

9/18/09

Flush the Kids

Activity Description

Students learn about how a septic system works, and what the components of wastewater are from household use. Students learn how some of the components are treated or filtered out by the septic system and how others, such as nutrients from human waste, pass through the system untreated, enter the groundwater and ultimately are a major contributor to coastal pollution.

Take Home Message

Septic Systems are effective at disposing of wastewater, but do not remove all contaminants, and are responsible for adding nutrients to ground and surface water that eventually will cause water quality problems.

Massachusetts Frameworks

Technology/ Engineering

Design, Produce and Use #2

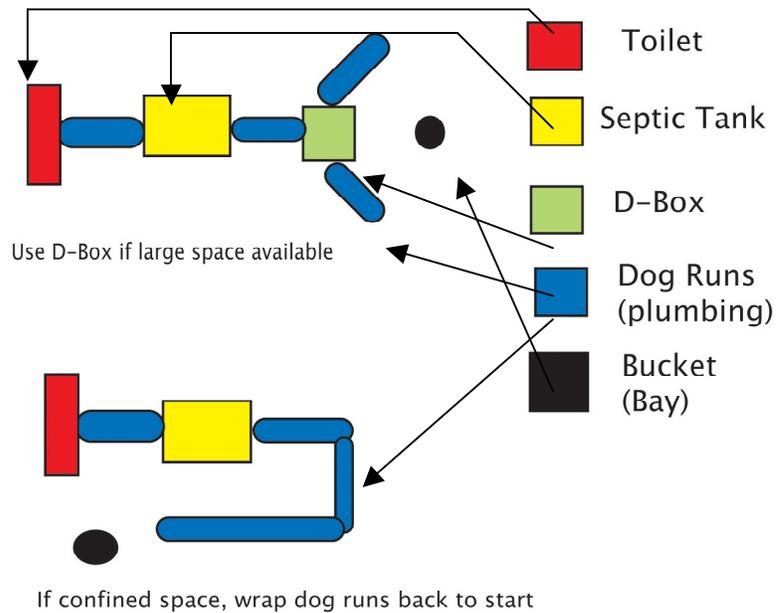
Supplies

- Septic System Model- toilet seat base and tank top, pop-up tent/Distribution box/ tunnels, fabric panels (grey, green, striped), fabric pockets for bacteria and phosphorous, netting for grease
- Clear Plastic Cups (clean water)
- Wastewater Component Cards- Nitrogen, Phosphorous, Bacteria, Solids & Grease.
- Black basin (ocean), props to add to the ocean (seaweed, dead fish, clothes pins)

Set-Up

1. Set up the toilet by attaching the styrofoam tank to the top of the seat base. Attach the FLUSH THE KIDS sign to the tank.
2. Unfold the tent/screen house, making sure that each and every frame edge is flat, and there are no kinks in them (this can lead to total collapse of the tent, so check every edge. Also unfold the D-box (distribution box) if you are going to have enough room to use it.
3. Unfold 3 or 4 of the dog runs, depending on how much room you have and whether or not you are going to use the d-box. If space is limited, set up one run between the toilet seat and the tent, and attach another two runs together to represent a long leach pipe. If you have enough space, you can have one pipe extend out of the screen house to the dbox, and then another two runs extending out from either side of the D-box. (See diagram)
4. Cover the septic system with the fabric panels, the grey felt goes around the sides (pull it so that it hangs smoothly) and is held on by large black clips, the green felt just drapes over on the top, the canvas panels are pinned to the grey felt near the entrance (make sure that the inlet side of the canvas fabric is nearest to the toilet seat side. The striped nylon panels Velcro and or pin to the inside of the main room.
5. Pin up the pockets for the cards as follows: Solids is at the bottom of the first tank (pockets are sewn on panel), Bacteria can go anywhere in the first and second tank, Phosphorus is near the exit to the leaching field or on the D-box if used. Grease will “float” on top of the blue netting...sort of drape it over the roof pole and pin to two corners.
6. Organize clear cups, and wastewater component cards.
7. Place the black basin that represents the surface water a short distance from the end of the leaching tunnels, this is where nitrogen ends up. Have the supply of algae (colored plastic shreds), dead (plastic) fish and scallop shells nearby.

Set up for Flush the Kids

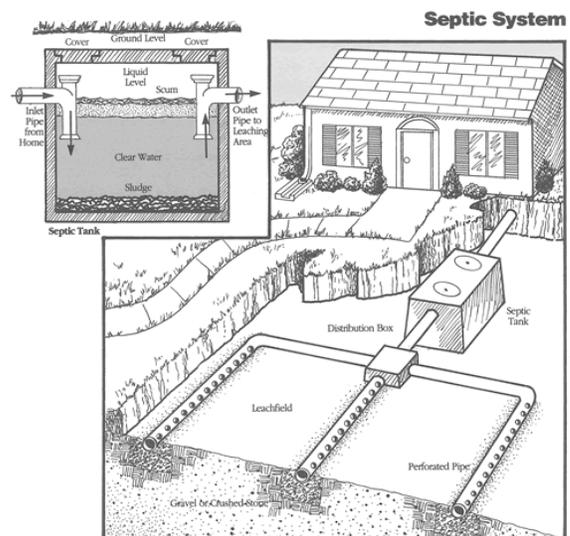


Septic Systems

Septic systems are one reason it is hard to keep the water in the aquifer as clean as we would like. On Cape Cod most homes have a **septic system** instead of a connection to a sewer system. With a septic system, wastewater from the home goes into a tank in the ground and is broken down by bacteria through a natural process. Although these systems work well to remove pathogens and recycle most of the components of wastewater, they do not remove excess nutrients.

The Title V septic system works as a series of steps. The wastewater in the septic system is separated based on density differences. The sludge settles to the bottom, less dense materials such as fats and oils rise to the top, and the remaining wastewater stays in the middle, where bacteria break up many of the compounds. This water flows through a pipe to the distribution box and then out into through a series of perforated pipes called the leaching field.

When the water slowly drips out out of the pipes, it gets filtered by the sand and gravel underground, which removes bacteria and some viruses. After a few years the sludge from the bottom of a septic tank will have built up and will need to be pumped. If it is not removed, the sludge can build up so far that it flows out into the leach field and will clog it. The system will back up onto the lawn, or even into the house.



Individual on-site septic systems have been used historically on Cape Cod. This was a viable wastewater solution for an area with a relatively small and spread out population. As the population has grown, more water is withdrawn from the aquifer, and the water returned to the aquifer is increasingly polluted.



Activity Procedure/ Script

First kids learn about what a septic system does:

- **Does any one know what happens to the water when you flush your toilet?**
 - Show them the toilet that is connected to a septic system, where all of the wastewater in your house goes. Wastewater was once nice clean water, but by doing all of the jobs around the house it has picked up some rather nasty extra features.
- **What are some of the other sources of wastewater besides the toilet?**
 - Shower, sink, dishwasher, washing machine.
 - Point out to the students that along with the clean water that goes down the drain, wastewater is full of other things, some good and some bad. Talk about the constituents that are represented by the cards and where they come from, grease from cooking oils, solids from dirt and poop, also toilet paper, bacteria from our intestines, nitrogen from our urine, and phosphorus from detergent.
- **Now lets see what happens when the wastewater goes into the septic system – the system is sort of like an underground chemical factory, where wastewater gets reorganized.**
 - Begin by using the side of the display on the model to explain how a septic system works.
 - Show them how the wastewater or “sewage” enters into the septic tank and the solids sink to the bottom while the grease floats to the top and is trapped by a “T” pipe.
 - Bacteria are like the factory workers, they are very necessary to make the septic system work. Bacteria break down the solids at the bottom of the tank, and stabilized the nutrients so they can be used again by other living things.
 - The liquid waste, which contains the nutrients, nitrogen and phosphorous flows out of the tank and into the distribution box.
 - Bacteria are here too, they convert the nitrogen and phosphorous to more stable compounds.
 - The liquid leaves the d-box and leaks out into the soil in the leaching tunnels. Phosphorous is trapped on the soil particles and the nitrogen keeps moving through the soil and travels along with the groundwater. Some bacteria are trapped in the leaching field as well, and keep working to make the wastewater components less toxic.
- **But as hard as the bacteria has tried it’s not able to do it all, and not all of the contaminants in wastewater are removed by the septic system.**
 - The nitrogen keeps moving through the system, and into the groundwater, it eventually enters the coastal waters, and causes the algae to grow more rapidly. This results in poor water quality and can harm aquatic life.

Now they will get to be “Flushed!”

- **Now we will pretend that each of you is a molecule of clean water. But as we know wastewater is clean water with some extra features! You are each going to get a cup that represents clean water!**

Add the contaminants to each cup, explaining the source of each one.

- **Your job is to enter the septic system, and using the knowledge that you have just learned, to figure out where each of the components are supposed to be deposited, so that the wastewater can be cleaned up. Look for the labeled pockets to put your contaminant cards in.**

Make sure that the kids each have several bacteria cards

- **You will find several bacteria cards, don't forget that bacteria is important to make the septic system work! Bacteria is needed to break down the solids, and to stabilize the nutrients in the leaching tunnel and helping to make you a cleaner water molecule. The nitrogen card is the hardest one to take care of. Nitrogen stays in your cup, all the way until you get to the ocean.**
 - Each student will now enter the septic system. Flush them one at a time.
 - You will have to coach them to remind them where the cards are to be deposited.
 - As they exit the system- remind them that they need to deposit their last card, by placing it in the coastal waters and reinforce what happens to the bay when too much nitrogen get in it...algae blooms, low DO, fish kills, loss in eel grass, habitat declines, dead shell fish, etc.
 - As the cards pile up in the coastal waters, we can throw in algae (streamers) dead scallops, and dead fish (plastic fish).

Clean-Up

During the Festival

- After several groups have gone through the system, you will need to empty the containers and resort the contaminant cards.
- Once the ocean is really polluted, you can take out the algae and fish, and start over with a clean body of water.
- Test and retest the pop-up house to make sure that it has no kinks, and isn't going to collapse

After the festival

- Take apart the septic system,
- If it is the **HARD MODEL**: be extra careful to keep hardware together with the pipes. There is a place for each part and make sure that each part goes back where it came from. Lash the pipes together with bungee cords. Handle the plastic pipes carefully, they crack easily.
- If it is the **PORTABLE MODEL**, carefully fold the house and screen rooms in, till the house is flat and secure with toggles, collapse and secure the D-box.
- Carefully fold each of the side drops, and the box and tank covers (hard model only). Collapse and secure the tunnels. The top of the toilet separates from the seat, so it's easier to move. Handle the top of the toilet carefully, the Styrofoam is fairly fragile.
- Empty all of the containers and resort the contaminant cards so they are ready for the next festival.
- Help to load the parts into a truck for transport back to Barnstable.