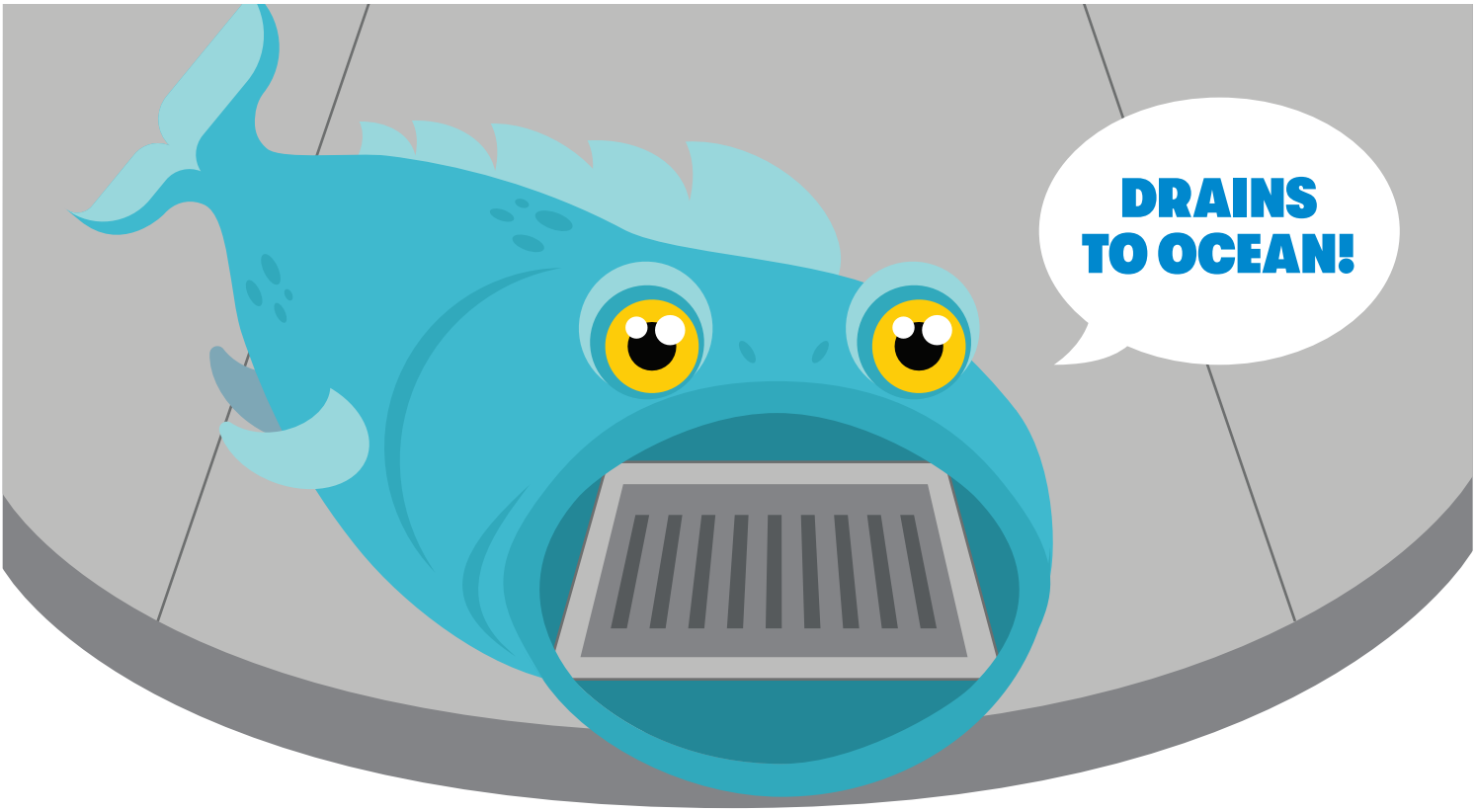
The Tech Interactive at Home

Build a Storm Drain

Who says all the fun has to happen at The Tech Interactive? This DIY engineering activity can be put together with inexpensive materials or objects you find around the house.



Introduction

In this design challenge, you'll be designing a storm drain cover that catches litter in order to protect our waterways. By thinking about the kind of waste that might wash into storm drains and then into waterways, you can consider immediate, localized action as well as larger systems that can protect our planet.

While the initial activity can be around 45 minutes, don't be surprised if you find yourself spending 60 minutes or more perfecting your creation and even researching the impact of humans on earth and how we can protect the planet.

Design Challenge

Create a storm drain cover that can keep trash out while letting water pass through in order to protect our waterways.

Subject:
Engineering Design Challenge, Earth Science

Ages:
7-13

Time:
45 minutes to 1 hour

Key concepts:
Watershed, pollution, storm drains, iteration, problem-solving

Materials

You will need materials for four parts of this challenge:

1. **The Drainage Pipe System (waterproof container)**
2. **Your Drain Cover Frame (to hold your design)**
3. **The Drain Cover (your design!)**
4. **The Litter**

We've added suggestions of materials for each of these parts, but use whatever you have on hand — be creative. Just remember, everything is going to get wet!

Drainage Pipe System

Since you'll be testing out the storm drain cover you build with water and litter, you will need to create a 'drainage pipe system' to catch the water and any litter that passes through your drain cover design. Don't worry, it's easy — just use any deep-sided, waterproof container with an opening and a flat top.

Drain Cover Frame

Before you start designing your storm drain cover, you will need to create a frame to build on. This can be a lid that fits your container (that you can cut) or a frame a little larger than your 'drainage pipe system' so that it can be placed easily on top. *(Directions on the next page.)*

Litter

You'll also need to find some water-safe items to act as the litter to test your drain cover with. Think about what kind of litter you see in the storm drains by your home or by your school. Explore your junk drawer, toy box, yard, or recycling bin to find unique items.

Storm Drain Cover

Now you need to find some materials for your storm drain cover design — remember they will need to be able to span the gap in your frame, either on their own, or when attached to each other. Here are some questions you might ask during the material hunt:

- How heavy are these materials? Can your frame support their weight?
- How rigid or flexible are the materials? How can they be used to construct a storm drain?

Drainage Pipe System

Choose one:

- Large bucket
- Empty plastic storage/file box
- Small trash can
- Yogurt container (32 oz or larger)

Drain Cover Frame

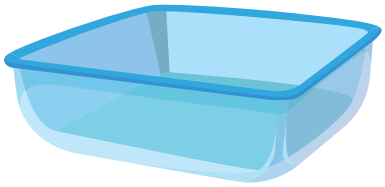
Choose materials based on the size of your drainage system.

- Plastic lid (that you can cut)
- Cereal/cardboard box

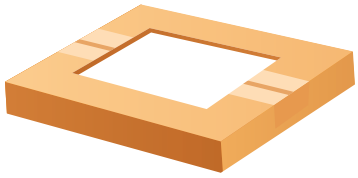
Litter

- Recycled items
- Sticks and leaves
- Misc. waterproof items

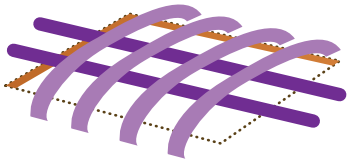
1 Drainage Pipe System



2 Drain Cover Frame



3 Drain Cover (your design!)



4 Litter

Long things

- Cooking and grilling skewers
- Pencils
- Bungee cords
- Pipe cleaners
- String

To create filters

- Laminate or glossy paper
- Yarn/string
- Cloth
- Cut up pieces of old tights or nylons
- Plastic fruit container mesh

Connectors

- Binder clips
- Rubber bands
- Paper clips
- Twist ties
- Pipe cleaners (chenille stems)

Tools and peripherals

- Scissors
- Tape
- Hot glue (older engineers only)
- Paper and pencil to draw and plan

Instructions

Before designing your storm drain cover, you will need to build your drainage system and cover frame.

1. Choose a Drainage Pipe System. Review the materials options and choose a waterproof container.

2. Build the Drain Cover Frame

- Create a frame that sits on your container by cutting one side off a cereal box or other box, leaving a small lip of about 2-3 inches on all sides. Next, open up the center of the frame by cutting a large opening, again leaving a lip of 2-3 inches on all sides.
- Have a box lid with no bottom — use that cutting an opening as described above.
- If using a yogurt container, cut out the center of the lid, leaving at least 1" of the edge intact.

For younger engineers you can place holes at certain intervals around the framelips to enable them to attach materials to build their storm drain cover.

3. Find some Litter. Place your litter in a jug or similar container about the size of your 'drainage pipe system' or smaller, and fill it half-way with water. Leave to one side until it is time to test your design.

4. Design your Storm Drain Cover. You're finally ready to build and test your storm drain design!

Tips:
For younger engineers, consider cutting materials to the proper size for the drain cover before you begin.

For older engineers, you can add another challenge by making a budget they must work to (give everything a price, or limit them to using a certain number of each type of material). Can they design it with constraints on the number of materials they can use?

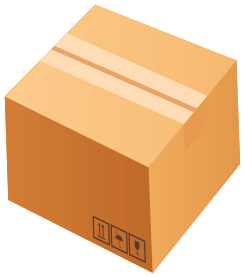
It's time to build!

When it comes to building your drain cover, any place with space to cut, attach and experiment will do, but remember that your materials will get wet as you test and iterate! Think like an engineer: Set out materials and give yourself a chance to explore and experiment while you build.

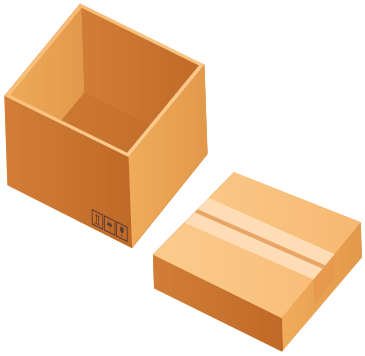
Let your imagination run wild — what can you design to catch all the litter you hunted down earlier? How will you keep the litter out while still letting water in?

How to make the Drain Cover Frame to build on

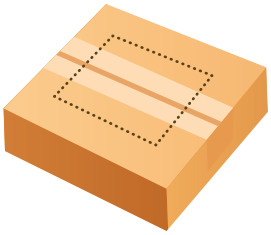
Find a cardboard box roughly the size of the container/pan/trash can you will be using.



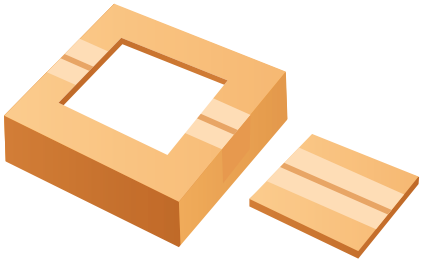
Cut off the taped up end, leaving an edge of about 2-3 inches.



Cut a rectangle out of the flat side of the box end — again leave an edge of about 2-3 inches.



Voilà! You have a Drain Cover to build on for our Storm Drain activity. You can pre-cut holes around the edge if you wish to aid with building/attaching filter material.



Test it out!

Find a place that can get wet, just in case you get some flooding. This could be a driveway, backyard, kitchen sink or the bathtub.

Once you have finished building your drain cover, place it over the top of your drainage pipe system, get your jug of litter and water, and pour it over.

Observe:

- Was there any flooding?
- Did any litter get through?
- How did your materials stand up to the storm?

Use what you learned to modify your design and test again! How can you optimize your drain cover to get all the trash out and still prevent flooding?

Protecting the Waterways

Large and small pieces of solid debris can cause a multitude of problems for our waterways — from creating clogs and flooding to introducing harmful pollutants into waterways (including the ocean). Research the details of how different pollutants affect waterways to inform your design.

Share Your Results! Keep us posted about your design challenges on social media with **#TheTechatHome.**

Explore More

- What new designs can you make or new litter can you stop?
- Can you create a drain cover that will filter different types of litter for easier sorting?
- Can you stop the pollution if the storm comes from a different angle?