

Vernal Pool

Eastern Woodland Vernal Pool Sparse Vegetation (CEGL006453)

General Description: Vernal Pools are small (generally less than one acre), ephemeral pools that occur in natural basins within upland forests. Vernal pools typically have no permanent inlet or outlet streams and have very small watersheds. These temporary pools generally last only a few months and then disappear by the end of summer, although some pools may persist in wet years. During their dry period, vernal pool depressions may be recognized by the sparse vegetation, by stained leaves marked by seasonal high water, and by the soils that have many more wetland characteristics than the surrounding upland soils. The periodic drying means that there are no fish populations in vernal pools, but there is a unique assemblage of species that typically includes amphibians (such as spotted salamanders and woodfrogs), specialized insects (such as caddis flies), molluscs (fingernail clams), and other invertebrates (fairy shrimp). Vernal pools typically lack trees but are shaded by trees growing in the surrounding upland forest. The vegetation that grows in vernal pools is highly variable in composition and abundance, although most pools have only sparse vegetation. Herbaceous species commonly found in vernal pools include sensitive fern (*Onoclea sensibilis*), marsh fern (*Thelypteris palustris*), common water-horehound (*Lycopus uniflorus*), royal fern (*Osmunda regalis*), cinnamon fern (*Osmunda cinnamomea*), mad-dog skullcap (*Scutellaria lateriflora*), rice cutgrass (*Leersia oryzoides*), and bladder sedge (*Carex intumescens*). Buttonbush (*Cephalanthus occidentalis*) may be present in some vernal pools. Unlike most natural communities that are characterized primarily by their vegetation composition, vernal pools are defined by the physical and hydrologic characteristics of the basin and by the animal species associated with the pool, including mole salamanders, wood frogs, and invertebrates.

State Rank: S3

Spatial Pattern: Small Patch

Minimum Size: 200 square feet (smaller pools with high factor ranking may be included with justification)

Element Occurrence Separation

Separation Barriers: Each vernal pool is associated with its own small watershed and the hydrologic conditions of that watershed and should be treated as a separate EO. Barriers between nearby pools that affect amphibian migration may be natural features (river or cliff) or cultural features (roads, walls, or other development) and are addressed under landscape context.

Separation Distance – Different Natural/Semi-Natural Communities: Each pool is considered a separate EO, except for adjacent pools that are connected at high water levels or are contained within the same watershed. Pools within 600 feet may be considered part of a pool cluster and ranked accordingly higher under landscape context.

Separation Distance – Cultural Vegetation: same as natural vegetation.

Alternative Separation Procedure: none

Separation Justification: These small pools are very dependant on the soil and hydrologic conditions of individual watersheds. Nearby pools in separate watersheds may have very different characteristics and should be considered separate EOs. However, a cluster of vernal pools within a small area is a positive feature for amphibian breeding habitat and this factor affects the ranking of individual pools under landscape context.

Rank Procedure

Four ranking factors are used for vernal pools. In addition to the standard factors, amphibian breeding habitat is added as a fourth factor. Documented successful amphibian breeding in a pool is closely related to the condition of the pool, its hydrologic period (depth and duration of standing water), and the surrounding landscape context. The Natural Heritage Inventory of Vermont Fish and Wildlife Department has decided to track only those pools that provide successful amphibian breeding, even though other pools provide other important biological functions. Amphibian breeding habitat is the primary factor and is weighted at 40%. The other three factors are all weighted equally at 20%.

Calculation: A=4, B=3, C=2, D=1

(Amphibian breeding rank x 0.4) + (Condition rank x 0.2) + (Landscape Context rank x 0.2) + (Size rank x 0.2) = EO Rank

Element occurrence ranks and their corresponding calculated numeric values:

EO Rank	Numeric Values
A	>3.25 and ≤4.00
B	>2.50 and ≤3.25
C	>1.75 and ≤2.50
D	>1.00 and ≤1.75

Element Occurrence Rank Factor 1 – Amphibian Breeding

A Specifications

- a) Produces 20 or more mole salamander (spotted, blue-spotted, or Jefferson salamanders) egg masses in one year, **or** produces terrestrial young (metamorphosed juveniles) of mole salamanders in most years; **or**
- b) Supports many breeding wood frogs that produce 50 or more egg masses in one year; **or**
- c) Is used by the state-endangered western chorus frog.

B Specifications

- a) Produces 6 to 19 mole salamander egg masses in one year, **or** produces terrestrial young of mole salamanders in some years; **or**
- b) Supports breeding wood frogs that produce 25 to 49 egg masses in one year.

C Specifications

- a) Produces 1 to 5 mole salamander egg masses in one year, **or** produces terrestrial young of mole salamanders in occasional years; **or**
- b) Supports breeding wood frogs that produce 1 to 24 egg masses in one year.

A/C Specifications

Presence of mole salamander or wood frog larvae in the pool, or presence of adult mole salamanders or wood frogs congregated for breeding, or presence of fairy shrimp in the pool.

Note: The presence of amphibian larvae or adults indicates breeding but does not equate with number of egg masses or production of terrestrial young, so the rank could be A, B, or C for this

factor. Similarly, the presence of fairy shrimp is associated with high quality pools and may be associated with amphibian breeding. Calculate the overall rank using both the A and C Amphibian Breeding rank and use the resulting numeric range to determine the EO Rank (it may be a split rank, AB or BC).

D Specifications

Pool visited during the appropriate season and there is no evidence that the pool produces terrestrial young of mole salamanders or successful breeding of wood frogs. **Note: pools that are D-ranked for amphibian breeding habitat are not considered state-significant by VT Fish and Wildlife Department.**

E Specifications

Pool not assessed during the appropriate season for amphibian breeding so no rank can be assigned to this factor. The pool needs to be re-evaluated before an overall pool rank can be calculated.

Ranking Specifications Justification

Element Occurrence Rank Factor 2 – Condition

The condition rank of a vernal pool is based primarily on the physical condition within the actual high water boundary of the pool, but since some critical environmental factors occur outside the pool boundary (such as shading from adjacent trees and changes in surface water runoff in the watershed) the condition rank also takes these factors into account.

A Specifications

All of the following apply:

- a) No physical disturbance below the high water line of the vernal pool basin, including alteration of the soil profile (ditching or filling) or vehicle trails (skidders, bicycles, ATVs, etc.).
- b) Forest directly adjacent to the pool is mature and undisturbed by logging, with the canopy providing shade and leaf litter for the pool, and naturally fallen trees and branches providing habitat structure in the pool.
- c) The hydrologic regime of the pool has not been altered by physical disturbance of the pool basin, the pool's outlet, or the pool's watershed (roads, trails, or ditches within the pool's watershed may alter water flow to the pool).
- d) Pool vegetation falls within the natural range of variation of reference quality pools for species composition and abundance. An example of non-reference conditions would be abundant shrubs or trees that are flood intolerant and would indicate that the pool has a very short period of flooding, possibly resulting from a hydrologic alteration.
- e) No exotic plant species present in the pool.

B Specifications

At least one of the following apply:

- a) Some physical disturbance below the high water line of the vernal pool basin has occurred, and either this disturbance is minor in its effect on soils and vegetation or the disturbance happened long ago and recovery is nearly complete.

- b) There has been selective logging in the adjacent forest, but the canopy still provides shade and leaf litter for the pool, and naturally fallen trees and branches provide habitat structure in the pool.
- c) The hydrologic regime of the pool may have been altered by minor physical disturbance of the pool basin, the pool's outlet, or the pool's watershed, but there does not appear to be a significant adverse effect on pool hydrology.
- d) Uncharacteristic species may be present but they are in low abundance and do not indicate an altered pool hydrology. Pool vegetation falls within the natural range of variation of reference quality pools for species composition and abundance.
- e) Exotic species may be present in small numbers and can be controlled with relatively minor effort.

C Specifications

At least one of the following apply:

- a) Significant physical disturbance below the high water line of the vernal pool basin has occurred, altering either the soil profile or vegetation.
- b) The forest adjacent to the pool has been heavily cut or part of the land adjacent to the pool is agriculture or other developed land uses. The forest canopy provides limited shade and leaf litter for the pool, and there are few naturally fallen trees and branches providing habitat structure in the pool.
- c) The hydrologic regime of the pool has been altered by physical disturbance of the pool basin, the pool's outlet, or the pool's watershed, with a significant adverse effect on pool hydrology.
- d) Pool vegetation includes uncharacteristic species indicating an altered pool hydrology or substrate.
- e) Exotic species may be present in large numbers and can be difficult to control.

D Specifications

At least one of the following apply:

- a) Ditching, grading, or filling have occurred in the vernal pool basin and have eliminated many of the basin characteristics.
- b) The forest adjacent to the pool has been clear-cut or all of the land adjacent to the pool is agriculture or other developed land uses. The forest canopy provides no shade and leaf litter for the pool, and there are no adjacent trees and branches to provide habitat structure in the pool.
- c) The hydrologic regime of the pool has been significantly altered by physical disturbance of the pool basin, the pool's outlet, or the pool's watershed, resulting in either a basin that does not hold water or that is permanently or semi-permanently flooded.
- d) Pool vegetation is dominated by uncharacteristic species indicating an altered pool hydrology or substrate.
- e) Exotic species may be dominant and control is unlikely.

Ranking Specifications Justification

A- and B-ranked pools are within the natural range of variation of reference quality pools and are expected to provide most pool functions. D-ranked pools are highly degraded and have lost most pool functions.

Element Occurrence Rank Factor 3 – Landscape Context

A Specifications

a) **Highly connected:** area around the vernal pool is largely intact natural vegetation, with species interactions and natural processes occurring across communities over an area of at least 500 acres. The vernal pool's watershed is of primary concern for water quality and quantity issues, and the 600 foot zone adjacent to the pool is of primary concern for amphibians (see justification below); **and**

b) 0 to 600 feet from pool edge: a mature forest (A-rank forest condition) with closed canopy and abundant downed coarse woody debris and no artificial barriers to amphibian movement.

B Specifications

a) **Moderately connected:** area around the vernal pool is moderately intact natural vegetation, with species interactions and natural processes occurring across many communities over an area of at least 500 acres; **and**

b) 0 to 600 feet from pool edge: 100% of the area occupied by forest with selection harvesting and retained canopy closure of at least 60%, common downed coarse woody debris, and no woods roads or skid trails that have created ruts that create amphibian breeding sinks; or more than 50% of the area occupied by mature forest (A-rank forest condition) and the remainder in agriculture or other developed condition. No or few other artificial barriers to amphibian movement within the forested area.

Note: If there are one or more additional vernal pools within 600 feet and these pools provide amphibian breeding at the A or B rank level, the Landscape Context rank should be shifted up from a B to an A.

C Specifications

a) **Moderately fragmented:** area around the vernal pool is largely a combination of cultural and natural vegetation with barriers between species interactions and natural processes across communities; vernal pool is surrounded by a mix of fragmented forest, agriculture, and rural development; **and**

b) 0 to 600 feet from pool edge: young or disturbed forest present around the vernal pool, occupying 50% or more of this area; this forest provides moderate upland amphibian habitat and there are barriers to amphibian movement such as roads, or other development, or there are deep ruts in woods roads or skid trails that may create amphibian breeding sinks.

Note: If there are one or more additional vernal pools within 600 feet and these pools provide amphibian breeding at the A or B rank level, the Landscape Context rank should be shifted up from a C to a B.

D Specifications

a) **Highly fragmented:** area around the vernal pool is mostly surrounded by agriculture and/or urban development. Vernal pool is at best buffered on one side by natural communities.

b) 0 to 600 feet from pool edge: there is less than 50% forest, marginal upland amphibian habitat, and there are significant barriers to amphibian movement.

Ranking Specifications Justification

Semlitsch (1998) estimated that 95% of mole salamanders stayed within 164.3 m (534 feet) of the breeding pool. He termed this terrestrial habitat supporting 95% of the population around the pool a “life zone”. A recent Vermont study found that adult spotted and Jefferson salamanders moved a combined average of 112.8 m (366 feet) from breeding pools, with spotted salamanders (136.8 m; 445 feet) averaging farther than Jefferson salamanders (92.8 m; 302 feet) (Faccio 2001). Both species could migrate over 200 m (650 feet) from breeding pools. Faccio (2001) estimated that 95% of these salamanders stayed within 157.1 m (516 feet) of breeding pools. Females were found to travel significantly farther from pools than males, indicating that “life zones” would need to be larger for females. Combining his data with those for these two species from the Semlitsch (1998) study, Faccio (2001) estimated a “regional salamander life zone” of 175 m (575 feet).

Element Occurrence Rank Factor 4 – Size

Vernal pool area should be measured based on high water levels.

A Specifications

Very Large (>5,000 square feet)

B Specifications

Large (>2,500-5,000 square feet)

C Specifications

Moderate (400-2,500 square feet)

D Specifications

Small (<400 square feet)

Ranking Specifications Justification

There are few vernal pools over one acre in Vermont. Larger pools tend to provide more habitat for amphibian breeding, however size of pool is not necessarily related to depth and duration of flooding. Very small pools are more likely to dry up in the early summer unless they are associated with a seep or other source of water.

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Ranking Specifications Authorship: Eric Sorenson and Mark Ferguson