

**Buffalo River Area of Concern:
A Monitoring Plan for the Delisting of “Impaired” Beneficial Use Impairments**

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Prepared by Buffalo Niagara Riverkeeper



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Introduction

In 2013-2014, Buffalo Niagara Riverkeeper assumed the task of developing a Monitoring Plan for the 8 of the 9 “Impaired” Beneficial Use Impairments (BUIs) in the Buffalo River Area of Concern (AOC). This process began with the formation of two “Sub Groups” comprised of people with expertise or significant interest in either Habitat or Water Quality issues. It was determined early on in the process that the Delisting Criteria for all of the BUIs needed to be updated to reflect current data and to assure that the goals were reasonable and obtainable while keeping in mind that the AOC program is not meant to restore the designated areas to a pristine state but rather an ecological functional environment within the confines of its geographical setting. The updated Delisting Criteria are presented in Table 1.

Two main Management Actions have been identified which need to be completed in order to restore the health of the Buffalo River AOC: remediation of contaminated sediments and restoration/enhancement of habitat. Sediment remediation began in 2011 with USACE Enhanced Navigational Dredging and will be completed in 2014 as part of the Great Lakes Legacy Act Program (GLLA). The GLLA also includes monitoring 2 years and 5 years after the project is completed as well as in-water habitat restoration. The Buffalo River Habitat Action Plan has identified 13 sites that need to be restored/enhanced within the AOC.

This report is intended to supplement the updated BUI chart by outlining the sampling efforts needed to redesignate the Buffalo River AOC, post Management Actions. Anticipated and/or scheduled sampling events that would partially or fully satisfy the sampling requirements, are listed at the end of each BUI section. Any additional sampling that has been recommended to evaluate the Delisting Criteria is described afterwards. It is envisioned that any additional sampling would need a funding source to be identified and a full QAPP developed at the time of the sampling project. A comprehensive review of previous sampling efforts was done as the basis of this report; however, when developing detailed sampling protocols for each project it is recommended that the listed sources for that BUI be reviewed. In the event that results from sampling efforts do not meet the standards detailed in the Delisting Criteria, alternative delisting methods are discussed.

The updated BUI Delisting Criteria chart and this report were thoroughly vetted through the Sub Groups, Remedial Advisory Committee (RAC), NYS Department of Environmental Conservation (NYSDEC), and the US Environmental Protection Agency (USEPA). However, this report should be seen as a “living document” which needs to be reviewed and updated periodically to reflect any new projects or data acquired in the Buffalo River AOC.

Table 1- Buffalo River BUIs and Delisting Criteria - 2014

Beneficial Use Impairment Indicator		2014 Status	Known or Likely Cause of Impairment	Delisting Criteria
1	Restrictions on Fish & Wildlife Consumption	Impaired	PCB's and Chlordane in sediments.	1) There are no AOC-specific fish and wildlife consumption advisories by New York State (e.g. carp for PCBs).
2	Tainting of Fish & Wildlife Flavor	Impaired	Phenolic compounds and Chlorobenzenes.	1) No exceedances of water quality standards within the AOC (6NYCRR Part 703.5) for compounds (Phenolic compounds and Chlorobenzenes) associated with tainting.
3	Degradation of Fish & Wildlife Populations	Impaired	Low dissolved oxygen, river channelization, and contaminated sediments.	1) BUI #5 (Bird or Animal Deformities or Reproductive Problems), BUI #6 (Degradation of Benthos), and BUI #14 (Loss of Fish and Wildlife Habitat), are removed or in recovery; AND 2) Fish surveys find that the resident fish community is "fair" to "good" based on applicable fish community biological indices (IBI); AND 3) Wildlife surveys confirm the presence of healthy and reproducing indigenous populations in the AOC.
4	Fish Tumors and Other Deformities	Impaired	Contaminated sediments and navigational dredging.	1) Analysis shows that the prevalence of neoplastic liver tumors found in Brown Bullheads, within the AOC, is not significantly higher than those found within a designated comparable control site.
5	Bird or Animal Deformities or Reproductive Problems	Impaired	PCBs, DDT, and metabolites in sediments.	1) Deformities or reproductive problem rates are not statistically different from inland background levels as reported by wildlife officials or trained observers conducting the tree swallow, mink, and wildlife surveys within the AOC; AND 2) Whole body tissue concentrations of contaminants of concern in small mid-trophic level prey fish identified in the AOC are not statistically different than Lake Erie.
6	Degradation of Benthos	Impaired	Contaminated sediments and navigational dredging.	1) Benthic macroinvertebrate communities are non-impacted or slightly impacted according to NYSDEC indices; AND 2) In the absence of conclusive community structure data, the toxicity of sediment-associated contaminants is not statistically higher than controls.
7	Restrictions on Dredging	Impaired	Various contaminants in sediments.	1) There are no restrictions on routine commercial or recreational navigation dredging by the U.S. Army Corps of Engineers (COE) 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.
8	Eutrophication or Undesirable Algae	Not Impaired		None
9	Restrictions on Drinking Water	Not Applicable		Not Applicable
10	Beach Closings	Not Applicable		Not Applicable
11	Degradation of Aesthetics	Impaired	Floatables, debris and foul odor from CSOs and upper watershed.	1) Minimize debris, general litter, floatables, or biological and chemical contaminants in the river through the signing of the Buffalo Sewer Authority's Long Term Control Plan and the application of Best Management Practices through the enactment of the City of Buffalo Green Code.
12	Added Cost to Agriculture	Not Impaired		None
13	Degradation of Phytoplankton or Zooplankton Populations	Not Impaired		None
14	Loss of Fish & Wildlife Habitat	Impaired	Physical disturbance such as bulk heading, dredging and steep slopes, and lack of suitable substrate.	1) Restore Habitat Connectivity; AND a) Enact the City of Buffalo's new unified development ordinance, the City of Buffalo Green Code, which contains explicit zoning provisions imposing a minimum 100-foot development setback and a 50-foot vegetative buffer (§ 5.5.3.A.5. C-W-100 Standards). b) Implement the Buffalo River Habitat Action Plan (2013). 2) Improve Water Quality a) Major anthropogenic causes of low dissolved oxygen, including navigational dredging and combined sewer overflows (CSOs), are not a limiting factor for supporting aquatic life.

Monitoring Requirements for BUI #1- Restrictions on Fish and Wildlife Consumption

Beneficial Use Impairment Indicator	Known or Likely Cause of Impairment	Delisting Criteria
Restrictions on Fish & Wildlife Consumption	PCB's and Chlordane in sediments.	1) There are no AOC-specific fish and wildlife consumption advisories by New York State (e.g. carp for PCBs).

Sample Media:

Samples to be analyzed:

- New York State Department of Environmental Conservation (NYSDEC) standard fillet for edible size fish.
- Whole body samples for Young of Year (YOY).

Sample size: In each of the four zones, 10 fish from each of the four species will be collected:

- Carp (*Cyprinus carpio*) - edible size
- Largemouth Bass (*Micropterus salmoides*) - edible size
- Brown Bullhead (*Ameiurus nebulosus*), Yellow Perch (*Perca flavescens*) or Pumpkinseed (*Lepomis gibbosus*), depending upon availability - edible size
- Bluntnose Minnow (*Pimephales notatus*) - YOY, fall

Analytes:

The fish samples will be analyzed for the following:

- PCBs as Aroclors
- Organochlorine pesticides
- Mercury
- Arsenic
- Cadmium
- Lead
- PAHs

Frequency:

Discrete samples will be collected at each location.

Duration of Sampling – from NYSDEC, 2012

- Collect the first round of fish samples [two] year[s] post-dredging to assure that current advisories are adequately protective and to provide initial indication of remediation efficacy.
- In order to remove the current restrictive fish advisory, even if the first round of sampling indicated that the current restrictive advisory could be removed, NYSDOH (New York State Department of Health) would require at least one more round of sampling taken. Site managers may want to review the data from the first round of post-remediation sampling before deciding whether this second round of sampling occurs at years 3, 4, or 5. For example, if fish in the first round of sampling still have elevated PCB levels we may want to wait additional years before taking the next round of samples.
- Additional rounds of sampling could be indicated depending on the results of the two rounds of sampling.

Sample Location(s): – from NYSDEC, 2012

Fish should be collected from four zones:

- Zone 1: Buffalo Ship Canal south of Michigan Street bridge
- Zone 2: Buffalo River from Michigan Street bridge to Ohio Street bridge
- Zone 3: Buffalo River from bend one fourth mile east of Katherine Street upstream to Babcock Street (this zone is aimed at sampling the most contaminated area)
- Zone 4: Buffalo River from Babcock Street to Route 67 bridge

Anticipated or Scheduled Sampling Events:

Post Legacy Act Sediment Remediation monitoring 2yr & 5yr (2016 & 2019).

- The “current” scheduled sampling at year 2 does not include the sampling required to delist this BUI. Funding for sampling that meets the minimum requirements as outlined above needs to be secured. The first round of sampling for the Buffalo River should take place two years post dredging, instead of one year as outline in the NYDEC 2012 memo, to align with post dredging monitoring and to avoid any additional disturbance of the sediment that may occur as a result of in water habitat restoration scheduled for 2015.
- Scheduled sampling at year 5 does meet the sampling requirements needed to delist this BUI (fish fillets must be taken to meet sample specification by NYSDOH and NYSDEC). However, sampling in year 2 must occur prior to year 5 and concentration levels should be considered, as stated in the Duration of Sampling section. Funding to sample for all fish species at all locations, must be secured.

Additional sampling may be needed as detailed in the Duration of Sampling section. The schedule of sampling may also need to be adjusted do to unforeseen delays in sediment remediation efforts.

Extending long-term monitoring beyond 5 years post-remediation was recommended in the Ecology & Environment (2011) report.

- No funding is in place, nor is sampling scheduled to occur.

Desired Outcome:

Based on NYDOH advisory levels, the Buffalo River Area of Concern (AOC) specific fish consumption advisory will be lifted. It is anticipated and expected that the Buffalo River AOC will continue to have a fish consumption advisory equal to that of Lake Erie.

An “In Recovery” designation for this BUI could occur as early as 2017 based on the Great Lakes Legacy Act Sediment Remediation and Year 2 post-dredging monitoring results (funding is needed to be secured to complete the monitoring efforts detailed above).

Notations/Special Considerations:

No AOC specific wildlife consumption advisories are in place by the NYS DOH for the Buffalo River, therefore no sampling procedures for wildlife are included in this document.

Collection for Bluntnose Minnow YOY must occur in the fall.

When sampling for Brown Bullhead, collection will need to occur at dusk or night (an alternative species may be chosen as described above).

Monitoring Requirements for BUI #2 – Tainting of Fish and Wildlife Flavor

Beneficial Use Impairment Indicator	Known or Likely Cause of Impairment	Delisting Criteria
Tainting of Fish & Wildlife Flavor	Phenolic compounds and Chlorobenzenes.	1) No exceedances of water quality standards within the AOC (6NYCRR Part 703.5) for compounds (Phenolic compounds and Chlorobenzenes) associated with tainting.

Sample Media:

Samples to be analyzed: Water column samples.

Sample size: Five sites will be sampled, 3 within the Buffalo River AOC and 2 upstream of the AOC. Sample size will meet the NYSDEC requirements for each of the analytes as shown in the table below.

Parameter	Container	Preservation	Holding Time (from time of sample collection)
Volatile Organics	3 x 40mL Glass, Teflon-lined septum cap	Cool, 4°C	14 days
Semi-volatile Organics	2 x 1 L Amber Glass, Teflon-lined cap	Cool, 4°C	7 days for extraction / 40 days for analysis
Total Phenolics	2 x 1L Glass, Teflon-lined cap	Cool, 4°C, H ₂ SO ₄ to pH < 2	As soon as possible (not to exceed 28 days)

Table adapted from NYSDEC (2013)

Analytes:

Water Column Samples will be analyzed for the following parameters (E&E 2011):

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

Table adapted from 6 NYCRR Chapter X, Part 703

Frequency:

Sampling will be conducted three times per year, with one event occurring during each of the spring, summer, and fall seasons.

Duration of Sampling – at least three years (additional sample years possible if determined to be necessary).

Sample Location(s) – from NYSDEC, 2013

Three sites within the AOC boundaries were selected due to the proximity to potential sources of contamination, the flow of the river, and their ability to allow for safe access and collection of samples.

Two sites are just upstream of the AOC boundary at confluences of Buffalo and Cazenovia Creeks.

Stream	Station ID	Approx. Latitude	Approx. Longitude	Description
Sampling Locations Within Buffalo River AOC Boundaries				
Buffalo River	BFRV-A	42.8716	-78.8728	Bridge on Michigan Ave
Buffalo River	BFRV-B	42.8641	-78.8609	Near park at south end of Hamburg St. (CSO outfall site)
Buffalo River	BFRV-C	42.8631	-78.8427	Bridge on South Park Ave
Sampling Locations Upstream of the AOC Boundaries				
Cazenovia Creek	CAZCR-A	42.8595	-78.8224	Bridge on Southside Pkwy.
Buffalo Creek	BFCR-A	42.8637	-78.8211	Bridge on Seneca Street

Table adapted from NYSDEC, 2013

Anticipated or Scheduled Sampling Events:

NYSDEC is currently conducting a 3-year water quality assessment in the locations listed above for the recommended analytes.

- The QAPP has been approved and sampling started in 2013.

No additional monitoring should be needed beyond the NYSDEC study but additional sampling that may be considered includes Great Lakes Legacy Act post-remediation monitoring 2yr and 5yr (2016 and 2019).

Extending long-term monitoring beyond 5 years was recommended in E&E (2011) report.

Desired Outcome:

It is anticipated that full delisting of this BUI can commence in 2015 or 2016 based on the results of the study and NYSDEC determination that fish tainting is no longer a concern in the AOC. The draft report for this study is scheduled to be completed by the end of 2015 and the final report is scheduled to be completed in 2016.

Notations/Special Considerations

It is recognized that any tainting that may exist within the Buffalo River AOC only pertains to fish flavor; there is no evidence that it affects other wildlife (NYSDEC 2013).

Monitoring Requirements for BUI #3 – Degradation of Fish and Wildlife Populations

Beneficial Use Impairment Indicator	Known or Likely Cause of Impairment	Delisting Criteria
Degradation of Fish & Wildlife Populations	Low dissolved oxygen, river channelization, and contaminated sediments.	<ol style="list-style-type: none"> 1) BUI #5 (Bird or Animal Deformities or Reproductive Problems), BUI #6 (Degradation of Benthos), and BUI #14 (Loss of Fish and Wildlife Habitat), are removed or in recovery; AND 2) Fish surveys find that the resident fish community is “fair” to “good” based on applicable fish community biological indices (IBI); AND 3) Wildlife surveys confirm the presence of healthy and reproducing indigenous populations in the AOC.

Delisting Criteria 1

A full explanation of the monitoring protocols for this Delisting Criteria is provided under each of the respective BUIs.

Delisting Criteria 2

Sample Media:

Samples to be analyzed: Based on CH2MHILL (2012), species composition, abundance, size distribution and biomass by species will be documented at each survey location.

Sample size: Not applicable as the objective of this sampling event is to determine abundance, composition, and size.

Analytes:

None

Frequency:

An electroshocking run of approximately 15 minutes at each site.

Duration of Samples - One round of samples taken at each location with a minimum of two consecutive sampling events needed.

Sample Location(s): (CH2MHILL, 2012)

- Three locations consistent with previous sampling [events].
 - One upstream, one downstream, and one city ship canal location.
- Two additional locations maybe chosen based on results of first three locations.
- Sample location will be chosen to be consistent with previous work and to document remedy effectiveness at sites proposed for restoration.

Anticipated or Scheduled Sampling Events:

Buffalo River Great Lakes Legacy Act Post Remediation Monitoring - 2yr & 5yr (2016 & 2019).

- Scheduled sampling of fish communities at year 2 and 5 meet the sampling requirements needed to delist this BUI. Funding must be secured to ensure this sample occurs.
- Additional monitoring and funding may be needed to fully delist this BUI if results do not provide the desired outcome.

Desired Outcome:

Results will be extrapolated to compare with 2013 baseline data so that a determination can be made of whether or not the fish community is “fair” to “good” based on applicable IBI’s. For full delisting of this BUI, two consecutive sampling events where fish communities are determined to be “fair” to “good” are required. Delisting Criteria 1 and 3 must also be satisfied for delisting to occur.

Notations/Special Considerations:

None

Delisting Criteria 3

Sample Media

Samples to be analyzed: Three vertebrate faunal assemblages will be surveyed (AES and Conservation Connect, 2013) . General habitat characteristic will also be recorded for comparison.

- Avifauna.
- Herpetofaunal.
- Mammals.

Sample size: Not Applicable – observational survey.

Analytes:

Not Applicable – observational survey.

Frequency:

Ongoing observational survey meant to capture seasonal and diurnal variations in presence of species.

Duration of Samples - Each survey will be collected over the course of a sampling season. At least three surveys (years) in addition to the baseline survey are required to take account for variability such as weather and population fluctuations (see Notation Section). If funding permits, five surveys (years) are recommended.

Sample Location(s):

Sampling points were selected in stratified random fashion, ensuring adequate representation of all available habitat types for target fauna. Stratifying sampling efforts by land cover with specific knowledge of target fauna natural history is proven to increase precision of population estimates. A total of 20 points were ultimately selected within the selected habitat types, 15 within the AOC (study area) and 5 within neighboring locations (reference area). (AES and Conservation Connect, 2013)

Anticipate or Scheduled Sampling Events:

Wildlife Survey.

- Baseline sampling is complete. Funding needs to be secured for the survey to be replicated allowing for population trends to be established. Funding should be secured to accomplish at least three additional sampling events, allowing for delisting to occur.

Desired Outcome:

Depending on the implementation of the management actions (habitat restoration), it is anticipated that this BUI could be considered for re-designation as early as 2017. If, through the replication of the wildlife survey, data comparison confirms that there is a healthy and reproducing indigenous avifauna, herpetofaunal, and mammal population in the AOC, full delisting of this BUI could occur. Delisting Criteria 1 and 2 must also be satisfied for delisting to occur.

Notations/Special Considerations:

Strict adherence to the original survey methods (described above), temporal and spatial execution (also described above), and adequate repetition of total survey effort over time will decrease controllable variability and, thusly, increase the probability of detecting actual population trends (Gibbs et al. 1998). To encourage adherence to the original survey methods for future surveyors, literature associated with various survey methods are hyperlinked within relevant sections and data sheets for reuse are found in Appendix III (AES and Conservation Connect, 2013). The full QAPP is included in the report as Appendix 2.

Monitoring Requirements for BUI #4 – Fish Tumors and Other Deformities

Beneficial Use Impairment Indicator	Known or Likely Cause of Impairment	Delisting Criteria
Fish Tumors and Other Deformities	Contaminated sediments and navigational dredging.	1) Analysis shows that the prevalence of neoplastic liver tumors found in Brown Bullheads, within the AOC, is not significantly higher than those found within a designated comparable control site.

Sample Media:

Samples to be analyzed: Liver samples will be collected from brown bullhead (*Ameiurus nebulosus*) larger than 25cm.

Sample size: 50 brown bullhead will be collected with 16-18 fish collected from each of the 3 zones. Every effort should be made to meet the minimum amount and size at each location. If, after extensive sampling (electrofishing and fyke netting) collection of 50 bullheads is not successful, possible alternative courses of action may include: (1) collecting more fish in one river section versus the others; (2) collecting fish from more than three river sections within the AOC; (3) collecting fish that are less than the 25 cm adult size range; or (4) as a last resort, collect less than 50 fish.

Analytes:

Histological analysis of liver tissue samples.

Frequency:

Discrete samples will be collected at each location.

Duration of Samples - One year (2019) with additional sample years if needed.

Sample Location(s):

Samples will be collected from three zones within the Buffalo River AOC (Environ et al., 2009). The control site to be used will be Long Point Inner Bay in Lake Erie - which was also the control site used for the Presque Isle Bay AOC Fish Tumors and Other Deformities BUI - (Pennsylvania Department of Environmental Protection, 2012).

- Zone 1 – River Mile 5.6-6.25
- Zone 2 – River Mile 3.4-4.6
- Zone 3 – River Mile 1.25- 1.9

Anticipated or Scheduled Sampling Events:

Buffalo River Great Lakes Legacy Act Post Remediation Monitoring - 2yr & 5yr (2016 & 2019).

- Scheduled sampling for year 2 does not meet the sampling requirements needed to delist this BUI. Funding is neither secured nor recommended at this time.
- Scheduled sampling for year 5 does meet the sampling requirements needed to delist this BUI. If results show that the prevalence of neoplastic liver tumors are not significantly higher than the designated control site no further sampling would be needed and delisting could occur. Funding needs to be secured.

In the event that results from the year 5 monitoring are significantly higher than the control site, additional funding would need to be secured for a subsequent sampling event. An additional round of sampling should occur at least two years later. Sediment contaminant concentration trends should be looked at to help determine when additional sampling should occur.

Desired Outcome:

It is anticipated that this BUI could be redesignated to “In Recovery” in 2020 if samples show that the prevalence of neoplastic liver tumors in brown bullheads are not significantly higher than control sites.

Notations/Special Considerations:

Fish collection methods include electroshocking (primary techniques) and gill nets (secondary technique).

Samples will need to be taken at twilight/night.

Two consecutive sampling events removed from delisting criteria and were not carried through to the monitoring protocol.

Monitoring Requirements for BUI #5 – Bird or Animal Deformities or Reproductive Problems

Beneficial Use Impairment Indicator	Known or Likely Cause of Impairment	Delisting Criteria
Bird or Animal Deformities or Reproductive Problems	PCBs, DDT, and metabolites in sediments.	1) Deformities or reproductive problem rates are not statistically different from inland background levels as reported by wildlife officials or trained observers conducting the tree swallow, mink, and wildlife surveys within the AOC; AND 2) Whole body tissue concentrations of contaminants of concern in small mid-trophic level prey fish identified in the AOC are not statistically different than Lake Erie.

Delisting Criteria 1

*Details of the Wildlife Survey are provided in BUI #3.

Sample Media:

Samples to be analyzed:

- Swallows (*Hirundinidae*)
 - Eggs (complete content).
 - 12 day old nestlings (liver, blood, stomach samples).
 - Reproductive data.
- Mink (*Neovision vision*) carcasses (liver, jaw, teeth, brain and muscle tissue samples).

Sample size:

- Swallows – 2 eggs and 1 or 2 nestlings from each of the 20 nest boxes per sample season for 5 consecutive years.
- 10 Mink carcasses

Analytes:

Swallows – Full suite of legacy and emerging contaminants (including):

- dioxins and furans
- PCBs
- Mercury
- PBDEs
- non-PBDE flame retardants
- PFCs
- Other types of contaminants may be analyzed (e.g., PAHs)

Mink – Contaminants of Concern (COC):

- Total PCBs
- Dioxins (including coplanar dioxin-like PCB congeners) and furans
- Mercury
- PAH - need to be determined

Frequency:

- Swallows – samples will be collected once per sample season.
- Mink – samples will be collected from trappers as available until the desired amount of 10 carcasses is met.

Duration of Samples:

- Swallows – samples will be collected over 5 years, beginning in 2013.
- Mink – samples will be collected over the course of the 2014 sample season. Additional time may be required.

Sample Location(s):

- Swallows – 20 nest boxes within the AOC. Sites chosen by USGS biologist based on access and habitat quality.
- Mink – Anywhere within the AOC and up to three miles in proximity.

Anticipated or Scheduled Sampling Events:

USGS Swallow Study.

- Sampling is underway and fully funded.

NYS DEC Mink study.

- Sampling is underway and fully funded. (NYSDEC, 2013)

Wildlife Survey.

- Baseline sampling is complete. Funding needs to be secured for the survey to be replicated allowing for population trends to be established. It is the intention of the working group to pair this general wildlife survey with the other two surveys to ensure a broad assessment of the wildlife population is taken. This survey is required to delist BUI #3 as well.

Desired Outcome:

It is anticipated that this BUI could be redesignated to “In Recovery” by 2020 based on the implementation of management actions and if the results of the wildlife survey, swallow and mink studies show that deformities and reproductive rates are not statistically different than background levels as reported by wildlife officials or trained observers.

Notations/Special Considerations:

Wildlife Survey will be conducted as outlined in BUI #3 and used for delisting of this BUI.

The tree swallow study and the mink study are GLRI/AOC funded projects and it was the goal of the work groups to incorporate current relevant studies being conducted.

One of the swallow study locations has been affected by vandalism and as a result the location may change. This will be determined by USGS officials.

Delisting Criteria 2

Sample Media:

Samples to be analyzed - Fish of a size and species considered prey for the wildlife species under consideration must be used for the tissue data.

Sample size:

Buffalo River: 10 fish from each species in each of the four zones:

- Bluntnose Minnow (*Pimephales notatus*) - YOY, fall
- Largemouth Bass (*Micropterus salmoides*)
- 2 additional species yet to be determined
 - To minimize collection efforts Brown Bullhead (*Ameiurus nebulosus*), Yellow Perch (*Perca flavescens*) or Pumpkinseed (*Lepomis gibbosus*) may all be considered.
- Carp (*Cyprinus carpio*)- if of a size considered prey for wildlife

Lake Erie: Comparative sample size and species should be taken allowing for statistical analysis.

Analytes:

PCBs and DDT (and metabolites) levels in the Buffalo River will be compared to those of Lake Erie.

Frequency:

Discrete samples will be collected at each location.

Duration of Samples - One year with additional sampling years possible.

Sample Location(s):

To minimize cost, time and effort samples for the Buffalo River should be taken from the same four locations detailed in BUI 1.

Lake Erie sample locations will need to be determined, but locations should be chosen to ensure that they are statistically representative of Lake Erie contaminant concentrations.

Anticipate or Scheduled Sampling Events:

Buffalo River Great Lakes Legacy Act Post Remediation Monitoring - 2yr & 5yr (2016 & 2019).

- Monitoring at year 2 does not have any anticipated sampling that fits this BUI
- Scheduled monitoring at year 5 does have sampling efforts for the Buffalo River as detailed in BUI 1. However, as stated, funding for this sampling needs to be secured.

Additional sampling for Lake Erie is needed for comparison. Currently there is no anticipated or scheduled sampling for Lake Erie but funding needs to be secured to perform sampling.

Extend long-term monitoring beyond 5 years was recommend in E&E 2011 report.

- No funding is in place nor is sampling scheduled to occur.

Desired Outcome:

It is anticipated that this BUI could be redesignated as “In Recovery” by 2020 if concentrations of contaminants of concern (COC) found in the Buffalo River are not statistically different than those found in Lake Erie (at 95% confidence interval).

Notations/Special Considerations:

Years 2 and 5 GLLA (Great Lakes Legacy Act) remedy sediment contaminant monitoring data will be compared to the NYSDEC guidance values. This will help ensure that sediment containment levels are no longer a concern.

Sample sizes must ensure when comparing COC found in the Buffalo River with those in Lake Erie that a 95% confidence interval is met.

Monitoring Requirements for BUI #6 – Degradation of Benthos

Beneficial Use Impairment Indicator	Known or Likely Cause of Impairment	Delisting Criteria
Degradation of Benthos	Contaminated sediments and navigational dredging.	1) Benthic macroinvertebrate communities are non-impacted or slightly impacted according to NYSDEC indices; AND 2) In the absence of conclusive community structure data, the toxicity of sediment-associated contaminants is not statistically higher than controls.

Delisting Criteria 1

Sample Media:

Samples to be analyzed - Benthic macroinvertebrate communities.

Sample size - At each site, 3-5 replicate samples will be taken using Ponar grabs.

Analytes:

Not Applicable – the objective of this sampling event is to determine abundance, composition, and size.

Frequency:

Discrete samples will be collected at each location.

Duration of Samples - One sample event is schedule for year 2 and 5 post-Great Lakes Legacy Act remediation monitoring. Additional sampling maybe required.

Sample Location(s):

Community surveys at 5 locations within the Buffalo River AOC.

- River Miles (RMs) from mouth - 0.3, 1, 2.1, 4.75, 5.5

Anticipated or Scheduled Sampling Events:

None

Desired Outcome:

Two consecutive sampling events show that communities are “non-impacted” or “slightly impacted” according to NYSDEC indices, allowing for this BUI to be “In Recovery” status two years post sediment remediation and full delisting five years post remediation.

Notations/Special Considerations:

Results will be compared to historical (2009) data within the AOC.

A visual survey in Year 2 Legacy Act monitoring and limited taxonomy will be performed. A full taxonomy is scheduled to be completed at year five (CH2MHILL, 2012).

Delisting Criteria 2

Sample Media:

Samples to be analyzed - Composite sediment samples using Ponar grab.

Sample size - 10 sample locations

Analytes:

- 10-day acute toxicity tests conducted with the amphipod *Hyalella azteca* and the midge *Chironomus dilutes*.
- 4-day acute toxicity test and 28-day bioaccumulation test with the Oligochaete *Lumbriculus variegatus*.

Frequency:

Discrete samples will be collected at each location.

Duration of Samples - Samples will be collected as required.

Sample Location(s):

Sediment samples will be collected from 10 Samples areas:

- Locations: 02, 04, 06, 08, 12, 16, 20, 21, 25, and 27 (see figure 1.2 & 1.3 on page 196 in CH2MHILL, 2012, *Data Summary Report*)

Anticipate or Scheduled Sampling Events:

Buffalo River Great Lakes Legacy Act Post Remediation Monitoring - 2yr & 5yr (2016 & 2019).

- Scheduled sampling of benthic communities at year 2 and 5 meet the sampling requirements needed to delist this BUI. Funding must be secured to ensure this sample occurs.
- Additional monitoring and funding, to meet the two consecutive sampling requirements, may be needed to fully delist this BUI.

Desired Outcome:

Benthic macroinvertebrate community results may allow for an “In Recovery” status to be designated two years post sediment remediation with full delisting potentially within five years. If benthic macroinvertebrate community data is limited, results from the sediment toxicology may be needed to show that sediment levels are not statistically higher than control sites.

Notations/Special Considerations:

Future sampling should be based on the Appendix C of the CH2MHILL, 2012. This study was done in accordance with “Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates” (USEPA 2000).

Monitoring Requirements for BUI #11 – Degradation of Aesthetics

Beneficial Use Impairment Indicator	Known or Likely Cause of Impairment	Delisting Criteria
Degradation of Aesthetics	Floatables, debris and foul odor from CSOs and upper watershed.	1) Minimize debris, general litter, floatables, or biological and chemical contaminants in the river through the signing of the Buffalo Sewer Authority’s Long Term Control Plan and the application of Best Management Practices through the adoption of the City of Buffalo Green Code by the Common Council.

Desired Outcome:

Redesignation of this BUI may occur by 2015 if/when both the Buffalo Sewer Authority’s Long Term Control Plan is signed and the City of Buffalo Green Code is adopted by the Common Council. Through the adoption and implementation of this fundamental framework we will see a continuous increase in aesthetic quality of the Buffalo River. This will be the start of a long process of reducing and eliminating inputs through both point and non-point sources pollution. Furthermore, it was determined by the working group that this is the best means of reducing the known or likely causes of impairment that have historically plagued the Buffalo River.

Monitoring Requirements for BUI #14 – Loss of Fish and Wildlife Habitat

Beneficial Use Impairment Indicator	Known or Likely Cause of Impairment	Delisting Criteria
Loss of Fish & Wildlife Habitat	Physical disturbance such as bulk heading, dredging and steep slopes, and lack of suitable substrate.	<ol style="list-style-type: none"> 1) Restore Habitat Connectivity; AND <ol style="list-style-type: none"> c) Enact the City of Buffalo’s new unified development ordinance, the City of Buffalo Green Code, which contains explicit zoning provisions imposing a minimum 100-foot development setback and a 50-foot vegetative buffer (§ 5.5.3.A.5. C-W-100 Standards). d) Implement the Buffalo River Habitat Action Plan (2013). 2) Improve Water Quality <ol style="list-style-type: none"> a) Major anthropogenic causes of low dissolved oxygen, including navigational dredging and combined sewer overflows (CSOs), are not a limiting factor for supporting aquatic life.

Delisting Criteria 1a & 1b

Desired Outcome:

Loss of wildlife habitat and connectivity will be restored over time through the implementation of the Buffalo River Habitat Action Plan and the enactment of the City of Buffalo’s Green Code. The Buffalo River Habitat Action Plan has identified priority opportunities to increase habitat and the Buffalo Green Code will help further establish and protect critical connective corridors for wildlife.

Delisting Criteria 2

Desired Outcome:

Water Quality and aquatic (fish) habitat will be improved by continuing to diminish anthropogenic causes of low dissolved oxygen and increasing aquatic vegetation. Current hypoxic and sometimes anaerobic conditions in the AOC are primarily the result of pollution, eutrophication, and low flow. Implementation of the Buffalo Sewer Authority’s Long Term Control Plan will significantly decrease Combined Sewer Overflow (CSO) inputs, a major source of pollution and nutrient loading, and therefore greatly improving water quality and dissolved oxygen conditions. Aquatic habitat restoration is included in the Great Lakes Legacy Act Project and the Buffalo River Habitat Restoration Action Plan, further improving Aquatic Habitat.

Navigational dredging significantly impacts the flow conditions of the Buffalo River and therefore negatively impacts dissolved oxygen levels. However, it is understood that current dredging by the US Army Corps of Engineers is meant to maintain the navigational channel and prevent flooding from occurring upstream. That being said, every attempt to minimize the effects of dredging on the flow regime of the Buffalo River should be made.

It is anticipated that this BUI could be redesignated as “In Recovery” early as 2017 based on aquatic and upland habitat restoration proposed in the Great Lakes Legacy Act Project and the Buffalo River Habitat Restoration Action Plan. It is also anticipated that the City of Buffalo’s Green Code and the Buffalo Sewer Authority’s Long Term Control Plan will be implemented at the end of 2014, satisfying the other requirements for redesignation to occur.

References:

- Applied Ecological Services, Inc. & Conservation Connect. 2013. A Wildlife Survey of the Lower Buffalo River Area of Concern, Buffalo, Erie County, New York. Prepared for Buffalo Niagara Riverkeeper
- CH2MHILL. 2012. Data Summary Report Buffalo River AOC Baseline Remedial Assessment Study. Buffalo, New York. Prepared for EPA Region 10
- CH2MHILL. 2012. Appendix C Acute Toxicity and Bioaccumulation Assessment of Buffalo River Sediment. Buffalo, New York. Prepared for EPA
- CH2MHILL. 2012. Appendix H Sediment Remediation and Habitat Restoration Buffalo River Area of Concern. Buffalo, New York. Prepared for EPA
- Ecology and Environment, Inc. 2011. Interim Buffalo River Area of Concern (AOC) Strategic Plan for Beneficial Use Impairment (BUI) Delisting. Prepared for US Army Corps of Engineers Buffalo District
- Environ, MacTec, and LimnoTech. 2009. Sediment Remedial Investigation Report for the Buffalo River, New York
- NYSDEC, Division of Water & The College at Brockport, SUNY. 2013. Mink Study Strategy Research Needed to Delist BUIs in Three NYS AOCs
- NYSDEC. 2012. Fish Contaminant Monitoring Following Buffalo River Dredging Memo. Richter, W., Division of Fish, Wildlife and Marine Resources, NYSDEC, Albany, New York
- NYSDEC. 2013. Great Lakes Program Water Quality Assessment QAPP Buffalo River AOC - BUI Removal Tainting of Fish and Wildlife Flavor
- Pennsylvania Department of Environmental Protection. 2012. Presque Isle Bay Area of Concern Final Stage 3 Remedial Action Plan: Delisting. Pennsylvania Department of Environmental Protection, Office of Great Lakes.
- USGS Swallow Study http://www.umesc.usgs.gov/wildlife_toxicology/glri_project80.html
- Buffalo Sewer Authority's Long Term Control Plan <http://bsacsoimprovements.org/cso-control-plan/ongoing-projects/>
- City of Buffalo Green Code <http://www.buffalogreencode.com/>