

II. NATURAL WATER INFRASTRUCTURE

A. Buffalo's Surface Waterbodies

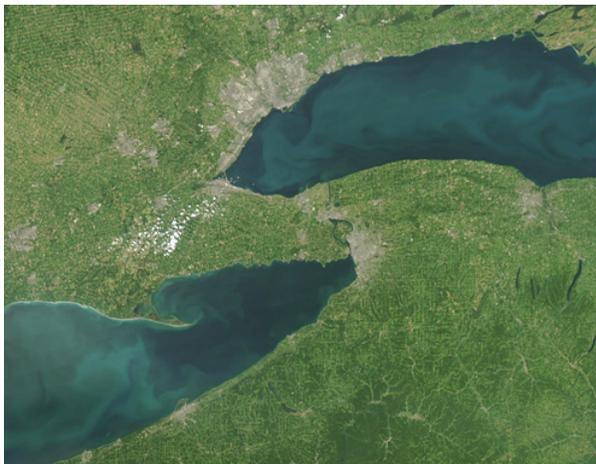
The City of Buffalo is strategically located at the eastern end of Lake Erie, as the Lake narrows to form the Niagara River strait.

1. Lake Erie

Lake Erie is the shallowest and smallest by volume of the Great Lakes, and as a result, the lake warms relatively quickly in the spring and summer and cools quickly in the fall. During winter, a large percentage of the lake is covered with ice, and occasionally freezes over completely.

The lake is naturally divided into three basins. The eastern basin is the deepest, with an average depth of 82 ft and a maximum depth of 210 ft. The eastern basin thermally stratifies every year impacting the internal dynamics of the lake physically, biochemically, and chemically.

2. The Niagara River



The Niagara River begins at the terminus to Lake Erie and flows 37 miles north to Lake Ontario. The entire drainage of the upstream Great Lakes system, an area of 263,700 square miles, drains into the Niagara River at Buffalo. The local watershed on the US side of the Niagara River has a drainage area of approximately 1,225

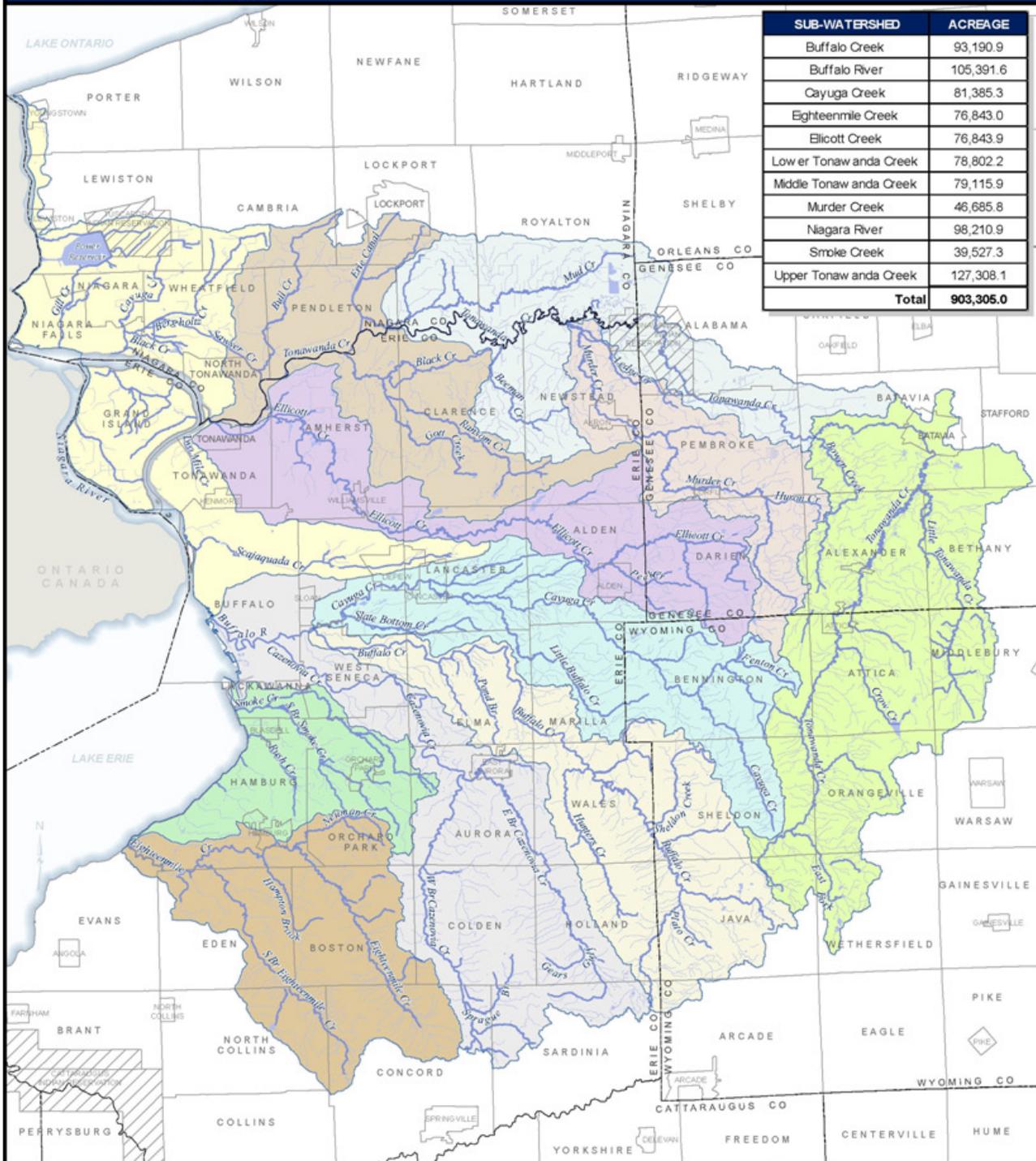
square miles. The Niagara River watershed encompasses the entire the City. The river carries an average flow of about 200,000 cubic feet per second from Lake Erie to Lake Ontario (83 percent of the tributary flow to Lake Ontario).

There are several tributaries to the river from the watershed on the US side near the City of Buffalo including Scajaquada Creek, Two Mile Creek, Tonawanda Creek, Cayuga Creek, and Gill Creek. Of these, only the Buffalo River and Scajaquada Creek are located in the City of Buffalo and the LVRA. Due to the gentle slope and small drainage areas of the river's local tributaries, their flows are not large except during times of heavy runoff.

Historically, Cornelius Creek was also a tributary to the Niagara River. It flowed through North Buffalo, along a path roughly following Hertel Avenue. As development began to occur, Cornelius Creek was replaced by the first Hertel Avenue trunk sewer in the late 1880s and by the second Hertel Avenue trunk sewer in the late 1920s. With the construction of the North Interceptor in the 1930s, the Hertel trunk sewers were connected to the interceptor system to allow conveyance of flows to the wastewater treatment plant. Consequently, what remains of Cornelius Creek is its discharge into the Niagara River, at Black Rock Canal Park, at CSO Outfall 055.

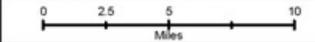


Niagara River Watershed and Sub-Watersheds WESTERN NEW YORK



SUB-WATERSHED	ACREAGE
Buffalo Creek	93,190.9
Buffalo River	105,391.6
Cayuga Creek	81,385.3
Eighteenmile Creek	76,843.0
Ellicott Creek	76,843.9
Lower Tonawanda Creek	78,802.2
Middle Tonawanda Creek	79,115.9
Murder Creek	46,685.8
Niagara River	98,210.9
Smoke Creek	39,527.3
Upper Tonawanda Creek	127,308.1
Total	903,305.0

 County
 Sub-Watershed
 Cayuga Creek
 Lower Tonawanda Creek
 Niagara River
 Municipality
 Buffalo Creek
 Eighteenmile Creek
 Middle Tonawanda Creek
 Smoke Creek
 Buffalo River
 Ellicott Creek
 Murder Creek
 Upper Tonawanda Creek



Data Sources:
 Sub-Watersheds : USGS 10-Digit Hydrologic Units;
 Waterways : NYS CSCIC Linear & Area Hydrography;
 NYS DOT Civil Boundaries.
 All data obtained from NYS GIS Clearinghouse.

Prepared by Lisa Matthias-Wiza, Sept 2010.

3. Scajaquada Creek/Jubilee Springs/Hoyt and Mirror Lakes

The Scajaquada Creek watershed drains an area of 29 fully urbanized square miles, of which 16 square miles lie outside the city limits. The creek is 15 miles long and has an average daily flow volume of 32 cubic feet per second and a 10-year peak flow of 2,900 cubic feet per second. Scajaquada Creek originates in the Town of Lancaster and flows west through the Town of Cheektowaga and the City of Buffalo to its outfall at the Black Rock Canal. From Pine Ridge Road in Cheektowaga, the creek runs through a 19,000 foot long, 14.75-foot by 29.5-foot rectangular arch called the Scajaquada Drain. A diversion and trash rack structure was built at the downstream end, at Main Street, to direct wet weather flows up to 455 million gallons per day into the Delavan Avenue trunk sewer to protect Hoyt Lake from pollution and to maintain a base flow in Scajaquada Creek.



Scajaquada Creek daylights in Forest Lawn Cemetery to form the only natural waterfall within the City's boundary. There are over 30 springs underneath the cemetery, and they recharge Scajaquada Creek as it flows downstream. The city's original water supply, called Jubilee Springs, originates here. After a cholera pandemic in 1832, Jubilee Springs Water Works sold the spring's water in bottles until the 1920s. To protect Hoyt Lake water quality, the Creek was separated from Hoyt Lake and directed into a concrete viaduct shortly after flowing beneath Delaware Avenue, flowing below ground and reemerging near the eastern end of Hoyt Lake. This viaduct is designed to convey up to 455 MGD of flow. When Scajaquada Drain

flows in excess of 910 MGD the Scajaquada Creek basin may overflow into Hoyt Lake.

The southern bank of Mirror Lake, which is located behind the Buffalo History Museum, is physically divided from the waters flowing through Scajaquada Creek by a concrete barrier.

4. Buffalo River

The Buffalo River flows into Lake Erie at the head of the Niagara River. The Buffalo River and its three major tributaries drain approximately 446 square miles in Erie, Genesee and Wyoming Counties, about 4% of which is located within the City limits. The river has an average daily flow volume of 365 cfs and a 10-year peak flow of 29,500 cfs. The gradient of the river is slight, less than one foot per mile. During periods of mean or low flows, the downstream end of the river is influenced by lake level variations and has an estuarine character. During the summer months, the river water is warm relative to lake water, and therefore less dense, resulting in the river water flowing on top of the cooler, denser lake water. This results in stratification in the water at the confluence of the river to the lake. In the fall, the situation can be reversed, with the river water being cooler and denser and flowing below the lake water. Although the Buffalo River discharges into the Niagara River at Lake Erie, its plume tends to stay on the eastern shore due to strong currents and a prevailing southwesterly wind, with little cross mixing.



The Buffalo River is a navigable waterway maintained by the US Army Corps of Engineers (USACE) for lake vessel access. The River is dredged from its mouth to a point just downstream of the confluence between the Buffalo River and Cazenovia Creek to a depth of 22 feet below low lake level datum.

The Buffalo River is fed by three tributaries: Cayuga Creek, Cazenovia Creek, and Buffalo Creek. Two of the

tributaries, Buffalo Creek and Cazenovia Creek, flow through the City of Buffalo LWRA. Cazenovia Creek joins the Buffalo River approximately 6 miles upstream of Lake Erie, just west of the Bailey Avenue Bridge. The creek drains 138 square miles (less than 1% of the watershed lies within the City of Buffalo limits) and runs through woodlands, small residential communities and recreational areas. Approximately 2.25 miles of the creek are within the City limits.



5. NYS Waterbody Designations

Article 15 of the Environmental Conservation Law (ECL) requires that all waters of the State be provided a class and standard designation based on a determination of their existing or expected best use for each waterway or waterway segment. This classification is based upon the characteristics of bordering lands, stream flow, water

quality, present and past uses and potential future uses. Waterbodies that are designated as C (T) or higher (i.e., C (TS), B or A) are collectively referred to as “protected streams” and are subject to the stream protection provisions of the Protection of Waters regulations. The New York State DEC Waterway Classifications for the City of Buffalo are provided in the following table.

Use Class		Water Body	Description
A (special)	(a) The best usages of Class A-S waters are: a source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. The waters shall be suitable for fish, shellfish, and wildlife propagation and survival. (b) This classification may be given to international boundary waters	Niagara River (American side)	Waters from the international boundary to the American shore above line due west from the south end of Bird Island Pier.
		Lake Erie	Main Lake/ North and northeast shoreline
A I	The best usages of Class A waters are: a source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. The waters shall be suitable for fish, shellfish, and wildlife propagation and survival.	Scajaquada Creek	Reach 2 - From the crossing on Main Street in the City of Buffalo downstream to mouth of Scajaquada Creek at the Niagara River.
B	The best usages of Class B waters are primary and secondary contact recreation and fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival.	Lake Erie/ Outer Harbor	Waters easterly of old or middle breakwater and south breakwater between the line from the northern end of old or middle breakwater to south pier light at US Coast Guard station and line represented by extension of Tiff Street to south end of south breakwater.
		Cazenovia Creek	Reach 1 - From the Cazenovia Street Bridge upstream to the junction of the East and West Branches of Cazenovia Creek.
		Delaware Park Hoyt Lake	

C	The best usage of Class C waters is fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.	Buffalo River	Downstream of confluence with Cayuga Creek to the mouth
		Cazenovia Creek	
		.	Reach 2 - From the Cazenovia Street Bridge downstream to the confluence with Buffalo River
		Scajaquada Creek	Reach 1 - From the crossing on Main Street in the City of Buffalo upstream to "tributary 4", which is in line with continuation of Frederick Drive, Town of Cheektowaga (underground portion).
		Black Rock Canal	Waters east of Unity Island and Bird Island Pier between canal locks and a line from the south end of Bird Island Pier to Buffalo Harbor Light #6.
		Erie Basin Marina	Waters southerly of line from Buffalo Harbor Light #6 to south end of Bird Island Pier; easterly of line from south end of Bird Island Pier to north end of north breakwater; easterly of north breakwater; easterly of line from south end or north breakwater to north end of old or middle breakwater and northerly end of line from north end of old or middle breakwater to south pier light at US Coast Guard Station.

6. Surface Water Quality

The NYSDEC Division of Water periodically publishes a list of surface waters that cannot be fully used as a resource or have problems that can damage their

environmental integrity. The “Priority Waterbodies List” is used as a base resource for the NYSDEC Division of Water program management. The Niagara River and its tributaries within Buffalo have been included on the 2013 Priority Waterbodies List.

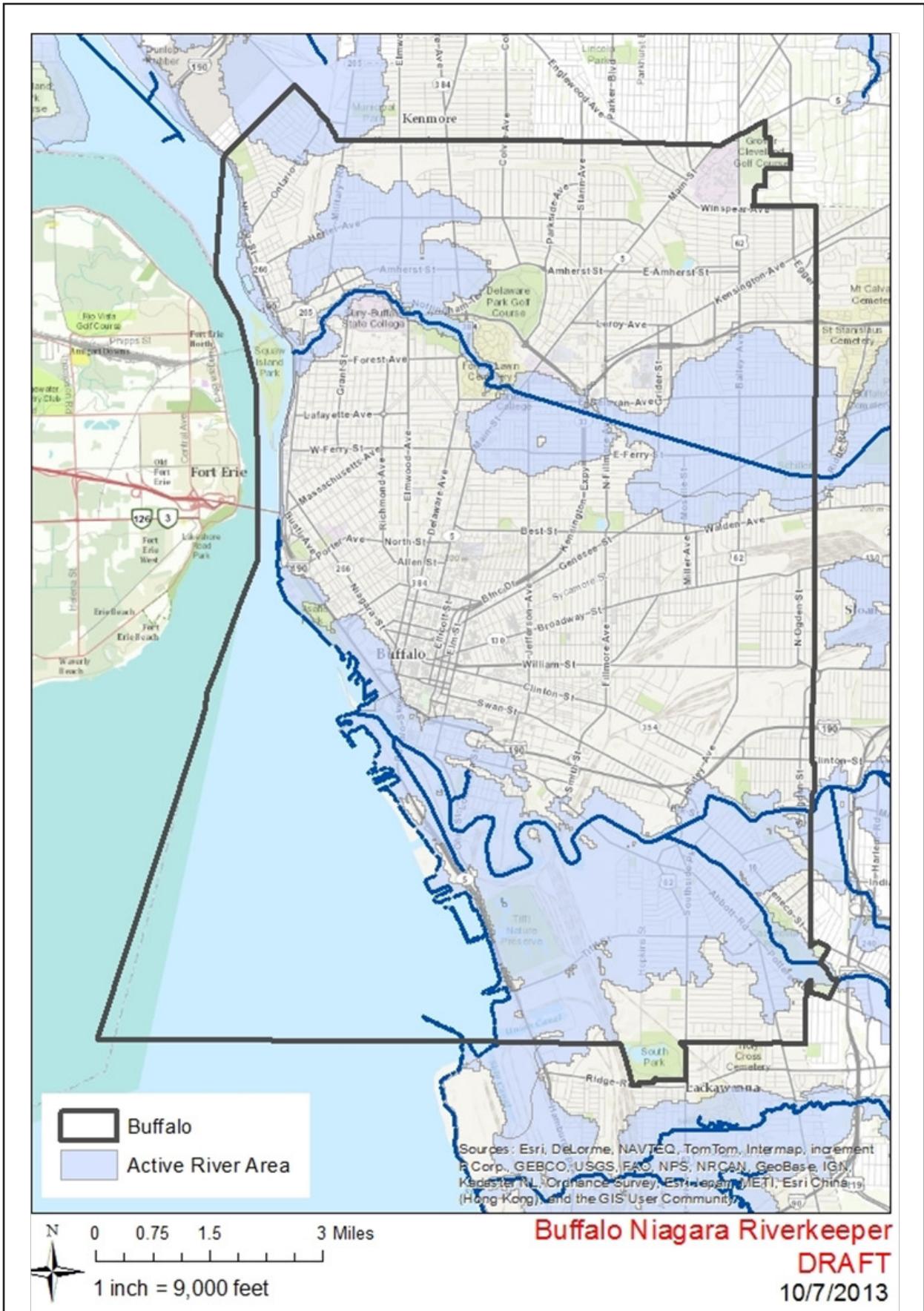
Water Body	Impaired Use	Severity	Data	Type of Pollutant	Source
Black Rock Canal	Fish Consumption	Impaired	Good	Priority Organics (PCBs)	Contaminated Sediments
	Aquatic Life	Stressed		Non-priority Organics (PAHs)	Habitat Modification
	Habitat/ Hydrology	Impaired			CSO Runoff Urban Runoff Landfills
Buffalo River	Fish Consumption	Impaired	Good	Priority Organics	Contaminated Sediments
	Fishing	Impaired	Good	Oxygen Demand Metals Pathogens	Urban Runoff Land Disposal
	Fish Propagation	Stressed	Good	Silt/Sediment	Industrial Municipal Storm Sewers CSOs Hydromodification
Cazenovia Creek	Fishing	Stressed	Some	Silt (sediment)	Streambank Erosion
	Fish Propagation	Stressed	Some	Oxygen Demand	Construction
	Fish Survival	Stressed	Some	Pathogens Hydromodification	Urban Runoff On-site Systems Roadbank Erosion

Water Body	Impaired Use	Severity	Data	Type of Pollutant	Source	
Niagara River	Fish Consumption	Impaired	Good	Priority Organics (PCBs, PAHs)	Land Disposal	
	Water Supply	Threatened	Some		Pesticides	Contaminated Sediments
	Aquatic Life	Stressed	Some	Water Level/Flow		Urban Runoff
	Habitat/Hydrology	Impaired		Non-priority Organics		CSOs
					Hydrologic/Habitat Modification	
Scajaquada Creek	Bathing	Precluded	Some	Aesthetics	CSOs	
	Aquatic Life	Precluded	Some	Priority Organics	Urban/Stormwater Runoff	
	Habitat/Hydrology	Stressed	Some	Nutrients	Contaminated Sediments	
	Recreation	Impaired	Some	Silt/Sediment	Land Disposal	
	Aesthetics	Stressed	Some	Oxygen Demand	Chemical Leaks/ Spills	
				Salts	Hydromodification	
				Pathogens	Habitat Modification	
Delaware Park (Hoyt) Lake	Bathing	Impaired	Good	Nutrients	Urban/Stormwater Runoff	
	Fish Consumption	Impaired	Good	Algae/Weed Growth	Contaminated Sediments	
	Recreation	Impaired	Good	Priority Organics (PCBs)		
				Oxygen Demand		

B. Active River Area, Wetlands and Floodplains

I. Active River Area

The Active River Area (ARA) is a conservation framework for rivers and streams that integrates both physical and ecological processes that form, change and maintain a wide array of habitat types and conditions in and along rivers and streams. A draft map of the Niagara River ARA was prepared in connection with the Niagara Regional Habitat Conservation Strategy. The City of Buffalo is located within the low-watershed of the Niagara River. It contains almost 13 % of the 70,553 acres that comprise the Niagara River ARA. Within the City, the ARA includes both floodplain and wetlands areas



2. Federal Wetlands

The Federal Government, through the USACE, regulates wetlands regardless of size, in accordance with the Clean Water Act. These areas, mapped by the U.S. Fish and Wildlife Service, are designated as wetlands based upon the presence of three features: hydric soils, wetland vegetation and specific hydrologic conditions.

A permit must be issued by the USACE if a wetland is disturbed or filled, or development is proposed within identified wetland areas. A Water Quality Certification could also be required from the NYSDEC, based upon the amount of federal wetland to be filled or otherwise disturbed.

The U.S. Fish and Wildlife Service National Wetland Inventory classifies the Niagara River corridor, Scajaquada Creek, North Buffalo Harbor, Buffalo Ship Canal, Buffalo River, and Cazenovia Creek as Federal wetlands. The areas in and around Times Beach Nature Preserve, Tift Nature Preserve, the southern portion of Gallagher Beach and certain lands in the Buffalo Lakeside Commerce Park (BLCP), are also designated as potential wetland habitats.

3. State Wetlands

Pursuant to the New York Freshwater Wetlands Act, the NYSDEC regulates activity within State-designated freshwater wetland areas and the area immediately adjacent to wetlands (within 100 feet).

The New York Freshwater Wetlands Act assigns classifications to State wetlands ranging from Class I (Highest) to Class IV (lowest). According to the act:

- ▶ Class I wetlands are the most significant, providing the most critical benefits and habitat value, a reduction of which is acceptable only in the most unusual of circumstances. A permit will be issued only if it is determined that the proposed activity satisfies a compelling economic or social need that clearly and substantially outweighs the loss of or detriment to the benefit(s) of the Class I wetland.
- ▶ Class II wetlands provide important wetland benefits, the loss of which are acceptable only in very limited

circumstances. A permit will be issued only if it is determined that the proposed activity satisfies a pressing economic or social need that clearly outweighs the loss of or detriment to the benefit(s) of the Class II wetland.

Class I and II wetlands have been designated within the City of Buffalo LWRA. NYSDEC controls a small number of freshwater wetlands south of the Buffalo River. They include:

- ▶ the Times Beach Class I wetland, which is also underlain by an unconfined aquifer;
- ▶ Several Class I wetlands located in Tift Nature Preserve and BLCP, and wetlands located along the rail corridors; and
- ▶ A Class II wetland area located south of Tift Street, within the BLCP.

Where practicable, upland wetland areas designated in the Buffalo LWRA have been protected in the City's UDO as open space.

4. Floodplains

The City of Buffalo LWRA contains flood zones that have been designated by the Federal Emergency Management Agency (FEMA) as areas subject to potential flood hazards. These areas or flood zones are depicted on the FEMA Flood Insurance Rate Maps (FIRMs) developed for the City. The flood zones are established based upon the degree to which an area is susceptible to flood damage. The two general flood zones that exist within the LWRA include:

- ▶ "AE" Zone – (also called the area of special flood hazard), which is the area of land that would primarily experience still water flooding, without significant wave activity, during a 100-year storm; and
- ▶ "C" Zone – which are areas of minimal flooding.

Flood zones or plains are flat areas that surround streams and are periodically inundated with water due to overbank flow. As shown on Map 10, most of the surface water bodies found within the LWRA are surrounded by 100-year floodplains.

Where possible, publicly held lands within the current 100-year floodplain have been preserved as parkland or open space under the UDO. Two neighborhoods are located within the current 100-year floodplain along the Buffalo River: Kaisertown and South Buffalo's Seneca Street community.

Flood berms buffer most of Kaisertown from flood risk, while the Seneca Street community is aided in part by the protective function of the Seneca Bluffs wetlands. Planned improvements to the Bailey Avenue bridge over the Buffalo River may also help reduce ice jams and associated upstream flooding. The continued dredging of the Buffalo River navigation channel also provides some flood management capacity.

FEMA has presented draft revised floodplain maps for the City with a projected effective date of March 2015. The current draft expands the flood hazard area to include several developed and/or redevelopment priority areas, as follows:

- ▶ The Black Rock Village area between Niagara Street and the Niagara River north of the Black Rock Locks;
- ▶ most properties in the First Ward/Cobblestone/Canalside portion of the City, located between the I-190 to the north and Buffalo River to the South; and
- ▶ some lands in south Buffalo to the east of Seneca Street to South Park, north of Tiff Street.

Article 31 of the City Charter regulates land use and development that occurs within in the 100-year flood plain and floodway, a hydrologically determined area with a one percent chance of flooding in any given year.

C. Habitat Resources

I. New York State Designated Significant Coastal Fish and Wildlife Habitats

As shown on Map 10, State-designated Significant Coastal Fish and Wildlife Habitats were identified within the LWRA. These habitat areas include the Times Beach diked disposal site, North Buffalo Harbor, the Small Boat Harbor and Tiff Nature Preserve. Habitat designation by the NYSDOS was based on the area's fish and wildlife

population levels, species vulnerability, ecosystem rarity, human use and replaceability. For additional information on the types of species within these habitats, please refer to the NYSDOS Division of Coastal Resources website (http://nyswaterfronts.org/waterfront_natural_narratives.asp)

A. Times Beach

Times Beach is located in the City of Buffalo, one mile southwest of downtown. This 55-acre fish and wildlife habitat is a partially filled, diked, dredge spoil disposal site on the shore of Lake Erie. It is owned by the City of Buffalo and is leased to the USACE. The USACE constructed the Times Beach diked disposal site in 1971 to contain dredged sediment from the Buffalo River, Buffalo Harbor, Black Rock Canal and Tonawanda Harbor, that was determined to be unsuitable for open-lake disposal. Dredged sediments were deposited in the Times Beach site over a 4-year period from 1972-1976. Deposited sediments contain varying concentrations of organic and inorganic pollutants originating from industries along the Buffalo River and Harbor.

Times Beach contains several distinct physical zones, including: a deep water zone up to about 6 feet in depth, with submergent aquatic plants; a low-lying mud or silt flat zone of variable width (inundated by high lake levels); a gradually sloping shallow water zone with emergent marsh vegetation; and an upland zone, containing tall herbs, grasses, and stands of variously sized trees and shrubs.

The site lies on the eastern end of Lake Erie, a critical geographical feature for bird migration north in the spring and south in the fall. More than 220 species of birds have been observed on the site including Pied-Billed Grebe, (State threatened), Peregrine Falcons, Bald Eagles (State endangered), Cooper's hawk (State threatened), Common Tern (State threatened), and Osprey (State threatened).

Times Beach features public walkways and bird viewing blinds, as well as educational and interpretive features.

B. North Buffalo Harbor

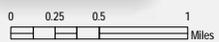
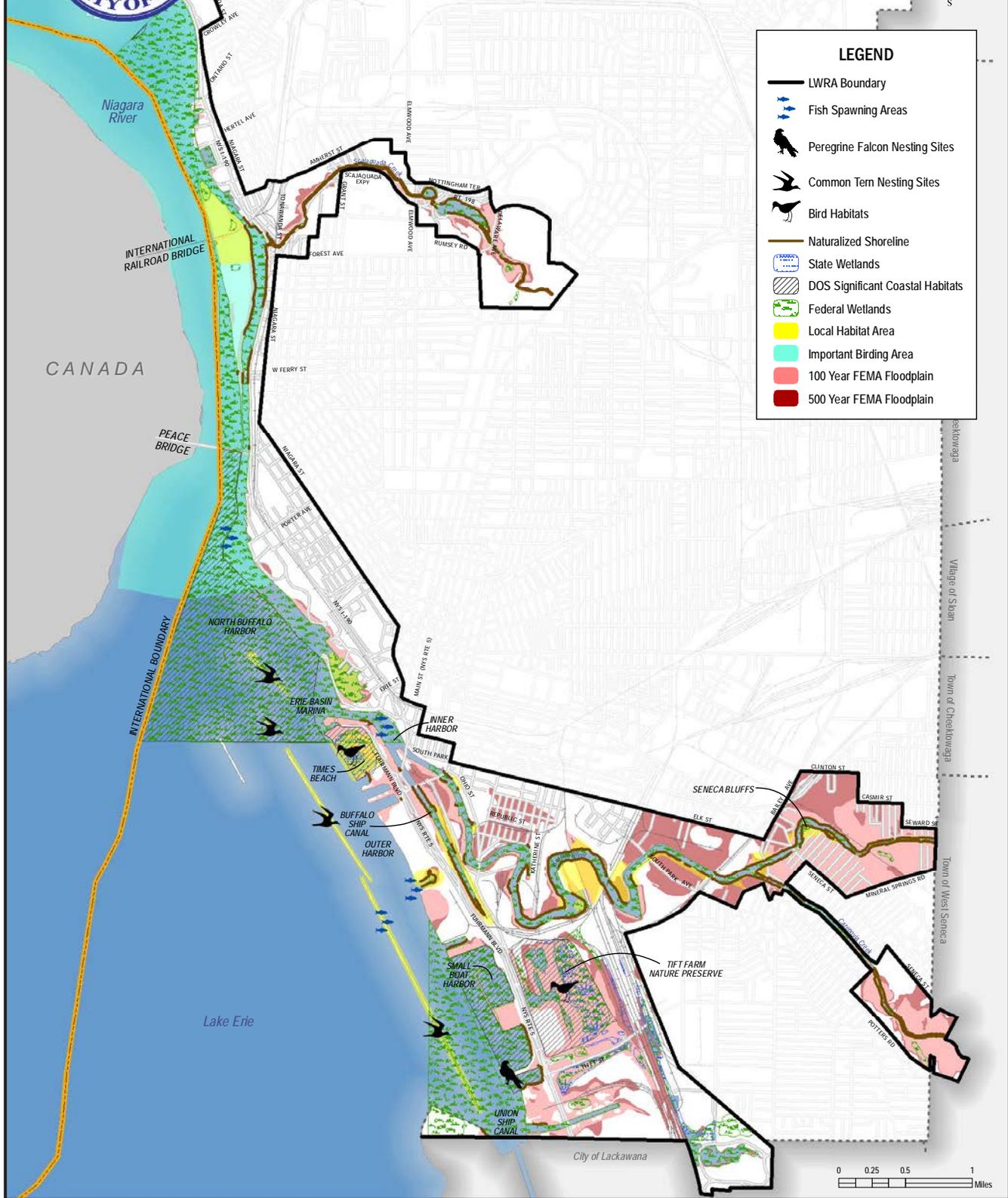


CITY OF BUFFALO LOCAL WATERFRONT REVITALIZATION PROGRAM Natural Resources



LEGEND

- LWRA Boundary
- Fish Spawning Areas
- Peregrine Falcon Nesting Sites
- Common Tern Nesting Sites
- Bird Habitats
- Naturalized Shoreline
- State Wetlands
- DOS Significant Coastal Habitats
- Federal Wetlands
- Local Habitat Area
- Important Birding Area
- 100 Year FEMA Floodplain
- 500 Year FEMA Floodplain



MAP 10 - NATURAL RESOURCES

The North Buffalo Harbor is located in the northeast corner of Lake Erie, at the head of the Niagara River. This harbor consists of approximately 800 acres of open Lake water and upper river channel, extending roughly from the mouth of the Buffalo River to the Peace Bridge. Water depths vary from less than six feet over several small reefs to over 20 feet below mean low water. The harbor is home to several important wildlife communities including:

- ▶ 150 nesting pairs of Herring Gulls, on the sand and gravel bar located at the north end of Donnelly's



Wall, their only nesting area between Buffalo and the eastern basin of Lake Ontario.

- ▶ 400 nesting pairs of Common Tern on the broken concrete surfaces of three of the breakwalls, including Donnelly's Wall, the North End Light Breakwater and the abandoned lighthouse near Middle Reef. This is the largest colony of this declining species anywhere in the Great Lakes.
- ▶ Concentrations of many waterfowl species including loons and grebes, as well as gulls, and terns, are present in North Buffalo Harbor during spring and fall migrations (March-April and September-November, respectively). Winter waterfowl surveys done by NYSDEC have tallied up to 68,000 ducks in this open area at one time, and weekly surveys done throughout the winter regularly count 20,000 and above. The birds take advantage of the open water created downstream of the Lake Erie ice boom, feeding on the abundant supply of small fish, such as emerald shiners and shellfish.

- ▶ Muskellunge is a native apex predator fish species with local populations supported entirely by natural reproduction in the Buffalo Harbor and Upper Niagara River. During the early 1990's survey work in shallow, vegetated embayments in the Buffalo Harbor indicated that young-of-year muskellunge were present in four of these embayments, indicating that these areas were muskellunge spawning habitats (Culligan et al 1994). More recently, from 2007 to 2009, young-of-year muskellunge have been collected from two embayments: "Ice Boom Bay" (the embayment directly south of the Times Beach Preserve) and the Bell Slip. The numbers of young muskellunge collected at these locations recently are generally much lower than during the early 1990's.
- ▶ North Buffalo Harbor supports a major urban fishery, of regional significance. Predominant fish species occurring in the harbor include rock bass, white bass, smallmouth bass, yellow perch, walleye, northern pike, muskellunge, brown trout, rainbow trout, and coho salmon. Among the most popular fishing spots are near Donnelly's Wall, and the "fish market" located just outside of the southern portion of Bird Island Pier.

C. Small Boat Harbor

The Small Boat Harbor is located on the Outer Harbor and has an area of approximately 165 acres. The Small Boat Harbor is the only sizable shallow water embayment on Lake Erie in Erie County (generally less than 12 feet deep below mean low water). Sheltered from prevailing winds and wave action by a two-mile long rock breakwall, the harbor is armored on three sides with rip-rap, concrete bulkheads, and gravel-cobble beach; the fourth side (westerly) is open to the Outer Harbor, with an approximate 30-foot deep dredged navigation channel. This protected location has resulted in enhanced sediment deposition and growth of submerged aquatic macrophytes, such as water milfoil, wild celery, and pondweeds. Substrates vary from a mixture of sand, gravel, and cobble, in some nearshore areas, to a dark brown gelatinous type sediment (gyttja).

The harbor supports a highly productive and diverse littoral community, with concentrations of many fish and wildlife species occurring in the area. Studies of the harbor in 1981 demonstrated that this was a diverse and productive fisheries habitat. The major adult fishes found in the area were pumpkinseed, yellow perch, and brown bullhead, along with largemouth bass, muskellunge, carp, and freshwater drum. Ichthyoplankton sampling revealed substantial reproduction by centrarchids, shiners, and yellow perch. Carp and drum may also enter the area to spawn. By midsummer, the Small Boat Harbor is ideal for centrarchids and bullheads as macrophytes fill the embayment. The Small Boat Harbor is the largest, most obvious nursery area for numerous harbor and lake species on the Erie County shoreline. In addition, the harbor supports a productive macrobenthic community, dominated by snails and clams.

Submerged, rooted macrophytes and their associated invertebrates and fish provide valuable food resources for many species of waterfowl and other migratory birds. The Small Boat Harbor attracts concentrations of these birds during spring and fall migrations (March-April and September-November, respectively), with some species remaining until the harbor freezes in early to mid-winter. The most abundant birds observed during these periods are the diving ducks, including canvasback, scaups, mergansers, common goldeneye, scoters, mallard, black duck, Canada goose, loons, grebes, and gulls. Hundreds of these birds are regularly found in the area during late fall, with the greatest numbers occurring when open waters on Lake Erie are rough. Prior to ice-up, the Small Boat Harbor serves as a refuge and feeding area for some of the larger concentrations of waterfowl in North Buffalo Harbor. During the summer months, ring-billed gull, herring gull, and common tern may feed in the area, but the extent of their use has not been documented. The concentrations of birds which utilize the harbor, and the availability of good public access and vantage points, makes this a popular birdwatching site during waterfowl migration periods and in early winter.

The harbor provides high quality recreational fishing opportunities throughout the year. Anglers from throughout the Buffalo metropolitan area are attracted

to the diverse warmwater fisheries, and ice fishing is especially popular.

D. Tift Nature Preserve

Tift Nature Preserve is the largest contiguous fish and wildlife habitat area within the City of Buffalo. The 264-acre former landfill was designated a preserve in 1976 and is owned by the City of Buffalo and operated by the Buffalo Museum of Science.

Of special importance is the relatively undisturbed wetland area, which is the largest of its kind along the Lake Erie coastline. The site includes a 75-acre cattail marsh, small freshwater ponds and old canal remnants, old fields (partly covering a former solid waste transfer site), forested wetland, and shrub-sapling stages of succession.

Birds of 264 species and subspecies have been recorded in and immediately adjacent to its boundary including least bittern, American bittern and osprey. Tift is home to white tailed deer, beaver, muskrat, weasel, mink, red and grey fox and coyotes. Reptiles and amphibians include northern water snake, snapping and painted turtles, bullfrog, green frog, northern leopard frog, and Jefferson salamander, which are year-round residents. At least two species of fish, the central mudminnow and brook stickleback, are present. Tift Preserve also contains a population of burrowing crayfish, one of only three known localities for this species in New York State.

2. Rare or Endangered Species Habitat



The New York State Natural Heritage Program had identified rare or endangered species throughout New York State. According to their records, the City of Buffalo LWRA includes ninebark, a rare vascular plant; gull and common tern nesting areas; two rare fishes, mooneye (*Hiodon tergisus*) and lake sturgeon (*Acipenser fulvescens*), both New York State threatened species; and peregrine falcons. Lake sturgeon have been caught at the north gap of the Buffalo Harbor within the LWRA. Lake sturgeon are listed as a threatened species in New York; therefore, there is no open season for the fish and possession is prohibited. Anglers are more likely to encounter sturgeon in May and June when the fish gather to spawn on clean gravel or cobble shoals and in stream rapids.



In 2010, a nesting pair of peregrine falcons, a state endangered species, was discovered on the Cargill Pool grain elevators at the foot of Tiffet Street, along Fuhmann Boulevard. A New York State threatened species, the common tern, makes its home on the breakwalls in the Buffalo Harbor, as described earlier.



3. Niagara River Globally Significant Important Bird Area

The Niagara River has been designated as a Globally Significant Important Bird Area (GSIBA), a rare designation given by National Audubon to only 71 other sites in the world. The eastern end of Lake Erie provides two geographic features that assist in the lake crossing. One is Long Point, Ontario, a peninsula of land that juts 28 miles out into Lake Ontario, greatly narrowing the crossing. Birds “jump off” the end of the peninsula, and greatly reduce the time they spend over water before they reach the opposite shore. The second feature is the isthmus formed where Lake Erie drains into Lake Ontario via the Niagara River. Migratory birds are drawn to these features because most birds do not like to cross expanses of water where they lose the critical thermal updraft provided by warm air rising over land that reduces the metabolic cost of flight. Additionally, if they tire while flying over water, death is almost certain because in the large open waters of Lakes Erie and Ontario, there are no islands on which to land.

According to the Audubon Society of New York, the Niagara River GSIBA annually supports one of the world’s most spectacular concentrations of gulls, with 19 species

recorded and one-day counts of over 100,000 individuals. The site is particularly noteworthy as a migratory stopover and overwintering site for Bonaparte's Gulls, with one-day counts of 10,000 to 50,000 individuals (2 to 10 % of the world population). Herring Gull one-day counts vary from 10,000 to 50,000 and Ring-billed Gull one-day counts vary from 10,000 to 20,000 individuals. The river also hosts a remarkable diversity and abundance of waterfowl. Winter surveys taken by NYSDEC have shown a 22-year average of 2,808 Canvasbacks (32 % of state overwintering population), 7,527 Common Mergansers (31 % of state overwintering population), 2,015 Common Goldeneyes (29 % of state overwintering population), and 2,369 scaup (6 % of state overwintering population). Annual peak numbers for Canvasbacks range from 2,000 to 15,000, for Common Goldeneyes from 2,300 to 3,000, for Common Mergansers from 2,500 to 12,000, and for Greater Scaup from 2,500 to 15,000 individuals. The river also supports breeding colonies of Common Terns, Herring Gulls, Ring-billed Gulls, Black-crowned Night Herons (50 to 60 pairs), Great Blue Herons, Great Egrets, and Double-crested Cormorants. The habitats along the river edge support an exceptional diversity of migratory songbirds during spring and fall migrations. Many of the migrating species find habitat and refuge at the various open areas and nature preserves that exist in the vicinity of the river, including Times Beach Preserve and Tiff Nature Preserve (which is also designated by the Audubon Society as an IBA).

4. Local Habitat Areas and Restoration Sites

The following habitat sites have been identified through either Buffalo or Niagara River Great Lakes Area of Concern habitat analysis and restoration efforts. Highly detailed information regarding each habitat site on the Buffalo River has been developed in conjunction with the Buffalo River Ecological Restoration Master Plan and Buffalo River Sediment Remediation Feasibility Study.

► Unity Island

A former City of Buffalo landfill, the north end of Unity Island was closed and developed as a passive park. According to 2012 Natural Land Cover analyses associated with the Niagara River Habitat

Conservation Strategy development (NRHCS), the north end of the Island and park currently offers pond, emergent wetland, grassland/shrub and woodland habitats. In addition, the eastern edge of Unity Island, between the International Railroad Bridge and the West Ferry Lift bridge features forest habitat and is often frequented by herons, waterfowl and gulls.



► Scajaquada Creek

According to the 2012 NRHCS, Scajaquada Creek offers woodland open water and grassland/shrub habitat along its course from Forest Lawn Cemetery to the Black Rock Channel. The US Army USACE of Engineers is studying the lower reaches of Scajaquada Creek, including opportunities to improve habitat in the Creek corridor.



► City Ship Canal

The head of the City Ship Canal is owned by CSX railroad land portion. According to the Buffalo River

Feasibility Study, this area has been identified as one of the Buffalo River Habitat Opportunity Areas. Although City Ship is an artificial channel, it has value as a habitat link between Lake Erie coastal and Buffalo River habitats, especially for waterfowl and fish in need of nesting and resting places. Native shoreline and aquatic vegetation has naturalized the western edge of the canal, south of the active industrial area. Buffering, removal of debris and slag piles from the eastern bank and sediment remediation would increase the habitat value of the canal. Numerous fish species have been observed at the head of the City Ship Canal, including largemouth bass, rock bass, crappie, bullhead, carp, redbreast, sunfish, and goldfish.

▶ Ohio Street/Dead Creek

One of three projects completed under the 1996 Buffalo Fish and Wildlife Habitat Restoration Demonstration Project, this project established fish-spawning habitat and improved passive fishing access at Dead Creek on Ohio Street. The site is owned and managed by the New York State Department of Environmental Conservation and is maintained by the City of Buffalo Parks department.

Fish species observed at this location include largemouth bass, small mouth bass, rock bass, and sunfish. There is abundant fishing along this stretch in areas with natural and unnatural cover/overhanging vegetation.

This remnant “canal” once connected the Buffalo River to what is now “Father Conway Park”. The parcel now still functions as a combined sewer overflow (CSO) outfall. Due to river hydrology, this canal collects debris, trees, and litter.

▶ Katherine Street Peninsula

This 4.8-acre parcel features almost one thousand linear feet of naturalized shoreline with mature vegetation within the 100-foot floodplain.



Figure 1 - Katherine Street Peninsula

▶ Blue Tower Turning Basin

The Blue Tower Turning Basin located east of the foot of Katherine Peninsula at the southern end of Concrete Central Peninsula is named for the blue Buffalo River Improvement Corporation (BRIC) water tower located to the south. The shoreline in this area of the River is natural with overhanging vegetation. Due to Buffalo River flow and deposition patterns, significant debris has accumulated along the eastern shore of the River at the site. The New York State DEC has identified a large freshwater bryozoan colony, characteristic of unpolluted, unsilted ponds and streams, at the site.



Figure 2 - View south towards Blue BRIC Tower Turning Basin

► Concrete Central Peninsula (CCP)

Because of its isolation, Concrete Central Peninsula has remained relatively undisturbed. Located within the 100-year floodplain, CCP has been identified in Buffalo River greenway plans and by USACE as a “refuge for species not generally expected in an urban ecosystem” including peregrine falcon, snapping turtle, painted turtle and leopard frog”.

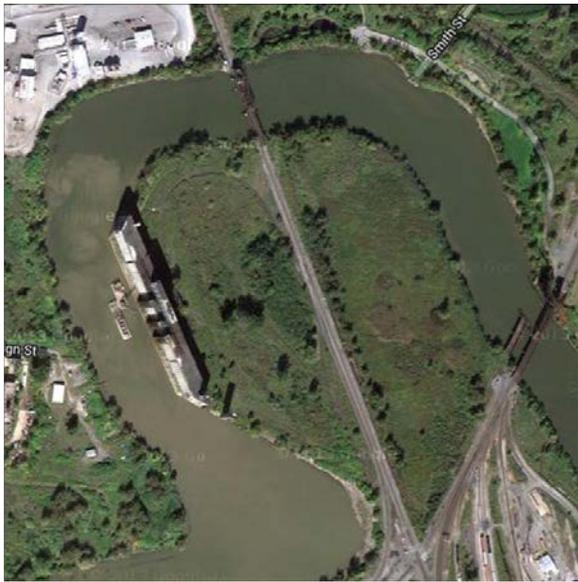


Figure 3 - Concrete Central Peninsula

► Red Jacket Riverfront Park (also known as the Smith Street Recreation Site)

Red Jacket Riverfront Park is 44 acres of open space located at the end of Smith Street, including 7 acres owned and maintained by Erie County. One of three projects completed under the 1996 Buffalo Fish and Wildlife Habitat Restoration Demonstration Project, wetlands reconstruction, habitat restoration, invasive species management and passive public access facilities were created at Red Jacket Park.

The park was formerly the site of parking areas for the employees of Concrete Central. Bought by Erie County in the 1990s, the site was remediated and turned into the open space park that exists today. The park includes a series of nature trails with benches that guide visitors

through the various ecosystems present within the park. These include marshlands, forests, meadows and the riparian corridor of the Buffalo River. The park also includes murals painted on an old concrete wall along Smith Street, a fishing pier at the terminus of Smith Street, a canoe/kayak launch area, several parking areas for visitors and river overlook areas.



Figure 4 - Wetland Restoration Project at Smith Street

► Buffalo Color Peninsula

The Buffalo Color Peninsula site is located on the northern bank of the Buffalo River, between River Mile 4.5 and 5.0. In 1997, Honeywell Corporation implemented the following measures to address contamination on the site: 1) installation of a slurry wall surrounding the entire site to isolate groundwater; 2) removal of wastefill from outside of the slurry wall, including sediment from the river bank; and 3) stabilization of the excavated river bank using riprap, geotextile liner, or concrete extending out to near the navigation channel dredge limit. Since the site has been remediated, upland grassland habitat has become established.



Figure 5 - Buffalo Color Peninsula Grassland

► Riverbend

The Riverbend habitat restoration site is comprised 4,320 linear feet and 9.8 acres of shoreline area located at the RiverBend Commerce Park property. The RiverBend site provides one of the longest stretches of undeveloped shoreline in the Buffalo River Area of Concern and was identified in the 1989 Buffalo River RAP as a high priority restoration “Habitat Restoration Opportunity Area” site.

Buffalo Niagara Riverkeeper received grant funding from the US Environmental Protection Agency and the National Oceanic Atmospheric Administration to complete a riparian habitat restoration project on the site. Riverbank enhancements include the planting of native trees and vegetation for habitat as well as invasive species removal.

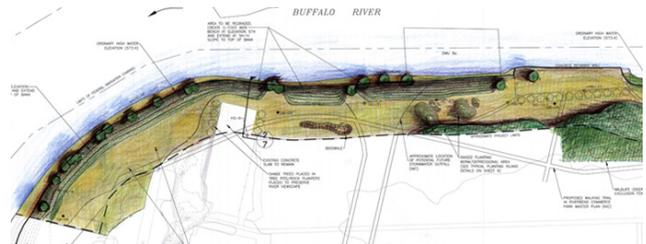


Figure 6 Riverbend Habitat Restoration Plan

► Babcock Street/Exxon Mobil Former Terminal

The site is 90 acres in size and located on Elk Street in the City of Buffalo. The site is bisected by Babcock Street running north-south and Prenatt Street, which is a paper street, running east-west. The goal of the voluntary brownfield cleanup action for the site is to achieve cleanup levels that protect public health and the environment. In addition to contamination management the project will involve:

- riverbank stabilization and vegetation to prevent contaminated fill from eroding into the Buffalo River; and
- the construction of a treatment wetland to manage storm water on site.



Figure 7 Elk Street Redevelopment Plan

▶ Old Bailey Woods

The Old Bailey Woods site, near the confluence of the Buffalo River and Cazenovia Creek, is a large wooded lot that is used by local residents for fishing and passive recreation. This 3.1-acre lot, which is the only floodplain forest in the City, was designated as a passive park under a settlement agreement associated with the development of the Iron Mountain Records facility, east of the site. There is an internal dirt path that allows access to this property from either Payson Street or Bailey Avenue.



Figure 8 - Old Bailey Woods Fishing Access

▶ Bailey Avenue Peninsula (Confluence Point)

One of three projects completed under the 1996 Buffalo Fish and Wildlife Habitat Restoration Demonstration Project, habitat restoration, invasive species management and passive public access facilities were created at Confluence Point Park at the confluence of Cazenovia Creek and the Buffalo River. This 3.8-acre Erie County-owned and maintained site provides walking trails, scenic overlooks of the Buffalo River and interpretive signage. The site is used heavily for fishing by local residents and also offers several scenic vistas with benches.



Figure 9 - Bailey Peninsula/Confluence Point

▶ Seneca Bluffs

Seneca Bluffs Natural Habitat Park is a designated Erie County wetlands restoration area located at the Seneca Street Bridge, between Elk Street and Avon Place. It consists of 15 acres of riparian floodplain located in a heavily urbanized area along the Buffalo River. Habitat types include floodplain island, seasonally flooded wetland, forested floodplain, and upland meadow, along with 2,500 feet of shoreline. Migratory birds, wading birds and waterfowl make use of this site. Challenges include the domination of approximately 85 percent of the site by invasive and non-native plants and areas of shoreline that are actively eroding.

The City owns a small number of undeveloped street right-of-ways that extend toward the river immediately upstream of Seneca Bluffs. These include Avon Place and the terminus of Leamington Place, Avondale Place and Juniata Place. This area is submerged when melting snow increases the flow and subsequent water level in the Buffalo River.



Figure 10 - Seneca Bluffs

▶ Houghton (Stachowski) Park to City Line

From Bailey Avenue east to the City line, including substantial City-owned acreage at Houghton Park, the north shore of the Buffalo River is characterized by forested floodplain, emergent wetland habitat and upland grassland areas.



Figure 11 - Buffalo River facing east to South Ogden Bridge

▶ Buffalo School Sites along the Buffalo River

Public school properties at Southside Elementary, Red Jacket Elementary and South Buffalo Charter School are located adjacent the Buffalo River and contain woodland, grassland and important shoreline habitat resources.

▶ Bell Slip/100 year floodplain/ Outer Harbor Shoreline



The 2,300 linear feet of shoreline at the Outer Harbor Bell Slip was enhanced as part of the \$13.5 million Outer Harbor Greenbelt project. Improvements included soil remediation, installation of new stone revetment and slope embankment to prevent erosion, landscaping, construction of shallow water habitat supportive of fish spawning, and installation of bio-engineered compost to support vegetation and attract wildlife. Substantial portions of the vacant land north of the Ford Terminal Complex on the Outer Harbor are within the 100-year floodplain and serve as natural protective features.

▶ Ship Canal Commons



As part of the wildlife habitat improvements at Ship Canal Commons, large tree trunks were weighted and placed on the bottom of the Union Ship Canal and partially buried in an underwater stabilization berm, with the roots exposed, to create artificial reefs. Floating rafts of willow logs also provide cover for fish. A one-half acre portion of the site, adjacent to the northwest corner of the canal, was excavated to create a small marsh where native aquatic plants were placed.



D. Fish Resources

While no commercial fisheries are known to exist on Lake Erie in New York, Lake Erie remains the largest freshwater commercial fishery in Canada, and one of the most valuable freshwater commercial fisheries in the world. In 2011, the Lake Erie commercial fishing industry caught nearly 22 million pounds of fish worth \$28 million, much of which were sold to food stores and restaurants in Ontario, the U.S. and around the world. The total value of Lake Erie's commercial fishery was \$194 million in 2011.

Within the Buffalo LWRA, Lake Erie and Niagara River are home to several sport fishing charter businesses, bait shops, numerous shoreline fishing sites with large numbers of residents, including the City's growing immigrant communities, relying upon locally caught fish as a source of protein.

There is an abundance of fishery resources in the LWRA, including both native and non-native species. Native species found in Lake Erie and the Upper Niagara River include: largemouth and smallmouth bass, yellow perch, walleye, northern pike, muskellunge, rock bass, sheepshead, smelt, emerald shiners and lake sturgeon. In general, the potential for overfishing is not considered to be a problem; however, catches of certain highly-sought species, such as muskellunge, walleye or steelhead, under certain conditions, may pose concerns for anglers and fisheries managers.

NYSDEC's management of Lake Erie fishery resources includes a component focused on providing steelhead and rainbow trout fishing opportunities, particularly in the major tributaries. Approximately 250,000 steelhead are stocked annually in selected New York tributaries of Lake Erie, including about 45,000 in the Buffalo River system. Steelhead are stocked in early spring, usually April, in Cayuga Creek, Cazenovia Creek and the Buffalo River in order to imprint the young so they will return to these streams when they mature. Since 2005, a portion of steelhead have been stocked into holding pens in the Buffalo River at the Bison City Rod and Gun Club to improve survival and imprinting. The fish are held

for about three weeks, fed, monitored, measured and released by volunteers.

The Buffalo River has a long history of significant environmental degradation. There are numerous reports describing a variety of factors related to the degradation, including impacts upon aquatic resources. There have also been substantial improvements in the fish community in recent decades. Many of the fish species expected to be found in this type of habitat are present, although abundance of many highly desirable native fish species, such as smallmouth bass, walleye, northern pike, and muskellunge, is low. There are many limitations to achieving a fully-recovered fish community in the Lower Buffalo River. They include physical factors such as lack of shallow areas, excessively high surface water temperatures, seasonal low flows, lack of natural shoreline, lack of underwater cover, and poor condition of bottom sediments. Important chemical limitations include episodes of dissolved oxygen depletion and contaminated sediments. Reduced areas of aquatic vegetation, associated wetlands and contiguous shoreline vegetation are biological factors that have been identified as problematic for fish populations.

During 2003, NYSDEC, in cooperation with an advisory group, initiated a walleye restoration project for the Buffalo River. The objective of the project is to establish a self-sustaining, riverine walleye population in the Buffalo River. This project could potentially develop a seasonal walleye fishery in the Buffalo River and enhance walleye fishing in the Buffalo Harbor. A successful spawning population of walleye in the Buffalo River would diversify walleye reproduction in Lake Erie, helping to ensure more consistent walleye recruitment in Lake Erie. From 2004 to 2007, approximately 76,000 walleye fingerlings and approximately 419,000 walleye fry have been stocked into the Buffalo River, in anticipation that stocked fish would survive and return as adults to spawn. Unfortunately, in 2007, NYSDEC fish disease policy to contain the spread of viral hemorrhagic septicemia (VHS), caused a suspension of the stocking program, and it is hoped that the stocking program can be continued once disease related issues are resolved. In 2008, DEC conducted follow-up walleye sampling activities in the Buffalo River

since this was the first year that both males and females of the 2004 stocking cohort would be fully mature and perhaps detectable as a spawning concentration. No adult walleye were detected during this sampling effort; however, additional effort will be expended in the future to monitor success of the stocking activities.

A most notable aquatic resource in the LVRA is the presence of emerald shiners, a small, silvery minnow found in great abundance on a seasonal basis. Large numbers of shiners, a native species, are found in the Buffalo Harbor, Buffalo River and Upper Niagara during late winter, spring and early summer. The adult emerald shiners migrate in association with ice flows from Lake Erie into the Niagara River. This species is an important food item for many of the fish-eating birds and predatory fish found in the system. These abundant minnows are also a staple of the local baitfish industry. However, the importance of locally caught shiners has diminished greatly since 2006/2007 when Federal and State fish disease regulations were implemented to control the spread of VHS. Prior to that time, large numbers of emerald shiners were commercially dipped from the Niagara River for local sale, as well as transport to other bait dealers in New York and other northeastern states.

Protection of emerald shiners and their migratory corridor is important. Each year during late summer and fall, millions of young shiners migrate upstream, against the current, from the Niagara River to Lake Erie where they grow to adults. In the river, these very small, young minnows have limited swimming capabilities and they swim along the shoreline of the River, taking advantage of areas where current velocities are reduced by rocks and other cover. In the vicinity of the Peace Bridge, where current velocities are very fast, habitats conducive to migrations are very limited, especially where there are long stretches of smooth, vertical concrete or metal structures.

The Buffalo LWRP policies aim to help rebuild the Lake Erie-Niagara River food web, supporting sport and subsistence fishing in the short term and contributing to the long term restoration of sustainable commercial fishing in NY's Lake Erie waters.

E. Wildlife

LVRA natural systems host large native deer and turkey communities; several rare, threatened or endangered species; and a globally significant bird corridor. Because hunting is prohibited due to urban site conditions, the City, and the LVRA in particular, serves as an informal regional wildlife preserve.

F. Globally Significant Important Bird

The function of the BirdLife Important Bird and Biodiversity Area (IBA) Programme is to identify, protect and manage a network of sites that are significant for the long-term viability of naturally occurring bird populations, across the geographical range of those bird species for which a site-based approach is appropriate. The Niagara River corridor was the first globally significant IBA to be jointly identified by cooperating organizations in Canada and the United States. It was formally dedicated in December 1996.

The Niagara River annually supports one of the largest and most diverse concentrations of gulls in the world. More than 100,000 individuals can be observed foraging along the river during fall and early winter. A total of 19 gull species have been recorded (60% of all New World gull species), with up to 14 species being recorded on a single day. The number of gulls and diversity of species generally peak in November. Two species occur in globally significant numbers: Bonaparte's Gull and Herring Gull.

During fall and early winter 10,000 or more Bonaparte's Gulls can regularly be observed along the river (over 2% of global population). Peaks of more than 40,000 individuals have been observed on several occasions (1973, 1977, 1990, 1991) representing over 8% of the global population. Over the course of the fall and early winter season up to 100,000 birds have been estimated to pass through this site (over 20% of the global population).

Herring Gulls are also abundant; 20,000 or more individuals can be observed regularly with a maximum of 50,000 individuals being reported on a single day. This represents the regular occurrence of almost 6% of the North American Herring Gull population (ssp.

smithsonianus) with upwards of 14% of the population being reported on a single day. The national threshold for Ring-billed Gulls is also regularly exceeded during spring migration.

Waterfowl concentrations during fall and winter also regularly exceed 20,000 individuals of more than 20 species. At least two species (Canvasbacks and Common Mergansers) are regularly present during late fall and early winter in numbers just above 1% of their estimated North American populations; Greater Scaup are occasionally present in significant numbers, and Common Goldeneyes are regularly present in numbers approaching the 1% threshold.

Due to the regional geography, large numbers of migrating raptors and landbirds cross the river during migration. Normally they do not stop in large numbers along the river corridor. Some specific sites along the river corridor are also significant for colonial nesters such as Black-crowned Night Herons, Common Terns, and Ring-billed Gulls.

I. Fish Consumption Advisories

While commercial fisheries do not exist in Buffalo, many people, including many members of the City's growing immigrant community, rely upon fish consumed from the Buffalo and Niagara Rivers in Buffalo as a primary protein source. Unfortunately, fish from fresh waters are more likely to be contaminated than fish from remote marine waters because many fresh waters are close to human activities and contamination sources. When those fishing locations contain fish with higher contaminant levels, the people who eat them will have higher contaminant exposures.

For many years, the New York State Department of Health has issued fish consumption advisories for both the Buffalo and Niagara Rivers within the Buffalo LWRA. The warnings are designed to protect public health until the contamination is removed from the food chain and fish are safe to eat.

Buffalo Niagara RIVERKEEPER, Jericho Road Ministries, and the New York State Department of Health have partnered to educate residents of Western New

York on the risks of eating polluted fish from local waterways through outreach and events. The program has produced innovative and simplified public health materials in numerous languages and has conducted extensive outreach to at-risk communities who depend on local fish as a food source.

2. Water Dependent Industrial Uses

Once the predominant use along the City's waterways, waterborne industrial transport has dramatically declined. Still, the ability to ship bulk good remains essential to the following important ongoing Buffalo industries:

- ▶ General Mills (water borne bulk materials delivered via the City Ship Canal);
- ▶ ADM (water borne bulk materials delivered via the Buffalo River);
- ▶ LaFarge (bulk cement delivered via the Buffalo River);
- ▶ Port Crescent Land Company (bulk sand delivered via the City Ship Canal); and
- ▶ Bulk material delivery associated with the Child's street grain elevator complex.

Because the City is located on an international border, the Department of Homeland Security works closely with the above entities to ensure all sites meet border security regulations.

G. Invasive Species

According to the US EPA:

During the past two centuries, invasive species have significantly changed the Great Lakes ecosystem. In turn, the changes have had broad economic and social effects on people that rely on the system for food, water, and recreation.

An "invasive species" is a plant or animal that is non-native (or alien) to an ecosystem, and whose introduction is likely to cause economic, human health, or environmental damage in that ecosystem. Once established, it is extremely difficult to control their spread.

At least 25 non-native species of fish have entered the Great Lakes since the 1800s, including round goby, sea lamprey, Eurasian ruffe, alewife and others. These fish have had significant impacts on the Great Lakes food web by competing with native fish for food and habitat. Invasive animals have also been responsible for increased degradation of coastal wetlands; further degrading conditions are resulting in loss of plant cover and diversity.

Non-native mussels and mollusks have also caused turmoil in the food chain. In 1988, zebra mussels were inadvertently introduced to Lake St. Clair, and quickly spread throughout the Great Lakes and into many inland lakes, rivers, and canals. Since then, they have caused severe problems at power plants and municipal water supplies, clogging intake screens, pipes, and cooling systems. They have also nearly eliminated the native clam population in the ecosystem.

The spiny water flea (*Cercopagis pengoi*) was the most recent species to enter the Great Lakes. This organism, a native of Middle Eastern seas, is a tiny predatory crustacean that can reproduce both sexually and, more commonly, parthenogenically (without fertilization). This allowed them to quickly populate Lake Ontario.

The Great Lakes have also been troubled by fast-growing invasive plants such as common reed (*Phragmites australis*), reed canary grass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria*), curly pondweed (*Potamogeton crispus*), Eurasian milfoil (*Myriophyllum spicatum*), frogbit (*Hydrocharis morsus-ranae*), and two types of non-native cattails (*Typha angustifolia* and *Typha glauca*).

Some of these plants are prolific seed producers, which allows them to spread rapidly over large areas. Invasive purple loosestrife, for example, are 2-3 meters tall and can produce 2.7 million seeds each year. Others reproduce from fragments of root or rhizome, which hinders removal and control. All have become established quickly in the Great Lakes, displacing the native plant populations that support wildlife habitat and prevent erosion. Their prevalence in recreational waters also hinders swimming and boating.

In the St. Lawrence River, studies have found that disturbances by boat or fish may facilitate the spread of common reed, a very persistent invasive plant. Dense beds of common reed may threaten local fish and bird habitats.

To prevent and control additional invasions in the Great Lakes, coordinated efforts are under way by U.S. and Canadian governments, eight state governments, two provincial governments, and regional and local programs. Invasive species management is identified in the NY Great Lakes Action Agenda.

Thirty percent of invasive species have been introduced in the Great Lakes through ballast water. In the early 1990's, the U.S. Coast Guard began requiring ships to exchange their ballast water, or seal their ballast tanks for the duration of their stay. The Coast Guard later used their success in the Great Lakes to develop a ballast management program for the entire nation. Currently, the Coast Guard is in the process of developing ballast water discharge standards.

Lake Erie has been designated a No Discharge Zone by both the US EPA and the New York State Department of Environmental Conservation.

Based on the problems caused by non-native species, scientists are also closely watching other species that have invaded nearby ecosystems. Asian carp are of particular concern because they have been found in nearby waterways that eventually connect to the Great Lakes. In 2004, EPA and other state and local agencies began construction of a permanent electric barrier to prevent the fish from entering Lake Michigan.

H. Great Lakes Areas of Concern (AOCs)

The Buffalo and Niagara Rivers have been identified as two of 43 toxic hot spots on the Great Lakes that have been designated by EPA and the International Joint Commission (IJC) as "areas of concern". An AOC is a place that is so heavily polluted by raw sewage, contaminated sediments, invasive species, and habitat and wetland destruction that the damage threatens the ecosystem, the economy, water quality and the health of the community. The Buffalo and Niagara Rivers, their sediments and nearshore areas have been impaired by over a century of industrial activities and municipal waste discharges. Contamination of the river channels continues today from upstream non-point sources, CSO discharges, and historic contaminants contained in river sediments and riverfront brownfields.

The Niagara River AOC is located in Erie and Niagara counties in western New York. This AOC extends from Smokes Creek near the southern end of the Buffalo Harbor, north to the mouth of the Niagara River at Lake Ontario. Past municipal and industrial discharges and waste disposal sites have been a source of contaminants to the Niagara River. A long history of development has also changed the original shoreline along much of the river, affecting fish and wildlife habitat. Habitat degradation and the survival of aquatic life in this AOC have been impaired by toxic chemicals, such as PCBs, mirex, chlordane, dioxin, dibenzofuran, hexachlorocyclohexane, PAHs, and pesticides. Fish migration from Lake Ontario has an influence on the Niagara River community, as does the related affects of invasive species. Metals and cyanides in the sediment prevent open lake disposal of bottom sediments dredged from the river. Sources and loadings of pollutants causing use impairments in the Niagara River include these sediments, as well as inactive hazardous waste sites, CSOs, and other point and nonpoint sources. Contamination originating from discharges within Lake Erie's watershed contributes to effects in the Niagara River and Lake Ontario.

The Buffalo River AOC is located in the City of Buffalo. The river flows from the east and discharges into Lake Erie, near the head of the Niagara River. The Buffalo River "impact area" extends from the mouth of the Buffalo River to the farthest point upstream at which the backwater condition exists during Lake Erie's highest monthly average lake level. The impact area is 6.2 miles in length. The AOC also includes the entire 1.4-mile stretch of the Buffalo Ship Canal, located adjacent to the river. The AOC impact area is characterized by historically heavy industrial development in the midst of a large municipality. There are three major streams in the watershed that create the AOC "source area": Cayuga Creek, Buffalo Creek and Cazenovia Creek. The total drainage area for the Buffalo River watershed is approximately 440 square miles.

To address these problems, NYSDEC, in conjunction with the Buffalo Niagara Riverkeeper and citizen advisory committees, prepared Remedial Action Plans (RAPs) for the Buffalo River in 1989 and the Niagara River in 1994. The RAPs, and subsequent updates, identified Beneficial Use Impairments (BUI) for each river, set forth by the IJC, as well as plans to remediate the impairments.

Buffalo River and Niagara River Areas of Concern, Beneficial Use Impairments

IJC's Beneficial Use Impairments		Buffalo River AOC Status (as of 2011)	Known or Likely Cause	Niagara River AOC Status	Known or Likely Cause
1	Restrictions on Fish & Wildlife Consumption	Impaired	PCB's and chlordane in sediments	Impaired	PCB's and chlordane in sediments
2	Tainting of Fish & Wildlife Flavor	Impaired	PAHs in sediment	Not Impaired	-
3	Degradation of Fish & Wildlife Populations	Impaired	Low dissolved oxygen, river channelization, and contaminated sediments	Unknown	-
4	Fish Tumors and Other Deformities	Impaired	Contaminated sediments	Impaired	Contaminated sediments
5	Bird or Animal Deformities or Reproductive Problems	Impaired	PCBs, DDT, and metabolites in sediments	Impaired	-

IJC's Beneficial Use Impairments		Buffalo River AOC Status (as of 2011)	Known or Likely Cause	Niagara River AOC Status	Known or Likely Cause
6	Degradation of Benthos	Impaired	Contaminated sediments and navigational dredging	Impaired	Contaminated sediments
7	Restrictions on Dredging	Impaired	Contaminated sediments	Impaired	Contaminated sediments
8	Eutrophication or Undesirable Algae	Not Impaired	-	Not Impaired	
9	Restrictions on Drinking Water Consumption or Taste and Odor Problems	Not Applicable	-	Not Impaired	
10	Beach Closings	Not Applicable	-	Not Impaired	
11	Degradation of Aesthetics	Impaired	Floatables, debris, and foul odor from CSOs and upper watershed	Not Impaired	-
12	Added Costs to Agriculture and Industry		Not Applicable	-	Not Impaired
13	Degradation of Phytoplankton and Zooplankton Populations	Not Impaired	-	Not Impaired	-
14	Loss of Fish & Wildlife Habitat	Impaired	Physical Disturbances such as bulkheading, dredging, steep slopes, and lack of suitable substrate	Impaired	Physical disturbances and low water quality