

# **GIS in the K-12 Curriculum: Delaware Initiatives**

**Presented by: Nicole M. Minni  
Water Resources Agency, Institute for Public  
Administration, University of Delaware**

# GISEWG – Who we are

- **Delaware Geographic Data Committee (DGDC)**
  - Cooperative effort among state agencies, the University of Delaware, county and municipal governments, and others to build a Delaware GIS Community and improve the coordination of the use of GIS and spatial data in Delaware
- **GIS in Education Working Group (GISEWG)**
  - GIS professionals from state government, academia and private sectors dedicated to helping expand the use of GIS and other geospatial technologies in Delaware schools.
  - assist with planning and carrying out classroom geospatial activities/lessons
  - Resource for educators

# Professional Partners for GIS

## New Castle County

- John Laznik (Chair)  
University of Delaware
- Brian J. Smith  
GeoDecisions, Inc.
- Miriam Pomilio  
Delaware Geological Survey
- Lyn Anderson  
Delaware Career Resources Center
- Tripp Fischer  
DNREC, Division of Air and Waste Management
- Joe Watson  
Delaware Transit Corporation

## Kent County

- Debbie Sullivan  
DNREC, Office of the Secretary
- Jason Miller  
Kent County Public Works
- Scott C. Hoffman  
CABE Associates, Inc.

## Sussex County

- Nicole Minni  
University of Delaware  
Institute for Public Administration,  
Water Resources Agency (IPA-WRA)
- John Inkster  
DNREC, Division of Soil and Water
- Mike Mahaffie  
Delaware Office of State Planning  
Coordination

# K-12 GIS in Education Award

2002



2003



2004



2005



2006



2007

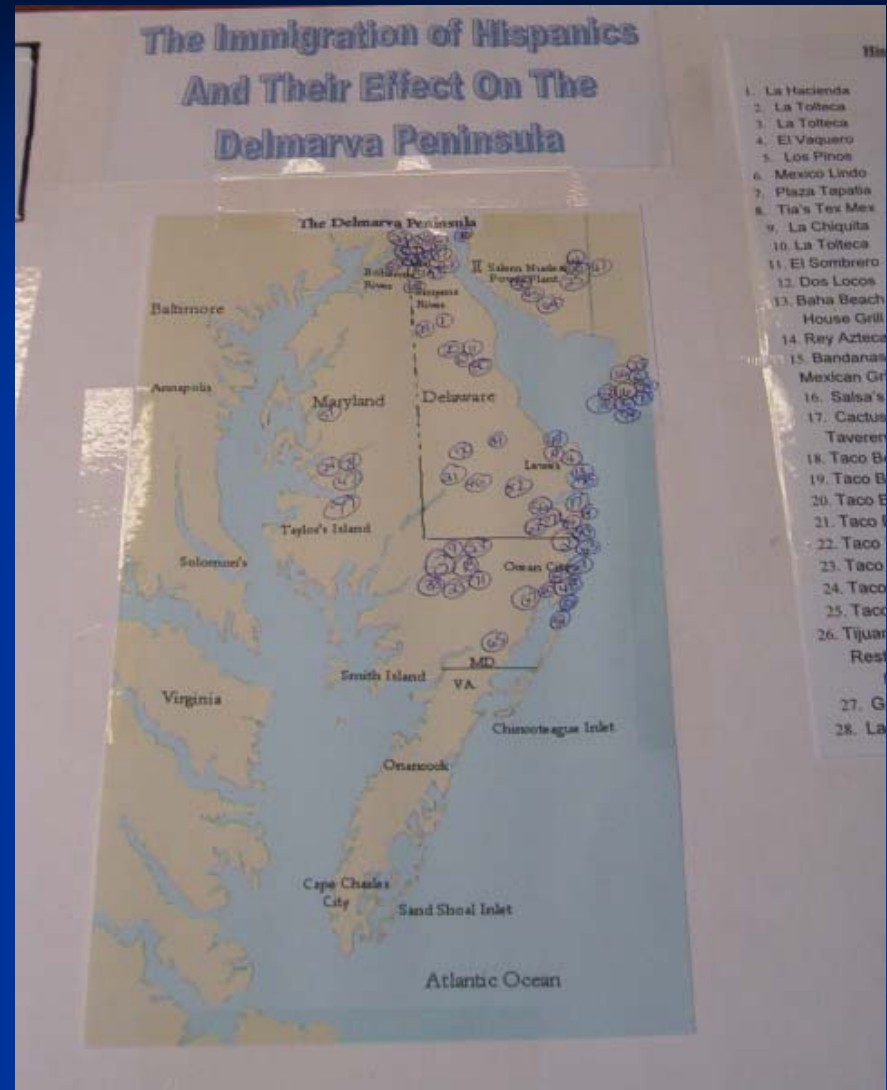
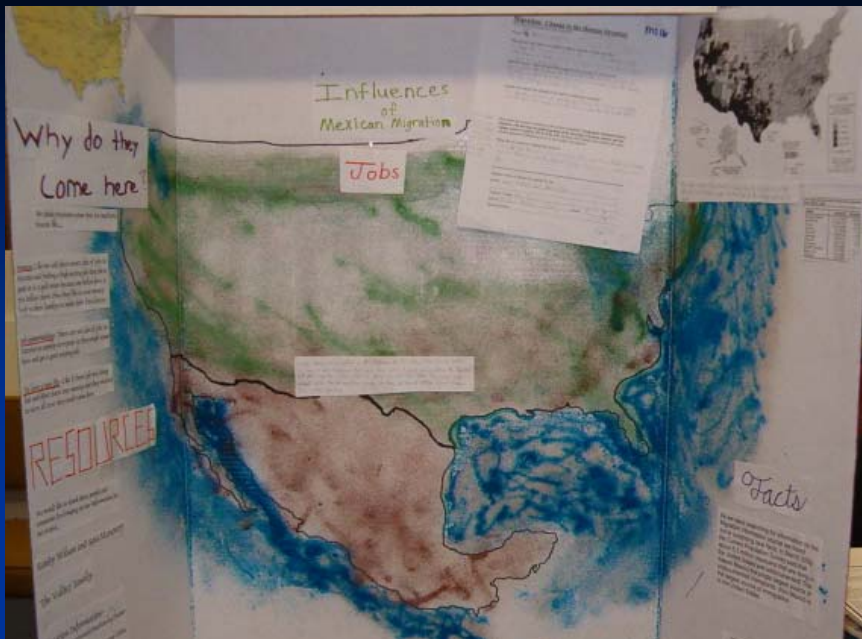


**Educator(s) who has been instrumental in furthering the use of digital spatial data, internet mapping services, or Geographic Information Systems (GIS) in Delaware K-12 Schools.**

# K-12 Student Contest

- Entries are displayed at annual Delaware GIS Conference
- Attendees vote for their favorite
- Student winners receive prizes and certificate presented in classroom
- Free registration for educator to next year's conference





# Past Projects

- 2001 Presentation on GIS at Delaware Geographic Alliance (DGA) summer workshop
- GPS School Locations for Delaware Center for Educational Technology (DCET)
  - GPS Traveling Lab
  - [www.dcet.k12.de.us/instructional/travelinglab/gpslabflyer.html](http://www.dcet.k12.de.us/instructional/travelinglab/gpslabflyer.html)
  - Cape Henlopen School District has its own gps lab
- 2003 Kent County 4-H
  - Community Mapping Project
    - Location of 4-H members and their clubs
    - Analyze where to focus outreach for new members
- 2003 GIS Night, held at Lake Forest High School

# 2004 Land and Water Unit - 4<sup>th</sup> Grade Students

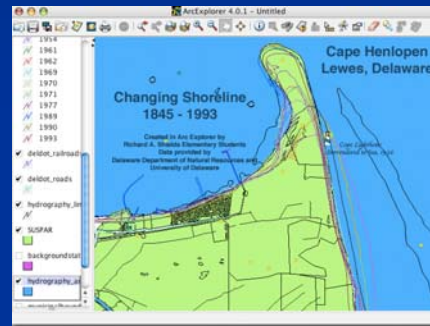
- Richard Shields Elementary School, Lewes, DE
- Introduction to Maps
- Transparency Overlay for GIS Student Contest
- GPS Historical Tour of Lewes
- Planting of Beach Dune Grass
- ArcExplorer Project showing change in coastline





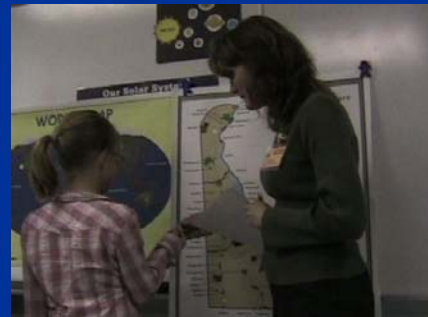
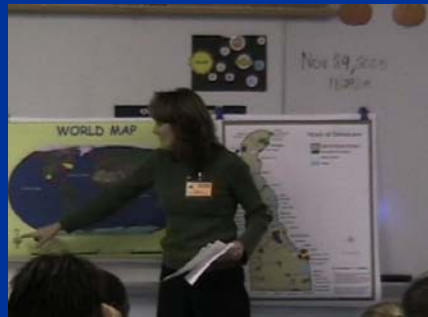
# Richard Shields Elementary

- **Changes Over Time: A Regional Study**
  - Two study areas: Cape Henlopen & Roosevelt Inlet
  - Constructed map layers showing changes over time
    - Habitat, Vegetation, Shoreline, roads, marshes, water bodies
  - Use GIS and GPS units to obtain, manage, and display data
  - [edcommunity.apple.com/ali/story.php?itemID=786](http://edcommunity.apple.com/ali/story.php?itemID=786)
- **ArcView Watershed Project – Create Data**



# Past Projects

- 2004 Presentation to the IPA, Democracy Project
  - Lesson Plan – ESRI, Crossing the Line
- 2005 Geography Awareness Week – DGA Migration, the Human Journey
  - 3rd Grade Shields Elementary
  - 4th Grade HOB Elementary



**Guide to Mapmaking**



Maps are drawings or pictures of places that use point, line, and area symbols, as well as color, to show how selected human and physical features are located and relate to one another. No single map can show everything, so the features shown on each map are chosen for a special reason. It is impossible to show the spherical Earth on a flat surface without changing its shape (try peeling an orange and flattening it out!), so cartographers, or mapmakers, use different *projections* to show certain important parts of the map, even if it means that other parts are not correct.



**Map:** A drawn picture of a place, usually drawn to *scale* on a flat surface.

**Cartographer:** A person who makes maps.

**Map projection:** The process of taking information from a three-dimensional (globe) surface and putting it into a two-dimensional (flat) surface. Learn more about map projections by visiting the National Geographic feature "Round Earth, Flat Maps" (<http://www.nationalgeographic.com/2000/projections>).

**Key Map Elements**

A good map should tell you what it is about (title), which direction north is (orientation), when the map was made or updated (date), who made the map (author), what the symbols mean (legend or key), how distances on the map relate to distances on the ground (scale), where to find selected places on the map (index), how to find places on the map (grid), and where the map's information comes from (sources or credits).

However, not every map will identify all of this information. The more information provided, the better you will be able to evaluate it.

The acronym **DOGSTAILS** makes it easy to remember the important parts of a map:

- Date**            **D** When the map was made
- Orientation**   **O** Directions (north arrow)
- Grid**            **G** Locates places on the map
- Scale**           **S** What the map distance is
- Title**            **T** What, where, and when
- Author**         **A** Who made the map
- Index**           **I** Map address of places
- Legend**        **L** What the symbols mean
- Sources**       **S** Basis for map information

**Mapmaking Guide (3-5)**

**Title:** This explains what the map shows.



**Orientation:** In most cases, "north" is at the top of a map. A **north arrow** is a symbol showing the direction in which north lies; a **compass rose** shows all four directions (N, S, E, W).



**Date:** This shows when the map was made.

**Author:** Text identifying the cartographer or organization responsible for making the map.

**Legend or Key:** A guide showing what the map's symbols and colors mean.



**Scale:** This shows distance on the map. An inch on a map may show a mile, 100 miles or 1,000 miles. You should look at the scale key to see how much it equals.

**Types of Scale**

Verbal	words	one inch equals one mile
Number	ratio or fraction	1:63,360
Graphic	divided line (like a ruler), usually showing miles or kilometers	

**Index:** Just like an index in a book, a map index tells you where to find certain places on a map.



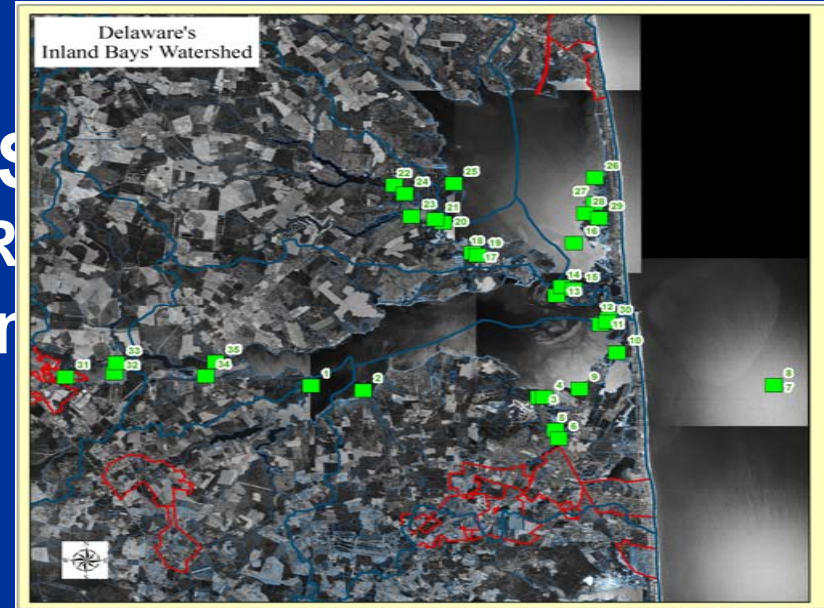
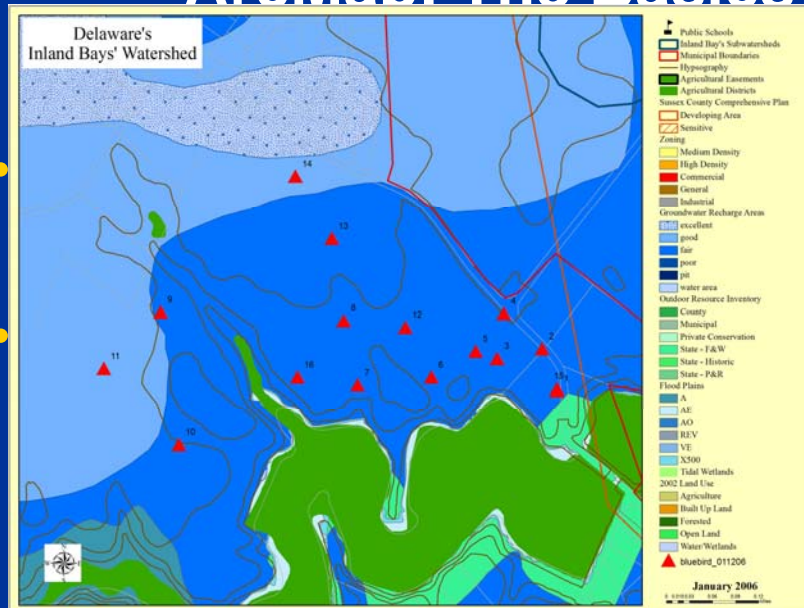
**Grid:** Most maps have "grids" over them. This helps you to pinpoint different sections on the map. Grids can just be crossing lines, or they can be lines of longitude and latitude.

**Sources:** This tells where the information on the map came from.

# Past Projects

- 2005-2006 Professional Development Day
  - Held in October, 15 - 19 Teachers
  - Hands-on GIS Workshop
  - 2 Lessons from ESRI, Mapping Our World Book

## ArcMap: The Basics



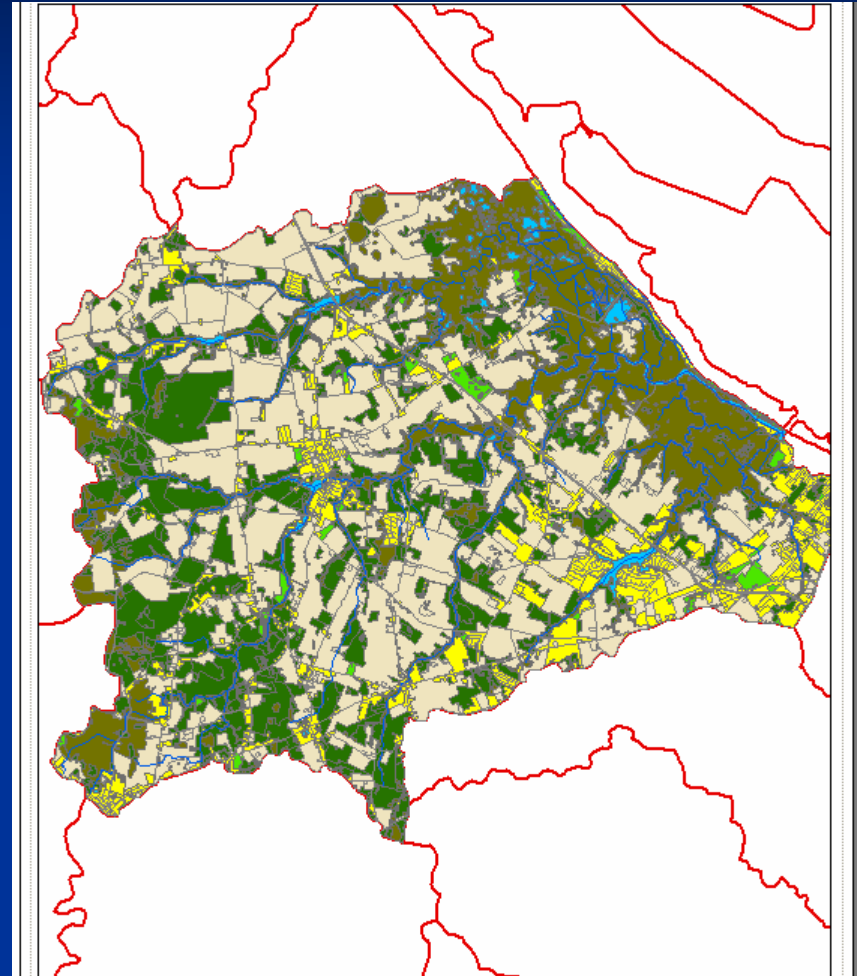
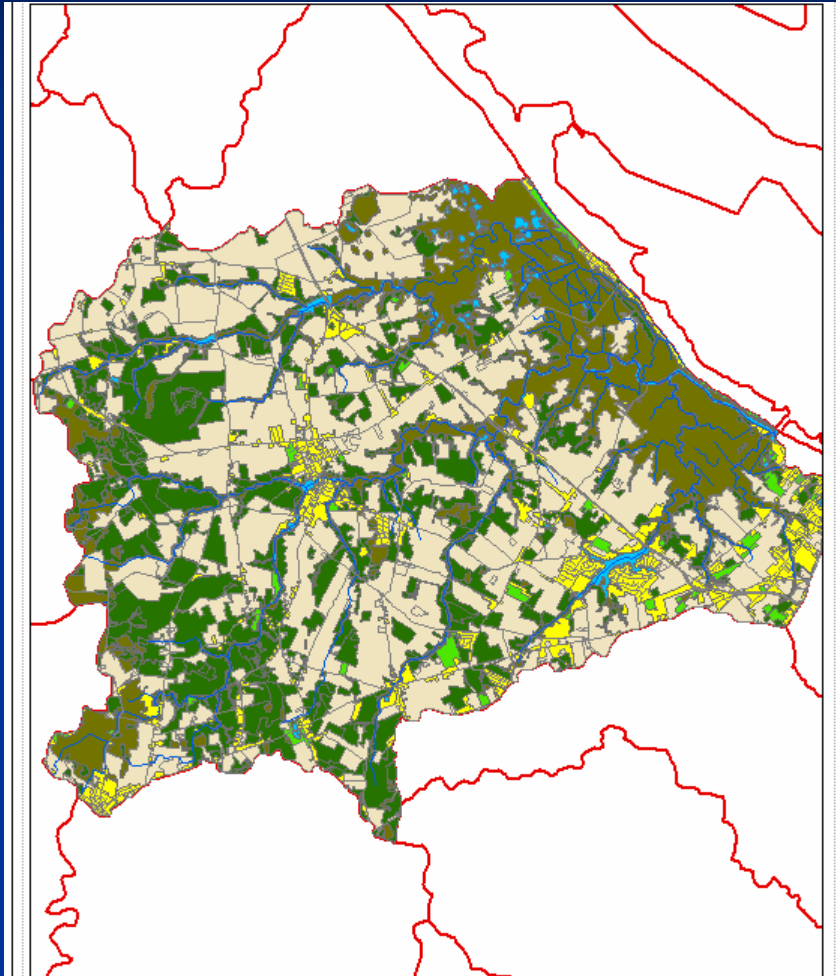
# Steve with his nesting boxes



# Past Projects

- **2006 – Delaware Instructional Technology Conference**
  - Exhibited
- **2006 Fall - Chesapeake and Delaware Watershed**
  - Presentation on “What is GIS?” and Resources Available
  - Two Hour Hands-on Workshop
    - Free 60 Day Trial CD of ArcView GIS 9.1
    - ArcView Project
    - ArcExplorer CD and ArcExplorer Project
    - Where is Your Watershed Address poster?

# Land Use Change 1992-2002





# Two Exercises

- Exercise 1: Introduction to the ARCGIS Interface
- Exercise 2: Clipping, editing fields, calculating and summarizing

Chesapeake and Delaware Watershed Ecology Workshop GIS in Education Working Group	04/29/06
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**Exercise 1**  
**GIS Basics: An Introduction to ArcGIS**

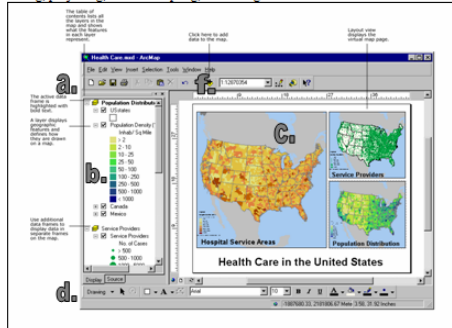
The following lessons will introduce you to some of the basic functions and uses of a GIS. We will be using ESRI's ArcMap software (part of the ArcGIS suite of products), but the general concepts and procedures will apply for most popular software packages that you will encounter. If you are not comfortable with the basic use of a personal computer, or if you do not wish to complete this exercise on your own for any reason, please let an instructor know, and you will be paired with another student.

1. **Lesson 0 Starting ArcMAP**

- Open windows file manager or "My Computer".
- Navigate to the your data folder and double-click the *StateLandUse.mxd* icon.

2. **Lesson 1 The Application**

- Menus and toolbars at the top of the window represent the primary method for interacting with your data. You may add a data layer, alter its properties, begin an editing session, or perform more advanced functions such as buffering, route tracing, projecting, custom scripting, etc. through these controls.



b. The frame along the left side of the window contains the Table of Contents,

Page 1 of 5

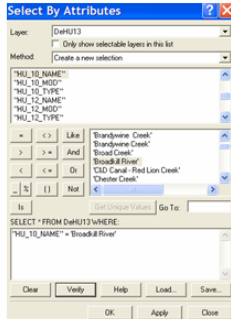
Chesapeake and Delaware Watershed Ecology Workshop GIS in Education Working Group	04/29/06
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**Exercise 2**  
**Clipping, adding fields, calculating, and summarizing data**

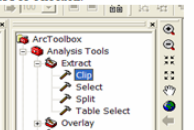
**The Scenario:**  
You want to see how the land use within the Broadkill Watershed has changed from 1992 to 2002.

1. **Lesson 1. Selecting and clipping data to a desired extent**

- Open map titled *Broadkill Watershed.mxd*.
- The data layers *bkw\_roads* (roads), *bkw\_NHDline* (hydrology), *bkw\_elevation* (topography), *delw2* (state-wide 1992 land use), *bkw\_parcel* (parcels), *bkw\_recharge* (ground water recharge), *bkw\_city\_towns* (cities and town), *DeHUC13* (Watershed Boundaries), & *Broadkill\_dissolve*, should be present in the table of contents.



- Next we are going to select the Broadkill Watershed from the State (DeHU13) file to create a separate file of just the Broadkill Watershed. On the Tool bar at the top select Selection and then Select "Select by Attributes." The dialog box appears. For layer click the drop down and select DeHU13.
- Under Method make sure it reads Create a new selection. In the next window double click on "HU\_10\_NAME", then click on the = sign, then click on Get Unique Values button. Now the values for the attribute HU\_10\_NAME appear. Double click on Broadkill River. Your window should look like the one on the right.
- Your selected polygons will turn blue within you Data Frame. Now right-click on DeHU13 and hover over Selection arrow; and select Create Layer from Selected Features. Your new data layer will appear in your table of contents named DeHU13 selection.
- Make ArcToolbox active within the view frame by clicking on the Toolbox icon. Note the various categories of tools.



# DelTech Upward Bound Program

- Summer of 2006
- Overview presentation on geospatial technology
- Intro to GPS
- Envirotech - environmental benefits of nanotechnology
- Students gathered for kayaking
- Intro to GIS
- Added points to the map



three  
 water quality and  
 water outfalls

# Delaware Geographic Alliance

- Delaware DataMIL
- Series of six maps for each Municipality
  - final print size of 17 x 22
  - A pdf of each map posted on the DGA web site
- New Castle County: Newark, Middletown, Mt. Pleasant or Talleyville area
- Kent County: Dover, Smyrna, and Milford
- Sussex County: Georgetown, Milton, Rehoboth Beach or Lewes, and Seaford
- DGA wrote lesson plans for the teachers to use the maps

# Present Projects

- **2007 Spring - Chesapeake and Delaware Watershed Workshop**
- **2007 – Delaware Instructional Technology Conference**
  - Exhibited
  - Two hour hands-on GIS Workshop
- **2007 – Professional Development Day at Cape Henlopen High School**
  - Building Site License, ArcGIS ArcView
  - Gave away ESRI, Mapping Our World Book
  - Hands-on workshop

# Sussex Central Middle School

- 2006 – 2007 School Year
- Building Site License, ArcGIS ArcView
- Three lessons from the ESRI Mapping Our World Book
  - ArcMap: The Basics
  - In the Eye of the Storm: A regional case study of Latin America and the impact of Hurricane Mitch



d: A



# 2007 Projects

- **March – Professional Development Day at Cape Henlopen High School**
  - Building Site License, ArcGIS ArcView
  - Gave away ESRI, Mapping Our World Book
  - Hands-on workshop scheduled for after school on May 24, 2007
- **April – Delaware Instructional Technology Conference**
  - Exhibit
  - Two hour hands-on GIS Workshop
- **April – Gunning Bedford Middle School**
  - Mapping Our World Lesson, Module 4
  - Delaware DataMIL with a Smartboard
  - Teachers Mr. Hollis and Becky Reed

# 2007 Projects Continued

- **Southern Elementary**
  - Assisted teacher with the K-12 Student Contest entries
  - Looked at how the Valero gas station serves their community
- **Laurel Middle School**
  - Introduction to GPS
  - Students had to write a report on what they learned
  - Students had to instruct other students on GPS





# DelTech Upward Bound Summer 2007

- To engage TRIO students in planned, educationally-related work and learning experiences that integrate knowledge and theory with practical application and skill development in a professional setting
- To determine how and where water flows in and around the Owens Campus
- To identify types of careers (requiring a postsecondary degree)





# GIS Map prepared for DTCC



Click on map to see layers

# DCET Academy

- **One day class titled, GPS101 for the Beginner: Ideas for the K-12 Classroom**
  - 11 teachers from across the state
  - Hands-on instruction
  - Gathered way points
  - Converted way points
  - Created excel table
  - Brought points within ArcExplorer Java Edition
  - Extracted data from the DataMIL
  - Created a map
  - Lesson plan ideas

# Software Options

- **ArcExplorer Java Edition**

- Free download -  
[www.esri.com/software/arcexplorer/index.html](http://www.esri.com/software/arcexplorer/index.html)
- Add data, select, buffer, pan, zoom, identify
- Connect to Internet Mapping Sites and the Geography Network

- **ArcGIS ArcView**

- \$500 for a Building Site license for 500 seats
- District licenses are based on student enrollment
- Add, **create**, and analyze data
- Creation of maps
- Connect to Internet Mapping Sites and the Geography Network
- District License is based on student enrollment

# GIS Resources

- Environmental Systems Research Institute (ESRI) K-12
  - [www.esri.com/industries/k-12/index.html](http://www.esri.com/industries/k-12/index.html)
  - Mapping Our World: GIS Lessons for Educators
  - ArcLessons - [gis.esri.com/industries/education/arclessons/arclessons.cfm](http://gis.esri.com/industries/education/arclessons/arclessons.cfm)
  - Virtual Campus Classes [campus.esri.com/](http://campus.esri.com/)
- Exploring Water Resources, by Michelle Hall
- Exploring the Dynamic Earth, by Michelle Hall
- Learning to Think Spatially: GIS as a Support System in the K-12 Curriculum, by The National Academies
- AmericaView - <http://www.americaview.org/>
- TUGIS – Chesapeake Bay & Mid-Atlantic from Space  
<http://chesapeake.towson.edu/education/>
- Geography Network - [www.geographynetwork.com/](http://www.geographynetwork.com/)
- Lesson Planet - [www.lessonplanet.com/search/Geography](http://www.lessonplanet.com/search/Geography)
- GIS in K-12 Curriculum New Zealand
  - [egis.eagle.co.nz/schools/index.htm](http://egis.eagle.co.nz/schools/index.htm)
- Google Earth - [earth.google.com/](http://earth.google.com/)

# Lessons Learned / Future Direction

- **Packaged GIS project related to curriculum**
  - Demonstrate it first
- **ESRI, Mapping Our World Book - student answer sheet**
  - Provide teachers the time to work through the exercise(s)
  - Assist the teacher in every way that you can
  - 30+ students and 1 teacher
  - Students of all levels are getting an understanding of GIS!!!
  - student answer sheet – highlight sections to differentiate between the task and the questions
- **Update and maintain GIS in Education Working Group Website**
  - Posting lessons
  - Listing resources
- **Geospatial Technology Cluster**



# Questions?

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**Final thought: Our kids, your students, and generations to come at some time in their life will be exposed to geospatial technologies. Lets continue to prepare them to live and work in the 21<sup>st</sup> Century.**

