Message in a Bottle

A community activity guide
for building awareness of single use plastics
& their environmental impact

Clean Valley Council
Roanoke, Virginia

with 2019-20 funding from
the Virginia Department of Environmental Quality
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A message from CVC...

We recognize that hands-on learning introduces one of the most effective ways to instill environmentally conscious living in young people. Interactive and actionable instruction blossoms into something memorable for the individual, constituting a positive impact for the learner and the community.

While we are taught to recycle in the hopes of decreasing pollution, only 9% of plastic is actually recycled, leading to eight million tons of plastic being dumped into the ocean each year. While this problem requires global, large-scale cooperative efforts to correct, the solution begins with individual habits.

At Clean Valley Council, our passion is hands-on environmental education. This program is the first of many that creates a pathway to community learning and action. A community action program (CAP) spins off from our PBL lesson, Stop the Slop, to add a more in-depth learning and awareness. Ultimately, our intent is to decrease the negative impact single-use plastic leaves on our planet.

Our Message in a Bottle community action program adopts and teaches innovative means of repurposing this pollution. Join us in tackling this problem head-on, creatively refraining from contributing to the single-use plastic entering our landfills and remaining there permanently.

While the shift to a 100% sustainable community will take time and cooperation, your help is one large step to a cleaner environment.

Mary Ann Brenchick
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About This Guide

Environmental Connections
What can one plastic bottle teach us? We’re a solution to our own pollution! This guide offers activities that help us understand plastic waste and its environmental impact. Starting with a simple “bottle brick” challenge, participants create something new. In the process they increase their own awareness while also building community. Their public art creation both reflects and amplifies this stewardship message.

Community Connections
The projects highlighted in this guide are versatile. Their “many-hands-make-light-work” approach suits many organizations keen to promote environmental learning and action in fun and creative ways. These organizations can include community groups, service clubs, as well as schools. The most fruitful projects, in fact, often involve different groups working together on different aspects of their shared activity.

If you are considering a project, invite representatives from interested groups together for overall brainstorming and planning. By the end, you’ll notice you’ve built more than a bottle brick wall or an earthen bench: you’ve strengthened stewardship across your community.

Classroom Connections
Teachers, you can integrate this project with the classroom. Message in the Bottle supports community-integrated real-life learning that is a hallmark of 21st century instruction. It supports The Profile of the Virginia Graduate, which highlights the value of the 5 C’s: communication, collaboration, critical thinking, creative thinking skills and civic responsibility. These same skills are developed by high-quality problem and/or project-based learning (PBL). The “bottle brick” design/build activities also encourage engineering processes promoted by state departments of education. In sum, there are many ways this community project can enrich your classroom.

Message in the Bottle activities can also reinforce specific course content and skills. With thoughtful planning, project elements can support math, art, language arts, and social studies (civics). The project’s focus on single-use plastic and watershed protection also aligns with science instruction across multiple grades. Here’s a science sampler, for example, from the Virginia Standards of Learning:

Grade 3.8 The student will investigate and understand that natural events and humans influence ecosystems.

Grade 4.8 The student will investigate and understand that Virginia has important natural resources. Key resources include a) watersheds and water; b) plants and animals;

Grade 5.9 The student will investigate and understand that the conservation of energy resources is important.

Grade 6.8 The student will investigate and understand that land and water have roles in watershed systems. Key ideas include d) natural processes, human activities, and biotic and abiotic factors influence the health of a watershed system.
Grade 6.9 The student will investigate and understand that humans impact the environment and individuals can influence public policy decisions related to energy and the environment.

MS Life Science.9 The student will investigate and understand that relationships exist between ecosystem dynamics and human activity.

HS Earth Science.6 The student will investigate and understand that resource use is complex. Key ideas include a) global resource use has environmental liabilities and benefits; b) availability, renewal rates, and economic effects are considerations when using resources; c) use of Virginia resources has an effect on the environment and the economy; and d) all energy sources have environmental and economic effects.

HS Biology.8 The student will investigate and understand that there are dynamic equilibria within populations, communities, and ecosystems. Key ideas include d) natural events and human activities influence local and global ecosystems and may affect the flora and fauna of Virginia.

HS Environmental Science, Guideline V: Human impact, global climate change, and civic responsibility:
- The student will investigate and understand the human impact on our environment.
- The student will investigate and understand pollution and waste management.
- The student will investigate and understand civic responsibility and environmental policies.
FACT SHEET: Plastics and the Single-Use Problem

Plastic is one of the most important scientific discoveries in human history. Its widespread use has changed our world and will continue to shape our future. Plastic has improved quality of life around the globe and has saved countless lives. Technological advancements across numerous fields would not have been possible without the material properties and characteristics of plastics. Medicine, transportation, and construction are just a few areas revolutionized through use of plastic.

So what’s the issue? If so many good things have happened because of plastic, why are we saying it harms the planet? The answer: not all plastic is used in the same way. The type of “plastic” that has had the most negative impact on our landfills and the environment is known as **single-use plastic**.

**Single-use plastics** are those that are meant to be used just once before being discarded. Common types of single-use plastics are grocery bags, drink bottles, straws, cups, lids, and food packaging. This includes all the poly-styrene foam too. Just think about all the things you and your family buy at the store. How many of those items are wrapped in plastic? Do you carry them home in plastic bags?

### Plastic bags by the numbers....
1. Americans use 100 billion plastic bags a year!\(^1\) That’s 330 times more than there are people in America.
2. Plastic bags are used for an average of 12 minutes.\(^3\)
3. The average American family takes home 1,500 plastic shopping bags per year.\(^2\)

### How about plastic bottles?
1. Around the world, one million plastic bottles are purchased every minute.\(^4\)
2. Annual consumption of plastic bottles is set to top half a trillion by 2021.\(^5\)

### But what about recycling?
1. 91% of plastic IS NOT Recycled!\(^6\)
2. According to Waste Management, one of the largest trash/recycling collection providers in the U.S., only 1 percent of plastic bags are returned for recycling.\(^1\)

### Is it really a problem though?
1. Eight million tons of plastic is dumped into the ocean every year.\(^7\)
2. Plastic and microplastic have been found in nearly every type of marine animal from birds, whales, and plankton to the fish and shellfish humans eat every day.
3. The Great Pacific Garbage Patch is 2X the size of Texas or 3X the size of France.\(^8\)
4. By 2050, there will be more plastic (by weight) in the ocean than fish.\(^9\)

These facts and figures show us why we need to change our ways. While the shift to a 100% sustainable solution will take time and global cooperation, there are plenty of things that we can do to help right now. This resource guide introduces several fun, creative ways you and your community can repurpose single-use plastic, keeping it out of our landfills and the natural world.
National Geographic

Kids vs. Plastic

Great collection of videos, articles, tips, plastic-free guides, games, and more to educate kids (and adults) about the plastic pollution problem and how to help make a difference.


Plastic Pollution Resource Library

Videos, articles, and lessons for educators to share with students.

- [https://www.nationalgeographic.org/topics/resource-library-plastic-pollution/?q=&page=1&per_page=25](https://www.nationalgeographic.org/topics/resource-library-plastic-pollution/?q=&page=1&per_page=25)

Reuters

Drowning in Plastic – 1,000,000 plastic bottles sold every minute!

Visual representation of plastic bottle consumption around the world. 60 second video.


Plastic Education

Website with facts, articles, videos and lessons for plastic education.

- [https://www.plasticeducation.com/plastic-education](https://www.plasticeducation.com/plastic-education)

Trex Recycling Programs including the Plastic Film Recycling Challenge

- [https://www.trex.com/recycling/recycling-programs/](https://www.trex.com/recycling/recycling-programs/)

Peace on EarthBench Movement

- [http://www.earthbench.org](http://www.earthbench.org)

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References supporting our Plastic and the Single-Use Problem Fact Sheet

1: [http://www.wmnorthwest.com/guidelines/plasticvspaper.htm](http://www.wmnorthwest.com/guidelines/plasticvspaper.htm)
2: [https://www nr dc.org/media/2008/080109](https://www nr dc.org/media/2008/080109)
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| **Messages in a Bottle** | What are the costs and benefits of single-use plastics?  
How can we use our “bottle brick” challenges to encourage public reduction of single-use plastic? | Participants stuff plastic drink bottles with non-recyclable plastic, creating plastic bricks for functional art building projects.  
Participants learn about plastic and its pros/cons through games, videos, etc. | A stockpile of “plastic bricks” ready for use in community build projects (see “Build a Better Bench,” below) |
| **Follow the Plastic** | What kind of industries and careers help reduce plastic waste? | Participants connect their own plastic-reduction initiatives with broader community investigations, tours, and interviews. | Varies: could be a short video, social media post, report, or career poster. |
| **Build A Better Bench** | **Goal:** Understand the local situation  
How can we create a one-of-a-kind public bench from our bottle bricks that benefits our community—while also creating greater awareness of plastic waste? | Participants design and build a free-form earthen bench, using plastic bricks as foundational material. | A beautiful and inspiring community bench that also teaches others to care for the earth and reduce plastic waste.  
A stronger participant group and community. |
MESSAGE IN THE BOTTLE: Engagement Pathways

Doing a recycling project? Or a plastic waste campaign? Let your activity be a springboard for even greater good. This guide offers three routes for connecting your project with more people and action. Each pathway is its own journey, but all flow to the same goal: zero plastic waste.

- **Message in a Bottle**
  Build knowledge about single-use plastic waste while making “bottle bricks.”

- **Follow the Plastic**
  Explore careers and industries that reduce plastic waste.

- **Build a Better Bench**
  Create community (and a bench) to raise awareness about plastic waste.

**Message in a Bottle**

**Concept**
Repurpose non-recyclables by stuffing an empty plastic bottle full of non-recyclable wrappers and bags. Once you’re done, you’ve made a “bottle brick.”

Making bricks is fun and shows how waste can turn into a resource. It is an excellent way to talk about waste, litter pollution, and the issues affecting our local rivers. Making a bottle brick is an activity that helps us reflect on how much plastic trash we encounter on a daily basis. This activity can stand alone, or better yet, serve as first step to a community-build project: functional art!

**Logistics**
The process is simple and can be an individual or group project, occurring in one sitting or over time. Each participant needs:
- an empty 20 oz. soda or sports drink plastic bottle with cap: clean and dry
- a stick, dowel, or wooden spoon.
- a collection of plastic non-recyclables such as package wrappers and shopping bags

Invite participants to collect their own non-recyclables as they go about their day. The gathering itself increases personal awareness of all the ways non-recyclables feature in our daily living.

To make the brick, methodically tamp the collected material into the empty plastic bottle. If you are creating bricks for a building project, be consistent about the size/shape of bottle you use.
- Use clean, dry fill only – a quick rinse and dry of your chip bag makes it a ready resource
- Shred the plastic fill if necessary
- Make sure to really tamp down the fill as you go, from bottom to top: you want it firm.
- Replace the cap on the bottle once it is filled. Decorate the bottle with sharpies if inclined.

The entire process takes about an hour. Now you’ve got a brick ready as a building material.

**Connections**
- Enhance the activity by creating teachable moments.
Design lessons or even games using the fact sheet and the additional resources. The info-rich games could include your homemade versions of Jeopardy, 2 Truths and a Lie, Concentration (matching game), and information relays. Or check of the National Geographic resource on p. 6, “Kids vs. Plastic.”

- Share and discuss an informational video or two during a group stuffing party.
- If in a school setting, integrate this hands-on activity into curriculum.
  - **Math**: weighing, graphing (type of materials collected, number of bricks created by class)
  - **Language Arts**: create a public display explaining and showcasing the project, complete with research paragraphs created by students on related topics; have students write letters to family members or friends, inviting them to help collect material for the project and/or make and contribute their own plastic bricks
  - **Science**: investigate plastic-related topics, human impact/pollution.
  - **Art**: Create a school sculpture using the bricks to illustrate the problem of non-recyclables.

**Additional Resources**
- A how-to-make-a bottle-brick 4 min. video made by CVC: [https://www.youtube.com/watch?v=7na3rZ7Zjvg&t=51s](https://www.youtube.com/watch?v=7na3rZ7Zjvg&t=51s)
- A fun 3:19 minute tik tok video CVC made for an Earth Day Virtual Facebook event called "Bottle Brick Bounce" [https://www.youtube.com/watch?v=gRCkJZGkPjw](https://www.youtube.com/watch?v=gRCkJZGkPjw)

**Follow the Plastic**

**Concept**
Working with youth on a recycling project? Carry the energy into an opportunity to explore waste-reduction careers. Invite speakers from the community to share how their work connects to helping society minimize waste.

Think broadly about this topic. All kinds of people have opportunities to promote waste reduction through their work: not only waste managers, but also researchers, journalists, materials engineers, corporate sustainability managers, and artists. Whom could your youth meet, either virtually or in person? Follow-up the career investigations by touring recycling collection centers and industries, virtually or in person.

**A Real-Life Middle School Example**
*Part 1, Classroom prep:* A Read Mountain Middle School teacher in western Virginia introduced her students to concepts related to plastics and environmental hazards through classroom resources available through Clean Valley Council.

Her students then completed a cost/benefit analysis of producing plastic containers versus glass or aluminum. They also investigated the cost/benefits of recycling companies and recycling centers in local communities. This work included considering the differences between single stream and separated recycling. Once students were invested in the their topic, their teacher guided their focus to career exploration, with special focus on engineering.
Part 2, Community connection: Students traveled to the corporate headquarters of TREX in Winchester, VA, for a tour of its plant. TREX repurposes plastic recyclables into composite deck material. According to teacher Ronda Malcolm the goal of the middle school trip was to explore up close the engineering practices and processes that major companies are going through to take trash and make it into a new and viable product. During the tour, students had access to view all of the different machines, how they work and process efficiently plastics, and an expert tour guide who understood each machine to allow students to ask inquiry questions in the maintenance, design, and process the machines went though to be created. This field trip was one of the culminating activities to tie recycling, environmental issues, public health concepts, and engineering to tangible jobs students could explore in the future.

At the end of our tour (about a 90 minute tour through the grounds and equipment of Trex), 5-6 of the Trex main corporate leaders took part in a 45-60 minute question and answer period in which the students were actively engaged in asking engineering and design questions, job quality and environmental quality questions, etc.

Additional Resources
If you can’t physically tour an industry in person, try virtual. Here are two industry leaders, both of whom are Virginia manufacturers with active online presence. Can your students to find other industries putting sustainability at the heart of their operations?

- **Trex: Composite Deck Flooring**
  4 min. video about the manufacturing process, and its role in repurposing plastic waste: https://www.trex.com/inspiration/blog/detail/trex-built-on-sustainability-ecofriendly-values/
  Trex also sponsors a motivating recycling challenge for schools, with winners receiving composite benches or bird houses for their schools: https://www.trex.com/recycling/recycling-programs/

- **Mohawk: Recycled Plastic Carpets**
  3 min. interview with a representative from Mohawk Industries explaining its diversion of almost 8 billion plastic bottles a year into material for carpets around the world. The last minute illustrates the recycling steps from bottle to carpet yarn. The second video (2:18) shows the process in action.
  https://www.youtube.com/watch?v=r6kx9T4niL0
  https://www.youtube.com/watch?v=RDI596l3rkk

Build a Better Bench

Concept
Make a one-of-a-kind community bench using your previously made plastic bottle bricks. In the process, create public art, learn building skills, strengthen group dynamics, and share stewardship messages with your community: it’s win-win-win-win!
The bottle bricks form the foundational material for a free-flowing bench structure ideally suited for creative expression. Examples of hand-made “Earth Benches,” can be found all over the world, as documented by this go-to website: http://www.earthbench.org/how-to-earthbench.html

Logistics
This construction project takes some time, resources, and planning. It invites lots of public participation along the way, itself a method of community outreach. While this project may be too complex for some classrooms to manage start to finish on their own, an Earth Bench is a great project for community collaboration: many partners make light work.

The Earth Bench is also an ideal project for Eagle Scouts, church groups, camps, or other organizations who have the resources and flexibility to bring a community-enhancing dream to life.

The Product

- **The Bench**
  The Earth Bench is a solid, hand-made structure that is filled with plastic bottle bricks and covered with a mortar mix. Traditionally the cob mix is made on site with a combination of clay, straw, earth, sand, and water. Cement, however is an option.

  The nature of the materials enables a free form design unique to your group’s vision and the bench site. You can construct your bench with or without a back, the former being simpler.

- **Its Roof**
  Earthen benches need protection from the elements or they will erode in a few years. You will need to budget and plan for construction of a free-standing roof, which will also create welcome shade for those bench sitters. Benches finished in concrete do not require a roof.

The Materials
By design, earthen construction uses low-cost or even cast-away materials close at hand. The construction gives these materials new life and purpose: recycling at its best.

- **The stuff**: rocks, stones, bricks, or asphalt chunks (“urbanite”); gravel; clay, sand, straw bales, and water (and tarp for mixing these ingredients together); bottle bricks; sand bags (to contain fill); sticks or chicken wire. Optional: cement, plaster. Roofing materials of choice. Paint. Mosaic materials.

- **The tools**: shovels, trowels, water buckets, level, measuring tape, scissors, 5-gallon buckets, wheelbarrows, window screens (for sifting materials), gloves, first aid kit.

The Process
Taking your bench from idea to reality involves several construction phases plus community involvement and coordination. The Earth Bench website (http://www.earthbench.org/how-to-earthbench.html) provides details, drawings, and video tutorials for each step. As overview:

1. **Prepare Site**
   - Select site, determine size/design of the bench, secure permission to dig and build.
   - Dig foundational trench (15 cm) and fill with sand or gravel for drainage.
• Use larger stones to create a base on top of the drainage.

2. **Create bench “mass.”**
   • Stack sand/clay-filled bags on top of the stone base.
   • Cover the sandbags with natural mortar or cement and plastic bottle bricks.
   • Add bench back structure if desired.

3. **Protect & Decorate**
   • Cover the structure with natural (cob) or commercial plaster, add mosaics, dry and paint.
   • Design, build roof.
   • Cover bench with linseed oil every two years to prevent weathering.

**Community Engagement**
Focus on the *process*, not just the product: how can creating the Earth Bench bring community together and increase awareness of earth stewardship?

Develop a community engagement plan alongside your construction plan:

1. Identify what you need to complete the project in terms of materials, labor, skill, and funding.

2. Identify what community goals you want to accomplish as well. For example, how might you build community understanding by bringing different kinds of people together? What needs energizing in your community? What needs healing or building?

3. Brainstorm groups in your community whose participation would help you with your specific project goals. How might these groups also strengthen their own interests by also helping yours?

4. Consider civic groups, business sponsors, service groups, scouts, churches, schools, after school programs, libraries, universities, artist groups, builders, construction companies, and clubs. No group needs to be part of your project from beginning to end, but all can take pride in playing a role. By involving others, you will have not only built a better bench at the end of your project, but a stronger and more environmentally informed community too.
Additional Resources

1. **Clean Valley Council and friends**
   a. **Clean Valley Council website** - [www.cleanvalley.org](http://www.cleanvalley.org)
   b. **Peace on Earthbench Movement** - [www.earthbench.org/](http://www.earthbench.org/)
   c. **The Harvest Collective** - [www.theharvestcollective.net/](http://www.theharvestcollective.net/)

2. **Community Partners**
   a. **School Partners** – Many schools are actively seeking projects that link their students to service-learning in their community. If you are a community group, ask around, and keep asking until you find a teacher or administrator fired up by the idea. Work together to imagine how this project might also meet this teacher’s goals, whether they be academic, vocational, or civic. Many schools also run afterschool programs, which is another, less formal way to connect up. Partnering with higher education is also a possibility, especially through service clubs.

   b. **Government Agencies**
      Local offices may also have pro bono staff, resources, and insight to share.
      * Municipal solid waste/recycling managers
      * Landfill operators
      * Local 4-H Extension offices

   c. **Local non-profit organizations**
      Many types of organizations might be keen to partner with you in this project. In addition to environmental groups, also remember youth and community development agencies, arts groups, building trade clubs, STEM groups, and more. Don’t forget your library: would it be a good site for the bench? Or a public park?

3. **Other Helpful Resources** (free)
   a. **Project-Based Learning materials from PBL Works**: A treasure trove of free materials, templates, lessons, rubrics, and blogs. Website: [http://pblworks.org](http://pblworks.org)

   b. **Community-Action and Problem-Solving Resources from Earth Force**: Free educator guides and lessons supporting student voice and choice, empowered decision-making processes, environmental civic action, and more. Website: [http://earthforceresources.org](http://earthforceresources.org)
Appendix A

SAMPLE PROJECT INVITATION LETTER
(used by CVC for its community Earthbench project in Spring 2019)

Hello [teacher’s name]

Clean Valley Council is organizing an exciting new eco-art project in Vinton, VA and you and your students are invited to build it with us! We are building an “Earthbench” with “Bottle Bricks” and installing it next to the Glade Creek Greenway. You may be asking yourself, what is an earth bench, and what is a bottle brick. Follow along and we’ll show you what it is all about and how participating will enlighten students about their own environmental impact.

An Earth Bench is a bench constructed from reclaimed and natural materials. Benches are decorated as a mosaic with colorful reclaimed tile so that it is not only a functional installation but a piece of public art as well. CVC is partnering with Davey Stewards from The Harvest Collective to build the bench. Davey is an environmental entrepreneur who has constructed earth benches in different parts of the U.S as a part of Pick Up America - a three-year coast-to-coast highway litter clean up.

Making bottle bricks is an essential component of building the earth bench. Making bricks can be used as a hands-on activity to turn waste into a resource. It is an excellent way to talk about waste, litter pollution, and the issues affecting our local rivers. Making a bottle brick is an activity used to help students reflect on how much plastic trash they encounter on a daily basis and to put it in the best possible place - as functional art!

The process of creating bottle bricks is simple and can be done during class time or homework. It can be completed in one sitting or completed as one can sustainably dispose of their plastic waste over the course of a couple of weeks. The process involves students collecting their plastic trash that is not recyclable such as plastic bags and food packaging and methodically tamping it into a 20 oz soda or sports drink bottle. It is amazing how much plastic can be stuffed into a bottle brick and also how much we encounter on a weekly basis and do not even think about.

If you are interested in being a part of this project, we would love to provide a presentation for your class, share the project with students as a way they can achieve volunteer hours doing something fun in the community. We are looking to build the bench in late, so setting up a presentation and/or a time to make bottle bricks before then would be ideal.

To learn more about Earthbenches, please visit http://www.earthbench.org

Thank you and please don’t hesitate to reach out with questions.
Appendix B: WHAT IS AN EARTH BENCH?

An earthbench, or **bottle brick bench**, is a bench made from cob and plastic waste. The bench provides the opportunity for people to come together to build a community space, while raising awareness about litter prevention and protecting clean water in our streams.

The bench features the innovative application of using **bottle bricks as a fill material covered by 2-3 inches of cob**. Bottle Bricks are 20 oz Gatorade bottles or soda bottles stuffed with plastic inorganic waste, such as plastic bags, cellophane, stickers, clean food wrappers, cigarette butts (without tobacco), shiny paper, and/or receipts.

**Cob** is a mix of sand, clay, straw, and water, usually mixed with feet on tarps, that hardens like concrete after it dries. People come together to make cob and push it onto the bench, covering the bottles and the foundation.

The foundation of the bench is built on a gravel trench and stacked first with flat repurposed concrete and given a more visually appealing perimeter of flat river rocks. The next layer is made from **earthbags** – which are polypropylene sand bags stuff full of fill dirt or sand and tamped flatly into place. The bricks are added in the backrest of the bench.

A **mosaic** can be laid into the final layer of the cob on the backrest or the back of the bench. A bench can be made with two seating areas or one. Most importantly, **the bench should be covered by a roof** to prevent the cob and mosaic from weathering away.

As a last step, the entire bench is coated in **linseed oil** to slow weathering. This final coat should be applied every two years. Without proper care, the seat might weather and need reapplications of cob and/or mosaic pieces might fall off and need to be reapplied.
The bench’s roof will be built to support a **green roof** and retrofitted with rain barrels to demonstrate a best stormwater management practice. A green roof is a roof that is built to support plants and filter the stormwater that falls on its roof. We hope to use a small solar powered pump to deliver occasional water from the rain barrels to our plants on the green roof.

**The purpose of this project is to bring people in the community together to make functional art, while catalyzing a discussion around our waste and relationships to water.** Our goal for this project is to engage 250 students – from the university to elementary levels in building the bench in some way.