Rain Gardens

Train the Trainers

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What is a Rain Garden?

- https://www.youtube.com/watch?v=3frkqNjScpk
- https://groundwater.org/rain-gardens/

Rain Garden definition

"a depressed area in the landscape that collects rainwater from a roof, driveway or street and allows it to soak into the ground. "

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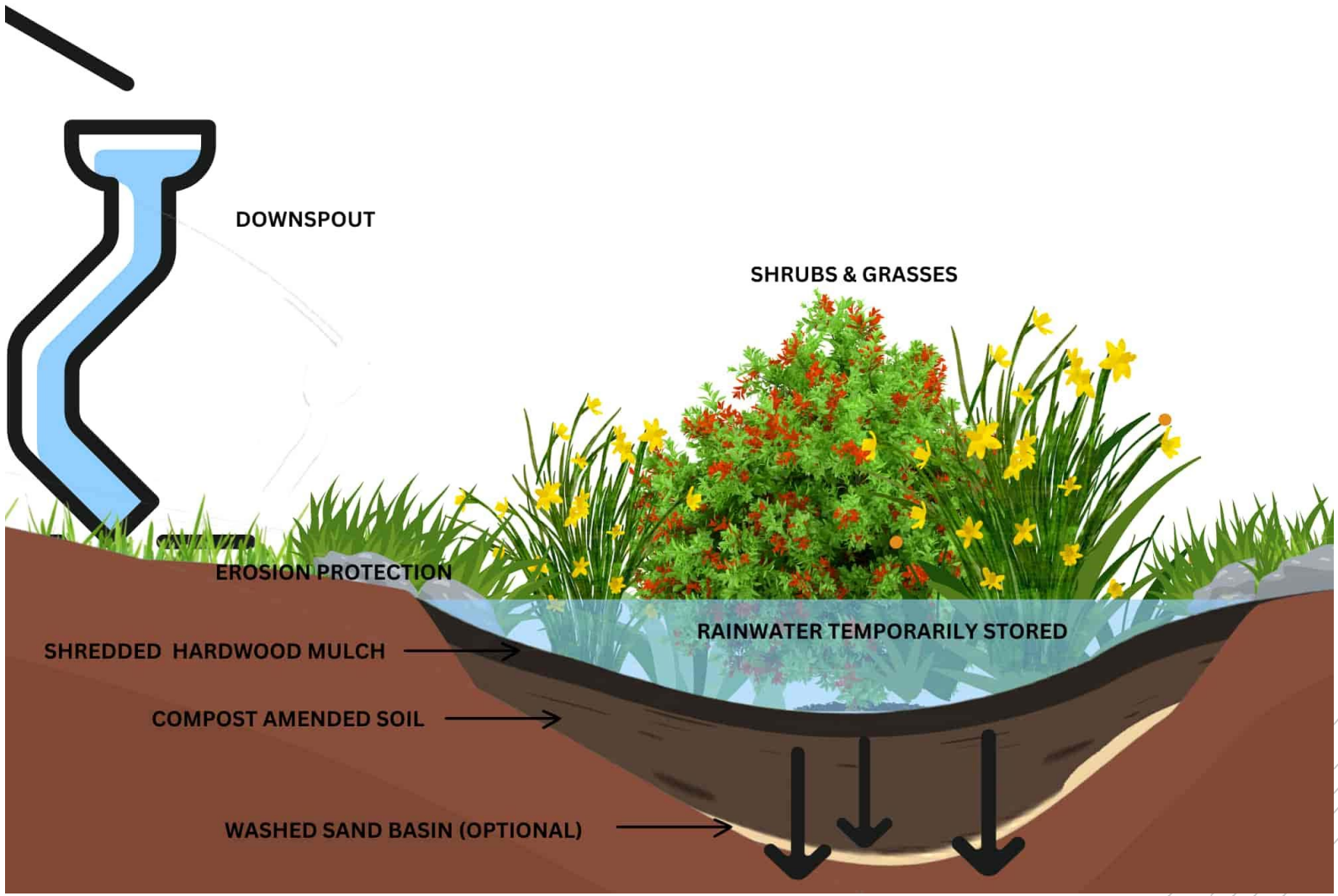

Benefits of rain gardens

- Help filter pollutants in runoff.
- The biodiversity provides shelter and food for butterflies, bees, and other wildlife [while keeping mosquitos away].
- Cost effective and beautiful way to reduce runoff and flooding.

Quick review!

- A new rain garden is being built to help reduce flooding and filter stormwater. The surface area of the rain garden is **1,728 square inches**.

Convert this measurement into **square feet**.

[1 square foot= 144 square inches]

$$1728\ inches^2 \cdot {}^{1ft^2}/_{144inches^2} \rightarrow \frac{1728}{144} = \mathbf{12\ ft^2}$$

- Calculate the total volume of water in gallons from given dimensions and rainfall depth.

Unit conversion review!

- Unit conversions are super important when designing a rain garden, for example, if you know a rain garden holds 50 cubic feet of water, how many gallons is that?
  - We know 1 cubic foot = 7.48 gallons
  - 50*7.48= 374 gallons
- A rain garden receives 3 inches of rainfall over an area of 100 square feet. Convert the rainfall to cubic feet, then to gallons.
  - Rainfall in feet=3/12=0.25 feet
  - Volume (cubic feet)=Rainfall (feet)×Area (square feet)=0.25×100= 25 cubic feet
  - Volume (gallons)=25 cubic feet×7.48 gallons per cubic foot=187 g allons
- A rain garden is 10 feet long, 6 feet wide, and 2 feet deep. What is its volume in cubic feet? Convert the result to gallons.
  - Volume = Length × Width × Depth = 10*6*2 = 120 cubic feet
  - Gallons = 120 *7.48 = 897.6 gallons

Stop and think…

- **Why is it important for engineers to get these conversions right?**

Day 2
[calculating volume and surface area of rain gardens]

How can math help us when designing a rain garden?

- Volume: how much water the rain garden can hold.
  - Length * Width * Depth [rectangular]
  - πr^2*depth [circular]
- Flow Rate: how quickly water enters the rain garden in an amount of time.
  - Volume/ Time
- Surface Area: area for planting vegetation.
  - Length * Width [rectangular]
  - πr^2 [circular]

Volume

- **<u>Volume</u>**: how much water the rain garden can hold.
  - Length * Width * Depth [rectangular]
  - πr^2*depth [circular]

Surface Area

- **Surface Area**: area for planting vegetation.
  - Length * Width [rectangular]
  - πr^2 [circular]

Example Problem #1

- A circular rain garden has a radius of 5 ft and a depth of 3 ft. What is its volume? What is the surface area?

Example #2

- A rectangular rain garden has a length of 7ft, a width of 4 feet, and a depth of 3 ft. What is its volume? What is the surface area?

Example Problem #3

- A circular rain garden has a radius of 7 ft and a depth of 2 ft. What is its volume? What is the surface area?

Example #4

- A rectangular rain garden has a length of 4ft, a width of 3 feet, and a depth of 1ft. What is its volume? What is the surface area?

Work in pairs to solve these volume and area problems.

Why is understanding volume important when designing a rain garden?

Day 3
[calculating flow rate of rain gardens]

Flow Rate

- **Flow Rate:** how quickly water enters the rain garden in an amount of time.
  - Volume/ Time

Example problem #1

- A rectangular rain garden measures 10 ft by 6 ft and is 2 ft deep. What is its volume? If 60 cubic feet of water flows into the garden in 15 minutes, what is the flow rate?

Example problem #2

- A circular rain garden measures 5 feet in radius and 2 ft deep. What is its volume? What is the area? If 45 cubic feet of water flows into the garden in 30 minutes, what is the flow rate?

Stop and think…

Day 4
[Designing your own rain gardens!]

Review!

- **Volume**: how much water the rain garden can hold.
  - Length * Width * Depth [rectangular]
  - πr^2*depth [circular]
- **Surface Area**: area for planting vegetation.
  - Length * Width [rectangular]
  - πr^2 [circular]
- **Flow Rate**: how quickly water enters the rain garden in an amount of time.
  - Volume/ Time

Break into groups and design your own rain gardens!

Include measurements in drawing [to scale], show calculations for surface area, volume, and flow rate.

Timer

Presentations!

Share your designs with the class