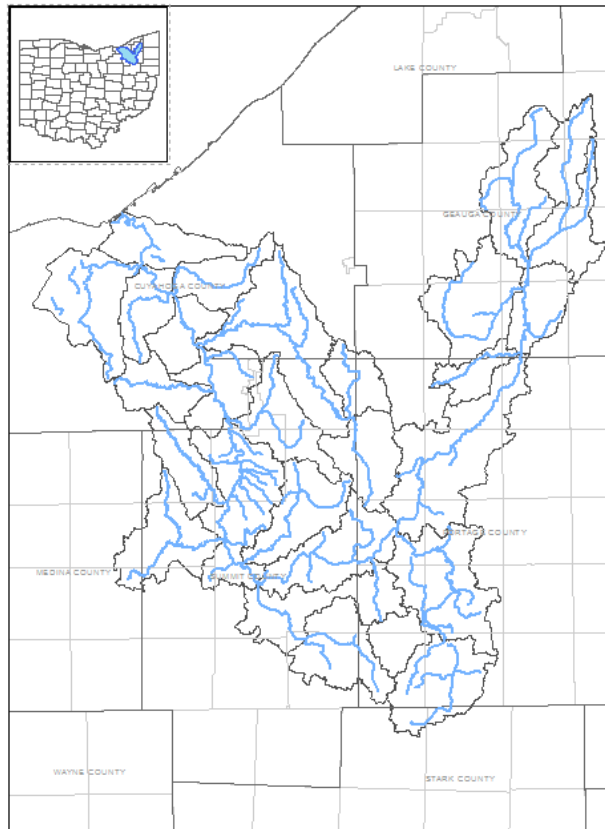


Study Plan to the Cuyahoga River Mainstem - 2017

Cuyahoga, Summit, Portage, and Geauga Counties



Division of Surface Water
Ecological Assessment Section & Northeast District Water Quality
June 9, 2017

2017 Study Plan to the Cuyahoga River Mainstem - 2017

Cuyahoga, Summit, Portage, and Geauga Counties

June 9, 2017

Prepared by
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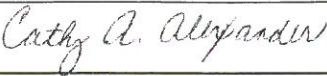


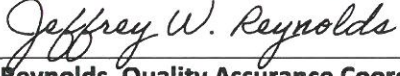

John R. Kasich, Governor

State of Ohio

Craig W. Butler, Director

Ohio Environmental Protection Agency

Signatory Page

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	7/14/2017
Bill Zawiski, Water Quality Supervisor/Study Team Leader, Northeast District	Date

Introduction

As part of Ohio's statewide monitoring strategy, a biological and water quality assessment will be conducted in the Cuyahoga River basin during the 2017 field season. This study plan will focus specifically on the mainstem of the Cuyahoga River basin. The Cuyahoga River study area is entirely contained within the 8-digit hydrologic unit code (HUC) 04110002 and is composed of twenty-eight 12-digit watershed assessment units (WAUs) and one large river assessment units (LRAUs). Ambient biology, macrohabitat and water quality data will be collected from the sites listed in Table 1. Details regarding matrixes, parameters, and sample frequency are also included in the Table 1. An analytical parameter list with associated methods and reporting limits is presented in Table 2.

Sampling Objectives

- 1 Systematically survey and assess the mainstem of the Cuyahoga River in support of Clean Water Act Sections 305(b) and 303(d);
- 2 Gather ambient environmental information (biological, chemical, and physical) from the Cuyahoga River mainstem to assess current beneficial uses (aquatic life, recreation and water supply);
- 3 Document any changes in biological, chemical, and physical conditions of the Cuyahoga mainstem from historical data, thus expanding the Ohio EPA data base for statewide trends analysis (e.g., 305[b]);
- 4 In 2018, the Cuyahoga River tributaries and any areas of nonattainment on the mainstem documented in 2017 will be assessed.

Total Maximum Daily Load

The Cuyahoga River basin has three TMDLs approved by US EPA. Cuyahoga River TMDLs were calculated for the upper, middle, and lower river sections including their associated tributaries. The upper river section was approved September 2004, the middle river section was approved in March 2000, and the lower river section was approved September 2003. Copies of these reports can be found on the Ohio EPA web page at: <http://epa.ohio.gov/dsw/tmdl/CuyahogaRiver.aspx#116484790-cuyahoga-river-middle>

Beneficial Use Assessment

The status of all beneficial uses listed for the Cuyahoga River mainstem will be evaluated except the ship channel (RM 5.6 to mouth), Lake Rockwell, and East Branch Reservoir. Current beneficial use designations for the Cuyahoga River mainstem are listed in Ohio Administrative Code (OAC) Chapter 3745-1-26, Table 26-2. Regarding aquatic life uses, the entire Cuyahoga River mainstem is designated warmwater habitat (WWH), except the Cuyahoga river ship channel. All of the Cuyahoga River mainstem is presently listed as primary contact for the recreation use, except for Lake Rockwell. The agricultural water supply (AWS) and industrial water supply (IWS) uses apply to the entire mainstem of the Cuyahoga River, except Lake Rockwell, which is designated as a public water supply (PWS).

SAMPLING ACTIVITIES

Chemical/Physical Water and Sediment

Chemical sampling locations within the study area are listed in Table 1. Conventional chemical/physical water quality samples will be collected 5 times at each designated location. Sediment samples will be collected at 30 locations. Chemical parameters to be tested are listed in Table 2. Surface water sampling will occur across a variety of flow conditions, from lower flows to moderate and higher flows.

Bacteriological Sampling

Bacteriological sampling locations within the study area are listed in Table 1. Water samples for bacteriological analyses will be collected to determine PCR use status at each sampling locations. Each site will have at least 5 sets of *Escherichia coli* (*E. coli*) samples tested within a 90-day period that falls between the Memorial Day and Labor Day holidays.

Biological Assemblage and Habitat

Fish and macroinvertebrate assemblage samples will be collected at sample locations listed in Table 1. Qualitative Habitat Evaluation Index (QHEI) scores will be calculated by evaluating habitat at all sampling locations. Biology and habitat will be assessed by the Ecological Assessment Section of the Ohio EPA at all sampling locations except for 8 locations in the lower river section, where the biological and habitat assessment will be conducted concurrently with Northeast Ohio Regional Sewer District (NEORS) staff. NEORS is a Level III Credible Data collector and this effort will serve to benchmark their collection and assessment capabilities with Ohio EPA staff.

Large River Nutrient Assessment

Specialized nutrient sampling will be done at 13 locations designated in Table 1. The objectives of these sites are to determine the influence of nutrients on the aquatic life beneficial use and further support nutrient criteria development. The sampling protocols were detailed in a memo to Ohio EPA water quality staff (Dripps and Alexander, personal communication, February 22, 2017). Sestonic chlorophyll-a samples will be collected at sites with a drainage area greater than 700 square miles.

QUALITY ASSURANCE/SAMPLING METHODS**Ohio EPA Manuals**

All biological, chemical, data processing, and data analysis methods and procedures adhere to those specified in the Surface Water Field Sampling Manual for water quality parameters and flows (Ohio EPA 2015c), Biological Criteria for the Protection of Aquatic Life, Volumes II - IV (Ohio EPA 1977, 1987, 1989a, 1989b, 2015a, 2015b), The Qualitative Habitat Evaluation Index (QHEI); Rationale, Methods, and Application (Ohio EPA 1989b, 2006) for habitat assessment, and Ohio EPA Sediment Sampling Guide and Methodologies (Ohio EPA 2015e).

Use Attainment

Attainment/non-attainment of aquatic life uses will be determined by using biological criteria codified in OAC 3745-1-07, Table 7-1. Numerical biological criteria are based on multi-metric 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 the appropriate tiered WWH biocriteria based on ecoregion.

Attainment/non-attainment of recreational uses will be determined using *E. coli* criteria codified in OAC 3745-1-37, Table 37-2. Water quality must meet a 90-day geometric mean and a statistical threshold not to be exceeded more than 10% of the time

Stream Habitat Evaluation

Physical habitat is evaluated using the QHEI developed by the Ohio EPA for streams and rivers in Ohio (Ohio EPA 1989b, 2006). 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 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

A combination of quantitative and qualitative methods will be employed to monitor benthic macroinvertebrate communities. Quantitative collections are made through the use of modified Hester-Dendy multiple-plate artificial substrate samplers, deployed at all biomonitoring sites. Once deployed, artificial substrates are left to colonize, in-stream, for a six-week period. Qualitative sampling will be conducted at all biomonitoring stations. This sampling method consists of a basic inventory of macroinvertebrate taxa from natural substrates, noting dominant taxa among major habitat types (e.g., riffle, run, pool, and margin). Macroinvertebrate sampling protocols are detailed in Ohio EPA (2015b).

Fish will be sampled at each sampling location using pulsed DC headwater, wading, or boat electrofishing methods depending on watershed size at each sampling zone. Sites will be sampled twice during the sampling index period. The number of passes may be adjusted as necessary based on best professional judgment of the fish crew leader. Reasons for a single pass monitoring at sites otherwise identified as needing multiple passes may include, extremely difficult and time consuming access, work delays related to weather, or the emergence of alterations (natural or otherwise) to the point of access or sampling reach, rendering replication of the initial effort hazardous or costly, or both. Fish are processed in the field which includes identifying each individual to species, counting individuals at all sites, weighing individuals at wading and boat sites, and recording external abnormalities. Fish sampling protocols are detailed in Ohio EPA (2015b).

Surface Water

Surface water grab samples will be collected and preserved using appropriate methods as outlined in the Surface Water Field Sampling Manual (Ohio EPA 2015c) and delivered to the Ohio EPA Division of Environmental Services (DES) for analyses. Field measurements of dissolved oxygen, pH, temperature and conductivity will be made using YSI Professional Plus meters along with all grab samples for surface water chemistry.

Bacteria

Water samples will be collected into appropriate containers, cooled to 4°C, and transported to Adams Water Laboratory Inc, in Akron, Ohio within 6 hours of sample collection. All samples will be analyzed for *E. coli* bacteria using U.S.EPA approved methods.

Chlorophyll

Sestonic chlorophyll-*a* samples will be collected and preserved using appropriate methods, as outlined in Appendix II of the Surface Water Field Sampling Manual (Ohio EPA 2015d) and delivered to the Ohio EPA DES for analyses.

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 Ponar sediment samplers. Collected sediment will be placed into appropriate containers, iced (to maintain 4°C) and shipped to the Ohio EPA DES for analysis. Sampling and decontamination protocols will follow those listed in Appendix III of the Surface Water Field Sampling Manual (Ohio EPA 2015e).

Field Quality Control Samples

Ten percent of the total water samples will be submitted to the lab as field quality control samples. About 5% will be duplicates, including replicates if necessary, and about 5% will be blanks, including equipment blanks. Matrix spike duplicates will be collected for organic water samples at a minimum of 5%. Field instruments will be calibrated daily using manufacturer guidelines. All field quality control requirements and data validation methods are detailed in the Surface Water Field Sampling Manual (Ohio EPA 2015c).

Table 1. Cuyahoga River study area sampling stations.

Station	Station Name	RM	Area (miles ²)	Latitude	Longitude	Sampling
303830	Cuyahoga R. @ Scranton Rd. Habitat Restoration	2.7	906	41.48798	-81.69375	C, B, Sd, F2, MQ, O, N _{LR}
F01W43	Cuyahoga R. at Cleveland @ LTV Footbridge	5.9	788	41.4633	-81.6806	C, Sd, F2, O, N _{LR}
502130*	Cuyahoga R. at Cleveland @ Lower Harvard Ave	7.1	786	41.4478	-81.685	C, B, Sd, F2, MQ, O, N _{LR}
F01A56*	Cuyahoga R. at Cleveland, UPST Bradley Rd Smelters	8.3	746	41.4394	-81.6708	F2, MQ
200025	Cuyahoga R. 1.7 Miles DST Cleveland Southerly WWTP	8.9	745	41.4344	-81.6639	F2, MQ
F01S09	Cuyahoga R. DST Southerly WWTP @ Conrail RR	9.7	744	41.4269	-81.6658	C, B, Sd, F2, MQ, N _{LR}
F99Q02*	Cuyahoga R. DST Cleveland Southerly WWTP	10.3	744	41.4211	-81.6592	C, B, Sd, F2, MQ, O, N _{LR}
F01A25*	Cuyahoga R. UPST Cleveland Southerly WWTP	10.95	743	41.418175	-81.647669	C, B, Sd, F2, MQ, N _{LR}
F01S10*	Cuyahoga R. UPST Cleveland Southerly WWTP @ RR & S.R. 21	11.33	730	41.4178	-81.6417	C, B, Sd, F2, MQ, O, N _{LR}
F99Q03*	Cuyahoga R. at Valley View @ I-480 Bridge	12	709	41.4097	-81.6344	F2, MQ
502020	Cuyahoga R @ Old Rockside Rd at Independence	13.18	707	41.3953	-81.63	C, B, Sd, O, N _{LR}
F01S11*	Cuyahoga R. @ Hillside Rd	15.61	698	41.3789	-81.6147	C, B, Sd, F2, MQ, O, N _{LR}
F01S12	Cuyahoga R. @ Fitzwater Rd	17.3	597	41.3567	-81.5981	C, B, Sd, F2, MQ, N _{LR}
300509*	Cuyahoga R. near Brecksville @ St. Rt. 82 (DST Dam)	20.67	583	41.32158	-81.58731	C, B, F2, MQ, N _{LR}
502170	Cuyahoga R. @ Station Rd (Impounded)	20.8	583	41.31833	-81.58697	C, B, Sd, F2, MQ, N _{LR}
300510	Cuyahoga R. near Old Carriage Trail (Impounded)	22.4	559	41.30298	-81.57302	F2, MQ
F01S13	Cuyahoga R. at Jaite @ Highland Rd	24.1	555	41.288764	-81.56504	C, B, Sd, F2, MQ, N _{LR}
F01A58	Cuyahoga R. @ Boston Mills Rd	26.5	499	41.2628	-81.5603	C, B, Sd, F2, MQ
502010	Cuyahoga R. @ DST Akron WWTP @ Bolanz Rd	33.2	480	41.2019	-81.5686	C, B, Sd, F2, MQ, O
200042	Cuyahoga R. at Akron, 0.5 Mi DST Old Portage Trail	39.7	433	41.1386	-81.5528	C, B, Sd, F2, MQ,
502150	Cuyahoga R. at Akron @ Cuyahoga St.	42.6	340	41.1169	-81.525	C, B, Sd, F2, MQ, O

Station	Station Name	RM	Area (miles ²)	Latitude	Longitude	Sampling
200037	Cuyahoga R. at Cuyahoga Falls, UPST Waterworks Park	48.7	331	41.1492	-81.4567	C, B, Sd, F2, MQ, O
300516	Cuyahoga R. at Munroe Falls, UPST Old Dam (Free Flowing)	50	326	41.1411	-81.435	C, B, Sd, F2, MQ
300574	Cuyahoga R. DST Fish Creek WWTP (Free Flowing)	51	323	41.1369	-81.4183	C, B, Sd, F2, MQ, O
300518	Cuyahoga R. at Kent, UPST Old Dam (Free Flowing)	52	320	41.1392	-81.3922	C, B, Sd, F2, MQ
F01S17	Cuyahoga R. UPST Kent WWTP @ Fuller Park	54.32	293	41.1494	-81.3675	C, B, Sd, F2, MQ
F01W70	Cuyahoga R. @ Standing Rock Cemetery (Free Flowing)	55.8	292	41.165	-81.3517	C, B, Sd, F2, MQ
F01P29	Cuyahoga R. DST Lake Rockwell @ Ravenna Rd	57.67	208	41.1803	-81.3358	C, B, Sd, F2, MQ
F01S19	Cuyahoga R. at Shalersville @ St. Rt. 303	64.3	178	41.245	-81.286	C, B, Sd, F2, MQ, O
F01W22	Cuyahoga R. at Mantua, UPST Mantaline Corp.	69.96	159	41.2826	-81.22	C, B, Sd, F2, MQ
502030	Cuyahoga R. at Hiram Rapids @ Winchell Rd	75.83	151	41.3406	-81.1669	C, B, Sd, F2, MQ, O
F01W77	Cuyahoga R. @ Russell Park	83.8	82	41.425	-81.1567	C, B, Sd, F2, MQ
F01A53	Cuyahoga R. at Burton @ St. Rt. 87	87.26	38	41.4647	-81.1275	C, B, Sd, F2, MQ
F01P51	E. Br. Cuyahoga R. near Middlefield @ St Rt. 608	90.86	18.6	41.5028	-81.0969	C, B, Sd, F2, MQ
F01G02	Cuyahoga R. @ Chardon-Windsor Rd	96.2	6.3	41.5625	-81.0924	C, B, Sd, F2, Mq

*indicates sampling locations NEORS will be conducting the biological sampling

Sample Type Key		# Sites	# Passes
Stream Water Chemistry Totals	C	31	5
• subset with organics	O	13	1
• subset with larger river nutrient protocol	N _{LR}	13	5
Macroinvertebrate Totals			
• Quantitative	MQ	32	1
• Qualitative	Mq	33	1
Fish Totals			
• Fish 2 pass	F2	33	2
E. coli	B	30	5
Sediment	Sd	30	30

Table 2. List of parameters that will be analyzed by matrix with analytical method and reporting limits presented. Temperature, dissolved oxygen, pH and conductivity will be measured in the field.

Parameter	Method	Stream	Sediment
Oxygen Demand			
BOD, 5-day ^A	SM 5210B	2 mg/L	
Chemical Oxygen Demand	SM 5220D	20 mg/L	
Physical Properties			
Alkalinity	USEPA 310.1	5 mg/L	
Hardness	USEPA 200.7	10 mg/L	
Specific Conductance	SM 2510B	1 µS/cm	
Total Dissolved Solids	SM 2540C	10 mg/L	
Total Suspended Solids	SM 2540D	5 mg/L	
% Solids	SM 2540G		0 %
Nutrients			
Ammonia	USEPA 350.1	0.05 mg/L	
Nitrate-Nitrite	USEPA 350.1	0.5 mg/L	
Nitrite	USEPA 353.2	0.02 mg/L	
Total Kjeldahl Nitrogen	USEPA 351.2	0.2 mg/L	
Total Phosphorus	USEPA 365.4	0.01 mg/L	50 mg/kg
Total Organic Carbon ^A	SM 5310B	2 mg/L	0.1 %
Anions			
Chloride	USEPA 325.1	5 mg/L	
Sulfate	USEPA 375.2	10 mg/L	
Cations			
Aluminum	USEPA 200.7	200 µg/L	
Barium	USEPA 200.7	15 µg/L	
Calcium	USEPA 200.7	2 mg/L	
Iron	USEPA 200.7	50 µg/L	
Magnesium	USEPA 200.7	1 mg/L	
Manganese	USEPA 200.7	10 µg/L	
Potassium	USEPA 200.7	2 mg/L	
Sodium	USEPA 200.7	5 mg/L	
Strontium	USEPA 200.7	30 µg/L	
Toxic Metals			
Zinc	USEPA 200.7	10 µg/L	8 mg/kg
Arsenic	USEPA 200.8/SM 3113B	2 µg/L	0.8 mg/kg
Cadmium	USEPA 200.8/SM 3113B	0.2 µg/L	0.08 mg/kg
Chromium	USEPA 200.8	2 µg/L	0.8 mg/kg
Copper	USEPA 200.8	2 µg/L	0.8 mg/kg
Lead	USEPA 200.8/SM 3113B	2 µg/L	0.8 mg/kg
Nickel	USEPA 200.8	2 µg/L	0.8 mg/kg

Parameter	Method	Stream	Sediment
Selenium	USEPA 200.8/SM 3113B	2 µg/L	0.8 mg/kg
Mercury	USEPA 245.1/SM 3113B		0.02 mg/kg

Bacteria			
Escherichia coliform	USEPA 1603	10 CFU	
Algal Biomass			
Chlorophyll-a ^B	USEPA 445.0	0.3 µg/L	0.3 µg/L
Organic Compounds			
Atrazine	OEPA 704.0	0.2 µg/L	
Glyphosate	USEPA 547	5 µg/L	
Carbomates	USEPA 531.1	0.5 µg/L	
Semi-volatile organics	USEPA 625	2-20 µg/L	
Semi-volatile organics	USEPA 8270C		.4-2 mg/kg
Aldrin	USEPA 8082A/OEPA 590.1		4 µg/kg
a-BHC	USEPA 8082A/OEPA 590.1		4 µg/kg
b-BHC	USEPA 8082A/OEPA 590.1		4 µg/kg
d-BHC	USEPA 8082A/OEPA 590.1		4 µg/kg
γ-BHC	USEPA 8082A/OEPA 590.1		4 µg/kg
4,4'-DDD	USEPA 8082A/OEPA 590.1		4 µg/kg
4,4'-DDE	USEPA 8082A/OEPA 590.1		4 µg/kg
4,4'-DDT	USEPA 8082A/OEPA 590.1		4 µg/kg
Dieldrin	USEPA 8082A/OEPA 590.1		4 µg/kg
Endosulfan I	USEPA 8082A/OEPA 590.1		4 µg/kg
Endosulfan II	USEPA 8082A/OEPA 590.1		4 µg/kg
Endosulfan Sulfate	USEPA 8082A/OEPA 590.1		4 µg/kg
Endrin	USEPA 8082A/OEPA 590.1		4 µg/kg
Endrin Aldehyde	USEPA 8082A/OEPA 590.1		4 µg/kg
Heptachlor	USEPA 8082A/OEPA 590.1		4 µg/kg
Heptachlor Epoxide	USEPA 8082A/OEPA 590.1		4 µg/kg
Methoxychlor	USEPA 8082A/OEPA 590.1		4 µg/kg
Mirex	USEPA 8082A/OEPA 590.1		4 µg/kg
Hexachlorobenzene	USEPA 8082A/OEPA 590.1		4 µg/kg
PCB-1016	USEPA 8082A/OEPA 590.1		20 µg/kg
PCB-1221	USEPA 8082A/OEPA 590.1		20 µg/kg
PCB-1232	USEPA 8082A/OEPA 590.1		20 µg/kg
PCB-1242	USEPA 8082A/OEPA 590.1		20 µg/kg
PCB-1248	USEPA 8082A/OEPA 590.1		20 µg/kg
PCB-1254	USEPA 8082A/OEPA 590.1		20 µg/kg
PCB-1260	USEPA 8082A/OEPA 590.1		20 µg/kg

^A – Sample parameter for streams if greater than 500mi²

^B-Sample sestonic Chl-a for streams greater than 700mi² and nutrient sites

Study Team Members and Contact Information

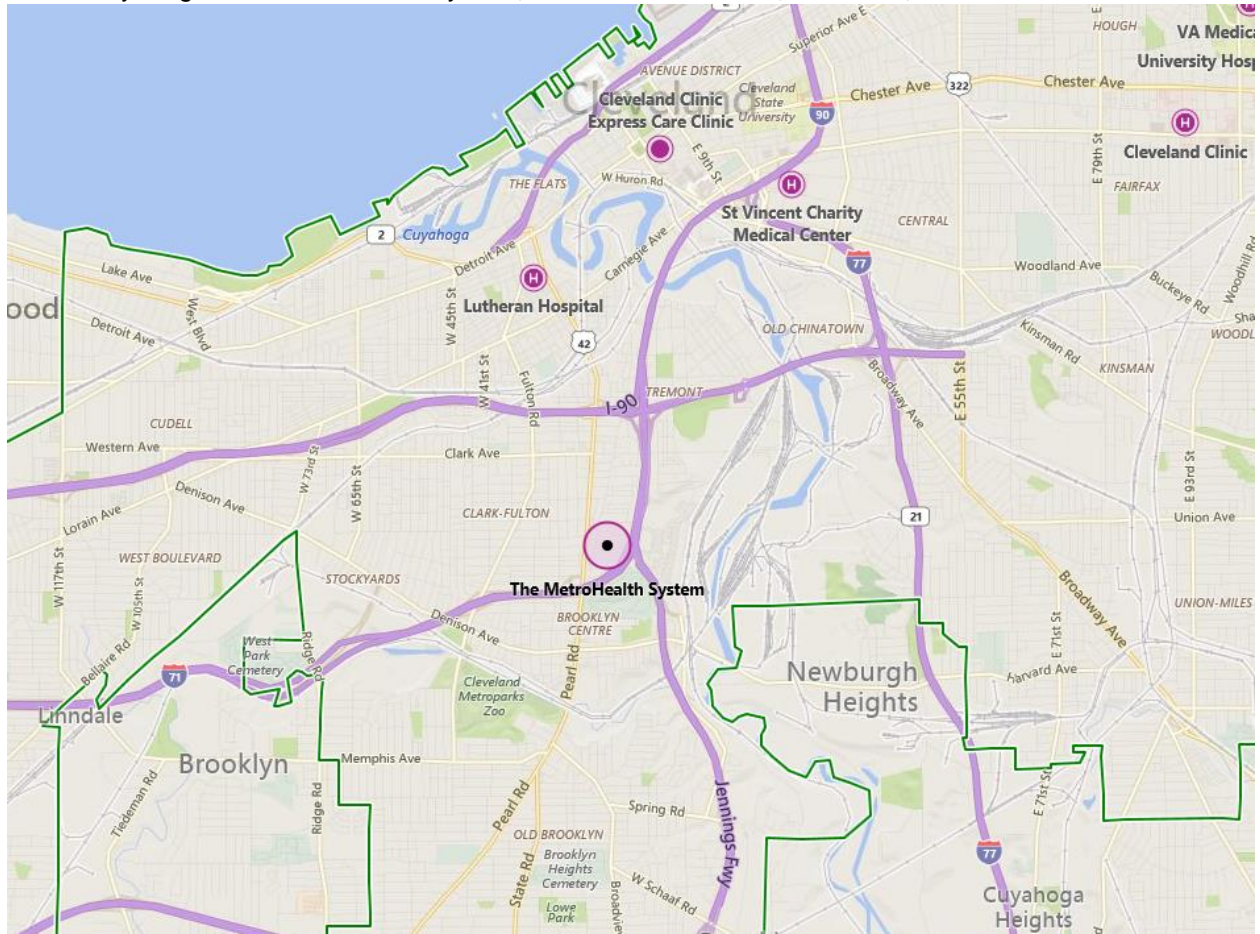
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Jennifer Carlson (District WQ)	330-963-1228
Melinda Harris (TMDL Coordinator)	614-644-4132
Mike Settles (PIC)	614-728-0035
Chris Skalski (Standards)	614-644-2144
Jeff Reynolds (Quality Management)	614-705-1011
Joe Loucek (401/Wetlands)	330-963-1258
Gary Klase (Fish Tissue)	614-644-2865
Chris Maslo (District Drinking Water)	330-963-1164

Law Enforcement Contact Information

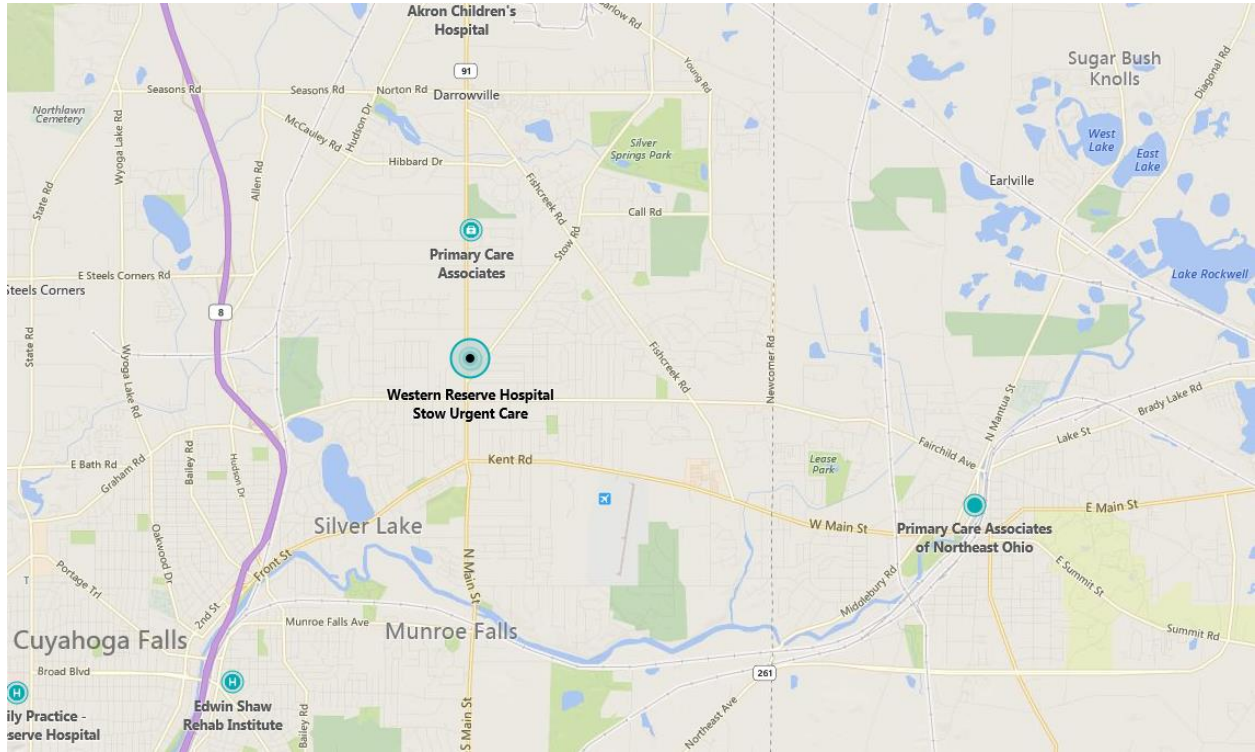
Cuyahoga County Sheriff	(216) 443-6000
Summit County Sheriff	(330) 643-2181
Geauga County Sheriff	(330) 296-5100
Lake County Sheriff	(440-350-5500)
Cuyahoga County Wildlife	(330) 245-3033
Summit County Wildlife	(330) 246-3042
Portage County Wildlife	(330) 245-3040
Lake County Wildlife	(330) 245-3034

Local Hospitals

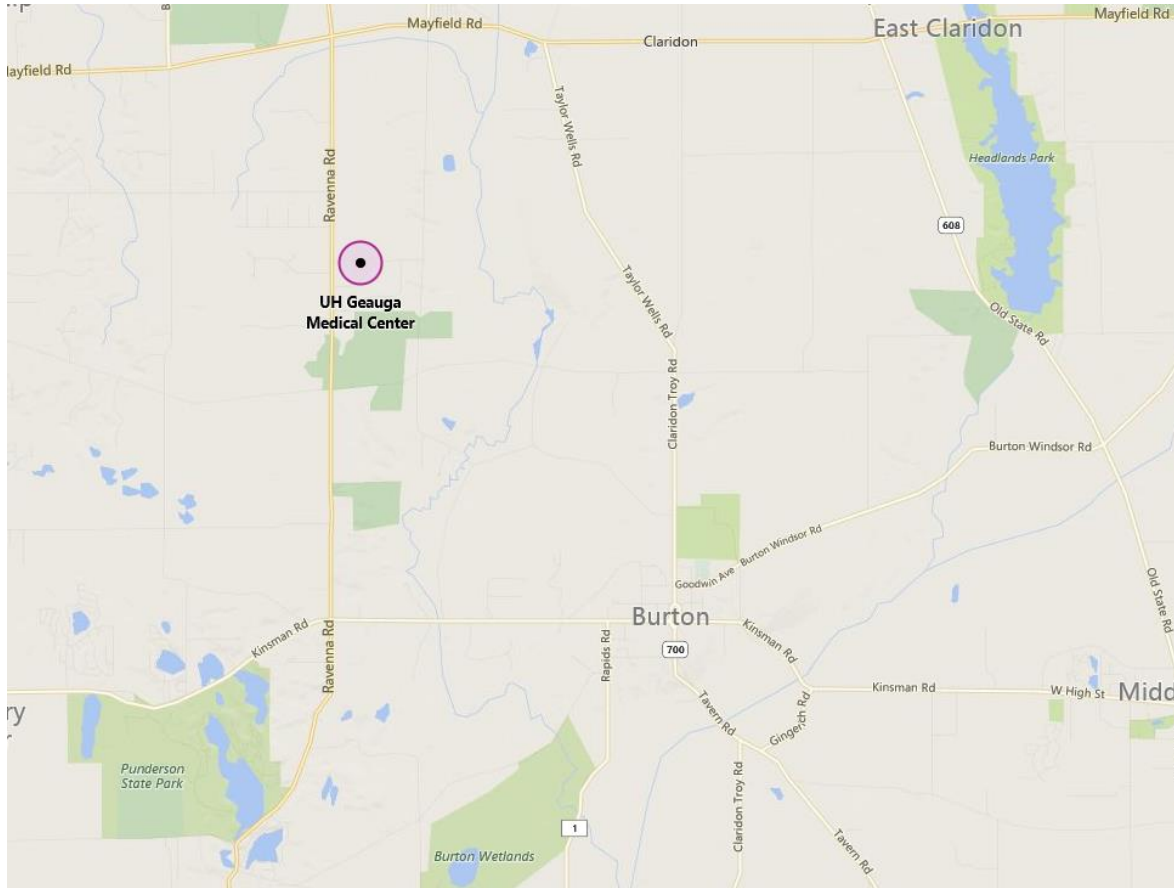
Lower Cuyahoga: The MetroHealth System, 2500 Metrohealth Dr, Cleveland, OH 44109



Middle Cuyahoga: Western Reserve Hospital Stow Urgent Care, 3913 Darrow Rd Ste 100, Stow, OH 44224



Upper Cuyahoga: UH Geauga Medical Center, 13207 Ravenna Rd, Chardon, OH 44024



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