Stormwater Utilities

Impervious Surface Delineation Using Remote Sensed Data

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WOOLPERT

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Impervious Surface Delineation
(Traditional Methods)

Traditional Techniques to Create an Impervious Surface Layer

Traditional Photogrammetric techniques captured 3D impervious features using stereo aerial imagery

Traditional Techniques to Create an Impervious Surface Layer

Heads-up digitizing techniques captured 2D of impervious features from ortho-imagery

Many Utilities Use As-built Plans (CAD Drawings) to Update The Impervious Layer

Impervious Surface Delineation
(Using Automated Feature Extraction)

Feature Extraction of Impervious Surfaces

Process:

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

Feature Extraction of Impervious Surfaces

Input Datasets

- Digital Ortho-Imagery

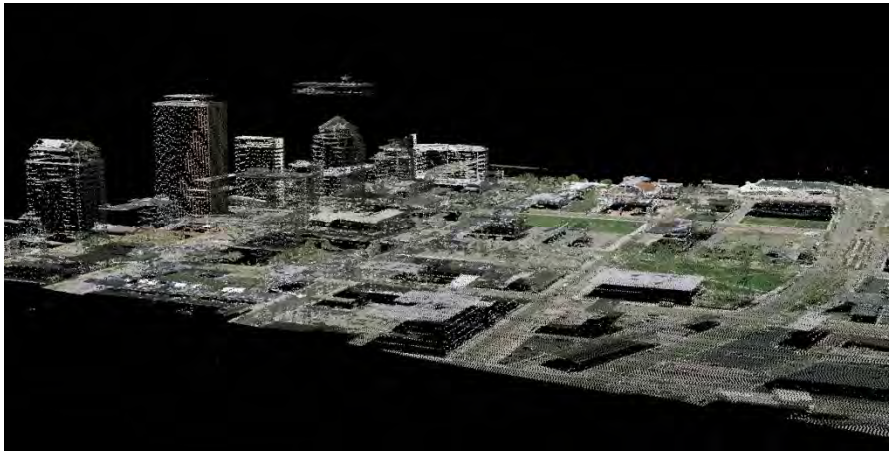
Natural Color

Color Infrared

Feature Extraction of Impervious Surfaces

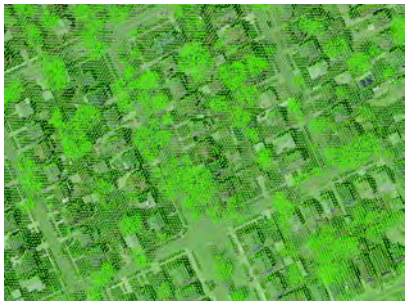
Input Datasets

- Aerial LiDAR (Light Detection And Ranging)
  - 1-meter or denser point spacing



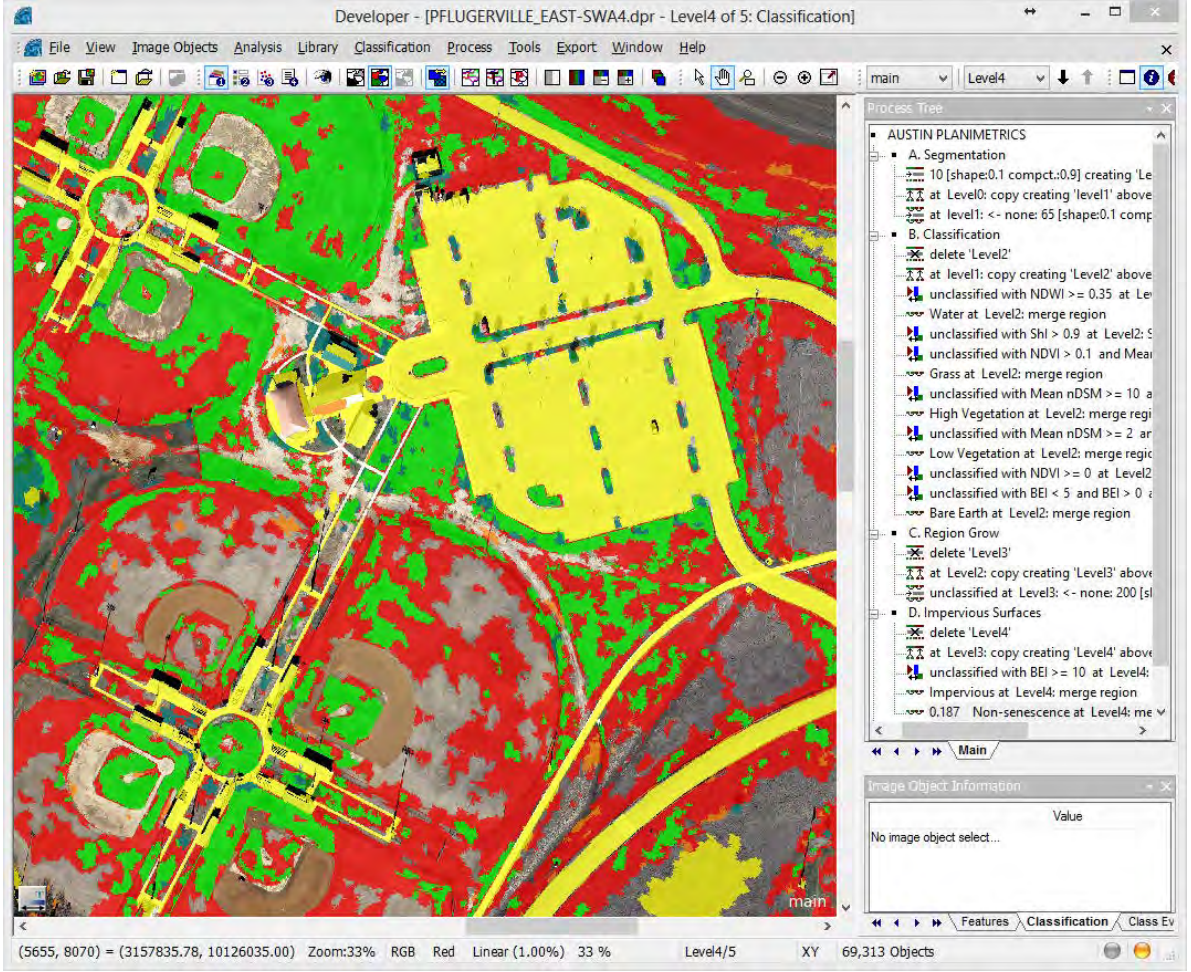
LiDAR Point Cloud

Intensity

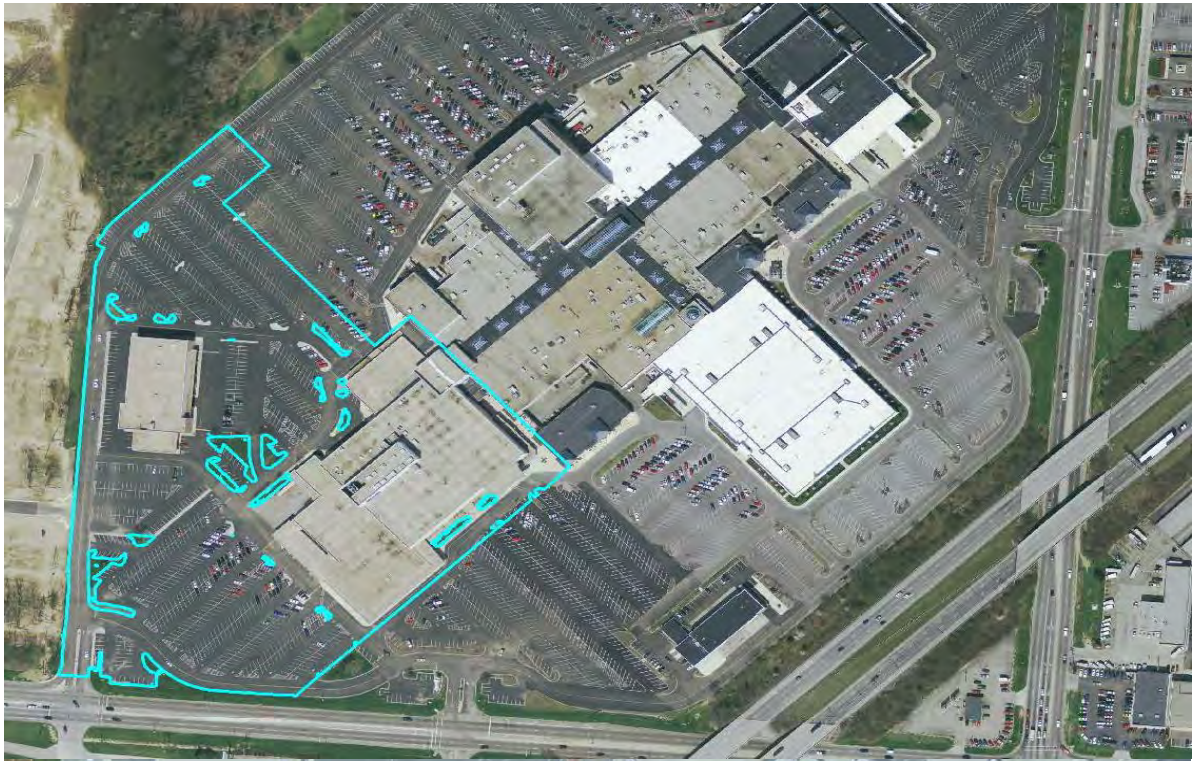


Patterning

Feature Extraction of Impervious Surfaces



Existing VS. New Dataset



Results

Estimated Dollars Comparing LiDAR Data with Current Data

Owner	Total Charges	Comment	Annual Income
Sears and Roebuck	$31.94	30 Day Billing Cycle	**$383.28**
Lazarus Inc	$37.79	31 Day Billing Cycle	**$453.48**
EM Columbus LLC	$5.94	30 Day Billing Cycle	**$71.28**
		Total Estimated Annual Income	**+$908.04**

- LiDAR – Light Detection and Radar
- ERU – Equivalent Residential Unit
- 1 ERU = 2,000 Square Feet

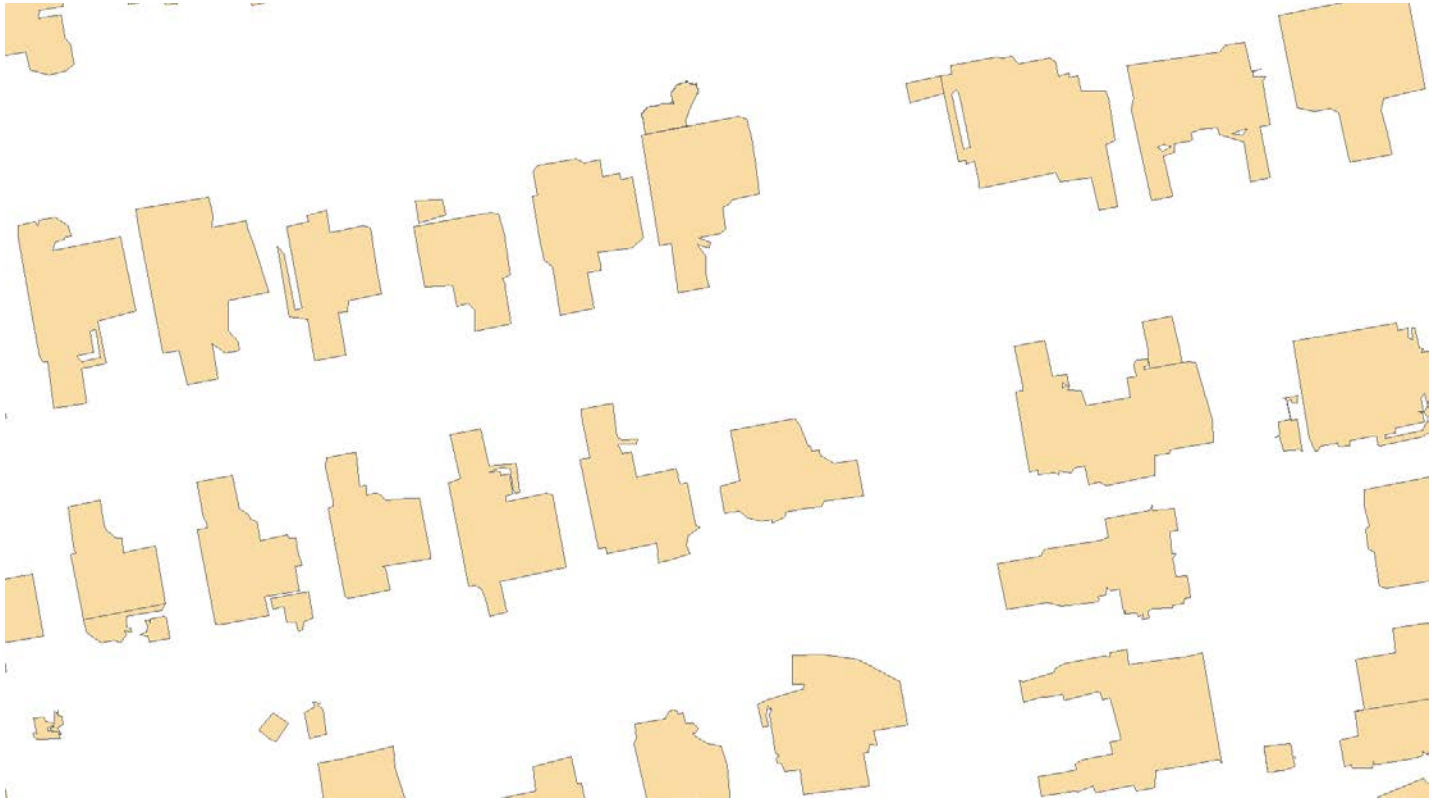
Citywide Impervious Surface Extraction
Non-Residential Parcels

Citywide Results

Decrease from existing impervious surface area

Increase from existing impervious surface area

Residential Parcels



Residential Parcel Test Sample

City of Columbus, Ohio

Residential Impervious Surface Pilot Area Calculation

Area	Parcel Count	Impervious Surface Total (Sq. Ft.)	Old Sq.Ft	Old Fee Monthly	New Fee Monthly	Difference	Old Fee Yearly	New Fee Yearly	% Change
Franklinton	152	256480.532	304000	$980.40	$827.15	($153.25)	$11,764.80	$9,925.80	-15%
German Village	289	693749.797	578000	$1,864.05	$2,237.34	$373.29	$22,368.60	$26,848.08	20%
Hilliard	261	981239.977	522000	$1,683.45	$3,164.49	$1,481.04	$20,201.40	$37,973.88	88%
Worthington	72	343320.525	144000	$464.40	$1,107.20	$642.80	$5,572.80	$13,286.40	138%

Client Benefits

Advantages of Using Feature Extraction For Impervious Surface Delineation

- Provides a fair and equitable assessment of impervious surfaces
- Repeatable process. keeps your utility up-to-date
- Provides a streamlined and cost effective process
- Decreases human error
- Scalable to “fit” the area-of-interest
- Release technicians to perform other tasks
- Utilizes analysis of multiple data sources – strengthens results

Existing Clients

Sampling of Current/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
- York County, South Carolina
- City of Hamilton, Ohio
- City of Toledo, Ohio
- City of Wilmington, Ohio
- City of Duluth, Minnesota
- York County, Pennsylvania

Woolpert Stormwater Partnership

WOOLPERT

How does the Stormwater Parternship work?

Establish & Identify

Establish program goals, review master plan and agree on schedule.

Begin Program

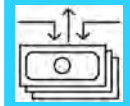
Collect aerial imagery and map impervious surface. Prioritize improvements. Inform citizens.

Integrate

Woolpert integrates the mapping data into the utility's billing system.

Earn

Begin generating additional revenue.



Invest & Communicate

Apply additional revenue to fund city improvement projects. Activate citizen plan.

Support & Maintain

Provide mapping updates and tech support.

Top 5 Benefits of the Stormwater Partnership

Revenue Increasing

Generate additional revenue without increasing existing rates.

Cutting-Edge Technology

Woolpert's patent-pending technology has been proven to discover an average of 15% more revenue than traditional approaches.

Accelerated Community Improvements

Fast-track improvements to stormwater and resiliency projects with new, untapped revenue.

A Fully Managed Partnership

Throughout the 10-year partnership, Woolpert will handle all maintenance and support, as well as various services.

Accurate and Defendable

Using impervious surface data to define commercial and residential areas shows how each parcel impacts stormwater infrastructure and is billed based on impact.

Thank You

Questions???

Stormwater Partnership Background

- **What is a Stormwater Utility?**
  - A stormwater utility is similar to water, sewer and other utilities
  - In this case, the service includes:
    - The control of stormwater runoff through construction
    - Operation and maintenance of a stormwater system

- **Why is Woolpert a good fit for stormwater management?**
  - Woolpert is a national leader in both geospatial and stormwater management.
  - Our patent-pending technology solution uses LiDAR and digital imagery to measure and calculate actual impervious surfaces, ensuring highly-accurate data.
  - Our comprehensive stormwater solution gives Woolpert the flexibility to develop well-rounded watershed management programs for our clients.

LiDAR
Light Detection And Ranging

- An optical remote sensing technology that utilizes lasers to determine the elevation of an object or surface by using time and distance.
- Used for surveying and mapping to capture points on a surface of an object to create a point cloud.
- Capable of accuracies of < 10cm @ 95%
- Ability to fly at night (active sensor)
  - Very useful in Florida!
- Fast and effective method to accurately model the terrain

Traditional Airborne Linear Scanning Lidar