How Feature Extraction Provides Return on Investment

Impervious Surface Delineation Utilizing Remote Sensing

WOOLPERT

Brian Stevens, CP, GISP
(Program Director)

Woolpert at a glance.

1911

Opened first office in Dayton, Ohio

23

Offices across the nation

600

More than 600 employees

26 Offices across the nation.

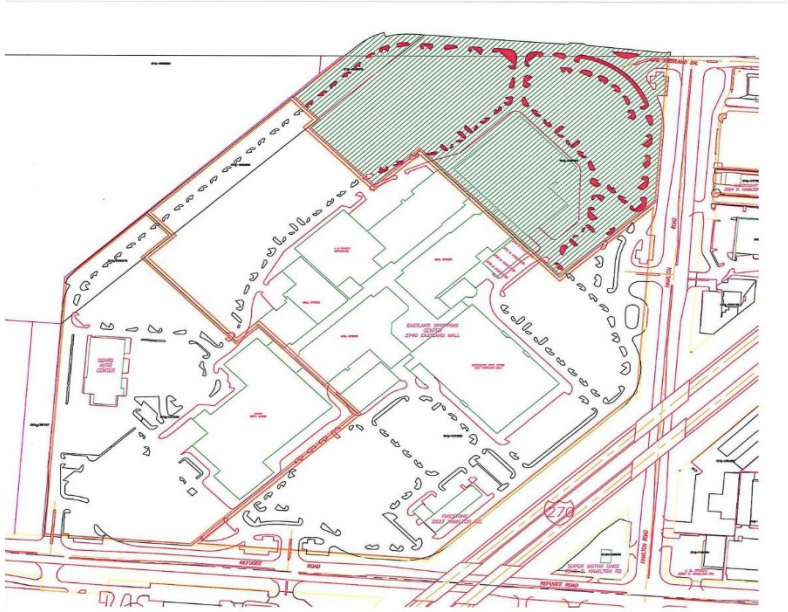
Woolpert Office Locations:

Arlington, VA
Atlanta, GA
Charleston, SC
Charlotte, NC
Chesapeake, VA
Chicago, IL
Cincinnati, OH
Cleveland, OH
Columbia, SC
Columbus, OH
Dallas, TX
Dayton, OH
Denver, CO
Fairview Heights, IL
Florence, KY
Greenville, SC
Houston, TX
Indianapolis, IN
Miami, FL
Orlando, FL
Pittsburgh, PA
Richmond, VA
Scottsdale, AZ
St. Louis, MO
Tampa, FL
Toledo, OH

Impervious Surface Delineation (Traditional Methods)

Traditional Methods of Determining Impervious Surfaces

As-Built Drawings



Determining Impervious Surfaces Using Traditional Methods

2D and 3D Heads-up Digitizing

Impervious Surface Delineation (Feature Extraction)

Determining Impervious Surfaces Using Feature Extraction

Remote Sensing

- Semi-Automated Feature Extraction using Remote Sensing
  - Transforming Data into Information
    - Utilize base mapping (ortho-imagery and LiDAR)
    - Utilize existing GIS data (parcel mapping)
  - Integrating Impervious Surface Layer with Billing System

Determining Impervious Surfaces Using Feature Extraction

Remote Sensing – Input Datasets

Digital Orthoimagery

Natural Color

Color Infrared

Determining Impervious Surfaces Using Feature Extraction

Remote Sensing – Input Datasets

Orthoimagery Pixel Resolution Comparison

Determining Impervious Surfaces Using Feature Extraction

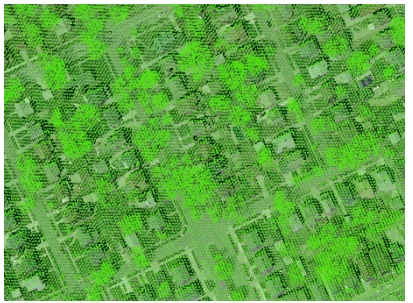
Remote Sensing – Input Datasets

Aerial LiDAR (Light Detection And Ranging)

- 1-meter or denser point spacing

LiDAR Point Cloud

Intensity

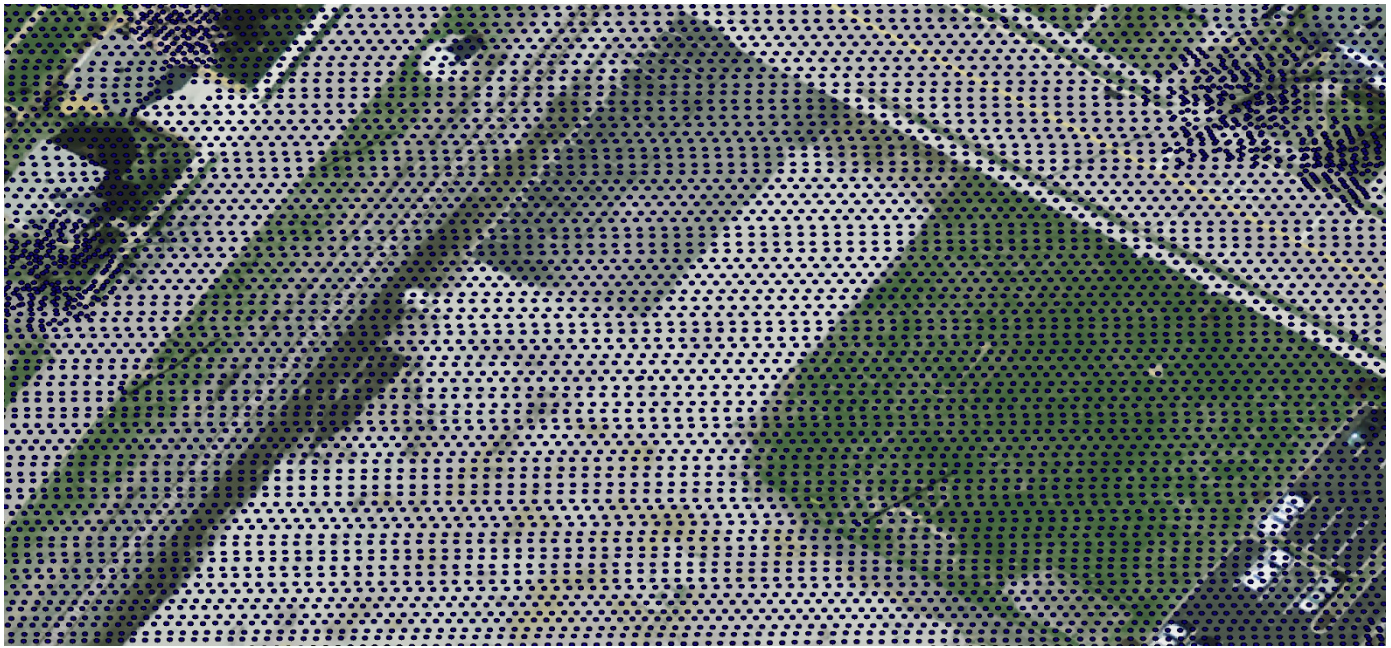


Patterning

Determining Impervious Surfaces Using Feature Extraction

Remote Sensing – Input Datasets

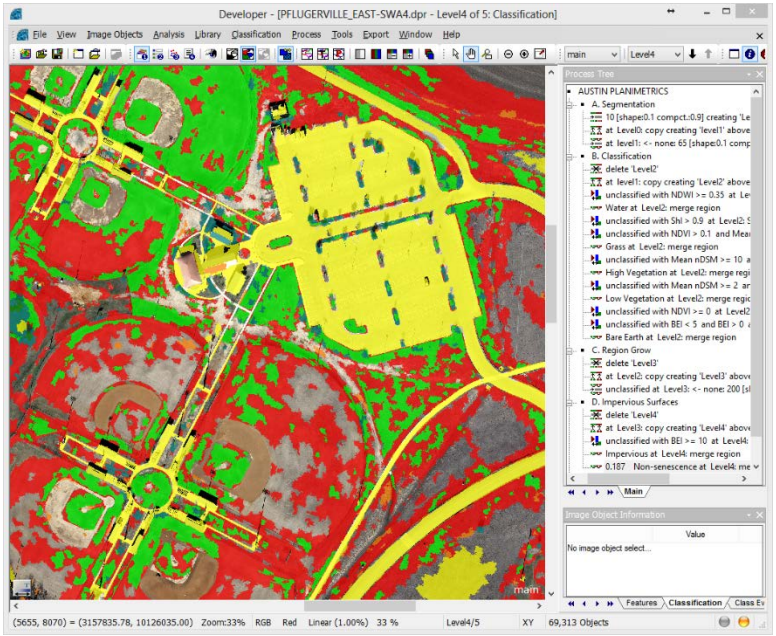
LiDAR Point Density Comparison



Determining Impervious Surfaces Using Feature Extraction

Remote Sensing

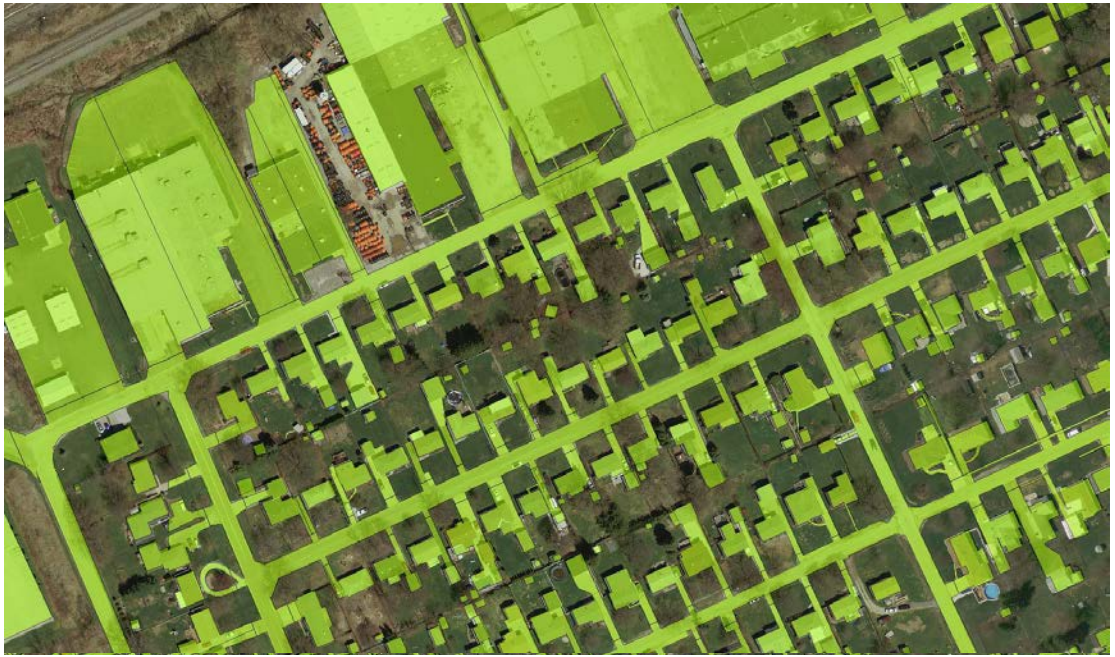
Object Oriented Remote Sensing



Determining Impervious Surfaces Using Feature Extraction

Remote Sensing

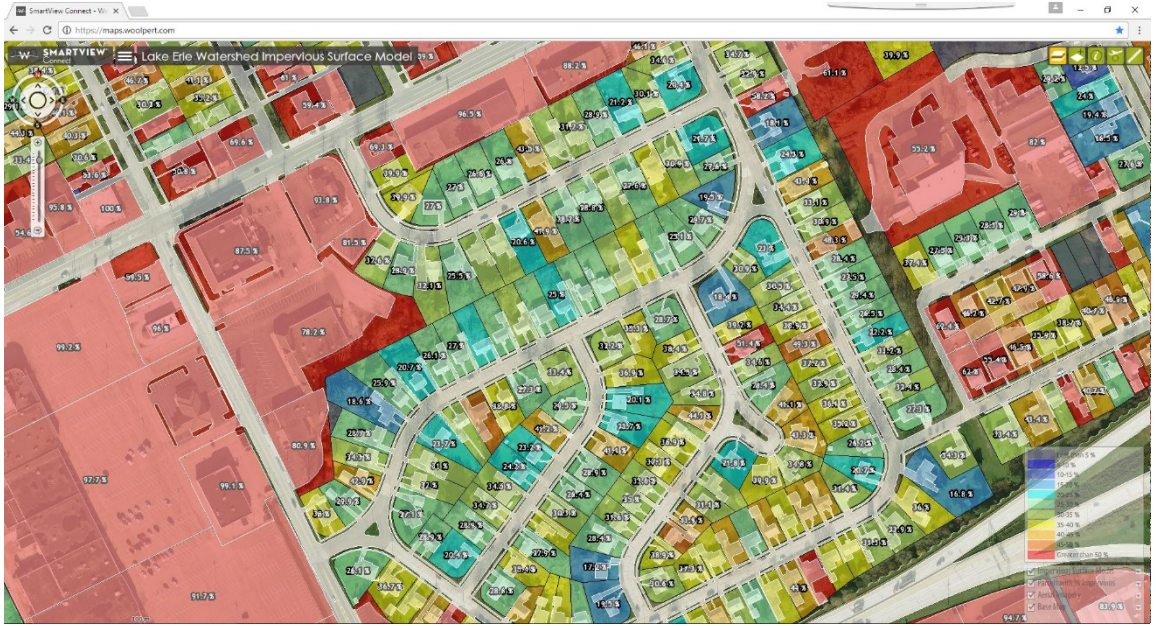
Impervious Surface Delineation



Determining Impervious Surfaces Using Feature Extraction

Remote Sensing

Impervious Surface Delineation



Determining Impervious Surfaces Using Feature Extraction

Remote Sensing

Impervious Surface Delineation

Decrease from existing impervious surface area

Increase from existing impervious surface area

Determining Impervious Surfaces Using Feature Extraction

Overall Benefits

- **Fair** and **Equitable** Means of Evaluating Stormwater Runoff
- Increase Efficiency within the Office
- Reduce Human Error (much more objective process)
- Provides a Streamlined and Cost Effective Solution

Return on Investment Analysis

Determining Impervious Surfaces Using Feature Extraction

Return-on-Investment

Return on Investment

- City of Columbus, Ohio
- City of Indianapolis, Indiana
- City of Springfield, Ohio

Determining Impervious Surfaces Using Feature Extraction

Return-on-Investment

City of Columbus, Ohio

- Population of 822,553 (2013 estimate)
- Service Area: ~700 square miles
- Non-Residential Parcels Only

	ERU (Equivalent Residential Unit)	Fee (monthly)	Square Feet
Existing			
New			
Difference	150,800	$425,000	301,600,000
Change			

Determining Impervious Surfaces Using Feature Extraction

Return-on-Investment

City of Indianapolis, Indiana

- Population of 843,393 (2013 estimate)
- Service Area: ~400 square miles
- Non-Residential Parcels Only

	BBU (Base Billing Units)	Fee (monthly)	Square Feet
Existing	1,470,935	$1,618,028	1,446,468,367
New	1,525,640	$1,678,204	1,517,728,074
Difference	54,705	$60,175	71,259,707
Change	4%	4%	5%

Determining Impervious Surfaces Using Feature Extraction

Return-on-Investment

Realized Return (first year)

3x – 5x client initial investment

- Example: City of Indianapolis, Indiana
- $235,000 initial investment
- $722,106 realized annual return

Annual Return (2nd year and beyond)

- $722,106 Additional Annual Revenue (Indianapolis, Indiana)

Determining Impervious Surfaces Using Feature Extraction

Return-on-Investment

City of Springfield, Ohio

- Population of 59,357 (2013 estimate)
- Service Area: ~30 square miles
- Non-Residential and Residential Parcels

	ESU Equivalent Service Unit)	Fee (monthly)	Square Feet
Existing	78,473	$100,537	141,930,800
New	85,697	$112,094	162,659,093
Difference	7,224	$11,557	20,728,293
Change	9%	11%	15%

Determining Impervious Surfaces Using Feature Extraction

Return-on-Investment – Existing Clients

- City of Springfield, Ohio
- City of Columbus, Ohio
- Pennsylvania DEP (Lake Erie Watershed, Erie, Pennsylvania)
- City of Indianapolis, Indiana
- City of Hobart, Indiana
- City of Hamilton, Ohio
- City of Duluth, Minnesota
- Butler County, Ohio

Determining Impervious Surfaces Using Feature Extraction

Return-on-Investment – Contracting

- Statewide Imagery/LiDAR – E.g. Ohio, Indiana, Maine
- State Term Contracts – E.g. Ohio GIS State Term
- Grants – E.g. Sea Grant
- GSA – Lake Erie Watershed (Pennsylvania DEP)
- Existing Stormwater Utility Contracts –
- Federal – NOAA, USGS
- RFP, RFQ, SOQ – E.g. Indianapolis
- Cost Share – Public Private Partnership

Ohio State Imagery Program (OSIP3)

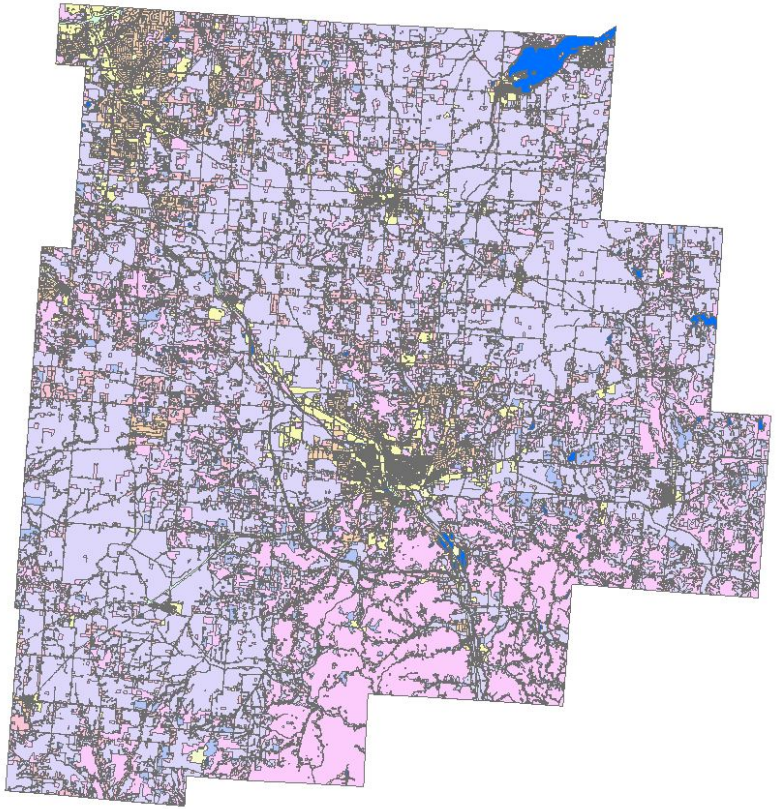
OSIP:

- Multi-Year
  - 2017 – 2020
- Multi-Service
  - Base & Enhanced Orthoimagery
  - Aerial LiDAR
  - Oblique Aerial Imagery
  - Parcel & GIS Related Services
  - Remote Sensing
    - Landcover
    - Building Outlines
    - Change Detection

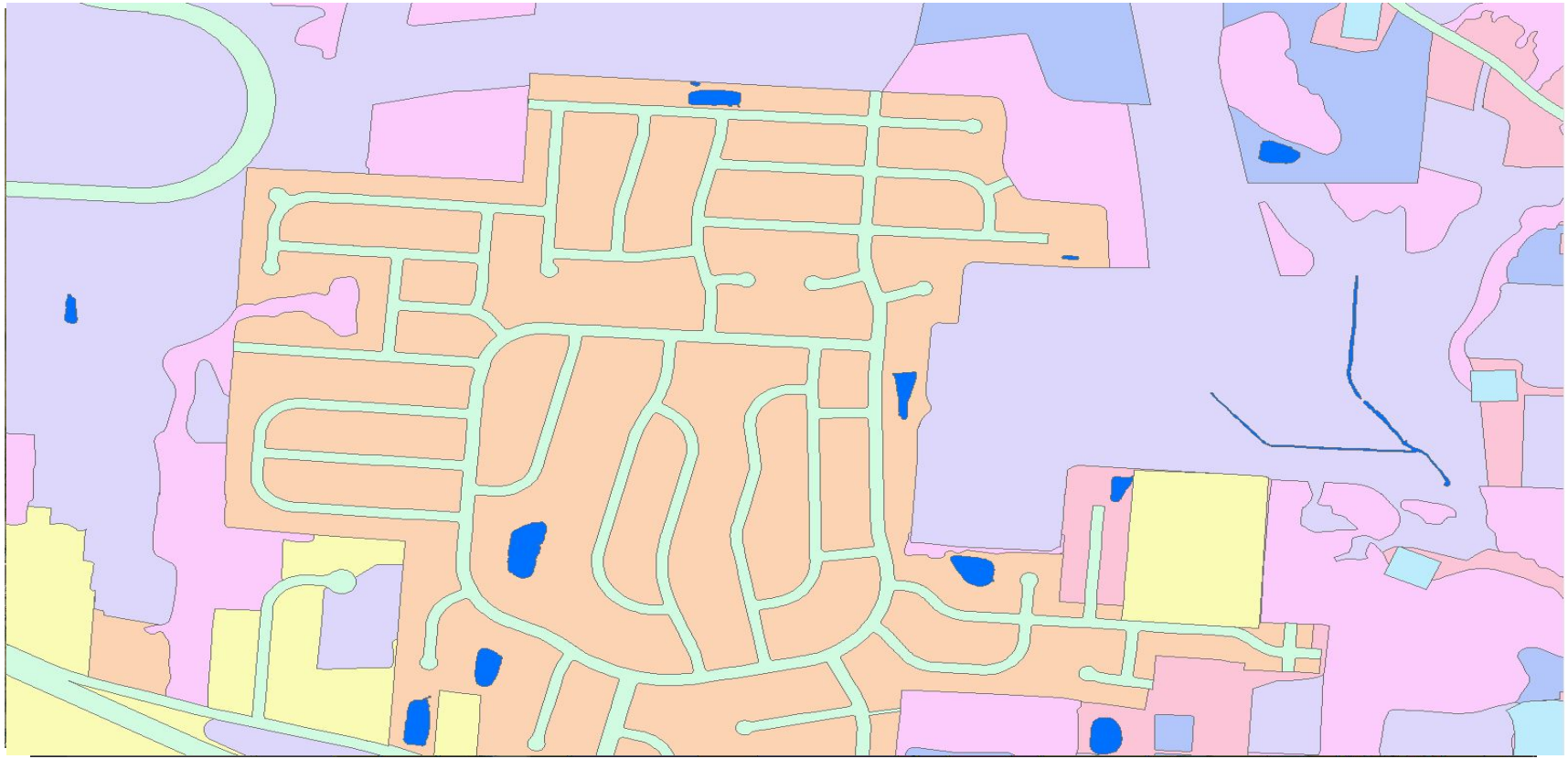
Additional Uses

Land-Cover Delineation

Land-Cover

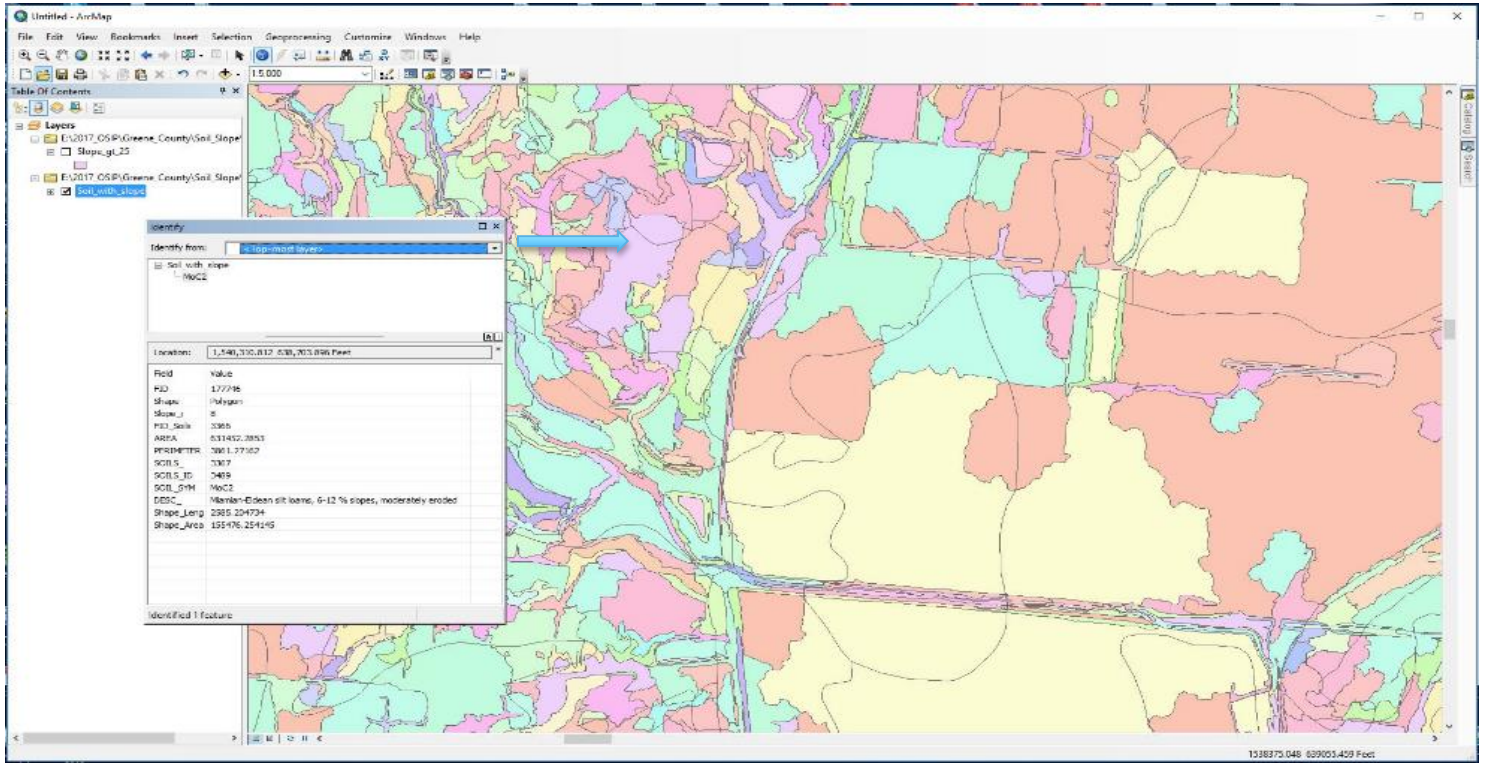


Land-Cover



Slope Analysis

Slope Analysis



Slope Analysis

Structure Outlines/Change Detection

Structure Outlines

Change Detection

Questions???