Vermont Rapid Assessment Method for Wetlands v.2.1
User's Manual and Scoring Form

Vermont Department of Environmental Conservation
Watershed Management Division
Wetlands Program
1 National Life Drive
Montpelier, VT 05620

March 24, 2017

Charlie Hohn, Laura Lapierre, Tina Heath, Zapata Courage, and Danielle Owczarski.

Contents

Acknowledgements

We would like to thank the EPA for grant support and feedback; the watershed management division; and the Ohio EPA for creating the ORAM protocol that is the basis for VRAM. We would also thank all of the people who helped with testing and provided feedback, including the entire Wetlands program and BASS lab, Bob Zaino, Danielle Owczarski, Jim Deshler, Hannah Philips, Angelica Quintana, James Brady, Glen Gingras, Gus Goodwin, Alison Marchione, Jason Berard, Jim Andrews, and many others! And lastly, we would like to thank anyone who takes the time to learn this methodology and gets their boots on the ground helping us learn more about our valued wetlands.

Vermont Rapid Assessment Method (VRAM): A methodology for assessing wetland condition, function, value, and quality.

1.0: Introduction

The Vermont Agency of Natural Resources Wetlands program monitors the status of wetlands throughout the state. While detailed surveys conducted by the bioassessment team are vital, there is also need for a more rapid protocol that can be used by a wider range of people of varied background who are interested in Vermont's wetlands. That protocol, a result of hard work by wetlands ecologists, resource managers, and other stakeholders in Vermont and elsewhere, is laid out here. A VRAM survey collects data on a wide range of wetland characteristics, and provides information on wetland function, value, and condition that approximates the data obtained in the more detailed and technical bioassessment surveys. Data is collected by assigning a number to each factor as described below. We are excited about the increased level of information that VRAM will provide about our wetlands, and about the increased interest in wetlands generated when stakeholders conduct a VRAM survey. Thank you so much for your interest!

2.0: General Information about Wetlands

Wetlands are places where land and water meet, and where these conditions support animals and plants that depend on soils that are saturated at least part of the time. Despite covering only a small part of the state – probably under 5 percent of the state's land – they support a very high diversity of species. One study in a similar forest in southern Quebec found that wetlands covering a small part of the study area supported almost half the total plant species present (Flinn, et. al 2008). Similar levels of wetland species diversity occur in Vermont, and many of these include rare species. But that isn't all wetlands provide! They provide a wide variety of functions and values that benefit everyone in Vermont, including:

- **Water Storage of Flood Water and Storm Runoff** -Wetlands fill with water during heavy rain and rapid snowmelt, and release this water later, reducing the speed and severity of floods and increasing water flow during droughts. For instance, during Tropical Storm Irene a destructive flood moved through Rutland, but then flowed into wetlands along Otter Creek and dissipated much of its flow. When the flood reached Middlebury it caused almost no damage (Watson, et. al 2016).
- **Water Quality**-Wetlands improve the water quality in Vermont's streams, rivers, and lakes. When water polluted with nutrient, sediment, or toxic chemicals flows into a wetland, much of these pollutants are absorbed by the plants and soils. The water flows out of the wetland 'filter' cleaner than when it flows in. Some of this clean water also soaks into the ground through the wetland and ends up in the groundwater – later to emerge in wells and springs.
- **Fish Habitat**-Wetlands provide places for fish to grow and reproduce; food for fish in the form of insects and other small organisms; and cool clean water many fish species require to survive.
- **Wildlife Habitat** - Wetlands provide habitat for many of Vermont's animal species. Among the well-known animals in Vermont that use wetlands are moose, beavers, mink, wood ducks, loons, and salamanders, but there are also many others. Many of these species could not survive in Vermont without intact wetland habitat.

- **Rare, Threatened and Endangered Species Habitat -** As mentioned above, wetlands support a very high diversity of species especially considering their relatively small area. These include many rare, threatened, and endangered animals and plants. Some of these exist only in wetlands.
- **Exemplary Natural Communities**- As with species, natural community diversity is disproportionately high in wetlands. Over half the natural community types that occur in Vermont – as well as a similar proportion of the exemplary natural communities tracked by Natural Heritage Inventory - are wetlands. These include special places such as bogs, fens, and cedar swamps. There are even a few wetlands with old-growth forests, which are very rare in Vermont.
- **Education and Research**- Wetlands provide valuable opportunities of study in the natural sciences. Wetlands are visited by a wide range of Vermont students and scientists ranging from pre-school students to professors working on internationally-known research projects.
- **Recreational and Economic Benefits**- Wetlands provide places to hunt, fish, birdwatch, canoe, and contribute to the economics of outdoor gear providers and ecotourism operations. They are an iconic part of the landscape that is memorable to tourists visiting the state. Clean water and reduced floods also provide significant economic benefit.
- **Open Space and Aesthetics** Wetlands can help define character and overall beauty of the landscape and may be some of the few remaining natural spaces in highly developed areas. As one of the only naturally unforested ecosystem types in the state, marshes often command sweeping natural views of Vermont's most wild landscapes. Many of the most enigmatic and beautiful views of Vermont are seen from Vermont's marshes and beaver meadows.
- **Erosion Control-**Wetlands help to control erosion by stabilizing soil and dissipating wave and current energy along streams, rivers, and lakes. This function protects human created structures and natural ecosystems that would otherwise succumb to erosion – and also improves water quality, because sediment and the chemicals trapped in it can act as pollutants when erosion occurs.

Figure 1: sediment-rich floodwaters in Blanchard Brook in Montpelier. If this stream flows into a wetland, the water will slow, reducing the magnitude and strength of the flood, and much of the sediment and associated pollutants will drop out of the water. In addition, if there were more intact wetlands upstream this level of erosion may never have occurred.

3.0: Why VRAM?

To effectively manage Vermont wetlands, we must know their condition (ranging from poor to excellent) and function. The Wetlands Program has been conducting detailed surveys, also known as 'Tier III' surveys, which involve identifying every plant in a section of wetland, doing chemical analysis of water quality, and describing the soils. Tier III surveys provide detailed and valuable data, but are time intensive, require extensive botany experience, and can only be conducted during the summer. The Vermont Rapid Assessment Method (VRAM) was created so that a wider group of people can quickly gather condition and function data for a larger set of wetlands over a longer field season (including most of the snow-free period). The data collected includes both the condition of the wetland and the functions it provides, and approximates the data that would be collected by a more in depth Tier III survey.

With the VRAM tool, anyone interested in understanding and conserving wetlands - like you – can add to our wetlands knowledge base. To conduct a VRAM assessment, you will assign a numeric score to a variety of metrics, following the directions on this protocol and on the data sheet. This data will be sent to the Wetlands program or entered in an online Data Portal. The scores are used to determine the condition and status of a wetland, which is crucial information for the Wetlands Program's conservation goals.

4.0: Interpreting the Results

As you conduct your VRAM survey, you will generate numbers that tell you about the condition, function, and value of a wetland. Because questions about what these numbers mean often come up during the process of filling out the form, this section is included here near the beginning of this document. In general, higher numbers indicate more function or better condition, but this may not always be the case as described below.

4.1: Condition

The condition metric (calculated in the Data Portal) ranks the extent to which humans have caused degradation of the wetland. A high score indicates a mostly undisturbed wetland, and a low score indicates a wetland that has been heavily impacted by human activity. This factor is most useful when you want to gage the impact humans have had on a wetland – for instance, to see an example of a wetland in its natural condition, or to find a wetland that needs restoration work. This metric does not include factors such as the size or type of the wetland or whether it supports specific wildlife or plant species, but is very useful to get a feel for the 'health' of a wetland and tracking its status wetlands over time. Low-scoring wetlands may be prioritized for habitat restoration efforts, and high-scoring wetlands can be expected to remain in excellent shape if conserved and left alone. A low score does not indicate that the wetland does not provide important functions and values.

4.2: Function and Value

The function and value metric represents the extent to which the wetland has features that add to the overall Functions and Values as listed above. Wetlands with high scores are likely to be exemplary in several of the Functions and Values. However, in some cases wetlands may have a relatively low

Function and Value score and still provide exemplary value in one or two criteria, and this number only provides an overview.

Note that these numbers are not meant to guide restoration or management. For instance, a wetland with deeper water gets a slightly higher VRAM score than a shallow-water wetland, but artificially raising the water level in a wetland could severely damage the ecosystem by killing many of the plants. A wetland with connectivity to a stream may receive points, but artificially connecting a stream to a wetland could severely damage both. Restoration and management should be conducted to move a wetland towards more natural conditions, and VRAM is not meant to be used to judge restoration or mitigation project success

4.3: Other Metrics

The Vermont Wetlands Program is currently investigating the idea of developing additional metrics in the Data Portal that will display other characteristics of the wetland. These might display statistics on which functions and values the wetland could provide, note potentials for restoration, or offer other information.

4.4: Grand Total (Quality)

The 'Grand Total' score, which includes all factors and can range from 1 to 100, combines the wetland's condition, its function, and its value. This combination is known as the wetland *quality*. This score is affected by a variety of factors including whether humans have disturbed the wetland; the extent to which the wetland provides some of the functions and values listed above; and the type and number of species and natural communities within the wetland. This number is calculated by combining the scores on the VRAM sheet or calculated in the Data Portal.

Based on the cumulative score of tallying up each of the six metrics that were assessed on the VRAM form, the wetlands are assigned into three categories representing their combined condition, function, and value (Table 1). In instances where the wetland is at the edge of the range for a score, the wetland can be assessed in more detail to determine which category is most representative of its current state.

Table 1. Interim scoring breakpoints for wetland status categories for VRAM Grand Total score.

VRAM v 2.0 Score (points)	Wetland Status
3-64	Poor
65-84	Moderate
85-100	Reference

4.5: What Does the Grand Total Mean?

Different types of wetland will receive somewhat different VRAM scores. For instance, a small bog will receive a lower score than a large beaver meadow complex in similar condition. The VRAM score is best used to compare wetlands of similar types. If you are only interested in the condition of the wetland, you can use the condition index to gain a measure of wetland condition independent of function-related factors such as wetland size and diversity of water sources.

In some cases, you may notice minor changes on the Data Portal from the numbers you submitted. This may happen if the Wetlands Program obtains additional information about a wetland (for instance, a rare species recently found in the wetland unbeknownst to the surveyor) or if there are adjustments to protocol over time.

5.0: Before you Begin

Prior planning is essential to successional VRAM surveys. Before you step out into the swamps, you will need to select a wetland with appropriate characteristics, choose an appropriate time of year to visit, verify that the wetland is safe and legal to access, and conduct a 'desktop review' of the resources and potential stressors to the wetland. The VRAM area must also be defined either before you enter the wetland or before you complete the survey.

5.1: Selecting a Site

The VRAM process starts with a plan to visit a wetland. Perhaps the wetland is on your property, is in an area your organization manages, is a study site for your class or project, or is an important and valued part of your town. A few considerations on site selection are listed below:

- Privacy – if you survey a wetland on your land and provide data to the Wetlands program, you agree to allow the data to be used by the Wetlands program for data analysis purposes, and displayed in mapping on the Data Portal. Do not survey wetlands on another person's private land without landowner permission. Instead, invite the landowner to explore the wetland with you, if they are interested.
- Safety – understand and be prepared for the conditions during your site visit. Wetlands may contain natural hazards such as deep mud; unstable terrain; dead snags ready to tip over; and poison ivy and sumac. Many wetlands are in rugged terrain and difficult to access, and weather conditions can be dangerous especially during the cold season or when there is a risk of thunderstorms. Do not travel off-trail without knowledge in off-trail navigation and tools such as compass, GPS, and maps. It is safest (and also easier to conduct VRAM surveys) when you travel in a group of two or more.
- Protecting the wetland – some wetlands, such as bogs and fens, may be sensitive to disturbance. Bringing a large group to a heavily visited wetland and roaming off a boardwalk to conduct a VRAM survey could cause damage to the wetland. Instead, plan on a group of two or three people. If you are visiting a large wetland with more people you can send out several such groups to different parts of the wetland. Some rare plants or animals may be sensitive to human disturbance. Always avoid disturbing wildlife especially nesting birds such as loons. Invasive species can be very damaging, so make sure your clothes and boots are free of weed seed and mud before entering the wetland.
- Scope – Conducting a VRAM on a very large wetland complex such as Missisquoi Delta or the Victory Basin could be a difficult, multi-day endeavor, and in many cases these large wetlands already have VRAM or Tier III data. Consider another citizen science project like iNaturalist or eBird if you wish to explore these wetland complexes. Conversely, very small wetlands are

difficult to rank and classify using the VRAM protocol. Do not conduct VRAM on any wetlands under 0.25 acres unless they are a Seep or Vernal Pool (see Thompson and Sorenson, 2005)– these two wetland types are naturally very small and can be ranked using VRAM.

- Timing and Conditions – if there is a foot of snow on the ground, put away the VRAM form and reach for your skis or snowshoes. You won't be able to see enough of the wetland to collect useful data. If water levels are high and the wetland may be flooded, wait for another day to visit. The best time to visit is during the summer when plant species are easiest to identify. Spring or fall surveys can be conducted if you are able to identify common invasive species given the off-season conditions.
- Redundancy – before visiting a wetland, visit the data portal to see if VRAM data has already been conducted. A re-survey could be useful in some circumstances, but isn't always helpful.

5.2: Is it a wetland?

While some wetlands are obvious, in other cases it may be difficult to determine if a site is a wetland. VRAM is intended only for use within wetlands and will not provide valuable results if conducted in an upland. There are three factors which can be used to determine if something is a wetland. The most important, but sometimes difficult to determine, is hydrology. If a site has standing water or saturated soil during a dry period in the summer, it is probably a wetland. However, in the spring, or after heavy rains, non-wetland sites can also have these features. Likewise, during periods of dry weather wetland hydrology may be difficult to discern even in true wetlands. An easier to use characteristic of wetlands is that they support hydrophytic ('water loving') plant species. Plants that are usually or always in wetlands include cattails, bulrushes, alders, willows, winterberry holly, and black ash. Beaver dams are generally only built in wetlands (or result in the creation of wetlands). Conversely some plant species almost never occur in wetlands, such as large, mature individuals of red or white oak, sugar maple, or red pine. (they may appear as seedlings but do not live to maturity). A more technical but very important factor is soils. Wetland soils, known as hydric soils, may have features such as mottles, a dull gray color, or deep accumulations of muck or peat.

5.3: Determining area to survey

Before you begin the VRAM process you need to determine the area to be surveyed.

Generally, the entire wetland is surveyed, meaning a contiguous area not separated by hydrologic breaks such as cascades or upland areas. In small wetlands the entire area can be visited, but in the largest wetlands only a subset of the wetland will be visited. Try to visit the areas representative of the wetland – for instance if there is cattail marsh and cedar swamp, try to visit both. As you conduct your survey, sketch a map of where you visited on the datasheet. If you only saw a portion of the wetland, sketch and describe what you saw. It may be helpful to bring a GPS in the field, take geotagged photos, or if appropriate add observations to a citizen science app like iNaturalist that can track your location (see section 7.2). The photo to the right shows a possible example of a field sketch of a VRAM survey. Note that the wetland to the south, beyond the rapids, would need a separate VRAM form. However, if possible it would be advisable to view more of the wetland

than just the area highlighted in yellow – in this case perhaps a quick visit to the bridge near the waterfall for a view of the wetland from the south.

5.4: Desktop Review

Before you even set foot in the field, you can obtain a great deal of information using your computer. The ANR Wetland Inventory Map is one of the best ways to do this. Here you will find information on endangered species, state significant natural communities, impaired waterways, wildlife habitat, and other features that may influence your scoring and will help you plan your field visit. You can also map the wetland and measure its size in the Atlas. Reviewing aerial photos on the Atlas or a webpage like Google Maps is very helpful in filling out some of the metrics as well. For users with more advanced resources, Esri ArcGIS (or an open source alternative like QGIS) can be used to view data available from the Vermont Center for Geographic Information (VCGI) and other sources, and can also be used to create detailed maps.

5.5: Supplies

Consider bringing the following to a wetland – they may be optional or essential depending on the site.

- GPS
- Camera
- Binoculars – in addition to birdwatching you can catch views of other parts of the wetland from a distance.
- Rubber boots or waders, depending on the depth of water in the wetland
- Canoe or kayak for wetlands associated with streams or lakes
- Clipboard and paper – waterproof 'rite in the rain' paper is very helpful
- Map and compass
- Food, water, and appropriate clothing
- Smartphone with map app like Google Maps
- Field guides to help identify plants and animals

5.6: A Note about Notes

When visiting a wetland in the field, informal notes and photos can end up being as useful as the data you set out to collect. The VRAM datasheet (Appendix A) has a section for notes, which is described below. Consider taking a field notebook or tablet to the field and making even more extensive notes and sketches. Photos can also be very useful. If possible, take several photos that give an overview of the wetland. If you have the time and expertise, document the dominant plant species in the wetland, any unusual plant species, and any animals observed in or near the wetland. Photos of known or unknown plant species can also be useful, and can be used to help with identification. Other important factors to note include current and recent weather; hydrology; soil conditions; and any human impacts to the wetland. Many of these can be noted on the portion of the VRAM form devoted to notes (see section 6.7).

6.0: Conducting the VRAM Survey

As you conduct a VRAM survey, you will assign points to a number of factors concerning the wetland and its surroundings. Use this manual and the data sheet to assign a number to each factor. When assigning points, use whole numbers rather than decimals. If you are instructed to use an average and it results in a decimal number, round up or down as deemed appropriate.

6.1: Metric 1: Wetland Area (Maximum point value: 6)

Determine the size of the wetland area based on the mapping you conducted, and rank based on the categories outlined on the VRAM form. If you only surveyed part of the wetland, estimate the size of the entire wetland area as described above, *not only the area visited*. Aerial photos on websites or programs such as Google Earth can be helpful. Acreage can be measured in the Wetland Inventory Map (see links section for more information)

Figure 2: This vernal pool would receive a low score for size, but this does not mean it is in poor condition - vernal pools are small!

6.2: Metric 2: Upland Buffers and Surrounding Land Use (maximum point value: 14)

Question 2a: Average buffer width (0 to 7 points)

The upland buffer is the area of intact natural habitat, usually consisting of forest, that surrounds a wetland. The buffer serves to protect the wetland from outside disturbances called edge effects that may cause problems such as declining water quality, disturbance to some animal species, or introduction of

invasive species. For the purposes of VRAM the buffer is measured up to 50 meters, and areas further than 50 meters from the wetland edge are instead addressed in metric 2b.

While forest is the most common buffer type, other natural features that may constitute a buffer include open water on lakes and rivers; naturally bare cliffs; and rock outcroppings. Human created or strongly human influenced features do not count as buffers – these include farm fields, lawns, houses, roads, and parking lots.

Rank the buffer based on the criteria on the form based on the average overall buffer width surrounding the wetland.

Many of the buffer characteristics can be determined on aerial photos, but any areas of question should be visited in the field.

The buffer width is averaged on all sides of the wetland. Measure the buffer length, up to 50 meters, in each direction from the wetland, average these numbers, and consult the table on the VRAM form to assign a score.

Example: In the air photo to the right (VCGI color infrared imagery, Westford, Vermont), the inner boundary represents the wetland, with the buffer included in the outer polygon. There is a forest (the red trees that fills the entire 50 meter buffer area to the west of the wetland. To the south of the wetland there is a farm field within the entire potential buffer area, so this portion is considered to have no buffer. To the east the river offers some buffer (25 meters), but beyond is a cleared and disturbed field not considered as buffer.

The wetland mapped in the example was assigned a score of 4 because the buffer is over 50 meters wide to the north and west, but there is no buffer to the southeast, and to the east there is no high-quality buffer other than the narrow (25 meter. wide) river. So averaging the scores based on the VRAM scoring criteria:

- North= 50 m
- West = 50 m,
- South/Southeast = 0 ft
- East = 25 m.

The average buffer size here is around 30 meters, so a final score of 4 points is assigned.

In the case of irregularly shaped or very large wetlands, the buffer may be measured from multiple sides or estimated in size. Some areas may also act as partial buffers, such as a wide buffer that has recently been selectively logged. Estimate the buffer width that is the best fit

Question 2b: Intensity of Predominant Surrounding Land Use(s) (1 to 7 points).

In addition to the buffer itself, the wider-scale landscape influences wetland condition. For instance, a wetland surrounded by a large tract of forest will experience less impacts than a wetland surrounded by

development, even if that wetland has a fully intact buffer. Land use or disturbance is especially likely to affect the wetland if it occurs in the watershed of the wetland – the area that drains directly into the wetland. Runoff from rainwater and snowmelt may wash pollution, sediment, invasive species seeds, or garbage into a wetland even if there is a protective buffer present. When assessing this factor, consider the environment beyond the buffer, with special emphasis on places in the wetland's watershed (areas that drain into the wetland).

Review the VRAM form and choose the category that best fits the surrounding land use of the wetland. Note that intermediate numbers from averaging two scores may be used as well. For instance, if half of the surrounding land use of a wetland is second growth mature forest (very low intensity – 7 points) and the other half is young, disturbed shrubland (5 points), you would assign a score of 6. See the examples below.

Example 1. The wetland is a deep vernal pool located entirely within a large, contiguous patch of second growth forest. Upland forest extends from 100 to 300m on all sides of the wetland and includes the entire watershed of the vernal pool. Well to the west and north of the wetland, there are farm fields. The wetland is entirely surrounded by second growth forest well beyond the 50-meter buffer area and should receive a score of 7.

Example 2. The wetland is a small softwood swamp with mature forest on two sides. On the other sides of the swamp is an active cornfield with no buffer between it and the wetland. Because the forest area qualifies as "very low" (7) but the farm field qualifies as "high" (1), an average score of 4 is assigned.

Example 3. The wetland is an isolated cattail marsh in a shallow depression. On one side, the wetland has no buffer and is immediately adjacent to an active farm field. On the other three sides, the wetland is surrounded by a new fallow field. Since the fallow field qualifies for a 3 and the active fields a 1, and they cover approximately the same portion of the area surrounding the wetland, an average score of 2 is assigned.

Figure 3: The intact mature forest surrounding this wetland contributes to its excellent condition. Since the entire wetland is surrounded by intact forest, this would receive 7 points under Question 2B.

6.3: Metric 3: Hydrology (Maximum point value: 30).

Stated simply, the hydrology of a wetland describes how water moves into, through, and out of the wetland. As wetlands are defined by their wetness, hydrology is a very important component of wetland condition and function and thus receives the most potential points of any metric in the VRAM. In this section, several characteristics of the water in and near the wetland are evaluated.

Most of the hydrology characteristics must be assessed in the field. The easiest time to evaluate the hydrology of a wetland is during the growing season. Consider recent rain events that may be adding extra water to the wetland. If visiting in the spring or fall, consider snowmelt or freezing of water and envision what the wetland may look like during the summer. The hydrology may be difficult or impossible to assess during times of extensive spring flooding or deep snow cover.

The maximum number of VRAM points assigned in this section is 30. A wetland with very high hydrology function and condition may receive a sum of factors greater than 30. If this occurs the rater should assign a score of 30.

Question 3a: Sources of Water (Cumulative score; maximum of 17 points)

The source of water in a wetland is important to the functions it provides. For instance, wetlands along a river or stream may help to slow down floodwaters or absorb pollution in the stream during floods. Wetlands like bogs that are fed only by precipitation may receive a low score here because they do not fulfill those functions, but may still be important, excellent-condition wetlands.

Evaluate the wetland for sources of water, and then assign each one a rank from 0 to 3 using the metric in Table 2 below. Note that many sources will usually receive a zero. Also note that precipitation almost always receives at least one point. If the wetland is a marginal wetland which is not receiving very much water, or if the water inflow has been disrupted and decreased by changes to hydrology, the highest score of any factor could be 2 or even 1.

Check all the following water sources that contribute to the wetland. Do not include features that flow near or out of the wetland but do not supply water to the wetland itself. For instance, if seasonal streams flow into a basin swamp and a perennial stream flows out of the wetland, you would not include points for the perennial stream. All wetlands will have at least one water source, and some will have several sources of water.

High pH groundwater

In many areas of Vermont, the bedrock is rich in calcium and other nutrients. Springs flowing from this type of bedrock bring high pH water with high nutrient content. Wetlands supplied by this type of groundwater support unique natural communities like Rich Fen (photo to right) and Calcareous Red Maple-Tamarack Swamp and also often support rare plants.

In Vermont, groundwater is considered high pH if the pH is neutral (7) or higher. This can be measured directly with a pH meter, but it can also be inferred from the presence of special plants known as calciphiles. When these species are seen in abundance, high pH groundwater can be inferred. These species may include tamarack (*Larix laricina*), northern white cedar (*Thuja occidentalis*), red-osier dogwood (*Cornus sericea*), and shrubby cinquefoil (*Dasiphora floribunda*). The strongest indicators are small characteristic herbs and wildflowers such as grass of parnassus (*Parnassia glauca*), yellow sedge (*Carex flava*), porcupine sedge (*Carex hystericina*), and the dramatic presence of showy lady's slipper orchid (*Cypripedium reginae*). (Pictures of and notes about all of these species can be found at the Go Botany website or in a local field guide)

High pH groundwater is also indicated by presence of certain natural communities as listed below in Table 3. If your desktop review found one of these natural community types mapped here, the wetland has at least some high pH groundwater. Consult Wetlands Woodlands Wildlands (see section 7.2) if you think you may have found an unmapped example one of these natural communities. If you aren't sure, taking photos and notes about the plant species and other wetland characteristics you observe may allow the Wetlands program to determine if you have found one of these unusual, special wetlands.

Table 2: Wetland Natural Communities that Occur in Areas of High pH Groundwater
Intermediate Fen
Rich Fen
Calcareous Red Maple-Tamarack Swamp
Calcareous Riverside Seep
Northern White Cedar Swamp
Northern White Cedar Sloping Seepage Forest

Other groundwater

Even groundwater that is not of high pH provides nutrients to a wetland. Groundwater also provides a consistent source of cool, clean water, and most springs have more consistent water flow than the flow of small streams or supply of precipitation. Some wetlands are stream headwaters that have only groundwater input but a stream as an output. These wetlands provide the important value of slowly releasing clean spring water into a stream, even during periods of dry weather.

Groundwater can be observed directly if you see water seeping out of the ground on the edge of a wetland or a seep flowing into the wetland from a slope above. Tests of water chemistry can also detect groundwater. Without either of those indications you can detect seepage by the abundance of certain plant species including heartleaf

foamflower (Tiarella cordifolia), black ash (Fraxinus nigra), wood nettle (Laportea canadensis), and spotted touch-me-not (Impatiens capensis - see left). However, these species can also occur outside of seepage areas.

If you are uncertain if groundwater is feeding the wetland, do not score this field but note the possibility and reason for uncertainty in your notes. Photos of the possible seepage area or the plant species growing there may also be helpful.

Precipitation

This factor ranks the extent to which local precipitation directly influences the water level. This includes rain and snow falling directly into the wetland as well as water that flows down adjacent slopes during times of heavy rain or snowmelt. If the runoff flows into defined stream channels – even those that flow only during rain storms and snowmelt – it would be counted as an intermittent stream and not precipitation.

At least some precipitation falls into all Vermont wetlands. In some wetland types, however, it is the only significant source – which has important ecological implications. Bogs and rich fens are fed primarily or exclusively by precipitation. In part because precipitation is naturally acidic and because no stream flow flushes it out of bogs, these ecosystems can become very acidic and nutrient poor, which leads to them supporting unique ecosystems containing only species that can tolerate these conditions. Likewise vernal pools typically are fed only by precipitation. Because there is no stream connection, fish can not access the vernal pools, which is vital for breeding success of some amphibians. Vernal pools and wetlands containing bogs would generally receive a precipitation score of 2 or 3. Acidic basin swamps like Hemlock-Sphagnum Acidic Basin Swamps are high in watersheds with little seep or stream inflow, and might also receive a score of 2.

Most wetlands have at least some precipitation influence and thus would receive a score of 1. However, there are some cases where precipitation does not provide significant input. This occurs when a wetland is saturated or inundated by a perennial lake, pond or river for the entire growing season. These wetlands retain deep water regardless of the local rain or snowmelt as water flows in from elsewhere. These wetlands might receive a precipitation score of 0. However, if the water source typically dries up during the summer, and precipitation provides water to the plants during that time (as with most wetlands along Lake Champlain) a 1 would be more appropriate. Imagine stretching a giant tarp over the entire wetland and adjacent buffer. If the amount of water would not change significantly, then the wetland might score 0. Do not include precipitation flowing into the wetland from streams from outside the wetland.

Seasonal/Intermittent surface water

Mark this factor if there is evidence that water flows into the wetland from seasonal or intermittent streams (streams that dry up during most summers or other dry periods). **Note** that only defined intermittent stream channels should be included. Eroded gullies or water pouring down a slope during a downpour do not count as intermittent streams and should be considered precipitation-fed.

During the summer, a seasonal/intermittent stream will often be indicated by the presence of dry or mostly-dry stream channels (with a defined channel and usually smooth rocks or sand) entering the wetland. In the spring or fall or after heavy rain these streams will often be flowing making the distinction with perennial streams difficult. Seasonal or intermittent streams tend to be small, often steep, and lack deep pools. They will usually have few wetland plants along their banks and will not contain fish; beavers also usually do not build dams on seasonal or intermittent streams.

Perennial surface water (lake or stream)

Perennial surface water consists of lakes or streams that have water all the time (excepting extreme drought). In Vermont all rivers, lakes, and ponds are considered perennial surface waters. If the wetland is visited during a time of high runoff, such as spring or after heavy rains, it may be difficult to distinguish smaller perennial streams from intermittent streams. Consult the description of seasonal/intermittent surface water above for more information on this distinction. The wetland receives perennial surface water if any of the following conditions exist:

- The wetland is along the shoreline of a lake or pond.
- A perennial stream flows into or through a substantial part of the wetland.
- The wetland is in a floodplain or backwater with direct connectivity to a river.

Figure 4: This wetland along the Winooski River receives perennial surface water from the river.

Question 3b: Connectivity (Cumulative score; maximum of 4 points).

This question awards points to a wetland based on its position in the larger-scale landscape. These factors represent the extent to which the wetland provides hydrology-related (and other) functions and values.

In 100 year Floodplain (1 point).

Score this category if the wetland is in a flood plain. A flood plain is an area that floods regularly and supports soils deposited by these floods. Flood plain mapping is available at http://floodready.vermont.gov/assessment/vt_floodready_atlas but note that this mapping may not include localized floodplains along smaller streams in undeveloped areas. Floodplains are often characterized by presence of silver maple and ostrich fern, piles of flood debris, exposed areas of sand, gravel, or silt deposits, and presence of abandoned river channels and oxbow wetlands. The topography is mostly flat except for these channels and for small terraces. Floodplains generally have sandy or silty soils, but these soil types are not limited to flood plains.

For the purposes of this protocol, include areas within the 100-year flood plain (which have at least a 1% chance of flooding each year). Do not include a wetland in a floodplain if it is mapped as such but obviously is well outside the flood influence area (map error), or if it is at a flood interval more than 100 year flood. Do not include areas that can fill with water during floods, but are not associated with a river

or significant stream – for example, a basin wetland fed by small streams that fills with water during heavy rains is not a flood plain. Sandy and silty soils are a good guide here. Note also that not all flood plain areas are wetlands, and a VRAM assessment should not be conducted in a floodplain that is not a wetland.

Wetland provides a buffer between a waterway and human land use (1 point).

This category refers to wetlands that occur between a stream or lake and areas of intensive human use such as farms, villages, ski resorts, and lawns. These wetlands intercept runoff from developed areas, and help absorb pollution and sediment before it enters the water body. Conversely, the wetland protects the settled areas from erosion, wave action, and high-intensity flooding. Many of these wetlands also occur in flood plains.

Note that this factor refers to the wetland itself as a buffer and not to buffers as described in Metric 2.

Figure 5: This wetland is on the edge of a river. If a farm field or building is behind the trees, the wetland will slow down and filter water flowing from that human use before it reaches the river.

Figure 6: The area next to this river. This wetland will intercept water and nutrients flowing from the farm to the north before they enter the river. This would get a point for this factor.

Wetland is part of a habitat complex/forest block (1 point).

Both this and the next question ask whether the wetland is in physical proximity to or a part of other nearby wetland or upland natural areas. Score this factor if the wetland is part of a sizable habitat block that also contains other areas of intact wetland and/or upland forest. Utilizing aerial imagery from a source such as Google Maps or the Wetlands Atlas is helpful in scoring this metric.

Wetland is part of an important riparian/upland corridor (1 point).

Corridors are long areas of habitat that connect other larger areas of habitat. These often follow riparian areas (such as rivers) but also occur in upland areas. While they often refer to passage through human-influenced areas they may also refer to linear features along rivers or streams. Corridors allow species to disperse and migrate. Wetlands in corridors are especially valuable if they offer stepping stones to other areas of wetland in the habitat blocks they connect to.

To the left is an example of a corridor that does not follow a river. That narrow band of forest connects two larger patches to the east and west. A wetland in that forest would be part of this corridor.

Question 3c: Average Maximum Water Depth (1, 2, or 3 points).

Wetlands containing areas of deeper water (inundation) often support more diversity of habitats for the species that inhabit them. The presence of deeper water within a wetland may also provide a resiliency to the wetland hydrology during times of dry seasons or drought. Wetlands that fill with deep water during times of heavy precipitation and release it gradually reduce both flood and drought impact. Some wetlands do not have evidence of surface water but have permanently saturated soils due to a high groundwater table. All wetlands will have at least one point – if the site does not have at least seasonal saturation in the upper 12 inches of soil, it is not a wetland and should not be assessed using VRAM.

This factor refers to the **average depth of water throughout an entire wetland** during times of high water such as average spring snowmelt. If a wetland is visited during the dry summer months, an estimate may be made. Look for high water lines on trees, and note whether spring aerial photos show more water than is currently present. Conversely, some wetlands, such as those along ponds, may have deep water all year. However, the pond itself, or the center of a large stream channel, should not be included in the depth measurement. Do not include deep inundation caused by extreme weather events like Tropical Storm Irene that go beyond the typical spring snowmelt flood.

Question 3d: Average Duration of Inundation/Saturation (range of 1 to 4 points).

Wetlands that stay wet or inundated for longer periods may support more habitat for animals like waterfowl and amphibians that depend on flooded wetlands. Conversely, wetlands such as floodplains that only periodically flood can provide higher stormwater retention. This question can be difficult to answer if you only visit a wetland once, but a look at the vegetation, the soil, and a review of aerial photos from different times of year may be helpful.

Semi- to permanently inundated or saturated wetlands are always wet except perhaps during unusual dry periods. Regularly inundated/saturated wetlands are sometimes dry, but have water for much of the year including some of the growing season. Seasonally inundated wetlands have standing water in the spring, fall, and after extreme rain events, but otherwise do not. Seasonally saturated wetlands are similar to seasonally inundated wetlands except the soil is wet but without significant standing water.

If inundation or saturation status varies across the wetland, take an average for the wetland overall. If a wetland contains a perennial stream or small pools of permanently saturated open water but also a drier area that is only seasonally saturated, then average the score considering the area each regime covers. In the example above, if most of the wetland has perennial water score a 3 but if most is only seasonally saturated score a 2. Decimal scores such as 2.5 are best avoided.

As with question 3c, all sites that qualify as wetland will score at least 1 point.

Question 3e: Human Modifications to Natural Hydrology (range of 0 to 12 points-may be averaged).

In this question, the Rater looks at the wetland and determines the extent to which **human activities** have affected the natural hydrologic regime (the way water moves through a wetland). These activities can be dramatic, as when a dam or ditch is in the wetland, or can be subtler, as when ATV traffic has created ruts that change how water flows through the area. They can also consist of impacts outside the wetland but in the wetland's watershed, such as urban runoff or dams along a stream that feeds the wetland, or a dam downstream that can affect water level or sediment deposits in the wetland.

When evaluating this question, compare the wetland with what it would look like without human influence. **Do not include beaver dams as a modification unless they are anchored on a human structure such as a road or levee.** Do not include large-scale disturbances such as climate change or acid deposition unless they are having a disproportionate and specific impact on the wetland being assessed.

Identify all the hydrologic stressors noted in or affecting the wetland. Disturbances not on the Hydrologic Stressors list on the VRAM form can be listed under 'other'. Mark all stressors that may be present even if they do not decrease the score the wetland gets in this factor.

Stressor Definitions:

- **Ditch-** a narrow, channel that has been dug into the ground, usually to drain water out of or away from a wetland. Often straight or in a grid pattern.
- **Tile -** a drainage system with pipe draining water and emerging out of the ground on the downhill side of the wetland. Used to make farm fields drier.
- **Dike-** a linear mound of soil meant to regulate or stop water flow.
- **Weir-** a structure that cuts across the flow of water forcing the water to the side or over its top. Often used to divert water into ditches.
- **Dredging** – removal of soil or other natural material to create a channel, boat path, or pond in a wetland.
- **Stormwater input –** water that flows from impervious human-created landscapes such as farm fields or parking lots during storms, often bringing with it sediment, high-velocity water, or pollution. Do not include natural impervious landscapes such as rock outcroppings.
- **Point source –** Pollution entering the wetland or its feeder streams from a specific source such as a drain spout exiting a manure storage area.
- **Filling/Grading** – Material such as soil, rock, or debris dumped into a wetland to raise the land surface. Often conducted to provide a dry surface on which to place human structures.
- **Roadbed/RR Track** – A linear path where a road or railroad cuts through a wetland. Often associated with filling/grading for the roadbed and ditches along its edges.
- **Other** – a hydrologic disturbance that does not fit the other categories. Describe in the notes section provided.

All available information, field visits, aerial photos, maps, etc. can be used to identify a possible ongoing or past hydrologic disturbance. Consider both severity and recovery in this ranking. For instance, extensive ditching in a wetland 12 years ago would have greater current impact than one rut from an ATV created two days ago. In instances where the Rater believes that a wetland falls between two categories, or where the Rater is uncertain as to which category is appropriate, it is appropriate to "double check" and average the score.

```
12                    9              7              5              3              2                   1
I---------------------I--------------I--------------I-------------I--------------I-------------I-------------------------I
  none or none apparent              recovered/low severity        recovering/moderate severity   recent/severe/no recovery
```

Disturbance Level ***Definitions:***

- **None or none apparent-** There are no apparent human-caused modifications to the hydrology of the wetland or the watershed feeding into it.
- **Recovered/Low Severity-** The wetland appears to have recovered from past modifications which altered the wetland's natural hydrologic regime, and/or the disturbance is very low in severity.
- **Recovering/moderate severity-** The wetland appears to be in the process of recovering from past severe modifications which altered the wetland's natural hydrologic regime, and/or recent disturbance of moderate severity have occurred.
- **Recent/severe/no recovery -** The wetland has not recovered from past modifications, and/or the modifications are very recent or ongoing and their impact is severe.

Example 1. The wetland is a complex of marshes, fens, and forested wetlands located around the perimeter of a natural lake. In the 1930s, portions of the wetland were filled and dredged to develop a private beach/picnic/campground area. A dike with a weir was installed to deepen the lake by several feet. The private beach is still in use throughout the growing season. Significant areas of mature wetlands remain, with mostly-mature vegetation that fits what would be expected in these natural community types. *Score:* the past disturbances did not seriously impact this groundwater-driven wetland system, although a considerable amount of wetland was probably flooded when the lake level was raised. The system appears to have recovered from this disturbance. "Recovered" should be checked and the wetland receives a score of 7.

Example 2. The wetland is a forested wetland with shallow pools located in a forest parcel. Surrounding farm fields have been ditched and tiled and are actively farmed and the soil map shows large areas of hydric soils extending through portions of the woodlot into the surrounding farm fields. The remaining wetland areas appear to be at the local low point. A ditch passes along one side of the woodlot. The herbaceous layer in the wetland appears degraded and over-run by disturbance-loving species. *Score:* Average between "recovering" and "recent or no recovery" since it appears that the ditching and tiling has and is diverting water from this remnant wetland but it is unclear whether the wetland has not recovered or is in the process of recovering from this hydrologic modification. The score is 1 or 2 depending on the severity of the disturbance.

Example 3. Wetland is a seasonally-flooded, forested wetland on the flood plain of a creek. The wetland abuts a wooded ridge and is located at the side of a former pasture. The understory is regularly cleared and woody debris removed by the owner. Some selective cutting has also occurred. However, no evidence of soil rutting or other disruptions to hydrology are noted. *Score:* "none or none apparent" (12 points) since the disturbances, while substantial, have not affected the wetland's natural hydrology (see Metric 4: habitat alterations for assessment of the impacts).

6.4: Metric 4: Habitat Alteration and Development (Maximum point value: 20).

While hydrology may be the single most important factor influencing function, value, condition, and ecology of a wetland, there is a range of other factors and activities which also affect wetland quality and cause disturbances to wetlands. This metric evaluates disturbances to the ecosystem of the wetland – the plants, the animals, and the soils.

Question 4a: Substrate/Soil Disturbance (range of 1 to 4 points-may be averaged).

This question assesses the level of disturbance to the soil and surface substrates of the wetland. For this factor, assign the appropriate number to **describe the present state** of the wetland. A 1 indicates the highest level of disturbance; 4 indicates no significant substrate or soil disturbance.

Examples of substrate/soil disturbance include:

- Filling and grading
- Plowing
- Grazing/soil disturbance by animal trampling
- Vehicle use in wetland (motorbikes, off-rode vehicles, construction vehicles)
- Sedimentation
- Dredging
- Other physical disturbances to the surface substrates or soils.

Question 4b: Habitat Development (range of 1 to 7 points).

This question asks the Rater to assign an overall qualitative rating of how well-developed the wetland is in comparison to other similar wetlands. A scoring continuum is presented from poor to excellent. Choose the number that best fits the overall habitat development of the wetland based on the list below. Consider the age of plants, the species composition, the development of vertical layers, and other factors which indicate a mature natural community. Do not downgrade for natural succession such as blowdowns or beaver disturbance.

- **Excellent-**Wetland appears to represent the best of its type or class. All natural communities in the wetland are well-developed with mature vegetation and a full suite of species representative of a mature example free of human disturbance.
- **Very Good-**Wetland appears to be a very good example of its type or class but is lacking in some characteristics which would make it excellent.
- **Good -**Wetland appears to be a good example of its type or class but because of past or present disturbances is not excellent.
- **Moderately Good -**Wetland appears to be a moderately good example of its type or class.
- **Fair -**Wetland appears to be a fair example of its type or class but shows significant alterations because of past or present disturbances.
- **Mediocre -** Wetland appears to be a poor example of its type or class but natural communities can still be recognized as present.
- **Poor -**Because of past disturbance, the habitat lacks development. Defined natural communities are not present and the vegetation is characterized by disturbance-loving species, invasive species, and/or planted species such as hayfield cover plants.

Question 4c: Habitat alteration (range of 0 to 9 points-may be averaged).

Evaluate the extent to which humans have altered the habitat in the wetland. This question does not discriminate between wetlands with different types of habitat, e.g. between a forested vernal pool and a forested wetland. Compare the wetland to your assessment of what the wetland would be like without any human habitat alterations (a "reference" condition wetland would score 9). As with hydrologic modifications, this factor considers both the severity of the disturbance and how recent it was.

As you assess the wetland, mark all the habitat alterations observed using the list on the datasheet. After you do this, assess the extent to which these alterations have affected the wetland and rate this factor accordingly. If disturbances have occurred that are not on the list, check 'other' and note them. In some cases, alterations may no longer be affecting the wetland and the score would be 9.

Figure 7: This wetland has experienced heavy disturbance and now is full of invasive species with little recovery. The score would be low – perhaps a 2 depending on overall conditions.

Example 1. The wetland is a forested swamp which was heavily grazed by cattle no more than 5 years ago. The wetland is near a large mature second growth forest that supports other forested wetlands that were fenced off from the pasture. The characteristic shrubs of this natural community type are mostly absent. There are many herbs, which consist of a mix of speceis characteristic of the wetland type and disturbance-loving species such as goldenrods. One area includes a small but expanding infestation of reed canary grass. (*Phalaris arundinacea*) Score: the wetland has partially recovered from the heavy grazing, but is still seriously altered from its natural condition. The Rater assigns a score of "3" to this wetland.

Example 2. The wetland is a forested seepage swamp located in a block of mature forest. The wetland supports a diverse array of plants, all of which are characteristic of forested seepage wetlands. Beyond the edges of the forest block, there are extensive areas of farm fields. Score: the Rater should check none or none apparent (9 points). There is disturbance in the area around the wetland, but the wetland itself has fully intact habitat and does not appear to have been disturbed by associated activities.

6.5: Metric 5: Vermont's Natural Heritage (Maximum point value 10).

This metric assigns 10 points to the wetland if it includes state significant natural communities or rare species. Note that if both are present, the score is still 10. The only possible scores for this metric are 10 or 0.

Vermont's *natural communities* are repeatable groups of species that occur in set habitat conditions. The Vermont Natural Heritage Inventory (NHI) tracks the best examples of each type of natural community, including both wetland and upland ecosystems. These natural communities have been mapped; the mapping is available on the Vermont Natural Resources Atlas or the Wetland Atlas. To score this factor, review the Atlas for any examples of state significant natural communities within the wetland. If any are present, score 10 points. If you visit a wetland that supports an exemplary ecosystem, but it is not mapped as such, record as much information on the plant species and ecosystem structure as possible, taking pictures if possible. The Wetlands program and NHI may be able to determining if the natural community is state significant based on this information. Note that the NHI does not currently track floating or submerged natural communities or beaver wetlands.

For information on classifying natural communities, please consult the guidebook *Wetland, Woodland, Wildland* (Thompson and Sorenson, 2005). For a list of all known wetland (and upland) natural community types in the state, see
http://www.vtfishandwildlife.com/common/pages/DisplayFile.aspx?itemId=111319

Rare Species in this context include any State or Federal threatened or endangered species or species with a state rarity rank of S1, S2, or S2S3. Rare species are present in many of Vermont's wetlands. If any such species are recorded on the Natural Resources Atlas, or if you find a species that you are confident meets these qualifications, award 10 points here. If possible, include a photograph of the rare species. If you think you may have found a rare species but you are not certain, take as many photographs as possible including all important features of the plant (flowers, leaves and where they join the stem, trunk, and fruits if present) and describe the species in the notes. Do not collect a sample of a species that may be rare.

Uncommon species (species with a rarity rank of S3) do not result in points being assigned to this field, but they may indicate high-quality habitat conditions. Please note any S3 species in the notes field and take a photo if possible.

Note: No wetland can ever receive more than 10 points for this metric. A wetland with several state significant natural communities and several rare species still receives a score of 10. If none are found, it receives a score of 0.

6.6: Metric 6: Habitat Structure and Microtopography (Maximum point value: 20).

This metric assigns rankings to a variety of features related to the structure of the habitat and microtopography in wetlands. Because plant communities reveal so much about the conditions they occur in, they are the focus of this section. Even in their death, plants produce features such as snags and coarse woody debris that are important components of wetland habitat. Features of microtopography such as hummocks and pools are also evaluated.

Question 6a: Vegetation Cover Types (score each habitat type on a range of 0-3 pts and add total)

Ecologists divide Vermont plant communities into several layers based on their heights and characteristics of plants present. In this metric you rate the condition and abundance of several vegetation layers as described below. Open water and certain other features are also ranked.

Begin scoring this metric by viewing as much of the wetland vegetation as possible, with the categories in mind. Some wetland natural communities, such as floodplain forests, may have well-developed examples of every layer type; other natural communities, such as cattail swamps, may only support one significant layer. Since wetlands can support more than one natural community, one needs to consider the wetland as a whole including each natural community present.

Both the quantity and the condition of each layer is considered for the ranking. To score a 3, a layer must both be present in much of the wetland AND be in good condition. Aerial photos may be helpful to determine the aerial extent of layer types. Use Table 3 and the definitions and guidelines below when assigning score.

Table 3: Communities and Microtopography Scoring	
0	Not found or insignificant (<0.25 acres)
1	Present. Low to moderate cover/condition
2	Low cover and high quality or high cover and moderate quality
3	Significant cover and high quality

<u>Please note</u>: some important and high-quality wetlands, such as bogs, may receive a low score here. Wetlands without complex vertical structure do not provide the same diversity of habitat as other wetlands, but do provide specialized habitat that often supports rare plant species which do not occur elsewhere.

NOTE: Seeps and Vernal Pools under 0.25 acres are generally too small to have fully recognizable and differentiated strata. When you assess these wetlands, choose only the most representative and significant layer and rank it 0-3.

Vegetation layer definitions<u>:</u>

- **Aquatic Bed vegetation** consists of submerged herbaceous vegetation such as eelgrass or floating-leaved vegetation such as water lilies. Note that during dry periods these species may be lying exposed on mud flats, but would still be ranked as aquatic bed. This category does not include any woody shrubs (i.e. buttonbush) regardless of how deep in the water they are.

- **Emergent/herbaceous vegetation** in this context refers to all herbaceous (non-woody) vegetation unless it is floating or completely submerged during normal growing season conditions. Examples of emergent or herbaceous vegetation include ferns, wildflowers, grasses, sedges, and cattails. Regardless of the height, include all herbaceous vegetation here and exclude all woody vegetation including tree or shrub seedlings. Species that would NOT be included in this layer include alder, winterberry holly, sweet gale, leatherleaf, maples, birches, or anything else with hard stems that live for more than a year. This also does not include mosses.

- **Shrub vegetation** is defined here by maximum height, not by the number of stems, plant species, or diameter at breast height (DBH). All woody vegetation under 15 feet (4.5m) tall is considered a shrub. Do not count any of the species that meet the criteria for Aquatic Bed or Emergent/Herbaceous regardless of its height.

- **Forested vegetation** is defined here by minimum height, not by the number of stems, plant species, or diameter at breast height (DBH). All woody vegetation over 15 feet (4.5m) tall is considered a tree and part of the forest vegetation component.

- **Open water** includes areas typically covered in open water. If you are visiting the wetland during an unusually wet or dry time, estimate how much open water would be present during a summer of average precipitation. Open water includes any lakes, ponds, large backwater pools, streams, etc, but does not include small, shallow, temporary features such as shallow water in a cattail swamp or vernal pools. Include open water that is directly connected to and adjacent to the wetland. A slow-winder stream meandering through a wetland would be included, but when a wetland is on a lakeshore, only the portion of the lake directly adjacent to a wetland is assessed – do not include the entirety of Lake Champlain when assessing a bulrush marsh on its shore.

- **Other** refers to areas of a wetland that function as habitat but cannot be defined by the above vegetation cover types. This may include areas of bare ground occurring without vegetation, such as at the mouths of rivers where there are areas of sand or mud due to sedimentation or a ground layer of leaf litter in vernal pools that contain no vegetation. If it is an extremely dry period and you are looking at the bed of a water body that is usually open water, rank as open water, but a mud flat that is regularly exposed to the air each summer would be included here.

Consider species diversity compared with a reference-condition wetland when assigning a rank. In a cedar swamp, for example, a high-scoring herb layer should have many species, because a good-condition cedar swamp typically has a very diverse herb layer. However, cedar swamps are often strongly dominated by only cedar in the tree layer, so lack of tree species diversity would not result in a low tree layer score. Disturbance or other degradation of condition may be indicated by low species diversity, or by abundance of plants such as goldenrod (*Solidago* spp.) and joe pye weed (*Eutrochium* spp.) that thrive in areas of high disturbance. However, note that natural disturbance (as with a beaver wetland or floodplain) can also lead to abundance of disturbance-loving species, and wetlands should not be scored lower because of natural disturbance. Goldenrod in a spruce swamp may indicate human disturbance, but goldenrod in a beaver meadow is a native species occurring in its native natural community.

Example 1: The wetland includes both cedar swamp and rich fen, each making up about half of the sizable wetland. The cedar swamp has an excellent-condition tree layer with mature cedars, and an

understory with a dense and diverse herb layer also in excellent condition – species diversity is very high, and in fact several rare plants are present. The Rich Fen has a dense layer of herbs, also in excellent condition, and a significant but not abundant patchwork of shrubs on its edges. The tree score is 2 because the quality of the layer is high but it only is present in half of the wetland. The shrub layer scores a 1. There are enough shrubs to add habitat diversity and they are in good condition, but quantity is very low. The herb layer scores a 3 because a high quality herb layer is present in most or all of the wetland.

Example 2: The wetland occurs amidst as substantial area of meandering river. Other than the open river, the wetland supports a very dense layer of the invasive grass common reed (*Phragmites australis*). The wetland receives a score of 1 for the herb layer and a zero for the shrub and tree layer. The common reed is six feet tall, but is an herbaceous plant so it is counted as an herb. However, the condition of the layer is poor because it consists of a monoculture. The open water receives a score of 2. It has been included in the VRAM boundary because it intersperses throughout the wetland and is hydrologically connected to the area of common reed. The cover of open water is high. However, the river is known to be disturbed somewhat because of heavy recreational use, pollution, and presence of invasive fish, so is considered moderate quality.

Figure 8: The wetland shown here supports aquatic bed vegetation in the foreground, emergent herb vegetation in the center, and tree and shrub vegetation in the background. The river would be considered open water.

Question 6b: Diversity of Habitat Types (Horizontal Interspersion) (range from 0-5 points)

This metric describes the amount of variation of the habitats within a wetland when observed through the **birds-eye-view perspective.** This variation can occur at a low to a high spatial scale, and may take the form of several natural community types occurring in a patchwork, OR for a single natural community that has highly varied vegetation on a horizontal level. Consider both the number of habitat types AND the extent to which they are interspersed (see example map below) Do not include diversity on a vertical plane because that is covered under Question 6A.

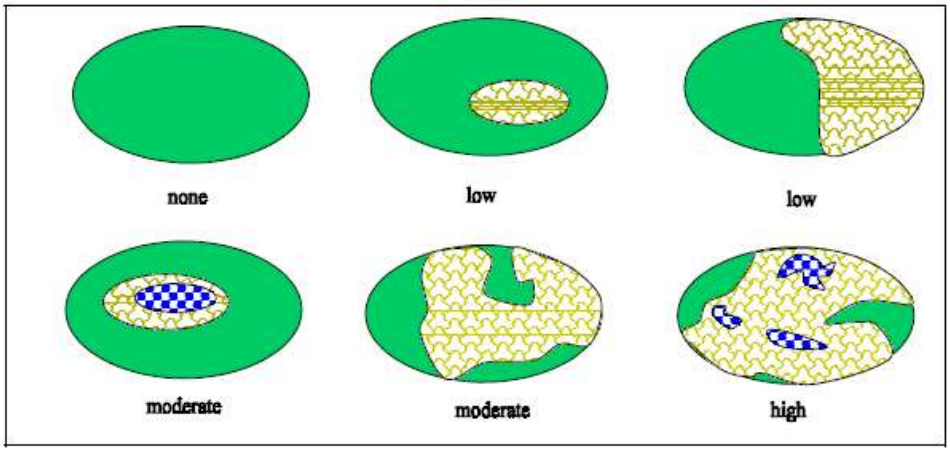


Figure 9: Hypothetical maps of wetlands with different scores for this metric. The different colors and patterns represent different habitat patches.

A wetland with varied vegetative types and well-distributed habitat patches offers more habitat to a wider range of animal and plant species than a wetland with the same vegetation throughout. Some wildlife species require large tracts of similar habitats (low interspersion), but many others use a variety of habitats at different stages in their life cycle and require multiple habitat types in close proximity to one another (high interspersion).

Low diversity of habitat types does not necessarily indicate an inferior or damaged wetland, and some wetlands, especially those in especially extreme habitats, may naturally have low interspersion. However, high diversity of habitat types almost always indicates a high-quality wetland.

Example 1: A floodplain forest along a meandering river supports a floodplain forest with areas of mature silver maple, patches of cedar, alder thickets lining the river, and a backwater pool lined with sedges and filled with water lilies. This wetland has very high diversity of habitat types and would receive a score of 5.

Example 2: A cattail marsh supports a thicket of cattails, but does not have any other significant areas of habitat except a small patch of alders on one edge. This wetland receives a score of 1 – there is some habitat diversity, but the level is low.

1. .

Figure 10: The floodplain forest below, on the Clyde River, has at least four (4) habitat types. Note the open water, the sedges and grasses, the shrub patches, and the areas of forest.

Question 6c: coverage of invasive plants (range from plus (+) 1 pt. to negative (-) 5 points)

Invasive plants are plant species that invade habitat and can displace or exclude native animal and plant species. These plant species typically are native to a place some distance outside of Vermont, but have been introduced by human activities into the Vermont landscape. They often do not have natural predators to keep them in balance with the ecosystem; therefore, they can spread and dominate the area in which they have been introduced.

Invasive plants reduce the value of wetlands by excluding native species, and sometimes alter the way water flows through wetlands and flood plains. The presence of invasive species may also be an indicator of other disturbance to the wetland, such as nutrient-rich runoff or human-caused soil disturbance or vegetation removal.

The scoring of invasive plant presence is based on estimated percent (%) coverage of the wetland area by any one or combination of invasive species. Points are subtracted from the overall wetland score as the area of invasive species coverage increases, indicating a lower value of wetland quality.

There are many invasive species that may occur in Vermont's wetlands. It is best to become familiar with the most common and problematic ones before conducting wetlands surveys. Examples of invasive plants that may occur in Vermont wetlands include but are not limited to:

- **Non-woody/Herbaceous:** Purple loosestrife (*Lythrum salicaria*), yellow iris (*Iris pseudoacorus*), common reed (*Phragmites australis*), and reed canary grass (*Phalaris arundinacea*). These last two species have both invasive and native strains but are usually invasive, especially when in large dense patches.
- **Shrubs:** Morrow's honeysuckle (*Lonicera morrowii*) and glossy buckthorn (*Frangula alnus*)
- **Aquatic bed:** water chestnut (*Trapa natans*) and Eurasian milfoil (*Myriophyllum spicatum*).

Figure 11: This cattail marsh wetland has been invaded by purple loosestrife. Ultimately, the purple loosestrife may expand to the point that other species are not present and the overall species diversity of the wetland is reduced.

For more information and photos, see the links above or http://vtinvasives.org/ and https://gobotany.newenglandwild.org/ . If you observe invasive species, record which species is/are present on the VRAM form. If you see a species that appears invasive, but are not sure of identification, take clear photos of the plant including leaves and flowers/seeds if present, and utilize field guides or other resources, including emailing photos to the Wetland Program to see if identification can be determined. Remember to take note of the percent coverage so you can score this section after identification.

ALERT: If you walk through a wetland containing invasive species, please be sure to carefully clean your clothes, boots, and equipment before leaving the site. Remove all mud and attached plant matter so that you do not spread the invasive species to other areas.

Question 6d: Microtopography (score each parameter on a scale of 0 to 3 pts and add total)

This question addresses small (micro) features and characteristics of wetlands that add to habitat diversity, especially for wildlife. Presence of these features add to wetland function, but also note that some wetlands, such as bogs, may naturally lack most of these features and still be wetlands of high value.

To score this question, review the descriptions of each microtopography type below and rank them based on the scale in Table 4 below. Note that the scoring is very similar to that in Question 6A.

Table 4: Communities and Microtopography Scoring:	
0	Not found or insignificant
1	Present. Low to moderate cover/condition
2	Low cover and high quality or high cover and moderate quality
3	Significant cover and high quality

Vegetated Hummocks or Tussocks

Hummocks are mounds of soil that rise above the surface of a wetland. These are often formed from a pile of soil and decomposing roots created by an uprooted tree. Tussocks are similar in appearance but form when plants like grasses, ferns, and sedges grow into large clumps. The clumps accumulate dead leaves and other matter and can be well over a foot tall, usually with a plant growing from the top. Tussock sedge (*Carex stricta*) is especially likely to build tussocks, as the name implies. These mounds add to the habitat value of a wetland. Because they can be destroyed by extensive soil disturbance, their presence also indicates a lack of soil disturbance in the recent past.

Figure 12: Cinnamon ferns grow on hummocks, rising them above the saturated soils of a swamp (left). Sedges create tussocks in a wetland associated with the Little Otter Creek river (right).

Coarse Woody Debris greater than 6 Inches in Diameter

This metric ranks the abundance of fallen logs and large limbs in the wetland. These features add to the habitat diversity of the wetland, and as described above may also transition into hummock topography over time. Presence of coarse woody debris also can indicate older, less disturbed forests that offer additional habitat values. Include fallen debris or tilted dead trunks that lie at a 45-degree angle or greater and measure 6 inches in diameter or larger. Note also that rotted fallen logs can be difficult to distinguish from hummocks. If the log still is made of solid wood include it here, but if it is completely crumbled to the point of becoming soil include it as a hummock instead.

Figure 13: This wetland (the Black Gum Swamp in Vernon) includes a range of coarse woody debris types including still-leaning trunks, fallen logs, and logs that are mostly covered in moss.

Figure 14: this log meets the 6-inch diameter requirement for course woody debris. As it decays it is slowly turning into a hummock. Vegetation that cannot tolerate inundation, such as the pitcher plant, is already colonizing the new habitat niche.

Standing Dead Wood greater than 10 inches dbh

This metric scores the abundance of standing dead trees, also known as snags. DBH refers to diameter at breast height (4.5 feet above the ground). To be counted here the snag must be at least 4.5 feet tall and 10 inches of DBH. This is surprisingly large – some sizable, tall snags will not qualify. Snags offer important habitat to many animals, especially nesting birds such as wood ducks, herons and bats. Of course, wetlands that do not contain trees will generally not contain snags, but make sure to check along the wetland edge. If it is 'rooted' within the wetland it should be counted. Note that if the snag is tilted to 45 degrees or greater it will instead be counted as coarse woody debris above.

Figure 15: An example of very high snag density, with a heron rookery also present. This wetland was probably flooded by beaver, killing the trees that previously grew here. Beaver-flooded snag 'forests' like this are common in Vermont and will often score a 3 in the Standing Dead category.

Figure 16: This wetland has many snags, but most of them are under 10 inches DBH or under 4.5 feet tall. Thus it would receive only a 1 under the Standing Dead category. Note there is also coarse woody debris present, and some of the stumps may be transitioning into hummocks as they decompose

Amphibian breeding pools

This metric tracks the presence of amphibian breeding pools. These consists of pools that have several inches of water (or more) in the spring, but that dry up most summers. An amphibian breeding pool excludes fish that would otherwise eat breeding amphibians or their eggs and larvae. In the spring and early summer amphibian eggs may be directly observed. Later in the season this may be inferred by the presence of areas of bare ground with little or no vegetation or leaf litter.

For this factor to score a 3, the pools should be discrete and completely isolated from access by fish. This usually means vernal pools or similar pools within wetlands. Pools in beaver meadows or floodplains that are intermittently accessible by fish and are not consistently used by species like wood frogs and mole salamanders should receive a lower score. Presence of generalist amphibians such as newts that can breed in perennial pools does not indicate an amphibian breeding pool under this criteria.

Above: The best examples of amphibian breeding pools are vernal pools such as this example on Raven Ridge in Hinesburg (left), but amphibian breeding pools can also exist in many other types of wetland. Photo on right is an egg mass of wood frogs. These are usually visible in the spring and early summer but not by the late summer when the pool is usually dry.

6.7: Additional Notes

This section may seem optional because it is on a separate page, but is in fact one of the *most important* parts of VRAM. These notes provide the context that pins together the data and allows for interpretation of the score.

General Notes Including Weather Conditions:

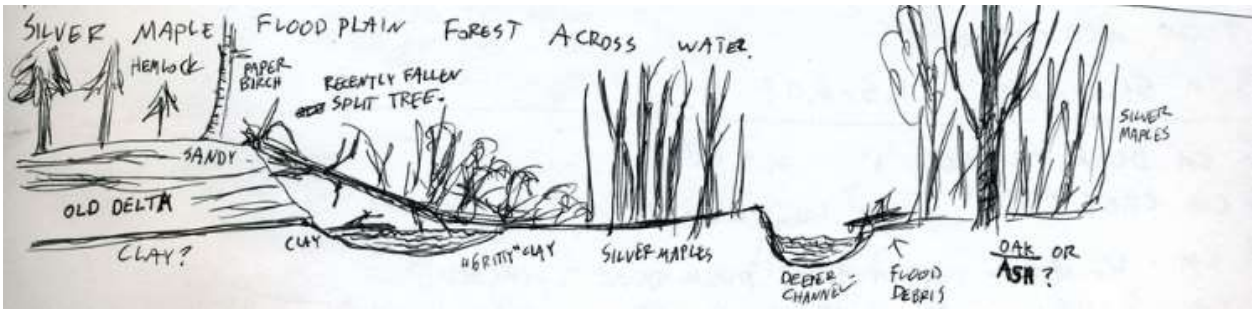
In this section, note anything special, unusual, or notable about the wetland and your survey. A description of recent weather is vital to understanding the hydrology of a wetland, as water levels and the status of plants can change based on recent precipitation or temperature. Note if there has been recent rain and the approximate quantity (heavy, light, or moderate can be sufficient). Also note any extremes of temperature or wind. In addition to weather, other factors you might note include evidence of human disturbance, unusual hydrology, or visible effects of natural disturbance. There is a separate section below for noting species observed.

Map of Assessed Area/Sketch of Wetland Structure

In this section, draw a rough map of the wetland and the area which you saw. It is not necessary for it to be detailed, but it is important that this information is included. If for some reason, you cannot draw a map, please describe the extent of the wetland and surveyed area in text notes.

Include GPS coordinates, or if this is not possible, a detailed description of where the wetland is. This is crucial as VRAM data without a known location cannot be used. Advanced VRAM participants can include other features on the map such as presence of stream channels or different natural community types.

A 'cross section' sketch of the wetland can also be very useful, showing the layers of vegetation and changes as one moves from the edge to the center. See below for an example. These sketches do not need to be detailed or artistically complex, and are just to communicate information.



Dominant/Important Species

In this section, note the dominant species of the wetland. To the extent possible, list the most abundant tree, shrub, and herb species, and any notable evidence of animal use or of unusual or rare plant species. For more experienced naturalists with sufficient time in the wetland, a longer list of all species observed can be very valuable. Species can also be entered into the iNaturalist website or app with photos, with a link sent to the Wetlands program (do not use iNaturalist for VRAM on private property unless the landowner approves, and do not add rare species that might be prone to collection or harassment). An iNaturalist observation of an unknown species with one to several good photos of the plant will often result in a crowd-sourced ID.

7.0: References, Sources, Further Information

7.1: References

Flinn KM, Lechowicz MJ and Waterway M (2008) Plant species diversity and composition of wetlands within an upland forest. American Journal of Botany1216-1224.

ORAM – the protocol from Ohio which VRAM is based on.
Mack, John J. 2001. Ohio Rapid Assessment Method for Wetlands, Manual for Using Version 5.0.
Ohio EPA Technical Bulletin Wetland/2001-1-1. Ohio Environmental Protection Agency, Division of
Surface Water, 401 Wetland Ecology Unit, Columbus, Ohio.
VRAM was initially adapted from ORAM, with changes to account for the different ecological and cultural landscape of Vermont. Over time both states have continued to refine their protocols, so these are not as similar as they once were. However, ORAM is still the basis of VRAM. See also http://www.epa.ohio.gov/dsw/401/ecology.aspx .

Thompson and Sorenson. 2005. Wetland, Woodland, Wildland – A Guide to the Natural Communities of Vermont. Published by the Vermont Department of Fish and Wildlife and The Nature Conservancy.
This is the primary source of information for wetland (and upland) natural communities in Vermont, and an essential guide to anyone who wishes to classify wetland types using this methodology. This book is available online – go to http://www.vtfishandwildlife.com/learn_more/fish_and_wildlife_library and click on 'Books'.

Watson, K.B., Ricketts, T.H., Galford, G.L., Polasky, S., O'Niel-Dunne, J., 2016.Quantifying flood mitigation services: the economic value of Otter Creek wetlands and floodplains to Middlebury, VT. Ecol. Econ. 130, 16–24.

7.2: Relevant Links

Go Botany, https://gobotany.newenglandwild.org/
Go Botany is an excellent online tool for plant identification. It includes all plants known to occur in New England, along with range information, wetland status, abundant photos and identification keys.

iNaturalist.org, https://www.inaturalist.org
iNaturalist is a citizen science website that is very active in Vermont. Data can be entered using a free app or through the website. Crowdsourced ID is often available if good pictures are taken. It can also be helpful to review where species have already been observed. Note that this is an 'open data' site – if you are on private property and do not want the location public, or if you are observing a species that is prone to collection such as an orchid, either obscure the location on the website or don't add it. However it can be a great tool and companion to VRAM when appropriate. If you are interested in using iNaturalist in concert with VRAM please send an email to Charlie.hohn@vermont.gov so that your observations can be tracked by the Wetlands program.

Vermont Invasives. http://vtinvasives.org/
This website describes many species of invasive plants and their impacts

Vermont Natural Community Types -
http://www.vtfishandwildlife.com/common/pages/DisplayFile.aspx?itemId=111319
This website lists all of the described natural community types in Vermont, as well as their equivalent in the NatureServe International Ecological Classification Standard. For VRAM, use the natural communities in the first column. See Thompson and Sorenson 2005 for more information. Note that this table includes upland natural communities. Wetland natural community types begin at the 'Floodplain Forests' heading on Page 3.

Vermont Wetlands Program, Vermont Agency of Natural Resources,
http://dec.vermont.gov/watershed/wetlands .
See this website for further information about wetlands including their functions and values and the protections, laws, and permits that apply to wetlands.

Vermont Wetlands Inventory Map: http://anrmaps.vermont.gov/websites/WetlandProjects/default.html
And tutorial for its use:
http://dec.vermont.gov/sites/dec/files/wsm/wetlands/docs/wl_Vermont_Inventory_Map.pdf
A great source for "desktop review" with layers of wetland mapping, endangered species occurrence, exemplary wetland natural communities, air photos, and other features.

Appendix A: Sample VRAM Form

VRAM v. 2.0 Field Form Quantitative Rating (Modeled after the ORAM v. 5.0)

Site: | Rater(s): | Date:

Metric 1. Wetland Area (size) (Note: 1 acre is 0.4 hectares)

max 6 subtotal

Assign score for entire assessment area based on size classes below. Sketch map on page 3.

- >50 acres (6 pts)
- 25 to <50 acres (5 pts)
- 10 to <25 acres (4 pts)
- 3 to <10 acres (3 pts)
- 0.3 to <3 acres (2 pts)
- 0.1 to <0.3 acres (1 pt)
- <0.1 acres (0 pt - vernal pools and seeps)

Metric 2. Upland Buffers and Surrounding Land Use

max 14 subtotal

2a. Calculate average buffer width (with max being 50m).

- Entire. Buffer of at least 50 m around entire wetland (7)
- Wide. Buffer of at least 50m around nearly all of wetland, with small interruptions. (6)
- Medium. Barriers average 25 to <50 m around wetland perimeter. (4)
- Narrow. Buffers average 10m to <25m around wetland perimeter (1)
- Very Narrow. Buffers average <10m around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or take an average between two.

- Very Low. Second growth or older forest, naturally vegetated conserved land, etc. (7)
- Low. Old-field (>10 years old), successional shrubland, or young forest. (5)
- Moderately High. Rural residental, fenced pasture, park, fallow field. (3)
- High. Urban, industrial, dense residential, row crops, etc. (1)

Metric 2 Notes:

Metric 3. Hydrology.

max 30 subtotal

3a. Sources of water. Rank importance of each from 0 to 3

- High pH groundwater
- Other groundwater
- Precipitation
- Seasonal/intermittent stream or pond
- Perennial lake, stream, or river

3c. Average maximum water depth. Select one.

- >0.7 m (3)
- 0.4 to <0.7 m (2)
- <0.4 m (3)

3b. Connectivity. Score all that apply.

- In 100 year floodplain (1)
- Buffer between waterway and human use (1)
- Part of habitat complex/forest block (1)
- In important riparian or upland corridor (1)

3d. Average duation of saturation.

- Semi- to permanently wet (4)
- Regularly inundated/saturated (3)
- Seasonally inundated (2)
- Upper 12" soil seasonally saturated (1)

hydrologic stressors - check all that apply

- Ditch
- Tile
- Dike/Weir
- Dredging
- Other (describe below)
- Stormwater input
- Point source
- Filling/grading
- Roadbed/RR track

3e. Human modifications to natural hydrology.

Rank from 0 to 12 using scale below.

- None or none apparent (12)
- Recovered/low severity (7)
- Recovering/moderate severity (3)
- Recent/severe/no recovery (0)

Describe stressors:

Other Metric 3 Notes:

Metric 4. Habitat Alteration and Development

max 20 subtotal

4a. Substrate disturbance

- None or none apparent (4)
- Recovered/Low Severity (3)
- Recovering/Moderate Severity (2)
- Recent/Severe/No Recovery (1)

4c. Habitat alteration. Rank from 1-9 based on scale blw.

- None or none apparent (9)
- Recovered/low severity (6)
- Recovering/moderate severity (3)
- Recent/severe/no recovery (1)

4b. Habitat Development

- Excellent (7)
- Very Good (6)
- Good (5)
- Moderate (4)
- Fair (3)
- Mediocre (2)
- Poor (1)

Habitat alteration - Check all that Apply

- Mowing
- Dike
- Selective Cutting
- Water Pollution
- Herb/Aquatic Bed Removal
- Agriculture
- Nutrient Enrichment
- Grazing
- Clearcutting
- Woody Debris Removal
- Shrub/Sapling removal
- Sedimentation
- Dredging
- Other:

Other Metric 4 Notes:

Metric 5. Vermont's Natural Heritage

max 10 subtotal

check all that apply and score as indicated

- State Significant Natural Community (10)
- Rare, Threatened, Endangered, or S2 species (10)

List all observed natural communities and rare spp.:

Metric 6. Habitat Structure and Microtopography

max 20 subtotal

6a. Vegetation Cover Types. Rank each from 0 to 3.

- Aquatic Bed
- Emergent/Herbaceous
- Shrub
- Forested
- Open Water/Submerged Vegetation
- Other (list here:)

Communities and Microtopography Scoring:	
0	Not found or insignificant
1	Present. Low to moderate cover/condition
2	Low cover and high quality or high cover and moderate quality
3	Significant cover and high quality

6b. Diversity of Habitat Types (Horizontal Interspersion)

- High (5)
- Moderately High (4)
- Moderate (3)
- Moderately Low (2)
- Low (1)
- None (0)

6c. Coverage of Invasive Plants (score may be negative)

- Monoculture (>75% cover) (-5)
- Dense (26-75% cover) (-3)
- Moderate (5-25% cover) (-1)
- Sparse (<5% cover) (0)
- None observed (1)

6d. Microtopography (score on 0 to 3 scale)

- Vegetated Hummocks or Tussocks
- Coarse Woody Debris >6 inches diameter
- Standing dead >10 inches dbh
- Amphibian Breeding Pools

GRAND TOTAL (MAX 100 POINTS)

See manual for interpretation of score

VRAM Additional Notes Sheet

Site:	Rater(s):	Date:

General Notes including Weather Conditions:

Map of Assessed Area/Sketch of Wetland Structure. Include location map and ideally GPS coordinates:

Dominant/Important Species Observed (optional):

(additional space on back of this form)

Appendix B: Field 'Cheat Sheet'

VRAM CHEAT SHEET 2017

REMEMBER:

- Be safe and aware of your surroundings
- Be aware of and avoid spread of invasive species.
- Be respectful of landowners/do not trespass
- Visit as much of the wetland as possible/safe and note what you did and did not see.

ASSESSMENT AREA:

If possible, assess entire wetland that is contiguous (not separated by hydrologic breaks such as cascades or upland). Note and sketch a map of the area assessed. Make sure you are in a wetland – site should have wetland plants, soil, hydrology

DESKTOP REVIEW:

Use the wetland inventory map to review size, buffer, surrounding landscape, and presence of exemplary natural communities and rare species.

LOCATION:

Don't forget to mark your location with some form of GPS (even a geotagged smartphone photo can work in a pinch)

METRIC 1: Wetland Area

Rank based on area in acres. Best assessed from the Wetland Inventory Map or Google Earth, use field visit to verify boundary.

METRIC 2: Upland Buffers and Surrounding Land Use:

2A: Buffer is best assessed on air photos, use field visit to verify. The buffer is the 50 acres of upland or water surrounding the wetland.

2B: Surrounding Land Use: Rank based on area that drains into or directly influences wetland.

METRIC 3: HYDROLOGY

3A: Water Source:

Table 1: Status of Water Source	Score
Extremely important	3
Moderately important	2
Significant	1
Insignificant	0

Natural Communities that May Indicate High pH Groundwater
Intermediate Fen
Rich Fen
Calcareous Red Maple-Tamarack Swamp
Calcareous Riverside Seep
Northern White Cedar Swamp
Northern White Cedar Sloping Seepage Forest

Natural Communities Primarily Fed by Precipitation
Bogs
Vernal Pools

Seasonal streams lack fish and dry up during dry periods, perennial streams are well established, may have beaver dams, and usually have fish.

3B: Use floodplain maps or look for evidence of flooding such as flood debris, old river channels, or sediment deposits. Wetland provides a buffer if it is between river or lake and development. A forest block is a large area of natural forest that includes the wetland, a corridor is a habitat connection that species use to move between or through forest blocks.

3C Estimate average maximum depth based on signs of water level during spring. Floodplains fluctuate widely in water level, bogs usually do not.

3D: Average duration of inundation/saturation best assessed during time of dryness, estimate how logn the wetland is inundated (standing water) or saturated (soaked soils)

3E: Human impacts to hydrology are ranked based on severity of current impact and only include human disturbances that affect water movement

Human Impact Definitions (used in several metrics)

- **Recovered/Low Severity**- wetland recovered from past modifications which altered natural hydrology and/or disturbance is very low in severity.
- **Recovering/moderate severity**- wetland in process of recovering from past hydrologic modifications and/or recent disturbance of moderate severity.
- **Recent/severe/no recovery** – recent or severe past modifications – wetland not recovering yet.

METRIC 4: Habitat Alteration and Development

4A: rate level of disturbance to soil and substrate using metric in *3E*.

4B: rank habitat development from excellent (ie. old growth, untouched) through poor (ecosystem not functioning).

4C: rank disturbance of habitat using metric in *3E*

METRIC 5: Vermont's Natural Heritage

- **Add 10 points if any significant natural communities or rare species are known to occur (use wetland/Heritage map)**
- **Add 10 points for any new examples of the above found during survey**
- **Total can not exceed 10 points.**

METRIC 6: Habitat Structure and Microtopography

6A: **definitions – rank using Table 4**

Aquatic bed – floating or submerged plants e.g. water lilies or eelgrass

Emergent/herbaceous – all non-woody vegetation e.g. grasses, sedges, wildflowers, ferns, cattails

Shrub – All woody vegetation <15' tall

Tree – all woody vegetation >15' tall

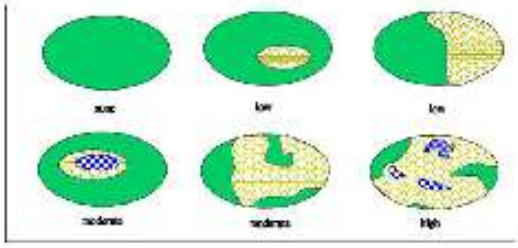
Open Water – ponds, streams, etc that are present most of year – no puddles or post-rain runoff

Other – naturally bare ground, mudflats, etc

Table 4: Communities and Microtopography Scoring

0	Not found or insignificant (<0.25 acres)
1	Present – low to moderate cover/condition
2	Low cover and high quality or high cover and moderate quality
3	Significant cover and high quality

6B: **diversity of habitat types – bird's eye perspective based on rubric below.**



6C: **invasive plants – common wetland species:**

- **Non-woody/Herbaceous: Purple loosestrife (*Lythrum salicaria*), yellowiris (*Iris pseudoacorus*),common reed (*Phragmites australis*), and reed canary grass (*Phalaris arundinacea*). These last two species have both invasive and native strains but are usually invasive, especially when in large dense patches.**
- **Shrubs: Morrow's honeysuckle (*Lonicera morrowii*) and glossy buckthorn (*Frangula alnus*)**
- **Aquatic bed: water chestnut (*Trapa natans*) and Eurasian milfoil(*Myriophyllum spicatum*).**

6D: **Rank using table 4 (see *6A*)**

Hummocks/Tussocks – natural mounds in a wetland

Coarse Woody Debris – dead fallen logs or stems >6 inch diameter lying at >45 degree angle

Standing Dead Wood – dead trees/snags at least 10 inches diameter at breast height (this is pretty big)

Amphibian Breeding Pools – vernal pools or other small usually seasonal pools that are free of fish.

ADDITIONAL NOTES:

Note the weather conditions for today and anything still influencing hydrology or plant activity including recent rain, temperatures, frosts, wind storms, etc. Draw a map and if possible a cross section diagram of the wetland. List any dominant species of plant that you can identify or notable animal observations or sign, taking photos of unknown dominant plants.