

From Classroom to Implementation in Two Years:

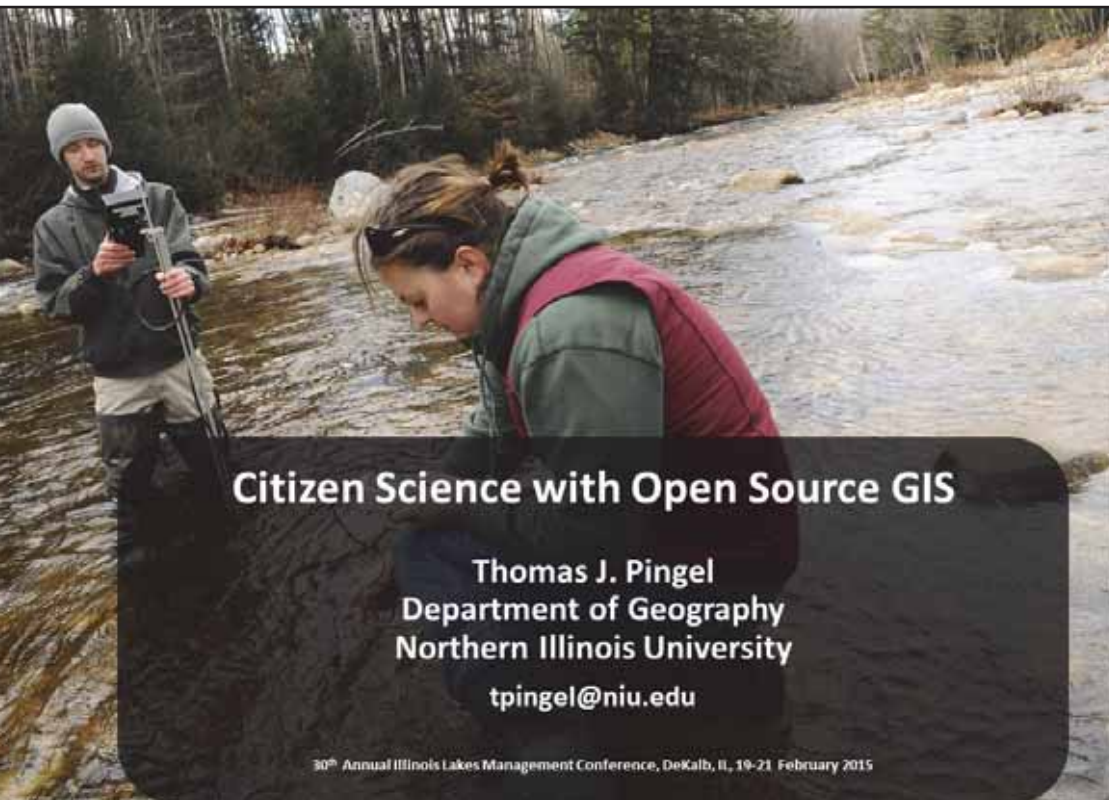
QGIS is a Powerful Lake Management Tool

Illinois Lakes Management Association - 2017 Conference

Pete Mesha, PE, LEED AP, FACEC

Chair – Lakes & Dams Committee, Lake Wildwood Association, Inc.

Group President – Transportation & Infrastructure, Wight & Company



Citizen Science with Open Source GIS

Thomas J. Pingel
Department of Geography
Northern Illinois University
tpingel@niu.edu

30th Annual Illinois Lakes Management Conference, DeKalb, IL, 19-21 February 2015

Slides courtesy of Thomas Pingel, Northern Illinois University



Citizen Science

- Term just added to the Oxford English Dictionary in June 2014
 - *“Scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions”*
- Citizen Scientists
 - Provide experimental data
 - Raise new questions
 - Co-create scientific culture

Levels of Citizen Science

- Crowdsourcing
 - Citizens-as-sensors
 - Collect and contribute data, perhaps unknowingly!
 - Twitter feeds
- Distributed Intelligence
 - Citizens help to interpret data
 - Amazon’s Mechanical Turk
- Participatory Science
 - Aid in problem identification and definition
 - Active in data collection
- Extreme citizen science
 - Collaboration and analysis



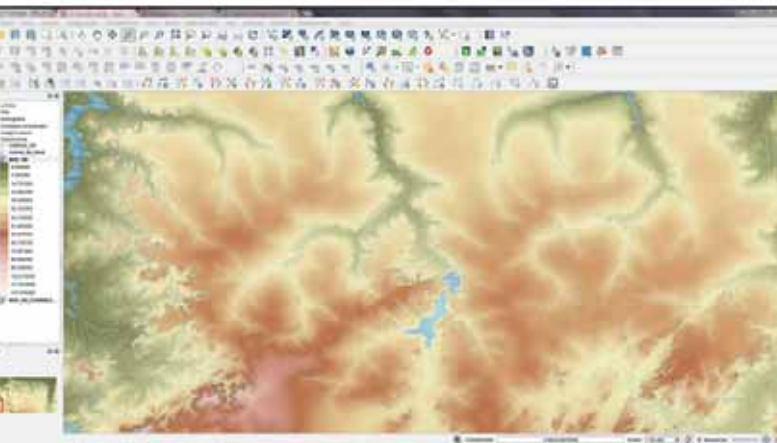
(from Haklay, 2013)



the most promising developments for citizen geoscience is the development of a very good, open source, free GIS:

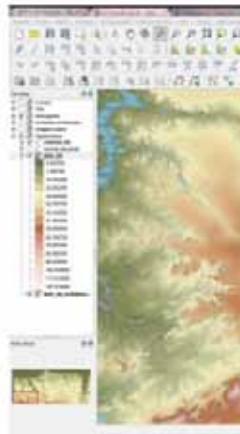
QGIS

(formerly Quantum GIS)



Slide courtesy of Thomas Pingel, Northern Illinois University

QGIS allows for more than just
It puts the tools for **visualization** a



Slide courtesy of Tho

What do you really need to know to get started?

1. How do I get QGIS?
2. Where do I get data?
3. What are the basic kinds of data?
4. What is a Spatial Reference System?
5. How do I create my own data?
6. How do I start to visualize and analyze my own data?
7. How can I teach myself how to use QGIS?

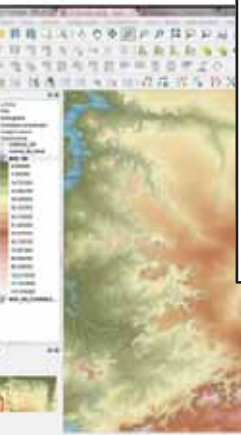
Slide courtesy of Thomas Pingel, Northern Illinois University

How
The tool req
how geogr
manipulat

Slide courtesy of Thomas Pingel, Northern Illinois University

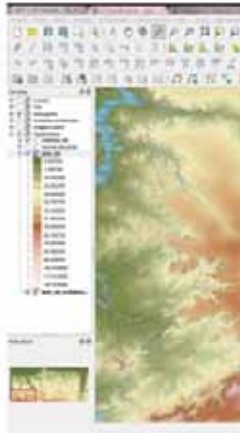
the most promising
development of

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Slide courtesy of Thomas Pingel, Northern Illinois University

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How
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5. How do I create my own data? ✓
6. How do I start to visualize and analyze my own data? ✓
7. How can I teach myself how to use QGIS? ✓

Slide courtesy of Thomas Pingel, Northern Illinois University

Slide courtesy of Thomas Pingel, Northern Illinois University

Slide courtesy of Thomas Pingel, Northern Illinois University

How do we teach ourselves QGIS?

- Bring Professor Pingel back for round two!
- It's all about independent study - QGIS has great tutorials, independent user groups, and a trove of "how-to" YouTube videos.
- It's intimidating to start with a blank map canvas.
- It's an investment to learn how to fetch on-line GIS data sets and put them on QGIS.
- It's easy to learn how to turn on and to turn off the mapping layers for viewing or printing.
- It's yet a deeper level of investment, but not too hard, to learn to coordinate field data capture with GPS devices and create new mapping layers.

At Lake Wildwood our formula for learning:

One obsessive Committee Chair,

+ An accommodating General Manager and Board,

+ A science advisor on-call for guidance,

+ A savvy millennial staffer,

+ A crew of citizen GPS-data-logger-volunteers = Success (hopefully)

Where do the GIS data come from?

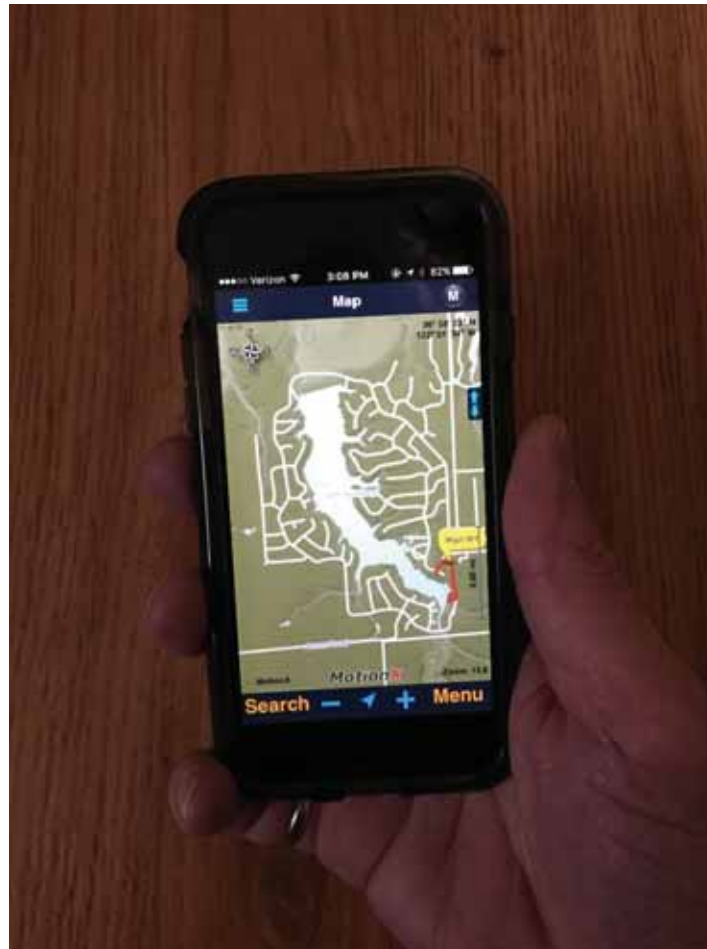
1. Find existing maps on-line and add them to QGIS:
 - *USGS, SCS, National Map, Natural Earth, County Records, etc.*
 - *Open Layers Maps – Open Streets Map and others.*
2. Digitize features directly onto the QGIS map canvas (usually by tracing features over aerial imagery).
3. Collect data in the field with GPS data loggers, manual sediment depth tools, and stream and rainfall gages, to create new features in the QGIS project.

Examples of GPS Data-Loggers



Trimble geo7x
Professional Grade
=>\$15,000 - \$25,000
(1 centimeter accuracy)

Smartphone w/GPS app
*Citizen Grade => \$0 +-
(3 +- meter accuracy)*



Garmin GPSMAP 64s
*Citizen Grade => \$400 +-
(3 +- meter accuracy,
includes barometric altimeter)*

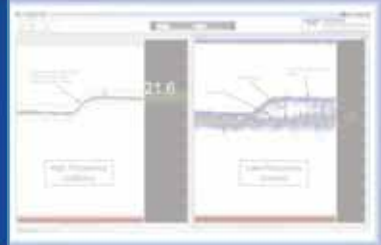
Sediment Measurement Options



Slide courtesy of Peter Berrini

Open Science

Sediment Measurement Options

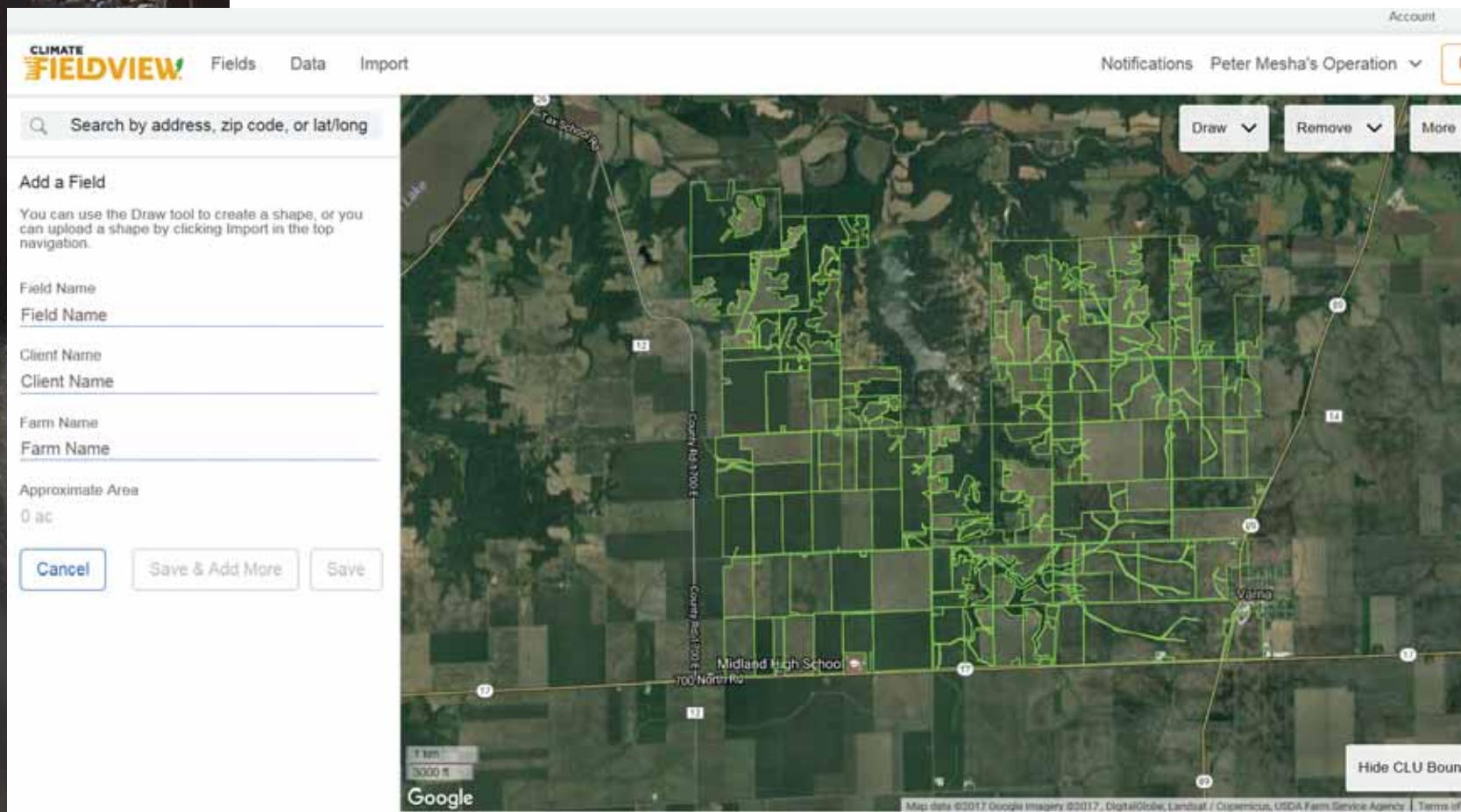
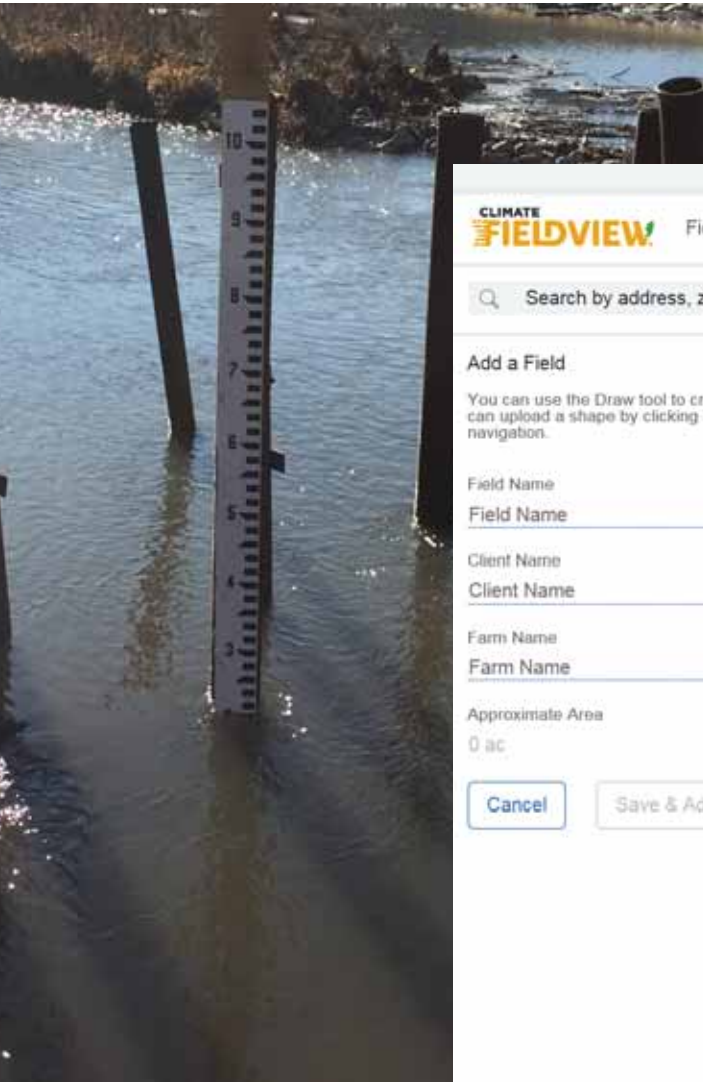


Slide courtesy of Peter Berrini

Getting Rainfall and Creek Stage Data



Getting Rainfall and Creek Stage Data



Account

CLIMATE FIELDVIEW Fields Data Import

Notifications Peter Mesh's Operation

Search by address, zip code, or lat/long

Draw Remove More

Add a Field

You can use the Draw tool to create a shape, or you can upload a shape by clicking Import in the top navigator.

Field Name
Field Name

Client Name
Client Name

Farm Name
Farm Name

Approximate Area
0 ac

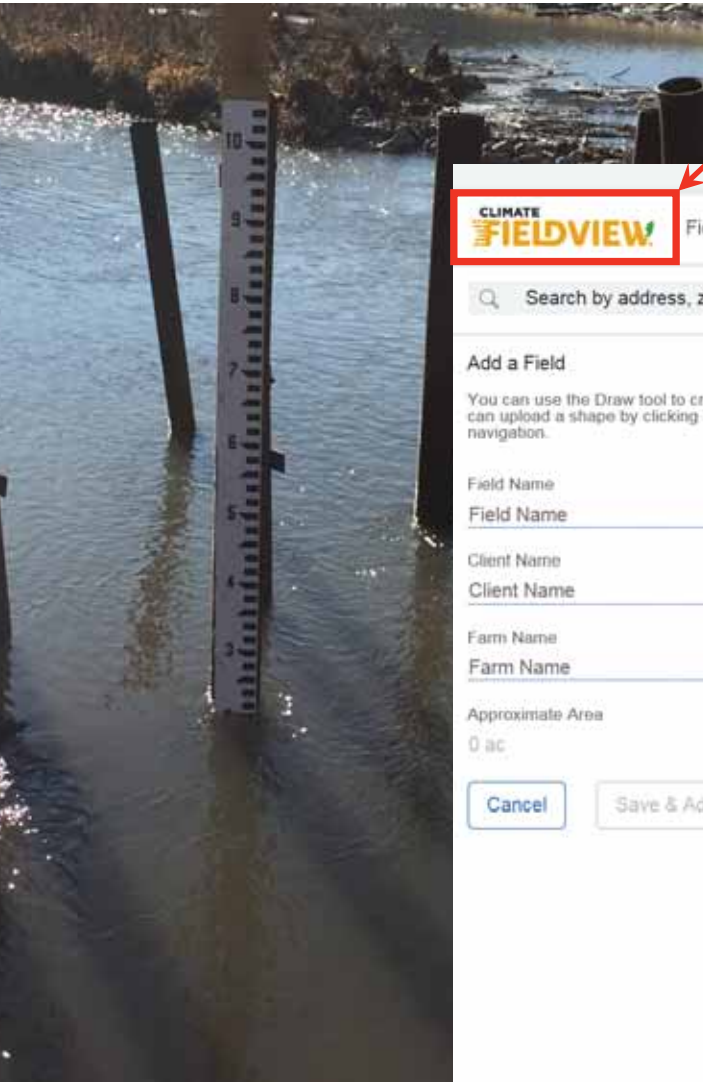
Cancel Save & Add More Save

1 km 3000 ft

Google

Map data ©2017 Google Imagery ©2017, DigitalGlobe, Landsat / Copernicus, USDA Farm Service Agency | Terms of Service

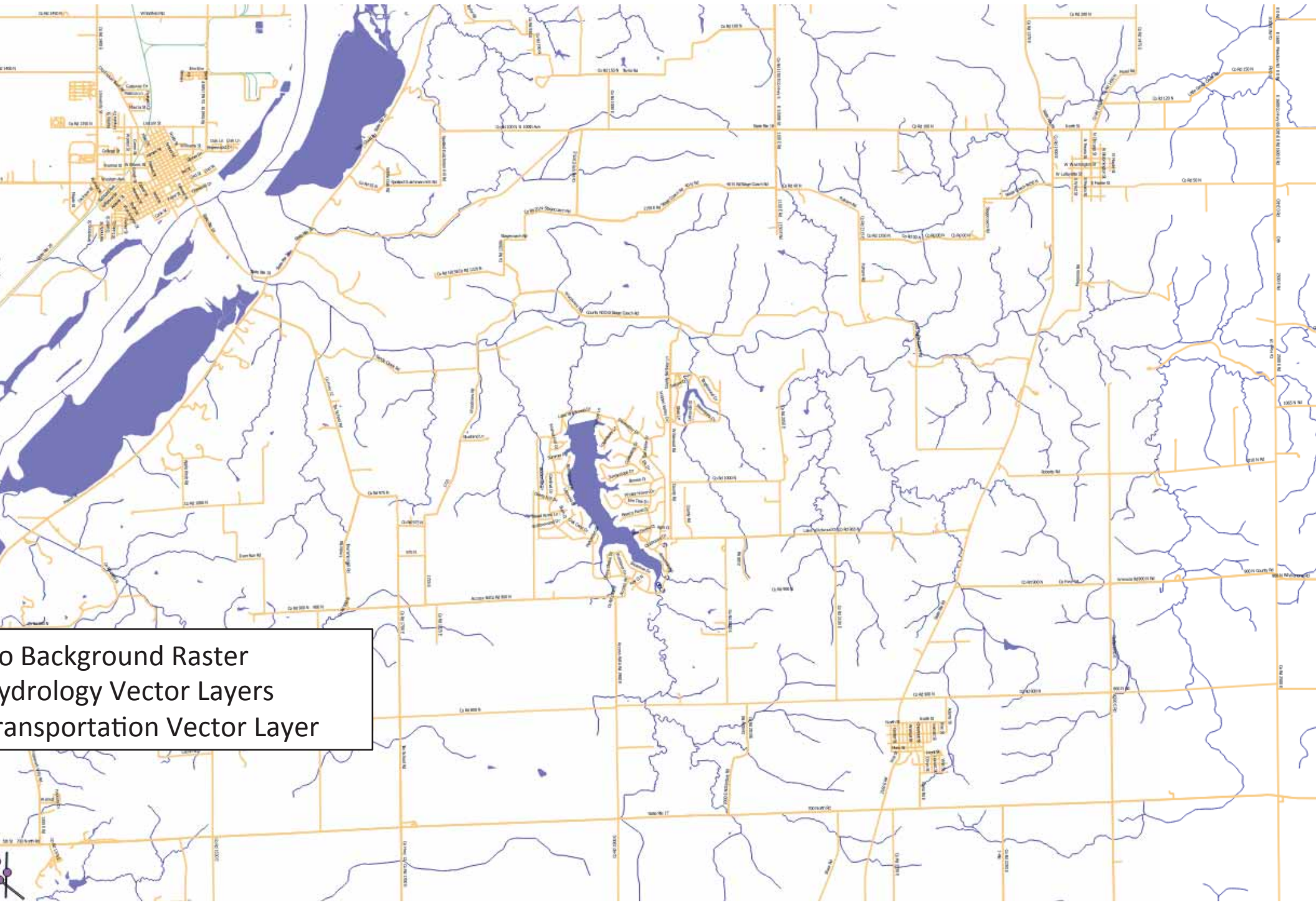
Getting Rainfall and Creek Stage Data



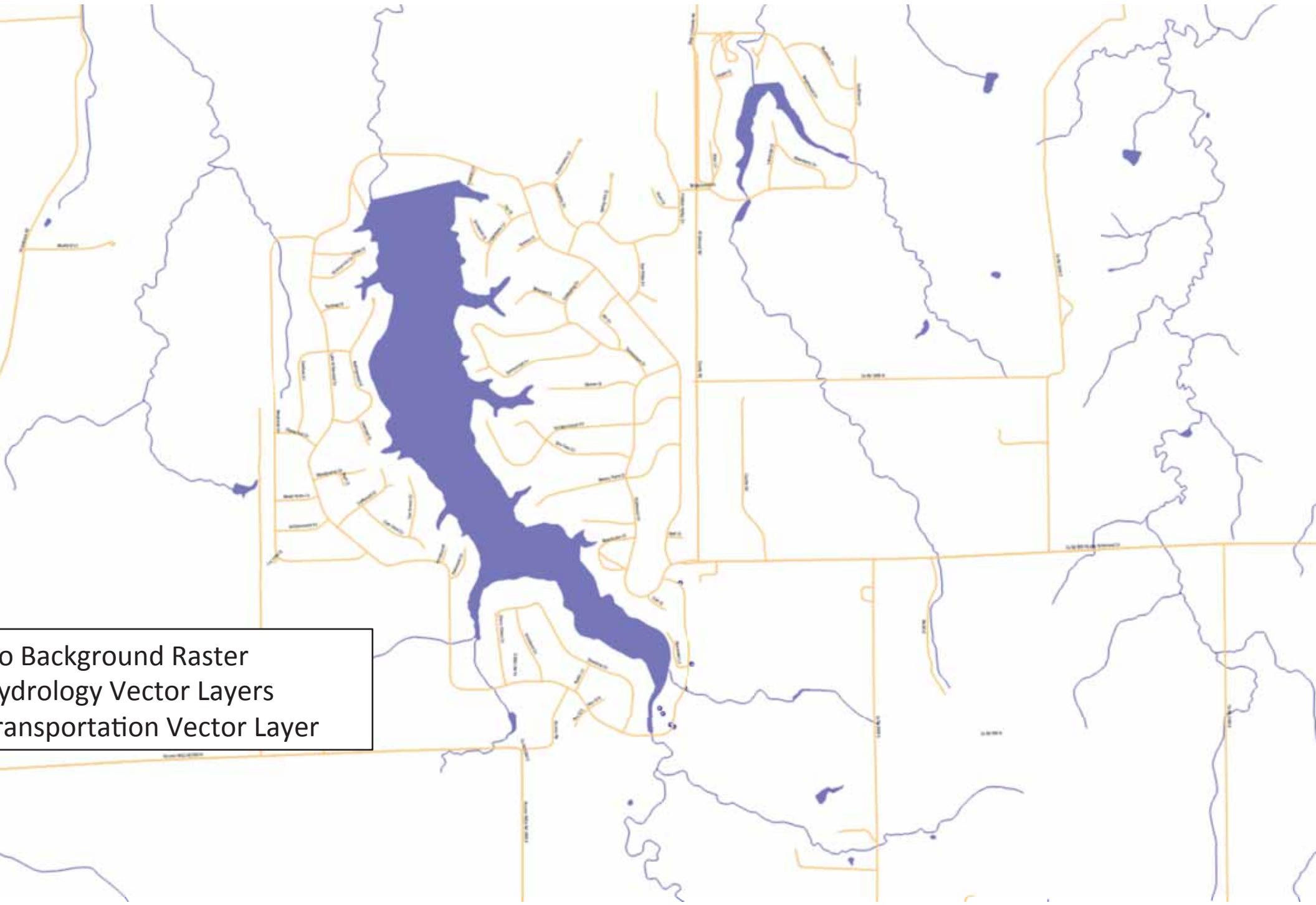
Climate Corporation

The screenshot shows the Climate FieldView web application. At the top left, the logo 'CLIMATE FIELDVIEW' is highlighted with a red box. Below the logo is a search bar with the text 'Search by address, zip code, or lat/long'. To the right of the search bar are navigation tabs for 'Fields', 'Data', and 'Import'. Further right, there are links for 'Notifications' and 'Peter Mesha's Operation'. Below the search bar is a section titled 'Add a Field' with instructions: 'You can use the Draw tool to create a shape, or you can upload a shape by clicking Import in the top navigator.' This section contains input fields for 'Field Name', 'Client Name', and 'Farm Name', each with a 'Field Name' label above it. Below these fields is an 'Approximate Area' field showing '0 ac'. At the bottom of this section are three buttons: 'Cancel', 'Save & Add More', and 'Save'. To the right of the form is a satellite map showing a farm with green field boundaries. The map includes labels for 'Midland High School' and 'Varna'. At the bottom of the map, there is a scale bar for 1 km and 3000 ft, and a 'Hide CLU Bound' button. The bottom right corner of the map shows copyright information: 'Map data ©2017 Google Imagery ©2017, DigitalGlobe, Landsat / Copernicus, USDA Farm Service Agency | Terms of Service'.

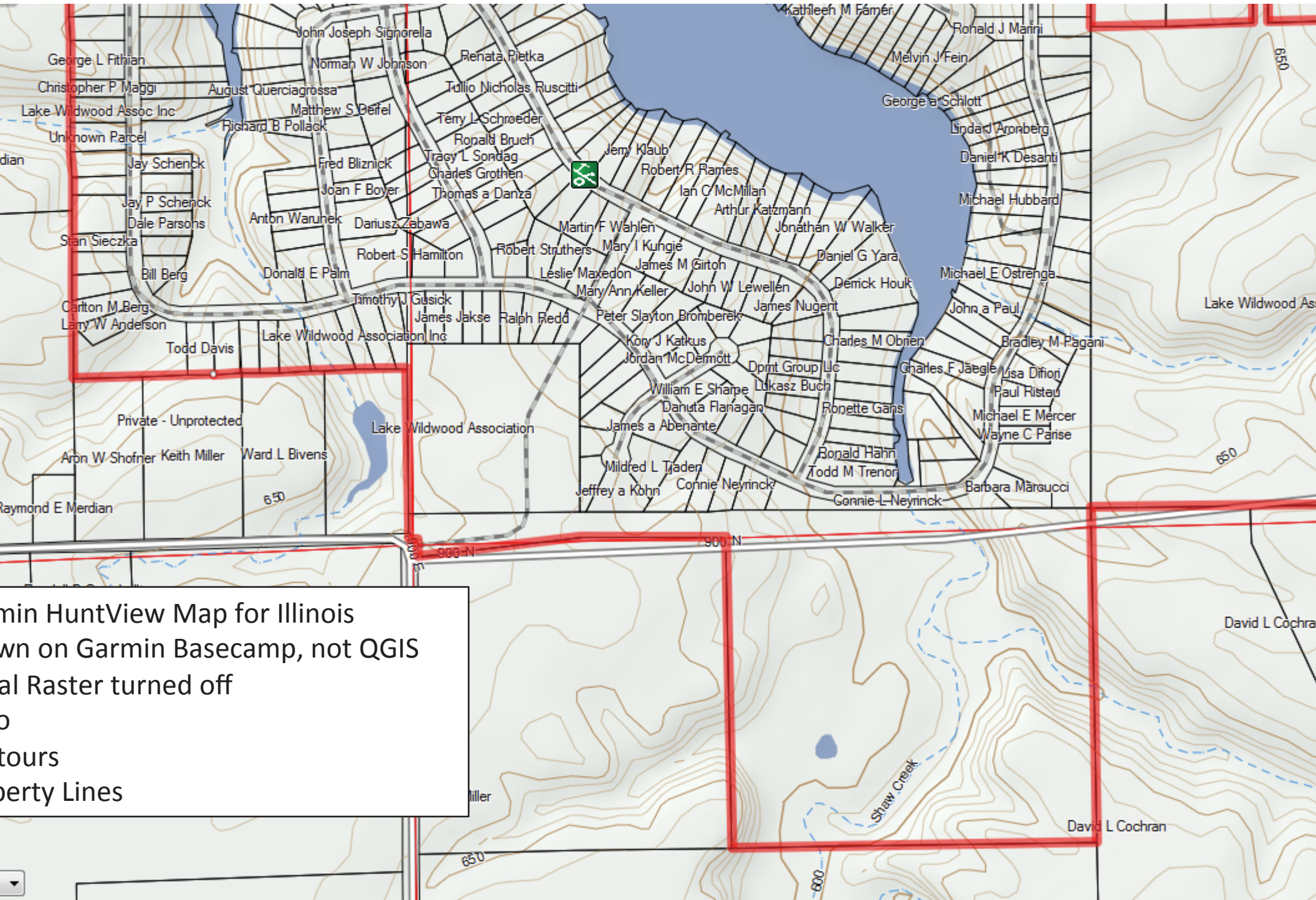
(This is what your QGIS map canvas will look like before you add data)



o Background Raster
o Hydrology Vector Layers
o Transportation Vector Layer

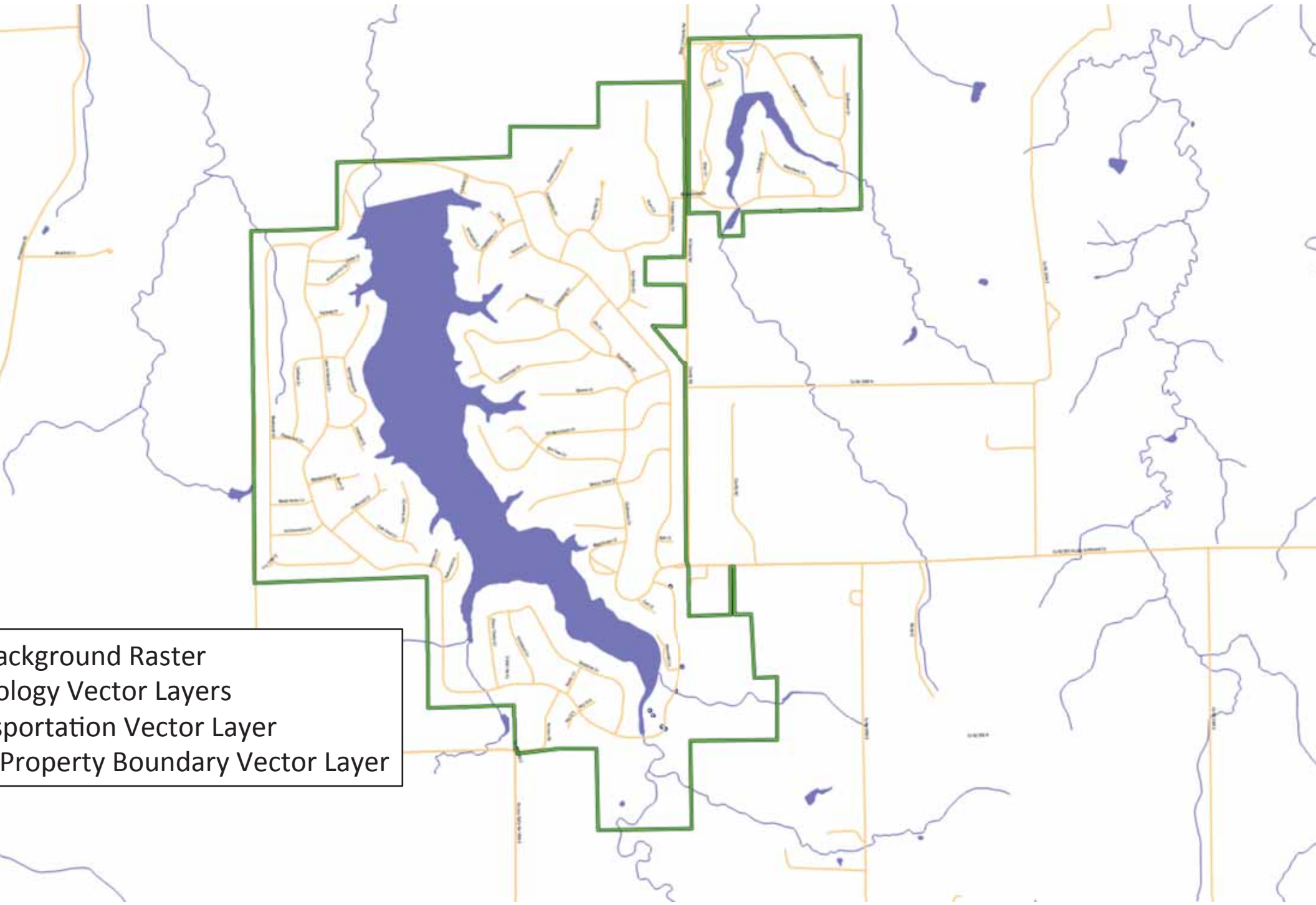


o Background Raster
Hydrology Vector Layers
Transportation Vector Layer

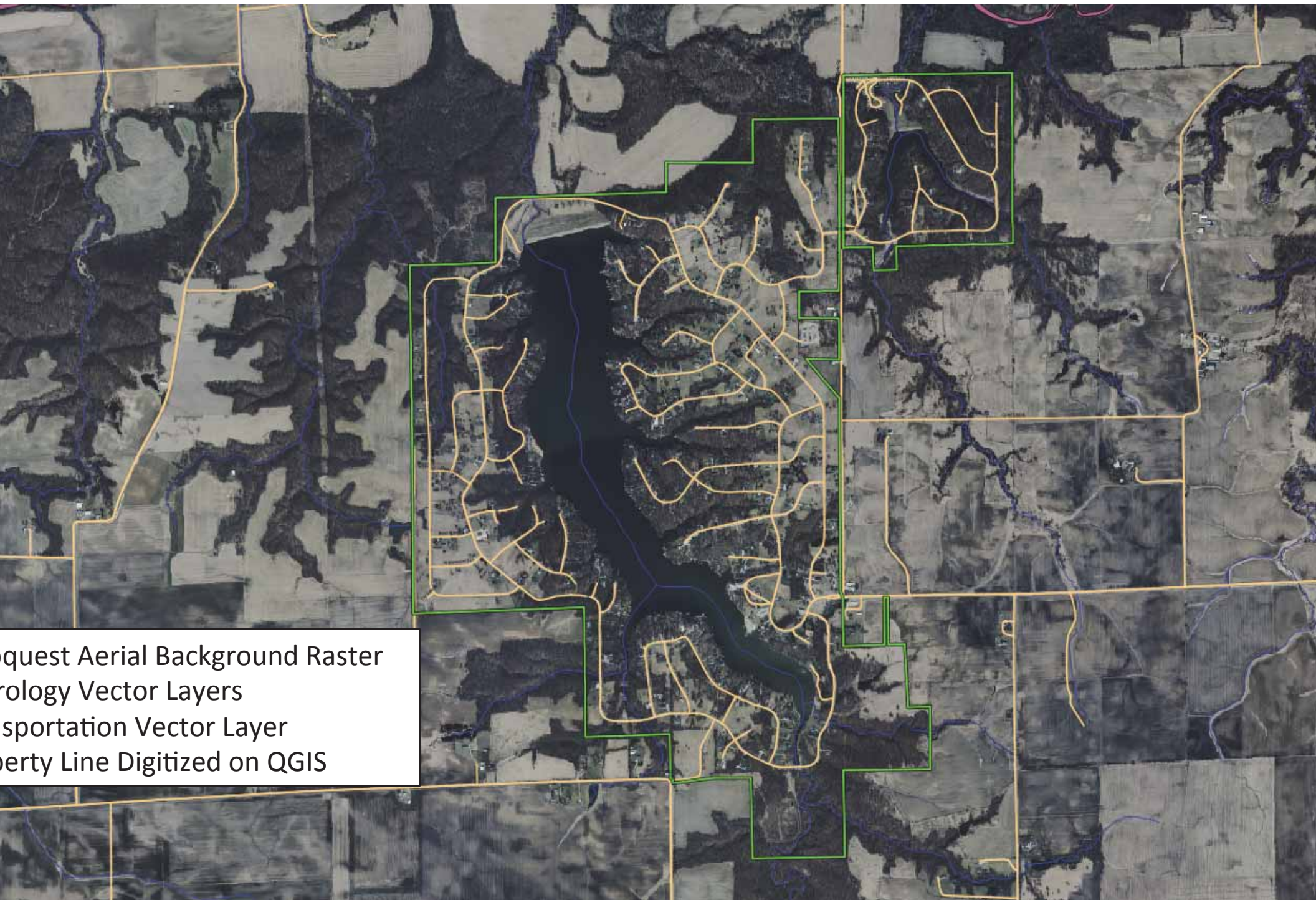


Admin HuntView Map for Illinois
own on Garmin Basecamp, not QGIS
al Raster turned off
to
tours
Property Lines

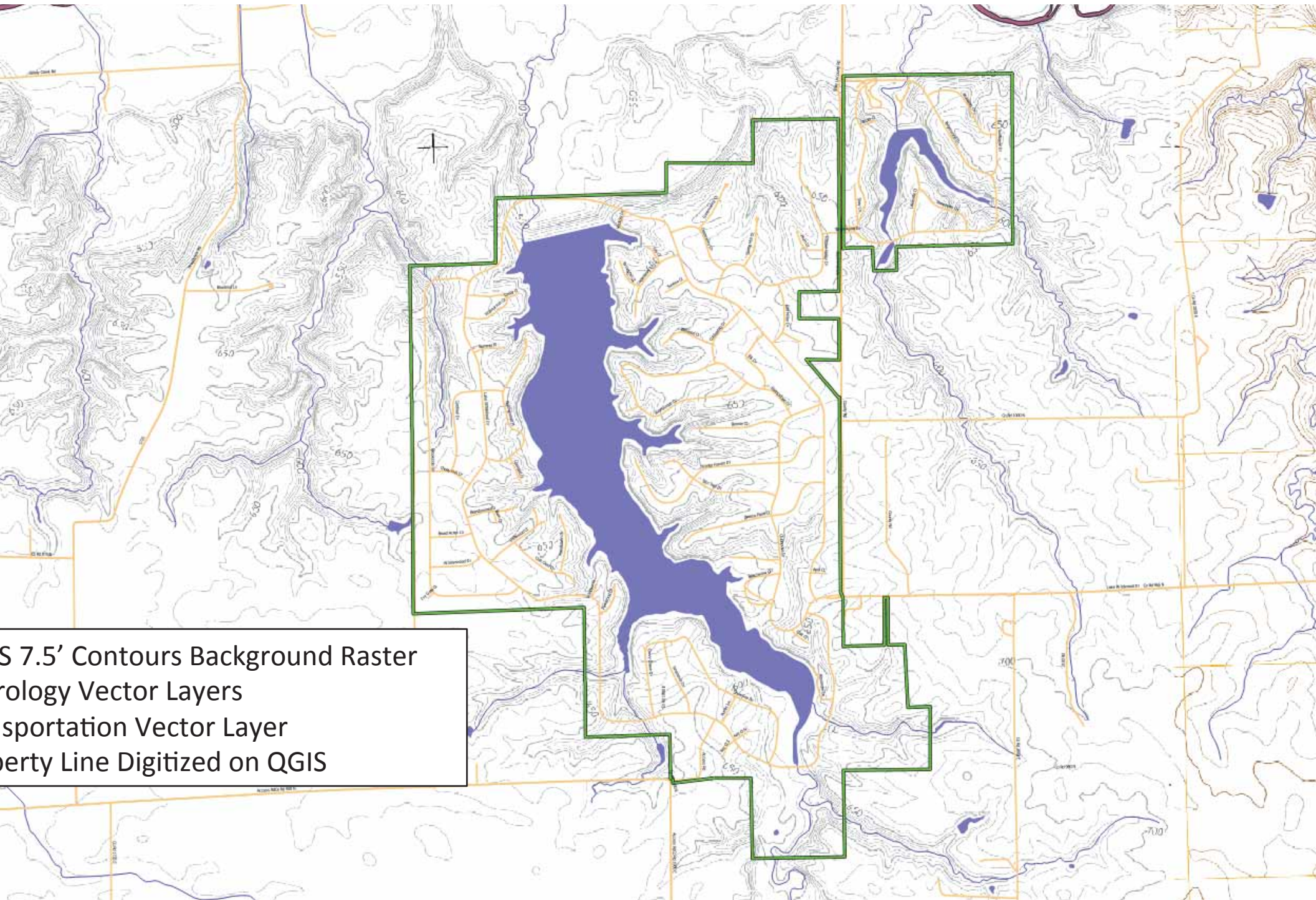




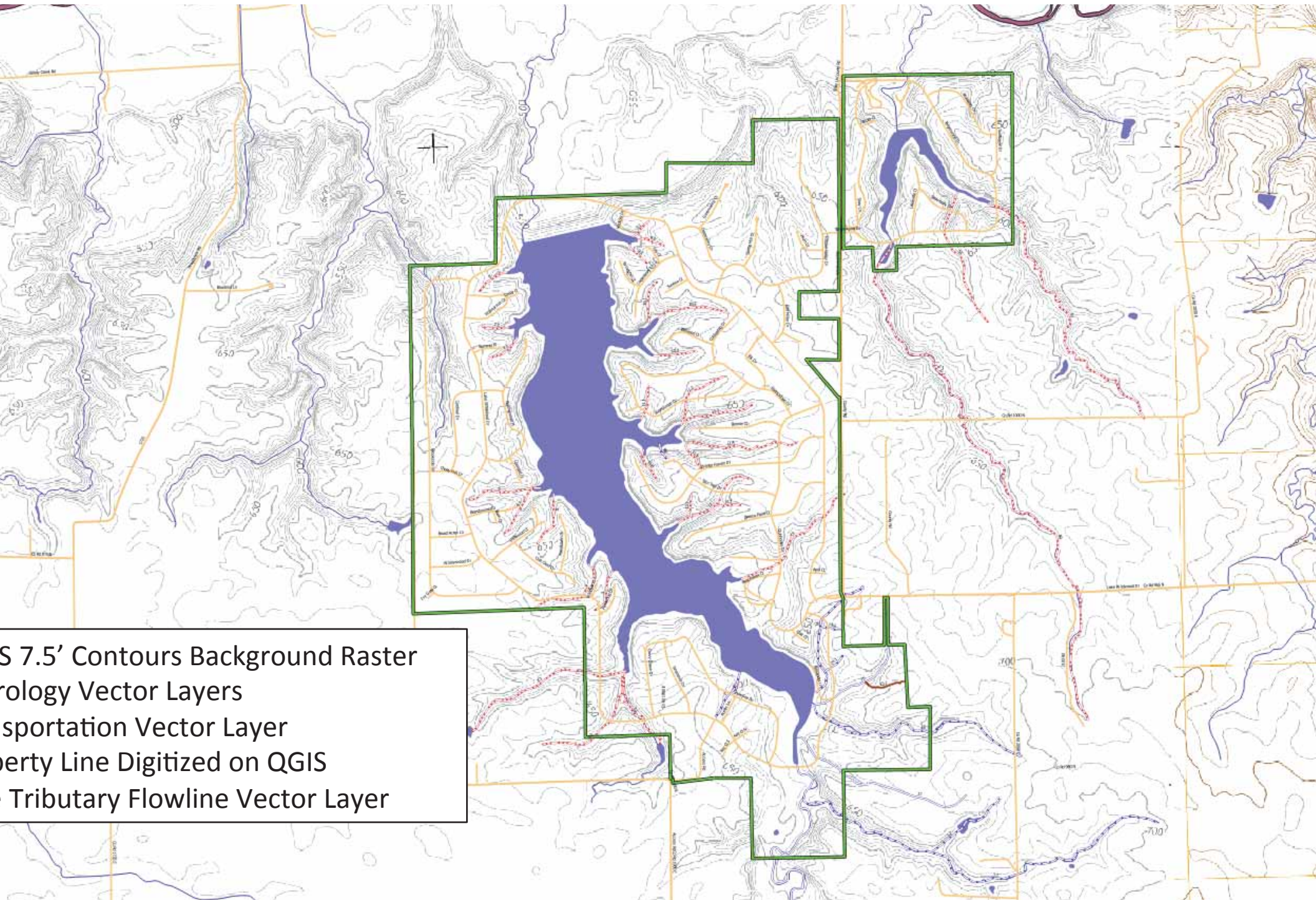
Background Raster
Topology Vector Layers
Transportation Vector Layer
Property Boundary Vector Layer



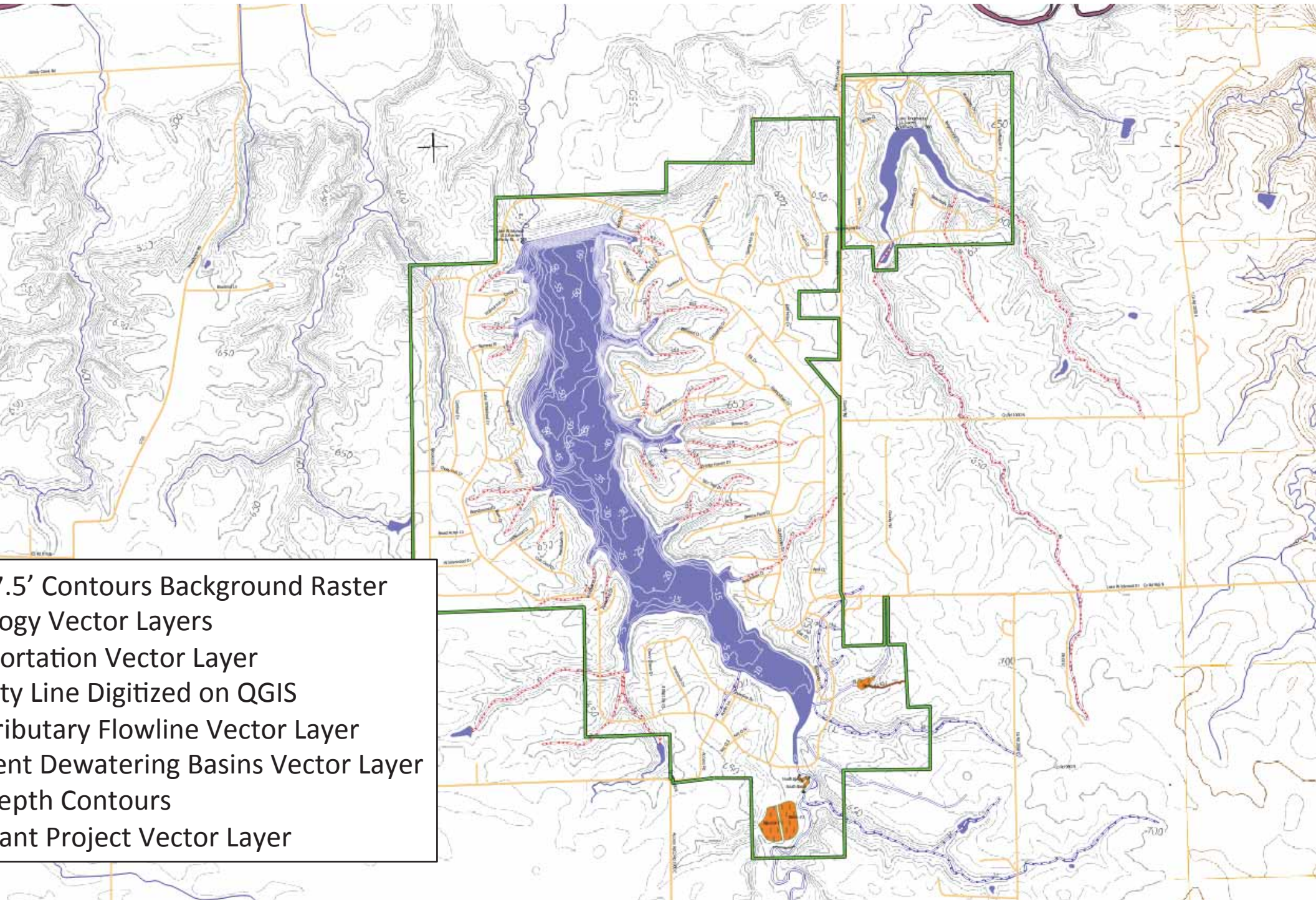
Request Aerial Background Raster
Hydrology Vector Layers
Transportation Vector Layer
Property Line Digitized on QGIS



S 7.5' Contours Background Raster
ology Vector Layers
sportation Vector Layer
erty Line Digitized on QGIS

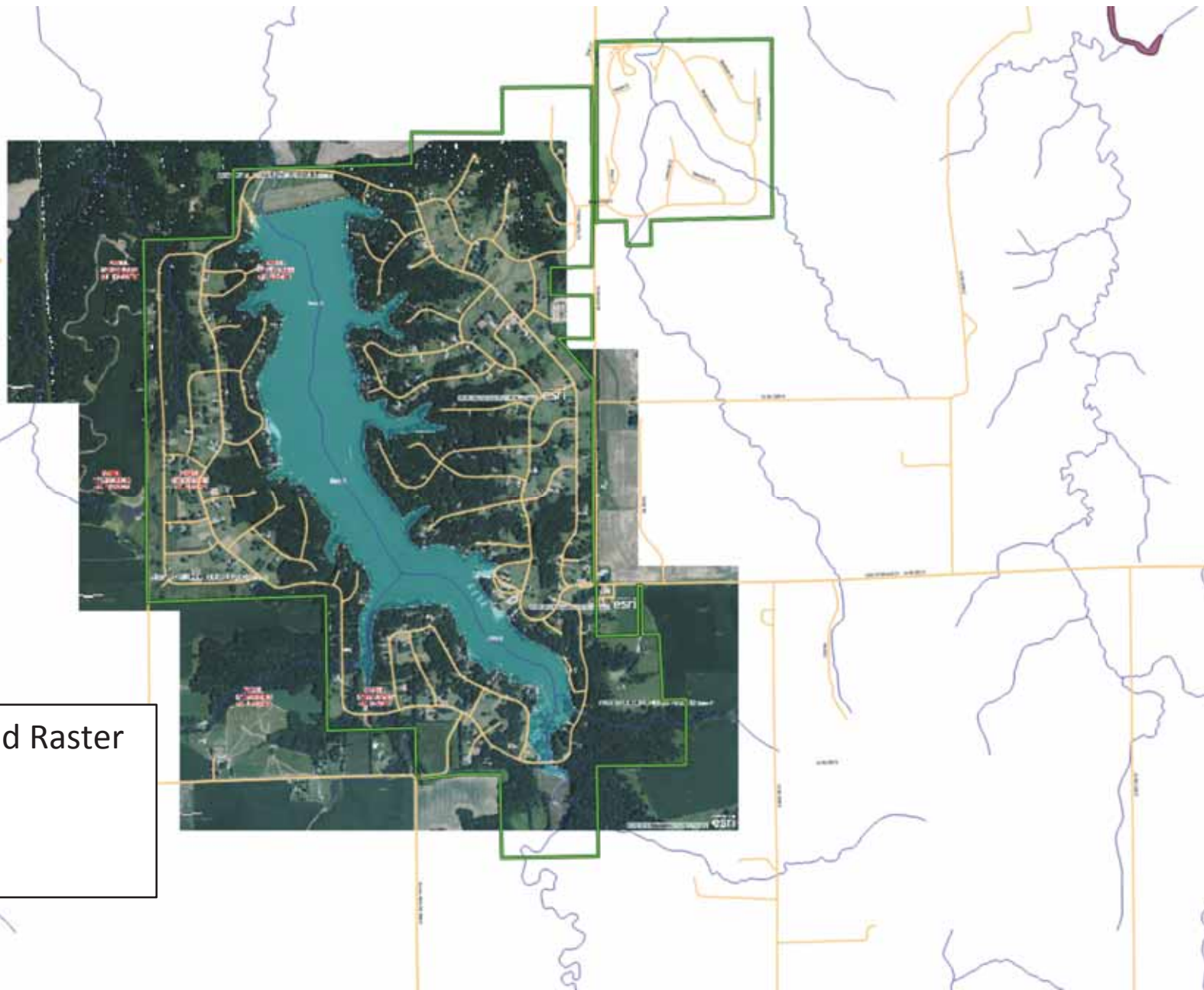


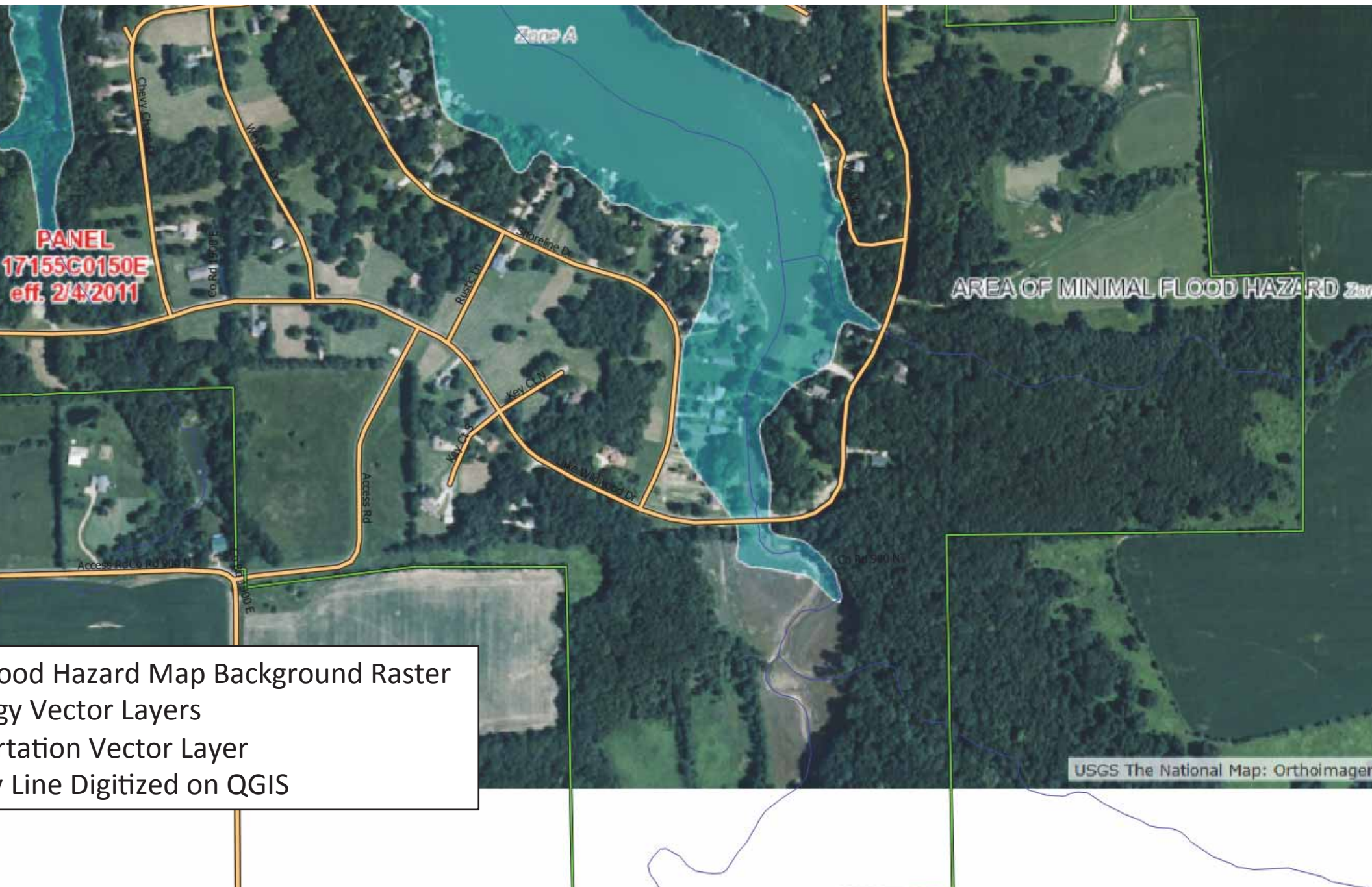
S 7.5' Contours Background Raster
Hydrology Vector Layers
Transportation Vector Layer
Property Line Digitized on QGIS
Tributary Flowline Vector Layer



7.5' Contours Background Raster
Technology Vector Layers
Transportation Vector Layer
Property Line Digitized on QGIS
Tributary Flowline Vector Layer
Wetland Dewatering Basins Vector Layer
Depth Contours
Plant Project Vector Layer

Flood Hazard Map Background Raster
Elevation Vector Layers
Transportation Vector Layer
Water Line Digitized on QGIS





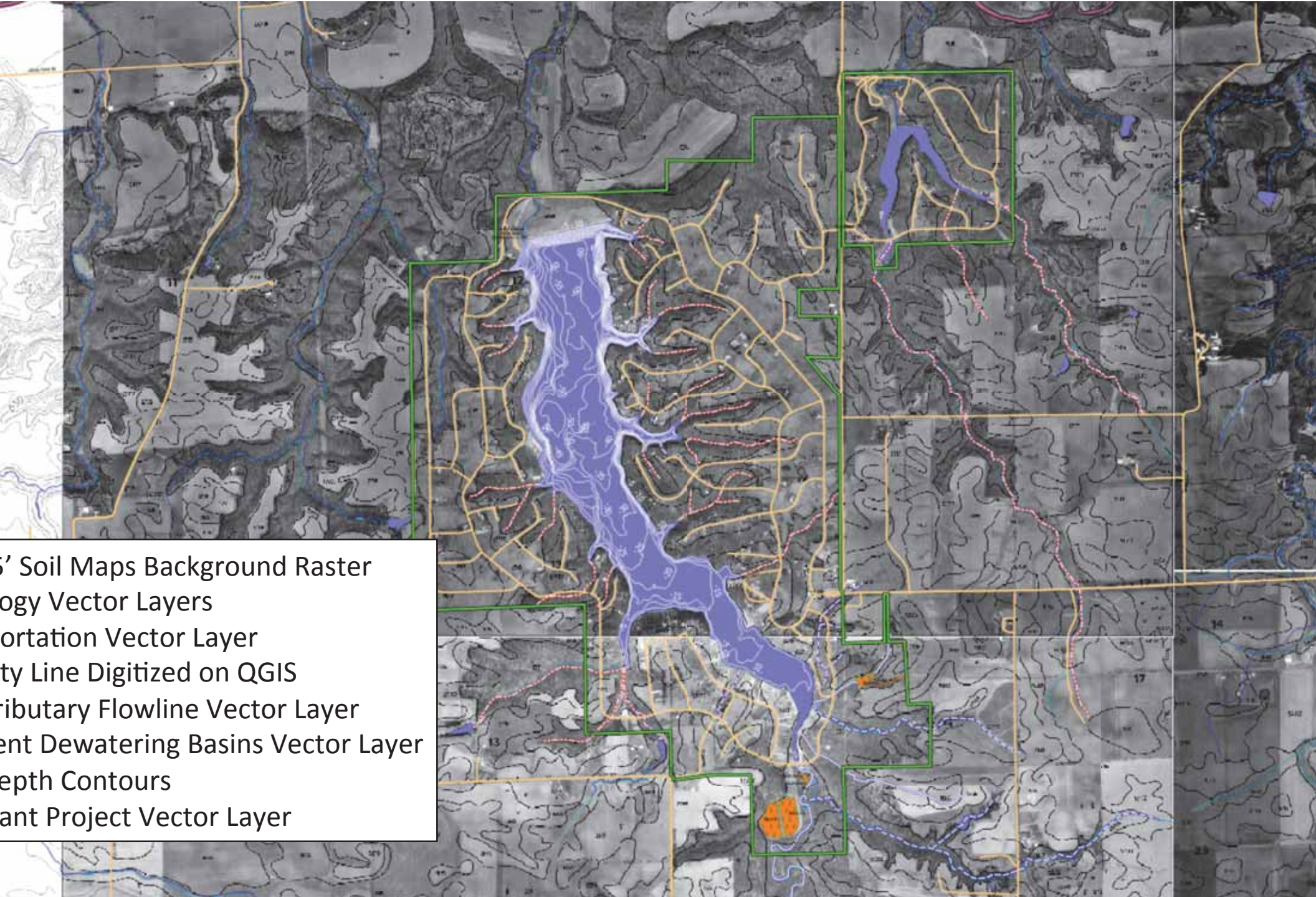
PANEL
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eff. 2/4/2011

Zone A

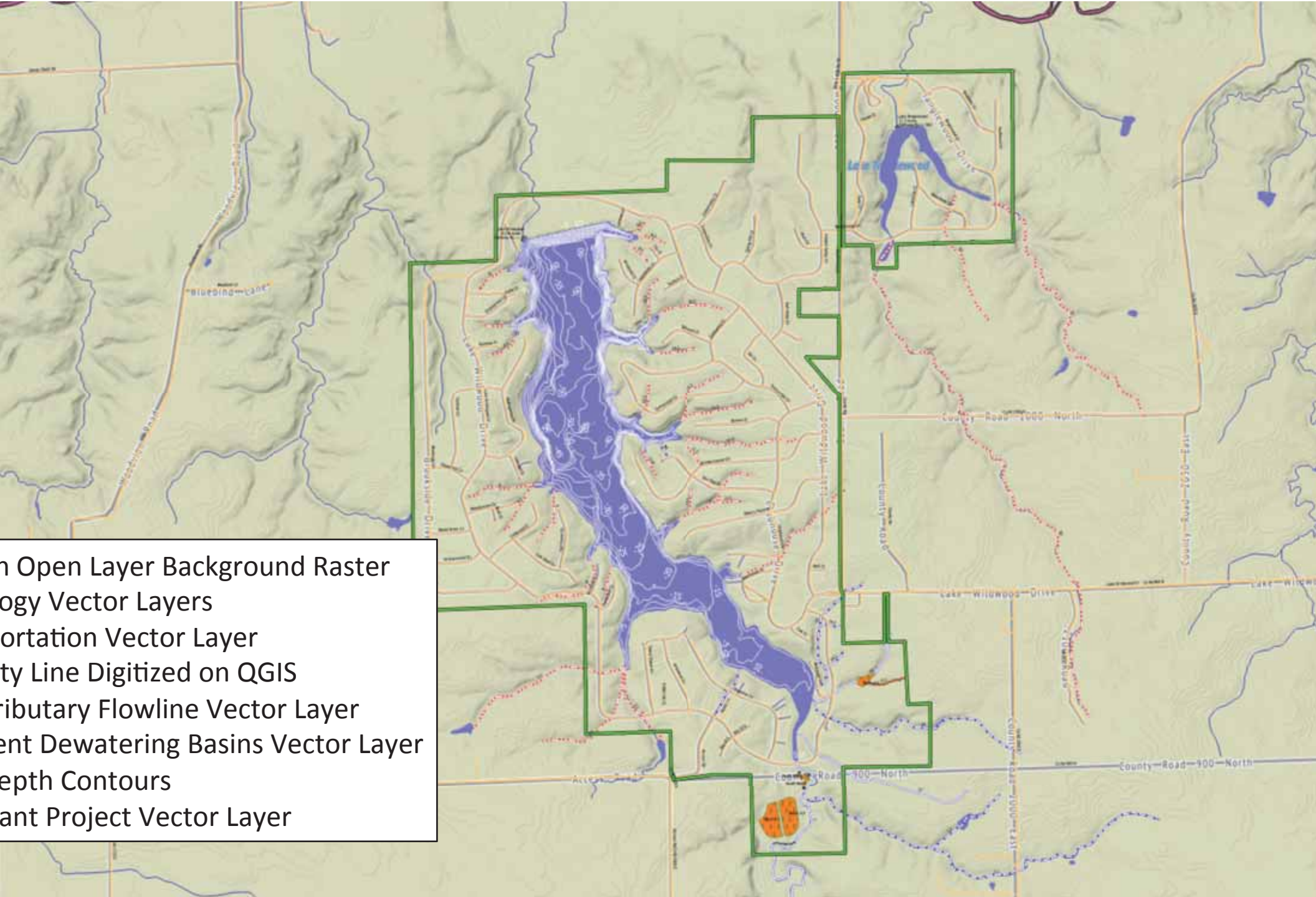
AREA OF MINIMAL FLOOD HAZARD

Flood Hazard Map Background Raster
Property Vector Layers
Elevation Vector Layer
Road Line Digitized on QGIS

USGS The National Map: Orthoimagery

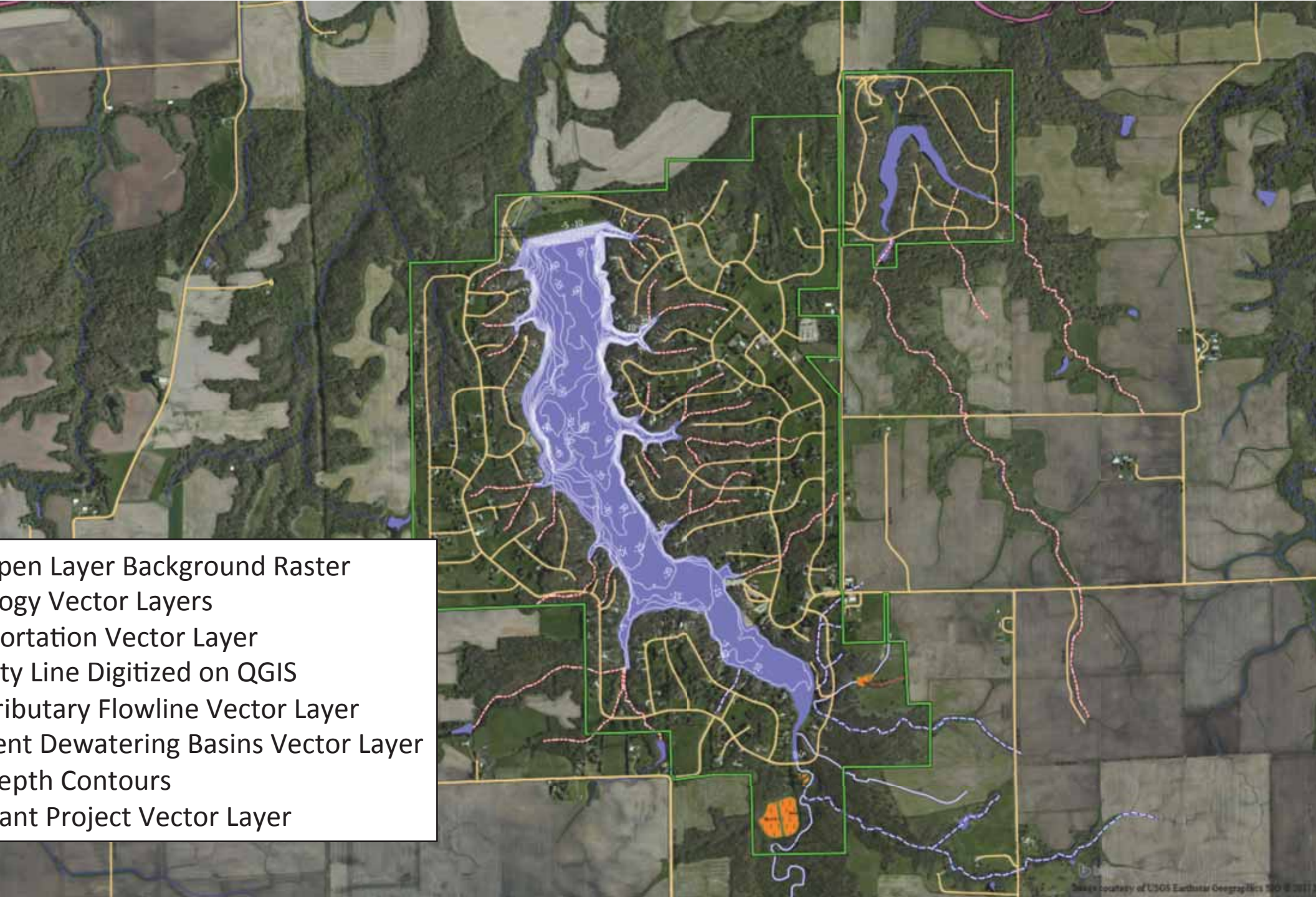


5' Soil Maps Background Raster
Hydrology Vector Layers
Transportation Vector Layer
Property Line Digitized on QGIS
Tributary Flowline Vector Layer
Dewatering Basins Vector Layer
Elevation Contours
Plant Project Vector Layer

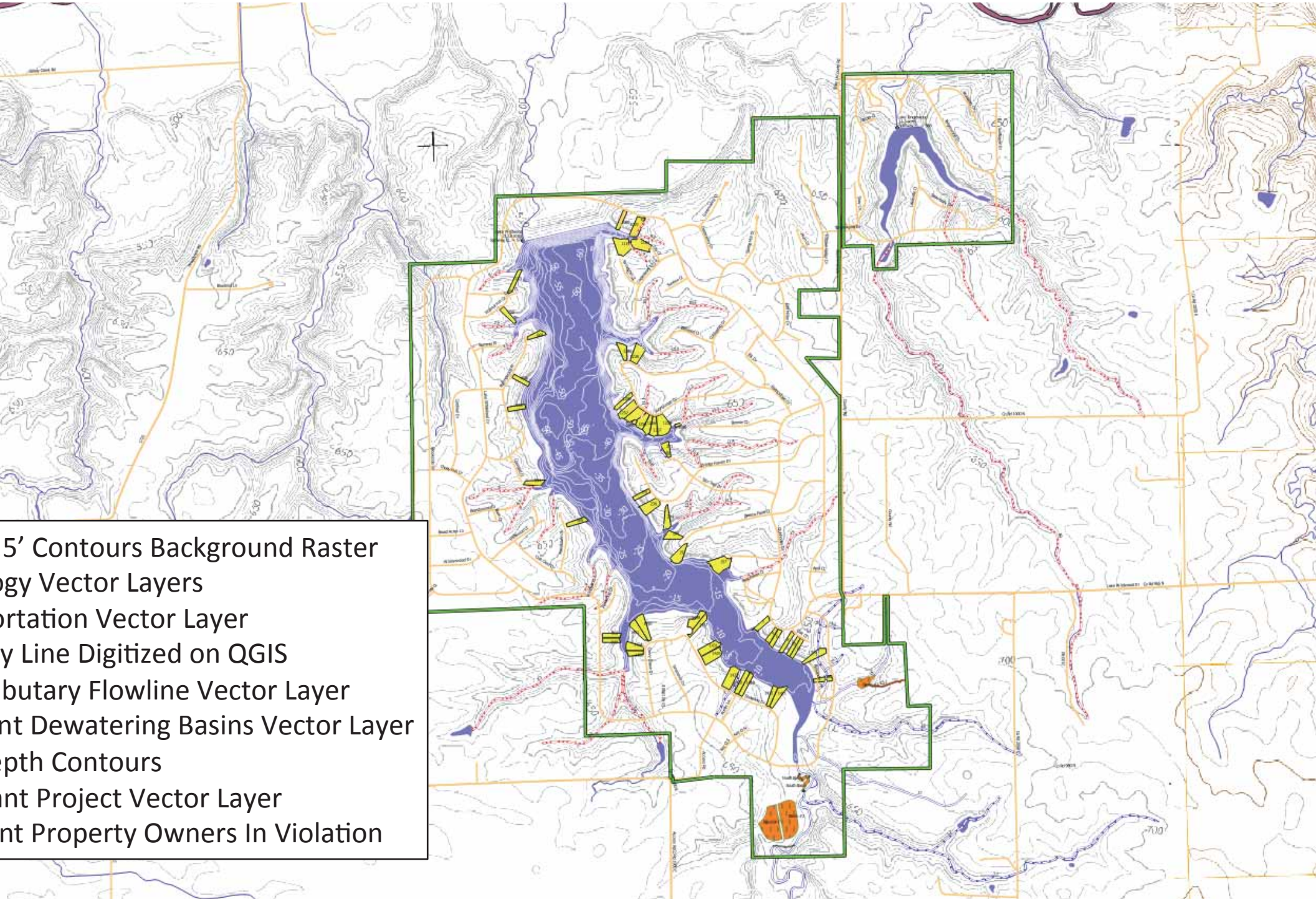




Physical Open Layer Raster

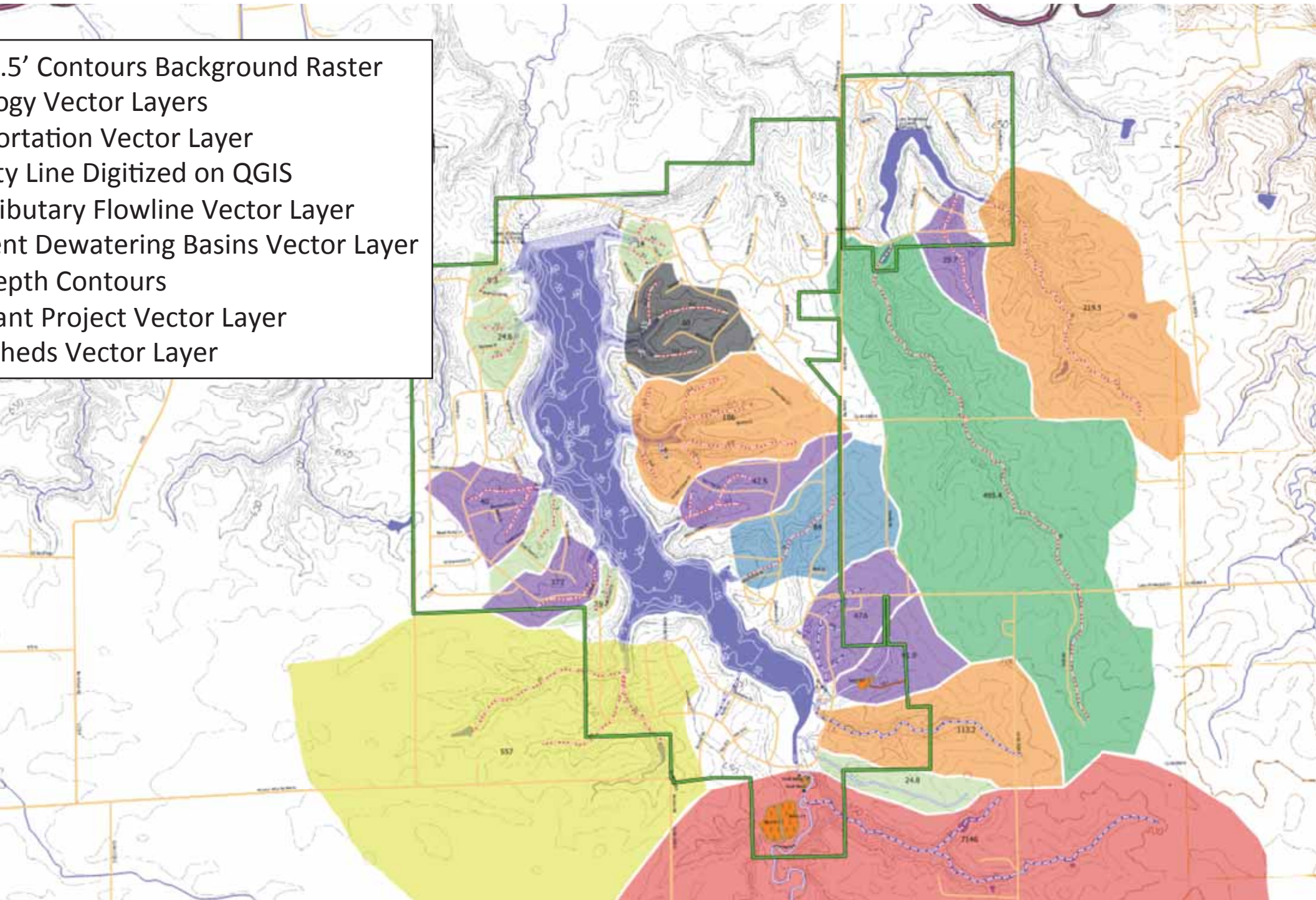


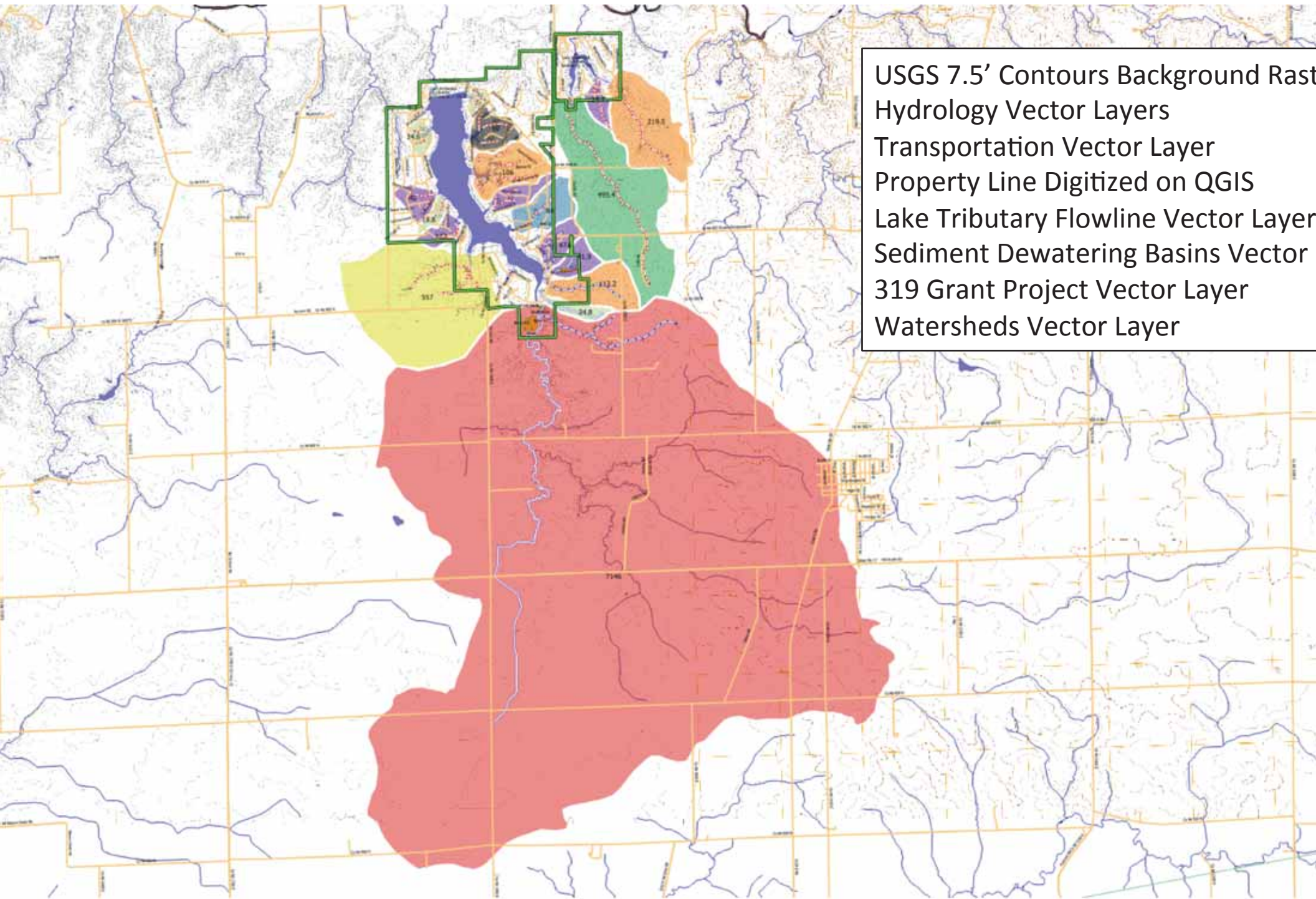
Open Layer Background Raster
Topography Vector Layers
Transportation Vector Layer
Property Line Digitized on QGIS
Tributary Flowline Vector Layer
Wastewater Treatment Plant Dewatering Basins Vector Layer
Elevation Contours
Wastewater Treatment Plant Project Vector Layer



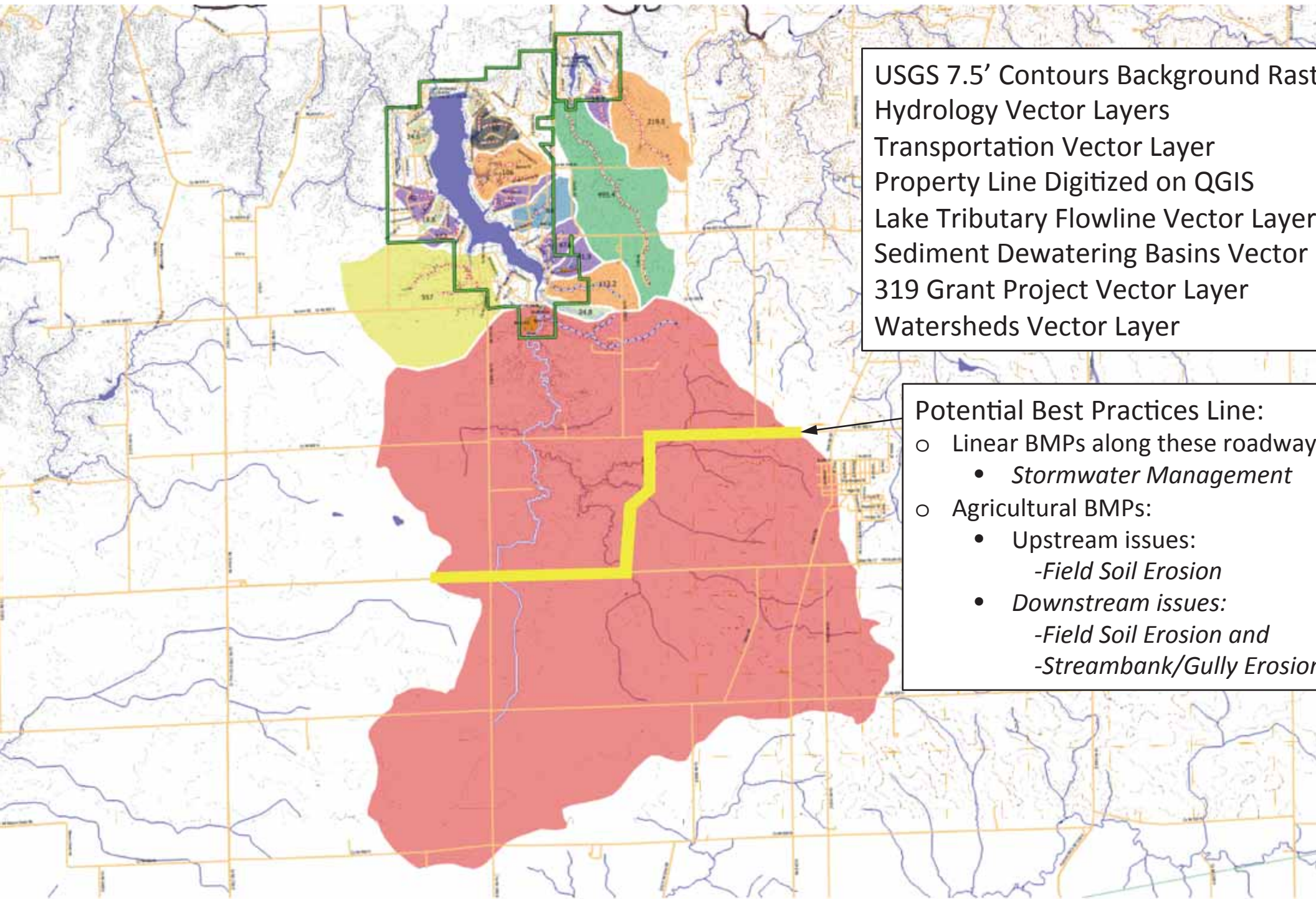
5' Contours Background Raster
Hydrology Vector Layers
Transportation Vector Layer
Subsidence Line Digitized on QGIS
Subsidence Flowline Vector Layer
Subsidence Dewatering Basins Vector Layer
Depth Contours
Subsidence Project Vector Layer
Subsidence Property Owners In Violation

1.5' Contours Background Raster
Hydrology Vector Layers
Transportation Vector Layer
Property Line Digitized on QGIS
Tributary Flowline Vector Layer
Wetland Dewatering Basins Vector Layer
Depth Contours
Wetland Project Vector Layer
Watersheds Vector Layer





USGS 7.5' Contours Background Raster
Hydrology Vector Layers
Transportation Vector Layer
Property Line Digitized on QGIS
Lake Tributary Flowline Vector Layer
Sediment Dewatering Basins Vector
319 Grant Project Vector Layer
Watersheds Vector Layer



USGS 7.5' Contours Background Raster
Hydrology Vector Layers
Transportation Vector Layer
Property Line Digitized on QGIS
Lake Tributary Flowline Vector Layer
Sediment Dewatering Basins Vector
319 Grant Project Vector Layer
Watersheds Vector Layer

- Potential Best Practices Line:
- Linear BMPs along these roadway
 - *Stormwater Management*
 - Agricultural BMPs:
 - *Upstream issues:*
 - Field Soil Erosion*
 - *Downstream issues:*
 - Field Soil Erosion and*
 - Streambank/Gully Erosion*

**LAKE
Wildwood**



Hey and Associates, Inc.

NONPOINT SOURCE WATER POLLUTION CONTROL PROGRAM

LAKE WILDWOOD STREAM AND FLOODPLAIN RESTORATION

Best management practices are being installed at this site to improve water quality in Shaw Creek and Lake Wildwood.

Funded in part by Section 319 of
the Clean Water Act
FAA Number: 3191313

For more information, contact:
Illinois EPA at 217-782-3362, or
Lake Wildwood Management at 309-463-2047

Lake Wildwood Section 319 Project Varna, Illinois

Client:

Lake Wildwood Association
Joan Boyer, General Manager
1000 Lake Wildwood Drive
Varna, IL 61375
Office (309) 463-2047

Engineer:

Hey and Associates, Inc.
8755 West Higgins Road, Suite 835
Chicago, IL 60631
Office (773) 693-9200
Fax (773) 693-9202

Benchmark:

Chiseled "K" on the top of the eastern side of the
3x72" headwall south of Lake Wildwood Drive.
Elevation = 590.57.



Scale = N.T.S. Project Area ↑

Sheet Index:

1. Cover Sheet
2. General Notes
3. Summary of Quantities
4. Project Overview
5. Topsoil Stripping and Tree Protection Plan South Area
6. Topsoil Stripping Plan Fill Area
7. Grading and Drainage Plan North Area
8. Grading and Drainage Plan South Area
9. Grading and Drainage Plan Fill Area
10. Cross Sections - North Area
11. Cross Sections - North Area
12. Cross Sections - South Area
13. Soil Erosion and Sediment Control/Restoration Plan North Area
14. Soil Erosion and Sediment Control/Restoration Plan South Area
15. Soil Erosion and Sediment Control/Restoration Plan Fill Area
16. Details
17. Details
18. Details

Call J.U.L.I.E. 1-800-892-0123 at least 48 hours before start of construction with the following:
County: Marshall
City or Township: Varna
Tax, Range & Section: T30N, R17W, Sec. 19

The information shown on this drawing concerning type and location of underground utilities is not guaranteed to be accurate or all inclusive. The Contractor is responsible for making his own determination as to the type and location of underground utilities as may be necessary to avoid damage thereto.

PROFESSIONAL SEAL

Signature: *Jeffrey A. Wiersma*
Date: 11/10/15
License Expires: 11-30-2015
This document shall not be considered a valid technical submittal unless it bears an original seal and signature.

Base Survey Information provided by:
Woods Valley Surveying & Consultants, Inc.

No.	Point	Date
1	Final	4/6/15
	Reconnaissance	

Hey and Associates, Inc.
Engineering, Ecology and Landscape Architecture
8755 W. HIGGINS ROAD, SUITE 835
CHICAGO, ILLINOIS 60631
OFFICE (773) 693-9200
FAX (773) 693-9202
CHICAGO@HEYASSOC.COM

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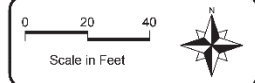
Lake Wildwood Section 319
Project
Varna, Illinois

Cover Sheet

PROJECT NO.	13-0208	REVISION NO.
DESIGNED BY	TCF	1
DRAWN BY	TCTCFN	
CHECKED BY	BRD	
APPROVED BY	JAW	
DATE	02/10/15	SHEET NO.
		1
		OF
		18

Final

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LEGEND

- 1 ft Existing Contour Lines
- 1 ft Proposed Contour Lines
- Limits of Disturbance
- Wetland Boundary
- Edge of Creek
- Existing Storm Sewer
- Tree Protection
- Existing Tree
- Erosion Control Blanket
- Reshaped Bank and Rock Toe
- Rock Riffle
- Topsoil and Native Plant Seed
- Detail Number
Sheet Number

1	Final	4/9/15
No.	Revision/Issue	Date

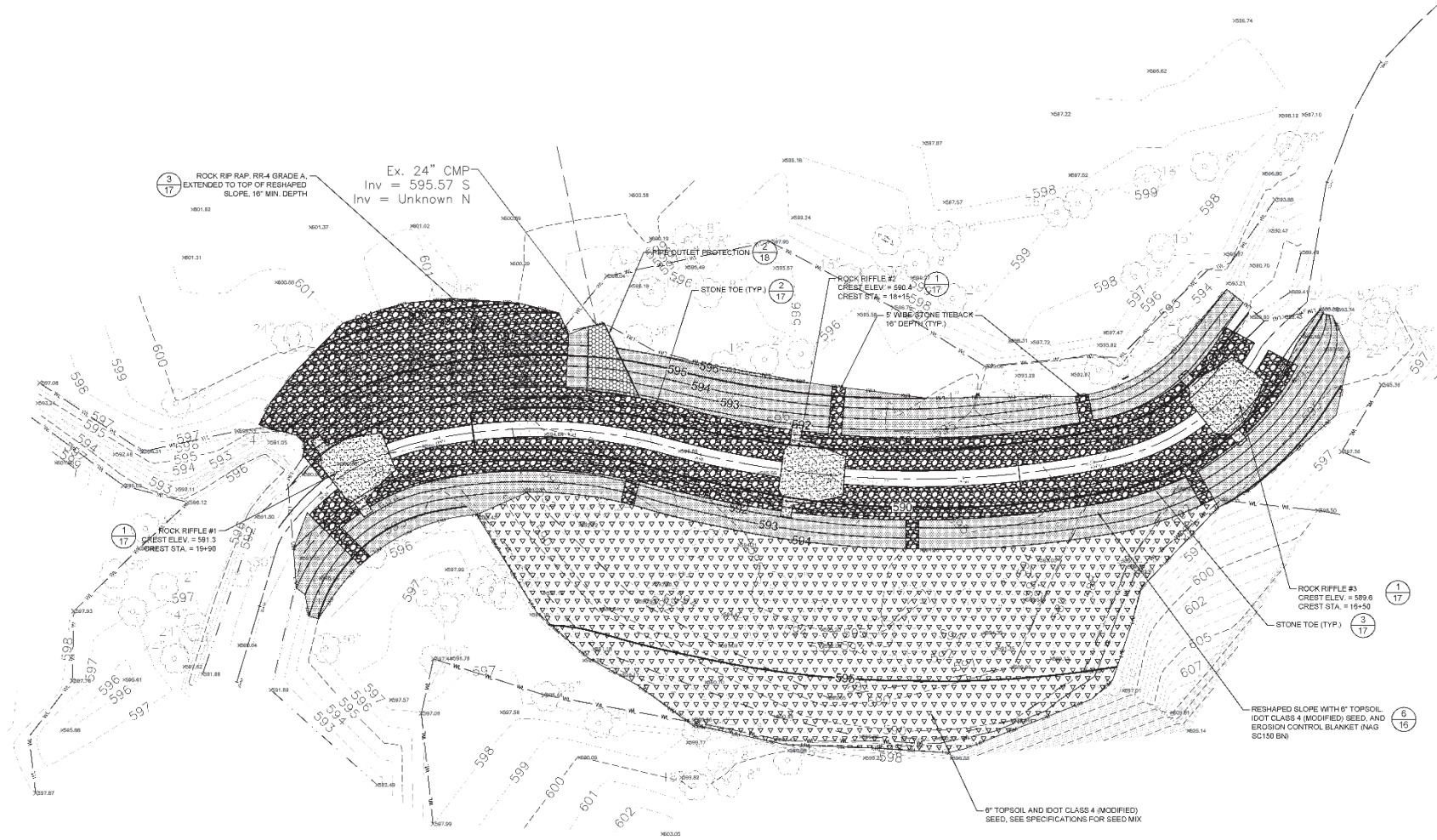
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Lake Wildwood Section 319
 Project
 Varna, Illinois

Soil Erosion and Sediment
 Control/Restoration Plan
 South Area

PROJECT NO.	13-0368	DRAWING NO.	
DESIGNED BY	TCT	14	
DRAWN BY	TCT-CFR		
INFORMED BY	BRO	SHEET NO.	
APPROVED BY	JAW		
ISSUE DATE	3/31/2015	14	18

Final



3
17
ROCK RIP RAP, RR-4 GRADE A,
EXTENDED TO TOP OF RESHAPED
SLOPE, 10' MIN. DEPTH

Ex. 24" CMP
Inv = 595.57 S
Inv = Unknown N

2
18
PIER OUTLET PROTECTION

1
17
ROCK RIFLE #2
CREST ELEV. = 596.4
CREST STA. = 16+15

2
17
STONE TOE (TYP)

5
16
5' WIDE STONE TIEBACK
10' DEPTH (TYP.)

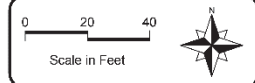
1
17
ROCK RIFLE #3
CREST ELEV. = 599.6
CREST STA. = 16+50

3
17
STONE TOE (TYP.)

6
16
RESHAPED SLOPE WITH 6" TOPSOIL,
100 CLASS 4 (MODIFIED) SEED, AND
EROSION CONTROL BLANKET (WAG
SC150 BN)

6" TOPSOIL AND 100 CLASS 4 (MODIFIED)
SEED, SEE SPECIFICATIONS FOR SEED MIX

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1	Final	4/9/15
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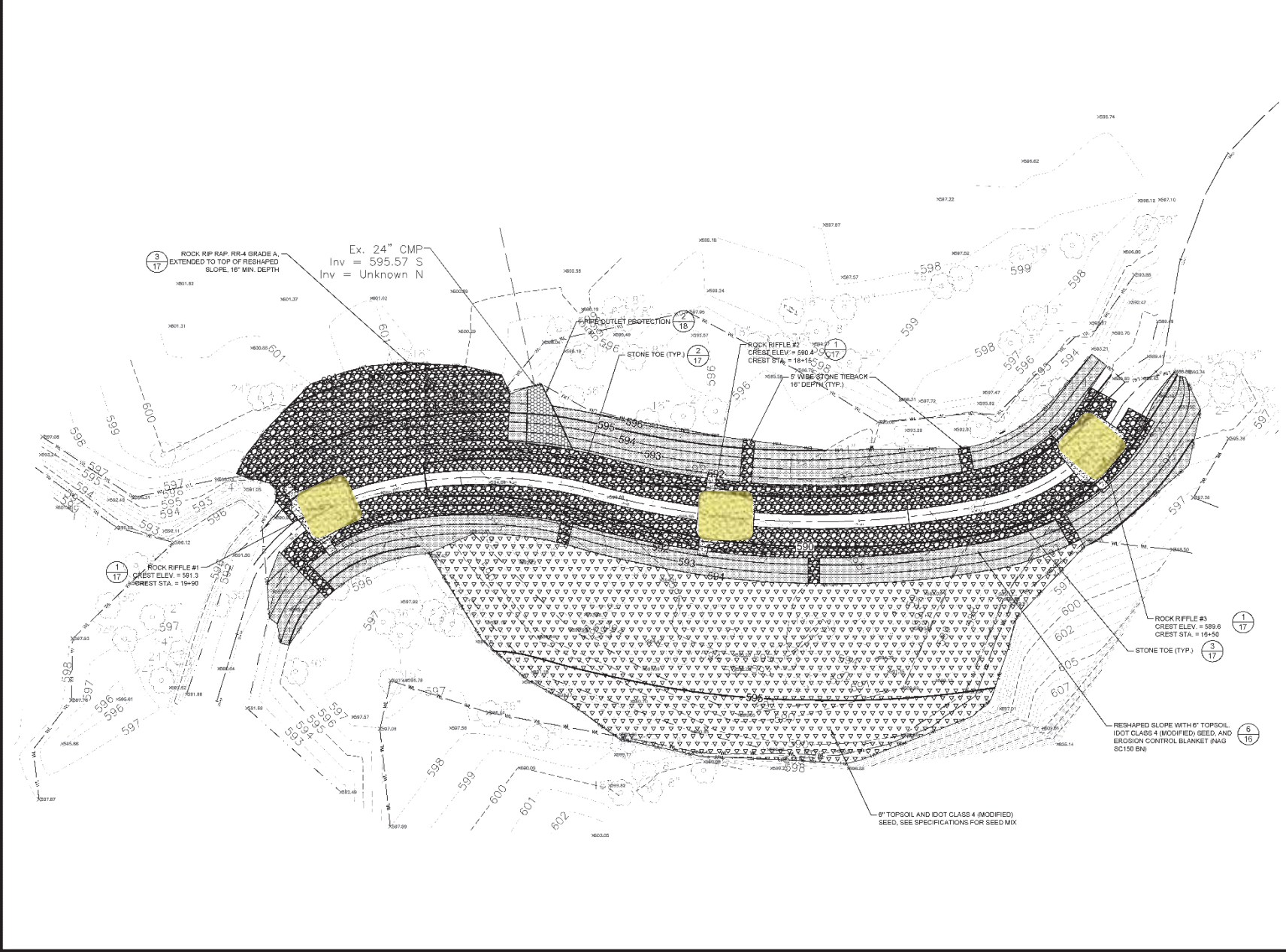
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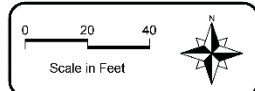
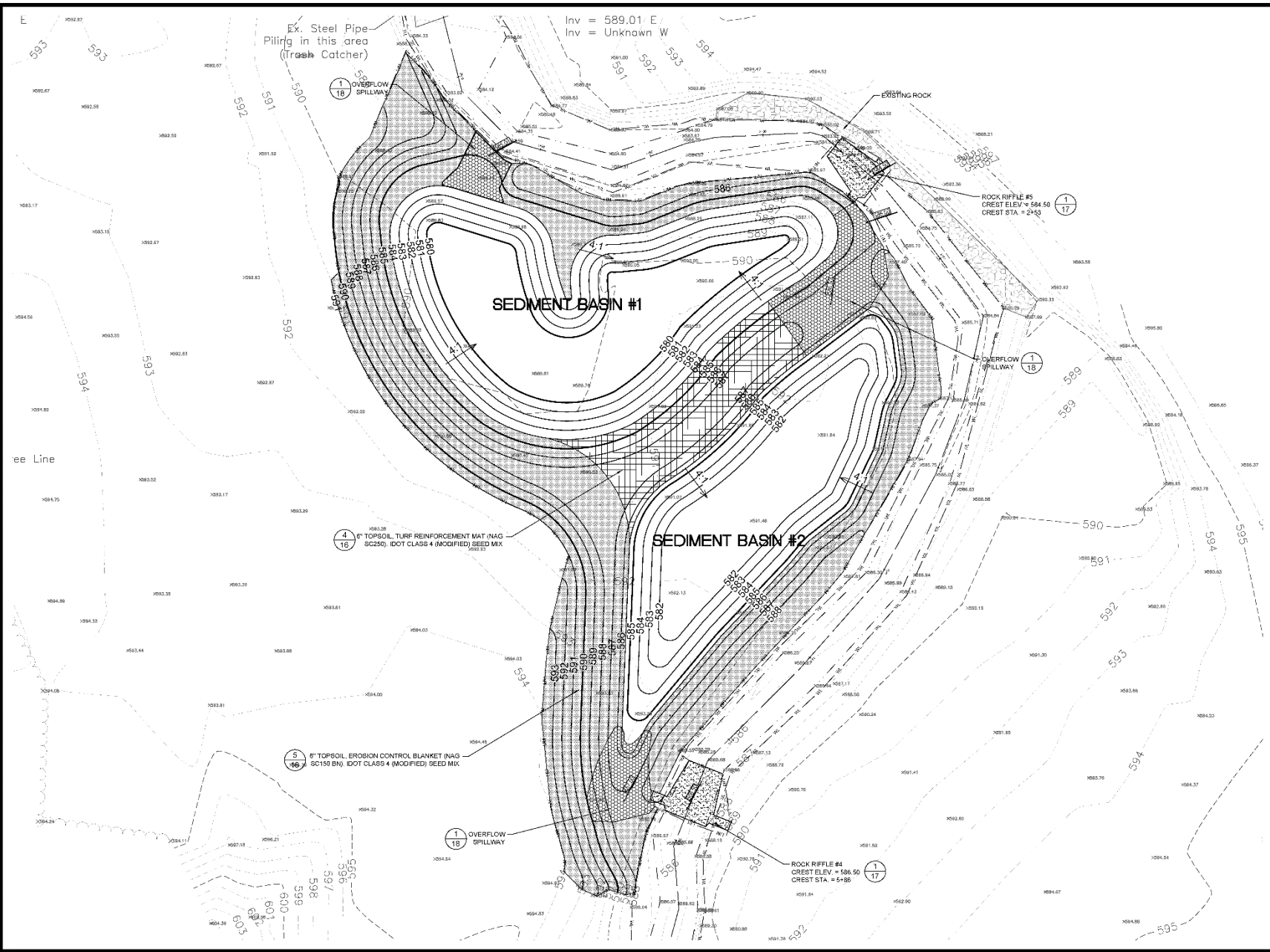
Soil Erosion and Sediment
 Control/Restoration Plan
 South Area

PROJECT NO.	13-0368	DRAWING NO.	
DESIGNED BY	TCT	14	
DRAWN BY	TCT-CFR		
INFORMED BY	BRO		
APPROVED BY	JAW	SHEET NO.	
ISSUE DATE	3/31/2015	14	OF 18

Final



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LEGEND

1 ft Existing Contour Lines

1 ft Proposed Contour Lines

Limits of Disturbance

Wetland Boundary

Edge of Creek

Existing Storm Sewer

Existing Overhead Electric Lines

Silt Fence

Tree Protection

Existing Tree

Erosion Control Blanket

Rock Riffle

Spillway

Turf Reinforcement Mat

Detail Number
Sheet Number

1	Final	4/9/15
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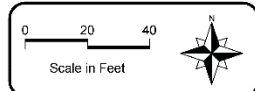
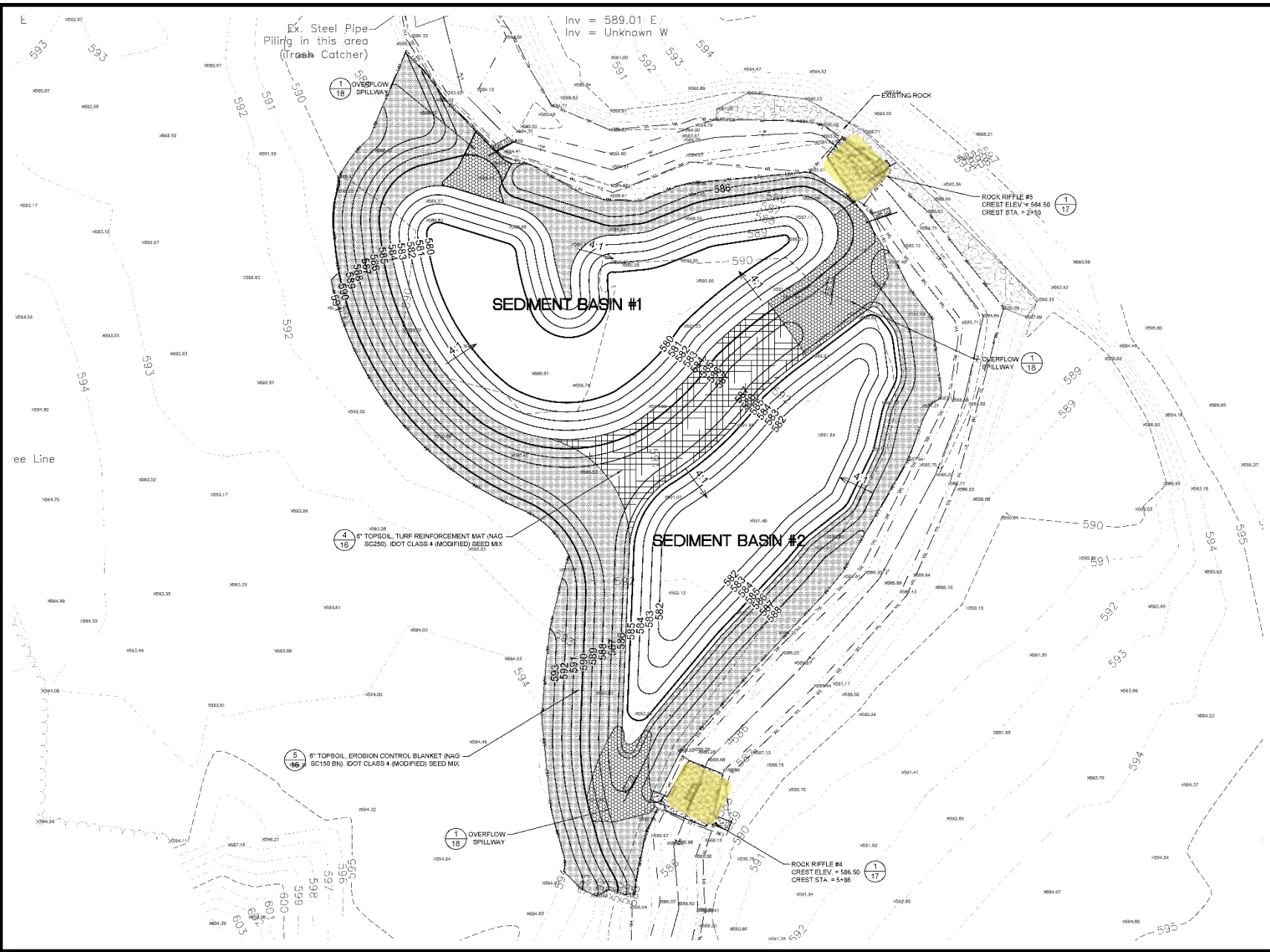
Lake Wildwood Section 319
 Project
 Varna, Illinois

Soil Erosion and Sediment
 Control/Restoration Plan
 North Area

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DESIGNED BY	TCT	13	
DRAWN BY	TCT-CFR		
INCHARGE BY	BRO		
APPROVED BY	JAW	SHEET NO.	
DATE PLOTTED	3/31/2015	13	OF 18

Final

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LEGEND

1 ft Existing Contour Lines

1 ft Proposed Contour Lines

Limits of Disturbance

Wetland Boundary

Edge of Creek

Existing Storm Sewer

Existing Overhead Electric Lines

Silt Fence

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Existing Tree

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Rock Riffle

Spillway

Turf Reinforcement Mat

Detail Number
Sheet Number

1	Final	4/9/15
No.	Revision/Issue	Date

Hey and Associates, Inc.
 Engineering, Ecology and Landscape Architecture
 8755 W. HIRSHIN ROAD, SUITE 835
 CHICAGO, ILLINOIS 60631
 OFFICE (773) 693-9200
 FAX (773) 693-9202
 CHICAGO@HEYASSOC.COM
 PROFESSIONAL DESIGN FIRM
 LICENSE NO. 184.002429

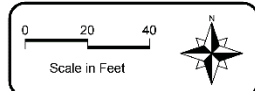
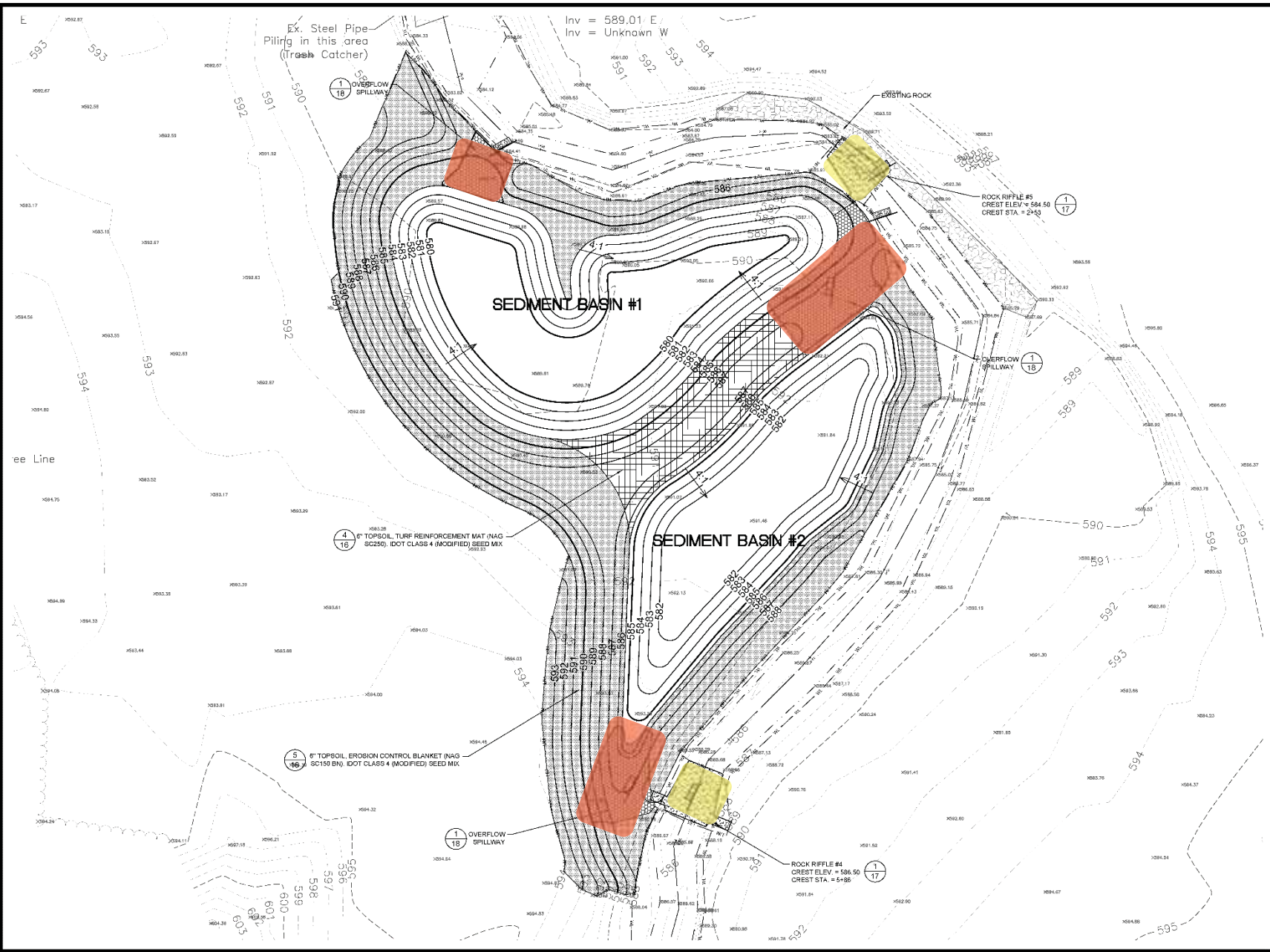
Lake Wildwood Section 319
 Project
 Varna, Illinois

Soil Erosion and Sediment
 Control/Restoration Plan
 North Area

PROJECT NO.	13-0368	DRAWING NO.	
DESIGNED BY	TCT	13	
DRAWN BY	TCT-CFR		
INCHARGE BY	BRO		
APPROVED BY	JAW	SHEET NO.	
DATE PLOTTED	3/31/2015	13	OF 18

Final

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LEGEND

1 ft Existing Contour Lines

1 ft Proposed Contour Lines

Limits of Disturbance

Wetland Boundary

Edge of Creek

Existing Storm Sewer

Existing Overhead Electric Lines

Silt Fence

Tree Protection

Existing Tree

Erosion Control Blanket

Rock Riffle

Spillway

Turf Reinforcement Mat

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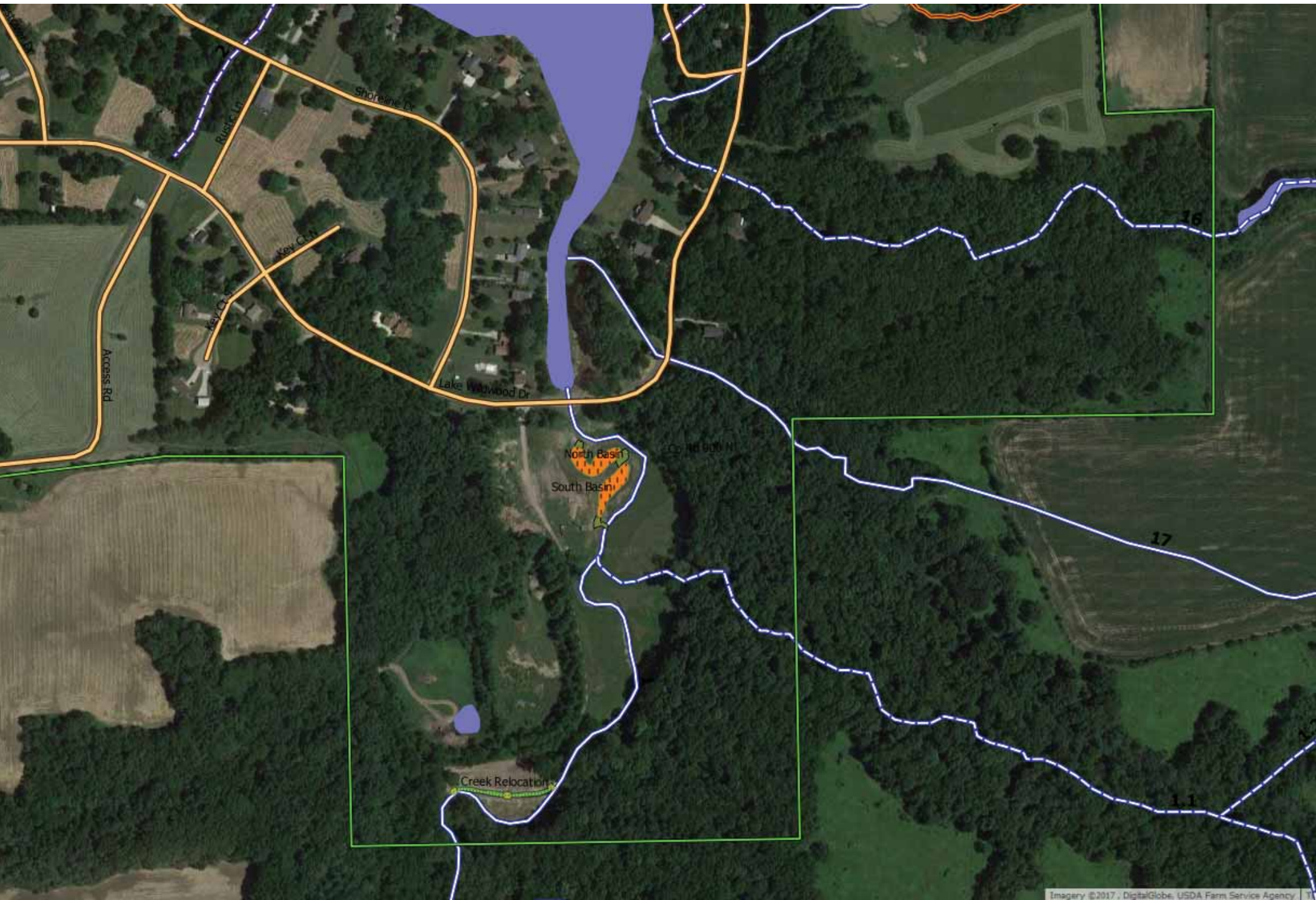
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Basin Operations:
in-series, off-line basins.
Controlled with entrance and exit rip-
stone overflow spillways.
Basins "Activate" at 30 cfs flow in
Creek
"Sweet spot" is at 150 cfs – 75% of
Creek flow is captured by the
basins.
Basins "Lose functionality" (except for
sand removal) at +/-2 year storm
(cfs).

Section 319 Grant:
• \$83,500 EPA (35%)
• \$155,300 LWA (65%)
• \$238,800 Total

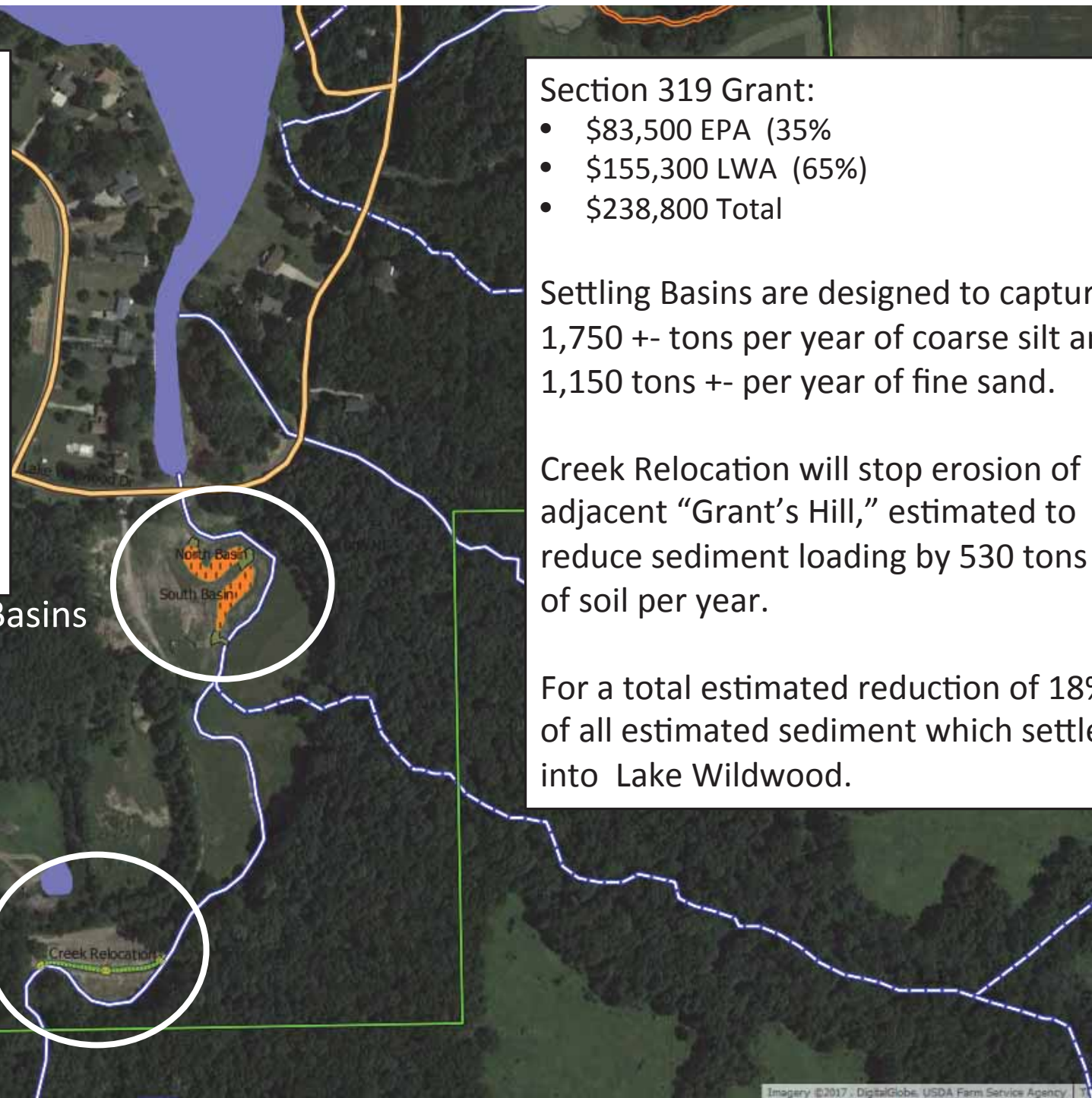
Settling Basins are designed to capture
1,750 +/- tons per year of coarse silt and
1,150 tons +/- per year of fine sand.

Creek Relocation will stop erosion of
adjacent "Grant's Hill," estimated to
reduce sediment loading by 530 tons
of soil per year.

For a total estimated reduction of 18%
of all estimated sediment which settles
into Lake Wildwood.

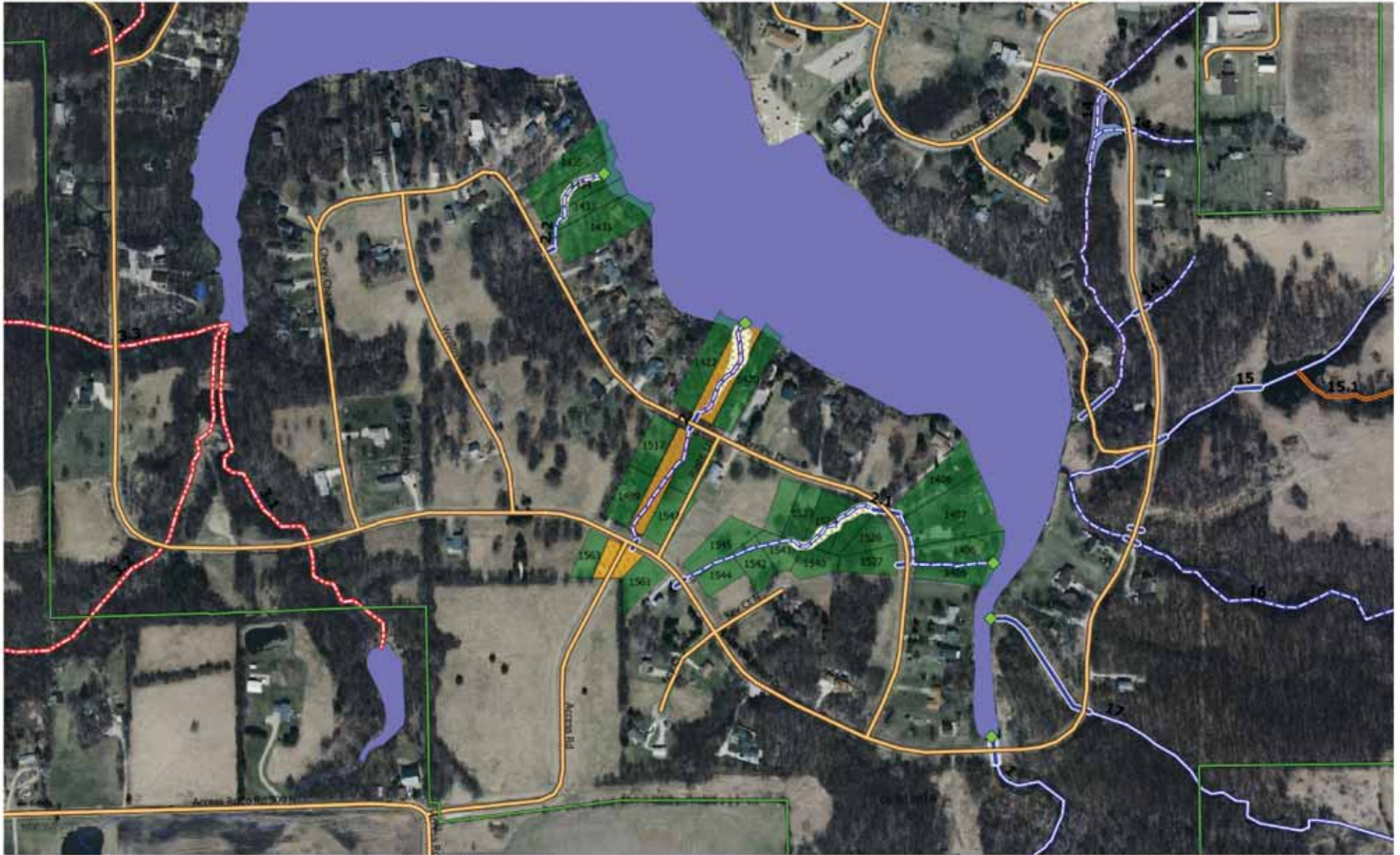
Settling Basins

Creek Relocation



Our Citizen Scientists at Work



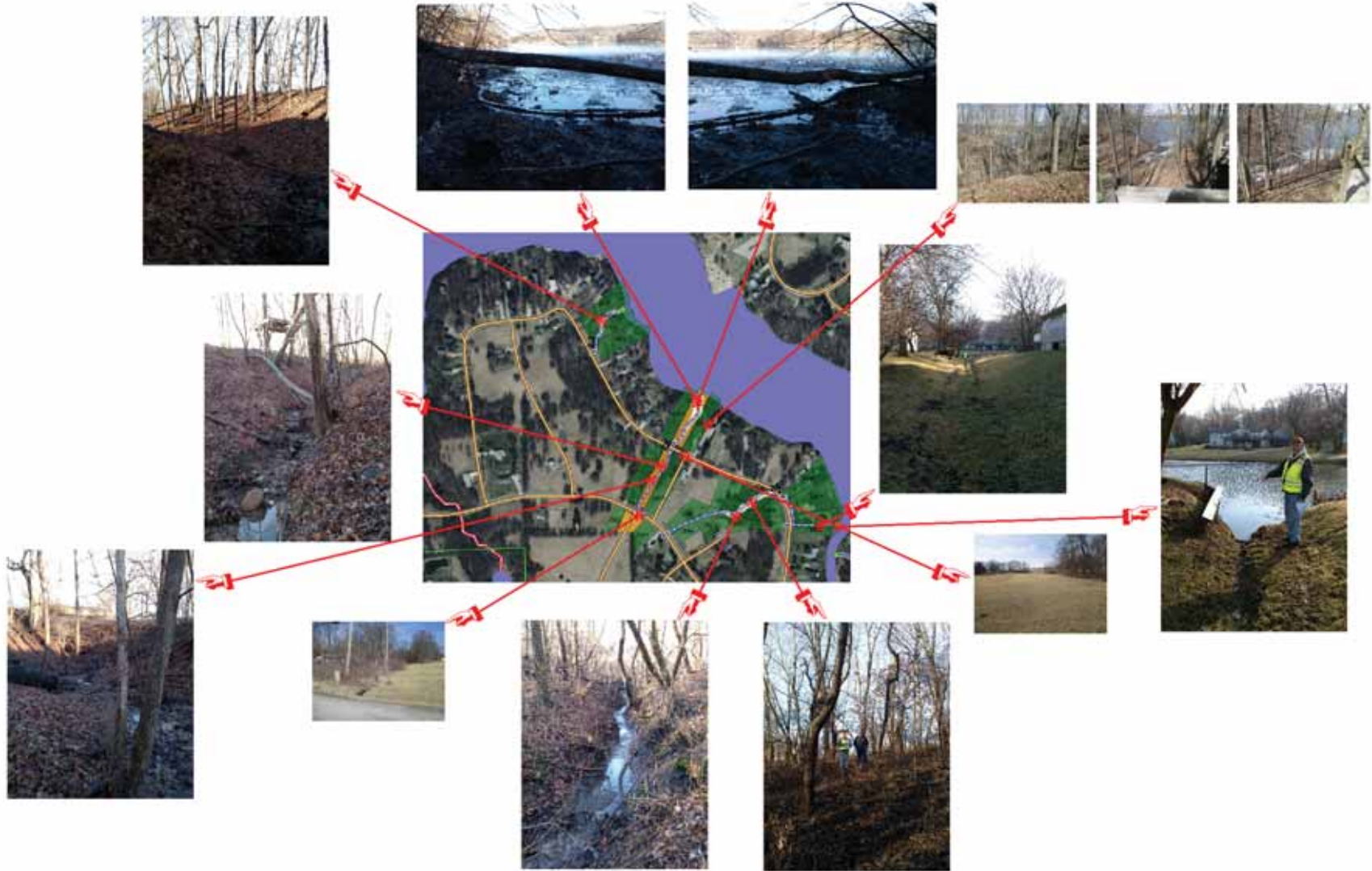


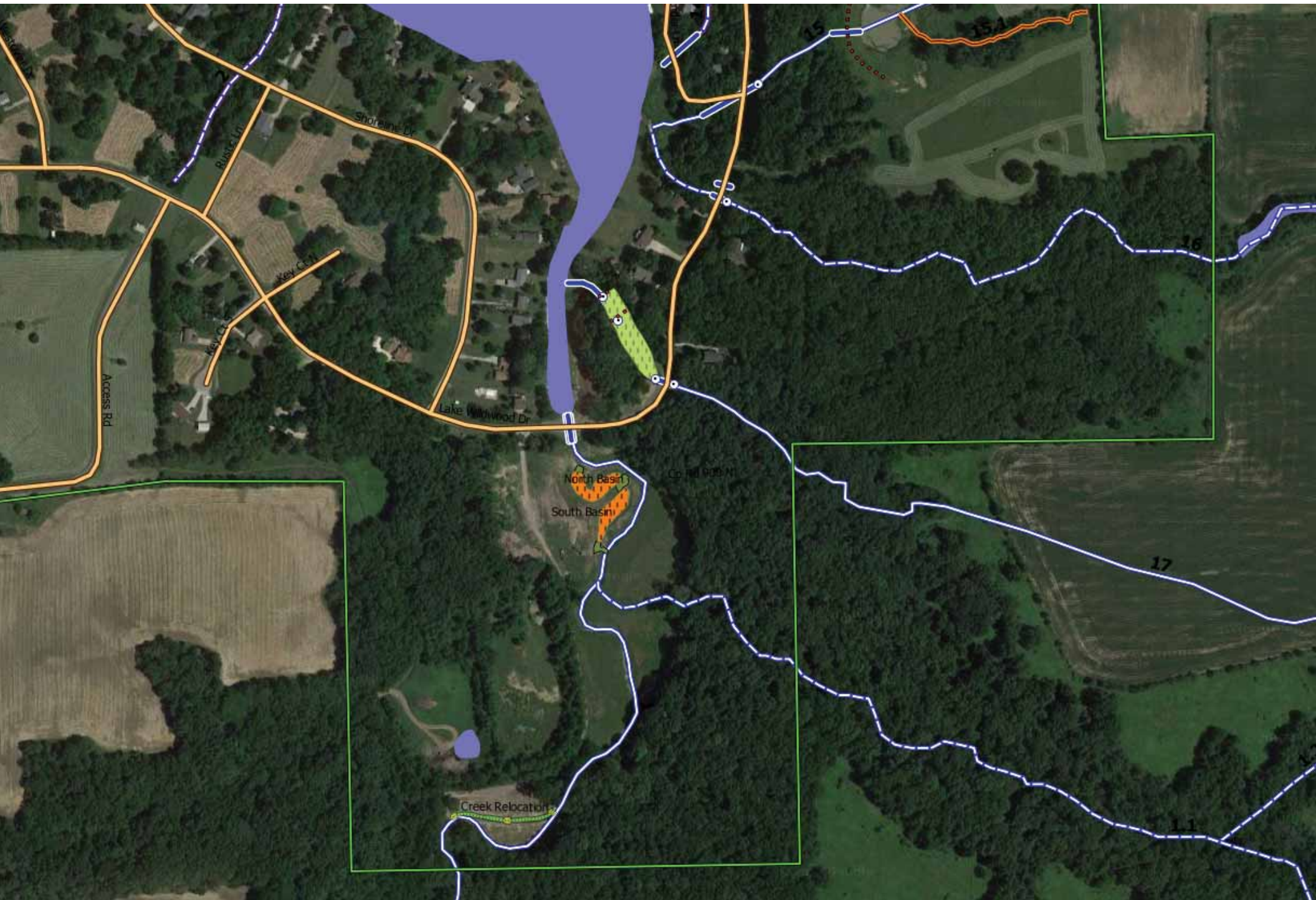
Tributary 2.x Area Survey - 1/21/2017

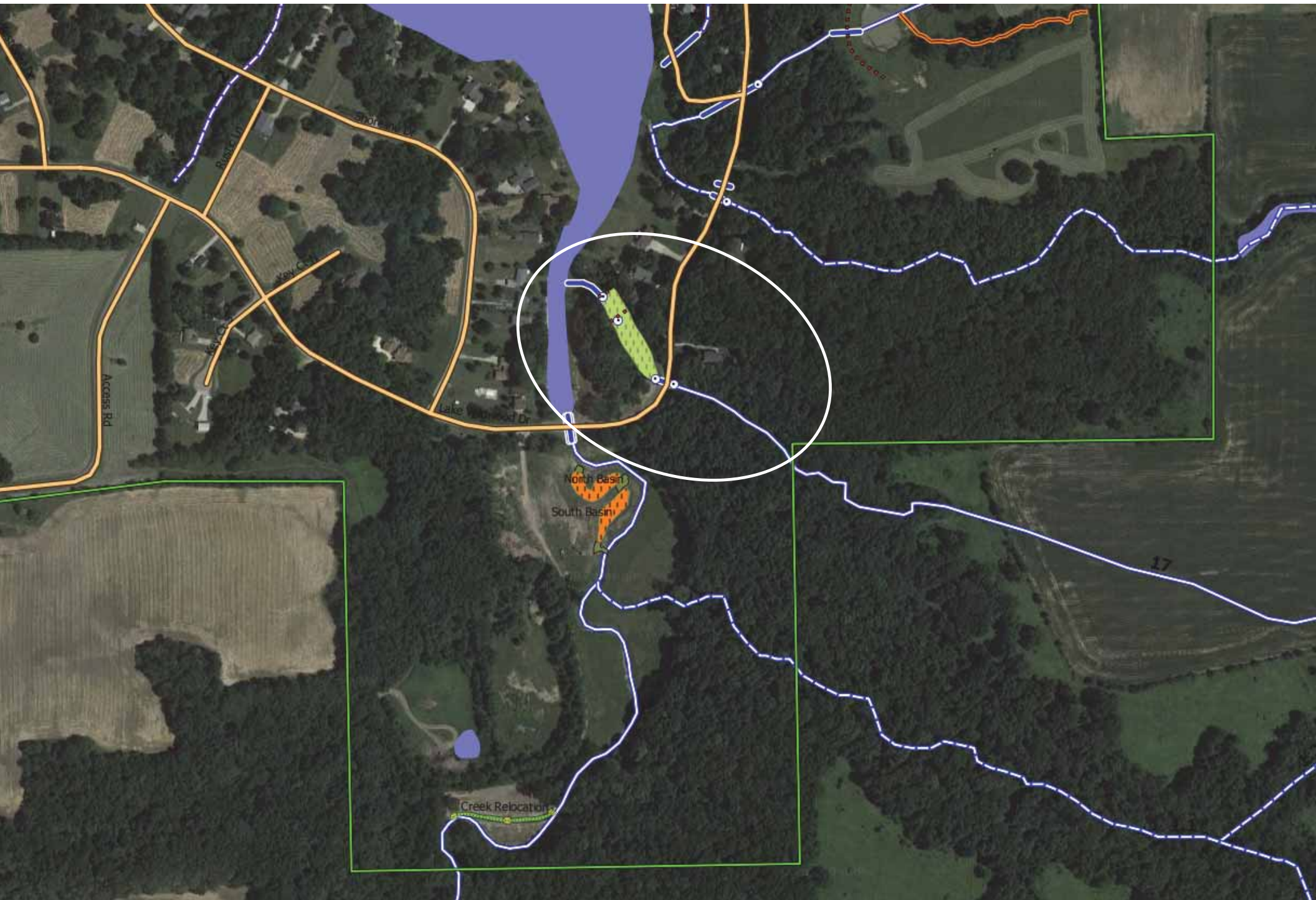


Tributary 2.x Area Survey - 1/21/2017

Tributary 2.x Area Survey - 1/21/2017







Access Rd

North Basin

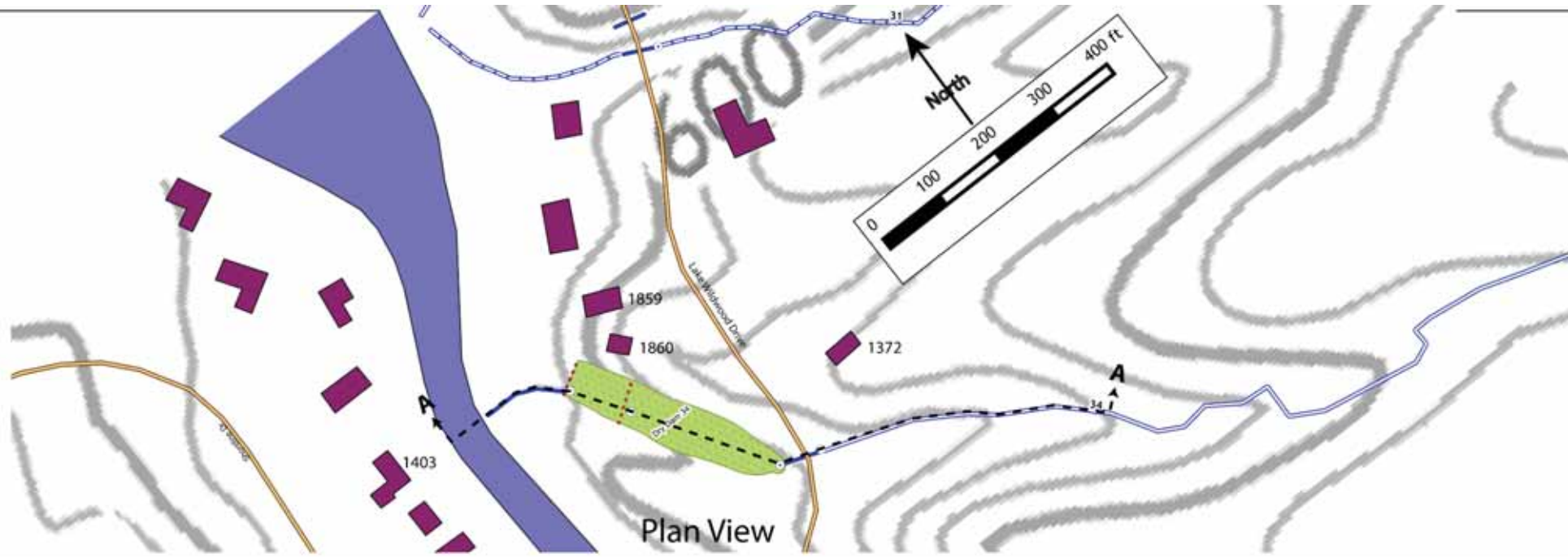
South Basin

Creek Relocation

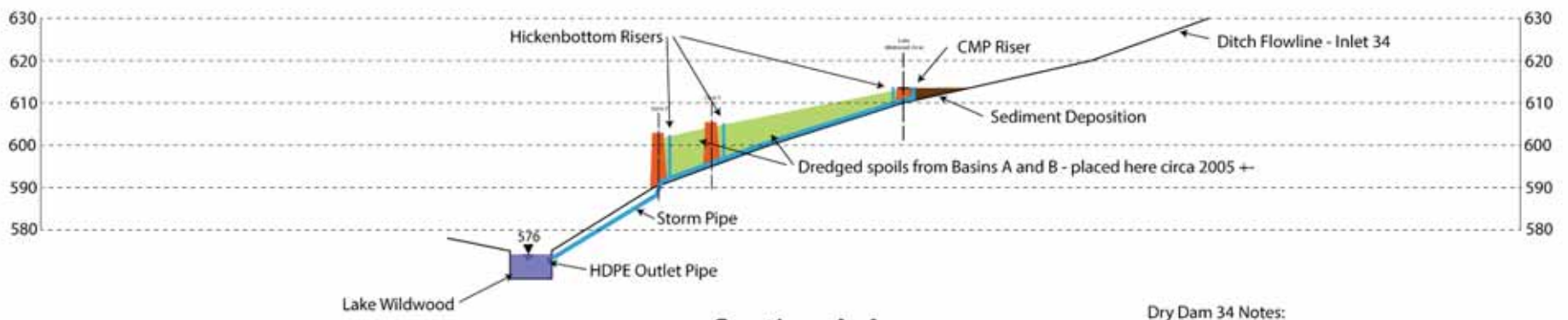
North Basin

South Basin

17



Plan View



Section A-A

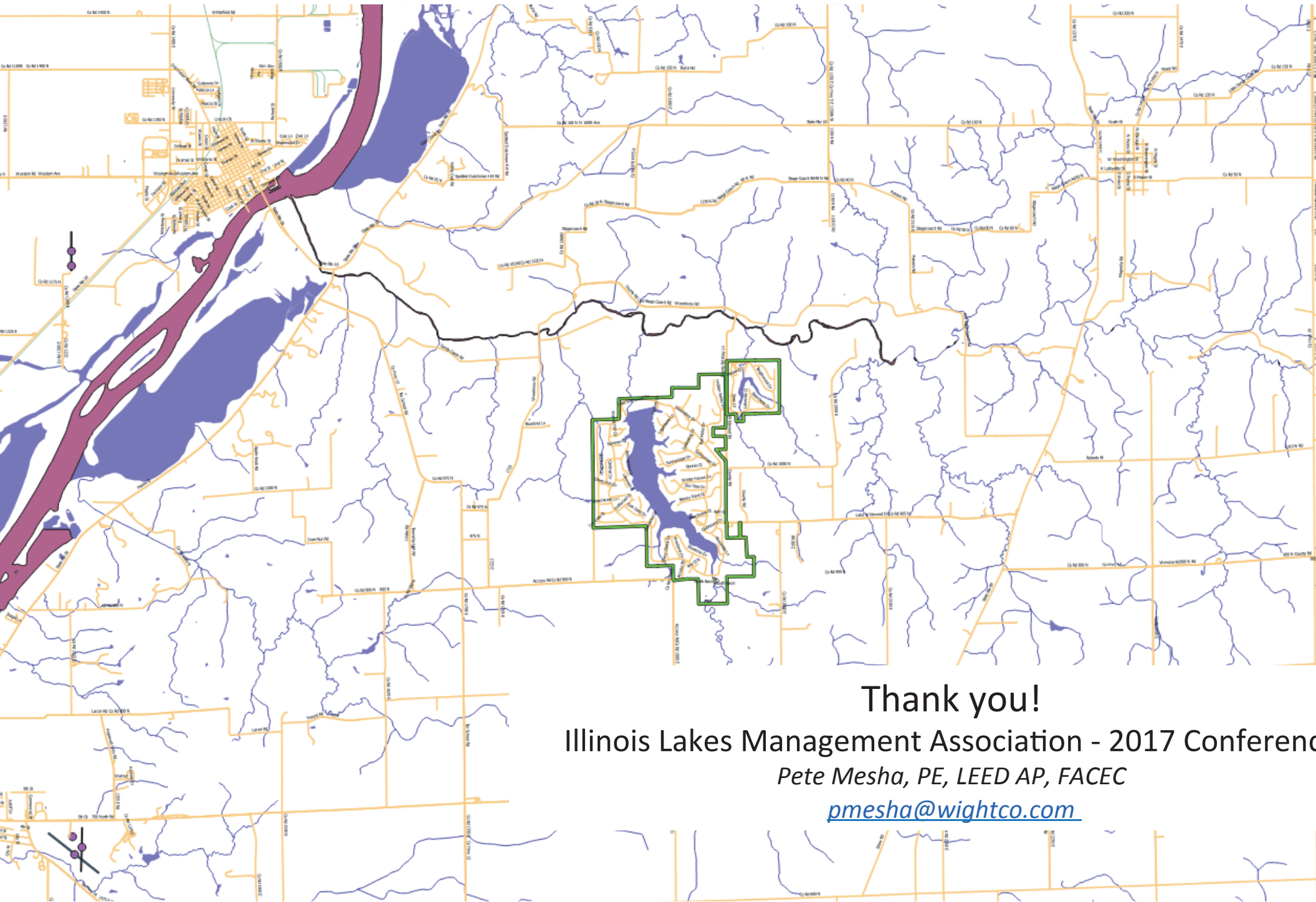
Existing Conditions
Dry Dam 34

Dry Dam 34 Notes:
 - Assessment survey performed by PM/BE in Jan 2016.
 - Primary Function - Dredged Spoils Disposal
 - Secondary Function - Inlet 34 Sediment Removal

Citizen Science

My thoughts on “Citizen Science” in practice at Lake Wildwood:

- Our members are quite capable of collecting and mapping useful data,
- Having the in-house ability to produce a variety of maps is in itself very useful for:
 - *Clearer communications in meetings, and,*
 - *Tracking completed projects/phases year-over-year, and,*
 - *Helping to prioritize geo-spatial tasks using only our improved observation skills, and,*
 - *Through improved visualizations, helping our members better understand our project planning activities (a picture is worth a thousand words), and,*
 - *Improving the scope statements that our scientists, engineers and contractors rely on to provide needed services to our Association.*
- We are fortunate to have science and engineering advisors on-call for guidance as needed.



Thank you!

Illinois Lakes Management Association - 2017 Conference

Pete Mesha, PE, LEED AP, FACEC

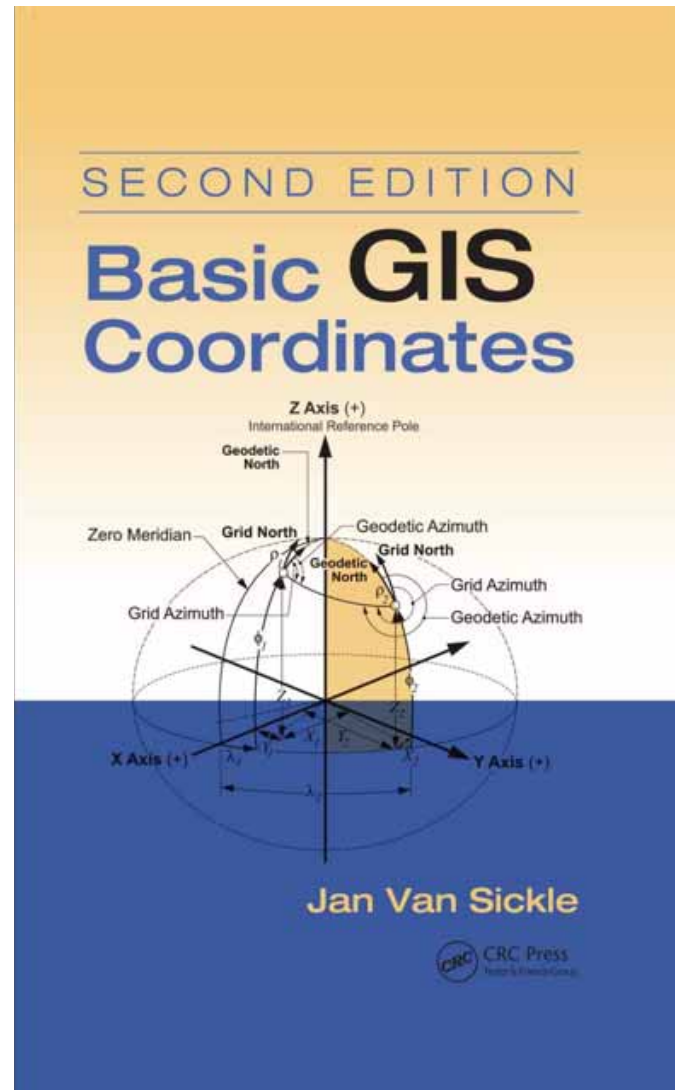
pmesha@wightco.com

Spatial Reference Systems

To fully understand Spatial Reference Systems is a tall order – This text is available from Amazon if you are curious.

Fortunately, you can run QGIS with a general understanding of Spatial Reference Systems.

Study the QGIS Tutorial on this subject.



Spatial Reference Systems

face

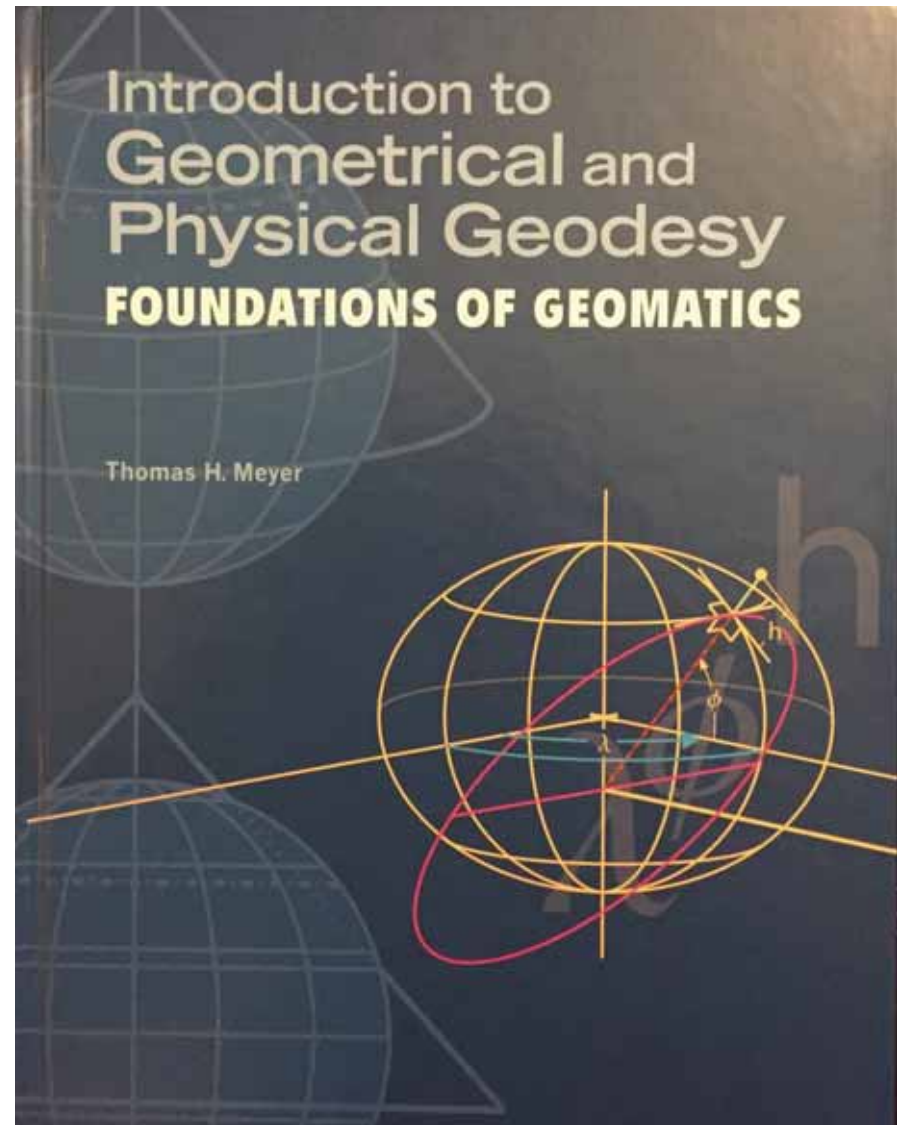
Thomas H. Meyer

was first exposed to geodesy while studying mathematics at Texas A&M University. I was taking a course in geographic information systems (GIS) and, during an exercise, came upon a dialog box with a field whose value indicated the datum to which my data were referred. I had no idea what this meant, so I asked another student. I was told, "Who knows? Just accept the defaults."

Fully understand Spatial Reference Systems is a tall order – This text is available from Amazon if you are interested in the subject.

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Citizen Science

- Term just added to the Oxford English Dictionary in June 2014
 - *“Scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions”*
- Citizen Scientists
 - Provide experimental data
 - Raise new questions
 - Co-create scientific culture

Levels of Citizen Science

- Crowdsourcing
 - Citizens-as-sensors
 - Collect and contribute data, perhaps unknowingly!
 - Twitter feeds
- Distributed Intelligence
 - Citizens help to interpret data
 - Amazon’s Mechanical Turk
- Participatory Science
 - Aid in problem identification and definition
 - Active in data collection
- Extreme citizen science
 - Collaboration and analysis



(from Haklay, 2013)



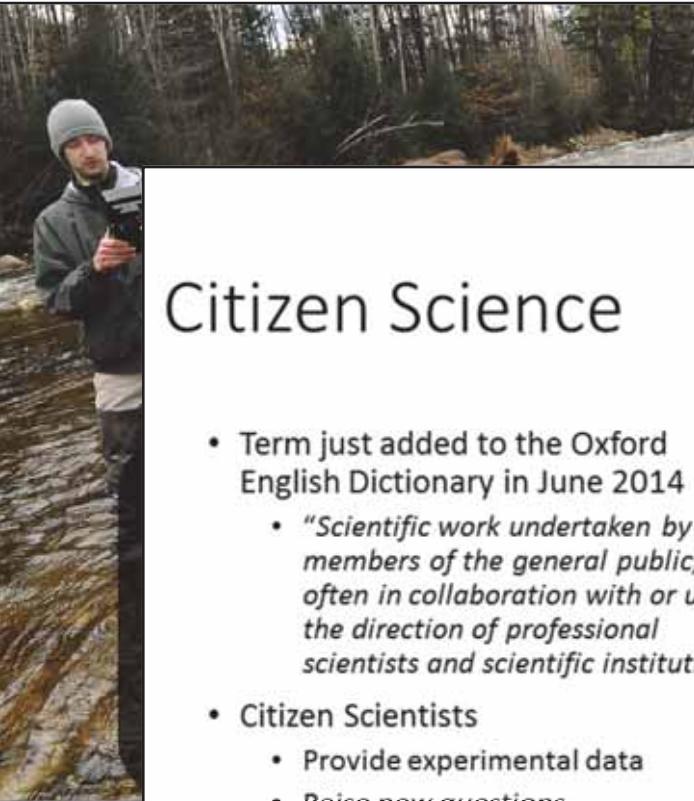


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Slides courtesy of Thomas Pingel, Northern Illinois University



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Levels of Citizen Science

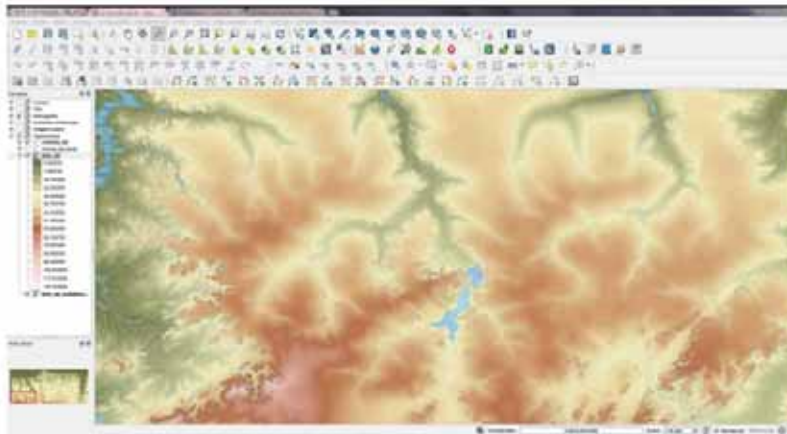
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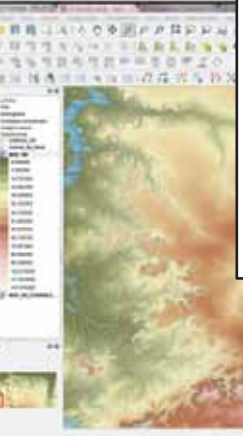
QGIS allows for more than just mapping.
It puts the tools for **visualization** and **analysis**
in your hands.



Slide courtesy of Thomas Pingel, Northern Illinois University

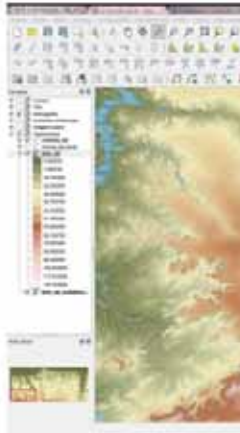
the most promising
development of

(fo



Slide courtesy of Thomas Pingel, Northern Illinois University

QGIS allows for more than just mapping.
It puts the tools for **visualization** and **analysis**



Slide courtesy of Tho

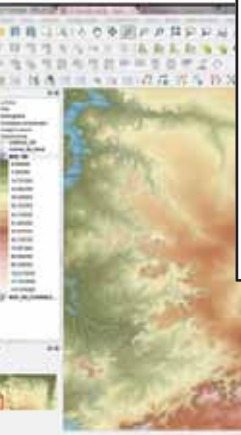
However, GIS is a big topic.

The tool requires some basic knowledge of
how geographic information is created,
manipulated, stored, and represented.

Slide courtesy of Thomas Pingel, Northern Illinois University

the most promising
development of

(fo



Slide courtesy of Thomas Pingel, Northern Illinois University

Spatial Reference Systems

There are more than 1,000 horizontal geodetic datums and over 3,000 Cartesian coordinate systems, sanctioned by governments around the world and currently in use, to describe our planet electronically and on paper."

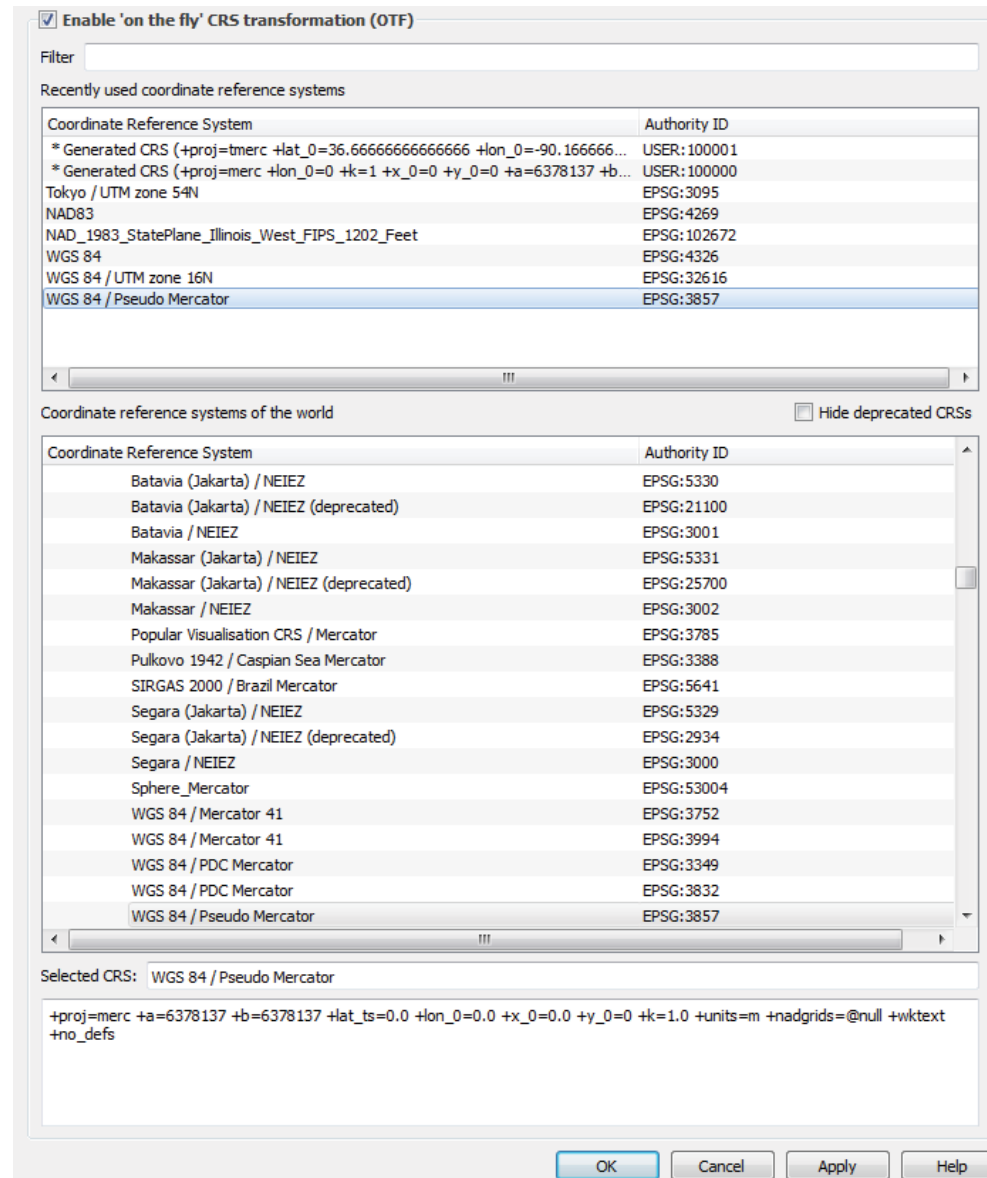
- Jan Van Sickle

we have been using a default SRS : WGS/Pseudo Mercator EPSG:3857 – Just for ease of use.

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Spatial Reference Systems

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Cartographic Projection Procedures for the UNIX
Environment—A User's Manual

by

Gerald I. Evenden¹

Open-File Report 90-284

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards. Use of tradenames is for purposes of identification only and does not constitute endorsement by the U.S. Geological Survey.

May 13, 1990

¹Woods Hole, MA 02543

