APPENDIX 2:
MAINTENANCE & MONITORING

Going Beyond Installation

A restoration plan is only as good as its maintenance and monitoring plans will allow. A **long-term maintenance strategy** planned in conjunction with an installation plan will help to ensure that a restoration plan functions as originally intended.

Ecosystem monitoring should also be planned in advance to ensure that restoration intentions become realities after restoration plans are installed. Monitoring also gives projects the tools managers need to adapt maintenance and management strategies as site conditions change over time.

Of course, sufficient **funding** must be put in place to ensure that a restoration vision can be successfully installed, managed, and monitored. To that end Appendix 1 provides an opinion of the probable cost for restoration of the Bay View Wetland. Chapter 5 of the master plan also explains how the Bay View Wetland contributes to the goals set forth in the region's Milwaukee Estuary Remedial Action Plan.

Showing that the project has worth at both local and regional scales will help potential granting agencies understand that the project has tremendous potential to set a precedent for coastal restoration along Lake Michigan in addition to becoming an ecological ammenity for the City of Milwaukee.

Expected Outcomes

Vegetation Performance Standards

The performance standards to be used for evaluating vegetation established during the restoration and construction phase of the Bay View Wetland are measured using the sampling data methods described on page 6 of this appendix.

Quantitative standards for vegetation monitoring on page 6 were developed based on USACE wetlands mitigation criteria (US EPA 2008), with site specific modifications. These standards are as follows:

- Species selected for the planting should be native to the county where the mitigation site is located

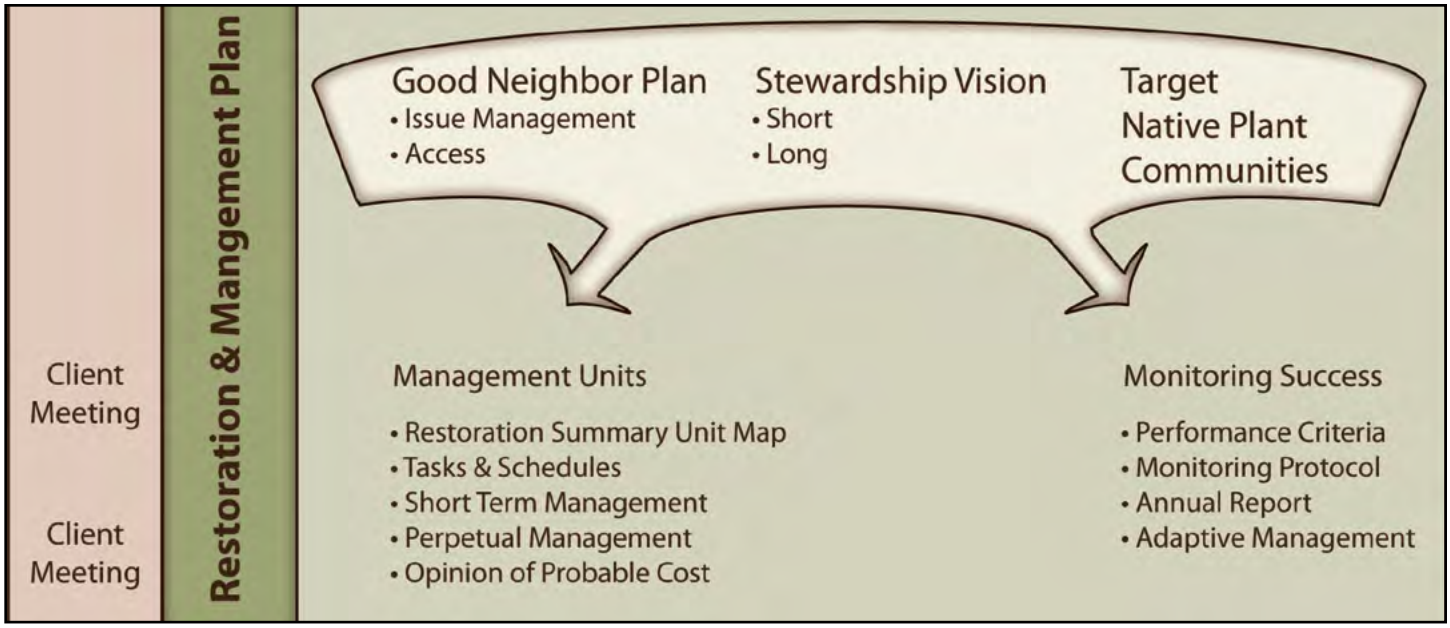

Figure A2.1: The process for completing a restoration and management plan is adaptable, but should generally consider and plan for management and monitoring in addition to installation

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and should be appropriate for the hydrologic zone to be planted.

- A minimum number of native perennial species proposed for establishment must be present within each plant community to meet performance standards. The number of species will be determined in the next phase of design.
- Species dominance should be determined by calculating importance values (IV), with at least two parameters, frequency and cover, used to calculate species importance.

  Cattails (*Typha spp*), reed canary grass (*Phalaris arundinacea*), and common reed (*Phragmites australis*) and non-native species should cumulatively comprise no more than a percentage of the dominance measure (for example, a USACE standard dictates that invasive species should comprise less than 20% of the dominance measure). The native perennial species within each wetland plant community should be represented at a certain percentage of the total dominance measure. These percentages will be determined in the next phase of design.

Hydrology Performance Standards

For both short- and long-term hydrology monitoring, the performance standards should be derived from the latest version of the USACE Wetlands Delineation Manual, published in 1987. The wetlands hydrology criteria (performance standards) identified in this document includes the use of direct measurements of water levels and soil moisture (e.g., primary indicators) as well as other types of supporting observations/evidence of hydrology (secondary criteria).

Creating/Preserving Reptile and Amphibian Habitat

Data collected each year during surveys should be compared to previous sampling efforts. This data can be used to document new species observed on site, as well as to compare survey numbers to estimate greater or lower populations of species. Feeding and breeding observations can indicate suitable habitat for reptile and amphibian species (egg masses, etc.). Methodologies for sampling fish and other wildlife can be found in the Habitat and Monitoring section.

Maintaining and creating amphibian habitat is an important goal for the Bay View Wetland Restoration

Maintenance and Management

Proposed management objectives for native plantings include:

- Stabilize and maintain soil systems (slope and toe stability) to reduce erosion, sedimentation, and nutrient loading.
- Maintain healthy native ground cover vegetation to hold soil in place, and improve water quality.
- Reduce non-native herbaceous species so they do not impede ecological functions at the site.
- Create a relatively low maintenance environment.
- Maintain aesthetically pleasing but naturalized plant communities.
- Manage the site for the long-term sustainability of native plants.
- Improve habitat quality for wildlife.

Short-term Maintenance (Years 1-5)

Schedules

Typical short-term maintenance activities include: mowing, herbicide application, prescribed burning (if appropriate), and supplemental seeding.

Two typical management schedules for the establishment of new vegetation are listed below.

Option A manages vegetation with mowing and herbicide.

Option B includes prescribed burns as part of the short-term maintenance schedule. The schedules indicate in which quarter of a year work should be conducted by highlighting the quarter with bracket symbols (Ex. 12[3]4 , work proposed should be conducted in the third quarter of a calendar year or between the months July, August, and September.)

Option A: Weed Management

		Year 1	Year 2	Year 3	Year 4	Year 5
1.	Weed Management and Site Inspection	1[2] [3]4	1[2] [3]4	1[2] [3]4	1[2] [3]4	1[2] [3]4
Assess site conditions, identify threats, ie: Phragmites, buckthorn, garlic mustard. Recommend mowing where necessary and/or design herbicide application plan.						
2.	Mowing.	1[2] [3]4	1[2] [3]4	1[2] [3]4	1[2][3]4	1[2][3]4
Conducted twice annually for weed control.						
3.	Herbicide Management	[1][2][3][4]	[1][2][3][4]	[1][2][3][4]	[1][2][3][4]	[1][2][3][4]
Wick or spray application to non-native invasions, phragmites and garlic mustard, woody invasives such as buckthorn.						
4.	Additional Management Techniques	1[2] [3]4	1[2][3]4	1[2] [3]4	1[2] [3]4	1[2] [3]4
[ ] Indicates the quarter of the year when activities may occur						

Option B: Prescribed Burns

		Year 1	Year 2	Year 3	Year 4	Year 5
1.	Weed Management and Site Inspection	1[2] [3]4	1[2] [3]4	1[2] [3]4	1[2] [3]4	1[2] [3]4
Assess site conditions, identify threats, ie: Phragmites, buckthorn, garlic mustard. Recommend mowing where necessary and/or design herbicide application plan.						
2.	Mowing.	1[2] [3]4	1[2] [3]4	1[2] [3]4	1[2][3]4	1[2][3]4
Conducted twice annually for weed control.						
3.	Herbicide Management	1[2][3]4	1[2][3]4	1[2][3]4	1[2][3]4	1[2][3]4
Wick or spray application to non-native invasions, phragmites and garlic mustard, woody invasives such as buckthorn.						
4.	Prescribed Burn	1 2 3 4	1 2 3 4	1 [2] 3 4	1 2 3 4	1 2 3 4
Beginning the fourth year following seeding as conditions permit in wet meadows and mesic prairie						
5.	Supplemental Seeding	1 [2] 3 [4]	1 [2] 3 [4]	1 [2] 3 [4]	1 2 3 4	1 2 3 4
Only if required to meet vegetation coverage standards. Seeding should occur in spring or fall (dormant).						
[ ] Indicates the quarter of the year when activities may occur						

Management Techniques

Below are descriptions of management techniques that are commonly employed to manage restoration areas:

- ### Mowing

  Vegetation in the seiche wetland transition zone, wet meadows, and mesic prairie communities should be mowed to a height of 6-12 inches after vegetation has reached a height of 25 inches and before non-native annual species go to seed. This should be done twice annually during the first and second years (during the growing season). Mowing should be conducted only as needed following the second growing season.

- ### Prescribed Burning

  Prescribed burns should be integrated into a site's management strategy during the spring of the third growing season provided sufficient fuel in the form of grass material or leaf litter is available to carry the burn. The most important decision in prescribed burning is to time the burn correctly based on an ecologist's recommendations.

  Timing will determine which plants put on new growth after the burn and how abundant they will be. The key is to burn undesirable plants when they are at the weakest point in the growth stage: when their energy reserves are near the lowest levels during active growth around the time of flowering. Desired species should be just starting to green up (1 or 2 inches of new growth) when they are burned.

  Frequent burns in a tallgrass prairie generally increase the height and density of warm-season grass species. Burning should occur in April or eary May in southeast Wisconsin for the best response. Growth of the warm-season species planted in the "wet meadow" and "mesic prairie" zones are encouraged by the early-May burns. In warm springs, earlier plant growth dictates that burns occur sooner.

  Generally prescribed burns in late February or March are to be avoided in meadows and prairies as these burns will favor many undesirable, cool-season species (plants that are the first to actively grow in the spring). At the same time, many undesirable, cool-season species are held

Prescribed burning

in check or reduced by early to mid-April burns in southeast Wisconsin. Cool-season species are more productive after early spring burns than after fall burns. However, fall burning of a mixed-prairie will also reduce ground cover that will trap snow, reducing spring soil moisture content the following spring. Therefore, early to mid-April burns are generally preferred to burning in the fall or in February/March in meadows and prairies.

Unlike meadows and prairies, floodplain forests should be burned in March or very early April to avoid harming ephemeral spring flowers which sprout in early spring.

Depending on yearly rainfall, maintenance of native grasslands in good conditions may require only one fire every two to three years. However, do not burn in a drought year. Loss of vegetative cover will magnify drought conditions and possibly increase wind and water erosion of soil.

Prescribed burns should be conducted by a crew experienced in burn planning and permit application as well as prescribed burn management. If burning is not feasible, mowing to a height of 6 inches is an appropriate substitute, and should be conducted in fall after plants have gone dormant for the season.

- ### Supplemental Seeding

  If seeded areas greater than approximately five square meters become more than 50% bare during the first four years, the land manager should

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implement a remedial action plan that takes into consideration the site goals and specific deficiencies causing the remedial action. The action plan should include a strategy for restoring vegetation cover to bare areas. If at all possible, seed mixes originally specified for the project should be used for remedial seeding.

Long-term Maintenance (Years 6 – 10)

It is imperative that long-term maintenance (up to 10 years and in perpetuity) continue after short-term maintenance is complete. Long-term maintenance may include some or all of the short-term maintenance activities, but is expected to become less frequent assuming that prescribed burning becomes a primary management tool for controlling non-native species. Prescribed burns, reseeding/planting, and herbicide management are among the long-term maintenance tasks that may need to occur.

Herbicide Application

Schedule

		Year 6	Year 7	Year 8	Year 9	Year 10
1.	Herbicide Management	1[2][3]4	1[2][3]4	1[2][3]4	1[2][3]4	1[2][3]4
Wick or spray application to non-native invasions, phragmites and garlic mustard, woody invasives such as buckthorn.						
4.	Prescribed Burn	1 [2] 3 4	1 2 3 4	1 2 3 4	1 [2] 3 4	1 2 3 4
Beginning the fourth year following seeding as conditions permit in wet meadows and mesic prairie						
5.	Supplemental Seeding &Planting	1 [2] [3] 4	1 [2] [3] 4	1 [2] [3] 4	1 [2] [3] 4	1 [2] [3] 4
Only as desired						
[ ] Indicates the quarter of the year when activities may occur						

Management Techniques

- #### Prescribed Burning

  Prescribed burn management is recommended as the primary method for long-term management of all the native plant communities.

  Prescribe burn management is a good primary method for long-term management of the native plant communities. If burning is called for it should occur approximately every 2-3 years. If prescribed burning is not feasible, mowing (to a height of 6 inches) is an appropriate substitute if done during the appropriate times of the year (early to mid-April or during the fall following plant dormancy). If the site is burned in Year 4, it should be burned next in Year 6 or 7.

- #### Supplemental Seeding

  Seeds do not always grow as intended and remedial work is sometimes needed. Additional seed can be installed to supplement initial seeding, to cover bare areas, or to out-compete nuisance species. Appropriate species will be determined in future phases of the restoration design.

- #### Herbicide management

  Herbicide application to perennial weeds will likely be required as a long-term management strategy even when native species become established. Herbicide application should be limited to areas where mowing or prescribed burning is not effective. The best application period is just before non-native species and weeds flower or set fruit.

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- Approach to Weed Control

Integrated Pest Management (IPM) is an effective and an environmentally sensitive approach to managing invasive species that relies on combining complementary control practices. An IPM program uses current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available control methods, is used to manage impacts by the most economical means, and with the least possible hazard to people, property, non-target organisms, and the environment. The goal of IPM is to integrate the use of alternative management activities with herbicide control to eradicate or keep populations of invasive species in check. Alternative management techniques include mowing and prescribed burning, described above.

Herbicide Application: Herbicide application will be an important method of invasive species control where mowing or prescribed burn management is not effective. Herbicide should be applied to target species using a hand-held wick applicator whenever possible to avoid spraying native species. The best application period is just before flowering. Herbicide should be applied by a professional applicator certified in Wisconsin. The applicator must adhere to application instructions on the label and only use herbicides that have been approved for use in the state of Wisconsin. Herbicide should be applied at the selected applicator's discretion for control of non-native or weedy species in order to achieve performance guarantees or benchmarks. It is recommended that herbicide be applied to target invasive and weedy species up to two times annually during the first through third growing seasons following installation of native plantings, and as-needed in following seasons.

Specific species that should be targeted for herbicide application are described in the Restoration Action Plan (Page 52).

Mechanical Control: In addition to mowing, mechanical control methods such as weedwhacking, cutting, and hand-pulling may be the most efficient and effective techniques to reduce relatively small, localized populations of invasive species. Mechanical removal should occur before invasive species flower and go to seed.

Biological Control: Natural biological processes and materials can provide control of invasive species with minimal environmental impact and often at a lower cost than other methods. Biological control is now considered the most viable option for control of heavy infestations of purple loosestrife. One species of weevil, *Hylobius transversovittatus*, is often used to control purple loosestrife. It lays eggs in the stem and upper root system of the plant, and its larvae feed on root tissue as they develop. Additionally, two species of leaf-eating beetles (*Galerucella calmariensis* and *Galerucella pusilla*), and another weevil that feeds on the flowers (*Nanophyes marmoratus*) are being used to stress the plants in multiple ways. Research has shown that most of these insects are almost exclusively dependent on purple loosestrife and do not threaten native plants, although one species has shown some cross-over to native loosestrife. These insects will not eradicate populations, but may significantly reduce the size so cohabitation with native species becomes possible.

Habitat Monitoring Protocol

This section provides a description of methods proposed to measure the restoration outcomes of the Bay View Wetland site.

Vegetation Monitoring and Surveys

Vegetative cover and planting success or failure is

Purple Loosestrife at the Bay View Wetland Site

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one of the fastest and easiest ways to measure a planting or restoration's performance. Vegetation sampling often requires very simple tools and a great deal of data can be collected relatively quickly. Unlike faunal sampling, traps do not need to be set or checked in order to get a snap shot of the performance. In general the two most important vegetation sampling criteria are Percent Cover and Diversity.

Measurement Methods and Techniques

Percent cover should be measured to determine how much of the site has been successfully established with vegetation. The typical method for estimating percent vegetative cover is the Line Transect Method (described in sampling protocols).

Diversity of species present should be measured to determine how habitat communities have established and identify if invasive species threaten the success of the restoration. Many methods can be used to measure diversity including:

- Line transects and nested 1 square meter sample quadrats
- Comparison between permanent and annually randomized transects
- Timed meander searches
- Nested belt transects-cover intercept and diameter breast height
- Point-plot avian census techniques
- Derived measures
- Frequency of occurrence
- Importance value
- Richness
- Habitat ratings

Sampling Protocols

Line transect locations should be established during the baseline survey. A 100-meter measuring tape should be pulled taut along a chosen compass bearing. These transect end points should be GPS surveyed and permanently marked with ground flush steel rebar rod upon completion of site earth work for subsequent vegetative monitoring.

Nested 1 Square Meter Sample Quadrats should be placed at 10-meter increments along each transect. At 10-meter increments along the measuring tape, a circular meter square quadrat should be centered over the tape and the herbaceous plant percent cover (a measure of the vertical projection of photosynthetic leaf area) should be measured in each quadrat: The recorded data at each quadrat typically includes:

- Percent cover by species including all woody plants of less than 1.0-meter height
- Percent cover by substrate type (fine litter, 1 hour combustible fuels), coarse litter (>1 hour combustible fuels), rock, bare soil, and bryophytes (mosses, lichens, liverworts, etc.)

The following information and results will be derived from the data collected from each quadrat:

- Frequency of occurrence (percent of the total number of sample quadrats in which each species occurs)
- Richness (number of plant species present within the quadrat)
- Erosion control effectiveness (average +/- St. Deviation for percent bare soil and percent total plant and substrate cover/quadrat)
- Absolute and relative cover
- Frequency of occurrence
- Importance Value (IV), the summation of relative

Vegetation monitoring using a sample quadrat

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cover and frequency of occurrence for a given species IV, percent cover, and frequency of occurrence data will be calculated for each plant species for each transect, community type, and overall site performance level

A Timed Meander Search (TMS), described below, is used to measure plant species richness and diversity in each community type. The TMS technique involves slowly walking through each plant community type and listing new plant species while blocking the search into increments of time.

The TMS sampling technique is conducted over representative areas of the site. The TMS method develops time-equated plant species lists. The data contribute to the development of total plant species lists and help quantify diversity for each plant community. The data contribute not only to the species lists and diversity measurements, but statistics can be developed from this data to help characterize community development and compare different areas within the same community type.

Nested Belt Transects-Cover Intercept and DBH
Woody vegetation equal to or greater than 1.0-meter height should be sampled along the identical 100-meter linear study transects laid out for percent cover as described above. Parallel belts, two meters wide and nested within the 100-meter transects, should be laid out on both sides of a study transect. The woody plants greater than or equal to 1-meter encountered within each 4-meter wide x 100-meter linear belt transect should be measured for:

- Percent canopy intercept (vertical projection of photosynthetic leaf area, over measured lineal distance of transect tape)
- Survivorship (measured as alive or dead canopy intercept)
- Diameter and if appropriate, Diameter at Breast Height [DBH- 4.5 feet above ground]
- Number of stems for each woody plant species

Along with the permanent transects used to measure vegetation (e.g. annual use of identical quadrat and belt transect locations), a number of different **randomized transects** could be installed each year. An appropriate number of the additional random transects should be determined statistically. These random transects would be sampled in the

Visual inspection of soil for hydric characteristics

same way as the permanent transects. Data would be summarized, analyzed and compared statistically with the analysis from the permanent transects. The statistical comparison can be used to evaluate whether the paired samples are from significantly similar populations, as well as, confirm the assumption of random sampling, which strengthens statistical robustness.

Hydrology Monitoring

The presence of hydrology required to support the functions of the wetlands and adjacent areas should be evaluated during construction (short-term) and throughout the management phase (long-term). Short-term hydrology criteria is needed to evaluate the short-term (e.g., by year 2) attainment of hydrology criteria in the construction area in order for vegetation to reestablish. In addition to the short-term criteria, long-term monitoring of hydrology is recommended to evaluate the overall project effectiveness.

The hydrologic monitoring methods can utilize wells (Telogs), continuous soil moisture recorders, hand held manual soil moisture meter probes, and the observation of primary and secondary hydrologic characteristics (the prevalence of vegetation which is adapted for anaerobic soil conditions and other secondary characteristics) to determine hydrology for the site.

The Bay View Wetland site includes both wetland and upland areas. Upland areas, which do not require the presence of wetland hydrology or the

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presence of hydric soils or hydrophytic vegetation, would not be subject to the hydrology demonstration. For this project, areas that would be subject to the hydrology determination include:

- Emergent/Seiche Wetlands
- Forested Wetlands/Floodplain Forest
- Wet/Sedge Meadows

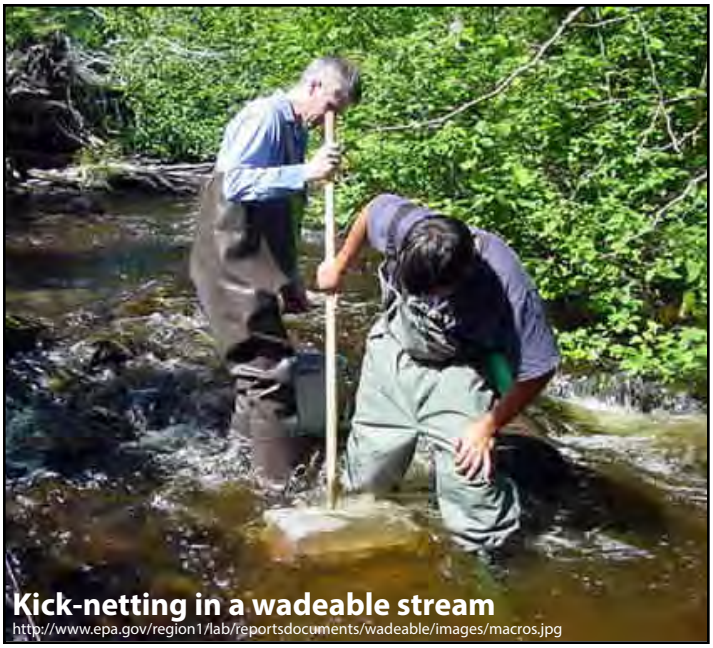
Vegetation sampling is one way that a site can be evaluated for health and to determine the success of a restoration. However, habitats are more than just vegetation; they comprise many faunal species as well. The following describes appropriate faunal sampling techniques.

Macroinvertebrate Sampling (WDNR)

Time of year, sampling site selection, and sampling technique are key factors to be considered when collecting macroinvertebrate samples.

The assemblage of macroinvertebrates found at a site can give researchers additional information about a site's water quality. Certain types of macroinvertebrates such as Mayflies (*Ephemeroptera*), and Caddis flies (*Trichoptera*) are generally found in high quality waterbodies, while other types like fly larvae (*Diptera*) can thrive in low quality water.

A high diversity of macroinvertebrates is one indicator of a healthy waterbody, whereas a shallow waterbody whose macroinvertebrate community is mostly fly larvae likely has water quality issues which need to be addressed.



Kick-netting in a wadeable stream
http://www.epa.gov/region1/lab/reportsdocuments/wadeable/images/macros.jpg

General Sampling Guidelines
(based on WIDNR guidelines)

- Collect samples in the spring (March – May) or in the fall (September – November).
- Collect samples in riffles (shallow areas where water breaks over rocks).
- Sample where the flow velocity is at least 0.3 meters per second.
- Sample substrates composed of course gravel to larger rubble (< 0.3 meters diameter).
- Sample similar environments and standardize protocols (points 1 – 4) at all assessment sites if possible, particularly if comparisons are being made between or among sites, or at sites over time.
- In the absence of riffles, vegetation caught in logjams, snags, or vegetation overhanging from the stream banks can be sampled. Investigators should be aware that a direct comparison between samples collected from different habitats is undesirable.
- For baseline monitoring, one sample per stream assessment reach is sufficient. Additional samples can be collected and processed later if additional data is needed.

Equipment

Net mesh size strongly influences the types and proportions of macroinvertebrate taxa collected. A 600-micron mesh kick net should be used for collecting baseline macroinvertebrate samples. Kick net frames are available in various sizes and shapes. Rectangular or D-shaped net 4 frames are good choices. Smaller triangular-shaped net frames are also available, but their relatively small size miss many of the invertebrates dislodged from the substrate when kick sampling.

Sampling Methods

Sample with a kick net by holding the net frame firmly against the stream bottom and disturbing the substrate upstream (approximately a full arm's length) from the net with your feet. Dig deeply into the substrate with the heel or toe to dislodge macroinvertebrates from the streambed. Avoid kicking course debris into the net (let the macroinverte-

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brates wash downstream into the net). Make sure that the plume of silt that results from disturbing the substrate is flowing into the net, this plume also contains the dislodged invertebrates.

In streams that lack riffles, vegetation (twigs, leaves, grass) caught in instream snags or logjams, or riparian vegetation overhanging into the stream can be sampled in lieu of kick netting. Sample by jabbing the net into the vegetation to dislodge the clinging invertebrates.

The net should be inspected often to make sure the invertebrates that are being dislodged are washing into the net. If two people are collecting the sample, one person can hold the net while the other manually removes vegetation from the snag or logjam and rinses it into the net, or shakes the snags to loosen the vegetation caught so it drifts into the net. Course debris should be removed from the net, while making sure to rinse the macroinvertebrates that are clinging to the vegetation back into the net.

Sampling Effort, Number of Macroinvertebrates / Sample Volume

More than 100 macroinvertebrates should be collected per sample, if possible. A quantity of debris about the size of a softball should contain over 100 macroinvertebrates, and such a sample should take approximately 3 minutes or less to collect.

Inspect the net contents to insure that more than 100 macroinvertebrates have been collected. If it is determined that insufficient numbers of macroinvertebrates are captured after initial sampling efforts, sampling should be extended for a second period of equal duration and noted on the field sheet. If insufficient numbers exist after completion of the second sampling effort stop collecting and preserve the sample. Low numbers of organisms may be indicative of water quality or habitat problems and should be noted on the field sheet.

Sample Handling and Preservation

After the sample is collected, rinse fine sediment from the net by forcefully swishing the net through the water a few times, being careful not to lose the organisms captured. Removing fine sediment from the net makes lab picking of the sample easier and helps insure adequate preservation of the sample.

Discard large sticks, rocks, and undecomposed

A dragonfly larva is one example of a macroinvertebrate found in streams and wetlands
www.benthos.org

leaves from the net after rinsing any clinging macroinvertebrates back into the net. Transfer the fine debris and macroinvertebrates to a tightly sealing plastic or glass wide-mouth jar of sufficient size. Inspect the net and transfer clinging macroinvertebrates into the sample jar. The sample debris should occupy less than 1/2 the sample jar's volume.

Make sure that the container is properly labeled. Labels should have at least the following information:

- sample ID number
- replicate number
- waterbody name
- collector's name
- a split-sample designation if a single sample's contents has to be placed in 2 separate containers due to large sample quantity.

Place a label inside the sample jar, using bond paper written in pencil. Initially preserve the sample with 80-85% alcohol (isopropyl or ethanol). Higher concentrations of alcohol make some invertebrates brittle, making taxonomic identification more difficult or impossible. Fill the sample jar to the top with the alcohol solution. Be sure to tightly seal the sample container and gently invert the container several times to thoroughly mix the sample and preservative.

Within 24 hours pour-off the alcohol solution and refill with fresh 80-85% alcohol. Samples containing

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large amounts of filamentous algae or other organic materials should be preserved and re-preserved several times. Poorly preserved samples are unpleasant to analyze, and decayed organisms make taxonomic identifications difficult or impossible.

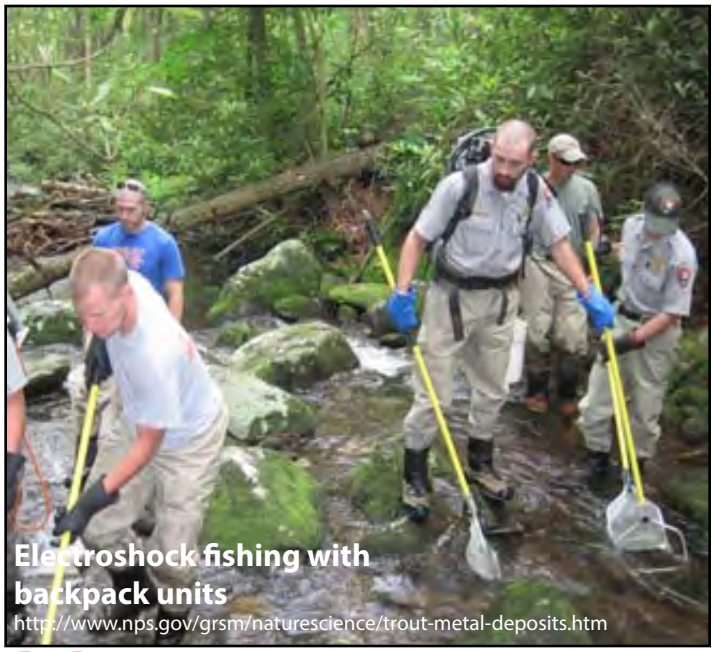
Fish Sampling

Starting in year 1 of the monitoring program reaches of the channel, portions of the seiche and the pond should be sampled with an **electro-fishing** unit. Each survey reach should be blocked off with a heavily weighted shore seine at the upstream and downstream ends. Floats of the seine will be propped up with poles to make sure that fish passage over the seine is not possible.

Each reach will be electro-fished in a single pass starting at the downflow end blocking the net moving upstream. A two man netting team will collect the fish and place them in a tote for processing at the end of the run. Collected fish should be identified to species and counted. A sample of fish from each species and each site will be measured in maximum total length to the nearest millimeter and released back into the reach they were collected. All data will be recorded on the fish sampling data form. Fish sampling is recommended in all years of the monitoring program.

Reptile and Amphibian Sampling

Several survey techniques can be employed in order to effectively sample a wide variety of habitats and attempt to encounter as many species as possible.



Electroshock fishing with backpack units
http://www.nps.gov/grsm/naturescience/trout-metal-deposits.htm

The primary method to be used will be **visual encounter surveys**. Visual encounter surveys are timed, systematic visual searches of suitable habitat. Shoreline and other appropriate habitats are walked slowly and visually searched for reptiles and amphibians. In addition, any frogs or toads heard calling in the immediate vicinity of a sampling station also can be noted during visual encounter surveys. Visual encounter surveys should be conducted during the day and night in order to maximize the likelihood of detecting species.

Dip netting, seining, cover turning, and aquatic funnel traps can also be used to complement visual encounter surveys. These additional sampling approaches can be employed to maximize the possibility of detecting species that generally remain hidden in vegetation, underneath cover, or in other areas where they may go undetected during visual searches.

Cover turning is the lifting and turning of cover objects, such as rocks, logs, boards, and other large objects under which animals typically find shelter. Cover objects encountered at a sampling station are turned and then returned to their original position after being searched. Aquatic funnel traps, consisting of standard minnow traps, can be used to sample amphibian larvae and adults in pond and stream habitats.

All collected or encountered reptiles and amphibians should be identified to species and counted. Numbers of organisms occurring in large numbers, such as tadpoles or calling frogs should also be estimated and representative individuals should be collected for identification. Any animals collected during sampling should always be released unharmed in the location where they were found following identification and enumeration, with the exception of a few representative specimens of tadpoles which may have to be retained.

Bird Surveys

Sampling should be conducted during the breeding season (typically late May through late June). An additional sampling for bird species could occur in spring and fall for detecting migratory bird species. Sampling points should be spatially correlated or coincide with transect end points and habitat types.

Representative study locations should be chosen

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throughout the Bay VIew Wetland site after an initial reconnaissance of the property. Locations to be studied on the site would be identified once a fundamental understanding of the complexity, patchiness, and types of avian habitat present on the site are ascertained. Study points should be spaced sufficiently throughout the site to ensure independence of data from other study points.

Bird surveys typically rely on modified methods designed for quantification of richness and relative abundance of bird species.

At each study point birds should be surveyed daily at dawn through mid-morning over four consecutive days during summer breeding under suitable meteorological conditions. Arrival at each study point should be followed by one-to-two minutes of acclimation while data sheets are being labeled as to time, date, surveyor, study point number, and survey identification.

During **timed surveys** (using stopwatch) the bird species heard or observed each minute are recorded and their location mapped. Surveys typically continue until no additional species are recorded at each study point, often requiring 15-20 minutes of total survey time. Surveys are terminated after at least four consecutive minutes in which no new-recorded species identified. Additional listings of birds observed or heard in the property but not at study points should be noted while moving between study points.

Identification and nomenclature of birds should follow Robbins and the American Ornithological Union. Raw field data can be entered into a database to create a list of birds as well as for summary and analysis.

If the study were conducted as described above it would **determine the breeding status** of species. Avian breeding status on the site should follow the criteria adopted by the Illinois Department of Conservation (IDOC) for the Breeding Bird Atlas Project or other appropriate criteria. These criteria are:

- **Observed:** A species, male or female, was observed during the breeding season, but no evidence exists to indicate the species is breeding.
- **Possible:** A species, male or female, was observed in suitable habitat and at a time during the breeding season that indicated it was possible that breeding occurred. Singing males often indicate possible breeding.

A red wing blackbird nest at the Bay View Wetland site

- **Probable:** Several types of observations are available that would indicate the species is probably breeding. Multiple males singing in suitable habitat, a pair (male and female) observed in suitable habitat, a permanent territory is identified by multiple observations of a singing male or male/male conflicts, courtship or copulation is observed, or agitated behavior.
- **Confirmed:** This is the most important level of classification. Observation in this category indicates direct evidence that the species is breeding at the site. Nest building by species other than wrens or woodpeckers, physiological breeding evidence, distraction displays, a used nest or eggshells, recently fledged young, an occupied nest, adults carrying a fecal sac or food, a nest with eggs, or a nest with young seen or heard.

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