Lesson Title	GIS Day - Flooding
Length of Lesson	90 mins
Created By	Corey Ladner, Charles Vaughan, Kendra Wright
Subject	General Science
Grade Level	7th and 8th
State Standards	7th Grade: 1c 8th Grade: 4c, 4h
DOK Level	DOK 2 (Compare, Make Observations, Collect and Display, Interpret, Distinguish)
DOK Application	Organize, represent, and interpret data. Solve routine multiple-step problems.
National Standards	Grades 5-8: • A: Science as Inquiry • D: Earth and Space Science • E: Science and Technology • F: Science in Personal and Social Perspectives
Graduate Research Element	N/A

Student Learning Goal:

MS 7th Grade:

1c (Inquiry): Collect and display data using simple tools and resources to compare information (using standard, metric, and non-standard measurement).

MS 8th Grade:

4c (Earth and Space Science): Examine weather forecasting and describe how meteorologists use atmospheric features and technology to predict the weather.

4h (Earth and Space Science): Justify why an imaginary hurricane might or might not hit a particular area, using important technological resources.

National Standards for Grades 5-8:

A: Science as Inquiry:

- IDENTIFY QUESTIONS THAT CAN BE ANSWERED THROUGH SCIENTIFIC INVESTIGATIONS. Students should develop the ability to refine and refocus broad and ill-defined questions. An important aspect of this ability consists of students' ability to clarify questions and inquiries and direct them toward objects and phenomena that can be described, explained, or predicted by scientific investigations. Students should develop the ability to identify their questions with scientific ideas, concepts, and quantitative relationships that guide investigation.

- USE APPROPRIATE TOOLS AND TECHNIQUES TO GATHER, ANALYZE, AND INTERPRET DATA. The use of tools and techniques, including mathematics, will be guided by the question asked and the investigations students design. The use of computers for the collection, summary, and display of evidence is part of this standard. Students should be able to access, gather, store, retrieve, and organize data, using hardware and software designed for these purposes.

- THINK CRITICALLY AND LOGICALLY TO MAKE THE RELATIONSHIPS BETWEEN EVIDENCE AND EXPLANATIONS. Thinking critically about evidence includes deciding what evidence should be used and accounting for anomalous data. Specifically, students should be able to review data from a simple experiment, summarize the data, and form a logical argument about the cause-and-effect relationships in the experiment.

- USE MATHEMATICS IN ALL ASPECTS OF SCIENTIFIC INQUIRY. Mathematics is essential to asking and answering questions about the natural world. Mathematics can be used to ask questions; to gather, organize, and present data; and to structure convincing explanations.

- UNDERSTANDINGS ABOUT SCIENTIFIC INQUIRY. Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations.

D: Earth and Space Science:

- STRUCTURE OF THE EARTH SYSTEM. Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate, because water in the oceans holds a large amount of heat.

E: Science and Technology:

- DESIGN A SOLUTION OR PRODUCT. Students should make and compare different proposals in the light of the criteria they have selected. They must consider constraints – such as cost, time, trade-offs, and materials needed – and communicate ideas with drawings and simple models.

- UNDERSTANDINGS ABOUT SCIENCE AND TECHNOLOGY. Technological designs have constraints. Some constraints are unavoidable, for example, properties of materials, or effects of weather and friction; other constraints limit choices in the design, for example, environmental protection, human safety, and aesthetics.

F: Science in Personal and Social Perspectives:

- NATURAL HAZARDS. Internal and external processes of the earth system cause natural hazards, events that change or destroy human and wildlife habitats,

damage property, and harm or kill humans. Natural hazards include earthquakes, landslides, wildfires, volcanic eruptions, floods, storms, and even possible impacts of asteroids.

- RISKS AND BENEFITS. Risk analysis considers the type of hazard and estimates the number of people that might be exposed and the number likely to suffer consequences. The results are used to determine the options for reducing or eliminating risks.

- RISKS AND BENEFITS. Students should understand the risk associated with natural hazards (fires, floods, tornadoes, hurricanes, earthquakes, and volcanic eruptions), with chemical hazards (pollutants in air, water, soil, and food), with biological hazards (pollen, viruses, bacterial, and parasites), social hazards (occupational safety and transportation), and with personal hazards (smoking, dieting, and drinking).

- RISKS AND BENEFITS. Important personal and social decisions are made based on perceptions of benefits and risks.

Materials Needed (supplies, hand-outs, resources):

- Computer lab to facilitate activity
- PowerPoint file – INSPIRE_Flooding _11_01_12_PowerPoint.pptx
- Activity sheet – INSPIRE_Flooding _11_01_12_ActivitySheet.doc
- ArcGIS web-based map data – http://www.arcgis.com/home/webmap/viewer.html?webmap=5f769c45def346b58b981f608284ff18

Lesson Performance Task/Assessment:

By using a hypothetical hurricane and real geography/flood-zone data, students will evaluate the consequences of flooding for two populated areas near the Tangipahoa river along the Mississippi-Louisiana border. In the scenario proposed to students, the hurricane is expected to unleash heavy rains with expected flooding along the river. The students will be asked to determine whether to open the Tangipahoa dam (thereby causing flooding for the southern region of the river in LA) or keep the dam closed (causing flooding in the northern region in MS). They will have to make this decision based on land coverage, populations, and schools/roads within the potentially affected areas.

Once a decision has been made to keep the dam open or shut, the students will then propose the action to the (hypothetical) governors of MS and LA. Since one state will

ultimately take more damage than the other in this scenario, students will need to convincingly indicate why they made this decision.

Lesson Relevance to Performance Task and Students:
Students will use technology to evaluate a real-world flooding crisis and determine the best possible outcome. They will also gain practice at publically addressing a problem and stating their reasons for action.

Anticipatory Set/Capture Interest:
Students will view a simulated news report about an impending hurricane as a large group before splitting into their specialty GIS day groups.

Guided Practice:
After viewing basic information about hurricanes and flooding, the instructor will indicate that the Tangipahoa river area faces heavy raining and imminent flooding from a hypothetical hurricane. Indicate that the students are faced with a difficult decision: either leave the dam closed and allow potential flooding of the upstream region, or open it and allow potential flooding of the downstream region.

The instructor should show how to open the ArcGIS map using a web browser. Demonstrate how to add/remove layers and view the map legend. Also, demonstrate how to get data from the maps by clicking on pertinent regions. Show how to perform basic calculations (e.g., averages) where needed.

Independent Practice:
The students will use the ArcGIS map and activity sheet provided to answer basic questions about the potential flood zones around the Tangipahoa river. They will collect important data about the flood zones, such as population, land area, land coverage, and roads/schools present, to find the better solution. Once their decision is made, students may be asked to report their findings to the class.

Remediation and/or Enrichment:
Remediation – IEP; partnering with other students

Enrichment – Add probabilities to the scenario so that students can semi-quantify the risks. For example, if the dam remains closed, the chance of flooding is 80% for upstream and 30% downstream (due to the dam being breached). However, if the dam is opened, there is only a 20% chance of flooding upstream yet 90% downstream.

Check(s) for Understanding:
Review activity sheet with students and have students practice what they can report out to the Governor about what they have determined using GIS about their topic (Evacuation, Storm Track, Flooding). Also, select a couple of students who will do the reporting out to the governors.

Closure:
Students will reconvene in the main room to report out to the Governor about their findings and to hear about what the other groups discovered using GIS.

Possible Alternate Subject Integrations:
Geosciences, Meteorology

Teacher Notes:
Teachers should familiarize themselves with ArcGIS before attempting to use this lesson. You will need to create a username and password to sign in and use this program for yourself. Learn how to add/remove layers, change the map style, and search the database for pertinent data sets as needed. However, the training is worthwhile since this is a very technology-based lesson that will meet numerous standard requirements!

https://www.arcgis.com/about/index.html