



Vernal Pool near Upper Shavers Fork of the Cheat, Randolph County, West Virginia

West Virginia Vernal Pool Volunteer Monitoring Manual

Funded in part by the United States Environmental Protection Agency Wetlands Program Development Grant

Developed in Partnership with the following Agencies:

West Virginia Department of Environmental Protection

West Virginia Division of Natural Resources

United States Geological Survey - Amphibian Research and Monitoring Initiative (USGS-ARMI)

United States Fish & Wildlife Service - Canaan Valley National Wildlife Refuge



Table of Contents

Introduction	2
Scheduling Your Vernal Pool Visits and Survey Days	2
Winter - Spring (Amphibian Breeding Season)	3
Survey Instructions	3
Level 1	3
Level 2	5
Level 3	8
Equipment Decontamination	9
Dry Pool Data Sheet Entries	10
Voucher Photographs	10
Submitting Your Data	10
Equipment List	10
L1 - L2	10
L3 - All of the above, plus:	11
Optional Equipment	11
Acknowledgement	12
Reference List	12
Appendix A: West Virginia Ecoregions Map	13
Appendix B: West Virginia Watersheds	14
Appendix C: USGS ID Guide	15

Introduction

Vernal pools, or ephemeral ponds, are natural or constructed basins that fill with water from rain and snowmelt during the winter and early spring. They provide important breeding habitat for amphibians, such as wood frogs, spring peepers, and salamanders. As these pools often dry out during the summer and fall seasons, they do not support fish or other traditional aquatic predators. Therefore, they are a safer location for frogs and salamanders to lay their eggs and for the young to mature.

Vernal pool water quality and the surrounding forest habitat are critical for the survival of vernal pool wildlife, including amphibians, fairy shrimp, caddisflies, and other species that rely on these temporary sources of clean, fresh water. Unfortunately, development and the resulting loss of habitat and degraded water quality may threaten these ephemeral wetlands.

Vernal pool volunteer monitors will select a pool or pools to visit one to three times per year, submit photos of the pool and any amphibian egg masses to our WV iNaturalist Project, and complete the vernal pool volunteer data sheet at either Level 1, Level 2, or Level 3. The level will be determined by the volunteers' level of training and the amount of time they are able to commit to the survey.

Scheduling Your Vernal Pool Visits and Survey Days

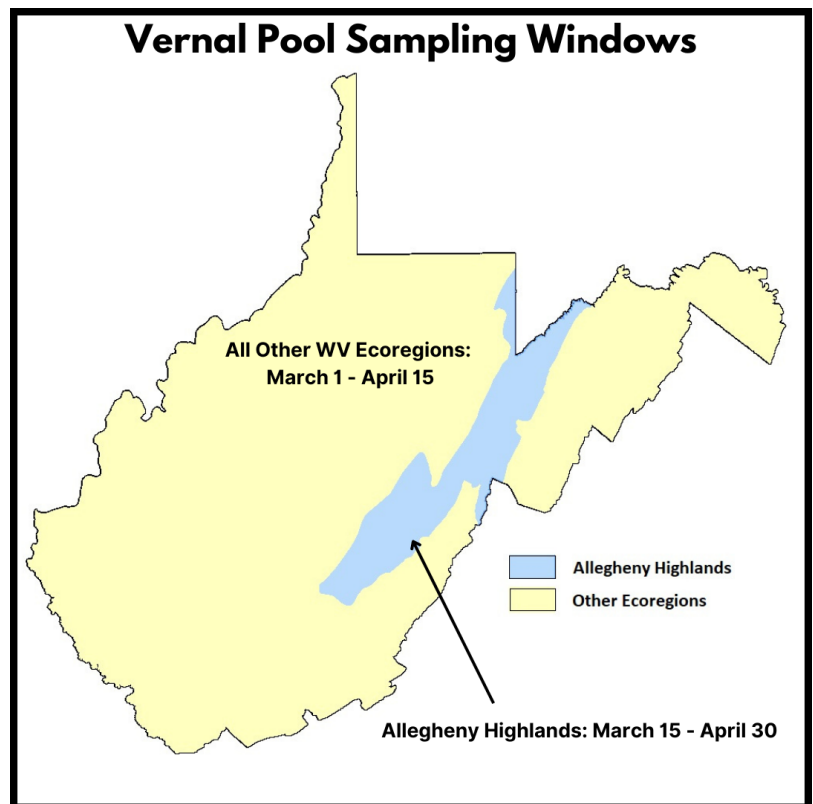
Level 1 surveys may be completed with just one visit. While multiple visits are preferred, we understand that not all project participants will have the time to commit to multiple visits.

For Level 2 and 3 surveys, you should plan to visit the pool twice, at least one week apart, during the appropriate breeding season sampling window for the ecoregion where the pool is located. Then, return once in the summer or fall to conduct a dry period survey.

Sampling Window by Ecoregion:

Allegheny Highlands: March 15 - April 30

All Other WV Ecoregions: March 1 - April 15



For a map that includes all of West Virginia's ecoregions, see Appendix A.

Winter - Spring (Amphibian Breeding Season)

Survey Instructions

Level 1

Level and Visit #: Enter the Level (1, 2, or 3) and whether this is your first, second, or third visit for this season. The first two visits should fall within the breeding season sampling window as listed by ecoregion. The third visit should occur during the dry period. Level 1 monitors will indicate Level 1 for the level and will only be expected to make one to two visits to the pool, which must be during the breeding season sampling window.

Vernal Pool Name and Code: If we provide you with the pool to visit, then we will also provide you with the vernal pool name and code. If you are collecting data on a new pool, you may name the pool and give it a vernal pool code. The code should indicate the watershed, ecoregion, and descriptor for the pool. Example for a vernal pool in the Cheat HUC-8 watershed in the Allegheny Highlands ecoregion near Lambert Run, VP-CHAH-LA1.

Watershed/Ecoregion/County: Indicate your HUC-8 watershed where the pool is located, if known. If not, the SOS Coordinator or your Basin Coordinator can provide you with the HUC-8 based on the coordinates. Or, you can look to find which watershed you are in [using this map](#) and in Appendix B. Also indicate the basin and county. The West Virginia ecoregion map is found in Appendix A.

Vernal Pool Coordinates: Indicate the latitude and longitude for your vernal pool. If the pool is dry, you may enter coordinates from the center of the pool. Otherwise, enter coordinates from the edge of the pool.

Organization & Monitor Name(s): Enter the name of the organization you are monitoring with, as well as all of the monitors at the site during the survey.

Date & Time: Enter the date and the time you start the survey at the pool.

Current Air Temperature: Enter the current air temperature and indicate whether Fahrenheit or Celsius.

Sky & Wind Codes: Use the USGS-ARMI sky and wind code scales that follow. The sky conditions and wind can affect visibility in the pool, and could impact the monitor's ability to determine the number of egg masses present. Wearing polarized glasses improves visibility in the pool when there is sun glare.

USGS-ARMI **SKY CODE:** Do not conduct surveys if sky codes are 6 or above.

Code	Sky Condition
0	Clear or few clouds (<20% of sky)
1	Partly cloudy or variable (20-50% of sky)
2	Cloudy or overcast (>50% of sky)
3	Fog
4	Mist
5	Showers or light rain
6	Heavy rain
7	Sleet/Hail
8	Snow

USGS-ARMI **WIND CODE:** Do not conduct surveys if wind codes are 6 or above.

Code	mph	Indicators of Wind Speed
0	<1	calm , smoke rises vertically
1	2-3	light air movement , smoke drifts
2	4-7	light breeze , wind felt on face, leaves rustle
3	8-12	gentle breeze , leaves/twigs in constant motion, raises dust
4	13-18	moderate breeze , small branches move
5	19-24	fresh breeze , small trees begin to sway
6	25-31	strong breeze , large branches move
7+	>31	strong wind

Pool Size (Estimate during the first two visits; measure with tape reel if the pool is dry on the third visit.)

If you have a GPS device, you may track the perimeter to calculate the pool area. If not, estimate the size of the pool. The data sheet provides visual cues to help with your estimate. A large, opened golf umbrella is about one (1) square meter, a parking space is about ten (10) square meters, a three-car garage is about one hundred (100) square meters, a major league baseball infield is about one thousand (1,000) square meters, and a Walmart Supercenter is ten thousand or more (10,000+) square meters. Using these as reference, estimate the size of the pool.

Pool Type: If known, indicate whether the pool is naturally occurring, constructed, a log/gas/tire rut, other, or unknown. If other, please describe the type of pool.

Egg Masses Observed?: From the edge of the pool, indicate whether you observe amphibian egg masses in the pool. In Level 1, you do not need to specify the kind of egg mass, but you should take at least two photos of each type observed. See Voucher Photographs section for details. Indicate whether the number of egg masses are abundant (more than 10 egg masses), some (between 4 - 10 egg masses), or few (1-3 egg masses).

Pool has water? Answer whether the pool currently has water present and if it's full/nearly full (>75% full), partial (25 - 75% full), near dry (1-25% full), dry (0%), or unsure. Use the substrate and vegetation to determine pool size. When the pool has started to recede, you may be able to observe its former edges by the lack of vegetation and/or blackened leaf litter.

Ice Cover: During the early breeding season, you may still encounter ice covering the top of the pool. If so, indicate if the ice covers greater than 75% of the surface, 25 - 75% of the surface, less than 25%, or none, for no ice present.

Tree Canopy: Record the percent of the pool that is covered by tree canopy: Mark “Yes”, if any part of the pool is covered by the surrounding tree canopy and “No” if the pool is completely exposed. Then indicate if greater than 75% of the surface, 25 - 75% of the surface, or less than 25% of the pool is covered by tree canopy. Look up from the edge of the pool at the four cardinal points around the pool and estimate the tree canopy cover. During the dry season visit, you do this from the center of the pool as well. If there is not yet leaf cover, do not try to envision coverage during a different season. Indicate the current coverage when you conduct the survey, but be sure to note the date, weather, and time of day on your survey in the appropriate fields.

Level 2

To complete the data sheet at Level 2, do all of the above Level 1 metrics and then continue on to Level 2.

Woody Debris:

- Part one: Look for sticks, logs, and other woody debris in the pool. If present, determine if it is **abundant** (present in more than 50% of the pool) or in **some** (present in 1 - 50% of the pool) parts of the pool.
- Part two: Then **circle what size is present, coarse, fine, or circle both**. The U.S. Forest Service defines coarse woody debris (CWD) as dead pieces of wood including downed, dead tree and shrub boles, large limbs, and other woody pieces that are severed from their original source of growth or are leaning more than 45 degrees from vertical. CWD transect diameter must be > 3.0 inches (7.6cm). Fine Woody Debris (FWD) Dead branches, twigs, wood splinters 0.1 to 2.9 inches (0.3 - 7.4 cm) in diameter.

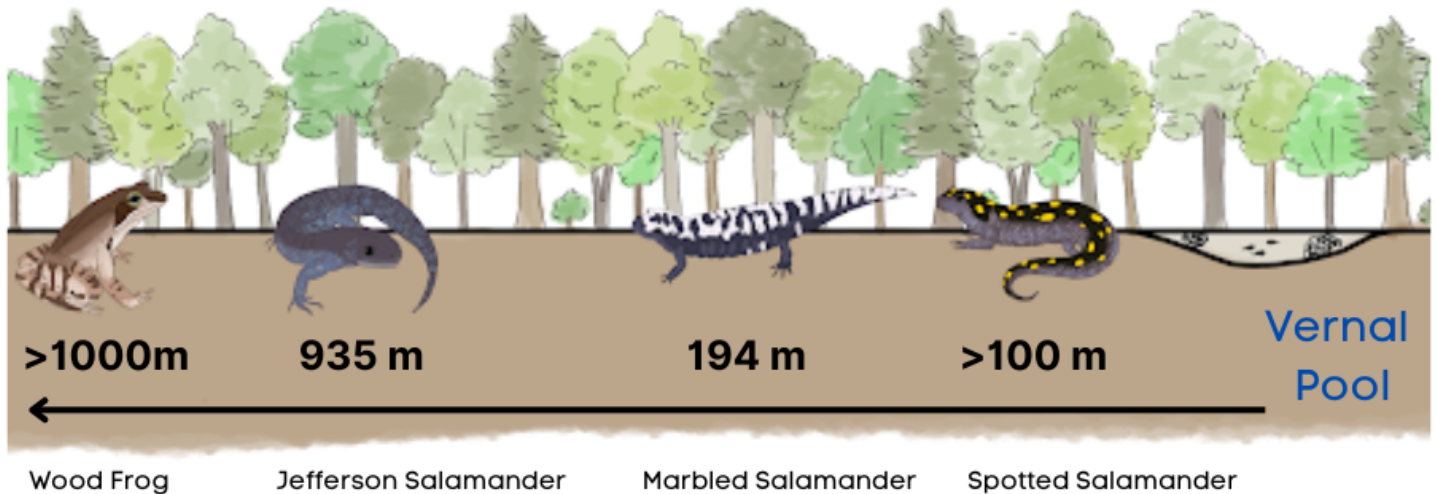
Pool Vegetation: What live vegetation is found in the pool? Circle all that are present.

- Floating or submerged: Examples include duckweed, or grasses/sedges that have not yet emerged.
- Emergent: Grasses, sedges, rushes, reeds, irises, other wetland herbs.
- Shrubs: Examples include alder, blueberry, rhododendron,
- Trees: broadleaf and evergreen

Natural Forest Buffer: How much of the forest surrounding the pool is intact, providing upland habitat for amphibians and a buffer?

For amphibians like salamanders and wood frogs, the upland forest habitat surrounding a vernal pool is every bit as important as the pool itself. They utilize the upland habitat throughout the rest of the year, when not at the pool during the breeding season. Therefore, protecting the surrounding forest is vital for amphibians and to create a buffer around the pool to protect water quality of the pools.

On your data sheet, indicate whether a 10-meter (approximately 33-foot) forest buffer surrounds the pool. A measuring tape reel is useful to measure out from the edge of the pool. You may use aerial photos and mapping applications to evaluate the buffer that is beyond reasonable foot travel at the survey site and note that in your comments.



Average Distance (in meters) Traveled from the Vernal Pool and Suggested Upland Forest Buffer Size for representative Vernal Pool Amphibians

Distances Source: Virginia Herpetological Society

A natural forest buffer is a mix of native tree, shrub, and herbaceous plants, appropriate for the area. The mix of vegetation and tree species may vary depending on the location within the state.

Indicate whether 75% or more of the surrounding area (10-meter out from the edge of the pool) is covered with natural forest vegetation, 25 - 75% cover, less than 25%, or no buffer present. Indicate whether you have checked aerial photos in addition to visual inspection from the pool if evaluating beyond 10-meters.

Forest Buffer Dominant Type: If a forest buffer is present, what type of tree is most common: broadleaf trees and shrubs, evergreen/conifers, or a mix of both? Space is available on the data sheet to note additional tree species if you are comfortable with tree identification.

Water Clarity/Turbidity: Look down through the water in the pool in an area with no glare. Wear polarized glasses if necessary. Indicate whether the water is clear (you can see all the way to the bottom easily), slightly turbid (you can see the substrate and bottom of the pool, but there is some sediment or murkiness in the water column), or turbid/opaque (you cannot see the bottom of the pool due to murky, muddy, or discolored water). If you cannot see the bottom of the pool, but the water is clear and the obstruction is due to algae, indicate that in the Algae Abundance field below, not here.

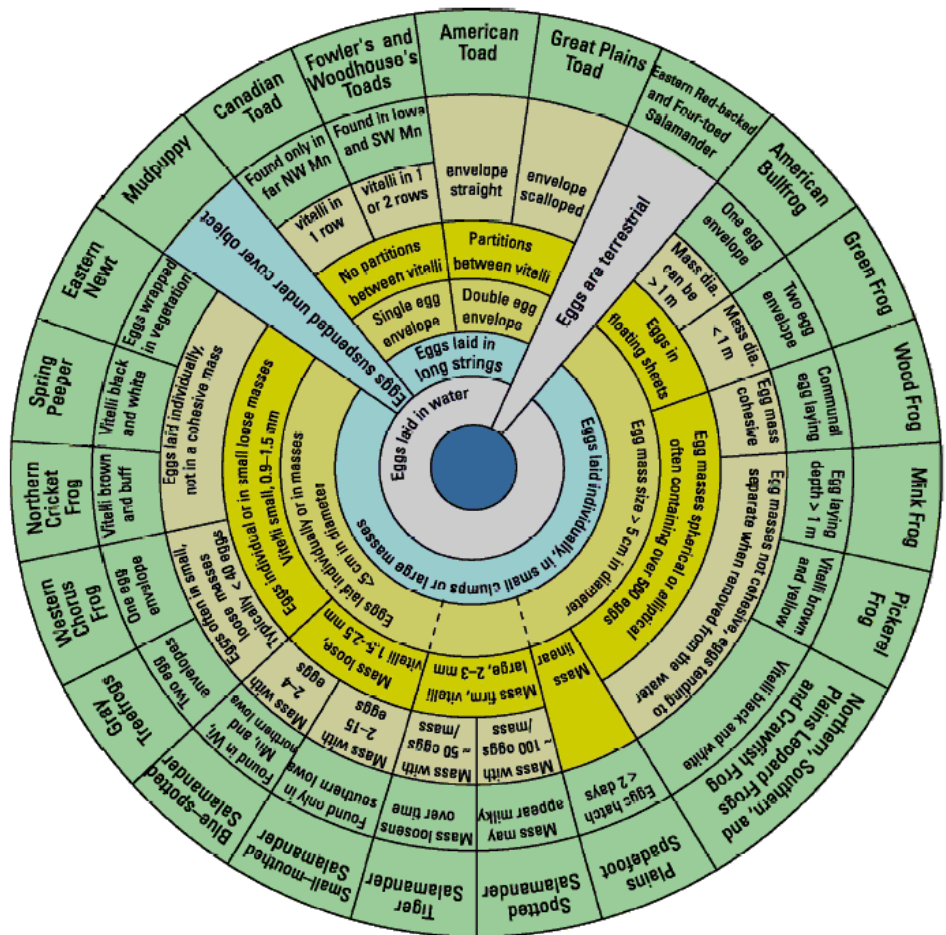
Algae Abundance: Indicate if you see algae in the water and the percent of the pool that is affected by algal growth.

Pool Substrate: If the substrate is visible, what is its composition? Circle all that are present (broadleaf leaf, conifer leaf/needles, sediment, other, or unknown). If you select "other", please describe.

Egg Mass ID:

Use available amphibian and vernal pool egg mass identification guides for help identifying amphibian egg masses, tadpoles, adults and macroinvertebrates that may be visible in the pool. Check the box if you observe adults, tadpoles, or egg masses for each species listed. For egg masses, also provide a count of the number you can observe from the edge of the pool. Do not enter the pool for observations.

This guide, at right, is courtesy of the *United State Geological Survey (USGS) A Field Guide to Amphibian Larvae and Eggs of Minnesota, Wisconsin, and Iowa.*



A list of other useful amphibian identification guides is found in on the West Virginia Department of Environmental Protection's Wetlands Resources Guide webpage, found here: <https://dep.wv.gov/WWE/getinvolved/Pages/Wetland-Resources-Guide.aspx>

Stranded Egg Masses: Indicate here if there are any egg masses that are already stranded outside of the pool, or if it's likely that they will be stranded before the tadpoles emerge.

Percent of Pool Surveyed: For larger vernal pools, it may be impossible to accurately count egg masses that are at or near the center of the pool. In that case, only count egg masses that are easily observed from the edge of the pool. Then estimate the percentage of the pool that you were able to survey.

Fish: While observing the pool, do you see any fish? If so, your pool may be a more permanent wetland or pond and not a vernal pool. Vernal pools do not necessarily dry out every year, but they do dry out at least some years, preventing fish populations from becoming established.

Other Aquatic Biota: Indicate if you observe fairy shrimp, caddisfly larvae, dragonfly or damselfly nymphs, mayfly larvae, aquatic worms, mosquitoes, beetles (predaceous diving beetles, other beetles), true bugs (water boatmen, water strider, backswimmers), or other macroinvertebrates in the vernal pool. Fairy shrimp are indicator species for vernal pools.

Other Terrestrial Biota: Rusty blackbirds are commonly seen visiting vernal pools. Please note if you observe rusty blackbirds during your visit. Also indicate another other terrestrial wildlife you observe at the pool, or evidence of their presence.

Comments: Use this space to record any additional observations.

Level 3

Level 3 certification requires attendance at a Level 3 training and passing the Level 3 certification exam.

For Level 3 volunteers, complete all Level 1 and Level 2 survey observations and then continue here.

The Level 3 metrics require interaction with the pool in order to collect a water sample and to record the water temperature. As amphibians in vernal pools are sensitive to disturbance and vulnerable to ranavirus die offs, all boots and gear should be sanitized before and after visiting a vernal pool and before visiting another pool.

pH - Using the sample bottle, rinse the bottle three times with pool water, keep the third collection to test pH using pH indicator solution kit. Or, use a probe that is properly calibrated. Ideally, use a telescoping arm to collect sample water 1 meter from the edge of the pool without entering the pool.

Temperature: Using an armored, non-mercury thermometer, as provided with the WV Vernal Pool monitoring kit, hold the thermometer at least 2 inches below the surface of the pool for 2 minutes. Then record the temperature in degrees Celsius.

Turbidity: Using the Lamotte turbidity tubes provided in the WV Vernal Pool monitoring kit, measure the pool turbidity. Turbidity may increase when there is nearby disturbance to the soil and an impaired forest buffer, resulting in increased sediment pollution.

You may use a meter or kit to test **Conductivity and/or Dissolved Oxygen** if you have this equipment. These tests are not required and are not currently provided with the WV Vernal Pool monitoring kit.

Follow all instructions for the equipment used, including the calibration requirements. Equipment may include meters, sondes, and chemistry kits.

Equipment Decontamination

All equipment and clothing that comes in contact with potentially contaminated soil or water will be decontaminated between wetland sites, to avoid spreading rana virus, chytrid fungus, snake fungal disease, or invasive plant species between wetlands. Potentially contaminated soil includes all wet soils in West Virginia. Disposable equipment intended for one-time use will not be decontaminated, but will be packaged for appropriate disposal.

All footwear must always be decontaminated between sites, along with any other items that contact wetland soils and water.

Decontaminate prior to leaving for the field if possible. If you must decontaminate at the field site, set up the decontamination area at least 30 meters (100 ft) from the wetland edge. There are four required steps to decontamination.

1. Brush off all soil, seeds, and vegetative matter.

2. Rinse clean with water. Use a stiff brush as needed. Do not forget boot treads. A pump sprayer (2-gallon capacity or sized according to crew needs) makes it easy to rinse when away from piped water.

3. Spray with 10% bleach solution (1 part bleach to 9 parts water) and allow to soak for 5 minutes. Do not forget the bottom of your boots. The bleach solution must be used or replaced each week as it loses its effectiveness over time, unlike concentrated bleach which does not get “denatured” quickly. A small sprayer such as a plant mister or hairspray sprayer works well.

4. Rinse with water. Bleach should not be introduced into the wetland.

The above method should be adequate for current conditions. Please check the Northeast Partners Amphibian and Reptile Conservation guidelines to stay up-to-date with the current recommended decontamination best practices.

Helpful Videos on Decontamination Methods:

[WVDEP Decontamination Video](#): Go to the [WVDEP Environment Matters YouTube Channel](#) and search for Wetlands Decontamination Steps, or type <https://youtu.be/ejR0SEXazOE> into your web browser.

NEPARC & Susquehanna Wildlife Society's *Save Our Amphibians & Reptiles: How YOU Can Reduce the Spread of Disease* Video available on the [NEPARC website](http://northeastparc.org/emerging-diseases/), at <http://northeastparc.org/emerging-diseases/>.

Dry Pool Data Sheet Entries

Conduct the survey as during the first two visits, but with the following changes:

Pool Measurements: When the pool is dry, capture coordinates from the center of the pool and determine the length and width of your pool.

Substrate Survey: When the pool is dry, you can examine the substrate of the pool to evaluate leaf litter composition.

Tree Canopy: Record the percent of the pool that is covered by tree canopy: Mark "Yes", if any part of the pool is covered by the surrounding tree canopy and "No" if the pool is completely exposed. Then indicate if greater than 75% of the surface, 25 - 75% of the surface, or less than 25% of the pool is covered by tree canopy. Look up from the edge of the pool at the four cardinal points around the pool and estimate the tree canopy cover. During the dry season visit, you do this from the center of the pool as well. If there is not yet leaf cover, do not try to envision coverage during a different season. Indicate the current coverage when you conduct the survey, but be sure to note the date, weather, and time of day on your survey in the appropriate fields.

Voucher Photographs

During your survey, take at least two (2) photos from different perspectives or occurrences of each vernal pool amphibian and macroinvertebrate species you observe. Please see the USGS-ARMI Voucher Photo Guide for in-depth instructions.

Submitting Your Data

Upload photos to the [WV Vernal Pool iNaturalist Project](https://www.inaturalist.org/projects/west-virginia-vernal-pools) at <https://www.inaturalist.org/projects/west-virginia-vernal-pools>. Then, email your photos and scanned PDF WV Vernal Pool Data Sheet to the SOS Coordinator, saveourstreams@wv.gov.

Equipment List

L1 - L2

Datasheet

Instruction Manual

Egg Mass & Macroinvertebrate ID Guide

Mobile Device or Digital Camera
Mobile Device or GPS Unit
Polarized Glasses to better view egg masses and aquatic biota
Decontamination Kit

L3 - All of the above, plus:

Armored Thermometer
pH test kit
Dissolved Oxygen meter/kit (optional)
Conductivity meter/kit (optional)

Optional Equipment

Tape Reel to assist in estimating forested buffer size
Gaia GPS tools

Contact Information:

For questions about the Vernal Pool Monitoring Program, and to submit data sheets,
Please contact:

West Virginia Save Our Streams Coordinator
callie.c.sams@wv.gov or
saveourstreams@wv.gov

Or visit the [WV Department of Environmental Protection Watershed Improvement Branch Contact List](#)
and reach out to your Basin Coordinator.

<https://dep.wv.gov/WWE/Programs/nonptsources/Pages/WIBstaff.aspx>

Acknowledgement

The West Virginia Vernal Pool Monitoring Program was made possible by an EPA Wetlands Program Development Grant to the West Virginia Department of Environmental Protection Division of Water and Waste Management Watershed Assessment and Watershed Improvement Sections. The program was developed in partnership with the West Virginia Division of Natural Resources, United States Geological Service Amphibian Research and Monitoring Initiative, Fish and Wildlife Service Canaan National Wildlife Refuge, United States Forest Service Monongahela National Forest, National Park Service New River Gorge, watershed associations, master naturalist groups, and volunteers from across the state of West Virginia. We appreciate you!

Reference List

During the development of this protocol and survey data sheet, our working group with representatives from the agencies listed above reviewed other states' and agencies' existing vernal pool monitoring programs, including:

[Connecticut Association of Wetland Scientists](#)

[Maine Audubon](#)

[Maine Of Pools and People, Vernal Pools of the Northeast and Midwest](#)

[Massachusetts Vernal Pool Association](#)

[Michigan Vernal Pool Patrol](#)

[Wisconsin Ephemeral Ponds Project](#)

[Vermont Vernal Pool Monitoring Project](#)

[Ohio Vernal Pool Network](#)

[Pennsylvania Natural Heritage Program Vernal Pool Registry](#)

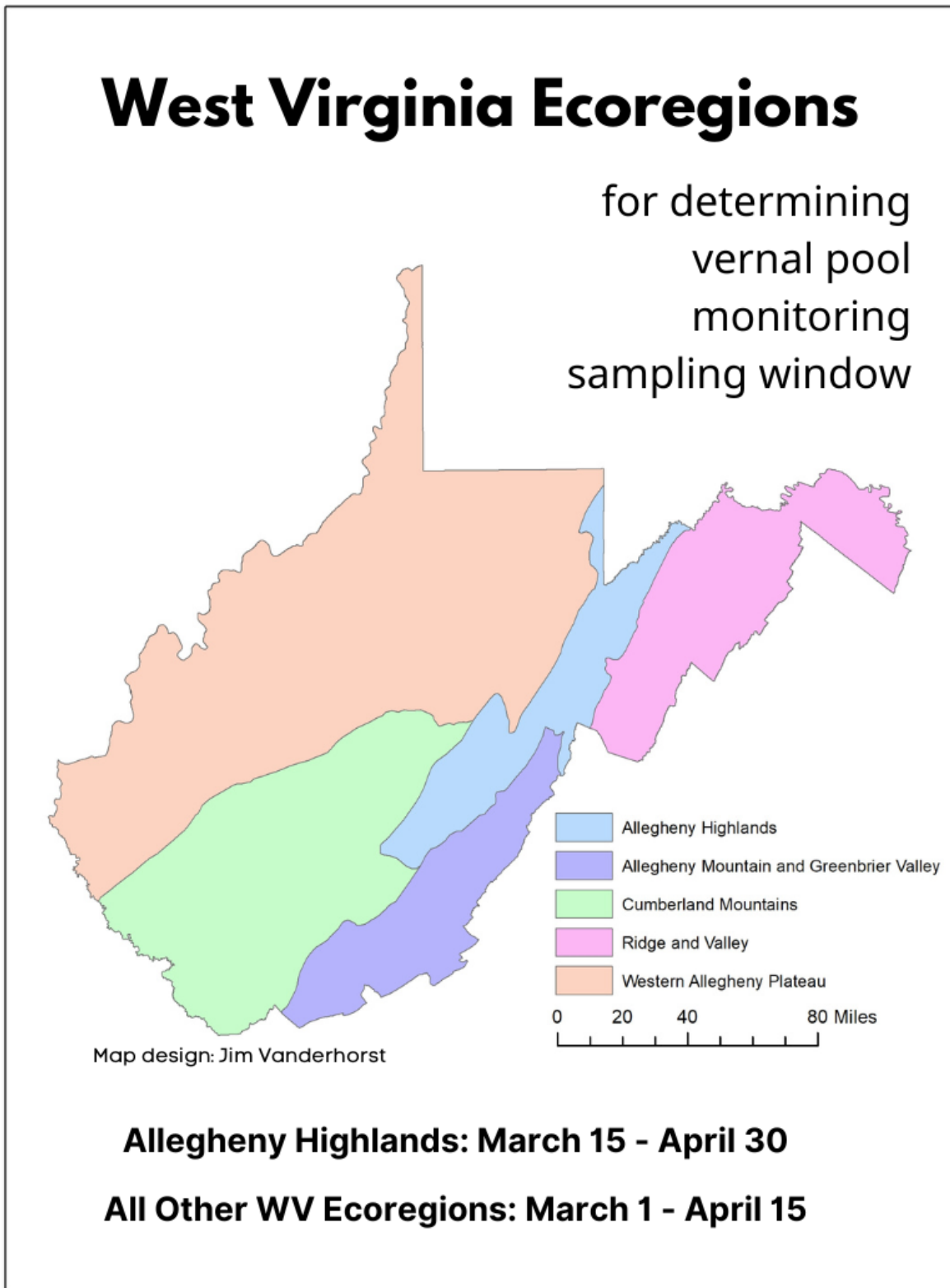
[United States Fish & Wildlife Service - Canaan Valley National Wildlife Refuge](#)

[United States Geological Survey - Amphibian Research and Monitoring Initiative](#)

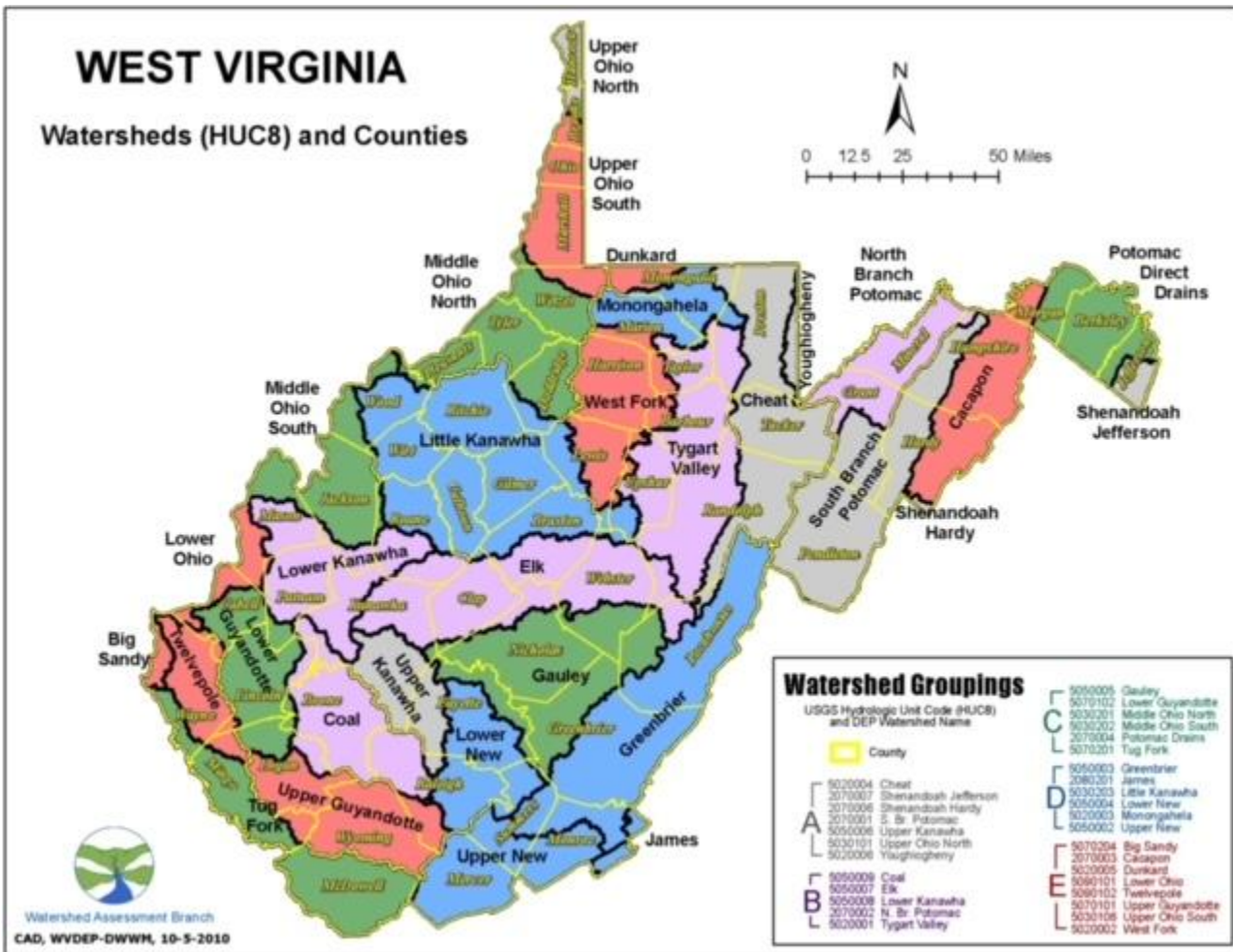
A comprehensive reference list will be provided on the WVDEP's Wetland Resource Guide available here:

<https://dep.wv.gov/WWE/getinvolved/Pages/Wetland-Resources-Guide.aspx>

Appendix A: West Virginia Ecoregions Map



Appendix B: West Virginia Watersheds



Watershed	WVDEP Code
Big Sandy	BS
Cacapon	PU
Cheat	MC
Coal	KC
Dunkard	ML
Elk	KE
Gauley	KG
Greenbrier	KNG
James	J
Little Kanawha	OLK
Lower Guyandotte	OGL

Lower Kanawha	KL
Lower New	KNL
Lower Ohio	OL
Middle Ohio North	OMN
Middle Ohio South	OMS
Monongahela	MU
North Branch Potomac	PNB
Potomac Direct Drains	PL
Shenandoah Hardy	PSN
Shenandoah Jefferson	PS
South Branch Potomac	PSB
Tug Fork	BST
Twelvepole	OT
Tygart Valley	MT
Upper Guyandotte	OGU
Upper Kanawha	KU
Upper New	KNU
Upper Ohio North	OUN
Upper Ohio South	OUS
West Fork	MW
Youghiogheny	MY

Appendix C: USGS ID Guide

United State Geological Survey (USGS) A Field Guide to Amphibian Larvae and Eggs of Minnesota, Wisconsin, and Iowa

