

GREEN DESIGN SOLUTIONS

TEACHER'S GUIDE TO HANDOUTS

Handout #1, SITE

Preserve Open Land

- Ecology
- Biodiversity
- Erosion

Heat Islands

- Thermodynamics
- Physics
- Micro-climates

Sun Angles

- Solar System
- Global Geography
- Geometry (angles / shadows)

Prevailing Winds & Weather Patterns

- Meteorology
- Climatology

Water Conservation

- Biology
- Chemistry
- Physics

Handout #2, WATER

Cincinnati Water Works, Teacher Resource Center:
www.cincinnati-oh.gov/water/pages/-3329-/

Where does our water come from?

- Water Cycle
- Urban Systems
- Biology
- Ecology
- Climatology

Where does all the water go?

- Climatology
- Natural Systems
- Geology
- Man-Made systems
- Physics
- Engineering

Water-Mobile

- Balance
- Symmetry
- Form
- Manual Manipulation
- Physics

Working Water Cycle MODEL:
www.ucar.edu/learn/1_1_2_4t.htm

Handout #3, Energy

SUN physics

- geology
- observation
- experimentation
- communicating and evaluating through charts and graphs
- Passive energy sources
- thermodynamics

Solar Classroom Activities:

www.wattsonschoools.com

WIND passive systems

- harnessing for electricity
- Wind Power Article & Activities (from "Our Ohio.org") www.ouohio.org/food_fam/htmlff_2/hh06_wind.php

EARTH geothermal, earth as insulator

ACTIVITIES:

INTERIOR AIR CURRENTS

- observation
- physics of gasses

INSULATION

- thermodynamics
- hypothesis, observation, conclusion

MORE energy related activities at www.energyquest.ca.gov

Handout #4, Materials and Resources

Think Globally, Buy Locally

- manufacturing
- transportation
- conservation

MORE info: www.cradletocradlehome.com
The three R's — apply to buildings, too.

Handout #5, Indoor Environmental Quality

Clean Air — refer back to Handout #3, for Wind and air currents

- Biology
- Micro-pollutants
- mechanical vs. natural systems

Good Lighting

- biology
- physics
- electronic systems (light harvesting)

Sun Angles

- geography
- earth/space science

BONUS: VIDEO... Approximate 30° sun angle at NOON in Yukon, Canadian territory with "**Sun Dogs**" — have students research the phenomena and check out this video. (amazing!)
web.mac.com/sclimie/iWeb/Site/Sun%20Dogs%20November%202020,.html

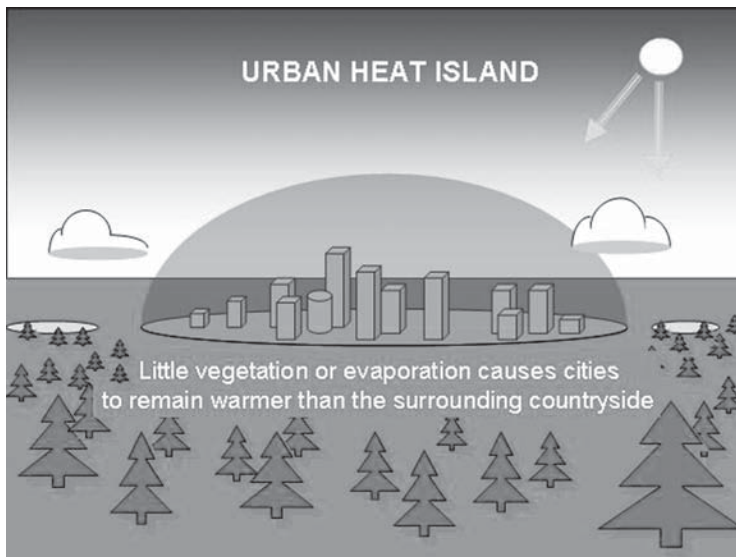
Quiet Spaces

- Acoustics
- Observation, evaluation
- 5 Senses

Other resources on sustainable development strategies:
www.sustainablenc.org/thewaytogo/main/index.htm

GREEN DESIGN SOLUTIONS

...► SITE



Open land

Un-paved, un-built areas where plants can grow, provide shade, and use rainwater.

Sun Angles

Stay Cool & Turn off Those Lights!

Topic: Energy Conservation / Orientation to the Sun

Assignment: Discuss the effects of the sun shining in the classroom or any room. On a sunny day in the afternoon, how does a room on the north side feel different then a room on the south side of your school or home? Why is this

the case? How is exposure to the sun different throughout the day? Explore three (3) ways to shade the classroom and discuss advantages and disadvantages of them. How can sunlight be used effectively? Discuss the use of daylight and how it can reduce the need for electric lighting.

Prevailing Winds & Weather Patterns

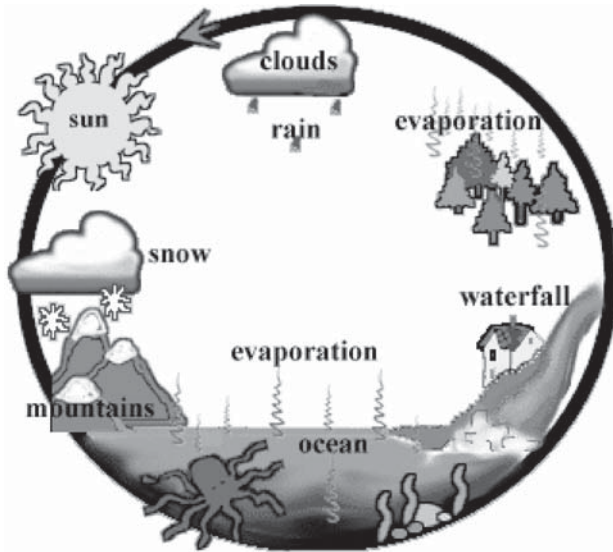


Which direction does our “next day’s” weather approach? In Cincinnati, our weather comes primarily from the West and Northwest. Track the weather pattern on your favorite news weather website for a period of time by printing the satellite images at regular intervals until you have 25 pictures. Create a flip-book of the images, and see the weather fly!

GREEN DESIGN SOLUTIONS

...► SITE

Water Conservation



Rain water flows into storm sewers and picks up contaminants on the ground along the way. Storm water in Cincinnati flows directly to our rivers, and is not treated like our drinking water is. Using water on a site rather than letting it flow away, and minimizing hard surfaces conserves our local, regional, and national waterways. Buildings can use rainwater to flush toilets, and to water landscaping.

Then there is **GRAYWATER**: Graywater is on-industrial (not from factories) wastewater generated from domestic processes such as washing dishes, doing laundry and taking a bath or shower. Every building makes Graywater, and is more than half of the water that goes down the drain in a house. Find ways you can use graywater in your project on your Ideas Form. HINT: "Wikipedia".



Green design solutions:

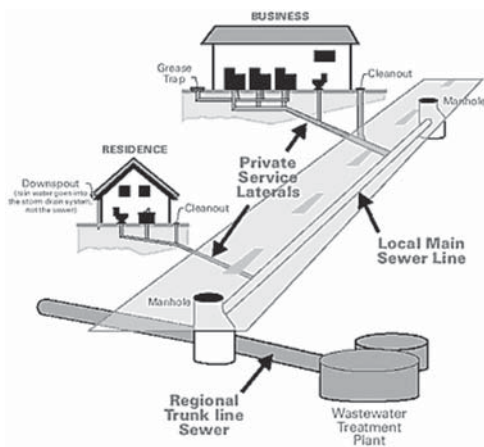
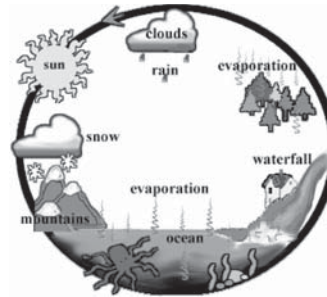
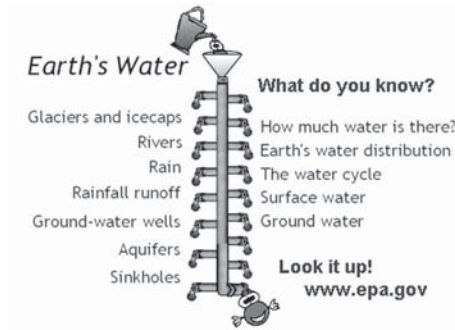
1. Compact buildings allow for more open outdoor space.
2. Balance buildings and hard surfaces with planted areas, and/or use green roofs.
3. Use all the rain that falls on your site.
4. Orient buildings to use natural daylight instead of electrical lights.
5. Shape and place buildings to minimize wind resistance (structures can be lighter if the wind is directed around them, making them cheaper to build).

GREEN DESIGN SOLUTIONS

WATER

Where does our water come from?

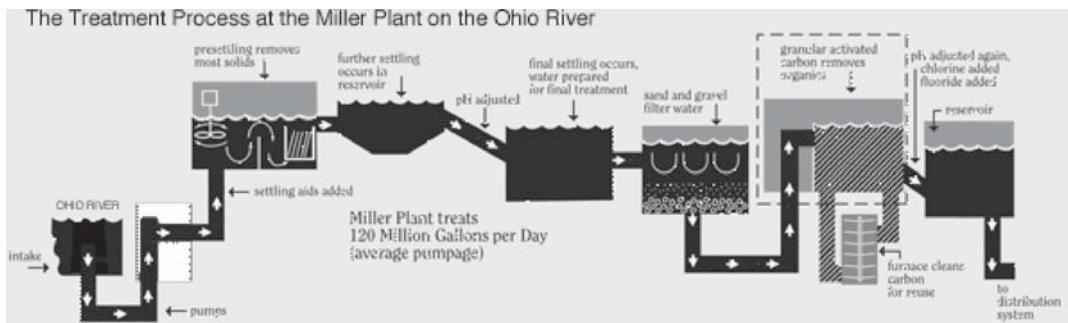
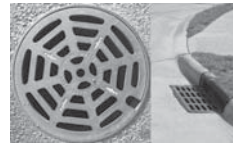
Ever wonder where the water comes from when you turn on the tap? In the Cincinnati Area served by Cincinnati Water Works, the water comes from two sources: the Ohio River and the Great Miami Aquifer.



Water we use goes into the sewer system.

The sewer system collects all drains (sinks, toilets, showers, floor drains) and leads the muck to the water treatment plant where it is cleaned and re-introduced into the drinking water system.

Water that hits the ground can soak in and become **GROUNDWATER**, or runs into streams that flow into rivers, that flow into the oceans.



Where does all the water go?
"All drains lead to the ocean, kid."
 — Finding Nemo

GREEN DESIGN SOLUTIONS

▶ WATER

Keep our earth's water clean

All water on the earth has always been on the earth in one form or another. If one point of the water system is polluted, the rest of the system suffers.

Here are some ways to help keep our water clean:

Keep chemicals and man-made liquids away from storm drains.

Use the water that falls on your property on your property rather than sending it down a drain. (irrigate landscaping or vegetable garden, make a pond or wetland garden)

Clean driveways and sidewalks regularly from oil and other pollutants. When rainwater falls on hard surfaces, it picks up pollutants before running into the soil or storm drains.

Green design solutions:

1. Collect rainwater from your building's roofs for irrigation and use within the building or on your site. Research GRAYWATER and how it can be used to reduce the amount of municipal (city) water your buildings use (and pay for).
2. Use rooftop pools of collected rainwater for cooling in summer
3. Use all the rainwater that falls on your site. Drain hard surface areas into landscape areas.

Visit www.epa.gov/kids/water.htm for interactive games about our earth's water system.

(Outdoor) Water Mobile

You can fill it with water, or hang them out in the rain, and voila! a gravity-powered fountain!

Supplies: plastic drinking cup (not styrofoam)
18+/- Glass or plastic beads, trinkets, doo-dads (they have to be able to get wet — remember, metal items will rust unless they're aluminum).
Thin wire or poly string / fishing line



!! no paper or paints ... it's meant to get wet !!

Prep-work:

1. Punch holes around the sides of the container, 6 equally spaced (+/-) about 1/4" from bottom, and 3 equally spaced holes 1/4 " from the top. Holes at the bottom should be twice as big as the string or wire to be used.
2. Cut three 30" long strings or wire for the 'mobile' parts to be attached to.
3. Cut three 12" long strings for the hanger pieces.

Project Steps

1. String the bottom holes, by pulling each of the three 30" strings through two adjacent holes, starting outside the cup. You should end up with six equally-long hanging strings from the bottom.
2. Arrange beads and doo-dads on each of 6 strings (number of major steps in the water cycle) Mount your items at different heights for visual interest, order, and pattern.
3. Tie the 12" strings to three points on the top of the container, and connect together evenly at the top, so the cup hangs level.
4. Test your mobile with water outside or over a bathtub.

Hang your mobile outside in a place where rainwater will fill it, and where the "runoff" can go into the soil.

GREEN DESIGN SOLUTIONS

► ENERGY

Power Sources and The Three Elements — an alternative [energy] band.

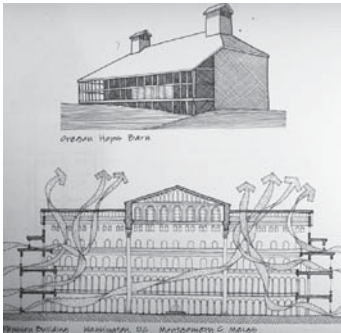
Lead singer: THE SUN — warms the earth and oceans. Is an integral part of the water system. Provides humans with Vitamin D and is essential for health and well-being. Without sunlight, people get sad and depressed!



» Green design solutions USING THE SUN:

- Use sunlight to gain heat in winter on sunny days — provide shades that operate to shield windows in summer to reduce air conditioning energy needs.
- Collect the sun's heat and transfer it through your building via a hot water system and/or use solar-heated water to reduce your hot water energy needs.
- Create electricity by using solar panels.

Guitar & Keyboard: WIND — As gentle as a soft breeze on a hot summer day or as violent as a category 5 hurricane uprooting trees and houses alike, the wind is a powerful force to be reckoned with. Wind exposes the passage of time as it pushes the clouds across the sky. Always in motion from the spinning of the earth and heated by the sun, wind carries our weather, aids natural pollination, supports birds on the wing and cools the earth.



» Green design solutions USING THE WIND:

- Wind turbines harness the wind's energy to generate electricity.
- Properly arranged interior spaces with operable louvers, windows and skylights can use local wind patterns to circulate air through a building, reducing the energy needed for mechanical air handling systems.
- Buildings (and the people within) need fresh air. If the same air re-circulates through a building for too long, bacteria, mold, dirt and dust particles become health hazards. Fresh air = happy, healthy people.

Drums and percussion: EARTH — the foundation for all human activity, the earth holds the sun's heat, and radiates it back to the atmosphere. Variations in the earth's crust create places for holding or transporting water, provides shelter and rooting space for its inhabitants and is the constant, common background to life as all humans know it.



» Green design solutions USING THE Earth:

- Geothermal systems use the natural stable warmth of the earth at 10 meters below the surface to heat a building in winter and cool it in summer.
- Thermal Mass — earth berms or homes built into the earth reduce the weather exposure of the home, allowing the interior to retain its heat in winter and stay cool in the summer.

GREEN DESIGN SOLUTIONS

ENERGY

Air Currents

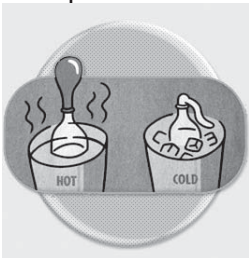


Air Moves! Really!

Example: Hot Air Balloon. 'nuff said, right? To make it go up, turn up the fire. To make it go down, keep the fire off. So what does that have to do with buildings? If hot air rises, in the summertime, to get rid of excess hot air from a building, open an upper floor window or a skylight. Rising hot air will “pull” itself out. This makes a vacuum. Open a low window to let cool air in, and voila! Fresh air circulation with no electric fans required.

EXPERIMENT...You're full of hot air!

(“bottles and balloons” reproduced from: www.nationalgeographic.com/ngkids)



You will need

Two deflated balloons
Two empty soda bottles
Two bowls or pails
Hot water
Ice cubes

1. Securely place deflated balloons over the tops of two empty soda bottles.
2. Put the bottles in two plastic bowls or pails.
3. Fill one container with hot water and one with ice cubes. Observe what happens.

HOW does it work??

The hot water heats the air in one bottle and the ice cools the air in the other. When air gets warm, it expands and rises, which inflates the balloon. Cool air contracts, causing the other balloon to shrink.

INSULATION — Do you really need that parka in August?

Buildings use insulation to keep the heat IN, in the winter time, and keep the heat OUT in the summer time. What kinds of materials are used to insulate buildings? Why?

EXPERIMENT: What materials make the best insulation??

(reproduced from www.energyquest.ca.gov/projects/)



You will need

Three of the following materials to test:
Down jacket Plastic foam
Leaves Gloves/mittens
Dirt Aluminum foil
Cotton sock Wool sock

Large piece of paper
FOUR small to medium glass jars with lids (baby food, salsa, spaghetti sauce)
Large board or tray to place all your items on.
A gallon jug of warm to hot water (don't scald yourself) from a sink.
A good thermometer
A note book and pencil

Step 1: On a page in the notebook, make a chart. Down the left side, list all of the different items you'll be testing, and create four columns across the top labeled 1, 2, 3, and control.

Step 2: Quickly fill all the jars with hot water from the jug.

Step 3: Measure the temperature of the water in each

jar then screw on the lid. Write down the temperature of each jar on your chart. They should all be the same temperature.

Step 4: Wrap or surround each of three jars with one of the materials, leaving one jar uncovered as a “control.” Place them all on the tray or board.

Step 5: Carry the board outside where it's colder, and let them sit for one hour.

Step 6: When the first hour is up, take off the materials, unscrew the lids and measure the temperature of the water in each jar. Write down the temperature in your notebook next to each item.

Step 7: Re-fill the jars with hot water, but this time leave the jars outside longer (one, two, three hours or more).

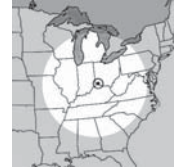
Step 8: Compare the differences between the temperatures of each of the jars. Which one(s) kept the water same temperature as before? What materials work better? Is there a point where none of the materials works to keep the jars hot?

GREEN DESIGN SOLUTIONS

► MATERIALS AND RESOURCES

Made in the USA / Made in Cincinnati — it's not just being patriotic or "home town proud"...

When we buy materials that are manufactured close to the project, we invest in our local economy and reduce transportation costs & energy in the form of gasoline. Less miles to travel, reduces the amount of carbon emissions from trucks and semis.



Cradle to Cradle

things that just keep on going.. and going...

You... Buy a can of soda at the store,
drink the soda,
and send the can out in the recycling bin.

At the recycling center...

cans are cleaned, crushed and bailed
bails are melted down and some new aluminum is added
molten aluminum is cast into INGOTS
ingots are pressed into long, thin sheets, rolled up and sent to the can manufacturer
aluminum sheets are made into cans
cans sent to the soda company, are filled and shipped to the grocery store.

You... buy a soda can at the store,...



Recycling **one** aluminum can saves enough energy to run a TV or computer for three hours!

Did you know: The last soda can you drank out of may contain aluminum from a can that someone drank out of in the 1960's ?



Not all recyclables are being recycled... Be on the lookout for containers that the recycling company in your area does not process. Not all materials that are labeled as "recyclable" can be re-made into "new" quality items. Some types of paper and plastics lose key properties once they've been through the system once, and one time through the recycling system, plastics usually end up as something that is not typically collected.. Glass and steel are the two materials which can be used over and over again.

GREEN DESIGN SOLUTION: Ask for and seek out items and materials that have a long life (as what they were intended to be) or, that are either 100% recyclable or biodegradable, that is, things that will never enter the landfill system, and/or will be come food for the earth or its creatures.

GREEN DESIGN SOLUTIONS

► INDOOR ENVIRONMENTAL QUALITY

Buildings shelter and provide spaces for human activity, so they must provide what humans need:

Clean Air



Air carries lots of things that can hurt people if concentrated. “Sick Building Syndrome” is partly caused by bad air circulation, and is when pollen, dust, bacteria, and other icky things get built up in the system and make people who spend time in the building sick.

By using special filters and sensors that measure toxins in the air, the fresh air that needs to be pulled into a building can be reduced. This makes the temperatures easier to maintain and so it takes less energy to heat and cool it.

Daylight

Turn off that light! Use sunshine to light spaces during the day - the tricky part is reducing glare that makes you want to close the blinds or shades.



THINK ABOUT IT

»»» On a sunny day, is it easier to see things around you with or without a baseball cap to shade your eyes? Why?

» GREEN DESIGN SOLUTION: Where there are windows that are in the sun most of the day, buildings need shading systems so the light can be used, but it isn't harsh or glaring. Exterior sun shades, fins, and operable louvers are some methods of shading. Deep overhangs (where the roof hangs way out like a baseball hat over the window areas) also do the job. Making large windows translucent, lets the sun light up the room without the heat and glare of direct sunlight.

Quiet Spaces



Loud spaces make it hard to hear people talk, and sometimes hard to hear yourself THINK! Noise from the air conditioner or furnace, echoes off of hard surfaces from activities in a room (ever notice how the bathroom is louder than your bedroom?) can be very distracting — especially in a classroom or office where people are trying to work!

When talking about how sound acts in a space, you're talking about acoustics.

GREEN DESIGN SOLUTIONS

▶ INDOOR ENVIRONMENTAL QUALITY

Healthy Materials



Ever walk into a room that's just been painted? Or sat in a brand new car? Or walked over a newly installed carpet? What do these things smell like? Did you know that new stuff doesn't have to stink? Many of the materials we use every day give off vapors into the air around them. It's not always harmful, but the less a new material smells bad, the better.

» GREEN DESIGN SOLUTION: Use materials that have No- or Low-VOC (Volatile Organic Compounds). Products that are Low-VOC release little to no vapors into the atmosphere. (Things that don't smell bad when they're new.) Hundreds of manufacturers are working to make their products healthier for humans and the environment.

Comfortable Temperatures



Spaces with controlled heat gain (sun shading), combining with natural ventilation & circulation, and digital heat and cooling controls are easier for the people inside to control and make comfortable to work in.

ACTIVITY: How much dirt is in YOUR air?

Ask your parents if you can help change the air filter in your home's furnace the next time it's due. (filters

should be changed monthly to reduce strain on the fans and save energy) Weigh the new filter before putting it in place. Weigh the old filter (with all the dirt and dust) before throwing it out. Since the filters themselves are probably the same size and manufacturer, the difference in weight will be the amount of dirt it has caught out of the air in you home. Divide the weight by the number of days since the last time the filter had been changed. How many ounces of dirt/dust were collected per day? Think about ways you can reduce the amount of dirt/dust in the air in your home.

