Niagara County Department of Health

OLLCOTT BEACH SANITARY SURVEY REPORT

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The Environmental Division of the Niagara County Department of Health completed this sanitary survey report for Olcott Beach, located in the Town of Newfane. Funding was procured through the U.S. Environmental Protection Agency's Great Lakes Restoration Initiative (GLRI) via a grant administered through the NYS DOH.

We are particularly grateful for the help provided by the Town of Newfane, in particular the Town Supervisor, Timothy Horanburg, the Town Board, and their staff in assisting in the completion of this study and for working so carefully to assure that park patrons have a safe and enjoyable experience at the bathing beach.

This project could not have been completed without the help of the following Niagara County DOH Environmental staff: Paul Dicky P.E., managed project details including meteorological data analysis and assisted in coordinating special Eighteenmile Creek monitoring. Joseph Baronich also provided significant field work on this project, by collecting water samples and environmental data, and assisting with special water quality studies. A heartfelt thanks goes out to Darleen Corp for her tireless data entry. This project could not have been completed without their assistance.

Seasonal staff were directly involved in data collection and data entry. I place on record, our sincere thank you to our interns Rachel Anderson, Erika and Megan Moltrup, and Rene Herc.

Thanks are also owed to our GIS specialist, Lisa Casey, for her invaluable assistance and mapping skills.

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BACKGROUND

Sanitary surveys help state and local beach program managers and public health officials identify sources of beach water pollution, assess the magnitude of pollution, and identify priority locations for water testing. Bathing beach sanitary surveys are useful tools to protect public health as they provide information necessary for indentifying rehabilitation needs and can define sustainability requirements

This sanitary survey of Olcott Beach was funded through a grant from the Environmental Protection Agency's (USA EPA) Great Lakes Restorative Initiative (GLRI). The survey was conducted and this report prepared by staff of The Niagara County Department of Health to meet requirements outlined for sanitary surveys in the New York State Sanitary Code Subpart 6-2 (July 2011) and EPA's Great Lakes Beach Sanitary Survey User Manual (US EPA May 2008). Staff of other involved agencies, including the New York State Department of Environmental Conservation (NYS DEC), New York State Department of Health (NYSDOH), Niagara County Soil and Water Conservation District, and Cornell Cooperative Extension of Niagara County were also contacted to determine potential pollution sources for the beach and watershed. Department staff completed EPA's GREAT LAKES BEACH ANNUAL SANITARY SURVEY form entitled "Annual Sanitary Survey for Olcott Beach" (Attachment 1).

PARK SETTING

Olcott Beach is located on the shores of Lake Ontario in the Hamlet of Olcott, Town of Newfane, Niagara County. The Beach is open to the public and owned by the County of Niagara and operated by the Town of Newfane (*Figure 1*).

Lifeguard monitored swimming is available from noon until 7:00 pm Memorial Day weekend through September, weather permitting. Niagara County's Krull Park is a beautiful recreational complex with excellent views and access to Lake Ontario.

The 325 acre park had its beginnings in the late 19th century when lakeside tourism was an important revenue stream for the railroad industry. The section of the park north of Main Street is often referred to as Olcott Beach, and is a shaded mix of walkways, pavilions, picnic tables and restrooms. The sandy shore has provided a unique recreational experience allowing both residents and visitors of Niagara County a family friendly beach experience.

South of Olcott Beach is the family recreation portion of the park, with numerous small shelters and two playgrounds to host family parties. Basketball and tennis courts are also found alongside the park road. For those that need peace and quiet, the numerous groves in this section offer a peaceful spot to relax in the shade.

The southeast portion of the park is where all the sport and playing fields are located. Aside from the baseball diamonds and soccer fields, visitors can also access a splash park, four exercise stations, a designated model airplane field, and horseshoe pits. In winter the park still attracts visitors for cross-country skiing, ice-skating (in two locations), and offers a warming house with vending machines.

BEACH AND SWIMMING AREA

The swim area is located along the shoreline of Lake Ontario between existing piers as depicted in (Figure 1). Swimming is only permitted in the designated swim area. The beach has approximately 375 feet of developed shoreline with a life guarded swim area that is approximately 230 feet x 50 feet. The beach consists of mostly sand with stones. Routine beach maintenance occurs on a continual basis during the swimming season. Small debris and trash are removed daily by hand by park staff. Litter and debris are found at the beach relatively frequently. Floatables are occasionally found in the water after storms and can consist mainly of street litter. Natural debris usually consists of algae, small branches, and bark. The swimming area is utilized exclusively by day use patrons, with an average of 25 people swimming on weekdays. On weekends and holidays, bather load averages about 50 patrons, with as many as 75 patrons using the beach on a busy day.

An important element of this sanitary survey is the Tier classification of the beach according to grant requirements and NYS DOH beach risk assessment recommendations. The Tier classification of bathing beach waters dictates the frequency and location of monitoring and the assessment of recreation waters on the basis of the periods of recreational use of the waters, the nature and extent of use during certain periods, the proximity of the waters to known point and nonpoint sources of pollution, and any effect of storm events on the bathing waters. Olcott beach has been classified as a Tier 1 bathing beach according to the aforementioned requirements. As a result, Olcott Beach has been given the highest priority for water quality monitoring.

Recommendations for improvements can be found in the "Summary of Findings and Recommendations" section of this report.

SANITARY FACILITIES

Bathroom sanitary facilities are located adjacent to the beach at Krull Park and appear to be sufficient to meet existing demand (*Figure 1*). The location of the bathhouse is approximately 670 linear feet from the bathing area which is slightly in excess of the *Recommended Standards for Bathing Beaches* criteria that public restrooms should be provided within 500 feet of a public beach (GLUMRBOSSE 1990). The bathhouse is connected to the Municipal Public Sanitary Sewer system.

A tracer dye test was initiated on June 19th, 2014 and completed on July 1st, 2014 to confirm that the area sanitary sewerage system and storm sewer system were functioning properly with no discharge of untreated sewage to the ground surface or surface waters of New York State.

A tracer dye was poured directly into a number of sanitary manholes and stormwater catch basins in the area of the beach. The bathing beach area including the mouth of Eighteenmile Creek was examined over the next twelve days and no dye was observed. Based on the results of the tracer dye test, it does not appear that the local Municipal Public Sanitary Sewer or Storm Sewers are a source of bacteria to the swim area.

Figure 1. Location Map for Olcott Beach at Krull Park

METEOROLOGICAL CHARACTERISTICS

Departmental field staff collected data on weather conditions at the beach at the time of bacteriological sample collection on a "Bathing Beach Water Quality Form" *(Attachment 2)*. Rainfall levels are recorded daily on a Weather Underground Olcott website (http://www.wunderground.com). The data collected demonstrates that the weather at Olcott Beach at Krull Park is typical for lakeside property. There can be significant fluctuations in temperature, rainfall, and wind speed and direction throughout the operating season.

A historical review was conducted comparing meteorological data to bacteriological levels with data collected from 2008 to 2012. Patterns emerged which led us to draw certain conclusions:

1. Water samples with unsuitable levels of bacteria occur at the greatest rate when lake water is recorded as being between 65 and 70 degrees Fahrenheit (with a 70% water quality failure rate)

2. Correlations were found between wind direction and poor water quality. There was a 40% water quality failure rate when the winds were from the North to North-Northwest and a 36% failure rate when the winds were from the West to South-Southwest.

3. A third correlation was found comparing wave height and failing water quality. Large and medium waves produced an 86% failure rate and all noted waves produced a 66% failure rate comparing that to a 33% failure rate with noted calm waters. It is noted that the potential for wave generation increases when the winds blow across the lake from the northerly direction and so is loosely correlated with the conclusions in item number 2.

Interpretation of these observations has created several theories. The correlation to temperature seems to indicate a preferred environmental situation where bacteria thrive in the water. The wind and wave findings seem to indicate the possibility of bacteria getting entrained in sediment/shore sand and becoming re-released into the environment with water agitation. Or there may be a contributing factor whereby lake pollution is being brought to shore by the wind/waves making one suspicious of boats dumping waste water offshore rather than utilizing marina pump-out stations and/or Eighteenmile Creek discharge being redirected back to shore. It is noted that an active marina is located in the area of study at the mouth of 18 mile Creek.

WATER QUALITY SAMPLING

Bacteriological Results

Bathing beach water quality monitoring procedures are outlined in the NYSDOH GLRI QAPP *Manual for Bathing Beach Water Quality Monitoring* "*Model Sample Collection and Handling Protocol"* and in this Departments Bathing Beach Work Plan. Joseph Baronich; Public Health Sanitarian and or his assistant intern were responsible for the collection and submittal of samples to our certified contract laboratory (ELAP #10472). Analysis was conducted by Erie County Department of Health, Public Health Lab located at Clinical Center Bldg. AA, 462 Grider St., Buffalo, NY 14215. All samples were tested for *E. coli* using EPA Method 1603.

Bathing Beach bacteriological water quality is monitored at two sampling points (Shallow $43^0$20'22.09"N; 780 42'45.62"W & Deep $43^0$20'22.29"N; $78^0$42'45.62"W), located within the center

of the swim area in approximately 2.5 and 4.0 feet deep water respectively (*Figure 1*). Sample results from either of these two monitoring stations determine if the beach remains open, is closed for swimming, or reopens after a closure. Single grab sample *E. coli* results provide a snapshot of water quality in a specific location at a specific date and time. As with all grab sampling, a single sample exceedance reflects the level of bacteria in the swim area at that exact location and time of sampling. These exceedances can result from short-term events, such as storms, rainfall, wave action, bird droppings, algae, and combined sewage overflows. In accordance with US EPA's guidelines, E. *coli* has been the primary indicator of beach water quality used by the department since 2003. Prior to 2003, fecal coliform was used to determine bacteriological water quality. Water quality can vary significantly, within a short period, with some days having very low levels of bacteria and other days having extremely high levels of *E.coli*. Exceedance rates of the NYS Sanitary Code standard of 235 *E. coli* colonies /100 ml have varied from year to year (*Table 1)*.

Logarithmic mean sample results from these two monitoring points provide a measure of the beach's water quality over a 30-day period. A running geometric mean is used when evaluating the long-term microbiological suitability of recreation water quality. The geometric mean can provide a better indication of water quality over an extended time. An elevated log mean indicates the need to assess potential pollution sources that are more likely to impact a beach on a continuing basis, such as improper sewage discharges or runoff from large agricultural operations. The NYS Sanitary Code *E. coli* log mean standard limit of 126 colonies/100 ml is based on the mean of the logarithms of the results of the total number of samples collected in a 30-day period.

The beach at Olcott Beach has exceeded the log mean standard 92 times in past ten years (*Table 1*). This indicates a persistent impact from one or more pollution sources in the watershed of the beach. This station was monitored for indicator bacteria a minimum of once per-week from 2004 to 2014.

Table 1. Olcott beach bacteriological Water Quality Trend Data for E. coli. cfu/100ml (2004-2014)

	Single Sample Results				**Log Mean Results**			
	Low	*High*	Exceedances (>/=235 cfu/100ml)		*Low*	*High*	Exceedances (>/=126 cfu/100ml)	
Year			Number	%			Number	%
2004	<5	**1,400**	9	25	18	**214**	6	33
2005	<5	**690**	3	8.3	7	**102**	0	0
2006	<10	**1,030**	18	37.5	10	**393**	13	54
2007	<10	**590**	4	11.1	10	**209**	3	16.7
2008	<10	**7,800**	18	37.5	10	**469**	10	41.6
2009	<10	**4,100**	31	53.4	10	**1,032**	16	55.2
2010	10	**>10,000**	35	62.5	62	**1,218**	24	85.7
2011	<10	**>10,000**	27	40.9	14	**639**	17	51.5
2012	<10	**540**	5	10.9	9	**98**	0	0
2013	<10	**1,000**	11	22.0	<10	**261**	3	12.0
2014	<10	**600**	3	7.5	20	**123**	0	0

*Results in red exceed the standard for single sample results (235 cfu /100mL) or the standard for log mean results (126 cfu /100mL)

Field Data Results

Field staff record water quality and environmental data at the time of bacteriological sample collection. Field parameters include, water & air temperature, water & sky condition, 24-hr prior precipitation, pH, and current direction (*Table 2*). This data was recorded on a "Bathing Beach Water Quality Data Form" (*Attachment 2*)

Table 2. Water Quality Field Parameters.

Parameter	Measured (M) or Estimated (E)	Equipment / Method Used
Water Temperature	M (Deg F)	Alcohol-in-glass thermometer
Air Temperature	M (Deg F)	Alcohol-in-glass thermometer
pH	M (SU)	LaMotte Pro 250 DPD Test kit
Water Condition	E	Visual Assessment
Sky Condition	E	Visual Assessment
Current Direction	E	Visual Assessment
Algae	E	Visual Assessment

A review of the most recent 2014 data indicates the average water temperature was 64°F with an average air temperature of 62°F during the swimming season. Wind velocity averaged 8.0 mph in 2014. A review of the data from 2008 through 2014 indicates a maximum seasonal average water temperature was 70°F (2012). The maximum seasonal average air temperature was 70°F (2011). Finally, the maximum seasonal average wind velocity was 8.0 mph (2014).

Water Condition (Clarity) varies considerably during the bathing season. In general, cloudy turbid water was determined to be weather related as a result of high wave action, and runoff from Eighteenmile Creek.

Shoreline algae is observed on a regular basis at the beach beginning in late June early July. Algae was present in the water on most days as it became entrapped between the piers. The algae amount in nearshore areas was usually recorded as "moderate" (21-50%).

With respect to birds on the beach, gulls and geese were found throughout the sampling season. Some fecal material from birds was observed on the beach on about a third of the sampling days. In contrast, the piers encompassing the swim area had excessive fecal matter the vast majority of the time.

BEACH CLOSURES

In an effort to protect the public from illness, Olcott Beach has a monitoring and closure protocol in place protective of public health. The Bathing Beach swimming area is officially closed to the public when water quality standards found in Chapter I of the NYS Sanitary Section 6-2.15 are exceeded (E.coli >235 cfu/100ml). During a closure, no one is allowed in the water. Protocols for beach closures are identified in the departments approved annual Bathing Beach Monitoring Workplan.

Existing regulations require beaches to be closed whenever a public health hazard exists that is an imminent threat to the health or safety of the public. In general, beaches may be closed because of preemptive closure protocols, bacteriological results, physical factors (e.g. rainfall, wave height, algae deposition), chemical factors (e.g. oil/grease, chemical spills) or other disease causing circumstances (e.g. illness outbreaks). The current protocol provides for closures of the beach based on a single exceedance of the E. coli grab sample standard. This means that the beach is closed and re-sampled immediately following a bacteriological water quality exceedance. There have been 35 closures during the bathing season since 2004 for a cumulative time period totaling 136 days (Table 3).

A review of the data indicates that, this is one of the highest rates of closure for any beach in Western New York. The beach was closed for much of the bathing beach season in 2009 and 2011 due to elevated bacteria levels. High indicator bacteria levels are usually observed following intense rainfall or high wave action often associated with strong winds, especially originating from the North. Rainfall and high wave action causes high turbidity and poor water clarity in the swim area.

Table 3. Closures of the bathing beach at Olcott beach.

Date Closed	Date Re-opened	Number of Days Closed	Reason for Closure
7/28/2004	8/10/2004	7	Elevated E. coli Bacteria Levels
8/31/2004	Closed for the Season	0	Elevated E. coli Bacteria Levels
8/16/2005	8/23/2005	7	Elevated E. coli Bacteria Levels
6/27/2006	07/04/2006	8	Elevated E. coli Bacteria Levels
7/13/2006	7/15/2006	2	Elevated E. coli Bacteria Levels
7/18/2006	7/20/2006	2	Elevated E. coli Bacteria Levels
8/01/2006	8/15/2006	14	Elevated E. coli Bacteria Levels
8/07/2007	8/17/2007	10	Elevated E. coli Bacteria Levels
6/18/2008	6/19/2008	1	Elevated E. coli Bacteria Levels
7/01/2008	7/04/2008	3	Elevated E. coli Bacteria Levels
7/22/2008	7/27/2008	5	Elevated E. coli Bacteria Levels
8/05/2008	8/07/2008	2	Elevated E. coli Bacteria Levels
7/07/2009	7/10/2009	3	Elevated E. coli Bacteria Levels
7/14/2009	7/15/2009	1	Elevated E. coli Bacteria Levels
7/28/2009	7/29/2009	1	Elevated E. coli Bacteria Levels
8/04/2009	8/15/2009	11	Elevated E. coli Bacteria Levels
8/18/2009	8/24/2009 Closed for Season	6	Elevated E. coli Bacteria Levels
8/04/2010	8/18/2010	14	Elevated E. coli Bacteria Levels
7/06/2011	7/07/2011	1	Elevated E. coli Bacteria Levels
7/19/2011	7/23/2011	4	Elevated E. coli Bacteria Levels
7/26/2011	7/28/2011	2	Elevated E. coli Bacteria Levels
8/04/2011	8/06/2011	2	Elevated E. coli Bacteria Levels
8/09/2011	8/13/2011	4	Elevated E. coli Bacteria Levels
8/16/2011	8/19/2011	3	Elevated E. coli Bacteria Levels
8/23/2011	8/25/2011	2	Elevated E. coli Bacteria Levels
8/31/2011	Closed for the Season	0	Elevated E. coli Bacteria Levels
6/26/2012	6/29/2012	3	Elevated E. coli Bacteria Levels
7/10/2012	7/12/2012	2	Elevated E. coli Bacteria Levels
8/07/2012	8/09/2012	2	Elevated E. coli Bacteria Levels
6/05/2013	6/07/2013	2	Elevated E. coli Bacteria Levels
6/11/2013	6/15/2013	4	Elevated E. coli Bacteria Levels
7/02/2013	7/04/2013	2	Elevated E. coli Bacteria Levels
8/14/2013	8/17/2013	3	Elevated E. coli Bacteria Levels
7/10/2014	7/12/2014	2	Elevated E. coli Bacteria Levels
7/30/2014	8/01/2014	2	Elevated E. coli Bacteria Levels

WATER QUALITY STUDIES

NCDOH conducted several water quality special studies at the Beach in 2011, 2012 and 2013 including Eighteenmile Creek watershed sampling and source tracking studies *(Appendix A)*. Findings from these studies have demonstrated that:

The bacteriological water quality can vary substantially and is negatively affected by severe storms with high wave action and rainfall runoff.

Harmful algal blooms are an ongoing problem at Olcott where nutrient-rich pollution can spur algal growth. Studies have identified elevated phosphorous levels in Eighteenmile Creek.

Watershed bacteriological testing in 2011 indicates that Eighteenmile Creek is not a major bacteriological pollution source for the beach at Olcott during dry weather.

Agricultural land uses in the Eighteenmile Creek Watershed may be a pollution source.

Nearby cottage communities are connected to public sewers and not likely contributing bacterial pollution at the beach. Tracer dye testing of nearby public sanitary and storm facilities indicated that the system was functioning properly and does not appear to be a pollution source.

Studies have shown that shoreline sand has been identified as a source for waterborne disease-causing microorganisms. The spaces between the sand grains support the survival of certain bacterial, viral, and protozoan pathogens. This is an attractive play area, especially for children.

Bacteroides associated with ruminants and humans were detected in water samples from Olcott beach. In addition, *Helicobacter sp*. associated with geese was also detected.

Canadian Geese are a major pollution source along Lake Ontario, including Olcott Beach

POTENTIAL POLLUTION SOURCES

NCDOH staff conducted several water quality studies, reviewed existing data, and published reports in an attempt to identify potential pollution sources in the Olcott Beach Eighteenmile Creek watershed. A number of published reports included analysis of existing land use types within the watershed. Based on these studies, potential pollution sources for the beach are felt to be related primarily to pollution from waterfowl (mainly geese), agricultural runoff, and wastewater treatment plant discharges including wet weather overflows, stormwater outfalls/runoff, and algae.

An analysis of land uses in the watershed of Eighteenmile Creek shows agricultural activities are likely a primary pollution source. The watershed of Olcott Beach Park is predominately agricultural land, constituting approximately 57% of the watershed. The next most common land use is forested land at 27%. Developed or urban areas only account for a small portion of the watershed; however, a portion of the City of Lockport exists within the watershed including a municipal wastewater treatment plant (WWTP) with wet weather overflows, resulting in a possible major source of pollution.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

Multiple factors are influencing the water quality at Olcott Beach. A number of potential pollution sources have been identified through our sanitary survey work and a review of existing reports both within and outside the department. Sources identified using land use analysis and discussions with other agencies include: agricultural runoff, birds, beach sand quality, algae, storm water overflows, and runoff from developed areas. Recommendations that are based on the sanitary survey results are outlined below:

Algae: The majority of the warm weather season, algae masses remain in the beach area trapped between the piers for a considerable length of time. It has also been demonstrated that these algal masses not only protect indicator bacteria from die-off, but can serve as a medium for their growth. These algae blooms are a much larger issue affecting Lake Ontario water quality requiring a concerted effort by all parties to resolve. NCDOH can work with other agencies such as the Niagara County Soil and Water Conservation District, Cornell Cooperative Extension of Niagara County, and the NYS Department of Environmental Conservation to advise the agricultural community on Best Management Practices and CAFCO recommendations to prevent the runoff of nutrients into waterways entering Lake Ontario. It was also concluded that the City of Lockport's wastewater treatment plant is having an impact on the water quality of Eighteenmile Creek. The City of Lockport WWTP is a major source of nutrients to the "West Branch" of Eighteenmile Creek. Studies have shown that Total Phosphorus (TP) concentrations just downstream of the WWTP averaged 165.1 µg P/L, which is significantly above the 20 µg P/L NYS Guideline for Ambient Levels of Phosphorus in Surface Waters. The results from 26 August 2009, a nonevent period, provided clear evidence that the WWTP located on West Jackson Street was impacting downstream areas of Eighteenmile Creek. Nutrient concentrations were determined to be higher downstream of the treatment plant when compared to sites upstream of the plant. (Makarewicz & Lewis 2010).

NCDOH's Environmental Educator can contribute to public education efforts regarding reduction in residential household use of fertilizers on lawns that could result in run-off into Lake Ontario and contribute to algae blooms. NCDOH will continue to monitor the effects of algae on beach water quality and attempt to educate the public as time and funding permits.

Promote best management practices (BMPs) for agriculture: A copy of the this sanitary survey report will be sent to the Niagara County Soil and Water Conservation district office, and Cornell Cooperative Extension of Niagara County, along with correspondence indicating that agriculture

runoff, including livestock, near streams has been identified as a potential pollution source for this beach. Local Soil and Water Conservation District staff and staff of Cornell Cooperative Extension of Niagara County can help inform local farm owners of best management practices to ensure that plant nutrients, bacteria, sediment and agricultural chemicals are controlled so that pollution of surface water does not occur, limiting its use for recreation. Efforts to implement defensible remedial strategies that minimize nutrient loss from agricultural land will require interdisciplinary efforts involving research, extension and demonstration projects that educate farmers, the livestock industry, and the general public as to what is involved in ensuring clean water.

Bird Feces: Canada Geese are a major pollution source along Lake Ontario including Olcott Beach. Source tracking results confirm the presence of bacteria associated with geese in water samples collected from the beach swim area. The Town of Newfane in conjunction with Niagara County Parks should implement a program to control the numbers of geese in the park in an effort to reduce their impact on beach water quality.

An integrated management program which includes a variety of safe, practical, and effective techniques usually provides the best relief from Canadian goose droppings. The integrated approach should include banning the feeding of waterfowl, habitat modification, harassment, control of nesting, and in some cases, legal sport harvest (goose hunting), and humanely implemented removal of geese. Efforts by Town and park staff can include egg oiling, habitat alteration, and the use of grid wires along the piers (see attached NYSDEC & USDA brochure "When Geese Become a Problem" *(Attachment 3*).

The Parks Department and Town of Newfane should contact the U.S. Department of Agriculture (USDA) in an effort to reduce impacts on water quality as outlined in their brochure Management of Canada Goose Nesting (*Attachment 4*)

Beach Cleaning*:* The current level of beach cleaning and raking should be continued. As both algae and bird feces have been identified as major contributors to poor water quality, clearing of algae and bird feces along near-shore areas including the piers should be a priority. Consideration should be given to specialized beach cleaning equipment to remove algae and bird droppings.

Maintenance of the sand at the beach*:* The sand beneath the water along the shoreline is subject to stirring up and dispersion over time. Studies have shown that sand within the swash zone along the beach area have high levels of bacteria. This suggests that the sand is acting as a reservoir for bacteria, and could possibly impact bacteria levels in the water. Proper grooming and periodic replacement of sand can help reduce bacteria harbored in beach sand. Sand brought in to replenish the beach should be thoroughly washed and of a grain size sufficient to ensure a quality swimming experience and minimize turbidity generation by swimmer activities. In addition, the source of the sand should be as similar as possible to naturally occurring sand in the area.

Stormwater Runoff*:* Stormwater is the largest known source of pollution that causes beach advisories. One of the best ways to curb stormwater pollution is by implementing green infrastructure techniques to retain and filter rainwater where it falls, and letting it soak back into the ground rather than allowing it to overflow into waterways. These techniques include strategically placed rain gardens in yards, tree boxes along sidewalks, green roofs, and permeable pavement. Any future capital and rehabilitation projects that meet the threshold of one or more acres of disturbance within the watershed should use the New York State Stormwater Management Design Manual and obtain and follow the required permits.

Wastewater Discharges: Fecal contamination of our nation's recreation waters originates from many sources, including shoreline development, sanitary wastewater collection and treatment facilities, septic systems, urban runoff, disposal of human waste from boats, bathers themselves, agricultural animal feeding operations and natural animal sources such as regional wildlife. Source tracking studies conducted in August 2013 indicated human sources of bacteria at the beach. A dye test conducted by NCDOH staff in June 2014 did not show any deficiencies in the municipal sanitary and stormwater sewerage systems in the vicinity of the bathing beach. However, systems should be checked yearly and any future deficiencies found with the municipal wastewater systems should be corrected immediately.

The Olcott Marina located upstream from the beach has a sewage pump-out station for watercraft. The U.S. Environmental Protection Agency and the New York State Department of Environmental Conservation on December 8, 2011, announced that a 3,675 square mile area of Lake Ontario including the waters adjacent to the Town of Newfane, is now a "no discharge zone," which means that boats are completely banned from discharging sewage into the Lake. Educational efforts at the Marina should highlight the aforementioned information.

Public Education: A public education program should be implemented at the park to inform park patrons about water quality monitoring at the beach, potential pollution sources in the watershed, and watershed protection. The Niagara County Soil and Water Conservation District has developed an educational brochure for the Eighteenmile Creek Watershed (*Attachment 5)* that outlines ways the public can help protect their watershed and bathing beach. The brochures should be available at the parks maintenance office, the Olcott marina and the bathhouse near the beach.

Watershed Protection: The Eighteenmile Creek watershed covers approximately 90 square miles, an extremely large area. Protecting the watershed from contamination is critical for improving current beach water quality. Development plans within the watershed should be thoroughly reviewed to ensure that they will not detrimentally impact water quality.

Climate Change: Climate Change adds yet another stress to a Great Lakes ecosystem already struggling with aquatic invasive species, deleterious land use changes, point and nonpoint source pollution, toxic chemical contamination, and wetlands loss. Potential climate change impacts include reduced water levels, increased frequency of intense storm events, increases in flood and runoff related impairments, warmer water temperatures and an increase in algae blooms. Some of the above impacts can result in infrastructure failures, causing additional bathing beach water quality degradation. Krull Park Staff should consider impacts of climate change in any construction or restoration work completed at the park. In particular, wastewater and stormwater collection infrastructure should be constructed and sized to best handle anticipated impacts from climate change, including significant fluctuations in water levels or the effects of more extreme weather events (e.g. increased runoff or erosion). Park staff can take steps to identify locations and conditions of exiting storm drains and culverts, and keep these areas obstruction free.

Notifications of Regulatory Authorities: Notifying regulatory authorities, owner, operator and other concerned parties of the results of this survey could improve water quality at the beach and within Lake Ontario. Letters and copies of the sanitary survey report will be sent to New York State DEC Region 9, Cornell Cooperative Extension of Niagara County, and the local Soil and Water Conservation District to notify them of the potential pollution sources identified during sanitary survey work *(Attachment 6).*

APPENDIX A: WATER QUALITY STUDIES

NON-SWIM STATION MONITORING

The Department has been conducting weekly water bacteriological quality monitoring of our Lake Ontario bathing beach areas in Niagara County since our inception in 1965. Presently, six of the monitoring points are located along the shores of Lake Ontario with the remaining three obtained from inland swimming ponds.

In addition, the Mouth of Eighteenmile Creek, located just upstream of the swimming area, has been monitored consistently during the beach season from 2012 through 2014. All of these stations are located outside of the Olcott bathing beach boundary as noted in (*Figure 2*).

Eighteenmile Creek Mouth (SP#3): The swimming beach is located approximately 1,735 linear feet east of the mouth of Eighteenmile Creek. Single sample results from this station are in line with the beach area, with similar *E.coli* results. (Table 4).

NYSDEC classifies (Eighteenmile Creek Drainage Basin Classification) the water at the mouth of *Eighteenmile* Creek as Class B (suitable for primary and secondary contact recreation and fishing) (NYS DEC 2013). The remainder of upstream waters and tributaries of the Creek, however, vary from Class A through D depending on location. (NYS DEC 2013).

Table 4. Eighteenmile Creek Mouth Water Quality Trend Data for E. coli/100ml.

	Single Sample Results				**Log Mean Results**			
	Low	*High*	Exceedances (>/=235 cfu/100ml)		*Low*	*High*	Exceedances (>/=126 cfu./100ml)	
Year			Number	%			Number	%
2012	<4	**260**	2	14.3	24	**204**	1	7.1
2013	<10	**4,500**	4	13.8	30	**239**	8	27.6
2014	<10	**450**	2	7.69	17	**183**	4	15.4

*Results in red exceed the standard for single sample results (235 cfu /100mL) or standard for log mean results (126 cfu /100mL)

Figure 2. Non-Swim Monitoring Station Mouth Eighteenmile Creek

Camp Kenan: The next routine monitoring station located approximately 8-miles east (downstream) of Olcott beach is Camp Kenan (*Figure 3)*. Single sample results for *E.coli* indicate infrequent high levels of bacteria at this station (*Table 5*).

Table 5. Camp Kenan Water Quality Trend Data for E. coli. /100ml

	Single Sample Results				Log Mean Results			
	Low	*High*	Exceedances (>/=235 col./100ml)		*Low*	*High*	Exceedances (>/=126 col./100ml)	
Year			Number	%			Number	%
2012	<4	**560**	5	11.4	9	**98**	0	0
2013	<10	**240**	3	8.3	14	**283**	2	11.1
2014	<10	**210**	0	0	10	**117**	0	0

*Results in red exceed the standard for single sample results (235 col. /100mL) or standard for log mean results (126 col. /100mL)

Conclusions. Intermittent high bacteria results at the beach may be due to influence from the mouth of Eighteenmile Creek, particularly after heavy rainfall. Extensive water quality studies have been completed of Eighteenmile Creek; see 2011 Watershed Studies (pg 19) for more information.

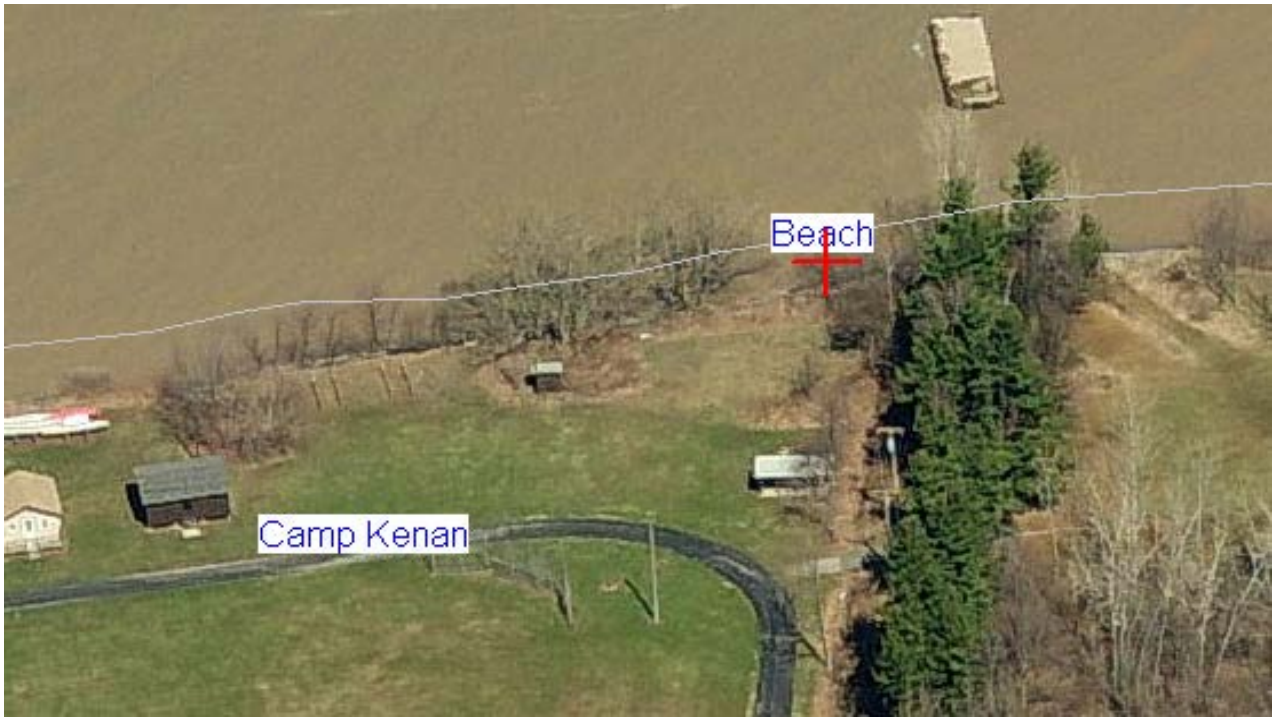


Figure 3. Non-Swim Monitoring Station Camp Kenan

2011 EIGHTEENMILE CREEK WATERSHED STUDY

The Eighteenmile Creek watershed (*Figure 4)* is located along the southern shore of Lake Ontario in Niagara County, New York. Eighteenmile Creek flows generally to the north and discharges into Lake Ontario, through Olcott Harbor, approximately 18 miles east of the mouth of the Niagara River. The watershed has a drainage area of approximately 90 square miles and includes Eighteenmile Creek; the two main tributaries, the East Branch and the Gulf, and minor tributaries. In addition, much of the flow in the main branch of Eighteenmile Creek comes from water diverted from the New York State Barge Canal.

On August 31, 2011 and again on October 20, 2011 an intensive watershed bacteriological sampling program was conducted by departmental staff. This survey included collecting samples from the swim area at Olcott Beach, as well as collecting samples from up to seventeen stations along Eighteenmile Creek and its associated plume in Lake Ontario (Figures 5, 6 & 7). Sampling was repeated at the same stations on the second sampling event and expanded to include the Creek's plume in Lake Ontario, after a moderate amount of rainfall (0.56 in) occurred the night before. Water samples were tested for Air & Water Temperature, pH, Fecal Coliform and E.coli (*Table 6 & 7*). Lab Reports are available (*Attachment 7*).

Table 6. Water Quality Parameter Results for Watershed Points (August 31, 2011).

Sample Date: 08/31/2011

18 MILE CREEK SAMPLING

Samplers: Joseph Baronich & Rene Herc

Sample Number	Location See Map	Latitude North	Longitude West	Sample Time EST	pH SU	H_2O Temp °F	Air Temp °F	Fecal Coliform CFU/100ml	e.Coli CFU/100ml
						New York State Bathing Beach Water Quality Limits		1,000	235
14	18 Mile East of Canal	43.176250	78.686100	1:35 PM	7.7	75	79	60	10
13	18 Mile West of Canal	43.176500	78.686440	1:30 PM	7.8	77	79	110	130
12	18 Mile Up Str WWTP	43.184580	78.703120	12:50 PM	7.7	78	79	380	190
11	Lcpt WWTP Effluent	43.186280	78.706110	1:15 PM	7.5	76	82	7,200	6,200
10	18 Mi Down Str WWTP	43.189570	78.705570	12:35 PM	7.7	75	79	3,100	1,500
9	18Mile East Branch	43.228617	78.704006	12:10 PM	7.8	76	78	170	210
8	18 Mile Junction	43.228810	78.704440	12:05 PM	7.7	76	78	780	1,600
7	18 Mile West Branch	43.228647	78.704522	12:00 PM	7.8	76	78	610	1,700
6	2nd Dam	43.278990	78.707580	11:20 AM	7.8	75	76	630	560
5	Burt Dam Above	43.313500	78.715060	10:50 AM	8.1	75	70	20	10
4	Burt Dam Below	43.313920	78.715690	10:30 AM	7.8	72	70	260	170
3	West Beach	43.339153	78.720989	10:05 AM	7.9	73	74	<10	<10
2	18 Mile Mouth	43.340800	78.719470	9:55 AM	7.8	73	74	40	20
1	Olcott Beach	43.339630	78.713150	9:30 AM	7.8	73	74	210	160

Lab: Erie Co. Public Health Lab

SU = Standard Units

°F = Degrees Fahrenheit

CFU = Colony Forming Units

EST = Eastern Standard Time

Table 7. Water Quality Parameter Results for Watershed Points (October 20, 2011).

Sample Date: 10/20/2011

18 MILE CREEK SAMPLING

Samplers: Joseph Baronich & David Zak

Sample Number	Location See Map	Latitude North	Longitude West	Sample Time EST	pH SU	H_2O Temp °F	Air Temp °F	Fecal Coliform CFU/100ml	e.Coli CFU/100ml
							New York State Bathing Beach Water Quality Limits	1,000	235
1	18 Mile East of Canal	43.176250	78.686100	8:50AM	7.7	52	51	420	280
2	18 Mile West of Canal	43.176500	78.686440	8:55AM	7.7	54	51	1,700	720
3	18 Mile Up Str WWTP	43.184580	78.703120	9:10AM	8.0	52	50	3,600	2,300
4	Lcpt WWTP Effluent	43.186280	78.706110	9:30AM	7.2	58	50	>10,000	>10,000
5	18 Mi Down Str WWTP	43.189570	78.705570	9:40AM	7.5	54	50	>10,000	>10,000
6	18Mile East Branch	43.228617	78.704006	10:10AM	7.6	57	48	510	650
7	18 Mile West Branch	43.228647	78.704522	10:15AM	7.7	56	49	3,300	1,700
8	18 Mile Junction	43.228810	78.704440	10:20AM	7.6	56	49	2,500	1,800
9	2nd Dam	43.278990	78.707580	10:45AM	7.7	55	52	620	380
10	Burt Dam Above	43.313500	78.715060	11:00AM	7.7	55	50	70	30
11	Burt Dam Below	43.313920	78.715690	11:20AM	7.6	56	50	50	50
12	18 Mile Harbor	43.336789	78.716153	11:03AM	7.3	54	50	110	60
13	18 Mile Mouth Plume	43.340783	78.719036	11:11AM	7.5	54	50	40	30
14	West Beach Plume	43.340783	78.721369	11:14AM	7.5	54	50	10	<10
15	Plume West of Beach	43.341414	78.716036	11:17AM	7.5	53	50	20	30
16	Plume at Beach	43.341669	78.713139	11:21AM	7.5	53	50	40	20
17	Plume East of Beach	43.341931	78.711211	11:25AM	7.5	54	50	10	30
18	Olcott Beach Deep	43.339525	78.712661	11:40AM	7.7	55	50	40	10
19	Olcott Beach Shallow	43.339483	78.712661	11:45AM	7.7	55	50	20	40

Lab: Erie Co. Public Health Lab

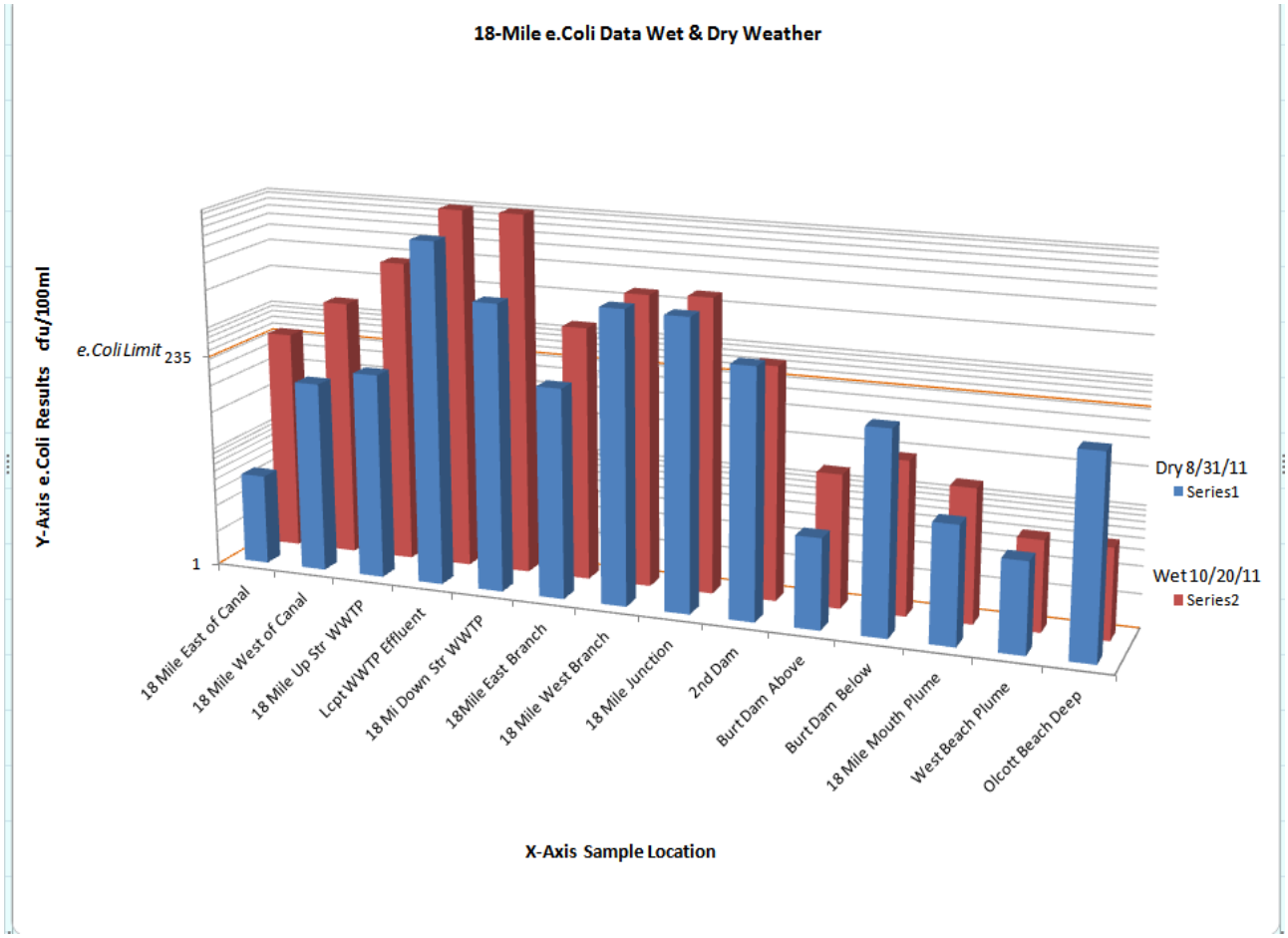
SU = Standard Units

°F = Degrees Fahrenheit

CFU = Colony Forming Units

EST = Eastern Standard Time

Graph 1. Water Quality Parameter Results for Watershed Points (August 31, 2011 & October 20, 2011).



Conclusions. Overall, bacteria levels were higher on the second sampling event after a moderate amount of rainfall the night before (0.56 in.) (Graph 1). During each sampling event, bacteria levels were at acceptable levels (well within bathing beach water quality limits) at the Burt Dam (Graph 2) and continued downstream to the bathing beach area. The sampling does show that bacteria levels can be extremely high upstream of the Burt Dam and under higher rainfall conditions, could likely contribute to higher bacteria levels at the beach.

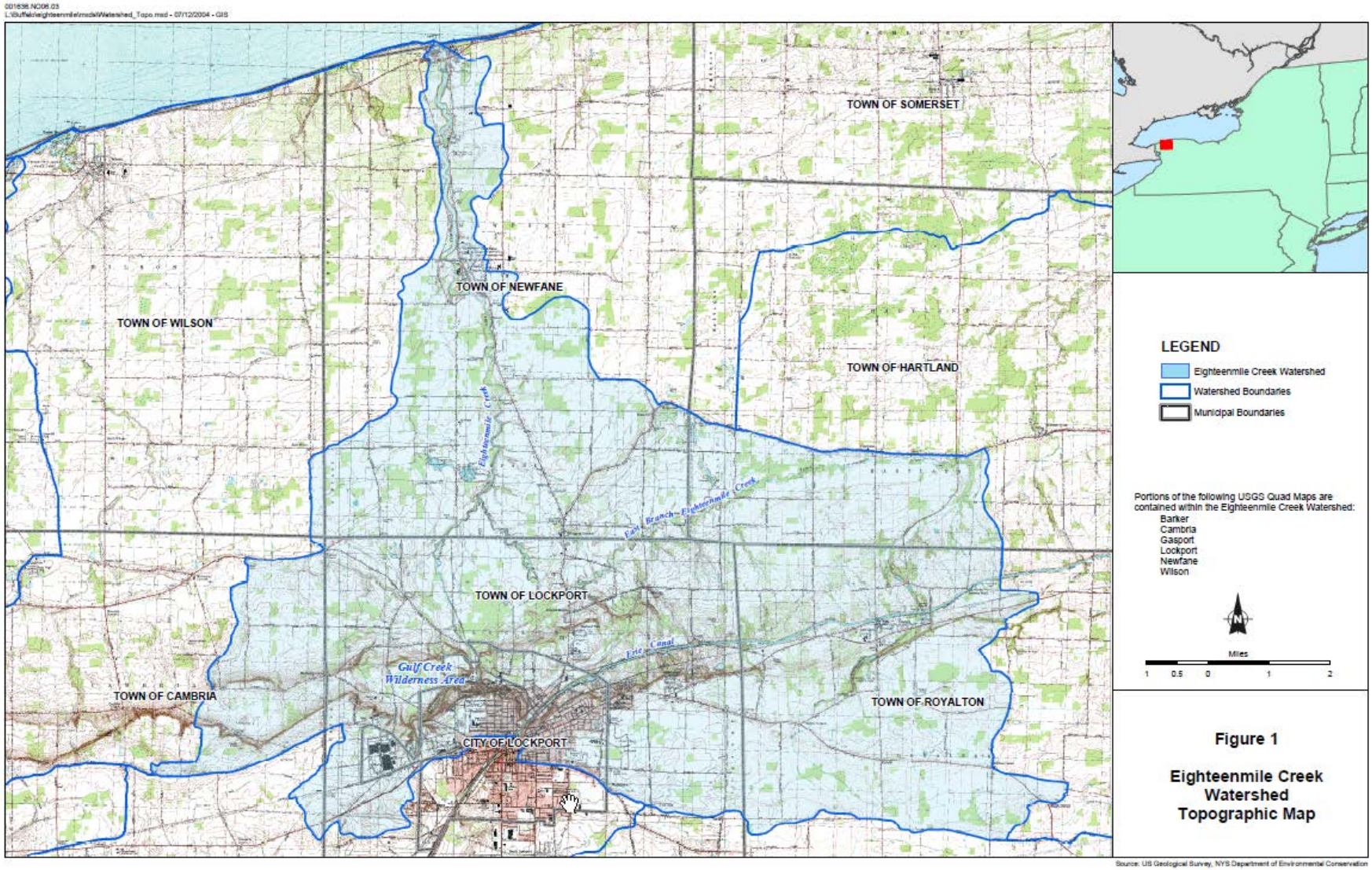


Figure 4. Eighteenmile Creek Watershed

Niagara County Environmental Health

Eighteenmile Creek
Water Quality Parameter Results

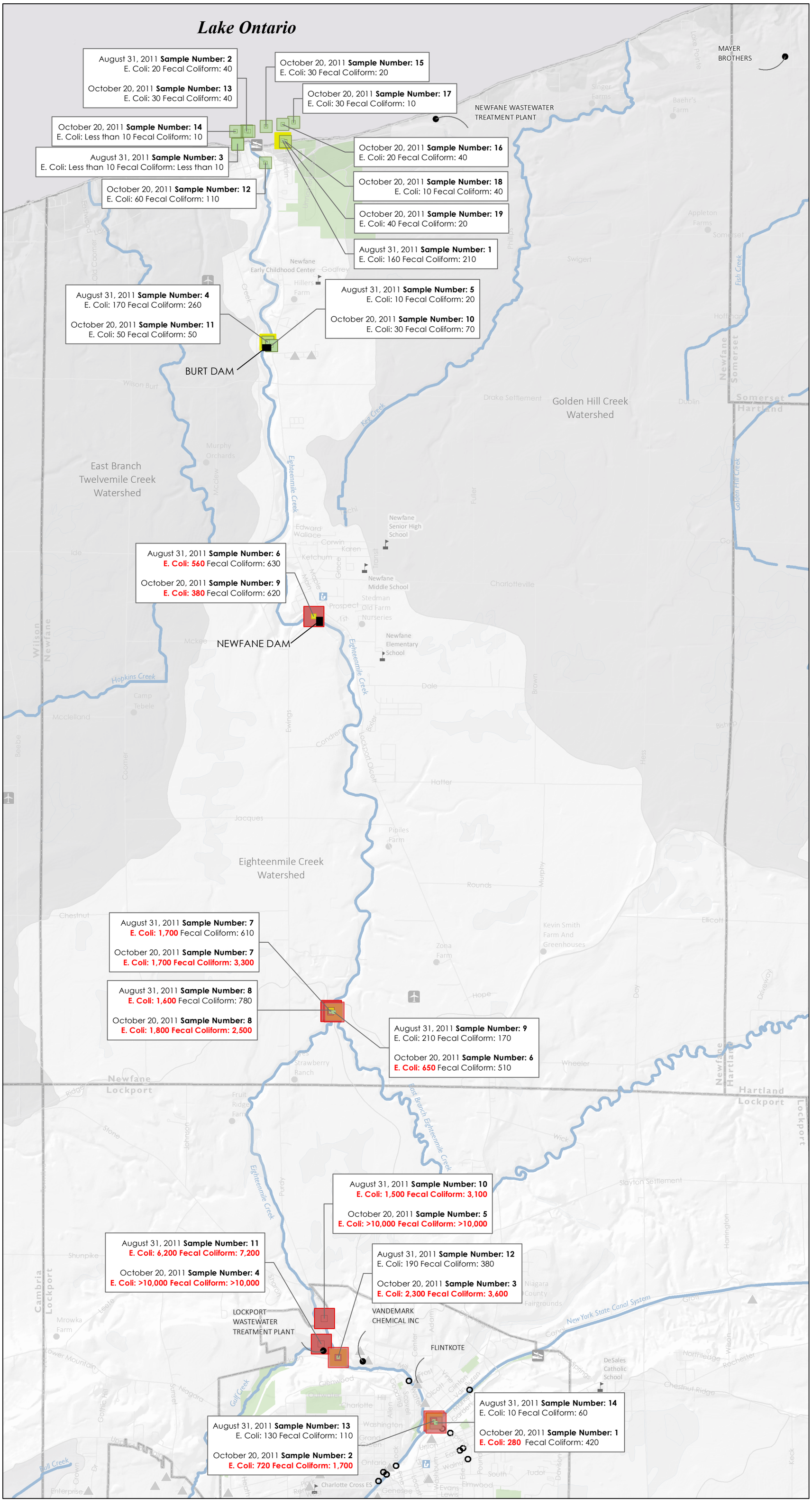


Figure 5. Eighteenmile Creek Sample Points Aug 31, 2011. & Oct 20, 2011.

SAMPLING

Fecal Coliform (CFU/100 ml)

- 10 - 620
- 621 - 999
- 1,000 - Greater than 10,000

e.Coli (CFU/100 ml)

- Less than 10 - 100
- 101 - 234
- 235 - 6,200

KEY

- Library
- School (K-12)
- NYSDEC State Pollutant Discharge Elimination System (SPDES)
- Boat Launch/Marina
- Combined Sewer Overflow (CSO)
- NYSDEC Remediation Sites
- Airport
- Stream/Creek (USGS NHD)
- Street (NYS Street Centerline)
- NYSDEC Freshwater Wetland (2014)
- Park
- Municipality

N

0 0.5 1 2

Miles

Data Sources:

Park, Municipal Boundary, Library, School, Airfield: Niagara County Office of Real Property (2014)

SPDES, Wetlands, Marina, CSO, Remedial Sites: NYSDEC (2015)

Streets: NYS GIS Program Office (2014)

Stream/Creeks: USGS NHD (2015)

Sampling Data: Niagara County Environmental Health Department (2011)

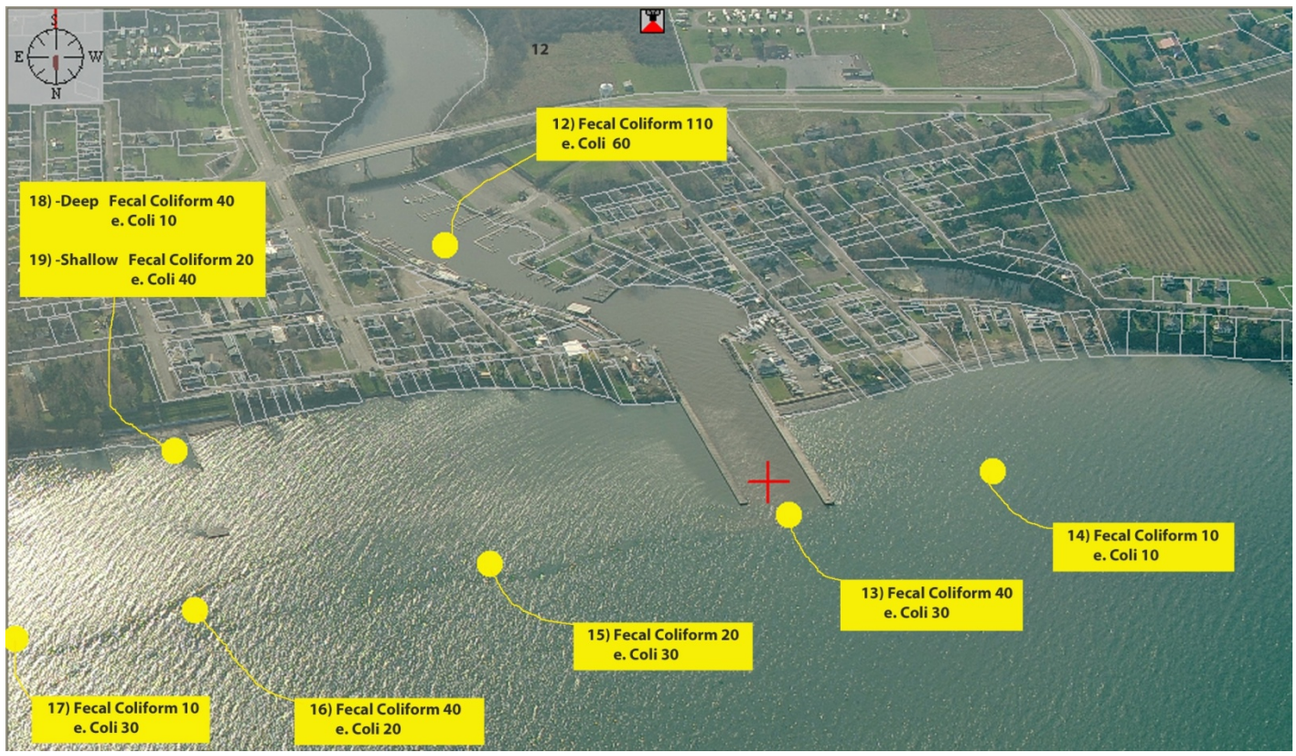
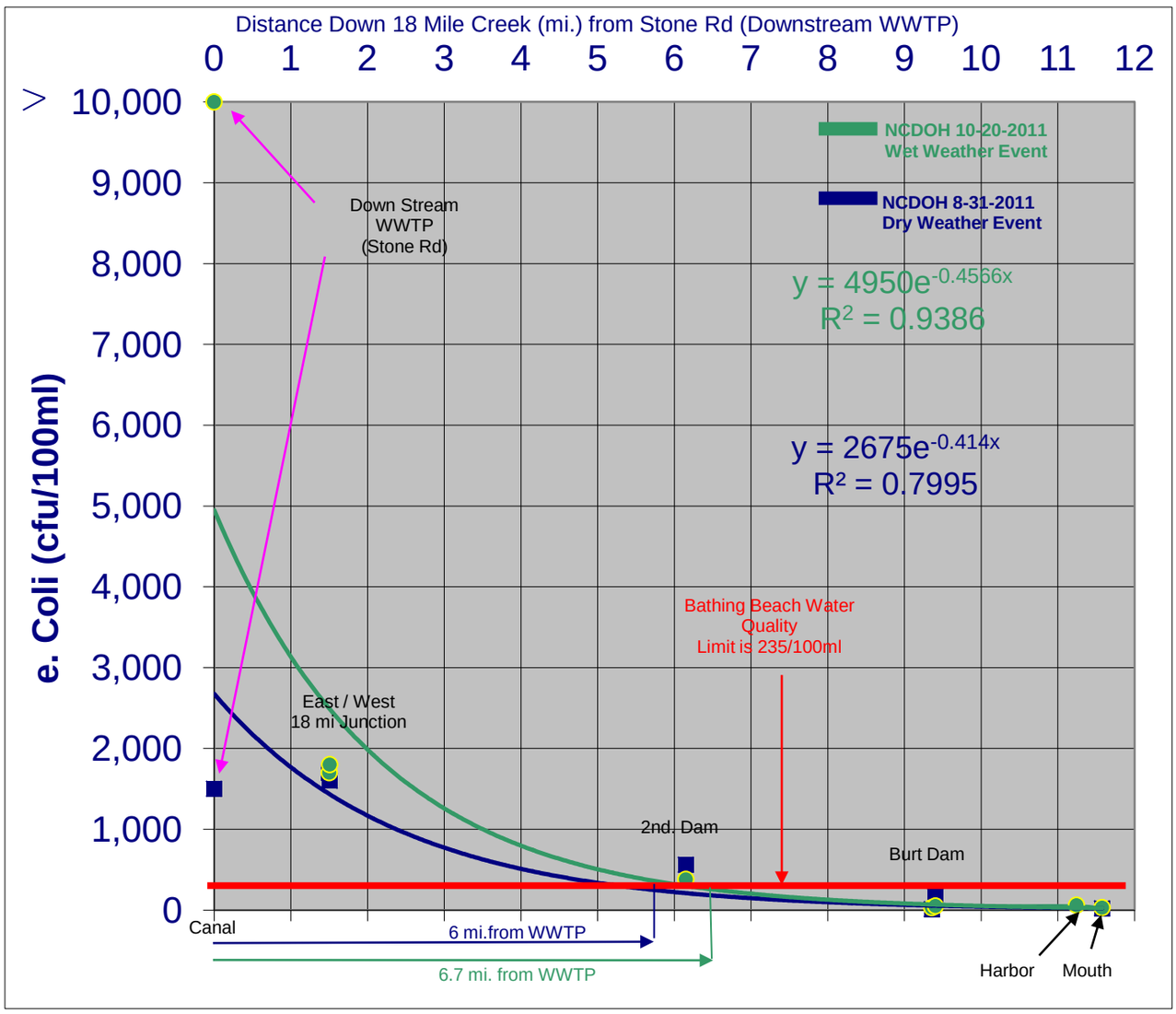


Figure 7. Mouth of Eighteenmile Creek/Lake Ontario Sample Points Oct 20, 2011.



Graph 2. Water Quality Parameter Results for Watershed Points (August 31, 2011 & October 20, 2011).

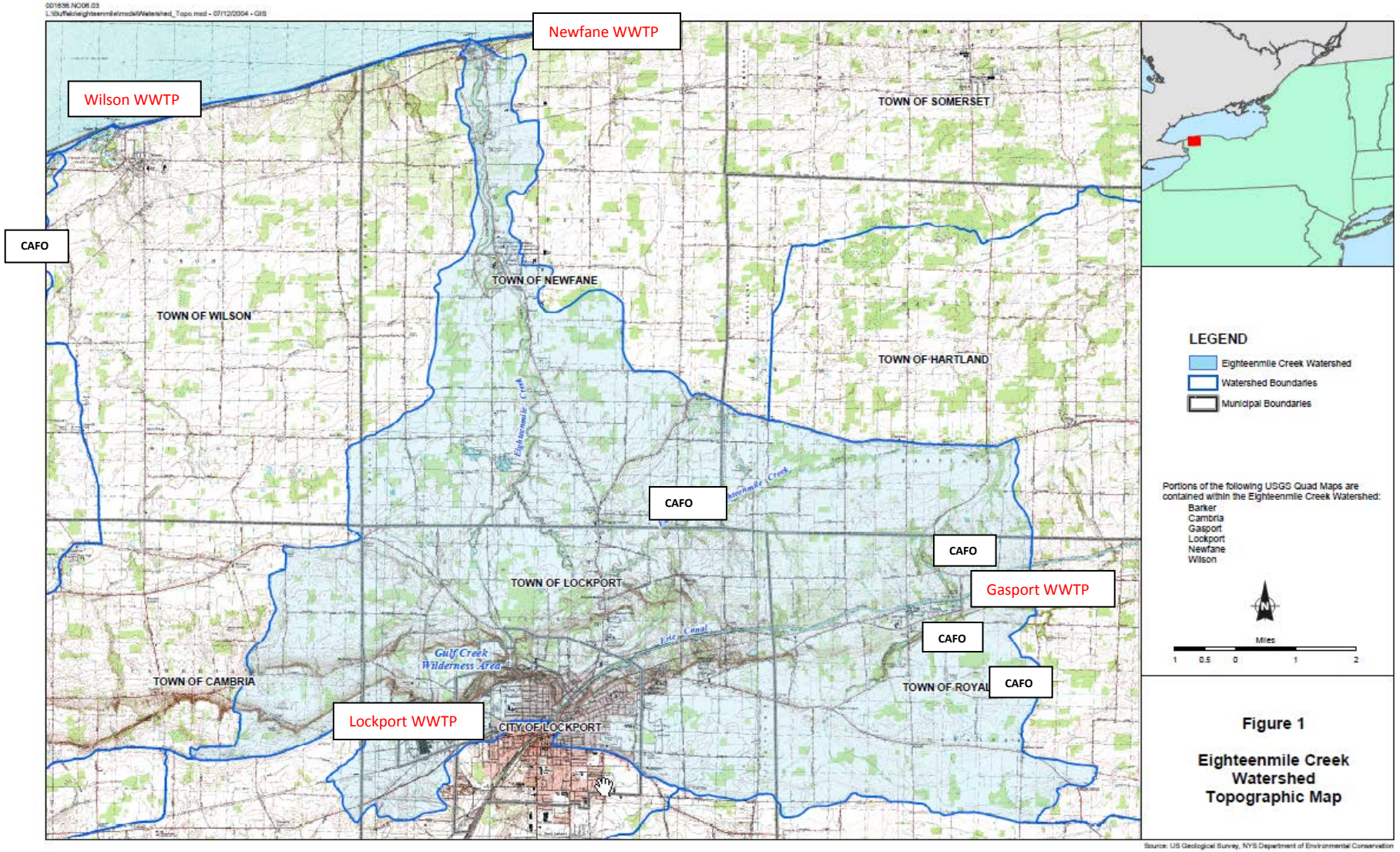


Figure 8. Eighteenmile Creek Watershed Municipal Wastewater Treatment Plants & CAFO Sites.

Conclusions. Overall, bacteria levels were elevated throughout the main branch of Eighteenmile Creek upstream of the Burt Dam. Eighteenmile Creek has a greater likelihood of impacting the beach water quality due to its close proximity (*Figure 2*) to the beach and the west-to-east long shore current on Lake Ontario. Phytoplankton and vegetation were also abundant at many sample stations, which indicate high levels of nutrient loading from various watershed sources. Algal blooms resulting from excessive nutrients in the near shore regions are unsightly, odorous, and detrimental to bathing water quality.

Previous studies in 2010 have indicated that phosphorus is of concern as it stimulates the growth of plants, causing blooms of algae such as Cladophora. Total phosphorus (TP) levels in the lakeside waters (average=41.8+/-9.8 µg P/L) were lower than in Creek water (average=124.7+/- 12.3 µg P/L) indicating dilution with lake waters and perhaps uptake by algae. But clearly, the Creek is impacting the nearshore waters of Lake Ontario. Both lakeside and Creek phosphorus levels exceeded the NYSDEC ambient guideline of 20 µg P/L for phosphorus concentrations. (Makarewicz and Nowak 2010)

Furthermore, a study in 2006 indicated that the total phosphorus concentration of Eighteenmile Creek was 42% higher during rainfall events (244.7 µg P/L) versus non-event Creek (171.9 µg P/L) conditions with a maximum concentration of 915.5 µg P/L that occurred during an event on 4 July 2004. The mean non-event total phosphorus concentration of Eighteenmile Creek (171.9 µg P/L) was compared to other watersheds in western and central New York. The Eighteenmile Creek value was eclipsed only by watersheds that had a heavy loss of phosphorus from agricultural muckland (Ley Creek in Oswego County at 270.8 µg P/L) and a watershed that receives discharge from a municipal sewage treatment plant (Lower Northrup Creek in Monroe County at 263.6 µg P/L). Eighteenmile Creek lost an annual average of 33 metric tons of total phosphorus during the two-year monitoring period. That rate translates to 90 kg of phosphorus lost per day. Seasonally, 41% of the total phosphorus was lost from the watershed in winter followed by the spring season where another 25% of TP was lost (Makarewicz, Lewis, White, Seider, Digiacomo 2006).

Finally, it has been reported that Eighteenmile Creek's phosphorus loss is nearly six times that of Twelvemile Creek West (0.67 g P/ha/day) and over 12 times that of Twelvemile Creek East (0.30 g P/ha/day), which are both are Niagara County watersheds that are heavily in agriculture. (Makarewicz, Lewis, White, Seider, Digiacomo 2006).

Eighteenmile Creek receives a discharge from the City of Lockport's wastewater treatment plant that does elevate the total phosphorus concentration of Eighteenmile Creek. (Makarewicz, Lewis, White, Seider, Digiacomo 2006).

There is evidence that the City of Lockport's Wastewater Treatment Plant (WWTP) is having an impact on the water quality of Eighteenmile Creek. The Eighteenmile Creek site at Stone Road represents losses from only a small (5%) percentage of the upper portion of the watershed but receives effluent from the wastewater treatment plant as well as water from the Erie Canal. Total phosphorus was significantly higher at Stone Road compared to Ide Road (240.9 µg P/L versus 181.3 µg P/L). Both pH and dissolved oxygen were significantly higher at Ide Road than at the Stone Road site. These differences in phosphorus, dissolved oxygen and pH are likely due to the effluent from the WWTP in Lockport that is discharged into this portion of the Creek. (Makarewicz, Lewis, White, Seider, Digiacomo 2006).

In order to allow further evaluation of the impact of the Lockport WWTP and Erie Canal on Eighteenmile Creek, we estimated nutrient, soil losses and discharge for the Stone Road portion of the watershed based on continuous measurements of discharge at Ide Road. By using this approach, 46% of the

discharge measured at Ide Road originated from the watershed above Stone Road. Similarly, 57% of the total phosphorus, 61% of nitrate, 33% of total suspended solids, 44% of total Kjeldahl nitrogen and 65% of the sodium loss measured at Ide Road originated upstream of Stone Road: the urban area portion of the watershed (5% of the total watershed area) that included the WWTP and Erie Canal effluent. The previous estimate was based on continuous measurements of discharge at Ide Road, regression derived continuous discharge at Stone Road and event chemistry at only the Ide Road site. Instantaneous loads of nutrients and suspended solids were also calculated based on actual sampling days. This approach suggested that the Stone Road segment of Eighteenmile Creek may account for over 70% of the discharge and over 85% of the nutrient load. (Makarewicz, Lewis, White, Seider, Digiacomo 2006)

Two Municipal Wastewater treatment Plants are presently permitted to discharge into Eighteenmile Creek. Their effluent is monitored per the requirements of current SPDES permits for each facility, which list effluent limitations and monitoring requirements that must be adhered to avoid violations of water quality standards.

The City of Lockport Wastewater Treatment Plant (WWTP) (NY-0027057) is required by a NYSDEC SPDES permit to monitor their discharge at outfall 001-M on a daily basis for phosphorus. A review of the 2014 data indicates that the maximum monthly average concentration for phosphorus was reported as 600 ug P/L in July of 2014.

The Gasport Wastewater Treatment Plant (NY-0029963) that discharges to the east branch of Eighteenmile Creek is not required to monitor for phosphorus under the terms and conditions of their SPDES permit. The Permit, with an effective date of May 22, 2014, requires the facility to conduct sampling in the East branch of Eighteenmile Creek to define the bacteriological impact of their wastewater discharge to the creek. A total of four rounds of sampling consisting of an upstream location and five downstream samples must be completed between May 1, 2015 and October 15, 2015.

The location of two Municipal Wastewater Treatment Plants and associated discharges within the watershed could result in increased bacterial loading during heavy rainfall events. The City of Lockport combined sewer system periodically discharges untreated combined stormwater overflow into Eighteenmile Creek during periods of significant precipitation. Over the past years, 18 of the City's original 31 combined sewer overflows (CSO) have been separated by installing new sewer line for either the sanitary or storm sewer system. Six of the remaining thirteen CSOs have the potential to discharge to Eighteenmile Creek. The remaining seven outfalls have the potential to discharge into the Erie Barge Canal. Since Eighteenmile Creek receives constant augmented flow from the Erie Barge Canal, all of the remaining thirteen outfalls (*Figure 9*) have the potential to negatively affect the water quality in Eighteenmile Creek.

Although water quality has improved substantially over the years, additional controls over point sources and funds dedicated to sewer infrastructure improvements are needed. Congressman Brian Higgins has recently (4/22/2015) announced legislation aimed to update water infrastructure essential to protecting the Great Lakes. The Great Lakes Nutrient Removal Assistance Act would provide the U.S. Environmental Protection Agency with $500 million of funding to upgrade publicly owned wastewater treatment plants in the Great Lakes basin with nutrient removal technology.

It was noted that the watershed is predominately agricultural, with farm fields adjacent to the stream in many locations. Lawn areas were also immediately adjacent to parts of the stream. Fertilizing of lawn areas and agricultural fields are also likely a major source of nutrient loading into the creek.

In addition, four Concentrated Animal Feed Operations (CAFO) sites (*Figure* 8) are also located within the watershed that could also lead to the discharge of animal manure runoff into the stream. Finally, the land storage and spreading of manure and use of fertilizers in the agricultural and residential community can add to both bacterial and phosphorous loading.

In 2005, The Niagara County Soil and Water Conservation District (NCSWCD) began implementing the Agricultural Environmental Program (AEM) within the Eighteenmile Creek watershed. AEM is a voluntary, incentive-based program that helps farm operators make common-sense, cost effective, and science-based decisions that help meet business objectives while protecting and conserving the State's natural resources. (NYS Ag & Markets, 2006)

Since the program was initiated, NCSWCD has been conducting farm assessments and evaluating water quality on a number of farms within the watershed. A total of six agricultural farms within the watershed have completed agricultural Best Management Plan (BMP) Implementation Projects.

The completed BMP's have reportedly tremendously reduced nutrient and sediment loading from the farms by preventing contamination from reaching the Creek. (Niagara County Soil & Water Conservation District, Eighteenmile Creek Remedial Action Plan, Stage II Update, Dec 2011)

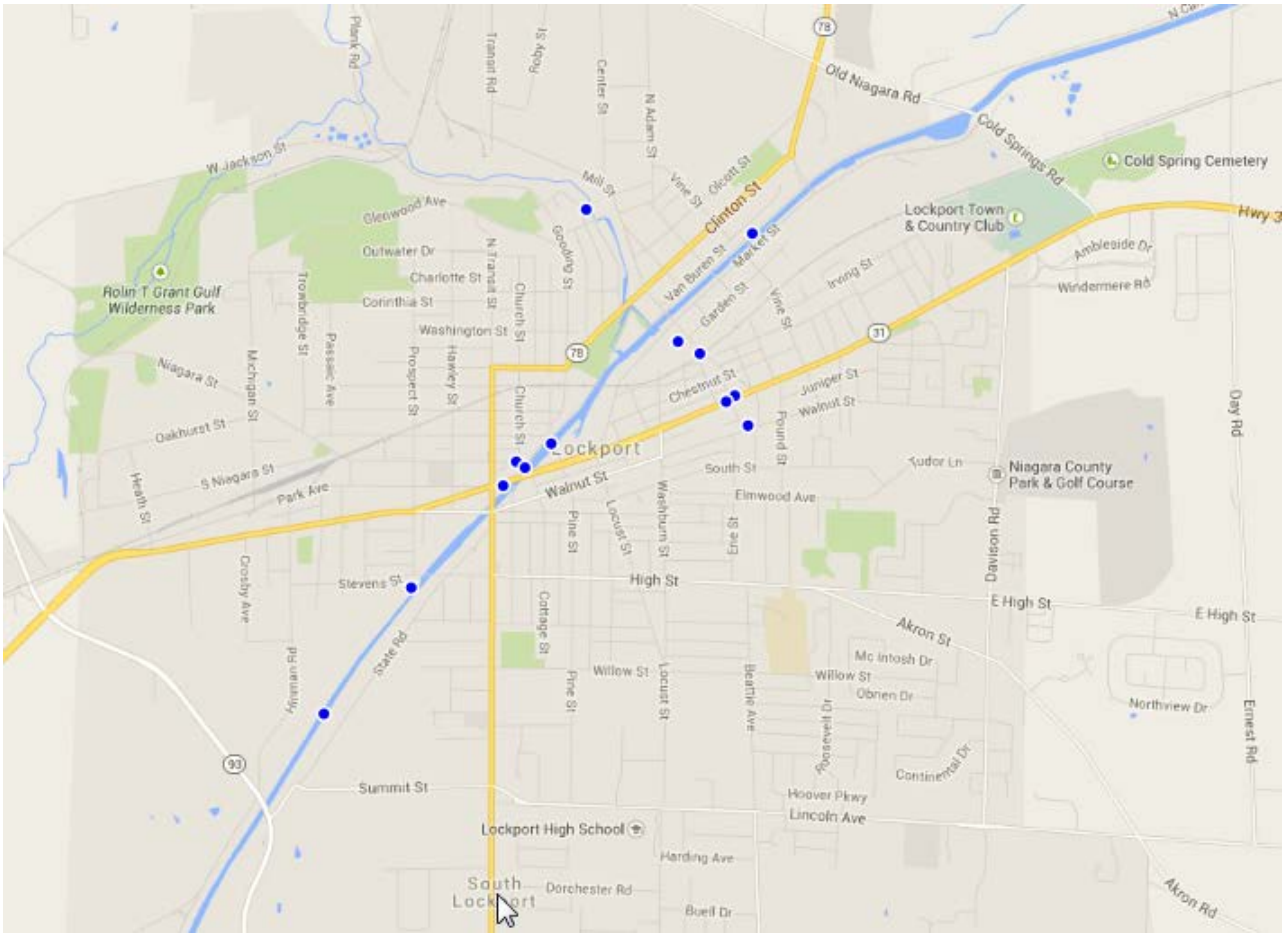


Figure 9. City of Lockport WWTP 13 Combined Sewer Overflows

2012 and 2013 BACTERODIES SOURCE TRACKING STUDY

In an attempt to determine the source of indicator bacteria at Olcott beach, water samples were collected for source tracking with analysis by the NY State Department of Health Wadsworth Laboratory (*Attachment 8*). One liter water samples were collected from the beach on August 6, 2012, September 26, 2012 and August 14, 2013. In addition, a one liter sediment sample was taken from the swim area on September 26, 2012. Amplification of host species-specific 16S rDNA genes from *Bacteroides sp.* served as the basis for microbial source-tracking studies.

The August 6, 2012 results indicated PCR products typical of Bacteroides associated with ruminants were detected in the swim area and mouth of Eighteenmile Creek.

The September 26, 2012 water sample results indicated PCR products positive for general Bacteroidales however, no association with ruminants, humans, geese, or gulls were identified in the swim area. Sediment sample results from the swim area indicated PCR products typical of Helicobacter sp. associated with geese were detected.

The August 14, 2013 results indicated PCR products typical of Bacteroides associated with both ruminants and humans were detected in the swim area samples. In addition, PCR products typical of Helicobacter sp. associated with geese were detected in the swim area. The sample taken at the mouth of Eighteenmile Creek indicated PCR products typical of Bacteroides associated with ruminants were detected. In addition, PCR products typical of Helicobacter sp. associated with geese were detected. Finally, PCR products typical of Bacteroidales associated with humans were **not** detected at the mouth of Eighteenmile Creek.

PCR products typical of Bacteroides associated with both ruminants and humans were detected in the samples. In addition, PCR products typical of Helicobacter sp. associated with geese were detected. Based on these results, it can be assumed that watershed sources, including agricultural operations, wastewater treatment plants, and failing onsite septic systems, may be contributing bacteria pollution to the beach during heavy rainfall events. In addition, there are localized impacts from geese near the swim area.

Source tracking samples were also collected at nearby NYS Wilson-Tuscarora Park beach in the Town of Wilson by the NYS Office of Parks, Recreation and Historic Preservation. This beach, located on the shore of Lake Ontario is approximately 8 miles upstream (west) of Olcott Beach and is operated by the NYS Office of Parks, Recreation and Historic Preservation. Results from these samples collected on August 14th, 2013 also indicated the presence of bacteria associated with ruminants, humans, and geese (NYS DOH 2013).

APPENDIX B: POTENTIAL POLLUTION SOURCES

From E&E Report of " Eighteenmile Creek Comprehensive Watershed Management Plan" (Feb 17, 2004)

Potential sources of contaminants for the beach include land use in the watershed, algae deposition at the beach, and birds at the beach. A study was initiated by departmental staff to determine the potential for pollution within the watershed. The results of these efforts are described below.

LAND USE

The Great Lakes Center at Buffalo State College updated the land use/land cover (LULC) data layer for the Eighteenmile Creek watershed in 2004

Type of Land Use	Percent of Land Use
	(2004 LULC Data)
Agricultural Land	57.14%
Residential Use	7.96%
Commercial/Industrial	4.24%
Other Urban/Transportation and Utility	3.13%
Forest and Wetlands	26.96%
Open Water	0.59%

Agricultural Land

According to the LULC datasets, agricultural land comprises the largest land use within the watershed. Agricultural land within the watershed is used for row crops, pasture, and orchards. The majority of the agricultural land is used for pasture and hay; however, fruit trees are also a common crop planted on the lake plain, below the escarpment.

Residential

Residential land is a mixture of high and low intensity development. According to the class definitions for Low and High Intensity Residential Land Use provided by USGS for the National Land Cover Data (NLCD), low intensity residential areas have a mixture of constructed materials and vegetation. Constructed materials account for 30-80 percent of the cover. Vegetation may account for 20 to 70 percent of the cover. These areas most commonly include single-family housing units. Population densities will be lower than in high intensity residential areas. High intensity residential areas include highly developed areas where people reside in high numbers. Examples include apartment complexes and row houses. Vegetation accounts for less than 20 percent of the cover. Constructed materials account for 80 to 100 percent of the cover

Commercial/Industrial

The City of Lockport is the major commercial and industrial center of the watershed area. This land use appears to be most dense in the western portion of the city, along the Niagara Escarpment. Delphi-Harrison is a major industrial facility located in this area. Other areas of high commercial/ industrial development include Burt, Newfane, Wrights Corners, and Gasport. In these areas commercial/ industrial land uses tend to be located along major roadways such as Rt. 78 and Rt. 31.

Recreational

Recreational land uses are important areas of consideration within the watershed. These areas include parks and marinas. The park-land serves to maintain green space in areas of urban or commercial/ industrial development and also provide opportunities for hunting, fishing, swimming, and hiking. Examples of parks within the watershed include: the Rollin T. Grant Gulf Wilderness Area, Highland Park, Krull Park, Olcott Beach, and Royalton Ravine County Park. Other recreational land uses within the watershed include golf courses and marinas. Olcott Harbor, at the mouth of Eighteenmile Creek, is used to house many pleasure and fishing boats during the summer months. The Erie Canal is also an important recreational land use; providing fishing, boating, and hiking opportunities.

Forests and Wetlands

Forests and wetlands are important areas of consideration within the watershed. These areas provide habitat for a variety of species and provide other valuable ecological functions.

The watershed of Eighteenmile Creek is predominately agriculture (Figure 10). Agricultural land uses constitute 57.14% of the watershed. The next most common land use is forested land (26.96%).

Developed areas only account for a small portion of the watersheds; approximately 7.96% of the watershed. The majority of residential land is located within the City of Lockport and to a lesser extent the small towns located throughout the watershed. High intensity development is largely located within the City of Lockport. Small areas of high intensity residential are located in Newfane and Gasport. The remainder of the residential land is typical of rural areas, with houses occurring in relatively light densities.

Based on an **analysis of land uses**, runoff from agricultural cropland and animal pastures are the most likely major sources of bacteriological indicators and pollution in the Eighteenmile Creek watershed. Developed areas are much less likely to be contributing pollution to the beach area, based on the small percentage of the watershed and the availability of municipal public sanitary sewers however, a portion of the City of Lockport exists within the watershed including a Municipal Wastewater Treatment Plant (WWTP) with wet weather overflows, resulting in a possible major source of pollution.

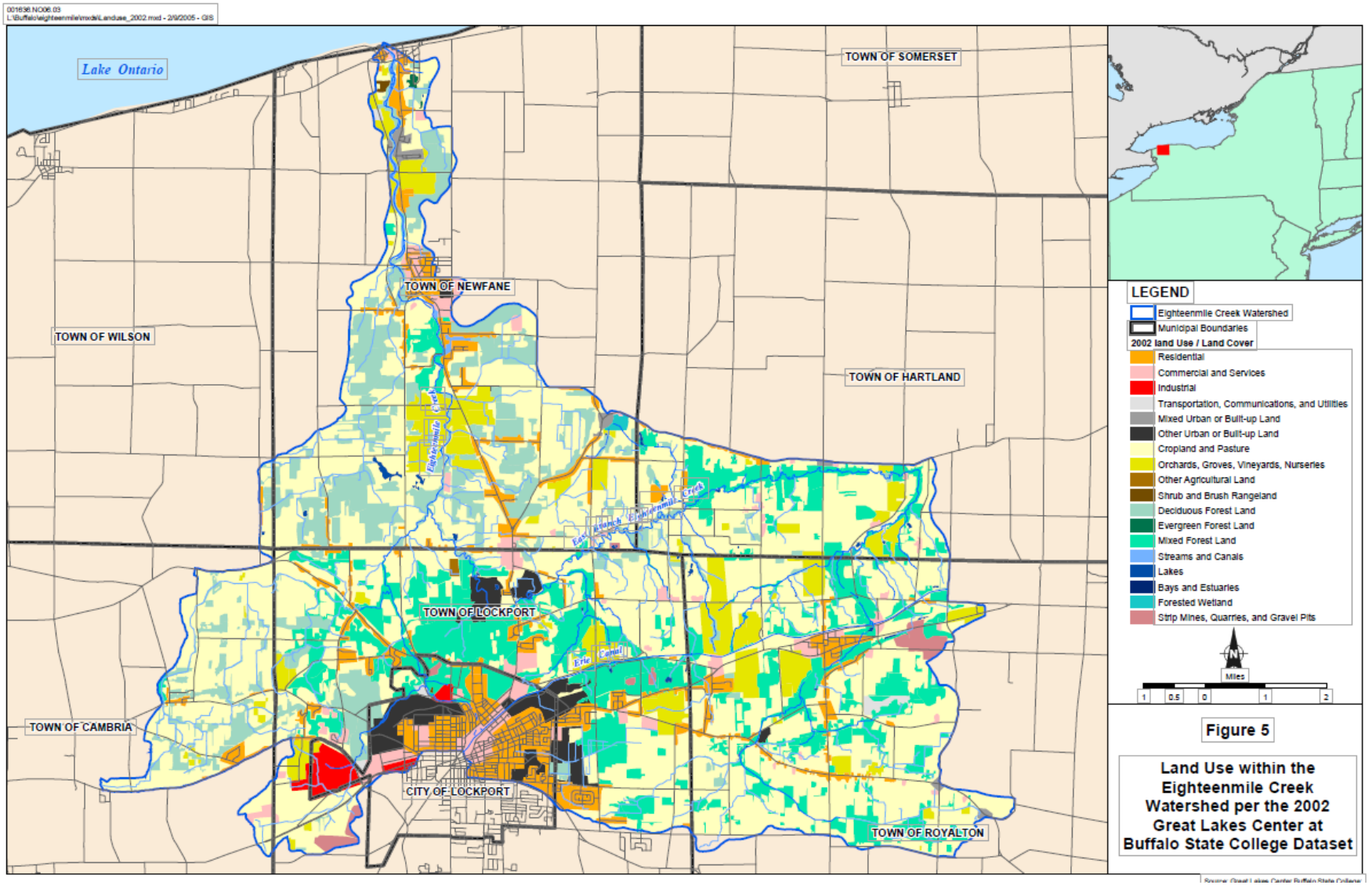


Figure 10. Eighteenmile Creek Watershed Land Use Classification

APPENDIX C: QUALITY CONTROL

Data Management This project was conducted in accordance with the procedures outlined in our workplan and the Quality Assurance Project Plan (QAPP) (New York State DOH). All data quality objectives for this project have been met. Overall project goals included: training, audits, instrument/equipment testing (inspection and maintenance), instrument calibration, and data management. Details of how goals were met are described below.

Training. Training of NCDOH permanent and seasonal staff was conducted in accordance with Section A.8 "Special Training Certification" including Appendix B, C, I, L &M of the NYSDOH QAPP (July 13, 2011). Staff was trained on how to complete the on-site sanitary survey forms (*Attachment 1*) and proper techniques for sample collection and collection of corresponding field data. Staff were given electronic copies of monitoring manuals and protocols, including the Department of Health's *BEACH Grant QAPP,* and equipment testing manuals. On-site training and materials review were recorded on the Niagara County GLRI Staff Training Form.

Field Audit. An audit was conducted by NYSDOH on two occasions during the contract period to determine if departmental field staff was collecting data in accordance with the NYSDOH QAPP. The audit included observation of staff's field data collection techniques, recording of data, and proper equipment use. Equipment was also calibrated at the time of the audit.

Instrument Inspection/Calibration. Instruments used in the study were inspected before use and calibrated according to specifications outlined in their user manuals. Field staff recalibrated equipment as needed. Chain of custody forms were filled out by field staff for each sample submitted for laboratory analysis. Data managed by NCDOH includes: closure data, monitoring data, and environmental data.

In addition to overall project goals, data quality objectives were outlined in Section A7 of the NYSDOH QAPP. Data quality objectives were outlined for the following data quality indicators: precision, accuracy, representativeness, comparability, completeness, and sensitivity. All data quality indicators were met for each task, including for the (a) consultation with outside agencies, (b) collection of routine monitoring data and corresponding field data, (c) conducting validation studies, (d) analysis of geo-locational data, (e) collection of source tracking samples.

APPENDIX D: PROJECT EVALUATION

Project Obstacles and Successes Even before the project began; this multifaceted endeavor faced several obstacles.

Inadequate Skills for the Project – The project sometimes required sampling and geo-locational skills that the project's contributors did not possess. Project management identified the needed competencies, evaluated the available staff and provided training where needed. Outsourcing of GIS water quality mapping to a specialist was also identified as a need and was subsequently subcontracted to a professional.

Resource Deprivation – In order for offshore Lake Ontario plume sampling to be completed efficiently and effectively, we had to provide sufficient resources. We contacted the Niagara County Sheriff's Office Marine Division for assistance and they provided a boat, marine safety equipment, and personnel to escort our sampling staff so monitoring in accordance with our sampling plan could be successfully completed.

Private Property Access – The sampling program along the 18-Mile Creek corridor required access to private property to accomplish the project objectives. Land owners were identified using real property records, meetings were scheduled, permission was obtained, access was granted and sampling was completed.

Time Deadlines – A successful project requires time management especially during our most demanding summer season. Through experience, we have found that repeatedly asking a team for the impossible can quickly result in declining morale and productivity. Using our summer interns and volunteers from other programs assisted in completing the project in a timely manner.

In conclusion, the project was an overall success. All of the goals and objectives of the work plan were completed in a timely manner.

APPENDIX E: REFERENCES

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