Appendix II – Quality Assurance Project Plan (QAPP)

Lower Buffalo River Wildlife Survey

Quality Assurance Project Plan

Prepared For:

U.S. Environmental Protection Agency
Region 2
290 Broadway
New York, NY 10007-1866

Prepared by:

Applied Ecological Services
1100 East Hector Street, Suite 398
Conshohocken, PA 19428

On Behalf of:

Buffalo Niagara RIVERKEEPER
1250 Niagara Street
Buffalo, NY 14213

October 3, 2011
Version 2

1.0 Approval Page

Frederick Luckey, Project Officer
U.S. EPA Great Lakes National Program Office

1/23/12
Date

Donna Ringel, Quality Assurance Officer
U.S. EPA ~~Great Lakes National Program Office~~ Region 2

1/25/12
Date

Katherine Winkler, Buffalo River RAP Project Manager
Buffalo Niagara Riverkeeper

2-7-12
Date

Katy Brown, Quality Assurance Officer
Buffalo Niagara Riverkeeper

2-7-12
Date

Michael McGraw, Project Manager/Lead Biologist
Applied Ecological Services, Inc.

3/1/12
Date

Jason Carlson, Quality Assurance Officer
Applied Ecological Services, Inc.

2/22/12
Date

2.0 Table of Contents

Acronyms and Abbreviations

AES	Applied Ecological Services
CC	Conservation Connects
BNR	Buffalo Niagara RIVERKEEPER
BRRAP	Buffalo River Remedial Action Plan
BUI	Beneficial Use Impairment
DQO	Data Quality Objective
ERMP	Buffalo River Ecological Restoration Master Plan
FSBR	Feasibility Study for the Buffalo River
IJC	International Joint Commission
LBR	Lower Buffalo River
GIS	Geographic Information System
GLNPO	Great Lakes National Program Office
GLRI	Great Lakes Restoration Initiative
GLWQA	Great Lakes Water Quality Agreement
NYSDEC	New York State Department of Environmental Conservation
QAPP	Quality Assurance Project Plan
QA	Quality Assurance
QA / QC	Quality Assurance/Quality Control
USEPA	U.S. Environmental Protection Agency

3.0 Distribution List

U.S. Environmental Protection Agency
Region 2
290 Broadway
New York, NY 10007-1866
Attn: Frederick Luckey

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17921 W. Smith Road
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Attn: Jason Carlson

Applied Ecological Services, Inc
1100 East Hector Street, Suite 398
Conshohocken, PA 19428
Attn: Michael McGraw

4.0 Project/Task Organization

The Buffalo Niagara Riverkeeper (BNR) will serve as the grant administrator for this project. Technical support for this project is being provided by Applied Ecological Services (AES) via contract with BNR. Conservation Connects (CC) will be assisting AES with survey efforts. All project team members are responsible for adhering strictly to all protocols in this Quality Assurance Project Plan (QAPP); further, team members are required to obtain approval from the Project Manager at his or her agency in advance of any deviation to Quality Assurance (QA) protocols. In addition to the QA/QC activities detailed in this QAPP document, AES has internal QA systems and plans in place that will be used for all project activities.

Specific details about the roles and responsibilities of team members for this project are provided below.

Katherine Winkler (BNR), Project Grant Administrator. Ms./Mrs. Winkler will coordinate tasks across all agencies contributing to this project and will serve as the primary point of contact for the overall project. In addition, she will serve as the primary point of contact for BNR and maintain coordination with the biological contractor (AES).

Katy Brown, (BNR), QA Officer. Ms./Mrs. Brown will serve as the QA Officer for BNR. She will be responsible for ensuring that all work conducted in execution of the project is relevant and timely in reference to the goals and expectation of BNR.

Michael McGraw (AES), Project Manager/Lead Biologist. Mr. McGraw will conduct and provide oversight for the collection of biological data, ensuring completion of tasks and deliverables according to the project schedule. Mr. McGraw will serve as AES's primary point of contact for the project.

Sheila Hess (CC), Co-Project Manager. Ms./Mrs. Hess will provide QA/QC of sampling point locations, biological data collection, and data analysis. In this role, she will be co-managing the project with Mr. Michael McGraw

Jason Carlson (AES), QA Officer. Mr. Carlson will serve as the QA Officer for AES. He will be responsible for ensuring the full implementation of all applicable QA activities required under this project as provided in this QAPP.

Frederick Luckey, USEPA Project Officer. Mr. Luckey will serve as the Project Officer on behalf of the U.S. EPA Great Lakes National Program Office.

Donna Ringel, USEPA QA Officer. Ms./Mrs. Ringel will serve as the QA Officer on behalf of the U.S. EPA Great Lakes National Program Office. She will be responsible for ensuring the full implementation of all applicable QA activities required under this project as provided in this QAPP.

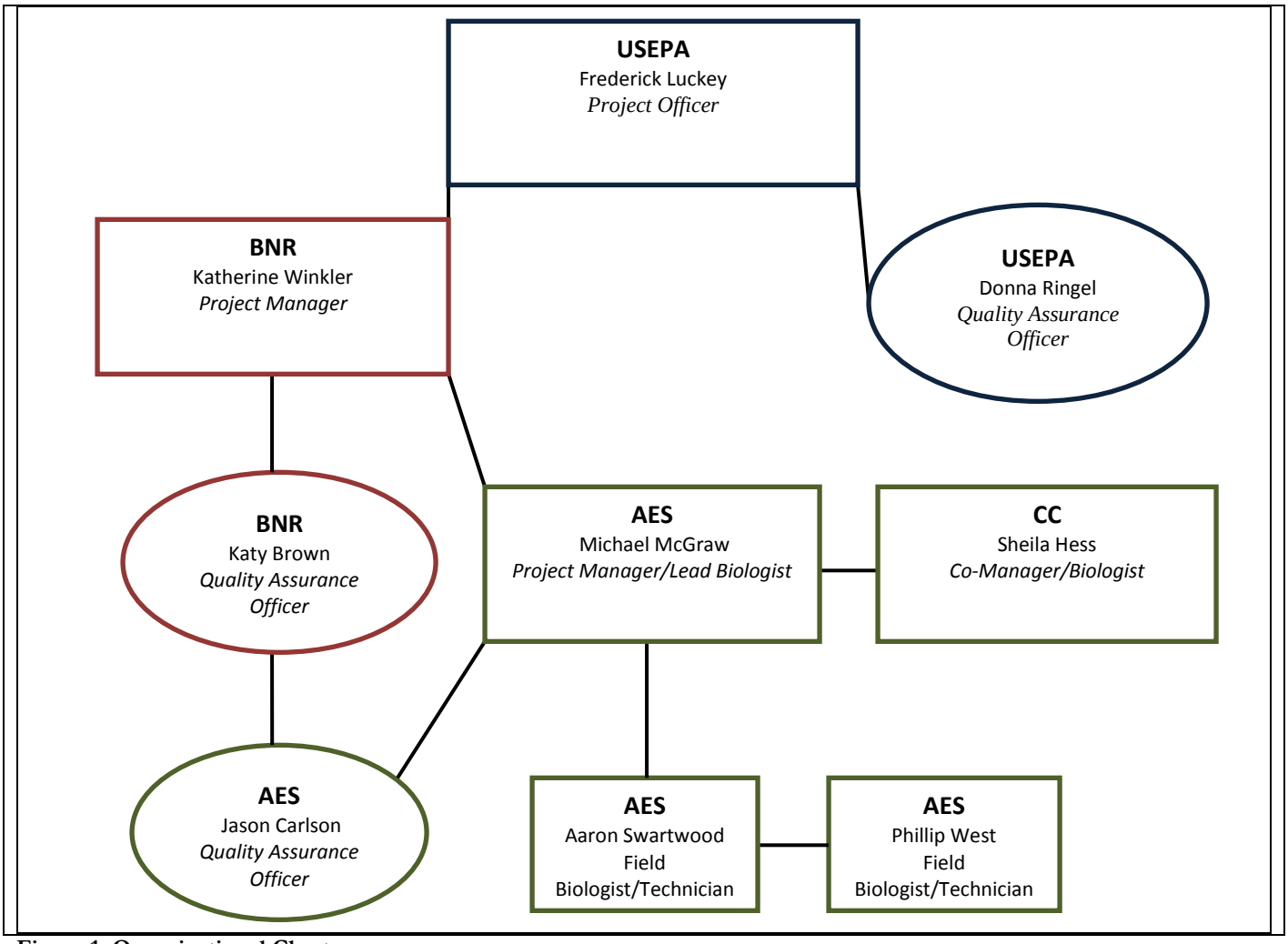


Figure 1. Organizational Chart.

5.0 Special Training Requirements/Certification

No special certification is required for this project beyond the already high degree of academic training and professional experience that AES and CC staff has obtained in order to fulfill job requirements commensurate with their current assignments. The AES and CC staff has a wealth of experience and education in wildlife biology, restoration ecology, population biology, Laurentian Great Lakes ecosystems, northeastern United States ecosystems, herpetology, avifaunal biology, and GIS. AES and CC staff involved on this project are skilled project managers as well as experienced scientists with many years experience conducting field biology.

A NYSDEC Scientific Collector's Permit will be obtained for the project by the lead biologist (Mr. McGraw)

6.0 Project Context, Problem Definition and Background

6.1 Project Context/Definition

Currently, no baseline data exists to assess the status of wildlife populations within the LBR AOC. The expressed intention of the wildlife survey detailed within this plan is to generate empirical data sets of extant species richness and abundance for three target vertebrate assemblages (mammals, herpetofauna, and avifauna) within the Lower Buffalo River (LBR) Area of Concern (AOC). A secondary intention is to provide a standardized and repeatable protocol for future biological sampling within the LBR AOC. The results of the 2011-2012 survey effort will be the baseline data within a comparative metric in determining AOC Beneficial Use Impairment (BUI) status (namely, BUI #s 3 & 14). As further detailed within this plan, the surveys will be strategically linked to existing natural spaces adjacent to and/or within the LBR as well as proposed and existing ecosystem-related activities (such as aquatic and terrestrial habitat enhancements, ecological restoration initiatives, and pollutant remediation) set forth within in the Buffalo River Remedial Action Plan (RAP), ensuring that the data gathered will best serve the intentions of the United States Environmental Protection Agency (USEPA), BNR, the LBR, and associated ecosystems as specified within the Buffalo River (RAP).

6.2 Background

Situated between the Onondaga and Portage Escarpments, the Buffalo River Watershed lies within the Erie Plain of western New York, an area steeped in rich cultural and natural history. Historically, the convergence of the Cayuga, Buffalo, and Cazenovia Creeks was a sight of bountiful fishing, vast forested landscapes, and rich populations of plant and wildlife. The progression of Buffalo into a major industrial city in the early 19th and 20th centuries altered much of the natural landscape in the region, particularly in and around the LBR. Industrial pollution remains as a lasting legacy of the industrial and post industrial eras. Over the centuries, development and changes in the lakes themselves and associated river systems have left many of these soft edges hardscaped and bulwarked. Marshes and other coastal wetlands have been channelized, impounded and altered by invasive species. Transportation systems, industrial infrastructure, and other development has removed from lake edges the transitional wetland-upland systems and broken the once continuous habitat connections to rivers and other aquatic systems. These sensitive ecosystems where water meets land not only provided critical nutrient processing, hydrologic control (including natural stormwater management), and niche-partitioning of resident floral and faunal assemblages, but also played a most critical role in the migratory success of millions of migrant shorebirds and waterfowl each year.

The results of anthropogenic impacts on the LBR ecosystem and many other areas within the Great Lakes led to an international response in efforts to cease continued degradation of water quality within the Laurentian Great Lakes Region. The USEPA along with the United States and Canada International Joint Commission (IJC) generated the Great Lakes Water Quality Agreement (GLWQA) in the 1980's which required the development of a RAP for each of the 43 AOCs identified within the GLWQA. Within each RAP, BUIs are identified as impaired or delisted for each AOC. Of the 14 BUI's listed within the Buffalo River RAP, nine are currently impaired, three

of which are directly related to fish and wildlife habitat and populations. Of these, two are directly related to the survey efforts within this plan (degradation of fish and wildlife populations & loss of fish and wildlife habitat). BNR continue to work in conjunction with federal and state agencies towards the ecological and aesthetic revitalization of the LBR. In 2003, the BNR was awarded the responsibility of coordinating the implementation of the Buffalo River RAP. As part of this implementation, they have hired AES to perform the studies as described within this plan. As proposed dredging, habitat enhancement, and ecosystem restoration efforts are implemented, a perceived goal is that wildlife habitat (both biotic and abiotic components) and, subsequently, wildlife populations will improve within the LBR AOC (Figure 2). This study will outline the basis from which to prove this response over time.

The direct effect on wildlife populations is the impairment and/or lack of historically occurring critical habitat. For the expressed purposes of this survey effort (and in attempts to ensure that all data collected is directly relevant to the GLWQA/RAP goals), habitat is a species-specific term and is defined as "the place where a micro-organism, plant or animal species lives". More importantly, critical habitat is defined "as a place which provides resources to a species whose presence is dependent upon these resources and, in the absence of these resources, would not support viable populations of said species. A home range is the area which contains all critical habitat resources required to fulfill a species' life history. Critical habitat resources for the purposes of this effort are the following:

<u>Avifauna</u>

- Nesting Habitat (breeding population)
- Foraging (breeding, migratory[1], wintering)
- Shelter/Structure/Roosting (breeding, migratory[1], wintering)

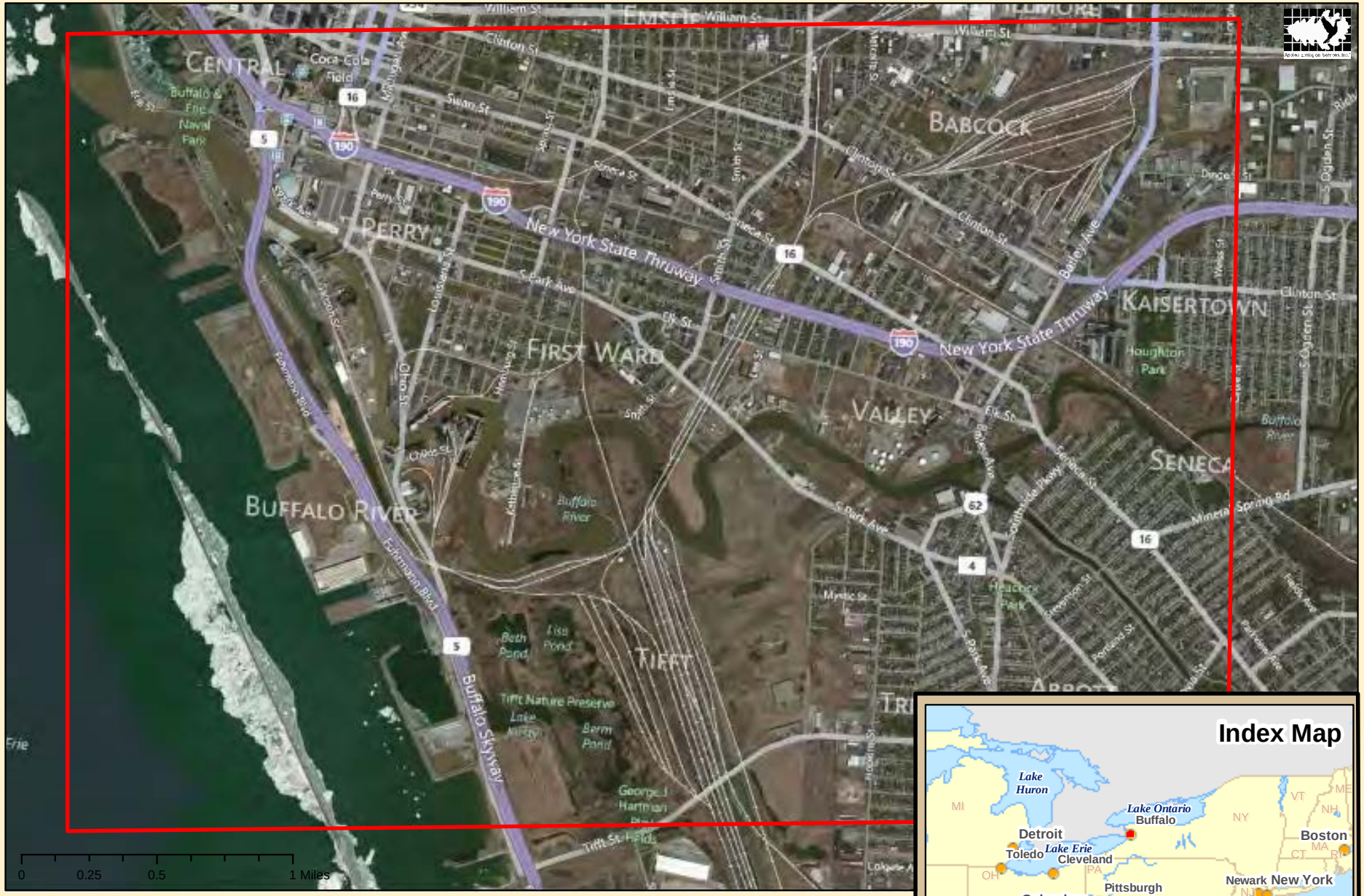
<u>Herpetofauna</u>

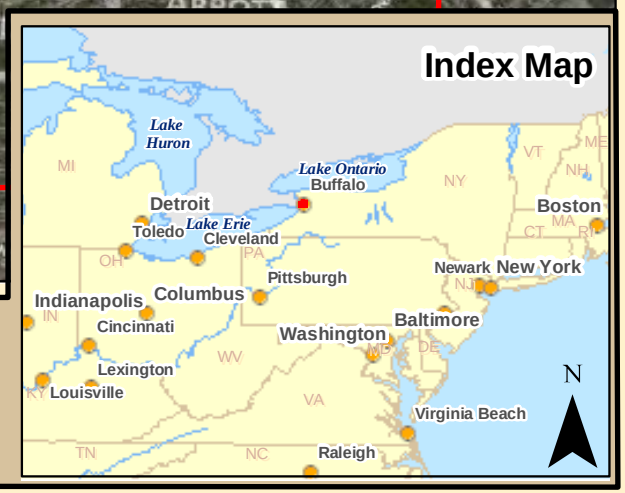
- Hibernacula/Denning Sites
- Foraging Habitat
- Breeding Pools (amphibians)
- Nest-Laying sites (turtles and oviviparous snakes and lizards)
- Rookery Sites (aquatic/semi-aquatic turtles, viviparous snakes and lizards)

<u>Mammalia</u>

- Hibernacula/Den Sites
- Foraging Stations/Middens
- Foraging Habitat

[1] Mortality rates of migratory birds have been linearly correlated with stopover habitat loss/impairment. This issue has become a global conservation concern, thereby defining stopover requirements as critical habitat resources. Due to the historic relevance of the Great Lakes Region for shorebird, passerine, raptor and waterfowl migrations AES will document any identified critical stopover locations still existing within the AOC.





Legend

Project Boundary

Figure 2.

Study Area

6.3 Statement of Project Relevance and Goals

The Great Lakes Water Quality Agreement (GLWQA) is a major federal program intended to protect and restore water quality and related ecosystems within the basin of the Laurentian Great Lakes. The BNR has received funding from the Buffalo River RAP Coordination Fund to conduct variety of investigations relevant to the implementation of the RAP, including a baseline wildlife survey to detect species richness and diversity within the existing habitat of the LBR AOC. This project will gather the necessary faunal data to drive specific ecological restoration/ habitat enhancement efforts as well as provide a standard for comparison of habitat quality and wildlife populations within the AOC, and effort driven by the intended delisting of BUI #s 3 and 14 of the Buffalo River RAP.

The goal of this project is to generate a baseline of empirical data on the existing relative abundance and species richness of mammals, reptiles, amphibians, and birds within the AOC by completing the following:

- Identification of sampling locations throughout the AOC and one off-site reference location.
- Conducting year one surveys at the determined sampling locations.
- Consolidation and analysis of data gathered and prepared within a formal scientific report. This report will detail all sampling methods and provide geo-referenced maps of sampling locations for future replication.

The results will provide the following value to the existing efforts as related to the Buffalo River RAP, ERMP, FSBR, and other relevant technical documents:

- A standardized set of geo-referenced survey locations and repeatable protocols for target fauna inventory within the LBR AOC
- Baseline species richness and abundance data of target fauna for comparison to future data sets
- Key insight on existing faunal assemblage habitat usage and habitat needs within the AOC (which often proves critical in generating the best ecological response to created/enhanced ecosystems)

This development of both spatial and temporal parameters is the framework for monitoring restoration ecology projects proposed within the AOC. In addition to water quality and hydrology, bio-indicators (i.e. target species/faunal assemblages) are an extremely valuable tool to design, merit the success/failure of, and implement critical maintenance and modifications for ecosystem restoration.

7.0 Project/Task Description

Deployment of the project will occur in phases as follows:

AES and CC will conduct scientifically valid methods to determine the presence/absence of three main faunal vertebrate assemblages (Birds, Herpetofauna, and Mammals).

Phase I-Site Reconnaissance, Rapid Ecosystem Assessment and Sampling Location Geo-referencing

To maximize survey value and standardize our data collection, the survey team will conduct an initial site visit with the expressed intention of locating and geo-referencing all locations where data will be collected during the survey effort. Due to the highly urbanized landscape within the survey area, sample locations will be selected in areas where remnant wildlife habitat is most likely to be present, with a focus on areas that have recently been restored/enhanced and proposed restoration/enhancement areas. During site reconnaissance, AES and CC biologists will search the entire survey area to characterize the available wildlife habitat (including man-made structures such as refuse piles, abandoned lots, and building ruins) to support bird, reptile, amphibian, and mammal species of the region. Additionally, offsite locations will be 'scouted' for their potential to serve as a reference natural area to the study. Upon determining a suitable reference natural area it will be selected and concurrently surveyed using identical methods.

Due to the integrated nature of this effort, AES will work with USEPA and BNR to determine the best representation of sampling sites throughout the AOC. Currently, AES is aware of 5 locations which will be sampled due to their direct relation to Great Lakes Legacy Act Projects (Head of City Ship Canal, Katherine Street Peninsula, and Ohio Street) and current habitat restoration efforts (Seneca Bluffs and River Bend)

In a proactive effort, AES has reviewed proposed restoration initiatives within both the ERMP and the FSBR and pre-propose a total of approximately 25 avifaunal sampling locations (Section 10.1, Figures 5, 6, & 7). Upon the completion of Phase I, at least 6 transect and area-constrained survey locations will be identified and mapped for herpetofaunal and mammal search efforts (see Section 10.1, Figure 8 for proposed locations). Exact transect locations and lengths will be determined and geo-referenced during the initial site reconnaissance visit. Transects will consist of both road-cruising/driving transects (2) and walked transects (~4, two on either side of the river). Road-cruising transects will be routes along the roads which nearest border the river on each bank. Their lengths will be slightly longer than the length of the AOC (ends will be at the terminus of the two survey locations which are farthest apart). Each transect will be searched no less than 8 times and no more than 12 during the survey effort. Please consult section 10.2 for transect search methods.

Phase II- Conduct Biological Surveys within the Study Area

Beginning in the fall of 2011 (immediately upon the approval of this QAPP), AES and CC will commence appropriate faunal survey methods. All four seasons will be represented in the survey effort, with Phase II ending in the fall of 2012. Please refer to Sections 10.1 and 10.2 for a description of each survey method to be employed. Upon completion of Phases I and II a final scientific report will be prepared for submission of all data collected.

AES has selected a variety of scientifically valid survey methods to achieve the project goals as described within the Request for Proposals for Technical Consulting Services for a Wildlife Survey in the Buffalo River (NY) Area of Concern (BNR 2011) and further defined within the 'ConsultantGuidance.doc' document electronically mailed August 23, 2011. For each target faunal assemblage, various survey methods are combined to generate a relatively comprehensive assessment, with special emphasis on species highlighted within the above-referenced 'ConsultantGuidance.doc' document. Survey methods for each target faunal assemblage are as follows (please refer to section 10 for details on each survey method, frequency and dates of surveys and other relevant information):

Avifauna

- Unlimited-distance Point Count method
- Transect Search method
- Time-constrained Search method
- NYSDEC marsh bird survey (if available habitat is present) protocol

Herpetofauna

- Anuran Calling Survey
- Transect Search method
- Time-constrained Search method
- Random Opportunistic Search method

Mammals

- Active Acoustic Monitoring for Bats
- Transect Search method (including road transects)
- Time-constrained Search method
- Sherman Live Trapping Arrays
- Random Opportunistic Search method

7.1 Project Management

AES will develop regular progress status reports (every 2 months, totaling approximately 6 progress reports) to be submitted to the distribution list recipients (USEPA, BNR, AES & CC) throughout the project timeline. AES and CC will oversee the development of a final scientific report for this project.

7.2 Project Schedule

This timetable (Figure 3) reflects key seasonal windows for the varying wildlife survey components, where surveys will be executed under suitable weather conditions within the respective windows. As weather forecasts will dictate, exact survey dates will be adjusted to best adhere to the displayed schedule.

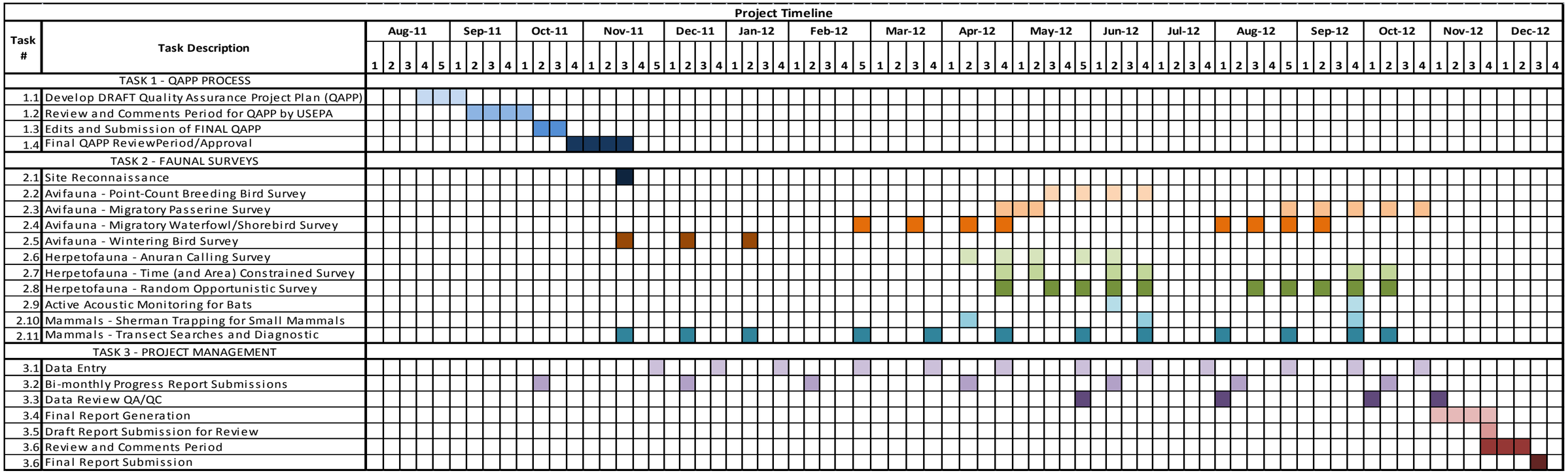


Figure 3. Project Timeline and Survey Schedule Matrix

8.0 Quality Objectives and Criteria for Measurement Data

Data Quality Objectives (DQOs) are quantitative and qualitative statements that clarify the intended use of data and specify the quality of data needed to support a decision. Data of known and documented quality are essential components for the success of the project, as these data will be used to support the decision-making process for future habitat restoration and human use along the LBR.

The primary data quality objective is to generate as complete a record as possible of the confirmed extant populations of avifauna, herpetofauna, and mammals within the within the constraints of the project budget and schedule. This is necessary to inform the rest of the tasks outlined in the section above. Information collected under this step will be screened according to the QA objectives outlined in this section.

The following summarizes the data quality objectives for this project.

8.1 Data precision. Usually, precision is the measure of agreement among repeated measurements of the same property under identical, or comparable, conditions; calculated as either the range or as the standard deviation. As with comparability, AES will exercise well defined survey methods at defined sample locations to minimize random error. Temporal, seasonal, and climatic variable repetition will be strongly suggested within the final report deliverable for all replications of this survey effort as well. To this extent, all climatic and temporal variables will be documented on original data sheets for every survey effort and be provided within the final report deliverable.

8.1.1 Accuracy. Statistically, accuracy is a measure of the overall agreement of a measurement to a known value. It includes a combination of random error (precision) and systematic error (bias) components of both sampling and analytical operations. Our "accuracy" goal is to ensure that information generated and collected is as accurate as possible within project constraints. To meet this goal, AES will document all QA/QC measures conducted when the initial field observations are documented. All information collected within this project will be of an observational nature using standardized observation methods, including well known techniques to minimize systematic error (surveyor bias and surveyor fatigue). Both herpetofaunal and mammalian survey methods may result in temporarily captured individuals, but no physical specimens will be removed from the site.

The accuracy of survey site (location) replication will be guaranteed by geo-referencing and map generation as well as survey markers posted at each location.

8.2 Bias. Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction. When conducting observation-based surveys this is a critical component to consider. As a well documented means to minimize systematic error in wildlife biology data collection, an established protocol is provided for equipment used/employed to minimized surveyor bias. Additional considerations are derived from existing literature on minimizing observer bias in wildlife surveys (Bart et al. 2004).

8.3 Representativeness. Representativeness is a qualitative term that expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. For this study this pertains to both the available wildlife habitat within the AOC and the combination of methods selected to gather data. Due to various spatial and temporal constraints (property access, safety concerns, budget, timeline, or otherwise), representative locations are determined within the AOC for this survey effort with best efforts to achieve n=N. Specific to this project, some locations have been predetermined due to existing habitat enhancement, restoration, and previous studies. AES and CC will use the most complete and accurate information available to select representative sample point locations within the LBR AOC, including the ERMP, LBR RAP, FSBR, and direct recommendations and requests from both BNR and USEPA. In addition, a site reconnaissance effort will be conducted prior to any survey efforts to verify satisfactory habitat representativeness. Rarely in population biology and wildlife biology do possibilities exist to study a population in its entirety. To this extent, a sample population (n) will be observed within the total population (N) with best efforts to achieve n/N = 1.

8.4 Comparability. Comparability is a qualitative term that expresses the measure of confidence that one data set can be compared to another and can be combined for the decision(s) to be made. AES will be setting the standard for wildlife population data collection within the AOC moving forward. All survey methods are well documented within current, peer-reviewed scientific literature and are repeatable. Survey locations will be considered permanent or a close to permanent as possible for indefinite data comparison moving forward. AES will also review previous bird surveys conducted by NYDEC and BOS to include as much of this historical survey data as possible within statistical comparisons. However, the current survey effort is to be considered baseline data for comparison moving forward.

8.5 Completeness. Statistically, completeness is a measure of the amount of valid data needed to be obtained from a measurement system. Because the bulk of this project is conducting field surveys, completeness of each task will be merited by the amount of survey hours completed within suitable seasons for target fauna. With the understanding of inherent variability within a landscape as well as the probabilities of occurrence for the varying animal groups, executing survey protocols detailed within Sections 10.1 and 10.2 will generate a valid amount of data to satisfy this definition of completeness.

8.6 Sensitivity. For this project, sensitivity is assumed to relate to the minimum level of detectability for species confirmation. For herpetofauna and small mammals, observations are likely to involve captured individuals which may be examined closely for diagnostic morphological characteristics and be photographed. For avifauna, many observations may be quite brief (visually and/or audibly) or less than ideal for diagnostic confirmation in other forms (poor lighting, distance, noise pollution/disturbance, etc.). For these observations, the minimum level of detectability will be 100% confirmation. Any observations which are not 100% confirmed will be documented, but not valid within the analytical process.

8.7 Logical consistency. The logical consistency of data (including geographic feature attributes) will be checked during data processing. For example, AES will verify that identified suitable locations for surveys associated with potentially suitable habitats. Additionally, reviews of collected

data will check for species/season/habitat coordination and question/investigate observations inconsistent with historical and life history data for the region and species. Logical consistency checks will be used to assure that the data quality objectives are achieved. For avifaunal observational data, logical consistency checks also include verifying and reviewing all songs, calls, and chip notes of passerine suspected to be potentially present within the AOC to maintain this data as consistently 'fresh' within the minds of observers. For migratory and wintering seasons, basic plumage molt reviews will be important. Logistical consistency checks for herpetofauna will be most closely tied to literature and reference review as well, ensuring that search efforts are best put forth at optimal times and conditions for species potentially present within the AOC. Fortification of species-specific search images will be exercised as well. For mammals, regularly measuring observed tracks and retaining found hair and scat samples for cross-referencing will be valuable in providing logical consistency in the data.

8.8 Measures to Ensure Quality Data. AES will maintain an Excel Spreadsheet database for cumulative data input and overall data flow tracking, including QAQC steps throughout the project timeline. All data will be transferred from original datasheets into a cumulative master spreadsheet no later than 14 days from the date of collection. AES will internally QA/QC all data entry and compare with original data sheets on a bi-monthly basis to ensure all data is properly and accurately transferred from the field and the observer(s) to the statistical database and, subsequently the final report and associated statistical analyses. Both the AES Project Manager and Quality Control Officer will conduct these internal audits. All QC steps including senior staff review of all data will be tracked in the spreadsheet.

9.0 Non-direct Measurements (Secondary Data)

All peer-reviewed articles which support survey methodology for this project will be archived within a digital storage file located on the AES server for referencing. Project filing, document naming/indexing and folder structures will utilize AES' standard operating procedures.

All secondary data obtained from other sources will be critically reviewed and applied to this project appropriately. Currently, there are no surveys conducted for the target animal groups within the AOC designed to document extant fauna with the expressed intention of providing comparative data correlative to enhancement, restoration, and remediation efforts proposed within the AOC. Avifaunal assessments of the Lower Buffalo River/AOC and tributary streams (outside AOC/reference location) have been conducted previously (NYSDEC, 1993; BOS/Canisius College, 2005-06). Methods and sample locations varied between these studies. This variation limits the direct statistical value of these data sets. However, anecdotal information may support general population trends and total species richness lists may be compared on an anecdotal basis. AES will obtain copies of any reports/data summaries (secondary data) associated with these survey efforts for potential comparative value upon completion of Phase II. These reports will provide direct value when determining survey point locations and best efforts to overlap surveyed areas will be made to increase the probability of comparability with data collected from this project. Herpetofaunal and mammal studies were conducted informally and/or on an anecdotal basis and seem currently under-represented. If other applicable data or studies become available throughout the life of this project AES will evaluate these and integrate them into the study as appropriate.

10.0 – Field Monitoring Requirements

10.1 Sampling Process Design

This project has been designed to document the current species richness and abundance of three main faunal assemblages; the herpetofauna, the avifauna, and the mammals inhabiting the LBR AOC. Within these general assemblages are target species (15 herpetofauna, 61 bird, and 3 mammal species) whose conservation status is currently of greatest need within the region (BNR, personal communications; New York Wildlife Action Plan, NYSDEC). We have selected a total of 9 scientifically valid survey methods (described below) to achieve this goal. Understanding both the physical scope of this project as well as its role within larger goals associated with the Buffalo River RAP, the survey design takes a nearly comprehensive approach[2].

Faunal Assemblage	Survey Method	Targets within Faunal Assemblage	Data Type	Relevant Citations
Avifauna	Unlimited-Distance Point Count Method	Breeding Passerine Population	Species Richness and Relative Abundance	Dawkins 1981, Verner 1985
	Unlimited-Distance Point Count Method	Migratory Passerine Population	Species Richness and Relative Abundance	Hutto et al. 1986
	Unlimited-Distance Point Count Method	Wintering Bird Population	Species Richness and Relative Abundance	Gutwiller 1981
	Transect, Opportunistic and Meander Searches	Migratory Passerine, Migratory Shorebirds, Migratory Waterfowl, Migratory Raptors	Species Richness and Relative Abundance	Tiebout III 2005
Herpetofauna	Anuran Calling Survey	Breeding Frog and Toad Population	Species Richness	Mossman et al. 1998, Bridges and Dorcas 2000, Weir 2001, Crouch III and Paton 2002, Weir and Mossman 2005
	Transect, Time and Area-Constrained, and Random Opportunistic Searches	Snake, Turtle, Salamander, Frog, and Toad Population	Species Richness and Relative Abundance	Ford and Burghardt 1993, Hayek and Buzas 1997, Webb and Shine 1998, Tiebout III 2005
Mammal	Active Acoustic Bat Monitoring	Foraging and Migrating Bat Species	Species Richness and Relative Abundance	O'Farrell and Gannon 1999
	Sherman Live Trapping	Small Terrestrial Mammals	Species Richness	Maly and Cranford 1985, Slade et al. 1993
	Transect, Time and Area-Constrained, and Random Opportunistic Searches	All Mammal Species (exluding all bat species but Eastern Red Bat)	Species Richness	

Figure 4. Survey Methods Summary

[2] In order to remain within the budget and provide the best and most appropriate data for the project goals, the following efforts will be under-represented within the design and, thus, prevent it from being wholly comprehensive. Diurnal raptor migration has comparatively less influence or significance to the proposed efforts and target outcomes of the survey effort as related to the Buffalo River RAP and will only be observed opportunistically during other survey events within migration periods. Trapping efforts for herpetofaunal investigations are costly relative to proposed search methods (which have recently proven as significantly more time and cost effective by Tiebout III 2005). Lastly, fully aquatic river-dwelling amphibians (neotenic larval life stages and adult common mudpuppy) will not be targeted within the survey effort.

Due to the integrated nature of this effort, AES will work with USEPA and BNR to determine the best representation of sampling sites throughout the AOC. Currently, AES is aware of 5 locations which will be sampled due to their direct relation to Great Lakes Legacy Act Projects (Head of City Ship Canal, Katherine Street Peninsula, and Ohio Street) and current habitat restoration efforts (Seneca Bluffs and River Bend).

In a proactive effort, AES has reviewed proposed restoration initiatives within both the ERMP and the FSBR and pre-propose a total of 23 avifaunal sampling locations (Figures 5, 6 and 7). Upon the completion of Phase I, at least 6 area-constrained survey/transect locations will be identified and mapped for herpetofauna and mammal search efforts (Figure 8).

Locations Within the AOC

Sample Location #	Name of Area	Habitat Type
1	Smith Street Park	Upland Forest
2	Smith Street Park	Forest/Pond
3	Ohio Street Park	Urban/Developed
4	Ohio Street Park	Woodlot
5	Concrete Central (east)	Fallow Field
6	Concrete Central (east)	Fallow Field/Open River (east side)
7	Concrete Central (west)	Fallow Field
8	Concrete Central (west)	Fallow Field/Open River (west side)
9	Katherine Street Peninsula	Riparian Forest
10	Katherine Street Peninsula	Emergent Wetland
11	Katherine Street Peninsula	Emergent Wetland/Riparian Forest
12	Katherine Street Peninsula	Emergent Wetland/Open River
13	Steelfields	Fallow Field
14	Steelfields	Fallow Field/Open River
15	Steelfields	Fallow Field/Forest Edge
16	Steelfields	Upland Forest
17	Bailey Woods	Upland Forest
18	Bailey Woods	Riparian Forest/Open River
19	Bailey Peninsula	Riparian Forest
20	Bailey Peninsula	Riaprian Forest/ Open River
21	Dead Man's Creek	Urban Stream/River Confluence
22	Head of City Ship Canal	Urban/Developed
23	b/w Bell & NFTA Slip	Dune/Open Water

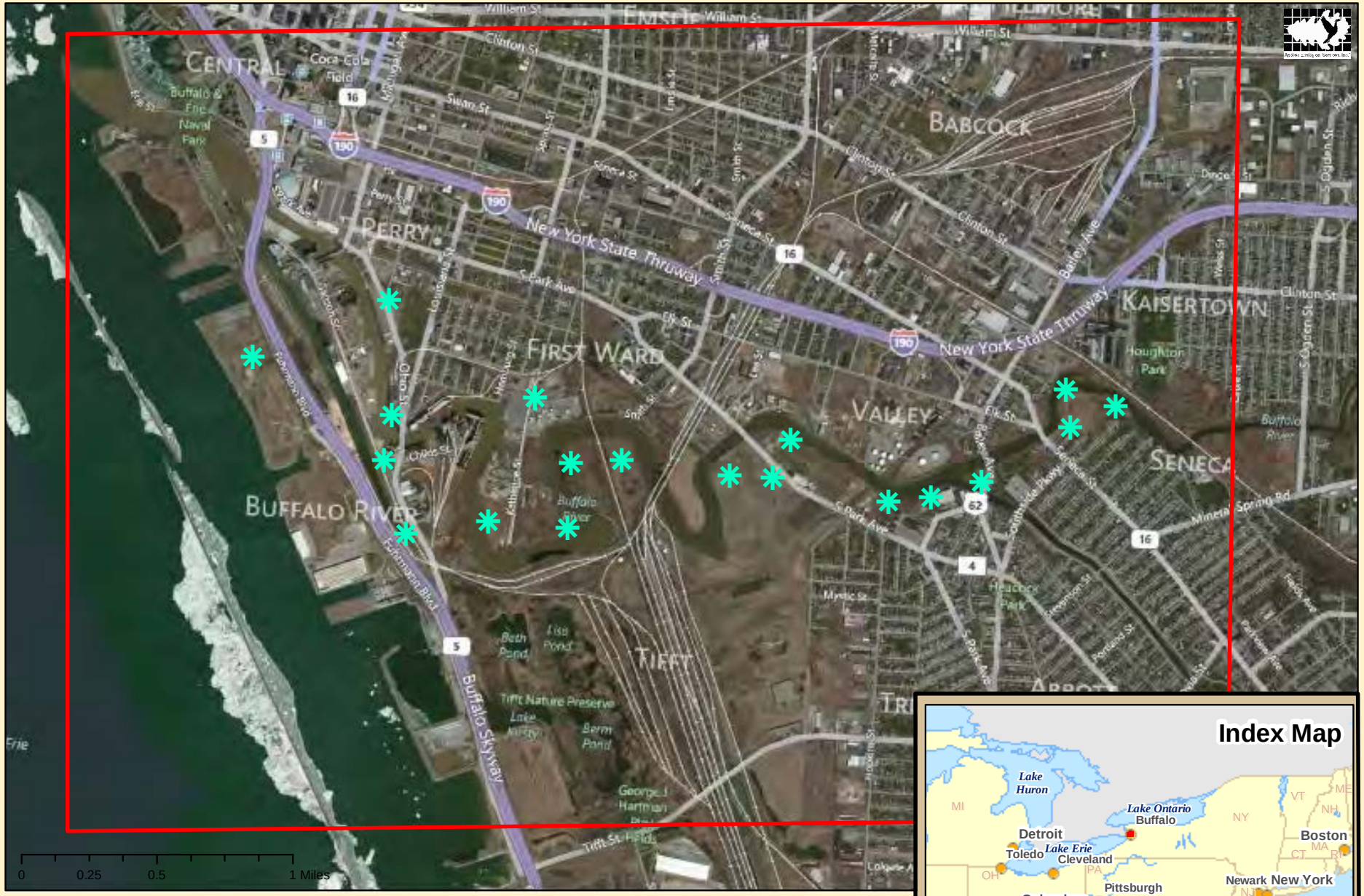
Figure 5. Proposed Avifaunal Survey Point Locations within the AOC

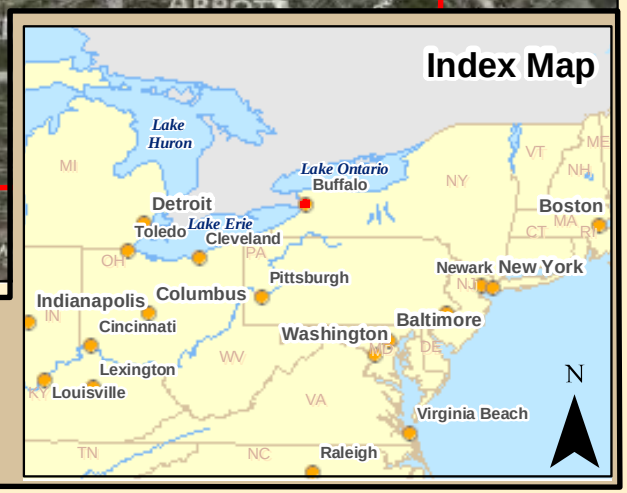
Locations Outside of AOC

Sample Location #	Name of Area	Habitat Type
1	Seneca Bluffs	Riparian Forest/Open River
2	Seneca Bluffs	Riparian Forest
3	Seneca Bluffs	Upland Forest
4	Seneca Bluffs	Field/Meadow
5	Seneca Bluffs	Floodplain Wetland
6	River Bend	Riparian Forest/Open River
7	River Bend	Riparian Forest
8	River Bend	Upland Forest
9	River Bend	Field/Meadow
10	River Bend	Floodplain Wetland

Figure 6. Proposed Avifaunal Survey Point Locations Outside of the AOC

True reference locations for this project will be difficult to sample, mainly due to distance, budget, and paucity of actual 'reference' locations (remnant, healthy, native riverine ecosystems within the region which emulate the historically present ecosystem which the associated efforts strive to restore). For these reasons, AES will sample existing locations relevant to the restoration and enhancement of the Buffalo River ecosystem located outside of the AOC. One location was selected (Seneca Bluffs) to conduct the same survey methods and effort. While this location is not a true 'reference' location, it represents a comparatively more natural/wild habitat patch along a tributary stream to the LBR, providing some level of comparative habitat use.



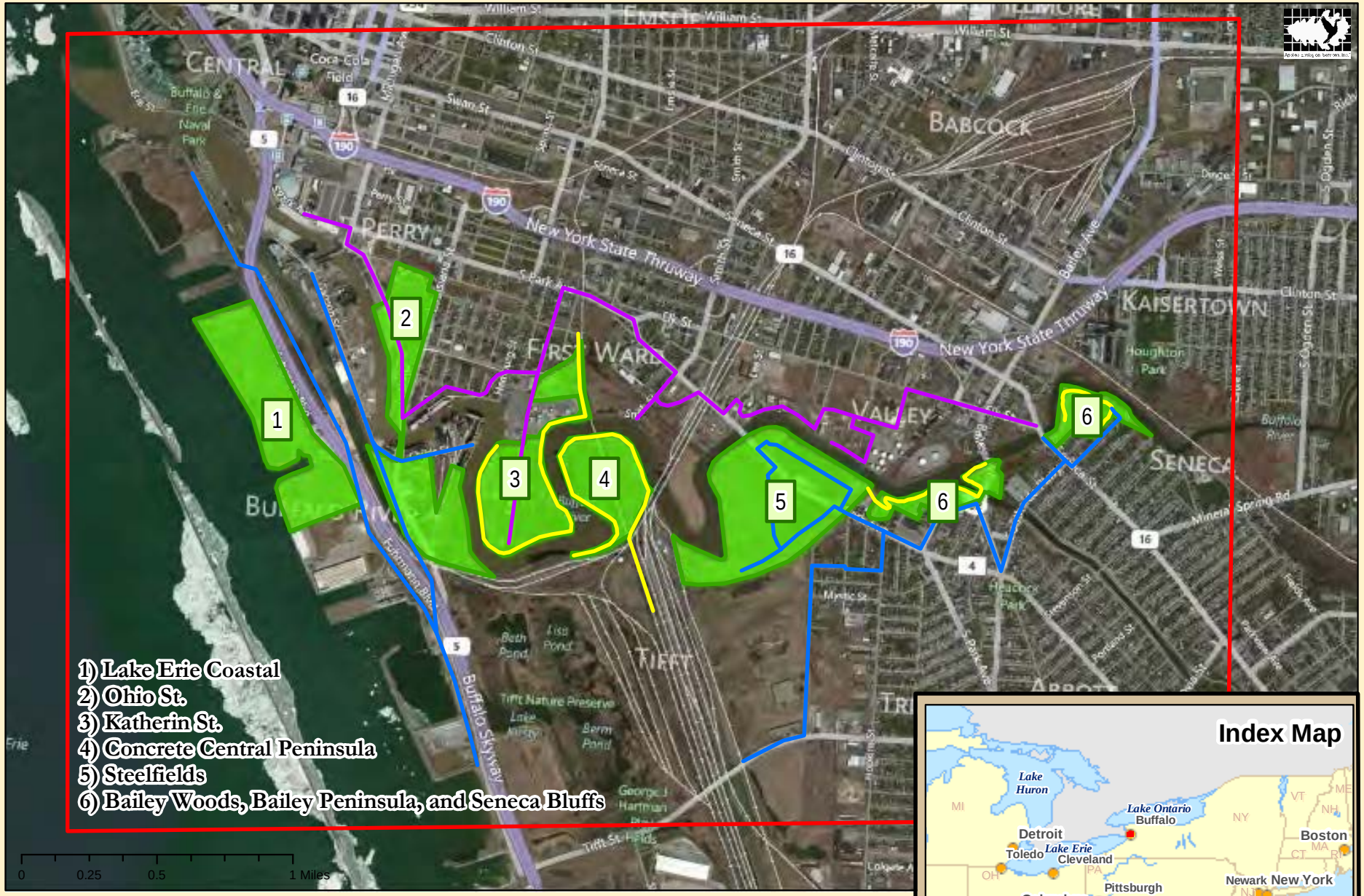


Legend

- Project Boundary
- Avifauna Survey Locations

Figure 7.

Avifauna Survey Locations



Legend

Project Boundary

Proposed Area-Constrained Survey

Proposed Transect Locations

Road Cruising North

Road Cruising South

Walking Transect

Figure 8.

Proposed Areas for Area-Constrained Surveys and Transects

10.2 Sampling Methods

AVIFAUNA

Breeding Passerine Point Count Surveys - An unlimited-distance point count method (Dawkins 1981, Verner 1985) will be used at pre-established, fixed locations throughout the survey area and reference natural area. Efforts to best allocate this effort will be guided by formulas and methods described in Barker et al. (1993). Count duration will be 10 minutes at each site. Data will be grouped into 0-3 minute, 3-5 minutes, and 5-10 minute intervals (standard count duration periods) to increase comparability potential of the collected with varying historic and future data sets. Abundance within each sample location is not counted beyond 10 minutes to minimize double-count probability and standard error (Smith et al. 1998, Verner 1988). All breeding bird points will visited 3 times during the breeding season, spaced at least seven days apart. GPS, detailed base maps and location stakes will all be used to ensure consistent and accurate relocation of sample sites throughout the year. Adequate navigation tools will also ensure the necessary efficiency and stealth needed when moving into and between sampling position. In case of GPS equipment failure (tree canopy, poor satellite configuration, etc) base maps will be detailed enough to allow field staff to easily navigate into position.

Migratory Bird Surveys (passerine) – One avifaunal biologist (single-observer method) will conduct site visits to search for birds at all sample locations during peak migration times for various bird groups (see schedule/life history matrix). At least 3 spring and 5 fall surveys will be conducted. To minimize variation in detection probability, best efforts will be made to use the same observer throughout the study. Similar to breeding bird surveys, all other avifaunal survey periods will follow general unlimited-distance point count survey methods. Unlike the breeding bird surveys, if species richness continues to increase beyond 10 minutes during migratory bird surveys, sampling duration will be extended until a 3 minute period passes with no additional new species observed. If the observer reaches twenty minutes at one point, he/she will move on the next point to maintain a standardized level of accuracy and precision in estimations as well as successfully survey all points within the allotted time frame.

Migratory Bird Transect Searches - In addition to fixed-location point counts, migratory bird surveys will be supplemented with area search methods as well, including multiple-observer area searches and transect routes along the LBR shorelines and through forest and field habitats. These methods will involve actively searching for bird presence by sight (naked eye, roof prism 10x binoculars, and/or 60X spotting telescope) and sound. In addition to visual and audible observations of living birds, diagnostic evidence of bird presence, such as nests, feathers, carcasses, cough pellets, or otherwise will be documented. Any rare, threatened or endangered species observed will be thoroughly documented. Best efforts to further document rare species will be done by photo and/or digital audio recordings when possible.

For river (waterfowl and shorebird) and opportunistic migrant raptor searches, a Kowa TSSN 880 Series, 60X high powered spotting telescope and tripod will be used in addition to binoculars. Observations will consist of confirmed visual and/or audible accounts of species detected. Relative abundance will be noted as accurately as possible for all species observed. In the case of large flocks, rafts, or kettles of birds, relevant methods within Ralph and Scott (2003) will be applied for abundance estimate counting methods.

Migratory bird survey start time and duration will vary with season, current weather, and species targets (passerine versus raptors versus waterfowl, etc.). Typically, passerine migration surveys will consist of morning (6AM-11AM) and (occasionally) late afternoon/early evening (430PM – 630PM) survey efforts. Shorebird surveys will be conducted in the morning and late afternoon as well. Opportunistic diurnal raptor searches will only be conducted when weather conditions are conducive to migration and birds are being observed. For spring, N and NW winds are preferred as well as clear to partly cloudy skies. For fall the winds are best from any southern derivation, but E and SE winds will likely prove valuable for onsite observations as migrants are pushed to the diversion line/shores of Lake Erie (early observations will determine what conditions are best for the site and will then be exploited for the remainder of the survey effort). Similar conditions to those stated above for diurnal raptor migration will be preferred during the evenings prior to passerine and other nocturnal migrant species surveys.

Wintering Bird Surveys – Unlimited distance point counts will be completed sampled for wintering bird species. Accuracy and precision of species richness estimates increases with observation duration (Gutzwiller 1981), so these points will be surveyed for twenty minutes (versus the 10 minute breeding passerine survey). Survey times will be extended to dawn to dusk for these surveys to maintain sample size/statistical power.

Optional/Additional Survey/ NYSDEC Breeding Marsh Bird Protocol – Should one or more suitably-sized marsh ecosystems (combination of emergent vegetation, submergent vegetation, and open water) be present within the AOC or Seneca Bluffs site, AES will perform at least one breeding marsh bird survey following the NYSDEC protocol (detailed on data sheet provided in Section 12.0). In brief, this method involves broadcasting potentially present marsh bird species calls (from the NYSDEC breeding marsh bird protocol CD) in timed-intervals accompanied by timed pauses for listening. If the habitat is not present, this survey method will not be implemented.

The varying survey methods and sample locations are capable of determining presence/absence of all 61 target bird species/species of greatest conservation need (provided by BNR), but is designed as a comprehensive approach and, therefore, no species/observations will be omitted from the survey effort.

HERPETOFAUNA

Due to their cryptic nature and ability to remain concealed and/or motionless for extended periods of time, reptiles and some amphibians are often difficult to sample. In fact, detection probabilities are often needed to validate representative population sampling. AES will rely on our trained and experienced herpetologist to conduct the most effective and valuable survey methods to gather presence-absence data (species richness and abundance). Due to bi-modal activity behavior exhibited

in most reptile and amphibian species, surveys will be conducted within the spring-early summer (when animals emerge and egress from hibernacula, breed, and re-locate to foraging habitat), and the fall (when neonate snakes, turtles, and numerous recently metamorphed amphibian species are emerging from nesting sites/breeding pools and most ectotherms are relocating to suitable hibernacula locations). The varying survey methods and sample locations are designed to determine presence/absence of 14 out of 15 target herpetofaunal[3] species/species of greatest conservation need (provided by BNR), but is not limited to documenting these species.

Anuran Calling Survey - Calling amphibian surveys will be conducted at each pre-determined sampling location. When possible, reference locations will be visited before or simultaneously to survey efforts onsite to validate presence/absence. Dates will be selected based upon northwestern New York breeding amphibian phenology and climatic and weather conditions (see Figure 3 for selected survey weeks). A minimum of 4 surveys will be conducted at least two weeks apart. Opportunistically observed concentrations of breeding amphibians will be noted, surveyed, and georeferenced as well. This is an extremely valuable, non-intrusive, and cost-effective means of determining critical habitat, species diversity/richness, and loosely defined relative abundance estimates. Protocol will follow nationally implemented methodology to provide maximum comparability to other and future data sets (Weir and Mossman, 2005).

Time- and Area-Constrained Surveys - AES herpetologists will target peak activity seasons and times of day to traverse pre-established linear transects throughout the AOC. After a rapid reconnaissance, transect routes will be strategically selected to intersect, parallel, and/or expose key potential habitat, including basking structures, nesting mounds, surface cover (refuse piles and coarse woody debris), foraging habitat, and overwintering habitat. A minimum of nine visits will be made throughout the study timeline, targeting key activity periods and optimal climatic conditions within these periods. Selected reference community locations will be surveyed in a similar fashion. This method has been recently considered not only the most cost efficient, but the most effective method for determining comprehensive herpetofaunal presence/absence at a location (Tiebout III, 2005).

Random Opportunistic Searches - This scientifically valid survey method is not limited by temporal or spatial constraints and is largely dependent upon the discretion of the observer. The observer may exploit unforeseen encounters with optimal basking locations, potential nesting grounds, surface concealment cover, or other structural habitat attractive to snakes, turtles, or amphibians while conducting other activities onsite. Only skilled herpetologists find true value in this, as a keen sense for subtle changes in climatic conditions and the ability to recognize optimal conditions during certain seasons and times of day are often a catalyst for this method to be successful.

[3] The common mudpuppy (*Necturus maculosus*) is a fully aquatic salamander species which inhabits large rivers and streams. A competent survey effort for this species would involve searching the Lower Buffalo River bed substrate and, therefore, cannot be represented within the survey design. No aquatic trapping or submerged search efforts/dives will be conducted during this survey.

MAMMALS

The City of Buffalo is deeply connected to both a major river system and the Great Lake Erie. These water resources are both known to support a variety of large, medium, and small-sized mammals. With varying land use history and a clash of human and natural systems, there is potential to find everything from river otter and mink to Norway rat and short-tailed shrew along the banks of the Buffalo River. The varying survey methods and sample locations are designed to determine presence/absence of the 3 target mammal species/species of greatest conservation need (provided by BNR), but is not limited to documenting these species.

Bat Habitat Assessment and Active Acoustic Monitoring for Bats (Transects and/or Time-Constrained Searches) – An assessment will be completed of the site and its potential to provide favorable habitat for commuting and foraging bats. Bats of the region will be researched and species habitat preferences will be used to identify features in the project location which are known to be used by different species of bats. The results will be used to identify active acoustic monitoring transect routes within the project location which incorporate representative areas likely to be used by bats as well as areas considered less favorable. Surveying these routes involves walking or driving pre-determined transects along a trail or road (or walking through target habitat locations) with a bat detector recording all bat calls. Active monitoring provides information on bat distribution and habitat use, as well as abundance and potentially population trends (depending on how many nights are recorded). Acoustic monitoring will be conducted in locations determined as potential foraging locations (following the Phase I site recon and bat habitat assessment efforts) during the late spring/early summer and fall migration periods when both resident and migrant bats may be observed.

Sherman Live Trapping Arrays – The AES/CC Team will use the scientifically valid and humane Sherman Trapping methods for small mammals. After site reconnaissance, trap arrays/clusters will be established. Trapping events will be in selected locations (approximately 6) and continue for three consecutive nights. All trap locations will be geo-referenced. Trapping events will occur three separate times, spaced at least 30 days apart, at each mammal trapping location.

At each established location, 15 Sherman live traps will be baited with a dollop of peanut butter and placed in a clustered array. These traps are prefabricated metal hinged boxes (2.5" x 2.5" x 8") with a pressure sensitive trap door. These traps will then be checked the following morning and every 24 hours thereafter. Observers will use forceps and industrial gloves to remove captured animals. A clear plastic container will be used to temporarily retain captured individuals for proper identification. All captured individuals will be released at the capture location. On the first and second mornings, the traps will then be re-baited and returned to the capture location. On the third morning, traps will be collected, cleaned/disinfected, and stored for future use.

Time-Constrained Searches – As we familiarize ourselves with the AOC we will identify key track and scat corridor locations and then use them as search transects. In addition, we will scan and search for critical habitat and other evidence of mammal presence, such as middens, burrows (and other created shelters), and roadside carcasses. A suite of high-powered optics will be on our person while conducting surveys, including a 60X Kowa Optimed TSN 880 – Series High Powered Spotting Telescope and Manfrotto/Bogen Tripod. While this will be used for scanning for basking turtles

within the river, it will prove quite valuable for observing distant mammal behavior (including, potentially, river otter) and difficult access locations where mammal activity may be present.

Transect Searches – Following a site reconnaissance/survey location ground-truthing exercise, Approximately 6 transects will be established within the AOC (2 driving, 4 walking). Methods for searching transects are the following:

> *Road-cruising* - Drive slowly with hazards on scanning the road sides for dead-on-road (DOR) and alive-on-road (AOR) animals. When target animals are encountered an observer will exit the vehicle and examine the remains or remove the animal from immediate harm's way. All observers will wear a reflective vest at all times during road-cruising surveys. Difficult identifications will be photographed and/or collected for later identification.
>
> *Walking Transects* – At least one observer will slowly walk each transect while consistently searching for target animals. Searches will include use of binoculars, spotting telescopes, and physically searching the immediate area, including flipping rocks/debris and walking through grassy areas to flush animals. Observed animals will be documented by time and location along transect. Photographs will be taken if possible.

10.3 Field Quality Control (QC)

In order to maintain consistent survey methods and generate the desired statistical power in the data collection, AES will maintain the following QC protocols;

- Geo-reference AND landmark each survey location point for exact point replication
- Generate adequate and detailed base maps for relocation of survey locations if GPS malfunctions.
- Orient observer alignment via compass readings prior to each sampling
- Familiarize and calibration of all field staff and teams to data forms, methods, equipment and QC procedures prior to field deployment
- Carry a clipboard containing survey methods and instructional aids, such as
  - AOU alpha codes for North American bird species
  - Beaufort Wind Scale Codes
  - Amphibian Calling Intensity Codes
  - Habitat Classification Codes
  - Listed Methods for Point Count Survey Execution (see 10.3.1)

As a project dependent upon strictly judgmental data, there is likely to be observations which cannot be confirmed to the species level. In these circumstances, AES and CC observers will make field note observation details to support the observation. These sorts of observations will be then later analyzed to determine the level of certainty to which they can be presented within the data. For example, a relatively medium-sized raptor observed in poor lighting on a windy day at ~1000ft elevation on set wings with a relatively prominent head projection, long tail, and rounded wings would likely be classified as an unknown Accipiter (UNAC) and supporting observations will be

supplied. Any observations which are not 100% certain will be presented in this manner and, therefore, the data will err on the side of conservative to remain reliable.

10.3.1 Point-Count Method for Data Collection (for QC)

Time of Day Limitations

Spring passerine migration: Dawn to 11am or until a noticeable drop in bird activity; and 5pm to dusk

Breeding bird survey: Dawn to 10am or until a noticeable drop in bird activity; if activity remains high at 10am, continue until 11am or a noticeable drop in bird activity.

Fall passerine migration: Dawn to dusk.

Weather Constraints

Surveys should be conducted during weather that promotes bird activity.

a. Steady rain, poor visibility or steady strong winds (steady wind over 25mph) are not acceptable. Brief periods of rain, light drizzle and gusts up to 30mph are acceptable if birds remain active.

Point Count Procedure

1. When approaching a sampling point, assess whether a single AES land-cover type covers >50% of the plot. If there is no dominant habitat, move the point location into the intended dominant type for that point.
2. Arrive at point and wait 5 to10 minutes for birds to habituate to the surveyor's presence.
3. While waiting, begin filling in the general point and weather information on the data sheet.
4. If visiting a point for the first time, take a GPS reading. For all GPS readings at sampling points in a project site, use a four letter code made of the first initials of key words (e.g., Big Muddy = BIMU) followed by a unique number for each sampling point. Number sampling points consecutively beginning at 100. On subsequent visits, do not take a GPS reading as it severely complicates data management. Write the coordinates on the data sheet and indicate the location of the point on your field map if it differs from the proposed point on the field map. Write down the nearest street location or other unique location identifier for the point.
5. On the first visit to a point identify the dominant and other significant AES habitat cover types at the site. For each, visually estimate the percent of the habitat within a 100m radius of the point, or within the observable radius if less than 100m.
    a. The dominant habitat has >50% cover in the 100m radius area.
    b. Other significant habitats will cover >10% of the 100m radius area.
6. On the first visit to a point sketch and label the habitat cover type in the circle on the data sheet. Note the dimensions of the habitat, including distances from the sampling point. Note significant features in the 100m radius area, such as roads, hedgerows, houses, ditches with grass cover, etc.

a. In the notes section add details on type of crop, percent tree cover, maturity of forest, etc.

Habitat Cover Type	Description
Developed	Residential, commercial, industrial, and other developed land, including developed green space (e.g., golf-course, city park).
Cropland	Regularly cultivated land. Pasture, haymeadow, and fallow field are grasslands.
Barren Land	Land with sparse to no vegetation (e.g., mines, landfills, construction sites, sparsely vegetated shores).
Grassland	Grass and herbaceous plants cover ≥90% of the ground in uplands.
Upland Shrub-Scrub	Shrubs and scrubby or mature trees cover 10-50% of the ground. Includes brushland and savanna with trees and shrubs.
Upland Broadleaf Forest	Trees cover cover ≥50% of the ground. Broadleaf deciduous trees are ≥90% of the tree cover.
Upland Coniferous Forest	Trees cover ≥50% of the ground. Coniferous (needle-leaved) trees are ≥90% of the tree cover.
Upland Mixed Forest	Trees cover ≥50% of the ground. A mixture of broadleaf and coniferous trees, with each covering <90% of the forest.
Forested Wetland	A wetland or lowland flooded area with 50-100% tree cover.
Shrub-Scrub Wetland	A wetland with 10-50% cover by shrubs, scrubby and mature trees. Includes savanna with trees and shrubs.
Emergent Wetland	A wetland with ≥90% cover of herbaceous plants.
Open Water	Water and sparse to no vegetation cover; rivers, streams, lakes, ponds.

7. For passerine surveys, record all birds seen and heard at the point in 10 minutes for an unlimited distance from the point. Record data in the appropriate time increment. Record each species observation separately and note the number of individuals of a species for each observation.
8. Use the AOU 4-digit alpha codes for species. A master alpha code list is available from AES.
9. For other data, use the codes provided on the data sheet.
10. For flight height, indicate units used (m or ft). Meters are preferred.
11. The notes column in the bird data section is for noting the identifying features of a bird for later identification or for clarification or explanation of data.
12. During the breeding season, some states require that a breeding confirmation level be recorded for each species observed. Use the local breeding confirmation level guidelines.

11.0 Analytical Requirements

11.1 Analytical Methods

In the field, the data collected will be judgmental in nature and will not require any specialized analytical equipment. Analysis for this project is assumed to be defined as the process of analyzing the raw data collected and how it is interpreted

At the end of each month, AES will perform data processing. Data processing involves downloading and cataloging any geo-referenced data, reviewing all observational notes for clarifications and converting all hand-written data into the digital data storage spreadsheets. After data is digitally entered information will be reviewed by the staff member who collected the data in the field and data flow/progress will be indexed into a master spreadsheet. (See table in Section 12.0). This will include QA/QC of all collected data. Upon the completion of Phase II, total data sets will be analyzed to generate graphs and relevant comparisons, such as foraging guild percentages, spatial concentrations of individuals, habitat/species correlations, and other. Since the results of this survey are essentially the baseline for future replications, the data itself will largely be stand alone and will serve to provide further analytical capabilities as comparable data sets are collected over time. Estimations on populations and a species richness list will be provided for the entire AOC as well as at individual sample locations.

The AES Project Manager will be providing continuous monitoring of project activities and will provide guidance to project staff on the resolution of technical issues. If the issue is significant and corrective action is required, the AES Project Manager will document the issue and inform the AES QA Manager and work with them to address the issue.

11.2 Quality Control

AES will follow set quality control procedures when collecting judgmental data. The best methods are established observer bias minimization practices and adherence to established season, climatic, and temporal recommendations for performing the various survey methods.

Furthermore, our data will be compared to existing and concurrent data sets that may be available (BOS study 1993, www.birdingonthe.net daily postings for the area/region, and undocumented reports that may be available via USEPA or BNR) to further validate population estimates, significant corridors, or otherwise.

Geo-referenced sample locations will be accurate to 2M and will also be marked at the site (via flagging or staking). Original data sheets will provide sketches of each location to assist in replicate sample efforts in the future

12.0 Data Collection, Handling and Custody Requirements

Data collection and data flow are maintained by the AES Project Manager. The data sheets (Figures 10, 11, 12, 13 & 14) are used to document all collected field data. In addition, project staff will

maintain a Data Flow Tracker spreadsheet that will track critical data handling efforts including QAQC and data archival steps (see example below).

Data Flow Tracker

Field Form Inventory					Data Processing/QAQC/Data Archival						Data Archival	
Site	SiteName	FieldForm	FieldDate	FieldStaff	ScanDate	ScanStaff	DateEntered	DataEntryStaff	FieldStaffReviewDate	FieldStaffReview	FieldFormLocation	DocName
1	Seneca Bluffs	Avifaunal	Nov 15 2011	JLC	Dec 10 2011	JJR	Dec 15 2011	JJR	JLC	Dec 20 2011	G:\Documents\11-0543 Buffalo River Wildlife Surveys\Field Forms	AVI01_jlc_2011nov15
2	Seneca Bluffs	Avifaunal	Nov 15 2012	JLC	Dec 10 2012	JJR	Dec 15 2012					
3	Seneca Bluffs	Avifaunal	Nov 15 2013	JLC	Dec 10 2013	JJR	Dec 15 2013					

Figure 9. Example Data Flow Tracker to be used for QA/QC in Data Collection, Handling, and Custody

Upon completion of each survey event field forms will be scanned and saved electronically on the secure internal server network. Once data are securely stored, archived and viewed from the internal server system, original hard copy field forms will be stored at the AES office located in Conshohocken, PA until completion of the project, at which time they may be mailed to the USEPA or BNR for permanent storage (at which time photocopies/printed scans of the originals will be filed at the AES office).

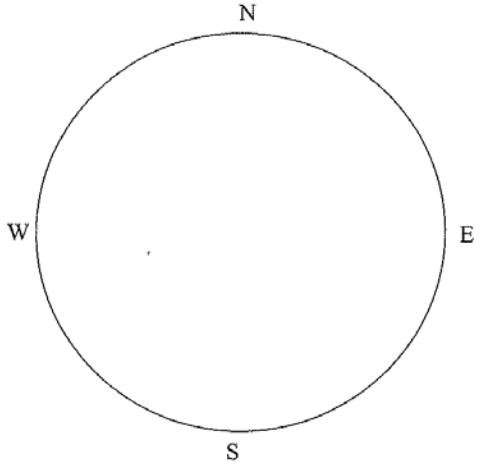
PASSERINE - Bird Point Count Data Sheet

Project Name _____ Sample Point ID # & Name _____

Date _____ Start Time _____ Stop Time _____ X coordinate, Y coordinate _____

Observer _____ Wind Spd. _____ Wind Dir. _____ Sky _____ Temp _____ Dominant (>50%) AES Habitat Type _____

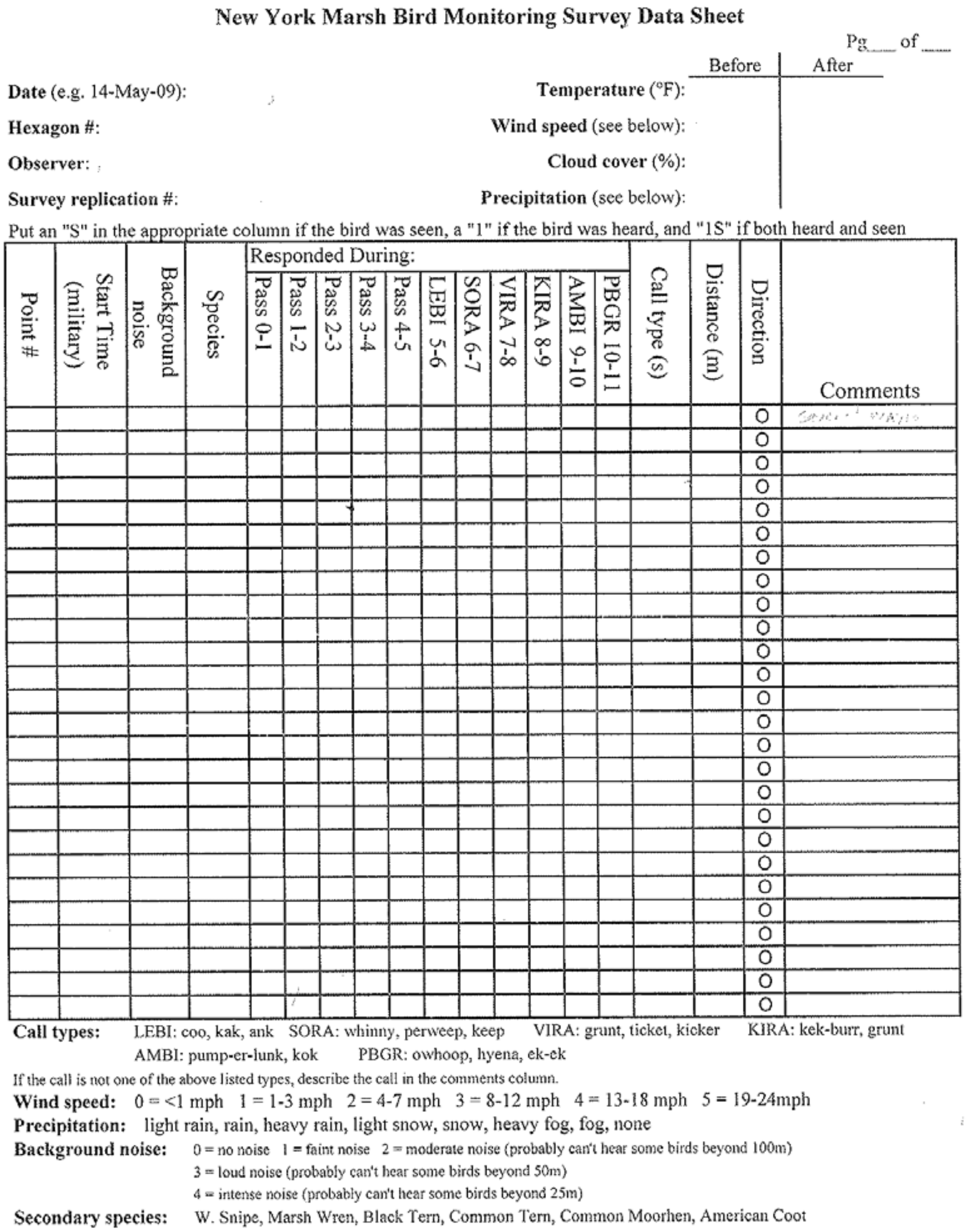
Other Habitats _____



Wind	Sky	AES Habitat Type
0 = none	0 = <10% clouds	Developed
1 = 1-3mph	1 = partly cloudy	Cropland
2 = 4-7 mph	2 = mostly cloudy	Barren Land
3 = 8-12 mph	3 = overcast	Grassland
4 >12 mph	4 = rain	Upland Shrub-Scrub
	5 = fog	Upland Broadleaf Forest
Behavior		Upland Coniferous Forest
F = flying		Upland Mixed Forest
S = soaring		Wetland Forested
P = perching or on water		Wetland Shrub-Scrub
Fo = foraging		Wetland Emergent
MD = mating display		Open Water
O = other		

Notes:

Alpha Code	Behav. Code	Dir. from Point	Dist. from Point (m)	Flight Dir.	Ht. (ft or m)	0-3 min	3-5 min	5-10 min	10-15 min	15+ min	Notes



New York Marsh Bird Monitoring Survey Data Sheet

Pg___ of ___

	Before	After
Date (e.g. 14-May-09): **Temperature** (°F):		
Hexagon #: **Wind speed** (see below):		
Observer: **Cloud cover** (%):		
Survey replication #: **Precipitation** (see below):		

Put an "S" in the appropriate column if the bird was seen, a "1" if the bird was heard, and "1S" if both heard and seen

Point #	Start Time (military)	Background noise	Species	Responded During:											Call type (s)	Distance (m)	Direction	Comments
				Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	LEBI 5-6	SORA 6-7	VIRA 7-8	KIRA 8-9	AMBI 9-10	PBGR 10-11				
																	○	[illegible]
																	○	
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Call types: LEBI: coo, kak, ank SORA: whinny, perweep, keep VIRA: grunt, ticket, kicker KIRA: kek-burr, grunt
AMBI: pump-er-lunk, kok PBGR: owhoop, hyena, ek-ek

If the call is not one of the above listed types, describe the call in the comments column.

Wind speed: 0 = <1 mph 1 = 1-3 mph 2 = 4-7 mph 3 = 8-12 mph 4 = 13-18 mph 5 = 19-24mph

Precipitation: light rain, rain, heavy rain, light snow, snow, heavy fog, fog, none

Background noise: 0 = no noise 1 = faint noise 2 = moderate noise (probably can't hear some birds beyond 100m)
3 = loud noise (probably can't hear some birds beyond 50m)
4 = intense noise (probably can't hear some birds beyond 25m)

Secondary species: W. Snipe, Marsh Wren, Black Tern, Common Tern, Common Moorhen, American Coot

Calling Amphibian Survey

Project Location: [redacted] **Survey Date:** _____

Calling Location ID: **Surveyor(s) Initials:**

Time START		Time STOP		Photo(s) Taken?

Climatic Variables

Amb Temp (°C) _____ Sur Temp (°C) _____

Amb RH (%) _____ Sur RH (%) _____

Circle One: (refer to codes on back)

Precipitation Code	0	1	2	3	4*	5*
Beaufort Wind Code	0	1	2	3	4*	5*

* - unsuitable to perform survey

Wildlife Observations

Calling Amphibians	Calling Intensity Code (refer to code on back)				# of Individuals
American Toad *B. americanus*	0	1	2	3	
Fowler's Toad *B. fowleri*	0	1	2	3	
Chorus Frog *P. triseriata*	0	1	2	3	
Spring Peeper *P. c. crucifer*	0	1	2	3	
Wood Frog *L. sylvatica*	0	1	2	3	
N. Leopard Frog *L. pipiens*	0	1	2	3	
Pickerel Frog *L. palustris*	0	1	2	3	
Gray Treefrog *H. versicolor*	0	1	2	3	
Cricket Frog *A. crepitans*	0	1	2	3	
Green Frog *L. c. melanota*	0	1	2	3	
Bullfrog *L. catesbeiana*	0	1	2	3	

Additional Species and Wildlife Observations: _____

Applied Ecological Services, Inc.

Precipitation Scale:

Precipitation Code	Description
0	No Precipitation
1	Fog/Mist
2	Light Rain/Drizzle
3	Moderate Rain. Steady precipitation but not too much noise pollution
4	Heavy Rain. Significant noise pollution. Impedes breeding beahavior.
5	Extreme weather. Hail, thunder, and/or lightening storms. Do not perform survey

Beaufort Wind Scale:

Beaufort Wind Scale	Wind Speed (mph)	Description
0	<1	CALM: smoke rises vertically
1	1 to 3	LIGHT AIR: rising smoke drifts; weathervane inactive
2	4 to 7	LIGHT BREEZE: leaves rustle; can feel wind on face
3	8 to 12	GENTLE BREEZE: leaves and twigs in constant motion
4	13 to 18	MODERATE BREEZE: moves small branches (too windy to monitor)
5	19 to 24	FRESH BREEZE: small trees sway (too windy to monitor)

Calling Intensity:

Calling Intensity Code	Description
0	No frogs or toads can be heard calling.
1	Individual calls (con-specific) are not overlapping. Count individuals
2	Some (con-specific) overlap of calls , but individuals still distinguishable
3	A full chorus/cacophony; constant, continuous, and overlapping calls (con-specific)

Additional Notes: _____

Applied Ecological Services, Inc.

ROS/TCS	Date	Surveyor	
Project Number		Time In	Time Out
Description of Area			
IN		OUT	
Amb Temp		Amb Temp	
Amb RH		Amb RH	
Sur Temp		Sur Temp	
Sur RH		Sur RH	
Soil		Soil	
Other Weather Descriptions			
Photos?	Photographer?		
Species Observed and Relevant Notes:			

13.0 Testing, Inspection, Maintenance and Calibration Requirements

13.1 Instrument/Equipment Testing, Inspection, and Maintenance

All equipment for observational data collection is provided by AES and will be maintained by the project manager. Binoculars and spotting telescopes used for surveys will be regularly cleaned with forced air, brushes, lens cleaning solution, and lens paper and diopter calibrations will be done as needed. Prior to all survey efforts, batteries will be checked for power in thermo hygrometers, GPS units, cameras, cell phones, digital soil thermometers, and other battery operated equipment.

Field Checklist

EQUIPMENT	SUPPLIES	PERSONAL
Binoculars	Data Forms	Hat (Sun/Warmth)
Camera	Pens/Pencils (2)	Light/Heavy Gloves
GPS Unit	Field Guides	Raingear
Compass	Field Maps	Mud Boots
Clipboard	Road Maps	Hiking Boots
Hand Lens	Bird Call CDs/Tapes	Sunblock
Field Pack	Batteries AA (4)	Insect Repellent
Soil Thermometer	Bird Alpha Codes	Sunglasses
Spotting Telescope	Travel Itinerary	Water Bottle
Tripod	First Aid Kit	Credit Card/Cash
Thermo hygrometer		Food/Snacks
Small Collection Container		Cell Phone
Snake Bags		
Stump Ripper/Hook		
Reflective Mirror		

13.2 Instrumentation/Equipment Calibration and Frequency

No equipment critical to this survey effort will require any equipment calibration

13.3 Inspection/Acceptance of Supplies and Consumables

There are no acceptance criteria for field supplies relative to this survey effort..

14.0 Data Management

All geo-referencing, observational data, photographs, and other data generated or collected for this project will be documented and archived in its original format. These and other datasets, as needed, will be compiled as Excel spreadsheet files, database files, and GIS files and stored on a secure network. Consistent applications will be utilized for modeling and database creation methods.

AES will use standardized data sheets for data collection in the field. These sheets will be collected by the AES project manager following each individual survey effort, scanned/saved electronically, and stored in a file. At the end of every month these data sheets will be transcribed into prefabricated Excel spreadsheet templates.

In addition, AES will develop a data library of all pertinent data used in the project.

A strict file management and file naming structure will be used in order to ensure data efficiently, integrity and organization. AES QAO will be responsible for enforcing data management standards for each discipline.

The data library system is composed of a file folder system and a file directory database. When source data are collected, it is first entered into the "DATA" directory. The directory is subdivided into folders. Each data delivery or download is placed into a single file folder. The directory may be further subdivided upon delivery or to accommodate the needs of the data. While the data are in this directory, it is reviewed and processed as required to conform to library protocol (coordinate systems, field names, etc.). Any changes in format or content of the data will be noted.

Once the data enters the data library (FROMsource20081219), it is protected from any further manipulations. Copies of the data can then be checked out of the library for various uses including further manipulation, interpretation, and analysis. Any altered data are placed into a third folder named "AES" and is stored under the heading of the analysis, model, or manipulation performed.

AES will ensure that the most recent versions of their project information and work products are distributed to the appropriate personnel. In addition, the AES project manager will ensure that the most recent version of the QAPP is distributed to the appropriate personnel. At the completion of the project, the deliverable files will be included with the final report.

15.0 Assessment and Oversight

Assessments will occur at the outset and conclusion of each project phase. In addition, assessments will occur quarterly to ensure continued implementation of QA procedures. Assessments will be conducted by the AES and BNR Project Managers and QA Officers. As research is conducted, AES and BNR will maintain close communication with EPA as necessary. Should significant data quality issues arise; they will be documented and brought to the attention of the QA Officers and the EPA Project Manager.

AES and BNR will discuss any issues that arise as we gather information and develop deliverables. AES and BNR will identify any difficulties associated with locating necessary information or other unforeseen issues that could affect data collection or analysis. If any modifications to data collection or methods are significant, communication and approval will be sought from the EPA Project Manager.

As data are reviewed internally, checks will be made to flag missing, incomplete and/or erroneous data. If errors are discovered AES and BNR will discuss corrective action as necessary. The AES Project Manager and QA Officer will be responsible for identifying and implementing pertinent corrective action. The QA Officer's will be responsible for reviewing and approving corrective procedures associated with erroneous data.. If a problem persists or pertinent solutions are not agreed upon by both parties, insight from the EPA will be requested.

The AES and BRN Project Managers and QA Officers will review their respective agencies' deliverables. BRN and AES staff will ensure that all products are clearly written and free of typographical errors, and that they accurately describe any limitations of the information.

16.0 Data Review, Validation, Verification and Usability

This section describes the approach that will be used to assess the usability of field and analytical data and results generated for the AOC. The elements of Section D will be enacted in sequence with Quarterly Reports in order to ensure that the results meet the objectives of the project. At the end of Task 2 year one, the data will be reviewed and used and evaluated by BRN. Critical comments compiled in the evaluation of these data will be reconciled and corrected for year 2.

16.1 Data Review, Verification, and Validation

Data generated and collected for inclusion in the project will be reviewed according to the data quality objectives outlined in Section 8.0. Field data, summary tables, project results and conclusions will be reviewed for logical consistency as outlined in Section 8.0.

AES and BRN will identify and document data quality issues and deviations from Section 8.0's operating procedure and immediately bring them to the attention of the EPA Project Manager if significant.

The product quality reviewers will validate and verify the results of these reviews. This process requires:

- Reporting missing or questionable data,
- Reporting compensations for missing data,
- Conducting internal review of the work product by senior staff,
- Revising work products based on the technical direction from BNR.

Because this project involves the collection of primary baseline data, field results will be compared to other similar studies in the area. Field data will be evaluated and compared to information found at the reference site. In addition all data will be reviewed by an AES senior level staff person. Critical inspection of all data will include checks on identified species, frequency, abundance, and other that become necessary to the project. Unexpected results, findings or observations will be identified, documented and reaffirmed if possible.

The AES QA Officers will perform independent reviews of the information collected and the project deliverables generated by their team as described in Sections 7.0 and 8.0. Deliverables will also be reviewed by the Project Manager and the collaborating agency from which they originated. Project managers will discuss issues identified by QA Officers as appropriate to verify the action(s) necessary to resolve them. Project managers will then be responsible for seeing that the chosen corrective actions are executed.

16.2 Reconciliation with User Requirements

AES will provide deliverables in formats which facilitate the end use of the data they contain.

AES will generate draft reports and present them to BNR for review and comment as scheduled in the project timeline. For the purposes of this project and future projects which may be able to use the data generated in this project, the index system used by AES will include source information and a general description of any limitations of a data file.

17.0 Reporting, Documentation and Records

This project will involve an iterative process with open communication among AES, BRN, and EPA. Discussions will address quality assurance issues as needed and may include limitations and constraints in the information sources and/or assumptions made about the information.

Deliverables to be submitted with quality assurance information include:

- Draft and final QAPP
- GIS maps and field data/forms
- Electronic project files
- Progress reports
- Final Report

The following reports will be made available to all parties listed on the project Distribution List in Section 3.0 as they are produced: project status reports, results of performance evaluations, results of periodic data quality assessments, reports of significant QA problems, conducted as described in Section 15.0.

All documentation from AES and CC will be delivered via Microsoft Word and PDF format. Any presentations will be done in Microsoft PowerPoint. Geographic information will be in shapefile and PDF format. Summarized and statistical data will be in Microsoft Excel spreadsheet format. Digital delivery of final products will be nicely organized and delivered via CD or external hard drive with all necessary supporting data, including all digital photograph and digital audio files taken on site.

AES will provide sufficient server storage via a networked SAN storage system throughout the life of the project. This set up is designed to perform daily tape backups which are housed both on and off site for recovery purposes. In addition a secure File Transfer Protocol (FTP) is set up in order maximize efficiency for data transfer amongst the project team. AES will also back up and store all hard copy and electronic information (including working files) it generates for this project in its Conshohocken, PA office for five years after the contract's expiration date. The AES Project Manager will ensure that the most recent versions of AES's project information and work products are distributed to the appropriate personnel.

BNR will back up and store all finished hard copy and electronic information for this project in its Buffalo, NY office for five years after the contract's expiration date.

References

Bart, J., S. Droege, P. Geissler, B. Peterjohn, and C.J. Ralph. 2004. Density Estimation in Wildlife Surveys. Wildlife Society Bulletin, Vol. 32, No. 4 (Winter, 2004), pp. 1242-1247

Bridges, A.S. and M.E. Dorcas. 2000. Temporal Variation in Anuran Calling Behavior: Implications for Surveys and Monitoring Programs. Copeia 2000:587-592

Crouch III, William B. and P.W.C. Paton. 2002. Assessing the Use of Call Surveys to Monitor Breeding Anurans in Rhode Island. Journal of Herpetology, Vol. 36, No. 2, pp. 185-192 (2002)

Gutzwiller, Kevin J. 1991. Estimating Winter Species Richness with Unlimited-Distance Point Counts. The Auk, Vol. 108, No. 4 (Oct., 1991), pp. 853-862

Ford, N. B. and G. M. Burghardt. 1993. Perceptual mechanisms and the behavioral ecology of snakes. Pp.117-164. In R. A. Seigel and J. T. Collins (Eds.), Snakes-Ecology and Behavior. McGraw-Hill, New York, New York, U.S.A.

Hayek, L.-A., and M. A. Buzas. 1997. Surveying Natural Populations. Columbia University Press, New York, New York, U.S.A.

Hutto, Richard L., S. M. Pletschet, and P. Hendricks. 1986. A Fixed-Radius Point Count Method for Nonbreeding and Breeding Season Use. The Auk, Vol. 103, No. 3 (Jul., 1986), pp. 593-602

Maly, M. S., and J. A. Cranford 1985. Relative capture efficiency of large and small Sherman live traps. Acta Theriologica, 30:165-167

Mossman, M.J., L.M. Hartman, R.Hay, J.R. Sauer, and B.J. Dhuey. 1998. Monitoring long-term trends in Wisconsin frog and toad populations. In M.J. Lanoo, Status and Conservation of Midwaestern Amphibians, pp. 169-205. University of Iowa Press, Iowa City.

O'Farrell, Michael J. and W. L. Gannon. 1999. A Comparison of Acoustic versus Capture Techniques for the Inventory of Bats. Journal of Mammalogy, Vol. 80, No. 1 (Feb., 1999), pp. 24-30

Slade, Norman A., M.A. Eifler, N.M. Gruenhagen, and A.L. Davelos. 1993. Differential Effectiveness of Standard and Long Sherman Livetraps in Capturing Small Mammals. Journal of Mammalogy, Vol. 74, No. 1 (Feb., 1993), pp. 156-161

Tiebout III, H. 2005. An inventory of the herpetofauna of Valley Forge National Park. Unpublished report. Submitted to the National Parks Service in 2005.

USEPA. (2006). EPA Requirements for Quality Management Plans (QA/R-2). EPA/240/B-01/002 US Environmental Protection Agency, Office of Environmental Information, Washington DC. http://www.epa.gov/quality/qs-docs/r2-final.pdf

USEPA. (2006). EPA Requirements for QA Project Plans (QA/R-5) (2006) EPA/240/B-01/003 US Environmental Protection Agency, Office of Environmental Information, Washington DC. http://www.epa.gov/quality/qs-docs/r5-final.pdf

Verner, J. 1985. Assessment of counting techniques. Current Ornitholog2y: 247-302.

Verner, J. 1988. Optimizing the duration of point counts for monitoring trends in bird populations. U.S. Forest Service Research Note PSW-395

Webb, J. K., and R. Shine. 1998. Using thermal ecology to predict retreat-site selection by an endangered snake species. Biological Conservation 86:233-242.

Weir, L. 2001. NAAMP unified protocol: call surveys. North American Amphibian Monitoring Program, Patuxent Wildlife Research Center, Patuxent, MD.

Weir, L. A., and M. J. Mossman. 2005. North American Amphibian Monitoring Program (NAAMP). In M. J. Lannoo (ed.), Amphibian Declines: Conservation Status of United States Species, pp. 307-313. University of California Press, Berkeley.