissue only.	Watson	Seneca

- C – Inorganic water chemistry, no metals.
- Cb- E-Coli bacteria
- Co – C and 624-625 organics (organics collected twice)
- Co+ - Co and 608 PCBs (collected twice)
- Cm – C and metals
- Cp – C and 525 new age herbicides (collected twice)
- Cp⁵ – C and 525 new age herbicides (collected five times)
- D- Datasonde
- F – Single pass fish site
- F2 – Two-pass fish site (for reference sites, or drainage area 20 sq. miles or greater)
- FT – Fish Tissue
- M – Macroinvertebrate qualitative site
- MT – Macroinvertebrate quantitative site (for reference sites, or drainage area 20 sq. miles or greater)
- PO4 – Orthophosphates
- S – Sediment metals/8270 BNAs/8081
- Sp – S and 8082 PCBs
- Sv – S and 8260 VOCs
- D – Datasonde site

419-609-9223 (cell) or 419-684-7749 (work)

Type	Number of Sites
Total	50
Water chemistry	43
Bacteria	12
Fish	1 Pass 18 2 Pass 14
Macroinvertebrate	Qual 18 Quant 14
Fish Tissue	4
Sediment	12
Datasonde©	9

*Contact Ronald Scheufler (landowner) before sampling:

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

STATION	STREAM	RM	DA	Location	Issue	Sampling	POINT_X	POINT_Y	USGS_Quad
U04K06	Albright Ditch	0.60	3.8	State Route 228	Upstream MHP, HUC12	C	-83.01530795	41.22020410	Watson
U04G25	Beaver Creek	3.48	43.4	State Route 101	Sentinel,PWS, Chem@RM 2.88, Upst. Lowell	CmbPO4BOD5p ⁵ ,MT,F2,D	-83.02083009	41.22970818	Watson
U04K03	Beaver Creek	4.00	20.9	State Route 101	Dwnst. Leafy Oaks RV	C,MT,F2	-83.02510656	41.22509397	Watson
U04K02	Beaver Creek Reservoir	0.00	10.0	Beaver Creek Reservoir	Sediment and Fish Tissue only.	Sp,FT	-83.02074662	41.23772039	Watson
U05S03	Buck Creek	0.20	4.5	Twp. Rd. 223	Historical toxicity	Cmo+,M,F,Sp	-82.98323806	41.32869165	Clyde
U05W37	Caswell Ditch	0.85	3.9	Bogart Road	Reference site	C,MT,F2	-82.7475	41.3975	Sandusky
300670	Cold Creek	0.30	3.0	Bardshar Road	Spatial	Cb,M,F	-82.77272126	41.44305651	Castalia
U04G26	Emerson Creek	1.83	22.0	Twp Road 179	Spatial	C,MT,F2	-82.99483826	41.22982084	Fireside
U04K07	Emerson Creek (aka Royer Ditch)	6.85	15.2	Roy Meyers Road	Dwnst. sludge Fields,HUC12	Cm,M,F	-82.91790630	41.22078059	Fireside
U04K08	Emerson Creek (aka Royer Ditch)	10.10	6.4	County Road 46	Upst. sludge Fields, HUC 12	Cm,M,F	-82.89470066	41.19000883	Fireside
U04K01	Green Creek	5.06	78.3	TR 239 (Balsizer Rd)	Sentinel	CmbPO4BODp, MT,F2,D	-83.02906634	41.37828796	Wightmans Grove
U04G20	Green Creek	9.08	74.0	County Road 229	Spatial	C,MT,F2,D	-83.06051707	41.34175280	Fremont East
U04S10	Green Creek	12.85	71.0	Dewey Road	Dwnst. Green Springs, longitudinal coverage	C,MT,F2	-83.05759670	41.30665898	Fremont East
U04G24	Green Creek	18.80	53.0	County Road 34	Dwnst. Lowell	C,MT,F2	-83.08435934	41.24121550	Watson
201385	Little Pickerel Creek	1.25	5.9	Yetter Road	Verify CWH	Cb,M,F	-82.88126372	41.40791008	Vickery
U05P09	Mills Creek	0.07	42.0	Monroe Street	Sediments	Sp	-82.73598011	41.44618252	Sandusky

STATION	STREAM	RM	DA	Location	Issue	Sampling	POINT_X	POINT_Y	USGS_Quad
U05P05	Mills Creek	1.34	39.7	Perkins Avenue	Spatial, Sentinel, Dwnst. Old Ford Plant	CmbPO4BODpo +,MT,F2,D	-82.732125	41.433317	Sandusky
U05S18	Mills Creek	3.70	35.0	Strub Road	Dwnst. quarry	Cm,MT,F2	-82.73699131	41.40949500	Sandusky
U05P07	Mills Creek	5.20	29.0	Bogart Road	Dwnst. livestock	Cm,MT,F2	-82.75812304	41.39756549	Castalia
U05S06	Mills Creek	6.03	29.0	State Route 99	Upst. quarry and livestock	Cm,MT,F2,D	-82.77061600	41.39180433	Castalia
U05S07	Mills Creek	10.40	21.0	Portland Road	Spatial	Cm,MT,F2,S	-82.80871668	41.34190064	Bellevue
U05K10	Pickereel Creek	6.26	9.5	Reinicke Rd (TR 233)	Spatial	C,M,F	-82.96874449	41.35766062	Clyde
U05S04	Pickereel Creek	3.30	43.7	Twp. Rd. 247	Sentinel	CbmpPO4BODp, MT,F2,D	-82.95855208	41.38718242	Vickery
U05K14	Pipe Creek	0.90	28.6	US 6	Sediment only.	Sp	-82.67939402	41.44124582	Sandusky
U05K15	Pipe Creek	2.30	22.8	Columbus Avenue	Sentinel, urban area, bacteria	CmbPO4BODp, MT,F2,D	-82.69575625	41.42905512	Sandusky
U05K16	Pipe Creek	6.60	18.4	Schenk Road	Dwnst. NASA, bacteria	Cm,M,F	-82.70767584	41.37914871	Sandusky
U05K17	Pipe Creek	8.15	14.7	Patten Tract Road	Dwnst. golf course, Upst. NASA	Cm,M,F	-82.72796255	41.36533988	Kimball
U05K18	Pipe Creek	10.90	9.4	Harris Road	Dwnst. quarry, Upst. golf course	Cm,M,F	-82.74887571	41.33843965	Kimball
K01K20	Plum Brook	1.00	6.8	Perkins Road	Chem only, MS4	Cm	-82.64042077	41.42028890	Sandusky
U05K08	Raccoon Creek	1.1	35.1	Brugger Road	Sediment only	Sp	-82.97938078	41.42936084	Vickery
U05W17	Raccoon Creek	5.45	22.5	Twp. Rd 244 (Karbler Road)	Spatial, sentinel	CmbPO4BODpo +,M,F,Sp,FT,D	-82.99277625	41.37934197	Vickery
U05W10	Raccoon Creek	10.18	12.2	Twp. Rd. 223	Dwnst. bridge	Cmo+,M,F,Sp,FT ,D	-82.98742970	41.32870612	Clyde
U05W08	Raccoon Creek	10.76	13.3	Adj. Clyde Dump	Chem. only. Characterize leachate from dump.	Cmo+	-82.98656164	41.32014348	Clyde
U05W33	Raccoon Creek	11.01	11.6	Clyde WWTP mix zone	Mix zone, chem only	Cmo+	-82.98565206	41.31762216	Clyde

STATION	STREAM	RM	DA	Location	Issue	Sampling	POINT_X	POINT_Y	USGS_Quad
U05P04	Raccoon Creek	11.32	11.3	US 20	Upst. CSO and WWTP, Dwnst. Whirlpool	Cmo+,M,F,Sp	-82.98534664	41.31254858	Clyde
U05S01	Raccoon Creek	13.60	8.6	Upst. Limerick Road	Upstrm. Clyde	Cmo+,M,F,Sp	-82.97779614	41.28450264	Clyde
U05K09	Raccoon Creek Reservoir	0.00	10.0	Limerick Road	Sediment and Fish Tissue only.	Sp,FT	-82.97843357	41.29005340	Clyde
K01K21	Sawmill Creek	1.00	13.5	Boos Road	Spatial	Cbm,M,F	-82.59691001	41.40380755	Huron
U05S09	Snyder Ditch	2.46	4.3	Knauss Road	Dwnst. Bellevue WWTP	Cmo,D	-82.81436819	41.30225010	Bellevue
U05S11	Snyder Ditch	3.85	3.1	Goodrich Road	Upst. Bellevue WWTP	Cm	-82.82389765	41.28342429	Bellevue
U05K13	Snyder Ditch	5.00	1.5	Railroad tracks	PDWS, chem only	Cmp ⁵	-82.82416656	41.26770667	Bellevue
U05K05	South Creek	4.00	18.1	Whitmore (TR 247)	Spatial	Cb,M,F,	-83.00950727	41.39166578	Wightmans Grove
U05G01	South Creek	7.92	7.1	County Road 229	Spatial	C,M,F	-83.01793174	41.34230592	Fremont East
U05K06	South Creek	11.30	5.1	1672 CR 236 (Spayd Rd aka Sherman Rd)	Sediment only. Historical leach dump site.	Sp	-83.01296426	41.29771423	Fremont East
U05K07	South Creek	11.70	4.9	Limerick Road	Sediment only. Upstream leach dump site.	Sp	-83.01005610	41.29253911	Fremont East
U05K11	Strong Creek	2.00	4.6	Twp. Rd 268	North of Vickery, bacteria	Cb	-82.93513799	41.38859121	Vickery
U05K12	Strong Creek	2.90	4.0	Twp. Rd 272	Upst. of Vickery, bacteria	C	-82.92587008	41.38001859	Vickery
U05K19	Taylor Ditch	0.80	2.9	DeWitt Avenue	Urban influence of upst. pond and ducks.	Cm	-82.68581690	41.42022717	Sandusky
U05K20	Taylor Ditch	2.70	1.5	Bogart Road	Chem only	Cm	-82.68549854	41.39607091	Sandusky
U04K04	Westerhouse Ditch	0.62	16.2	State Route 19	Upstream MHP, HUC12	M,F	-83.02286577	41.21299320	Watson

STATION	STREAM	RM	DA	Location	Issue	Sampling	POINT_X	POINT_Y	USGS_Quad
U04K02	Westerhouse Ditch	3.25	9.6	Snavelly Road	HUC12	Cb,M,F	-83.00662349	41.18366899	Watson

Table 4. List of chemical/physical water quality parameters to be analyzed/measured in surface water, sediment, and fish tissue from the Sandusky Bay tributaries 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

REFERENCES

- Hughes, R. M., D. P. Larsen, and J. M. Omernik. 1986. Regional reference sites: a method for assessing stream pollution. *Env. Mgmt.* 10(5): 629-635.
- Karr, J.R. and D.R. Dudley. 1981. Ecological perspective on water quality goals. *Env. Mgmt.* 5(1): 55-68.
- Ohio Environmental Protection Agency. 2006. Ohio EPA manual of surveillance methods and quality assurance practices, updated edition. Division of Environmental Services, Columbus, Ohio.
<http://www.epa.state.oh.us/dsw/documents/Field%20Manual%203-6-06%20revision.pdf>
- Ohio EPA. 2004. State of Ohio Cooperative Fish Tissue Monitoring Program, Fish Collection Guidance Manual Final. March 2004
<http://www.epa.state.oh.us/dsw/fishadvisory/FishCollectionGuidanceManual05.pdf>
- Ohio EPA. 2001. Sediment sampling guide and methodologies, 2nd edition. Nov. 2001. Division of Surface Water, Columbus, Ohio.
<http://www.epa.state.oh.us/dsw/guidance/sedman2001.pdf>
- Ohio EPA. 1997. Draft. Biological Criteria for the Protection of Aquatic Life: Volume IV: Fish and Macroinvertebrate Indices for Ohio's Lake Erie Nearshore Waters, Harbors, and Lacustraries. Division of Surface Water, Ecological Assessment Unit, Ohio EPA, Columbus, Ohio, USA.
- Ohio EPA. 1987a. Biological criteria for the protection of aquatic life: Volume I. The role of biological data in water quality assessment. Division of Water Quality Monitoring and Assessment, Surface Water Section, Columbus, Ohio.
<http://www.epa.state.oh.us/dsw/bioassess/BioCriteriaProtAqLife.html>
- Ohio EPA. 1987b. Biological criteria for the protection of aquatic life: Volume II. Users manual for biological field assessment of Ohio surface waters. Division of Water Quality Monitoring and Assessment, Surface Water Section, Columbus, Ohio
<http://www.epa.state.oh.us/dsw/bioassess/BioCriteriaProtAqLife.html>
- Ohio EPA. 1989a. Addendum to biological criteria for the protection of aquatic life: Users manual for biological field assessment of Ohio surface waters. Division of Water Quality Planning and Assessment, Surface Water Section, Columbus, Ohio.
<http://www.epa.state.oh.us/dsw/bioassess/BioCriteriaProtAqLife.html>
- Ohio EPA. 1989b. Biological criteria for the protection of aquatic life: Volume III. Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities. Division of Water Quality Planning and Assessment, Columbus, Ohio.
<http://www.epa.state.oh.us/dsw/bioassess/BioCriteriaProtAqLife.html>
- Omernik, J.M. 1987. Ecoregions of the conterminous United States. *Ann. Assoc. Amer. Geogr.* 77(1): 118-125.
- Rankin, E.T. 1989. The qualitative habitat evaluation index (QHEI): rationale, methods, and application. Division of Water Quality Planning and Assessment, Columbus, Ohio.
<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.



St. Vincents Hospital

From the North

- I-75 South to I-280 (Exit 208)
- I-280 South to Greenbelt Parkway (Exit 11)
- Greenbelt Parkway to right on Cherry Street

or

- US 23 to I-475 East
- I-475 East to I-75 North (Exit 20A)
- I-75 North to Berdan Avenue (Exit 205B)
- Berdan Avenue to right on Cherry

From the South

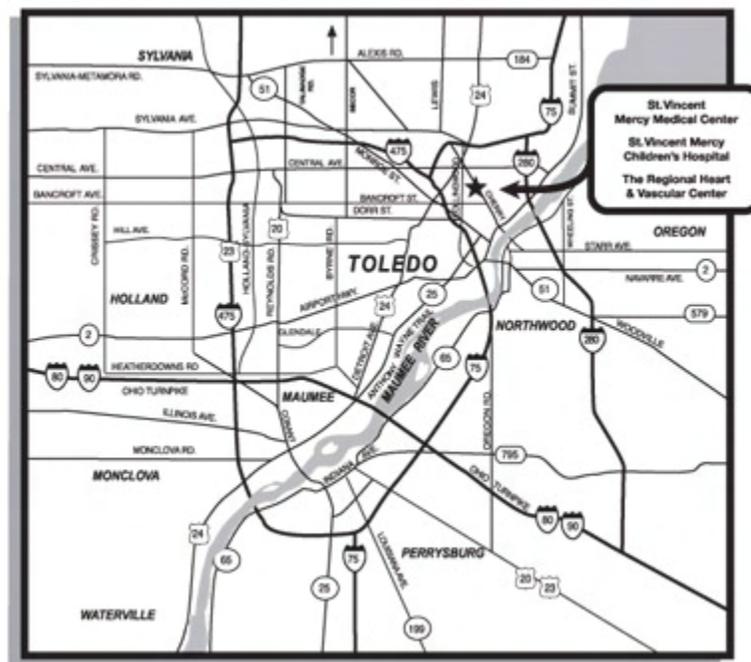
- I-75 North to Downtown/US-25 (Anthony Wayne Trail) (Exit 201B)
- Left onto Erie Street
- Erie Street to left on Cherry Street

From the East

- I-280 North to Summit Street (Exit 10A)
- Summit Street to right on Cherry Street

From the West

- I-475 East to I-75 North (Exit 20A)
- I-75 North to right on Berdan Avenue (Exit 205B)
- Berdan Avenue to right on Cherry Street



University of Toledo Hospital

From I-75/475 Northbound or US 23/475 Southbound:

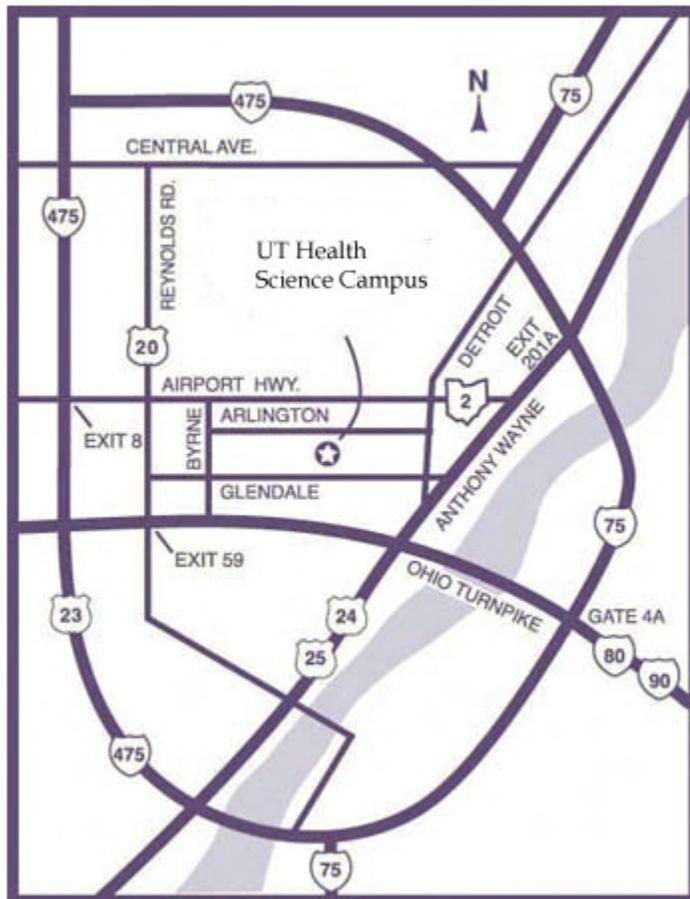
Use Exit 8 (Airport Highway, State Route 2). Proceed east on Airport Highway three miles to Byrne Road. Turn right on Byrne Road and proceed to Arlington Avenue (first traffic signal). Turn left on Arlington and proceed to UT Health Science Campus entrance. Turn right on Hospital Drive.

From I-75 Southbound:

Use exit 201A (Maumee/U.S. 25) to Anthony Wayne Trail. Go south on Anthony Wayne Trail to Glendale Avenue. Turn right on Glendale Avenue and proceed west to MUO Boulevard, (third light) and turn right.

From Ohio Turnpike, East or Westbound:

Use Exit 59 for Maumee and Toledo; head toward Toledo from toll booth and proceed north one mile on Reynolds Road (U.S. 20) to Glendale Avenue. Turn right on Glendale Avenue. Drive three miles to MUO Boulevard (fifth light) and turn left.



St. Charles Mercy Hospital

From Toledo & Points Northwest

I-475 East to I-75 North to I-280 South. I-280 South to Exit 7, Oregon (State Route 2/Navarre). Turn left off of exit ramp onto Route 2 heading East. Turn right on Wheeling.

From Toledo Downtown

Head East on Cherry Street crossing Martin Luther King Bridge. Turn left on Starr. Follow Starr to Wheeling, Turn right on Wheeling. The hospital is on Wheeling at Navarre Avenue. Total miles from downtown to hospital is approximately 4 miles.

From Toledo Express Airport

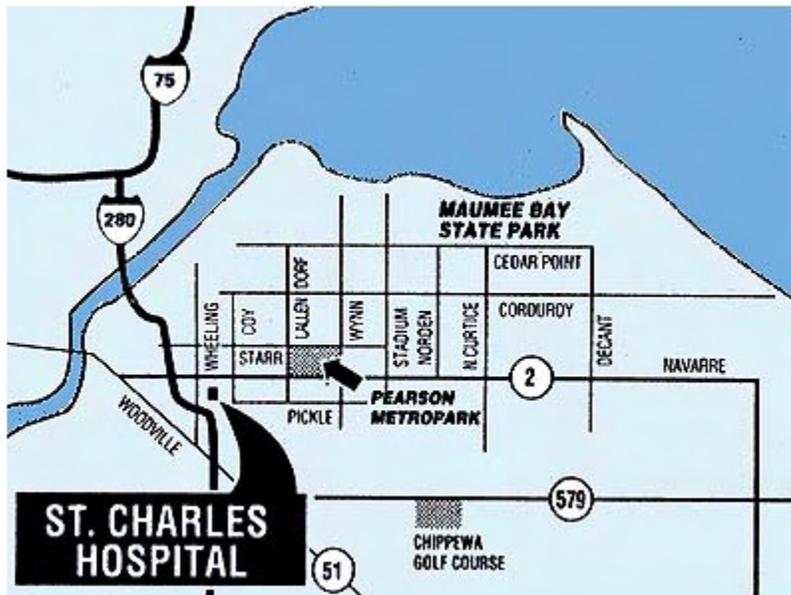
Follow signs to I-80/90 (Ohio Turnpike). I-80/90 East to Exit 5, I-280. I-280 North to Exit 7, Oregon (State Route 2/Navarre). Turn right (North) off exit ramp onto Wheeling.

From Columbus & Central Points

State Route 23 North. Connect with I-75 North near Findlay; follow signs toward Toledo. I-75 North to 795 East. 795 East to I-280 North. I-280 North to Exit 7, Oregon (State Route 2/Navarre). Turn right (North) off exit ramp onto Wheeling.

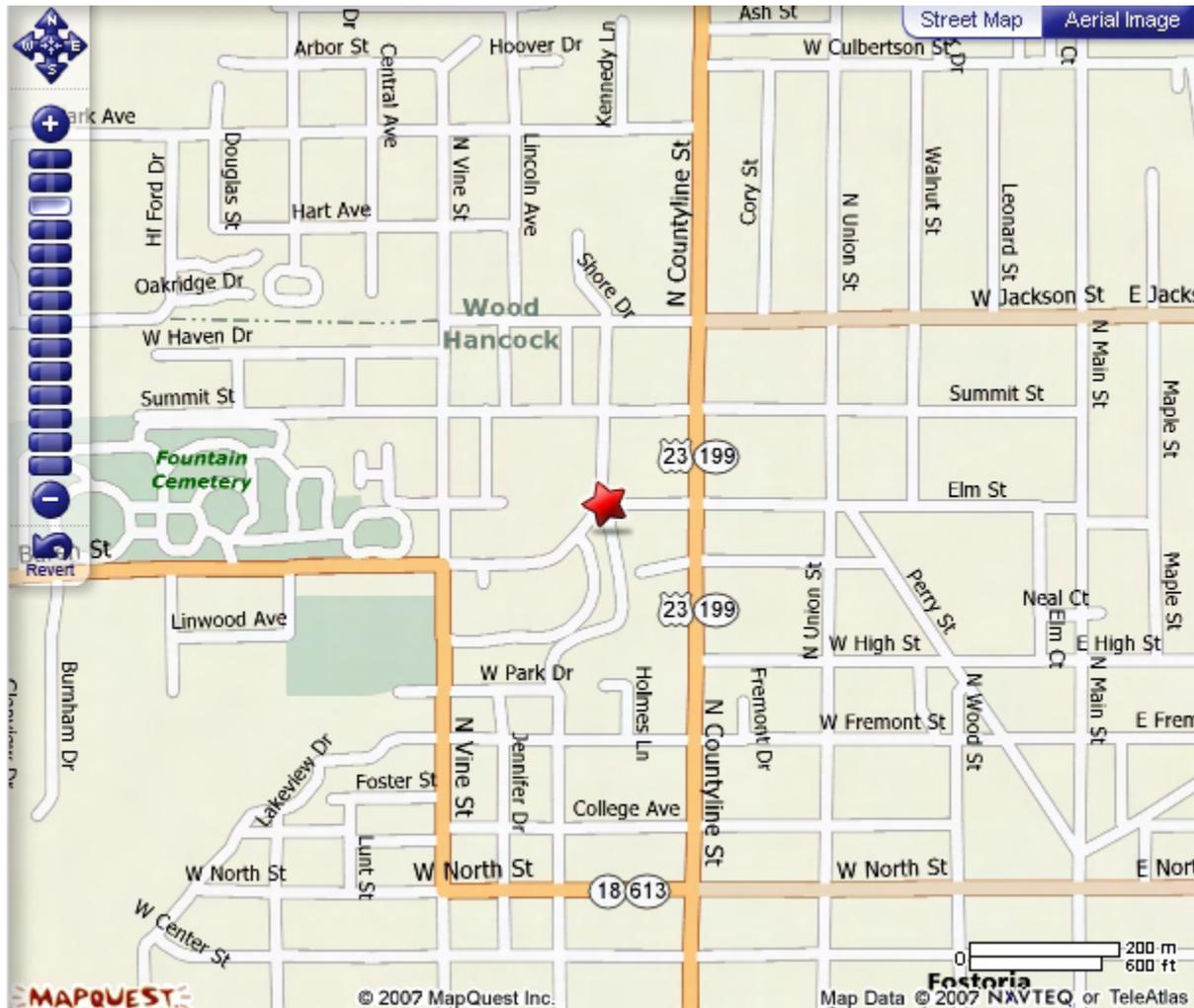
From Cincinnati/Dayton & Southwestern Points

I-75 North towards Toledo. I-75 North to 795 East. 795 East to I-280 North to Exit 7, Oregon (State Route 2/Navarre). Turn right (North) off exit ramp onto Wheeling.



Fostoria Community Hospital

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



Blanchard Valley Hospital

COLUMBUS:

Leaving Columbus take 315 North to 270 East. Take 270 to 23 North (you're only on 270 a few minutes).

Route 23 takes you through Delaware, on to Upper Sandusky and to Carey. In Carey, Route 23 becomes Route 15, but the road continues straight. Take the Route 68 exit when you near Findlay and turn right off of the exit. This road (Route 68) turns into Main Street and just follow it through the residential section. After a few traffic lights, you'll see Blanchard Valley Hospital on the left.

FROM LIMA:

Take I-75 North to Findlay. Take the Route 68/15 exit and stay in the right-hand lane to immediately take the first exit, which is the Lima Avenue Exit. You'll see the Findlay Airport on your left - turn right onto Lima Avenue. (It will seem like you are driving in circles...and you are!) Travel down the road and at the first traffic light, turn right onto Western Avenue. At the next traffic light, turn left onto Lake Cascades Parkway. Take this road to the next traffic light and turn right onto South Main Street.

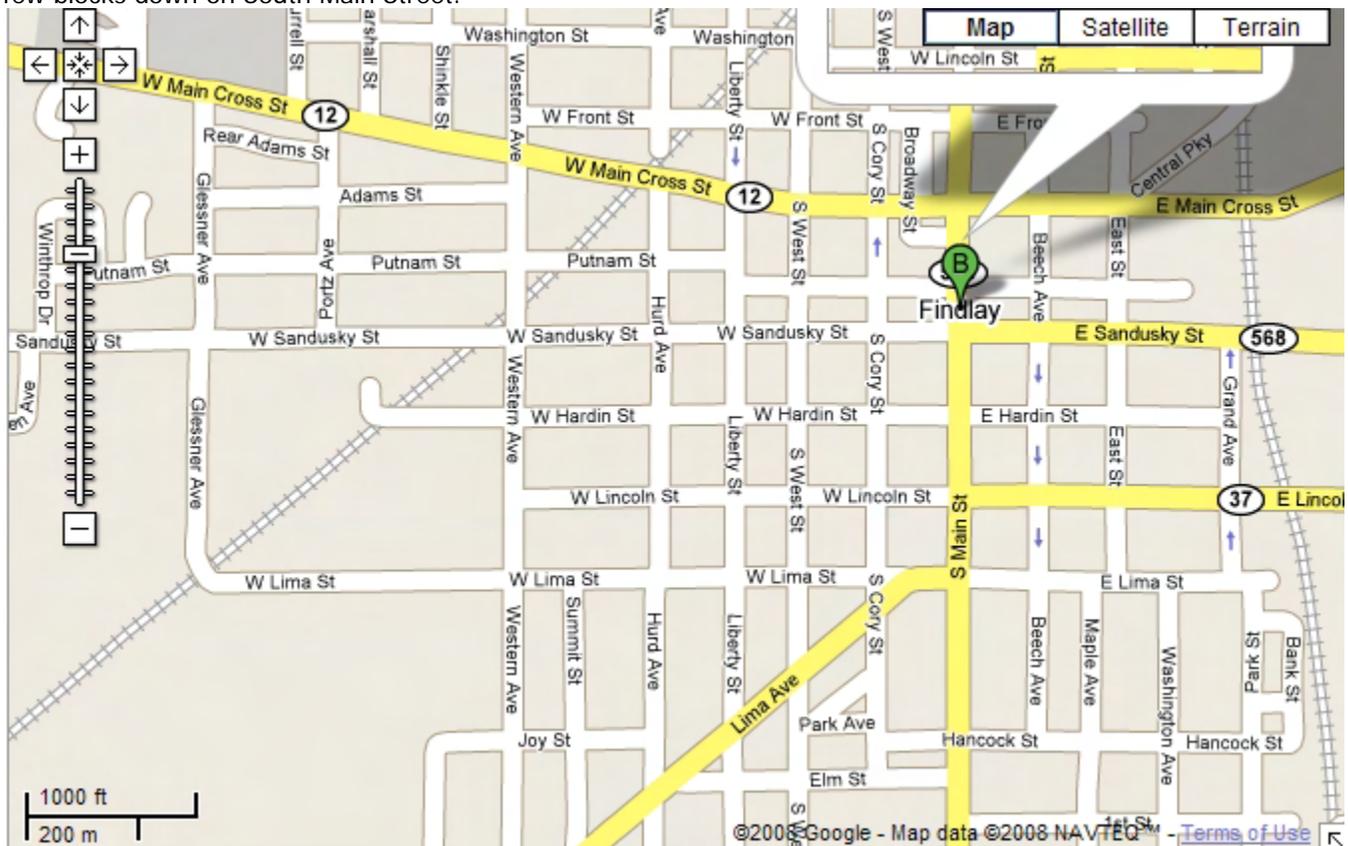
Blanchard Valley is on the right-hand side of the road a few blocks down on South Main Street.

FROM TOLEDO:

Take I-75 South to Findlay. Take Exit #157 and turn left onto Route 12. Travel toward town across the railroad tracks and to Main Street (the Hancock County Courthouse on right). Turn right onto Main Street and travel south through town. Proceed through the residential area and the hospital will be on the right.

FROM 224 (East or West)

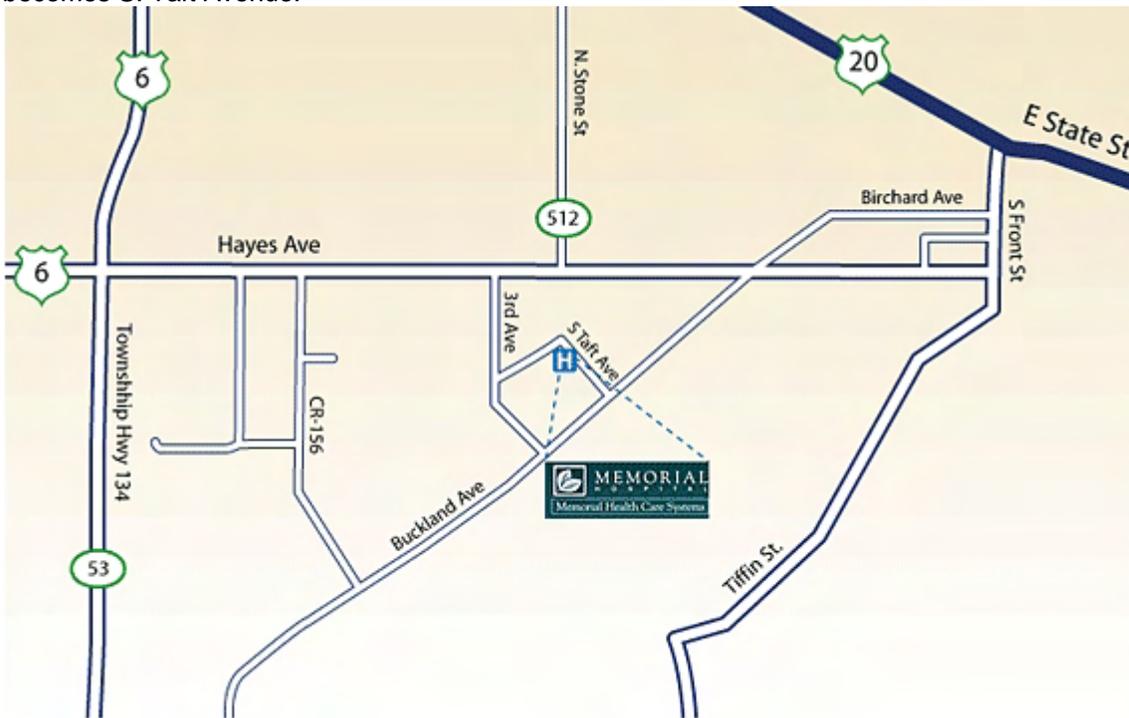
Take 224 toward Main Street. Go south on Main Street through town. Blanchard Valley is on the right-hand side a few blocks down on South Main Street.



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.



Fisher-Titus Medical Center



Directions

From the East via US Route 20

Follow Route 20 West toward Norwalk. Just before town limit, turn right onto Route 20 Bypass. Follow Route 20 Bypass approximately 2 miles to Route 250. Turn right onto Route 250 and follow for 1/4 mile. Fisher-Titus Medical Center is on the left.

From the West via US Route 20 (also Route 18)

Follow Route 20 East toward Norwalk. Exit at Route 250 and turn left at top of ramp. Follow Route 250 for 1/4 mile. Fisher-Titus Medical Center is on the left.

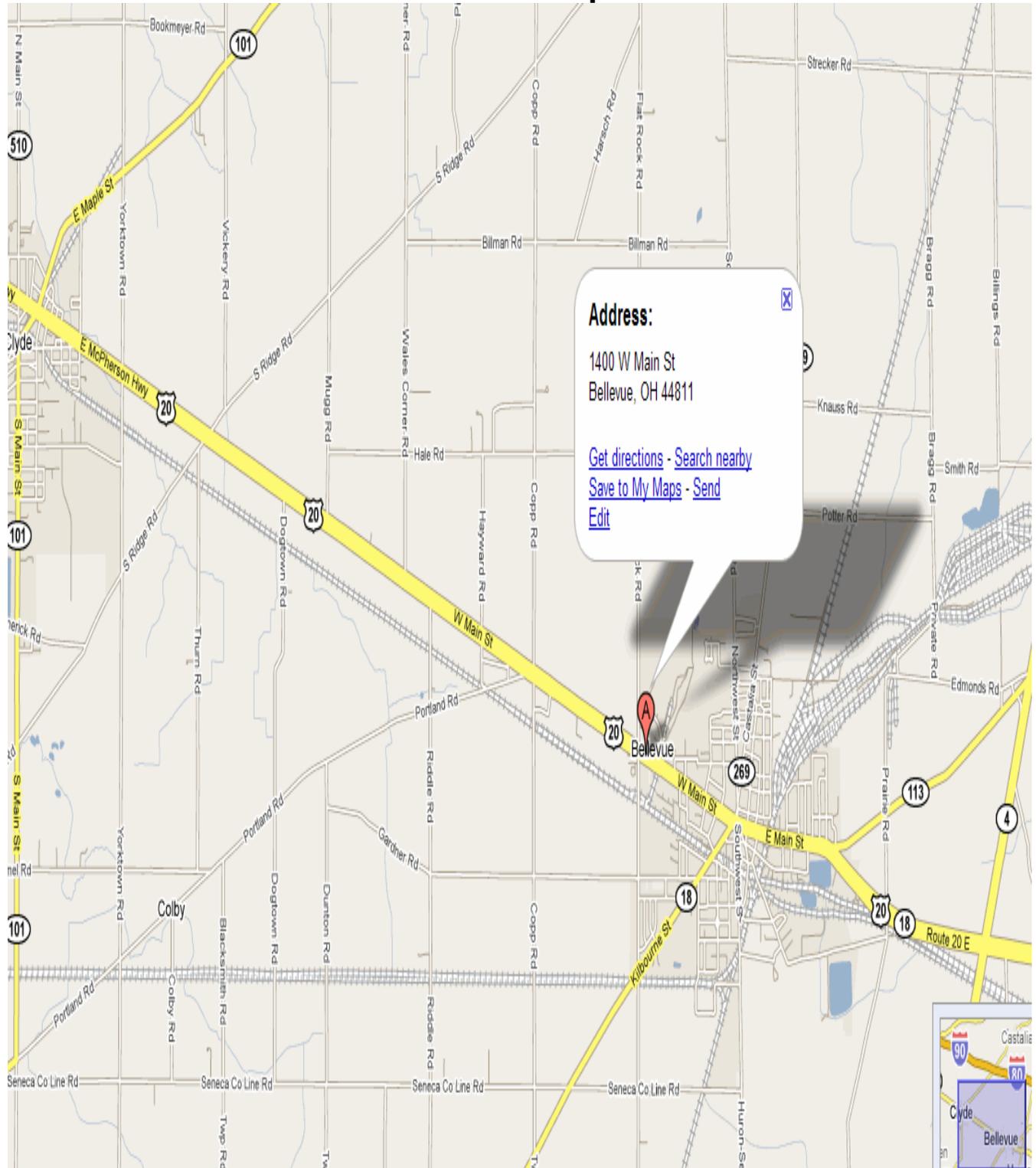
From the North via US Route 250

Follow Route 250 North through downtown Norwalk, heading South of town. Fisher-Titus Medical Center is 1/4 mile before Route 20, on the right.

From the South via Route 13 or Route 250

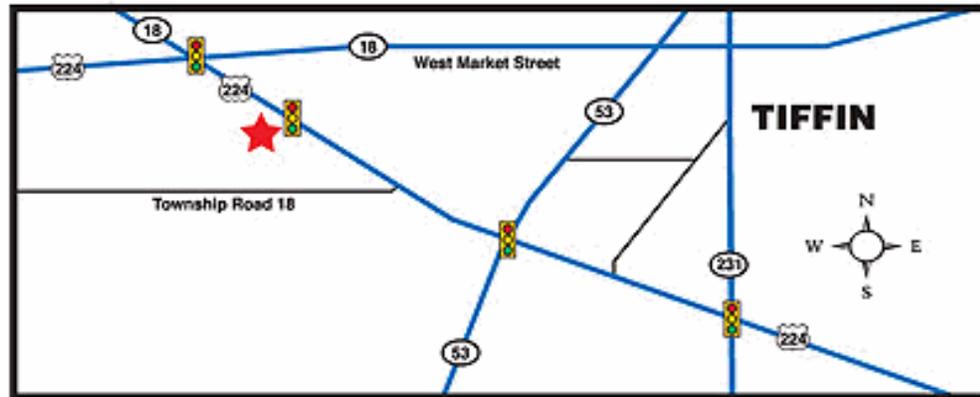
Follow Route 13 (250) North toward Norwalk. Once past the Route 20 junction, Fisher-Titus Medical Center is 1/4 mile down, on the left.

Bellevue Hospital



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