4. ROLLIN’ DOWN THE RIVER: Riverine Systems
Chapter 4 Essential Questions:

WHAT IS A RIVERINE SYSTEM?

HOW DO WE USE OUR RIVERS?

WHERE DO I STAND ON RIVER ISSUES?
ROLLIN DOWN THE RIVER:
Riverine Systems

OBJECTIVES:
• List four characteristics of a riverine system.
• Define the riparian zone.
• Identify three measurements for use in assessing water quality.
• Describe a process that changes water quality.

MULTIPLE INTELLIGENCES LEARNING ACTIVITIES:

Verbal/Linguistic: Using printed media, obtain information about a river.

Using a story grid, write a newspaper article.

Using Bloom’s Taxonomy of Questions, formulate questions about a problem.

Logical/Mathematical: Using a PNI (Positive, Negative, Interesting) chart, analyze riverine problems.

Interpersonal: Compete in a Tangipahoa River Trivia game using questions formulated from Bloom’s Taxonomy of Questions.

Naturalist: Using topographical maps and tracing paper, select either a river on the North Shore of Lake Pontchartrain or a bayou on the South Shore to find all the drainage connections to this water body. Trace connecting tributaries and drainage ways going out from the channel.

Introduction:
Flowing into, out of, and through the Lake Pontchartrain Basin are rivers which provide water for habitat, bring nutrients, take away waste products and provide areas of scenic beauty and recreation. Some of the major rivers are the Tangipahoa, Tchefuncte, Tickfaw, Amite, Bogue Falaya, Bogue Chitto, and West Pearl Rivers.
Headlines

**Process:**

1. Have students read the headlines about rivers in the Lake Pontchartrain Basin.
2. Ask students to identify what problem the headline is highlighting; this is the issue.
3. Ask students to choose a river in the Lake Pontchartrain Basin that has some significance to them. They may have boated on it, driven over it or lived on or near it.
4. Ask different students to share their personal experiences about any of the rivers in the Basin.
5. Have students research the river they selected. Sources of information include:
   - School or public library
   - Internet
   - Lake Pontchartrain Basin Foundation (LPBF)
   - The Times-Picayune or other local newspapers
   - La. Department of Environmental Quality (DEQ)
   - La. Department of Natural Resources (DNR)
   - La. Department of Health and Hospitals (DHH)
6. Make a large class size map of the Lake Pontchartrain Basin with its rivers. Attach headlines or articles of interest to the associated rivers.
Tangipahoa River Stays Closed After Big Fish Kill

A River Runs Through It...
Volunteers to help clean up area rivers...
from Tickfaw to the West Pearl

Suit Seeks Recovery of Creosote Cleanup Costs...
along Bayou Bonfouca in Slidell
RIVER

**ANATOMY OF A RIVER**

- **STREAM BANK**
  - may be **BEACHES** or **BANKS**
  - part of **RIPARIAN ZONE**

- **CHANNEL**
  - may be **STRAIGHT**, **MEANDERING**, or **BRAIDED**

- **FLOODPLAIN**
  - is **FLATLAND**

- **RIVER BOTTOM**
  - **SUBSTRATE** such as **COBBLES**, **MUD**, or **SAND**

- **VEGETATION**
  - such as **PLANTS**, **SHRUBS**, and **TREES**
ANATOMY OF A RIVER

CHANNEL:
The **channel** is the area of a river or stream which periodically or continually contains moving water. Stream channels may have one of several shapes:
- Straight (a fairly uncurved line)
- Meandering (loops and curves)
- Braided (like strands of water that have been braided)

STREAM BANKS:
Stream banks are the portions of the stream which restrict lateral movement of water. Stream banks may be:
- Sandy beaches
- Mud banks
- Subject to erosion due to:
  - swift moving currents along the cutbank of the river;
  - loss of vegetation due to building or change of land use.

Stream banks are part of the **riparian zone** or the vegetated area adjacent to a waterbody, stream or river. A riparian zone is important to the health of the river or stream because it:
- serves to filter runoff from the land before it drains to the river. These filtered materials may be soils, vegetation, or organisms suspended in the runoff;
- slows down the velocity or speed of the water flowing into the river, thus decreasing erosion;
- supplies vital habitat for aquatic and semi-aquatic animals, and
- holds the stream bank soils together, preventing erosion.
**FLOODPLAINS:**
Floodplains are the flat areas of land covered by materials deposited by the river when it floods. These materials or sediments may be sands, silts or clays as well as organic material. These areas:

■ contain nutrient rich soils;
■ are located near a source of usable water;
■ are flat lands available for agricultural use;
■ may contain valuable wetlands, and
■ usually flood when the river overflows its banks; this fact alone may be an important consideration in choosing to build in a floodplain.

**VEGETATION:**
The variety of plants, woody shrubs and trees along the banks of the channel and in the floodplain are called streamside vegetation. This vegetation is important because:

■ it is home to many different kinds of animals;
■ it forms a buffer between the forested lands, pasture lands or more developed areas and the channel of the river or stream, and
■ it serves to stop erosion along the banks of the stream since tree roots hold soil together.

**RIVER BOTTOM OR SUBSTRATE:**
A river or stream bottom may be composed of rock, gravel, cobbles, sand or mud substrates.

**Rock, gravel, or cobbles:**
■ provide a hard substrate;
■ provide a place for aquatic plants and animals to live, and
■ form riffles where water running over the rock surface becomes well oxygenated.

**Sandy and muddy bottoms:**
■ are found when the river or stream is slow-moving;
■ occur because the low velocity of the stream is not enough to transport larger sediments such as rocks and cobbles, and
■ are a habitat for burrowing animals.
Protecting Rivers:
The Clean Water Act of 1972 provides that the surface waters of the country be restored and maintained to biological, chemical and physical integrity. The integrity is judged by biological, chemical, and physical parameters.

Chemical Parameters include measuring:
- Dissolved minerals picked up from the substrate;
- Any contaminants such as volatile organics, radioactive materials, heavy metals, or toxic chemicals;
- Dissolved oxygen which is necessary for aquatic organisms' respiration and other processes;
- BOD or biochemical oxygen demand or aerobic decomposition. For example, a high degree of decomposition gives a stream a high BOD because it needs a lot of oxygen to break down the organic components found there;
- pH - the measure of the hydrogen ion in water, which makes it either acidic or alkaline;
- Hardness - a measure of magnesium or calcium found in the water. For example, we often notice this when showering: soap and water either lathers easily (soft water) or lathers with difficulty (hard water);
- Phosphates and nitrates - plant nutrients which are introduced into the water from run-off. Fertilizers from farms and detergents cause excessive plant and algae growth.

Physical Parameters include measuring:
- Temperature - important to many fish species and provides an optimum climate for metabolic processes, activity and reproduction. The temperature of water affects its chemical concentrations. For example, cold water holds more dissolved oxygen than does warm water;
- Turbidity - a measure of the clarity of water. Turbidity is important because clear water allows photosynthesis to take place at a greater depth;
- The color of water - indicates the presence of dissolved substances and suspended material which affect such processes as photosynthesis;
- Pathogens - disease causing organisms, which may be present, such as, *Escherichae coli* found in the intestines of warm-blooded animals.

Water Quality is changed by such things as:
- Sediment, e.g., development along river banks causing heavy sediment deposits into the river or stream;
- Dumping of wastes, either hazardous or non-hazardous materials, e.g., pesticides or paint from boat yards;
- Agricultural wastes, e.g., manure from dairy feed lots washing into streams.
TREASURED TANGIPAHOA

The Tangipahoa River begins as an upland stream in Mississippi and flows southeastward from the Mississippi-Louisiana state line through Tangipahoa Parish into Lake Pontchartrain. As it makes its way southward, it flows through rolling hills where it has a sand and gravel substrate. South of Highway 190, the characteristics of the river change to those of a lowland stream where flat land levels off and the water becomes sluggish, curvy, and often muddy. The Tangipahoa is listed in Louisiana as a Wild and Scenic Stream. It was used for boating, tubing and swimming, as well as fishing. Since 1987, it has been closed to primary contact recreation (tubing and swimming) due to high bacteria levels.

The Tangipahoa River and the lands which surround it were heavily impacted by land use changes such as timber harvesting or clearing for pasture, subdivisions and roads. This land use change contributed to erosion and increased sedimentation in the drainage basin of the Tangipahoa River.

The Tangipahoa River channel:
- Is straight in the upland stream area as it flows south to Highway 190, with a sand and gravel substrate;
- Becomes a lowland stream with a muddy substrate south of Highway 190.

The stream bank:
- Has bluffs in the upland areas where the land lies far above the high water of the river;
- Has sandy beaches or gravel areas in streamside deposits;
- Has cypress swamps near the point at which the stream enters Lake Pontchartrain;
- Has lush vegetation, either forest or swampy wetland, lining other areas of the stream bank.

The floodplain:
- Is composed of pine forest and pasture lands in the upland area;
- Consists of cypress and tupelo swamp in the lowland area where the stream widens.
ACTIVITY: Issues About Rivers

Materials:
- Copies of Reporting Story Grid, (Page 95).
- Copies of Issues About Rivers concept map (at the top of this page).

Process:

1. Place students into cooperative groups.

2. Using the accompanying concept map Issues About Rivers, have the class brainstorm the issues concerning the Tangipahoa and several other rivers in the Basin. If you find additional areas of concern or issues, add those to the original concept map or design one in the group. Make a concept map for each river represented by your group.

3. Using the articles and additional information gathered by students in the first activity, Rivers of the Basin, have each group focus on a particular river of interest.

4. Using the Story Grid examine several of the newspaper articles brought into the cooperative group. When reading or writing a newspaper article look for the Who, What, When, Where, Why, and How shown in the format of the Story Grid. Fill in the accompanying Reporting Story Grid for several of the articles discussed.

Sample (blank):

<table>
<thead>
<tr>
<th>WHO</th>
<th>WHAT</th>
<th>WHEN</th>
<th>WHERE</th>
<th>WHY</th>
<th>HOW</th>
</tr>
</thead>
</table>

|   |   |   |   |   |   |   |   |   |   |   |   |

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Sample:

<table>
<thead>
<tr>
<th>WHO</th>
<th>WHAT</th>
<th>WHEN</th>
<th>WHERE</th>
<th>WHY</th>
<th>HOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citizens For A Clean Tangipahoa (CFACT)</td>
<td>Clean up litter and dumping sites</td>
<td>During fall Beach Sweep</td>
<td>Along a five mile stretch of the Tangipahoa River</td>
<td>Mission of the organization</td>
<td>Asked interested school children to participate</td>
</tr>
</tbody>
</table>

5. Choose an issue for a newspaper article that your group will write about a river in the Lake Pontchartrain Basin.

**Option A:**
Research an issue for a river in the Basin. Use resources listed in Rivers of the Basin activity.

**Option B:**
Using the past experiences of students in the cooperative group, interview and write an article about their connection to issues about rivers in the Basin. For example, write an article about lack of septic systems on the Tchefuncte River where a student and her family have a weekend camp or a students’ favorite fishing spot in Bayou Lacombe that is littered by boaters’ garbage.

6. When writing a newspaper-type article be sure to put the most important or most interesting information first. Articles may have any of the components (who, what, when, where, why, or how) first.

7. Complete your article by writing a headline. Headlines are often “attention getting” or sensational. Many times headlines are not written by the author of the article. In your cooperative group generate an appropriate headline.

8. Include graphics, photos or illustrations to make the article appeal to your audience. Cartoons can be an effective communication tool also.

9. After completion of the newspaper article, each cooperative group will put articles about rivers together in a class newspaper. Use legal size paper, cutting and pasting articles to fit. Be sure that you check spelling, grammar and punctuation.

10. Copy the newspaper for other classes or school groups.
<table>
<thead>
<tr>
<th>REPORTING STORY GRID</th>
<th>WHO</th>
<th>WHAT</th>
<th>WHEN</th>
<th>WHERE</th>
<th>WHY</th>
<th>HOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article One</td>
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<td>Article Two</td>
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<td>Article Five</td>
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</tbody>
</table>

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**ACTIVITY: Problems with Rivers**

**Materials:**

- [PNI Chart (next page)]

**Process:**

1. **PNI** is a unique way of looking at an idea, problem, solution or scenario. The “P” is the Positive side of the idea, problem, solution or scenario; the “N” is the Negative side, and the “I” is the Interesting or unique side.

2. **PNI**s help students develop a different perspective which can lead to more careful analysis. It also allows students to have an opportunity to look at both “sides” of an idea before criticizing or pronouncing a judgment.

3. Students should list in the **PNI** chart all of the positive, negative, and interesting aspects of the situation. They need to examine all the aspects before making a decision about the situation or problem.

4. **Modeling the Process:** Using the **PNI** chart on a transparency, analyze the following situation. A few positive, negative and interesting ideas are listed below; however, students will come up with others. Write the ideas in the appropriate part of the **PNI** chart.

   **Situation:** Boaters must wear a life jacket while on the Tangipahoa River.
   - **P**: ………Wearing life jackets save lives.
   - **N**: ………Life jackets don’t allow for a good suntan.
     Life jackets are bulky.
   - **I**: ………Life jackets make us easily identifiable and can be personalized.

5. Ask students to practice on the following idea:

   **Situation:** People who “tube” on the Tangipahoa River should pay a small charge for using the river, perhaps $1.00 toward the cost of picking up trash.
   - **P**: ……………………………………………………………………………………………………
   - **N**: ……………………………………………………………………………………………………
   - **I**: ……………………………………………………………………………………………………

6. Using the ideas presented here, complete a **PNI** for each idea.

   **Idea:** All dairy farms must have lagoons to trap cow manure.
   - **Idea:** Until the Tangipahoa River is approved for swimming, no one should use the river for recreation.
Idea: The land bordering the Tangipahoa River should be available for building homes, shopping centers and schools.

Idea: The moving water in streams is a good way to flush away hazardous material from boat building and painting facilities.

7. In order to successfully complete a PNI, students may have to investigate topics such as: hazardous wastes, boat building, land development, land conservation, or nature preserves.

8. Ask the students for ideas, problems or issues to analyze.

EXTENSION:

Analyze other critical issues of rivers in the Lake Pontchartrain Basin which focus on water quality. Sources of information about these issues would be the local newspaper, conservation newsletters or the Lake Pontchartrain Basin Foundation newsletter. Make a PNI chart for each of these issues.
ACTIVITY: Questions about Rivers

Benjamin Bloom theorized that learning could be divided into six levels. These six levels are: knowledge, comprehension, application, analysis, synthesis and evaluation. Students will be given the opportunity in this activity to formulate questions in each domain. Using a list of verbs (Page 100) which are associated with each of the levels, ask students to develop questions about the Tangipahoa River.

Materials:

- Newspaper articles about rivers in the Lake Pontchartrain Basin
- Library resources, Internet, and materials on rivers
- Bloom’s Taxonomy of Questions, (Page 100).

Process:

1. Present information about rivers in general and then specifically about the Tangipahoa River.
2. Ask students to form cooperative groups to read and discuss the articles about rivers they have collected in other activities.
3. Model how to formulate questions at each level of Bloom’s Taxonomy using the Bloom’s Taxonomy of Questions Worksheet (Page 100).

Examples include:

Knowledge: What is a streambed, channel and floodplain?

Comprehension: Describe the problems a homeowner would face living in the Tangipahoa floodplain?

Application: Illustrate an “ecologically safe” method which could be designed for building a bridge over the Tangipahoa River.

Analysis: What information would you present to the local historical committee to nominate the Tangipahoa River as a national scenic river?

Synthesis: Design a waste flow model to demonstrate how sand, silt, cobbles, gravel and mud fall out.

Evaluation: What criteria would you use to allow building along the Tangipahoa River?

4. Using “verbs” from the Bloom’s Taxonomy of Questions Worksheet, compile a list of knowledge questions from the class. Put knowledge questions on index cards.
5. Using the worksheet provided, create questions for each of the other levels of Bloom’s Taxonomy.

6. As questions are formulated, write them on index cards. Add all questions to the stack.

7. After all the questions have been formulated, shuffle the index cards and play a **Tangipahoa River Trivia** game. Have cooperative groups compete against each other. Score points for correct answers. Set aside questions which are not easily answered and have students look up the answers or design the projects. Share responses and products with the class.

**EXTENSION:**

Using a standard calendar, write a Tangipahoa River Trivia fact or question on each of several days of the week for a selected period of time. Fill in with similar information about other rivers in the Lake Pontchartrain Basin. Share the calendar with another class.
# Bloom’s Taxonomy of Questions Worksheet

## Examples of verbs used in each of Bloom’s levels

### Knowledge:
- Recall information.
  - define
  - list
  - recognize
  - name
  - match
  - label

**Sample:**
Define stream bank, floodplain, and substrate.
Draw and label a diagram of a typical stream.

### Comprehension:
- Interpret information in your own words.
  - classify
  - report
  - describe
  - select
  - discuss
  - translate

**Sample:**
Describe in your own words what happens when a stream's velocity slows.

### Application:
- Apply knowledge or generalize to a new situation.
  - apply
  - interpret
  - use
  - demonstrate
  - sketch
  - dramatize
  - illustrate
  - solve
  - prepare

**Sample:**
Dramatize some of the problems a homeowner might encounter by building in a floodplain.

### Analysis:
- Break down knowledge into parts and show relationship among parts.
  - categorize
  - criticize
  - examine
  - compare
  - differentiate
  - question
  - contrast
  - discriminate
  - test

**Sample:**
Contrast building in the coastal zone with building in a river floodplain.

### Synthesis:
- Bring together parts of knowledge to form a whole and build relationships for new situations.
  - arrange
  - create
  - prepare
  - compare
  - design
  - propose
  - construct
  - organize
  - write

**Sample:**
Design an environmentally responsible subdivision to be built near the Tangipahoa River.

### Evaluation:
- Make judgement on the basis of established criteria.
  - assess
  - estimate
  - select
  - attack
  - evaluate
  - support
  - defend
  - score
  - value

**Sample:**
 Decide whether you are in favor of building on a floodplain; defend your position in a debate.
ACTIVITY:
Drainage Detectives

Background:
Have you ever wondered from where the rivers get their water? Have you ever driven over a bridge and wondered where the little creek underneath leads? In this activity, students will discover the answers to these questions. Using maps, you and your students will select either a river on the North Shore of Lake Pontchartrain or a bayou on the South Shore to find all the drainage connections to this water body. If a field trip can be taken, “ground-truthing” the maps (physically finding the drainage ways that lead to the water body) can add to student understanding of drainage systems.

Objectives:
1. Use maps to determine a water body’s drainage system.
2. Make connections between tributaries and the main channel.
3. Relate features of a two-dimensional map to the actual site.

Teaching Materials:
- Map of the Lake Pontchartrain Basin with water bodies. (See link to Environmental Atlas on Lake Pontchartrain Basin Foundation’s website www.saveourlake.org).
- Copies of USGS topographic map for the particular water body. Make sure you get the right scale for the size of the water body you have chosen. (New Orleans Map Company is a good source.)
- Several sheets of tracing paper per student.
- Pencils and colored markers.

Getting Ready:
1. Prior to this activity, review the Chapter 1 activity “The Water Cycle” with the students.
2. Obtain a map of the Lake Pontchartrain Basin that shows water bodies in order to make your choice of which one to investigate.
3. Once you have chosen a water body for investigation, obtain the proper-scaled topographic map. They can be expensive, so sections of the topo map may be copied for each student.
4. Distribute maps, tracing paper, pencils and markers.
5. Review with students how to read a topo map. Use the legend on the map to understand the symbols. You can get a topo map symbol chart from New Orleans Map Company if you need more explanation.
6. Discuss the following procedure with the students before they begin their drainage detecting.

**Procedure:**

1. Put tic marks (small crosses) in pencil at each of the four corners of your map.
2. Lay a piece of tracing paper on top of your map. Using masking tape, put a small piece of tape at each corner of the tracing paper, binding it to your map. Make sure you put little pieces at each corner.
3. Trace the tic marks onto the tracing paper. This is done so that if you need to untape the tracing paper after you trace the drainage pattern, you can register it back together for future tracing.
4. Starting from the main channel, use a pencil to trace all connecting tributaries and drainage ways going out from the channel.
5. If there are names of these tributaries on the topo map, pencil them onto the tracing paper too.
6. Once you have finished tracing, untape the tracing paper and color your watershed with the markers. Use different colors for different types of tributaries (Notice that some tributaries are larger than others, and some are intermittent).
7. Identify and mark places along the tributaries and the main channel where roads cross. Look for other public access points (i.e., parks, boat launches, etc.). If you take a field trip you will want to stop at a few of these sites for ground-truthing.

**Extensions:**

1. **Determine what kind of vegetative habitat is most dominant around this water body.**
2. **Research the kind of critters that might be found in this habitat.**
3. **Make a poster of the habitat with pictures of its critters in it.**