



United States Department of Agriculture

Agricultural Research Service

Hydraulic Engineering Research Unit: Impacting Engineering Practice in Support of Agriculture, Conservation, and the Environment



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Activity Book

Agricultural Research Service

The Agricultural Research Service (ARS) is the chief scientific in-house research agency in the U.S. Department of Agriculture (USDA). ARS finds solutions to agricultural problems that affect Americans every day from field to table. ARS has 750 research projects within 17 National Programs. ARS has 90+ research locations, including a few overseas laboratories.

The USDA-ARS Hydraulic Engineering Research Unit (HERU) is located in Stillwater, Oklahoma. The HERU provides research support to develop criteria for the design and analysis of safe, economical structures and channels for the conveyance, storage, disposal, and measurement of runoff water. Additionally, HERU scientists develop basic knowledge of the hydraulics of surface water flows for use in planning measures needed for environmentally appropriate control of runoff water and/or assessing the safety and efficiency of existing measures and determine the ability of vegetation, riprap, and /or various manufactured materials to protect hydraulic structures and channels from erosion.

For more information, contact:

USDA, Agricultural Research Service
Hydraulic Engineering Research Unit
1301 N. Western Rd.
Stillwater, OK 74075
Phone: 405-385-5476

<https://www.ars.usda.gov/plains-area/stillwater-ok/hydraulic-engineering-research/>

ARS Dam Safety Word Scramble Answer Key: 1) USDA, 2) Floodplain, 3) Rainfall, 4) Dam, 5) Irrigation, 6) Hydraulics, 7) Agriculture, 8) Flood control, 9) WindDAM, 10) Spillway, 11) Stepped Chute, 12) Dam Safety, 13) HERU, 14) ARS, 15) Watershed
Message: ARS for Dam Safety
ARS Hydraulic Engineering Research Unit Crossword Puzzle Challenge Answer Key: ACROSS – 1) Watershed, 5) ARS, 6) Conservation, 8) Spillway, 10) Agriculture, 12) Engineering, 14) Science, 15) Soil; DOWN – 2) Rehabilitate, 3) HERU, 4) Dams, 7) USDA, 9) Water, 11) Research, 13) Erosion, 16) Flood

Did you know.....

Since 1948, nearly 12,000 dams and associated conservation practices in more than 2,000 watershed projects encompassing 160 million acres in 47 states have been constructed as part of the USDA Small Watershed Program.

These projects have improved the quality of life and the environment in rural communities by protecting people's lives and property; conserving soil and water resources; reducing flooding; providing economic development, recreation, and rural and municipal water supplies; enhancing water quality; and improving wetlands and wildlife habitat. The estimated benefits provided exceed \$2.3 billion annually.

The USDA Small Watershed Program was created by the passage of the Flood Control Acts of 1936 and 1944 and expanded nationwide by the Watershed Protection and Flood Prevention Act of 1954.

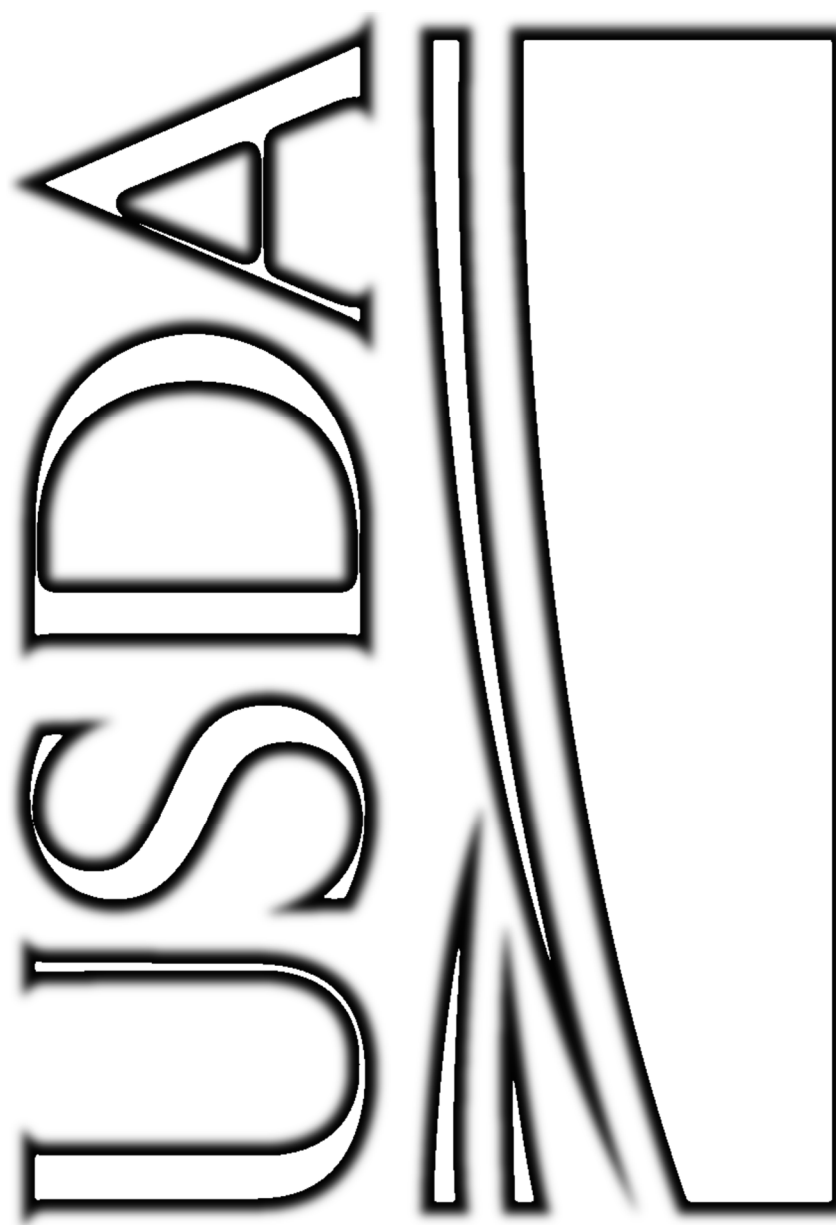
Scientists and engineers with the USDA-Agricultural Research Service (ARS) Hydraulic Engineering Research Unit (HERU) in partnership with the USDA-Natural Resources Conservation Service (NRCS) provide innovative research in engineering, hydraulics, hydrology, and soil mechanics in support of the USDA Small Watershed Program.

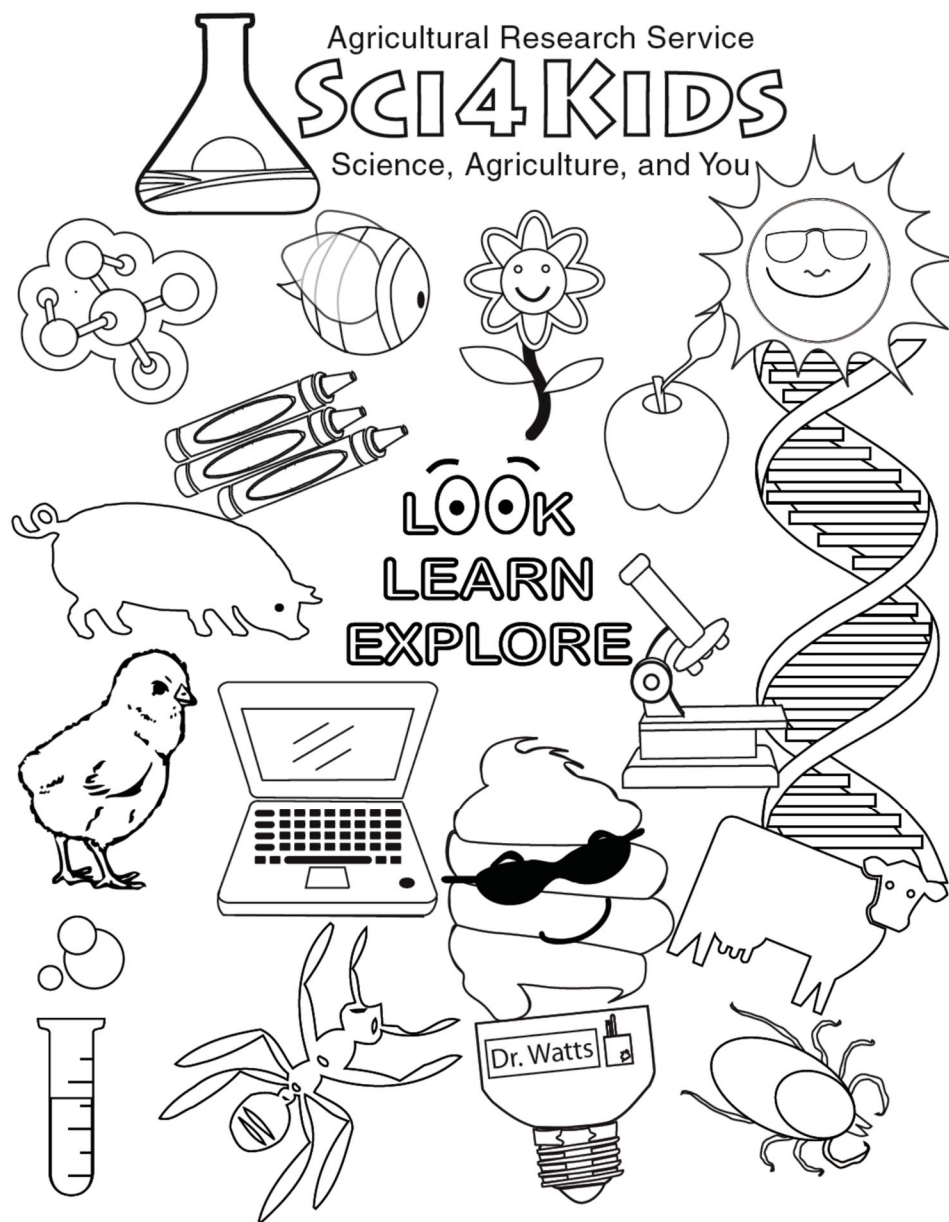
The USDA-ARS HERU in Stillwater, Oklahoma occupies approximately 100 acres of land adjacent to Lake Carl Blackwell and has been in continuous operation since 1940. Water is drawn inexpensively from the adjoining lake and is delivered by gravity through a network of channels and pipes to indoor and outdoor experiments.

The USDA Small Watershed Program was selected as a historic landmark by the American Society of Agricultural and Biological Engineers (ASABE) in 2011. This recognition honored the successful partnership between the USDA-ARS, USDA-NRCS, and local units of government like conservation districts and city/county governments.

The USDA-ARS HERU was recognized as a historic landmark by ASABE in 1990 for design concepts for vegetated channels.

USDA-ARS HERU scientists develop engineering tools like software, design standards, and soil testing equipment for designing and analyzing new and aging earthen dams and structures used for stabilizing streambeds and stream banks experiencing erosion.





WATER CONSERVATION TIPS FOR THE HOME

1. Watering your lawn and/or garden in the early morning before the sun is intense or during the evening after the sun has gone down helps reduce the water lost from evaporation.
2. Recycle rainwater for use by collecting rainwater from the downspouts of rain gutters. The collected water may be used to water the garden, flowers, or lawn. However, collected rainwater is not advised to drink.
3. Mulch or water retaining organic matter in the soil can reduce the amount of water needed to water the flower beds and/or garden.
4. Drought tolerant plants use less water, so be selective in your landscaping.
5. Check the alignment of your sprinklers; best to water the grass rather than sidewalks and streets.
6. Lawn mowers and weed eaters can damage sprinkler heads, so it is best to periodically check them for damage.
7. Adjust your watering schedule to the weather or season.
8. Water landscape only when needed. Watering too much and too frequently can result in weed growth and/or plant disease.
9. Check local watering conservation program mandatory watering schedules.
10. Washing dishes in the dishwasher uses less water than washing dishes by hand.
11. 1,000 gallons of water can be saved a month by running your washing machine and dishwasher when full.
12. Collect water you use for rinsing produce and reuse it to water houseplants.
13. Take shorter showers, and turn the water off while brushing your teeth.
14. Soak pots and pans instead of letting the water run while you scrape them clean.
15. If you accidentally drop an ice cube on the floor while filling your glass, don't throw it in the sink, but rather drop it in a house plant instead.

WATERSHED PROTECTION

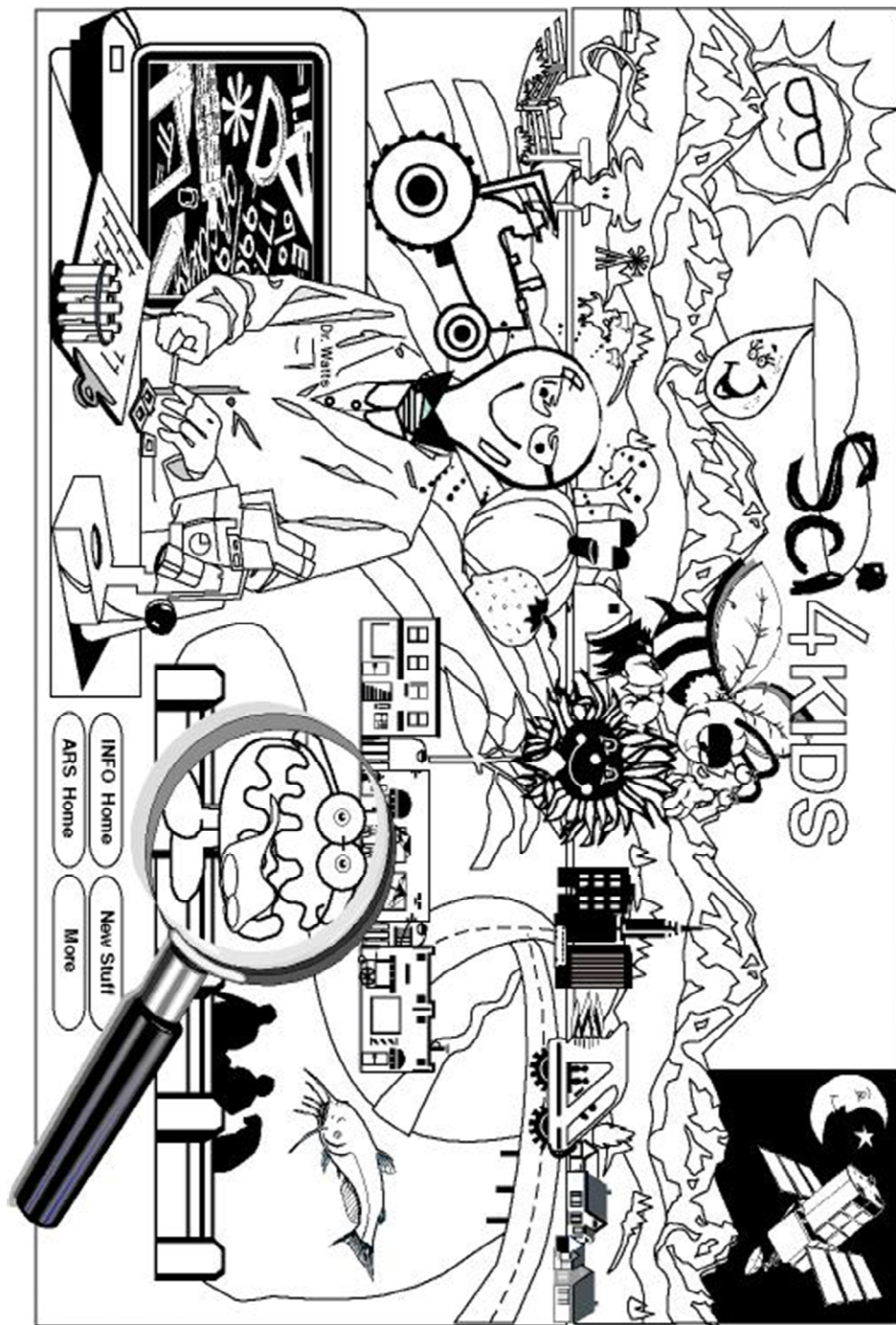
WORD FIND

C O N S E R V A T I O N P L H S M F Y
 I U K O R Y B D R I O V R E S E R Q A
 S T Y S T R E A M S P B W H G F R I R
 M B V E S N W I R R I G A T I O N U P
 A W F J O Y S E K A Z Q T J A D S U R
 D A G R I C U L T U R E E P L M E W O
 S D R P L S I T F C H S R A I N O L T
 Q N H E K X S D N O I T A R O P T V E
 C A F E S Y R E H A B I L I T A T E C
 W L L A K E T H P O C T B M T Q N S T
 Z T I E M H A S D R I N K I N G R G I
 S E F M G U B R D K O R B F C X C P O
 S W D U A L K E C O U A H K L Z S C N
 F L O O D T C T I H H S R U N O F F S
 Z R O B G H E A N O I S O R E Z T O N
 D M A N A G E W H Y D R A U L I C D K

FIND THE FOLLOWING WORDS. WORDS MAY BE FORWARDS,

BACKWARDS, UP, DOWN OR DIAGONAL.

USDA ARS NRCS WETLAND SOIL PROTECTION DAMS
 FLOOD WATER HERU CONSERVATION AGRICULTURE
 SAFETY IRRIGATION REHABILITATE RESEARCH DRINKING
 DROUGHT LAKE RUNOFF STREAMS MANAGE RESERVOIR
 CLIMATE RAIN WATERSHED HABITAT HYDRAULIC EROSION



ARS HERU WORD SCAMBLE

1 DUAS

HINT: United States Department of Agriculture

2 LAODFPIONL

HINT: Lowland which borders a river, usually dry but subject to flooding

3 ALFRILNA

HINT: Form of precipitation

4 MDA

HINT: Structure constructed for the purpose of impounding water

5 NOGTRIRAI

HINT: Benefit farmers gain from USDA small watershed dams

6 SDUHYLCASRI

HINT: Study of how fluids behave when in motion; may apply to flow of liquids in pipes, rivers, and channels.

7 GECAILUTRUR

HINT: The science or practice of farming, including cultivation of the soil to grow crops and to rear animals to provide food, wool, and other products

8 OLFOD TCORLON

HINT: The technique of trying to control rivers and/or tributaries with dams to minimize the occurrence of floods.

9 NWMDAI

HINT: Software for predicting embankment dam breach that was developed by HERU scientists in collaboration with NRCS engineers and Kansas State University

10 LSIWYALP

HINT: An outlet pipe or channel serving to discharge water from a dam

11 SPPTEDE CUTHE

HINT: Type of spillway over the top of dam typically made of roller compacted concrete

12 ADM FEATYS

HINT: State of keeping a water impoundment safe

13 RUEH

HINT: Hydraulic Engineering Research Unit

14 SAR

HINT: Agricultural Research Service

15 RTSDEWAHE

HINT: Area of land that contains a common set of streams and rivers that all drain into a single larger body of water, such as a larger river, a lake or an ocean.

Use the clues below to complete the crossword puzzle. You may use an internet search engine of your choice to assist you. Answer key is found at the bottom of page 13.

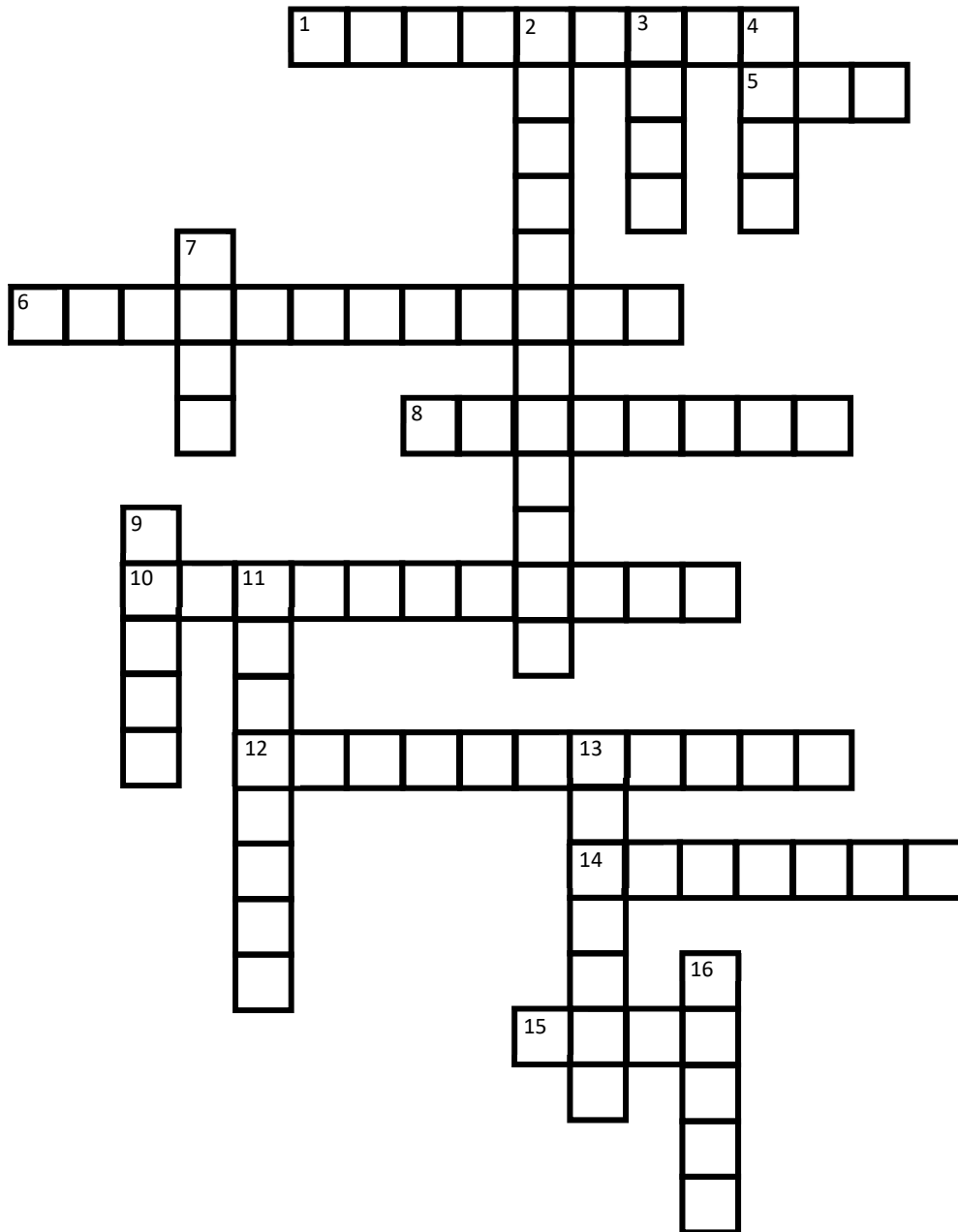
ACROSS

1. Area of land that contains a common set of streams and rivers that all drain into a single larger body of water, such as a larger river, a lake or an ocean.
5. Agricultural Research Service
6. Preservation, protection, or restoration of the natural environment, and of wildlife
8. An outlet pipe or channel serving to discharge water from a dam
10. The science or practice of farming, including cultivation of the soil to grow crops and to rear animals to provide food, wool, and other products
12. Scientific field and job that involves taking our scientific understanding of the natural world and using it to invent, design, and build things to solve problem and achieve practical goals
14. Field of study that deals with the natural world; for example, biology, physics and chemistry
15. Loose upper layer of the Earth's surface where plants grow

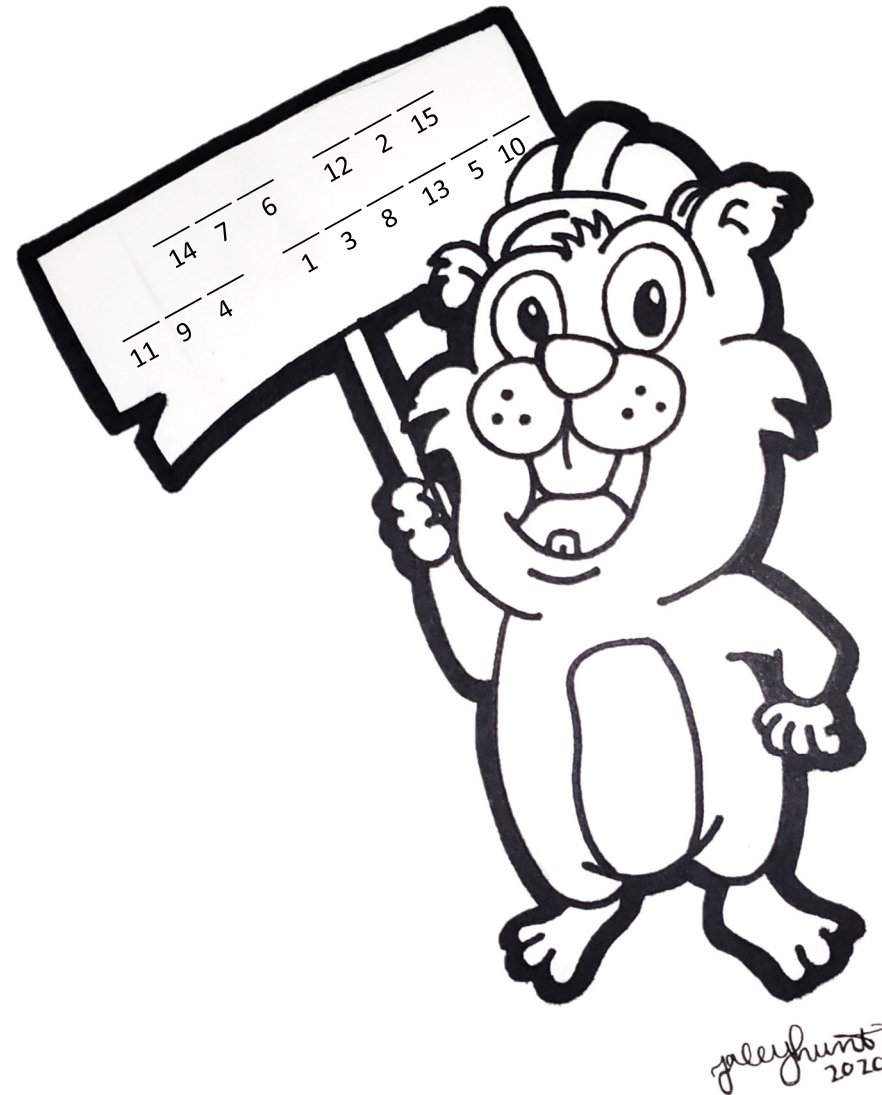
DOWN

2. Restore or bring back into good condition
3. Hydraulic Engineering Research Unit
4. Structures for the purpose of impounding water
7. United States Department of Agriculture
9. Covers almost 75% of the Earth's surface in the form of streams, rivers, lakes, and oceans.
11. Investigation or experimentation aimed at the discovery and interpretation of facts.
13. Process where natural forces like water, wind, ice, and gravity wear away rocks and soil.
16. Temporary overflow of lands that are normally dry

ARS HERU CROSSWORD PUZZLE CHALLENGE



Unscramble the HERU related words to the left. You may use an internet search engine of your choice to assist you. Then match the highlighted letter from each word with the correct numbered line below to spell out the message. Answer key is found at the bottom of page 13.



Artwork by Jaley Hunt, 8th grade student
Summit Middle School Edmond, OK

Painting with Soil

Procedures developed by Janis Lang
USDA-NRCS National Soil Survey Center
Lincoln, Nebraska

Teaching Objective:

“To have fun and to gain a deeper appreciation of soils – one of our most important natural resources.”

Introduction:

Soils are one of the most important natural resources. They also are important for the beauty their many colors add to our landscapes. Most of us overlook this natural beauty because we see it every day. Often these colors blend with vegetation, sky, water, etc. Soil colors serve as pigments in bricks, pottery, and artwork. The color and texture of soil painting is fascinating and a creative opportunity for all ages of students.

Materials:

Soil (dried in air) Hammer/mallet Paper cup (4 oz.)

Pencils Masking tape Sponges and rags

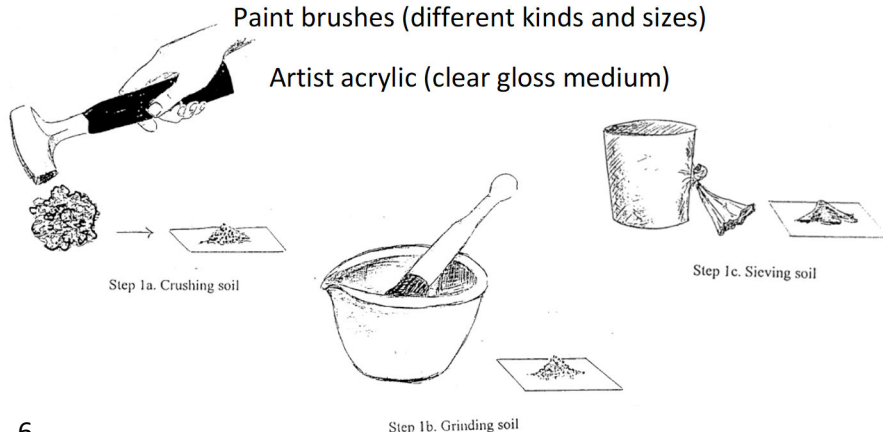
Knee high hose Water color paper

Mortar and pestle (rubber-tipped)

Ink pens (black, different tip sizes)

Paint brushes (different kinds and sizes)

Artist acrylic (clear gloss medium)



Procedures:

Soils

1. Gather many colors of soil.
2. Place dried soil on a piece of paper and crush into pieces with hammer or mallet. (Figure Step 1a)
3. Place some of the crushed soil into a mortar. Use a rubber-tipped pestle to crush the soil into a fine powder. Repeat to crush all of the different colored soils. (Figure Step 1b).
4. Place some powdered soil in a paper cup. Wrap a knee high hose over the top 2 or 3 times. Turn cup upside down over a piece of paper and gently shake out finely powdered soil. (Figure Step 1c)
5. Place the different soils in paper cups – notice the colors and textures.



Artwork by Janis Lang

Artwork

1. Lightly sketch artwork on water color paper with pencil. When satisfied with composition use ink for permanent lines.
2. With masking tape, carefully tape paper edges to table or board. This is done so that the artwork will dry flat.
3. Pour small amount of artist acrylic in small paper cups. Add small amounts of finely powdered soil. You may also want to add a few drops of water to the soil mix.
4. Experiment with depth of color and mixing the different soils.
5. Use different sizes and kinds of paint brushes, sponges, and rags. Experiment and have fun.
6. Layering the colors. When your artwork is dry you may want to apply another layer of soil paint.
7. You may want to use a black ink pen to make finishing touches on your artwork.

Activity Time:

The estimated time is about 1 to 2 hours.