

## Attachment C: Additional Information on Wetland Assessment Protocols

Table C1. Wetland Assessment Protocols								
Name	Rapid	Region	Type	Condition/ Impacts	Function	Social	Restore	Source
Avian Richness Evaluation Model	○	◐	○	●	H	◐	●	(Adamus, 1993). AREM measures avian richness, habitat suitability, and species composition of lowland wetlands of Colorado Plateau region. Habitat scores for each species based on indicators. Potential social values used to weight scores. Uses a computer model.
DE Method <sup>1</sup>	●	○	●	●	Hy, WQ, H, S	○	?	(Jacobs, in progress) Assess condition of tidal and nontidal wetlands in DE based on the presence or absence of stressors; rapid and easy to use; overall score determines condition for each HGM subclass evaluated.
Descriptive Approach/ Highway Method	●	◐	●	◐	Hy, WQ, H, S, G	●	○	(USACE, 1995). Designed for highway and roadway projects; a qualitative approach developed by regulators that uses a multidisciplinary team to evaluate proposed impacts on 13 wetland functions and values. Applied in ME, MA, and CT
Evaluation Planned Wetlands	●	●	●	◐	Hy, WQ, H, S	●	●	(Bartoldus et al., 1994). EPW evaluates functional capacity for 6 functions with individual and overall functional scores. Used to compare wetland types
FL Wetland Quality Index	○	○	○	○	○	?	●	(Lodge et al. 1995). (FWQI) Developed to evaluate freshwater wetlands mitigation sites using 17 indicators. Not applicable for natural wetlands. Overall score generated by summing weighted indicator scores divided by total possible points.
FL Wetland Rapid Assessment Procedure <sup>1</sup>	◐	○	◐	●	H	○	●	(Miller et al. 1999). (WRAP) Regulatory tool designed for evaluating non-tidal mitigation projects with a habitat emphasis (based on HEP). 6 variables assessed with several indicators scored between 0-3. Overall score for site is sum of variable scores/total possible points. Limited to same-system comparisons.
Habitat Assessment Technique	●/○	●	●	◐	H, B	●	○	(Cable et al. 1989). (HAT). Direct survey of bird species (diversity and uniqueness) to determine breeding habitat. Most useful in states with extensive inventory on breeding birds.
Habitat Evaluation Procedures	○	●	●	●	H	○	●	(USFWS, 1980). (HEP) Widely used since 1970's but requires a lot of effort. Measure of habitat structural features to derive habitat suitability score for at least 5 indicator species. Sum of scores is multiplied by overall acreage. Should use regional models.

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HGM Approach	●/○	●	●	●	●	●	●	(Smith et al. 1995).. How to practically apply Brinson 1993 HGM. Regional models currently being developed for many wetland types
Hollands/ Magee Method	●	●	○	●	Hy, WQ, H, S, G	●		(Hollands and Magee, 1985). Non-tidal wetlands in Northeast & Midwest. Series of multiple choice questions related to 10 wetland functions/values giving each functional indicator a numerical score. Overall score derived from weighted function scores compared to other wetlands.
Index of Biological Integrity (IBI)	●/○	●	●	●	B	○	○	(Karr 1999 and Danielson 1998). Under development in a number of states including MN, OH, and ND (Danielson 1998). Data is collected from each site and analyzed to determine the reference standard for each metric. An index of biological integrity (IBI) is calculated from scored metrics for each site.
Interim HGM	●/○	●	●	●	●	●	●	(NRCS 1998). Measure of functional capacity of a site relative to wetlands from the same regional wetland subclass. Used by NRCS to assess wetland functions when addressing a minimal effect or mitigation request under the 1996 Farm Bill. When the models are developed into approved HGM Approach models (e.g., calibrated using reference wetlands), then they may also be used in the 404 Regulatory Program.
Larson/Golet method	○	●	●	○	Hy, WQ, H, G	●	○	(Larson, 1976). The first rapid assessment method and is basis for newer methods. It assesses wildlife, groundwater potential, and visual-cultural values for freshwater wetlands in the Northeast. Comparative numerical ranking of a series of wetlands with scores for each value. Extensively used in RI and MA
MD Dept of Env. Method	○	○	●	○	Hy, WQ, H, S, G	●	○	(Fugro East, Inc 1995). (MDE) Not rapid, assesses 6 functions and includes opportunity/social metrics using HGM-light approach. Stressors and landscape features not considered. Specific for non-tidal, palustrine vegetated wetlands.
MA Coastal Zone Mngmt Method <sup>1</sup>	●	○	●	●	H	○	?	(Hicks and Carlisle, 1998). Based on 5 landscape indicators and 8 wetland quality indicators (indicators scored 0-6) with separate versions for freshwater wetlands and salt marshes. Total score calculated from sum of all indicators divided by total points possible. Rapid field, with some desktop tasks.
MN Routine Assessment Method	●	○	●	●	Hy, WQ, H, S, G	●	●	(MN Board of Water & Soils Resources, 2003). (MNRAM) Scores 12 functions based on 72 questions (high to low or yes/no) and includes social values. Each function is rated low to exceptional based on scores. Additional evaluation for restoration potential, sensitivity to development, and stormwater treatment needs. No overall score, includes computer program.

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MT Wetland Assessment Method <sup>1</sup>	●	○	◐	●	Hy, WQ, H, S, G	◐	●	(Berglund 1999).. Regulatory method to evaluate sites where proposed impacts may occur. Evaluates 12 functions and places sites into regulatory categories based on uniqueness or high value, disturbance and replacement potential.
NH Coastal Method	○	○	○	○	Hy, WQ, H, S	●	○	(Cook et al., 1993). Assesses 9 functions and has a good list of rapid indicators, particularly for social values. Good example of how to adapt non-tidal method to a tidal system. No overall score per site.
NH/CT Method	○	○	◐	○	Hy, WQ, H, S, G	●	●	(Ammann and Stone, 1991) Numerical scoring for 14 functions and values in non-tidal wetlands
NJ Freshwater Wetland Mitigation Quality Assess.	○	●	○	●	Hy, WQ, H	○	●	(NJDEP, 2001). WMQA. Based on WRAP, this procedure was developed to evaluate ability of a mitigation wetland to function as a natural wetland over time. Intended as an information tool rather than regulatory. Assesses 6 wetland functions
OH Rapid Assessment Method <sup>1</sup>	●	○	◐	●	○	●	?	(Mack, 2001). (ORAM) Used for regulatory and condition assessment purposes. Easy to use and provides overall quality rating based on 6 metrics (presence or absence of disturbance indicators and ecological condition). Used to place wetlands into three management categories. Method includes some value added measurements.
OR Freshwater Wetlands Method	○	○	◐	○	Hy, WQ, H	●	○	(Roth et al. 1996). OFWAM , primarily an in-office assessment for use in local planning at landscape level. Evaluates 9 functions (including value-added indicators) and assigns broad categories of performance.
Penn State Stressor Checklist <sup>1</sup>	●	○	◐	●	○	○	○	(Brooks et al. 2002) Tabulates number of stressors present and accounts for ameliorating effects of buffer. Weights all stressors the same, but overall score lowered if buffer is impaired (outfalls or encroachment). Requires landscape analysis prior to fieldwork.
Rapid Assessment Procedure	●/○	◐	○	●	Hy, WQ, H, G	●	●	(Magee, 1998). 8 functions based on HGM classes for depressional wetlands in the glaciated northeast and midwest. It also serves as a template and provides a step-by-step process for developing rapid assessment procedures for various regions of the continental US.
VA Institute of Marine Science Method	○	○	○	○	Hy, WQ, H, S	●	○	(Bradshaw 1991) (VIMS) assesses non-tidal coastal plain wetlands (mostly streams) for opportunity to perform seven functions (there is an extensive mapping component). Each function evaluated by set of factors ranked high-low, weighs heavily on measures of opportunity/social. No overall score

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WA state wetland rating system (eastern and western)	●	○	○	○	○	●	?	(WA Dept of Ecology, 1993). Regulatory method designed to evaluate wetlands based on sensitivity to disturbance, rarity, irreplaceability, and functions provided. Sites categorized into 4 regulatory classes based on series of yes/no and categorical answers. Eastern method classifies wetlands into 4 categories based on function or opportunity (evaluates those of a certain HGM type) and then narrows to 3 categories based on special characteristics.
WA Wetland Function Assessment	●/○	○	○	●	Hy, WQ, H, S, G	○	●	(Hruby et al., 1998). Measures potential for recharge, removing sediments and nutrients, and provides measures of habitat suitability for a variety of wetland species.
Wetland Evaluation Technique	○	●	●	●	Hy, WQ, H, S, G	●	○	(Adamus, 1987 1991). (WET) Basis for many state methods. 11 functions, habitat suitability for birds and fish, and social significance. Yes/no for 80 questions resulting in high-low ratings for social significance, and effectiveness for each function. No overall site score. A version specifically for bottomland hardwoods of the Southeast exists.
WETThings.	●	◐	●	●	H,	○	●	(Whitlock et al 1995). A series of models for predicting the presence of habitat for specific species of wetland-dependent amphibians, reptiles, and mammals in New England.
Wetland Value Assessment Method	●	○	○	●	H	○	●	(EWG 1998; LDNR 1994). WVA Based on HEP, but modified to be rapid, is community based, rather than species oriented, and targets LA coastal wetlands
WI Rapid Assessment Method	◐	○	◐	○	Hy, WQ, H, S, G	●	○	(WI Dept of Nat. Resources 1992). (WIRAM) Scores 8 functions and values for non-tidal wetlands in WI based on yes/no presence of indicators. Low-exceptional categories based on professional judgment for each function. Special features and red flags also identified; no overall score.

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<p>Table derived from information presented by Bartoldus (2000); Fennessey et al., (2004), WWF (1992), and Hatfield et al., (2004).</p> <p><sup>1</sup>Methods recommended by Fennessey et al., (2004) based on four criteria: rapid; measures condition (social values not included); on-site assessment; and is verifiable.</p> <p><b>Rapid:</b> ● ≤1/2 day; ½ ≤1 day; ○ &gt;1 day; ●/○ rapid only if models exist already</p> <p><b>Region</b> (applied): ● Nation-wide application; ½ regionally restricted; ○ application to specific state or area within a state</p> <p><b>Type</b> (of wetland): ● can be used on all wetland types; ½ limited; ○ single type</p> <p><b>Condition/Impacts:</b> ● Measures condition or assesses relative level of impact; ½ If you include social values, then could be used as impact analysis; ○ Does not measure condition or impact analysis</p> <p><b>Function:</b> Measures specific functions related to Water Quality, Habitat, Hydrology, Shoreline/Sediment Stabilization, Groundwater, or Biological Condition), ● varies based on region/type, ○ unknown or no functional score</p> <p><b>Social:</b> ● Includes values (education, recreation) as “function”; ½ social values used to group sites (high-low)</p> <p><b>Restore:</b> ● Method used to measure restoration potential, design, or assess mitigation site compliance</p>								

<b>Table C2. Methods for Remote Wetland Assessment</b>	
Source	Description
Abbruzzese et al., 1990	<b>Synoptic Approach</b> by EPA; using mapping to address water quality, life support, and hydrologic wetland functions to rank watersheds or other landscape units
Bradshaw, 1991*	<b>VA Institute of Marine Science Method (VIMS)</b> assesses non-tidal coastal plain wetlands for opportunity to perform seven functions using desktop and mapping analysis (there is also a minor field component). Each function evaluated by set of factors ranked high-low, with guidance on rating each function high-low. No overall score
Brooks et al., 2004	Recommended for state and local agencies using GIS for first cut at assessing wetland condition. Described method based on use in seven PA watersheds using synoptic land cover maps.
Brown et al., 1993	Method for identifying potential wetland mitigation sites using GIS
Gwin et al., 1999	Extensive field visit to 96 wetlands to assign HGM/ establish wetland profiles in Portland, OR
Larson et al., 1998	Watershed level assessment of wetland function, condition, and sensitivity for New England.
Mazzarella (no date)	<b>EPA Region III.</b> Three-tiered approach to using geospatial information to strategically target wetland restoration opportunities. First tier at HUC-8 level looking at historic wetland locc, 303(d), and % land use. Second tier looks at soils, topo, and land use. Third tier focuses on likelihood of wetland to provide water quality function based on surrounding landscape/position.
Roth et al., 1996*	<b>OR Freshwater Wetlands Method (OFWAM).</b> Primarily an in-office assessment for use in local planning at landscape level. Evaluates 9 functions (including value-added indicators) and assigns broad categories of performance.
Spivey and Ainslie (no date)	Assigning HGM in several southeastern watersheds using GIS
Stallman et al., 2005	Baldwin County, AL using GIS to assign HGM functions and rank potential sites for restoration, enhancement, and conservation
Sutter and Wuenscher, 1996	<b>NC Coastal Region Evaluation of Wetland Significance (NC-CREWS).</b> Evaluates 11 functions using GIS analysis. A High, Medium, or Low rating is assigned to each of 39 parameters that describe the landscape and internal wetland characteristics. The parameter ratings are successively combined to produce ratings (H, M, or L) for sub and primary functions. The primary function ratings are combined to form an overall rating of the wetlands ecological significance (i.e., beneficial significance, substantial significance, or exceptional significance).
Tiner et al., 2000; Tiner, 2003a; Tiner, 2003b; Tiner, 2005	Using GIS to add HGM factors to revised NWI; preliminary functions to current & historic wetlands in Nanticoke watershed, MD
Zampella et al., 1994	<b>NJ Watershed Method for the NJ Pinelands.</b> To assess watershed/wetland integrity and potential impacts by using a GIS and watershed-level landscape approach; delineate drainage areas (units) and calculates the following for each: final watershed integrity score (WIS) and final drainage unit's potential impact score (PIS).
* Also includes a field component, but primarily desktop analysis	

<b>Table C3. Volunteer Based Wetland Assessment Methods</b>	
<b>Source</b>	<b>Assessment Description</b>
Bryan et al. 1997	<b>ME Tidal Method</b> from Maine Citizens guide to tidal wetland evaluation and restoration
USEPA, 2002	<b>EPA Methods for Evaluating Wetland Condition:</b> Describes various methods/programs for volunteer wetland biomonitoring.
Firehock et al. 1998	<b>Isaac Walton League.</b> Wetland monitoring methods for volunteers groups with 3 levels of assessment for evaluating soils, water quality, and biological communities (plants, fish, bugs, birds, and amphibians and mammals)
Longpoint Observatory 1997	Freshwater marsh monitoring program in great Lakes area, used only for birds, amphibians, and habitats
Purinton and Mountain 1996	Volunteer guide developed in MA for assessing flow restrictions in tidal wetlands
James et al 1996	Methods manual for training volunteers on wetland monitoring in Pacific Northwest; based on Magee method for Portland, OR

