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<tr>
<td>AOC</td>
<td>Area of Concern</td>
</tr>
<tr>
<td>BCP</td>
<td>Brownfield Cleanup Program</td>
</tr>
<tr>
<td>BMP</td>
<td>best management practice</td>
</tr>
<tr>
<td>BNR</td>
<td>Buffalo Niagara Riverkeeper</td>
</tr>
<tr>
<td>BOA</td>
<td>brownfield opportunity area</td>
</tr>
<tr>
<td>BOD</td>
<td>biological oxygen demand</td>
</tr>
<tr>
<td>BSA</td>
<td>Buffalo Sewer Authority</td>
</tr>
<tr>
<td>BUDC</td>
<td>Buffalo Urban Development Corporation</td>
</tr>
<tr>
<td>BUI</td>
<td>beneficial use impairment</td>
</tr>
<tr>
<td>COC</td>
<td>Certificate of Completion</td>
</tr>
<tr>
<td>CSO</td>
<td>combined sewer overflow</td>
</tr>
<tr>
<td>CSO</td>
<td>combined sewer overflow</td>
</tr>
<tr>
<td>DDD</td>
<td>dichlorodiphenyldichloroethane</td>
</tr>
<tr>
<td>DDE</td>
<td>dichlorodiphenyldichloroethylene</td>
</tr>
<tr>
<td>DDT</td>
<td>dichlorodiphenyltrichloroethane</td>
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<tr>
<td>DELT</td>
<td>deformities, eroded fins, lesions, and tumors</td>
</tr>
<tr>
<td>DOS</td>
<td>(New York State) Department of State</td>
</tr>
<tr>
<td>E &amp; E</td>
<td>Ecology and Environment, Inc.</td>
</tr>
<tr>
<td>ERMP</td>
<td>Ecological Restoration Master Plan</td>
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<td>ERP</td>
<td>Environmental Restoration Program</td>
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<tr>
<td>FS</td>
<td>feasibility study</td>
</tr>
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<td>GLLA</td>
<td>Great Lakes Legacy Act</td>
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<tr>
<td>GLNPO</td>
<td>Great Lakes National Program Office</td>
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<tr>
<td>GLRI</td>
<td>Great Lakes Restoration Initiative</td>
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<tr>
<td>HWS</td>
<td>hazardous waste site</td>
</tr>
<tr>
<td>IJC</td>
<td>International Joint Commission</td>
</tr>
<tr>
<td>LTCP</td>
<td>Long-term Control Plan</td>
</tr>
<tr>
<td>mg/kg</td>
<td>milligrams per kilogram</td>
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<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>NPL</td>
<td>National Priorities List</td>
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<td>NYSDEC</td>
<td>New York Department of Environmental Conservation</td>
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<td>NYSDOH</td>
<td>New York State Department of Health</td>
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<tr>
<td>PAH</td>
<td>polycyclic aromatic hydrocarbon</td>
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<tr>
<td>PCB</td>
<td>polychlorinated biphenyl</td>
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<tr>
<td>RAC</td>
<td>Remedial Advisory Committee</td>
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<td>RAP</td>
<td>remedial action plan</td>
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<tr>
<td>RCP</td>
<td>Riverbend Commerce park</td>
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<tr>
<td>RD</td>
<td>remedial design</td>
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<tr>
<td>RG</td>
<td>remedial goal</td>
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<tr>
<td>RIBS</td>
<td>rotating integrated basin studies</td>
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<tr>
<td>SAP</td>
<td>sampling and analysis plan</td>
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<tr>
<td>SPDES</td>
<td>State Pollutant Discharge Elimination System</td>
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<tr>
<td>SWAC</td>
<td>surface-weighted average concentration</td>
</tr>
<tr>
<td>TSS</td>
<td>total suspended solids</td>
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<td>USACE</td>
<td>U.S. Army Corps of Engineers</td>
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<td>USEPA</td>
<td>U.S. Environmental Protection Agency</td>
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<tr>
<td>VCP</td>
<td>Voluntary Cleanup Program</td>
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Executive Summary

This report recommends a series of actions, projects, and programs to improve relevant conditions in the Buffalo River Area of Concern (AOC) and document restoration and protection of beneficial uses in support of the eventual delisting or re-designation of this AOC. The actions, projects, and programs thus identified are listed in Table ES-1 and achieve one or more of the following goals:

- Reducing chemical concentrations in Buffalo River AOC sediment or surface water
- Controlling or eliminating sources of contaminants to the Buffalo River or its tributaries
- Restoring aquatic or shoreline habitats in the Buffalo River AOC or upstream from the AOC impact area along Cayuga, Cazenovia, or Buffalo creeks
- Monitoring chemicals in sediment, surface water, or biota.

Table ES-1 also presents a schedule for implementing these actions, projects, and programs. In essence, Table ES-1 represents the overall strategy for delisting the individual Beneficial Use Impairments (BUIs) and, eventually, the Buffalo River AOC as a whole. This strategy is intended to be flexible and open to modification as necessary as conditions change in response to actions taken. The following points are noteworthy:

- Baseline sampling of surface water, sediment, and biota should be implemented before navigational dredging begins in mid-2011. Also in 2011, a baseline wildlife population survey will be implemented; the Buffalo River Ecological Restoration Master Plan (ERMP) will be completed; habitat restoration work will begin at Riverbend (upland only) and Seneca Bluffs; and work will commence on an Enhanced Fish Consumption Advisories and Outreach project.

- Enhanced navigational dredging by the U.S. Army Corps of Engineers (USACE) is scheduled to occur between approximately June and December 2011.
Executive Summary

- Legacy Act dredging and capping is assumed to begin in 2012, the year following navigational dredging, and will take three years to complete, according to the Draft Final Feasibility Study for the Buffalo River (ENVIRON et al. 2010). Short-term monitoring of water and sediment occurs concurrently with this work to ensure that sediment resuspension and residual sediment contamination do not exceed levels determined to be acceptable during remedial design.

- Habitat restoration within the AOC at the six sites identified in the Draft Final Ecology Engineering Evaluation Report for the Buffalo River (ENVIRON and MACTEC 2010) is assumed to be implemented post-remedial dredging and capping (2012 to 2015).

- The first round of long-term monitoring of surface water, sediment, and biota occurs when dredging is complete (late 2014), and at Year 2 (2016) and Year 5 (2019) following remedy completion, as specified in the Buffalo River feasibility study (FS) (ENVIRON et al. 2010).

- It is assumed that the Hamburg Drain Floatables Control Facility will be completed in late 2012.

- It is assumed that remedial work at the 12 remaining Class 2 New York State Superfund sites in the Buffalo River watershed will continue until all sites have been remediated.

- Several existing programs—Buffalo Sewer Authority (BSA) Combined Sewer Overflow (CSO) Long-Term Control Plan (LTCP); New York State Voluntary Cleanup Program (VCP), Brownfield Cleanup Program (BCP), and Environmental Restoration Program (ERP); State Pollutant Discharge Elimination System (SPDES) permit monitoring and renewal; New York State Department of Environmental Conservation (NYSDEC) Rotating Integrated Basin Studies (RIBS); biannual shoreline sweeps; and the Western New York Stormwater Coalition—will continue indefinitely, with the objective of providing long-term protection to the Buffalo River system.

- Development of the Riverbend Commerce Park will be completed in approximately 10 years.

- The first round of extended long-term monitoring will be implemented in approximately 2022, three years after the last round of long-term monitoring specified in the Buffalo River FS, with an additional round every three years until two consecutive rounds confirm that all use impairments have been eliminated. Some delisting criteria call for repeated sampling until a specific target has been met. Also, this approach is consistent with the desire of Buffalo Niagara Riverkeeper (BNR) to take an active approach to BUI delisting (i.e., collected data to show that delisting targets have been met) and provide for long-term stewardship of the system.
Table ES-1. Project Implementation Strategy for the Buffalo River AOC

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<td>Initiate after navigational dredging. 3-year duration (Environ et al. 2010).</td>
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<td>- Short Term Monitoring</td>
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<td>At Years 0, 2, and 5 after dredging (Environ et al. 2010a)</td>
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<td>Implement in early 2011 before navigation dredging begins.</td>
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<td>Hamburg drain floatables project assumed complete by late 2012.</td>
</tr>
<tr>
<td>Continued NYS Superfund Site Remedial Work (Section 1.4.5.8)</td>
<td>✔️</td>
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<td>Continues until all sites are remediated.</td>
</tr>
<tr>
<td>Other NYS Cleanup Programs (Section 1.4.5.9)</td>
<td>✔️</td>
<td></td>
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<td>Program must continue indefinitely to safeguard river.</td>
</tr>
<tr>
<td>Continued SPDES Permit Monitoring/Reactivation (Section 1.4.5.10)</td>
<td>✔️</td>
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<td>Program must continue indefinitely to safeguard river.</td>
</tr>
<tr>
<td>Continued RBIS Sampling by NYSDEC (Section 1.4.5.11)</td>
<td>✔️</td>
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<td>Program assumed to continue indefinitely to protect resource.</td>
</tr>
<tr>
<td>Biannual Shoreline Sweeps, (Section 1.4.5.12)</td>
<td>✔️</td>
<td></td>
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<td>Program assumed to continue indefinitely to protect resource.</td>
</tr>
<tr>
<td>Riverbend Development Master Plan (Section 1.4.5.13)</td>
<td>✔️</td>
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<td>Program assumed to continue indefinitely to protect resource.</td>
</tr>
<tr>
<td>WNY Stormwater Coalition BMP Efforts (Section 1.4.5.14)</td>
<td>✔️</td>
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<tr>
<td>Recommended New Projects</td>
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<tr>
<td>E-Extended Long-term Monitoring of Sediment, Biota, and Surface Water (Section 2.1)</td>
<td>✔️</td>
<td>✔️</td>
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<td>✔️</td>
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<td>✔️</td>
<td>Implement every third year following FS-related monitoring.</td>
</tr>
<tr>
<td>Survey of Fish and Wildlife Officials and Others for Tainting Complaints (Section 2.2.2)</td>
<td>✔️</td>
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<td>✔️</td>
<td>As before and after FS dredging. Continue longer if tainting found.</td>
</tr>
<tr>
<td>Buffalo River ERMP Implementation</td>
<td>✔️</td>
<td>✔️</td>
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<td>✔️</td>
<td>✔️</td>
<td>Fifteen year duration assumed.</td>
</tr>
<tr>
<td>Mink Survey for Buffalo River AOC and Watershed (see Section 2.5.1)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
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<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>Implement after dredging and capping are completed.</td>
</tr>
</tbody>
</table>

**BIU Status Check**

- Evaluate Attainment of Delisting Criteria and Delist BIUs as Appropriate

**Remarks**

- Indicates that a project is implemented or ongoing during that calendar year.

**Key:**

- AOC = Area of concern.
- BCP = Brownfield Cleanup Program.
- BSP = Best Management Practice.
- BSA = Buffalo Sewer Authority.
- BSU = Beneficial use impairment.
- CSO = Combined sewer overflow.
- ER = Environmental Restoration Program.
- ERMP = Ecological Restoration Master Plan.
- FS = Feasibility study.
- GLLA = Great Lakes Legacy Act.
- HWS = Hazardous waste site.
- NYS = New York State.
- NYSDEC = New York State Department of Environmental Conservation.
- PAC = Polychlorinated biphenyls.
- PCB = Polychlorinated biphenyls.
- RD = Remedial design.
- RBIS = Rotating Intensive Baseline Study.
- SPDES = State Pollutant Discharge Elimination System.
- USACE = U.S. Army Corps of Engineers.
- VCP = Voluntary Cleanup Program.
- WNY = Western New York.
Executive Summary

- Buffalo River ERMP implementation is assumed to begin as soon as practicable and to continue for the long-term, although the level of activity is expected to vary from year to year, depending on funding.

- Lastly, when dredging is complete (expected in 2015) and after each round of long-term and extended long-term monitoring, the Buffalo River Remedial Advisory Committee (RAC) should evaluate attainment of the delisting criteria for each BUI and recommend delisting BUIs as appropriate. Interaction with NYSDEC is required for BUI delisting. Revision of delisting criteria, if appropriate and desirable, can be considered at these points in the overall process.

The following conclusions can be drawn from the above information (see Table ES-1) and from the evaluation presented in this report:

- A suite of actions originating at the local, state, and federal level are required to address current BUIs and protect the Buffalo River in the long-term. Most of these actions are forthcoming federally supported projects (e.g., navigational dredging by the USACE, sediment remedial dredging and capping) or ongoing state and local programs (e.g., SPDES permit monitoring and renewal, BSA CSO LTCP). A few of the actions are new recommendations.

- The actions, projects, and programs described in this report can be ranked or scored based on the number of BUI delisting criteria they address. The highest scores were given to (1) the forthcoming navigational and remedial dredging projects because these projects remove the cause of many BUIs in the AOC (i.e., contaminated sediments); (2) the baseline monitoring and extended long-term monitoring projects because these projects provide the data needed to track recovery over time; and (3) ongoing NYSDEC programs responsible for hazardous waste site (HWS) cleanup and SPDES permit monitoring and renewal because these projects limit potential inputs of contaminants to the AOC. Projects dealing with habitat restoration also received comparatively high scores.

- Collectively, the actions, projects, and programs identified in this report should eliminate BUIs in the Buffalo River AOC within 8 to 15 years. AOC delisting can proceed after all individual BUIs have been delisted following the process described in NYSDEC (2010), U.S. Environmental Protection Agency (USEPA 2001), and International Joint Commission (IJC 1991) guidance.

- Low dissolved oxygen levels in surface water and benthic community impairment may persist in some areas of the Buffalo River if navigational dredging continues for commercial purposes and flood control; however, this situation should not prevent delisting of applicable BUIs based on IJC (1991) guidance. IJC (1991) recognizes that it may not be possible to fully restore
Executive Summary

Some beneficial uses because of natural factors (e.g., sedimentation) or social or economic factors (e.g., the necessity to dredge navigational channels may preclude fully restoring the benthic community). In these cases, delisting may proceed as long as justification for the remaining impairment is provided in the Stage 3 Remedial Action Plan (RAP).

Continued coordination between local, state, federal, and private groups under strong local leadership is needed to advance the overall delisting process. The leadership provided by Buffalo Niagara Riverkeeper as RAP coordinator over the past eight years has been instrumental in helping to move forward remedial planning, habitat restoration, and source control projects in cooperation with the USEPA, NYSDEC, the City of Buffalo, and other federal, state, and local entities.

During the process of developing this strategic plan, Ecology and Environment, Inc. (E & E) received input from various members and technical advisors of the Buffalo River Area of Concern Remedial Advisory Committee (RAC), including representatives of BNR, NYSDEC, the USEPA, the Buffalo Urban Development Corporation (BUDC), and others. Nonetheless, this plan should not be considered to be approved by the RAC members or technical advisors or the agencies they represent. This plan represents consultant study recommendations to the Buffalo River AOC RAC. It is up to the RAC to accept all or some of the recommendations and incorporate what is appropriate into the Buffalo River Remedial Action Plan as an addendum to the current RAP Stage 2 Report. Because the RAP Stage 2 Report is the official government document of record, the AOC RAP addendum must be approved by NYSDEC, as the state steward of the AOC under the Statewide Water Quality Program, and then be reviewed by the USEPA and submitted to the IJC, although no IJC concurrence is needed. Throughout the process, it is the responsibility of NYSDEC and the USEPA to judge whether the Stage 2 RAP addendum complies with state/federal requirements.
1 Introduction

Ecology and Environment (E & E) has prepared this Strategic Plan for Beneficial Use Impairment Delisting for the Buffalo River Area of Concern for the U.S. Army Corps of Engineers – Buffalo District (USACE) under Contract Number W912P4-10-D-002 (Lake Ontario Sediment Management and Great Lakes Restoration Initiative [GLRI] Planning). This report satisfies, in part, the requirements for Task 10 in the USACE Architect-Engineer Scope of Work (June 25, 2010) and E & E Contract Proposal (August 19, 2010).

During the process of developing this strategic plan, E & E received input from various members and technical advisors of the Buffalo River Area of Concern (AOC) Remedial Advisory Committee (RAC), including representatives of the Buffalo Niagara Riverkeeper (BNR), the New York State Department of Environmental Conservation (NYSDEC), the U.S. Environmental Protection Agency (USEPA), the Buffalo Urban Development Corporation (BUDC), and others. Nonetheless, this plan should not be considered to be approved by the RAC members or technical advisors or the agencies they represent. This plan represents consultant study recommendations to the Buffalo River AOC RAC. It is up to the RAC to accept all or some of the recommendations and incorporate what is appropriate into the Buffalo River Remedial Action Plan (RAP) as an addendum to the current RAP Stage 2 Report. Because the RAP Stage 2 Report is the official government document of record, the AOC RAP addendum must be approved by NYSDEC, as the state steward of the AOC under the Statewide Water Quality Program, and then be reviewed by the USEPA and submitted to the International Joint Commission (IJC), although no IJC concurrence is needed. Throughout the process, it is the responsibility of NYSDEC and the USEPA to judge whether the Stage 2 RAP addendum complies with state/federal requirements.

This report is organized as follows:

- The remainder of Section 1 describes the project scope and objectives; Beneficial Use Impairments (BUIs) and delisting criteria for the Buffalo River AOC; and forthcoming and ongoing projects relevant to delisting the BUIs.

- Section 2 identifies actions, projects, and programs needed to achieve the objective or goal of each delisting criterion for each BUI. Forthcoming and ongoing projects as well as recommended new projects are identified. In addition, a brief description of how each action, project, or program is expected to
help achieve the objective of each delisting criterion is provided. Lastly, approximate cost estimates are provided for recommended new projects.

- Section 3 summarizes the actions, projects, and programs that will advance BU1 delisting and an overall strategy or schedule for implementation.

- Conclusions are provided in Section 4.

1.1 Scope and Objectives
This strategic plan recommends a series of actions to (a) improve relevant conditions in the Buffalo River AOC to the maximum extent practicable and (b) document restoration and protection of beneficial uses in the AOC in support of its delisting or re-designation. This strategic plan also includes rough cost estimates for recommended new projects.

1.2 Description of the AOC
The Buffalo River is located in the City of Buffalo, Erie County, New York (see Figure 1-1). With its three main tributaries—Cayuga Creek, Buffalo Creek, and Cazenovia Creek—the Buffalo River has a drainage basin of approximately 446 square miles (mi²) (New York State Department of Conservation 1989). The Buffalo River AOC “impact area” extends from the mouth of the Buffalo River to the farthest point upstream at which backwater conditions exist during Lake Erie’s highest monthly lake level. The impact area is 6.2 miles in length. The AOC also includes the entire 1.4-mile stretch of the City Ship Canal, located adjacent to the river (see Figure 1-1).

The Buffalo River has undergone many changes over the past 180 years with regard to water and sediment quality and physical structure. These changes had, and continue to have, a great impact on the biota, water and sediment quality, and shoreline of the river. Impairments of the Buffalo River include degradation of benthos; fish tumors and other deformities; loss of fish and wildlife habitat; degradation of fish and wildlife populations; tainting of fish and wildlife flavor; fish consumption advisories; bird and animal deformities and reproductive problems, and degradation of aesthetics.

Degradation of the Buffalo River began with the growth of the City of Buffalo and use of the river for municipal waste disposal in the early 1800s. The degradation continued with pollutant loadings from the grain milling and manufacturing industries that were constructed and operated along the river. The problems of pollution were compounded by the deepening and widening of the river for navigation, which increased hydraulic residence time and sedimentation. By the 1920s, the Buffalo River was described as a septic basin with little or no dissolved oxygen. No fish were found in the river at that time.

In the late 1960s, water quality and benthos and fish communities in the Buffalo River began to recover as a result of flow augmentation and a decrease in industrial waste loading resulting from pollution abatement programs and factory
Figure 1-1 Buffalo River AOC Site Location
Buffalo, NY
1 Introduction

closings. This recovery continued through the 1970s, 1980s, and into the 1990s. Despite these improvements the Buffalo River remains impaired and degraded. Historical sediment contamination and poor habitat quality persist as major obstacles to full recovery, and combined sewer overflows and upstream pollutant inputs remain as issues of concern. Remediation is required to address these problems and support an environment that can overcome current impairments.

Additional information regarding the historical use of the river and current impairments are provided in the Buffalo River Remedial Action Plan (NY SDEC 1989), the Buffalo River Section 312 Environmental Dredging Existing Conditions Report (E & E 2008a), the Sediment Remedial Investigation Report for the Buffalo River (ENVIRON et al. 2009), and ENVIRON et al. (2010)

1.3 BUls and Delisting Criteria

A Compendium of Delisting Targets and Beneficial Use Impairments in the United States Great Lakes Areas of Concern (USEPA 2010) identifies nine BUls for the Buffalo River AOC of the 14 possible IJC (1991) beneficial uses. Table 1-1 lists the nine BUls for the Buffalo River AOC and their delisting targets or criteria. The delisting targets for the Buffalo River AOC were developed locally by the Buffalo River RAC via a thorough assessment process and are consensus-based. If warranted, the criteria listed in Table 1-1 may be revised by the RAC based on the results of future monitoring and assessment or unforeseen future developments in the AOC.

USEPA (2001) allows individual BUls in an AOC to be delisted under the following circumstances:

- When the locally developed delisting criteria have been met;
- When the impairment is due to natural rather than man-made causes;
- When impairment is not limited geographically to the AOC but, rather, is typical of regional conditions;
- When the source of the impairment is outside the boundaries of the AOC; or
- When the beneficial use cannot be fully restored, even when all practical remedial actions have been implemented, because of other factors affecting the AOC.

NYSDEC (2010) has published similar guidance on delisting BUls in New York State AOCs. After all of the BUls within an AOC have been delisted, the AOC as a whole may be delisted. NYSDEC, the USEPA, and the IJC concurrence is required to delist individual BUls and the AOC as a whole.
<table>
<thead>
<tr>
<th>Beneficial Use Impairment</th>
<th>Status</th>
<th>Delisting Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Restrictions on Fish and Wildlife Consumption</td>
<td>Impaired</td>
<td>There are no AOC-specific fish and wildlife consumption advisories by New York State (e.g. carp for PCBs); AND When contaminant levels due to watershed or in-place contaminants in resident native and exotic fish and wildlife populations that could be consumed do not exceed current NYS Standards.</td>
</tr>
<tr>
<td>2. Tainting of Fish and Wildlife Flavor</td>
<td>Impaired</td>
<td>For a period of 3 consecutive years, no exceedances of water quality standards or criteria for compounds associated with tainting within the AOC; AND For a period of 3 consecutive years, no reports of tainting from fish and wildlife officials or informed public observers.</td>
</tr>
<tr>
<td>3. Degradation of Fish and Wildlife Populations</td>
<td>Impaired</td>
<td><strong>Fish Populations</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fish surveys find that the resident fish community is fair to good based on applicable fish community biological indices for two consecutive surveys; AND The frequency of occurrence of DELT anomalies in bottom-dwelling fish does not exceed recommended levels; AND Whole-body concentrations of Endocrine Disruptors (including, but not limited to: PCBs, dioxins, and pesticides) in bottom-dwelling fish do not exceed critical tissue concentrations for adverse effects on fish; AND Water quality measures (based on NYS RIBS or other monitoring) meet state standards for at least a Class C river.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Wildlife Populations</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wildlife surveys find that diversity and abundance of birds, mammals, reptiles and amphibians in the AOC are comparable to a suitable reference site; AND Wildlife assessments confirm no significant toxicity from water column or sediment contaminants; AND Diversity of amphibian populations in AOC pocket wetlands is similar to upstream (and/or) Tifft marsh levels; AND Diversity of benthic populations in the AOC is comparable to upstream levels.</td>
</tr>
<tr>
<td>4. Fish Tumors or Other Deformities</td>
<td>Impaired</td>
<td>Survey data confirm the absence of neoplastic liver tumors in bullheads or suckers (as compared to control site) for two consecutive sampling events; AND Contaminants in water and sediments in the AOC do not exceed NYS standards.</td>
</tr>
<tr>
<td>5. Bird/Animal Deformities or Reproductive Problems</td>
<td>Impaired</td>
<td>Deformities or reproductive problem rates are not statistically different that inland background levels as reported from wildlife officials or trained observers; AND Concentrations of bioaccumulative chemicals in fish do not exceed levels associated with reproductive problems in piscivorous wildlife; AND/OR Concentrations in sediment do not exceed levels associated with benthic impairment that could result in reproductive problems in omnivorous and benthivorous birds and wildlife.</td>
</tr>
</tbody>
</table>
### Table 1-1 Buffalo River AOC Beneficial Use Impairments, Status, and Delisting Criteria

<table>
<thead>
<tr>
<th>Beneficial Use Impairment</th>
<th>Status</th>
<th>Delisting Criteria¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Degradation of Benthos</td>
<td>Impaired</td>
<td>Benthic macroinvertebrate communities are non-impacted or slightly impacted according to NYSDEC indices for two consecutive sampling events; OR In the absence of conclusive community structure data, the toxicity of sediment-associated contaminants is not statistically higher than controls.</td>
</tr>
<tr>
<td>7. Restrictions on Dredging Activities</td>
<td>Impaired</td>
<td>There are no restrictions on routine commercial or recreational navigational dredging by the USACE or another entity across any part of the AOC, such that no special management measures or use of a confined disposal facility are required for the dredged material due to chemical contamination.</td>
</tr>
<tr>
<td>11. Degradation of Aesthetics</td>
<td>Impaired</td>
<td>Minimize debris, general litter, floatables, or contaminants in the river or shoreline via point source or non-point sources through the implementation of Best Management Practices; AND Organic, chemical, and biological contaminants should not persist in concentrations that can be detected as visible film, sheen, or discoloration on the surface, detected by odor, or form deposits on shorelines and bottom sediments.</td>
</tr>
</tbody>
</table>
| 14. Loss of Fish and Wildlife Habitat | Impaired | **1. Restore Habitat Connectivity**  
   a. A minimum 100-foot buffer on new development of native vegetation on each riverbank is maintained and enforced upstream from the Ohio Street Bridge; AND  
   b. Significant floodplain, wetland, or riparian habitat areas in the AOC are protected and/or restored; AND  
   c. A minimum 25% of the AOC shoreline is restored to natural slope, shallows, and aquatic (emergent and submerged) native vegetation, including naturalizing areas of the City Ship Canal shoreline. |
|                           |            | **2. Improve Stream Quality Index scores from “poor” to at least “good”**  
   a. Water quality measures (based on NYS RIBS or other monitoring) meet state standards for at least a Class C river; AND  
   b. Aquatic habitat scores are fair to good AND/OR the lower Buffalo River is no longer listed as “stressed” for aquatic life on the NYS Priority Waterbodies List. |
|                           |            | **3. Restore hydrologic function to support habitat and species goals listed in BUI 3.**  
   a. Reduce navigational dredging in the AOC to support aquatic habitat and species goals (BUI 3); AND/OR  
   b. Restore and protect natural flows, meanders, and stream habitat in River Corridor opportunity areas upstream of the AOC. |

¹ USEPA (2010).

**Key:**
- **AOC** = Area of Concern.
- **BUI** = Beneficial use impairment.
- **DELT** = Deformities, eroded fins, lesions, and tumors.
- **NYS RIBS** = New York State Rotating Integrated Basin Studies.
- **NYSDEC** = New York State Department of Environmental Conservation.
- **PCB** = Polychlorinated biphenyls.
- **USACE** = U.S. Army Corps of Engineers.
1.4 Significant Forthcoming and Ongoing Activities Relevant to BUI Delisting

Several significant projects relevant to BUI delisting will be implemented in the Buffalo River AOC in the near future, including (1) dredging and capping of contaminated sediments in the AOC as described in the Draft Final Feasibility Study for the Buffalo River, New York (ENVIRON et al. 2010); (2) habitat restoration and enhancement at selected locations in the AOC as described in the Ecology Engineering Evaluation Report, Buffalo River, New York (ENVIRON and MACTEC 2010); (3) navigational dredging by the USACE; and (4) various additional projects designed to fill data gaps and/or improve conditions relevant to specific BUIs. These projects are described below.

1.4.1 Buffalo River Great Lakes Legacy Act (GLLA) Sediment Dredging and Capping

The Buffalo River Feasibility Study (FS) prepared by ENVIRON et al. (2010) as part of the GLLA project presented remedial alternatives for addressing historical deposition of contaminants in the river sediments. The FS was prepared on behalf of the Buffalo River Project Coordination Team, which included the USEPA Great Lakes National Program Office (GLNPO), the BNR, NYSDEC, the USACE, USEPA Region 2, and Honeywell International, Inc. The FS built on historical information presented in the Sediment Remedial Investigation Report for the Buffalo River (ENVIRON et al. 2009), and relied on analyses of hydrological, ecological, and sediment conditions within the Buffalo River to support an evaluation of potential remedial measures. The FS identified an appropriate remedial alternative to cost-effectively manage the risks associated with chemicals of concern in Buffalo River AOC sediments. The proposed alternative—Alternative 5, Enhanced Protectiveness Dredging—does the following:

- Targets removal of sediments from areas with total polycyclic aromatic hydrocarbon (PAH) concentrations greater than 1 toxic unit (16 milligrams per kilogram [mg/kg]) in the upper 0 to 1 foot sediment interval.

- Achieves surface-weighted average concentration (SWAC) remedial goals (RGs) for polychlorinated biphenyls (PCBs) (0.20 mg/kg), mercury (0.44 mg/kg), and lead (90 mg/kg) through dredging (in the Buffalo River and City Ship Canal) or capping (at the end of the City Ship Canal).

- Targets removal of sediments from areas with elevated point concentrations of PAHs, PCBs, lead, and mercury at depths of 0 to 4 feet.

- Targets removal of sediment from areas that are associated with the presence of oil and grease, as identified in core logs from sediment investigations in 2005, 2007, and 2008.

- Includes confirmation monitoring of sediment and operational monitoring of water and air during remedy implementation. Detailed monitoring plans, in-
including a Residuals Management Plan, will be provided as part of the remedial design (RD).

- Includes long-term monitoring of sediment following completion of the remedy. When dredging is complete, and at Year 2 and Year 5 following remedy completion, surface sediment (0 to 1 foot) chemical concentrations will be measured to confirm that the total PAH RG and SWAC RGs for lead, mercury, and total PCBs have been achieved. If not, additional measures may be implemented in accordance with decision rules identified in the FS.

- Includes long-term biological monitoring at Years 1 and 5 following remedy implementation. Biological monitoring will include one or more of the following metrics: benthic community surveys, fish community surveys, analysis of chemical concentrations in fish, and analysis for the presence of liver lesions in brown bullheads. ENVIRON et al. (2010) did not mention including a phytoplankton population survey or nutrient and algal-pigment sampling under long-term monitoring. However, such sampling was recommended by Irvine and Murphy (2009) and agreed to by the Buffalo River RAC and therefore should be included. The long-term monitoring data will be used to evaluate changes in conditions and support BUI delisting.

The proposed alternative is expected to take three years to implement and cost approximately $40 million (ENVIRON et al. 2010). Dredging to remove contaminated sediments could begin in late 2011 or early 2012, after completion of navigational dredging by the USACE in 2011. Figure 1-2 shows locations of areas to be dredged or capped under the proposed alternative. Remedial design is under way.

1.4.2 Baseline Chemical and Biological Sampling

Development of a Baseline Sampling and Analysis Plan (SAP) for the Buffalo River AOC is under way through the USEPA Great Lakes National Program Office. The goal of the baseline sampling is to evaluate the current status of the Buffalo River AOC before remedial work or navigational dredging is implemented. The Baseline SAP is comprehensive and will include collection and analysis of bulk sediment, sediment porewater, and biota for chemicals of concern; collection of sediment for toxicity and bioaccumulation testing; in-stream and riparian zone habitat surveys; and perhaps fish community assessment. The data collected during the baseline assessment will be used to supplement existing sediment, fish, and habitat data (e.g., ENVIRON et al. 2009, Skinner et al. 2009, Irvine et al. 2005a).

1.4.3 Buffalo River GLLA Habitat Restoration and Enhancement

The FS presents habitat restoration project locations to facilitate permit compliance for remedy implementation and to provide a conceptual approach for mitigation agreed upon by the USEPA Great Lakes National Program Office, NYSDEC, the USACE, BNR, and Honeywell International, Inc. The scale of potential impacts on existing ecological resources was determined based on the proposed al-
ternative, which is expected to affect approximately 3 acres of aquatic vegetation beds. Potential restoration projects are located within 0.75 miles of areas affected by the proposed alternative to ensure that the restored system addresses the same ecological functions that are affected by the remedy. Restoration of aquatic vegetation has been proposed at six locations: Kelly Island, City Ship Canal, Ohio Street shoreline, Katherine St. Peninsula, Buffalo Color Peninsula shoreline, and the Riverbend parcel (see Figure 1-3). These projects are expected to mitigate impacts from the remedy while providing additional restoration above and beyond mitigation. The restoration projects are described in ENVIRON and MACTEC (2010) and will be finalized during remedial design. Landowner acceptance of the restoration projects will be necessary prior to project implementation. If any of the selected sites are unable to be constructed, then a project of equal scope shall be considered in its place, including the potential expansion of one of the remaining projects, if such an expansion provides comparable scope.

1.4.4 Enhanced Navigational Dredging
The USACE is planning to conduct maintenance dredging of the federal navigation channel in the Buffalo River AOC beginning in June 2011 and ending in November 2011. The federal navigation channel crosses several areas where environmental dredging is planned under the proposed remedial alternative (see Figure 1-2). The USACE will use its navigational dredging authority to remove contaminated sediments from the navigational channel in the AOC. Remedial dredging and capping based on the preferred FS alternative (see Section 1.4.1) will be implemented as soon as possible after the USACE maintenance dredging.

1.4.5 Other Forthcoming or Ongoing Actions and Programs
Additional actions or programs designed to fill data gaps and/or improve conditions relevant to specific BUIs are described below.

1.4.5.1 Buffalo River Ecological Restoration Master Plan (ERMP)
The ERMP is currently being developed and when complete will play a key role in the recovery of the Buffalo River AOC and upstream areas. The ERMP will be the culmination of extensive efforts by multiple federal, state, and local agencies and, most importantly, the citizens of Buffalo, its neighboring towns, and Erie County. It is a stakeholder-driven, collaborative effort to develop well-defined steps for the future ecological restoration of the river and builds on past and ongoing clean-up efforts. The primary goals of the ERMP are to protect water and habitat quality in the Buffalo River and its tributaries and assist efforts to eliminate three habitat-related BUIs in the AOC: Degradation of Fish and Wildlife Populations; Degradation of Benthos; and Loss of Fish and Wildlife Habitat.
Remedy Alternative 5

Target the PAH remedy goal (RG) of 1 TU in surface (0-1 ft) sediment, SWAC RGs for PCBs, mercury, and lead, and elevated PAH, PCB, mercury, and lead concentrations at sediment depths of 0-4 ft.

Figure 1-2 Sediment Dredging and Capping Areas Under the Proposed Alternative
Buffalo, NY

Source: ENVIRON et al. (2010)
Figure 1-3  Habitat Restoration Sites Proposed in the Buffalo River Feasibility Study

Legend

- Habitat Restoration Project Locations
- Remedy Alternative 5
  - Dredge
  - Cap

Source: ENVIRON et al. (2010)
The ERMP project area has been defined as the Buffalo River upstream from Lake Erie to the first impassible barriers to fish movement on each of the three main tributaries—Cayuga Creek, Buffalo Creek, and Cazenovia Creek. The project area includes 37.2 miles of river or creek channel; 43,800 acres of watershed; and various habitat types, including floodplains, wetlands, and other significant tracts of open space. Because the land closest to the Buffalo River and its tributaries has the greatest influence on in-stream habitat and water quality, a “focus area” was established that extends inland 500 feet from the channel centerline. The resulting focus area comprises a 1,000-foot wide corridor that includes 4,700 acres, or about 1.7 percent of the entire 280,000-acre Buffalo River watershed.

The ERMP proposes restoration projects on 26 sites within the focus area (see Figure 1-4). Projects include combinations of measures appropriate for each site that will improve ecological functions in the Buffalo River and its tributaries. Proposed measures include: (1) invasive species control and management; (2) stabilization of stream banks; (3) aggressive planting of native vegetation; (4) establishment of submerged aquatic vegetation and emergent shoreline vegetation; and (5) creation of in-channel structures to protect stream banks and provide in-stream habitat. These projects would contribute to delisting habitat-related BUIs in the AOC by creating in-channel habitat, reducing erosion and subsequent sedimentation of benthic environments, and creating or enhancing riparian habitats.

1.4.5.2 Buffalo River AOC Upland Habitat Restoration at Riverbend

This project will design, implement, and monitor a high-priority habitat restoration project in the Buffalo River AOC, as identified in the FS, ERMP, and Buffalo River RAP (NYSDEC 1989). The Riverbend site project would provide 2,800 linear feet and 6.3 acres of shoreline/riparian restoration and would bring the RAP to a level of 40% complete for delisting target 1c for BUI 14 – Loss of Fish and Wildlife Habitat (see Table 1-1). This project will also contribute to delisting of BUI 3 – Degradation of Fish and Wildlife Populations. The funding required to implement this project was recently acquired by BNR. A project schedule is not yet available. (http://bnriverkeeper.org/2010/10/great-lakes-restoration-initiative-grants-to-riverkeeper/).

1.4.5.3 Baseline Inventory of Mammal, Bird, Amphibian, and Reptile Populations

Under their 2010 to 2012 RAP coordination grant, BNR has acquired funding to coordinate a baseline inventory of mammal, bird, amphibian, and reptile populations in the Buffalo River AOC (http://bnriver-keeper.org/2010/10/great-lakes-restoration-initiative-grants-to-riverkeeper/). Limited data and information are currently available regarding wildlife populations in the area. This project will provide baseline data regarding the type and number of wildlife species utilizing the AOC prior to any significant remediation efforts. The results will be used during the delisting process of BUI 3 – Degradation of Fish and Wildlife Populations and BUI 14 – Loss of Fish and Wildlife Habitats.
1.4.5.4 Wetlands Restoration at Seneca Bluffs
BNR and its partner, the Erie County Department of Environment and Planning, recently received funding for wetland and riparian restoration at Seneca Bluffs Natural Habitat Area, located 500 feet upstream from the Buffalo River AOC (http://bnriverkeeper.org/2010/10/great-lakes-restoration-initiative-grants-to-riverkeeper/). The Seneca Bluffs restoration will include planting native trees, shrubs, and forbs of high wildlife value in upland, wetland, and island habitats; restoring aquatic plant species where practicable; and long-term habitat quality monitoring. Invasive species control is required in all areas of the site. This project will help advance the delisting of BUI 3 – Degradation of Fish and Wildlife Populations and BUI 14 – Loss of Fish and Wildlife Habitats.

1.4.5.5 Enhanced Fish Consumption Advisories and Outreach
BNR and NYSDEC are seeking to improve fish consumption advisories and outreach in the Buffalo River AOC and Niagara River watershed. Current advisories will be revised to improve information transfer to high-risk communities. Local community and refugee outreach groups will collaborate in translating and distributing non-traditional outreach materials. This project will fill a significant gap in understanding the fish consumption patterns of subsistence anglers and will help to inform future education and policy efforts. One goal of the project is to reduce human exposure to PCBs and other contaminants in fish. Hence, it is relevant to BUI #1 – Restrictions on Fish and Wildlife Consumption. Additional information is available from the BNR website (http://bnriverkeeper.org/2010/10/great-lakes-restoration-initiative-grants-to-riverkeeper/).

1.4.5.6 City of Buffalo Combined Sewer Overflow Long-Term Abatement Plan
The Buffalo Sewer Authority (BSA) continues construction on storm sewers as identified in the Draft Combined Sewer Overflow (CSO) Long-Term Control Plan (LTCP). This plan is a system-wide study that assesses and prioritizes improvements needed to comply with USEPA policy and conditions of the BSA operating permit. Thus far, the BSA has completed a $4.2 million storm sewer separation project on Cazenovia Creek Outfall #35 and Mumford Street, which serve the southeast corner of the City of Buffalo.

The BSA also continues to coordinate storm sewer construction with the Buffalo Department of Public Works, Parks, and Streets at various locations throughout the city, including major storm sewer construction along Main and Seneca Streets (Buffalo Sewer Authority 2009). Recently, the BSA received $2.1 million in funding from the NYSDEC Water Quality Improvement Project for a CSO abatement project designed to divert flow from the Swan Trunk sewer and modify existing flow diversion structures in the Swan Trunk sewer to significantly reduce CSO discharges to Lake Erie and the Buffalo River. (For additional details see http://www.ci.buffalo.ny.us/Home/Mayor/Leadership/Press_Releases/ImproveWaterQuality). CSO abatement projects are relevant to BUI # 11 – Degradation of
Aesthetics, and BUIs 3 and 14, which require sustained, good water quality for delisting.

1.4.5.7 Other Buffalo Sewer Authority Initiatives
In fiscal year 2009, as part of the redevelopment of Buffalo’s Inner Harbor, the BSA was awarded $8.6 million in funding through the American Recovery and Reinvestment Act, allowing for construction of the Hamburg Drain Floatables Control Facility, which will collect and process floatables from the 20 sewer regulators within the Hamburg drain system that discharge combined sewage to the Buffalo River during wet weather events. This initiative is relevant to BUI 11 – Degradation of Aesthetics.

1.4.5.8 New York State Superfund Site Remedial Work
According to BNR (2008), there currently are 12 inactive hazardous waste sites in the Buffalo River watershed with a Class 2 designation from NYSDEC. Ten of these sites (and their NYSDEC site numbers) are identified in BNR (2008): Buffalo Color Area D (915012); Buffalo Outer Harbor-Radio Tower Area (915026); Ramco Steel (915046B); Republic Steel–LTV (915047); Altift Landfill (915054); Lehigh Valley Railroad (915071); Depew Landfill (915105); 318 Urban Street (915151); Mr. C’s Dry Cleaner (915157); and the Fourth Street Site (915167). NYSDEC designates sites as Class 2 when 1) the disposal of hazardous waste has been confirmed and the presence of such hazardous waste or its components or breakdown products represent a significant threat to the environment or to human health or 2) hazardous waste disposal has not been confirmed, but the site has been listed on the federal National Priorities List (NPL). Additional remedial work at these sites is needed to prevent migration of contaminants to the Buffalo River or its tributaries.

1.4.5.9 Other New York State Cleanup Programs
New York State established the Voluntary Cleanup Program to address the environmental, legal, and financial barriers that often hinder the redevelopment and reuse of contaminated properties. The VCP was developed to enhance private sector cleanup of Brownfield sites by enabling parties to remediate sites using private rather than public funds and to reduce the development pressures on “greenfield” sites. In 2003, the VCP was incorporated in the then new Brownfield Cleanup Program (BCP). To help support cleanup under the VCP/BCP, an Environmental Restoration Program was established in 1996 and initially funded with $200 million from the New York State Clean Water/Clean Air Bond Act of 1996 (http://www.dec.ny.gov/chemical/8444.html). Sites included in the VCP, BCP, and/or ERP are not added to the state’s official registry list. These sites either have a classification code of A or C. An A classification is assigned to a non-registry site where work is under way and not yet complete. A C classification is used for sites where NYSDEC has determined that remediation has been satisfactorily competed and has received a Certificate of Completion (COC) but may require ongoing maintenance. According to BNR (2008), 20 sites in the VCP, BCP, and/or ERP with an A classification are located within the Buffalo River water-
shed (see Table 1-2). Continued work at these sites is needed to prevent migration of contaminants to the Buffalo River or its tributaries.

### Table 1-2 Sites in the New York State VCP, BCP, and ERP with an A Classification

<table>
<thead>
<tr>
<th>Site Number</th>
<th>Site Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>V00215</td>
<td>Sovereign Specialty Chemicals Inc.</td>
</tr>
<tr>
<td>V00319</td>
<td>Hanna Furnace</td>
</tr>
<tr>
<td>V00370</td>
<td>Pizza Hut</td>
</tr>
<tr>
<td>V00435</td>
<td>Hanna Furnace</td>
</tr>
<tr>
<td>V00619</td>
<td>Steelfields</td>
</tr>
<tr>
<td>V00663</td>
<td>Buffalo Business Park</td>
</tr>
<tr>
<td>B00149</td>
<td>Buffalo Outer Harbor</td>
</tr>
<tr>
<td>B00164</td>
<td>Hanna Furnace (Subparcel 3)</td>
</tr>
<tr>
<td>B00174</td>
<td>Franczyk Park</td>
</tr>
<tr>
<td>B00196</td>
<td>Boone Park</td>
</tr>
<tr>
<td>E915181</td>
<td>90 Hopkins St</td>
</tr>
<tr>
<td>E915182</td>
<td>Sycamore Village</td>
</tr>
<tr>
<td>E915193</td>
<td>Buffalo Lakeside Commerce Park</td>
</tr>
<tr>
<td>C915201</td>
<td>Exxon Mobil Oil</td>
</tr>
<tr>
<td>C915204</td>
<td>Steelfields Area IV</td>
</tr>
<tr>
<td>C915208</td>
<td>275 Franklin St</td>
</tr>
<tr>
<td>C915209</td>
<td>Former Buffalo China Site</td>
</tr>
<tr>
<td>C915211</td>
<td>NOCO #S41</td>
</tr>
<tr>
<td>C915221</td>
<td>Sonwil Buffalo</td>
</tr>
<tr>
<td>C915223</td>
<td>Niagara St. and Pennsylvania Ave.</td>
</tr>
</tbody>
</table>


1. Assigned to sites where investigative or remedial work is underway and not yet complete.

Key:  
- BCP = Brownfield Cleanup Program.  
- ERP = Environmental Restoration Program.  
- VCP = Voluntary Cleanup Program.

### 1.4.5.10 Continued SPDES Permit Monitoring and Renewal

NYSDEC regulates industrial and municipal wastewater discharges to the Buffalo River watershed through the SPDES program. Permit discharge monitoring and renewal in the Buffalo River watershed must continue to protect the investment that will be made in sediment remediation in the AOC and to ensure that beneficial uses of the river and its tributaries remain unimpaired for future generations.

### 1.4.5.11 Continued RIBS Sampling by NYSDEC

The rivers and streams in the Buffalo River watershed are sampled as part of the RIBS program under NYSDEC. The Buffalo River is routinely sampled every year. Sampling of the Buffalo River takes place at the Ohio Street Bridge. Thirteen additional sites within the Buffalo River watershed also are sampled under the RIBS program, but sampling at these sites takes place only once every five years. The basin was last sampled in 2006, but a report for that sampling event is
not yet available from NYSDEC. The last available RIBS report (NYSDEC 2005) is for sampling conducted in 2001. The next round of sampling is scheduled for 2011.

Each RIBS report is a quantitative summary of the concentrations of chemical and physical constituents in the water column, sediments, and biological tissue. The concentrations are compared with assessment criteria to determine if designated uses of the waterbody are supported. The water quality data and information generated by the RIBS program are used to support many monitoring and assessment functions within the NYSDEC Division of Water, including development of the Waterbody Inventory/Priority Waterbody List.

The NYSDEC (2005) RIBS assessment summary for the Buffalo River is as follows: (1) water quality parameters of concern are iron, ammonia, water temperature, and dissolved oxygen; (2) macroinvertebrate sampling (using artificial substrate samplers) indicated a slightly impacted condition; (3) there continues to be a fish advisory for carp (eat none) due to PCB contamination; (4) no significant mortality or reproductive impairment of the water flea (Ceriodaphnia dubia) was detected at this site; and (5) no sediments were collected. Continued RIBS sampling by NYSDEC will help demonstrate improvements in the Buffalo River in response to remedial work and, therefore, this sampling is relevant to the eventual delisting of several BUIs.

Finally, in 2011, for the next round of intensive sampling in the Buffalo River watershed, the RIBS program will include PCB sampling of sediment and benthic invertebrates to help investigate potential PCB source areas in the Buffalo River watershed (Novak 2011). This work is relevant to the eventual delisting of BUIs 1, 3, and 5. These BUIs have delisting criteria that are based on reducing levels of bioaccumulative chemicals in fish.

**1.4.5.12 Biannual Shoreline Sweeps.**
For the past 15 to 20 years, BNR has organized biannual (spring and fall) cleanups along the Buffalo River and other local waterways to remove litter and other accumulated debris using volunteers from local communities. This program is relevant to BUI 11 – Degradation of Aesthetics (http://bnriverkeeper.org/get-involved/cleanups).

**1.4.5.13 Riverbend Development Master Plan**
Riverbend Commerce Park (RCP) is a brownfield reclamation site (formerly known as Steelfields) that once housed the Republic Steel and Donner Hanna Coke facilities and is part of the larger South Buffalo Brownfield Opportunity Area (BOA). The City of Buffalo and BUDC have set forth goals for the RCP site including (1) to become a model for sustainable development; (2) to foster long-term economic growth by leveraging the assets of the site and region; (3) to apply placemaking principles to create special public spaces and a new community on the banks of the Buffalo River; and (4) to achieve the vision of the South Buffalo BOA Master Plan in a manner that will minimize harmful impacts on the envi-
ronment as well as foster the ongoing remediation and environmental restoration of the Buffalo River. To achieve these goals, BUDC selected Sasaki Associates to lead a consultant team charged with creating a plan to market and develop the RCP property. Further information is available at http://www.ecidany.com/budc-projects-riverbend-development-plan. Reclamation of the RCP site will benefit the Buffalo River by managing storm water runoff from the site to the river and by promoting development in a manner that protects shoreline and riparian areas. These efforts will contribute to delisting BUIs with delisting criteria designed to improve water quality and riparian habitats in the AOC.

1.4.5.14 Western New York Stormwater Coalition
The municipalities of Western New York have joined together to develop storm water management programs to protect local waterways and enhance quality of life in Western New York. The overall goal of the Coalition is to use regional collaboration to identify existing resources and develop programs to reduce the negative impacts of storm water pollution and runoff. Much information regarding this effort may be found at http://www.erie.gov/environment/compliance//pollution_sw2.asp and is designed to enhance public knowledge and awareness of storm water pollution and provide information to individuals and households to prevent storm water pollution and protect water quality. The Coalition’s Management Plan (2008) includes a description of best management practices (BMPs) related to: (1) public education and outreach; (2) public participation and involvement; (3) illicit discharge detection and elimination; (4) construction site runoff control; (5) post-construction storm water management; and (6) pollution prevention and good housekeeping operations for municipal operations. Collectively, these BMPs will help eliminate or minimize storm water impacts on local waterways, including the Buffalo River and its tributaries. These efforts will contribute to delisting BUIs with delisting criteria designed to improve water quality and aesthetics in the AOC.
2 BUIs and Projects/Actions to Address Impairments

For each of the nine impaired beneficial uses at the Buffalo River AOC (see Table 1-1), actions, projects, and programs that will help eliminate or minimize the impairment are identified. These actions, projects, and programs are divided into two groups: (1) ongoing or forthcoming and (2) recommended new. Those in the first group have been described by other parties (see Section 1.4) and will be funded by federal, state, or private monies that have already been identified. Those in the second group are described for the first time in this report and are candidate projects for GLRI proposals in 2011 or later years. Rough cost estimates are provided for the new, recommended projects. The discussion below is organized by BUI, typically with a subheading for each delisting criterion for that BUI.

2.1 BUI 1: Restrictions on Fish and Wildlife Consumption
Human and ecological receptors using the Buffalo River AOC may be at risk from PCBs, PAHs, and metals in fish based on recent studies (e.g., Sultrac 2007, ENVIRON et al. 2009, Skinner et al. 2009) and current fish consumption advisories (New York State Department of Health [NYSDOH] 2010). These substances are present at elevated concentrations in sediments in the Buffalo River AOC and can enter the aquatic food web of the river via bioaccumulation from sediment (U.S. Army Corps of Engineers 2003). Remediation of AOC sediments is critical to addressing the two delisting criteria under this BUI, both of which are based on chemical residues in fish (see Table 1-1).

Forthcoming or ongoing projects that will address this BUI include the following:

1. **Buffalo River GLLA Sediment Dredging and Capping.** This forthcoming action will significantly reduce concentrations of PCBs and other chemicals in surface sediment in the Buffalo River AOC, thereby reducing chemical uptake into fish and other aquatic biota, and provide for limited monitoring after remedy completion. See Section 1.4.1 for a summary of the proposed work.

2. **Baseline Chemical and Biological Sampling.** This project will assess the current conditions in the AOC, including chemicals concentrations in fish, before remedial work, navigation dredging, or habitat restoration is implemented (see Section 1.4.2).
3. **Enhanced Navigational Dredging.** This forthcoming action will significantly reduce concentrations of PCBs and other chemicals in sediment in the navigation channel in the AOC, thereby reducing chemical uptake into benthic invertebrates, bottom-dwelling fish, and other aquatic biota in the long-term (see Section 1.4.4).

4. **Enhanced Fish Consumption Advisories.** As discussed above, an important element of this project is the education of immigrant groups regarding potential risks resulting from consumption of fish from the Buffalo River AOC and other area waterways (see Section 1.4.5.5). This project will not ameliorate the underlying cause of risk in the Buffalo River AOC (contaminated sediments), but it will help reduce human exposure to chemicals in fish and therefore is relevant to this BUI.

5. **Continued Hazardous Waste Site Remediation under the New York State Superfund Program and Other State Programs.** Any programs that reduce inputs of chemicals to the Buffalo River or its tributaries from inactive hazardous waste sites (see Section 1.4.5.8) and/or brownfields (see Section 1.4.5.9) will help to eliminate this impairment.

6. **Continued SPDES Permit Monitoring and Renewal** (see Section 1.4.5.10). Any program that reduces inputs of chemicals to the Buffalo River and/or its tributaries will help to eliminate this potential impairment.

Recommended new projects that will help address this BUI include:

1. **Extended Long-term Monitoring of Sediment, Biota, and Surface Water.** This recommended action would extend sediment, biota, and surface water monitoring beyond Year 5 following remedy implementation (see Section 1.4.1) in case all BUIs are not delisted by that time. Table 2-1 lists target media and parameters to be included in an extended long-term monitoring plan to address this BUI and the other eight Buffalo River BUIs and is based on the delisting criteria in Table 1-1. The list of target media and parameters in Table 2-1 is considered an upper limit for one round or extended long-term monitoring. The actual list of target media and parameters will be reduced if one or more BUIs are delisted before the first round of extended long-term monitoring is conducted in approximately 2022.

The cost estimate for this project is noted in Table 2-2.
**Table 2-1 Target Media and Parameters to be Incorporated into the Extended Long-term Monitoring Plan for the Buffalo River AOC**

<table>
<thead>
<tr>
<th>Media</th>
<th>Parameter</th>
<th>BUI Relevance</th>
<th>Rationale</th>
<th>Comments</th>
</tr>
</thead>
</table>
| Fish  | PCBs, pesticides, dioxins/furans, other endocrine disruptors, mercury, and ancillary parameters (lipids, percent moisture) | BUI 1 – Restrictions on Fish and Wildlife Consumption  
BUI 3 – Degradation of Fish and Wildlife Populations (Criterion 3 for fish)  
BUI 5 – Bird or Animal Deformities or Reproductive Problems (Criterion 2) | PCBs are the principal chemicals of concern in fish based on Skinner et al. (2009), ENVIRON et al. (2010), and NYSDOH (2010). Monitoring PCBs in fish is needed to track recovery of three BUIs. Analysis for pesticides, dioxins/furans, and other endocrine-disrupting chemicals are called out in BUI 3 (Criterion 3 for fish). | PCBs are the principal chemicals of concern in fish based on Skinner et al. (2009), ENVIRON et al. (2010), and NYSDOH (2010). Monitoring PCBs in fish is needed to track recovery of three BUIs. Analysis for pesticides, dioxins/furans, and other endocrine-disrupting chemicals are called out in BUI 3 (Criterion 3 for fish). |
| Community composition and DELTs | BUI 3 – Degradation of Fish and Wildlife Populations (Criteria 1 and 2 for fish) | Historically, fish diversity and abundance in the Buffalo River AOC has been poor due largely to degraded aquatic habitat and poor water quality. See Irvine et al. (2005) and ENVIRON et al. (2009) for methods and baseline data. | | |
| Bullhead liver tumor prevalence. | BUI 4 – Fish Tumors and Other Deformities (Criterion 1) | Liver tumors in bullheads are associated with PAH exposure. PAHs are one of the principal COCs in Buffalo River sediments. See Lauren et al. (2010) for historic and baseline data and Baumann (2010) for reference data. See Rafferty and Grazzo (undated) for methods. | | |
| Surface Water | Organoleptic chemicals (i.e., phenolic compounds and chlorinated benzenes) | BUI 2 – Tainting of Fish and Wildlife Flavor | Chlorinated and unchlorinated phenols are the chemicals most often associated with taste and odor problems in fish. Chlorinated benzenes may also cause taste and odor problems in fish. The USEPA (2010) indicates that this BUI is impaired. Riverkeeper's position is that this BUI should not be redesignated unless data are available to justify a change in status. NYSDEC (1998) water quality standards for chemicals associated with fish tainting (chlorobenzene, dichlorobenzenes, trichlorobenzenes, total-chlorinated phenols, and total-unchlorinated phenols) are available. | |
Table 2-1  Target Media and Parameters to be Incorporated into the Extendeda Long-term Monitoring Plan for the Buffalo River AOC

<table>
<thead>
<tr>
<th>Media</th>
<th>Parameter</th>
<th>Rationale</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water quality parameters (dissolved oxygen, temperature, TSS, etc.); SVOCs (including PAHs); metals; PCBs; chlorinated pesticides,</td>
<td>BUI 3 – Degradation of Fish and Wildlife Populations (Criterion 4 for fish)</td>
<td>Historically and sometimes currently, dissolved oxygen and other water quality parameters in the AOC have been unacceptable for desired aquatic life uses. NYSDEC (1998) has promulgated water quality standards for Class C and other water body classes for a wide range of chemicals.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BUI 4 – Fish Tumors and Other Deformities (Criterion 2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>BUI 14 – Loss of Fish and Wildlife Habitat (Criterion 2a)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phytoplankton population survey together with nutrient and algal pigment sampling.</td>
<td>BUI 13 – Degradation of Phytoplankton Populations</td>
<td>Currently, BUI 13 is not considered impaired at the Buffalo River AOC (USEPA 2010). However, because some anthropogenic impact on the phytoplankton community in the AOC is evident, a periodic phytoplankton population survey together with nutrient and algal-pigment sampling were recommended by Irvine and Murphy (2009). This recommendation was accepted by the RAC.</td>
</tr>
<tr>
<td>Sediment</td>
<td>PCBs, PAHs, lead, mercury, and ancillary parameters (TOC, AVS/SEM).</td>
<td>BUI 5– Bird or Animal Deformities or Reproductive Problems (Criterion 3)</td>
<td>PCBs are the principal bioaccumulative COCs in AOC sediments and are believed to be the primary source of PCBs in AOC-resident fish. Liver tumors in bullheads are associated with PAH exposure. PAHs are one of the principal COCs in AOC sediments. PAHs, PCBs, lead, and mercury are indicator chemicals in AOC sediments and can be toxic to benthic life and restrict dredging activities.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BUI 4 – Fish Tumors and Other Deformities (Criterion 2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>BUI 6 – Degradation of Benthos</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>BUI 7 -- Restrictions on Dredging Activities</td>
<td></td>
</tr>
<tr>
<td>Tox. to benthic macroinvertebrates</td>
<td>BUI 6 – Degradation of Benthos (Criterion 2)</td>
<td>BUI 6 – Degradation of Benthos (Criterion 2)</td>
<td>Metals and organic contaminants in sediment may affect the survival and growth of benthic macroinvertebrates. Standardized tests with field-collected sediments and laboratory-reared organisms are available and provide a direct measure of sediment toxicity or the lack thereof. This parameter may be used to track improvements in the condition of the benthic community over time instead of assessing benthic community structure or composition.</td>
</tr>
</tbody>
</table>
Table 2-1  Target Media and Parameters to be Incorporated into the Extended\(^a\) Long-term Monitoring Plan for the Buffalo River AOC

<table>
<thead>
<tr>
<th>Media</th>
<th>Parameter</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benthic</td>
<td>Benthic community survey</td>
<td>BUI 6 –Degradation of Benthos (Criterion 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Metals, organic contaminants, and/or habitat quality may affect the survival, growth, diversity, and/or abundance of benthic life. Standard methods for collecting and evaluating benthic macroinvertebrate community data are available (Bode et al. 2002). This parameter may be used instead of sediment toxicity tests to track improvements in the condition of the benthic community over time.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Comments</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wildlife</td>
<td>Bird, mammal, amphibian, and reptile diversity and abundance</td>
<td>BUI 3 –Degradation of Fish and Wildlife Populations (Criteria 1 and 3 for wildlife)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Needed in order to track improvement in wildlife abundance and diversity in the AOC in response to habitat restoration.</td>
</tr>
</tbody>
</table>

\(^a\) To begin when the monitoring described in the Buffalo River Feasibility Study ends, at Year 5 after remedy implementation.

\(^b\) Based on delisting criteria from USEPA (2010).

\(^c\) Possible target species include carp, brown bullhead, largemouth bass, pumpkinseed, and yellow perch, as per Skinner et al. (2009).

Key:

- **AOC** = Area of Concern.
- **AVS** = Acid volatile sulfides.
- **BUI** = Beneficial Use Impairment.
- **COC** = Chemical of concern.
- **DELTs** = Deformities, eroded fins, lesions, and tumors.
- **NYSDEC** = New York State Department of Environmental Conservation.
- **NYSDOH** = New York State Department of Health.
- **PCBs** = Polychlorinated biphenyls.
- **PAHs** = Polycyclic aromatic hydrocarbons.
- **SEM** = Simultaneously extracted metals.
- **TOC** = Total organic carbon.
- **TSS** = Total suspended solids.
- **USEPA** = United States Environmental Protection Agency.
Table 2-2 Approximate Cost Estimates for Recommended New Projects in the Buffalo River AOC Strategic Plan for BUI Delisting

<table>
<thead>
<tr>
<th>Project</th>
<th>Approximate Cost Estimate(^1)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extended Long-Term Monitoring</td>
<td>$117,690</td>
<td>See Appendix A.1 for further information. Cost estimate is for one round of monitoring (i.e., each time the monitoring is done) and assumes that all parameters listed in Table 2-1 will require monitoring. This cost estimate is considered an upper limit on the cost of one round of extended long-term monitoring. The actual cost per round may be lower for reasons provided in Appendix A.1.</td>
</tr>
<tr>
<td>Survey for Fish Tainting Complaints</td>
<td>$6,400</td>
<td>See Appendix A.2</td>
</tr>
<tr>
<td>Buffalo River ERMP Implementation</td>
<td>$200,000 to &gt; $1,000,000 for each site.</td>
<td>See Appendix A.3</td>
</tr>
<tr>
<td>Mink Video Surveillance</td>
<td>$71,400</td>
<td>See Appendix A.4 for project description and basis of cost estimate.</td>
</tr>
</tbody>
</table>

Note: \(^1\) = 2011 dollars.
Key:
- > = Greater than.
- AOC = Area of Concern.
- BUI = Beneficial Use Impairment.
- ERMP = Ecological Restoration Master Plan.

2.2 BUI 2: Tainting of Fish and Wildlife Flavor

This BUI is assumed to be impaired because of elevated levels of many contaminants in sediment, continued CSO inputs, seasonally poor water quality, and other factors.

2.2.1 Organoletic Chemicals in Surface Water

Phenolic compounds, especially chlorinated phenols, are the chemicals most often associated with taste and odor problems in fish. According to the Ohio USEPA (2005), phenols and related compounds may be present in waste streams from oil refineries, coke plants, gas plants, some chemical production facilities, plastics manufacturing, road surfacing, dye production, and various industries and processes that use phenolic substances as raw materials. Chlorinated benzenes also may cause taste and odor problems in fish. These compounds have many industrial uses, including manufacturing of dyes, insecticides, fumigants, metal polishes, moth repellants, pharmaceuticals, dielectric fluids, synthetic transformer oils, and lubricants (Smith et al. 1988). Lastly, various hydrocarbon mixtures including coal tar waste, kerosene, gasoline, and petroleum refinery wastes, can taint fish flavor (Thomas 1973).
Forthcoming or ongoing projects that will address this delisting criterion include several of those discussed above under BUI 1 and including the following:

1. **Buffalo River GLLA Sediment Dredging and Capping.** This action will remove a significant mass of PAHs and other hydrocarbon contamination from AOC sediments (see Section 1.4.1). Because some of these compounds can produce off-flavor in fish, this action will directly address a potential cause of this impairment.

2. **Baseline Chemical and Biological Sampling.** As part of the baseline assessment of the Buffalo River AOC (see Section 1.4.2), E & E recommends that surface water samples be collected from various locations in the Buffalo River and City Ship Canal and analyzed for the five organoleptic chemicals for which NYSDEC has promulgated water quality criteria (see Table 2-3).

3. **Enhanced Navigational Dredging.** This action will remove a significant mass of PAHs and other hydrocarbon contamination from sediment in the navigational channel of the AOC (see Section 1.4.4). Because some of these compounds can produce off-flavor in fish, this action will directly address a potential cause of this impairment.

4. **Continued Hazardous Waste Site Remediation under the New York State Superfund Program and Other State Programs.** Any actions that reduce inputs of chemicals to the Buffalo River or its tributaries from inactive hazardous waste sites (see Section 1.4.5.8) and/or Brownfields (see Section 1.4.5.9) may help with delisting this BUI.

5. **Continued SPDES Permit Monitoring and Renewal** (see Section 1.4.5.10). Any program that reduces inputs of chemicals to the Buffalo River and/or its tributaries may help with delisting this BUI.

### Table 2-3 New York State Water Quality Standards Applicable to Tainting of Fish and Wildlife Flavor.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Standard or Guidance Value (µg/L)</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorobenzene</td>
<td>50</td>
<td>None.</td>
</tr>
<tr>
<td>Dichlorobenzenes</td>
<td>50</td>
<td>Applies to sum of 1,2-, 1,3-, and 1,4-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>dichlorobenzene.</td>
</tr>
<tr>
<td>Phenols, total chlorinated</td>
<td>1</td>
<td>Refers to the sum of these substances.</td>
</tr>
<tr>
<td>Phenols, total unchlorinated</td>
<td>5</td>
<td>Refers to the sum of these substances.</td>
</tr>
<tr>
<td>Trichlorobenzenes</td>
<td>50</td>
<td>Applies to sum of 1,2,3-, 1,2,4-, and 1,3,5-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>trichlorobenzene.</td>
</tr>
</tbody>
</table>

Recommended new projects that will help address the first delisting criterion for this BUI include:

1. *Extended Long-term Monitoring of Sediment, Biota, and Surface Water.* This recommended action would extend monitoring, including collection and analysis of surface water samples for organoleptic chemicals, beyond the years specified in the FS (see Section 1.4.1). At a minimum, the surface water samples should be analyzed for the five chemicals for which NYSDEC (1998) has water quality standards for freshwater, aquatic-life aesthetics (see Table 2-3). (This new project is described in more detail in Section 2.1, above.).

The cost estimate for this project is noted in Table 2-2.

**2.2.2 Survey of Fish Flesh Tainting Problems**

Forthcoming or ongoing projects that will address this delisting criterion include:

1. *Enhanced Fish Consumption Advisories* (see Section 1.4.5.5). This project provides an opportunity to gather information from the public regarding the presence, or lack thereof, of tainted fish flavor in the Buffalo River AOC. Presently, this is not a stated objective of the project but an adjustment to the project work scope to help address this delisting criterion seems reasonable.

Recommended new projects that will help address this delisting criterion are:

1. *Survey of Fish and Wildlife Officials and Others for Tainting Complaints.* To directly address this criterion, a survey of fish and wildlife officials or other informed observers is recommended. A project description, including an example survey questionnaire, is presented in E & E (September 5, 2008) (see Appendix B).

The cost estimate for this project is noted in Table 2-2.

**2.3 BUI 3: Degradation of Fish and Wildlife Populations**

Fish and wildlife populations in the Buffalo River AOC have been adversely affected by past discharges of industrial and municipal wastes, habitat loss, poor water quality, and other factors.

**2.3.1 Fish Populations**

There are four delisting criteria for fish populations (see Table 1-1). Projects that will address these criteria and lead to the eventual delisting of this BUI are identified below.

**2.3.1.1 Criterion 1: Fish Community Composition**

Forthcoming or ongoing projects or programs that will address this delisting criterion include those that will reduce sediment chemical concentrations; improve water quality; improve in-channel and riparian habitat; and support baseline and future monitoring, including:
1. **Buffalo River GLLA Sediment Dredging and Capping** (see Section 1.4.1). This forthcoming action will significantly reduce concentrations of various contaminants in surface sediment in the AOC, thereby reducing bioaccumulation in fish and their prey in the long-term. This project also includes biological monitoring, including fish population surveys, at Years 1 and 5 following remedy implementation.

2. **Baseline Chemical and Biological Sampling** (see Section 1.4.2). As part of the baseline assessment, a fish community survey will be conducted at various locations within the AOC. These data will provide the final baseline against which future improvements are measured.

3. **Enhanced Navigational Dredging** (see Section 1.4.4). This forthcoming action will significantly reduce concentrations of various contaminants in surface sediment in the navigational channel of the AOC, thereby reducing bioaccumulation into fish and their prey in the long term.

4. **Buffalo River GLLA Habitat Restoration and Enhancement** (see Section 1.4.3). Restoration of in-channel and/or riparian habitats at the six sites identified in ENVIRON and MACTEC. (2010) are expected to benefit AOC fish populations.

5. **Buffalo River ERMP Development** (see Section 1.4.5.1). The ERMP identifies sites in and upstream from the AOC that are suitable for in-channel and riparian habitat restoration. Restoration at sites in the AOC is expected to benefit fish populations in the AOC. Restoration at sites along Cayuga, Cazenovia, and Buffalo Creeks may indirectly improve the fish community in the AOC given that fish move between the AOC and upstream areas.

6. **Buffalo River AOC Upland Habitat Restoration at Riverbend** (see Section 1.4.5.2). This project is expected to improve fish habitat adjacent to the Riverbend parcel by shading near-shore areas of the river channel.

7. **Wetlands Restoration at Seneca Bluffs** (see Section 1.4.5.4). Restoration of this site, which is just upstream from the AOC, is expected to indirectly improve the fish community in the AOC because fish move between the AOC and nearby upstream areas.

8. **City of Buffalo CSO Long-Term Abatement Plan** (see Section 1.4.5.6). This ongoing program is expected to improve water quality in the AOC by reducing loadings of biological oxygen demand (BOD), nutrients, metals, and other substances, thereby benefitting fish populations throughout the AOC.

9. **Continued Hazardous Waste Site Remediation under the New York State Superfund Program and Other State Programs** (see Sections 1.4.5.8 and 1.4.5.9). These programs reduce chemical inputs to the Buffalo River and its...
tributaries from inactive hazardous waste sites and/or brownfields, thereby improving water quality and benefiting fish populations in the AOC.

10. Continued SPDES Permit Monitoring and Renewal (see Section 1.4.5.10). This program minimizes inputs of chemicals to the Buffalo River and/or its tributaries, thereby benefiting water quality and fish populations in the AOC.

Recommended new projects that will help address this delisting criterion are:

1. Extended Long-term Monitoring of Sediment, Biota, and Surface Water. This recommended action would extend monitoring, including fish population surveys, beyond the years specified in the FS (see Section 1.4.1). This new project is described in more detail in Section 2.1 above.

The cost estimate for this project is noted in Table 2-2.

2. Buffalo River ERMP Implementation. The ERMP being developed will provide a list of suitable sites within the AOC and along Cayuga, Cazenovia, and Buffalo creeks where habitat restoration can be implemented. Restoration at these sites is expected to improve fish habitats in the AOC and upstream areas and should help improve the health of the fish community in the AOC.

The cost estimate for this project is noted in Table 2-2.

2.3.1.2 Criterion 2: Deformities, Eroded Fins, Lesions, and Tumor Anomalies

Deformities, eroded fins, lesions, and tumors (external) are collectively referred to as DELT anomalies. The frequency of occurrence of DELT anomalies indicates the health and condition of individual fish. These abnormalities occur infrequently or are absent from minimally impacted sites but occur frequently in areas where toxic chemicals are concentrated or below point sources of pollutants (Irvine et al. 2005a). Forthcoming or ongoing projects or programs that will address this delisting criterion include those that will reduce sediment chemical concentrations, limit inputs of contaminants to the Buffalo River and its tributaries, and include monitoring for DELT anomalies. These projects are:

1. Buffalo River GLLA Sediment Dredging and Capping (see Section 1.4.1). This forthcoming action will significantly reduce concentrations of contaminants in surface sediment in the AOC, thereby reducing exposure of fish to chemicals that may cause DELT anomalies. This project also includes biological monitoring, including monitoring for DELT anomalies, at Years 1 and 5 following remedy implementation.

2. Baseline Chemical and Biological Sampling (see Section 1.4.2). As part of the baseline assessment, evaluation of fish for DELT anomalies will be conducted at various locations within the AOC. These data will provide the final baseline against which improvements are measured.
3. *Enhanced Navigational Dredging* (see Section 1.4.4). This forthcoming action will significantly reduce concentrations of contaminants in surface sediment in the navigational channel in the AOC, thereby reducing exposure of fish to chemicals that may cause DELT anomalies.

4. *City of Buffalo CSO Long-Term Abatement Plan* (see Section 1.4.5.6). This ongoing program is expected to reduce loadings of metals, organic chemicals, and other contaminants to the AOC, thereby helping to reduce fish exposure to these substances. Consequently, this program should help reduce the occurrence of DELT anomalies in AOC-resident fish.

5. *Continued Hazardous Waste Site Remediation under the New York State Superfund Program and Other State Programs* (see Sections 1.4.5.8 and 1.4.5.9). These programs reduce chemical inputs to the Buffalo River and its tributaries from inactive hazardous waste sites and/or brownfields, thereby helping to reduce fish exposure to substances that may cause DELT anomalies.

6. *Continued SPDES Permit Monitoring and Renewal* (see Section 1.4.5.10). This program minimizes inputs of chemicals to the Buffalo River and/or its tributaries, thereby helping to reduce fish exposure to substances that may cause DELT anomalies.

Recommended new projects that will help address this delisting criterion are:

1. *Extended Long-term Monitoring of Sediment, Biota, and Surface Water.* This recommended action would extend monitoring, including evaluation of fish for DELT anomalies, beyond the years specified in the FS (see Section 1.4.1). This new project is described in more detail in Section 2.1, above.

The cost estimate for this project is noted in Table 2-2.

### 2.3.1.3 Criterion 3: Chemical Residues in Fish

This delisting criterion specifies that whole-body concentrations of endocrine-disrupting chemicals (e.g., PCBs, dioxins, pesticides, etc.) in bottom-dwelling fish do not exceed critical tissue concentrations for effects on fish. Dyer et al. (2000) presents critical tissue concentrations that could be used to evaluate fish chemical data for this delisting criterion. Forthcoming or ongoing projects that will address this delisting criterion are similar to those listed under BUI #1—Restrictions on Fish and Wildlife Consumption (see Section 2.1) because the delisting criteria for that BUI also focus on bioaccumulative chemicals in fish. Those projects are:

1. *Buffalo River GLLA Sediment Dredging and Capping* (see Section 1.4.1). This forthcoming action will significantly reduce concentrations of PCBs and other chemicals in surface sediment in the AOC, thereby reducing bioaccumulation into fish. This project also includes biological monitoring, including
2. **Baseline Chemical and Biological Sampling** (see Section 1.4.2). This forthcoming project will assess current conditions in the AOC, including chemical concentrations in fish, before remedial work, navigation dredging, or habitat restoration is implemented, thereby providing current baseline data against which future changes can be measured.

3. **Enhanced Navigational Dredging** (see Section 1.4.4). This forthcoming action will significantly reduce concentrations of PCBs and other chemicals in surface sediment in the navigational channel in the AOC, thereby reducing bioaccumulation into fish.

4. **Continued Hazardous Waste Site Remediation under the New York State Superfund Program and Other State Program** (see Sections 1.4.5.8 and 1.4.5.9). These ongoing programs reduce chemical inputs to the Buffalo River and its tributaries from inactive hazardous waste sites and/or brownfields, thereby helping to reduce fish exposure to bioaccumulative substances.

5. **Continued SPDES Permit Monitoring and Renewal** (see Section 1.4.5.10). This ongoing program minimizes inputs of chemicals to the Buffalo River and/or its tributaries, thereby helping to reduce fish exposure to bioaccumulative substances.

Recommended new projects that will help address this delisting criterion are:

1. **Extended Long-term Monitoring of Sediment, Biota, and Surface Water.** This recommended action would extend monitoring, including analysis of fish samples for PCBs and other bioaccumulative chemicals, beyond the years specified in the FS (see Section 1.4.1). This new project is described in more detail in Section 2.1, above.

The cost estimate for this project is noted in Table 2-2.

### 2.3.1.4 Criterion 4: Water Quality Measures Meet Class C River Standards

This delisting criterion specifies that water quality measures in the AOC (based on NYSDEC RIBS or other monitoring) meet New York State standards for at least a Class C river. According to NYSDEC regulations:

> The best usage of Class C waters is fishing. These waters shall be suitable for fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.
The principal water quality parameters of concern with respect to fish population health are iron, ammonia, water temperature, and dissolved oxygen (NYSDEC 2005[see Section 1.4.5]). Low dissolved oxygen levels in the AOC are largely the result of three factors: (1) thermal stratification in the dredged portion of the river during low flows, which reduces aeration; (2) high sediment oxygen demand together with a long water residence time resulting from the presence of a deep navigational channel, and (3) background BOD (Irvine et al. 2005b). Because navigational dredging is needed for commercial and flood-control purposes, the dissolved-oxygen problem in the AOC cannot be entirely ameliorated. However, it is possible to improve dissolved oxygen levels in nearshore areas through riparian zone restoration, thereby creating a corridor with acceptable water quality for fish migration. Metals and total suspended solids (TSS) are contributed to the AOC largely from upstream sources and CSOs, with upstream sources contributing a much greater load (Irvine et al. 2005b).

A number of forthcoming and ongoing projects are expected to address the principal water quality problems in the AOC by helping to alleviate the sources of the problem and/or providing monitoring to track changes over time, including the following:

1. **Buffalo River GLLA Sediment Dredging and Capping** (see Section 1.4.1). This forthcoming action will significantly reduce concentrations of metals, PAHs, PCBs, and other chemicals in AOC sediments, thereby helping to reduce concentrations of these substances in surface water due to sediment re-suspension in the long-term, although short-term increases in surface water chemical concentrations are likely to be observed during remedy implementation.

2. **Baseline Chemical and Biological Sampling** (see Section 1.4.2). This forthcoming project will assess current conditions in the AOC, including chemical concentrations in surface water, before dredging or habitat restoration is implemented, thereby providing current baseline data against which future changes can be measured.

3. **Enhanced Navigational Dredging** (see Section 1.4.4). This forthcoming action will significantly reduce concentrations of metals, PAHs, PCBs, and other chemicals in sediments in the navigational channel in the AOC, thereby helping to reduce concentrations of these substances in surface water due to sediment re-suspension in the long term, although short-term increases in surface water chemical concentrations are likely to be observed during remedy implementation.

4. **Buffalo River GLLA Habitat Restoration and Enhancement** (see Section 1.4.3). Restoration of in-channel and/or riparian habitats at the six sites identified in ENVIRON and MACTEC (2010) are expected to improve water quality in the AOC in several ways: (1) by reducing bank erosion, which in turn should reduce inputs of TSS and contaminants from riparian areas; (2) by
creating shade in near-shore areas, which will reduce water temperature and result in greater dissolved oxygen levels in near-shore surface water; and (3) by expanding submerged and emergent aquatic plant beds, which will add dissolved oxygen to the water by photosynthesis and filter suspended solids from the water column.

5. **Buffalo River ERMP Development** (see Section 1.4.5.1). The ERMP identifies sites within the AOC and along Cayuga, Cazenovia, and Buffalo creeks that are suitable for in-channel and riparian habitat restoration. Restoration at these sites is expected to improve water quality in the same manner as restoration at the six FS restoration sites (see above project).

6. **Buffalo River AOC Upland Habitat Restoration at Riverbend** (see Section 1.4.5.2). This project is expected to improve water quality adjacent to the Riverbend parcel by shading near-shore areas of the river channel and reducing bank erosion.

7. **Wetlands Restoration at Seneca Bluffs** (see Section 1.4.5.4). Restoration of this site, which is just upstream from the AOC, is expected to improve water quality in the same manner as restoration at the six FS restoration sites (see above).

8. **City of Buffalo CSO Long-Term Abatement Plan** (see Section 1.4.5.6). This ongoing program is expected to help improve water quality in the AOC by reducing loadings of BOD, TSS, and metals although, as mentioned above, CSOs are not the principal sources of BOD, TSS, and metals to the Buffalo River AOC.

9. **Continued Hazardous Waste Site Remediation under the New York State Superfund Program and Other State Programs** (see Sections 1.4.5.8 and 1.4.5.9). These programs reduce chemical inputs to the Buffalo River and its tributaries from inactive hazardous waste sites and/or brownfields, thereby benefiting water quality in the AOC.

10. **Continued SPDES Permit Monitoring and Renewal** (see Section 1.4.5.10). This program minimizes inputs of chemicals to the Buffalo River and/or its tributaries, thereby benefiting water quality in the AOC.

11. **Continued Annual RIBS Monitoring of the Buffalo River** (see Section 1.4.5.11). Surface water samples are collected every year in the Buffalo River at the Ohio Street Bridge under the RIBS program. These data provide a valuable long-term record of changes in TSS, dissolved oxygen, and other water quality parameters in the AOC.

12. **Riverbend Development Master Plan** (see Section 1.4.5.13). Reclamation of the RCP site will benefit the Buffalo River AOC by managing storm water runoff from the site to the river and by promoting development in a manner
that protects shoreline and riparian areas. These efforts will help improve wa-
ter quality in the AOC.

13. **Western New York Stormwater Coalition BMP Implementation** (see Section 1.4.5.14). Continued implementation of storm water BMPs will help reduce loadings of contaminants (e.g., metals, PAHs, oil and grease, etc.), suspended solids, and floatables to the Buffalo River AOC and its tributaries.

Recommended new projects to address this delisting criterion include the follow-
ing:

1. **Extended Long-term Monitoring, Sediment, Biota, and Surface Water** (see Section 2.1). This recommended action would extend monitoring of sedi-
ment, biota, and surface water beyond the years specified in the FS (see Sec-
tion 1.4.1). Surface water data collected from this effort will be used to sup-
plement surface water data from the NYSDEC RIBS program. Table 2-1 lists target parameters for surface water to be included in an extended long-term monitoring plan. This new project is described in more detail in Section 2.1, above.

The cost estimate for this project is noted in Table 2-2.

2. **Buffalo River ERMP Implementation.** The ERMP being developed will pro-
vide a list of suitable sites within the AOC and along Cayuga, Cazenovia, and Buffalo creeks where habitat restoration can be implemented. Restoration at these sites is expected to improve water quality in the AOC and upstream ar-
 eas by reducing erosion, creating shade and cooler water in littoral areas, and restoring wetland vegetation that can filter suspended solids from the water.

The cost estimate for this project is noted in Table 2-2.

### 2.3.2 Wildlife Populations

There are four delisting criteria for wildlife populations (see Table 1-1). Projects that will help address these criteria and lead to the eventual delisting of this BUI are identified below.

#### 2.3.2.1 Criterion 1: Wildlife Diversity and Abundance

This criterion specifies that diversity and abundance of birds, mammals, reptiles, and amphibians in the AOC should be comparable to a suitable reference site. As of January 2011, a suitable reference site has not been identified. However, this deficiency should not preclude moving forward with projects or actions to im-
prove the attractiveness of the AOC to wildlife. Forthcoming and ongoing pro-
jects that will accomplish this objective and/or provide monitoring to periodically evaluate wildlife diversity and abundance in the AOC include the following:

1. **Buffalo River GLLA Habitat Restoration and Enhancement** (see Section 1.4.3). Restoration of in-channel and/or riparian habitats at the six sites iden-
2 BUIs and Projects/Actions to Address Impairments

tified in ENVIRON and MACTEC (2010) are expected to greatly improve wildlife habitats in the AOC and thereby improve wildlife diversity and abundance.

2. **Buffalo River ERMP Development** (see Section 1.4.5.1). The ERMP identifies sites in the AOC and upstream from the AOC along Cayuga, Cazenovia, and Buffalo creeks that are suitable for in-channel and riparian habitat restoration. Restoration at these sites is expected to increase wildlife diversity and abundance in the AOC and nearby upstream areas.

3. **Buffalo River AOC Upland Habitat Restoration at Riverbend** (see Section 1.4.5.2). This project will directly improve wildlife habitats in the AOC and thereby increase wildlife diversity and abundance in the AOC.

4. **Baseline Inventory of Mammal, Bird, Amphibian, and Reptile Populations** (see Section 1.4.5.3). BNR has acquired funding to coordinate a baseline inventory of mammal, bird, amphibian, and reptile populations in the Buffalo River AOC. This project will provide baseline data against which improvement can be measured.

5. **Wetlands Restoration at Seneca Bluffs** (see Section 1.4.5.4). Restoration of this site, which is just upstream from the AOC, may indirectly increase wildlife diversity and abundance in the AOC because wildlife may move from this nearby site to the AOC to satisfy their food, habitat, and other needs.

Recommended new projects that will address this delisting criterion are as follows:

1. **Extended Long-term Monitoring, Sediment, Biota, and Surface Water** (see Section 2.1). This recommended action would extend biological monitoring, including monitoring for wildlife diversity and abundance, beyond the years specified in the FS (see Section 1.4.1). This new project is described in more detail in Section 2.1, above.

   The cost estimate for this project is noted in Table 2-2.

2. **Buffalo River ERMP Implementation**. The ERMP being developed will provide a list of suitable sites within the AOC and along Cayuga, Cazenovia, and Buffalo creeks where habitat restoration can be implemented. Restoration at these sites is expected to increase wildlife diversity and abundance in the AOC and nearby upstream areas.

   The cost estimate for this project is noted in Table 2-2.
2.3.2.2 Criterion 2: Wildlife Assessments Confirm No Significant Toxicity

This delisting criterion specifies that “wildlife assessments confirm no significant toxicity from water column or sediment contaminants.” E & E interprets this criterion to imply that surface water and sediment chemical concentrations in the AOC should not exceed New York State criteria for wildlife protection. Chemical concentrations in sediment were evaluated during development of sediment remedial goals in the Buffalo River FS (ENVIRON et al. 2010). The remedial goals selected were designed to be protective of wildlife (and human receptors). Hence, attainment of these goals should ensure that wildlife species using the AOC are not experiencing toxic effects from chemicals in sediment.

NYSDEC (1998) has promulgated water quality criteria for dioxins/furans, dichlorodiphenyldichloroethane (DDD), dichlorodiphenyldichloroethylene (DDE), dichlorodiphenyltrichloroethane (DDT), mercury, and PCBs. Surface water data from future monitoring efforts can be compared with these criteria to assess potential risks to wildlife.

Forthcoming and ongoing projects that are relevant to this delisting criterion include projects related to sediment remediation, monitoring, and source control:

1. Buffalo River GLLA Sediment Dredging and Capping (see Section 1.4.1).
2. Baseline Chemical and Biological Sampling (see Section 1.4.2).
3. Enhanced Navigational Dredging (see Section 1.4.4)
4. City of Buffalo CSO Long-Term Abatement Plan (see Section 1.4.5.6).
5. Continued Hazardous Waste Site Remediation under the New York State Superfund Program and Other State Programs (see Sections 1.4.5.8 and 1.4.5.9).
6. Continued SPDES Permit Monitoring and Renewal (see Section 1.4.5.10).
7. Continued Annual RIBS Monitoring of the Buffalo River (see Section 1.4.5.11).
8. Western New York Stormwater Coalition BMP Implementation (see Section 1.4.5.14).

Recommended new projects that will address this delisting criterion through remediation, monitoring, or source control include the following:

Extended Long-term Monitoring, of Sediment, Biota, and Surface Water (see Section 2.1). The cost estimate for this project is noted in Table 2-2.
2.3.2.3 Criterion 3: Amphibian Diversity in Pocket Wetlands
This criterion specifies that “diversity of amphibian populations in AOC pocket wetlands is similar to upstream and/or to Tifft marsh levels.” This delisting criterion is similar to the first delisting criterion for wildlife populations (see Section 2.3.2.1) but is focused on amphibians in specific AOC habitats. In general, the forthcoming and ongoing projects that apply to that delisting criterion also apply here, and are as follows

1. **Buffalo River GLLA Habitat Restoration and Enhancement** (see Section 1.4.3).
2. **Buffalo River ERMP Development** (see Section 1.4.5.1).
3. **Buffalo River AOC Upland Habitat Restoration at Riverbend** (see Section 1.4.5.2).
4. **Baseline Inventory of Mammal, Bird, Amphibian, and Reptile Populations** (see Section 1.4.5.3).
5. **Wetlands Restoration at Seneca Bluffs** (see Section 1.4.5.4).

Recommended new projects that will address this delisting criterion are the same as those for the first delisting criterion under wildlife populations (see Section 2.3.2.1) and are:

1. **Extended Long-term Monitoring, Sediment, Biota, and Surface Water** (see Section 2.1). The cost estimate for this project is noted in Table 2-2.
2. **Buffalo River ERMP Implementation**. The cost estimate for this project is noted in Table 2-2.

2.3.2.4 Criterion 4: Diversity of Benthic Populations
This criterion specifies that the diversity of benthic populations in the AOC be comparable to upstream levels. The benthic community in the AOC is negatively affected by at least three factors: sediment contamination, poor water quality (low dissolved oxygen in particular), and navigational dredging. Forthcoming remedial work in the Buffalo River AOC will address the first factor, but not the other two. Habitat restoration is expected to improve dissolved oxygen levels in the littoral zone but not in the navigational channel where the problem is most evident. Low dissolved oxygen levels in the navigation channel are the result of thermal stratification during low flows, which reduces aeration, and a high sediment oxygen demand, together with a long water residence time (Irvine et al. 2005b). Because navigational dredging will continue, the navigational channel is not expected to be able to support a benthic community with a diversity similar to that found upstream. However, it should be possible to improve benthic community diversity outside the navigational channel through a combination of habitat restoration and sediment remediation to reduce contaminant concentrations.
Forthcoming and ongoing projects relevant to this delisting criterion are as follows:

1. *Buffalo River GLLA Sediment Dredging and Capping* (see Section 1.4.1). This forthcoming action will significantly reduce concentrations of metals, PAHs, and other chemicals in AOC sediments, thereby improving the quality of benthic habitats in the AOC.

2. *Baseline Chemical and Biological Sampling* (see Section 1.4.2). This forthcoming project will assess current conditions in the AOC, including benthic-community composition, before dredging or habitat restoration is implemented, thereby providing current baseline data against which future changes can be measured.

3. *Enhanced Navigational Dredging* (see Section 1.4.4). This forthcoming action will significantly reduce concentrations of metals, PAHs, and other chemicals in sediments in the navigational channel in the AOC, thereby improving the quality of benthic habitats.

4. *Buffalo River GLLA Habitat Restoration and Enhancement* (see Section 1.4.3). Restoration of in-channel and/or riparian habitats at the six sites identified in ENVIRON and MACTEC (2010) are expected to result in improved conditions for benthic invertebrates in the littoral zone near those sites.

5. *Buffalo River ERMP Development* (see Section 1.4.5.1). The ERMP identifies sites within the AOC and along Cayuga, Cazenovia, and Buffalo Creeks that are suitable for in-channel and riparian habitat restoration. Restoration at sites within the AOC is expected to improve conditions for benthic invertebrates at those sites.

6. *Buffalo River AOC Upland Habitat Restoration at Riverbend* (see Section 1.4.5.2). This project is expected to improve water quality and benthic habitats adjacent to the Riverbend parcel by creating shade and reducing bank erosion.

7. *Continued Annual RIBS Monitoring of the Buffalo River* (see Section 1.4.5.11). The RIBS program evaluates benthic community composition in the AOC at the Ohio Street Bridge using artificial-substrate samplers. These data provide a valuable long-term record of changes in community composition, but are restricted to one location.

Recommended new projects that will address this delisting criterion are:

1. *Extended Long-term Monitoring, Sediment, Biota, and Surface Water* (see Section 2.1). This recommended action would extend biological monitoring,
including benthic community surveys, beyond the years specified in the FS. This new project is described in more detail in Section 2.1, above.

The cost estimate for this project is noted in Table 2-2.

2. **Buffalo River ERMP Implementation.** The ERMP being developed will provide a list of suitable sites within the AOC and along Cayuga, Cazenovia, and Buffalo creeks where habitat restoration can be implemented. Restoration at sites within the AOC is expected to improve conditions for benthic invertebrates at those sites. The cost estimate for this project is noted in Table 2-2.

### 2.4 BUI 4: Fish Tumors and Other Deformities

#### 2.4.1 Criterion 1: Liver Tumors in Bullheads

Bullheads collected from the Buffalo River in the 1970s and 1980s were reported to have an elevated prevalence of liver tumors (NYSDEC 1989). These observations led to the Buffalo River being considered impaired for *Fish Tumors and Other Deformities* (NYSDEC 1989). Liver tumor prevalence in bullheads in the Buffalo River AOC has decreased since the 1970 and 1980s (Lauren et al. 2010) but still is elevated compared with the tumor prevalence considered typical for fish in reference locations in the lower Great Lakes (0% to 2% [Baumann 2010]). The prevalence of liver tumors in bullheads and other bottom-dwelling fish has been shown to be associated with PAH exposure (Lauren et al. 2010; Baumann 2010; NYSDEC 1989). Hence, projects that will reduce sediment PAH levels in the Buffalo River AOC are expected to ameliorate this impairment.

Forthcoming and ongoing projects applicable to this delisting criterion include the following:

1. **Buffalo River GLLA Sediment Dredging and Capping** (see Section 1.4.1). This forthcoming action will significantly reduce PAH concentrations in AOC sediments, thereby reducing exposure of bottom-dwelling fish to PAHs in the long-term. However, during remediation, the potential for exposure may increase as a result of sediment disturbance and resuspension. Nonetheless, the long-term benefit is considered to more than offset increased exposure in the short-term.

2. **Enhanced Navigational Dredging** (see Section 1.4.4). This forthcoming action will significantly reduce PAH concentrations in sediment in the navigational channel in the AOC, thereby reducing exposure of bottom-dwelling fish to PAHs in the long-term. However, during remediation, the potential for exposure may increase as a result of sediment disturbance and resuspension. Nonetheless, the long-term benefit is considered to more than offset increased exposure in the short-term.

3. **Continued Hazardous Waste Site Remediation under the New York State Superfund Program and Other State Programs** (see Sections 1.4.5.8 and 1.4.5.9). These programs help reduce inputs of contaminants to the Buffalo
River and its tributaries from inactive hazardous waste sites and/or Brownfields. Continued site cleanup under these programs will help to ensure that potential PAH sources to the Buffalo River and its tributaries are controlled or eliminated.

4. **Continued SPDES Permit Monitoring and Renewal** (see Section 1.4.5.10). This program minimizes inputs of chemicals to the Buffalo River and its tributaries. Continued operation of this program will help to ensure that potential PAH sources to the Buffalo River and its tributaries are controlled or eliminated.

Recommended new projects that will address this delisting criterion include the following:

3. **Extended Long-term Monitoring, Sediment, Biota, and Surface Water** (see Section 2.1). This recommended action would extend biological monitoring, including evaluation of bullheads for liver tumors, beyond the years specified in the FS. This new project is described in more detail in Section 2.1, above. The cost estimate for this project is noted in Table 2-2.

### 2.4.2 Criterion 2: Chemicals in Water and Sediment

This delisting criterion strives for acceptable sediment and water quality in the AOC by requiring that contaminant levels in these media not exceed NYSDEC (1998; 1999) standards. This criterion is similar to Criterion 4 for Fish Populations under BUI 3 – Degradation of Fish and Wildlife Populations; therefore, the projects and actions that are applicable to that criterion also apply here (see Section 2.3.1.4 for project list and rationale).

### 2.5 BUI 5: Bird or Animal Deformities or Reproductive Problems

There are three delisting criteria for this BUI (see Table 1-1). Projects that will help address these criteria and lead to the eventual delisting of this BUI are identified below.

#### 2.5.1 Criterion 1: Deformities or Reproductive Problems

This criterion specifies deformities or reproductive problems should not be statistically different from inland background levels. At the Buffalo River AOC, PCBs are the substances most likely to cause deformities or reproductive problems in wildlife because of their persistence, tendency to biomagnify in aquatic food webs, and toxicological properties. Piscivorous wildlife, especially piscivorous mammals (e.g., mink), are the species at greatest risk. For this reason, the sediment remedial goal for PCBs in the Buffalo River AOC is based on a mink exposure scenario (ENVIRON et al. 2010). In general, any projects or actions that reduce PCB levels in fish are applicable to this criterion.

Forthcoming or ongoing projects intended to reduce concentrations of bioaccumulative chemical in fish were identified under Criterion 3 for BUI 3 – Degradation
of Fish and Wildlife Populations (see Section 2.3.1.3 for project list and rationale).

Two recommended new projects relevant to this delisting criterion also were identified and described under Criterion 3 for BUI 3 (see Section 2.3.1.3). An additional new project is recommended specifically for this delisting criterion to provide data regarding mink presence and reproduction in the AOC compared with upstream areas:

1. **Mink Survey for the Buffalo River AOC and Watershed.** Haynes et al. (2007) studied mink, a sentinel species, in the Rochester AOC to address two BUIs: Degradation of Fish and Wildlife Populations and Bird or Animal Deformities or Reproductive Problems. That study used weather-proof video surveillance equipment to examine mink relative abundance and reproduction (as indicated by the presence of young mink) in and out of the AOC. Implementation of a similar video-surveillance study is recommended for the Buffalo River system to assess mink relative abundance and reproduction in the Buffalo AOC compared with upstream areas. It is recommended that this study not be implemented until after the sediment remedial work and habitat restoration described in the Buffalo River FS (see Sections 1.4.1 and 1.4.3) is completed. The disturbance caused by these activities would likely bias comparisons made between the AOC and upstream areas if data were collected during these activities. The cost estimate for this project is noted in Table 2-2. Appendix A-4 provides further information regarding this recommended project.

It should be noted that this project depends on the habitat restoration projects in the AOC increasing the amount and value of riparian and near-shore aquatic habitats for wildlife. If those projects are successful, then adequate habitat likely will exist in the future in the AOC to support mink. However, it is possible that mink may choose not to use the AOC for other reasons, such as proximity to human activities and/or availability of better habitat elsewhere. Hence, if the mink video surveillance study is conducted at a future date in the AOC and no mink are observed, this does not necessarily mean that mink reproduction is impaired in the AOC. Such a result would be inconclusive with respect to this delisting criterion. Conversely, if a mink video survey is conducted and mink families with young are observed, such a result would suggest that mink reproduction is possible and that the AOC is recovering. Regardless of the result, it is suggested that the results of the mink video surveillance study be used as part of a weight-of-evidence approach along with the data collected for the other two delisting criteria under this BUI.

### 2.5.2 Criterion 2: Chemical Residues in Fish

This delisting criterion specifies that concentrations of bioaccumulative chemicals in AOC fish should not be in excess of levels associated with reproductive problems in piscivorous wildlife (see Table 1-1). The goal of this criterion is similar to the goal of Criterion 3 under BUI 3—Degradation of Fish and Wildlife Populations; that is, to reduce levels of bioaccumulative chemicals in fish. Hence, the
same forthcoming/ongoing and new projects that were identified and described under Criterion 3 for BUI 3 also apply here (see Section 2.3.1.3 for project list and rationale).

2.5.3 Criterion 3: Sediment Chemical Concentrations in Benthivorous and Omnivorous Wildlife
This delisting criterion requires that chemical concentrations in sediment do not exceed levels that could result in reproductive problems in omnivorous and benthivorous birds and wildlife (see Table 1-1). E & E assumes that this criterion applies to all chemicals, not only bioaccumulative chemicals, with the goal of reducing exposure from incidental sediment ingestion and diet to an acceptable level. This issue was considered during development of sediment remedial goals for the Buffalo River FS for all chemicals of concern except PAHs; the PAH remedial goal is based on risks to benthic invertebrates (ENVIRON et al. 2010). Nonetheless, attainment of the sediment remedial goal for PAHs will greatly reduce wildlife exposure to PAHs and, coupled with biodegradation and deposition of clean sediment after remediation, should eliminate chronic risks to wildlife from PAHs in the long-term. In general, any projects or actions that reduce chemical concentrations in sediment, control potential sources in the watershed, limit uptake of chemicals into the aquatic food web, or provide for monitoring of chemicals in sediment and/or biota are applicable to this criterion. Forthcoming/ongoing and new projects that fall into this category were identified under Criterion 3 under Wildlife Populations for BUI 3 – Degradation of Fish and Wildlife Populations (see Section 2.3.2.2).

2.6 BUI 6: Degradation of Benthos
The benthic community in the Buffalo River AOC is negatively affected by sediment contamination, disturbance from navigational dredging, and low dissolved oxygen levels in surface water. The latter is a consequence of the effect of the navigational channel on river hydraulics (see Sections 2.3.2.4 and 2.3.1.4). Because navigational dredging will continue for commercial and flood-control purposes, the disturbance caused by this activity and the problem of low dissolved oxygen cannot be entirely ameliorated. However, it should be possible to improve the overall health of the benthic community outside of the navigational channel through a combination of habitat restoration and sediment remediation. There are two delisting criteria for this BUI—one related to benthic community composition and the other related to sediment toxicity (see Table 1-1). Projects and actions that will help address these criteria and lead to the eventual delisting of this BUI are identified below.

2.6.1 Criterion 1: Benthic Community Composition
The goal of this delisting criterion is very similar to the goal of Criterion 4 (AOC Benthic Macroinvertebrate Diversity Similar to Upstream Areas) under Wildlife Populations for BUI 3 – Degradation of Fish and Wildlife Populations. The projects that were identified to address that criterion are equally applicable here (see Section 2.3.2.4 for project list and rationale).
2.6.2 Criterion 2: Sediment Toxicity

The goal of this delisting criterion is to eliminate chemical toxicity in Buffalo River AOC sediments. Forthcoming/ongoing and new projects that are relevant to this criterion include those related to sediment remediation, monitoring, and source control. A list of these projects is provided in Section 2.3.2.2.

2.7 BUI 7: Restrictions on Dredging Activities

There is only one delisting criterion for this BUI—to eliminate restrictions on dredging and disposal of dredge spoils due to chemical contaminants (see Table 1-1). The proposed sediment remedial alternative for the Buffalo River AOC (see Section 1.4.1) and navigational dredging by the USACE (see Section 1.4.4) are expected to reduce sediment contamination in and near the navigational channel to a level where a confined disposal cell is no longer required for disposal of dredge spoils. The proposed alternative also includes confirmatory sampling when dredging is completed, and at Year 2 and Year 5 following remedy completion to confirm that sediment remedial goals have been achieved. Other forthcoming/ongoing and new actions, projects, and programs relevant to this delisting criterion include those related to sediment monitoring and source control. A listing of the projects is provided in Section 2.3.2.2.

2.8 BUI 11: Degradation of Aesthetics

Undesirable aesthetics may impair a variety of beneficial uses of the Buffalo River, including fishing, boating, bird watching, and development and use of residential, commercial, and recreational facilities adjacent to the river. Aesthetics may be impaired by the presence of unsightly, deleterious, and malodorous substances in and around the water; films and sheens on the water’s surface; and floating litter and other debris. Aesthetic impairments were much more evident decades ago when the primary land use adjacent to the river was industrial (NYSDEC 1989). Nonetheless, there is still a potential for aesthetic impairments to occur in the Buffalo River AOC because the river is in an urbanized area, CSO inputs continue, and other factors. There are two delisting criteria for this BUI—one designed to minimize debris, litter, and other floatables and one designed to minimize or eliminate unsightly films and sheens (see Table 1-1).

2.8.1 Criterion 1: Debris, Litter, and Floatables

Forthcoming and ongoing projects that will help to minimize aesthetic impairments resulting from floating debris include:

1. City of Buffalo CSO Long-Term Abatement Plan (see Section 1.4.5.6). This ongoing program is expected to improve water quality aesthetics in the AOC by reducing, and eventually eliminating, loadings of untreated sewage and other pollutants to the Buffalo River.

2. Other BSA Initiatives (see Section 1.4.5.7). In fiscal year 2009, as part of the redevelopment of Buffalo’s Inner Harbor, the BSA was awarded $8.6 million in funding through the American Recovery and Reinvestment Act, allowing for construction of the Hamburg Drain Floatables Control Facility, which will
collected and process floatables from the 20 sewer regulators within the Ham-
burg drain system that discharge combined sewage to the Buffalo River dur-
ing wet weather events.

3. *Biannual Shoreline Sweeps* (see Section 1.4.5.12). For the past 15 to 20 years, BNR has organized biannual (spring and fall) cleanups along the Buffalo Riv-
er and other local waterways to remove litter and other accumulated debris us-
ing volunteers from local communities (http://bnriverkeeper.org/get-
involved/cleanups).

4. *Western New York Stormwater Coalition BMP Implementation* (see Section 1.4.5.14). Continued implementation of storm water BMPs will help reduce inputs of debris, litter, and floatables to the Buffalo River AOC and its trib-

2.8.2 Criterion 2: Films and Sheens
Ongoing projects that will help to minimize aesthetic impairments resulting from films and sheens include the following:

1. *City of Buffalo CSO Long-Term Abatement Plan* (see Section 1.4.5.6). This ongoing program is expected to improve water quality aesthetics in the AOC by reducing, and eventually eliminating, loadings of untreated sewage and other pollutants to the Buffalo River.

2. *Western New York Stormwater Coalition BMP Implementation* (see Section 1.4.5.14). Continued implementation of storm water BMPs will help reduce inputs of oil and grease from roadways to the Buffalo River AOC and its trib-

2.9 BUI 14: Loss of Fish and Wildlife Habitat
The natural habitats that were once present in and along the Buffalo River AOC have been lost or severely degraded as a result of decades of development to sup-
port industrial and commercial activities. While signs of biological recovery have been documented in recent years (Irvine et al. 2005), much of the shoreline’s nat-
ural cover and vegetation has been removed, bank slopes have been altered or eliminated, and aquatic plant beds and wetland habitats have been greatly reduced in extent. Habitat restoration efforts could greatly speed recovery. The three de-
listing criteria for this BUI are designed to restore shoreline habitats, improve wa-
ter quality, and alleviate the impacts of navigational dredging on natural flows.

2.9.1 Criterion 1: Restore Habitat Connectivity
The three elements of this delisting criterion are collectively designed to restore riparian, wetland, and littoral zone habitats along the AOC shoreline to create a corridor for wildlife and fish movement (see Table 1-1). Forthcoming and ongo-
ing projects relevant to this delisting criterion include the following:
2. **Buffalo River GLLA Habitat Restoration and Enhancement** (see Section 1.4.3). Restoration of in-channel and/or riparian habitats at the six sites identified in ENVIRON and MACTEC (2010) are expected to greatly improve habitat connectivity in the AOC.

3. **Buffalo River ERMP Development** (see Section 1.4.5.1). The ERMP identifies sites in the AOC and along Cayuga, Cazenovia, and Buffalo creeks that are suitable for in-channel and riparian habitat restoration. Restoration at these sites will increase connectivity within the AOC as well as connectivity of the AOC with nearby upstream areas.

4. **Buffalo River AOC Upland Habitat Restoration at Riverbend** (see Section 1.4.5.2). Restoration at this site, which is located near the center of the AOC, is critical to increasing connectivity to upstream and downstream habitats.

5. **Buffalo River AOC Upland Habitat Restoration at Riverbend** (see Section 1.4.5.2). Restoration at this site, which is located near the center of the AOC, is critical to increasing connectivity to upstream and downstream habitats.

6. **Wetlands Restoration at Seneca Bluffs** (see Section 1.4.5.4). Restoration of this site, which is just upstream from the AOC, will promote connectivity of the AOC with wildlife habitats further upstream.

7. **Riverbend Development Master Plan** (see Section 1.4.5.13). The Master Plan for this site promotes development in a manner that protects shoreline and riparian areas.

Recommended new projects that will address this delisting criterion are:

**Buffalo River ERMP Implementation.** The ERMP being developed will provide a list of suitable sites within the AOC and along Cayuga, Cazenovia, and Buffalo creeks where habitat restoration can be implemented. Restoration at these sites will increase connectivity within the AOC as well as connectivity of the AOC with nearby upstream areas. The cost estimate for this project is noted in Table 2-2.

### 2.9.2 Criterion 2: Improve Stream Quality Index Scores

The two elements of this delisting criterion are designed to improve surface water quality in the AOC (see Table 1-1). In general, the goal of this criterion is very similar to the goal of Criterion 4 for Fish Populations under BUI 3 – Degradation of Fish and Wildlife Populations. The projects that were identified to address that criterion are equally applicable here (see Section 2.3.1.4 for project list and rationale). Irvine et al. (2005) describe indices for water quality, fish, and vegetation that are applicable to this delisting criterion.

### 2.9.3 Criterion 3: Hydrologic Function

There are two elements to this delisting criterion, one aimed at reducing navigational dredging in the AOC and the other aimed at protecting and/or restoring natural flows, meanders, and stream habitat upstream from the AOC (see Table 1-1). For this criterion to be satisfied, only one of these two elements needs to be addressed. Because the navigation channel in the AOC must be maintained for
commercial and flood-control purposes, it seems unlikely that navigational dredging can be reduced. Hence, to address this delisting criterion, projects that will protect and/or restore natural flows, meanders, and stream habitat upstream from the AOC must be implemented. Forthcoming and ongoing projects applicable to this goal include:

1. **Buffalo River ERMP Development** (see Section 1.4.5.1). The ERMP identifies sites in the AOC and along Cayuga, Cazenovia, and Buffalo creeks that are suitable for in-channel and riparian habitat restoration. Most of the sites identified in the ERMP are located upstream from the AOC (see Figure 1-4).

2. **Wetlands Restoration at Seneca Bluffs** (see Section 1.4.5.4). Restoration of this site, which is just upstream from the AOC, is applicable to the second element of this delisting criterion.

Recommended new projects that will address this delisting criterion are as follows:

*Buffalo River ERMP Implementation.* The ERMP being developed will provide a list of sites in the AOC and upstream from the AOC that are suitable for habitat restoration. Most of the sites identified in the ERMP are located upstream from the AOC (see Figure 1-4). The cost estimate for this project is noted in Table 2-2.
3

Summary of Proposed Actions and Overall Delisting Strategy

Table 3-1 lists actions, projects, and programs relevant to delisting BUls for the Buffalo River AOC and shows their relationships to the delisting criteria for each BUl. Each action, project, and program listed in Table 3-1 achieves one or more of the following goals:

- Reduces chemical concentrations in Buffalo River AOC sediment or surface water
- Controls or eliminates potential sources of contaminants to the Buffalo River or its tributaries
- Restores aquatic or shoreline habitats in the Buffalo River AOC or upstream areas along Cayuga, Cazenovia, or Buffalo creeks
- Provides for monitoring of chemicals in sediment, surface water, or biota.

The actions, projects, and programs listed in Table 3-1 are divided into two main groups:

- Forthcoming and ongoing
- Recommended new.

Those in the first group have been described by other parties (see Section 1.4) and will be funded by federal, state, or private monies that have already been identified. Those in the second group are described for the first time in this report and are candidate projects for GLRI proposals in 2011 or later years. The actions, projects, and programs in both groups will advance delisting of individual BUls and, eventually, the Buffalo River AOC as a whole.

E & E assigned a score to the actions, projects, and programs. The score equals the tally of the Xs in the delisting criteria columns in Table 3-1. The maximum score is 25 which corresponds to the number of delisting criteria for the nine Buffalo River BUls. The highest scores were given to (1) the forthcoming navigational and remedial dredging projects because these projects remove the cause of
3 Summary of Proposed Actions and Overall Delisting Strategy

many BUIs in the AOC (i.e., contaminated sediments); (2) the baseline monitoring and extended long-term monitoring projects because these projects provide the data needed to track recovery over time; and (3) ongoing NYSDEC programs responsible for HWS cleanup and SPDES permit monitoring and renewal because these projects limit inputs of contaminants to the AOC. Projects dealing with habitat restoration also received comparatively high scores. The lowest scores were assigned to specialty projects that pertain to only one or two delisting criteria. A low score indicates that a project addresses only a few delisting criteria, not that the project is unimportant. All of the projects identified in this report are important for BUI delisting and, eventually, delisting of the AOC as a whole.

Table 3-2 presents a schedule for implementing the actions, projects, and programs identified above. In essence, Table 3-2 represents the overall strategy for delisting the individual BUIs and, eventually, the Buffalo River AOC as a whole.

The following points are noteworthy:

- Baseline sampling of surface water, sediment, and biota should be implemented before navigational dredging begins in mid-2011. Also in 2011, a baseline wildlife population survey will be implemented; the Buffalo River ERMP will be completed; habitat restoration work will begin at Riverbend (upland only) and Seneca Bluffs; and work will commence on an Enhanced Fish Consumption Advisories and Outreach project.

- Enhanced navigational dredging by the USACE is scheduled to occur between approximately June and December 2011.

- Remedial dredging and capping is assumed to begin in 2012, the year following navigational dredging, and will take three years to complete (ENIVRON et al. 2010). Short-term monitoring of water and sediment occurs concurrently with this work to ensure that sediment resuspension and residual sediment contamination do not exceed levels determined to be acceptable during remedial design.

- Habitat restoration within the AOC at the six sites identified in ENVIRON and MACTEC (2010) will be implemented concurrent with remedial dredging and capping (2012 to 2015).

- The first round of long-term monitoring of surface water, sediment, and biota will occur when dredging is completed (late 2014), and at Year 2 (2016) and Year 5 (2019) following remedy completion, as specified in the Buffalo River FS (ENVIRON et al. 2010 [see Section 1.4.1]).

- It is assumed that the Hamburg Drain Floatables Control Facility will be completed in late 2012.

- It is assumed that remedial work at the 12 remaining Class 2 New York State Superfund sites will continue until remediation at all sites is complete.
3 Summary of Proposed Actions and Overall Delisting Strategy

- Several existing programs—CSO LTCP, New York State VCP/BCP/ERP, SPDES permit monitoring and renewal, NYSDEC RIBS monitoring, biannual shoreline sweeps, and Western New York Stormwater Coalition efforts—will continue indefinitely, with the objective of providing long-term protection of the Buffalo River system.

- Development of the Riverbend Commerce Park will be completed in approximately 10 years.

- The first round of extended long-term monitoring will be implemented in 2022, three years after the last round of long-term monitoring specified in the Buffalo River FS, with an additional round every three years until two consecutive rounds confirm that all use impairments have been eliminated.

- Buffalo River ERMP implementation is assumed to begin as soon as practicable and continue for the long-term, although the level of activity is expected to vary from year to year.

- Lastly, when dredging is complete (expected in 2015) and after each round of long-term and extended long-term monitoring the RAC should evaluate attainment of the delisting criteria for each BUI and recommend delisting BUIs as appropriate. Revision of delisting criteria, if appropriate and desirable, may be considered at these points in the overall process.
| Actions, Projects, and Programs | Score* | No AOC- specific advisories | No chemicals in excess of criteria in fish or wildlife | No complaints of benthic diversity for three consecutive years | Water quality standards for organoleptic chemicals not exceeded | Fish community good to fair for two consecutive surveys | DELTA do not exceed acceptable levels | Chemical residues in fish tissue not critical effect levels for fish | Water quality measures meet Class C river standards | Wildlife abundance & diversity in AOC similar to reference site | Wildlife assessment find no significant toxicity from water or sed. | Amphibian diversity similar to upstream areas | Benthic diversity similar to upstream areas |
|--------------------------------|--------|-----------------------------|-----------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|
| Forthcoming and Ongoing Actions and Programs |        |                             |                                                     |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |
| GLLA Dredging and Capping (Section 1.4.1) | 18     | X                            | X                                                   | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             |
| Baseline Chemical and Biological Sampling (Section 1.4.2) | 17     | X                            | X                                                   | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             |
| GLLA Habitat Restoration (Section 1.4.3) | 9      | XX                           | XX                                                  |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |
| Enhanced Navigation Dredging by USACE (Section 1.4.4) | 18     | X                            | X                                                   | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             |
| Buffalo River ERMP Development (Section 1.4.5.1) | 10     | X                            | X                                                   |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |
| Upland Habitat Restoration at Riverbend (Section 1.4.5.2) | 9      | X                            | X                                                   |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |
| Baseline Inventory of Wildlife Populations (Section 1.4.5.3) | 2      | X                            | X                                                   |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |
| Wetlands Restoration at Seneca Bluffs (Section 1.4.5.4) | 9      | X                            | X                                                   |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |
| Enhanced Fish Consumption Advisories and Outreach (Section 1.4.5.5) | 3      | X                            | X                                                   | X                                                             |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |
| C3O Long-Term Abatement Plan (Section 1.4.5.6) | 11     | X                            | X                                                   | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             |
| Other BSA Initiatives (Section 1.4.5.7) | 1      | X                            |                                                     |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |
| Continued NYS Superfund Site Remedial Work (Section 1.4.5.8) | 16     | X                            | X                                                   | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             |
| Other NYS Cleanup Programs (Section 1.4.5.9) | 16     | X                            | X                                                   | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             |
| Continued SPDES Permit Monitoring/Renewal (Section 1.4.5.10) | 16     | X                            | X                                                   | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             |
| Continued RBIS Sampling by NYSDEC (Section 1.4.5.11) | 9      | X                            |                                                     |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |
| Biannual Shoreline Sweeps. (Section 1.4.5.12) | 1      | X                            |                                                     |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |
| Riverbend Development Master Plan (Section 1.4.5.13) | 4      | X                            |                                                     |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |
| WNY Stormwater Coalition BMP Implementation (Section 1.4.5.14) | 6      | X                            |                                                     |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |
| Recommended New Projects |        |                             |                                                     |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |
| Extended Long-term Monitoring of Sediment, Biota, and Surface Water (Section 2.1) | 19     | X                            | X                                                   | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             | X                                                             |
| Survey of Fish and Wildlife Officials and Others for Tainting Complaints (Section 2.2.2) | 1      | X                            |                                                     |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |
| Buffalo River ERMP Implementation | 11     | X                            |                                                     |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |
| Mink Survey for Buffalo River AOC and Watershed (Section 2.5.1) | 1      | X                            |                                                     |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |                                                               |

Key:
- AOC = Area of concern
- BMP = Best Management Practice
- BSA = Buffalo Sewer Authority
- BSI = Beneficial use impairment
- CSO = Combined sewer overflow
- EERP = Ecological Restoration Master Plan
- FS = Freshwater study
- GLLA = Great Lakes Legacy Act
- NYS = New York State
- PCB = Polychlorinated biphenyls
- RD = Remedial design
- WNY = Western New York
- X = Project will help advance delisting and/or includes monitoring to document improvements.

Notes:
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- PCB = Polychlorinated biphenyls
- RD = Remedial design
- WNY = Western New York
- X = Project will help advance delisting and/or includes monitoring to document improvements.

Score is based on a tally of the Xs in the delisting criteria columns; maximum value is 25.

Recommended New Projects
- Extended Long-term Monitoring of Sediment, Biota, and Surface Water (Section 2.1)
- Survey of Fish and Wildlife Officials and Others for Tainting Complaints (Section 2.2.2)
- Buffalo River ERMP Implementation
- Mink Survey for Buffalo River AOC and Watershed (Section 2.5.1)
### Table 3-1 Summary of Relationships Between Actions, Projects, and Programs and BUIs for the Buffalo River AOC

#### Forthcoming and Ongoing Actions and Programs

<table>
<thead>
<tr>
<th>Actions, Projects, and Programs</th>
<th>BUI 4: Fish Tumors and other Deformities</th>
<th>BUI 5: Bird or Animal Deformities or Reproductive Problems</th>
<th>BUI 6: Degradation of Benthos</th>
<th>BUI 7: Restrictions on Dredging</th>
<th>BUI 11: Degradation of Aesthetics</th>
<th>BUI 14: Loss of Fish and Wildlife Habitats</th>
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<td>Criterion 1</td>
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<td>Criterion 1</td>
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</table>

#### Key

- **AOC** = Area of concern
- **BMP** = Best Management Practice
- **BSA** = Buffalo Sewer Authority
- **BUI** = Beneficial use impairment
- **C3O** = Combined sewer overflow
- **ERMP** = Ecological Restoration Master Plan
- **FS** = Feasibility study
- **GLLA** = Great Lakes Legacy Act
- **NYS** = New York State
- **PAE** = Pre-Historic excited carbon
- **PCBs** = Polychlorinated biphenyls
- **RD** = Remedial design
- **WNY** = Western New York

**X** = Project will help advance delisting and/or includes monitoring to document improvements.
Table 3-2. Project Implementation Strategy for the Buffalo River AOC

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>Initiate after navigational dredging. 3-year duration (Environ et al. 2010).</td>
</tr>
<tr>
<td>2012</td>
<td>Occurs during dredging and capping.</td>
</tr>
<tr>
<td>2013</td>
<td>Implement in early 2011 before navigational dredging begins.</td>
</tr>
<tr>
<td>2014</td>
<td>Assumed to occur during dredging and capping.</td>
</tr>
<tr>
<td>2016</td>
<td>Complete by mid 2011.</td>
</tr>
<tr>
<td>2017</td>
<td>2011 start and 2-year duration assumed.</td>
</tr>
<tr>
<td>2018</td>
<td>2011 start and 2-year duration assumed.</td>
</tr>
<tr>
<td>2019</td>
<td>Fifteen year duration assumed.</td>
</tr>
<tr>
<td>2020</td>
<td>Hamburg drain floatables project assumed complete by late 2012.</td>
</tr>
<tr>
<td>2021</td>
<td>Program must continue indefinitely to safeguard river.</td>
</tr>
<tr>
<td>2022</td>
<td>Program must continue indefinitely to safeguard river.</td>
</tr>
<tr>
<td>2023</td>
<td>Program assumed to continue indefinitely to protect resource.</td>
</tr>
<tr>
<td>2024</td>
<td>Riverbend Commerce Park development assumed complete by 2020.</td>
</tr>
<tr>
<td>2025</td>
<td>Program assumed to continue indefinitely to protect resource.</td>
</tr>
</tbody>
</table>

Recommended New Projects

- Extended Long-term Monitoring of Sediment, Biota, and Surface Water (Section 2.1)
- Survey of Fish and Wildlife Officials and Others for Tainting Complaints (Section 2.2.2)
- Buffalo River ERP Implementation
- Mink Survey in Buffalo River AOC and Watershed (Section 2.5.1)

BUI Status Check

- Evaluate attainment of delisting criteria and delist BUIs as appropriate

Key:
- indicates that a project is implemented or ongoing during that calendar year.

Notes:
- AOC = Area of concern.
- BCP = Brownfield Cleanup Program.
- BMP = Best Management Practice.
- BSAs = Buffalo Sewer Authority.
- BUI = Beneficial use impairment.
- CSO = Combined sewer overflows.
- ERP = Environmental Restoration Program.
- ERP = Ecological Restoration Master Plan.
- FS = Feasibility study.
- GLLA = Great Lakes Legacy Act.
- HWS = Hazardous waste site.
- NYS = New York State.
- NYSDEC = New York State Department of Environmental Conservation.
- PAC = Powdered activated carbon.
- PCBs = Polychlorinated biphenyls.
- RD = Remedial design.
- RIBS = Rotating Influent Batch Study.
- SDDES = State Pollutant Discharge Elimination System.
- USACE = U.S. Army Corps of Engineers.
- VCP = Voluntary Cleanup Program.
- WNY = Western New York.
Conclusions

This report identifies and describes actions that are critical to addressing current BUIs and for the long-term protection of the Buffalo River. This report also describes the relevance of these actions to the specific delisting criteria for each BUI. The following conclusions can be drawn:

- A suite of actions originating at the local, state, and federal level are required to address current BUIs and for the long-term protection of the Buffalo River (see Table 3-1). Most of these actions are forthcoming federally supported projects (e.g., navigational dredging by the USACE, sediment remedial dredging and capping) or ongoing state and local programs (e.g., SPDES permit monitoring and renewal, BSA CSO LTCP). A few of the actions are new recommendations.

- The actions, projects, and programs described in this report were assigned a score based on the number of BUI delisting criteria they addressed. The highest scores were given to (1) the forthcoming navigational and remedial dredging projects because these projects remove the cause of many BUIs in the AOC (i.e., contaminated sediments); (2) the baseline monitoring and extended long-term monitoring projects because these projects provide the data needed to track recovery over time; and (3) ongoing NYSDEC programs responsible for HWS cleanup and SPDES permit monitoring and renewal, because these projects limit potential inputs of contaminants to the AOC. Projects dealing with habitat restoration also received comparatively high scores.

- Collectively, the actions, projects, and programs identified in this report should eliminate BUIs in the Buffalo River AOC within 8 to 15 years (see Table 3-2).

- Low dissolved oxygen levels in surface water may persist in some areas of the Buffalo River if navigational dredging continues for commercial purposes and flood control, but this situation should not prevent delisting of affected BUIs based on the IJC’s approved list/delisting criteria (International joint Commission (ICJ) recognizes that it may not be possible to fully restore some uses because of natural factors (e.g., sedimentation) or social or economic factors (e.g., the necessity to dredge navigational channels may preclude fully restoring the benthic community). In these cases, delisting may proceed as long as justification for the remaining impairment is provided in the Stage 3 RAP.
Coordination between local, state, federal, and private groups under strong local leadership is needed to advance the overall delisting process.


References


_________. 2010. *Final Guidance for (Redesignation) Delisting of Great Lakes Areas of Concern (AOCs) and their Beneficial Use Impairment (BUI) Indicators in New York State*. Prepared by NYSDEC, Division of Water, Albany, NY.


Ohio Environmental Protection Agency. 2005. *Delisting Targets for Ohio Areas of Concern*. OEPA Division of Surface Water, Columbus, OH.


5 References


New Project Costing Assumptions and Cost Estimates
This appendix includes rough cost estimates (in 2011 dollars) and brief descriptions of the four recommended new projects in the *Buffalo River Area of Concern (AOC) Strategic Plan for Beneficial Use Impairment Delisting*. Those projects are:

- Extended Long-Term Monitoring (Appendix A.1)
- Survey for Fish Tainting Complaints (Appendix A.2)
- Ecological Restoration Master Plan Implementation (Appendix A.3)
- Investigation of Mink Use and Reproduction in the Buffalo River AOC (Appendix A.4)
Appendix A.1
Extended Long-Term Monitoring within the Buffalo River Creek Area of Concern (AOC): Brief Project Description and Rough Cost Estimate

This recommended project would extend monitoring of sediment, biota, and surface water beyond that specified in the Buffalo River AOC Feasibility Study (see Section 1.4.1). Table 2-1 lists target media and parameters to be included in the extended long-term monitoring plan. These target media and parameters are based on the delisting criteria provided in Table 1-1. The data collected under the extended long-term monitoring plan will be used to evaluate whether or not the Buffalo River AOC delisting criteria have been attained and to support BUI delisting. The approximate costs for laboratory support, field work, and reporting for one round of monitoring are summarized below:

- $53,150 for laboratory support.
- $35,300 for field work.
- $29,240 for data evaluation and reporting.
- $117,690 Total (one round).

This estimate is considered an upper limit for one round of extended long-term monitoring. The true cost per round may be lower for various reasons, such as:

- If other programs, such as the New York State Department of Environmental Conservation (NYSDEC) Rotating Integrated Basins Studies (RIBS) program, can be relied upon for some portion of sample collection and analysis; and
- If one or more BUls are delisted before extended long-term monitoring begins in approximately 2022 (see Table 3-2).

References


A New Project Costing Assumptions and Cost Estimates

Appendix A.2
Survey of Fish and Wildlife Officials and Others for Tainting Complaints: Brief Project Description and Rough Cost Estimate

This project is being recommended to address the second delisting criterion under Beneficial Use Impairment (BUI) # 2—Tainting of Fish and Wildlife Flavor. That criterion reads as follows:

*For a period of 3 consecutive years, no reports of tainting from fish and wildlife officials or informed public observers.*

A survey to address this criterion was described in E & E’s *Delisting Criteria for the Buffalo River Area of Concern for Selected Beneficial Use Impairments* (E & E 2008). A summary of the survey approach is provided here. A copy of the complete report is provided in Appendix B.

- Compile a list of fish and wildlife managers and others in the area that may have exposure to potential tainting complaints.

- Develop a survey form and conduct a survey with the above group. (An example survey form is provided in E & E 2008).

- In addition, conduct informal interviews with local anglers to gather first-hand information regarding potential taste and odor problems with fish from the AOC. There is a potential here for coordination with the *Enhanced Fish Consumption Advisories* project currently being implemented by Buffalo Niagara Riverkeeper (see Section 1.4.5.5). That project provides an opportunity to gather information from local anglers regarding the presence, or lack thereof, of tainted fish flavor in the Buffalo River AOC. Presently, this is not a stated objective of the *Enhanced Fish Consumption Advisories* project, but an adjustment to the project scope to help address this delisting criterion seems reasonable.

- Review the results of the surveys to make a determination regarding the status of this BUI.

We estimate that implementing a survey of fish and wildlife officials and others as described above can be done for $6,400. It follows, then, that the cost to implement the survey three times, as specified in the delisting criterion, is three times $6,400 or $19,200.

Reference

Appendix A.3
Buffalo River Ecological Restoration Master Plan (ERMP) Implementation: Brief Project Description and Rough Cost Estimate

An ERMP is being developed for the Buffalo River and its tributaries that will describe suitable sites for riparian and in-channel habitat restoration (see Section 1.4.5.1). As of February 2011, the preliminary draft ERMP included 26 potential habitat restoration sites along the shorelines of the Buffalo River, Buffalo Creek, Cayuga Creek, and Cazenovia Creek (see Figure 1-4). E & E assumes that restoration at these sites will result in 26 separate restoration projects. We also assume that the cost of implementing one project will fall within the range of costs for completed, ongoing, or planned habitat restoration projects at other sites along the Buffalo River and its tributaries. Examples of such projects and their costs are listed below:

- Buffalo River AOC Upland Habitat Restoration at Riverbend: $657,245 (see Section 1.4.5.2).
- Wetlands Restoration at Seneca Bluffs: $200,000 (see Section 1.4.54.).
- Kelly Island site: less than $250,000 (ENVIRON and MACTEC 2010).
- City Ship Canal: more than $1,000,000 (ENVIRON and MACTEC 2010).
- Ohio Street Shoreline: less than $250,000 (ENVIRON and MACTEC 2010).
- Katherine Street Peninsula (north shore): less than $250,000 (ENVIRON and MACTEC 2010).
- Katherine Street Peninsula (south shore): less than $250,000 (ENVIRON and MACTEC 2010).
- Buffalo Color Area D: $500,000 to $250,000 (ENVIRON and MACTEC 2010).
- Riverbend Upstream: more than $1,000,000 (ENVIRON and MACTEC 2010).
- Riverbend Downstream: $500,000 to $250,000 (ENVIRON and MACTEC 2010).

Based on these examples, E & E posits that the cost of implementing a restoration project at one ERMP candidate site will range from $200,000 to more than $1,000,000. The actual cost of restoration at any particular site depends on a number of factors, including size, existing conditions, degree of restoration necessary, nature of restoration (aquatic versus riparian), and other factors.
A  New Project Costing Assumptions and Cost Estimates

Reference

Appendix A.4
Mink Study within the Buffalo River Creek Area of Concern (AOC) and Watershed: Project Description and Cost Estimate

This investigation will take place within the Buffalo River AOC after sediment remediation and habitat restoration has been implemented and at an upstream reference site, and includes the following tasks:

- Desktop analysis to identify potential mink habitats within the AOC and watershed and site visits;
- Collection and analysis of video-recorded and field data; and
- Video and field data reporting of pertinent study findings.

Project Overview and Background
This project is designed to provide data regarding the relative abundance and population structure of mink in the Buffalo River AOC in the future, after sediment dredging and capping have been completed and some habitat restoration has occurred (2015 or later [see Table 3-2]). This will be done using weather-proof video surveillance equipment as was done by Wellman and Haynes (2006) in and near the Rochester Embayment AOC. This study will be a scaled-down version of the Wellman and Haynes (2006) study, with the objective of determining if mink are present and reproducing in the Buffalo River AOC and how their relative abundance and reproduction compares with a representative upstream reference area in the Buffalo River watershed. This study is being recommended to address Criterion 1 under Wildlife Populations for BUI #5 — Bird or Animal Deformities or Reproductive Problems. That criterion specifies that wildlife deformities or reproductive problems in the AOC should not be different than upstream areas. If video data show that mink are present and reproducing (as indicated by the presence of young mink) in the AOC, that would suggest that reproductive problems for piscivorous wildlife have been alleviated by sediment remedial work and that sufficient habitat is present to support mink reproduction. The mink has been selected as the focus of this investigation for the reasons described below.

American Mink
The American mink (Neovison vison) is a medium-sized mammal belonging to the Mustelid family, which also includes ferrets, weasels, fishers, otters, wolverine, and badgers. This species exhibits an elongate body and a long tail with relatively short legs and ears (NatureServe 2011). Mink occur throughout New York and most of the United States, Canada, and Europe (NYSDEC 2011; NatureServe 2011). Mink prefer forested areas within permanent or semipermanent wetlands, riparian areas, and lakes and marshes and generally occupy dens in hollow logs or those created by other aquatic to semi-aquatic species, such as beavers and muskrats. Within New York, habitat studies conducted by trappers have found mink
A New Project Costing Assumptions and Cost Estimates

most often in streams followed by beaver ponds, lakes, and marshes (NYSDEC 2011).

This species is carnivorous and lives on a diet consisting of animals that occupy riparian to aquatic ecosystems including small to medium-sized mammals, birds, fish, and crayfish (NatureServe 2011). Mink are usually solitary animals, however, males and females will begin associating during the late winter, upon initiation of the breeding season (NYSDEC 2011, NatureServe 2011). Between April and June, female mink give birth to between one to eight kits (with an average of four kits; NYSDEC 2011).

Mink have been described as a sentinel species, meaning that their presence/absence may indicate environmental conditions. Environmental contaminants such as mercury, DDE, DDT, dieldrin, and PCBs have been reported as having negative impacts on mink by causing weight loss and reproductive issues to captive individuals (NYSDEC 2011). It is for this reason that mink have been chosen as the harbingers of ecosystem health in the Great Lakes AOCs.

Project Specifics

Proposed Scope of Work for Mink Study in Eightemile Creek AOC

Weather-proof video surveillance equipment will be used to examine mink relative abundance and population structure within the Buffalo River AOC and at a representative upstream area. The data from this study will be useful in determining if BUI #5—Bird or Animal Deformities or Reproductive Problems—continues to be impaired in the AOC or is recovering in response to sediment remediation and habitat restoration. The overall scope can be implemented within one field season (February through November) but should not be implemented until sediment dredging and capping have been competed.

Task 1 – Desktop Analysis and Site Visit

This proposed project will begin with a brief desktop analysis to locate suitable video surveillance station locations. This task will include use of topographic maps and aerial imagery within the Buffalo River AOC and watershed to locate potential video surveillance stations based on suitable mink habitat (e.g., riparian areas, forested wetlands, etc.). Access to public and private land deemed suitable habitat will be coordinated with state and local agencies as well as landowners, and any applicable wildlife study permits will be attained from NYSDEC.

A site visit will occur during late winter to field-validate potential video station locations. Meetings with local fur trappers, if any—who are aware of local areas harboring mink populations—will also take place during the site visit to aid in video station site selection. Finally, the site visit will also include a time-meander field search. During this time, mink track concentrations that are found

---

1 Time-constrained searches consist of visual searches for a given wildlife species in its given habitat. They include a specific time constraint (e.g. 10 minutes), which aids in making inferences in relative abundance and diversity between various sites searched.
will be documented and incorporated as potential video surveillance stations. The two most suitable mink video surveillance sites—one within the AOC and one upstream reference site—will be selected based on results from the desktop analysis, input from local trappers, and time-meander searches.

Task 2 – Data Collection and Analysis
Eight video surveillance stations will be set up in mid-May and will continue monitoring until mid-November, which is the post-breeding period, a time when mink families would likely travel together. There will be four video stations each at the AOC location and upstream reference location. All video surveillance stations will be visited once per week, during which time batteries and video cassettes will be exchanged, camera lenses will be cleaned, and systems checks will be performed. All pertinent information concerning field data will be recorded onto standardized data sheets.

The video data will be analyzed for mink presence; however, other recorded wildlife species will also be noted. Special attention will be paid to the number of recorded mink at any given time, as multiple individuals recorded during the post-breeding season are indicative of family units and mink reproduction. All pertinent information concerning video data will be recorded onto standardized data sheets.

Task 3 – Reporting
A report will be generated outlining key findings and recommendations within approximately three months of completing field work. Also, a presentation of the study findings will be made to Buffalo Niagara Riverkeeper, the USACE, NYSDEC, and other interested parties.

Project Goals
The project goal is to determine if mink are present and reproducing in the Buffalo River AOC after sediment remediation and habitat restoration have been implemented and if mink relative abundance and population structure in the AOC are comparable with a representative upstream area.

Project Outcomes
This project will lead to an understanding of mink presence/absence and population structure in the Buffalo River AOC and watershed. The findings of this study and video evidence of mink presence and reproduction in the AOC will support delisting of BUI #5 at the Buffalo River AOC along with data for the other delisting criteria for this BUI.
A New Project Costing Assumptions and Cost Estimates

ESTIMATED BUDGET BY TASK

<table>
<thead>
<tr>
<th>Task No. and Description</th>
<th>Schedule</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Desktop Analysis and Site Visit</td>
<td>February</td>
<td>$12,600</td>
</tr>
<tr>
<td>2: Data Collection and Analysis</td>
<td>June – October</td>
<td>$46,000</td>
</tr>
<tr>
<td>3: Reporting</td>
<td>November – December</td>
<td>$12,800</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>$71,400</strong></td>
</tr>
</tbody>
</table>

References


Delisting Criteria for the Buffalo River AOC for Selected Beneficial Use Impairments
Delisting Criteria for the Buffalo River Area of Concern
for Selected Beneficial Use Impairments

Prepared by Ecology and Environment, Inc.
368 Pleasant View Drive
Lancaster, NY 14086

For
Buffalo Niagara Riverkeeper

5 September 2008
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Exhibit 3-1  Wildlife Populations Survey Form
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1. Introduction

As requested by Buffalo Niagara Riverkeeper, Ecology and Environment, Inc. (E & E) developed delisting criteria for three Beneficial Use Impairments (BUIs) at the Buffalo River Area of Concern (AOC) that currently are considered likely impaired (Buffalo Niagara Riverkeeper 2008). These BUIs are:

- Tainting of Fish and Wildlife Flavor,
- Degradation of Fish and Wildlife Populations, and
- Bird or Animal Deformities or Reproductive Impairment.

The criteria presented herein are based on a review of delisting criteria and technical supporting information for other Great Lakes AOCs and recent chemical and biological data for the Buffalo River AOC. In addition, E & E developed one or more approaches that could be used to evaluate the status of each BUI using readily available data. The application of these approaches could be used to establish monitoring programs for the BUI delisting criteria.
2. Tainting of Fish and Wildlife Flavor

2.1. ICJ Listing Guideline

Impairment is indicated when ambient water quality standards, objectives, or guidelines, for the anthropogenic substance(s) known to cause tainting are being exceeded, or survey results have identified tainting of fish or wildlife flavor (ICJ 1991).

2.2. Buffalo River AOC Listing Guideline

This beneficial use will be considered impaired if:

- Concentrations of compounds associated with tainting exceed New York State water quality standards or guidance values within the AOC, or
- Wildlife officials or other informed observers indicate that tainting of fish and wildlife flavor is found within the AOC.

2.3. Buffalo River AOC Delisting Target

- No exceedances of water quality standards or criteria for compounds associated with tainting within the AOC.
- No reports of tainting from fish and wildlife officials or other informed observers.

2.4. Buffalo River AOC Delisting Milestones

- If there is a potential for compounds associated with tainting to be present in the AOC, track changes in levels of these compounds in surface water until such time as there are no further exceedances of applicable water quality criteria.
- Survey fish and wildlife officials and other informed observers to determine if problems with tainting may exist in the AOC. Continue the survey on an annual basis until no problems with tainting are noted for two consecutive years.

2.5. Rationale

Phenol and chlorinated phenols are the chemicals most often associated with taste and odor problems in fish. According to OEPA (2005), phenols and related compounds may be present in waste streams from oil refineries, coke plants, gas plants, some chemical producing facilities, plastics manufacturing, road surfacing, dyes, disinfectants, and various industries and processes that use phenolic substances as raw materials.

Chlorinated benzenes also may cause taste and odor problems in fish. These compounds have many industrial uses including manufacturing of dyes, insecticides, fumigants, metal polishes, moth repellants, pharmaceuticals, dielectric fluids, synthetic transformer oils, and lubricants (Smith et al. 1988).
The State of New York has promulgated water quality standards for phenolic compounds and chlorinated benzenes to prevent taste and odor problems in aquatic organisms (see Table 2-1). Levels of these chemicals in surface water from the Buffalo River AOC below these standards should preclude tainting of fish or wildlife flavor.

2.6. BUI Assessment Approach

The Buffalo River AOC RAP indicates that further assessment is needed for this BUI. The following approach is recommended:

- Examine existing water quality databases for the Buffalo River AOC for information on phenolic compounds and chlorinated benzenes. Evaluate the available data with respect to the water quality standards presented in Table 2-1.

- Compile a list of fish and wildlife managers and others in the area that may have exposure to potential tainting complaints.

- Develop a survey similar to that provided in Exhibit 2-1 and conduct a survey with the above group.

- In addition, conduct informal interviews with local anglers to gather first-hand information regarding potential taste and odor problems with fish from the AOC.

- Review the results of the surveys to make a determination regarding the status of this BUI.

The above approach of data review and survey allows for initial assessment of this BUI as well as tracking of improvements.
Table 2-1. New York State Water Quality Standards Applicable to Tainting of Fish and Wildlife Flavor.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Standard or Guidance Value (ug/L)</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorobenzene</td>
<td>50</td>
<td>None.</td>
</tr>
<tr>
<td>Dichlorobenzenes</td>
<td>50</td>
<td>Applies to sum of 1,2-, 1,3-, and 1,4-dichlorobenzene.</td>
</tr>
<tr>
<td>Phenols, total chlorinated</td>
<td>1</td>
<td>Refers to the sum of these substances.</td>
</tr>
<tr>
<td>Phenols, total unchlorinated</td>
<td>5</td>
<td>Refers to the sum of these substances.</td>
</tr>
<tr>
<td>Trichlorobenzenes</td>
<td>50</td>
<td>Applies to sum of 1,2,3-, 1,2,4-, and 1,3,5-trichlorobenzene.</td>
</tr>
</tbody>
</table>

Exhibit 2-1

Tainting of Fish or Wildlife Flavor BUI Survey Form
Buffalo River Area of Concern (AOC)

1. Are you aware of any reports of tainted fish or wildlife flavor within the Buffalo River AOC? See attached map for AOC boundary. 
   _____NO _____YES (describe)

<table>
<thead>
<tr>
<th>Species</th>
<th>Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

2. Are there any programs in place to monitor for tainting of fish/wildlife flavor in the Buffalo River AOC?  
   _____NO _____YES (describe)
3. Degraded Fish and Wildlife Populations

3.1. ICJ Listing Guideline

Impairment is indicated when fish and wildlife management programs have identified degraded fish or wildlife populations due to a cause within the watershed. In addition, this use will be considered impaired when relevant, field-validated, fish or wildlife bioassays with appropriate quality assurance/quality controls confirm significant toxicity from water column or sediment contaminants.

3.2. Buffalo River AOC Listing Guideline

Listing guidelines are presented separately for fish and wildlife in Sections 3.2.1 and 3.2.2, respectively.

3.2.1 Fish

- Fish surveys find a poor resident fish community based on applicable fish community biological indices, such as the Index of Biotic Integrity (IBI), as a result of a cause within the AOC.

- The frequency of occurrence of deformities, eroded fins, lesions, and tumors (DELT anomalies) in bottom-dwelling fish exceed levels at applicable reference sites.

- Whole-body concentrations of endocrine-disrupting chemicals (including but not limited to polychlorinated biphenyls [PCBs], dioxins/furans, and chlorinated pesticides) in bottom-dwelling fish exceed critical tissue concentrations for adverse effects on fish.

- Basic water quality measures (e.g., dissolved oxygen, temperature, turbidity, *Escherisia coli*, etc.) exceed New York State standards for Class C or higher surface water bodies.

- Inadequate habitat is available for fish residence and reproduction.

3.2.2 Wildlife

- Wildlife surveys find lower abundance and diversity of birds, mammals, reptiles, or amphibians at the AOC compared with a suitable reference site.

- Wildlife officials and/or other informed observers report degraded wildlife populations within the AOC.

- Inadequate habitat is available for wildlife residence and reproduction.

3.3. Buffalo River AOC Delisting Targets

Delisting targets are presented separately for fish and wildlife in Sections 3.3.1 and 3.3.2, respectively.
3.3.1 Fish

- Fish surveys find that the resident fish community is fair to good based on applicable fish community biological indices, such as the IBI.

- The frequency of occurrence of DELT anomalies in bottom-dwelling fish does not exceed levels at applicable reference sites.

- Whole-body concentrations of endocrine disruptors (including but not limited to PCBs, dioxins/furans, and chlorinated pesticides) in bottom-dwelling fish do not exceed critical tissue concentrations for adverse effects on fish.

- Basic water quality measures (e.g., dissolved oxygen, temperature, turbidity, \(E.\ coli\), etc.) do not exceed New York State standards for Class C or higher surface water bodies.

- Adequate habitat is available for fish residence and reproduction.

3.3.2 Wildlife

- Wildlife surveys find that diversity and abundance of birds, mammals, reptiles, and amphibians at the AOC is comparable to a suitable reference site.

- No reports of degraded wildlife populations in the AOC from wildlife officials and other informed observers.

- Suitable habitat is available for wildlife residence and reproduction.

3.4. Buffalo River AOC Delisting Milestones

Delisting milestones are presented separately for fish and wildlife in Sections 3.4.1 and 3.4.2, respectively.

3.4.1 Fish

- A resident fish community rated as fair to good based on applicable fish community biological indices, such as the IBI, based on data from two consecutive surveys.

- Frequency of occurrence of DELT anomalies in bottom-dwelling fish less than 2% based on data from two consecutive surveys.

- Whole-body concentrations of endocrine disruptors (including but not limited to PCBs, dioxins/furans, and chlorinated pesticides) in bottom-dwelling fish less than critical tissue concentrations for adverse effects on fish based on data from two consecutive surveys.

- Basic water quality measures (e.g., dissolved oxygen, temperature, turbidity, \(E.\ coli\), etc.) do not exceed New York State standards for Class C or higher surface water bodies based on data from two consecutive surveys.
3.4.2 Wildlife

- Adequate habitat for fish residence and reproduction has been permanently reestablished.

- No differences in abundance and diversity of birds, mammals, reptiles, and amphibians at the AOC compared with a suitable reference area.

- No reports of degraded wildlife populations within the AOC from wildlife officials and other informed observers.

- Suitable, adequate habitat for wildlife residence and reproduction has been permanently reestablished.

3.5. Rationale

3.5.1 Fish

Irvine et al. (2005) surveyed the fish community of the Buffalo River AOC at 10 possible habitat restoration sites in 2003 and 2004. These authors show how fish-community data can be used to rate the fish community as poor, fair, or good based on the IBI. This type of analysis is highly relevant to determining the status of this BUI as it relates to fish populations in the AOC.

The frequency of occurrence of DELT anomalies depicts the health and condition of individual fish. These abnormalities occur infrequently or are absent from minimally impacted sites, but occur frequently in areas where toxic chemicals are concentrated (Rafferty and Grazio 2006). This type of analysis is highly relevant to determining the status of this BUI as it relates to fish population health in the Buffalo River AOC.

Many fish species accumulate contaminants from their environment. PCBs, and other endocrine disrupting chemicals are known to be present in sediments and fish from the Buffalo River (Preddice et al. 2006). Fish may be adversely affected by these chemicals when their body burden exceeds a critical threshold (Dyer et al. 2000). Comparing chemical concentrations in fish from the Buffalo River AOC with critical tissue concentrations for effects on fish (Dyer et al. 2000) is one line of evidence that can be used to determine the status of this BUI.

Fish abundance and diversity are known to be influenced by basic water quality parameters such as dissolved oxygen, temperature, and turbidity. In addition, fish abundance and diversity also are affected by the availability of in-stream habitat types, such as aquatic macrophyte beds. As such, measures of water and habitat quality have been incorporated into the delisting criteria for this BUI for fish.

3.5.2 Wildlife

Evaluating the condition of wildlife populations in the AOC should be possible by: (1) conducting site-specific surveys of birds, mammals, reptiles, and amphibians; (2) gathering information from wildlife officials and other observers knowledgeable about wildlife populations in the AOC; and (3) examining the availability of suitable wildlife habitat types in the AOC. According to the Draft Buffalo River Remedial Action Plan 2008 Status Report (Buffalo Niagara Riverkeeper 2008), a herpetological survey of the Buffalo River AOC is being conducted and a bird
survey was recently completed. A suitable reference area will need to be selected for comparison with survey data from the AOC. Finally, wildlife abundance and diversity are known to be influenced by habitat availability. As such, the availability of suitable habitat has been incorporated into the delisting criteria for this BUI for wildlife.

3.6. BUI Assessment Approach

The assessment approach for this BUI is presented separately for fish and wildlife in Sections 3.6.1 and 3.6.2, respectively.

3.6.1 Fish

- Examine recent fish community surveys and fish contaminant studies in the AOC for data on the following: (1) fish community composition and IBI scores; (2) DELT anomalies in bottom-dwelling fish; and (3) whole-body concentrations of endocrine disrupting chemicals in bottom-dwelling fish.

- Evaluate the fish-community data as per Irvine et al. (2005) to reach a conclusion about the relative health of the fish community (very poor, poor, fair, or good).

- Compare the frequency of DELT anomalies in AOC fish with the frequency expected in unimpacted rivers (less than 2%).

- Compare concentrations of endocrine disrupting chemicals in bottom-dwelling fish from the AOC with critical tissue concentrations for adverse effects on fish (Dyer et al. 2000).

- Examine recent water quality studies for data on basic water quality parameters such as dissolved oxygen, temperature, and turbidity. Compare these data with NYSDEC water quality standards for Class C surface water bodies.

- Evaluate the quantity and quality of in-stream habitat types needed to support fish residence and reproduction in the AOC.

- Make a determination regarding the status of this BUI for fish populations based on the weight-of-evidence from these five methods of evaluation.

3.6.2 Wildlife

3.6.2.1 Survey Wildlife Officials

- Compile a list of wildlife managers and other informed observers that are familiar with wildlife issues in the AOC.

- Develop a survey form on which available wildlife data can be readily summarized (see Exhibit 3-1 for example).

- Submit the survey form to wildlife managers and other informed observers and evaluate information on completed forms to help determine BUI status.
3.6.2.2 Evaluate Existing Wildlife Surveys

- Gather results from recent wildlife surveys in the AOC.

- Compare wildlife diversity and abundance in the AOC with diversity and abundance in a suitable reference area.

- Use results of comparisons to help determine whether or not wildlife populations in the AOC are degraded.

3.6.2.3 Evaluate Wildlife Habitats

- Evaluate the quantity and quality of habitat types needed to support wildlife residence and reproduction in the AOC.

- Use the results of the evaluation to determine whether or not suitable, adequate habitat is present for wildlife residence and reproduction.
Exhibit 3-1

Wildlife (Bird, Mammal, Reptile, Amphibian) Populations Survey Form
Buffalo River Area of Concern (AOC)

1. Do you have any monitoring data on wildlife population health within the AOC? See attached map for AOC boundary.
   ____NO  ____YES (please describe below)
   Species              Type of Study/Data
   _______________________________________________________________________________
   _______________________________________________________________________________
   _______________________________________________________________________________
   _______________________________________________________________________________
   _______________________________________________________________________________

2. Are you aware of any degraded wildlife populations within the AOC?
   ____NO  ____YES (describe)
   Species               Reason
   _______________________________________________________________________________
   _______________________________________________________________________________
   _______________________________________________________________________________
   _______________________________________________________________________________
   _______________________________________________________________________________

3. Are there any current programs/projects to improve degraded populations?
   ____NO  ____YES (describe what/where/when)
   _______________________________________________________________________________
   _______________________________________________________________________________
   _______________________________________________________________________________
   _______________________________________________________________________________
   _______________________________________________________________________________
4. Bird or Animal Deformities or Reproductive Problems

4.1. ICJ Listing Guideline

Impairment is indicated when wildlife survey data confirm the presence of deformities (e.g. cross-bill syndrome) or reproductive problems (e.g., egg-shell thinning) in sentinel wildlife species.

4.2. Buffalo River AOC Listing Guideline

This beneficial use will be considered impaired if:

- Bird or mammal deformities or reproductive problems due to sources within the AOC are documented by wildlife managers or other informed observers.

In addition, this beneficial use will be considered likely impaired if:

- Concentrations of chemicals in sediment and fish exceed levels associated with reproductive problems in wildlife.

4.3. Buffalo River AOC Delisting Targets

- No reports of deformities or reproductive problems in sentinel wildlife species from wildlife officials and other informed observers; and
- Concentrations of chemicals in sediment and fish do not exceed levels associated with reproductive problems in wildlife.

4.4. Buffalo River AOC Delisting Milestones

- Survey of wildlife officials and other informed observers indicates no apparent problems with deformities or reproduction in sentinel species.
- Evaluation of sediment and fish contaminant data indicates that levels of chemicals in sediment and fish do not exceed levels associated with reproductive problems in wildlife.

4.5. Rationale

The great blue heron (Ardea herodias) and mink (Mustela vison) are piscivorous wildlife species that are likely to use the Buffalo River watershed. As top-level predators, both the heron and mink are susceptible to chemicals that biomagnify in aquatic food webs, such as polychlorinated biphenyls (PCBs). Exposure to many bioaccumulative chemicals can result in deformities and/or reproductive problems in piscivorous wildlife (Sample et al. 1996, Swackhamer 2005).

Herbivorous and omnivorous wildlife species also use the Buffalo River watershed. Many such wildlife species, such as the muskrat (Ondatra zibethicus), Canada goose (Branta canadensis), raccoon (Procyon lotor), and mallard (Anas platyrhynchos), are known to ingest a considerable amount of sediment while foraging and therefore may be at greater risk than piscivorous wildlife from some contaminants.
4.6. BUI Assessment Approach

Two assessment approaches are recommended: (1) survey wildlife officials and other informed observers and (2) compare chemical concentrations in sediment and fish from the Buffalo River AOC with critical concentrations associated with reproductive effects in the muskrat, Canada goose, raccoon, mallard, great blue heron, and mink.

4.6.1 Survey Wildlife Officials

- Generate a list of wildlife officials and other informed observers that may have information on the status of wildlife populations in the Buffalo River AOC.
- Prepare a survey form on which available wildlife data can be readily summarized (see Exhibit 4-1 for example).
- Submit survey form to wildlife officials and other informed observers and evaluate information on completed forms to determine BUI status.

4.6.2 Chemicals in Fish

- Prepare a table of critical diet concentrations associated with adverse reproductive effects in the heron and mink for highly bioaccumulative chemicals detected in Buffalo River fish (see Table 4-1 for example).
- Compare concentrations of bioaccumulative chemicals in Buffalo River fish with critical diet concentrations to determine BUI status. Because the heron and mink typically do not consume fish greater than 25 cm (10 inches) in length (USEPA 1993), data for fish less than or equal to 25 cm in length should be emphasized in the comparison.

4.6.3 Chemicals in Sediment

- Prepare a table of critical sediment concentrations associated with adverse reproductive effects in the muskrat, Canada goose, raccoon, and mallard for chemicals detected in Buffalo River sediment.
- Compare concentrations of chemicals in Buffalo River sediment with critical sediment concentrations to determine BUI status.
- Alternatively, review the risk results for herbivorous and omnivorous wildlife from the revised ecological risk assessment for the Buffalo River AOC, when available.
Table 4.1. Critical Diet Concentrations for the Great Blue Heron and Mink for Highly Bioaccumulative Chemicals Detected in Buffalo River Fish.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>NOAEL-based Critical Diet Concentration (mg/kg)</th>
<th>LOAEL-based Critical Diet Concentration (mg/kg)</th>
<th>Effect and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Great Blue Heron</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BHC mixed isomers</td>
<td>3.2</td>
<td>12.8</td>
<td>Reduced egg hatchability and egg volume.</td>
</tr>
<tr>
<td>Chlordane</td>
<td>12.2</td>
<td>60.9</td>
<td>Mortality.</td>
</tr>
<tr>
<td>DDT + metabolites</td>
<td>0.016</td>
<td>0.16</td>
<td>Reduced fledgling success rate.</td>
</tr>
<tr>
<td>Dieldrin</td>
<td>0.44</td>
<td>-</td>
<td>Eggshell thickness, egg production, and nestling mortality.</td>
</tr>
<tr>
<td>Endosulfan</td>
<td>57</td>
<td>-</td>
<td>Adverse reproductive effects.</td>
</tr>
<tr>
<td>Endrin</td>
<td>0.057</td>
<td>0.57</td>
<td>Egg production and hatching success.</td>
</tr>
<tr>
<td>Methylmercury</td>
<td>0.036</td>
<td>0.36</td>
<td>Reduced egg and offspring production.</td>
</tr>
<tr>
<td>PCBs (total)</td>
<td>1.02</td>
<td>10.2</td>
<td>For Aroclor 1254. Reduced egg hatchability.</td>
</tr>
<tr>
<td><strong>Mink</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BHC mixed isomers</td>
<td>0.1</td>
<td>1.0</td>
<td>Increased mortality and decreased body weight of offspring.</td>
</tr>
<tr>
<td>Chlordane</td>
<td>14</td>
<td>28</td>
<td>Decreased viability and reduced abundance of offspring.</td>
</tr>
<tr>
<td>DDT + metabolites</td>
<td>4.5</td>
<td>22.5</td>
<td>Reduced number of offspring.</td>
</tr>
<tr>
<td>Dieldrin</td>
<td>0.11</td>
<td>1.1</td>
<td>Reduced number of pregnancies.</td>
</tr>
<tr>
<td>Endosulfan</td>
<td>0.84</td>
<td>-</td>
<td>Adverse reproductive effects.</td>
</tr>
<tr>
<td>Endrin</td>
<td>0.28</td>
<td>2.8</td>
<td>Reduced parental survival and number of offspring.</td>
</tr>
<tr>
<td>Heptachlor</td>
<td>0.73</td>
<td>7.3</td>
<td>Reduced offspring weight.</td>
</tr>
<tr>
<td>Methylmercury</td>
<td>0.11</td>
<td>0.18</td>
<td>Mortality, weight loss, and behavioral abnormalities.</td>
</tr>
<tr>
<td>PCBs (total)</td>
<td>1.02</td>
<td>5.04</td>
<td>For Aroclor 1254. Reduced number of offspring born alive.</td>
</tr>
</tbody>
</table>

1 Sample et al. 1996, Appendix D, Table 12.

Key:
- BHC = benzene hexachloride
- DDT = dichlorodiphenyltrichloroethane
- (dash) = not available
- LOAEL = lowest observed adverse effect level
- NOAEL = no observed adverse effect level
- PCBs = polychlorinated biphenyls
Exhibit 4-1

Bird or Animal Deformities Survey Form
Buffalo River Area of Concern (AOC)

1. Are you aware of any problems of bird or animal deformities within the AOC? See attached map for AOC boundary.

_____NO ______YES (describe)

<table>
<thead>
<tr>
<th>Species</th>
<th>Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

2. Are there any programs in place to monitor for bird or animal deformities in the AOC?

_____NO _____YES (describe) ____________________________

<p>| | |</p>
<table>
<thead>
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5. References


Ohio Environmental Protection Agency (OEPA). 2005. *Delisting Targets for Ohio Areas of Concern*. OEPA Division of Surface Water, Columbus, OH.


