

Middle School Lesson Plan #1

GRADE(S): 6th, 7th, 8th

TOPIC: Watershed Management

TITLE: Just What IS a Watershed?

OVERVIEW: The student will observe the elements of a local watershed and begin to develop an appreciation for the need to protect watersheds as valuable resources. The student will observe the interdependence of a variety of factors on a watershed. These factors include local geology, the ecology of the watershed, and the effect of man's influence.

TEXAS ESSENTIAL KNOWLEDGE AND SKILLS:

Science, 6th Grade

(a) Introduction

(2) As students learn science skills, they identify components of the solar system including the Sun, planets, moon, and asteroids and learn how seasons and the length of the day are caused by the tilt and rotation of the Earth as it orbits the Sun. Students investigate the rock cycle and identify sources of water in a watershed. In addition, students identify changes in objects including position, direction and speed when acted upon by force.

(b) Knowledge and Skills

(6.1) Scientific processes. The student conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:

(A) demonstrate safe practice during field and laboratory investigations

(6.2) Scientific processes. The student uses scientific methods during field and laboratory investigations. The student is expected to:

(B) collect data by observing and measuring

(C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence

(D) communicate valid conclusions

(E) construct graphs, tables, maps, and charts using tools including computers to organize, examine, and evaluate data

(6.14) Science concepts. The student knows the structures and functions of Earth systems. The student is expected to:

(B) identify relationships between groundwater and surface water in a watershed

Mathematics, 6th Grade

(b) Knowledge and Skills

(6.11) Understanding processes and mathematical tools. The student applies Grade 6 mathematics to solve problems connected to everyday experiences, investigations in other disciplines and activities in and outside of school. The student is expected to:

(A) identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics

(C) select or develop an appropriate problem-solving strategy from a variety of different types, including drawing a picture, looking for a pattern, systematic guessing and checking, acting it out, making a table, working a simpler problem, or working backwards to solve a problem

(6.12) Understanding processes and mathematical tools. The student communicates about Grade 6 mathematics through informal and mathematical language, representations, and models. The student is expected to:

(A) communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models

Social Studies, 6th Grade

(b) Knowledge and Skills

(6.6) Geography. The student understands the impact of physical processes on patterns in the environment. The student is expected to:

(B) describe and explain the physical processes that produce renewable and nonrenewable natural resources such as fossil fuels, fertile soils, and timber

(C) analyze the effects of physical processes and the physical environment on humans.

(6.7) Geography. The student understands the impact of interactions between people and the physical environment on the development of places and regions.

The student is expected to:

(B) identify and analyze ways people have modified the physical environment

(6.22) Social studies skills. The student communicates in written, oral, and visual forms. The student is expected to:

(B) incorporate main and supporting ideas in verbal and written communication

(C) express ideas orally based on research and experiences

(D) create written and visual material such as journal entries, reports, graphic organizers, outlines, and bibliographies

(E) use standard grammar, spelling, sentence structure, and punctuation

Science, 7th Grade

(b) Knowledge and Skills

(7.1) Scientific processes. The student conducts field and laboratory

investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:

- (A) demonstrate safe practice during field and laboratory investigations
- (7.2) Scientific processes. The student uses scientific methods during field and laboratory investigations. The student is expected to:
- (B) collect data by observing and measuring
 - (C) organize, analyze, make inferences, and predict trends from direct and indirect evidence;
 - (D) communicate valid conclusions
 - (E) construct graphs, tables, maps, and charts using tools including computers to organize, examine, and evaluate data
- (7.12) Science Concepts. The student knows that there is a relationship between organisms and the environment. The student is expected to:
- (A) identify components of an ecosystem
- (7.14) Science Concepts. The student knows that natural events and human activity can alter Earth systems. The student is expected to:
- (C) make inferences and draw conclusions about effects of human activity on Earth's renewable, nonrenewable, and inexhaustible resources

Mathematics, 7th Grade

(b) Knowledge and Skills

- (7.7) Geometry and spatial reasoning. The student uses coordinate geometry to describe a location on a plane. The student is expected to:
- (A) locate and name points on a coordinate plane using ordered pairs of integers
- (7.9) Measurement. The student solves application problems involving estimation and measurement. The student is expected to estimate measurements and solve application problems involving length (including perimeter and circumference), area, and volume.
- (7.13) Understanding processes and mathematical tools. The student applies Grade 7 mathematics to solve problems connected to everyday experiences, investigations in other disciplines and activities in and outside of school. The student is expected to:
- (A) identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics

Social Studies, 7th Grade

(b) Knowledge and Skills

- (7.10) Geography. The student understands the effects of the interaction between humans and the environment in Texas during the 19th and 20th centuries. The student is expected to:
- (A) identify ways in which Texans have adapted to and modified the environment and analyze the consequences of the modifications
- (7.21) Social studies skills. The student applies critical-thinking skills to organize and use information acquired from a variety of sources including electronic technology. The student is expected to:

- (A) differentiate between, locate, and use primary and secondary sources such as computer software, databases, media and news services, biographies, interviews, and artifacts to acquire information about Texas
- (7.22) Social studies skills. The student communicates in written, oral, and visual forms. The student is expected to:
 - (B) use standard grammar, spelling, sentence structure, and punctuation
 - (D) create written, oral, and visual presentations of social studies information

Science, 8th Grade

(b) Knowledge and Skills

- (8.1) Scientific processes. The student conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:
 - (A) demonstrate safe practice during field and laboratory investigations
- (8.2) Scientific processes. The student uses scientific methods during field and laboratory investigations. The student is expected to:
 - (B) collect data by observing and measuring
 - (C) organize, analyze, evaluate, make inferences, and predict trends from direct and indirect evidence;
 - (D) communicate valid conclusions
 - (E) construct graphs, tables, maps, and charts using tools including computers to organize, examine, and evaluate data
- (8.6) Science concepts. The student knows that interdependence occurs among living systems. The student is expected to:
 - (C) describe interactions within ecosystems

Mathematics, 8th Grade

(b) Knowledge and Skills

- (8.14) Understanding processes and mathematical tools. The student applies Grade 8 mathematics to solve problems connected to everyday experiences, investigations in other disciplines and activities in and outside of school. The student is expected to:
 - (A) identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics
 - (C) select or develop an appropriate problem-solving strategy from a variety of different types, including drawing a picture, looking for a pattern, systematic guessing and checking, acting it out, making a table, working a simpler problem, or working backwards to solve a problem
- (8.15) Understanding processes and mathematical tools. The student communicates about Grade 8 mathematics through informal and language, representations, and models. The student is expected to:
 - (A) communicate mathematical ideas using language, efficient tools, appropriate units, physical, or algebraic mathematical models

Social Studies, 8th Grade

(b) Knowledge and Skills

(8.30) Social studies skills. The student applies critical-thinking skills to organize and use information acquired from a variety of sources including electronic technology. The student is expected to:

(C) organize and interpret information from outlines, reports, databases, and visuals including graphs, charts, timelines, and maps

RELATED ESSENTIAL KNOWLEDGE AND SKILL:

English Language Arts and Reading, 6th Grade

(b) Knowledge and Skills

(6.15) Writing/purposes. The student writes for a variety of audiences and purposes and in a variety of forms. The student is expected to:

(A) write to express , discover, record, develop, reflect on ideas, and to problem solve (4-8)

(C) write to inform such as to explain, describe, report, and narrate (4-8)

English Language Arts and Reading, 7th Grade

(b) Knowledge and Skills

(7.15) Writing/purposes. The student writes for a variety of audiences and purposes and in a variety of forms. The student is expected to:

(A) write to express , discover, record, develop, reflect on ideas, and to problem solve (4-8)

(C) write to inform such as to explain, describe, report, and narrate (4-8)

English Language Arts and Reading, 8th Grade

(b) Knowledge and Skills

(8.15) Writing/purposes. The student writes for a variety of audiences and purposes and in a variety of forms. The student is expected to:

(A) write to express , discover, record, develop, reflect on ideas, and to problem solve (4-8)

(C) write to inform such as to explain, describe, report, and narrate (4-8)

DID YOU KNOW?

Activities in watersheds are having an important effect on water resources. Everything that occurs in a watershed contributes to the availability of the water used daily, whether it be for drinking/cooking, for swimming/boating, or in manufacturing. Understanding the processes that occur in a watershed can help each student understand the need to protect watersheds as a valuable resources. Terms often encountered when studying a watershed include:

watershed - defined by EPA as a geographic area in which, sediments, and dissolved materials drain into a common outlet.

pollutant - material or substance that is unwanted and can cause contaminated impure air, water and/or soil.

point source pollution - condition where an unwanted material or substance enters the environment (air, water and/or soil) from a single, discrete point such as a pipe.

non point source pollution - unwanted material or substance(s) that enter the environment (air, water and/or soil) from an general area and not a discrete or designated point, often carried by runoff or groundwater seepage into water sources.

hydrologic cycle - the cyclic pathway water follows in nature from rainfall and other forms of precipitation through use and discharge back into environment to evaporation/transpiration and condensation back to precipitation.

ecosystem - the plants and animals that live in a given area and their relationships to each other and the water, air, and soil in that area.

erosion - soil moved away from the original location by wind or water action.

intermittent stream - a stream that contains water only part of the time. (Common in areas with low rain fall averages).

LEARNING EXPERIENCE:

GENERAL TIME FRAME: 5-7 hours depending on length of field trip and student responses.

Description: Students will visit a watershed area surrounding a local creek, stream, pond, or reservoir and identify components of the watershed ecosystem as well geological features. Students will record observations and write a short report about the watershed area visited. The report is to include the effect (or possible effect) of man's activities on the watershed.

Time Frame: 2-4 hour field trip plus three 45-minute periods

Materials:

1. Data on the last rain event including duration, location, and amount
2. Topographic maps of watershed and surrounding area
3. Forms for recording data and observations during the visit to the watershed
4. Disposable cameras (optional) - 1 for every 2 or 3 students
5. Meter stick

Advanced Preparation:

1. Determine the watershed area to be visited. Check with the district science coordinator, district environmental center (if one exists), and/or local nature museums or clubs for suggestions.
2. Arrange for access to the watershed area during the anticipated date and time of the field trip. Have alternative days and/or times planned should it become necessary.
3. Arrange for transportation.
4. Determine whether or not the field trip will extend into lunch and plan for sack lunches, etc.
5. Make sure all permission slips are returned and are signed by a parent or guardian before the field trip. Follow all other school/district requirements for field trips including the provision for additional adults to accompany the students.

Procedure:

Before the field trip

1. Divide students into teams of 2 or 3 individuals.
2. Go over safety procedures.
3. Use a meter stick to determine the length of each student's stride. This information will be used by the students as a method of measuring or estimating distances.
4. Review the hydrologic cycle with an emphasis on the recycling of water by nature.
5. Discuss the last rain event - how long ago, how much rainfall was received, and how that information could influence what is seen during the visit to the watershed.
6. Discuss the possible effects of point source and non-point source pollution on the watershed.
7. Discuss/review how to read a topographic map.
8. Review procedures on how to record data and observations in an orderly manner.
9. Remind students to wear appropriate clothing and shoes for the field trip.
10. Make sure all permission slips have been returned and are signed by a parent or guardian.

During the field trip students should record the following information. (Photographs often help in describing what was seen.)

1. Descriptions of types of plants observed, the occurrence (rare, occasional, common) of each plant or plant type, and where each plant or plant type was encountered (in the water or approximate distance from the stream, creek, lake, etc.).
2. Descriptions of any animals observed, how many seen, and where they were encountered (approximate distance for the stream, creek, lake, etc.).

3. Descriptions and approximate numbers of any fish observed.
4. Evidence of other animals - footprints, etc.
5. General type of geology observed in the area.
6. Color of soil and rocks.
7. Location of any standing water (particularly after a rain).
8. A description of the stream or creek bed including type of sides and whether the stream was shallow or wide.
9. A description of water clarity - was the water surface green, foam on the surface, an oily sheen on the surface, the water cloudy or clear?
10. If the bottom of the water can be seen, what covered the bottom of the stream/creek bed or lake shore - gravel, small rocks, large rocks, mud/silt, solid rock, or a combination of any of these materials.
11. Whether or not the water had an odor - if so, attempt to describe the odor.
12. Whether or not any trash or debris was seen in or near the water along with a description of the trash or debris.
13. Whether or not there are any pipes or openings that put water or other substances directly into the water.
14. A description of water movement - was the water gently flowing, were any pools seen, was the water barely moving or not moving at all (stagnant), was the water rushing pass (rapids)?

After the field trip

Using the information gathered on the field trip, each student or group of students will write a short report which covers the following information:

- a. A description what was observed during the visit to the watershed.
- b. A map of the area showing the location of the watershed.
- c. Ideas about sources of any pollution (trash and/or debris) observed.
- d. Ideas of ways the watershed could be protected to maintain it as a water resource.

Teacher Talk:

Water is a valuable natural resource needed for different activities. The activities include residential/ residential, recreational, and agricultural use as well as use in manufacturing, mining, and electric power generation. As the demand on Texas available water supplies grows, the need to protect existing water resources - in addition to conservation, recycling/reuse, and the development of new water resources - becomes increasingly important. Watersheds contribute to both surface and ground water supplies. They are important water resources in meeting the ever increasing demand for water.

Teacher Questions	Possible Replies
1. Why is it important to maintain the ground cover in a watershed?	1. Student answers will vary. Example: Maintaining the ground cover reduces possible erosion of the soil thereby preventing

Teacher Questions	Possible Replies
	increased run-off with the result of less water going through the soil to the groundwater.
2. Why is it important to protect a watershed as a water resource?	2. Watersheds allow streams, creeks, ponds, lakes, etc. to be refilled with rain water. Watersheds also allow some of the water to be stored as ground water under ground.
3. What are some ways of protecting a watershed?	3. Student answers will vary. Examples of possible replies include keeping the ground cover in place, preventing dumping of trash or debris, and avoiding the discharge of harmful substances (pollutants) in the watershed.

RESOURCES:

Literature on water conservation by the Texas Water Development Board. View and order currently available brochures at <http://www.twdb.state.tx.us/assistance/conservation/pubs.htm>, contact Patsy Waters at patsy.waters@twdb.state.tx.us, fax an order form to (512) 936-0812, call (512) 463-7955, or write to:

Conservation
Texas Water Development Board
P.O. Box 13231
Austin, Texas 78711-3231

Maps of Texas River Basins, Aquifers, and Regional Reservoir Basin Maps are available on TWDB's website at <http://www.twdb.state.tx.us/mapping/index.htm>

State of Texas Water Quality Inventory by the Texas Commission on Environmental Quality: <http://www.tnrcc.state.tx.us/water/quality/>

Lesson plans and literature on water quality is also available from the Texas Commission on Environmental Quality at <http://www.tnrcc.state.tx.us/admin/topdoc/index.html>. Search for the following publications by number on TCEQ's website.

Lesson Plans and Resources for Teaching Environmental Sciences- GI 268
Water Education Team (WET) Instruction Handbook- GI 026
Land Use and the Water Cycle poster- GI 194
Conducting a Watershed Survey- GI 232
Watershed Owner's Streamwalk Guide- GI 218

For additional information, call (512) 239-1000, or write to:

Texas Commission on Environmental Quality
P.O. Box 13087

Austin, Texas 78711-3087

EXTENSIONS:

1. If there is an environmental center or nature museum in the area, invite a representative to speak to the students about the impact of man's activities on the watershed.
2. Instead of having each student write an individual report, divide the students into groups with 3 or 4 members. Have each group give an oral presentation to the class about what they observed on the field trip.