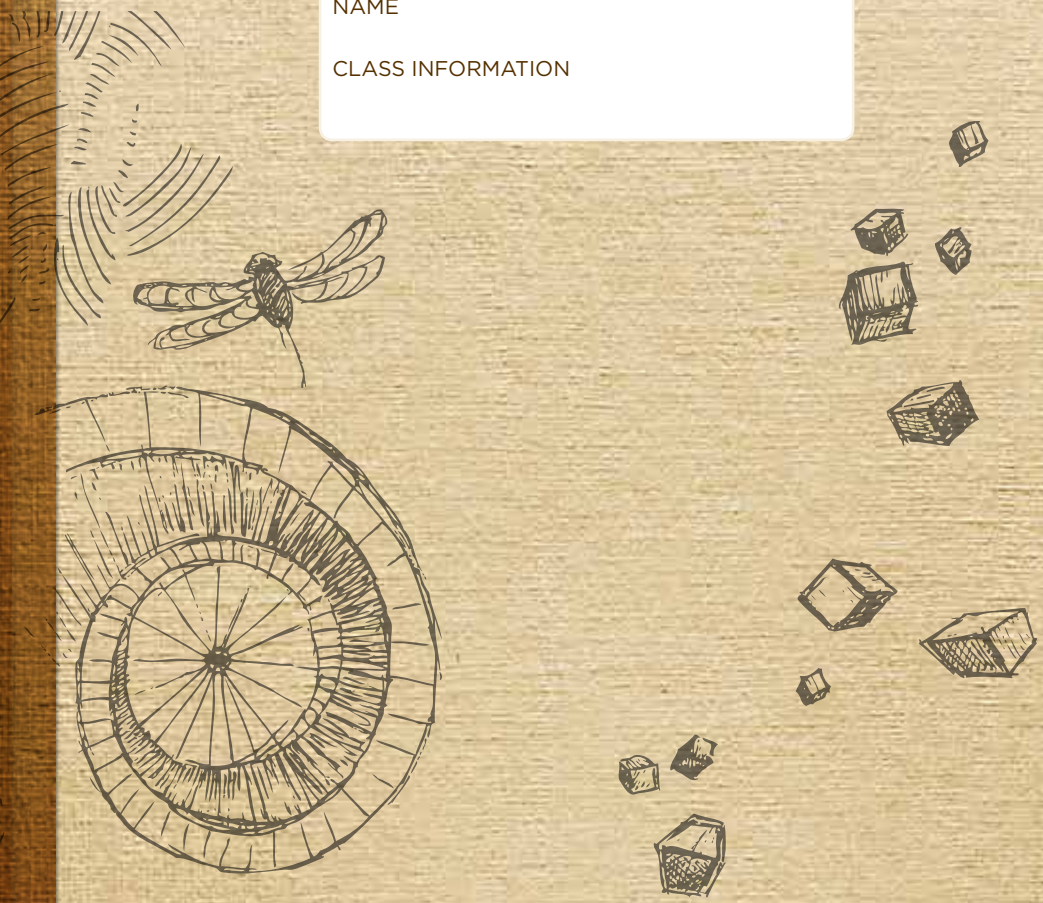
WATERSHED FIELD GUIDE + WORKBOOK

NAME

CLASS INFORMATION



NORTHEAST OHIO REGIONAL SEWER DISTRICT
STORMWATER/WATERSHEDS EDUCATION :: SEVENTH-GRADE LEVEL

Student safety contract

COMMITMENT TO SAFETY AND INSTRUCTION

Yes, I will...

- ○ Read the lab investigation before coming to class.
- ○ Wear protective equipment as directed to protect my eyes, face, hands and body while conducting activities.
- ○ Follow all instructions given by the instructor.
- ○ Conduct myself in a responsible manner at all times.

I, _____, have read and agree to abide by the safety regulations as set forth above, as well as any printed instructions provided by my instructor or the school district.

I agree to follow all other written and oral instructions given in class.

SIGNATURE DATE

Where does it go?

FREE WRITE

Where does the rain water go after a storm? How might gardens and rain barrels be good for the environment?

Where does it go?

VIDEO: WATCH, RESPOND, AND DISCUSS

1. How many gallons of wastewater does the Northeast Ohio Regional Sewer District treat in one year?

2. How does water flow in Northeast Ohio?

3. What are **combined sewers**?

4. How many treatment plants does the Northeast Ohio Regional Sewer District operate?

5. Once treated, where does wastewater go?

6. What is combined sewer overflow? How does it affect our environment?

7. What is Project Clean Lake? How long will it take?

8. Compare combined sewer overflow volumes today with those of the 1970s and the 2030s.

9. What is **green infrastructure**?

10. What questions do you have?

How much is it?

MEASURE YOUR SCHOOL PARKING LOT!

You will be working in groups to complete this activity. Your team will be assigned an area of the school parking lot to measure.

1. Make a general sketch of the school and parking lot on the blank page to the right.

2. Mark any **impervious** (paved) and **pervious** (not paved) surfaces on your sketch.

3. Measure your team's assigned area of the parking lot and mark your measurements on the sketch.

4. Share your measurements with the other groups and mark their measurements on your sketch.

5. If necessary, transfer your sketch to the next page using the measurements to draw your new sketch "to scale."

6. Calculate the area of the **impervious portions** of your school's parking lot. *Be sure to use the correct units of measurement in your answer.*

Rectangle: Area = Length x Width
Triangle: Area = (1/2 Base) x Height

The area of our school parking lot is: _____

EXPLAIN what happens to the rain that lands on the paved sections of the parking lot.

THINK about the surfaces outside your home. How much of the area is pervious vs. impervious?

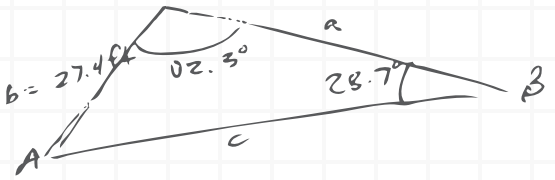
How much is it?

Draw a rough sketch of your school parking lot.

How much is it?

DRAWN TO SCALE

Refer to your rough sketch on the previous page. Use these pages to draw your sketch to scale. It might be helpful to mark the location of sewers or drains in the lot to help answer the questions on the bottom of the previous activity.


a
b = 27.4ft
82.3°
28.7°
B
A
c

Mini Labs: Absorption

LAB ONE

Predict what will happen to a stalk of celery when it is placed in the cup of colored water.

Place the stalk of celery into a cup with colored water. Observe the celery four times during the class period and record your observations here.

OBSERVATION 1 — 0 MINUTES	OBSERVATION 2 — ___ MINUTES
OBERVATION 3 — ___ MINUTES	OBSERVATION 4 — ___ MINUTES

You may have seen the celery demonstration before, showing how capillary action absorbs water through the plant. Dye allowed you to see the water moving.

THINK: The colored dye traveled with with the water. Why? Do plants also absorb any pollutants in the water? Explain if this beneficial or harmful to the environment.

Mini Labs: Color in a dish

LAB TWO

Predict what will happen when a few drops of colored water are left in the bottom of an open dish.

Place a few drops of colored water on the dish. Observe the colored water several times during the class period and record your observations here.

OBSERVATION 1 — 0 MINUTES	OBSERVATION 2 — ___ MINUTES
OBERVATION 3 — ___ MINUTES	OBSERVATION 4 — ___ MINUTES

Describe what happened to the water and the color. Why did it happen?

Mini Labs: Follow the flow

LAB THREE

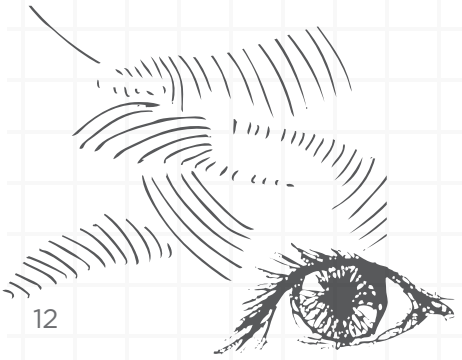
1. Crumple a sheet of paper and smooth it out only partially. *Be careful to leave some ridges to represent hills*.

2. Add various colors to the creases with the markers.

3. Place the paper in the pan and then gently spray some water onto the paper.

4. Watch what happens to the colors.

Record your observations here.

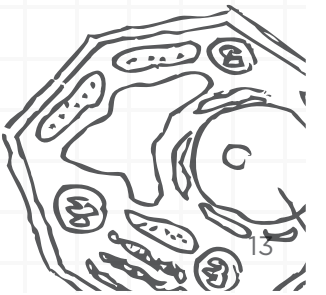


Mini Labs: Reflection

LAB FOUR

Now place the celery from LAB ONE into a plastic bag and tie it closed. Leave the bag in a warm spot overnight.

Record your observations here.



Green infrastructure

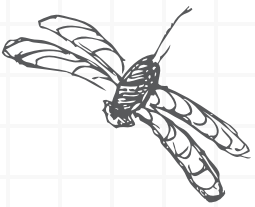
WHAT, WHY, AND HOW

What is green infrastructure? What does it do? Does it help the watershed? Well, you are about to find out!

Using the internet, research green infrastructure and water-absorbing plants. While you're working think about the questions below, and record your research findings in the graphic organizer on the opposite page.

1. How could we define the term green infrastructure?

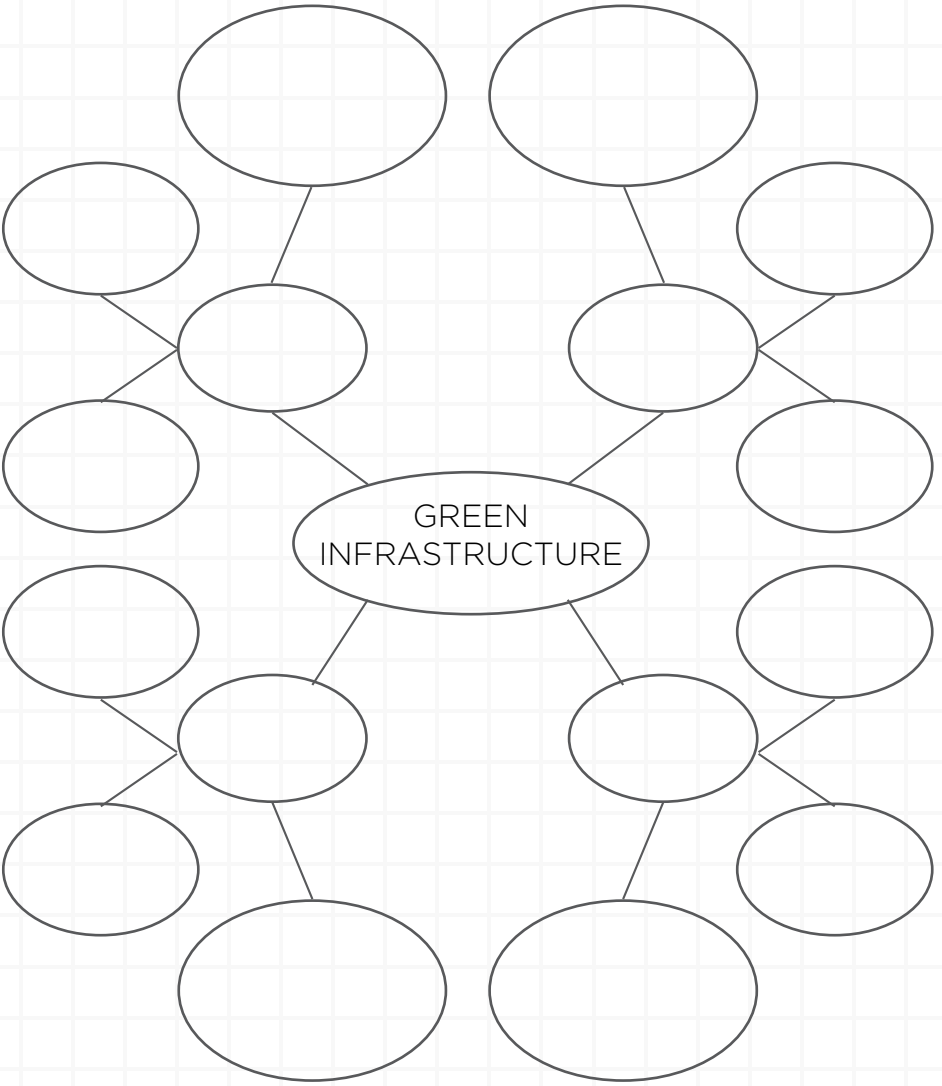
2. Where can we use green infrastructure?



3. Describe the benefits.

4. Are there disadvantages?

5. What types of plants work best to absorb the most water?



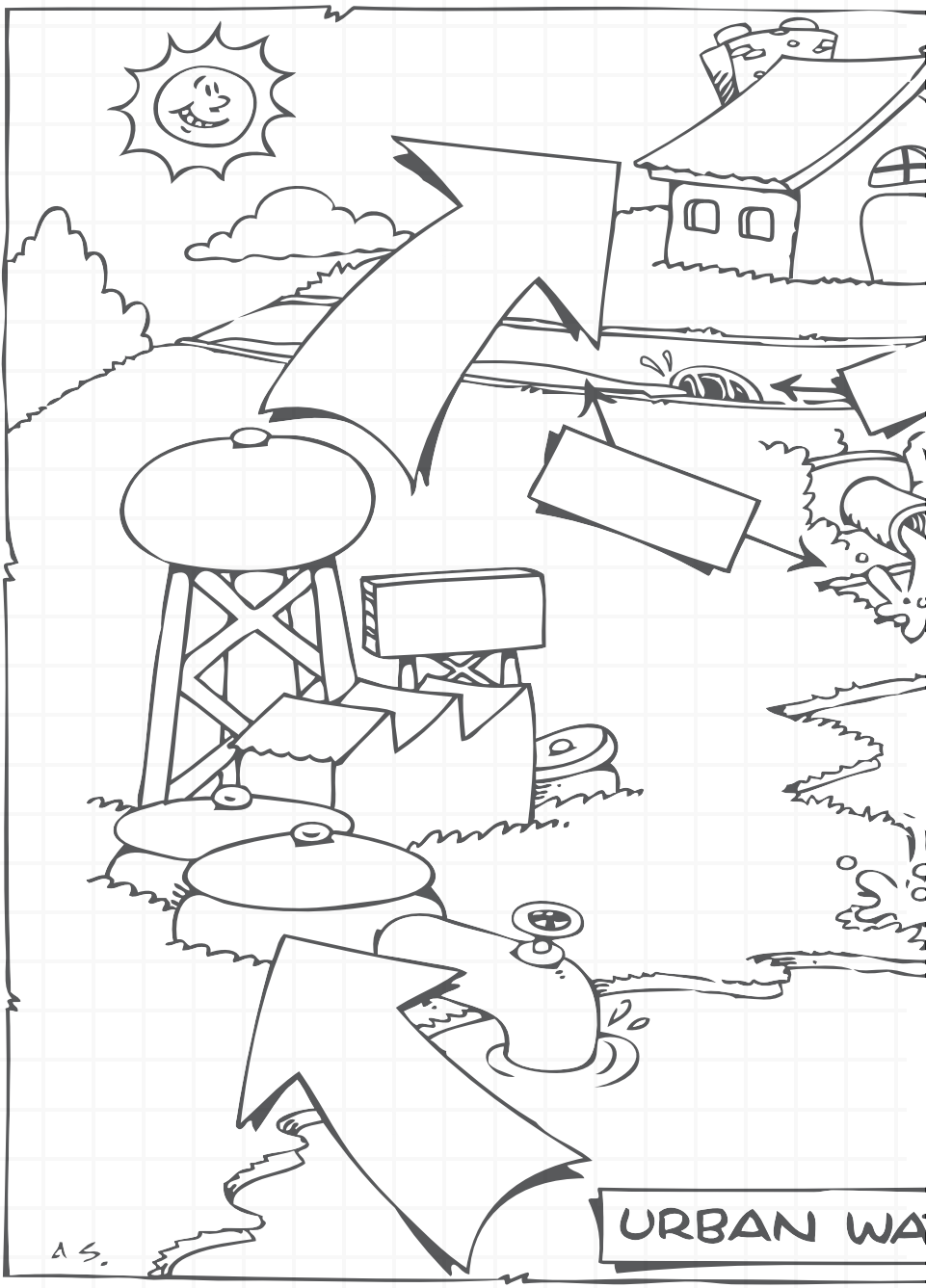
Green infrastructure

KNOWLEDGE AT WORK

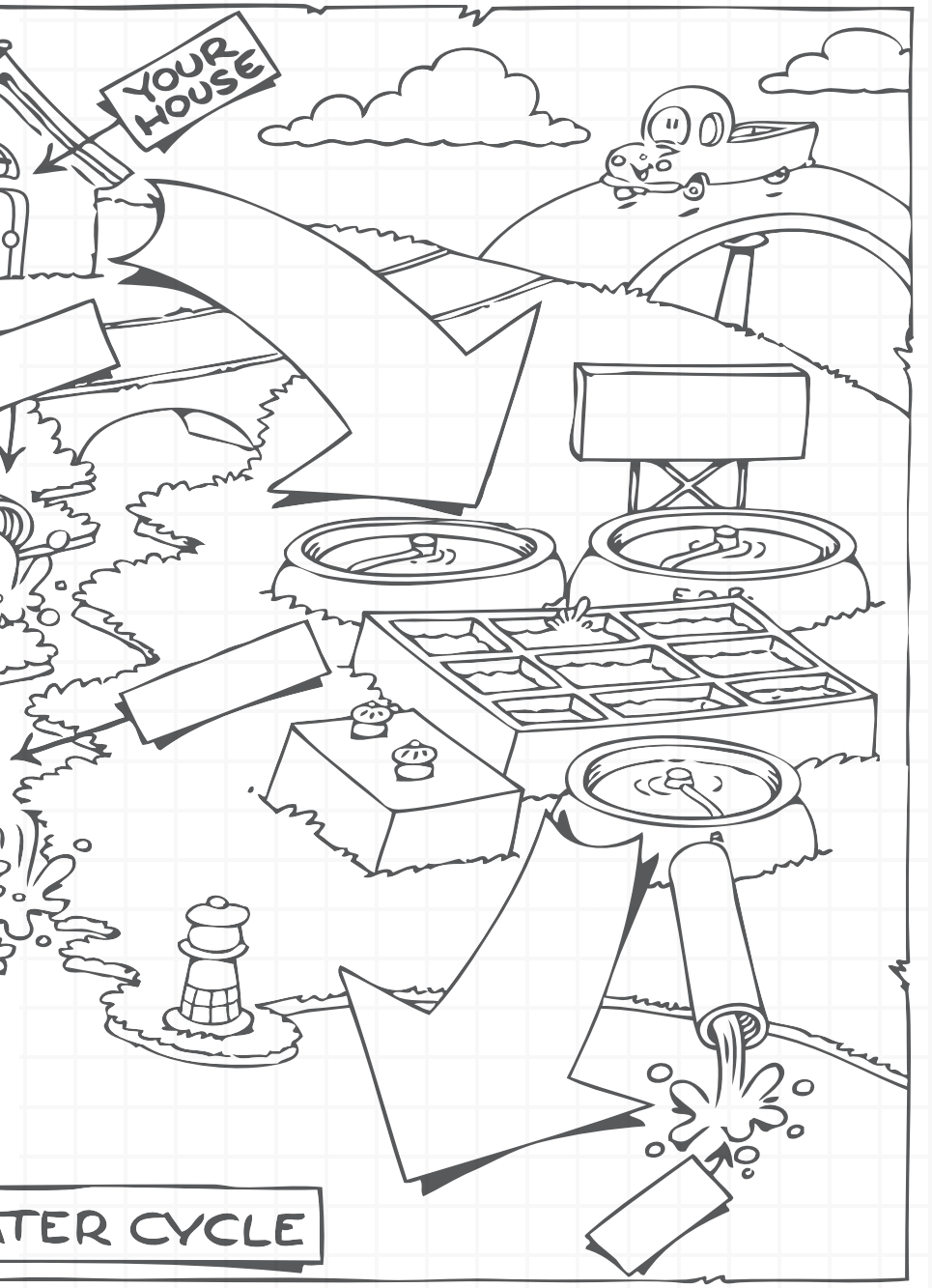
Using the information that you gathered, think about ways to incorporate **green infrastructure** into your school's parking lot. Write a letter to your principal with your ideas. Be sure to include why your plan would be good for the school and the environment.

The urban water cycle

HOW WATER MOVES IN NORTHEAST OHIO



How much of the water cycle do you remember? Fill in the picture below with as many words as you can remember!



How much is it? PART 2

MEASURING RAINFALL

Refer back to your measurements of your school parking lot from page 6. Now we know the area of the parking lot. So how much water falls on that parking lot each year?

According to the National Oceanic and Atmospheric Association, the average annual rainfall in Cleveland is 36.6 inches.

1. Convert 36.6 inches to match the unit of measurement you used on page 6.

2. To calculate the **volume**, multiply the lot's surface area by your answer above. Be sure to use the correct unit of measurement in your answer!

Non-verbal representation

Examples

WATER POLLUTION

Definition

Non-examples

POINT SOURCE

NON POINT SOURCE

Water distribution

ANALYZE AND DISCUSS

1. Analyze and conclude as to whether the distribution of water on Earth is fairly even.

2. Determine how much of the total water on Earth is available for human use.

3. Where is the majority of the freshwater located?

4. Justify the importance of protecting our freshwater supply from pollution.

5. Consider your ansewer to number 4. Is this an example of common good? Explain.

Glossary

TERMS FROM YOUR FIELD NOTEBOOK AND FOR CLASS DISCUSSION

A

Abiotic: Not associated with or derived from living organisms. Abiotic factors in an environment include such items as sunlight, temperature, wind patterns, and precipitation.

Atmosphere: The gaseous envelope surrounding the earth; the air.

B

Biotic:
1. Consisting of living organisms. An ecosystem is made up of a biotic community (all of the naturally occurring organisms within the system) together with the physical environment.

2. Associated with or derived from living organisms. The biotic factors in an environment include the organisms themselves as well as such items as predation, competition for food resources, and symbiotic relationships

C

Capillary action: Movement of water through very small spaces due to molecular forces called capillary forces.

Collection: Water that is sent to the water treatment system begins in collection.

Combined sewer overflow: Discharge of a mixture of storm water and domestic waste when the flow capacity of a sewer system is exceeded during rainstorms.

Condensation: The conversion of a gas to a liquid.

Condensation: When a gas turns into a liquid.

Conservation:
1. Protection of valued resources the prevention the management and care of natural resources.

2. Protection from change, the keeping or protecting of something from change, loss or damage.

Cuyahoga River: Located in Northeast Ohio in the United States. Outside of Ohio, the river is most famous for being "the river that caught fire" in 1969, helping to spur the environmental movement in the late 1960s and early 1970s. Native Americans called this winding water "Cuyahoga," which means "crooked river" in the Iroquois language.

Cycle(s)
1. Repeated sequence of events
2. Time between events
3. Complete process

E

Ecology: dealing with the relations and interactions between organisms and their environment, including other organisms.

Environment: all the external factors influencing the life and activities of people, plants, and animals.

Erosion: the process by which the surface of the earth is worn away by the action of water, glaciers, winds, waves, etc.

Evaporation: the process by which water is changed to gas or vapor; occurs directly from water surfaces and from the soil.

F

Filtration: Process by which water seeps into to ground.

Freshwater lakes: Naturally occurring water on the Earth's surface in ice sheets, ice caps, glaciers, bogs, ponds, lakes, rivers and streams, and underground as groundwater in aquifers and underground streams.

Freshwater: water found in rivers, lakes under the ground; fresh water is not salty and it is good to drink.

G

Gas: Matter that is neither liquid nor solid and expands or contracts rapidly and uniformly with temperature changes.

Glaciers: a large body of ice moving slowly down a slope or valley or spreading outward on a land surface.

Great Lakes: A group of five freshwater lakes of central North America between the United States and Canada, including Lakes Superior, Huron, Erie, Ontario, and Michigan. French traders first sighted the lakes in the early 17th century. Today the Great Lakes connect Midwestern ports with the Atlantic Ocean via the St. Lawrence Seaway.

Green infrastructure: Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, green infrastructure refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the scale of a neighborhood or site, green infrastructure refers to storm water management systems that mimic nature by soaking up and storing water.

Groundwater: The water beneath the surface of the ground, consisting largely of surface water that has seeped down: the source of water in springs and wells.

I

Ice Caps: An extensive dome-shaped or plate like perennial cover of ice and snow that spreads out from a center and covers a large area, especially of land.

Impervious: Not permitting penetration or passage, impenetrable.

Infiltration:
1. The penetration of water through the ground surface into sub-surface soil or the penetration of water from the soil into sewer or other pipes through defective joints, connections, or manhole walls.

2. The technique of applying large volumes of waste water to land to penetrate the surface and percolate through the underlying soil.

Investigation: A thorough inquiry intended to develop facts.

L

Lake: A body of fresh or salt water of considerable size, surrounded by land.

Lake Erie: forms Cleveland's northern boundary and is the most shallow and the southernmost of the five Great Lakes. A freshwater lake that provides transportation, employment, food, and recreation to residents of and visitors to Northeast Ohio.

Lake level: a measurement of the depth of water .

Liquid: Consisting of molecules that move easily, unlike those of a solid, but tend not to separate, as do those of a gas.

M

Matter: anything that has mass and takes up space.

N

Natural environment: Encompasses all living and non-living things occurring naturally on earth.

Natural resource: a naturally occurring material, e.g. coal or wood that can be exploited by people

Nonpoint sources: When rain and melting snow flow over the land, pollutants are picked up and carried away to Lake Erie via local streams and storm sewers. This run-off is called non-point source pollution because it enters our streams and storm sewers, not from a single, identifiable source, but from numerous sources spread over a large area.

Non-porous: not permeable to water, air, or other fluids. Not porous; especially not having vessels that appear as pores

P

Pervious: porous, penetrable

Pervious surface: designed to allow infiltration of stormwater through the surface into the soil below where the water is naturally filtered and pollutants are removed. Pervious pavement may include paving blocks, grid pervious concrete, or pervious asphalt pavers,.

pH: Measures the acidity of a solution. It is the negative log of the concentration of the hydrogen ions in a substance.

Point sources: water pollution coming from a single point, such as a sewage-outflow pipe.

Pollutants: Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

Pond: a body of water smaller than a lake, sometimes artificially formed, as by damming a stream.

Porous:
1. Full of or having pores;

2. Admitting the passage of gas or liquid through pores or interstices; and 3. Easily crossed or penetrated.

Precipitation: Liquid or solid water that falls to earth.

R

Recycle: to pass again through a series of changes or treatments.

Reservoir: A place where water is stored.

River: A large natural stream of water of fairly large size flowing in a definite course or channels or series of diverging and converging channels.

Runoff: that part of precipitation or snowmelt that appears in streams or surface-water bodies.

S

Saltwater: Water containing a large amount of salt, seawater.

Sanitary sewer: Relating to public health, especially general hygiene and the removal of human waste through the sewage system

Saturation: A state in which something is completely soaked with liquid (water)

Seas: The salt waters that cover the greater part of the earth's surface.

Sedimentation: The deposition or accumulation of sediments

Slope: To incline or slant upwards or downwards, as a hill.

Soil: The uppermost layer of the earth's surface; dirt.

Storm sewer: A sewer for carrying off rainfall drained from paved surfaces, roofs, etc.

Stormwater: any rainwater or melting snow or ice that flows over the surface of the land to the nearest sewers, lake or stream.

Stream: a steady current in water flowing in a channel or watercourse.

Surface water: All water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.)

T

Topographic maps: a map showing the relief features of the earth's surface, usu. by means of contour lines to show changes in elevation

Transpiration: to give off wastes from the surface in the form of vapor, as plants.

Tributary: a stream that flows to a large stream or other body of water.

Tributaries: The plural form of tributary.

W

Water cycle: The continuous movement of water on, above and below the surface of the Earth, including precipitation, condensation/transpiration, evaporation and collection.

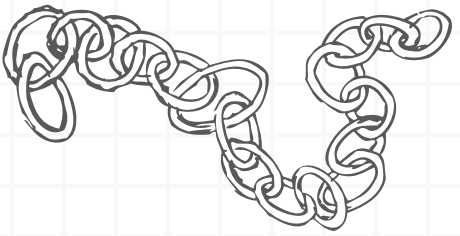
Water pollution: The addition of harmful chemicals to natural water. Sources of water pollution in the United States include industrial waste, run-off from fields treated with chemical fertilizers, and run-off from areas that have been mined.

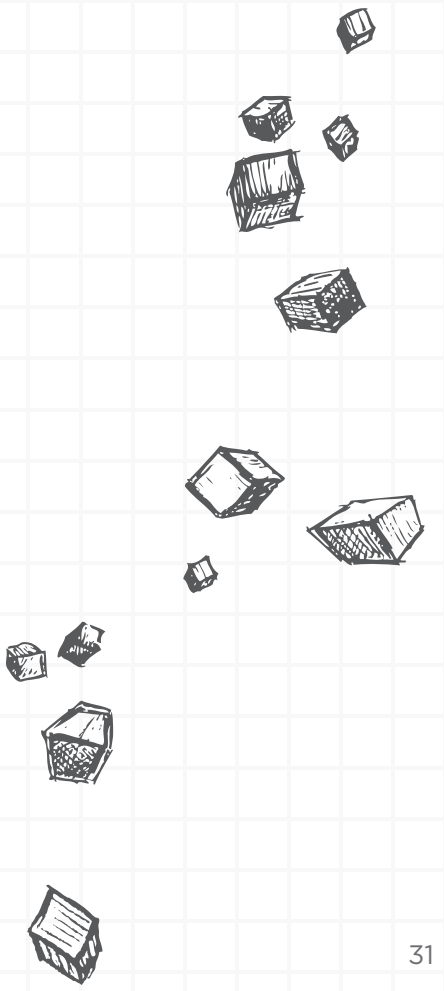
Watershed: The area of land that drains into a body of water.

Water table: The planar, underground surface beneath which Earth materials, as soil or rock, are saturated with water.

Wastewater: The sanitary sewage from homes and businesses as well as stormwater that enters the street sewers, streams and rivers.

Wetland: A marsh, swamp, or other area of land where the soil near the surface is saturated or covered with water, especially one that forms a habitat for wildlife.





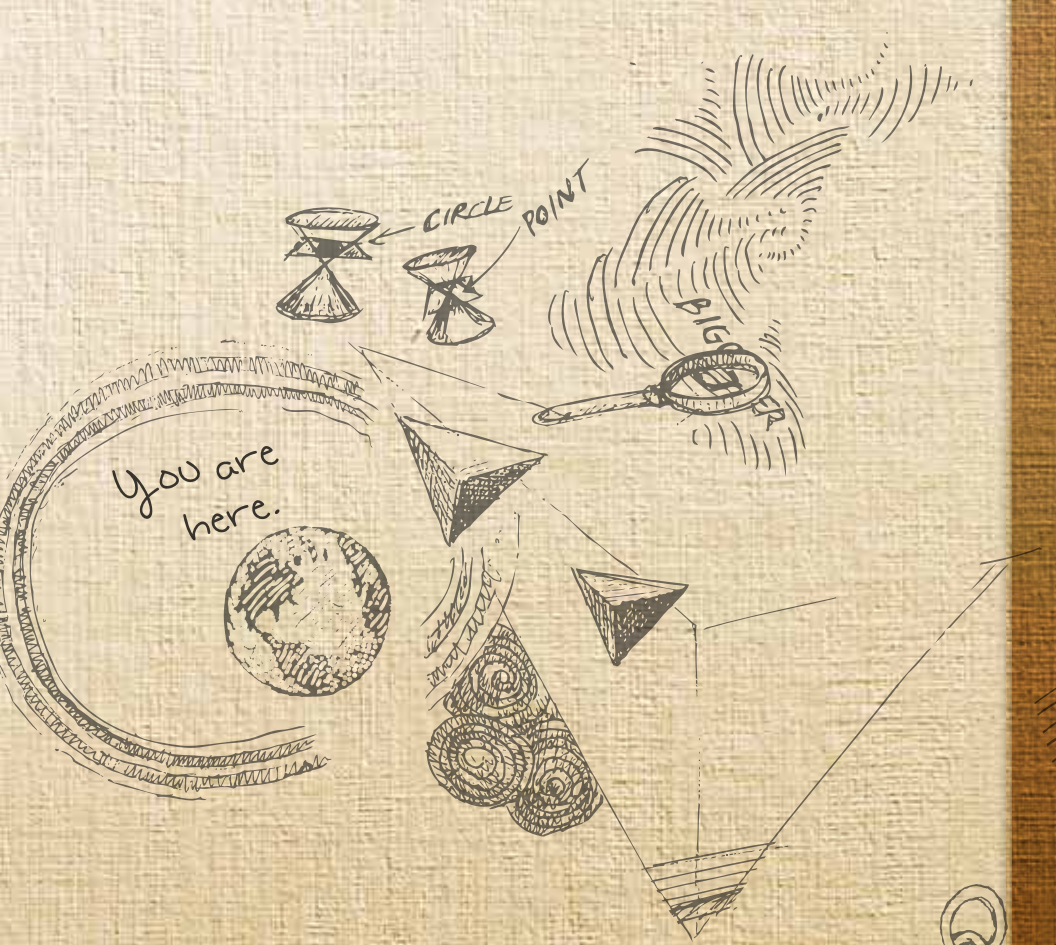
The Northeast Ohio Regional Sewer District leads effective wastewater and stormwater management to protect the health and environment of our region while enhancing quality of life.

We serve more than 60 communities and one million residents, and our three wastewater plants treat more than 200 million gallons of water every day.

ON THE WEB: neorsd.org

twitter.com/WallyWaterdrop

NORTHEAST OHIO REGIONAL SEWER DISTRICT
3900 Euclid Avenue, Cleveland, Ohio 44115 • (216) 881-6600



neorsd.org

Northeast Ohio Regional Sewer District

Your Sewer District... **Keeping our Great Lake great.**