

## Appendix E: Aquatic Studies

## Appendix E-1

### East River Preserve Parmelee Brook Water Quality Protection – December 2010

The benthic community of Parmelee Brook shows a wide range of diversity with each of the major feeding groups represented by some of the collected organisms. The mix of filter feeders, scrapers and predators gives credence to a well balanced ecosystem that can sustain these aquatic insects. Many of these larvae will provide a food source to young trout and other fish in the stream. Several of the collected organisms are sensitive to water pollution, exhibited by their low tolerance scores of 1 and 0 on the Hilsenhoff Biotic Index. This Index ranks all aquatic organisms from 0 – 10 in terms of their sensitivities to organic pollutants. Any organisms in the 0 – 2 range will not be present unless a water body possesses optimal water quality including high dissolved oxygen levels and cooler temperatures. The presence of some larger predator insects is valuable to the ecosystem but also to humans and other terrestrial organisms due to their feeding habits. These predators consume much of their diet in the form of mosquito and other biting fly larvae in the stream ecosystem. The dobsonfly and dragonfly larvae found in the stream are a natural check on the populations of these pest species. Even after hatching from the stream into their adult form, dragonflies will continue to consume many times their body weight in adult mosquitoes over their lifespan.

To continue to protect this well balanced stream ecosystem, it will be essential to maintain clean, clear, fast river flows to optimize potential dissolved oxygen levels. Maintaining tree cover to shade the water body is an important first step and can be obtained through the recognition of adequate buffer zones along the length of the water body. A valuable second step is to maintain the natural land cover of the watershed; much of the river characteristics are determined by the immediate land use surrounding the stream. Forested, undeveloped areas allow for infiltration of precipitation events, which provides several benefits to the water body. As the infiltrated water flows through the ground, many potential pollutants will bond with soil particles and in effect be 'scrubbed' from the groundwater. The rough terrain will also prevent localized sheet flow events that can cause scouring in the river bottom by reducing the velocity of any surface flows as they enter the stream. Finally, by avoiding any hot pavements or asphalt, the surface water flows will remain cooler and therefore not increase the water temperature of the stream, which would reduce the dissolved oxygen levels that all aquatic organisms rely upon for breathing.

Chris Sullivan  
Planning & Standards Division  
Bureau of Water Protection and Land Reuse  
CT Department of Environmental Protection  
79 Elm Street  
Hartford, CT 06106

## Appendix E-2

# East River Preserve Aquatic Resources Management Plan

Stephen Gephard

CT DEP Inland Fisheries Division

August 26, 2009

### I. Characteristics of the Aquatic Resources on the Preserve

#### 1. *The East River*

Habitat: The entire western boundary of the Preserve is created by the East River, which runs more-or-less north-south. The river has a watershed size of 20.044 square miles (Nosal 1997) and begins in the northern portion of Guilford as a series of brooks. The Southcentral Connecticut Regional Water Authority operates a minor out-of-basin diversion for drinking water at Iron Stream, a headwater tributary, but the stream flow of the watershed is otherwise unregulated. There are a handful of dams upstream of the Preserve, but these are obsolete mill or farm ponds that are now either unmanaged or managed for aesthetics and recreation. Just outside of the Preserve to the north are a series of lakes that were former gravel pits. These lakes are now surrounded by homes and landscaped. They are hydrologically connected to the East River and two small brooks within the Preserve flow into them.

There are no municipal or industrial discharges into the river upstream or downstream of the Preserve and water quality appears to be excellent but the stream was not assessed in the 2008 assessment of impaired waters in Connecticut (Wingfield 2008). Upstream of the Preserve the watershed can be described as residential/rural/open space. Downstream of the Preserve, there are extensive saltwater marshes in excellent condition. Near U.S. Route 1 and the mouth of the river there are commercial marinas and a number of commercial properties,

The portion of the East River within the Preserve is highly significant when viewed from a watershed perspective. The head-of-tide is located at the northwest corner of the Preserve and the upstream terminus of saltwater intrusion is located near the midpoint of the Preserve's western boundary. These two features greatly influence the distribution of plant and animal species along the East River. It is also very noteworthy that the areas upstream and downstream of the head-of-tide are undeveloped. Heads-of-tides in most Connecticut streams were developed for mills, ice ponds, shipbuilding, and fisheries facilities. The relatively broad valley, gentle gradient, and absence of a significant fall line in the East River apparently made it less attractive for such development and have resulted in high quality aquatic habitat to the present-day. Riparian woodlands are undisturbed and provide a nearly bank-to-bank overhead canopy for the river throughout the upper half of the Preserve. Stands of invasive aquatic plants are uncommon. The streambed substrate is in excellent condition with abundant gravel, cobbles, and boulders and relatively little silt and

muck that characterize the tidal portions of most coastal streams in Connecticut. Woody debris in the channel, important for fish habitat and nutrients, is common.

Fish Community: The East River estuary has not been sampled by professional fish biologists. However, Stephen Gephard (CTDEP/Inland Fisheries Division, Old Lyme, CT, pers. comm.) suggests that the estuarine fish community is typical of small coastal Connecticut streams and includes various species of killifish and sticklebacks and likely seasonal visitations by flatfishes, juvenile menhaden, tomcod, crevalle jack, striped bass, and juvenile bluefish. The portion of the watershed upstream of the Preserve is known to support a varied freshwater fish community that includes native cyprinids (minnows), white sucker, redbreast sunfish, pumpkinseed, chain pickerel, yellow perch, brown bullhead and brook trout (Hagstrom et al. 1991). Non-native largemouth bass, brown trout, and rainbow trout also exist, although natural reproduction of rainbow trout is unlikely to occur. Any of these species are likely to be observed in the upper portion of the Preserve from time to time.

Gephard performed a snorkeling survey from Sullivan Road to Bearhouse Hill Road on July 31, 2009 and observed schools of common shiners (*Luxilus cornutus*) and fallfish (*Semotilus corporalis*) and a few redbreast sunfish (*Lepomis auritus*). Nests of redbreast sunfish and perhaps other unobserved centrarchids were seen. At this time, the typical summer fish community was established and such summer communities in Connecticut streams are much less diverse than the fish communities encountered during the spring months (Stephen Gephard, CTDEP/Inland Fisheries Division, Old Lyme, CT, pers. comm.).

Perhaps the most significant fishery resource of the East River is its diadromous fish runs. The stream supports annual runs of alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), sea lamprey (*Petromyzon marinus*), sea-run brown trout (*Salmo trutta*), and American eel (*Anguilla rostrata*) (CTDEP/Inland Fisheries Division, unpublished data; Hagstrom et al. 1991). The last species is catadromous and a new wave of young-of-year colonizes the river each spring and individuals are able to live within the watershed for up to 20 years before migrating back to the sea to spawn. Few streams west of the Connecticut River in Connecticut support sea lamprey runs and the presence of the run in the East River is ecologically significant. Both the anadromous alewife and blueback herring (collectively known as river herring) have been in sharp decline since the mid-1980s and the State of Connecticut DEP has been working to protect runs and restore runs upstream of artificial barriers. The first two dams on the river (Capello Pond and Lower Guilford Lake) have functioning fishways due to the efforts of the DEP and two private homeowners' associations. These fishways have restored the runs to additional upstream miles of habitat and increased run sizes have resulted. The stream has been the focus of fisheries research by scientists at the Silvio Conte Anadromous Fisheries Research Center in Turners Falls, MA (Franklin et al. 2009). All of these factors make the fish runs in the East River important and ecologically significant (Stephen Gephard, CTDEP/Inland Fisheries Division, Old Lyme, CT, pers. comm.).

Rainbow smelt (*Osmerus mordax*) is an anadromous fish species formerly found in the East River but not documented in the river (or in any other Connecticut river) in many years. Smelt are still found in Long Island Sound in small numbers but no spawning runs in streams have been identified in recent years. The snorkeling survey of July 31, 2009 indicated that the East River within the Preserve and likely just upstream of the Preserve possesses very suitable habitat for smelt spawning and lacks the municipal discharges that are believed to have been a factor in the extirpation of many runs to the west.

Mussels: A cursory inventory of freshwater mussels was conducted during the snorkeling survey. Eastern elliptio (*Elliptio complanata*) and alewife floater (*Anodonta implicata*) were found. Eastern elliptio is relatively common in Connecticut whereas the alewife floater is restricted to streams with anadromous fish runs (Nedeau and Victoria 2003). Additional species of mussels may be discovered by more experienced mussel experts now or in the future as the number of anadromous fish increases.

## **2. Parmelee Brook**

Habitat: Parmelee Brook is a small second order brook with a watershed of 0.976 square miles [Drainage Basin ID= 5108-15-1](Nosal 1997). The headwaters are within the Preserve and the brook flows outside of the Preserve and onto preserves owned by the Guilford Land Trust, and then through privately-owned land before passing under Duck Hole Road and back into the Preserve. The headwaters are flat and swampy. Due to the presence of the wetlands, the brook retains stream flow during most times. Downstream of Duck Hole Road, the brook passes through a very old stone dam that is breached and no longer impounds water. The dam was located atop a small chasm and the stream drops about six feet through large boulders. Several hundred feet downstream of this dam is the remains of a much larger dam that is located at the head-of-tide. This dam is also breached and there is no impoundment behind it, although there is a flat, marshy section upstream of the dam where the old millpond existed. There is about 200 feet of free-flowing, natural stream upstream of this old millpond and the boulder chasm below the upper dam. This section of stream has excellent habitat for native stream fish, characterized by sand, gravel, and small cobble. There is natural riparian vegetation and abundant riparian tree canopy.

Fish Community: An electrofishing survey was conducted by Gephard and Town of Guilford volunteers on July 31, 2009, covering the habitat in between the two dams. Four species were documented: brook trout (*Salvelinus fontinalis*), blacknose dace (*Rhinichthys atratulus*), white sucker (*Catostomous commersoni*), and American eel (*Anguilla rostrata*). According to Gephard, the findings are significant because all species are native (no non-native species were found) and the community is likely to be exactly what was present 400 years ago before European Contact. No likely native species present then are lacking now. Intact Pre-contact fish communities are uncommon in Connecticut (Stephen Gephard, CTDEP/Inland Fisheries Division, Old

Lyme, CT, pers. comm.). Furthermore, the presence of young-of-year brook trout (as well as other size classes) demonstrates that the species is naturally producing. Brook trout is a cold-water species that is under pressure from development and climate change. Naturally-reproducing brook trout populations close to Long Island Sound are extremely uncommon and this population is ecologically significant (Stephen Gephard, CTDEP/Inland Fisheries Division, Old Lyme, CT, pers. comm.).

### **3. *Other Brooks***

There are several other unnamed first order brooks that are located within the Preserve. Most do not maintain significant flow during the summer months. None of them is believed to support fish populations, although small numbers of fish may ascend a short distance up the two streams in the northern portion of the Preserve from the small lakes (former gravel pits) that are outside of the Preserve. Steep grade changes in the stream profiles stop fish movement in less than 100 feet from the lake. These streams may be important for the maintenance of invertebrate and amphibian populations as well as specific plant communities, despite the lack of fish.

## **II. Existing Activities on the Aquatic Resources on the Preserve**

### **1. *The East River***

Presently, the East River supports light use by canoeists and kayakers. Most paddlers approach the Preserve from downstream and penetrate upstream as far as the water depth will allow, depending upon the tidal stage. Some swimming occurs just north of the Preserve (upstream of the Sullivan Road Bridge) but there are no established swimming holes and very little swimming is believed to occur within the Preserve. There have been no prohibitions to fishing within the area of the Preserve, but very little fishing is believed to occur within the Preserve.

### **2. *Parmelee Brook***

There is no indication of significant recreation along the brook within the Preserve. Hiking along the brook to observe historical artifacts may be one of the most common activities. There have been no prohibitions to fishing within the area of the Preserve but very little fishing is believed to occur within the Preserve. It is possible that the fact that this brook has been in private ownership may have inhibited anglers from visiting the brook.

### **3. *Other Brooks***

There is no indication of significant recreation or other activities associated with other unnamed brooks in the Preserve. Some brooks may be associated with cranberry bogs or other sites of interest and hikers may walk along them, but much of the

visitation is likely to be coincidental. Some of the brooks pass through small culverts when a trail or old road passes over them.

### **III. Management Issues, Activities, Opportunities for the Aquatic Resources on the Preserve**

#### ***1. East River***

- a) It is important that existing fish runs and fish habitat be protected. Since no development will occur in the Preserve, degradation of fish habitat is unlikely. Development of the opposite (western) bank is still possible and although such activities are beyond the scope of this management plan, the Town must be diligent in protecting the western bank from unwise land use.
- b) Paddling of canoes and kayaks is growing in popularity. There are a number of downed trees that span the East River within the Preserve. There will be pressure to cut and clear downed trees. However, downed trees in the river represent good fish habitat. Balance must be struck between opening paths for paddlers and leaving valuable woody debris for habitat. Notching logs that span the river to allow the passage of boats is preferable to total removal of the logs. Cutting of woody debris on the Preserve must be restricted to authorized persons and regulated judiciously.
- c) Land and water below the high tide mark are owned and regulated by the State and available to the public. The Town cannot regulate activities on the East River within the Preserve. In order to meet certain management objectives, the Town must rely on regulating access and activities on the land within the Preserve and educate the public on why restrictions for access and activities are important. For example, the Town cannot stop anyone from paddling up the East River, fishing, and cutting logs within the river. However, if such a paddler steps onto dry land within the Preserve, his/her activities are subject to the rules of the Preserve. Educational signs along the river in the downstream portions can inform paddlers of management objectives within the Preserve and ask waterborne visitors to voluntarily abide by them.
- d) The Town may wish to allow angling from the land within the Preserve. DEP fishing regulations change over time. For example, currently no harvest of river herring is allowed anywhere in Connecticut. The Town may wish to cooperate with the DEP to publicize such regulations by erecting sign boards near common access points where the DEP may post current regulation signs.

- e) More late winter/early spring monitoring of the Preserve is needed to determine if a remnant run of rainbow smelt exists in the East River. If the run is gone, the East River within the Preserve may represent a rare opportunity to attempt smelt restoration.

## **2. *Parmelee Brook***

- a) The brook trout population is a vulnerable resource. Brook trout are notoriously easy to catch by angling (Stephen Gephard, CTDEP/Inland Fisheries Division, Old Lyme, CT, pers. comm.) and heavy or unscrupulous angling pressure could deplete the adult population and threaten the self-sustainability of the population. The population may not have been subjected to angling pressure when the stream was privately-owned. Now that it is Town property, there may be pressure to fish it.
- b) The brook trout population is an ecologically significant resource occurring so close to Long Island Sound. This should become an index stream for study in cooperation with the DEP/Inland Fisheries Division and local universities. Long-term monitoring could track this population over time and through stages of climate change. Genetic studies in comparison with other small isolated brook trout populations could be informative. Angling could compromise the potential of this population to be studied for scientific purposes.
- c) Significant amounts of road sand were observed on Duck Hole Road. This sand could wash into the brook and degrade the trout habitat.

## **3. *Other Brooks***

- a) One brook is bisected by the CL&P overhead transmission line Right-of-Way. It is assumed that this clearing is maintained to some degree by the spraying of herbicides. Such herbicides could enter the brook and subsequently the lakes and ultimately the East River upstream of the Preserve. More information about this practice is needed and if it appears to be unsound for the brook, alternatives need to be discussed with CL&P.
- b) Both brooks that enter the lake have experienced 'head-cutting' due to artificial changes in the stream grade. The lake was a gravel pit that resulted in a lowering of the stream grade. Stream erosion in an upstream direction has cut an incised valley into both brooks. The erosion appears to have stopped in the northernmost stream because it encountered resistant substrate. The erosion in the southernmost stream seems to have paused because it encountered resistant tree roots. Heavy storms could circumvent those roots and cause new and damaging head-cutting.



- c) Gully erosion toward the lake is occurring south of the powerline crossing. It appears to be due to traffic by off-road vehicles, foot traffic, and storm runoff. This needs to be combated to avoid future damaging erosion.
- d) Some of the other brooks within the Preserve pass through culverts as they pass under an old road or trail. Since these streams do not support fish populations, passage through these culverts is not an issue but maintenance of the culverts will still be important to effectively convey water flow, protect the trails, and allow for passage of other aquatic organisms such as amphibians.

#### **IV. Recommended Planned Activities for the Aquatic Resources on the Preserve**

##### **1. *East River***

- 1) Develop a policy on cutting/removing large woody debris that allows recreational paddling but conserves fish habitat.
- 2) Erect a signboard(s) at key Preserve access points such as Sullivan and Bearhouse Hill roads to display educational information on fish and aquatic resources, State fishing regulations (e.g. river herring closure), and Preserve rules.
- 3) Consider low visual impact signs along the edge of the river near the downstream end of the Preserve to advise paddlers that they are entering the Preserve and ask them to comply with Preserve rules.
- 4) Cooperate with CTDEP biologists and others to allow regular monitoring and surveys of aquatic life in the river.
- 5) Engage in dialog with adjoining landowners (e.g. on western bank of East River) to encourage land and habitat protection, wise land management, and activities consistent with the Preserve's management plan to maximize the benefit of the Plan.

##### **2. *Parmelee Brook***

- 1) Post the stream within the Preserve as 'no fishing.'
- 2) Cooperate with the DEP and local universities to allow study and monitoring of the brook trout population.
- 3) Discuss with the Town Public Works Department ways to minimize the use of sand along the section of Duck Hole Road that is adjacent to Parmelee Brook and the possibility of prioritizing the road for spring sweeping (sand removal).

##### **3. *Other Brooks***

- 1) Discuss methods of right-of-way clearing with CL&P to minimize the use of herbicides around brooks.
- 2) Discuss with CL&P ways to combat gully erosion near the ponds.

- 3) Explore ways to armor the southern unnamed brook that flows into the pond to arrest 'headcutting.'
- 4) Conduct an inventory of culverts within the Preserve and develop an action plan for maintenance or modification.

## V. Literature Cited

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