Green Learning
Third Grade Teacher's Guide

Green Learning is an educational guide designed to help you meet SOL requirements while teaching important concepts about care of the environment to third grade students. As you read through the guide, you will see that it incorporates maps, reading passages, puzzles, and interactive class activities to teach concepts such as community beautification, pollution prevention, stormwater management, water conservation, resource management, recycling and wastewater treatment.

This teacher's guide includes suggested resources, educational activities, recommended discussion questions and identifies the SOLs met by each section of *Green Learning*.

Green Learning is provided for use by third grade students throughout Hampton Roads. It was created by askHRgreen.org, a public education and outreach program that encourages environmental stewardship among all residents in southeastern Virginia. askHRgreen.org is funded by the 17 cities and counties of Hampton Roads and administered through the Hampton Roads Planning District Commission (HRPDC). Members of askHRgreen.org include the cities of Chesapeake, Franklin, Hampton, Newport News, Norfolk, Poquoson, Portsmouth, Suffolk, Virginia Beach, and Williamsburg; the counties of Gloucester, Isle of Wight, James City, Southampton, Surry, and York; the Town of Smithfield; and the Hampton Roads Sanitation District (HRSD).

A portion of Green Learning was funded by the Chesapeake Bay Restoration Fund. You can support restoration activities in Virginia, such as this, by purchasing a Chesapeake Bay license plate.

Green Learning and this teacher's guide are available online at http://askhrgreen.org/gtk-gtd/green-learning-educational-guide

---

PAGE 2 – Where We Live in Hampton Roads

SOLs: English 3.10 | History 3.6 | Science 3.5, 3.6, 3.9, 3.10 l English 3.4

Resources:

- The Little Book of Big Data. Produced by the Hampton Roads Planning District Commission this resource provides lots of statistics about Hampton Roads including city/county profiles, maps/rankings, demographics, economic measures, transportation facts, real estate information and quality of life facts. https://www.hrpdcva.gov/uploads/docs/FinalPrinted_little-book-of-big-data.pdf
- Learn more about the different sources of pollution in the Chesapeake Bay. chesapeakebay.net/issues

Activity:

- Research other large estuaries around the world. Locate them on a map and describe the species that live there. Do they have similar challenges with pollution?
- Explore your local habitat and identify the different animals and plants you observe. Identify what resources the animals need and how/where do they find them.
- Investigate water pollution prevention practices used at school or at home.

Discussion:

- What are some other places that students have lived? How are they the same or different than Hampton Roads?
- The Chesapeake Bay is important for humans too. Discuss some of the benefits to the Hampton Roads community including the economy, tourism, health, recreation, etc.
- Discuss what students like most/least about living in a coastal community.

PAGE 4 – The Water Cycle

SOLs: Science 3.3, 3.9, 3.10 | Math 3.3, 3.4 l English 3.4
Resources:

- The Magic School Bus at the Waterworks (book) – Joanna Cole, Bruce Degen; Scholastic Books
- A Drop Around the World (book) — Barbara McKinney, Michael S. Maydak; Dawn Publications
- The Sun & the Water Cycle (virtual book + activities) https://www.pbslearningmedia.org/resource/buac35-sci-sunwatercycle/the-sun-and-the-water-cycle/#.Wmte566nGUk
- EPA Drinking Water & Ground Water Activities (toolkit) — Interactive games and worksheets; https://www3.epa.gov/safewater/kids/gamesandactivies.html

Activity:

Create Your Own Water Cycle

- Supplies: marker, water, tape, plastic sandwich zipper bag, blue food coloring (optional)
- Use the marker to draw a sun, a cloud, some land, and some water on the sandwich bag. Label the cloud as condensation, the space between the cloud and the ground as precipitation, and the space between the sun and water as evaporation.
- Heat water so that it is warm enough to steam but not boil. Add food coloring if desired.
- Carefully pour hot water into the bag, filling it about an eighth of the way full. You need to make sure there is space for the water to steam and condense.
- Zip the bag closed and tape to a window. Allow to sit for a few minutes. Steam will condense on sides (representing a cloud) and after several minutes water will begin to run down the sides representing precipitation.

Water Cycle in a Jar

- Supplies: jar, plants, bottle cap or shell of water, soil, sand, small rocks
- Layer items in jar beginning with small rocks, sand, soil, bottle cap or shell of water and plants. Place the jar near a sunny window and observe for at least a week. Create a chart to record your daily observations.

Water Filtration

- Supplies:

✓ 5 liters of "swamp water" (or add 2 1/2 cups of dirt or mud to 5 liters of water)

✓ 1 two-liter plastic soft drink bottle with its cap

✓ 2 two-liter plastic soft drink bottles (1 with the top removed, 1 with the bottom removed)

✓ 1 one-and-one-half-liter(or larger) beaker (or another soft drink bottle bottom)

✓ 20 grams (2 tablespoons) of alum (potassium aluminum sulfate - hint: should be available in pharmacy or spice aisle in grocery store)

✓ Fine sand (about 800 ml in volume)

✓ Course sand (about 800 ml in volume)

✓ Small pebbles or natural color aquarium rocks (about 400 ml in volume)

✓ 1 large (500 ml or larger) beaker or jar

✓ 1 coffee filter

✓ 1 rubber band

✓ 1 tablespoon

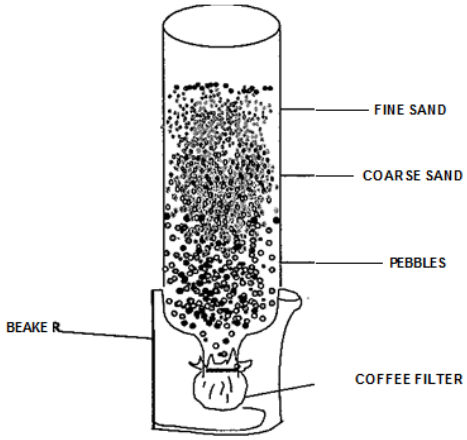
✓ Stopwatch

- Procedure:

1. Pour about 1.5 liters of the swamp water into a 2-liter bottle. Have students describe the appearance and smell of the water.
2. **Aeration** is the addition of air to water. It allows gases trapped in the water to escape and adds oxygen to the water. Place the cap on the bottle and shake the water vigorously for 30 seconds. Continue the aeration process by pouring the water into either one of the cut-off bottles, and then pour the water back and forth between the cut-off bottles 10 times. Ask students to describe any changes they observe. Pour the aerated water into a bottle with its top cut off.
3. **Coagulation** is the process by which dirt and other suspended solid particles are chemically "stuck together" into floc so that they can be removed from water. With the tablespoon, add 20 grams of alum crystals to the swamp water. Slowly stir the mixture for 5 minutes.
4. **Sedimentation** is the process that occurs when gravity pulls the particles of floc (clumps of alum and sediment) to the bottom of the cylinder. Allow the water to stand undisturbed in the cylinder. Ask students to observe the water at 5 minute intervals for a total of 20 minutes and write their observations with respect to changes in the water's appearance.

5. Construct a filter from the bottle with its bottom cut off as follows:

    - Attach the coffee filter to the outside neck of the bottle with a rubber band. Turn the bottle upside down and pour a layer of pebbles into the bottle—the filter will prevent the pebbles from falling out of the neck.
    - Pour the coarse sand on top of the pebbles.
    - Pour the fine sand on top of the coarse sand.
    - Clean the filter by slowly and carefully pouring through 5 liters (or more) of clean tap water. Try not to disturb the top layer of sand as you pour the water.



6. **Filtration** through a sand and pebble filter removes most of the impurities remaining in water after coagulation and sedimentation have taken place. After a large amount of sediment has settled on the bottom of the bottle of swamp water, carefully—without disturbing the sediment—pour the top two-thirds of the swamp water through the filter. Collect the filtered water in the beaker. Pour the remaining (one-third bottle) swamp water back into the collection container. Compare the treated and untreated water. Ask students whether treatment has changed the appearance and smell of the water.

- Advise students that the final step at the treatment plant is to add disinfectants to the water to purify it and kill any organisms that may be harmful. Because the disinfectants are caustic and must be handled carefully, it is not presented in this experiment. The water that was just filtered is therefore unfit to drink and can cause adverse effects. It's not safe to drink!

Discussion:

- Imagine you woke up to a day without water. Discuss how your day would be different. What would you miss most?
- What are some ways you could conserve water at home and at school?

PAGE 6 – Where Does It Go?

SOLs: Science 3.1, 3.2, 3.6

Resources:

- Follow Walter the Water Drop "Beyond the Drain" to find out what happens to the dirty water once we send it down the drain: https://www.youtube.com/watch?v=bFS-EviyrTw&list=FLUpFVMpy7ulrBYTgGIyaGPA&index=35
- HRSD Lesson Plans: http://www.hrsd.com/classroom

- *Amazing Aquifers!* What's an aquifer? What happens when we remove water from an aquifer? What does our aquifer look like? Students will answer these questions and more while building their own aquifer models. This module can be adjusted to meet the needs of any grade level classroom for a creative educational experience for all ages!
- *HRSD's Clean Water Curriculum* This Wastewater Teaching Unit for Fourth Graders is also suitable for Third Graders. Fourteen easy- to-use lessons help educators teach the importance of clean water and environmental protection.

- The Water Project: Download free Global Water Crisis Lesson Plans, including a separate K-5 Edition at https://thewaterproject.org/resources/lesson-plans/.

Activity:

4Liters Challenge

For hundreds of millions of people worldwide (and 1.7 million people in the US), water is everything. To survive, they have to get at least four liters - or about one gallon - a day. 4Liters is a challenge to live one day in water poverty. For 24 hours, use just four liters of water for everything you do and change the way you think about water forever. More information at https://www.4liters.org/.

Fats, Oils and Grease in the Pipes

Witness firsthand what happens when oil and food go down the drain.

Supplies:

- ✓ *Mason jar with lid*
- ✓ *Cooking oil/salad dressing*
- ✓ *Dish soap*
- ✓ *Various food products (scraps from lunch, grease, dried beans, etc.)*

Procedure:

1. Fill a mason jar ¾ full of water (this represents the washing water that comes from the tap when you do dishes).
2. Add a few teaspoons of cooking oil or salad dressing (this represents leftover oils used to cook the foods or natural fats from the food we cook).
3. Add about a handful (total) of the food products you have collected (this represents pieces of food that were not scraped off the plate).
4. Notice that the oil floats on the top of the water. Note how the other food items behave. Do some float? Do others sink? Do any dissolve?
5. Seal the jar tightly and shake. Explain that as water flows down the drain all the food items mix with the water.
6. Set the jar down and start a timer. Not the time it takes for the different materials to separate. Have any dissolved into the water?
7. Add a few drops of dish soap or detergent to the contents of the jar, seal and shake.

- Notice that this time the water is murkier. This is more representative of the water we actually send down the drain.
- The dish soap breaks the surface tension of the water, mixing the oil and water.
- Flushing this down the drain can cause clogs and backups in home plumbing and the sanitary sewer lines that run underground. Even the emulsified oil will eventually separate and coat the pipe walls even if it is further down the line. This is why running hot water does not help prevent grease clogs.

8. Set the jar down, watch and explain that in a properly maintained Grease Interceptor (used by restaurants and other facilities that do a lot of cooking) oil and food has time to separate from the water and be stored in the tank for removal instead of continuing into the wastewater system.

What Not to Flush

Determine what items should (and shouldn't!) be flushed down the drain through this hands-on, water-based activity. Encourage students to become Sewer Stewards while they have fun and get messy!

1. *Divide the classroom into groups of 5 students or less and provide each group with a large bowl containing a small amount of water.*
2. *Provide each group with common household materials, one at a time, and let them slowly swish the items around in the bowl of water to simulate a toilet flushing and water moving through a pipe.*
3. *After all items have been added and "swished", ask the students to find each item and determine if it, 1) stayed together, or 2) fell apart into tiny pieces. The items that stay mostly together should not be flushed. The only item that will break apart into tiny pieces is toilet paper. Students will learn to only flush the 3 Ps: Pee, Poo, and (Toilet) Paper!*

Suggested household items to investigate:

- ✓ *Toilet paper*
- ✓ *Cotton balls*
- ✓ *Baby wipes/wet wipes*
- ✓ *Q-tips*
- ✓ *Small plastic toys*
- ✓ *Floss*
- ✓ *Any other common items that can be easily cleaned up or thrown out*

Discussion:

- Have the students discuss some ways they could reduce waste at home, in the cafeteria and in the classroom. Preventing waste generation is the best way to be eco-friendly!
- Discuss the various machines involved in moving wastewater from your home to the wastewater treatment plant (tip: watch the Beyond the Drain video in the Resources section).

PAGE 8 – Litter Free Waterways

SOLs: Science 3.1, 3.6, 3.10 | Math 3.15 l English 3.4

Resources:

- Be An Ocean Guardian: lessons and activities http://www.conservewildlifenj.org/downloads/cwnj_688.pdf

- Understanding Marine Debris: games and activities for all ages https://marinedebris.noaa.gov/sites/default/files/publications-files/2015_TurningTideonTrash_HiRes_Final.pdf

Activity:
Team Up 2 Clean Up

Hold a school yard or community cleanup with students. Engage staff and parents to build pride in the school. Visit http://askhrgreen.org/team-up-2-clean-up to connect with the Clean Community Program Manager in your city or county. Managers will be able to provide tips and supplies for organizing a cleanup.

Trash Graph

Create your own trash graph! Wearing gloves, conduct a litter cleanup with a parent or guardian around your home, neighborhood or schoolyard. Once finished, separate the types of litter you found into categories: paper, plastic, metal, glass, waste. Make a graph to record what you found.

Discussion:

- What was the most littered item in your litter cleanup? Or what items do you frequently see on the ground?
- Where does the litter you observed come from? How did it end up on the ground?
- What's something you could do to help prevent some of the litter you have seen?

PAGE 10 – Oh, Poop!

SOLs: Science 3.1, 3.9, 3.10 l Math 3.3, 3.4, 3.15 l History 3.11

Resources:

- Stormwater Runoff: Learn the Issues https://www.chesapeakebay.net/issues/stormwater_runoff/
- askHRgreen.org Scoop the Poop Pledge: http://askhrgreen.org/gtk-gtd/pet-waste-scoop-poop/

Activity:

Where does the poop end up?

During a rainstorm, the water that flows over the land as runoff collects in channels such as streams, canals, or rivers that eventually flow into larger bodies of water like the Chesapeake Bay. The land area that drains water is a watershed.

- Materials:
  - ✓ Coffee filters
  - ✓ Shallow pan
  - ✓ Water-based brown markers, (green, black, red - optional)
  - ✓ Spray bottle of water

- Procedure

1. Crumple a coffee filter and then partially smooth it out being careful to leave some ridges which represent the different land elevations, or divides that separate watersheds.

2. Using a brown marker, color along the creases. Brown will represent the dog poop in your yard or neighborhood. You can add other colors on other creases to symbolize other things that will also runoff your yard and pollute our waterways such as: green (fertilizer from lawns), black (oil, gasoline from cars and roadways) and red (household chemicals and litter).

3. Place colored filters in a shallow pan.

4. Spray coffee filters with water and watch the color begin to flow.

5. Discussion questions:

   - What happened to the colors?
   - Where did they runoff to?
   - If using multiple colors - Did the pollutants mix together?

Protecting Our Water Resources: Student Activities for the Classroom

Pet owners can pollute water by not picking up their pet's waste in public places and in their own backyard. Dog poop contains harmful bacteria and parasites that can contaminate our water and spread diseases to humans. The average dog produces ¾ pounds of poop every day. 1,000 dogs will produce 750 pounds of waste a week. In 2017, there were more than 80 million pet dogs in America. That is a lot of poop! (Extension to fertilizer: Many homeowners also improperly use chemical fertilizers and apply more than the recommended amounts of fertilizer to lawns, gardens, and flowers.)

It is not good to leave dog poop sitting in your yard or to apply fertilizer during the rainy season. After heavy rains, they can wash into rivers and lakes and supply the aquatic plants with too many nutrients (like nitrogen and phosphorous.) As a result, algae can multiply faster and cause algae blooms. Algae blooms use the oxygen in the water. When the algae die, oxygen is also required to break down or decompose the dead algae. Both respiration and decomposition can make oxygen unavailable to fish and other aquatic life and may cause fish kills. When

plants and animals die, they settle to the bottom which causes the water body to gradually fill with sediment and organic material.

- Supplies:

✓ Two 5-gallon aquariums or similar containers
✓ Surface water to fill containers
✓ Index cards
✓ Permanent ink pen
✓ Tape
✓ Plant fertilizer
✓ Measuring spoons
✓ Grow light or sun lamp (optional)

- Procedure:

1. Explain that some of the wastes soak into the ground and pollute the water underground also.
2. Tell the students that this lesson will show them how too many nutrients can cause too much algae growth. Explain that animal wastes also have nutrients (such as nitrogen and phosphorous) in them and those nutrients are released as the waste "breaks down" over time. Since animal wastes also contain bacteria, which can be harmful to humans and other animals, explain that you will use another source of nutrients for the experiment rather than animal waste. Plant fertilizer will be used as the nutrient source. Emphasize that when the plants absorb animal wastes and plant fertilizers, they do not cause water pollution problems. If more nutrients are applied than the plants can absorb, the excess nutrients end up in the surface water and groundwater.
3. As the class watches, select volunteers to help you fill two fish aquariums with 5 gallons of pond or stream water.
4. Label one aquarium "A" and one "B" on an index card taped to each one.
5. Place 6 tablespoons of plant fertilizer in aquarium "A" as you explain that you are adding nutrients in the form of fertilizer in the water.
6. Aquarium "B" gets one half teaspoon of fertilizer.
7. Place aquariums near a window for light. If sunlight is unavailable use a grow light or sun lamp. Note: Do not place them in a cold place.
8. Have students record their observations on a daily basis for a week.

Discussion:

- Discuss the results of the experiment. Have the students guess why there is a difference in the two aquariums. Ask them which aquarium looks more polluted.
- Discuss how nutrient pollution could affect aquatic life. (Plants use oxygen to grow and oxygen is used to decompose the dead plants. Lots of plant use lots of oxygen and this makes the oxygen unavailable to other aquatic life. When this happens, the other animals can't breathe and sometimes get sick or die.)
- Have the students imagine they are fish and decide which bowl they would rather live in. Explain that after algae dies the oxygen in the water is used up, which the fish also need to breathe to stay alive. Ask which bowl will use up the most oxygen when the algae die? Conclude that small amounts of nutrients are beneficial, but too many are not good.

PAGE 12 – Rainy City

SOLs: Science 3.1, 3.6, 3.10

Resources:

- Stormwater Sentries is an online stormwater game that promotes awareness of the environmental impact from stormwater runoff into the Chesapeake Bay. Players take on challenges, complete missions, earn money and work to create a sustainable town designed to reduce stormwater runoff.
  http://www.stormwater.allianceforthebay.org/stormwater-sentries

- Build a rain barrel:
  http://pbskids.org/plumlanding/educators/context/131_build_a_rain_barrel.html

- Freddy the Fish Teaches About Stormwater:
  https://www.youtube.com/watch?v=jjPfLhJbdc0

Activity:

- Investigate storm drains in your neighborhood or near your school. Looking at a map, can you find which waterway they drain to? Many storm drains have medallions on them to remind you they drain to the Chesapeake Bay. You can request storm drain medallions from askHRgreen.org if yours doesn't have one. Design your own drain medallion that will remind people to keep trash and pollution away from the drain.
- Watch the video above to learn about rain barrels. Next, design your own rain barrel! What materials will you use? Where will you put it? Draw a picture of your rain barrel and show where you will put it. Write a paragraph explaining why holding and reusing rainwater is good for the environment. If your school allows, work as a class to build and install a rain barrel on your campus.
- Go on an impervious hunt! Ask students to predict whether a variety of surfaces will be pervious or impervious (i.e., will or will not allow water to drain). Next, walk around school to test your predictions by pouring a cup of water on different surfaces and have students write or draw their observations. See http://glaquarium.org/wp-content/uploads/2015/10/A-Very-Impervious-Situation-Lesson-Plan.pdf

Discussion:

- What are some ways you can make sure only clean rain water goes down the storm drain?
- What are ways you can help water soak into the ground instead of washing pollution away?

PAGE 13 – Down n' Dirty on the Farm

SOLs: Science 3.6, 3.7, 3.10

Resources:

- Infographic showing healthy soil and how it can become "just dirt" https://www.greenamerica.org/soil-not-oil-how-organics-can-feed-world/living-soil-vs-dead-dirt
- Explore the nutrient cycle and the important role it plays in reuse of water, energy and food by all ecosystems and species on the planet: https://www.greenamerica.org/soil-not-oil-how-organics-can-feed-world/living-soil-vs-dead-dirt

Activity:

Soil Erosion Lab

- Supplies:

✓ Three 2 liter bottles
✓ Potting soil
✓ Grass seed
✓ Water
✓ Stone (pebble or gravel work well)
✓ Graduated Cylinder
✓ 3 Beakers

- Procedure:
  1. Cut an empty 2 liter bottle in half, and place soil inside. Evenly spread grass seeds on this soil.
  2. Place it under a light source and wait for it to grow, making sure to water it every couple of days. Begin lab when grass is 2-4 inches in length.
  3. Fill two more 2 liter bottles with soil after they have been cut in half. Keep one soil by itself (control), and place a layer of gravel over the other soil filled bottle.
  4. Place one of the samples of soil on an elevated slope with a beaker below to catch runoff.
  5. Fill a graduated cylinder with 100mL of water.

6. Pour the water into the bottle, and catch the runoff in the beaker. While doing this use a timer to time how long it takes for the runoff water to empty into the beaker. Start the timer when pouring begins, and end when water stops emptying into the beaker.
7. Record the time, characteristic, and amount of water in the beaker.
8. Repeat steps 5-7 for the other two bottles of soil
9. Graph the amount of water collected in each beaker. Observe the characteristics of the water collected in each beaker. Which bottle produced the cleanest water? Which bottle produced the least amount of water?
10. Discuss real world implications of soil erosion and water quality.
11. Lab can be repeated with various combinations of soil type (clay/sand), soil cover (mulch/leaves) and vegetation to compare and contrast the results on erosion and water quality.

Soil Shake Up

- Supplies:

✓ Bottle or jar with lid. Wide-mouth jars work best
✓ Hand shovel
✓ Soil sample
✓ Water
✓ Tape or marker

- Procedure:
  1. Use the hand shovel to dig down 6 inches into the ground.
  2. Fill jar half full with dirt.
  3. Fill the rest of the jar with water and secure lid tightly.
  4. Shake jar for several minutes.
  5. Set the jar down and observe the soil particles as they settle. Sand will settle first on the bottom of the jar. Mark the top of this layer with a marker or tape.
  6. Wait one hour. Return to the jar and look for the layer of smaller particles on top of the sand. Mark the top of the layer as silt.
  7. Wait one day and return to the jar. Observe that the water should now be clear. Look for a layer of the smallest clay participles which should have settled on top of the silt. Mark the top of this layer.
  8. Discuss the composite of the soil sample. Rank layers from least to greatest.

Life Cycles

Have students identify the types of producers, consumers and decomposers on the farm (or in other landscapes on the Green Living Guide) and the role they play in the nutrient cycle.

Producers	Consumers	Decomposers
Make their own food	Eat other organisms for food	Break down dead material
		

Discussion:

- Discuss the relationship between the human need for food and the stresses it puts on the environment.
- Identify ways that farmers can make food production less harmful to the environment.
- What are some things you could do differently to reduce the impact your diet has on the environment?

PAGE 14 – Heroes for the Environment

SOLs: Science 3.10 I History 3.11

Resources

- askHRgreen.org offers local resources for schools including grants, lesson plans and activities.
- Keep America Beautiful holds recycling competitions and offers grants for school recycling and litter prevention activities: https://www.kab.org/our-programs/education/keep-america-beautiful-schools
- The Chesapeake Bay Foundation offers many resources for schools including field experiences, professional training for teachers, and free classroom activities and lesson plans: http://www.cbf.org/how-we-save-the-bay/with-schools/

Activities

- Have students review and take the Green Classroom Pledge: http://askhrgreen.org/gtk-gtd/green-classroom-take-pledge/
- Coordinate a storm drain marking project on campus or in a surrounding neighborhood: http://askhrgreen.org/programs/storm-drain-medallion/
- Apply for a askHRgreen.org Mini Grant to get $500 to fund an eco-friendly project in your classroom: http://askhrgreen.org/grants/environmental-education-mini-grant/

Discussion

- Identify an environmental problem in the school, at home or in the community and have students discuss solutions. How can students/parents/elected officials improve these problems?