SUPPORTING DOCUMENT 2:
ECOLOGICAL CONDITIONS AND LIVING INFRASTRUCTURE FRAMEWORK

MARCH 2013 FINAL REPORT

JAMESTOWN BOA AND LWRP
ECOLOGICAL CONDITIONS AND LIVING INFRASTRUCTURE FRAMEWORK



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INTRODUCTION

This report sets forth the results of work completed by Biohabitats, Inc. to assess ecological conditions and develop related recommendations for the City of Jamestown Brownfield Opportunities Area (BOA) and Local Waterfront Revitalization Program (LWRP) study areas along the Chadakoin River.

In support of this study, Biohabitats has conducted literature reviews, desktop analyses and field investigations to establish current ecological conditions within the study area. Drawing from this work, Biohabitats has developed a proposed "living infrastructure framework" for the study area that integrates ecological restoration, conservation, green infrastructure, and other opportunities into a cohesive structure that may serve as a basis for future land use planning and redevelopment decisions.

Section 1 of this report provides the ecological context for the study areas – natural resources history; regional priorities, considerations, and influences; and complementary efforts and concerns. Section 2 of the report focuses on ecological conditions within the study areas, and describes the results of the literature review, desktop analyses and field assessments. Section 3 of the report presents the recommended living infrastructure framework for the study area and details specific ecological recommendations within the study area.

1. STUDY AREA CONTEXT

1.1. Natural Resource History and Early Settlement

The Wisconsinan Glaciation reached its maximum extension approximately 20,000 to 18,000 years ago. As the glaciers retreated, melt waters dropped massive amounts of sediment and other materials along the landscape. New landscape patterns defined by the glacial retreat and melt created the Great Lakes, along with the major rivers and other tributaries, and other freshwater lakes in northern and western New York. Hardwood forests migrated slowly northward as gradual warming and extensive periods of increased precipitation combined with the transport of bird-, wind-, and water-borne seeds. All of these historic processes created the foundation materials and patterns that define the Chautauqua Lake and Chadakoin River watershed today. *(Reference: http://upload.wikimedia.org/wikipedia/commons/b/b0/Glacial_lakes.jpg; Barnes, Burton V., Donald R. Zak, Shirley R. Denton, Stephen H. Spurr. Forest Ecology. John Wiley & Sons, Inc. New York, NY. 1990. 4th edition 1998.)*

Chautauqua Lake formed as this glacial retreat occurred in western New York, approximately 16,000 years ago. It is understood to have formed with several advances and retreats of glacial ice. The lake appears now as almost two separate lakes, with a constriction in the center near Bemus Point. Glacial sediments dropping off the retreating glaciers likely formed the constriction. The deepest portion of the lake, near this constriction, is believed to be a kettle lake (a freshwater depression where a piece of glacier breaks off and slowly melts). The northern basin measures approximately nine miles long and 26 feet deep, while the southern basin is eight miles long and approximately 11 feet deep. The Chadakoin River drains Chautauqua Lake at its southernmost point, which is also the beginning of the study area for the BOA 1 Study and the LWRP. Because the river acts as the lake's outlet the Warner Dam was built to help regulate lake levels and help prevent flooding. From the Chadakoin River the water flows to the Conewango Creek east of Jamestown, which then flows into the Allegheny River to join the Monongahela in Pittsburgh to form the Ohio. *(Reference: http://www.jamestownpublicschools.org/highschool/localfieldtrip/riverwalk.html)*

The region has been inhabited by humans since approximately 12,000 BC, first with Paleo Indians as the glaciers receded. The Proto-Erie were followed by the Iroquois League of the Seneca Nation. A group called the Cornplanters, of the Seneca Nation, were noted for settlement along a hillside south of the Chadakoin near the present day Washington Street Bridge in a camp from 1797 until the 1830's. The Chautauqua County region was mainly known for its fishing and hunting resources. *(Reference: http://www.jamestownpublicschools.org/persell/faculty/jkresge/Site_3/Welcome_files/HistoricOverview.pdf)*

1.2. Regional Context

1.2.1. Regional Landscape Ecology

This region of western New York boasts a significant number of important glacially-influenced forests, swamps, rivers, ponds, marshes and meadow areas that help define the landscape, both in terms of natural resource value and habitat, but also in terms of historic human uses for industry and recreation. Designated natural resource areas, wildlife management areas, sanctuaries and preserves in the region provide important habitat for neo-tropical migratory birds and other endemic native wildlife. The areas

serve as both conservation as well as recreational resources and provide important clues to the landscape matrix that would have defined the region prior to widespread settlement.

There are several regional examples of sites where functional forest, riparian, and wetland communities can inform restoration, preservation and management along the Chadakoin River in terms of species diversity and habitat needs. See Figure 1.1 and descriptions below.

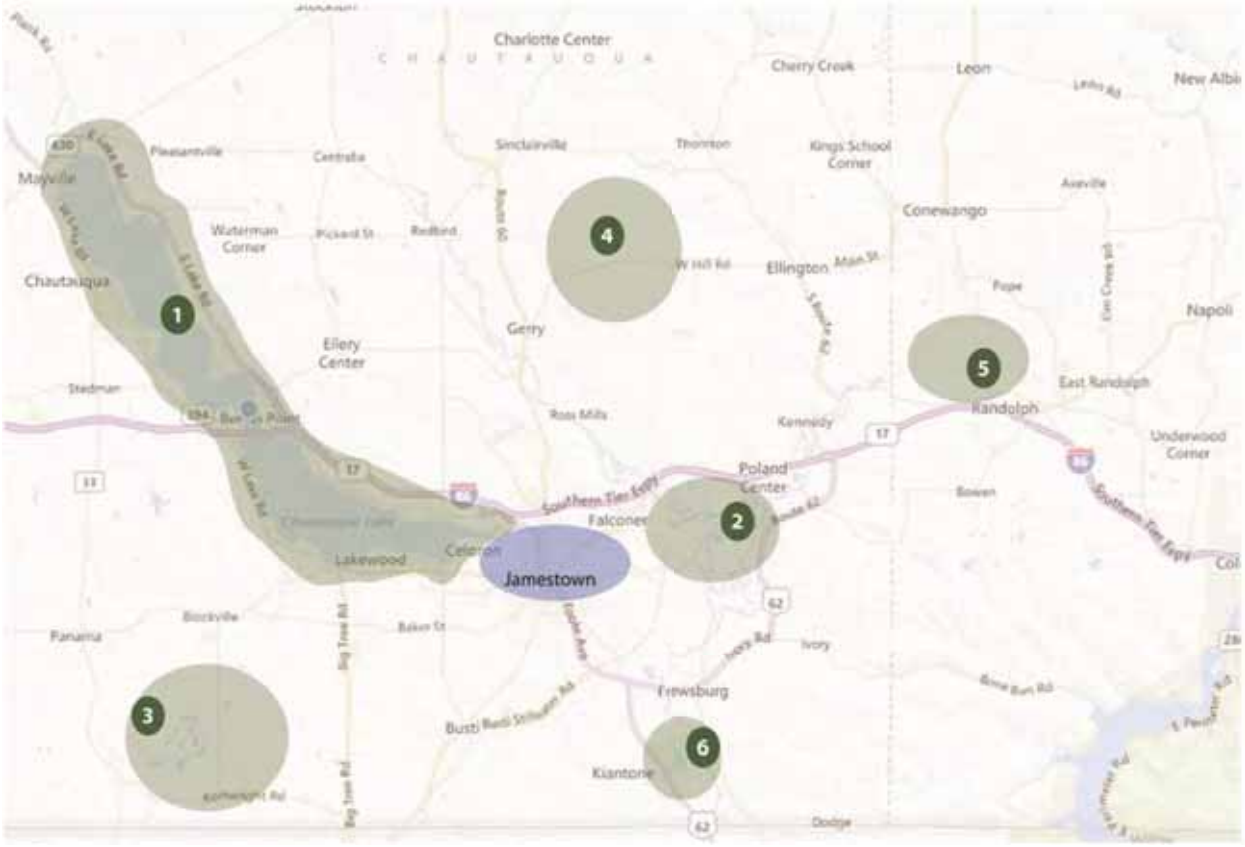


Figure 1.1. Regional landscape ecological resource areas (Map source: Bing.com – © 2010 NAVTEC © 2012 Microsoft Corporation)

Chautauqua Lake (1) has been designated as an Important Bird Area by the National Audubon Society of New York, as a major stopover for migration of waterfowl along the Atlantic Flyway. Species that have been documented include common loons, pied-billed grebes, tundra swans, hooded mergansers, lesser yellowlegs, Bonaparte's gulls, and black terns. The Lake also has a number of wildlife management areas including wetlands at ***Tom's Point***, extensive wetlands at ***Stow Farm***, natural shoreline at ***Cheney Farm***. A hardwood and conifer forest preserve at ***Dobbins Woods*** includes two of the tributaries to Chautauqua Lake and the ***Elm Flats Wetland Preserve*** is an 83-acre maple and shrub swamp at the headwaters of Big Inlet Creek that flows into Chautauqua Lake that provides important habitat.

There are also a number of significant natural resources outside of Jamestown proper, providing habitat patches within the region, and which may provide further reference for the ecological diversity and the value of improved habitat along the Chadakoin River. The Chadakoin River Watershed is within the Cattauraugus Highlands ecological zone, which is dominated by northern hardwoods (primarily oaks) and supports a variety of mammals, birds, reptiles and amphibians.

To the east of Jamestown, where the Chadakoin River meets Cassadaga Creek which then joins Conewango Creek, the **Hartson Swamp and Clay Pond Wildlife Management Areas (2)** are favored locations for birders and wildlife enthusiasts. These two areas include flat bottomland marshes and ponds where the rivers converge in varying meanders and oxbows. These glacially influenced wetlands are host to a wide variety of birds and native plants including: the pied-billed grebe, wood duck, hooded merganser, cliff swallows, northern flicker, common yellow-throat, yellow warbler, green heron, wood thrush, red-eyed vireo, Eastern towhee, as well as the Midland painted turtle, snapping turtle, bullfrog and Northern leopard frog. Plants of note include wild ginger, swamp dogwood, and northern arrowwood.

Further afield a few notable natural resource areas include (see Figure 1.1):

Hill Higher State Forest (3), to the southwest, includes wetland shrub swamps and emergent marsh areas that host among other wildlife, the endangered New York State raptor, the Northern harrier. This forest has vast areas blanketed by leatherleaf– indicative of glacial landscapes.

Hatch Creek State Forest (4), to the north, which is a popular nesting area for a number of birds including red-breasted nut hatches, golden crowned kinglets, blue-headed vireos, and dark eyed juncos. This forest is dominated by maples and black cherries and hosts a variety of ferns in its understory. During spring migration other birds of note include: the Eastern wood pewee, great crested flycatcher, red-eyed vireo, blue-headed vireo, chestnut sided warbler, black throated green warbler, scarlet tanager, and the yellow-billed sapsucker.

Conewango Swamp (5), to the northeast of Jamestown, hosts 900 acres of shrub swamp, as well as emergent marsh and wetland open water, managed by the New York State Department of Environmental Conservation (NYSDEC). It is managed mainly to provide habitat for resident and migratory species of birds as well as other wildlife, including beaver, muskrat, and mink.

Jamestown Audubon Center (6), to the south of downtown Jamestown, includes 600 acres of ponds, swamps, marshes, forest and open fields, which could perhaps provide reference for the transition of the Chadakoin Park to a more natural park landscape dominated by similar vegetative features. Besides the over 265 species of birds that are seen at the nature sanctuary, other wildlife including dragonflies and damselflies, frogs, turtles, snakes, muskrats, and waterfowl are abundant. Red maple, Northern red oak, Eastern hemlock, black cherry, and American beech dominate the canopy of the forested areas. The understory of the wetland areas and woods includes buttonbush and spicebush.

(References: http://www.rtpi.org/index.php?option=com_content&view=section&id=17&Itemid=166 & http://planningchautauqua.com/pdf/reports/Chautauqua_Lake_LWRP.pdf)

1.2.2. Migratory Flyway

In North America, birds migrate along four main routes, or flyways: the Atlantic, Central, Mississippi and the Pacific. The Atlantic flyway extends along the Atlantic Coast from the shores of Greenland south to the Gulf of Mexico, extending west to the Allegheny Mountains, and northwest through northern West Virginia and Northeast Ohio and then across the provinces of Canada to the Northwest Territories (Figure 1.2). The flyway includes Jamestown and western New York and serves as important migratory

route for shorebirds, raptors, waterfowl and pelagic birds, as well as butterflies, certain bats and dragonflies (Figure 1.3). *(References: http://www.fws.gov/migratorybirds/, http://www.birdnature.com/flyways.html)*

In this region of the Great Lakes there are several important smaller routes considered tributaries to the Atlantic Flyway. Of particular ecological significance is the Niagara Escarpment, designated as a UNESCO World Biosphere Reserve in 1990, which is a protected ecological reserve. It crosses two major biomes and includes significant areas of boreal needle leaf forest, temperate broadleaf forest, wetland complexes, cliff faces, slopes and aquatic systems including some of the major rivers and tributaries in the province of Ontario. The Niagara Escarpment is considered one of the most biologically diverse regions of Canada and hosts various rare plant and animal species (Figure 1.4). *(References: http://www.escarpment.org/landplanning/plan/index.php; http://www.unesco.org/mabdb/br/brdir/directory/biores.asp?code=CAN+06&mode=all)*



Figure 1.2. Atlantic Migratory Bird Flyway



Figure 1.3. Jamestown along the Atlantic Migratory Bird Flyway in the Great Lakes Region



Figure 1.4. The Niagara Escarpment as important wildlife corridor in the region (Map source Bing.com –© 2012 Microsoft Corporation)

As noted above, Chautauqua Lake has been recognized as a State Important Bird Area by a consortium of conservation and nature organizations including the National Audubon Society. This site falls within the Lower Great Lakes/St. Lawrence Plain Bird Conservation Region and includes the State-owned 16 mile-long Chautauqua Lake. The site is noted as an important stopover location for migrant birds, particularly waterfowl, and has typically supported over 1% of the estimated State wintering population of pied-billed grebes (Figure 1.5). More than 270 species of birds have been documented over the past 20 years, including the maximum numbers of selected species indicated in Table 1.1. The site is also listed in the 2002 New York State Open Space Conservation Plan as a priority site under the project name Chautauqua Lake Access, Shore Lands, and Vistas.



Figure 1.5. Pied-billed grebe (Source: U.S. Fish and Wildlife Service)

Table 1.1. Maximum Numbers of Selected Chautauqua Lake Bird Species Documented Over the Past 20 years

Common Name	Scientific Name	Totals
tundra swan	*Cygnus columbianus*	3,000
canvasback	*Aythya valisineria*	1,000
redhead	*Aythya americana*	800
lesser scaup	*Aythya affinis*	400
surf scoter	*Melanitta perspicillata*	100
long-tailed duck	*Clangula hyemalis*	120
bufflehead	*Bucephala albeola*	650
common goldeneye	*Bucephala clangula*	800
hooded merganser	*Lophodytes cucullatus*	1,200
common merganser	*Mergus merganser*	600
red-breasted merganser	*Mergus serrator*	400
ruddy duck	*Oxyura jamaicensis*	1,200
common loon	*Gavia immer*	40
pied-billed grebe	*Podilymbus podiceps*	120
horned grebe	*Podiceps auritus*	250
American coot	*Fulica americana*	4,500
semipalmated plover	*Charadrius semipalmatus*	50

Common Name	Scientific Name	Totals
killdeer	*Charadrius vociferus*	200
lesser yellowleg	*Tringa flavipes*	110
semipalmated sandpiper	*Calidris pusilla*	80
Bonaparte's gull	*Chroicocephalus philadelphia*	250
ring-billed gull	*Larus delawarensis*	8000
herring gull	*Larus argentatus*	3000
common tern	*Sterna hirundo*	87
black tern	*Chlidonias niger*	23

Source: http://iba.audubon.org/iba/viewSiteProfile.do?siteId=861&navSite=state

1.2.3. Fish Assemblages and Passage of Aquatic Species

Recent fisheries reports for the Chadakoin River are not available, but limited data on sportfish in Chautauqua Lake is provided in Citizens Statewide Lake Assessment Program (CSLAP) reports (2009 and 2010) and on the NYSDEC Outdoors web page for Chautauqua Lake (http://www.dec.ny.gov/outdoor/9230.html). It can be assumed that a number of these sportfish exist in the Lake outlet, which is similar to the habitat of the lake, and within the Chadakoin River below the Warner Dam, where the river is more free flowing (Table 1.2).

Table 1.2. Chautauqua Lake Sportfish

Common Name	Scientific Name
black crappie	*Pomoxis nigromaculatus*
bluegill sunfish	*Lepomis macrochirus*
brown bullhead catfish	*Ameiurus nebulosus*
largemouth bass	*Micropterus salmoides*
muskellunge	*Esox masquinongy*
pumpkinseed sunfish	*Lepomis gibbosus*
smallmouth bass	*Micropterus dolomieu*
walleye	*Sander vitreus*
white crappie	*Pomoxis annularis*
white perch	*Morone americana*
yellow bullhead	*Ameiurus natalis*
yellow perch	*Perca flavescens*

Chautauqua Lake is noted as supporting a coolwater fishery since it contains a mix of both warmwater (e.g. bass and sunfish) and coolwater species (e.g. walleye and yellow perch). Walleye and muskellunge are both stocked annually to support an active recreational fishery in the Lake.

East of Jamestown and Falconer, the Chadakoin River meets Cassadaga Creek and from there takes on the name of the latter. After approximately four to five river miles, the Cassadaga then joins the Conewango Creek and flows south into Pennsylvania. The portion of the Conewango in Pennsylvania is 13 miles long and was sampled by Pennsylvania Fish and Boat Commission staff on June 24, 2004 (*http://www.fishandboat.com/images/fisheries/afm/2004/2_07-07conewango.htm*). Captured sportfish included smallmouth bass (*Micropterus dolomieu*), northern pike (*Esox lucius*), walleye (*Sander vitreus*), rock bass (*Ambloplites rupestris*), bluegill (*Lepomis macrochirus*), and pumpkinseed (*Lepomis gibbosus*) (Table 1.3). Additional fish species included common carp (*Cyprinus carpio*), redhorse

(*Moxostoma sp.*), grass pickerel (*Esox americanus*), northern hogsucker (*Hypentelium nigricans*), spotfin shiners, sand shiner (*Cyprinella spiloptera*), logperch (*Percina caprodes*), and bluntnose minnow (*Pimephales notatus*). It can also be assumed that a number of these fish also exist in the Chadakoin River in the study area below the Warner Dam as the Chadakoin study area is approximately 20 river miles upstream from the Conewango at the Pennsylvania state line.

Table 1.3. Conewango Creek Sportfish Downstream of New York Border

Common Name	Scientific Name
bluegill sunfish	*Lepomis macrochirus*
northern pike	*Esox lucius*
pumpkinseed sunfish	*Lepomis gibbosus*
rock bass	*Ambloplites rupestris*
smallmouth bass	*Micropterus dolomieu*
walleye	*Sander vitreus*

During the field assessment of the Chadakoin River corridor performed in this study, fishermen above and below the Warner Dam reported commonly catching walleye and smallmouth bass from the stream. One fisherman angling under the Fairmount Avenue bridge proudly displayed a bucket containing a combination of crappie (*Pomoxis* sp.) and bluegill. A single longnose gar (*Lepisosteus osseus*) was observed cruising the shallows near Panzarella Park and common carp and white sucker (*Catostomus commersonii*) were observed in the river near Harrison Street. While no other fish data is available for the study area; it is likely that the river also supports a number of non-game fish including, other suckers such as redhorse (*Moxostoma* sp.), or the northern hogsucker (*Hypentelium nigricans*) as well as chubs, dace, and other minnows.

Strong, turbulent flow at the outlet of the Warner Dam appears to preclude upstream fish passage at this structure. Downstream beyond the Warner Dam there is one barrier to local fish passage and migration at the Dahlstrom Dam, near Buffalo Street and another potential blockage below the Dow Street bridge in Falconer. The elevation drop across the Dahlstrom Dam is approximately six feet, while the potential obstruction near Dow Street is a low head structure that may only act as a fish barrier during low flow conditions. Given these barriers, fish passage is limited to only downstream passage in the area between the Warner and Dahlstrom Dams. These structures prevent two-way passage for fish that reside in the Chadakoin (and other streams in the larger Conewango Creek watershed) and Chautauqua Lake. In addition to limiting fish passage, the barriers also inhibit non-motorized boat movement along the Chadakoin.

Related to fish passage are the migration and proliferation of freshwater mussels. Freshwater mussels have been identified by the United States Fish and Wildlife Service as being the most endangered group of organisms in North America as they are highly susceptible to channelization, sedimentation and hydromodification. Their unique life cycle requires a fish host to transport mussel larvae (glochidia) to new stream reaches, ensuring that mussel populations are continually transported to upstream areas. The Allegheny River and portions of the watershed are known to support globally significant populations of federally endangered freshwater mussels. Sixteen species of mussels, including one endangered species, were identified in Conewango Creek in 2005 (Pennsylvania Fish and Boat Commission, 2005). It is conceivable that these species could repopulate the Chadakoin if migration barriers are removed.

1.2.4. Regional Geology

The geology that defines the Conewango watershed is made up entirely of shale, including Marcellus shale formation (Figure 1.6). Aquifers exist within most of the major river valleys. While there are 129 primary soil series in the watershed, the major soil type is silt loam, formed by the weathering of the dominant shale bedrock.

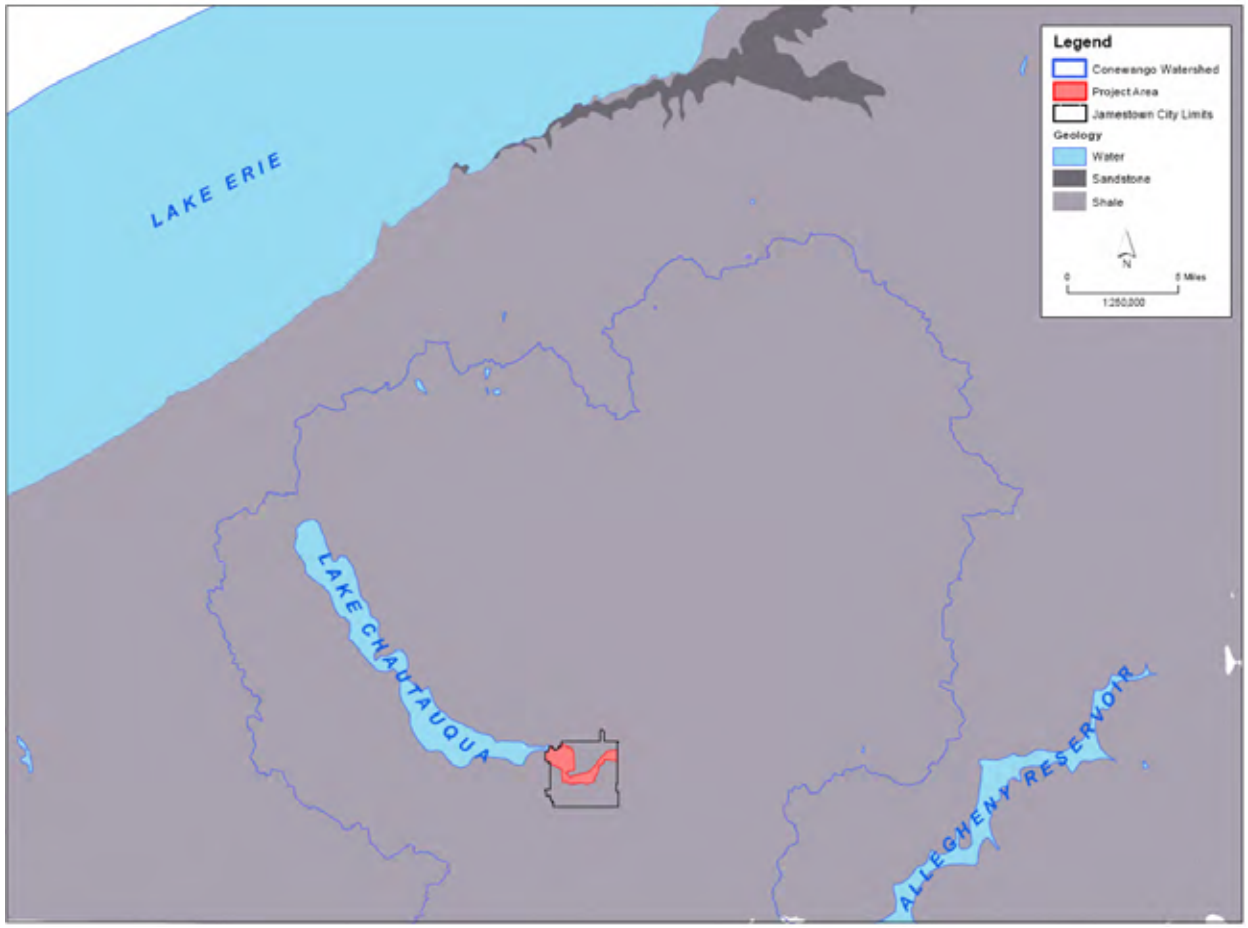


Figure 1.6. Geology of the Conewango Creek Watershed (refer to Appendix A for higher resolution version)

1.2.5. Regional Morphology

The Conewango watershed, which includes the Chadakoin River and Chautauqua Lake, lies within two physiographic provinces (Figure 1.7). The northwestern portion of the watershed is within the Erie-Ontario Lake Plain Province. This province was a glacial lakebed and therefore has limited relief; however, several large moraines and other glacial till formations add relief. This province parallels Lake Erie in a narrow band, approximately 4.5 to 6.5 miles from the coast. The remainder of the watershed is in the Allegheny Plateau Province. This area consists of rolling to steep hills carved by numerous creeks and streams. Three distinctive stream valleys are visible crossing the watershed in a northwest to southeast direction where they merge just east of Falconer and continue south into Pennsylvania. *(Reference: http://tapestry.usgs.gov/physiogr/physio.html)*

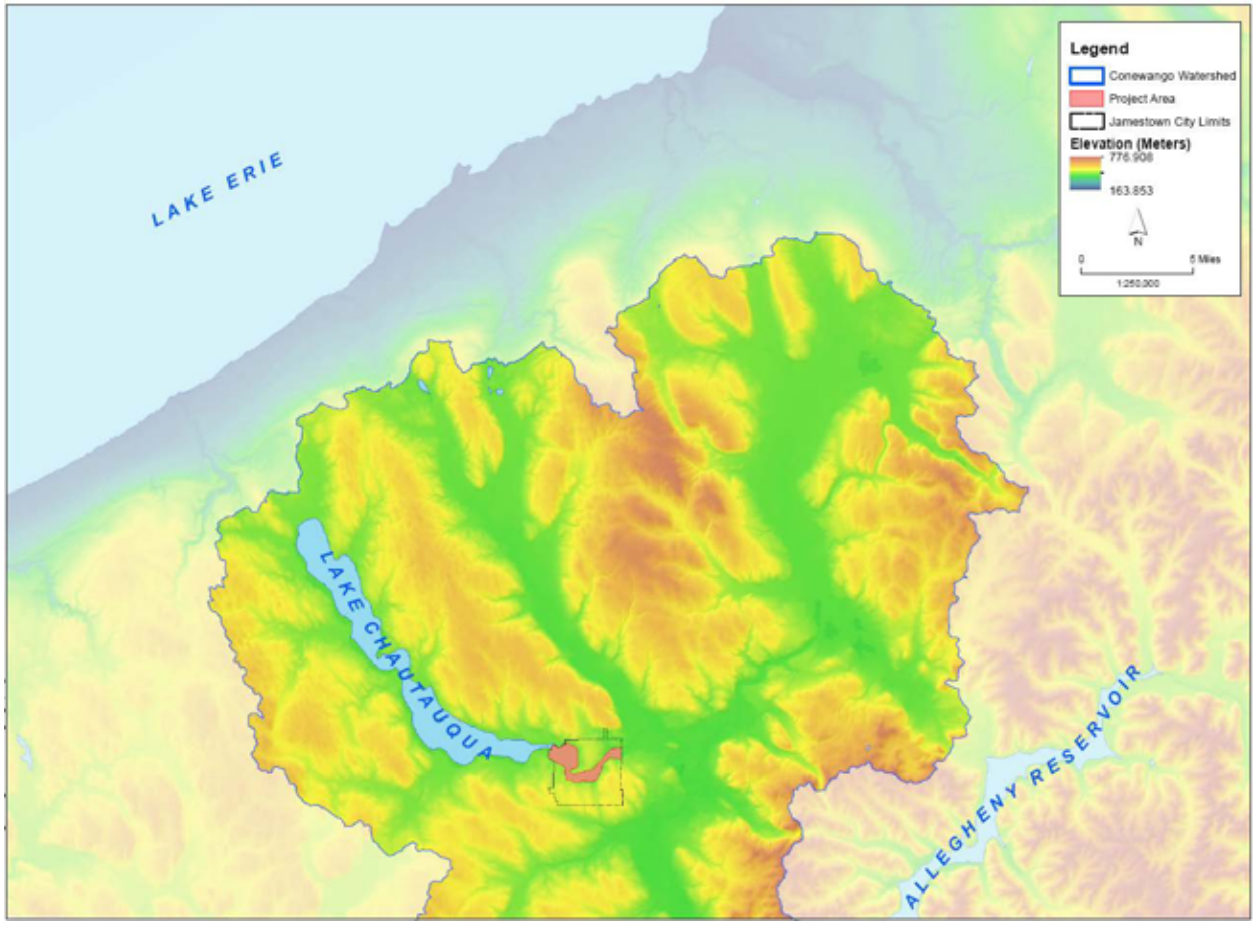


Figure 1.7. The morphology that defines the Conewango Creek watershed (refer to Appendix B for higher resolution version)

1.2.6. Regional Hydrology

The Conewango Creek watershed drains an area of nearly 900 square miles (Figure 1.8). The watershed contains approximately 780 miles of streams and 53 lakes. The Conewango is part of the larger Allegheny and Ohio River watersheds. The watershed is characterized by forest (47%) and agriculture (44%). The Chadakoin River, Cassadaga Creek, and Conewango Creek are the three main streams in the watershed, which also includes the 20 square mile Chautauqua Lake. (*Reference: http://www.conewangocreek.org/*)

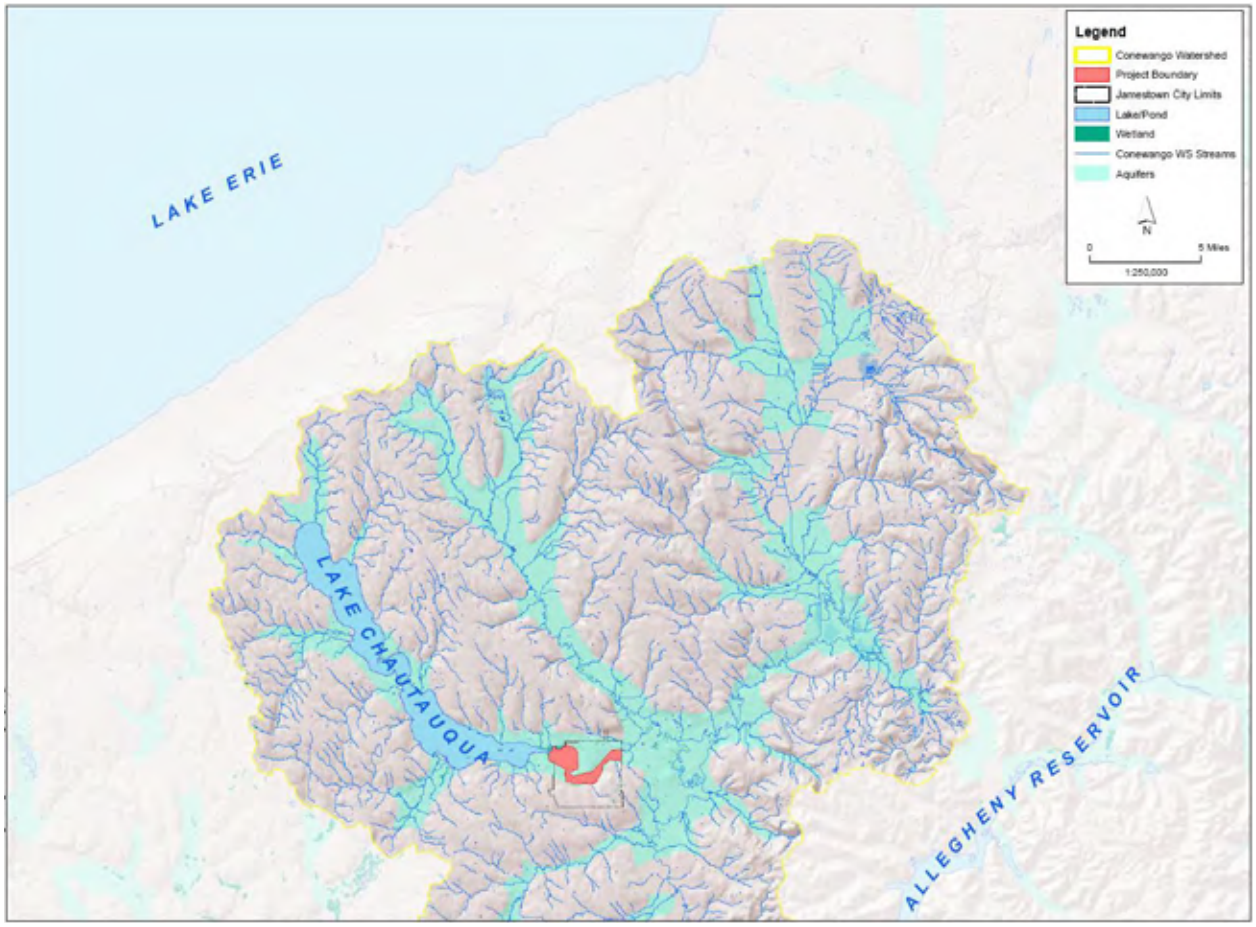


Figure 1.8. The streams, lakes and rivers that define the Conewango Creek watershed (refer to Appendix C for higher resolution version)

1.2.7. Regional Landcover

There is notable forest cover within the Conewango Creek watershed and this mapping provides the foundation for drawing potential ecological connections (Figure 1.9). Using this mapping, along with the regional hydrology, one begins to see potential wildlife corridors and habitat patches, for moving to and from significant forest and forested wetland patches for forage, breeding, and other habitat needs. Forests and agriculture dominate the land cover with varying wetland types dotting the larger stream valleys. Jamestown and surrounding areas make up the largest developed areas, although the overall urban footprint is only 4%.

Within the Conewango watershed there is limited urban development outside of the immediate vicinity of Jamestown. Developed open space areas are concentrated around the lakes and wetlands in the watershed. The watershed is dominated by deciduous and mixed forest, interspersed with areas of cultivation. Other important land cover in the watershed includes lakes, wetlands (forested and scrub-shrub), grassland and pasture.

1.3. Environmental Justice

Environmental justice becomes a concern for a community when a disproportionate amount of environmental harms, contamination and health issues are experienced by low income and minority individuals. Environmental Justice, or EJ, aims to provide for fairer treatment and meaningful involvement of all people in environmental decision-making (State of EJ 2008 conference). The State of New York has provided opportunities in past years to communities to apply for Environmental Justice Community Impact Grants. A majority of the study area for the BOA and LWRP studies has been identified by NYSDEC as a Potential Environmental Justice Area so there may be future opportunities to tap into this program for environmental restoration, urban agriculture, community gardening, environmental education, and other opportunities that could promote ecological health and community well-being along the Chadakoin River.

The "Potential Environmental Justice Area" designation, established in the State Commissioner's Policy 29 on Environmental Justice and Permitting, notes areas with populations that have met or exceeded at least one of the following statistical thresholds:

1. At least 51.1% of the population in an urban area reported themselves to be members of minority groups; or
2. At least 33.8% of the population in a rural area reported themselves to be members of minority groups; or
3. At least 23.59% of the population in an urban or rural area had household incomes below the federal poverty level.

This policy provides guidance for incorporating environmental justice concerns into the NYSDEC environmental permit review process and the NYSDEC application of the State Environmental Quality Review Act. The policy also incorporates environmental justice concerns into some aspects of the NYSDEC's enforcement program, grants program and public participation provisions. *(References: http://www.dec.ny.gov/public/36929.html; http://www.dec.ny.gov/public/899.html ; http://www.dec.ny.gov/public/31226.html)*

1.4. Concurrent and Complementary Ecologically Related Efforts

1.4.1. List of Publications and Studies

The following is a list of publications and studies that include all or a portion of the study area in their analysis and contain beneficial information related to the ecological analysis of said study area. The list is meant to provide a brief explanation as to the context of the document and is not intended to identify any potential data gaps or needs for additional studies.

Chautauqua County Equestrian Trail System Plan
(Chautauqua County Dept. of Planning & Economic Development, 2011. Chautauqua County Equestrian Trail System Plan, January 2011.)
This plan details the equestrian trail system plan for Chautauqua County, which showed no proposed trails near the study area.

Chautauqua 20/20 Comprehensive Plan

(Chautauqua County Dept. of Planning & Economic Development, 2011. Chautauqua 20/20 Comprehensive Plan, April 2011.)
Plan looks at four strategic issues; people and demographics, community, economy, and environment, which focuses on watershed, landcover and Chautauqua Lake data.

Chautauqua Lake Watershed Management Plan
(Chautauqua Lake Management Commission, 2010. Chautauqua Lake Watershed Management Plan, September 2010.)
Details management issues and background data on Chautauqua Lake and its watershed.

Chadakoin River Corridor Brownfield Opportunity Area Pre-Nomination Study
(City of Jamestown, 2008. Chadakoin River Corridor Brownfield Opportunity Area Pre-Nomination Study, October 2008.)
The pre-nomination study provides extensive background information on the Chadakoin and the environmental make-up of the study area and larger regional context.

Jamestown Riverfront Reclamation and Development Study
(City of Jamestown, Chadakoin Riverfront Planning Committee, 1991. Jamestown Riverfront Reclamation and Development Study, Addendum, November 1991.)
This study further examines the Chadakoin as five separate zones and looks to promote recreational, economical, and open space uses along the River.

City of Jamestown: Traffic and Streetscape Enhancement Plan
(City of Jamestown Department of Development, 2008. City of Jamestown: Traffic and Streetscape Enhancement Plan, September 2008.)
The plan examined existing traffic and circulation patterns, assessed the feasibility of making changes proposed in the Urban Design Plan, and developed guidelines for improvements to the physical streetscape within the City's downtown core.

Jamestown Neighborhood Revitalization Plan
(CZB LLC. Reinvesting in Itself: A Report to the City of Jamestown, March 2010.)
Key recommendations of plan were to develop gateways to the downtown at entry points to Jamestown and that riverfront development is unlikely to have a major appeal nor generate much expenditure by visitors.

Jamestown Urban Design Plan
(City of Jamestown, 2008. Jamestown Urban Design Plan, August 2008.)
The urban design plan identified three goals: transform the Chadakoin riverfront into a regional destination; strengthen the downtown core through new development, streetscaping and programming; and adopt and promote higher design standards for new development in keeping with Jamestown's character and heritage.

First Street: A Potential Proving Ground for Downtown and Neighborhood Revitalization Strategies
(Jamestown Renaissance Corp. First Street: A Potential Proving Ground for Downtown and Neighborhood Revitalization Strategies.)
This document highlighted a three-part vision which included: housing and retail at the Poulin Studio; dilapidated housing removal and community garden development; and industrial heritage park and parking improvements.

Porter Avenue Park: The Latent Link to a Riverfront Transformation
(Jamestown Renaissance Corp. Porter Avenue Park: The Latent Link to a Riverfront Transformation.)
Porter Avenue Park opportunities included utilization of three acres of undeveloped parkland, assemble multiple parcels adjacent to the riverfront for bundled demolition, Riverwalk development and park expansion, and linking a neighborhood, the Armory, and a school to the River and via Third Street to downtown.

The Allegheny River Drainage Basin: Sampling Years 1972-2002
(New York State Department of Environmental Conservation, 2006. The Allegheny River Drainage Basin: Sampling Years 1972-2002, May 2006.)
This NYSDEC report provides water quality assessments based on resident macroinvertebrates on the Chadakoin in Jamestown in three locations, which were all assessed as moderately impacted.

Brownfield Opportunity Areas Program: Guidance for Applicants
(New York State Department of Environmental Conservation, 2008. Brownfield Opportunity Areas Program: Guidance for Applicants, October 2008.)
Document details the application process for the NYSDEC BOA program.

CSLAP 2009 Lake Water Quality Summary: Chautauqua Lake
(New York State Department of Environmental Conservation, 2009. CSLAP 2009 Lake Water Quality Summary: Chautauqua Lake.)
Water quality summary provides detailed information on 2009 sampling of Chautauqua Lake including fish stocking and fish community.

CSLAP 2010 Lake Water Quality Summary: Chautauqua Lake
(New York State Department of Environmental Conservation, 2010. CSLAP 2010 Lake Water Quality Summary: Chautauqua Lake.)
Water quality summary indicated results close to normal in 2010 with assessments in the south basin slightly improving over recent years.

Draft 2012 Section 303(d) List of Impaired Waters Requiring a TMDL/Other Strategy
(New York State Department of Environmental Conservation, 2012. Draft 2012 Section 303(d) List of Impaired Waters Requiring a TMDL/Other Strategy, January 2012.)
Draft report indicated the Chadakoin is an impaired waterbody segment requiring a TMDL because of phosphorus from municipal/industrial urban runoff.

The 2003 Allegheny River Basin Waterbody Inventory and Priority Waterbodies List
(New York State Department of Environmental Conservation, 2007. The 2003 Allegheny River Basin Waterbody Inventory and Priority Waterbodies List, May 2007.)
Inventory identifies the Chadakoin's aquatic life and recreation as impaired and habitat/hydrology and aesthetics as stressed due to pollutants from various industrial, municipal, and other urban sources.

Warner Dam Flood Control Project
(New York State Department of Environmental Conservation, 2010. Warner Dam Flood Control Project, March 2010.)
Document details the history and technical information regarding the Warner Dam in Jamestown.

Chautauqua Lake Local Waterfront Revitalization Program
(New York State Department of State. Chautauqua Lake Local Waterfront Revitalization Program.)
This LWRP covered nine villages and towns around Chautauqua Lake and identified goals and objectives for the Lake.

Guidebook: Making the Most of Your Waterfront
(New York State Department of State, 2009. Guidebook: Making the Most of Your Waterfront.)
The guidebook details the LWRP, including case studies and background information about the application process.

Chautauqua County Greenways Plan
(Pashek Associates, 2012. Chautauqua County Greenways Plan, January 2012.)
This plan identified 10 high priority demonstration projects, which included the Chadakoin Park Trail (Jamestown Riverwalk Extension).

City of Jamestown Draft LWRP
(City of Jamestown, 2006. Draft LWRP.)
Organized project boundary into five zones and provided detailed information regarding regional environmental subjects.

1.4.2. Environmental Stakeholders

The following organizations and groups may be key environmental stakeholders as the BOA and LWRP studies progress:

- Chautauqua County Health Department - http://www.co.chautauqua.ny.us/departments/health/Pages/default.aspx
- Chautauqua County Planning Department – http://www.planningchautauqua.com
- Chautauqua County Soil & Water Conservation District – http://www.soilwater.org
- Chautauqua Lake Association – http://www.chautauqualake.org
- Chautauqua Rails-to-Trails – http://www.chaurtt.org
- Chautauqua Watershed Conservancy - http://www.chautauquawatershed.org/
- Cornell Cooperative Extension of Chautauqua County – http://www.cce.cornell.edu
- Jamestown Audubon Society – http://www.jamestownaudubon.org
- Jamestown Community College - http://www.sunyjcc.edu/
- NYSDEC (Region 9/Chautauqua County) – http://www.dec.ny.gov/outdoor/7786.html
- Roger Tory Peterson Institute – http://www.rtpi.org

2. STUDY AREA ANALYSIS

2.1. Study Area Description

The BOA and LWRP study area encompasses the Chadakoin River corridor within the City of Jamestown, stretching approximately seven river miles and including 1,414 acres of land. The river corridor begins at the outfall of Chautauqua Lake and flows through a series of Class I wetlands (as designated by NYSDEC), through downtown Jamestown and finally through predominately industrial sites at the eastern end of the corridor. The overall study area is actually three separate study areas based on their corresponding BOAs and the LWRP. For the purpose of this report, the study area is divided into four distinctive zones based on landscape form and position and the potential for ecological restoration and green infrastructure (Figure 2.1). Locations of the photos of the study area included in this section of the report are referenced in Figure 2.56.



Figure 2.1. Restoration and green infrastructure zones based on field and desktop assessments.

2.1.1. Zone 1: West End Natural Zone

Zone 1 coincides with the BOA Step 1 study area. It is bounded by the Western NY and PA rail line (located just south of Jones and Gifford Avenue) and West 8th Street on the south, the city boundary on the west, the Chadakoin River and Route 430 to the north, and Washington Street to the east. This zone encompasses the Chautauqua Lake outlet downstream to McCrea Point. The area is dominated by a large wetland complex west of the Chadakoin River (LW-10) and by Chadakoin Park to the east.

2.1.2. Zone 2: McCrea Point to Warner Dam

Zone 2 incorporates the western portion of downtown and is dominated by utility and transportation services. Starting at McCrea Point, the area is bound to the north by Route 394 and to the west by Hall Avenue. The southern and northern boundaries coincide with the LWRP and BOA Step 2 study area

boundaries. The Chadakoin is fairly confined in this stretch, with multiple bridge crossings and significant stretches of river walls and bulkheads.

2.1.3. Zone 3: Warner Dam to Gateway Center (Winsor Street)

Zone 3 includes the majority of Jamestown's downtown and commercial district. The zone is bound on the west by Washington Street and on the east by Winsor Street. At the center of the zone is the Gateway Center, which borders the Riverwalk and Chadakoin River.

2.1.4. Zone 4: Gateway Center to Tiffany Avenue (East of Winsor Street)

Zone 4 is dominated by industrial and vacant lots. The western boundary is Windsor Street, and the northern, southern and eastern boundaries coincide with the LWRP and BOA Step 2 study area boundaries.

2.2. Study Area Conditions

2.2.1. Study Area Geology

Located in the Appalachian Uplands physiographic province, the study area is composed of siltstone and shale with numerous exposed areas of bedrock. The Chadakoin River at the Chautauqua Lake outlet is kept broad and shallow by this bedrock.

2.2.2. Study Area Soils

Four major soils are identified within the study area based on the USDA NRCS Web Soil Survey. The western portion of the study area is dominated by Carlisle muck in wetlands LW-10 and Udorthents, landfill in the area of Chadakoin Park. The Udorthents, landfill soil type, because of the unknown fill components and potential for contaminants, could potentially influence ecological restoration and/or green infrastructure initiatives if excavation is required.

Soil types in the central part of the study area are composed almost entirely of urban land, again potentially limiting restoration and green infrastructure activities. Finally, the eastern portion of the study area includes two types of Chenango gravelly loam with a small ribbon of Hamlin silt loam along the Chadakoin River. These soils are typically well drained as they were formed in morainic glacial till and gravelly outwash deposits. (*Reference: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx*)

2.2.3. Study Area Morphology

A long history of varying industrial uses on the Chadakoin River have led to some dramatic changes in the site topography and associated drainage. Overall, the western portion of the study area is relatively flat. As the Chadakoin River passes McCrea Point it begins to change from a broad, wide river and floodplain, to a narrower river and corridor until it reaches Sprague Street. Historically the Chadakoin then entered a much broader floodplain extending the length of the study area, but industrial and commercial activities have essentially cut-off the Chadakoin from much of its floodplain. Various retaining walls, bulkheads, and buildings now form extensive stretches of riverbanks, thus removing traditional floodplain-river interaction. A number of these structures are in disrepair and present significant erosion hazards through potential failure. Several retaining walls were observed that had

been undermined and leaning into the river. On the north side of the Chadakoin River, the Western NY and PA Railroad bed has also changed the topography of the corridor and created a physical barrier to the river.

2.2.4. Study Area Hydrology

The Chadakoin River empties Chautauqua Lake. The lake and river's water level is maintained through a combination of the river's shallow bedrock channel, precipitation in the watershed, and by the Warner Dam. There is an approximate six-foot difference in surface water elevation above and below the dam. The Chadakoin is navigable by motorized boats up to McCrea Point, where it is also classified as a "5 mph No Wake Zone", and downstream to Warner Dam by small watercraft.

Between the lake outlet and McCrea Point, the Chadakoin is a broad, slow-moving river with fairly clear water (Figure 2.2). Once the river begins to narrow after McCrea Point, water clarity becomes poorer, although the river still exhibits the same, slow-moving nature. Once the river passes Warner Dam it flows more freely and includes riffles and pools. However, it is generally bound by some form of river walls, severely limiting access to its floodplain.



Figure 2.2. Chadakoin River at the Chautauqua Lake outlet at western end of Zone 1 (Source: Biohabitats; June 12, 2012)

The Chadakoin River is classified by the NYSDEC as a Class C stream, which identifies its best usage as supporting fisheries and suitable for non-contact activities. Only one tributary to the Chadakoin River is listed as a classified water body by the NYSDEC, being a small piped tributary that enters on the right bank between Institute Street and Foote Avenue. Historically there were most likely numerous tributaries within the study area, but based on the amount of industrialization in the river corridor, they would have been long ago piped and/or incorporated into the stormwater system. (*Reference: http://www.dec.ny.gov/imsmaps/ERM/viewer.htm*)

NYSDEC water quality assessment based on water column, sediments, invertebrate tissues and macroinvertebrate community were performed on the Chadakoin River in Jamestown in three locations in 1995 and two locations in Falconer from 1989 to 2002. All three sampling locations in Jamestown were assessed as moderately impacted with elevated levels of metals and Polycyclic Aromatic

Hydrocarbons (PAHs) documented in river sediments and invertebrate tissues. Water column samples also showed copper as a parameter of concern although toxicity testing of the water column showed no significant impacts. Most sampling indicated municipal and industrial inputs as the primary stressor. The Chadakoin also appears on the Draft 2012 Section 303(d) List of Impaired Waters Requiring a TMDL/Other Strategy based on phosphorus from municipal/industrial urban runoff and aquatic toxicity from agriculture. (*Reference: http://www.dec.ny.gov/docs/water_pdf/pwlallgy07.pdf*)

During the summer of 2011 the SUNY Jamestown Community College conducted water quality sampling as the request of the Conewango Watershed Association near the bridge in the center of Falconer on two separate occasions in June. Students sampled temperature, pH, dissolved oxygen, total phosphorus, nitrates, turbidity and fecal coliform with results falling within acceptable limits of NYS DEC's Water Quality Standards. (*Reference: http://www.dec.ny.gov/regs/4590.html*)

In addition to water quality sampling, sediment sampling of the Chadakoin River was conducted as part of a Remedial Investigation Report and a follow-up supplemental Remedial Investigation Report for the D.C. Rollforms/Ingersoll-Rand Site (Hazardous Waste Site #907019) in 1998. The original report indicated that concentrations of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs) and certain metals were higher in the upstream samples, with SVOCs and PCBs more than twice as high as the sample adjacent to the site. A number of metals exceeded their specific NYSDEC sediment criteria levels, which also prompted the NYSDEC to request additional sampling adjacent to the site.

An additional six sediment samples were collected adjacent to and downstream of the site with two additional samples collected upstream of the site. Although VOCs were collected during both sampling events, none exceeded available screening criteria for VOCs as outlined in the NYSDEC Division of Fish and Wildlife Technical Guidance for Screening Contaminated Sediments. Several metals were detected in the adjacent and downstream samples at average concentrations that were lower than average upstream concentrations, thus they were subsequently excluded from the list of chemicals of potential concern (COPCs). A number of metal concentrations were less than the severe effect level (SEL) however; five COPCs (copper, iron, lead, nickel and zinc) were present in the adjacent and downstream samples at average concentrations greater than their respective SELs, indicating their potential to pose an ecological risk and possible need for remediation. Eventually a cleanup action known as an Interim Remedial Action was begun in 1998 to remove contaminated soils from the site. (*Reference: Supplemental Remedial Investigation Report, D.C. Rollforms\Ingersoll-Rand Site, Jamestown, NY, Site Code 907019, February 1999*) Additional clean-up measures were implemented in 2007 and 2008 to prevent contaminants from migrating into the Chadakoin, which included streambank restoration, fish habitat structures and riparian buffer enhancements. (*Reference: http://www.dec.ny.gov/docs/regions_pdf/dcrollfs.pdf*)

The City of Jamestown uses the Cassadaga and Conewango Aquifers as its primary water supply even though the City sits over the Jamestown Principal Aquifer. The confined nature of the Cassadaga and Conewango Aquifers make them more ideal aquifers as they have sufficient yields due to their relatively high permeability and hydraulic conductivities. The study area is served by a municipal water system that is operated by the City of Jamestown Board of Public Utilities. (*Reference: City of Jamestown, 2008. Chadakoin River Corridor Brownfield Opportunity Area Pre-Nomination Study, October 2008*)

Two portions of the study area are classified wetlands and are under both federal (U.S. Army Corps of Engineers) and state (NYSDEC) jurisdiction (Figure 2.3). The largest wetland encompasses 308.6 acres

and is located on the right bank of the Chadakoin from the Chautauqua Lake outlet downstream to approximately McCrea Point and bordered to the south by Jones and Gifford Avenue. This wetland is classified as "Class I", which is the highest rank in New York State's four class ranking system. The U.S. Fish and Wild Service identifies the wetland as palustrine, freshwater forested/shrub wetland, broad-leaved deciduous, that is seasonally flooded/saturated.

The second and smaller wetland straddles the Chadakoin River and Chadakoin Park. The Chadakoin Park may have been part of this wetland complex before it served as a municipal landfill. This 41.5 acre wetland is also classified as "Class I." These wetlands are protected by NYSDEC and USACE wetland regulations and serve an important role in absorbing and holding floodwaters from downstream populated areas (Figure 2.3). These wetlands represent the majority of accessible floodplain areas within the study area as a large portion of the Chadakoin downstream of McCrea Point has been channelized by retaining walls, rip-rap, bulkheads, and building foundations. Only in small narrow stretches does the river have access to narrow floodplains, with the majority of these areas concentrated in the eastern portion of the study area. Flooding has been mostly eliminated by the Warner Dam regulating water levels, the large upstream wetlands complex, and the building of river walls throughout large stretches of the river corridor. (*Reference: http://www.dec.ny.gov/imsmaps/ERM/viewer.htm and John Jablonski, Chautauqua Watershed Conservancy, Personal Interview, April 25, 2012*)



Figure 2.3. NYS DEC Environmental Resource Mapper showing State regulated wetlands in green

2.2.5. Rare, Threatened and Endangered (RTE) Species

A request was sent to the New York Natural Heritage Program inquiring about the presence of rare, threatened and endangered (RTE) species within or near the study area. In a response letter dated June 7, 2012, it was indicated that records of one species of State Special Concern, the Eastern spiny softshell turtle (*Apalone spinifera spinifera*), were found at or near the project site. During field work, a female Eastern spiny softshell turtle (*Apalone spinifera spinifera*) was observed near the Riverwalk Center along

the Riverwalk Trail laying eggs in a landscaped mulch area (Box 1). Several additional turtles were observed on the downstream end of the Warner Dam and further downstream in the Chadakoin River. Observation reports of the Eastern spiny softshell turtle (*Apalone spinifera spinifera*) were sent to both the NYSDEC and the New York Natural Heritage Program at their request.

Eastern spiny softshell turtle (*Apalone spinifera spinifera*)





The Eastern spiny softshell turtle seeks food by probing along the bottom or in clumps of submerged vegetation for a variety of aquatic organisms including crayfish, aquatic insects, mollusks, earthworms, tadpoles, frogs , and minnows. They will sometimes conceal themselves in mud or sand in order to ambush prey as it is swimming along the stream bottom. Mating occurs in mid to late spring depending on temperatures and water levels. The turtles excavate nests within 300 feet of the shoreline in sand or gravel substrate where there is little to no vegetation growing. Digging and excavation can last approximately 40 minutes. Nests are flask-shaped and approximately 3-5 inches in diameter and 10 inches deep. Females typically lay one clutch of about 13-21 eggs, which are rigid and heavily calcified. Incubation takes approximately 80 days. Hatchlings must emerge from nests in time to hibernate over winter under water. Basking in sunny areas in shallow water is an important behavior is this species, aiding in digestion, egg maturation, immune system response, overall growth and health – which all depend on solar energy in this cold-blooded species. On warm sunny days the turtle will emerge from the water in sheltered locations in order to bask in the sun for hours at a time. Sometimes the turtles will congregate in large numbers at favored basking locations- where they can remain close to the water and have their legs submerged.
Source:
http://www.vtfishandwildlife.com/library/reports_and_documents/nongame_and_Natural_Heritage/Recovery%20Plans/Eastern_Spiny_Softshell_Turtle_Recovery_Plan.pdf

Box 1. Natural History and Ecology of the Eastern spiny softshell turtle (Apalone spinifera spinifera)

In addition, a New York State Endangered plant, Burdick's wild leek (*Allium burdickii*), was identified in search results from the New York State Environmental Resource Mapper in wetlands LW-4 and LW-10, which encompass the bulk of the BOA Step 1 study area. Burdick's wild leek (*Allium burdickii*) is known only to occur in Chautauqua County and any harvesting or removal is prohibited. This plant was not observed during our field investigations. Additional information on these species can be found on the following websites:

- Burdick's Wild Leek (*Allium burdickii*)
  http://plants.usda.gov/java/profile?symbol=ALBU2
  http://www.dec.ny.gov/pubs/81418.html
  http://www.stlawu.edu/academics/sites/stlawu.edu.academics/files/wild_leek_conservation.pdf
- Eastern Spiny Softshell Turtle (*Apalone spinifera spinifera*)
  http://www.vtfishandwildlife.com/library/reports_and_documents/nongame_and_Natural_Heritage/Recovery%20Plans/Eastern_Spiny_Softshell_Turtle_Recovery_Plan.pdf

http://www.dnr.state.oh.us/Home/species_a_to_z/SpeciesGuideIndex/easternspinysoftshellturtle/tabid/6618/Default.aspx
http://nyfalls.com/wildlife/Wildlife-reptiles-turtles.html
http://www.dec.ny.gov/animals/44455.html

A request was also to the U.S. Fish and Wildlife Service New York Field Office regarding the presence of federal RTE species within or near the study site. The response, dated June 13, 2012, referenced their website which provided a list of federally endangered, threatened and candidate species for Chautauqua County and indicated requests be made to the New York Natural Heritage Program. The U.S. Fish and Wild Service listed three species, however, none were indicated by the New York Natural Heritage Program as occurring within or near the study site.

- Chautauqua County Federally listed RTE species
  - Bald Eagle (*Haliaeetus leucocephalus*) - Delisted, however the eagles continue to receive protection under the Bald and Golden Eagle Protection Act.
  - Clubshell (*Pleurobema clava*) - Endangered
  - Rayed Bean (*Villosa fabalis*) - Endangered

2.2.6. Riparian and Shoreline Conditions

Riparian Buffers

Riparian buffers are an important component of healthy stream and river corridors. These vegetated zones on either side of the river corridor are critical to watershed health and management. Functioning riparian corridors are composed of a diverse array of native plants including trees, shrubs and grasses, and they help reduce pollution entering waterways by slowing down and filtering runoff, while providing important habitat and shelter for native aquatic and terrestrial wildlife.

Damage incurred during development along our shorelines has led to unintended negative impacts to our streams and their associated vegetated buffers. Buffers help to reduce flooding and erosion by stabilizing shorelines and absorbing high-velocity flows by providing a gently sloping floodplain.

Riparian zones along both edges should include 85% of their area in vegetation, more than 50% of which should be taller than knee height; fescues and other turf grasses should represent less than 15% of the plants; native plants should dominate; noxious weeds should make up less than 15% of all plants growing in the riparian areas. Buffers range in size based on the size of the waterway, but a good minimum is about 100'.*



*(*http://www.ny.nrcs.usda.gov/technical/practices/pc391.html; http://www.catskillstreams.org/pdfs/Riparian%20health%20checklist.pdf; http://www.tompkins-co.org/planning/Water%20Resources/documents/Tompkins_Co_Riparian_Buffer_Protection_Agreement.pdf)*

Box 2. Ecological Significance of the Riparian Buffer

Riparian and shoreline conditions within the study area are different between the BOA Step 1 study area and the remainder of the study area. The 2.5 river miles of the Chadakoin from the Chautauqua Lake outlet to McCrea Point consist of predominately natural shoreline and riparian areas. The two Class I wetlands buffer the majority of the river and are categorized as freshwater forested/shrub wetland. As observed during June 2012 field assessments by Biohabitats, the overstory is dominated by silver maple (*Acer saccharinum*), black willow (*Salix nigra*), elm species (*Ulmus sp.*), and ash species (*Fraxinus sp.*) (Table 2.1). The understory is dominated in varying degrees by highbush blueberry (*Vaccinium corymbosum*), winterberry (*Ilex verticillata*), royal fern (*Osmunda regalis*), sensitive fern (*Onoclea sensibilis*), and skunk cabbage (*Symplocarpus foetidus*) (Figure 2.4).

The riparian buffers within the majority of this reach are extensive. Along the left bank they vary from 50-1,000 feet wide up to the rail trail corridor, except for the stretch paralleling Clifton Avenue where the homes predominately have lawn right to the water's edge. Along the right bank the buffer is even more extensive as the wetland width varies between 400 feet wide and 0.5 miles wide. Once the Chadakoin approaches Jones and Gifford Avenue the buffer begins to narrow and once the Chadakoin reaches the Chautauqua Lake Rowing Association dock the buffer is mostly nonexistent as it is reduced to turf grass.

Human impacts are limited to fill, debris and a patch of Japanese knotweed (*Fallopia japonica*)on the right bank near the Chautauqua Lake outlet; several small commercial and residential docks on the left bank where the river approaches Route 430; relic piling along the left bank across from McCrea Point; and the docks and grounds associated with McCrea Point itself.

In general, the shorelines are gently sloping, thus exposing them to seasonal and episodic inundation. These inundations, sheer size, and limited human encroachment and visitation make these wetlands important areas for amphibians and birds. The City has designated the larger wetland as a bird sanctuary. In addition, the nature of the river and shoreline interaction lends itself to large concentrations of submerged and floating aquatic vegetation, also ideal habitat for resident fish species.



Figure 2.4. Wetlands LW-10 with silver maple overstory and sensitive fern understory (Source: Biohabitats; June 12, 2012)

Table 2.1. Observed BOA Step 1 Study Area Riparian Species

Common Name	Scientific Name
silver maple	*Acer saccharinum*
black willow	*Salix nigra*
elm sp.	*Ulmus sp.*
ash sp.	*Fraxinus sp.*
highbush blueberry	*Vaccinium corymbosum*
winterberry	*Ilex verticillata*
royal fern	*Osmunda regalis*
sensitive fern	*Onoclea sensibilis*
skunk cabbage	*Symplocarpus foetidus*

As the Chadakoin River passes McCrea Point it enters a highly commercial and industrial area with narrow riparian buffers and varying degrees of river walls. Throughout the remainder of this reach buffers typically range from 0 to 50 feet wide with few exceptions (Figure 2.5). Concrete and stone walls, gabions, bulkheads, and building foundations dominate shorelines. There is minimal floodplain interaction within this reach as the river is channelized in most instances below the adjacent land. This disconnect appears to be impacting nesting turtles as they must concentrate nesting sites in the limited areas with floodplain access, which in many cases are industrial areas.



Figure 2.5. Typical example of narrow riparian corridor with hardened stream banks (Source: Biohabitats, June 12, 2013)

It was observed by Biohabitats staff that invasive and pioneer species more adapted to disturbed conditions dominate the riparian vegetation in this section of the study area (Table 2.2). Buffer canopies are typically limited to one to two tree widths, thus providing minimal ecological benefits.

Table 2.2. Observed Central and Eastern Study Area Riparian Species

Common Name	Scientific Name
elm sp.	*Ulmus sp.*
ash sp.	*Fraxinus sp.*
*honeysuckle sp.	*Lonicera sp.*
poison ivy	*Toxicodendron radicans*

silver maple	*Acer saccharinum*
grape vine	*Vitis sp.*
*multiflora rose	*Rosa multiflora*
*Norway maple	*Acer platanoides*
willow sp.	*Salix sp.*
*tree of heaven	*Ailanthus altissima*
box elder	*Acer negundo*
silky dogwood	*Cornus amomum*
cottonwood	*Populus deltoides*
sumac sp.	*Rhus sp.*
raspberry sp.	*Rubus sp.*
Virginia creeper	*Parthenocissus quinquefolia*
paper birch	*Betula papyrifera*
*crown vetch	*Securigera varia*
catalpa	*Catalpa sp.*
*buckthorn	*Rhamnus sp.*
*Japanese knotweed	*Fallopia japonica*
elderberry	*Sambucus canadensis*
sycamore	*Platanus occidentalis*
***indicates invasive species**	

2.3. Study Area Observations

Biohabitats staff conducted river corridor and upland field assessments within the study area in June 2012. Field observations are described below.

2.2.1. Zone 1: West End Natural Zone

Wetlands LW-10

- This large wetland encompasses 308.6 acres and is located on the right bank of the Chadakoin from the outlet downstream to approximately McCrea Point and bordered to the south by Jones and Gifford Avenue.
- This wetland is classified as "Class I", which is the highest rank in New York State's four class ranking system. It is palustrine in nature and classifiable as a deciduous hardwood swamp with its canopy dominated by silver maple, black willow, elm species, and ash species, with its understory dominated by highbush blueberry, winterberry, royal fern, sensitive fern, and skunk cabbage.
- The northwest portion of the wetland shows some evidence of disturbance as invasive plant species, including a small patch of Japanese knotweed. Areas of historic fill were also observed. The remainder of the wetland showed little evidence of invasive species, except the random barberry and multiflora rose along the Chadakoin itself where there was an opening in the canopy.
- The wetland understory varies between a dense fern/herbaceous and a dense shrub cover (Figure 2.6).
- Silky dogwood is present along the edge of the Chadakoin and several channels, where more light was available in addition to swamp white oak observed along the channel behind the muck farm and radio tower.
- Wildlife observed included frogs, mallards, and an osprey with its prey.

- Pedestrian access is limited to a small portion of the northwestern corner, otherwise the dense vegetation and saturated soil was extremely difficult to traverse.



Figure 2.6. Wetland LW-10 from Chadakoin River (Source: Biohabitats; June 13, 2102)

Chadakoin River: Outlet to McCrea Point

- Throughout this stretch of river, the Chadakoin is a broad, slow-moving river with relatively clear water clarity, dominated by submerged aquatic vegetation (SAV) and floating American white waterlilies (Figure 2.7).
- Class I wetlands dominate both banks; wetland LW-4 (41.5 acres) to the east, wetland LW-11 (175.2 acres) to the north, and wetland LW-10 (308.6 acres) to the south and west.
- Chautauqua Lake Rowing Association and McCrea Point are the only development/docks on the right bank throughout this reach (Figure 2.8).
- Where Clifton Avenue approaches the river on the left bank, there are several old commercial structures as well as approximately six private homes with docks.
- Just past the private docks the City's active storage yard is visible from the river and Japanese knotweed is apparent.
- Across from McCrea Point some old bulkheads, pilings, and trash are visible.
- Numerous individuals were fishing at McCrea Point.
- Boat access is available at McCrea Point, although boat traffic appears to be very limited on this reach.



Figure 2.7. Chadakoin River with American white waterlilies (Source: Biohabitats; June 13, 2012)



Figure 2.8. McCrea Point bulkheads and boat access (Source: Steve Centi, April 22, 2012)

Chadakoin Park, Rail Trail Corridor, and Washington Street Corridor

- The overall native plant health qualitatively appears to be good along the river corridor (skunk cabbage and ferns in the understory).
- Canopy species observed within the park, rail trail corridor and marsh complex included: willows, spruce, maples, walnuts in wetter areas, catalpa, oaks, elms, and several groves of aspen scattered across the open space. Understory and open fields included: redtwig dogwood, viburnum, sumac, equisetum, sedges, juncus, alder, phlox, Virginia creeper, riverbank grape, and milkweed. Skunk cabbage and ferns inhabit the spaces nearer the wetland fringe of the river on the western edge and a small grouping of sagitaria inhabit the canal.
- Some invasive plant cover was observed, although it is not extensive. Invasive species noted across the site in small patches included mugwort, some areas of common reed, and multiflora rose. In

more disturbed areas along the rail trail and the two canals coming in from the river: stilt grass, bush honeysuckle, thistles, and coltsfoot. While common reed is limited throughout Chadakoin Park and adjacent vacant spaces, in those areas where it does appear it would be wise to control now, to limit future expansion of this species

- There are many wet areas throughout Chadakoin Park, especially the southern and eastern side along Lafayette Street, that could be allowed to transition (e.g., stop mowing) to wetland habitat as a more functional extension of the existing wetland edge along the Chadakoin River and as a stronger ecological buffer for wildlife and wetlands species along this corridor (Figures 2.9, 2.10 & 2.11).



Figure 2.9. Forested wetland (western) edge along Chadakoin Park(Source: Biohabitats; June 13, 2012) .



Figure 2.10. Wetland areas within Chadakoin Park (Source: Biohabitats; June 13, 2012).



Figure 2.11. Wetland area within Chadakoin Park (Source: Biohabitats; June 13, 2012).

- An existing mown trail around the northern portion of the park could be maintained and perhaps formalized as a nature trail loop through the existing wetland, wetland fringe, and meadow complexes in the area Figures 2.12 & 2.13).



Figure 2.12. A mown trail that circulates through the northern portion of Chadakoin Park (Source: Biohabitats; June 13, 2012).



Figure 2.13. Native plants, including milkweed, along the mown trail (Source: Biohabitats; June 13, 2012).

- In this same general vicinity as the mown path, the existing meadow and wetland /marsh area could serve as a great location for a Nature/Education Center. Perhaps such a center could be co-sponsored by the Audubon Society, Peterson Institute, and the Chautauqua Watershed Conservancy as a gateway to the Chadakoin River as an ecological and passive recreation destination) - along the 18th street/17th Street corridor into the Park.
- Some of the playing fields contain areas of standing water or are completely overgrown with vegetation. These can be restored as natural areas, while existing fields not in the floodplain can be enhanced to provide active recreation space in addition to the existing playground and skatepark (Figure 2.14).



Figure 2.14. Playground, pavilion, and other active recreation areas in Chadakoin Park (Source: Biohabitats; June 13, 2012).

- Two areas in need of enhancement or restoration are two canals that are connected to the Chadakoin River. They display signs of pollution and disturbance, including invasive species and

discolored water. They also provide evidence of habitat for nesting turtles, with eggshells observed along their banks. These require further consideration in terms of enhancement, treatment, and restoration (Figures 2.15 , 2.16 & 2.17).

- The above mentioned ground pollution is most likely related to the Chadakoin Park's previous use as a landfill and current classification as a Superfund (Class 3) site #907009. Thus any future site work and excavation in the Park will need to take into account the site's classification.



Figure 2.15. Drainage canal at 17th street (Source: Biohabitats; June 13, 2012).



Figure 2.16. Vegetation along the drainage canal (Source: Biohabitats; June 13, 2012).



Figure 2.17. Native wetland vegetation in the north-south drainage ditch along the eastern edge of Chadakoin Park near Lafayette Street (Source: Biohabitats; June 13, 2012).

- Chadakoin Park appears to receive stormwater runoff from adjacent developed sites to the north and east. A large amount of surface area adjacent to the park along Washington Avenue is under use as auto storage, repair, and sales, which potentially contribute polluted stormwater runoff. Existing ditches in the park running alongside these parcels can be expanded and modified to treat stormwater runoff prior to the runoff flowing into more sensitive habitat within the park (Figure 2.18).



Figure 2.18. Stormwater runoff flowing into the park from adjacent development (Source: Biohabitats; June 13, 2012).

- 10th Street and 11th Street on the southwest side of the park appear to be underutilized. To limit fragmentation, and support ecological improvement and overall habitat patch size, consider removing impervious cover and revegetating these rights-of-ways.
- Opportunities for gateway enhancements exist at key entrances to Chadakoin Park, including vegetation enhancement, stormwater management demonstration gardens, as well as signage to make the park appear more welcoming and appealing. This is particularly true at the 12th Street entrance (Figure 2.19).



Figure 2.19. The main entry to Chadakoin Park (Source: Biohabitats; June 13, 2012).

- There are also opportunities along Washington Street to augment the streets leading west from the residential neighborhoods to the east of Washington Street with sustainable stormwater treatment and enhanced canopy and safer crossings. Currently, heavy vehicular traffic makes the street feel unsafe for bikers or pedestrians. Although sidewalks exist, there are inadequate boulevard strips to buffer the pedestrian from the travel lanes (Figures 2.20 & 2.21). Street crossings also feel precarious, even at the existing park entries. A narrowing of Washington Street, as well as the inclusion of a safer bike lane and several pedestrian crossings could mitigate this situation, and can be designed to integrate stormwater management practices, highlight native plant species within the park, and accentuate gateways to the park, the rail trail, and the internal trails and the proposed nature center. More street trees can also be planted along the corridor to provide shade and soften the street edge further to create more of a boulevard feel.



Figure 1.20. Washington Street along Chadakoin Park, wide and uninviting for pedestrians and cyclists (Source: Biohabitats; June 13, 2012).



Figure 2.21. Opposite view from above figure (Source: Biohabitats; June 13, 2012).

2.2.2. Zone 2: McCrea Point to Warner Dam

Chadakoin River

- The river is more confined in this reach due to the prevalence of steep banks and/or bulkheads dominating the riverbanks. Water clarity also reduced in this reach.
- Five bridges cross the river in this reach and a replacement crossing at Sprague Street is currently being constructed for a total of six crossings.
- Riparian vegetation transitions to more disturbance tolerant species, such as catalpa, black locust, and Norway maple with patches of Japanese knotweed. River birch clumps have also been planted along trail in a couple spots.

- On the left bank just prior to crossing under the Fairmount Avenue bridge is a parking lot with only a narrow strip of vegetation along the river's edge. On the right bank several houses back up to the river just before and after the West 3rd Street bridge. The Jamestown Public Works Department dominates the right bank at Panzarella Park and the Warner Dam. High concrete walls make up the left bank (Figure 2.22).



Figure 2.22. Approaching Panzarella Park on the rightbank (Source: Biohabitats, June 13, 2012).

- The Chadakoin widens at the Warner Dam pool with sheet piling from the old water release channel on the right bank (Figure 2.23).



Figure 2.23. Just upstream of the Warner Dam showing bulkhead at edge of channel (Source: Biohabitats, June 12, 2012).

Upland and Vacant Lands

- This corridor is mainly in use as industrial, mostly inaccessible, and provides few areas with potential for ecological restoration, including potentially unused train tracks along the north shore of the river (if letting a portion of that area be wild would be agreeable to the rail users.)

- Other areas where access is blocked (along the rails) could be allowed to grow and periodically controlled for invasive species, as access seems limited, in terms of trails, unless there's an opportunity for a trail along the rails (Figures 2.24 & 2.25). Planting milkweed and other meadow and warm season grasses in these vacant lands that were once active rails would be interesting as a pollinator and bird corridor.



Figure 2.24. Rail yard on the north shore of the Chadakoin near the BPU facility (Source: Biohabitats; June 12, 2012).



Figure 2.25. Rail yard looking east (Source: Biohabitats; June 12, 2012).

- Consider signage, and greater access to the Porter Avenue Park at Steele Street, where currently an informal connecting trail runs from the ridge down to the valley floor along Steele, switching back through a patch of woodland on a steep slope (Figure 2.26).



Figure 2.26. Trail at Porter Avenue Park (Source: Biohabitats; June 12, 2012).

- Panzarella Park is lacking diverse vegetative structure. Adding more native vegetation and a greater diversity of size and species will help strengthen this park's ecological function as a corridor patch and recreation spot (Figure 2.27). The boardwalk edge along the southern tip could use some enhancement or improvement and this might be an ideal location for floating wetlands for enhanced habitat value and educational/wildlife observance.



Figure 2.27. Panzarella Park (Source: Biohabitats; June 12, 2012).

- There is an opportunity east of the Jamestown Board of Public Utilities (BPU) facility to enhance the shoreline and upland areas, riverside trail interface with the native river shoreline

enhancement/stabilization, and perhaps some integrated stormwater management of runoff from the BPU site. The shoreline slopes into the river much more gradually at this location than elsewhere along the urbanized water front, providing an opportunity for fringe emergent wetland restoration (Figure 2.28). This should be considered a potential gateway opportunity.



Figure 2.28. Shoreline restoration and stormwater management opportunity at site near BPU facility (Source: Biohabitats; June 12, 2012).

- Another particularly interesting space is the area under the Washington Street Bridge overpass just west of the Warner Dam where stormwater from the overpass drains directly onto the pavement near the supports (Figure 2.29). Instead the stormwater could be treated in vegetated stormwater planters that help shape an interesting gathering and social space below the underpass. The planting scheme and stormwater management practices implemented at this location could be expanded through enhanced streetscape design that connects to the Chadakoin at other locations (13th Street, 17th Street, Washington Street, Main, Steele, Victoria, Foote, Allen Street, Hopkins Avenue, Blackstone Avenue, Buffalo Street) – see Section 3 for further description.



Figure 2.29. The area under the Washington Street bridge where stormwater management could be integrated in the design of a new gathering space (Source: Biohabitats; June 12, 2012).

- Native vegetation can be utilized to screen views of some of the adjacent industrial facilities along Steele Street from the Riverwalk, so the inhabitant feels more connected to the river.

2.2.3. Zone 3: Warner Dam to Winsor Street

Chadakoin River: Warner Dam to Gateway Center

- The stream becomes more freely flowing in this reach with a variety of riffle and pool habitats.
- The stream substrate consists of a mix of cobble and sand intermixed with bricks, concrete slabs and the remains of old weir structures.
- The channel remains confined between steep banks and infrastructure.
- Direct access is limited to the area nearest to the Warner Dam, between Washington and Main Streets. Downstream from this point, both banks are composed of high, concrete, brick and gabion walls that extend to within roughly 400 feet of Harrison Street, where the walls yield to a thin strip of young forest on steep banks composed of rubble (Figure 2.30). This condition continues to the Foote Avenue bridge, except where it is interrupted by the foundations of buildings, and steel sheet pile associated with the Institute Street and Foote Avenue bridges.



Figure 2.30. Looking downstream at the Riverwalk (Source: Biohabitats; June 12, 2012).

- Riparian vegetation continues to reflect urban and disturbance tolerant species such as catalpa, black locust, and Norway maple with patches of Japanese knotweed.

Upland and Vacant Lands (existing "Riverwalk" plus proposed extension to Gateway Center)

- Various types of plantings, river stabilization, facilities and furnishings dot the Riverwalk leading to some inconsistency of styles, vegetation health, shoreline function and habitat value. Turf should be limited to selected areas where picnicking and active use might be desired. A much more robust vegetated edge along the Riverwalk and river shoreline is preferred.
- Enhanced native vegetation can be utilized to screen views of some of the adjacent parking lots along Harrison Street from the Riverwalk, so the inhabitant feels more connected to the river (Figures 2.31 & 2.32).



Figure 2.31. The Riverwalk near Warner Dam (Source: Biohabitats; June 12, 2012).



Figure 2.32. The Riverwalk near Riverwalk Center (Source: Biohabitats; June 12, 2012).

- The pocket park with sculpture on the north shore near the Main Street crossing is wooded and should stand as an example for more of the shoreline along the southern edge (Figure 2.33).



Figure 2.33. Pocket park near Main Street crossing and memorial (Source: Biohabitats; June 12, 2012).

- There are a few points where the natural shoreline still exists and could offer direct access to the water. Enhancements should be designed primarily for overall ecological function but with some accessibility to the river's edge for pedestrians (Figure 2.34).



Figure 2.34. Shoreline on opposite bank where streambank restoration could not only enhance ecological function, but provide pedestrian access (Source: Biohabitats; June 12, 2012).

- Overall the vegetation palette can be diversified and expanded to include denser plantings of native species and to provide better shoreline stabilization for the river with a more natural approach.
- A turtle was observed laying her eggs in the mulch alongside the Riverwalk Center. Creation of habitat and nesting areas along this reach of the river for turtles would be beneficial.
- There are steep banks along this corridor, requiring tailored restoration solutions.
- It is clear from interactions with members of the community that there is interest and care shown for the wildlife along this corridor, most importantly the waterfowl and turtles, and therefore there is an investment in wildlife health and survival among residents that can be strengthened in terms of stewardship and care of habitat areas.
- This corridor shows indications of Jamestown's service-oriented programs and facilities with the presence of the Gateway Center, churches, and health centers – most notably the Western New York Cancer Care Center at Foote Avenue (Figures 2.35 & 2.36).



Figure 2.35. Western New York Cancer Care Center at Foote Avenue (Source: Biohabitats; June 12, 2012).



Figure 2.36. Open space where urban agriculture and therapeutic gardens could provide amenity for nearby community members including the Gateway Center and Western New York Cancer Care Center (Source: Biohabitats; June 12, 2012).

- Associated with these locations there are vacant lands and shoreline areas (particularly on the southern shore) to draw connections to enhanced green spaces to promote ecological health, outdoor access, gardening, therapeutic landscapes, green jobs training locations, occupational health etc. This is particularly noted along Victorian Avenue from Harrison to Foote and even along Water Street. The vacant lands along the river shoreline here provide ample space for an extension of the Riverwalk eastward, expanding the church's open access raised bed vegetable garden at Victoria and Institute and utilizing the vacant lots for expansion of those public access gardens, broader shoreline buffers, therapeutic gardens, and orchards if the soils were found to be safe (Figures 2.37 & 2.38). See Section 3 for further details on study area potential.



Figure 2.37. Open space along Victoria Avenue near existing St. James garden that could be expanded providing stronger buffer along river and productive landscapes for surrounding residents (Source: Biohabitats; June 12, 2012).



Figure 2.38. Community Garden (Source: Biohabitats; June 12, 2012).

- There is potential along Victoria for narrowing or discontinuing car traffic to expand shoreline vegetation and buffer at this pinch point (Figure 2.39). There is also an opportunity for integrated stormwater management along this section too, before it enters the river (Figure 2.40).



Figure 2.39. Victoria Avenue near St. James Church, looking west (Source: Biohabitats; June 12, 2012).



Figure 2.40. Victoria Avenue along the Chadakoin (Source: Biohabitats; June 12, 2012).



Figure 2.41. Expanse of paved area behind Gateway Center (Source: Biohabitats; June 12, 2012).



Figure 2.42. Shoreline along Gateway Center property (Source: Biohabitats; June 12, 2012).



Figure 2.43. Chadakoin River behind Gateway Center property (Source: Biohabitats; June 12, 2012).

- According to anecdotal accounts, a few weeks before the June 2012 fieldwork, several turtles were observed behind the Gateway Center trying to nest in the asphalt upland of the river (Figures 2.41, 2.42 & 2.43). Employees at the Gateway Center described one turtle that bloodied herself by continuously trying to dig in the hot asphalt and the workers kept trying to move her to a better spot near the natural edge of the river.
- Downstream of Foote Avenue, the left bank remains hardened and stabilized for approximately 500 feet, then gives way to a narrow degraded forest. Here the stream passes behind the Western New York Cancer Care center and a number of attached warehouses. Along the right bend behind the warehouses, the river is easily accessible from a gravel parking lot that is adjacent to, and only about five feet above the river.
- From the warehouses down to King Street, the channel is free flowing and the riparian area is composed of a thin strip of young forest on steep banks composed of rubble.

- Riparian vegetation reflects more disturbance-tolerant and invasive species where the riparian edge is narrow. However, in areas of broader floodplain forest native species become much more prevalent.

2.2.4. Zone 4: Winsor Street to Tiffany Avenue (East of Winsor Street)

Chadakoin River: Winsor Street to Tiffany Avenue

Upland and Vacant Lands

- A number of vacant lands in this portion on both the northern and southern shores that are overgrown with vegetation, some native, some not.
- Species include: catalpa, maples, oaks, green ash, ferns, skunk cabbage, willows, maples, viburnum, riverbank grape, wild ginger, jack in the pulpit, may apple, warm season grasses and meadow plants in the upland near parking areas including milkweed, sumac, cottonwood, witch hazel, walnut, limited confers including some planted spruces.
- Nonnative and invasive species include: knotweed – quite prevalent along river shoreline the further east one travels, garlic mustard, poison ivy, stilt grass, vinca, ivy.
- Many of these spaces, especially those along the river by Harrison Street before Winsor, Allen Street, Buffalo Street, Blackstone Street are candidates for management, mainly invasive species management with some shoreline restoration where there is evidence of erosion or need for stabilization. Banks need restoration and stabilization near the vacant area west of Blackstone Fabrication (Figure 2.44).



Figure 2.44. Chadakoin River near Blackstone property (Source: Biohabitats; June 12, 2012).

- A few particularly important nodes include the vacant lots near the old Dahlstrom site (southwest of Buffalo Street), the lot and parking area at the elbow of the Chadakoin to the east of the Dahlstrom site, and the areas that connect to the Hope's Chadakoin Health/Nature Trail, mainly the south shore.
- The Dahlstrom building crosses over the river at one point and is currently being demolished from the eastern edge to just beyond the western bank of the river. This provides an opportunity to remove the walls along the river, grade the banks back to provide substrate for habitat and

reconnect the river to the flood plain – all of which can vastly improve river health and visitor experience in this location (Figures 2.45, 2.46 & 2.47).



Figure 2.45. Open space near Blackstone property (Source: Biohabitats; June 12, 2012).





Figure 2.46 & 2.47. Former parking for Dahlstrom property where open space could incorporate natural breakdown of pavement (Source: Biohabitats; June 12, 2012).

- In the floodplain area to the east of Bigelow, both north and south of the river, invasive species management is recommended, as the floodplain seems functional but is in need of an invasive species management plan (Figures 2.48, 2.49 & 2.50).



Figure 2.48. Wooded open space along Bigelow that could serve as a public park near eastern edge of LWRP (Source: Biohabitats; June 12, 2012).



Figure 2.49. Floodplain conditions near Bigelow open space node (Source: Biohabitats; June 12, 2012).



Figure 2.50. Floodplain conditions along Chadakoin, on eastern edge of LWRP (Source: Biohabitats; June 12, 2012).

- The Hope Chadakoin Trail, established by Hope Window's employees in 2007, is a highlight in this zone and could be used as a reference site for other portions of this zone in terms of trail form, design, maintenance, stewardship and vegetation (Figures 2.51, 2.52 & 2.53).



Figure 2.51. Hope's Chadakoin Trail signage at entry (Source: Biohabitats; June 12, 2012).



Figure 2.52. Hope's Chadakoin Trail (Source: Biohabitats; June 12, 2012).



Figure 2.53. Healthy fern understory along the Chadakoin Trail (Source: Biohabitats; June 12, 2012).

- Brick paving along Hopkins Avenue is a reminder of earlier aesthetics and urban forms (Figure 2.54). There is evidence of brick streets throughout the project area. Restoring some of these brick roadways (Section 3 Study Area Potential) as part of streetscape improvements would support an urban ecological design aesthetic and sustainable approach through the reuse of local materials and a permeable pavement option (stormwater management).



Figure 2.54. Old brick paving along Hopkins Avenue (Source: Biohabitats; June 12, 2012).

- Other vacant lots in the vicinity of the potential nature area and trail connection at Bigelow could be used for playing fields and other active recreation (Figure 2.55). There are fields that have started to show character of meadow or successional scrub/shrub that could be maintained as such.



Figure 2.55. Open space extension from Chadakoin River buffer (Source: Biohabitats; June 12, 2012).

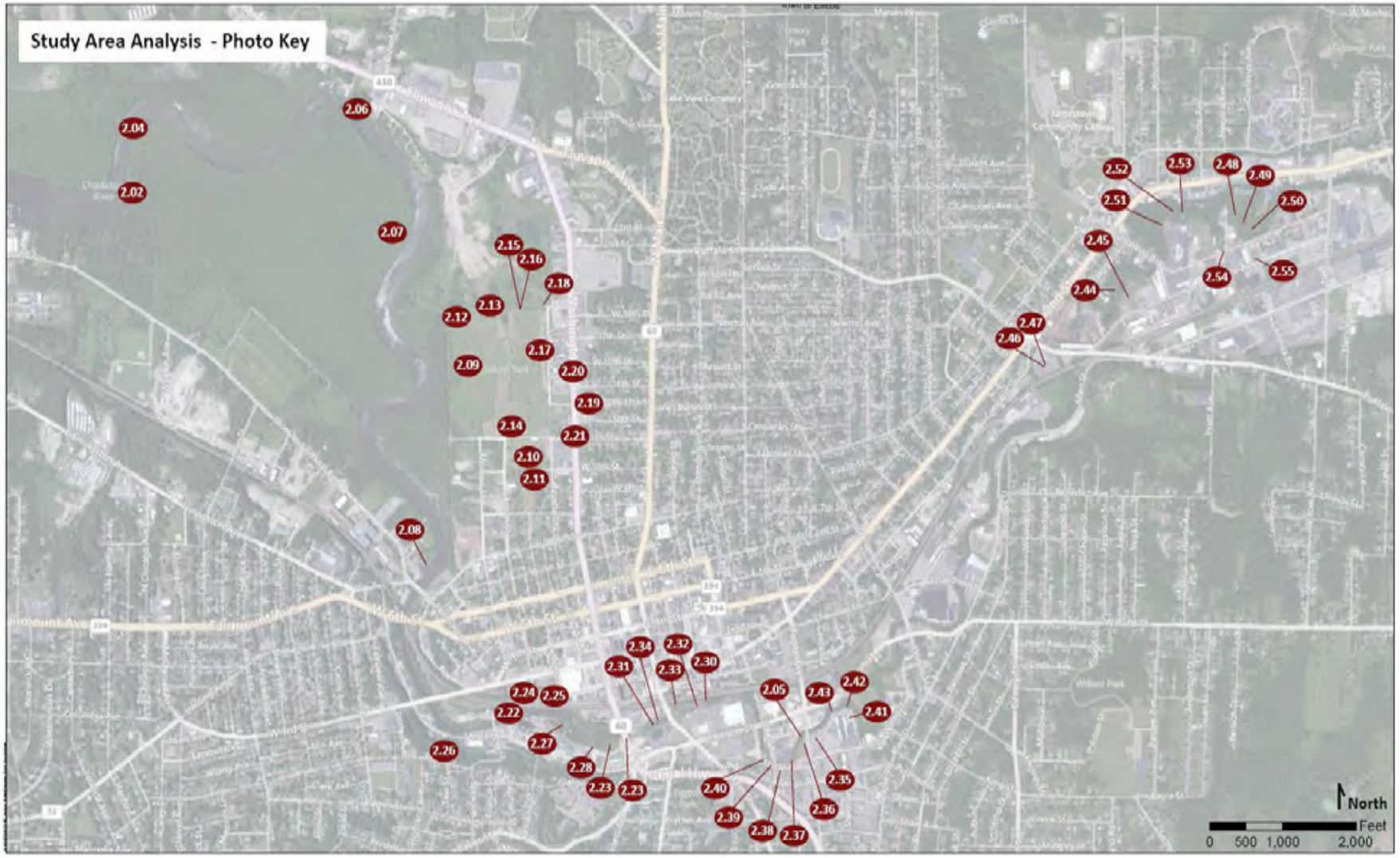


Figure 2.56. Study Area Analysis Photo Key (refer to Appendix D for higher resolution version)

2.4. Local Landscape Ecology

Jamestown was originally named "the Rapids" since the roaring Chadakoin River provided an important power supply for the early mill industry (saw mills, grist mills, and woolen mills) which helped to place the town on the map. Processed wood from these mills would be sent to towns as far away as the Ohio and Mississippi Rivers. Over time, the river became more and more polluted, and with only few exceptions attention turned away from the river as a natural resource as it became more of a dumping ground for various industries.

Despite this history there is hope for a thriving natural habitat community along the river, as well as the reintroduction of the river as a recreational and natural resource for the community. Several areas within the immediate vicinity of Jamestown provide valuable insight into the restoration and habitat potential along the Chadakoin (Figure 2.57). These sites include remnant wooded wetlands, marshes and older forest stands, as well as newer woodland in parks that host important tributary streams to the Chadakoin. Using the information below, along with the regional hydrology and landcover mapping, there are potential wildlife corridors and habitat patches, for moving to and from significant forest, forested wetland and meadow patches for forage, breeding, and other habitat needs. Each of the natural resource areas highlighted hosts impressive numbers of bird, amphibian and other wildlife species and provides habitat patches that may well be strengthened by the restoration and enhancement of the Chadakoin corridor. Because of their relative vicinity to the Chadakoin River and the broader Great Lakes/Niagara Escarpment Corridor, as well as their common landscape character traits, these local ecotypes provide indicators for the type of habitat that could be restored along the Chadakoin, providing expanded habitat corridors or ecological stepping stones. (http://www.rtpi.org/index.php?option=com_content&view=section&id=17&Itemid=166)

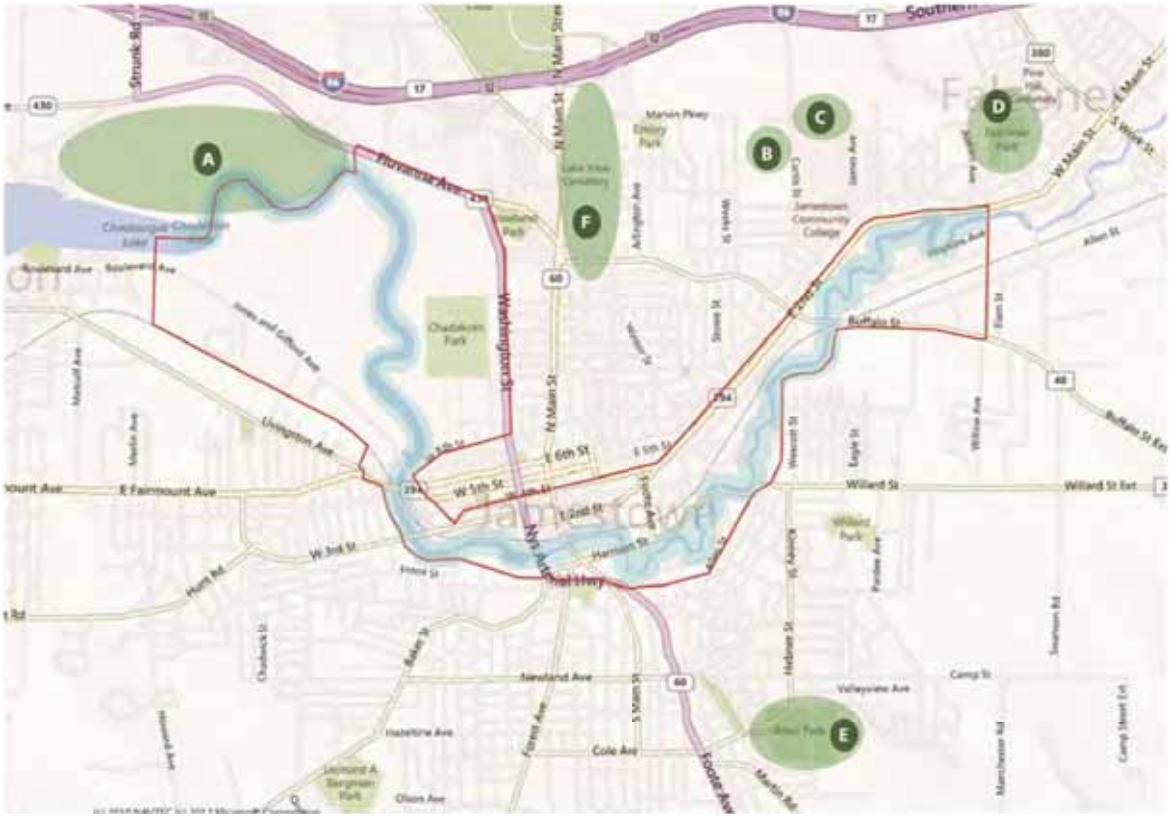


Figure 2.57. Local ecological reference sites (Map source: Bingmaps.com © 2010 NAVTEC © Microsoft Corporation)

The Chautauqua Watershed Conservancy's **Chautauqua Lake Outlet Wetland Greenway Preserve (A)**, encompasses 81 acres along the north shore of the outlet dominated by red maple and shrub swamp. A variety of ferns, as well as cardinal flower and buttonbush dominate in open areas. It provides important habitat for migratory birds and waterfowl at the southern end of Chautauqua Lake. Species that have been observed here include the pied-billed grebe, horned grebe, tundra swan, Canada goose, common merganser, hooded merganser, red-breasted merganser, common goldeneye, bufflehead, ospreys, bald eagles, great blue heron, green heron, black-crowned night heron and American bittern.

The Roger Tory Peterson Institute (B), dedicated to the legacy of ornithologist, educator, and naturalist Roger Tory Peterson (Figure 2.58). The 27-acre grounds include young stands of trees and a few large specimens of Eastern hemlock, American beech, and black cherry. Other native plants found on site include: American Hornbeam, red-osier dogwood, Northern arrowwood, serviceberry, witch Hazel, wintergreen and lowbush blueberry. The forest floor includes Christmas fern, hayscented fern, sensitive fern, cinnamon fern, and New York fern. Wildflowers in the meadow areas include blue flag, mayapple, Canada mayflower, star flower and spotted touch-me-not. Breeding snapping turtles are known to cross the site each spring. Other observed species include: smooth green snake, brown snake, common garter snake, and redbelly snake. Among the amphibians that may be found here are Northern leopard frog, bullfrog, wood frog, spring peeper, redback salamander, Eastern newt, and spotted salamander. Birds seen include: green heron, sandhill crane, great horned owl, broad-winged hawk, red-shouldered hawk, Cooper's hawk, sharpshinned hawk, American woodcock, wild turkey, ruffed grouse, Eastern phoebe, tree swallow, Eastern bluebird, pileated woodpecker, veery, wood thrush, tufted titmouse, common redpoll, purple finch, Eastern towhee, fox sparrow, brown thrasher, hooded warbler, prairie warbler, common yellowthroat, indigo bunting, and scarlettanager.



Figure 2.58. Landscape plantings and the surrounding woods at the Roger Tory Peterson Institute's visitor's center (Source: Biohabitats; June 12, 2012).

The Jamestown Community College Preserve (C), or "College Park" or the "100-acre lot," is a wooded preserve north of the main campus which provides a living learning/research lab for students as well as a recreational area for regional residents (Figure 2.59). The woodland, typified by eastern deciduous forest species – especially those in seasonally flooded and swampy areas, also hosts Moon River, a tributary to the Chadakoin River, which makes it a good reference for ecological function along wooded areas of the Chadakoin. Riffles along the creek host crayfish, mayflies, and caddisfly nymphs among

other aquatic species. Among the most prevalent species in the woodland are American beech, Black cherry, yellow birch, Eastern hemlock. Spring ephemeral herbaceous species include Spring beauty, red trillium, yellow trout lily, goldthread, Canada mayflower, and star flower. Amphibian species attracted to this habitat include: Spring peeper, wood frog, American toad, Northern leopard frog, bullfrog, spotted salamander, redback salamander, Northern two-lined salamander, and Northern Spring salamander. Other wildlife seen in the preserve include: wild turkey, spotted sandpiper, belted kingfisher, yellow warbler, common yellowthroat, mink, red fox, raccoon, muskrat, and deer.



Figure 2.59. College Park's woods and associated trails and facilities (Source: Biohabitats; June 12, 2012).

Falconer Millrace County Park (D), is a 7-acre preserve named for the old millrace located in the park, which dates back to the time when milled lumber was a major export from Jamestown to cities along the Allegheny, Ohio and Mississippi Rivers. While the prevalence of some invasive species (garlic mustard, poison ivy, and Japanese knotweed) has been noted as a problem in the wooded areas the park also features Northern Riverine Forest species including large silver maples and American sycamores. Other native species present include hickory, American basswood, box elder, slippery elm, and several large specimens of green ash and a large white oak. Large stands of native jewelweeds (spotted and pale) are also notable in this park. This park has river access and may provide further reference for trail connections along the Chadakoin River.

Allen Park (E), is considered a "small but scenic park" nestled into a mostly residential area in southern Jamestown. Minnow Creek is a prominent stream that runs along exposed shale walls in a ravine through the 35-acre park (Figure 2.60). There are a number of large Northern red oaks in the park, as well as wooded groves and shrub edges that provide important bird habitat for birds including black-capped chickadees and white-breasted nuthatches, migrating warblers and vireos, and summer breeding residents such as American robins and blue jays.



Figure 2.60. Minnow Creek runs through a wooded portion of Allen Park (Source: Biohabitats; June 12, 2012).

Lake View Cemetery (F), north of downtown Jamestown, is an 83-acre cemetery that boasts some of the oldest hardwood trees in the city. The cemetery location was chosen in 1858 for its well-drained soils. The glacially deposited sand and gravel arrived as meltwater, which flowed off a pausing or receding glacier approximately 15,000 years ago. The largest tree specimens include white oaks and red oaks. Other mature species include sugar maple, shagbark hickory, horse chestnut, Eastern hemlock, Eastern white pine, and red pine. Bird species seen in the cemetery include: American robin, blue jay, black-capped chickadee, Northern flicker, Eastern screech owl, and wood duck. A long list of sightings includes red-tailed hawk, Cooper's hawk, red-bellied woodpecker, yellow-bellied sapsucker, tree swallow, Eastern bluebird, Eastern kingbird, warbling vireo, Cape May warbler, ovenbird, bay-breasted warbler, Northern parula, Tennessee warbler, Northern mockingbird, and chipping sparrow. *(Reference: http://www.rtpi.org/index.php?option=com_content&view=section&id=17&Itemid=166)*

3. STUDY AREA POTENTIAL

3.1. A Living Infrastructure Approach

A living infrastructure approach integrates a site's rich ecological legacy with proposed redevelopment, creating a functional and sustainable landscape while cultivating thriving and complimentary human and natural resource communities.

For living infrastructure, the first step in understanding the site's potential for fostering ecological functionality is to examine the landscape's natural and hydrologic patterns (both current and historic) and the ecosystem services that could potentially be provided if the site was restored to its full ecological potential. Ecosystem services include food and raw material production, fresh water availability, treatment of stormwater runoff, air quality regulation, moderation of extreme weather events including flooding, pollination, erosion prevention and soil fertility, functional habitat, recreation space, tourism opportunity, aesthetics and a sense of place (The Economy of Ecosystems and Biodiversity, 2010).

Taking a living infrastructure approach provides a way to weave those ecosystem services into redevelopment by identifying the most important ecological nodes, restoration needs, and green corridors and connections as a framework that is responsive to ecological function and hydrologic management. Living infrastructure provides a palette of innovative practices which filter stormwater runoff, restore habitat, enhance local biodiversity, lower irrigation water demand, reduce fuel and maintenance costs, provide safer pedestrian and bicycle access routes and create new social and gathering spaces. This approach reinforces the connection between the urban fabric and the river, with a nod toward improving ecological function and water quality, and increasing green spaces, tree canopy, and productive landscapes within the river's most sensitive buffer zone on both banks.

Through this lens, Jamestown reconnects to the Chadakoin River corridor and neighboring natural areas, redefining its relationship with the resource that had once been its main economic driver, enhancing and restoring the river's ecological vitality while providing a renewed amenity for the community. Full restoration is not realistic, as the economic vitality of the city depends on mixed uses being integrated into the riparian fabric. However important ecosystem services within the living infrastructure framework provide for enhanced function and vitality of the river and its inhabitants.

3.2. Living Infrastructure Framework

A number of different opportunities for ecological restoration, urban ecological design in parks and natural spaces, and stormwater treatment begin to take shape along the Chadakoin River corridor, based on the field observations, as part of a living infrastructure framework for the BOA and LWRP study area.

Moving from west to east they vary from the natural and recreational opportunities in Chadakoin Park and the marsh/wetland complex along the western shore of the river to participatory landscapes in central city along the Riverwalk and extending to the Gateway Center. Moving further east many opportunities for restoring the river's floodplain functionality can be combined with new opportunities to invite residents along nature trails that highlight natural wooded shoreline habitat as the river regains its natural form. Table 3.1 below describes many of the practices that contributed to the overall living

infrastructure framework. Figure 3.1 shows the living infrastructure framework that can serve to inform design and redevelopment along the Chadakoin River.

Table 3.1. Living Infrastructure Practices

Practice	Description	Location
Vegetated stormwater treatment	Bioswale, bioretention, tree pits - Biofiltration uses a combination of plants and soil media in the removal of pollutants such as bacteria, nitrogen, phosphorus, heavy metals, oil and grease from stormwater runoff via adsorption, filtration, sedimentation, volatilization, ion exchange and biological decomposition. Swales can collect and convey surface stormwater runoff from streets, sidewalks and plazas. These practices are placed adjacent to impervious areas and should be designed to complement or enhance the existing landscape plantings.	Riparian buffer, streetscapes, site design
Green streets/ complete streets	Vegetated stormwater treatment integrated into streetscape improvements and design (green streets) that can be expanded to include safer pedestrian and bicycle access (complete streets). Practices may include stormwater tree pits, infiltration swales or curb bump-outs.	Perpendicular and parallel streets
Open space design & stormwater amenity	Larger-scale bioretention or wetlands can be artistically integrated into a site as naturalized water features, providing an aesthetic amenity as well as enhanced spaces for recreation and respite; planted with native vegetation that provide aesthetic accents, vibrant colors and texture, and spatial organization.	Site design
Productive landscapes	Especially in landscapes dominated by urban fill, conditioning the soil with a balance of nutrients, mycorrhizal fungi, compost, and other organic elements like biochar, promotes healthy soil function and processes. Urban agriculture can provide community space with productive lands for vegetables, fruit trees and other plants.	Site design, some areas of riparian buffer, where appropriate.
Novel aquatic habitat/ecosystem restoration practices & living shoreline restoration	Marsh/wetland plantings integrated into restored bulkheads, fish ladders, stream corridor restoration, etc.	Along the river's edge or in the river corridor
Green roofs	Lightweight vegetated roof system consisting of waterproofing material, growing medium, and specially selected plants	Roofs of new or restored buildings
Sedum rail plantings	Within rail lines, as green alternative to stone fill	Rails
Water harvesting	Harvested rainwater may be collected from most impervious areas such as rooftops or	Building Design

	plazas. Cisterns can be either above ground and integrated into the architecture of the building, or buried. Stormwater can be collected and reused for non-potable water uses within a building like flushing toilets, for landscape irrigation purposes, or for other uses like HVAC system make up water to support cooling systems.	
Wastewater treatment wetlands	Treatment of wastewater through vegetated wetland systems that are integrated into a site, as aesthetic amenity and treatment area	Site design



Figure 3.1. Living infrastructure framework for Jamestown (Source: Biohabitats, July 2012)

River Buffer Overlay Zone

As noted in Section 2, functioning riparian corridors are composed of a diverse array of native plants including trees, shrubs and grasses, which help reduce pollution that is entering waterways by slowing down and filtering runoff. They also provide important habitat and shelter for native aquatic and terrestrial wildlife. Their conservation and protection is critical to watershed health and management. The Chadakoin River's buffer width through the study area is variable in size and quality. It needs enhancement, in order to promote ecological function, water quality, and aesthetic appeal. The box below details the findings and provides context for the suggested enhancement potential described in this Section.

A riparian buffer is a permanent, naturally-vegetated area located adjacent to a stream, river, lake, pond or wetland. The wider the buffer, the more benefit it provides in terms of wildlife habitat, water temperature modulation, protection from nonpoint sources of pollution, flood mitigation, sediment removal, and bank stabilization. Ideally there would be no development within a functional riparian buffer, but along rivers like the Chadakoin where there already is a very large presence of development along the river it is suggested that the river corridor have a riparian buffer overlay zone, defining buffers along both banks of the river where living infrastructure design strategies help to improve habitat for turtles and other local wildlife, treat stormwater, increase tree canopy, and decrease paved surfaces (Figure 3.2).

The recommended buffers along the Chadakoin vary in width based on existing urban development characteristics and land use (Table 3.2). The east and west ends of the study area, Zones 1 and 4, have recommended buffer widths of 100 to 200 feet, while the central zones have recommended buffer areas of 50 to 100 feet minimum. Where possible, an enhanced wooded (vegetation only) buffer should be the preferred approach but where development is likely to occur, all new design should incorporate living infrastructure practices, as described in this section. Further detail can be provided on impacts and constraints, needs and opportunities, recommended native vegetation cover, buffer composition, and design and redevelopment techniques within the buffers.

Table 3.2. Buffer Characteristics

Zone	Location	Landcover	Character	Existing buffer widths	Proposed buffer widths for Buffer Overlay Zone
1	West End Natural Zone	wetland on both shores, more intact floodplain, some limited commercial/industrial	sloping , natural shoreline dominated by native vegetation with some limited areas of invasive species	Avg. 100' or more, limited areas of less 0- 25’	100-200'
2	McCrea Point to Warner Dam	commercial and industrial development, rail lines	steep, hardened in places; less floodplain, more areas of hardened shoreline, concrete or stone walls, gabion walls, prevalence of species associated with disturbed urban landscapes	0-50'	50-100'
3	Warner Dam to Gateway Center	downtown and commercial, limited industrial & residential	steep, hardened in places; less floodplain, more areas of hardened shoreline, concrete or stone walls,	0-50'	50-100'

			gabion walls, prevalence of species associated with disturbed urban landscapes		
4	Gateway Center to Tiffany Avenue	industrial, vacant and limited residential	naturalized shoreline, some areas hardened near old industrial sites, some areas of broad floodplain but some areas of steep slopes and with erosion	0-50'	100-200'

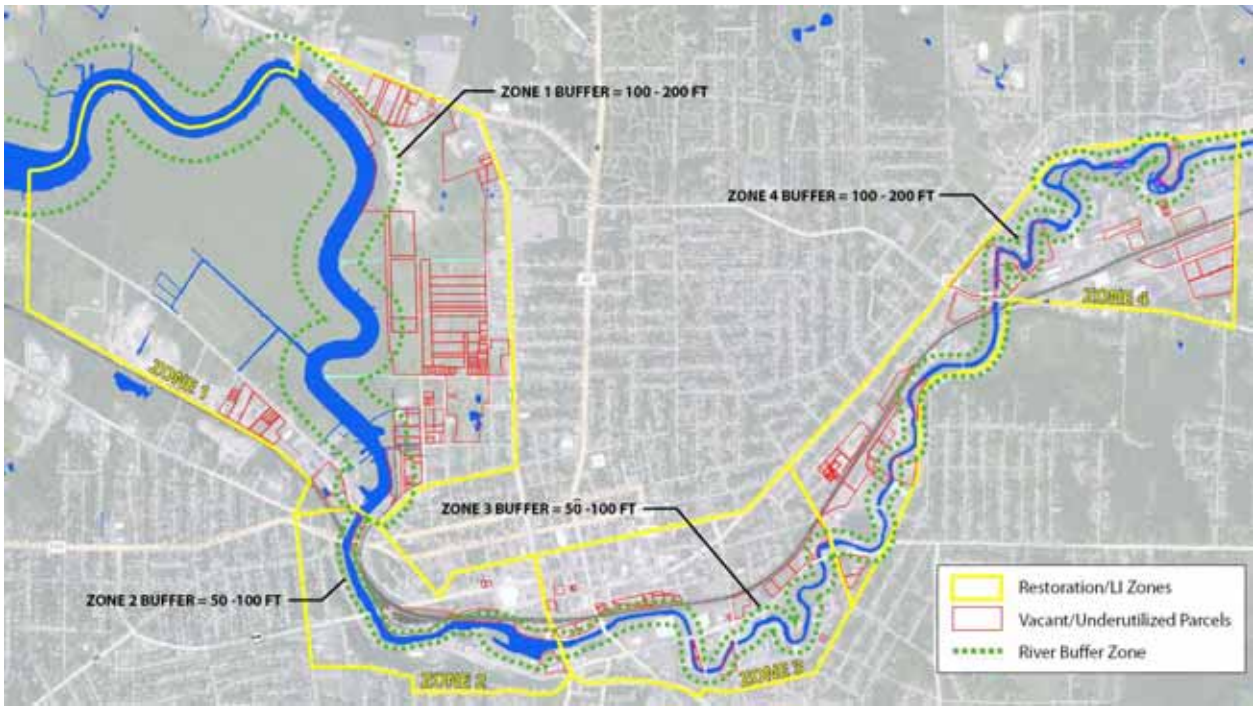


Figure 3.2. Buffer Overlay Zone Map (refer to Appendix E for a higher resolution version)

Ecological Priority Nodes Along the Chadakoin River

In order to help inform the overall regional planning efforts for the BOA and LWRP study area the following ecological priority nodes are identified as part of the suggested living infrastructure framework for Jamestown and the Chadakoin River (See Figure 3.1):

A. Chadakoin Park and Wetland/Marsh complex – combination of habitat enhancement, restoration, and active recreation with the potential inclusion of an environmental education center (partnership opportunity for Chautauqua Watershed Conservancy, Jamestown Audubon Society, and Roger Tory Peterson Institute)

B. McCrea Point – living shoreline restoration and stormwater management as needed

C. Panzarella Point and BPU site – shoreline restoration, stormwater management, native plant enhancement

D. Harrison Street to Foote Avenue permaculture/urban agriculture – productive and participatory landscapes that invite urban gardeners to help shape the landscape and enhance the riparian buffer with a series of gardens

E. Gateway Center habitat restoration and stewardship zone – shoreline restoration and impervious cover removal, potential for stewardship opportunities, productive landscapes partnered with food bank, green jobs training

F. Dahlstrom site river restoration node – restoration of riparian area floodplain and shoreline

G. Hope Windows to Bigelow Street to floodplain and upland park zone – management and enhancement of shoreline and floodplain, broadening connections of nature trail, creating new open space access areas and strengthening ecological character of river buffer, integrated stormwater management in parking lots with continued use

System Wide Recommendations

H. An expanded continuous trail system along the whole of the Chadakoin through Jamestown

I. Integrated living infrastructure practices required within the buffer zone on both banks of the river for any new development (see list of practices below)

J. Beyond the buffer, green extensions reach out from the river along major and secondary roads. These provide safe routes for pedestrians and bicyclists and create a more livable and functional urban environment with the integration of a suite of sustainable design practices. These extensions also provide a sense of entry along the river corridor as one arrives into Jamestown from the east and west.
   - Complete streets design on major roadways into and out of Jamestown including Washington Street, Main Street, 2nd Avenue, Harrison to Allen. (complete street = a street that incorporates pedestrians, bicyclists, drivers, and transit users in a safe manner, while incorporating stormwater management and native vegetation in street and curb design)
   - Green streets design along secondary streets from Chadakoin Park to the east into the neighborhoods, from the river to Allen Park, Falconer Park, and Jamestown Community College '100-Acre Lot' Woodland and the Roger Tory Peterson Institute. These sustainable streetscape designs promote ecological function along the street through integrated stormwater management and native vegetation, and improved access to green space.

Regional Implications

More broadly, a functional living infrastructure in Jamestown promotes ecological health in the region, providing improved habitat connections for migratory birds and other species that may be moving between various forest and wetland patches and along the river corridor. It also reduces the effects of urban heat island along the river providing for improved aquatic and terrestrial habitat and provides a

new recreational destination for visitors interested in ecotourism activities. Figure 3.3 shows the study area with green fingers that extend from the river corridor (along the suggested complete and green street corridors). Regional and local habitat areas that would be served include Chautauqua Lake (1), Hartson Swamp and Clay Pond Wildlife Management (2), Chautauqua Watershed Conservancy's Chautauqua Lake Outlet Wetland Greenway Preserve (3), The Roger Tory Peterson Institute (4), The Jamestown Community College Preserve (5), Falconer Millrace County Park (6), Allen Park (7), Lake View Cemetery (8), and Willard Park (9).

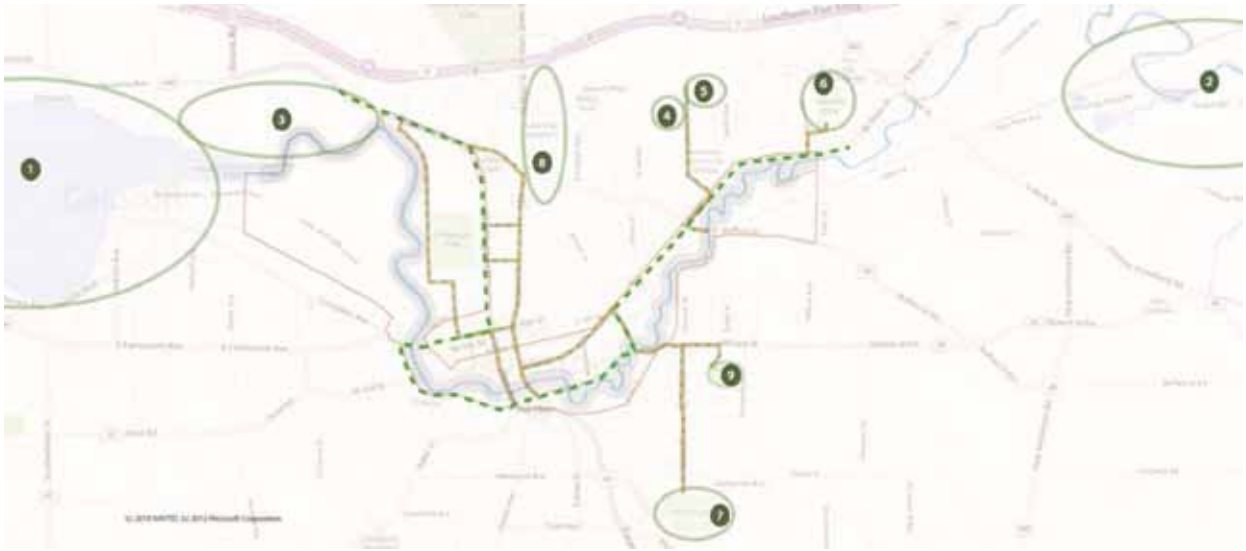


Figure 3.3. Living infrastructure promotes broad regional ecological connections (Biohabitats, July 2012)

3.3. Ecological Priorities in the Jamestown BOA and LWRP

Opportunities for ecological restoration and protection exist throughout the study area (Figure 3.4). Although the physical and land use characteristics of the zones differ greatly, the Chadakoin River is an element common to all zones, providing a basis for a holistic and comprehensive restoration strategy. The following sections provide specific priorities and recommendations regarding ecological restoration and protection within individual zones.



Figure 3.4. Jamestown ecological and living infrastructure opportunities (Source: Biohabitats July 2012)
(refer to Appendix F for a higher resolution version)

3.3.1. Zone 1: West End Natural Zone

Zone 1 is dominated by approximately 350 contiguous acres of Class I wetlands, making this the most significant ecological feature not only in Zone 1, but also within the entire study area. Combined with the adjacent expanse of additional Class 1 wetlands just outside the study area northwest of Zone 1, the wetland complex totals approximately 525 acres of palustrine forested wetland. The majority of this area is inaccessible due to dense vegetative cover and mucky soil, however the affects of humans are visible in a number of locations. In the northwest corner of wetland LW-10 there is evidence of past fill disturbances where Japanese knotweed has become established (Figure 3.5). The aggressive nature of this invasive plant with its rapid form of colonization through rhizome sections and new seedlings make this a formidable riparian invasive. At the present time the patch of knotweed is fairly small and manageable, and therefore should be addressed immediately before it spreads further downstream or to other parts of the wetland. If any significant forest openings were to occur in its vicinity it would likely become further established and could gain a significant foothold in the wetlands. Japanese knotweed was also observed on the edge of the municipal landfill where it meets the Chadakoin River. Clearing and disturbances have facilitated establishment at this location and should also be targeted for treatment before it becomes established in the river and greenway corridors. Additional invasive plant species observed in the wetlands however were limited to the river's edge on tussocks and stumps, so are less of a priority for short-term invasive species management.



Figure 3.5. Patch of Japanese knotweed found in wetland LW-10 (Source: Biohabitats, June 12, 2012)

Another key area within Zone 1 where invasive species management should be implemented is at Chadakoin Park. Most of the area west of the proposed greenway trail is classified as wetland, and judging by the existing hydrology, lands to the east were very likely wetlands prior to use of the area as a landfill and the subsequent creation of Chadakoin Park. There is some invasive cover, but not extensive. One species of note is common reed, which similar to knotweed once established, in that it can form extensive monoculture stands where eradication becomes extremely difficult. Common reed patches should be treated as soon as possible before they form extensive stands and spread into less disturbed wetland areas creating a more complicated management scenario. Per the request of the City, a separate invasive species memo was developed to address invasive species management in this Zone.

Due to its historic land use as part of the lake outlet wetland complex, coupled with the inability to support recreational activities on such saturated soils, the western portion of Chadakoin Park could be managed or restored to wetlands, fostering more passive ecologically focused forms of recreation. Perhaps the creation of a wetland boardwalk trail where park users can hike and observe wildlife could help create a new vision and purpose for the park. Other possibilities within the park include expanding the palustrine forested wetland on the western edge of the park, allowing wet areas in the south and east to naturally transition to wetland habitat, maintaining and expanding the mown trail in the northern portion of the park as a formal nature trail, and creating a nature/education center (Figure 3.6). Significant stormwater runoff from sites to the north and east of the park can be treated by retrofitting the existing ditches running parallel to said properties. Finally, the two canals connecting the park to the river can be modified to restore the local hydrology and to further enhance the wetland ecosystems. Evidence of turtle nesting habitat, fairly limited along the main stem of the Chadakoin once it passes McCrea Point, is also evident along these canals, providing an opportunity for enhanced habitat for some of the most impacted species in the region (see section 2.2.5 for more information on the Eastern spiny softshell turtle's habitat needs).



Figure 3.6. A mown trail in Chadakoin Park to be expanded, as part of recommended enhancements at the park that support ecological restoration and public access for education and passive recreation (Source: Biohabitats, June 12, 2012)

Washington Street along Chadakoin Park provides an important gateway opportunity for Jamestown. Redesign of this street as a complete street, (with narrower driving lanes, separate pedestrian and bike lanes, integrated stormwater management in tree pits, curb extensions, swales, and increased tree canopy) will improve the environmental quality and human experience of this corridor. Redesigning Washington Avenue will breathe new life into the adjacent spaces, as well as improve ecological and visual connection to the park. Additional green streets treatment (integrated stormwater management and enhanced tree canopy) along a few of the neighborhood streets that lead to the park will create further connections between residents and their valuable public spaces. (See Table 3.1 for further description of practices.)

Further downstream from Chadakoin Park there is evidence of dumping along Monroe Street, an active auto repair shop and scrap recycling facility (Figure 3.7). All of these activities are located upslope of the Chadakoin River as Monroe Street is only 475 feet from the river at its most narrow point. These facilities most likely contribute polluted stormwater runoff to the river and riparian corridor. This corridor between Monroe Street and the greenway trail falls within the 100-foot wetland adjacent area buffer as shown on the New York State Environmental Resource Mapper, thus under the Freshwater Wetlands Act is subject to NYSDEC regulations (Figure 3.8). (*Reference: http://www.dec.ny.gov/lands/4937.html*)



Figure 3.7. Dumping along the western side of Monroe Street (Source: Biohabitats, April 25, 2012)



Figure 3.8. NYSDEC Environmental Resource Mapper (screen capture) showing hatched 100-foot adjacent wetland area near McCrea Point.

Scrap recycling facilities face a multitude of pollution prevention issues including soil, groundwater, atmospheric and surface water contamination from the release of hazardous material during the salvage and recycling process. On-site contamination often occurs during vehicle disassembly and fluid drainage operations, which can quickly lead to off-site contamination. Based on its close proximity and uphill

location to the Chadakoin and a Class I wetland , it can be postulated that the facility has contributed pollutants to the watershed in the past and may be doing so today (Figure 3.9). Active scrap recycling facilities can be considered a non-compatible use within a 100-foot adjacent wetland area. Ideally the facility would be relocated elsewhere where appropriate best management practices could be installed and its negative impacts to the watershed better managed. However, relocation in most circumstances is not an option, thus stormwater best management practices (BMPs) should be implemented at the current location as it appears there are no existing stormwater management measures currently on-site and stormwater is free to move to adjacent streets and properties and eventually the Chadakoin River. Stormwater BMPs have been developed specifically for scrap recycling facilities and could be employed on-site and/or in between the facility and the Chadakoin.



Figure 3.9. Scrap recycling facility entrance (Source: Biohabitats, April 25, 2012)

Furthering the notion of the regulated 100-foot "adjacent area" wetland buffer, the Chadakoin River itself is not protected by any state or local riparian buffer ordinance. Because of the unique wetland habitat in Zone 1 and the ecosystem services provided by the wetlands and the river, a minimum 100-foot buffer, with a preferred width of 300 feet, should be established. This buffer will provide additional and complimentary nesting and forage habitat for birds and wildlife, provide travel corridors for migration and dispersal for birds and other wildlife, increase local genetic and habitat diversity, and help regulate microclimate. Although the majority of the buffer in this Zone is robust, once the Chadakoin passes south of Isabella Avenue the riparian buffer on both sides of the river shrinks drastically, averaging only 0-75 feet in width. Besides the scrap recycling facility, the most critical area in regards to buffering is the municipal yard north of Chadakoin Park, both of which lie within the 100-foot "adjacent area" wetland buffer. Japanese knotweed has also become established and activities on the property are visible from the Chadakoin River (Figure 3.10). If riparian buffer restoration efforts are initiated within this zone, Table 3.3 provides a suggested plant palette, specifically tailored to this zone and riparian conditions.



Figure 3.10. Piles of rubble at the municipal yard visible from the Chadakoin River (Source: Biohabitats, June 13, 2012)

Zone 1 Riparian Buffer Restoration Suggested Plant Palette	
Canopy	
Characteristic Species	
**Acer saccharinum*	silver maple
Platanus occidentalis	American sycamore
**Salix nigra*	black willow
**Ulmus americana*	American elm
Associates	
Acer negundo	box elder
Juglans nigra	black walnut
Larix laricina	tamarack
Populus deltoides	eastern cottonwood
Quercus bicolor	swamp white oak
Woody Understory	
Characteristic Species	
Cornus amomum	silky dogwood
Cornus sericea	red-osier dogwood
**Ilex verticillata*	winterberry
**Vaccinium corymbosum*	highbush blueberry
Associates	
Alnus serrulata	hazel alder
Alnus rugosa	speckled alder
Aronia melanocarpa	black chokeberry
Cephalanthus occidentalis	buttonbush
Clematis virginiana	Virgin's bower
Parthenocissus quinquefolia	Virginia creeper
Rosa palustris	swamp rose
Salix bebbiana	Bebb's willow
Salix discolor	pussy willow

Zone 1 Riparian Buffer Restoration Suggested Plant Palette	
Salix eriocephala	heart-leaf willow
Salix interior	sandbar willow
Salix lucida	shining willow
Salix petiolaris	meadow willow
Salix sericea	silky willow
Salix serissima	Autumn willow
Vitis riparia	riverbank grape
Herbaceous Understory	
Characteristic Species	
Buphthalmum salicifolium	ox-eye
Carex emoryi	Emory's sedge
Eupatorium purpureum	joe-pye weed
**Onoclea sensibilis*	sensitive fern
**Osmunda regalis*	royal fern
Solidago gigantea	smooth goldenrod
Symphyotrichum lanceolatum	white panicled aster
**Symplocarpus foetidus*	skunk cabbage
Verbesina alternifolia	wingstem
Associates	
Cinna arundinacea	sweet woodreed
Elymus virginicus	Virginia wildrye
Impatiens capensis	jewelweed
Laportea Canadensis	Canadian woodnettle
Leersia virginica	whitegrass
Muhlenbergia frondosa	wirestem muhly
Pilea pumila	Canadian clearweed
Teurium canadense	Canada germander
*species dominating existing wetlands	

Table 3.3. Suggested riparian buffer restoration plant palette for Zone 1.

In addition to providing and protecting habitat for birds and wildlife, McCrea Point offers an excellent opportunity to increase aquatic habit through the creation of living shorelines and incorporating fishing friendly structures to existing bulkheads. Riprapped, bulkheaded, mown, and eroding streambanks can be replaced with living shorelines, which use native plants, including grasses, trees and shrubs to provide stabilization while also adding beauty and habitat (Figure 3.11). Rather than weaken over time, these ecosystems get stronger, offering ongoing protection as well as habitat, water quality improvement and beauty. Fishing access areas could also be incorporated into the living shorelines, as McCrea Point appears to be the most popular fishing area in Jamestown. Where bulkheads are to remain, living seawall habitats techniques, such as steel/mesh baskets, can be anchored to the structure and planted with submerged or emergent vegetation to provide cover and support an invertebrate food base for fish.



Figure 3.11. Eroding mown banks at McCrea Point where living shorelines could be utilized (Source: Biohabitats, April 25, 2012)

3.3.2. Zone 2: McCrea Point to Warner Dam

As the Chadakoin River passes McCrea Point and enters Zone 2, not only does the river itself narrow considerably, but also so does its riparian vegetated buffer. The river is crossed by multiple bridges with Steele Street encroaching and paralleling the right bank while the Western NY and PA rail line parallels the left bank. Where present, the existing riparian buffer constitutes only a one to two tree width canopy or approximately 50 feet due to the close proximity of structures and infrastructure to the river. Although a 100-foot riparian buffer would be preferred, given the existing urban conditions establishing a 50-foot buffer is more realistic and feasible as a minimum width. Although this size buffer will not provide ideal wildlife habitat, it will provide some bank stabilization, aquatic habitat, water temperature modification, as well as, reductions in sediment loading. Although structures currently exist within the 50-foot buffer, the establishment of a regulated city buffer ordinance could limit future encroachment and provide requirements for a native vegetation zone, shoreline treatments, approved native plant species, and turtle nesting habitat. Table 3.4 provides a suggested list of appropriate plant species for the more urban riparian conditions and steep banks of Zones 2 and 3.

Zones 2 and 3Riparian Buffer Suggested Plant Palette	
Canopy	
Characteristic Species	
Acer rubrum	red maple
Acer saccharinum	silver maple
Carya ovata	shagbark hickory
Liriodendron tulipifera	tulip tree
Platanus occidentalis	American sycamore
Pinus strobes	white pine
Populus deltoides	eastern cottonwood
Quercus bicolor	swamp white oak
Tilia americana	American basswood
Associates	

Zones 2 and 3Riparian Buffer Suggested Plant Palette	
Betula populifolia	grey birch
Carya cordiformis	bitternut hickory
Juglans cinerea	butternut
Juglans nigra	black walnut
Larix laricina	tamarack
Nyssa sylvatica	black gum
Quercus macrocarpa	burr oak
Quercus palustris	pin oak
Ulmus americana	American elm
Woody Understory	
Alnus serrulata	hazel alder
Alnus rugosa	speckled alder
Amelanchier canadensis	Allegheny serviceberry
Carpinus caroliniana	ironwood
Cercis Canadensis	Eastern redbud
Clematis virginiana	Virgin's bower
Cornus amomum	silky dogwood
Cornus florida	flowering dogwood
Cornus sericea	red-osier dogwood
Hamamelis virginiana	witchhazel
Ilex verticillata	winterberry
Lindera benzoin	spicebush
Myrica pensylvanica	Northern bayberry
Parthenocissus quinquefolia	Virginia creeper
Physocarpus opulifolius	ninebark
Salix bebbiana	Bebb's willow
Salix discolor	pussy willow
Sambucus canadensis	American elderberry
Sassafras albidum	sassafras
Herbaceous Understory	
Ageratina altissima	white snakeroot
Arisaema dracontium	greendragon
Boehmeria cylindrica	false nettle
Impatiens capensis	spotted jewelweed
Impatiens pallida	pale touch-me-not
Laportea canadensis	Canadian wood nettle
Lobelia cardinalis	cardinal flower
Lobelia siphilitica	great blue lobelia
Onoclea sensibilis	sensitive fern
Peltandra virginica	green arrow arum
Polygonum virginianum	Virginia knotweed
Saururus cernuus	lizard's tail
Symphyotrichum puniceus	purple stem aster

Table 3.4. Suggested riparian buffer restoration plant palette for Zones 2 and 3.

The rails are a prominent part of the northern shore through this zone and therefore access and ecological restoration potential is limited. However, by working with the rail users and owners there may be ways to retrofit the rails including low plantings (e.g., sedum) between the rails. If there are portions of the rails or associated rail yards that are no longer in use there may be a way to plant them for pollinator habitat (Figure 3.12).



Figure 3.12. Overgrown area along the rail line on the north shore of the Chadakoin near the BPU plant (Source: Biohabitats, June 12, 2012)

In conjunction with riparian buffer protection, Zone 2 offers a number of opportunities for buffer restoration, specifically downstream of the BPU facility. Panzarella Park and the Riverwalk present opportunities for living shorelines. The shoreline between the Riverwalk and the Chadakoin River, just downstream of Panzarella Park, is very narrow, mown, and shows signs of erosion (Figure 3.13). These areas not only provide excellent opportunities for restoration, but for environmental education as well. Interpretive signage, informational kiosks or maps could provide insight into the history of the Chadakoin, the importance of watershed protection, and the resident Eastern spiny softshell turtles that inhabit the area.



Figure 3.13. Opportunities for living shoreline restoration along the Riverwalk (Source: Biohabitats, June 12. 2012)

Pockets for fishing and kayak/canoe access could be incorporated into the native plantings and additional plantings could be used to screen adjacent industrial and business activities from the Riverwalk (Figure 3.14). Stormwater management could also be incorporated to capture runoff from the neighboring BPU parking and storage lots.



Figure 3.14. Area along the Riverwalk where increased native vegetation could be added to provide amenity, riparian habitat and some screening (Source: Biohabitats, June 12, 2012)

Similar to McCrea Point, the bulkhead at Panzarella Park provides an excellent opportunity to hang or anchor additional baskets that can be planted with submerged or emergent vegetation to provide cover and foraging opportunities.

3.3.3. Zone 3: Warner Dam to Gateway Center

The narrow, confined riparian buffers in Zone 2 continue throughout the majority of Zone 3. Like Zone 2, a 100-foot riparian buffer would be preferred. Given the existing urban conditions establishing a 50-foot buffer is more realistic and feasible as a minimum width, see Table 3.4 for suggest plant species. Establishing a buffer will not only improve water quality, but also provide wildlife habitat critical to the breeding and survival of the Eastern spiny softshell turtle, a species of special concern in New York. During fieldwork a spiny softshell was observed laying eggs just off the Riverwalk near Gateway Center in a mulch bed, and many other anecdotal nesting attempts were reported by others.

Natural shoreline and buffer access throughout this reach is fairly limited, thus turtles are forced to nest in less than ideal locations or congregate in areas with easier floodplain access although nesting substrate may not be ideal (Figure 3.15). Active turtle breeding areas should be identified and buffers should be expanded in these areas if needed.



Figure 3.15. Typical high riverwalls preventing turtle access to floodplain (Source: Biohabitats, June 12, 2012)

The area directly behind the Gateway Center, along the river, may be an ideal location to work with the landowner to restore the shoreline, create more turtle habitat and increase green space through integrated stormwater management (Figures 3.16 and 3.17). This location is ideal for green jobs training associated with shoreline and habitat restoration, as well as ample opportunity for stewardship, and education associated with turtle and other important riverine habitat.



Figure 3.16. Narrow vegetated shoreline edge along the Chadakoin behind the Gateway Center (Source: Biohabitats, June 12, 2012)



Figure 3.17. The riparian shoreline behind the Gateway Center, where according to local residents a few dozen soft shell turtles tried to lay eggs unsuccessfully in the asphalt (Source: Biohabitats, June 12, 2012)

Just to the west of Foote Avenue there is ample opportunity on vacant/underutilized land to create an expanded urban agriculture/permaculture/productive garden space that ties into an extension of the Riverwalk from its current end point at Harrison Avenue, mainly on the south shore of the river (Figure 3.18). A portion of the river this corridor along Victoria Avenue is channelized and lacks a vegetated buffer. An extension of the Riverwalk could bring native vegetation along a new trail, expanded pedestrian access, and better connections to the river from the neighborhood to the South. The existing expanse of green space invites an expansion of the "Free Garden" concept started by St. James Church at the corner of Victoria Avenue. This space, along the space on Foote Avenue, across from the Cancer Care Center of Western New York could provide ample space for raised bed gardening, meditative gardens, even an orchard if the soils are suitable. Stormwater management could be integrated and an

increased tree cover along Foote could provide further benefit for the river's health and function, as well as the surrounding neighborhood. This expanded urban agriculture and participatory landscape node will be an important habitat location for pollinators (e.g., butterflies and bees) and birds as well.



Figure 3.18. Open space where gardens and enhanced shoreline tree plantings could be integrated (Source: Biohabitats, June 12, 2012)

The existing vacant/underutilized lots along Harrison to the east of Foote are a combination of scrub shrub, meadow and riparian woodland remnants (northern shore of the river). These lots should be preserved and managed as habitat nodes with some limited picnicking or viewpoint access areas for passing cyclists along Harrison. Shoreline and floodplain conditions along this portion of the river should be enhanced, with a combination of invasive species management, shoreline stabilization and native vegetative plantings as needed. Overall access is limited to the river, but one or two access points could be identified as overlooks and wildlife viewing areas. The meadow here will be important as pollinator habitat (Figure 3.19).



Figure 3.19. The meadow in an underutilized lot along Harrison (Source: Biohabitats, June 12, 2012)

3.3.4. Zone 4: Gateway Center to Tiffany Avenue (East of Winsor Street)

Within Zone 4 river access is limited because of active use on both north and south shores. Where access is available or where there is evidence of steep slopes along portions of southern shore, stabilization is recommended (Figure 3.20). There is a parcel identified as vacant/underutilized south of Benedict Avenue that should be conserved as an ecological node and restored as wooded riparian habitat.



Figure 3.20. Shoreline requires restoration and stabilization at this sensitive point south of River Street (Source: Biohabitats, June 12, 2012)

The Zone 4 riparian buffer should be a minimum of 100 feet, with a preferred width of 200 feet. Within this buffer riparian woodland plantings and other native vegetative plantings are recommended for stabilization and structure as well as habitat. Where redevelopment is planned or where existing development is slated to remain, living infrastructure practices should be incorporated, to enhance and increase tree and vegetative cover and promote water quality treatment. Although Zone 4 includes similar urban buffer conditions as Zones 2 and 3, it does include a number of broad floodplain features more representative of Zone 1, thus the suggested plant palette includes a number of species from both palettes (Table 3.5).

Zone4 Riparian Buffer Suggested Plant Palette	
Canopy	
Characteristic Species	
Acer rubrum	red maple
Acer saccharinum	silver maple
Carya ovata	shagbark hickory
Liriodendron tulipifera	tulip tree
Platanus occidentalis	American sycamore
Pinus strobes	white pine
Populus deltoides	eastern cottonwood
Quercus bicolor	swamp white oak
Tilia americana	American basswood

Zone4 Riparian Buffer Suggested Plant Palette	
Associates	
Acer negundo	box elder
Betula populifolia	grey birch
Carya cordiformis	bitternut hickory
Juglans cinerea	butternut
Juglans nigra	black walnut
Larix laricina	tamarack
Nyssa sylvatica	black gum
Quercus macrocarpa	burr oak
Quercus palustris	pin oak
Salix nigra	black willow
Ulmus americana	American elm
Woody Understory	
Alnus serrulata	hazel alder
Alnus rugosa	speckled alder
Amelanchier canadensis	Allegheny serviceberry
Aronia melanocarpa	black chokeberry
Carpinus caroliniana	ironwood
Cephalanthus occidentalis	buttonbush
Cercis Canadensis	Eastern redbud
Clematis virginiana	Virgin's bower
Cornus amomum	silky dogwood
Cornus florida	flowering dogwood
Cornus sericea	red-osier dogwood
Hamamelis virginiana	witchhazel
Ilex verticillata	winterberry
Lindera benzoin	spicebush
Myrica pensylvanica	Northern bayberry
Parthenocissus quinquefolia	Virginia creeper
Physocarpus opulifolius	ninebark
Rosa palustris	swamp rose
Salix bebbiana	Bebb's willow
Salix discolor	pussy willow
Salix sericea	silky willow
Sambucus canadensis	American elderberry
Sassafras albidum	sassafras
Vaccinium corymbosum	highbush blueberry
Vitis riparia	riverbank grape
Herbaceous Understory	
Ageratina altissima	white snakeroot
Arisaema dracontium	greendragon
Boehmeria cylindrica	false nettle
Buphthalmum salicifolium	ox-eye
Carex emoryi	Emory's sedge
Eupatorium purpureum	joe-pye weed

Zone4 Riparian Buffer Suggested Plant Palette	
Impatiens capensis	spotted jewelweed
Impatiens pallida	pale touch-me-not
Laportea canadensis	Canadian wood nettle
Lobelia cardinalis	cardinal flower
Lobelia siphilitica	great blue lobelia
Onoclea sensibilis	sensitive fern
Osmunda regalis	royal fern
Peltandra virginica	green arrow arum
Polygonum virginianum	Virginia knotweed
Saururus cernuus	lizard's tail
Solidago gigantea	smooth goldenrod
Symphyotrichum lanceolatum	white panicled aster
Symphyotrichum puniceus	purple stem aster
Symplocarpus foetidus	skunk cabbage
Verbesina alternifolia	wingstem
Associates	
Arisaema triphyllum	jack in the pulpit
Asarum canadense	wild ginger
Cinna arundinacea	sweet woodreed
Elymus virginicus	Virginia wildrye
Impatiens capensis	jewelweed
Laportea Canadensis	Canadian woodnettle
Leersia virginica	whitegrass
Muhlenbergia frondosa	wirestem muhly
Phodophyllum peltatum	mayapple
Pilea pumila	Canadian clearweed
Teurium canadense	Canada germander

Table 3.5. Suggest riparian buffer restoration plant palette for Zone 4.

One stretch in particular of the Chadakoin presents a prime opportunity to improve stream channel morphology and restore riparian habitat, from immediately downstream of the Dahlstrom Dam to the downstream end of the vacant Dahlstrom Factory Complex, which currently function as a barrier and a bottleneck, impairing the river's health.

Along this reach, the river is channelized and runs approximately 850 feet straight through a remnant raceway. At the end of the raceway, the flow reconnects to the downstream reaches of the Chadakoin, characterized by a more natural meandering flowpath with gently sloping banks and vegetated floodplain. Conversely, immediately upstream of the dam, the river is constricted by steeper banks with roads and development very close to the top of bank. In addition, the dam's approximate 6-foot height makes it a barrier to fish passage. The modifications to the river, which served to drive the industrial activities at the Dahlstrom complex, now serve as impairments to the Chadakoin.

At the time of this report, the Dahlstrom building was under demolition. Collapsing portions of the structure over and immediately flanking the river have been or are to be removed. In addition to removing the building, it would benefit the river to also remove the channel walls, grade the banks back at a minimum 3:1 slope and revegetate to a minimum of 100 feet from the river's edge. In addition, fish

passage could be attained at the dam (Figure 3.21)by gradually raising the channel invert immediately downstream of the dam via a fish ladder, rock ramp, or step pool structure. The dam could also be removed partially or entirely, potentially opening this section of river to passage by personal watercraft. This could have the dual impact of mitigating stream impairments to the quality habitat immediately downstream in Zone 4 by slowing and extending the flow, while also allowing aquatic life to migrate beyond this barrier.



Figure 3.21. The Dahlstrom Dam, located just upstream of the Dahlstrom facilities. (Source: Steve Centi, April 22, 2012)

In addition to channel restoration near the former Dahlstrom location, there is potential for a shoreline and floodplain restoration along the Chadakoin that could also incorporate mixed used development. Existing woodland along the river corridor should remain with some invasive species management recommended. A new nature trail through the property that connects to the bikeway along East Second Street/ Route 394 (New York State Bicycle Route 17) will help extend access to the river and the new continuous Jamestown Chadakoin River Trail. The open parking lot that has begun to revert to natural vegetation could become a public open space that incorporates the natural breakdown of the pavement as a design feature that explores the interface between historic development footprint the re-emerging ecology (Figures 3.22, 3.23 and 3.24).



Figure 3.22. The existing conditions at the Dahlstrom parking lot (Source: Biohabitats, June 12, 2012)



Figure 3.23. Rubble meadow at Washington Avenue Green, along the Delaware River in Philadelphia, PA (Source: Biohabitats, 2012)



Figure 3.24. Dendritic decay garden at Washington Avenue Green, Philadelphia, PA (Source: Biohabitats, 2012)

East of the Dahlstrom property the shoreline needs stabilization and restoration, as it rounds the bend, where there is a large outfall from the south. The shoreline requires stabilization and restoration and there is trash collecting at this bend in the river that needs to be removed (Figure 3.25). The existing upland open space (meadow) and parking properties near the Blackstone property should be maintained and restored as a combination of upland meadow and riparian woods (Figure 3.26). A new nature trail through this would help connect and expand on the existing Hope Window's Chadakoin trail just to the east.



Figure 3.25. Trash and debris along the Chadakoin east of the Dahlstrom property (Source: Biohabitats, June 12, 2012)



Figure 3.26. Parking and open space to the west of the Blackstone property along the river corridor (Source: Biohabitats, June 12, 2012)

The Hope shoreline property and nature trail would continue to be maintained as a functioning riverine corridor with integrated nature trail and access could be afforded to users from the community (Figure 3.27).



Figure 3.27. Hope Chadakoin Trail (Source: Biohabitats, June 12, 2012)

East of the Hope property the trail would continue along the riparian woodland behind the VFW to Bigelow Street, where a new park would serve as an end node of the expanded Jamestown Chadakoin River Trail system (Figure 3.28). This ecological pocket park would be maintained as woodland and floodplain with limited access to the river at this sensitive location. The riverbend to the east of Bigelow should remain floodplain with further management of invasive species and collection of trash (Figure 3.29).



Figure 3.28. Wooded open space at Bigelow across from the VFW (Source: Biohabitats, June 12, 2012)



Figure 3.29. Riverbend floodplain (Source: Biohabitats, June 12, 2012)

Upland of the riverbend floodplain there are two vacant lots that should be included as expanded buffer space, planted in riparian vegetation and maintained as park space (Figure 3.30). There is a grove of aspens on one of the lots that could use management and enhancement.



Figure 3.30. Underutilized lot south of Bigelow, which could incorporate new park. Source: Biohabitats; June 12, 2012