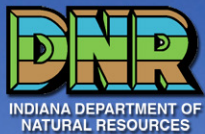




Effective use of LiDAR

INAFSM
September 7, 2016

Eric Moster
Engineering Section Manager



Effective use of LiDAR

We prefer you incorporate LiDAR into all of your model submittals

Ideas for using LiDAR to make better models

- 1) New approximate model – IDNR Zone A project
- 2) Add surveyed channel data and IDNR discharges (convert an approximate model to a detailed model)
- 3) Update existing (FIS, permit, or FARA) models with LiDAR and/or surveyed data (enhance an existing model)

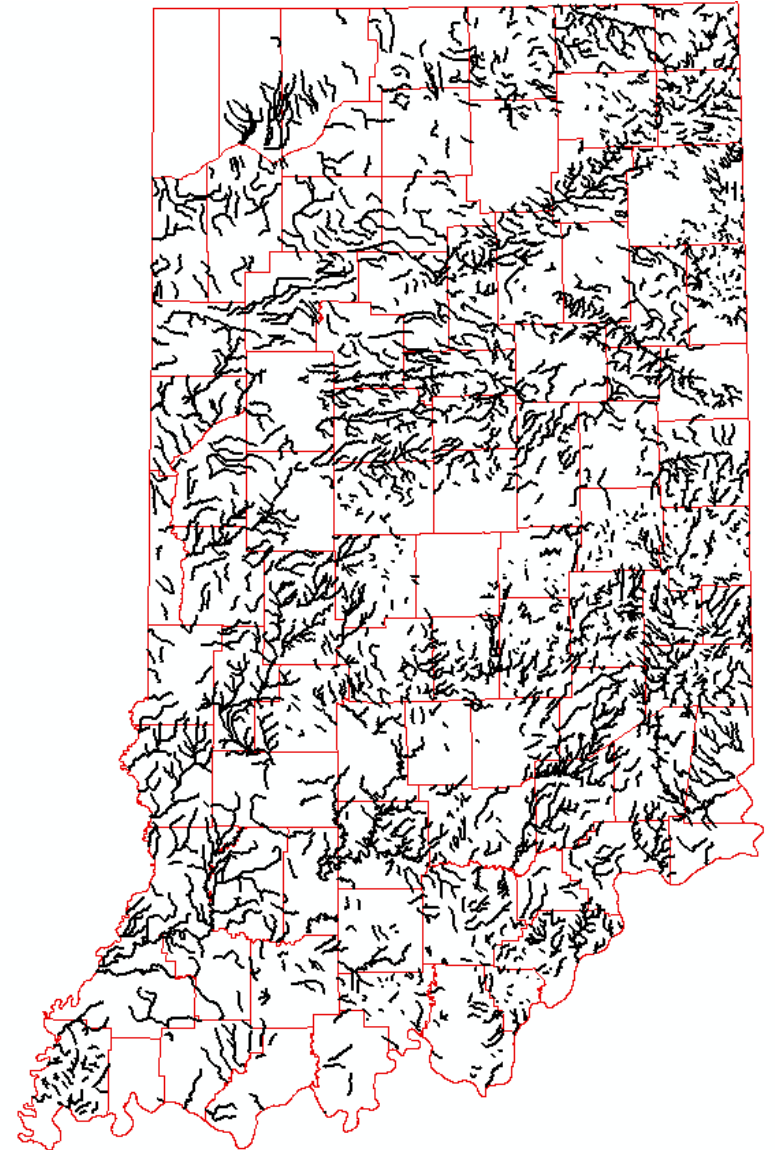


Zone A project

- FEMA guidance – all new zones must be model based
- Approximate model (no bridges)
- Hydrology : Purdue regression equations from Streamstats
- Bridges not modeled, but adjusted for using ineffective flow and manning's n-values, where necessary
- Full “RiskMAP” modeling, including 5 profiles (10%, 4%, 2%, 1% and 0.2% annual chance), Flood elevation points, Flood Boundary Standards points, depth grids, SFHA boundaries and floodways

What's done

- 10,000+ stream miles of floodplain completed
- 5,000+ stream miles of floodway done
- Working with Polis to add it all to INFIP as “Best available” layer





INDIANA DEPARTMENT OF
NATURAL RESOURCES



Floodmaps.in.gov

Indiana Floodplain Mapping Quick Links

Model library



- [The Indiana Floodplain Information Portal](#)

Launch INFIP, an interactive floodplain mapping tool, which includes address searching and eFARA, the Division of Water's on-line floodplain analysis submittal tools. INFIP also now includes the "Best Available Data" layer, showing up to date floodplain mapping information.

- [FEMA Map Service Center](#)

View and download official FEMA floodplain mapping products, including Flood Insurance Rate Maps, Flood Insurance Studies, Letters of Map Change (LOMA, LOMR-F, LOMR) FIRM database information, and preliminary and historic mapping products.

- [The Indiana Hydrology and Hydraulics Model Library](#)

View and download previous hydrologic and hydraulic models developed for Flood Insurance Studies, Construction in a Floodway applications, Floodplain Analysis / Regulatory Assessment (FARA), and others.

- [The General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana](#)

Technical guidance documents for developing floodplain modeling for submittal to the Division of Water. Also includes external links to other modeling information.

- [NOAA Atlas 14 Point Precipitation Frequency Estimates](#)

Estimates of rainfall depths and distributions for various return periods throughout the state.

Discharge calculator



- [The Indiana Peak Discharge Determination System](#)

Launch IPDDS, the Division of Water's hydrologic computation system. Includes directions on how to submit information to the Division for approval.

IDNR HEC-RAS tool



- [The Indiana DNR HEC-RAS Geometric Data Tool](#)

This tool uses the State of Indiana's LiDAR dataset, along with the National Hydrography Dataset, to create a Geometric Input file for HEC-RAS, the Corps of Engineers hydraulic modeling program.



IDNR HEC-RAS Geometric Data Tool Quick Guide

This tool will create a “.sdf” file that can be imported into a HEC-RAS geometry file, based on input cross sections and stream centerline. The “.sdf” file will be fully attributed with station / elevation points for each cross section, bank stations, channel and overbank lengths, and Manning’s N roughness coefficients.

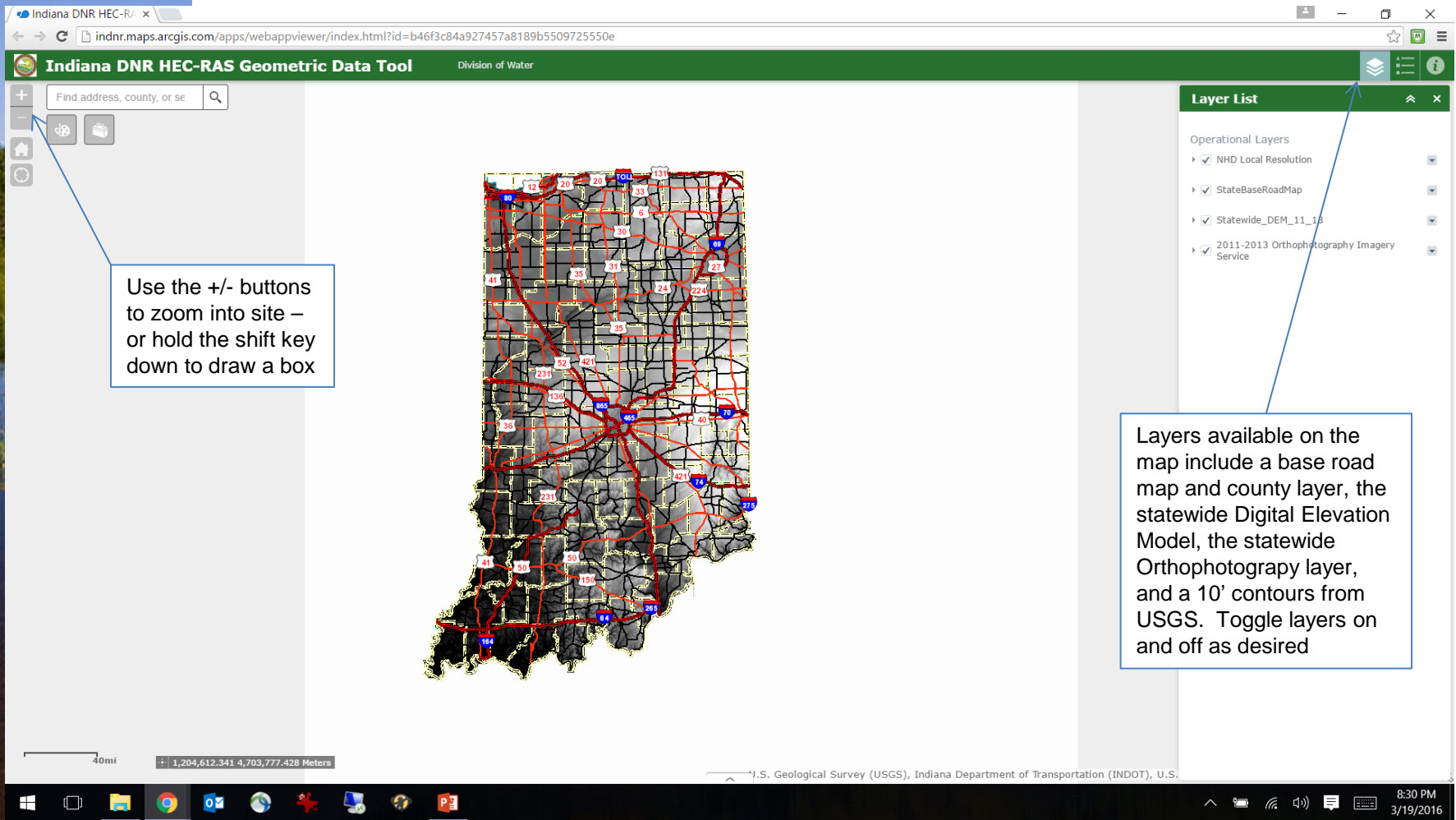
See the “Hydraulic Data Reference” for details on how the data is derived.

http://www.in.gov/dnr/water/files/wa-IDNR_HEC-RAS_Geometric_Data_Tool_Reference.pdf

Application:

<http://indnr.maps.arcgis.com/apps/webappviewer/index.html?id=b46f3c84a927457a8189b5509725550e>

Zoom into site



Indiana DNR HEC-RAS Geometric Data Tool

Division of Water

Find address, county, or se

Use the +/- buttons to zoom into site – or hold the shift key down to draw a box

Layer List

- Operational Layers
- NHD Local Resolution
- StateBaseRoadMap
- Statewide_DEM_11_13
- 2011-2013 Orthophotography Imagery Service

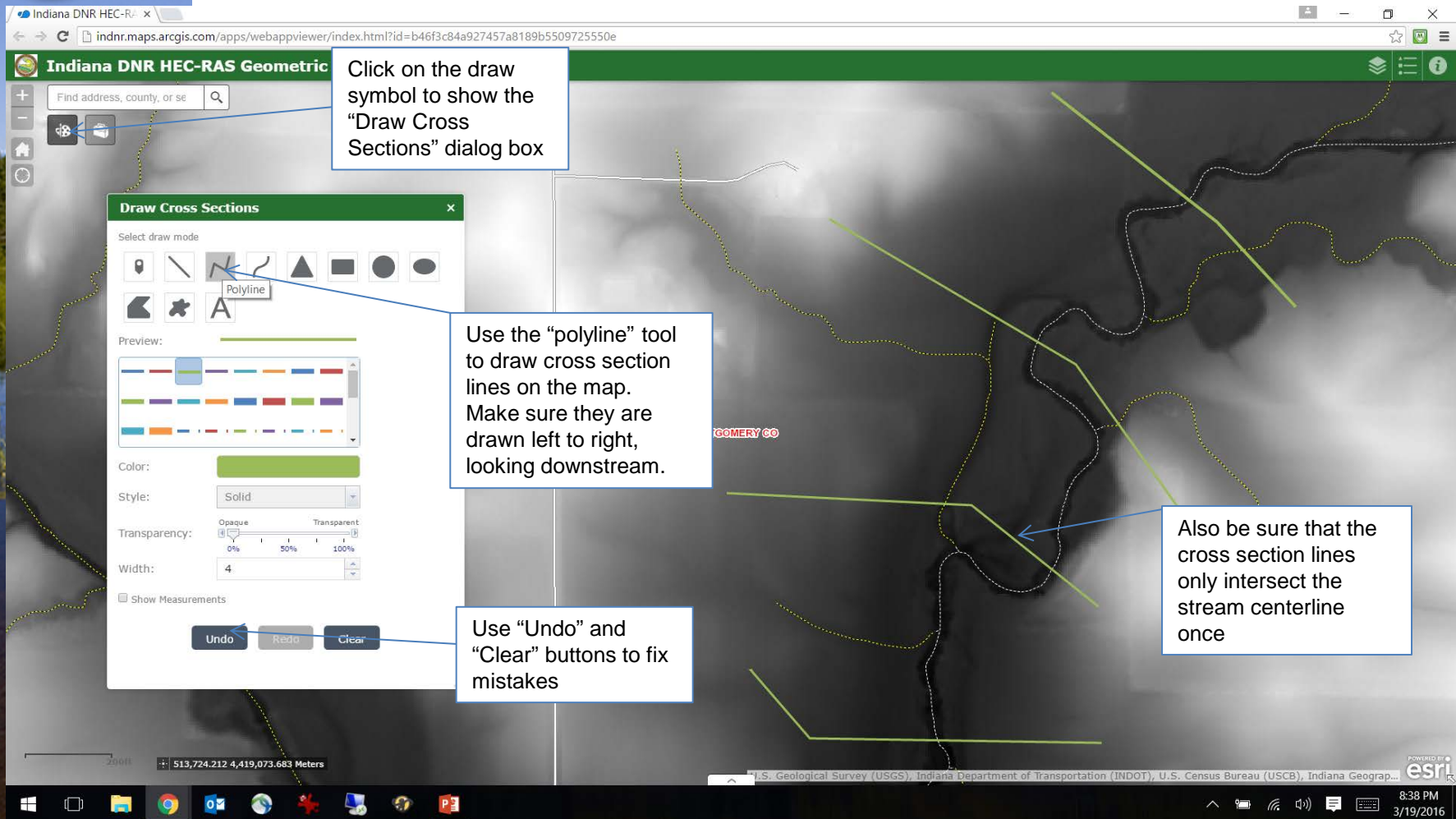
40mi 1,204,612.341 4,703,777.428 Meters

U.S. Geological Survey (USGS), Indiana Department of Transportation (INDOT), U.S.

8:30 PM
3/19/2016

Layers available on the map include a base road map and county layer, the statewide Digital Elevation Model, the statewide Orthophotography layer, and a 10' contours from USGS. Toggle layers on and off as desired

Draw Cross Sections



Indiana DNR HEC-RAS Geometric

Click on the draw symbol to show the "Draw Cross Sections" dialog box

Use the "polyline" tool to draw cross section lines on the map. Make sure they are drawn left to right, looking downstream.

Also be sure that the cross section lines only intersect the stream centerline once

Use "Undo" and "Clear" buttons to fix mistakes

Draw Cross Sections

Select draw mode

Preview:

Color:

Style: Solid

Transparency: 0% 50% 100%

Width: 4

Show Measurements

Undo Redo Clear

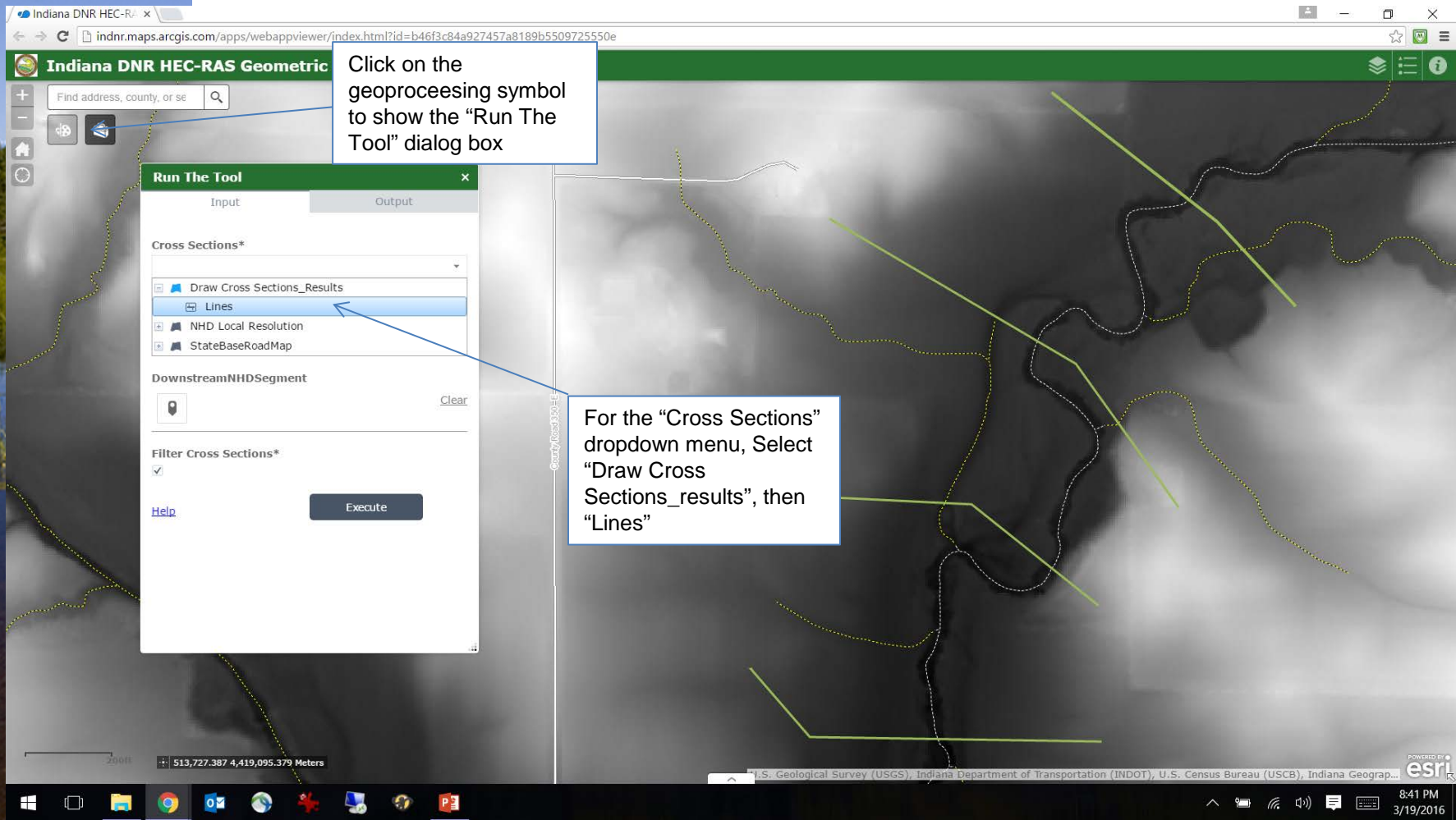
513,724,212 4,419,073.683 Meters

POWERED BY esri

U.S. Geological Survey (USGS), Indiana Department of Transportation (INDOT), U.S. Census Bureau (USCB), Indiana Geograp...

8:38 PM
3/19/2016

Run the tool



The screenshot shows a web browser window displaying the "Indiana DNR HEC-RAS Geometric" tool. The browser address bar shows the URL: `indnr.maps.arcgis.com/apps/webappviewer/index.html?id=b46f3c84a927457a8189b5509725550e`. The tool interface includes a search bar, a "Run The Tool" dialog box, and a map area. The "Run The Tool" dialog box has two tabs: "Input" and "Output". Under the "Input" tab, there is a "Cross Sections*" dropdown menu with the following options: "Draw Cross Sections_Results", "Lines", "NHD Local Resolution", and "StateBaseRoadMap". The "Lines" option is selected. Below this, there is a "DownstreamNHDSegment" field with a "Clear" button. At the bottom of the dialog, there is a "Filter Cross Sections*" checkbox which is checked, and an "Execute" button. A "Help" link is also present. The map area shows a river channel with several green lines drawn across it, representing cross-sections. Two callout boxes provide instructions: one points to a gear icon in the top left of the tool interface, and another points to the "Lines" option in the "Cross Sections*" dropdown menu. The bottom of the screen shows a Windows taskbar with various application icons and a system tray with the date and time: 8:41 PM, 3/19/2016. The bottom right corner of the map area features the text "POWERED BY esri" and "U.S. Geological Survey (USGS), Indiana Department of Transportation (INDOT), U.S. Census Bureau (USCB), Indiana Geograp...".

Click on the geoprocesing symbol to show the "Run The Tool" dialog box

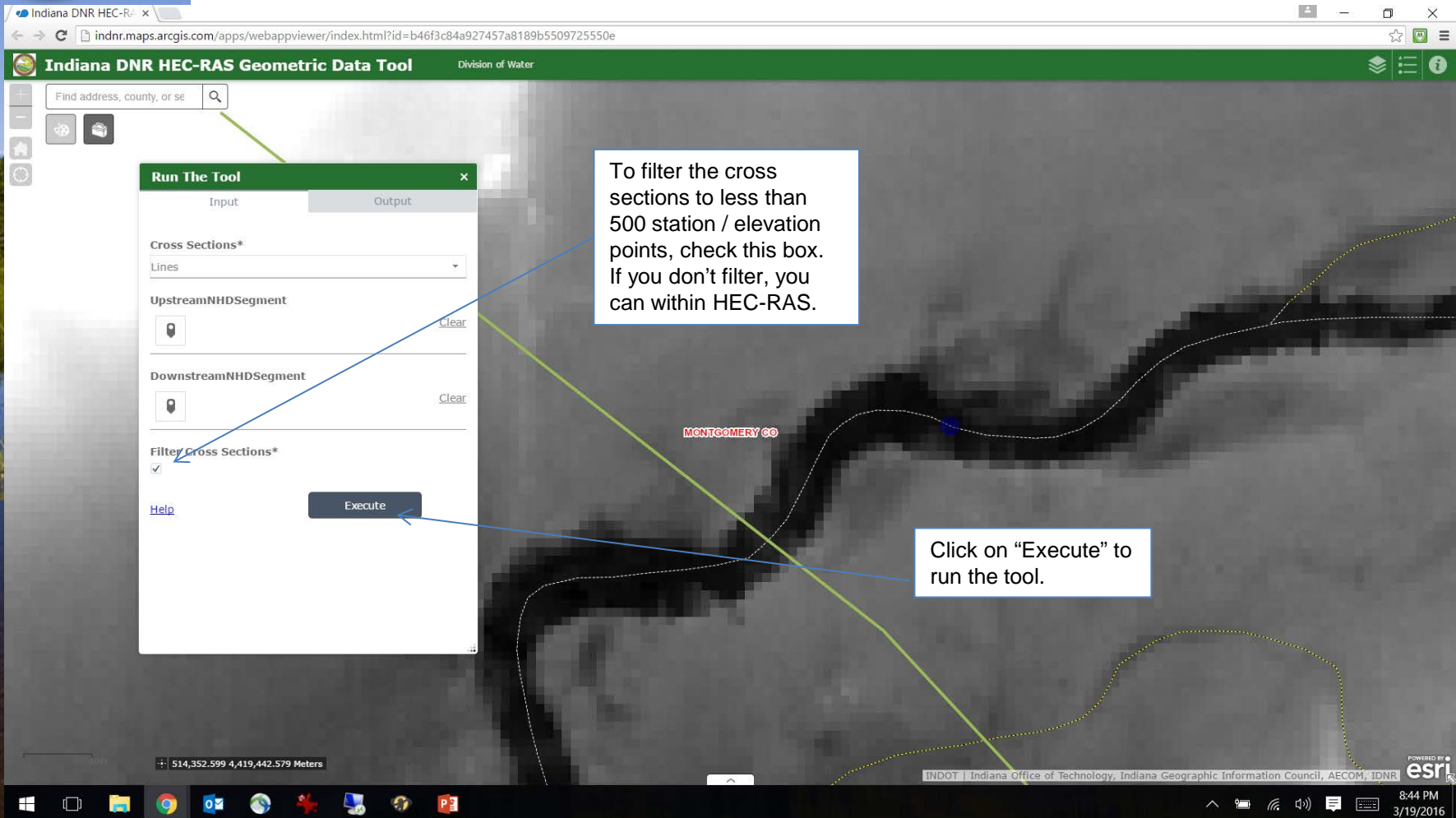
For the "Cross Sections" dropdown menu, Select "Draw Cross Sections_results", then "Lines"



Select upstream / downstream NHD segments

The screenshot displays the 'Indiana DNR HEC-RAS Geometric Data Tool' interface. The main map area shows a stream segment with a red label 'MONTGOMERY CO'. A green line is drawn across the map, and a blue arrow points to a specific point on the stream segment. A white callout box with a blue border contains the text: 'To select the upstream NHD segment, zoom into the map, then place a point on the stream segment. Do the same for the downstream segment'. Another white callout box with a blue border contains the text: 'Make sure you zoom in close and get the point on the line segment'. The 'Run The Tool' dialog box is open, showing the 'Input' tab. It has a search bar at the top with the text 'Find address, county, or se'. Below the search bar are several icons. The dialog box has two tabs: 'Input' and 'Output'. Under the 'Input' tab, there are three sections: 'Cross Sections*' with a dropdown menu set to 'Lines'; 'UpstreamNHDSegment' with a location pin icon and a 'Clear' button; and 'DownstreamNHDSegment' with a location pin icon and a 'Clear' button. At the bottom of the dialog box, there is a 'Filter Cross Sections*' section with a checked checkbox and a 'Help' link. An 'Execute' button is located at the bottom right of the dialog box. The background of the map shows a stream with a red label 'MONTGOMERY CO'. A green line is drawn across the map, and a blue arrow points to a specific point on the stream segment. A white callout box with a blue border contains the text: 'To select the upstream NHD segment, zoom into the map, then place a point on the stream segment. Do the same for the downstream segment'. Another white callout box with a blue border contains the text: 'Make sure you zoom in close and get the point on the line segment'. The bottom of the screen shows a Windows taskbar with various application icons and a system tray with the time '8:44 PM' and date '3/19/2016'. The bottom right corner of the map area has the text 'INDOT | Indiana Office of Technology, Indiana Geographic Information Council, AECOM, IDNR' and the 'esri' logo.

Run the tool



The screenshot shows the "Indiana DNR HEC-RAS Geometric Data Tool" web application. The interface includes a search bar at the top, a "Run The Tool" dialog box on the left, and a map of a river channel. The "Run The Tool" dialog box has two tabs: "Input" and "Output". Under the "Input" tab, there are fields for "Cross Sections*" (set to "Lines"), "UpstreamNHDSegment", and "DownstreamNHDSegment", each with a "Clear" button. A "Filter Cross Sections*" checkbox is checked. A "Help" link is at the bottom of the dialog. An "Execute" button is located below the dialog. A search bar at the top of the application has a magnifying glass icon. The map shows a river channel with a red label "MONTGOMERY CO" and a blue dot on the channel. A green line is drawn across the map. The bottom of the screen shows a Windows taskbar with various icons and a system tray with the date and time "8:44 PM 3/19/2016".

Find address, county, or se

Run The Tool

Input Output

Cross Sections*
Lines

UpstreamNHDSegment Clear

DownstreamNHDSegment Clear

Filter Cross Sections*

Help

Execute

To filter the cross sections to less than 500 station / elevation points, check this box. If you don't filter, you can within HEC-RAS.

Click on "Execute" to run the tool.

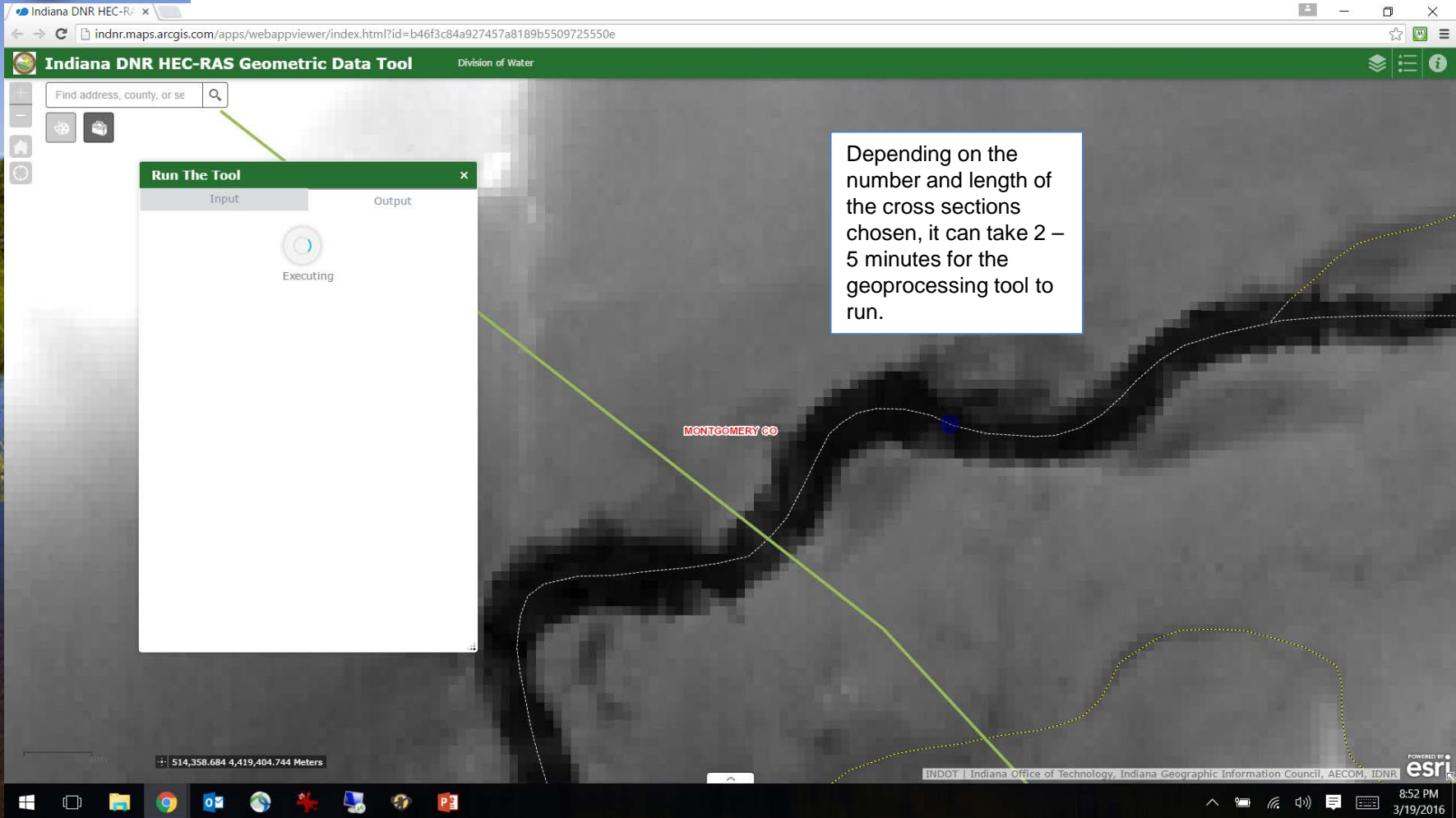
MONTGOMERY CO

INDOT | Indiana Office of Technology, Indiana Geographic Information Council, AECOM, IDNR

POWERED BY esri

8:44 PM
3/19/2016

Be Patient!



Indiana DNR HEC-RAS Geometric Data Tool

Division of Water

Find address, county, or se

Run The Tool

Input Output

Executing

MONTGOMERY CO

514,358,684 4,419,404,744 Meters

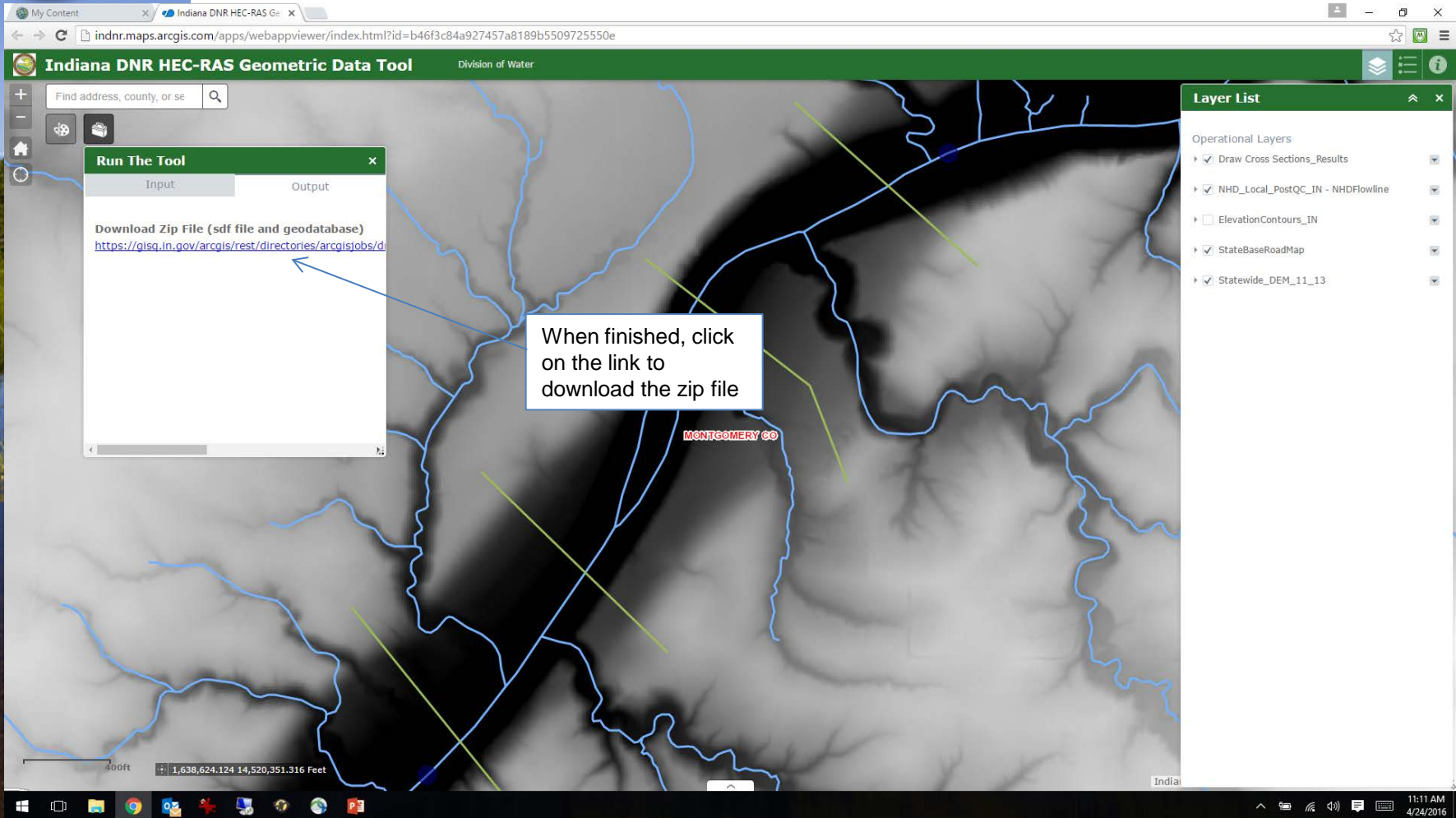
INDOT | Indiana Office of Technology, Indiana Geographic Information Council, AECOM, IDNR

POWERED BY esri

8:52 PM
3/19/2016

Depending on the number and length of the cross sections chosen, it can take 2 – 5 minutes for the geoprocessing tool to run.

Successfully Run



My Content | Indiana DNR HEC-RAS Geometric Data Tool | Division of Water

Find address, county, or se

Run The Tool

Input | Output

Download Zip File (sdf file and geodatabase)
<https://gisq.in.gov/arcgis/rest/directories/arcgisjobs/d>

When finished, click on the link to download the zip file

Layer List

Operational Layers

- Draw Cross Sections_Results
- NHD_Local_PostQC_IN - NHDFlowline
- ElevationContours_IN
- StateBaseRoadMap
- Statewide_DEM_11_13

400ft | 1,638,624.124 14,520,351.316 Feet

11:11 AM 4/24/2016

Downloaded Zip File

The gdb directory and sdf file will be buried under a series of directories – these are from the ArcGIS server environment



ZoneAlmport - WinZip Evaluation Version - Try our Free ZipShare

File Unzip/Share Edit Backup Tools Settings View Help Buy Now

BUY NOW Activate WinZip before your trial runs out! Purchase risk-free TODAY from our secure online shop. cnet 30 DAY MONEY BACK GUARANTEE

Files

Recent Zip Files

- ZoneAlmport.zip Downloads
- TC-99-SNS-02.rar Archive
- TC-99-SNS-01.rar Archive

Places

- Frequent Folders
- This PC 872 GB free of 921 GB
- Network
- Homegroup
- Add Cloud

scratch

ZoneAlmport.zip > Users > 1-ARCG-1 > AppData > Local > Temp > dnr > esritest9_gpserver > j25312cdf4a2d4651aece21afcd1b9dfc

Name	Type	Date modified	Size
ZoneA_001.gdb	Folder	4/24/2016 11:10 AM	
dnrZoneA.import.sdf	SDF File	4/24/2016 11:10 AM	92.8 KB → 92.8 KB

2 item(s)

Zip File: 62 item(s), 357.69 KB

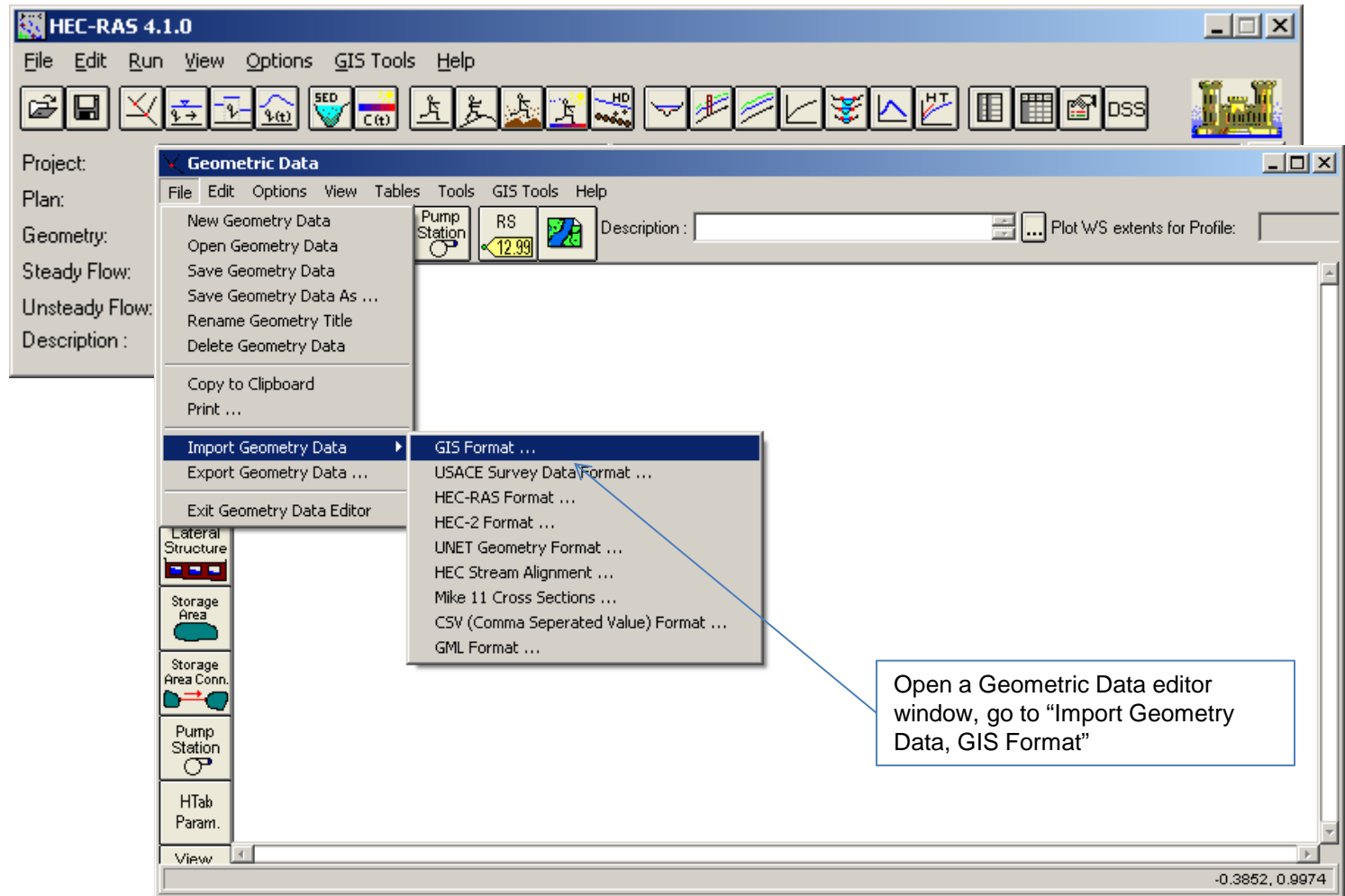
Actions

- Unzip All Files
- Convert & Protect Files
- Save or Share Zip

The geodatabase will contain the cross section and stream centerline shapes, along with a polygon shape representing the n value regions.

The sdf file is an ASCII file that can be imported into a HEC-RAS geometry file

Importing into HEC-RAS



The screenshot displays the HEC-RAS 4.1.0 software interface. The main window is titled "Geometric Data" and contains a menu bar (File, Edit, Options, View, Tables, Tools, GIS Tools, Help) and a toolbar with various icons. The "Import Geometry Data" menu is open, showing options such as "GIS Format ...", "USACE Survey Data Format ...", "HEC-RAS Format ...", "HEC-2 Format ...", "UNET Geometry Format ...", "HEC Stream Alignment ...", "Mike 11 Cross Sections ...", "CSV (Comma Separated Value) Format ...", and "GML Format ...". A blue arrow points from a text box to the "GIS Format ..." option.

Project:
Plan:
Geometry:
Steady Flow:
Unsteady Flow:
Description :

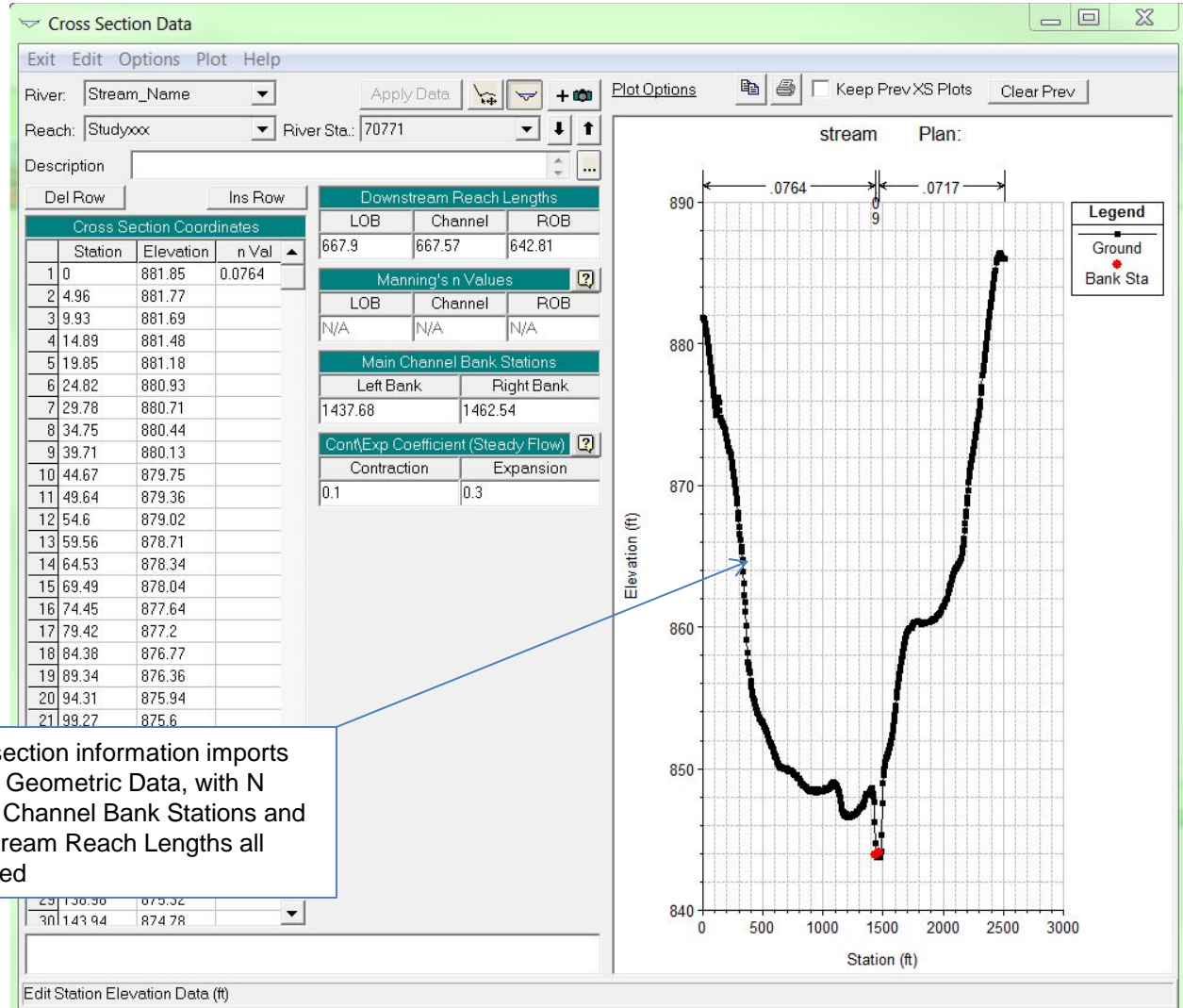
Import Geometry Data

- GIS Format ...
- USACE Survey Data Format ...
- HEC-RAS Format ...
- HEC-2 Format ...
- UNET Geometry Format ...
- HEC Stream Alignment ...
- Mike 11 Cross Sections ...
- CSV (Comma Separated Value) Format ...
- GML Format ...

Open a Geometric Data editor window, go to "Import Geometry Data, GIS Format"

-0.3852, 0.9974

Cross section data



Cross section information imports into the Geometric Data, with N values, Channel Bank Stations and Downstream Reach Lengths all populated



Disclaimer

This application, including its underlying data and web services are distributed "AS-IS" without warranties of any kind, expressed or implied, including but not limited to warranties of suitability of a particular purpose or use. These data graphical representations and are for public use informational purposes only. They are not to be construed as a legal document or survey instrument. The Indiana Department of Natural Resources assumes no liability. A detailed on-the-ground survey and historical analysis of individual features may differ from this data. Credit should be given to the Indiana Department of Natural Resources. **The IDNR provides no assurance that use of this tool will result in a model that can be approved by the Department for any purpose.** Modeling and other floodplain analyses should be directed by a licensed engineer experienced in hydrology and hydraulics.



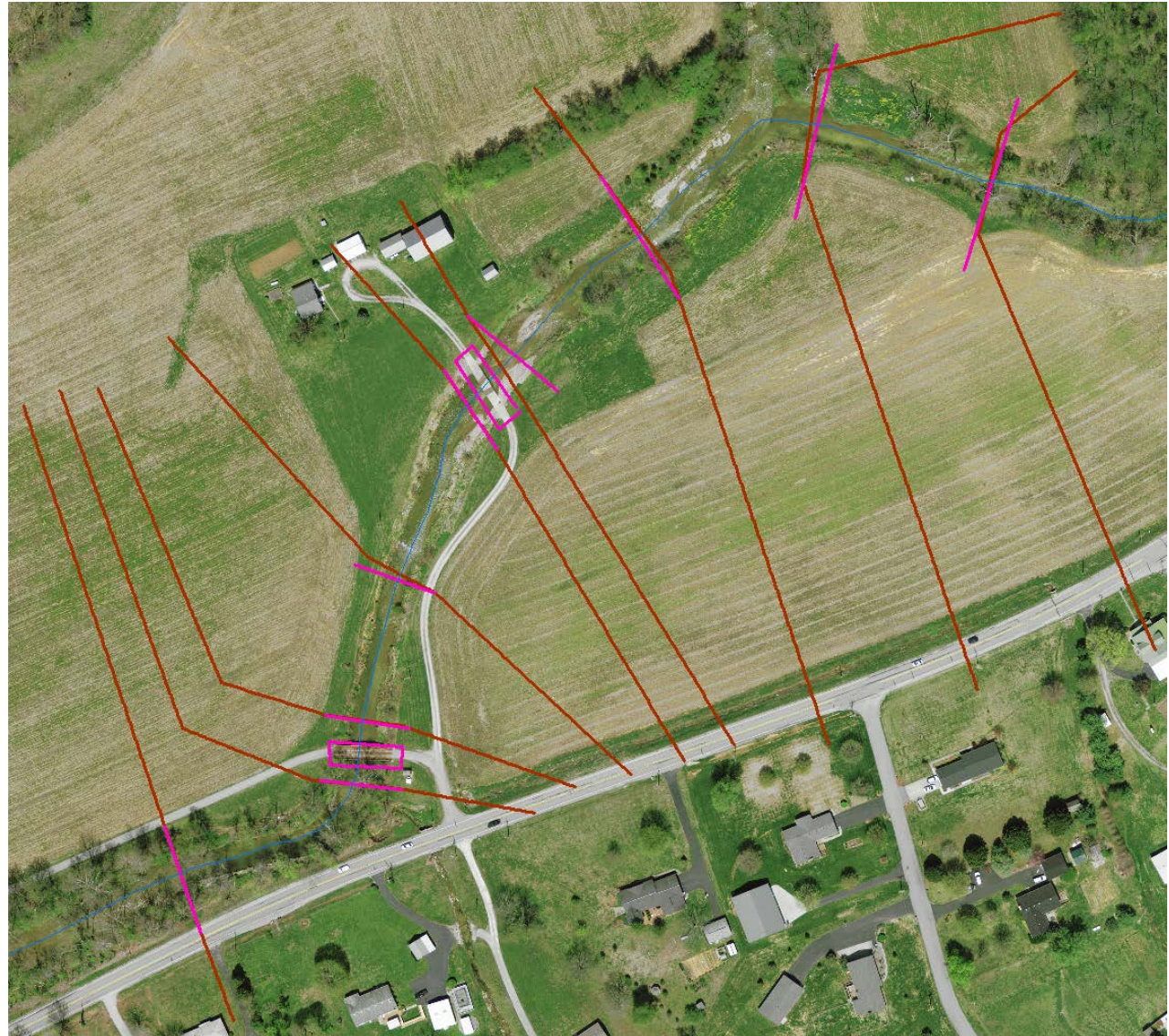
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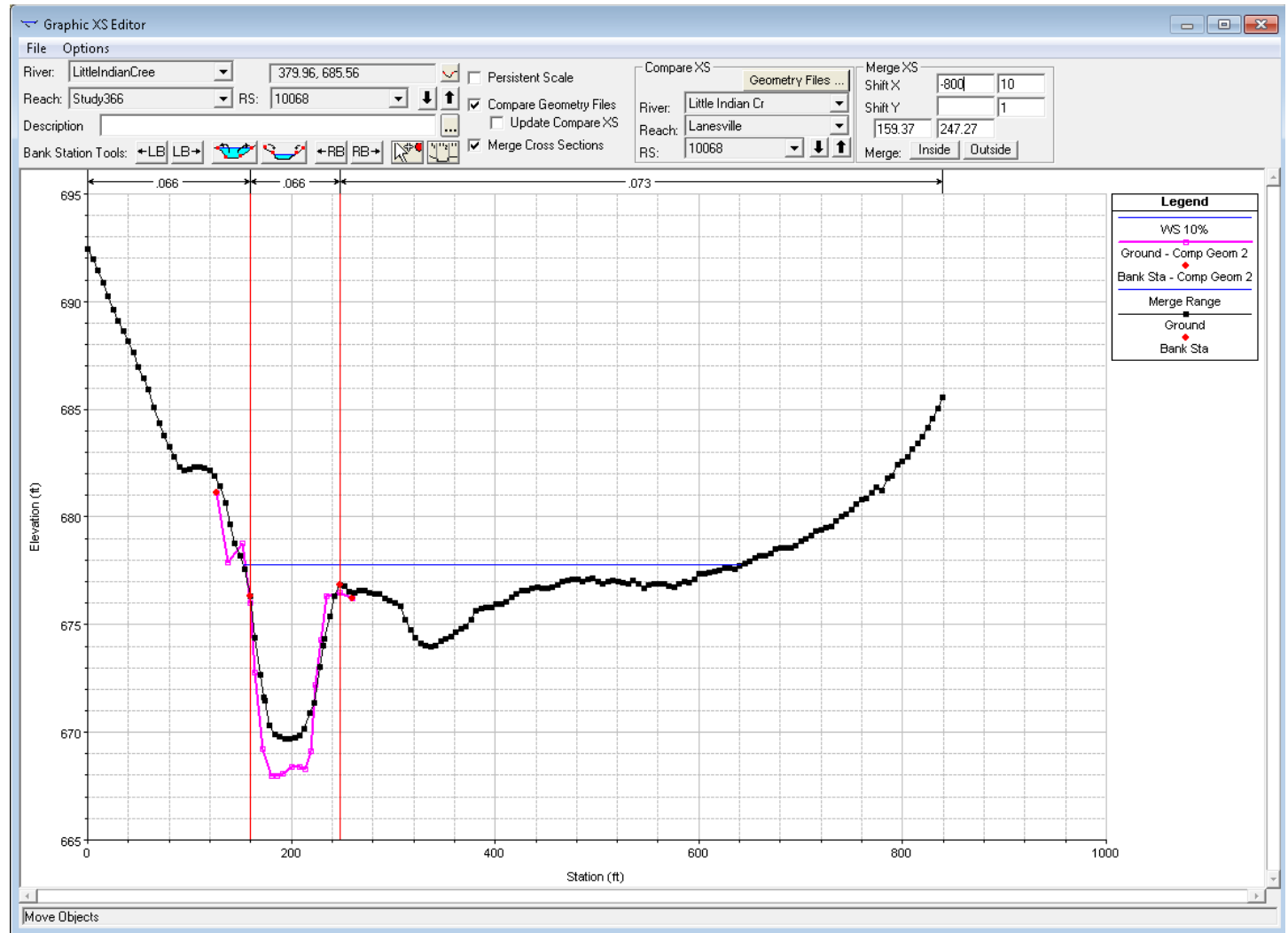
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Add Channel data









Compare and merge XSs





Getting IDNR discharge

Indiana Floodplain Mapping Quick Links

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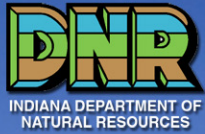
Discharge calculator 



How does IPDDS work?



- Click the “Request a discharge determination” button to run the program (can take a few minutes).
 - The program sends a request to the Streamstats server
 - Then queries the IDNR Unity databases for hydrologic information
 - Once complete a zip file can be downloaded



Detailed model complete

- You started with the approximate model
- You have added channel data from a survey at a few locations
- You have added bridge data for all bridges in the reach
- You requested discharges from IDNR and entered them in your model

Your detailed model is complete with minimal survey data required.





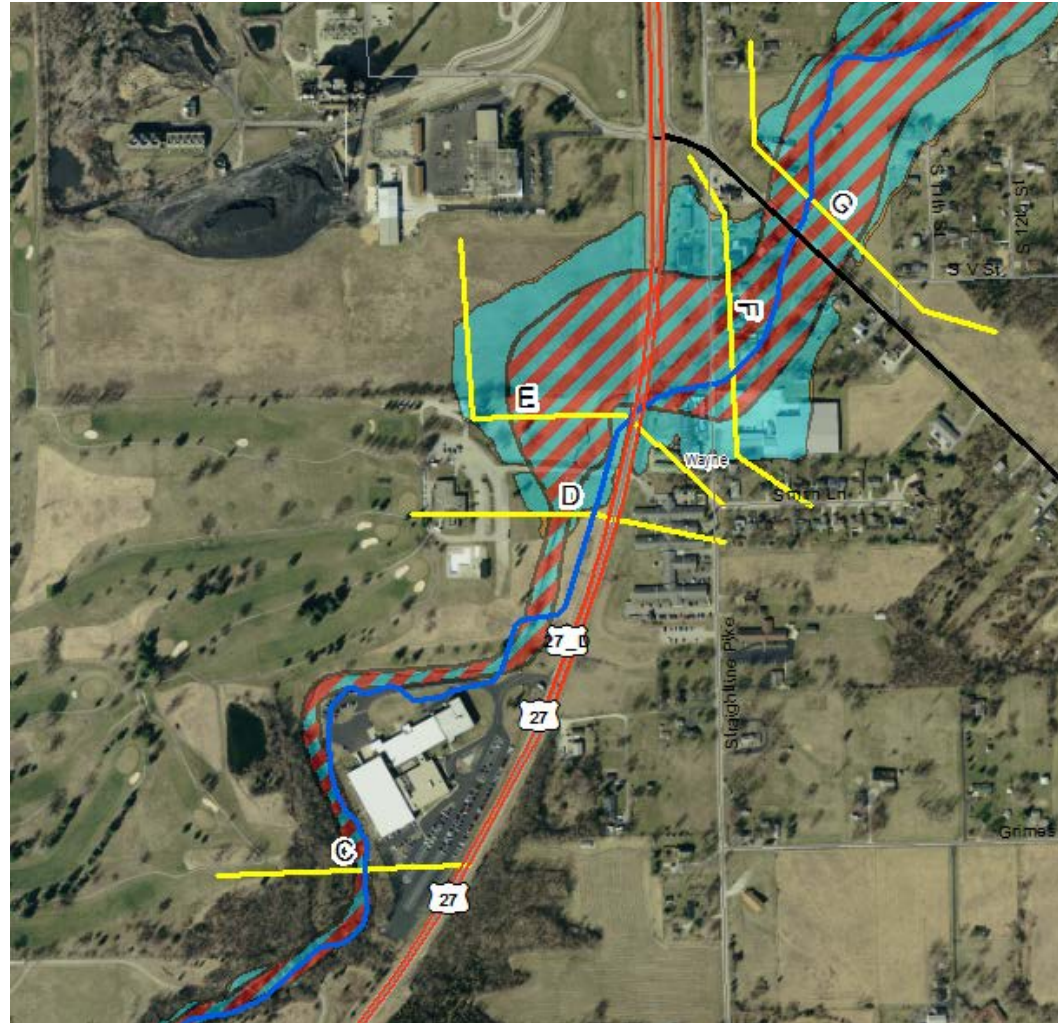
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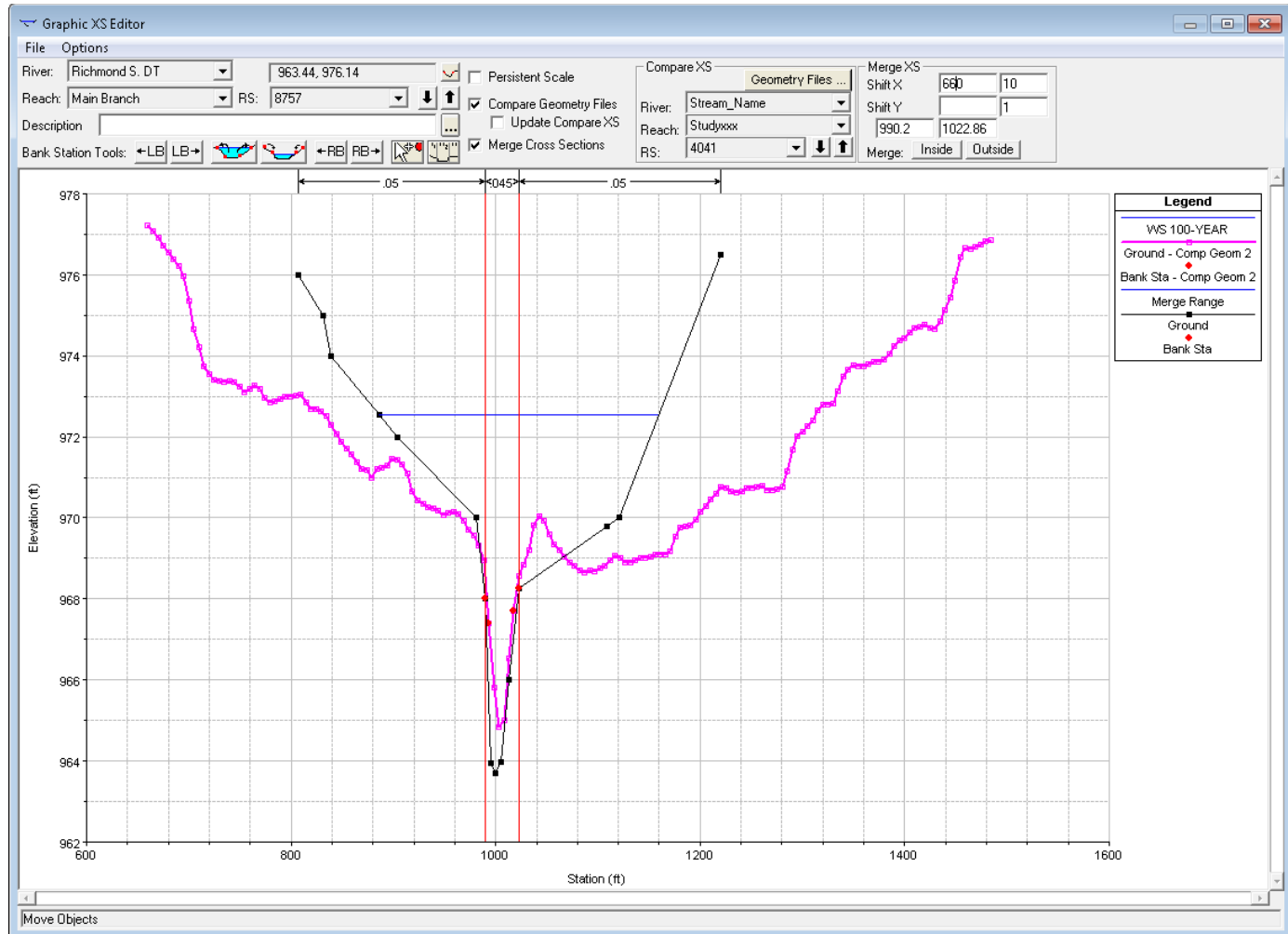
Update existing model



Update existing model

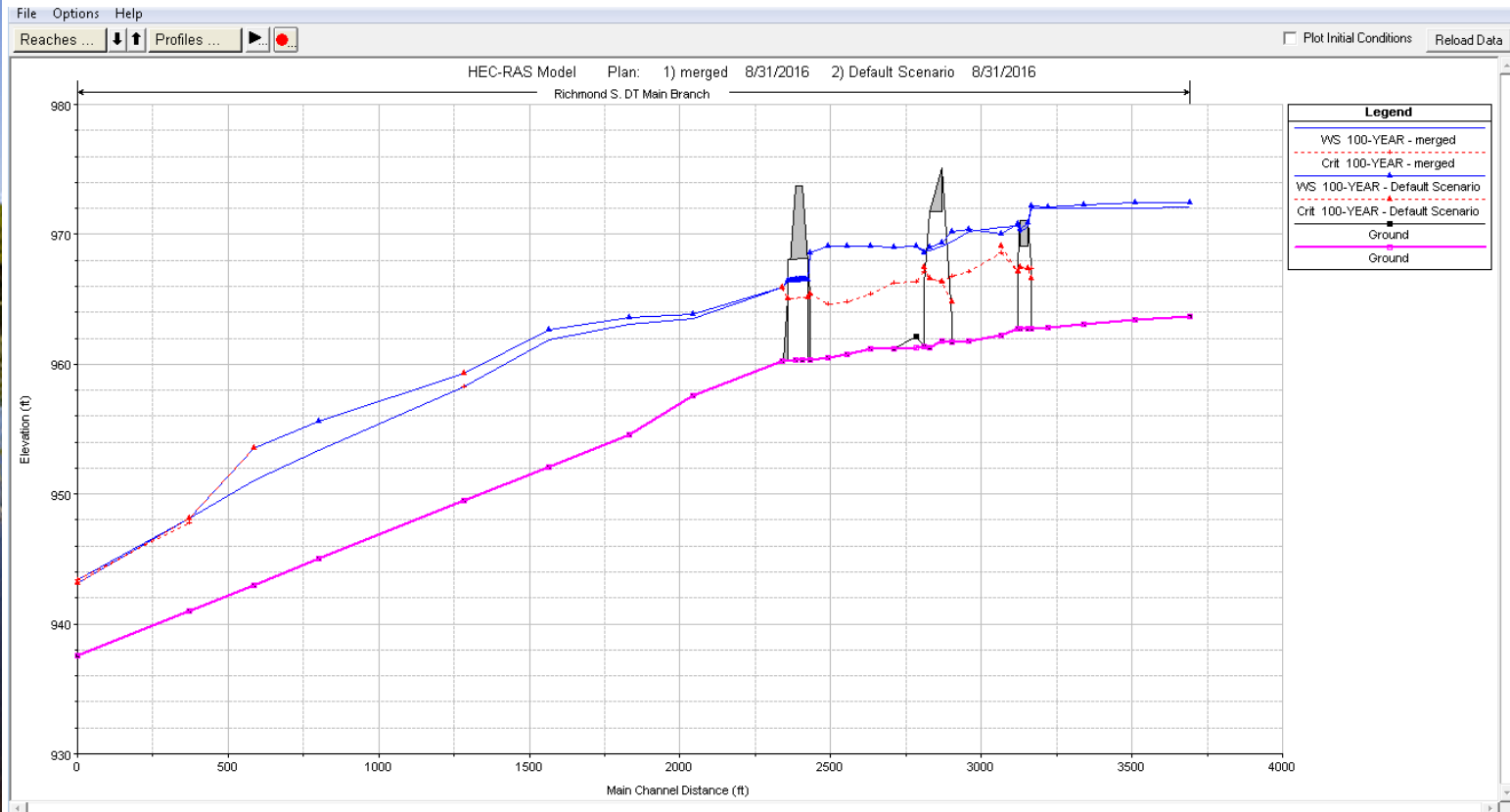


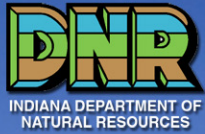
Compare and merge XSs



Compare flood profile

Look at the change in water surface after introducing LiDAR to the cross sections





When not to use LiDAR?

- When you have survey data for the entire site or better topographic data – expensive
- Using LiDAR is an inexpensive way to improve and extend all hydraulic models
- More to come with HEC-RAS 5.0





Questions????

Eric Moster
Engineering Section Manager
317-234-1054
ericmoster@dnr.in.gov