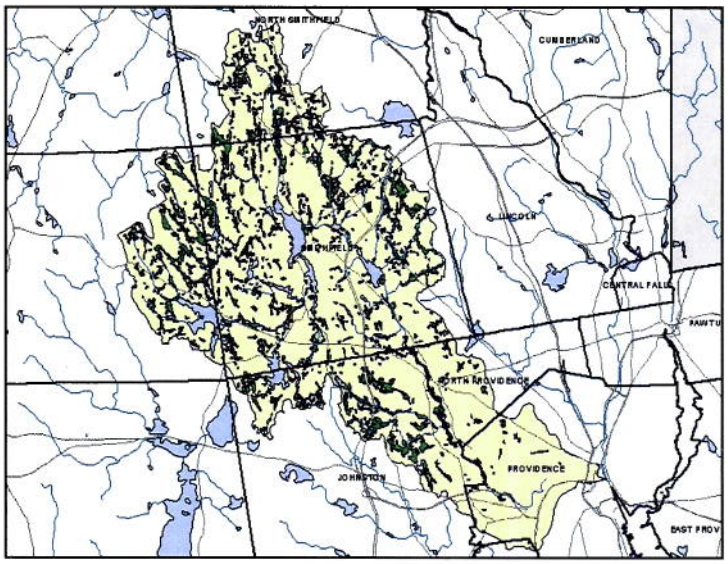
FRESHWATER WETLAND MONITORING AND ASSESSMENT

RAPID ASSESSMENT OF WETLAND CONDITION

Testing existing RAM's in Rhode Island
Year 1 – 2006



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INTRODUCTION

Rhode Island Freshwater Wetland Monitoring and Assessment Plan

The Rhode Island DEM Office of Water Resources, with funding from EPA, and with technical assistance from NEIWPCC, initiated a new effort to monitor and assess the ecological condition of freshwater wetlands in Rhode Island. The goal of wetland monitoring and assessment in Rhode Island is to improve wetland protection and management by understanding the cumulative impacts of human activities on wetland condition. Working with wetland staff and partners in the state, the Rhode Island Freshwater Wetland Monitoring and Assessment Plan (NEIWPCC and DEM, 2006) was developed, which details a multi-level approach to wetland monitoring, and outlines the following short and long-term objectives:

Short-term objectives

- Prioritize wetlands (and adjacent upland habitat) for protection through open space acquisition and other land protection mechanisms.

- Develop and implement methods for monitoring impacts to wetlands due to water withdrawals.
- Monitor and assess impacts to wetlands due to loss and degradation of adjacent upland habitats (buffer zones).
- Monitor location and extent to which invasive species are present and affecting wetland condition.

Long-term objectives

- Develop a database of information necessary to evaluate trends in wetland condition.
- Identify causes and sources of wetland degradation including cumulative impacts to wetlands.
- Identify program and policy changes needed to improve overall wetland condition statewide.
- Evaluate the effectiveness of wetland management and protection programs with respect to wetland condition.

With continued grant funding from EPA, a workplan was developed to begin projects in the first year of monitoring development, including selection and testing of existing Rapid Assessment Methods (RAMs) in Rhode Island, which is the focus of this report.

Rapid Assessment Methods for Evaluating Wetland Condition

Rapid assessments are field-based monitoring tools that provide information about wetland function or condition in a relatively short period of time. Conditional assessment tools are based on indicators that are derived from an understanding of the processes that create, maintain and degrade wetlands in the landscape (Fennessey, et al. 2004). The universal features of wetlands - hydrology, hydric soils, and the resulting biotic communities, particularly hydrophytic vegetation - are the basic foundations of assessment methods. Indicators of wetland condition can be based on the response of the wetland to stressors (e.g., the percent cover of invasive species), or on the stressors themselves (e.g., hydrologic modification), or both (Fennessey, et al. 2004).

Many states have developed rapid assessment methods for a variety of purposes including regulatory requirements, the evaluation of best management practices, assessment of ambient wetland condition on a watershed basis, and determination of mitigation project success. These methods have been shown to be sensitive tools to assess anthropogenic impacts to wetland ecosystems, and are important components of monitoring programs (Fennessey, et al. 2004).

In their report, "Review of Rapid Methods for Assessing Wetland Condition," Fennessy, et al. (2004) evaluated several existing methods. The criteria they used to evaluate the methods included the following:

a. The method can be used to measure wetland condition;
b. The method should be rapid;
c. The method should involve an on-site assessment; and
d. Results of the method can be verified.

Several methods reviewed in Fennessey, et al. (2004), were noted for meeting the above criteria. Given that these methods have proven effective in other states, and that resources are limited in Rhode Island, it was recommended in the monitoring plan that RI DEM test a few existing methods in the early phases of their state wetland monitoring.

METHODS

Selection of Existing Methods: Ohio Rapid Assessment Method (ORAM) and Delaware Rapid Assessment Protocol (DERAP)

During the development of the monitoring and assessment plan, DEM identified several protocols employed in other states that were of interest to Rhode Island. Relying heavily on the review of rapid assessments by Fennesey, et al. (2004), and consulting with EPA and with other states, Rhode Island selected the Ohio Rapid Assessment Method (ORAM) and the Delaware Rapid Assessment Protocol (DERAP) to test in freshwater wetlands in the State. Rhode Island wetland partners were briefed in a meeting in July 2006. Partner's questions and comments about the methods were considered during this assessment.

Ohio Rapid Assessment Method (ORAM)

Early development of ORAM began in 1996 as a tool used primarily to support Ohio's wetland permitting program. In the method, several metrics are evaluated, qualitatively or semi-quantitatively, to determine an overall assessment of wetland condition and value. Assessment metrics include those related to wetland size, buffer size and quality, surrounding land use, hydrology, substrate, habitat, plant communities, stressors to the wetland, and special wetland characteristics, such as the presence of rare plant communities or species (Table 1). This method has been used for many years in Ohio and has been revised and validated from detailed research studies of vegetation, amphibians, and other wetland biotic communities in Ohio. Although the primary use of the method is to support Ohio's wetland regulatory program, it is also being tested in Ohio, as well as in other states, to assess watershed based ambient condition of wetlands (J. Mack, pers. comm. 2006).

Table 1. ORAM Metrics (2001).

Metric Number	Title	Submetric
1	Wetland Size	• None
2	Upland Buffers and Surrounding Land Use	• Average Buffer Width • Surrounding Land Use
3	Hydrology	• Sources of Water • Connectivity • Maximum Water Depth • Duration of Inundation or Saturation • Modifications to Natural Hydrologic Regime
4	Habitat Alteration and Development	• Substrate Disturbance • Habitat Development • Habitat Alteration
5	Special Wetland Communities	• None
6	Vegetation Interspersion, Microtopography	• Wetland Vegetation Communities • Horizontal Community Interspersion • Presence of Invasives • Microtopography

Delaware Rapid Assessment Protocol (DERAP)

DERAP is used in Delaware as a non-regulatory tool to assess wetland condition on a watershed basis and to help identify potential restoration sites (A. Jacobs, pers. comm. 2006). The method evaluates wetland condition on a watershed level based on the presence or absence of stressors, using a checklist format. The list of wetland stressors was modified and updated for Delaware from the stressor checklist originally developed at the Penn State Cooperative Wetlands Research Center (A. Jacobs, pers. comm. 2006). The checklist is organized into three categories including stressors) to the habitat and plant community, 2) to wetland hydrology, and 3) stressors in the buffer zone (100 meters) surrounding the site (Table 2). To more accurately determine the condition of the assessed wetland area, a weighting system was developed for certain stressors on the list based on more detailed (tier 3) studies of the impacts of stressors to wetland condition (A. Jacobs, pers. comm. 2006). This list is still being revised and updated as new data are gathered.

Table 2. DERAP Stressor Checklist (2006).

1) Habitat/Plant Community Stressors	2) Hydrology Stressors	3) Buffer (100m) Stressors
• Mowing • Farmed • Grazing • Forest Harvesting • Excessive Herbivory • Presence of Invasive Species • Chemical Defoliation • Managed or Converted to Pine • Burned • Trails • Garbage/Isolated Dumping • Increased Nutrient • Road • Other	• Ditching • Channelized Stream • Stream Incision • Weir/Dam/Road • Stormwater Inputs • Point Source (non-stormwater) • Filling, Excavation • Microtopography • Excessive Sedimentation • Soil Subsidence/Root Exposure • Tidal Restriction • Other	• Development – Density • Sewage Disposal • Roads • Landfill/Waste Disposal • Channelized Streams or Ditches • Agriculture • Forest Harvesting w/in last 15 yrs • Piers/Docks/Moorings/Marinas • Golf Course • Mowed Area • Sand/Gravel Operation • Other

Prior to testing these methods in Rhode Island, project staff attended an ORAM training session and Mid-Atlantic Wetland Workgroup meeting and had conversations with the authors of the methods, John Mack (ORAM) and Amy Jacobs (DE RAP) to better understand how the methods work, and to answer specific questions about applying them in Rhode Island.

Site selection

For this pilot study, our goals were to 1) test the monitoring methods at wetland sites across a gradient of human disturbance to determine sensitivity of the methods to wetland condition; 2) identify modifications to the methods that would be appropriate for Rhode Island wetlands; 3) work primarily in one watershed; and 4) select sites that were readily accessible (i.e. where we did not need to seek private landowner permission to access).

Woonasquatucket River Watershed

To meet these goals, we targeted wetlands on publicly owned properties, primarily in the nearby Woonasquatucket River watershed. The Woonasquatucket River watershed is a 51 square mile HUC10 drainage basin located in northeastern Rhode Island that covers portions of Providence, North Providence, Johnston, Smithfield, North Smithfield, and Glocester. The watershed contains 3584 acres of freshwater wetlands which is 11 % of the watershed. The most common wetland type by area is deciduous forested swamp (68% of the watershed's wetlands), with coniferous forested swamps (17%),

shrub swamps (8%), shrub fens and bogs (3%), open water (3%), and emergent wetlands (2%) comprising the remainder of the wetland area (Miller and Golet 2001).

Land use in this watershed varies in intensity from urban within the City of Providence in the lower portion of the watershed, to suburban in the Town of Smithfield and a small area of Glocester in the central portion of the watershed, and more rural land areas in the northern portion of the watershed in Smithfield and North Smithfield.

Permission to visit wetlands was sought and granted by public property owners including from DEM, the Audubon Society of Rhode Island, the Town of Smithfield, and the Smithfield Land Trust. Glocester Land Trust properties were also visited. In total, 22 individual wetland units were assessed in this watershed (Table 3 and Figure 1).

Water withdrawal sites

Another early objective of testing RAM's in Rhode Island was to visit wetlands near community wells in the State to determine if RAM's could detect wetland stresses associated with groundwater withdrawal. While impacts to wetlands from groundwater withdrawal remains an important concern in the State, the sensitivity of the issue led us to focus on the Woonasquatucket watershed sites for this first year. We did, however, seek and receive permission from the Town of North Kingstown to visit a few of their community well locations in or near wetlands. Those sites were located in Washington County in three different watersheds; the Hunt River (one site, one wetland), Annaquatucket River (two sites, two wetlands), and Narrow River (three sites, two wetlands) watersheds (Figure 1). In addition to the well sites, publicly owned properties nearby in the Annaquatucket River (Lafayette Fish Hatchery owned by DEM) and the Narrow River watersheds (two properties owned by the Narrow River Land Trust) were visited with permission from the landowners (Table 3).

Table 3. Wetland monitoring and assessment sites.

Number	Site Name	Property Owner	# Wetland Assessment Units
Woonasquatucket River Watershed			
2	Buttonhole Golf Course	DEM	1
3 - 7	Deerfield Park	Smithfield, Town	5
8 - 10	Ethel Newman Wildlife Sanctuary	Audubon of RI	3
11 - 13	George Washington Picnic Grove	DEM	3
14	Heditsian Property	Glocester LT	1
16 - 17	Lynch Despres Wildlife Refuge	Audubon of RI	2
23	Pesaturo/Snake Den	DEM	1
18	Phillips Farm	Glocester LT	1

Table 3 Continued

Number	Site Name	Property Owner	# Wetland Assessment Units
20	Powdermill Ledges	Audubon of RI	1
21	Primrose Ledges	Audubon of RI	1
22	Smithfield DPW	Smithfield, Town	1
24	Village at Summerfield	Smithfield, Town	1
27	Winsor Park	Glocester LT	1
	Subtotal: 13 sites	4 owners	22 wetland units
Narrow River Watershed			
1	Butcher/Huff	Narrow River LT	1
19	Town of NK Wells 3, 7, 8 & Pierce Property	Town of North Kingstown, Narrow River LT	1
Annaquatucket River Watershed			
15	Lafayette Hatchery	DEM	1
25	Town of NK Well 5	Town of North Kingstown	1
Hunt River Watershed			
27	Town of NK Well 6	Town of North Kingstown	1
	Total: 18 sites	6 owners	27 wetland units

Collateral data collection

To prepare for fieldwork and complete ORAM forms, collateral data were gathered from aerial photographs, USGS topographic maps, floodplain maps, and RIGIS data layers (2006), including hydric soils, wetland coverage, land use, rare species, and RIDOT layers. Consultation with the RIDEM Natural Heritage Program (R. Enser, pers. comm. 2006) provided information regarding rare, threatened, and endangered species, as well as special wetland communities in Rhode Island (Enser and Lundgren 2006).

Application of rapid assessment methods in the field

Identification of Wetland Assessment Units

Following ORAM guidelines, wetland assessment boundaries were determined largely by hydrology and hydrogeomorphic (HGM) class. The hydrogeomorphic classification system evaluates the physical, chemical, and biologic functions of a wetland based on geomorphic landscape setting and water source that supplies water to the wetland system. Areas that have a "high degree of hydrologic interaction" and fall within the

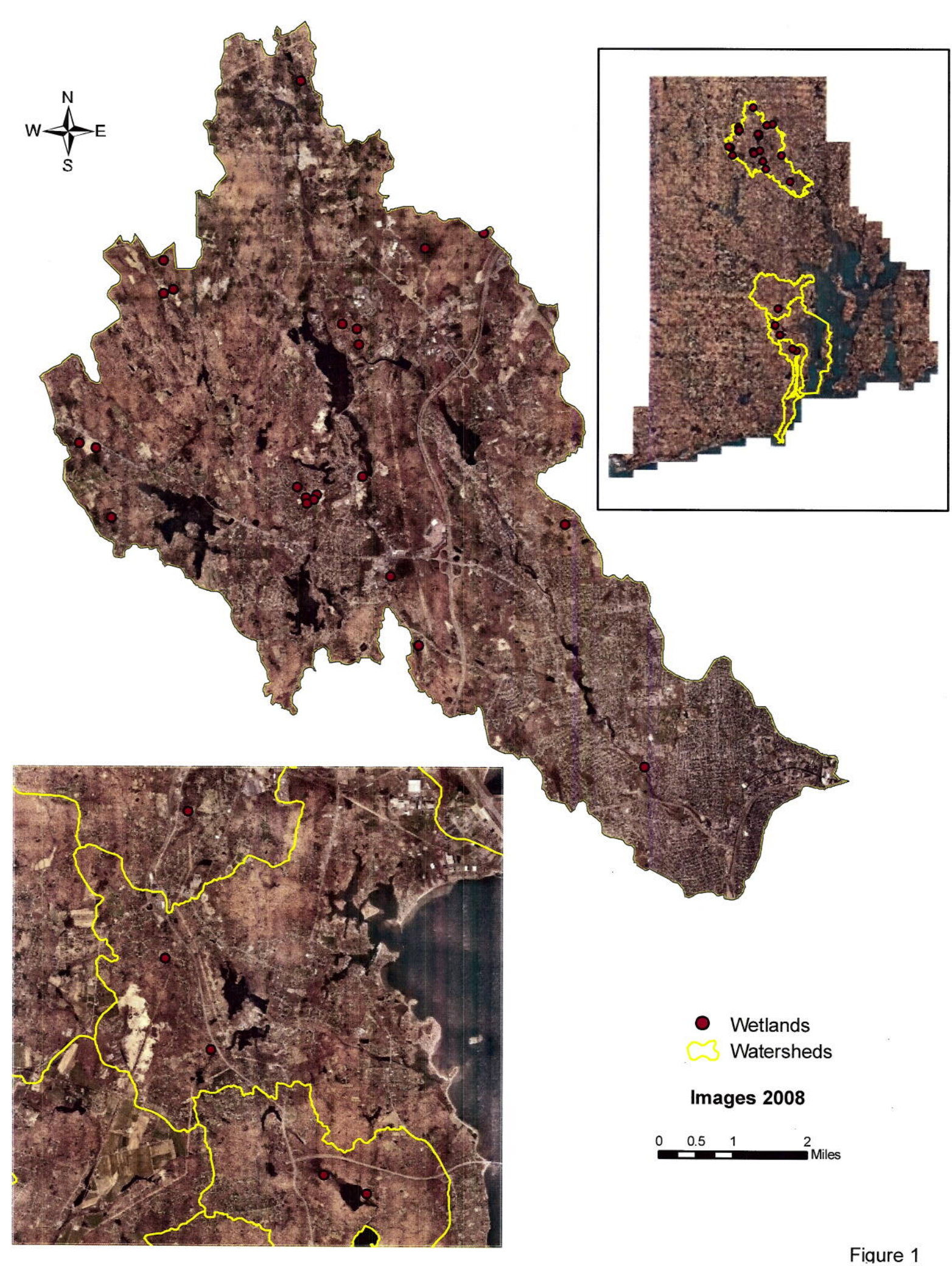

Figure 1

same HGM class are included in the same assessment unit, even if they contain several dominant vegetation communities (Mack 2001). When a continuous wetland is comprised of more than one HGM class, it is divided into different units by HGM class.

Unlike ORAM, the DERAP method is typically applied to a randomly selected point within a wetland, identified through a probabilistic sampling design. From that point, a circle with a radius of 40 meters is identified and the method is applied to that 0.5 hectare area around the point. Results are then reported on a wetland-wide basis, rather than for individual wetlands.

To be able to report the results of DERAP by individual wetland for this pilot study, we modified the method and applied it to the wetland assessment unit identified through the ORAM guidelines. According to the DERAP author, this was an acceptable modification given that the entire wetland was observed for stressors (A. Jacobs, pers. comm. 2006).

Field data collection

Wetlands were examined in September and October of 2006 by a team of two environmental scientists by walking around the perimeters and through the central portions of the wetlands when possible, i.e. when soils were dry enough to traverse the wetland. Observations of wetland and buffer size, surrounding land use, hydrology, depth of seasonal flooding, vegetation, micro-topography, and past or present disturbances were recorded on the field data sheets. Digital photographs were taken at each wetland to capture existing field conditions.

Data summarization

Once the field investigation was complete for each wetland unit, the ORAM scoring sheet and DERAP stressor checklist were filled in, including the collateral data gathered in the office. Additional notes were recorded for clarification when necessary. Data and results from the quantitative portion of ORAM, including the six metrics described in Table 1, were recorded in a digital Excel spreadsheet. Also recorded were qualitative notes from ORAM, and the list of stressors identified for each assessment unit through the DERAP method.

RESULTS

The two-person field team completed one to two wetland assessments per day. In total, 27 wetland assessment units were delineated and inspected. The field team utilized the GIS data (RIGIS 2006) and onsite inspections to assign each wetland or complex to one of three hydro-geomorphic (HGM) classes, including depressional, riverine, or slope wetlands. Following the guidelines in ORAM (Mack 2001), the sites were considered to be one unit if they were contiguous to other wetland and in the same HGM class. For example, several assessment units comprised large wetland complexes that included forested swamp, emergent marsh, pond, river and bog communities. Contiguous wetlands in different HGM classes were separated in to different assessment units.

Most of the wetlands assessed were depressional palustrine-forested wetlands dominated by red maple (*Acer rubrum*) trees with a mix of other deciduous hardwoods Including white ash (*Fraxinus Americana*), black birch (*Betula lenta*), yellow birch (*Betula alleghaniensis)* black tupelo (*Nyssa sylvatica*) and elm (*Ulmas americana*). The under story in these mostly depressional wetlands consisted of a mix of coast pepperbush (*Clethra alnifolia*), swamp azalea (*Rhododendron viscosum*), winterberry (*Ilex verticillata*) and high bush blueberry (*Vaccinium corymbosum*).

ORAM Results

Metric 1: Wetland size

Most commonly, the wetland assessment units were 3-10 acres in size. The smallest isolated wetland visited was a depressional buttonbush-dominated wetland, approximately 1 acre in size. The largest wetland assessed by the field team was approximately 108 acres and consisted of several hydric soils series and different plant communities. The largest wetlands were predominately red maple swamps with a pond or stream hydrologically connected to the forested swamps.

Metric 2: Upland buffers and surrounding land use

ORAM describes "Buffer" as the relatively intact vegetated landscape that has the capability of protecting the biological, physical and chemical characteristics of the wetland. To calculate average buffer width of each assessment unit, the field team estimated the width of all sides of the wetland polygon, or two sides if the wetland was narrow. (e.g. a riverine wetland with a fringe riparian wetland). Results for the average buffer width categories in ORAM from this study were very narrow (<10 meters) 2 wetlands; narrow (10 to 25 meters) 3 wetlands; medium (25 to 50 meters) 9 wetlands; and wide (>50 meters) 13 wetlands.

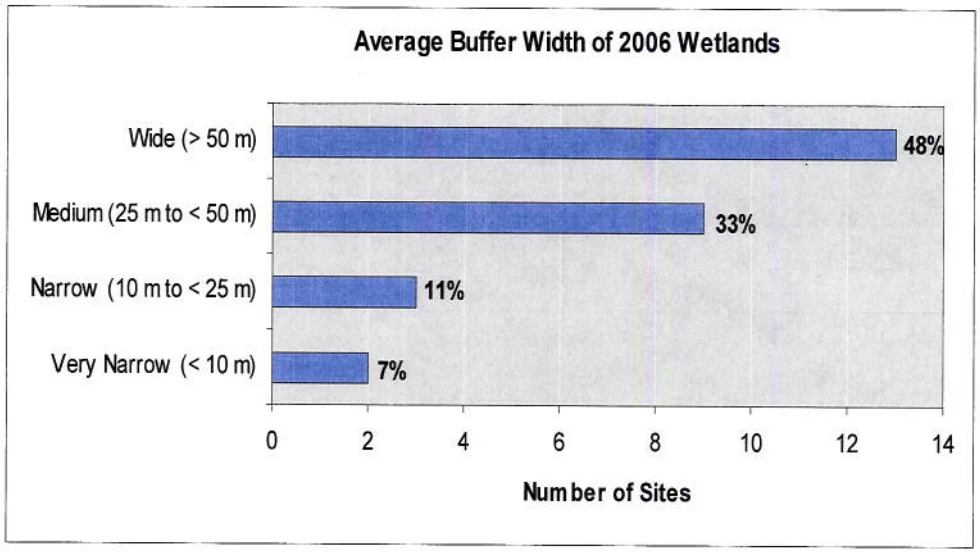

Figure 1. Average buffer width of wetland assessment units (from Kutcher June 2008).

Surrounding land use intensity was observed on the aerial photographs and in the field, noting factors such as the density of residential land use, the presence of roads, noise, ongoing construction activity, and other development in the surrounding area. The ORAM categories of surrounding land use range from 'very low', e.g. old forest, wildlife management areas and protected forested land, to 'high', e.g. urban, industrial, open pasture or farmed land. The most common land use category observed was 'moderately high' for the study sample. Land use around these wetlands consisted primarily of residential development and associated roads.

Metric 3: Hydrology

This metric records sources of water, connectivity, maximum water depth, duration of inundation or saturation, as well as modifications to natural hydrologic regime. Wetlands in this study were typically seasonally inundated or saturated wetlands as determined by water staining on the trees, the presence of adventitious root systems, tussock height, and visual observations. Common hydrologic modifications observed included the presence of roadbeds and storm drainage to wetlands. In fewer wetlands, modifications such as farm crossings (stone fords), trails, and fill were observed.

Metric 4: Habitat alteration and development

Nutrient enrichment and mowing were the most common habitat alterations in and adjacent to the wetland assessment units. Trails and off road vehicle use were evident in five wetlands, Trash was found in several wetlands, and invasive plants were identified in 21 of the wetlands. (For more on invasive species, see *Vegetation, interspersion, and microtopography* below).

Metric 5: Special wetland communities

This metric considers special features and community types present in each wetland or wetland complex. These include fens, bogs, old growth or mature forests, sites with known occurrences of rare, threatened, or endangered species, and sites that provide significant migratory songbird or waterfowl habitat. Three of the sites we visited contained bogs, nine had portions of mature forested wetland, and two sites are on record at DEM for supporting rare species. None were on record as significant migratory bird or waterfowl habitat.

Metric 6: Vegetation, interspersion, and microtopography

This metric evaluates horizontal interspersion of vegetative communities in the wetland assessment unit and deducts for the presence of invasive species. The ORAM categories for invasive species coverage include absent, nearly absent (<5%), sparse (5-25%), moderate (25-75%), and extensive (>75%) aerial cover. The most common category of invasive species observed was 'nearly absent,' recorded in 13 wetlands. Six wetlands did not have invasive plants, six wetlands had sparse aerial coverage and two had moderate coverage of invasive plants Invasive plant species observed included barberry (*Berberis vulgaris*), autumn olive (*Elaeagnus umbellata*), Asiatic bittersweet (*Celastrus orbiculatus*), Japanese knotweed (*Polygonum cuspidatum*), multiflora rose

(*Rosa multiflora*), tall reed (*Phragmites australis*) and reed canary grass (*Phalaris arundinacea*).

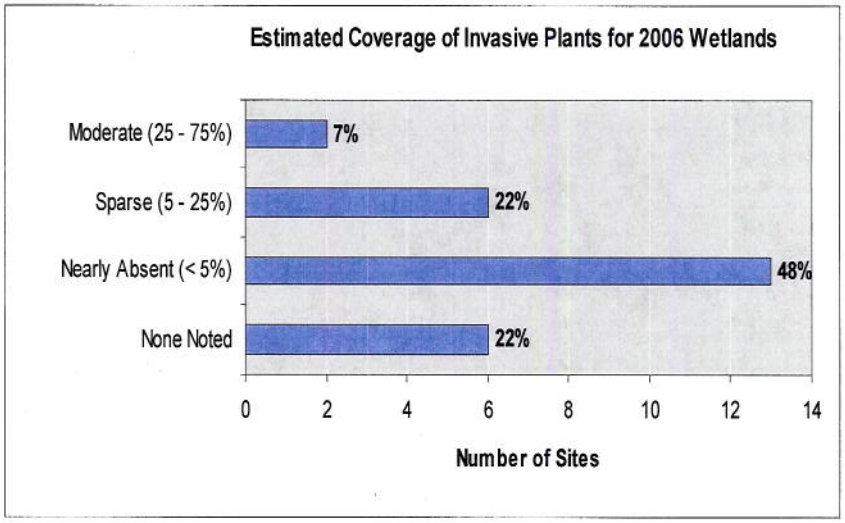

Figure 2. Estimated coverage of invasive plants in 2006 wetland assessment units (from Kutcher June 2008).

Horizontal plan view interspersion considers different strata and age classes within the wetland. This also takes into account the different plant communities that make up a wetland complex. In this study, four wetlands units were observed to have high interspersion, 12 had moderately high vegetative interspersion, four had a moderate amount, two had moderately low, and five wetlands exhibited low interspersion.

Microtopography observed in the wetlands included vegetated hummocks and tussocks, coarse woody debris, and depressions that provide amphibian breeding habitat. (Note: ORAM gives a positive value for microtopography identified. DERAP identifies microtopography as a negative element, e.g. log skidder rutting, faunal soil disturbance, and plowing.)

ORAM Scores

The quantitative portion of the ORAM method assigns scores to each metric, with a maximum total score of 100 points for all metrics combined. Although the points don't have specific meaning for an individual wetland, the 100-point scale provides a framework to compare the overall condition of wetlands in the same HGM class to each other. The range of scores for the 22 wetlands assessed in the Woonasquatucket River watershed was 33.5 to 81 points. The mean score in the watershed was 57.4 and the median score was 60. The range for all the wetlands assessed in this study was 33.5 to 90 points.

It should be noted that Rhode Island does not otherwise rank or assign numeric scores to freshwater wetlands and in past practice the DEM regulatory program has found assignment of scores to wetlands to be problematic because of a false presumption by applicants that lowered scored wetlands may be more easily altered and mitigated.

DERAP Results

In addition to the stressors listed in ORAM, the DERAP provided a list of habitat and plant community, hydrology, and buffer stressors to look for in the wetland assessment unit. Where observed, these stressors were recorded on the field sheets and included in the summary Excel datasheet with the ORAM results. Although there is also a scoring procedure for DERAP, it is dependent on a weighting system that is being developed for wetlands in Delaware, and may not be appropriate for Rhode Island wetlands. Therefore, we chose not to complete the scoring method for DERAP, deciding instead to simply identify the DERAP stressors to the wetlands for descriptive purposes.

DISCUSSION

The Ohio Rapid Assessment Method is easy to apply and could offer a useful structure and approach for wetland monitoring in Rhode Island. Organized by categories (metrics) with subcategories (attributes) within each, the method guides the reviewer to systematically observe the fundamental characteristics of a wetland, including hydrology, soils, and vegetation, as well as stressors to the wetland. This method is semi-quantitative and requires some measure of best professional judgment by the reviewer. The scoring system of ORAM, while not meaningful in absolute terms, is a useful way to make comparisons between wetlands of similar HGM classes, although Rhode Island does not otherwise utilize HGM.

Addressing short-term objectives

Rhode Island's short-term monitoring objectives could be assessed using ORAM by looking at the metrics collectively, or by evaluating certain individual metrics or submetrics. Collectively, ORAM metrics could be used to support best professional judgments about wetlands that could be prioritized for open space protection. ORAM identifies specific attributes of a wetland, such as it's size, connectivity to other wetlands or complexes, the presence of rare species, and habitat submetrics (in an urban or rural landscape), that may contribute to decisions about open space protection.

Specific ORAM metrics could address Rhode Island's objective of monitoring and assessing impacts to wetlands due to loss and degradation of adjacent upland habitat, or the buffer zone around the wetland. These include estimates of average buffer width and intensity of the surrounding land use, as well as stressors to the wetland, such as stormwater inputs, that originate from outside the wetland boundaries. The presence of invasive species may indicate that that a wetland is impacted by surrounding land use and the lack of an adequate buffer. Evaluating the location and cover of invasive species is another short-term objective that may be addressed using ORAM.

More difficult to determine is whether ORAM would be a useful tool for addressing potential impacts of water withdrawal on wetlands in the short-term. In this study, we visited wetlands near five community well sites, although we observed no obvious impacts to the wetlands from water withdrawal during our visits.

Addressing long-term objectives

Data and information gathered using this rapid assessment approach could be used to address Rhode Island's long term objectives of developing a database to evaluate trends in wetland condition, identifying causes and sources of wetland degradation, and evaluating the effectiveness of wetland management and protections programs. Those metrics and submetrics that are more descriptive in nature, such as maximum water depth, connectivity, duration of saturation, or the presence of different vegetation communities, may not seem to relate immediately or directly to wetland condition in the short-term, but can reveal changes in the wetland over time. For example, noticeable decreases in maximum water depth over time could indicate changes in hydrology that might be attributable to stress in the environment, perhaps from significant water withdrawals nearby. Determining whether the observed changes are the result of natural events or human-induced stressors would guide managers to identify and prioritize changes to wetland programs to improve protection, which is a long-term objective for the State.

Complex results - what we learned from wetlands assessed

Although there are clear examples of how ORAM data could be used immediately and directly to support short-term objectives, ORAM results are complex and reflect the fact that wetlands themselves are complex ecological systems. In an attempt to further understand how results for individual attributes of the wetlands related to the total ORAM results, we looked for correlations and patterns in the data.

As expected, it is relatively easy to explain the factors that resulted in whether a wetland fell on the high or low end of the spectrum. For example, wetlands on the high end of the spectrum consistently had high scores for most of the attributes assessed. In particular, these wetlands were larger, had wider buffers, were surrounded by less intense land use, did not appear to have modifications to the hydrology, supported a variety of wetland vegetation communities, and had high values for the microtopography attribute, i.e. they had hummocks and tussocks, coarse woody debris, some standing dead trees, and amphibian breeding habitat. In addition, they received additional points for supporting special wetland communities, such as a bog or rare species.

Wetlands that received the lowest overall scores generally were the smallest, had narrow buffers, some evidence of hydrologic modifications and habitat alterations, fewer wetland vegetation communities (i.e. less diverse habitat), and had the lowest scores for microtopography. On this lower end of the spectrum, we expected to see these opposite results for each metric compared to wetlands on the high end, and while this was true in general, it was not consistently the case.

Even the lowest scoring wetland assessment unit in our study, Buttonhole Golf Course (2.2 acres, score 33.5), had some attributes with higher scores than wetlands with higher overall scores, indicating that results for individual metrics do not necessarily predict overall results for that wetland, and that it is essential to look at the condition of the wetland as a whole. For example, Buttonhole had a greater variety of wetland vegetation communities than the wetlands at Deerfield Park. Buttonhole also had attributes that received similar scores to the very large wetland at Well #6 in North Kingstown (108 acres, score 73). Although they differed in size, the two wetlands both had narrow buffers, a similar intensity of land use surrounding them, and the same score for sources of water. However, unlike the wetland near Well #6, the wetland at Buttonhole had hydromodifications, habitat alterations, little variety in the microtopography, and no special wetland communities, factors that indicate a degraded system.

Wetlands that fell in the middle range of the spectrum also had similar scores for some metrics and different scores for others. To identify which were different and influenced the overall score, we looked at data for one wetland at the Ethel Newman property (wetland #1; score 45) compared to the wetland at Powdermill Ledges (score 57.5), as an example comparison. In this comparison, both wetlands were the same size and had similar buffer widths. The wetland at Ethel Newman had higher scores for land use intensity (i.e. less intense land use surrounding the wetland), sources of water (i.e. addition of perennial surface water), and connectivity (i.e. was also part of the 100 yr flood plain and part of a riparian or upland corridor). However, the wetland at Powdermill Ledges scored higher for hydromodification and habitat alterations (i.e. it was less altered than Ethel Newman), as well as wetland vegetation communities and microtopography (i.e. it was more diverse than Ethel Newman). As with wetlands at the high end of the scoring range in our study, the metrics related to hydrology and habitat seemed to influence the overall score more than intensity of surrounding land use, buffer width, or wetland size.

Notes about wetland size and buffer width

Although larger wetlands consistently rated higher using ORAM, the size category was only allocated a small number of points (6 out of 100), and wetlands greater than 50 acres did not receive any additional points. Total ORAM scores varied for wetlands that fell in the same size category (as defined by ORAM). For example, scores for wetlands in the 0.3 to 3 acre category ranged from 33.5 to 63.5, and wetlands in the 3 to 10 acre category had scores ranging from 43 to 69.5. Wetlands in the > 50 acre category had scores ranging from 70 to 89.5. Clearly, the larger wetlands received higher scores in this study, however, it was not strictly their size that influenced the score, and ORAM scores cannot be necessarily be predicted by size alone. The metrics that weighed more heavily than size and influenced the total ORAM score included those related to hydrology and habitat.

DERAP and the stressor checklist format

The Delaware Rapid Assessment Protocol is easy to apply and offers an organized list of stressors to look for in and around a wetland. Many of the items on Delaware's

stressor lists were included in ORAM. However, the Delaware list offers a few additional items, including trails, garbage/isolated dumping, and a history of forest harvesting activities in the wetland, as well as golf courses and sand/gravel operation in the buffer that were helpful to see (although they could be included in ORAM's "other" category). DERAP also provides somewhat more detail about certain stressors than ORAM. For example, if a weir, dam, or road was present in the wetland, the Delaware list included subcategories to further describe how much water was being impounded by that obstruction.

While useful in its current form, DERAP lacks sufficient detail to fully record stressors in Rhode Island. For example, one of the stressors listed in the buffer is roads, with subcategories including: mostly dirt roads; mostly 2-lane paved roads, and mostly 4-lane paved roads. We found it difficult to select a category when there was a mixture of road types in the buffer. Revisions to the list could consider stressors that are specific to Rhode Island (and remove those that are not), and it should include sufficient detail (in the form of appropriate categories) to accurately describe those stressors. With those revisions, this could be a useful tool in Rhode Island.

Identifying a list of stressors to wetlands could be useful for managers to identify and prioritize actions for removing stressors when feasible. It is important to note, however, that simply listing stressors does not fully describe the impact of those stressors on wetland condition. ORAM records a list of stressors, and then asks if those stressors have caused 'more than trivial' alterations to hydrology or habitat. Furthermore, the method prompts the user to evaluate whether the wetland has recovered from those disturbances and to what degree.

It seems most useful, then, for Rhode Island to continue monitoring for and recording stressors and further assessing the wetland to determine the degree to which those stressors are contributing to condition.

Recommendations for tailoring ORAM to RI

Buffer assessment

In Ohio, recording the average buffer width around a wetland appears to be adequate to satisfy their needs. In Rhode Island, however, we are furthermore interested in determining the impacts to a wetland due to the loss and degradation of upland buffer habitat. As such, it would be more useful for us to describe both buffer width and condition, perhaps by describing the composition of the buffer in more detail. Information is lost, at least on the individual wetland assessment unit scale, by averaging the width for all sides of the unit. For example, in this study there were several wetlands with very different buffer widths and compositions on different sides of the wetland. The wetland near Well #5 in North Kingstown had a wide, intact, forested buffer on one side, and a road with effectively no buffer on another side. Whereas the side with a wide buffer seemed to be ecologically healthy or undisturbed, the side with no buffer had invasive species and trash in the wetland.

Also, it is important to note that, for larger wetlands, a lack of upland buffer means that the wetland edges themselves become the buffer zone for the interior wetland. Therefore, the wetland could be degraded on the edges, but on the whole, still be relatively healthy, thus receiving a relatively high score by ORAM. Therefore information about the buffer, as well as the wetland itself, is important for accurately assessing the condition of the wetland.

Land use surrounding the wetland

In terms of understanding the landscape activities around the wetland, it might be helpful to describe land use around the wetland more quantitatively, or to provide more detail qualitatively, than ORAM requires. Categories ranging from 'very low' to 'high' in ORAM are comparatively useful, but do not necessarily provide enough detail for Rhode Island to improve its understanding of impacts to wetlands, or to make decisions about possible improvements to wetland protection programs.

Special wetland communities

In ORAM, points are added when a wetland supports a special wetland community. This approach is valuable to Ohio, considering that ORAM is used as a regulatory protection tool. In Rhode Island, it would also seem valuable to record where special wetland communities exist in the State and to monitor those wetlands over time. In preliminary discussions with the DEM Natural Heritage Program (pers. comm., R. Enser, 2006), we have developed a list of wetland communities to add to the method that are considered special or rare in Rhode Island that do not exist in Ohio. Also, given that there are wetland communities in Ohio that we do not have here, we propose deleting those from our application of the method. Additional consideration should also be given to certain plant and animal species that should be included with this list, and how these species should be assessed using a rapid assessment method.

Underlying the value of identifying special wetland communities is the assumption that a wetland that supports a rare community is likely to be ecologically healthy. Depending on the scale of interest, this may or may not be accurate. For example, in the vicinity of the wetland we visited on the Snake Den/Pesaturo property, DEM records show the presence of a rare species, which resulted in an automatic 10-point increase in the scoring for this wetland unit. Without any detailed information about the rare species in question (available, but not included in this study), it is not known whether that species is, in fact, present in the wetland or resides outside the wetland boundary. One side of this wetland is bordered by a large, intact, forested area (Snake Den Park), however, the other side is bordered by power lines. In this disturbed area, there is evidence of hydrologic and habitat modification, as well as a variety of invasive species. Given the disturbance to at least part of this wetland, it is important to consider whether the extra points for rare species is a useful indicator of wetland condition. Further consideration should be given to this metric in the method.

CONCLUSIONS

This small-scale pilot study demonstrated that rapid assessments provide useful information about wetlands in Rhode Island. With appropriate revisions, both ORAM and DERAP could be useful tools for monitoring wetlands in Rhode Island. The list of stressors included in the ORAM format could be expanded and revised from suggestions in DERAP, so that only one method would be used in the field. Data from this rapid assessment method could be used to address short-term and long-term objectives in Rhode Island, with the possible exception of observing impacts to wetlands from water withdrawals. In addition to the current objectives, monitoring data could possibly also be used to inform other wetland protection programs, such as identifying potential restoration opportunities, setting restoration priorities, or evaluating restoration success.

As the wetland monitoring and assessment program develops over time, revisions to the existing methods would help to improve and confirm results. It will be important to validate rapid results with more detailed information about wetland biological communities where possible. This can be achieved initially by correlating results of existing studies in Rhode Island with RAM results. As data about wetland condition in Rhode Island are gathered, it will be necessary to determine how wetland condition could be described or categorized in meaningful terms. This remains a challenge, not only for Rhode Island, but for all states, as we strive to protect and improve wetland condition.

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APPENDIX A

ORAM v. 5.0 *Quantitative Rating* Field Form

Background Information

Name:
Date:
Affiliation:
Address:
Phone Number:
e-mail address:
Name of Wetland:
Vegetation Communit(ies):
HGM Class(es):
Location of Wetland include map, address, north arrow, landmarks, distances, roads, etc.

Lat/Long or UTM Coordinate	
USGS Quad Name	
County	
Township	
Section and Subsection	
Hydrologic Unit Code	
Site Visit	
National Wetland Inventory Map	
Ohio Wetland Inventory Map	
Soil Survey	
Delineation report/map	
Wetland Size (acres, hectares)	

ORAM v. 5.0 Field Form Quantitative Rating

Site:	Rater(s):	Date:

Metric 1. Wetland Area (size).

max 6 pts. subtotal

Select one size class and assign score.

- ☐ >50 acres (>20.2ha) (6 pts)
- ☐ 25 to <50 acres (10.1 to <20.2ha) (5 pts)
- ☐ 10 to <25 acres (4 to <10.1ha) (4 pts)
- ☐ 3 to <10 acres (1.2 to <4ha) (3 pts)
- ☐ 0.3 to <3 acres (0.12 to <1.2ha) (2pts)
- ☐ 0.1 to <0.3 acres (0.04 to <0.12ha) (1 pt)
- ☐ <0.1 acres (0.04ha) (0 pts)

Metric 2. Upland buffers and surrounding land use.

max 14 pts. subtotal

2a. Calculate average buffer width. Select only one and assign score. Do not double check.

- ☐ WIDE. Buffers average 50m (164ft) or more around wetland perimeter (7)
- ☐ MEDIUM. Buffers average 25m to <50m (82 to <164ft) around wetland perimeter (4)
- ☐ NARROW. Buffers average 10m to <25m (32ft to <82ft) around wetland perimeter (1)
- ☐ VERY NARROW. Buffers average <10m (<32ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.

- ☐ VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- ☐ LOW. Old field (>10 years), shrubland, young second growth forest. (5)
- ☐ MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field. (3)
- ☐ HIGH Urban, industrial, open pasture, row cropping, mining, construction. (1)

Metric 3. Hydrology.

max 30 pts. subtotal

3a. Sources of Water. Score all that apply.

- ☐ High pH groundwater (5)
- ☐ Other groundwater (3)
- ☐ Precipitation (1)
- ☐ Seasonal/intermittent surface water (3)
- ☐ Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.

- ☐ 100 year floodplain (1)
- ☐ Between stream/lake and other human use (1)
- ☐ Part of wetland/upland (e.g. forest), complex (1)
- ☐ Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.

- ☐ >0.7 (27.6in) (3)
- ☐ 0.4 to 0.7m (15.7 to 27.6in) (2)
- ☐ <0.4m (<15.7in) (1)

3d. Duration inundation/saturation. Score one or dbl check.

- ☐ Semi- to permanently inundated/saturated (4)
- ☐ Regularly inundated/saturated (3)
- ☐ Seasonally inundated (2)
- ☐ Seasonally saturated in upper 30cm (12in) (1)

3e. Modifications to natural hydrologic regime. Score one or double check and average.

- ☐ None or none apparent (12)
- ☐ Recovered (7)
- ☐ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed

- ☐ ditch
- ☐ tile
- ☐ dike
- ☐ weir
- ☐ stormwater input
- ☐ point source (nonstormwater)
- ☐ filling/grading
- ☐ road bed/RR track
- ☐ dredging
- ☐ other_____

Metric 4. Habitat Alteration and Development.

max 20 pts. subtotal

4a. Substrate disturbance. Score one or double check and average.

- ☐ None or none apparent (4)
- ☐ Recovered (3)
- ☐ Recovering (2)
- ☐ Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.

- ☐ Excellent (7)
- ☐ Very good (6)
- ☐ Good (5)
- ☐ Moderately good (4)
- ☐ Fair (3)
- ☐ Poor to fair (2)
- ☐ Poor (1)

4c. Habitat alteration. Score one or double check and average.

- ☐ None or none apparent (9)
- ☐ Recovered (6)
- ☐ Recovering (3)
- ☐ Recent or no recovery (1)

Check all disturbances observed

- ☐ mowing
- ☐ grazing
- ☐ clearcutting
- ☐ selective cutting
- ☐ woody debris removal
- ☐ toxic pollutants
- ☐ shrub/sapling removal
- ☐ herbaceous/aquatic bed removal
- ☐ sedimentation
- ☐ dredging
- ☐ farming
- ☐ nutrient enrichment

subtotal this page

ORAM v. 5.0 Field Form Quantitative Rating

Site:	Rater(s):	Date:

subtotal this page

max 10 pts | subtotal

Metric 5. Special Wetlands.

Check all that apply and score as indicated.

- [ ] Bog (10)
- [ ] Fen (10)
- [ ] Old growth forest (10)
- [ ] Mature forested wetland (5)
- [ ] Lake Erie coastal/tributary wetland-unrestricted hydrology (10)
- [ ] Lake Erie coastal/tributary wetland-restricted hydrology (5)
- [ ] Lake Plain Sand Prairies (Oak Openings) (10)
- [ ] Relict Wet Prairies (10)
- [ ] Known occurrence state/federal threatened or endangered species (10)
- [ ] Significant migratory songbird/water fowl habitat or usage (10)
- [ ] Category 1 Wetland. See Question 1 Qualitative Rating (-10)

max 20 pts | subtotal

Metric 6. Plant communities, interspersion, microtopography.

6a. Wetland Vegetation Communities.
Score all present using 0 to 3 scale.

- [ ] Aquatic bed
- [ ] Emergent
- [ ] Shrub
- [ ] Forest
- [ ] Mudflats
- [ ] Open water
- [ ] Other_____

6b. horizontal (plan view) Interspersion.
Select only one.

- [ ] High (5)
- [ ] Moderately high(4)
- [ ] Moderate (3)
- [ ] Moderately low (2)
- [ ] Low (1)
- [ ] None (0)

6c. Coverage of invasive plants. Refer to Table 1 ORAM long form for list. Add or deduct points for coverage

- [ ] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [ ] Nearly absent <5% cover (0)
- [ ] Absent (1)

6d. Microtopography.
Score all present using 0 to 3 scale.

- [ ] Vegetated hummucks/tussucks
- [ ] Coarse woody debris >15cm (6in)
- [ ] Standing dead >25cm (10in) dbh
- [ ] Amphibian breeding pools

Vegetation Community Cover Scale

0	Absent or comprises <0.1ha (0.2471 acres) contiguous area
1	Present and either comprises small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2	Present and either comprises significant part of wetland's vegetation and is of moderate quality or comprises a small part and is of high quality
3	Present and comprises significant part, or more, of wetland's vegetation and is of high quality

Narrative Description of Vegetation Quality

low	Low spp diversity and/or predominance of nonnative or disturbance tolerant native species
mod	Native spp are dominant component of the vegetation, although nonnative and/or disturbance tolerant native spp can also be present, and species diversity moderate to moderately high, but generallyw/o presence of rare threatened or endangered spp
high	A predominance of native species, with nonnative spp and/or disturbance tolerant native spp absent or virtually absent, and high spp diversity and often, but not always, the presence of rare, threatened, or endangered spp

Mudflat and Open Water Class Quality

0	Absent <0.1ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 to <4ha (2.47 to 9.88 acres)
3	High 4ha (9.88 acres) or more

Microtopography Cover Scale

0	Absent
1	Present very small amounts or if more common of marginal quality
2	Present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of highest quality

GRAND TOTAL(max 100 pts)

Refer to the most recent ORAM Score Calibration Report for the scoring breakpoints between wetland categories at the following address: http://www.epa.state.oh.us/dsw/401/401.html

last revised 1 February 2001 jjm

APPENDIX B

DERAP v. 5.0 Field Form

DELAWARE RAPID ASSESSMENT Version 5.0

Site # _____ Site Name _____ Date _____

Observers _____ Completed? ☐

HGM Class _____ HGM sub-class _____ Reference or Assessment Site (circle one)

Natural Re-establishment Establishment Rehabilitation Enhancement (circle one)

Watershed _____ Photos _____

lat/long _____ AA size and shape _____

AA moved from original location? yes or no (circle one) If yes, reason _____

Qualitative Condition Rating Least Disturbed 1 2 3 4 5 6 Highly Disturbed (circle one number)

HABITAT/PLANT COMMUNITY (within site) Weight

FOREST HARVESTING w/in 50yrs
- ☐ Clear Cut
  - ☐ <10% ☐ 11-50% ☐ >50%
- ☐ Selective Cut

DOMINANT FOREST AGE
- ☐ 31-50 years
- ☐ 16-30 years
- ☐ 3 - 15 years
- ☐ </= 2 years

BAF(10) (of dominant forest) _____

CONVERTED FROM NATIVE FOREST
check all present
- ☐ Pine plantations
- ☐ Mowed
- ☐ Farmed
- ☐ Grazed
- ☐ Other _____

PRESENCE OF INVASIVE SPECIES
- ☐ < 1% ☐ 6 - 50%
- ☐ 1 - 5% ☐ > 50%

☐ **CHEMICAL DEFOLIATION**

☐ **EXCESSIVE HERBIVORY**
(e.g. pinebark beetle, gypsy moth, nutria)

☐ **BURNED**

☐ **GARBAGE/ISOLATED DUMPING**

HABITAT/PLANT COMMUNITY (within site) (CONTINUED) Weight

INCREASED NUTRIENTS
- ☐ Dense algal mats

Presence of Nutrient Indicator Species (dep. only)
- ☐ Dominating Site (>50%)
- ☐ NOT Dominating Site (<50%)

TRAILS AND ROADS
- ☐ Walking/ horse trails
- ☐ Non elevated road (Logging, dirt, ATV)
- ☐ Elevated road (dirt or gravel)
- ☐ Paved road

☐ **OTHER** _____

COMMENTS ON HABITAT/PLANT COMMUNITY

Assessment Area Sketch

DELAWARE RAPID ASSESSMENT Version 5.0

Site # _____ Site Name _____ Date _____

HYDROLOGY STRESSORS — Weight

DITCHES
(not including main channel for riverine)
- ☐ 1-3 shallow ditches (<.3m deep) within AA
- ☐ >3 shallow ditches in AA or 1 ditch (>.3m deep) in AA OR 1 ditch (>.6m deep) within 25m of AA
- ☐ >1 ditch .3-.6m deep or 1 ditch >.6m deep within AA

STREAM ALTERATION
- ☐ Channelized Stream (If yes)
  - ☐ Not maintained, reverting to natural morphology
  - ☐ Spoil bank only one AA side ☐ Spoil bank opposite AA
  - ☐ Spoil bank both sides
- ☐ Stream Incision

WEIR/DAM/ROAD
- ☐ Decreasing flooding of AA
- ☐ Impounding water <10% AA
- ☐ Impounding water 10-75% AA
- ☐ Impounding water >75% AA

☐ **STORMWATER INPUTS**

☐ **POINT SOURCE (NON-STORMWATER)**

FILLING, EXCAVATION (includes roads not impeding flow)
- ☐ <10% of AA
- ☐ 10-75% of AA
- ☐ >75% of AA

MICROTO ALTERATIONS - plowing, bedding, skidder tracks
- ☐ <10% of AA
- ☐ 10-75% of AA
- ☐ >75% of AA

EXCESSIVE SEDIMENTATION
- ☐ In stream channel
- ☐ In wetland

☐ **SOIL SUBSIDENCE/ROOT EXPOSURE**

☐ **TIDAL RESTRICTION**

☐ **OTHER** _____

COMMENTS ON HYDROLOGY

BUFFER STRESSORS(100m surrounding AA) — Weight

DEVELOPMENT - Density
- ☐ Commercial, Industrial
- ☐ Residential >2 houses/acre
- ☐ Residential </=2 houses/acre
- ☐ Residential </=1 house/ acre

IF DEVELOPED, WHAT TYPE SEWAGE DISPOSAL
- ☐ Sewer
- ☐ Septic

ROADS (most intense type, not including trails and logging roads)
- ☐ Mostly dirt or gravel roads
- ☐ Mostly 2-lane paved roads
- ☐ Mostly 4-lane paved roads

☐ **LANDFILL/WASTE DISPOSAL**

☐ **CHANNELIZED STREAMS OR DITCHES (>0.6m DEEP)**

AGRICULTURE

	adjacent	>10m
Row crops or nursery plants	☐	☐
Orchards	☐	☐
Poultry or livestock operation	☐	☐

☐ **FOREST HARVESTING WITHIN LAST 15 YEARS**

PIERS/DOCKS
- ☐ Slips/docks present
- ☐ Moorings present
- ☐ Individual piers # of piers in buffer _____

☐ **GOLF COURSE**

☐ **MOWED AREA**

☐ **SAND/GRAVEL OPERATION**

☐ **OTHER** _____

COMMENTS ON BUFFER

checked: _____
entered: _____

SUM of WEIGHTS: ____ Refer to protocol to assing weights and calculate total score **TOTAL SCORE:** ____

APPENDIX C

Excel Data Tables (Field Year 2006)

BACKGROUND DATA	METRIC 1 - WETLAND AREA			SCORE
Name of Wetland	Wetland Area (ORAM category)	Actual Wetland Area (approx. acres)	Wetland Area Score	Total Score
Lafayette Hatchery	> = 50 acres	67.5	6	70
Town of NK, Well #5	25 - < 50 acres	48.2	5	71
Town of NK, Well #6	> = 50 acres	108	6	73
Butcher/Huff	> = 50 acres	64	6	89.5
Pierce/NK Wells 3,7,8	25 - < 50 acres	43	5	90
Buttonhole Gulf Course	0.3 - < 3 acres	2.2	2	33.5
Deerfield Park #1	3 - < 10 acres	3.6	3	43.5
Deerfield Park #2	0.3 - < 3 acres	1.1	2	35
Deerfield Park #3	0.3 - < 3 acres	2.5	2	44.5
Deerfield Park #4	3 - < 10 acres	9.5	3	49
Deerfield Park #5	0.3 - < 3 acres	2.5	2	38.5
Ethel Newman #1	3 - < 10 acres	6	3	45
Ethel Newman #2	3 - < 10 acres	1.7	3	69.5
Ethel Newman #3	3 - < 10 acres	6.4	3	69.5
George Washington #1	3 - < 10 acres	7.5	3	61.5
George Washington #2	3 - < 10 acres	3.2	3	58.5
George Washington #3	3 - < 10 acres	1.9	3	67
Heditsian et al	3 - < 10 acres	5	3	68
LynchDepres #1	3 - < 10 acres	3.9	3	61
LynchDepres #2	> = 50 acres	90	6	77
Phillips Farm	0.3 - < 3 acres	1.7	2	63.5
Powdermill ledges	3 - < 10 acres	5.9	3	57.5
Primrose Ledges	10 - < 25 acres	18.6	4	81
Smithfield DPW	3 - < 10 acres	4.4	3	43
Snake Den/Pesaturo	10 - < 25 acres	18.8	4	77
Summerfield	10 - < 25 acres	10.1	4	56
Winsor Park	3 - < 10 acres	6	3	63

1. wetland area

BACKGROUND DATA	METRIC 2 - UPLAND BUFFERS AND INTENSITY OF SURROUNDING LAND USES				SCORE
Name of Wetland	Average Buffer Width	Average Buffer Width Score	Intensity of Surrounding Land Use	Surrounding LU Score	Total Score
Lafayette Hatchery	Wide (> 50 m)	7	Low	5	70
Town of NK, Well #5	Medium (25 m to < 50 m)	4	Low	4	71
Town of NK, Well #6	Narrow (10 m to < 25 m)	1	Moderately High	3	73
Butcher/Huff	Medium (25 m to < 50 m)	4	Low	5	89.5
Pierce/NK Wells 3,7,8	Wide (> 50 m)	7	Very Low	6	90
Buttonhole Gulf Course	Narrow (10 m to < 25 m)	1	Moderately High	3	33.5
Deerfield Park #1	Very Narrow. < 10 m	0	Moderately High	3	43.5
Deerfield Park #2	Very Narrow (< 10 m)	0	Moderately High	3	35
Deerfield Park #3	Medium (25 m to < 50 m)	4	Moderately High	3	44.5
Deerfield Park #4	Medium (25 m to < 50 m)	4	Moderately High	3	49
Deerfield Park #5	Medium (25 m to < 50 m)	4	Moderately High	3	38.5
Ethel Newman #1	Medium (25 m to < 50 m)	4	Low	4	45
Ethel Newman #2	Wide (> 50 m)	7	Low	5	69.5
Ethel Newman #3	Wide (> 50 m)	7	Very Low	7	69.5
George Washington #1	Wide (> 50 m)	7	Very Low	7	61.5
George Washington #2	Wide (> 50 m)	7	Very Low	7	58.5
George Washington #3	Wide (> 50 m)	7	Very Low	7	67
Heditsian et al	Wide (> 50 m)	7	Very Low	7	68
LynchDepres #1	Wide (> 50 m)	7	Low	5	61
LynchDepres #2	Wide (> 50 m)	7	Very Low	7	77
Phillips Farm	Wide (> 50 m)	7	Low	5	63.5
Powdermill ledges	Medium (25 m to < 50 m)	4	Moderately High	3	57.5
Primrose Ledges	Wide (> 50 m)	7	Low	5	81
Smithfield DPW	Narrow (10 m to < 25 m)	1	Moderately High	3	43
Snake Den/Pesaturo	Medium (25 m to < 50 m)	4	Moderately High	3	77
Summerfield	Medium (25 m to < 50 m)	4	Moderately High	4	56
Winsor Park	Wide (> 50 m)	7	Low	5	63

	METRIC 3 - HYDROLOGY														
Name of Wetland	Sources of Water (enter score for each that apply)					Sources of Water Score	Connectivity (enter score for each that apply)				Connectivity Score	Maximum Water Depth	Maximum Water Depth Score	Duration of Inundation/Saturation	Duration of Inundation/Saturation Score
	High pH GW	Other GW	Precipitation	Seasonal Surface Water	Perennial Surface Water		100 yr Flood Plain	Between stream/lake & other human LU	Part of wetalnd or upland complex	Part of riparian or upland corridor					
Lafayette Hatchery		3	1	3		7		1	1	1	3	< 0.4 m (< 15.7 in.)	1	Ave. Reg & Seas. Inundated	2.5
Town of NK, Well #5			1	3	5	9		1	1	1	3	> 0.7 m (27.6 in.)	3	SemiPerm to Perm	4
Town of NK, Well #6			1	3	5	9		1	1	1	3	0.4 to 0.7 m (15.7 to 27.6 in.)	2	SemiPerm to Perm	4
Butcher/Huff			1	3	5	9	1	1	1	1	4	> 0.7 m (27.6 in.)	3	SemiPerm to Perm	4
Pierce/NK Wells 3,7,8			1	3	5	9		1	1	1	3	> 0.7 m (27.6 in.)	3	SemiPerm to Perm	4
Buttonhole Gulf Course			1	3	5	9		1		1	2	0.4 to 0.7 m (15.7 to 27.6 in.)	2	SemiPerm to Perm	4
Deerfield Park #1			1	3		4			1		1	< 0.4 m (< 15.7 in.)	1	Seasonally inundated	2
Deerfield Park #2			1	3		4			1		1	0.4 to 0.7 m (15.7 to 27.6 in.)	1	SemiPerm to Perm	4
Deerfield Park #3			1			1			1		1	< 0.4 m (< 15.7 in.)	1	Seasonally inundated	2
Deerfield Park #4			1			1			1		1	0.4 to 0.7 m (15.7 to 27.6 in.)	2	Seasonally inundated	2
Deerfield Park #5			1	3		4			1		1	0.4 to 0.7 m (15.7 to 27.6 in.)	2	Ave. Reg & Seas. Inundated	2.5
Ethel Newman #1			1	3	5	9	1	1	1	1	4	< 0.4 m (< 15.7 in.)	1	Seasonally inundated	2
Ethel Newman #2			1	3	5	9	1	1	1	1	4	0.4 to 0.7 m (15.7 to 27.6 in.)	2	SemiPerm to Perm	4
Ethel Newman #3			1	3		4			1	1	2	< 0.4 m (< 15.7 in.)	1	Ave. Reg & Seas. Inundated	2.5
George Washington #1			1	3		4		1	1	1	3	< 0.4 m (< 15.7 in.)	1	Seasonally inundated	2
George Washington #2			1	3		4		1	1	1	3	< 0.4 m (< 15.7 in.)	1	Seasonally inundated	2
George Washington #3			1	3		4		1	1	1	3	< 0.4 m (< 15.7 in.)	1	Seasonally inundated	2
Heditsian et al			1	3		4		1	1	1	3	0.4 to 0.7 m (15.7 to 27.6 in.)	2	SemiPerm to Perm	4
LynchDepres #1			1	3		4		1	1	1	3	< 0.4 m (< 15.7 in.)	1	Seasonally inundated	2
LynchDepres #2			1	3		4			1	1	2	< 0.4 m (< 15.7 in.)	1	Regularly inundated or saturated	3
Phillips Farm			1	3	5	9		1	1	1	3	0.4 to 0.7 m (15.7 to 27.6 in.)	2	Ave. Reg & Seas. Inundated	2.5
Powdermill ledges			1	3		4		1	1		2	0.4 to 0.7 m (15.7 to 27.6 in.)	2	Regularly inundated or saturated	3
Primrose Ledges			1	3	5	9		1	1	1	3	< 0.4 m (< 15.7 in.)	1	Seasonally inundated	2
Smithfield DPW			1	3	5	9		1	1		2	0.4 to 0.7 m (15.7 to 27.6 in.)	2	SemiPerm to Perm	4
Snake Den/Pesaturo			1	3	5	9		1	1	1	3	< 0.4 m (< 15.7 in.)	1	Regularly inundated or saturated	3
Summerfield			1	3		4		1	1	1	3	< 0.4 m (< 15.7 in.)	1	Seasonally inundated	2
Winsor Park			1	3		4	1	1	1		3	0.4 to 0.7 m (15.7 to 27.6 in.)	2	Seasonally inundated	2

Name of Wetland	Modifications to Natural Hydrologic Regime (check all that apply - enter y for yes)										Have these hydro. mod's caused more than trivial alterations?	Category of Hydrologic Disturbance/Recovery	Hydrologic Modification Score	TOTAL Hydrology Score (max is 30, even though can add to more)	SCORE Total Score
	ditches	tiles	dikes	weirs	stormwater inputs (add'n of water)	point sources discharges (non-storm)	filling/grading	road beds/RR beds	dredging activites	other (specify)					
Lafayette Hatchery	y			y			y	y			yes	Recovered	7	20.5	70
Town of NK, Well #5			y		y		y				yes	Recovered	7	26	71
Town of NK, Well #6				y	y		y	y		power lines	yes	Recovered	7	25	73
Butcher/Huff					y			y		rte 138	not sure	Not Sure - Average Score	9.5	29.5	89.5
Pierce/NK Wells 3,7,8					y			y		rte 138	no	None or None Apparent	12	30	90
Buttonhole Gulf Course					y		y	y			yes	Recent or No Recovery	1	18	33.5
Deerfield Park #1			y		y		y	y			yes	Recovered	7	15	43.5
Deerfield Park #2			y				y	y			yes	Recovered	7	17	35
Deerfield Park #3							y	y		gravel	not sure	Not Sure - Average Score	9.5	14.5	44.5
Deerfield Park #4							y	y				None or None Apparent	12	18	49
Deerfield Park #5	y				y		y	y		landscape debris	not sure	Not Sure - Average Score	7	16.5	38.5
Ethel Newman #1								y		Cows,	yes	Recovering	5	21	45
Ethel Newman #2								y			not sure	Not Sure - Average Score	9.5	28.5	69.5
Ethel Newman #3											not sure	None or None Apparent	12	21.5	69.5
George Washington #1					y					ATV trails	not sure	Not Sure - Average Score	9.5	19.5	61.5
George Washington #2										ATV trails	not sure	Not Sure - Average Score	9.5	19.5	58.5
George Washington #3											no	None or None Apparent	12	22	67
Heditsian et al					y			y			no	None or None Apparent	12	25	68
LynchDepres #1											no	None or None Apparent	12	22	61
LynchDepres #2										gravel hiking trail	no	None or None Apparent	12	22	77
Phillips Farm					y						no	None or None Apparent	12	28.5	63.5
Powdermill ledges					y			y			not sure	Not Sure - Average Score	9.5	20.5	57.5
Primrose Ledges					y			y		trails	no	None or None Apparent	12	27	81
Smithfield DPW					y			y			yes	Recovered	7	24	43
Snake Den/Pesaturo					y			y		power lines	not sure	Not Sure - Average Score	9.5	25.5	77
Summerfield					y			y			no	None or None Apparent	12	22	56
Winsor Park								y		trails	no	None or None Apparent	12	23	63

	METRIC 4 - HABITAT ALTERATION AND DEVELOPMENT																					SCORE
Name of Wetland	Are there any Substrate/Soil Disturbances (list)	Have these soil disturbances caused more than trivial alterations?	Soil Disturbance Score	Habitat Development	Habitat Development Score	Habitat Alteration (check all that apply -enter y for yes)													Have these habitat alterations caused more than trivial alterations?	Category of Habitat Disturbance/Recovery	Habitat Alteration Score	Total Score
						mowing	grazing	clearcutting	selective cutting	woody debris removal	toxic pollutants	shrub/sapling removal	herbaceous layer/aquatic bed removal	sedimentation	dredging	farming	nutrient enrichment	other (specify)				
Lafayette Hatchery		not sure	3.5	Very Good	6												y	dirt road	no	None or None Apparent	9	70
Town of NK, Well #5	no	no	4	Good	5												y	invasives	yes	ave. none and recent	5	71
Town of NK, Well #6	power lines, filling, ditching near well	yes	3	Very Good	6												y	power lines	yes	Recovered	6	73
Butcher/Huff	no	no	4	Excellent	7									y			y	De-icing	not sure	Not Sure - Average Score	7.5	89.5
Pierce/NK Wells 3,7,8	dirt roads	yes	3	Very Good	6											y		gravel road	yes	Recovered	6	90
Buttonhole Gulf Course		not sure	3.5	Poor to Fair	2	y											y	invasives	yes	Recent or No Recovery	1	33.5
Deerfield Park #1	grading, filling, diking	yes	3	Moderately Good	4	y												road, noise, lights	not sure	Not Sure - Average Score	7.5	43.5
Deerfield Park #2	diking	yes	3	Moderately Good	4	y												road, noise, lights	yes	Recovered	6	35
Deerfield Park #3	no	no	4	Good	5	y													no	None or None Apparent	9	44.5
Deerfield Park #4	no	no	4	Good	5														no	None or None Apparent	9	49
Deerfield Park #5	no	no	4	Fair	3	y											y	shrubs uprooted	yes	Ave. Recov'd,Recov'ing	4.5	38.5
Ethel Newman #1	cows	yes	1	Moderately Good	4		y									y	y		yes	Recent or No Recovery	1	45
Ethel Newman #2	no	no	4	Excellent	7														no	None or None Apparent	9	69.5
Ethel Newman #3	no	no	4	Excellent	7														no	None or None Apparent	9	69.5
George Washington #1	ATV's	yes	1	Good	5													ATV trails	not sure	Not Sure - Average Score	7.5	61.5
George Washington #2	no	no	4	Good	5											y		ATV trails	no	None or None Apparent	9	58.5
George Washington #3	no	no	4	Very Good	6													trails	no	None or None Apparent	9	67
Heditsian et al	no	no	4	Very Good	6														no	None or None Apparent	9	68
LynchDepres #1	no	no	4	Excellent	7														no	None or None Apparent	9	61
LynchDepres #2	no	no	4	Excellent	7													gravel trail	no	None or None Apparent	9	77
Phillips Farm	no	no	4	Very Good	6	y													no	None or None Apparent	9	63.5
Powdermill ledges	no	no	4	Good	5													trails	not sure	Not Sure - Average Score	7.5	57.5
Primrose Ledges	no	no	4	Very Good	6													trails	no	None or None Apparent	9	81
Smithfield DPW	no	no	4	Fair	3												y	invasives	yes	Recovering	3	43
Snake Den/Pesaturo		not sure	3.5	Very Good	6				y			y						powerlines	not sure	Not Sure - Average Score	7.5	77
Summerfield	no	no	4	Good	5													subdivision	not sure	Not Sure - Average Score	7.5	56
Winsor Park	no	no	4	Very Good	6											y		paths	no	None or None Apparent	9	63

	METRIC 5 - SPECIAL WETALND COMMUNITIES						SCORE
Name of Wetland	Special Wetland Communities (check all that apply) NOTE: need to modify further for RI						Special Community Score (max 10)	Total Score
	Bog	Fen	Old Growth Forest	Mature Forested Wetland	Known occurrence of RTE species	Signif. migr. songbird/waterfowl hab.		
Lafayette Hatchery				5			5	70
Town of NK, Well #5							0	71
Town of NK, Well #6	10			5			10	73
Butcher/Huff	10			5			10	89.5
Pierce/NK Wells 3,7,8	10						10	90
Buttonhole Gulf Course							0	33.5
Deerfield Park #1							0	43.5
Deerfield Park #2							0	35
Deerfield Park #3							0	44.5
Deerfield Park #4							0	49
Deerfield Park #5							0	38.5
Ethel Newman #1							0	45
Ethel Newman #2							0	69.5
Ethel Newman #3				5			5	69.5
George Washington #1							0	61.5
George Washington #2				5			5	58.5
George Washington #3				5			5	67
Heditsian et al							0	68
LynchDepres #1							0	61
LynchDepres #2				5			5	77
Phillips Farm							0	63.5
Powdermill ledges							0	57.5
Primrose Ledges				5	10		10	81
Smithfield DPW							0	43
Snake Den/Pesaturo				5	10		10	77
Summerfield							0	56
Winsor Park							0	63

	METRIC 6 - VEGETATION, INTERSPERSION, AND MICROTOPOGRAPHY															SCORE
Name of Wetland	Wetland Vegetation Communities (enter value for cover scale)							Wetland Veg. Comm. Score	Horizontal (plan view) Interspersion	Horizontal Interspersion Score	Coverage of Invasive Plant Species	Invasive Plant Cover Score	Microtopography (enter value for cover scale)				Microtopography Score	Total Score
	Aquatic Bed	Emergent	Shrub	Forested	Mudflats	Open Water	Other						Vegetated hummocks and tussocks	Coarse woody debris	Standing dead trees	Amphibian breeding habitat		
Lafayette Hatchery	0	0	3	3	0	0	0	6	High	5	Nearly Absent (< 5%)	0	2	1	1	2	6	70
Town of NK, Well #5	2	2	3	3	0	2	0	12	Moderately High	4	Sparse (5 - 25%)	-1	3	1	1	3	8	71
Town of NK, Well #6	1	2	3	3	0	1	0	10	Moderately High	4	Nearly Absent (< 5%)	0	3	0	1	1	5	73
Butcher/Huff	3	2	3	3	0	2	0	13	High	5	Nearly Absent (< 5%)	0	3	1	1	1	6	89.5
Pierce/NK Wells 3,7,8	2	2	3	3	0	2	0	12	Moderately High	4	Absent	1	3	1	0	2	6	90
Buttonhole Gulf Course	1	1	2	0	0	1	0	5	Low	1	Moderate (25 - 75%)	-3	1	0	0	0	1	33.5
Deerfield Park #1	0	0	1	2	0	0	0	3	Moderately Low	2	Nearly Absent (< 5%)	0	1	1	0	1	3	43.5
Deerfield Park #2	0	0	3	0	0	0	0	3	Moderate	3	Nearly Absent (< 5%)	0	0	0	0	0	0	35
Deerfield Park #3	0	0	2	2	0	0	0	4	Moderately High	4	Nearly Absent (< 5%)	0	1	1	1	1	4	44.5
Deerfield Park #4	0	0	2	2	0	0	0	4	Moderate	3	Nearly Absent (< 5%)	0	1	2	1	1	5	49
Deerfield Park #5	0	0	1	2	0	0	0	3	Low	1	Sparse (5 - 25%)	-1	0	1	0	2	3	38.5
Ethel Newman #1	0	1	2	2	0	0	0	5	Moderately Low	2	Sparse (5 - 25%)	-1	1	0	0	1	2	45
Ethel Newman #2	3	3	0	2	0	0	0	8	low	1	Absent	1	2	0	0	3	5	69.5
Ethel Newman #3	0	0	2	3	0	0	0	5	Moderately High	4	Absent	1	0	2	2	1	5	69.5
George Washington #1	0	3	3	3	0	0	0	9	Moderately High	4	Nearly Absent (< 5%)	0	2	1	0	3	6	61.5
George Washington #2	0	0	1	3	0	0	0	4	Low	1	Sparse (5 - 25%)	-1	0	2	0	2	4	58.5
George Washington #3	0	0	3	3	0	0	0	6	Moderately High	4	Nearly Absent (< 5%)	0	2	1	0	0	3	67
Heditsian et al	1	2	1	3	0	0	0	7	Moderately High	4	Nearly Absent (< 5%)	0	3	0	1	1	5	68
LynchDepres #1	0	0	3	3	0	0	0	6	Moderately High	4	Absent	1	1	0	0	1	2	61
LynchDepres #2	0	1	3	3	0	0	0	7	High	5	Absent	1	3	1	0	2	6	77
Phillips Farm	0	0	2	3	0	0	0	5	Moderate	3	Nearly Absent (< 5%)	0	0	1	0	2	3	63.5
Powdermill ledges	2	1	1	2	1	2	0	9	Moderately High	3	Sparse (5 - 25%)	-1	2	3	0	2	7	57.5
Primrose Ledges	1	1	2	3	0	2	0	9	Moderate	3	Nearly Absent (< 5%)	0	2	2	0	2	6	81
Smithfield DPW	2	1	0	0	0	2	0	5	Low	1	Moderate (25 - 75%)	-3	2	0	0	0	2	43
Snake Den/Pesaturo	0	2	3	3	0	1	0	9	High	5	Sparse (5 - 25%)	-1	2	2	2	2	8	77
Summerfield	0	0	2	3	0	0	0	5	Moderately High	4	Absent	1	1	1	1	0	3	56
Winsor Park	2	0	2	3	0	0	0	7	Moderately High	4	Nearly Absent (< 5%)	0	2	0	0	2	4	63

	DERAP	DERAP	DERAP	SCORE
Name of Wetland	Stressors in Buffer (100 m surrounding site) (list all that were checked)	Hydrology Stressors (list all that were checked)	Habitat/Plant Community Stressors (list all that were checked)	Total ORAM Score
	development density, sewage disposal, roads (dirt, 2-lane, or 4-lane), landfill/waste disposal, channelized streams or ditches, agriculture (row crops, nursery plants, orchards, poultry or livestock), forest harvesting w/in last 15 years, golf course, mowed area, sand/gravel operation, other (list)	ditching (slight, moderate, severe), channelized stream (not maintained, spoil bank 1 side, or 2 sides), stream incision, weir/dam/road (decreasing flooding of site, impounding water < 10%; 10 - 75%; or >75% of site), stormwater inputs, point source, filling/excavation (<10%; 10 - 75%; or >75%), microtopography (<10%; 10 - 75%; or >75%), excessive sedimentation (in stream channel, in wetland), soil subsidence/root exposure, other (describe)	mowing, farmed, grazing, forest harvesting (list specific activity), excessive herbivory, presence of invasives spp (dominate or do not dominate), chemical defoliation, managed or converted to pine, burned, trails, garbage/isolated dumping, increased nutrient (direct application/runoff, and/or algal mats), road (logging road, dirt or gravel, paved), other (describe)	
Lafayette Hatchery	Gravel bank, mostly 2-lane paved roads.	Slight ditching, channelized stream.	Trails, nutrients direct, isolated dumping, some filling in the wetland.	**70**
Town of NK, Well #5	Residential < house/2 acre, mostly 4-lane paved roads.	Stormwater.	Garbage, road runoff, nutrients, invasives.	**71**
Town of NK, Well #6	Commercial, industrial, roads mostly 2-lane paved, golf course on eastside.	Stormwater.	Clear cutting at powerlines, invasives not dominate, small amount of trash, increase nutrients.	**73**
Butcher/Huff	4-lane road	Stormwater from rte-138	invasives not dominate, garbage near 138.	**89.5**
Pierce/NK Wells 3,7,8	Residential <1 house/2acres, roads dirt, 2, 4-lanes	filling and past excavation <10%	Dirt roads, trail.	**90**
Buttonhole Gulf Course	Golf Course on one side	Stormwater	invasives do not dominate, garbage tires and golf balls.	**33.5**
Deerfield Park #1	Roads, mostly dirt, mowing, previous gravel operation, park.	old gravel bank	invasives do not dominate	**43.5**
Deerfield Park #2	2-lane paved roads, mowed area.	filling and past excavation.		**35**
Deerfield Park #3	Roads, mostly dirt, mowing, previous gravel operation, park.	no stressors.	invasives do not dominate, garbage/dumping.	**44.5**
Deerfield Park #4	Residential <2 houses/ac, sand/gravel, septic, steep slope.	no stressors.	Trails, garbage, dirt road	**49**
Deerfield Park #5	Residential <2 houses/ac, sand/gravel, septic, steep slope. Mowing.	Stormwater, weir/dam/road <10% site	Trails, garbage, dirt road	**38.5**
Ethel Newman #1	Cows grazing in a portion, other agriculture.	Weir/dam/road impounding water <10% filling,excavation <10% road wall.	Grazing, forestry within 30-50 years, invasives-do not dominate. Increased nutrients cow manure, farm road.	**45**
Ethel Newman #2	Roads, mostly 2- lane.	weir/dam, impounding 10-75%	No Stressprs.	**69.5**
Ethel Newman #3	No stressors			**69.5**
George Washington #1	noise	ATV Trails in the wetland, soil root exposure.	ATV- trails	**61.5**
George Washington #2	noise		Trails	**58.5**
George Washington #3			Trails, and a few invasives	**67**
Heditsian et al	Some forest harvesting.	stormwater, gravel<10%	Some forest harvesting	**68**
LynchDepres #1	No stressors	no stressors.	paths	**61**
LynchDepres #2	trails, power lines.	no stressors.	Trails Aldrich fidelity, just a chevy blazer.	**77**
Phillips Farm	Roads 4-lane.	Stormwater.	Forestry 30-50 yearsa ago, some garbage.	**63.5**
Powdermill ledges	commercial industrial, road 2-lane paved	soil subsidence in stream channel erosion.	Garbage, trails, invasives.	**57.5**
Primrose Ledges				**81**
Smithfield DPW	Commercial, industrial, 2-lane paved roads, channelized streams, DPW salt, sand.	Stormwater, filling <10%.	Trails, garbage, dirt road	**43**
Snake Den/Pesaturo	Residential<2 houses/ac, mostly 2-lane paved roads,	Stormwater, filling, excavation.	Garbage, trails, invasives. Powerlines.	**77**
Summerfield	Residential <2 houses/ac, septic, roads mostly dirt.	Stormwater.	No Stressors.	**56**
Winsor Park	Residential < house/2 acre,	filling and past excavation.	Trails, dumping, increase nutrients from runoff.	**63**

APPENDIX D

Pre-field Meeting Notes and PowerPoint presentation (July 2006)

Freshwater Wetland Monitoring and Assessment in RI
Wetland Partners Meeting Notes
July 6, 2006

In attendance:
Kevin Cute, Megan Higgins, Emilie Holland, Eugenia Marks, Frank Golet, Peter Paton, Greg Mannesto, Andy Lipsky, Peter Holmes, Rick McKinney, Carol Murphy, Russ Chateauneuf, Sue Kiernan, Marty Wencek, Alisa Richardson, Hank Ellis, Paul Jordan, Peter Grace, Rick Enser, Deb Pelton.

Purpose of meeting
The purpose of this meeting was to update partners on wetland monitoring activities and solicit ideas and feedback on current projects.

Introduction/Background
After incorporating comments from partners, the plan for freshwater wetland monitoring and assessment is essentially complete. The plan has been reviewed internally and will be sent to the RIEMC for review. The plan will be posted as soon as possible on a new web page at DEM dedicated to wetland monitoring.

With receipt of an EPA wetland pilot demonstration grant, work on 3 projects is being conducted: 1) wetland profiles by watershed, 2) characterization of wetlands in proximity to water withdrawals, and 3) demonstration of rapid assessment methods for wetland monitoring. Each of these projects was described in brief during the meeting and is summarized below. Questions and discussion followed.

Review of ST and LT Plan Objectives:
The goal of wetland monitoring and assessment in Rhode Island is to improve protection and management of wetlands by understanding the cumulative impacts of human activities on the condition or health of wetlands. A three-tiered approach to monitoring, advocated by EPA, will be used to address the following long and short-term objectives, identified by DEM and partners:

Long-term objectives

- Develop a database of information necessary to evaluate trends in wetland condition.
- Identify causes and sources of wetland degradation including cumulative impacts to wetlands.
- Identify program and policy changes needed to improve overall wetland condition statewide.
- Evaluate the effectiveness of wetland management and protection programs with respect to wetland condition.

Short-term objectives

- Prioritize wetlands (and adjacent upland habitat) for protection through open space acquisition and other land protection mechanisms.
- Develop and implement methods for monitoring impacts to wetlands due to water withdrawals.
- Monitor and assess impacts to wetlands due to loss and degradation of adjacent upland habitats (buffer zones).
- Monitor location and extent to which invasive species are present and affecting wetland condition.

themselves (e.g. ditching, trash dumping, tree cutting), or a description of the response of a wetland to stressors (e.g. percent cover of invasive species). Wetlands can then be placed somewhere along a gradient of disturbance based on their assessed condition.

The Ohio Rapid Assessment Method (ORAM) contains a narrative section and a quantitative (or semi-quantitative) section that assesses 6 metrics: 1. Wetland size, 2. Upland buffers and surrounding land use, 3. Hydrology, 4. Habitat alteration and development, 5. Special wetland communities, and 6. Vegetation interspersion and microtopography.

The Delaware Rapid Assessment Procedure (DERAP) is a checklist of stressors affecting the habitat/plant community (13 stressors), hydrology (9 stressors), and buffer (12 stressors) of a wetland.

For both methods, there are several steps we're working on prior to field implementation:

1. Site selection

2. Access to sites

3. Definition of the assessment area

4. Classification of wetlands – Currently RI uses the Cowardin system to classify wetlands. We'll continue to use this, however, OH and DE also classify their wetlands using the HGM system and have found that to be helpful in sorting out their data and comparing wetlands of a similar class. Where possible, we will try to describe our wetlands by broad HGM class in the field (in addition to Cowardin), recognizing that this could be difficult at some sites.

5. Reporting results – One of the biggest challenges all states are facing is how best to report results of a conditional wetland assessment. Existing rapid assessment methods rely on a point system to place a wetland into condition categories, which are described narratively. We are sensitive to the concerns about "ranking" wetlands and about information about wetland condition being misused. The purpose of assessing wetland condition is to become aware of the ecological health of our wetlands so we can better protect, manage, and restore wetlands. Wetlands will not be "ranked" by these methods, but rather condition of the wetland resource will be described somehow.

Additional topics of discussion about RAMs

During the meeting, partners discussed the need for RI to validate RAM results with more detailed studies such as relating the number of breeding amphibians with predicted wetland condition, or correlating wetland condition with Odonate data or other "level 3" biological data, if possible.

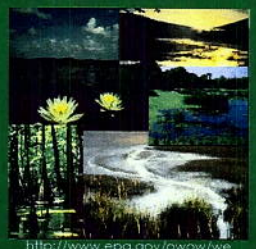
To help apply the RAM data to objectives, the suggestion was made to indicate which RAM metrics apply to which objectives, and to determine which stressors we can do something about once they are identified.

As we work to modify existing RAMs to RI conditions, the suggestion was made to collect continuous data and then break it down into groups or categories as they do in OH. For example, we can record actual wetland size and buffer widths, rather than putting them into the broader categories suggested by the ORAM method.

Questions for partners

During the meeting, we posed the following questions to partners:

- Are there special wetland communities in RI to replace those listed in ORAM that do not apply to RI?



http://www.epa.gov/owow/wetlands/types/images/wet.gif

Freshwater Wetland Monitoring and Assessment in Rhode Island

♦ Wetland Partners Meeting ♦

July 6, 2006

Deb Pelton
NEIWPCC at Rhode Island DEM

NEIWPCC ♦ RI DEM ♦

Wetland M & A Plan

Long-term objectives

- Develop a database of information necessary to evaluate trends in condition.
- Identify causes and sources of degradation including cumulative impacts to wetlands.
- Identify program and policy changes needed to improve overall condition statewide.
- Evaluate the effectiveness of management and protection programs with respect to condition.

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Wetland M & A Plan

Short-term objectives

- Prioritize wetlands (& adjacent upland habitat) for protection through open space acquisition & other land protection mechanisms.
- Develop & implement methods for monitoring impacts due to water withdrawals.
- Monitor & assess impacts due to loss & degradation of adjacent upland habitats (buffers).
- Monitor location & extent to which invasive species are present & affecting wetland condition.

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Year 1 Implementation Projects

With receipt of EPA Wetland Pilot Demonstration Grant

Landscape Scale (Level 1)

- Wetland profiles by watershed
- Water withdrawals in proximity to wetlands

Rapid Assessment (Level 2)

- Demonstration of Rapid Assessment Methods

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Wetland Profiles by Watershed

- Landscape scale project using existing GIS data to generate profiles of information on wetlands in each of RI's major watersheds.
- Best available baseline to compare with future changes.
- Summarize existing information on the type and extent of wetlands present in each watershed.
- Note special projects or research.

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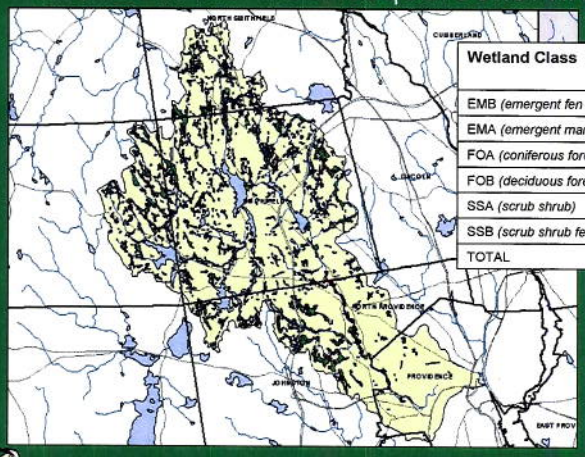
Wetland Profiles by Watershed

Wetlands in the Woonasquatucket River Watershed, RI



Wetland Class	Acres	% of each class
EMB *(emergent fen or bog)*	1.5	0.04%
EMA *(emergent marsh)*	202.6	5.65%
FOA *(coniferous forested)*	293.6	8.19%
FOB *(deciduous forested)*	2764.9	77.15%
SSA *(scrub shrub)*	248.6	6.94%
SSB *(scrub shrub fen or bog)*	72.6	2.03%
TOTAL	3583.9	

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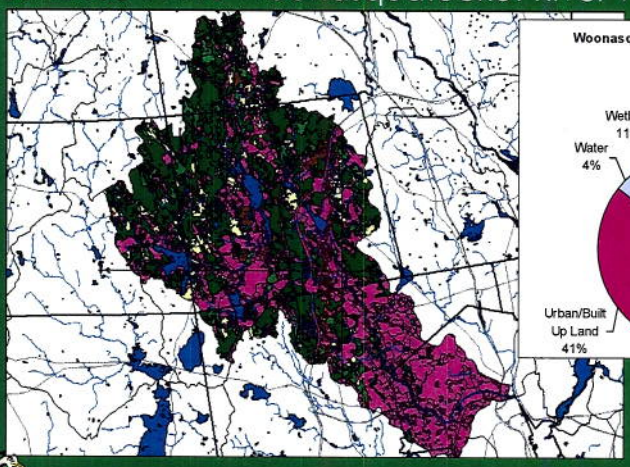
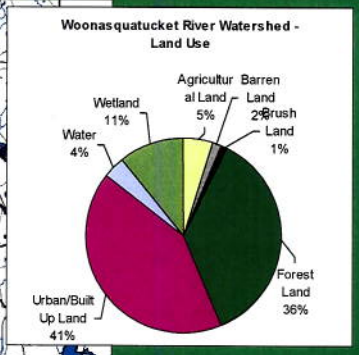
Wetland Profiles by Watershed

Landuse in the Woonasquatucket River Watershed, RI





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Wetland Profiles by Watershed

Planning to add:

- R, T, E species that are wetland specific (need data)
- Open space areas that contain wetlands (note public access)
- % impervious surface in the watershed

What other data are available?

- Wetland wildlife data by watershed?
- What else?

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Water Withdrawals Near Wetlands

- Use existing GIS to determine the extent to which wetlands and wells are in proximity to each other – potential for impacts to wetlands.
- Characterize wetlands in proximity to community wells, including distance from well to wetland edges, soil type, wetland class, surrounding land use, etc… (sorted by watershed)

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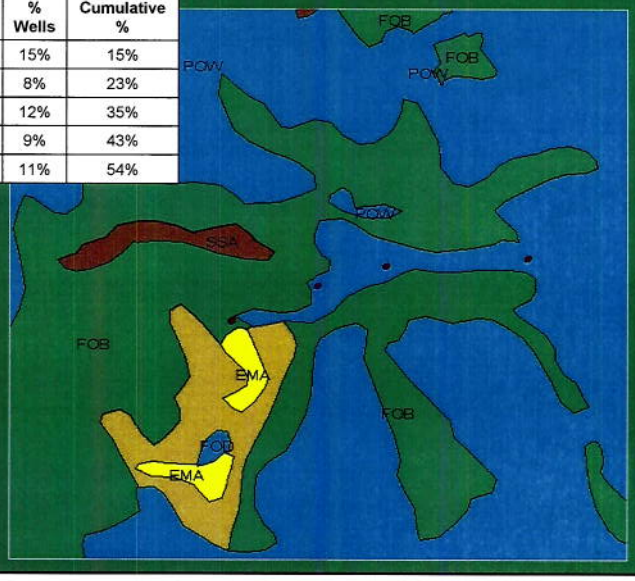
Water Withdrawals Near Wetlands

Distance to nearest wetland edge

distance (ft)	# Wells	Cumulative #	% Wells	Cumulative %
0	16	16	15%	15%
1 to 25	8	24	8%	23%
26 to 50	12	36	12%	35%
51 to 75	9	45	9%	43%
75 to 100	11	56	11%	54%



Water Withdrawals Near Wetlands

- 41 community wells in stratified drift with
  - pump rate >= 100 gpm
  - <= 100 ft. from wetland edge
  - in 7 watersheds, 11 sub-watersheds
- 162 acres of wetlands in 400 ft. radius of those wells
  - FOB: 104 acres
  - SSA: 27 acres
  - FOA: 12 acres
  - FOD: 8 acres
  - EMA: 7 acres
  - SSB: 4 acres

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Rapid Assessment Methods

- Based on indicators of wetland condition derived from 3 universal features:
  - Hydrology
  - Presence of hydric soils
  - Presence of hydrophytic vegetation and other biota

  Also consider landscape or hydrogeologic setting
- Assume that wetlands respond predictably to stressors from human activities.
  - Indicators based on response of wetland to stressor or on the stressors themselves.
  - Place wetlands along a gradient of disturbance.

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Demonstrate RAMs in RI

Test existing methods

- ORAM -
  Ohio Rapid Assessment Method
- DERAP -
  Delaware Rapid Assessment Procedure

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ORAM

Narrative and Quantitative questions

- Narrative questions - consider whether wetland is uncommon (e.g. bog, fen old growth forest), provides critical habitat, supports rare and endangered species… info. from official records (NHP, FWS).
- Quantitative questions – 6 metrics with submetrics for total of 16 questions.
- Results used to place wetland into 1 of 3 categories. (In Ohio, used for regulatory purposes)

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ORAM

Quantitative questions – 6 metrics, some with submetrics:

1. Wetland Size
2. Upland buffers and surrounding land use
3. Hydrology
4. Habitat alteration and development
5. Special wetland communities
6. Vegetation interspersion, microtopography

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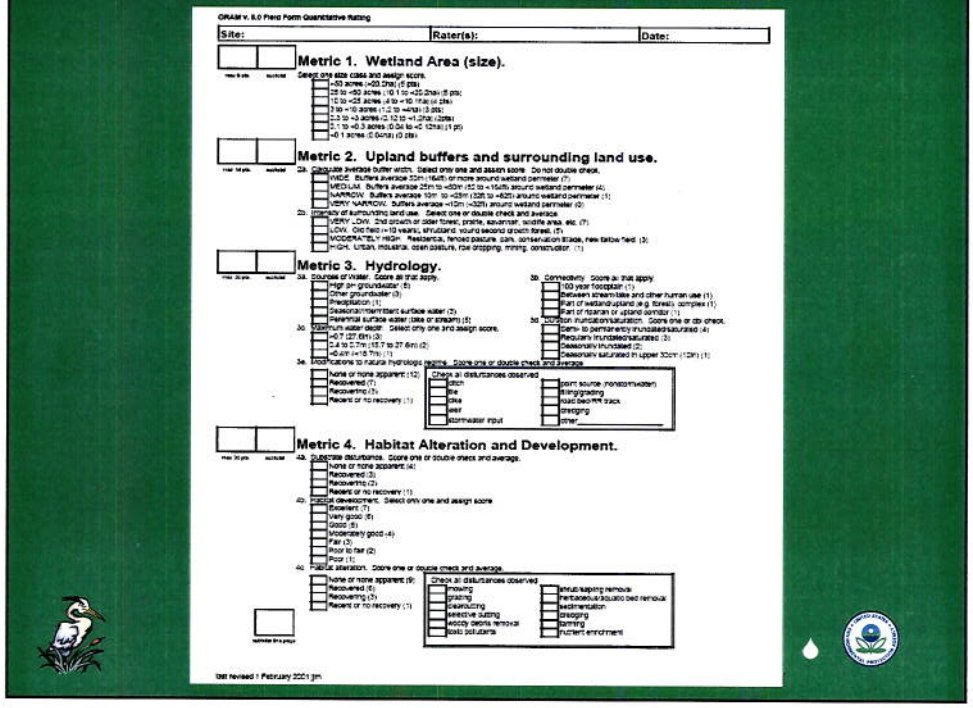
RI DEM


ORAM v. 5.0 Field Form Quantitative Rating

Site: | Rater(s): | Date:

Metric 1. Wetland Area (size).

Select one size class and assign score.

- ≥50 acres (≥20.2ha) (6 pts)
- 25 to <50 acres (10.1 to <20.2ha) (5 pts)
- 10 to <25 acres (4 to <10.1ha) (4 pts)
- 3 to <10 acres (1.2 to <4ha) (3 pts)
- 2.3 to <3 acres (0.12 to <1.2ha) (2pts)
- 1.1 to <2.3 acres (0.04 to <0.12ha) (1 pt)
- <0.1 acres (0.04ha) (0 pts)

Metric 2. Upland buffers and surrounding land use.

2a. Calculate average buffer width. Select only one and assign score. Do not double check.

- WIDE. Buffers average 50m (164ft) or more around wetland perimeter (7)
- MEDIUM. Buffers average 25m to <50m (82 to <164ft) around wetland perimeter (4)
- NARROW. Buffers average 10m to <25m (33ft to <82ft) around wetland perimeter (1)
- VERY NARROW. Buffers average <10m (<33ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.

- VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- LOW. Old field (>10 years), shrubland, young second growth forest. (5)
- MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field. (3)
- HIGH. Urban, industrial, open pasture, row cropping, mining, construction. (1)

Metric 3. Hydrology.

3a. Sources of Water. Score all that apply.

- High gw groundwater (6)
- Other groundwater (3)
- Precipitation (1)
- Seasonal/intermittent surface water (2)
- Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.

- 100 year floodplain (1)
- Between stream/lake and other human use (1)
- Part of wetland/upland (e.g. forest) complex (1)
- Part of riparian or upland corridor (1)

3c. Duration inundation/saturation. Score one or dbl check.

- Semi- to permanently inundated/saturated (4)
- Regularly inundated/saturated (3)
- Seasonally inundated (2)
- Seasonally saturated in upper 30cm (12in) (1)

3d. Hydrologic Alteration. Select only one and assign score.

- >0.7 (27.6in) (3)
- 0.4 to 0.7m (15.7 to 27.6in) (2)
- <0.4m (<15.7in) (1)

3e. Modifications to natural hydrologic regime. Score one or double check and average.

- None or none apparent (12)
- Recovered (7)
- Recovering (3)
- Recent or no recovery (1)

Check all disturbances observed

- ditch
- tile
- dike
- weir
- stormwater input
- point source (nonstormwater)
- filling/grading
- road bed/RR track
- dredging
- other

Metric 4. Habitat Alteration and Development.

4a. Substrate disturbance. Score one or double check and average.

- None or none apparent (4)
- Recovered (3)
- Recovering (2)
- Recent or no recovery (1)

4b. Habitat development. Select only one and assign score

- Excellent (7)
- Very good (6)
- Good (5)
- Moderately good (4)
- Fair (3)
- Poor to fair (2)
- Poor (1)

4c. Habitat alteration. Score one or double check and average.

- None or none apparent (9)
- Recovered (6)
- Recovering (3)
- Recent or no recovery (1)

Check all disturbances observed

- mowing
- grazing
- clearcutting
- selective cutting
- woody debris removal
- toxic pollutants
- shrub/sapling removal
- herbaceous/aquatic bed removal
- sedimentation
- dredging
- farming
- nutrient enrichment

Last Revised 1 February 2001 jm

DERAP

Stressor Checklist

- 3 Categories
  - Habitat/Plant community – 13 stressors + "other"
  - Hydrology – 9 stressors + "other"
  - Buffer – 12 stressors + "other"
- Results used to place wetland into 1 of 3 categories or "condition classes."

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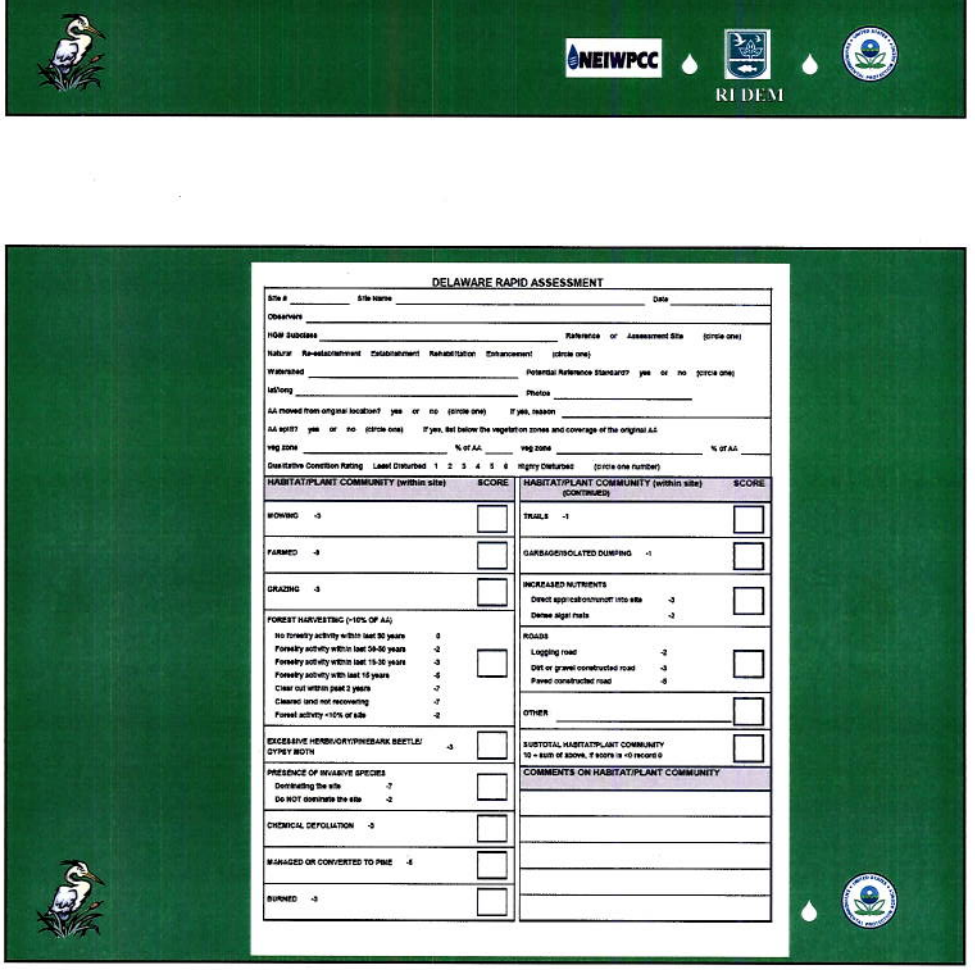

DELAWARE RAPID ASSESSMENT

Site # _____ Site Name _____ Date _____

Observers _____

HGM Subclass _____ Reference or Assessment Site (circle one)

Natural Re-establishment Establishment Rehabilitation Enhancement (circle one)

Watershed _____ Potential Reference Standard? yes or no (circle one)

lat/long _____ Photos _____

AA moved from original location? yes or no (circle one) If yes, reason _____

AA split? yes or no (circle one) If yes, list below the vegetation zones and coverage of the original AA

veg zone _____ % of AA _____ veg zone _____ % of AA _____

Qualitative Condition Rating Least Disturbed 1 2 3 4 5 6 Highly Disturbed (circle one number)

HABITAT/PLANT COMMUNITY (within site)	SCORE
MOWING -3	
FARMED -3	
GRAZING -3	
FOREST HARVESTING (~10% OF AA) No forestry activity within last 50 years 0 Forestry activity within last 30-50 years -2 Forestry activity within last 15-30 years -3 Forestry activity with last 15 years -5 Clear cut within past 3 years -7 Cleared land not recovering -7 Forest activity >10% of site -2	
EXCESSIVE HERBIVORY/PINEBARK BEETLE/ GYPSY MOTH -3	
PRESENCE OF INVASIVE SPECIES Dominating the site -7 Do NOT dominate the site -2	
CHEMICAL DEFOLIATION -3	
MANAGED OR CONVERTED TO PINE -5	
BURNED -3	

HABITAT/PLANT COMMUNITY (within site) (CONTINUED)	SCORE
TRAILS -1	
GARBAGE/ISOLATED DUMPING -1	
INCREASED NUTRIENTS Direct application/runoff into site -3 Dense algal mats -2	
ROADS Logging road -2 Dirt or gravel constructed road -3 Paved constructed road -5	
OTHER _____	
SUBTOTAL HABITAT/PLANT COMMUNITY 10 + sum of above, if score is <0 record 0	
COMMENTS ON HABITAT/PLANT COMMUNITY	

Implementation Decisions for RAMs

1. Site selection
2. Access to sites
3. Definition of assessment area
4. Classification of wetlands
5. Reporting results

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Adapting existing RAMs to RI

Questions:

- Are there special wetland communities in RI to replace those in OH?
- Wetland size categories – keep?
- Buffer width categories – keep?
- Concept of stressor checklist – is it useful, helpful?
- Are there stressors in RI that are not on DE's list? Are there stressors on DE's list that are not relevant to RI?

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