Wetland assessment data form for an adopted wetland site*

(please familiarize yourself with the accompanying instructions packet before beginning your study)

Site/group name _____

Observer(s) _____

Leader Email _____ Date assessed _____

What kind of wetland do you have? Use the key on page 3 of your instructions packet to ID your wetland type and check it below:

___ marine tidal fringe ___ estuarine tidal fringe ___ riverine ___ depressional ___ slope ___ flat

___ other (please describe):

Is your wetland created or manipulated? ___ YES ___ NO ___ Not Sure If YES, indicate which category applies:

___ constructed (created wetland) ___ enhancement (a non-degraded wetland modified to improve certain functions)

___ rehabilitated (repair of a degraded wetland) ___ other (e.g. stormwater basin, pond, etc.) describe:

Does your wetland have trees? Check the choice below that reflects the percentage of your wetland that is covered by trees.

___ none or <1% ___ 1-25% ___ 26-50% ___ >50%

How old are the trees in your wetland? If trees are present, determine the dominant tree type in the wetland and measure the Circumference at Breast Height (CBH) of three representative specimens, then use the formula & chart below to estimate age.

CBH (inches): _____ Tree 1 _____ Tree 2 _____ Tree 3

Average CBH _____ (of 3 from above) ÷ 3.14 x Growth Factor _____ (see chart at right) = Age _____ (check below)

____ >50 years ____ 21-50 years ____ 3-20 years ____ < 3 years

Growth Factor	Species
4.0	Red Oak, Sweet Gum, Green Ash
4.5	Red Maple
5.0	Black Cherry, White Oak
6.0	American Beech
7.5	Shagbark Hickory

How is your wetland vegetated? Using the descriptors found on page 5 of your instructions, rank the following types of plants in order of greatest to least coverage within your wetland (with 1 being greatest). Leave blank the types not found in the wetland.

___ trees ___ shrubs ___ non-woody, broad-leaved emergent plants ___ floating-leaved aquatic plants

___ grasses, reeds & sedges ___ submerged aquatic plants ___ mosses & ferns ___ open water (no plants visible)

Are other water bodies associated with your wetland? Check all types that apply and name the water body(ies) if known:

___ ditch ___ intermittent stream ___ small, always-flowing stream ___ large stream or river ___ pond

water body name(s): _____

Where is your wetland located? Provide county and watershed name (if known), and GPS lat/long coordinates (if available):

_____ county _____ watershed _____ latitude _____ longitude

if no GPS, location by road/street/intersection: _____

How large is your wetland? If GPS is available, use it to walk the wetland perimeter and determine its area. If not, estimate wetland area by using the aerial map scale or the pacing formula provided, and check off the size range from the list to follow:

_____ wetland area in acres (as determined by): ___ GPS ___ map measurement ___ pacing estimate (see below):

Measure the length of your pace in feet, then use that pacing distance to measure average length & width of your wetland.

____ length X ____ width = _____ area (in square feet) Compared to one acre (43,560 sq. ft.), our wetland is (check one):

___ much larger ___ somewhat larger ___ about the same size ___ somewhat smaller ___ a lot smaller

*adapted by: Gary Kreamer and Anthony Jackson, DE-ARE Center, from: *Delaware Rapid Assessment Procedure (version 6.0)* by Amy Jacobs, DE DNREC, 2010

This page is designed for assessing the presence of various conditions within your wetland that can indicate stress on the habitat. Check those boxes for which you observe evidence of the conditions described. If no such conditions are observed, leave the box blank. If you are unsure, place a '?' in the box; For tips on what to look for, see pages 6-10 of your instructions packet.

1. **Forest alterations:** Check if any of the following forest alterations are evident within your wetland area:
   - ☐ **Clear-cutting of trees** (practice of cutting down most to all trees in an area, as evidenced by many stumps)
   - ☐ **Pine Plantation** (management or conversion of parts of the wetland to pine plantation)
   - ☐ **Chemical Defoliation** (use of a broad-leaved herbicide on site to defoliate plants)

2. **Vegetative Alteration:** Check the boxes that apply to any of the following activities occurring within your wetland:
   - ☐ **Mowing** (any re-occurring mechanical activity that inhibits natural growth of vegetation)
   - ☐ **Farming** (part or all of the wetland is cultivated as part of a farming operation to grow crops)
   - ☐ **Grazing** (grazing activity from a goat, pig, sheep, cow or other animal rearing operation occurs within wetland)
   - ☐ **Clearing** (natural vegetation in wetland not regenerating due to land clearing, excavation or other disturbance)

3. **Nuisance Biological Activity:** Check if the following 'unbalanced' ecological conditions are evident in your wetland:
   - ☐ **Algae masses** (presence of large masses of algae on the water surface or as dense mats below the surface)
   - ☐ **Invasive plants** (if significant growth of any of the plants listed on page 7 of your instruction packet is evident)
   - ☐ **Excessive herbivory** (if wetland plants impacted by infestation of gypsy moths, pine beetles or other pests; or if showing browse lines on plants from deer or denuded mud flats from Nutria (see pics on page XX)
   - ☐ **Other signs of biological imbalance** (e.g. algal blooms, foul odors, bacterial masses, etc.) describe:

4. **Alterations to water flow & level:** Check the boxes for any of the following activities occurring within your wetland:
   - ☐ **Ditches** (presence of man-made ditches within wetland used for conveying water into or out of the site)
   - ☐ **Stream alterations** (if a stream in the wetland has been channelized, excavated or otherwise altered by man; sometimes visible as spoil piles along the stream caused by recent removal of soil from the channel)
   - ☐ **Stormwater inputs** (racks of debris or trash have moved into wetland from stormwater runoff or discharge)
   - ☐ **Point-source discharge** (a non-stormwater pipe directly enters the wetland or is within 100 meters of it)
   - ☐ **Weir/dam/culvert** (includes any man-made structure – such as dams, weirs or culverts in the wetland that can impact the flow of water by either impounding water at the site or inhibiting water getting to the site)

5. **Alterations to runoff & soil regime:** Check the boxes for any of the following activities occurring within your wetland:
   - ☐ **Impervious surfaces** (a paved road, parking lot or other such surface runs through or directly borders wetland)
   - ☐ **Soil disturbance** (evidence of plowing, skidder tracks or other major soil disturbances within the wetland)
   - ☐ **Filling or excavation** (evidence that soil has been dug out to excavate, or brought in to fill, part of the wetland)
   - ☐ **Excessive sedimentation** (abnormally high levels of sedimentation observed on the soil surface of the wetland due to alterations in the surrounding landscape from construction, agriculture or other human activities)
   - ☐ **Soil subsidence/root exposure** (settling or sinking of the ground due to underlying soil collapse, often evidenced by exposure of tree roots to the surface that would normally be covered with soil, see picture page XX)

6. **Other stressors:** Check and describe any other observed stressors in the wetland that could adversely affect its condition:
   - ☐ **Litter/trash** (accumulations of litter, piles of trash or other debris from human activities occur in the wetland)
   - ☐ **Other** (e.g. oil slicks, road salt runoff, etc.) please describe:

Page 3 AAW site assessment Wetland Buffer Stressors & QDR

In this section, you will be assessing the **buffer** area of the landscape that borders your wetland, corresponding roughly to the area extending out 100m (about a football field in length) in all directions from the outer edge of your wetland. Assessing this area is critical, since the condition and character of the buffer can have major impacts on the quality of the wetland habitat. Important note: if any parts of the buffer area are on private land, be sure to have landowner permission before walking there. If permission is lacking, follow the guidelines in your instructions packet for buffer assessment using aerial photography. See pages 10-11 of your instructions packet for more details on this and other aspects of completing this part of the assessment.

7. **Development:** Check the boxes that describe development pressures in the buffer; if possible, describe the extent of each:

- ☐ Commercial/industrial (stores, plants, factories, junkyards, etc.) ____ approximate % buffer area covered
- ☐ Residential (houses, condos, apartment buildings, etc.) ____ approximate number of houses per acre
- ☐ Agricultural (circle type and estimate amount) crops/orchard/nursery/livestock ____ approximate % of buffer
- ☐ Roads (check kind): ____ mostly dirt or gravel ____ mostly 2-laned paved ____ mostly 4-laned paved

8. **Other Buffer Stressors:** Check/tally the boxes to follow that relate to the other activities evident in the buffer:

- ☐ Forest harvesting in past 15 years (including selective cutting, clearing, thinning etc. within the buffer)
- ☐ Channelized streams or ditches (evidence of channelized streams or ditches > 2 feet deep in buffer)
- ☐ Piers, boat slips, docks or moorings (evidence of marina or boat-related activities within buffer area)
- ☐ Golf course (presence of a golf course, or part of a golf course, in the buffer area)
- ☐ Mowed area (evidence of recurring mechanical mowing/brush-cutting that impedes natural succession)
- ☐ Sand/gravel operations (presence of a sand and gravel operation in the buffer area)
- ☐ Landfill/waste disposal (presence of human-generated materials deposited over an extended period of time)
- ☐ Other (specify any additional observed buffer stressors in the space below):

9. Qualitative Disturbance Rating (QDR): Using the descriptors below, rate the overall site condition on a 1 to 6 Scale (where 1 = least disturbed and 6 = most disturbed). This rating takes into account both wetland and buffer. ☐

Minimal Disturbance (QDR 1 or 2): Natural structure and biotic community are maintained with only minimal alterations. *High condition sites have a mature plant community, intact wetland soils and a natural hydrologic regime. These sites have natural water flow into and out of the site, relatively undisturbed soils, and are located in a buffer landscape of mostly natural vegetation.* Examples of minimal alterations include: presence of a small ditch that is not conveying water, low occurrence of non-native species, targeting/cutting of a single tree, and small areas of altered habitat in the surrounding (buffer) landscape.

Moderate Disturbance (QDR 3 or 4): Moderate stressors to the wetland structure and/or biotic community. *Medium condition sites maintain some (but not all) components of high condition sites, such as: intact hydrology, undisturbed soils, intact buffer landscape, or mature biotic community despite some alterations*. Examples of moderate alterations include: presence of a large ditch or dam that either increases or decreases flooding, moderate stream channelization, mowing, grazing, forest harvesting, presence of invasives, and high impact land uses in the buffer.

High Disturbance (QDR 5 or 6): Severe stressors to the wetland structure and/or biotic community. *Low condition sites have severe alterations to the plant community, hydrology and soils. This can be a result of one severe alteration or multiple moderate alterations. These disturbances lead to a decline in the wetland's ability to effectively function in the landscape.* Examples of severe alterations include: extensive ditching or stream channelization, recent clear-cutting or conversion to a non-native vegetative community, and roads, fill, excavation or farming in the wetland.

Wetland Assessment Scoring Summary

Page 2: Wetland stressor boxes checked x2 (0-46 possible) _____

Page 3: Buffer stressor boxes checked x2 (0-24 possible) _____

Page 3: Qualitative Disturbance Rating x 5 (0-30 possible) _____

TOTAL Wetland Site Assessment Score (5 being the best possible, 100 the worst) ☐

List any significant stressors found while assessing your wetland:

Ideas for group stewardship projects to help alleviate stressors (removal of invasive species, native replantings, reduced mowing , etc.):

Wetland Functions & Values◊

The following questions are designed to help you do a visual evaluation of functions and values of your wetland site. Since these questions lack specific, measurable answers – people will vary in their responses. With that in mind, work your way through the questions using what you see and know about your wetland to answer each part, then decide on a quality rating (high/medium/low) for each value area. Record this information on the summary sheet below. See pages 12-14 of your instruction manual for more details.

FEATURE EVALUATED	HIGH or YES	MEDIUM or Unsure	LOW or NO
1. Is the wetland large in size or are there other similar wetlands in the area?			
2. Are there wooded areas adjacent to or connected to the wetland?			
3. Does the wetland offer varying areas of water depth?			
4. Are there islands, hummocks, logs, or other resting areas for wildlife in the wetland?			
5. How is the plant diversity (variety of plants) in and around the wetland?			
6. Are there rare plants or animals associated with this wetland?			
WILDLIFE HABITAT VALUE (summation of #1-6 above)			
7. Does the wetland offer an oasis of water supply for largely dry surrounding areas?			
8. Is the wetland situated so that it can soak up flood waters from a stream or river?			
9. Does the wetland offer stormwater drainage for a road, parking lot or other development?			
10. Is the wetland situated between developed upland areas and deeper water habitats?			
FLOOD CONTROL/WATER RETENTION FUNCTION (summation of #7-10 above)			
11. Does the wetland have a connection to a ditch, stream or other water body?			
12. Does the wetland offer stormwater drainage for a road, parking lot or other development?			
13. Is the wetland situated to provide buffering for surrounding farms, lawns or other developed lands?			
WATER QUALITY IMPROVEMENT FUNCTION (summation of #11-13 above)			
14. Is it possible to hike conveniently to and around the wetland?			
15. Is the water in the wetland accessible and deep enough to allow use of a canoe or kayak?			
16. Is there sufficient open water in the wetland for fishing and available shoreline access to do so?			
17. Does the wetland offer other recreational opportunities? Describe:			
RECREATIONAL VALUE (summation of #14-17 above)			
18. Does the wetland offer a refuge of natural habitat in a highly developed (urban) area?			
19. Is the wetland free of litter, trash or other such evidence of human activity?			
20. Does the wetland offer a sense of solitude, beauty or artistic inspiration?			
AESTHETIC VALUE (summation of #18-20 above)			
21. Is there a historic site, such as an old mill, stone bridge or historic building at or next to the wetland?			
22. Does the wetland have unique or especially interesting biological or ecological features?			
23. Is the wetland unusual for the local area because of its type, size or some other feature?			
24. Is the wetland near a school, nature center or other educational venue?			
25. Are there suitable/safe places for groups of students to gather near the wetland edge?			
EDUCATIONAL VALUE (summation of #21-25 above)			
Describe any other values you see in this wetland:			
OVERALL WETLAND FUNCTION & VALUE RATING (check box that takes into account all of the above)			

◊ Adapted from: Miller, Ronald, Frank Mitchell and Laura Ryder. A Study Guide to New England's Freshwater Wetlands. New Hampshire Fish & Game Department and University of New Hampshire Cooperative Extension.

Assessing Your Wetland (Read this before you go out into the field)

Why: This assessment is offered as a tool to engage you in monitoring the health of your adopted wetland site and identifying some potential stressors that might impact it now and in the future. The process of collecting data will also help you get to know your wetland better and prioritize projects for your group. In addition to providing valuable information to Adopt-a-Wetland (AAW), this activity is intended to be fun and educational!

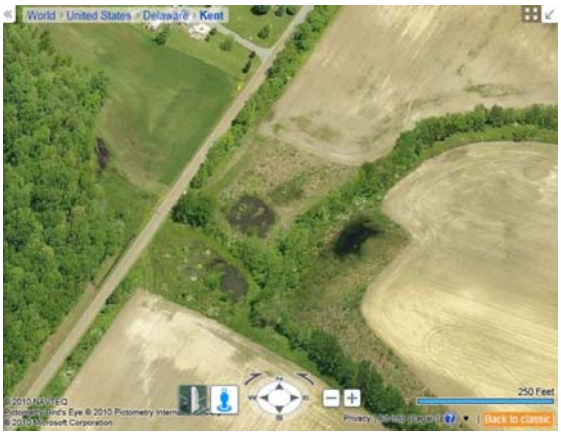
How: The assessment is based largely on the Delaware Rapid Assessment Protocol (DERAP), a procedure used by wetland scientists to monitor trends in the condition and function of Delaware wetlands. State natural resource managers use this data to help direct restoration and protection efforts on a watershed level. To learn more about this, check out: www.dnrec.delaware.gov/Admin/DelawareWetlands/Pages/Wetland-Monitoring-and-Assessment.aspx. Since the assessment must follow a strict protocol for the data to be meaningful, it is suggested that it be done only after those conducting the assessment have attended an AAW orientation training in its use.

When: Because of the important role vegetation plays, we suggest that this assessment be carried out during the season that things are green and growing (i.e. between June 1 and September 30). Once the initial assessment has been completed, we suggest that it be repeated once every five years - or sooner if significant threats to the wetland arise. By completing the assessment, the data you collect can not only serve as a baseline for evaluating future impacts, but also contribute meaningful information to the overall state wetland monitoring data base.

Where: If your wetland is less than or equal to an acre, base your assessment on the entire area. If your wetland is larger, select an area within it that is: roughly an acre, represents the ecological condition of the wetland, and encompasses the various land uses and plant zones present. On the third page of your data form, you are asked to assess the lands surrounding your wetland. This area is referred to as the **Buffer**. Sketch the location and shape of your wetland and buffer. Include key features such as: streams, ditches, ponds, roads, fields, and houses. Obtaining and printing an aerial map of your adopted site is also recommended as a prelude for doing the assessment. This can be a huge help in assessing land uses and stressors in the surrounding buffer. Thanks to new technology, aerial maps are readily available via the worldwide web at various sites. We suggest:

www.bing.com/maps/explore offers low-flying plane photo-based views of many (not all) areas; just type in the name of the nearest town or zip code, then click on the bird's eye menu option. This will bring up the aerial view – simply scroll and zoom in to your adopted site. Use the print feature to print out a copy of the map, and the distance scale to estimate the size of your wetland.

www.googleearth.com If Bing doesn't do it for you, try Google Earth. It allows you to zoom in on your site from different viewing angles, but be careful estimating size, as views from some angles can cause the area to appear skewed. Printing map copies is also not as easy from Google Earth as it is from Bing.



Getting ready: Preparation is essential to making the most of this experience. Allow one to two hours to complete the assessment. Assembling a team of 2-4 group members will make the task more manageable and enjoyable. Assign tasks to team members according to individual interests and abilities. If possible have each person fill out the form separately, and then meet to compare and come to consensus on answers. Complete as much of the assessment as your group is capable of confidently reporting. Careful attention to accuracy will make the results more useful.

Materials: In addition to boots for wading into the wetland, to carry out the assessment, you will need to bring:*

4-page data form 12-page instruction packet clipboards and pencils measuring tape (in inches)
optional: digital camera/cell phone (to photograph wetland features and utilize GPS features)

* contact the Adopt-a-Wetland office at (302) 735-8660 for obtaining the necessary forms and materials

Assessing Your Wetland (Instructions for page 1 of your data form)

Aside from the plant information, most of page 1 of the data form can be completed prior to visiting your site, using background knowledge and/or by accessing maps. Use the instructions below to assist you in doing this.

What kind of wetland do you have? Use the wetland key on page 3 of this packet to help identify your wetland type. Photographs and more detailed descriptions are offered on page 4 to assist further with the identification. If after using the key and reviewing the descriptions, you're still not sure what type of wetland you have, just write "*not sure*" and describe your uncertainty in the space next to "other" on your data form.

Is your wetland created or manipulated? Created/manipulated wetlands are ones that have been engineered by man to alter the physical, chemical, or biological characteristics of a site with the goal of restoring or establishing natural functions. Knowing the history of your site can help you know how to answer this. If you are pretty sure that your wetland is a created/manipulated one, but are not sure which category on the data form to check, just indicate this by writing so next to the "other" choice, and continue on to the next question on the form.

Does your wetland have trees? Wetlands with trees as the dominant plant type are properly called 'swamps'. Do your best to estimate the percentage of your wetland that is tree-covered and check the choice that applies.

How old are the trees in your wetland? If no trees occur within your wetland, write "NA" in the box. If trees are present, you may determine the approximate age of the dominant forest by age estimates based on relative sizes of the trees. A simplified approach to this for some of our common tree species follows.

1. Select three representative specimens of the most common tree species in your wetland.
2. With a tape measure, find the circumference of each tree (in inches) at breast height (4.5 feet above ground).
3. Average the three values. Record this number on the Average CBH line of the data sheet formula box.
4. Find the appropriate tree species growth factor from the chart and enter it into the formula provided.
5. Calculate and write down the average age of the three trees using the numbers entered into the formula.
6. Check the choice in the last line of the box that reflects the estimated average age for those wetland trees.

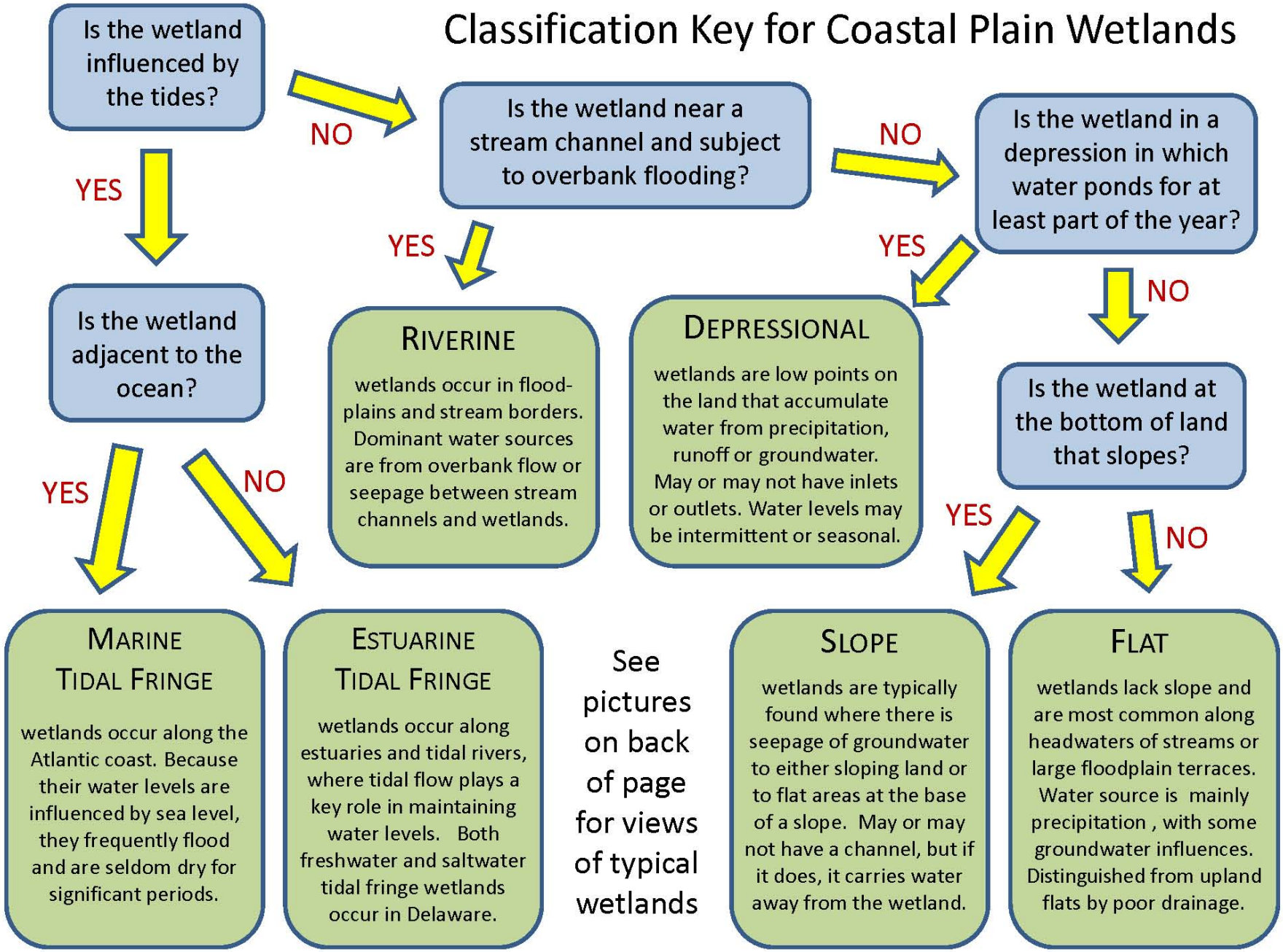
How is your wetland vegetated? The kinds and variety of plants found in a wetland not only are what defines it as a particular wetland type, but also can indicate quite a bit about the quality and condition of the wetland. Generally, the larger and healthier the wetland, the greater the variety of wetland plants that tend to grow there. Freshwater wetlands typically offer greater plant diversity than salt or brackish water habitats (since not as many plants are adapted to salty conditions). Use the illustrations on page 4 to help you identify the types of plants your wetland supports, and rank their relative abundance in the spaces provided next to each on your data sheet.

Are other water bodies associated with your wetland? Hopefully, local knowledge and observation should enable you to complete this section. If not, access to a topographic map (available for free download at: http://datamil.delaware.gov/geonetwork/srv/en/topos) can be helpful in identifying water body names and sources.

Where is your wetland located? If you're not sure which watershed your wetland belongs to, consult the Delaware watersheds directory at: www.deldot.gov/stormwater/watershed.shtml. If you have access to a GPS unit or GPS-capable smart phone, use it on site to capture latitude/longitude coordinates for your wetland and record those numbers in the spaces provided.

How large is your wetland? If a GPS unit is available and can be used to measure the wetland area, please do so. If not, and the shape of the wetland is roughly rectangular, use pacing or a tape rule to measure the approximate length and width and multiply the two to determine the area. If the shape is more circular, measure the distance across the widest point and divide by 2 to get r, and then use the formula, $3.14 \times r^2$ to approximate the area. If these approaches don't work for you, try using the aerial map scale to estimate area using the same formulas.

Classification Key for Coastal Plain Wetlands



Wetland types portfolio (use with "What kind of wetland do you have?" question on page 1 of your data sheet)

Depressional wetlands are located in low areas of the landscape, where water tends to pool up from precipitation, runoff and/or groundwater. They tend to be seasonally wet (in winter/spring), and may have inlets and/or outlets or lack them completely.

Flat type wetlands are slow-draining flat areas on the landscape. They are most common in the headwaters of watersheds or in large floodplain terraces. The water source is usually precipitation, though some groundwater influences may also occur.

Riverine wetlands occur in floodplains and along stream corridors. Water sources are typically overbank flow from the stream channel or subsurface flow between stream and wetland. In headwaters, riverine wetlands can integrate with slope, depressional and flats.

Slope wetlands are found at the base of low parts of sloping lands where water tends to seep out of the ground and accumulate, making for wet soil conditions. Do not confuse with the sloping banks of riverine wetlands, where the stream supplies the water.

Estuarine tidal fringe wetlands occur along estuaries and rivers. They integrate inland with riverine wetlands as tidal flow wanes and river flow dominates. Because tidal fringe wetlands flood frequently and are influenced by sea level, they are seldom dry.

Marine tidal fringe wetlands occur along the Atlantic Coast in Delaware. Like estuarine wetlands, marine tidal fringe wetlands frequently flood, and because water table elevations are mainly controlled by sea level, they rarely appear dry for long.

Categories of wetland plants

(to be used with "How is your wetland vegetated?" question on page 1 on your AAW wetland assessment data sheet).

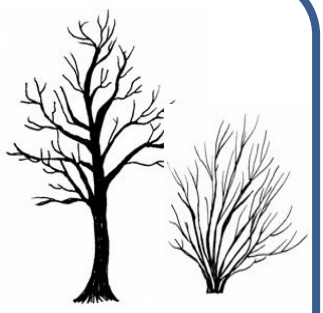
Broad-Leaf Emergents

Emergent plants are rooted in shallow water wetlands, with their stems and leaves emerging mostly above the water surface. **Broad-leaf emergents** are distinguished from grasses and sedges by their wider leaves.

Grasses & Sedges

Grasses & **Sedges** include emergent plants with thin stalks, and long, narrow leaves. **Grasses** have round stems whereas **Sedges** have stems that are triangular in cross-section.

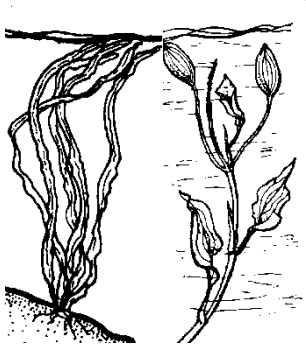
Trees and **Shrubs** are both woody plants. **Trees** tend to grow tall and thick, whereas **Shrubs** typically don't grow taller than 15' and have trunks less than 3-4" in diameter.



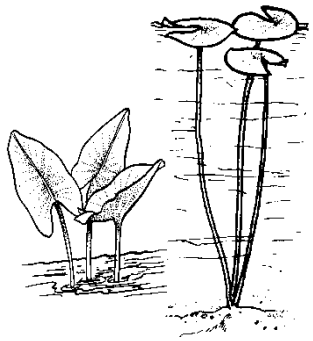
Trees & Shrubs

Mosses & Ferns are semi-aquatic plants that often occur in wetlands. They are easily identified by their respective growth forms.

Mosses & Ferns



Submerged plants occur in deeper water wetland habitats. Like emergents, they are rooted on the bottom, but, in contrast, most of the plant body (stems and leaves) is submerged below the water surface.



Floating-Leaved

Floating-leaved plants may be rooted on the wetland bottom (such as water lily) or not (duckweed), but all feature adaptations for the leaves to float on the water surface.

Several Illustrations (by Carol Watson) on this page were scanned from: S. Borman, R. Korth & J. Temte. 1997. Through the Looking Glass: A Field Guide to Aquatic Plants. Wisconsin Lakes Partnership.

Quality/Character of Vegetation (Instructions for page 2 of your data form)

These instructions refer to page 2 of your data form and relate to assessing the character and condition of the plant community, water regime (hydrology) and soils within the wetland, and potential stressors to those components that might impact wetland health. To best assess all components, we highly recommend doing this during the season when plant growth is well established (i.e. sometime between June 1 and September 30). Work through each item listed, placing a check mark in any boxes where the conditions described are observed. Any components for which you are uncertain, write a large "?" in the box, and include any pertinent comments in the space below it. The sections to follow provide more details on assessing the respective conditions.

1. **Forest Alterations:** Check the box(es) if there is evidence of any of the following activities in the wetland:

   Clear-cutting – This refers to the removal of large swaths of trees from an area. This can be evidenced by land that appears denuded, features a large number of stumps and other debris from logging operations, by even-aged stands of regenerating trees (with no old trees or mixed-age assemblages of trees), and/or by obvious site preparations such as trees that have been replanted in rows.

   Pine Plantation – Check here if all or part of the wetland has been converted to pine by planting after harvest, or by discouraging the growth of other species. This is typically evidenced by an even-aged stand of pine.

   Chemical Defoliation – Check here if you know or can see that broad leaf chemical herbicides have been applied on site to kill off broad-leaved species (e.g. so planted pines can prosper without competition). Such use can be indicated by a uniform defoliation of herbaceous and broadleaved woody plants in the area.

2. **Vegetative Alterations**: Check the box(es) if you find evidence of any of the following activities in the wetland:

   Mowing – This refers to any re-occurring activity that inhibits the natural succession of vegetation through mechanical means (i.e. mowing of grass or weed-whacking of brush in areas adjacent to development, along banks, and/or powerline right-of-ways).

   Farming – Check here if part or all of the wetland is cultivated as part of a farming operation to grow crops.

   Grazing – Check here if grazing activity (as part of an animal rearing operation such as goats, pigs, sheep, cows, etc.) occurs in the wetland. Do not include browsing by wildlife (captured under excessive herbivory).

   Clearing – Check here if the wetland has been affected by a disturbance such as land clearing, excavation etc. where natural regeneration of the native vegetation is not occurring. Examples include: bush-hogged fields, sites maintained as emergent wetlands, or flooded borrow pits that cannot recover.

3. **Nuisance Biological Activity –** Check if any of the following "unbalanced" ecological activities are observed:

   Algae masses – At certain times of the year, wetlands – especially those receiving high nutrient inputs from surrounding lands – can feature large masses or mats of algae along the water surface or on the bottom. These masses eventually die-back and decay resulting in low oxygen and other water quality problems. Check the corresponding box on your answer sheet if you observe such algal masses in your wetland.

   Invasive plants – Use the invasives list and photos on page 7-8 to assist you with identifying invasive plants that may be crowding out other plants in the wetland. Consider borrowing a wetland plants monitoring kit (available for loan through the AAW office), as it not only provides great resources for helping you identify some of the common wetland invasives, but also offers tips on how best to remove them from the wetland.

APPENDIX B - DELAWARE INVASIVE SPECIES LIST*

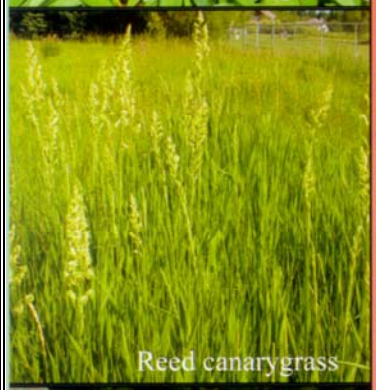
Acer platanoides Norway maple
Acorus calamus European sweetflag
Ailanthus altissima tree-of-Heaven
Akebia quinata five-leaf akebia
Alliaria petiolata garlic mustard
Ampelopsis brevipedunculata porcelain-berry
Aralia elata Japanese angelica-tree
Arthraxon hispidus joint-head arthraxon
Berberis thunbergii Japanese barberry
Bromus inermis awnless brome
Bidens polylepis awnless beggar-ticks
Cabomba caroliniana Carolina fanwort
Carex kobomugi Japanese sand sedge
Celastrus orbiculata Oriental bittersweet knotweed
Centaurea stoebe subsp. micranthos spotted knapweed
Cirsium arvense Canada thistle
Clematis terniflora Japanese virgin's-bower
Conium maculatum poison-hemlock
Echinochloa crus-galli barnyard grass
Egeria densa Brazilian waterweed
Elaeagnus umbellata autumn olive
Euonymus fortunei winter creeper
Ficaria verna/Ranunculus ficaria lesser celandine
Galanthus nivalis snowdrops
Gleditsia triacanthos honey-locust
Hedera helix English ivy
Hemerocallis fulva orange daylily
Humulus japonicus Japanese hops
Hydrilla verticillata hydrilla
Iris pseudacorus yellow iris
Leucojum aestivum summer snowflake
Ligustrum obtusifolium border privet
Lisustrum sinense Chinese privet
Ligustrum vulgare European privet
Lonicera japonica Japanese honeysuckle
Lonicera maackii Amur honeysuckle
Lonicera morrowii Morrow's honeysuckle
Ludwigia leptocarpa water-willow
Ludwigia peploides subsp. glabrescens floating seedbox
Lysimachia nummularia creeping loosestrife
Lythrum salicaria purple loosestrife
Magnolia kobus Kobus magnolia
Microstegium vimineum Japanese stilt grass
Miscanthus sinensis Chinese silver grass
Murdannia keisak marsh dewflower
Myriophyllum aquaticum parrot's-feather
Ornithogalum umbellatum Star-of-Bethlehem
Pachysandra terminalis pachysandra
Persicaria longiseta/Polygonum cespitosum longbristle
Persicaria perfoliata/Polygonum perfoliatum mile-a-minute
Phalaris arundinacea reed canary grass
Photinia villosa oriental redtip
Phragmites australis subsp. australis common reed
Phyllostachys aurea bamboo
Pinus thunbergiana Japanese black pine
Poa trivialis rough bluegrass
Pyrus calleryana Callery pear
Quercus acutissima sawtooth oak
Reynoutria japonica/Polygonum cuspidatum Japanese knotweed
Rhodotypos scandens jetbead
Rosa multiflora multiflora rose
Rubus phoenicolasius wineberry
Rubus triphyllus three-leaf blackberry
Schoenoplectus mucronatus/Scirpus mucronatus alien bulrush
Sorghum halepense Johnson grass
Thlaspi alliaceum roadside penny-cress
Typha angustifolia narrowleaf cattail
Urtica dioica subsp. dioica stinging nettle
Viburnum dilatatum exotic arrow-wood
Viburnum setigerum tea viburnum
Vinca minor lesser periwinkle
Wisteria sinensis Chinese wisteria

* Draft provided by William A. McAvoy, 6/08/2010. Field guides for identification of invasive species are available by requesting the '*Replacing Invasives with Natives*' loan monitoring kits from the AAW office at (302) 735-8660.


Garlic mustard


Sweet autumn clematis


Japanese stilt grass


Reed canarygrass


Multiflora rose

10 Least Wanted Wetland Invasives

Garlic mustard, *Alliaria petiolata* – The heart-shaped, toothed-edged leaves give off a garlic odor when crushed. Flower clusters are made up of white cross-shaped blossoms.

Oriental bittersweet, *Celastrus orbiculata* – This woody climbing vine is easily confused with our native American bittersweet (*C. scandens*), with which it hybridizes. The invasive form smothers native plants wherever it grows.

Sweet autumn clematis, *Clematis terniflora* - This semi-woody vine can reach 4" in diameter and climb over anything up to 30' high. The dark green compound leaves have 3 or 5 long glossy leaflets. The fragrant white flowers are about 1" in diameter.

Yellow-flag iris, *Iris pseudacorus* – When not in bloom, it may be recognized by dense clumps of fanned out 3-4' tall leaves with a distinct mid-rib.

Japanese stilt grass, *Microstegium vimineum* – Growing to 3½' tall with pale green, lance-shaped leaves, stilt grass bears some resemblance to bamboo. The 3" leaves feature a distinctly shiny mid-rib.

Mile-a-minute weed, *Persicaria perfoliata* - Thorns arm the underside of the light green triangular leaves and stems of this annual trailing vine.

Reed canarygrass, *Phalaris arundinacea* - This tall, perennial grass commonly forms extensive single-species stands along the margins of lakes and streams and wet open spaces, particularly in disturbed areas.

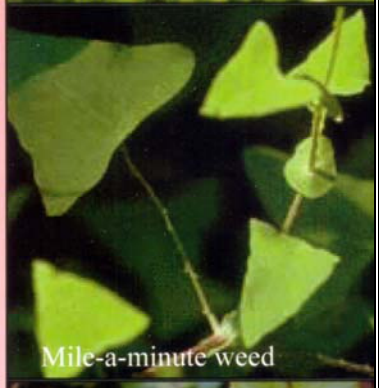
Lesser celandine, *Ranunculus ficaria* – Resembling our native marsh marigold, Lesser celandine can be distinguished by heart-shaped leaves, roots with tubers or bulblets, and its tendency to sprawl.

Multiflora rose, *Rosa multiflora* - This all too common rose forms impenetrable thickets. The base of each leaf stalk bears a pair of fringed bracts.

Common reed, *Phragmites australis* - The alien strain has tenacious, acid-producing roots that chokes out everything around it.


Oriental bittersweet


Yellow-flag iris


Mile-a-minute weed


Lesser celandine


Common Reed

Excessive herbivory – This part of the assessment is for noting impacts on the wetland from intense herbivory or infestation by various animals. Herbivory by deer can be observed as browse lines on the vegetation. Large exposed mud flats can be evidence of nutria activity. Pine beetle or gypsy moth damage is typically indicated by high densities of either dead or downed pine trees for the southern pine beetle or oaks for the gypsy moth. Areas affected by southern pine beetles are characterized by a central host tree with a large radius of dead trees, similar to a bull's eye. Affected trees can be wiped out in a week's time. The photos to follow illustrate typical examples of such herbivory.

Gypsy moth tent

Southern Pine Bark larvae

Nutria damage in tidal marsh

Other signs of biological imbalance – Various other conditions can indicate problems with wetland water quality from ecological imbalance. This may manifest itself in various forms, such as: foul odors, mats of (often whitish) bacterial growth, discoloration of the water (green, blue-green or even red) from massive blooms of single-celled algae, and other "unnatural" conditions that may be observed.

4. **Alterations to water flow & level:** Check the box(es) for any of the following that are visible in the wetland:

Ditches – Many Delaware wetlands have been impacted by ditching. This includes ditches that were dug for agricultural drainage, to protect residential areas and roads from flooding, and/or for past mosquito control purposes. Check this box if any of such man-made ditches are either within or bordering your wetland area.

Stream alterations – If a natural stream is present in your wetland area, walk the area of the stream channel. Look for any signs of alteration. Streams that have been channelized typically run straight (have less curves and meanders than natural streams), are of more uniform width, and often have an elevated area next to one or both sides of the stream where dredge spoil (from stream bank excavation) was deposited. Look for signs of spoil piles and/or evidence of excessive channel cutting and deepening. Check the corresponding box on your data sheet if any such conditions are observed in and along your wetland.

Stormwater inputs – Check this box if there is a discharge pipe or other conveyance from a stormwater source into the wetland. Such sources can impact the wetland in many ways, including transport of large volumes of sediment and other pollutants during high water times by the stormwater discharge source.

Point-source discharge – Check this box if there is a discharge pipe entering the wetland that can be traced to a point-source (e.g. a sewage treatment plant, industrial site or other such source). If the source is a known one, write in what you know about the source below this line on your data sheet.

Weir/dam/culvert – Use this section to indicate any man-made structures - including dams, weirs, culverts, or water control structures - that are impacting the flow of water through the wetland by causing water to impound (pool up) in the site and/or impeding water from getting to the site.

5. **Alterations to runoff & soil regime:** Check the box(es) for any of the following conditions in the wetland:

Impervious surfaces – This section takes into account impacts of rain and snow runoff from the urban-suburban landscape, including runoff from impervious surfaces (such as concrete walkways, paved roads or parking lots, or any other surfaces that prevent water from seeping into the ground).

Soil disturbance – Look for alterations to the natural soil surface, such as plowing, grading (ground smoothing), or tractor tracks (from skidders, ATVs, etc.).

Example of skidder tracks

Filling or excavation – This component asks you to examine the wetland for evidence of filling or digging activities. Fill includes man-made deposits of soil, rock products, or other waste materials that are added to the wetland by human activities. Trash and yard waste (such as lawn and brush clippings) and plant debris from logging should be considered as fill if they are in amounts large enough to cover an area and raise the wetland surface. Excavation refers to the process of digging, cutting or scooping, and removing material from a wetland.

Excessive sedimentation – Check this box if abnormal amounts of sediment are observed on the soil surface of your wetland site. Oftentimes, these appear as out-of-place subsurface soils that have been brought to the surface. Typical sources of such sedimentation are construction sites and tilled fields.

Soil Subsidence/root exposure - Removal of water (or other materials) from a wetland can result in underlying soil collapse. This is called soil subsidence and is often evidenced by the exposure of tree roots to the surface that would typically be covered with soil. The image at right illustrates root exposure from soil subsidence in an Inland Bays wetland flat (photo courtesy of Chris Bason).

6. **Other stressors –** Use this space to note any other stressors observed that could adversely affect the wetland.

Litter/Trash – Check the box here if litter, garbage or other forms of trash are noticeable in the wetland.

Other – Use this space to make note of any other observed signs or sources of stress on the wetland (e.g. oil slicks, road salt or other runoff chemicals, rip-rap added to wetland banks or borders, etc.).

Wetland Buffer Stressors & QDR (Instructions for page 3 of your data form)

These instructions have to do with assessing how well your wetland is protected from disturbances present in the surrounding landscape. For the purposes of this assessment, these surroundings are referred to as the buffer. The buffer includes the area radiating out from the borders of your wetlands 100 meters (approximately a football field in length) in all directions. The sections below relate to the numbered components on page 3 of your data form. As with the previous, check any boxes where the conditions/stressors described are observed. For any conditions that you are unsure of, just write a large "?" in the box, and include any comments in the space available. Important note: if any parts of the buffer area are on private land, be sure to have landowner permission before walking there. If permission is lacking, we suggest using Google Earth (www.earth.google.com) to access (and zoom in on) an aerial map of your wetland and use it to assess land uses and features impacting the buffer.

7. **Development:** Use this section to indicate sources of human development in the buffer, including commercial-industrial (businesses, stores, plants, factories, etc.), residential (single family houses, apartments, etc.), agricultural (row crops, truck crops, orchards, nurseries, livestock or poultry operations) and roads. For each category, indicate the extent and type, as requested on the space to the right of each on your data sheet.

8. **Other buffer stressors:** Check the box(es) for any of the following activities observed in the buffer area:

   Forest harvesting: – Check if there is any evidence of selective cutting, clear-cutting, or thinning of trees in the buffer within the last 15 years. Refer (if possible) to historical aerial photos for comparison.

   Channelized streams or ditches – Check if channelized streams or ditches >1-foot deep occur in the buffer.

   Piers, boat slips, docks or moorings – Check here if there is evidence of any of these activities in the buffer.

   Golf course – If any part of a golf course occurs in the buffer, indicate so here.

   Mowed area – Check here if any re-occurring mechanical mowing activity (other than that performed on residential lawns or golf courses) occurs in the buffer, such as clearing along power lines and right of ways.

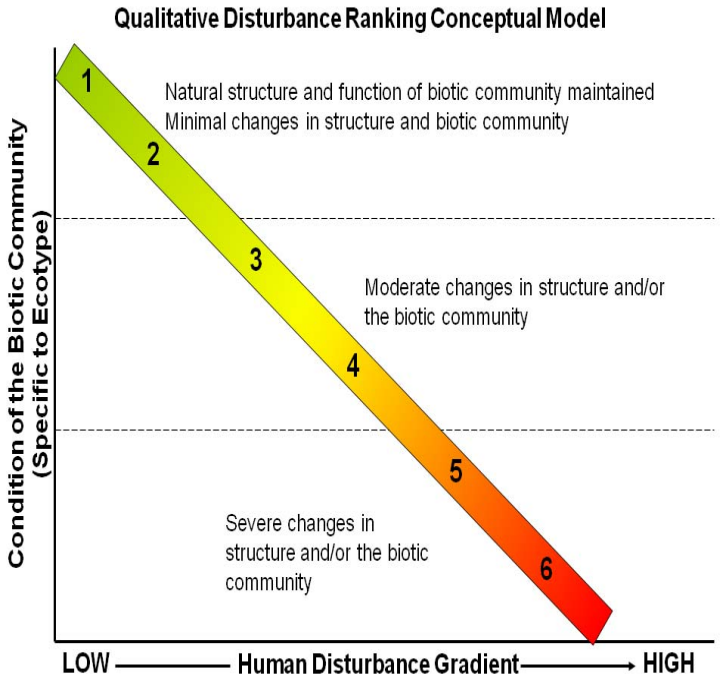
   Sand/gravel operations – Check here if sand and gravel excavation operations are present in the buffer.

   Landfill/waste disposal – If any part of the buffer area has been used as a landfill (municipal or private) or as a deposit site for road wastes or other human-generated materials, estimate the percentage of the buffer impacted, and select and record the answer choice option that reflects that level of impact.

   Other – Use this space to make note of any other land use activities in the buffer that might impact the wetland.

9. **Qualitative Disturbance Rating (QDR):** This is to be done by agreement of the entire field team upon completion of the site assessment. Following review of the data compiled on pages 2 and 3 of the data sheet, the observers can either decide on the QDR rating via group discussion and consensus, or by having each team member come up with his/her own rating and then averaging the results.

   The QDR assumes that the condition of the wetland (and surrounding buffer) declines with increased human disturbance. Best professional judgment should be used to assign the site a rating from least (1) to highly disturbed (6). Descriptions for high disturbance, moderate disturbance and minimal disturbance categories are provided on your data sheet.



Tallying up the totals: The box on the lower portion of page 3 of your data sheet asks you to tally up the totals for all of the check boxes on pages 2-3 of your data sheet, and using the multipliers provided, calculate the overall assessment score for your wetland site. In this case the lower the score, the higher the quality and less-impacted the condition of the wetland. Because of the great variation in wetland features, one needs to be careful in drawing comparative conclusions of scores between one wetland site and another. But the numbers can be useful in comparing scores for a given site to assess changes from one timeframe to another.

Wetland Functions & Values (Instructions for page 4 of your data form)

Rather than assessing potential stressors to your wetland site, as you did in the previous pages, in this final part of the assessment you will be looking at positive attributes of your wetland – at the level and kinds of functions, values and benefits that your wetland provides. This can help sharpen your observation and information collection skills, as you discover what features of wetlands contribute to their various functions and values. As with the previous, this assessment can also provide useful baseline information to revisit over time, relative to changes that may occur in and around the wetland area. Since many of these questions lack specific, measurable answers - requiring you as an observer to consider the concept involved and make a subjective diagnosis - different people may answer some questions differently. This is okay, because the activity is meant to stimulate awareness of the many benefits of wetlands. One should also realize in using this, that the extent of values one might expect to see in a given wetland may be colored by the kind of wetland it is. For example, if your wetland is a salt marsh, one can expect that naturally (due to extreme water level/salt fluctuations) there will a relatively lower diversity of plant and animal life there. Similarly, a freshwater wetland that is seasonal (wet at the surface for only part of the year) may appear quite different in some parts of the assessment then a more permanently wet site, depending on the time of year surveyed. Keeping such variations in mind, work your way through the rows of questions on the chart, using what you see at your wetland - as well as what you know about what's going on around it - to answer each part, then decide on an overall rating (high/medium/low) for each category of values, and ultimately (based on all areas assessed), for all values combined.

WILDLIFE HABITAT VALUES

1. Species diversity is generally greater in larger wetlands, or when other similar wetlands exist nearby. Some species are known to require a minimum "patch size" of suitable habitat. This can vary from up to 12 acres for Swamp Sparrow habitat to over 650 acres for Red-Shouldered hawk habitat. In addition, some species (Great Blue Heron, Virginia Rail, Black Tern, Marsh Wren) require a minimum degree of wetland density within their range. Distance between wetlands is also a factor for such species.

2. A wetland habitat is more valuable if animals, particularly mammals, can travel easily from one wetland to other wetlands and adjacent upland habitats. Things which create obstacles for wildlife movement include roads, power lines, railroads, cleared land, urban land, and large bodies of water. Maintaining viable habitat corridors and connectivity is a critical component of managing land for biodiversity. Wooded areas adjacent to wetlands are especially critical to many kinds of wildlife, including numerous neotropical birds and many species of amphibians. Many treefrogs and salamanders that live their adult lives in woodlands, rely on adjacent vernal pool wetlands to breed, lay eggs and grow their tadpole stages.

3. Water depth variations contribute to greater diversity of plant types, which in turn supports more wildlife.

4. Islands provide nest sites for birds and other animals which are more likely to be free of predators than sites on the shore. Hummocks, partially submerged logs, and other such areas provide basking areas for turtles and snakes, as well as shelter for various smaller animals.

5. This also gets as plant diversity as a barometer of wildlife diversity, ergo the more types of plant growing in your wetland, the more likely the wetland is to provide good habitat for wildlife. Wetlands with open water and submerged or emergent vegetation are generally considered to have greater habitat value for waterfowl than those with woody vegetation (shrubs/trees), but again the more varied the mix, the better.

6. Wetlands are known to support a high percentage of rare, threatened and endangered plants and animals, including many species of birds, butterflies, dragonflies, reptiles and amphibians. If you are aware of any of such species occurring in your wetland, make note of it here.

WATER RETENTION/FLOOD PREVENTION FUNCTIONS

7. Wetlands are often acknowledged for their water-holding functions for flood prevention, but those functions are just as valuable in times of drought. The benefits wetlands provide in terms of catching and holding water that would otherwise run-off and get carried away from the land should not be underestimated. In addition to providing a water source for wildlife, wetlands can serve as recharge zones for drinking water aquifers.

8. The capacity of wetlands to absorb flood waters, and reduce flooding along rivers, streams and other water bodies is one of their best known and most economically beneficial attributes. Unfortunately, we tend to realize this best when the wetlands have been removed (oftentimes to make room for the very developments that then become prone to flooding), costing the country billions of dollars in clean-up and repair costs.

9. Many wetlands are now being constructed to serve as catch basins for stormwater runoff from parking lots, roads and housing developments. Some 'natural' wetlands that have become surrounded by such activities can serve similar functions, though such inputs may over time diminish the quality of the habitat for other uses.

10. Wetlands are often situated as transitional areas between deeper water habitats, such as streams, rivers, ponds and bays, and the more upland areas where people live. As such they help soak up flood waters, buffer effects of storms, and otherwise mitigate the harmful impacts that may arise from those water sources.

WATER QUALITY IMPROVEMENT FUNCTIONS

11. Wetlands, through the biological activity of plants and microbes growing in them, are well known for their capacity for cleaning water that flows through them, especially by way of trapping sediments and removing excess nutrients. Wetlands that receive water from the land can thus improve the water quality of that water as it passes through them, so that by the time it flows out to a ditch, stream or other surface waters that carry the water downstream (ultimately to a large river, bay or ocean) it is often much cleaner than it was.

12. Wetlands that collect stormwater runoff can similarly provide a water quality improvement function. Retention-time is critical to this capacity - the longer water remains in a wetland, the more opportunity for pollutants to settle out, chemically degrade, become diluted, or be taken up by plants and microorganisms. Thus, wetlands with high stormwater storage capacity generally have higher pollution control capacity as well.

13. In this time of concern about nutrient problems in our waterways, many farmers are discovering the role wetlands can play in reducing those impacts, by preserving or reclaiming the wetland borders, or even constructing wetlands in the lower, less productive areas of their fields, to catch any excess fertilizers running off the land, again reducing the load of pollutants running off the land into nearby waterways. The same is true for wetlands bordering golf courses, housing developments and other fertilized landscapes.

RECREATIONAL VALUES

14. Hiking access increases recreational value as well as birding possibilities and other forms of enjoyment.

15-16. As water depth increases, so do some recreational opportunities such as boating and fishing. On the other hand, shallow wetlands may be more attractive for other forms of recreation, such as wildlife observations, walking, art and other educational activities.

17. Use this space to make note of any other recreational activities that your wetland provides - for example, the growing interest in wildlife watching as a recreational activity, a feature well-suited to wetlands areas.

AESTHETIC VALUES

18. Wetlands found in urban and other highly developed areas provide special aesthetic appeal, by offering a pleasing, attractive natural landscape that people can enjoy and appreciate.

19. Litter, vandalism, and other such disturbances detract from the aesthetic values in any environment. Where these impacts are absent, the aesthetic appeal of the area is enhanced accordingly. The same goes for buildings, construction and other signs of human impacts, which likewise detract from the natural appeal.

20. A sense of sanctuary and solitude can often be found in wetland areas. If it's there, you'll know it.

EDUCATIONAL VALUES

21. Past human uses of wetlands may spark special interest, especially if such sites are unusual in the area.

22. A wetland unique to its region (such as sea level fens or Atlantic White Cedar swamps in Delaware) is valued for its rarity alone, much as rare animal species attract special interest even if common elsewhere. A vernal pool in a small wooded area surrounded by housing developments is another example of this.

23. In recent times, scientific interest has sparked various special projects and studies in various wetland types, conditions or in certain geographic areas, such as: a survey of water beetles in Delmarva Bay wetlands, monitoring of rare amphibians, concerns about invasive species, and various other wetland components. Such initiatives can increase what we know about a given wetland and thus add to its uniqueness.

24. Wetlands on school grounds or within safe, walking distance of schools offer wonderful living learning laboratories for all kinds of interdisciplinary activities, including: nature exploration, ecology studies, journal writing, art and mathematics. If such wetlands are on private land, however, they may not be available for public educational use. Special permission is needed and land ownership may change with time, affecting future access.

25. This is a group management and safety issue, as well as a habitat impact concern. Depending on class size, teachers will want to make sure sufficient, safe space is available for assembling groups to do wetland activities, and that impact on the habitat is minimized. A small woodland vernal pool might suffer much from repeated trampling by large numbers of students, relative to a large area of marsh that has more area to spread the traffic.

OTHER VALUES

Use the space provided to describe any other functions, values or benefits of your wetland area that are not captured by any of the above.

OVERALL WETLAND FUNCTIONS & VALUES RATING

Tally up the various number of "High", "Medium" and "Low" ratings to come up with an overall rating of your wetland functions and values. Should your wetland score high in all areas evaluated, that would indeed make it a special one, as typically wetlands (depending on their location, condition, and the various stressors on them) that provide strong benefits in certain areas (e.g. wetlands that serve stormwater functions for flood control and water quality improvement) are not always so great in other ways (e.g. wildlife habitat and aesthetics). But as with the previous assessment pages, these findings can help you gauge changes in your wetland over time, as well as offer ideas for projects you can do to enhance its condition and value.