Captain Trash Wheel is Coming!

GRADE LEVEL: 1 - 8

TIME: 40 MIN

SUMMARY

In this lesson, students will be introduced to the history of Masonville Cove. Students will learn about an innovative engineering project that is showcased at Masonville Cove, Captain Trash Wheel. Through an interactive game, students will learn about the functions of different parts of the trash wheel.

OBJECTIVES

1. Students will interpret and discuss the pictures of the Trash Wheel parts, learning the function of each.
2. Students will participate in the game "Captain Trash Wheel is Coming!", which uses their knowledge of the trash wheel parts and their function.
3. Students will review the background surrounding the acquisition of a trash wheel at Masonville Cove.

VOCABULARY

- **Cargo** - Goods carried on a ship, aircraft, or motor vehicle.
- **Cargo Ship** - A ship that transports goods and materials from one port to another.
- **Dredging -** The process of removing sediment from shipping channels.
- **Dredged Material -** The sediment removed from the shipping channels.
- **Draft-** The vertical distance between the water surface and the bottom of the ship.
- **Incinerator** - A waste treatment process that involves the combustion of organic substances contained in waste materials.
- **Litter** - Trash, such as paper, cans, and bottles, that is left lying in an open or public place.
- **Mitigation -** In environmental work, these are projects or programs intended to offset the known impacts to an existing historic or natural resource.
- **Nonpoint Source Pollution** - Those inputs and impacts to the environment which occur over a wide area and are not easily attributed to a single source.
- **Point Source Pollution** - A single, identifiable source of pollution, such as a pipe or a drain.
- **Restoration** - The act or the process of returning something to its original condition.
- **Shipping Channels -** Areas in the water that are maintained to a depth that can accommodate cargo ships. They are marked by buoys and identified on nautical charts (so captains know where to travel).
- **Solar Energy** - Radiant energy emitted by the sun that is transformed into electric power using specially designed panels.
- **Trash Wheel** - A trash intercepting device placed in a river to collect and remove any floating debris before it reaches a harbor. Generally powered by both sunlight and water, the wheel lifts trash and debris from the water onto a conveyor belt that deposits into a connected floating dumpster.
- **Watershed** - An area of land defined by the body of water at its lowest elevation that receives all precipitation that has flowed over the land.
- **Water Wheel** - A large wheel driven by flowing water, used to work machinery or to raise water to a higher level.

MATERIALS

- Map of Masonville Cove and the Chesapeake Bay.
- Laminated pictures of the parts of a trash wheel.
- Laminated statements describing the function of the trash wheel parts.
- Display board to which pictures and words can be attached.
- An open space to play a run-around game.

BACKGROUND

In the early to mid-1900s, industry really began to boom in the Baltimore area. Products were being shipped in and out of the Port of Baltimore, and the need for railroad lines to carry these goods to other areas, like the mid-western US, became hugely apparent. The Baltimore and Ohio (B&O) railroad extended their lines through the Masonville community and the area slowly became more industrial rather than residential. While this development was good news for the state of Maryland (the Port was growing and there were jobs available) there were resulting negative effects on the Masonville community.

Masonville Cove was once a recreational area used by residents for fishing and swimming but the railroad tracks cut the community off from the Cove. After the recreational cove area was cut off, it turned into a dumping ground. Washing machines, household trash, tires, etc., accumulated in the cove area.

The area of the dredged material containment facility (DMCF) was a dumping ground as well, but for different materials including disassembled ships, concrete timbers, etc. This was relevant to the community because as unused buildings fell into disrepair and former recreation areas were used as dumping grounds, these elements of their home community were lost. Former community members had strong memories and emotional ties to Masonville Cove, and it took away from their sense of place and community when those areas were lost. Today, Masonville Cove and its surroundings offer a picturesque waterfront setting for nature exploration. The great effort to restore the cove, was achieved because of the mitigation associated construction of the Masonville DMCF for the placement of dredged material.

One of the mitigation projects is the Masonville Trash Wheel, also known as Captain Trash Wheel, a name chosen by the surrounding community. A Trash Wheel is an invention that combines old and new technology to harness the power of water and sunlight to collect litter and debris flowing through the storm drain culvert and stream of Masonville Cove.

Before

After

The stream's current provides power to turn the Trash Wheel's water wheel, which turns a conveyor belt, which lifts trash and debris from the water and deposits it into a floating dumpster barge. When the stream does not provide enough water current, a solar panel array provides additional power to keep the machine running. When the dumpster is full, it's towed away by boat, and an empty dumpster is put in place.

The trash that washes in through the Masonville storm drain culvert and stream originates as litter on surrounding streets that are part of the Masonville Cove watershed . The litter washes into storm drains on the

street during precipitation events. The storm drains funnel the mixture of rainwater and litter into the nearest body of water, in this case, Masonville Cove. If the litter were not intercepted, it could flow from Masonville Cove to the Patapsco River, to the Chesapeake Bay, and eventually the Atlantic Ocean. This type of nonpoint source pollution is called runoff pollution. Trash in the water is only one type of runoff pollution, and wildlife could ingest the trash or become entangled by it. The trash wheel mitigation project helps to remove trash from the water before it enters Masonville Cove and all of the connected waterways and wetlands, leaving the environment in a better state and safe for wildlife.

ACTIVITY

1. **Engage/Elicit (15 min):**
   The instructor should introduce the importance of the Port of Baltimore and briefly explain the concept of dredging to keep channels navigable. Explain the need for Masonville DMCF and point out Masonville Cove and the students' school on a map of the Chesapeake Bay watershed.

   Explain that runoff pollution travels through storm drain pipes and in this area the pollution will flow straight into Masonville Cove. Explain the concept of mitigation and what has been done at Masonville to reduce the environmental impact of the DMCF construction. Also explain what has been done by MDOT MPA to make the environment healthier than it was. Introduce one of the mitigation projects, Masonville's Captain Trash Wheel. Using the pictures provided, explain each different part of the trash wheel and its function. Ask the students to spot each part on the actual Trash Wheel as you go. Trash Wheel parts are depicted in the laminated pieces: (See Chart - Parts of Captain Trash Wheel)

   Explain to students that they will be using their knowledge of the trash wheel parts to act them out in a fun game called "Captain Trash Wheel is Coming!"

2. **Explore (20 min):**
   State the rules of the game "Captain Trash Wheel is Coming!" and have a few people model the actions you describe as you go.
   Rules:
   Assign one person to be the Captain Trash Wheel (CTW). The role of CTW is to call out the actions and dismiss the players who don't do the actions quick enough or who break from character. Once the CTW calls an action, each player has 3-4 seconds to start performing the action. If they don't find a group fast enough for the action involving more than one person or perform the right action, they are out of the game. Refer to the Call to Action Chart to explain the actions to the participants. (See Chart - Call to Action)

   Have the person in the role of CTW call out commands and dismiss those who make mistakes. Play as many rounds as you can and reserve 5 minutes at the end to review.

3. **Explain (10 min):**
   Rebuild the Trash Wheel: Pass out the pictures of trash wheel parts and descriptions, mixing them up throughout the group. If there is not enough for each participant to have their own, designate groups to share them. Give students 2 minutes to silently and correctly assemble the picture of the trash wheel on the board like you did at the start of the activity. Once the students have gotten it right, review the reason that Captain Trash Wheel is at Masonville.

4. **Evaluate/Wrap-Up (5 min):**
   Play the "Ask or Answer for a Prize" game. Terms will have been posted on the board for passive learning. The instructor will give students the option to ask a question about what they learned or answer with the term that matches a set of clues given by the instructor to earn a prize. If students choose the latter, the instructor begins to describe one of the words and students will race to raise their hands to guess which term they are describing. If possible, they or their group can earn a giveaway prize for their answer.

   - RUNOFF POLLUTION: Masonville Cove is part of the Chesapeake Bay watershed and is impacted by all human activity in the surrounding region as a result of runoff pollution.
   - STORM DRAIN: Litter on the ground within the Masonville Cove watershed washes into storm drains when it rains, transporting it to the stream at Masonville Cove. The trash

wheel is stationed at the end of this stream.

- TRASH WHEEL: This is a machine that is positioned at the location of storm drain pipes to catch floating litter before it flows into the main body of water.
- CARGO SHIPS: These are large vessels that carry goods to be sold in Maryland and throughout the country that were originally made in countries across the ocean.
- PORT OF BALTIMORE: This is the area in Baltimore where ships dock and offload their goods for transport throughout the United States. Goods are taken from the ships and placed on trucks and trains to get to their final destination.
- 50 FEET: This is the depth of water that is needed for cargo ships to travel safely into Baltimore Harbor.
- 21 FEET: This is the average depth of the Chesapeake Bay, which is not naturally deep enough to accommodate large cargo ships.
- DREDGING: Dredging shipping channels is something that occurs annually to keep channels in the bay deep enough for cargo ships to travel through. It is economically beneficial to the Port of Baltimore and Maryland as a whole because Port business brings a lot of money to the state of Maryland through jobs. It must be done to allow large cargo ships to get to the Port of Baltimore without running aground.
- DREDGED MATERIAL CONTAINMENT FACILITY: The sediment that is dredged from the bottom of the channels must be placed in special designated facilities, often located close to the area where the sediment was dredged.
- MITIGATION: Out of this economic need to dredge, habitats like Masonville Cove are restored. Masonville Cove provides unique Chesapeake Bay habitat to important resident and migratory species.

End with the final message: This is what we call a "win-win" situation. The Port of Baltimore can remain open for business and stay competitive with other ports while Maryland's environment can be protected for wildlife use. The Port of Baltimore has made it a priority to conduct dredged material containment projects that are environmentally responsible and desirable to the neighboring communities. Installing a trash wheel at Masonville Cove as a mitigation project helps to alleviate the impact of runoff pollution that threatens wildlife and wetlands.

DIVE DEEPER

Have students engage in a group discussion to answer the following questions:

1. What is the overall impression that students have of the Trash Wheel invention?
2. In what ways does it help to make the Masonville area better?
3. Do they think it is serving the purpose of offsetting the known impacts of the DMCF construction to the existing natural resources in the area?
4. Were there any elements of the Trash Wheel invention that surprised the students?

Parts of Captain Trash Wheel

Parts	Functions
Barge	Keeps the trash wheel floating
Wheel	Water flow makes it turn, and powers the conveyor belt as it moves trash into the dumpster
Dumpster	Holds trash and debris
Boom	Directs trash and debris to the front of the trash wheel
Solar Panel	Provides stored solar energy, which powers the wheel when the water current is not strong enough
Sail Cloth Cover	Protects the dumpster from the elements
Rake	Physically moves trash that has been channeled by the booms from the water onto the conveyor belt
Conveyor Belt	Transports trash from the water to the dumpster

Captain's Commands

Call	Action
Captain Trash Wheel's Coming!	Everyone stands at "attention" (in a salute) facing CTW, and they can't move from this position until the caller says, "At Ease!" If they laugh or break from the attention, they are dismissed.
Starboard!	Players run to the right.
Port!	Players run to the left.
Canvas!	Each student brings their hands together over their head and curve their arms down to imitate the canvas over the trash wheel.
Boom!	Groups of two students hold hands and create a V-shape with their arms to imitate the booms that lead trash to the trash wheel.
Conveyor Belt!	Groups of three students stand side by side. One person on the end acts like the rake scooping the trash to the conveyor belt, and the other two people shuffle their hands back and forth imitating the motion of the trash along the conveyor belt of the trash wheel.
Barge!	Groups of four students join hands to make a square shape between their arms imitating the shape of a rectangular barge.
Wheel!	Groups of five students stand in circle with their hands stacked in the middle. They walk around in a circle to imitate the Trash Wheel.