Quality Assurance Project Plan for Forested Wetland Monitoring and Assessment: Chicopee Watershed

Version 5 FINAL

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EPA RFA # EPA-2014-2015

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1.0 Project Management

1.1 Distribution List

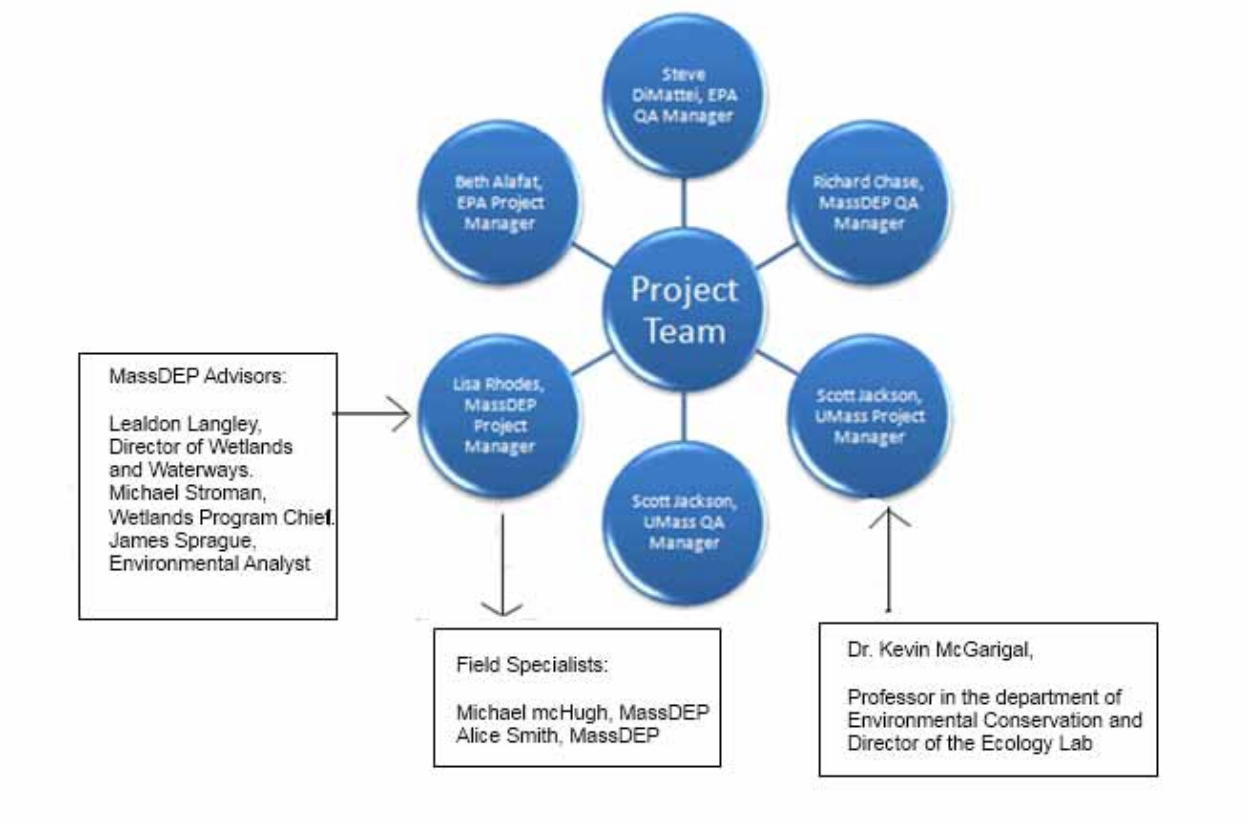
MassDEP, Director Wetlands & Waterways Program – Lealdon Langley
MassDEP, Wetland Program Chief – Michael Stroman
MassDEP, Environmental Analyst, MassDEP Project Manager – Lisa Rhodes
MassDEP, Quality Assurance Officer – Richard Chase
MassDEP, Advisor/Field Scientist – James Sprague
MassDEP, Field Scientist – Michael McHugh
EPA Regional Director, Jackie LeClair
EPA Project Manager, Beth Alafat
EPA, QA Manager, Steve DiMattei
UMass Advisor - Dr. Kevin McGarigal
UMass Project and QA Manager, Scott Jackson

1.2 Project/Task Organization

The participating individuals and/or organizations and their roles include:

Beth Alafat – EPA Project Manager – Oversee Grant commitments
Steve DiMattei- EPA QA Officer- participates in the development and implementation of QA/QC procedures for the project.
Lisa Rhodes - MassDEP Project Manager/Field Scientist – oversee the involvement of MassDEP personnel and project commitments; coauthor of results.
James Sprague – MassDEP Advisor / Field Scientist – participate in data review and decision-making to site selection; field data collection.
Michael McHugh – MassDEP Field Manager and Lead Analyst – participate in data review and decision-making relative to site selection; field data collection.
Alice Smith – MassDEP Field Scientist and Researcher – participate in research and field data collection.
Richard Chase – MassDEP QA Officer – participates in the development and implementation of QA/QC procedures for the project.
Lealdon Langley – MassDEP Advisor/Reviewer – participates in data review and decision-making relative to study development.
Michael Stroman – MassDEP Advisor/Reviewer – participates in data review and decision-making relative to study development.
Dr. Kevin McGarigal – UMass Project Manager - data review and decision-making relative to study development and statistical analyses.
Scott Jackson – UMass Project and QA Manager - Lead in Study methodology development, participation in data review and decision-making; coauthor of results.

1.2.1 Project Organization Chart



2.0 Problem Definition/Background

2.1 Demonstration Project:

Since 2006 MA has developed tools to monitor and assess (M&A) wetland condition based on EPA's *Application of Elements of a State Water Monitoring and Assessment Program for Wetlands* (April 2006). Our Level 1 Assessment is based on CAPS, a GIS based model [1] developed by UMass that predicts ecological integrity based on over 20 anthropogenic stressors (e.g. habitat loss, buffer zone impacts) and 3 resiliency metrics (e.g. connectedness). The CAPS output is the Index of Ecological Integrity (IEI), a score ranging from 0 to 1 for each 30 m^2 point on the landscape. The CAPS stressor gradient has been rigorously tested by UMass

[1] CAPS reports submitted to EPA include *DRAFT – A Framework for Ecosystem Monitoring and Assessment: The Conservation Assessment and Prioritization System (CAPS),* December 11, 2007*; Conservation Assessment and Prioritization System(CAPS)Western Massachusetts Assessment – Final Report* May 19, 2008; *Conservation Assessment and Prioritization System (CAPS) Preliminary Statewide Massachusetts Assessment,* June 2, 2009*; Developing Tools for More Effective Assessment of Wetlands and Aquatic Ecosystems – Final Report for Project 09-01/ARRA604,* August 18, 2010*; Development of a Comprehensive State Water Monitoring and Assessment Program for Wetlands in Massachusetts-Final Report for the FY07 Wetlands Development Grant – Phase 2b: Development of a Site Level Assessment Method (SLAM) for Forested Wetlands and field validation of the Conservation Assessment and Prioritization System (CAPS),* May 31, 2009, Revised February 11, 2010*; Development of a Comprehensive State Water Monitoring and Assessment Program for Wetlands in Massachusetts* February 28, 2011; *Progress Report* May 23, 2011 Reports were authored by UMass-Amherst. Also, *Development and Use of Aquatic Life Use Standards for Wetlands in Massachusetts dated May 12, 2011 co-authored by UMass-Amherst and MassDEP.*

using taxa abundance data collected in the field and approximates the 'Biological Condition Gradient' model for waters (www.umasscaps.org).

The Continuous Aquatic Life Use (CALU) approach for assessment is based on the relationship between IEI (i.e. constraints on biological condition identified from GIS data of the surrounding landscape) and the Index of Biological Integrity (IBI) (i.e. index of biological condition of a site based on field data). In this approach, IEIs and the IBI's yield scores that are continuous throughout their range and on the same scale and a site's biological condition compared to its landscape context can be assessed to determine if site condition is degraded, or if it falls within or exceeds the expected range of variability. See Section 3.2.4 for further detail.

In 2014 we will sample a total of 45 deciduous dominated (<30% conifer cover) forested wetland sites in the Chicopee River watershed. A total of 40 of the 45 have low IEI values (ranging from 0.1 to 0.25) and drain to waters which have been determined to be impaired for which a TMDL has not yet been developed. Those impaired waters were identified by the MassDEP Watershed Planning Program 2012 Integrated List of Waters (305(b)/303(d)) (http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/wbs2012.html). A total of 5 of the 45 sites are deciduous forested wetlands with high IEI values that also drain to impaired waters. The Chicopee watershed was selected in accordance with the MassDEP 5-year basin cycle for water quality sampling and reporting pursuant to the Clean Water Act. Wetlands with a low predicted IEI value where chosen because the CAPS model predicts that these are the most stressed wetlands. The five additional forested wetlands sites with high IEI (0.75-0.9) were chosen because the impaired water to which they drain has no low IEI wetlands within its subwatershed, so the intent is to see if the plant community data correlates to the prediction of a high IEI wetland.

Five additional wetlands that were sampled for the most recent National Wetlands Condition Assessment will be re-sampled using our monitoring and assessment strategy to provide a comparison of what the EPA wetland assessment found and what we find using our CALU approach. These sites will include three forested wetlands (one in the Taunton River Watershed and two in the Ipswich Watershed) and 2 salt marsh sites south of Boston. Vegetation sampling data will be used to assess wetlands at all 50 sites by utilizing vegetation based IBI's. Sites will then be assessed by comparing the field derived IBI with the CAPS predicted IEI and plotting the value on the CALU graph. Individual CAPS metrics will be assessed to determine which stressors are contributing the most to site condition so that we can recommend strategies for restoration or preservation (e.g. culvert improvements, impervious surface removal,) while collaborating with our water quality sampling group throughout this process. This assessment method will allow us to evaluate the sites for regulatory and/or best management practices to address any issues that are identified. These findings will also be reported in the next scheduled Integrated Waters report.

3.0 Project/Task Description

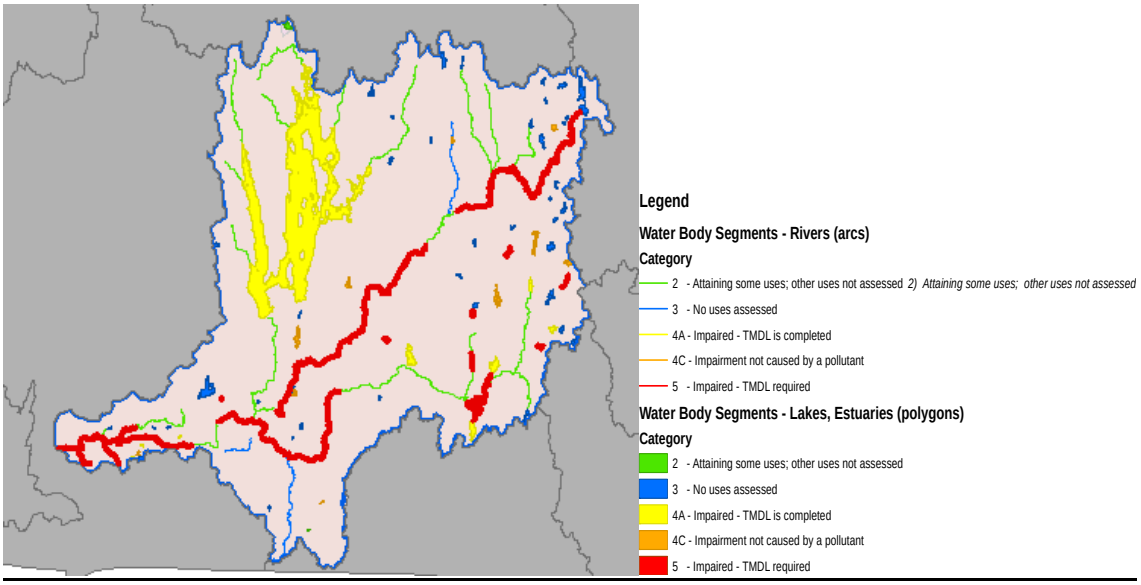
3.1 Selection of Sites

The MassDEP Division of Watershed Management (DWM), Watershed Planning Program (WPP) maintains a data layer (Integrated List of Waters: http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/wbs2012.html) that represents the combined reporting elements for the 2012 cycle of both sections 305(b) and 303(d) of the Federal Clean Water Act (CWA). The objective of this statute is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. As one step toward meeting this goal DWM administers a program to monitor and assess the quality of its surface waters and provide periodic status reports to the U.S. Environmental Protection Agency (EPA), and the public. Section 305(b) of the CWA codifies the process whereby waters are evaluated with respect to their capacity to support designated uses as defined in the Massachusetts Surface Water Quality Standards. Waters are identified as either: attaining some uses; no uses assessed, impaired (with a TMDL completed), Impaired (but impairment not caused by a pollutant), or Impaired with a TMDL required.

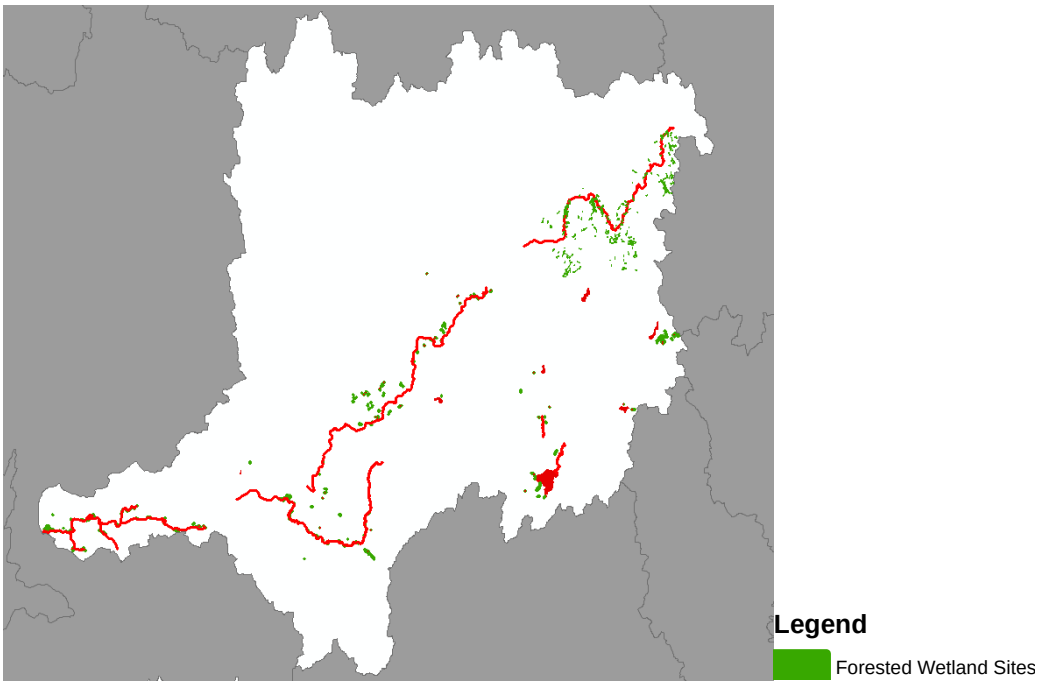
In order to assist in this process we are proposing to conduct our assessments in forested wetlands that are within the subwatersheds of impaired waters where a TMDL is required. The DWM data layer is available in a GIS format, allowing us to view the location of impaired waters on the landscape. DWM's data are available in a GIS, and by overlaying those data with the MassDEP Wetlands Data Layer (http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/depwetlands112000.html) along with digital elevation models developed by MassGIS, We are able to identify deciduous forested wetlands that are within the watershed of waters that have been identified as impaired. The pictures shown below provide an overview of these various GIS layers that were used for site selection in the Chicopee River watershed.

Chicopee Watershed

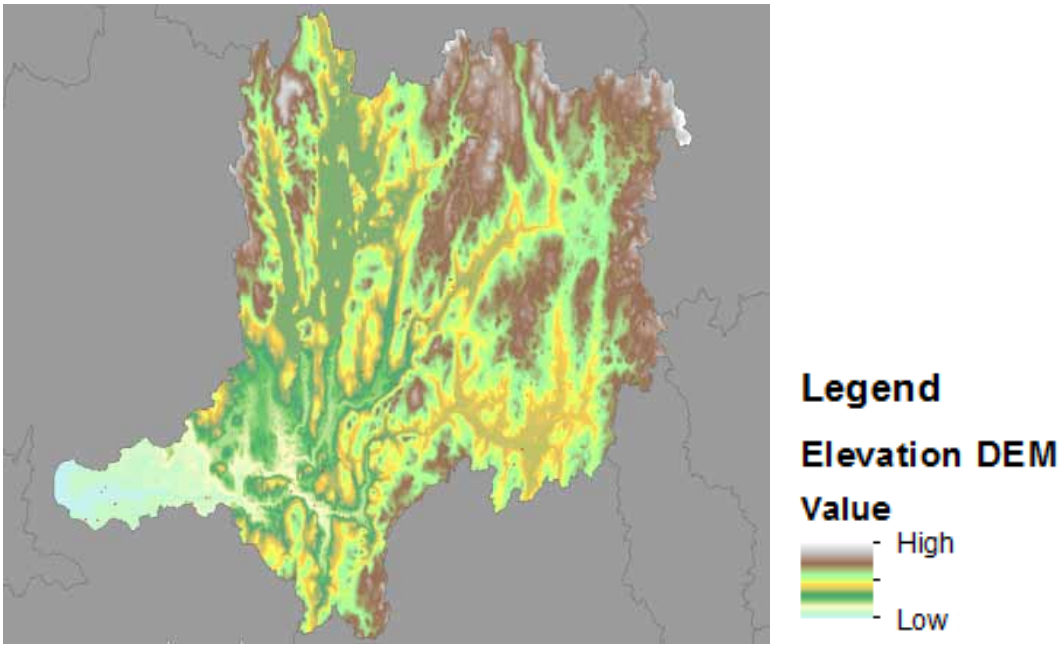
Impaired waters identified in red

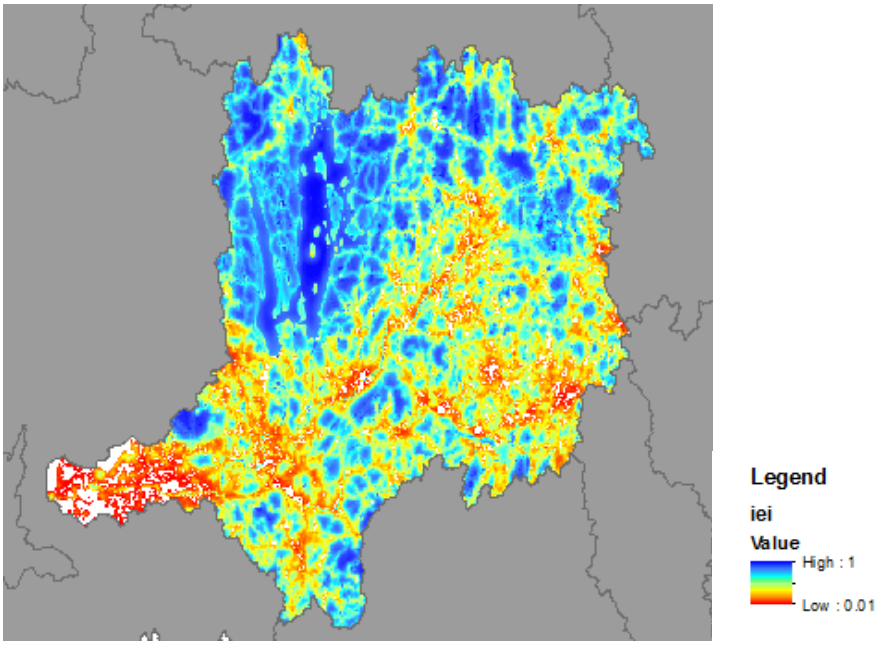


Forested Wetlands Sites along Impaired Waters



Digital Elevation Data





By assessing the watershed using the ArcGIS Suite of GIS software, we have identified 163 low IEI areas within forested wetlands that are within the subwatershed of each segment of the impaired waterbody.

Next we developed a method to randomly create a point (sample site) within each low IEI area of each wetland, and to randomize the order of those samples, so that we could have an unbiased (random) selection of sites to sample. Fortunately, ArcGIS provides tools specifically designed for such applications. Using the “create random point” tool in the ArcGIS toolbox, we

created one point, randomly placed within each low IEI wetland polygon. Using the random number algorithm associated with that same tool, we created a unique yet random number for each point within each wetland. We then order the sites numerically in our database. This effectively "shuffles the deck" of points to sample (i.e. they are now randomly located within each low IEI wetland polygon and randomly located throughout the watershed). Each site has a unique site identifier, which is simply a number 1 through 163 that identifies each site. We then start at the top of the list (site 1) and proceed down through the list until we have 40 viable sites to sample. We chose 40 because that is the number of sites that we felt we could reasonably accomplish over the course of the field season. We did the same exercise for the high IEI sites, to identify 5 randomly located high IEI forested wetland areas. The five National Wetlands Condition Assessment sites were randomly located by EPA and we are visiting the forested wetland and salt marsh sites, since those are the wetlands types that we currently have site level assessment methods and IBI's for. This provides for a total of 50 sites.

Since the majority of these sites are likely to be located on private property, landowner permission will be necessary in order to enter onto the property to conduct an evaluation of the replacement wetland. We will identify landowners by using the GIS point data that identifies each site to locate the owners using assessor's maps available either on-line or in town hall. Attached as Appendix A is a form letter that will be sent to landowners requesting that they contact MassDEP via phone or email to indicate their permission for us to access the site. If we do not hear back within 1-2 weeks we will call. We will consider going to homes and knocking on doors if access cannot be obtained through a phone call, but either way if we are unable to obtain permission we will drop the site and go to the next site on the list.

3.2 PHASE II: Site Visits and Data Analysis

3.2.1 Assessment Sites

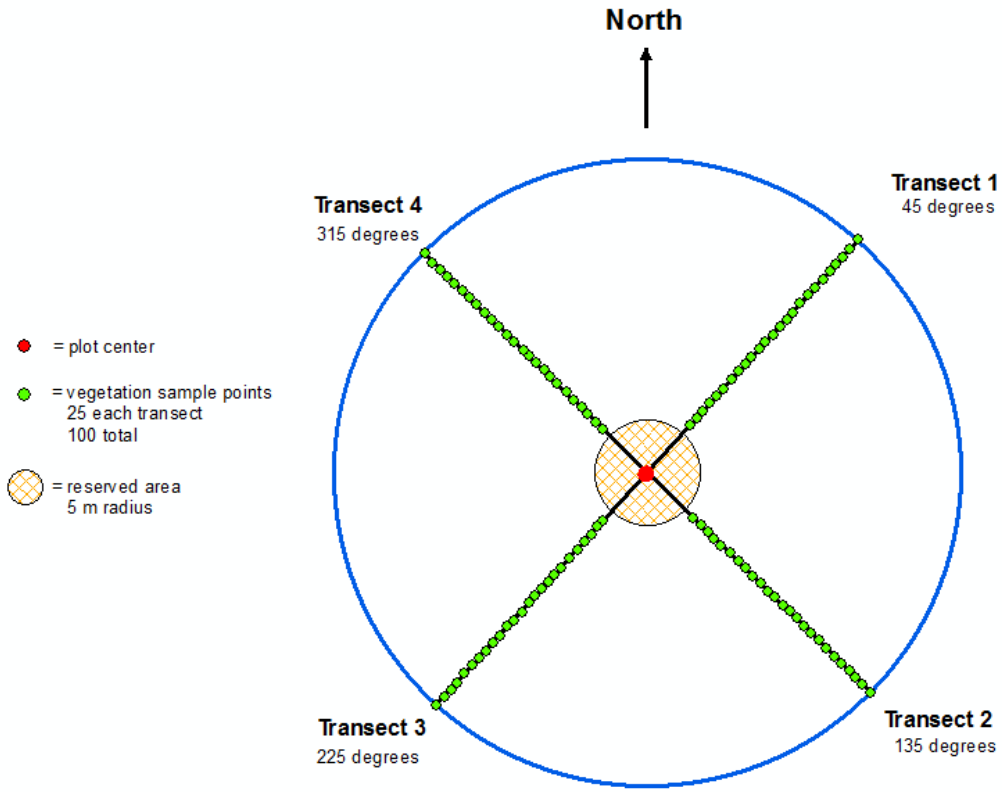
Each wetland area that is identified and where access permission is obtained will be visited to collect data. All sites will be located in the field using a Trimble Yuma 2 GPS unit and data will be entered directly into an excel spreadsheet using that same unit. GPS navigation will be used to locate each wetland plot. GPS precision must be 10 m or less and the navigator will stop and establish the plot once the distance to plot center is 0m. In the case of GPS interference from tree-canopy or atmospheric effects two procedures may be followed. The first is to wait 10 minutes for satellite reception to improve. If a dense forest canopy appears to be the problem use triangulation to locate the plot. We will approach the plot from three different locations where the canopy is mainly deciduous. Using compass and distance measurements provided by the GPS (precision must be 10 m or less), the plot will be located. It will not be necessary to hit the plot precisely it just needs to be selected without bias. As long as the field determined plot center falls within the original proposed plot, it will be deemed acceptable. Thus, if the plot center needs to be moved greater than 30 meters, then the site will be abandoned and the next site on the random list will be accessed. However, once a plot is established a reasonably precise GPS point is needed of the plot center. The strategy is: (1) do the best we can when locating the plot and (2) take a precise location (precision ≤ 10 m RMS) once the plot has been

established. Field workers will be on the plot for 1-2 hours and will be able to keep trying until they get good GPS coverage.

3.2.2 Vascular plants Data Collection

Vascular plant data will be collected as an indicator of community composition and species diversity, and provide useful information on potential threats to natural systems. Data collection will occur throughout the field season, June – October 2014. The procedure for sampling plants is:

a. Calculate species abundance of all vascular plants in a 30 m radius plot by using a point intercept method. Calculate percent cover as the tally of each plant species that is directly intercepted by a vertical projection from forest floor to canopy at one meter interval points along four 30 m transects (excluding a 5 meter reserved area at plot center) placed in the four ordinal directions. This creates 25 sample points along each of the four transects.



b. Following transect sampling conduct a 20-minute walk around (within) the entire plot and list species not encountered on transects. Assign these additional species a percent cover class of <1%.

While it is the intent of this study that the field crew implements the 30 meter radius plot sampling described above it is understood that "finger-like" or other odd shaped wetlands will be encountered. If the standard plot described above does not fit within the wetland to be sampled, it is acceptable to reconfigure the plot. A wetland could be sampled as long as it is at least 30m across the short axis and long enough to add the difference onto the long axis (for example 30m wide x 90m long, and could be longer on one end of the long axis than the other). There will always be 4 transects established and vegetation tallies will always occur at one meter intervals along those transects. A five meter reserved area at plot center will always remain reserved (i.e. no plant sampling is to occur within this area).

In all cases, taxonomic identification at the species level (preferred) or genus level (if species identification is not possible) will be achieved through the use of Regional Field Guides, technical keys, and reference to regional herbaria housed at research universities such as the Harvard University Herbarium or the University of Massachusetts Herbarium. In addition, other recognized experts within state government, private non-profits, and University settings are available to assist with the identification of difficult or unusual specimens. The physical collection of samples of vegetation will be limited to those species that cannot be identified in the field, and labeled in the field with a unique ID (e.g., "unknown sedge #1") site location, date, and person who collected the sample (Note tags that will be attached to samples in Appendix D). All wetland plants shall be identified in accordance with the USDA Plants Database (http://plants.usda.gov/java/) nomenclature.

3.2.3. Safety Considerations

All staff will be advised that they must follow the safety rules listed below.

- Fieldwork will not be conducted during flooding events or unsafe conditions such as electrical storms or high wind events.
- Special attention shall be given to Department of Public Health warnings and outbreak locations for West Nile Virus and Eastern Equine Encephalitis (EEE).
- Notice shall be given to the Project Manager as to locations and time of field work to be conducted and participating personnel. Practice "safety first."
- If there is no safe access to a site, the site assessment will be abandoned. Any decision to abandon a site must be reported to the Project Manager. Safety concerns for abandoning the site will be detailed in such report.
- Flagging tape will be used to mark access point locations for safe exit, in instances where such locations could be difficult to find as deemed appropriate by field crew.
- Good judgment will be used in selecting clothes and personal protection items. Common items needed include: high visible safety vests, extra clothing, sunshade,

sunscreen, hats, insect repellent, and waterproof knee boots— or chest waders with appropriate restriction waist belt or quick release hip waders for highest anticipated depths. Any staff not dressed appropriately for field work should not participate in the site assessments. Proper footwear is a must (e.g., no "flip-flops" for field work).

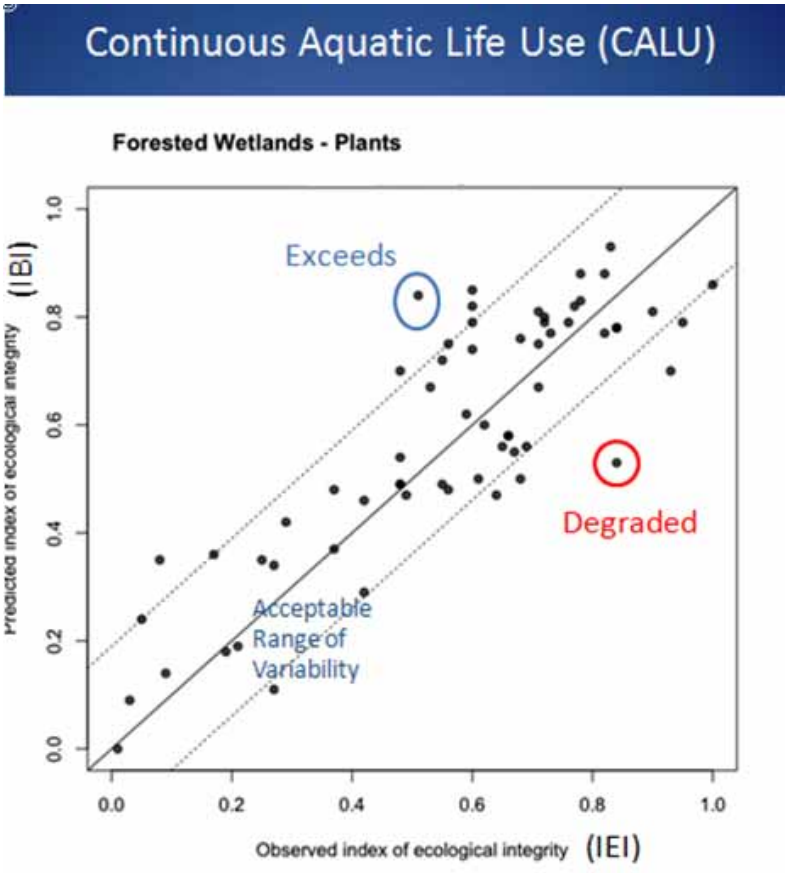
- Good judgment will be used in walking within wetlands; ditches/streams will be circumvented, or when deemed possible, crossed with caution.
- A safety equipment shall accompany all site visits and shall contain, at a minimum, the following items:
    - First aid kit
    - Insect repellant
- All personal and field equipment shall be cleaned and decontaminated upon exiting the wetland and before entering a new area to prevent the spread of invasive species.
- Personal clothing checks shall be conducted for deer & dog ticks.

3.2.4. Data Analysis

IBI & CALU

MassDEP staff will work with UMass-Amherst staff to develop IBI values based on the data collected in the field. At the time of this writing, UMass is developing software that will allow us to develop these IBI values so that they can be used for assessment. We expect that the software will be available by the end of 2014 and MassDEP will be trained to use it for this study. The sampled site's biological condition within its landscape context will be assessed relative to the lines on the Continuous Aquatic Life Use (CALU) figures similar to the one shown below, and relative to the CAPS IEI and individual metric values for that site and for the surrounding area. In conducting the CALU assessment, sites that fall between the dotted lines (acceptable range of variability) would meet the predicted biological condition; those falling above the highest dotted line would exceed the predicted biological condition; and sites falling below the lowest dotted line would be flagged as not meeting the predicted biological condition.

Those sites that meet or exceed the biological condition would be presumed to be performing at the ecological level that is expected given their landscape position. Sites that fall below the predicted level would be flagged for further evaluation to identify potential regulatory or best management practices that could address the reasons why the site is not meeting its predicted level. Once a CALU value has been developed, the IEI value and the values for the individual metrics will be used along with the CALU value to develop a comprehensive assessment for each wetland area.



Sites that have been deemed as not meeting their predicted condition could then be targeted for further investigation to determine which stressors may be contributing to the impairment of the associated water body. It should be noted that the stressors that are contributing to the degradation of a given site may not be ones modeled by CAPS (i.e. the site is being impacted by something that CAPS doesn't consider) The CAPS scenario builder software tool will be used to develop strategies for improving wetland condition however, some site based remediation opportunities may be too small for the CAPS scenario builder tool to be useful. Appropriate remedial strategies identified will also be reported along with the results of the sampling in the Integrated Waters Report.

4.0 Deliverables and Schedule

Table 4.1 Anticipated Schedules for Implementation

Project Tasks	Start/End (mo/yr)
Prepare QAPP	March 2014-June2014
Identify wetland Assessment Sites	April2014-May 2014

Obtain Landowner Permission	April 2014-June 2014
Conduct site visits for50 assessment sites	July 2014-October 2014
Data Analyses for assessment Sites	October 2014-April 2015
Prepare Report	December 2015

5.0 Quality Objectives and Criteria

5.1 Objectives and Criteria

QA/QC is laid out in the assessment sampling protocol as a system of audits, standard procedures, and training for each section of the data collection and management plan. These activities and procedures begin with the assessment protocol conceptualizations, where the data requirements are determined, and continue throughout all phases of the project to ensure that data quality meets those standards. Quality assurance is overseen by the Project Manager.

Along with proper methodologies, confidence in the quality of the data is critical in the subsequent assessment protocol development stages as well as during assessment protocol application. Therefore, quality assurance procedures must be incorporated into the assessment protocol and used in a reliable and consistent manner to provide reproducible data with known statistical properties. In addition to the standardized sampling, measurement, and data handling procedures listed above, the assessment protocol includes a statement of data quality standards and methods for: 1) training, 2) internal data audits, and 3) external data audits for which the Project Manager is responsible for coordinating.

Before quality assurance methods to maintain data quality standards can be developed, the quality standards must be determined. Terms used to express data quality standards and examples of the QA/QC used to assure those standards are given below (Sherman et al. 1991):

1) *Precision* - is a measure of mutual agreement among individual measurements of the same variable, usually under prescribed similar conditions. Data precision of the assessment protocol can be checked through the use of replicate field measurements and standard procedures.

2) *Accuracy* - is the degree to which a measurement reflects the true or accepted value of the measured parameter. It is a measure of the bias in a system. Accuracy depends on the technique used to measure a parameter and the care with which it is executed.

Standard procedures and QA audits are used to maintain data accuracy.

3) *Completeness* - is a measure of the amount of valid data actually obtained compared with the amount that was expected to be obtained under normal conditions. Ideally, 100% of the data should be collected. Data may be incomplete due to incomplete data collection, lost or damaged data forms, or errors in data transcription.

4) *Representativeness* - expresses the degree to which data accurately and precisely represent a characteristic of the parameter measured. Representativeness is established by proper site selection and appropriate spatial arrangement of sampling areas (i.e. site selection stratified by frequency distribution of selected metrics).

5) *Comparability* - expresses the confidence with which one data set can be compared to another. Collection of data by different investigators is the primary cause of variability in the data. Standardized procedures, internal QA audits, and training minimize variability in the data. Field testing of the assessment models will be used to determine the level of comparability achieved.

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Table 5.1 Data Quality Objectives

Parameter	Units	Expected Range	Accuracy (+/-)	Precision
Establishment of Assessment area wetland Plot	Square meters	2544-3108 square meters	+/- 10 %	95% agreement on actual measurements among separate observers
Vegetation assessment	Species presence (or genus if species ID is not possible);	50-3000 individual plant species	95% accuracy of identification at the species level; 100% agreement at the genus level. External expertise is available in the event that unfamiliar taxa are encountered ;	100% agreement on presence/absence among separate observers.
Location of plot center	meters	na	+/- 5 meters	+/- 5 meters

5.2 Documents and Records

The most current approved version of the QA Project Plan will be provided to the appropriate personnel by the Project Manager. All data collected will be maintained on a protected and backed up drive at the Boston Office of MassDEP, 1 Winter Street, Boston. The QAPPs will be dated to distinguish among different versions in case there are revisions made over the course of the project. The Project Manager will maintain all reports of the project status, including any problems and the proposed recommended solutions. The Final report will be provided in electronic form to everyone on the distribution list. Hard and soft copies of reports, as well as all electronic data records, will be maintained at MassDEP and made available upon request. In accordance with the Massachusetts Statewide Records Retention Schedule 02-11 (Section 14.8 Environmental Monitoring and Inspection Records) all data will be kept for a minimum of 15 years.

6.0 Data Generation and Acquisition

6.1 Data Collection

The data to be collected is described in the following table:

Table 6.1 Data Collection

Data	Method	Units	Sample Data Records[2]	Method Sample Preservative	Minimum Holding Time
Plant Community	Species presence (or genus if species ID is not possible);	Individual tally	Microsoft Office Excel 2007	NA	NA
Plot Center	Trimble Yuma 2 GPS Unit	State Plane Meters	ArcGIS Software Suite	NA	NA

6.2 Data Handling and Custody

All data will be downloaded immediately upon returning to the office. It will be downloaded to a master copy that is stored on protected and backed up drive at MassDEP. Two separate

[2] Note that the only data that will be taken from the field is if a sample plant specimen cannot be identified. The specimen will be identified in the office as quickly as possible and then discarded. All other plant data collection is by observation and recording in the field only.

Backup copies will be made, stored on a separate drive in the office and the other on a flash drive for offsite storage.

6.3 Quality Control

Quality Control will be maintained throughout the project through the following measures.

- Development of comprehensive field data collection methodologies discussed above in section 3.2.2. Note that Section 3.2.2 was developed as part of a previously approved QAPP.[3] Specifications provide for completeness and comparability of the data that is gathered. (completeness, comparability)
- Computer aided use of stratified random sampling procedures for site selection discussed above in section 3.2.1 provides for representative sample selection and accuracy of site locations on the landscape.
- Use of standardized field data collection procedures, such as transect establishment, point intercept methodology and time-constrained sampling provide for precision, accuracy, and repeatability.
- Prompt review and documentation of any changes to the SOPs will address precision, accuracy, and comparability.
- All field scientists have at least 10 years of experience in wetland evaluations. The use of highly qualified field scientists provide for precision, accuracy and comparability of data.
- Rigorous training, in both structured and informal settings, of all team members provides for precision, accuracy, and comparability.
- External validation of taxonomic identification for taxa with which the field crew has had limited prior experience (100% of samples) provides for accuracy and precision;
- Daily checks by field staff and periodic checks by the Project Manager to ensure that data forms are completely filled out, all data will be rechecked by the field scientist when they are entered into the final database (completeness).

It is important to maintain consistency in data collection and handling methods throughout the effort. It is not uncommon for methods to change as new situations arise and must be incorporated into the data set. The Project Manager is responsible for periodically inspecting the methods used and inconsistencies will be documented and if possible, corrected. Any significant changes will be made in coordination with EPA. If corrections are not possible, documentation will be included with the reference data for interpretation during subsequent analyses.

6.4 Instrument/Equipment Testing, Inspection, and Maintenance

Table 6.2 Instrument/Equipment Calibration, Inspection, Testing and Maintenance.

Equipment	Calibration	Inspection/testing	Maintenance
Trimble Yuma 2	As per manufacturer's specs	As per manufacturer's specs	As per manufacturer's specs

[3] See Forested Wetland Quality Assurance Project Plan
http://www.mass.gov/eea/agencies/massdep/water/watersheds/quality-assurance-project-plans-qapps.html

7.0 Assessment and Oversight

Reports to Management

The Project Manager will save and document all reports of the project status, including any problems and the proposed recommended solutions. Any deviations to the QAPP will be reported.

8.0 Data Validation and Usability

Data Review, Verification, and Validation

All data will be reviewed by the Project Manager to determine if the data meets QAPP objectives. Data will be reviewed, prior to being entered, in order to ensure completeness. The Project Manager will make the ultimate decisions to reject or qualify data.

Reconciliation with User Requirements

It is not uncommon for methods to change as new situations arise and must be incorporated into the data set. The data and methods will be periodically inspected for inconsistencies or user conflicts and will be documented and if possible, corrected. If corrections are not possible, documentation will be included for interpretation during subsequent analyses. If enough data are collected such that the final report can be written, then the project objectives will have been met and the project considered complete. If this is not the case, then the Project Manager will determine what additional information will be necessary to complete this project.

APPENDIX A
LANDOWNER LETTER

[Landowner Address] [Date]

Dear [Landowner]

The Massachusetts Department of Environmental Protection (MassDEP) Wetland Program will be conducting a field assessment of wetlands in the Chicopee River watershed during the summer of 2014. Our goal is to document the ecological integrity of forested wetlands in order to assess wetland health within Massachusetts as required by the Federal Clean Water Act. We have created a random sample of wetland areas, and one of those random wetland areas occurs on your property at [Site location]. Therefore, we are requesting your permission to enter onto your property in order to view the wetland.

The site visit will be conducted by two trained MassDEP field scientists and they will have MassDEP identification on them at all times. The assessment will likely take 1-2 hours and will involve documenting the plants that are present within a 30-meter radius plot. There will be no disturbance to the land. You do not need to be present during the visit (though you are welcome if you wish). Please be assured that any follow-up reporting to EPA on the data collected will not include property owner names and addresses.

We are scheduling this field work between June and October of 2014 and would appreciate it if you would sign the enclosed copy of this letter and mail it back to us in the enclosed stamped envelope. If you would prefer to call or email, you may contact Principal Investigator Michael McHugh at 617.556.1163 Michael.McHugh@Massmail.state.ma.us or myself at (617)292-5512 Lisa.Rhodes@Massmail.state.ma.us. If we don't hear from you, it is likely that one of our staff scientists will give you a call to follow up. MassDEP appreciates your assistance with this important work.

Sincerely,

Lisa Rhodes, Project Manager
Wetland Monitoring & Assessment Program

Appendix B Equipment

Trimble YUMA 2 Specification sheet: http://trimblemcs.com/downloads/Yuma-2_datasheet_Rev-B_English.pdf

Trimble YUMA 2 User's Guide: http://www.tiendagps.com.mx/sites/all/files/TrimbleYuma_OWM.pdf

Appendix C Site Forms

PLOT DIAGRAM

SITE ID:	**LOCATION:**	
DATE:	**STAFF:**	LATITUDE/LONGITUDE

Include the following: Number of transects; transect length; transect azimuth; and general location of plot within wetland.

N

COMMENTS:

SITE DATA FORM

DATE:	STAFF:	LOCATION:
SITE ID NUMBER:		

TRANSECT (degrees)	Plant: Genus and species	Tally Points 1-5	Tally Points 6-10	Tally Points 11-15	Tally Points 16-20	Tally Points 21-25	Sum of Tally
	Acer rubrum						
	Quercus rubra						
	Betula alleghienesis						
	Fraxinus pennsylvanica						
	Populus tremula						
	Carya ovata						
	Pinus strobus						
	Tsuga canadensis						
	Carpinus caroliniana						
	Vaccinium corymbosum						
	Clethra alnifolia						
	Physocarpus opulifolius						
	Rhamnus frangula						
	Sambucus canadensis						
	Ilex verticallata						
	Euonymus alata						
	Corylus americana						
	Toxicodendron radicans						
	Celastrus orbiculata						
	Rubus hispidus						
	Circuta maculata						
	Trientalis borealis						
	Mitchella repens						
	Maianthemum canadense						
	Cinna latifolia						
	Circea quadrifolia						
	Symplocarpus foetidus						
	Osmunda regalis						
	Osmunda cinnomomea						
	Onoclea sensibilis						
	Thelypteris thelypteroides						
	Carex stricta						
	Carex laxiflora						
	Carex folliculata						

Note: The data will be collected electronically using the Trimble YUMA 2 (or other comparable

unit), and not in hard copy format. If the electronic device is not available, the data could be collected in hard copy form. The data that will be collected is shown above. The plot diagram and general information will be uploaded in the format of a shapefile that can be viewed in ArcGIS. The plant data will be uploaded in the form of an excel spreadsheet.

Appendix D Plant Sample Tags

PLANT SAMPLE TAG	
DATE:	SITE ID:
SAMPLE ID:	Collector ID:
COMMENTS:	

PLANT SAMPLE TAG	
DATE:	SITE ID:
SAMPLE ID:	Collector ID:
COMMENTS:	

PLANT SAMPLE TAG	
DATE:	SITE ID:
SAMPLE ID:	Collector ID:
COMMENTS:	

PLANT SAMPLE TAG	
DATE:	SITE ID:
SAMPLE ID:	Collector ID:
COMMENTS:	

PLANT SAMPLE TAG	
DATE:	SITE ID:
SAMPLE ID:	Collector ID:

COMMENTS:

PLANT SAMPLE TAG	
DATE:	SITE ID:
SAMPLE ID:	Collector ID:
COMMENTS:	

PLANT SAMPLE TAG	
DATE:	SITE ID:
SAMPLE ID:	Collector ID:
COMMENTS:	

PLANT SAMPLE TAG	
DATE:	SITE ID:
SAMPLE ID:	Collector ID:
COMMENTS:	