



## APPLICATION FORM

All applications must include the following information. Separate applications must be submitted for each eligible program. **Deadline: June 3, 2019.** Please include this application form with electronic entry. If you do not receive an email confirming receipt of your entry within 3 days of submission, please contact [Gage Harter](#).

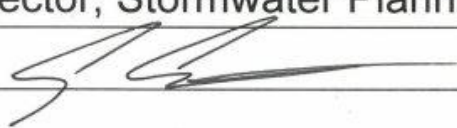
### PROGRAM INFORMATION

County: Fairfax County  
Program Title: Stream Critter Cube Lab  
Program Category: Environmental

### CONTACT INFORMATION

Name: Danielle Wynne  
Title: Ecologist IV  
Department: Public Works and Environmental Services  
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Email: danielle.wynne@fairfaxcounty.gov

### SIGNATURE OF COUNTY ADMINISTRATOR OR DEPUTY/ASSISTANT COUNTY ADMINISTRATOR

Name: Craig Carinci  
Title: Director, Stormwater Planning Division  
Signature: 

# Proposal for 2019 VACo Award: Fairfax County Department of Public Works and Environmental Services

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## **Program Title: Stream Critter Cube Lab**

**State the problem, challenge or situation faced by the locality and how the program fulfilled the awards criteria (innovation, partnering or collaboration and a model for other localities). Tell how the program was carried out, including financing and staffing, and the program's results.**

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The Stream Critter Cube Lab connects students with freshwater ecologists to learn how local scientists determine stream ecosystem health through monitoring the diversity of life found in each stream. This program is offered free of charge by ecologists from Department of Public Works and Environmental Services (DPWES) in Fairfax County, Virginia. In order to determine stream health, ecologists monitor various indicators, including benthic macroinvertebrates. These are creatures that live on the bottom of a stream, can be seen with the naked eye and lack a backbone. Different species of macroinvertebrates can tolerate different levels of water pollution. Some may be tolerant to pollution, while others may be very intolerant to pollution. The diversity and density of the species found per stream helps us determine the long term water quality condition of that stream. While it would be more meaningful to bring every student to a local stream to experience macroinvertebrate monitoring firsthand; unanticipated weather conditions and stream height from rain often can cancel field events. The Stream Critter Cube lab offers an easily transportable, low-cost option that still teaches real world scientific monitoring techniques during any weather condition.

This lab introduces students to stormwater and stream monitoring through an interactive dice game where students become the citizen scientists to help determine the water quality of an example stream. By rolling a dice, students “collect” a random sample of benthic macroinvertebrates, record their data,

interpret results, and can determine the overall quality of the stream. The goal of the program is to bring a stream to the classroom and teach student scientists about the importance of keeping our water clean for the benthics and for us. Response to this program has been overwhelmingly positive from both teachers and students.

Connecting students to non-traditional educational opportunities can provide a meaningful linkage to real world science that is not easily forgotten. Fairfax County, VA has the 10<sup>th</sup> largest public school population in the nation with 196 schools and centers. While every student should have the opportunity to have a meaningful watershed education experience, some schools do not have the ability to bring their students to a local stream to experience stream monitoring first hand. Fairfax County ecologists are dedicated to providing meaningful watershed education experience to all ages. The Stream Critter Cube lab is a program offered by local scientists that is an easily transportable, low-cost option that still teaches real world scientific monitoring techniques.



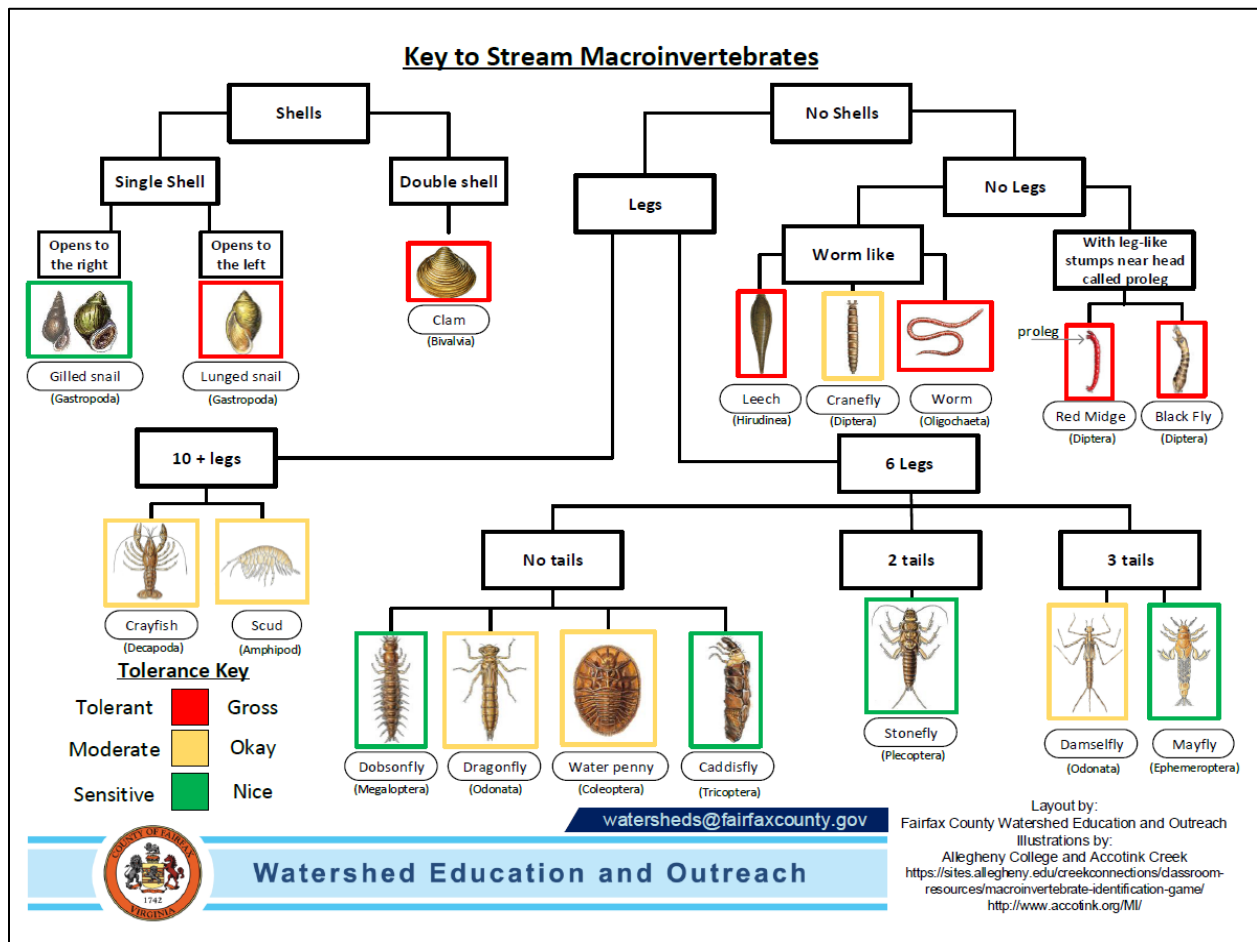
Figure 1- Students from Woodburn Elementary School using the Stream Critter Cube Lab

Fairfax County Watershed Education and Outreach's mission is to inspire students to be environmental stewards. As our future leaders of Fairfax County, teaching students about the health of our watershed can increase their environmental stewardship and help reduce our negative impact on water locally. As the number of students and schools we interact with grows, we do not want to

limit our educational programs to being weather dependent. Hence, we needed to develop a tool that

would allow staff to teach about the concept and methodology of freshwater monitoring without the freshwater! In order to solve this problem, staff developed the Stream Critter Cube lab. This lab:

- allows students to learn about life in streams,
- eliminates some real world constraints,
- introduces scientific monitoring methodologies,
- lets students participate in a simulated biological monitoring process, and
- connects in-classroom learning back to the health of our watershed.



**Tolerance Key**

Tolerant	<span style="display: inline-block; width: 15px; height: 15px; background-color: red; border: 1px solid black;"></span>	Gross
Moderate	<span style="display: inline-block; width: 15px; height: 15px; background-color: yellow; border: 1px solid black;"></span>	Okay
Sensitive	<span style="display: inline-block; width: 15px; height: 15px; background-color: green; border: 1px solid black;"></span>	Nice



**Watershed Education and Outreach**

[watersheds@fairfaxcounty.gov](mailto:watersheds@fairfaxcounty.gov)

Layout by:  
Fairfax County Watershed Education and Outreach  
Illustrations by:  
Allegheny College and Accotink Creek  
<https://sites.allegheny.edu/creekconnections/classroom-resources/macroinvertebrate-identification-game/>  
<http://www.accotink.org/MI/>

Figure 2 - Dichotomous Key developed for Stream Critter Cube Lab

The lab starts with an introductory presentation in which students learn that stormwater is simply water from a storm. When stormwater flows across land, it can pick up pollutants on its way to a stream or lake and potentially impact the quality of that local stream. Freshwater ecologists study the shape and life in streams to learn about water quality. Those fish and benthic macroinvertebrates live in our stream for years. This lab walks students through how we assess stream health by looking at living organisms like benthic macroinvertebrates and their tolerances to pollution in our water.

This program was adapted to fit our needs from Anne Arundel County Public School Environmental Literacy and Outdoor Education Center's 6th Grade program. They developed this lab as an introduction to water quality for a few schools who would take a field trip to Patapsco Valley State Park to search for benthic macroinvertebrates. Fairfax County has modified this program to engage students in kindergarten up through IB high school level and have implemented it with students in elementary, middle, and high school. A standard program was created for middle and high school level, then simplified for younger students. This provides an advanced and elementary version that meets the needs of all grade levels. Regardless of how the data is recorded on the sheet, the concept of the program remains the same and is well received by all audiences.

Fairfax County staff created a dichotomous key for the lab with a very simplified tier structure to help students find the benthic they rolled. It asks shells or no shells, legs or no legs, 6 legs or 10+ legs, no tails, etc. Just these simple questions scattered amongst a decision tree leads students to identify the benthic on their cube. In addition, the benthic tolerance level was indicated on the key by using a red, yellow, or green box surrounded each benthic to show their different tolerances to pollution in water. Some are sensitive to pollution, some of moderate tolerance, and others tolerant to pollution. If there are mostly sensitive benthics found, then it can be assumed that water quality is good. If we are finding only

moderate and lots of tolerant but no sensitive, this is a sign the water may have some pollution affecting it. We have also created graphs to help students visualize results. As ecologists who use numbers to rate our stream metrics, large numbers can sometimes be difficult for the public to interpret. Creating a visual graph and showing results in a different way resonates well and tells the story about the health of our waterways.

Students roll their dice 20 times to collect a stream sample. They identify the species for each roll and identify the species tolerance level. After 20 rolls are complete, they summarize the results and calculate a simplified Index of Biotic Integrity and effectually grade the stream. The grade is based on the number of sensitive, moderate and tolerant organisms in the sample, students give their stream a grade. This is a great opportunity to bring the streams to our students and help them learn some ways that everyone can keep our streams healthy so we can hopefully give all our streams an A+!

#### Stream Grade:

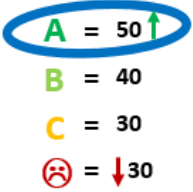
Number sensitive	<b>15</b>	x 3 =	<b>45</b>	←	<b>45</b> +	<b>10</b> +	<b>0</b> =	<b>55</b>	
Number moderate	<b>5</b>	x 2 =	<b>10</b>	←					
Number tolerant	<b>0</b>	x 1 =	<b>0</b>	←					

Figure 3 - Calculation to determine stream health

Understanding the influence of human impact on the ecosystem is frequently discussed throughout the school curriculum from elementary school through high school. The Stream Critter Cube lab is an ideal way to show students and teachers how the growing field of freshwater ecology utilizes a variety of monitoring activities to help determine the health of our local streams and watersheds.

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Figure 4 - Stream Critter Cube example

streams and watersheds.

Where this lab shines is its ability to demonstrate the real world monitoring activity using simple, affordable, transportable, and replicable lab set up. The critter cubes are simple blocks that are painted and with benthic macroinvertebrate illustrations cut out and pasted to each side. There are two different versions of blocks – one block has more tolerant species to represent an impacted stream while another block with more sensitive species is an example of a healthier stream ecosystem.

These 2-inch blocks cost about \$1 each to purchase and then need minor modification to create the final product. Most of the cost associated with the lab design and implementation is staff cost. All paper work has been laminated to eliminate cost of reprinting and set an example by reducing and reusing our materials. These simple materials also eliminate the need for access to technology and allows staff to use this lab anywhere without the need for electricity.

Connecting students to a real-world application of science is challenging at the best of times. When outreach and education programs are scheduled weeks or months in advance, it is incredibly beneficial to have a meaningful “plan B” option to an outdoor program in case the streams are not safe for students or to collect benthic macroinvertebrates from. The Stream Critter Cube lab has been a tremendously successful and useful tool to add into the Watershed Education and Outreach toolbox. This new lab has allowed staff to teach benthic macroinvertebrate monitoring during times of the year where it historically was not available to the public. Teachers obtain assistance by subject matter experts while the county benefits from a more knowledgeable resident population. Students who participate in the lab expand their working knowledge of watershed science and also have the opportunity to meet county scientists to explore possible career choices.

The success of a partnership can be achieved only if both groups benefit. Teacher feedback is extremely helpful to us to determine the effectiveness of our outreach programs:

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*The ecologists from the Watershed Education and Outreach program taught the Stream Critter Cube lab for four third grade classes at Centreville Elementary School. They were able to adapt the lesson to meet the needs of our students by having two different lessons prepared. This lesson enhanced our curriculum by giving students a hands on experience to learn about local ecosystems and steam life. – Heather Jones, Centreville Elementary School*

The Stream Critter Cube lab offers a new, much requested service to Fairfax County Public Schools and beyond by connecting students to a real-world lab application of science presented by specialists in the field. The program is low cost but high gains. Students who participate in the lab expand their working knowledge of benthic macroinvertebrate identification, use of a dichotomous key, watershed science, practice scientific thinking skills and are able to make connections between behaviors and environmental impacts. Fairfax County benefits from an educated community while students and teachers discover ways to learn about the health of their local environment. This program can be easily expanded and replicated to meet the needs of other jurisdictions across the country.

*Include a short overview of the program (no more than one page double-spaced)  
that can be used as a quick reference guide for judges.*

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*Include a brief summary of the program (3-4 paragraphs) that could be used for press releases, brochures, etc.*

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students outside. But often, with school requirements and location constraints it is not feasible to bring students to a stream or even bring elements of a stream to them. Sometimes we can collect and transport benthic macroinvertebrates (creatures that live on the bottom of a stream, can be seen with the naked eye, and lack a backbone) to students, but this is not always possible depending on the season and other weather conditions. As the number of students and schools we interact with grows, we do not want to limit our educational programs to being weather dependent. Hence, we needed to develop a tool that would allow staff to teach about the concept and methodology of freshwater monitoring without the freshwater!

In order to solve this problem, staff developed the Stream Critter Cube lab. This lab allows students to learn about life in streams, eliminates some real-world constraints, introduces scientific monitoring methodologies, lets students participate in a simulated biological monitoring process, and connects in-classroom learning back to the health of our watershed.

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