Exercise 6 – Infrastructure Team Mapping Project

Session Objectives - At the conclusion of this session you will be able to:

- ❑ Conduct a multi-user GPS project
- ❑ Edit line and polygon data in ArcMap 10 using advanced editing tools
- ❑ Calculate length and area using the Calculate Geometry function
- ❑ Quickly add GPS project information to the metadata

Materials created by*:* Eric Kelchlin, August 2011

Revision: January 2013

Software: DNRGPS 6.15, ArcGIS 10 SP 5

Directory Path: CSP7101\Exercise6

Imagery: NAIP_2010.sid

Data: Infrastructure_Project_Summary.docx

Map Document: Exercise6.mxd

GPS Project Summary

Title: Riverside Park Infrastructure Mapping Project

Requested by: Joe Maintenance (joe_maintenance@fws.gov)

Problem Statement:
Riverside has a network of paved trails and parking lots throughout Riverside Park. Facilities Operations would like to map the paved trails in the Central and Island park units to determine how much paving material would be needed for a complete replacement in the near future (open the Exercise6.mxd to see the park units). They would also like to determine how much asphalt would be needed to replace the large parking lot in the Central park unit. A team approach will be necessary to speed-up the data collection process due to time constraints. The trail segments should be merged into one layer with no dangles and gaps. The parking lot will need to have the islands completely removed from the polygon to not overestimate the asphalt area. Finally, Joe's supervisor requires that metadata be completed for all GIS layers due to high employee turnover.

Objectives & Methodology:
1. In teams of 2, collect the polyline and polygon features using a Garmin Map76CSx. Use a 2 second logging rate.
2. Download the GPS data using DNRGPS (v6.15) from both GPS units onto one computer and save the data as a line or polygon shapefile in the NAD83 UTM17 projection.
3. Using the Editor Toolbar and Advanced Editing Tools, remove line dangles and gaps and then merge the trail segments into one layer.
4. Add a Length (meters) field in the trail attribute table and use the Calculate Geometry function to calculate the length. Multiply by a trail length of 1.2 meters in width to calculate the area in square meters.
5. Remove the islands from the parking lot polygon using the Erase Tool.
6. Add an Area (square meters) field in the Parking Lot attribute table and use the Calculate Geometry function to calculate the area.
7. Copy and paste this GPS project summary into the Description field of the metadata.

Existing Data:
- Exercise6.mxd map document, NAIP_2010.sid imagery, and the Park_Units.shp layer

Deliverables:
1. To answer the question: how much paving material is needed for the trail and parking lot (square meters).
2. A "clean" trail and parking lot shapefile with length and area calculations in the attribute tables.
3. Metadata with the GPS project summery in the description field.

Items to Keep in Mind

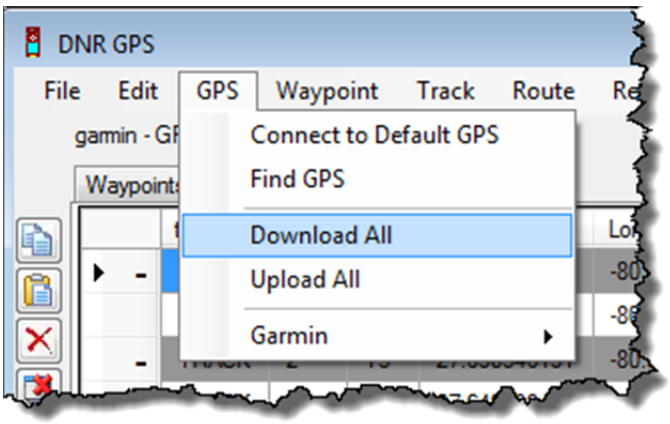
1. You have to decide where to start and stop the trail. You can't just turn the GPS unit on and walk….the result will be a connected spider web of overlapping useless data. Map trails in segments.
2. This is a team project, so work together to collect the field data. You may want to have one person get the parking lot and the other person the trails, but there are a lot more trails than parking lot.
3. Be careful not mix-up manually saved tracks and automatically saved active track logs when you save the line and polygon data from DNRGPS after the data download. This will result in duplicate layers in ArcMap.
4. Work on one computer when you come back from the field. You can split the data management duties or not. The decision is it's up to each team.
5. This exercise is purposely designed to push you're GIS skills into uncharted territory…so don't be shy to ask the instructor or neighbor for help.

SECTION 1 – Downloading and Saving Field Data

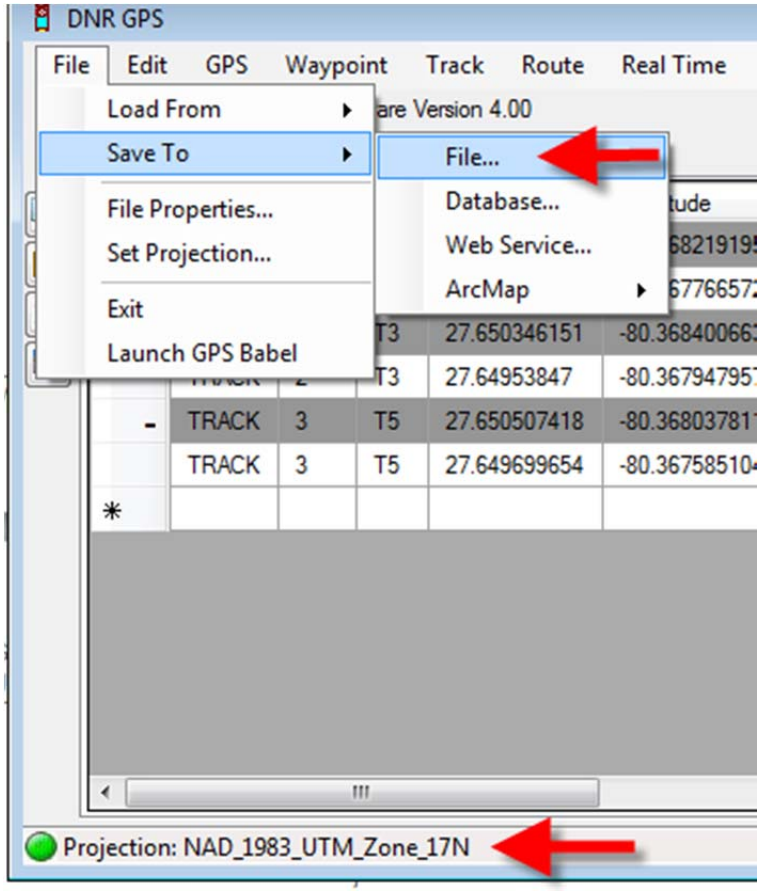
All data are located in the CSP7101\Exercise6 folder.

1. Download your trail (line) and parking lot (polygon) data onto a single computer. Save all you're work in the Exercise6 folder.

   - Use either the GPS or Tracks on the main menu in DNRGPS to download the data.



   - Save the named tracks or Active Track Log segments, depending on how you collected and saved the data in the field. Did you keep everything in the active track log and not save any tracks directly, or did you save each polygon or line segment separately. If you chose the latter, then save the named tracks, otherwise save the Active Track Logs.



- Make sure your projection information is correct before you save the data.

2. Open the **Exercise6.mxd** and add the GPS field data.

SECTION 2 – Clean-up the GPS Trail Data

This section illustrates some common editing tasks in ArcMap that are often utilized to clean-up GPS line and polygon data. Your objective is to connect all the line segments together, remove dangles and gaps. You can also adjust any poor data locations using the background imagery as a reference. You might only need to perform a couple tasks.

TASK 1: Set the Stage

1. Right-click in the "gray area" on the main toolbar and select the **Snapping** and **Advanced Editing** Toolbars. Move the toolbars to a desired location.

2. Click on the **Snapping** drop-down arrow and make sure Use Snapping is checked.

   - Make sure all 4 snapping buttons on the toolbar (Point, End, Vertex and Edge) are depressed.

   - Select the **Snapping > Options** and set the snapping tolerances to 10.

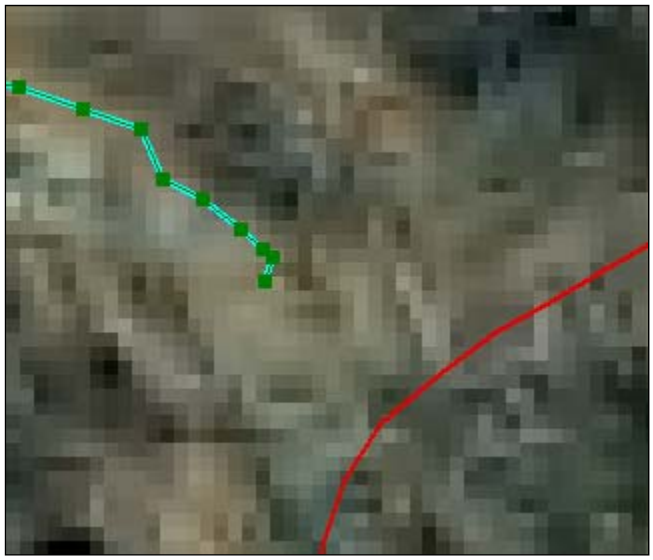
TASK 2: Connect Broken Lines

1. Start an editing session by selecting the drop-down arrow on the **Editor Toolbar** and select **Start Editing**.

2. Click on the Edit Tool on the Editor Toolbar.

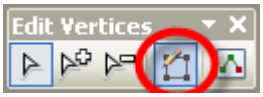
3. Zoom into the area you will be working in.

4. Using the **Edit Tool** , double click on the line that you want to edit to show its vertices (green boxes).



5. Place your mouse over the last vertex until it becomes a box surrounded by arrows. Left click and drag the vertex to the desired location on the other line. Notice how the vertex "snapped" to the edge of the other trail.

6. Click on the **Finish Sketch** icon on the floating **Edit Vertices** toolbar or anywhere on the map to accept your changes.



7. If you make a mistake, use the undo button on the **Standard** toolbar.

8. To insert a vertex, click on the Insert Vertex tool on the **Edit Verticies** toolbar.

9. To delete a vertex, click on the Delete Vertex tool on the **Edit Verticies** toolbar.

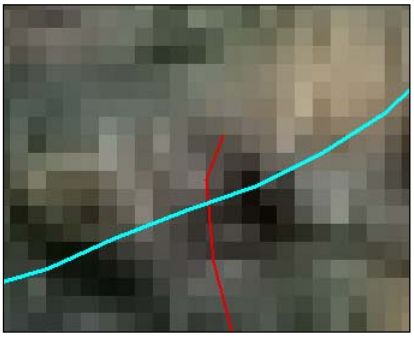
TASK 3: Trim lines

1. Zoom in to the area you will be working in.

2. Use the Edit tool to click once on the line which will be used to trim the desired line. We will trim the red line where it crosses the selected (blue) line.

3. Click on the Trim tool on the **Advanced Editing** toolbar.

4. Now, click on the red trail line above the blue selected trail to remove the overshoot.



TASK 4: Split lines

This is a useful tool when you have to a lot of vertices to delete and you don't want to waste your time deleting each one separately. The split tool cuts the line so you can delete entire line segments.

1. Zoom in to the area you will be working in. Highlight the trail to split with the Edit tool .

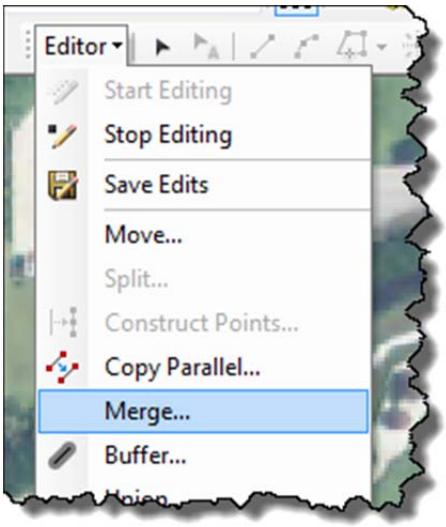
2. Click on the Split Tool on the **Editor** toolbar.

3. Click on the line where you want the split to occur. Select the line segment you want to delete and press the **Delete** Key.

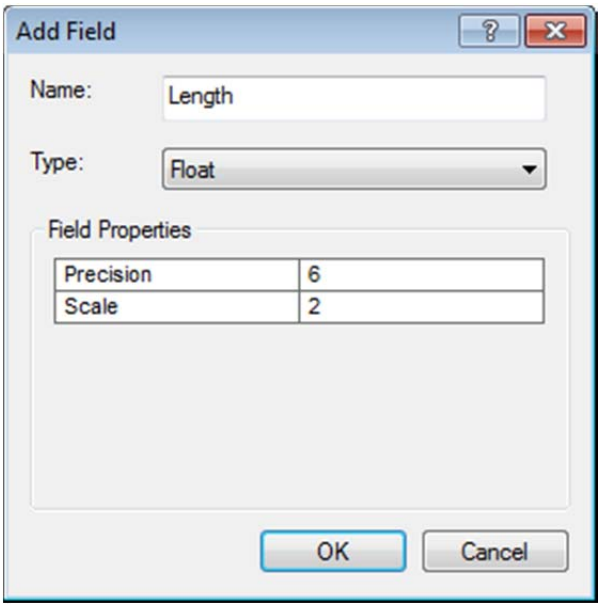
SECTION 3 - Calculate Trail Length and Area

1. Merge all the trail segments into one polyline after you're done with the line edits.

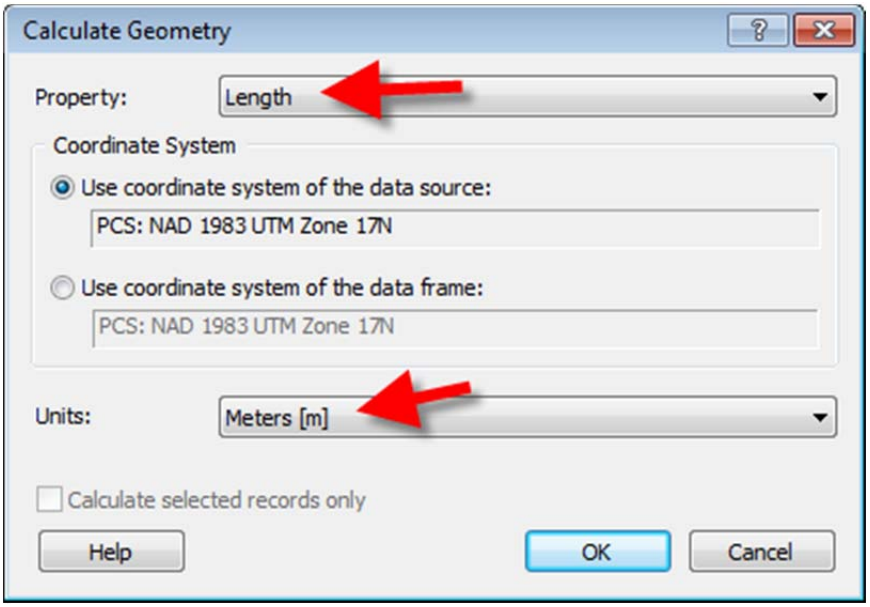
   - Select all the trail segments while still in edit mode. Then click Merge in the Editor Toolbar.



2. Open the attribute table and add two new fields from the Table Options drop-down menu . Name the fields **Length** and **Area**. Change the type to Float (i.e., a number with decimal places) with the Precision and Scale values as shown below. Precision is the number of digits in a number, and Scale is the number of digits right of the decimal place.



- To calculate length in meters, simply right-click on the Length field and select Calculate Geometry. You'll be warned that you are doing something outside of an editing session. Just go for it and click OK. Change the Property and Units as shown below. Click OK.



3. To calculate 2-dimensional area of a line, right-click on the Area field and select Field Calculator. Create the following expression and click OK.

[Length] *1.2

4. What's the total trail length _____(meters) and Area_____(Sq meters)?

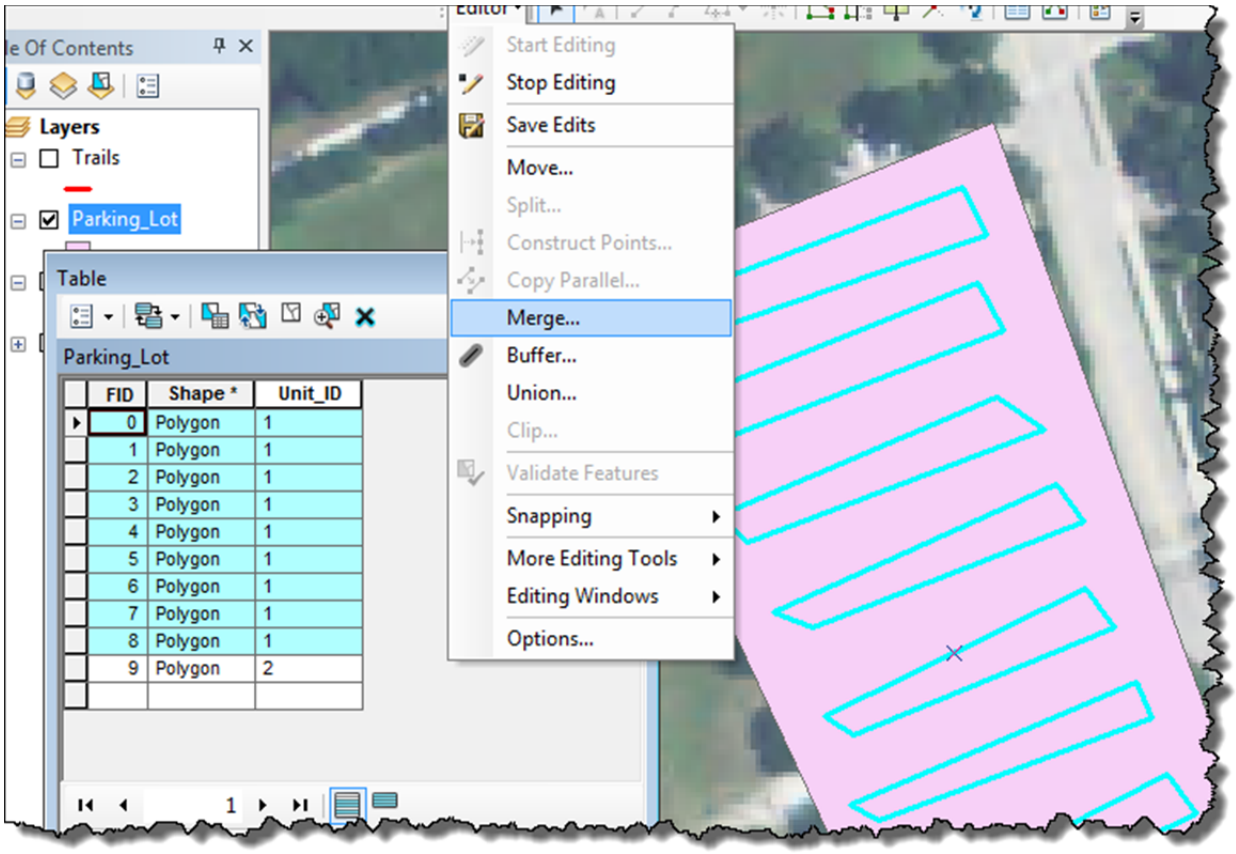
SECTION 4 – Erase the Islands and Calculate Parking Lot Area

Erasing the islands? Has the man lost it? Perhaps, but what we're referring to here is a tool called Erase that removes inner overlapping polygons and makes donut holes in the larger main polygon. The result is a clean polygon ripe for area calculation.

1. We need to make a separate layer that contains only the islands for the Erase Tool to work properly.

   - Start an editing session. Open the Parking_Lot attribute table and select all the islands.

   - Combine all the island polygons into one using the Merge tool on the Editor Toolbar.



   - Close the attribute table and stop the editing session.

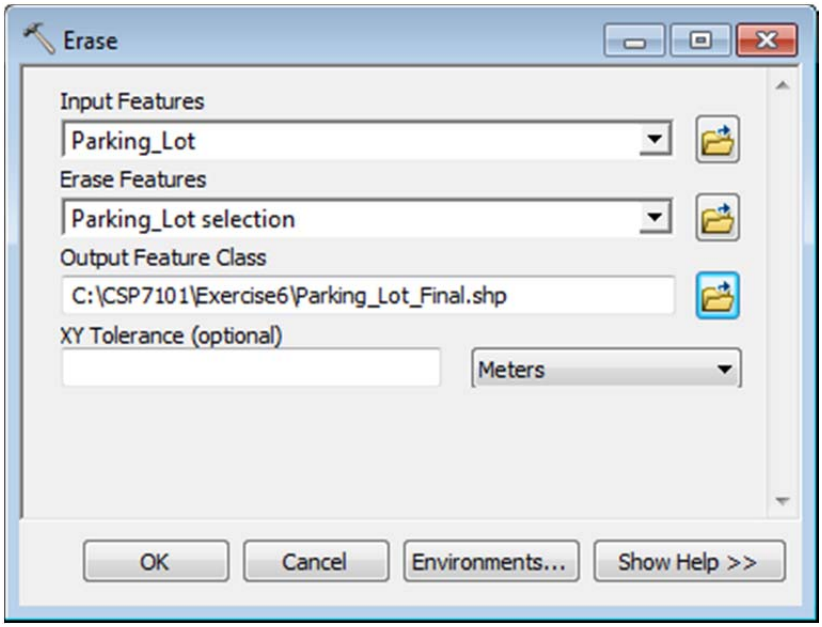
   - With the island polygon still selected in the attribute table, right-click on the Parking_Lot layer in the TOC and select **Selection > Data > Export Data**.

   - Name the new layer Islands. It will automatically appear in the TOC.

2. Next, use the Erase Tool to make donut holes in the Parking_Lot layer.

   - Type Erase in the Search box or open ArcToolbox and browse to Analyst Tools > Overlay to find the tool.

   - Fill-in the fields as shown below.



3. Add an Area field in the Parking_Lot_Final attribute table and calculate the total area in square meters as before. If your number seems really small than try to think in hectares. How many square meters in a hectare_____?

4. What is the Area of the Parking lot without the islands_____(square meters)?

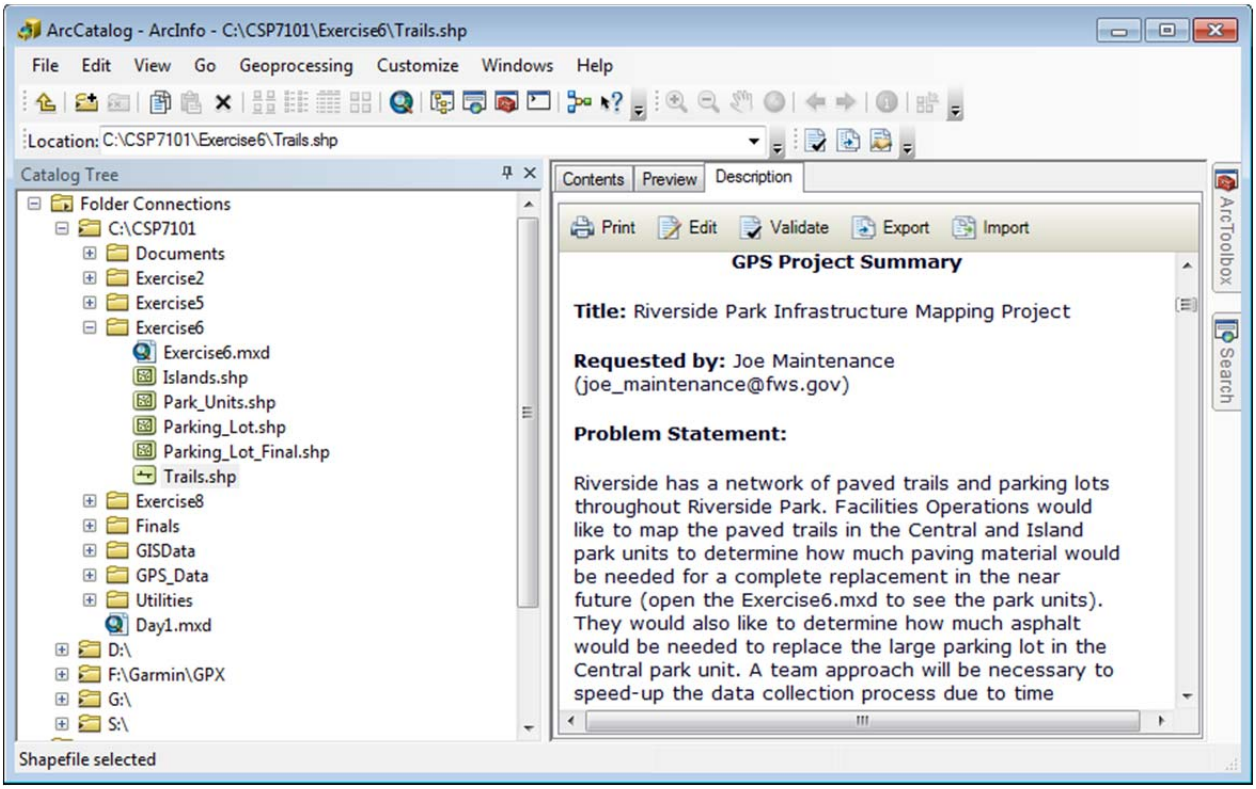
SECTION 5 - Add GPS Project Summary to the Metadata

This is a really quick way to add detailed metadata to your GIS layer. Most of us simply do not have the time to sit down and fill-out all the mandatory 11 sections of metadata. So, for practical purposes, I highly recommend that you add the GPS project summary to the description field. The GPS project summary contains plenty of information for someone else to evaluate the data quality, and that is essentially the main reason for metadata.

1. Launch ArcCatalog from the desktop.

2. To add metadata, simply highlight the **Trails** layer, select the **Description** tab and select the **Edit** tool in the Items Description window.

3. Click **Item Descriptions** in the Overview section and scroll down to Descriptions.

4. Open Windows Explorer and copy the text from the **Infrastructure_Project_Summary.docx** file in the Exercise6 folder and paste in the **Items Descriptions** field.

5. Click **Save**. That's it! As long as you have a GPS project summary you can create quick and easy metadata.