# Technology, Transportation, and Environmental Conflict Resolution

Jeremiah Dumas
Assistant Research Professor of Landscape Architecture
GeoResources Institute
Mississippi State University

USDOT/RITA ncrst sepp
National Consortium for Remote Sensing in Transportation
Streamlining Environmental and Planning Processes

# Using 3D Interactive Visualization Tools for Public Participation

**Dr. Laxmi Ramasubramanian**
Associate Professor
*Email: laxmi@hunter.cuny.edu*

HUNTER COLLEGE
Department of Urban Affairs & Planning

**Jennifer Weeks**
Senior Planner
*Email: weeks@pbworld.com*

PB

USDOT/RITA ncrst sepp
National Consortium for Remote Sensing in Transportation
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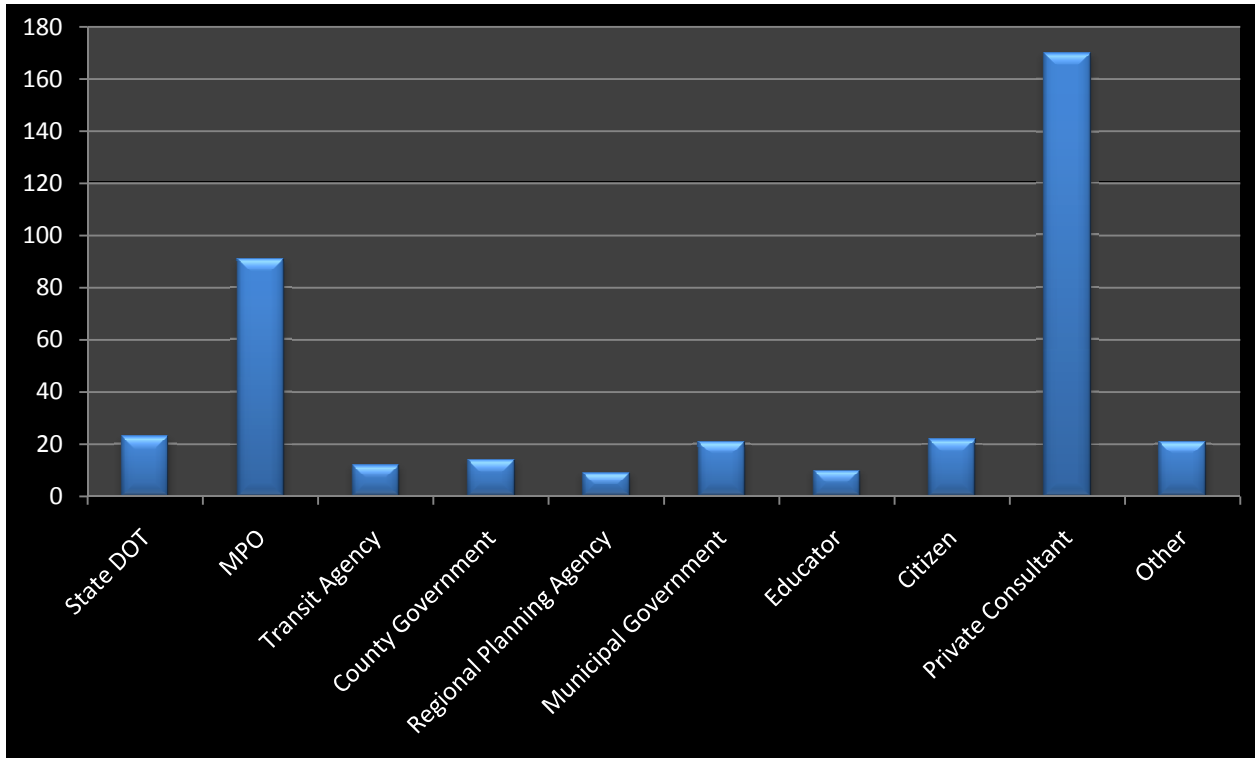
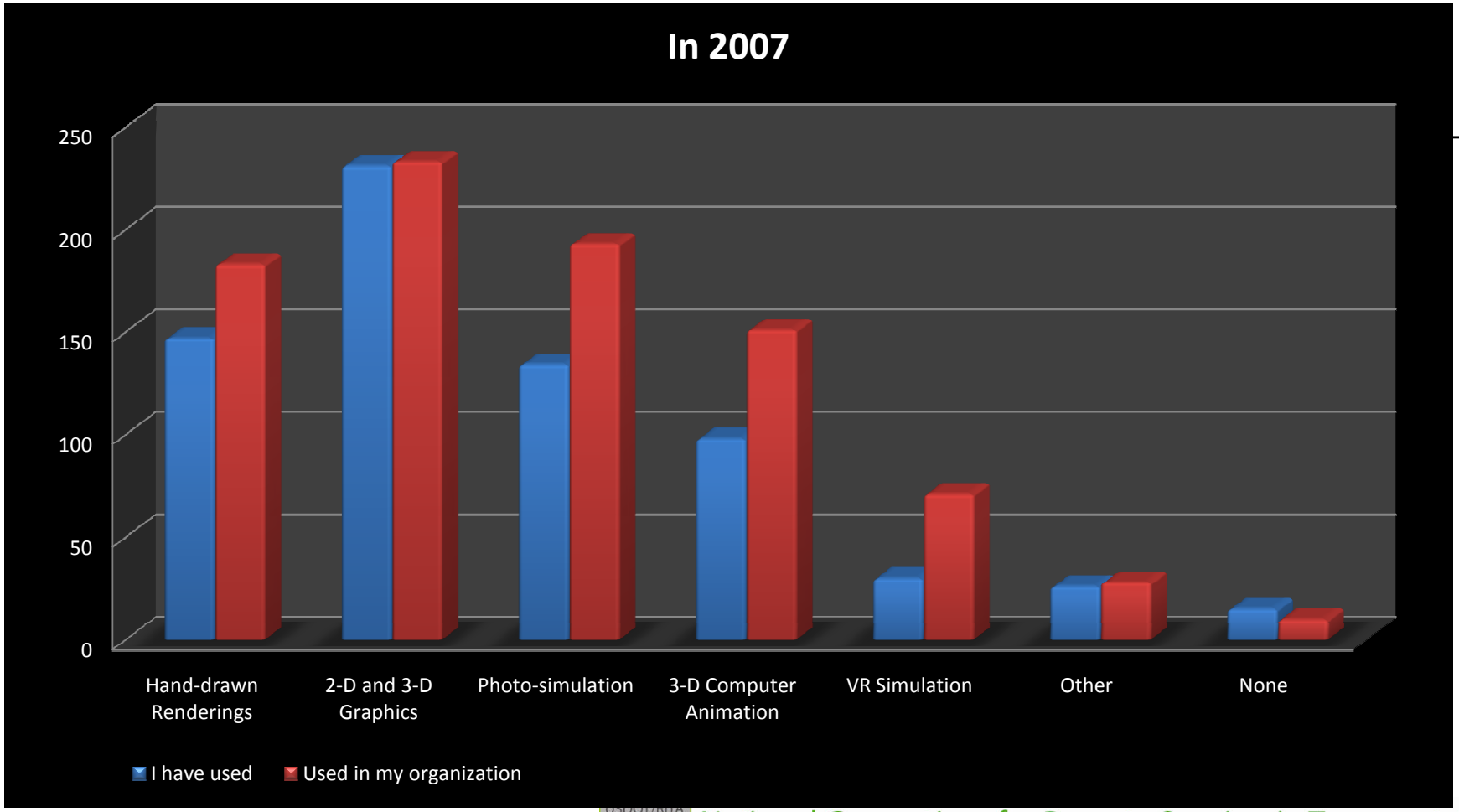
## Research Purpose

Examine the ***use*** and ***value*** of ***widely available Interactive 3-D Visualization Tools*** to support public involvement in transportation planning processes.

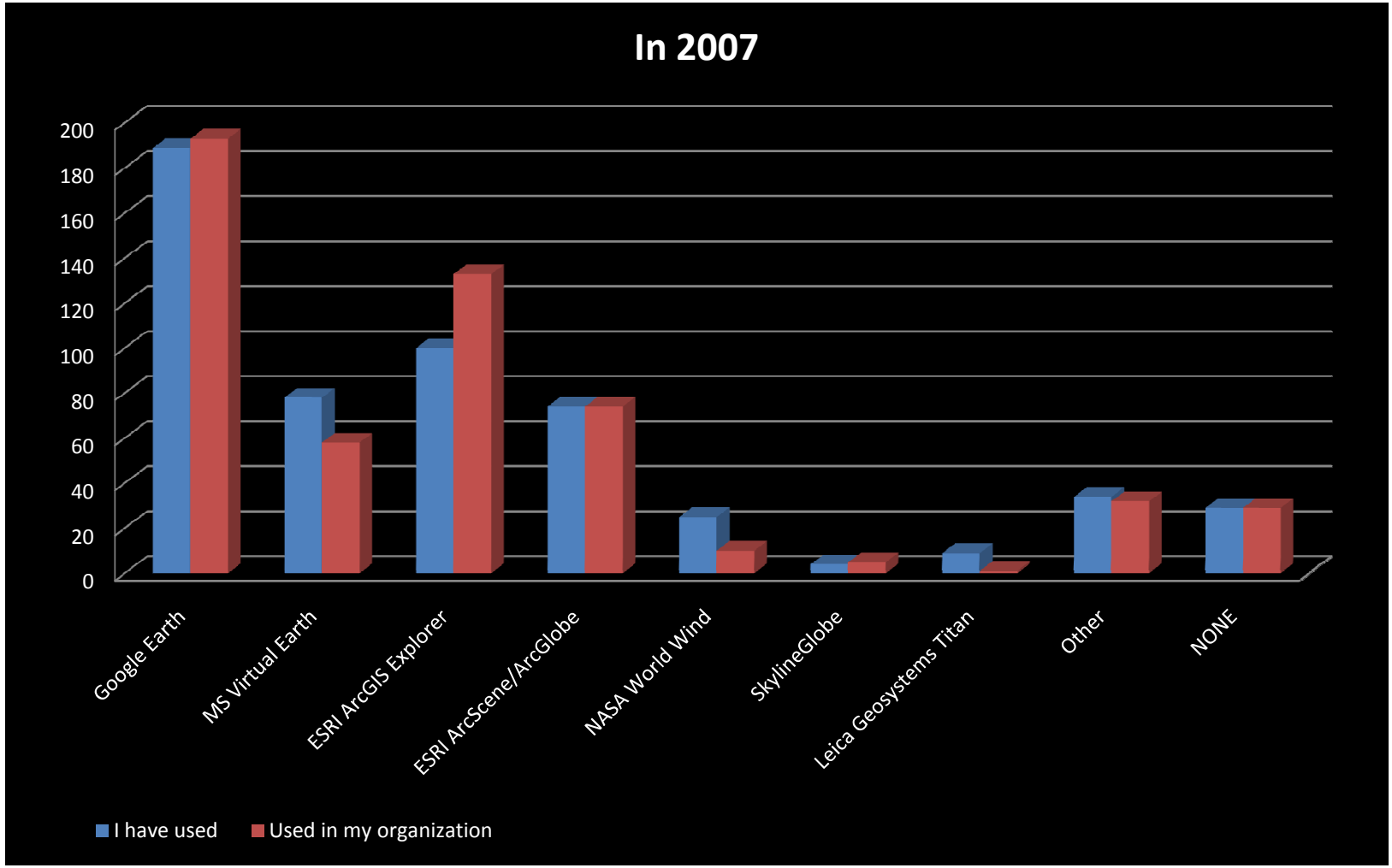
## **Profile of Respondents** (n=393, as of 1/10/08)



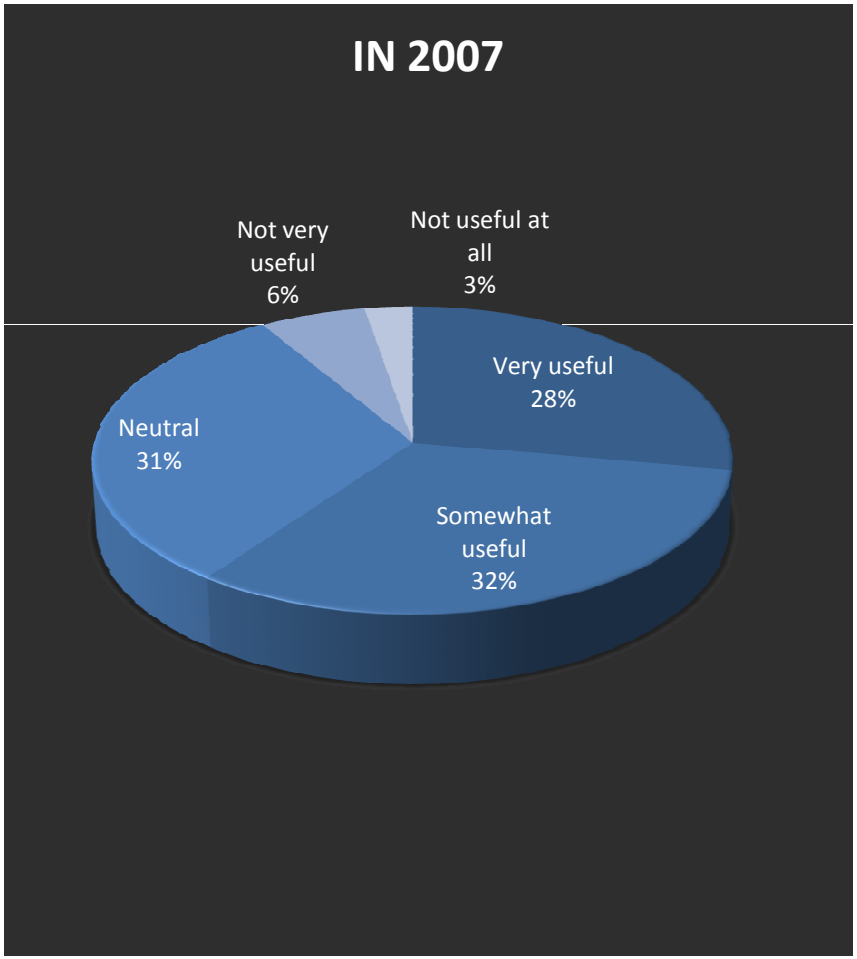
# Familiarity with 3 D Techniques

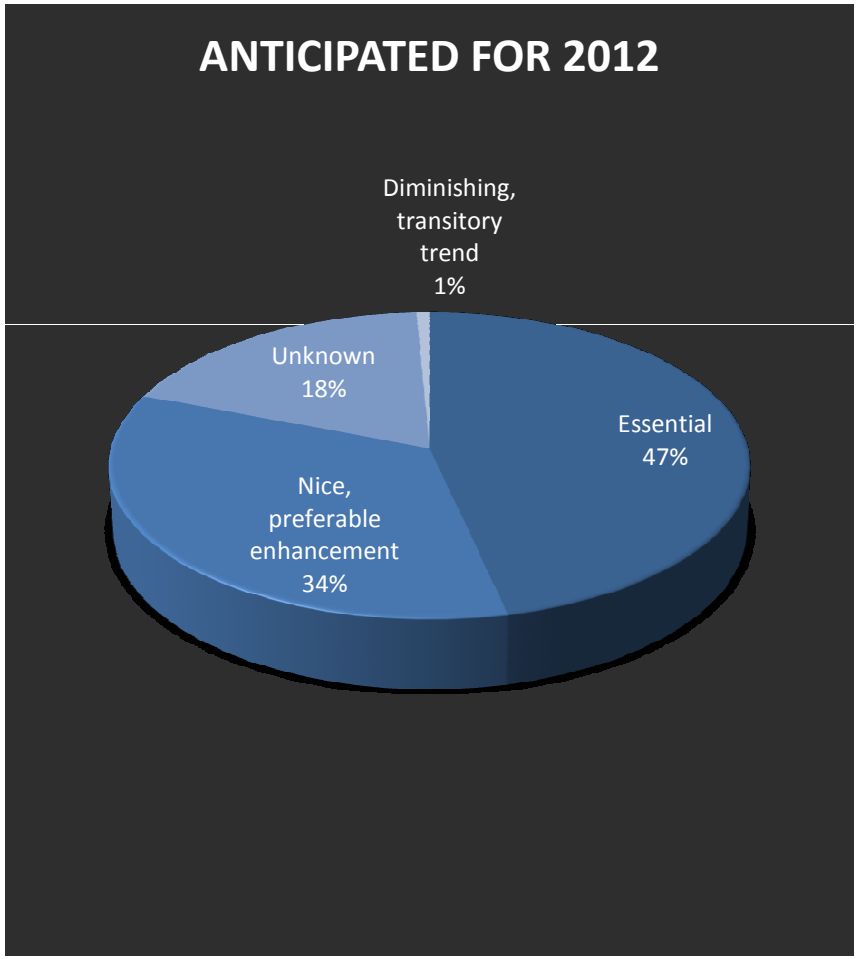


# 3D Interactive Visualization Tools



# Are 3D Tools Useful?



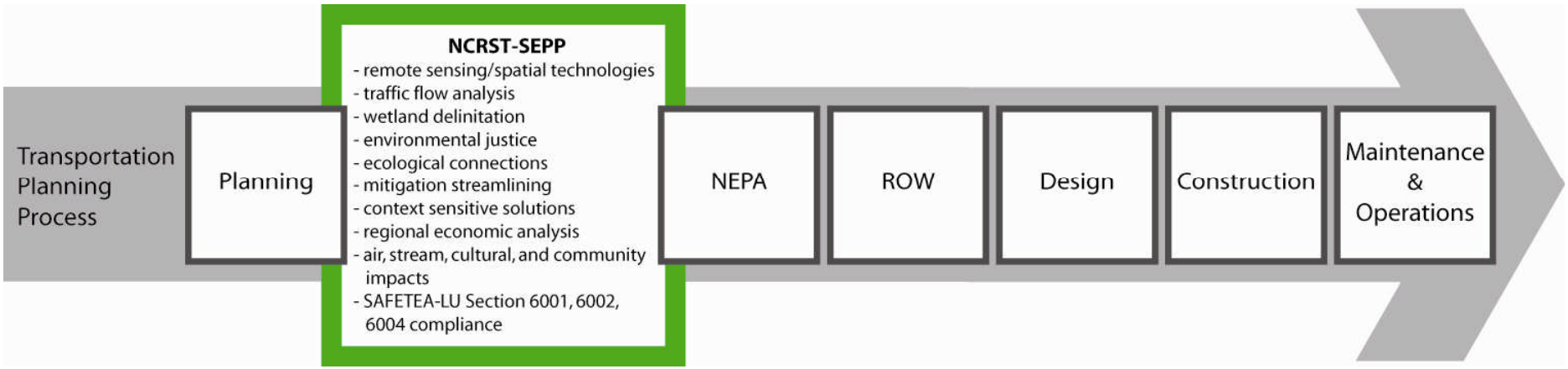



# Outline

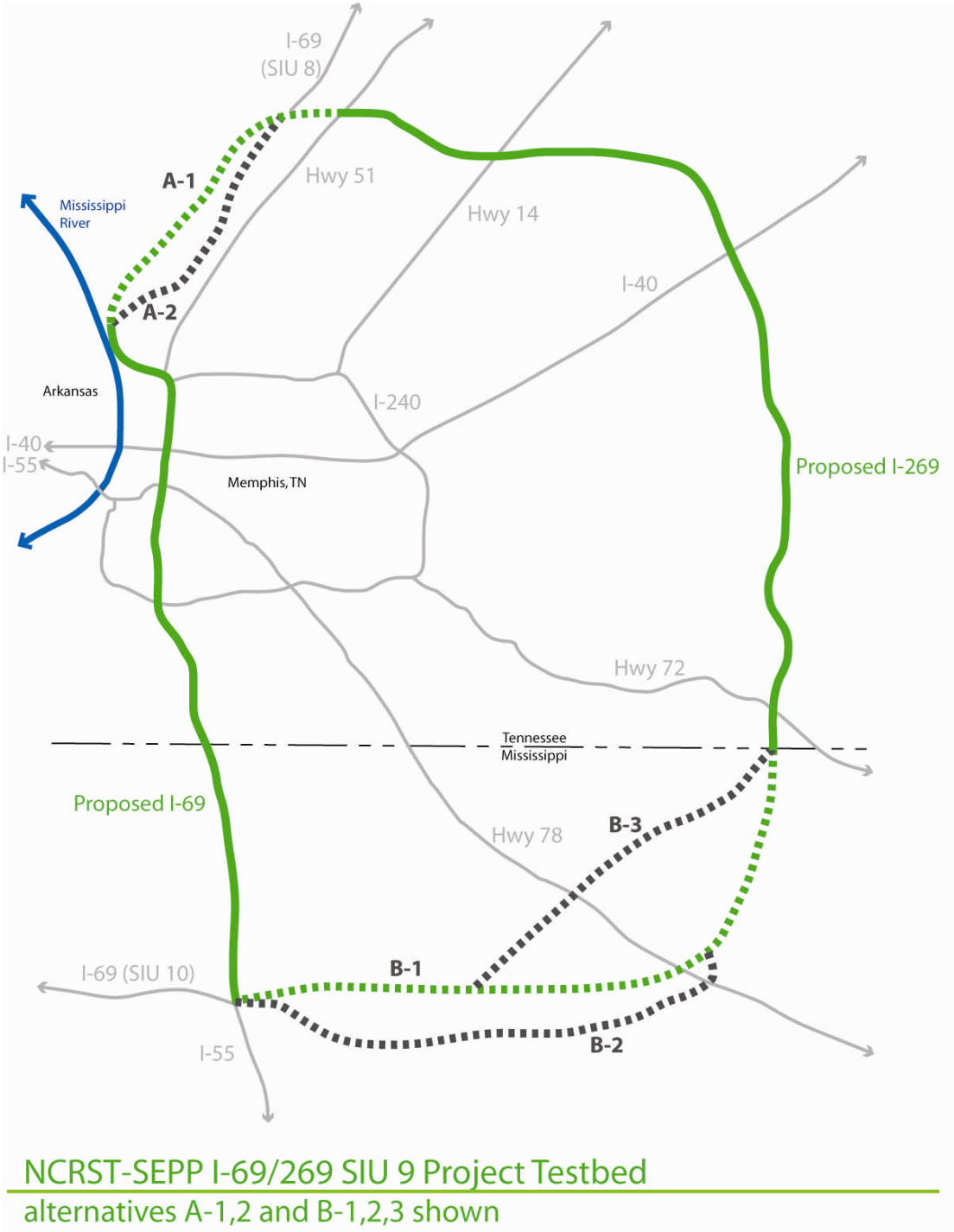
- Project Background
- Community Conflict
- Environmental Conflict

# Background Information

- I-69/I-269
- NAFTA Superhighway
- USDOT/RITA funded research
- Mississippi State University, Oak Ridge National Labs, Michigan Tech. Research Institute
- Streamlining of the EIS process with the use of spatial technologies and remote sensing technologies


Transportation Planning Process
Planning
NCRST-SEPP
- remote sensing/spatial technologies
- traffic flow analysis
- wetland delinitation
- environmental justice
- ecological connections
- mitigation streamlining
- context sensitive solutions
- regional economic analysis
- air, stream, cultural, and community impacts
- SAFETEA-LU Section 6001, 6002, 6004 compliance
NEPA
ROW
Design
Construction
Maintenance & Operations

Project Testbed



# Alternatives

- 5 were ultimately studied and evaluated in the Final EIS.
  - *A-1 (I-69) – 15.3 miles, 21 families and two businesses displaced, crosses 21 streams, fills 48 acres of wetlands, and converts 128 acres of farmland to ROW*
  - A-3 (1-69) – 15.3 miles, 60 families and 5 businesses displaced, crosses 20 streams, fills 53 acres of wetlands, and converts 95 acres of farmland to ROW
  - *B-1 (I-269) – 28.6 miles, 57 families and 6 businesses displaced, crosses 39 streams, fills 69 acres of wetlands, and converts 435 acres of farmland to ROW*
  - B-2 (I-269) – 30.6 miles, 100+ displaced families, crosses 46 streams, fills 51 acres of wetlands, and converts 497 acres of farmlands to ROW
  - B-3 (I-269) – 26.6 miles, 52+ displaced families, crosses 37 streams, fills 6 acres of wetlands, and converts 253 acres of farmlands to ROW
- A-1 and B-1 are the preferred alternatives

# National Environmental Policy Act (NEPA)

- Categorical exclusion
- Environmental assessment
  - Proposal need
  - Environmental impacts
  - Consulted agency and persons list
- Environmental Impact Statement
  - Discussion of purpose and need
  - Alternatives
  - Affected environment
  - Environmental consequences
  - List of preparers, agencies, organizations, and persons to who the statement is sent
  - Index
  - Appendix (if any)
- Integrated Planning
  - Intermodalism
  - Disaster management
  - Growth management
  - Comprehensive planning
  - Regional planning

# Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)

*" A Federal Agency may publish a notice in the Federal Register, pursuant to 23USC§139(1), indicating that one or more Federal agencies have taken final action on permits, licenses, or approvals for a transportation project. If such notice is published, claims seeking judicial review of those Federal agency actions will be barred unless such claims are filed within 180 days after the date of publication of the notice, or within a shorter time period as is specified in the Federal laws pursuant to which judicial review of the Federal agency action is allowed. If no notice is published, then the periods of time that otherwise are provided by the Federal laws governing such claims will apply."*

- Public participation and involvement is an integral part of any planning project.
- Research is showing the in-effectiveness of traditional "town hall" style meetings and innovative alternatives will be explored to more effectively integrate the public and local constituents into the planning process.
- Streamlining of EIS process
- Greater regional planning and intermodalism.

# Traditional Planning

- 56 house, 3 businesses, unavoidable fill of wetlands, etc. etc. etc.
- Improved traffic flow
- Reduced travel time
- Safety
- Economic development
- Environment concerns

# Enhanced Planning

- Context Sensitive Solutions (CSS) – Conflict Resolution
  - Wildlife
  - Greenway (existing and potential)
  - Historic and cultural corridors
  - Social corridors at urban nodes
  - Bike/Pedestrian corridors
  - Other transportation corridors
    - These all influence the economic, social, and environmental success of a corridor's development

"Context sensitive solutions (CSS) is a collaborative, interdisciplinary approach that involves all stakeholders to develop a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic and environmental resources, while maintaining safety and mobility. CSS is an approach that considers the total context within which a transportation improvement project will exist."

**Federal Highway Administration**

# CSS process and design

- Engage stakeholders and partners
- Purpose and need/problem definition and project visioning
- Alternative development, evaluation and selection
- Final design
- Review and approvals process
- Construction
- Maintenance and operations
- Evaluation: CSS performance measures

# CSS – regional, intergrated, resolves conflicts

- Housing
- Economy
- Children and Schools
- Environment
- Preservation and Revitalization
- Social Equity
- Open Space and Farmland
- Health and Aging

# Community Conflict

# Mississippi Highway 49

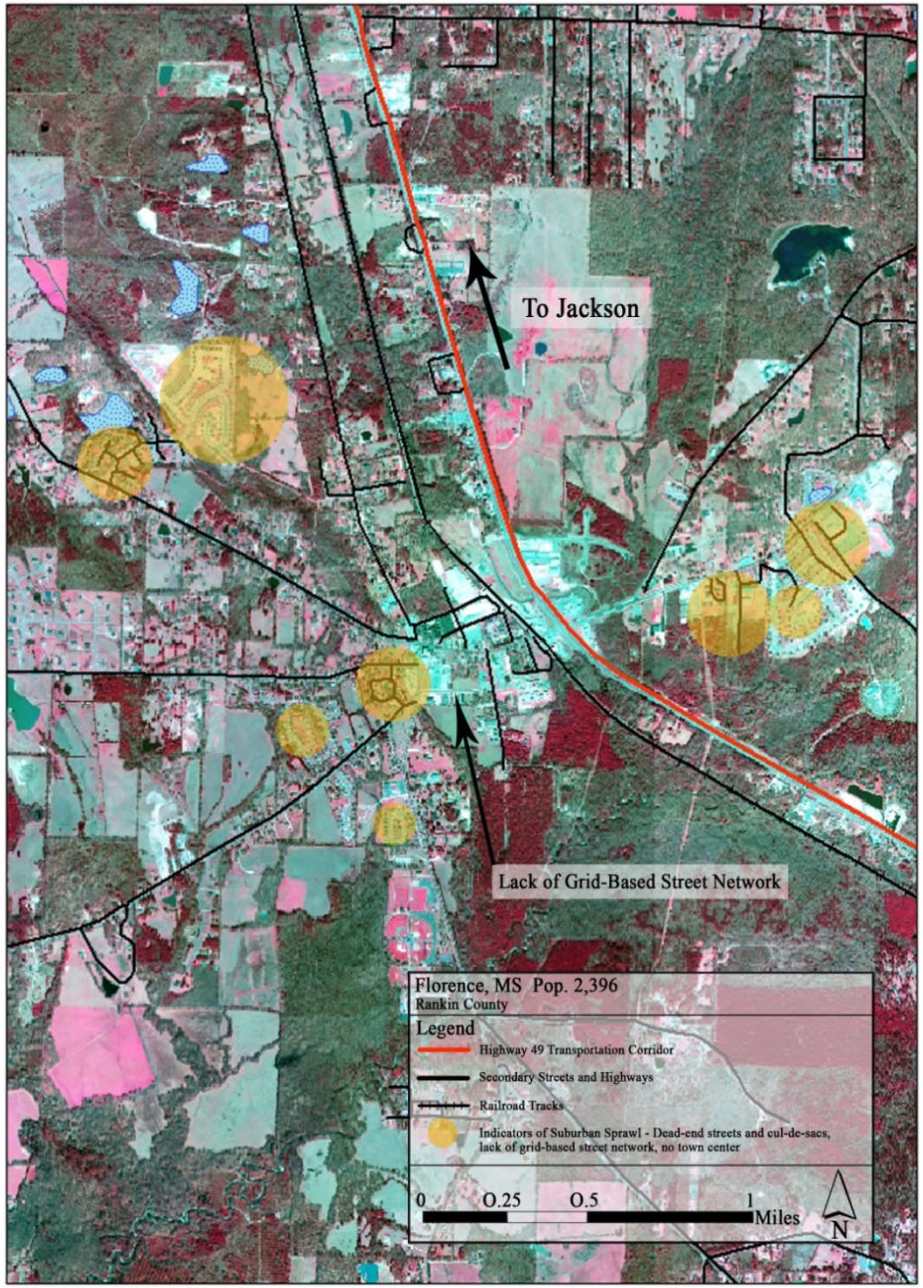
- Context Sensitive Solutions
- Smart Growth Study

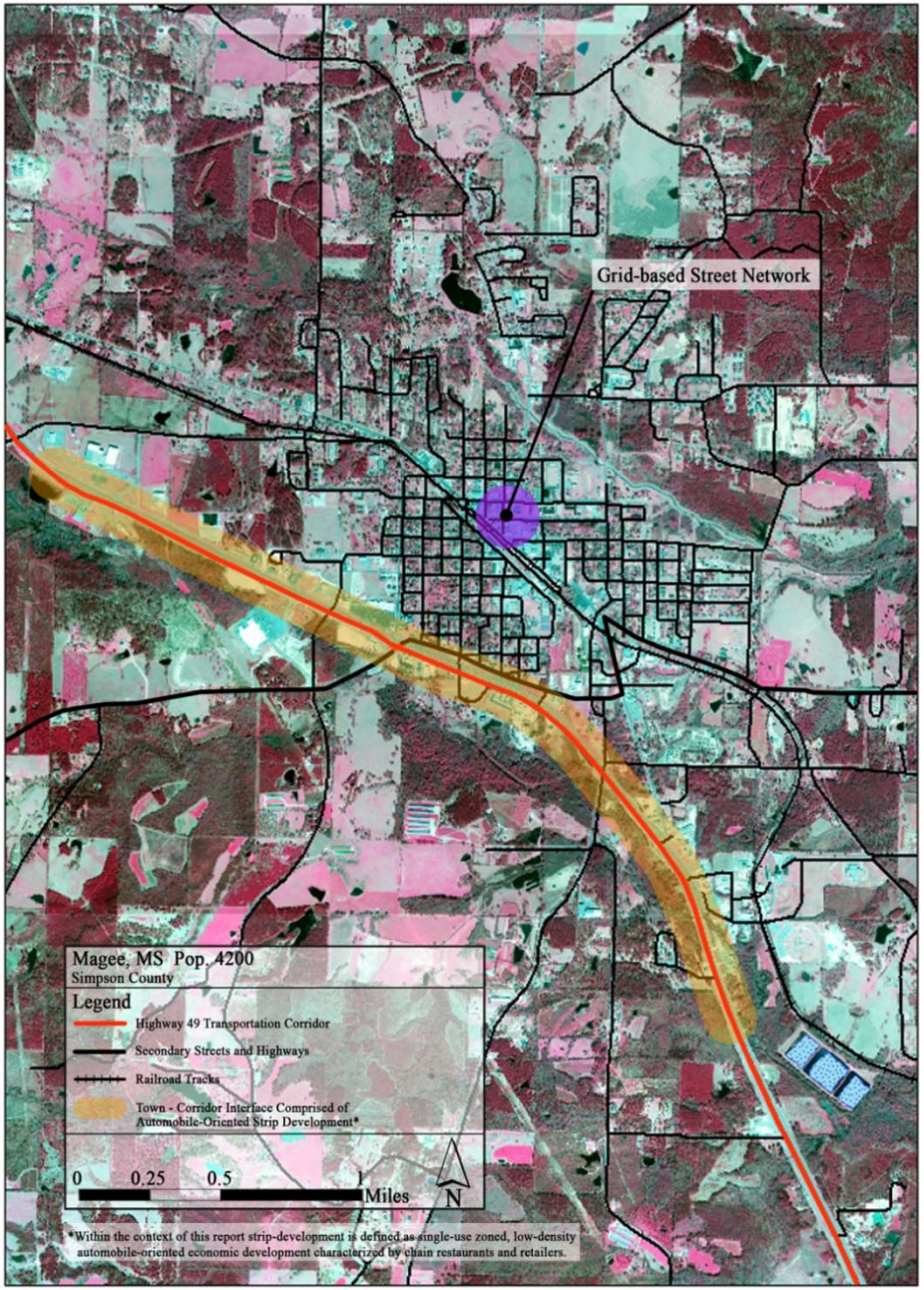
# CSS = Smart Growth

- From the 9 general principles, 8 specific principles directly related to the project area were developed
  - These principles help develop a selection matrix
    - Tool that selects model towns along the project corridor to examine the applicability of smart growth techniques to rural communities

1. Provide a variety of transportation choices
2. Direct development towards existing communities
3. Mix land uses
4. Take advantage of compact building design
5. Preserve open space, farmland, and critical environmental areas
6. Create a range of housing opportunities
7. Create walkable neighborhood
8. Create distinctive, attractive communities with a strong sense of place.

- Through evaluation and testing, we found that principles I-III, IV, VIII were the most relevant for transportation corridor planning.


To Jackson
Lack of Grid-Based Street Network
Florence, MS Pop. 2,396
Rankin County
Legend
Highway 49 Transportation Corridor
Secondary Streets and Highways
Railroad Tracks
Indicators of Suburban Sprawl - Dead-end streets and cul-de-sacs, lack of grid-based street network, no town center
0 0.25 0.5 1 Miles
N

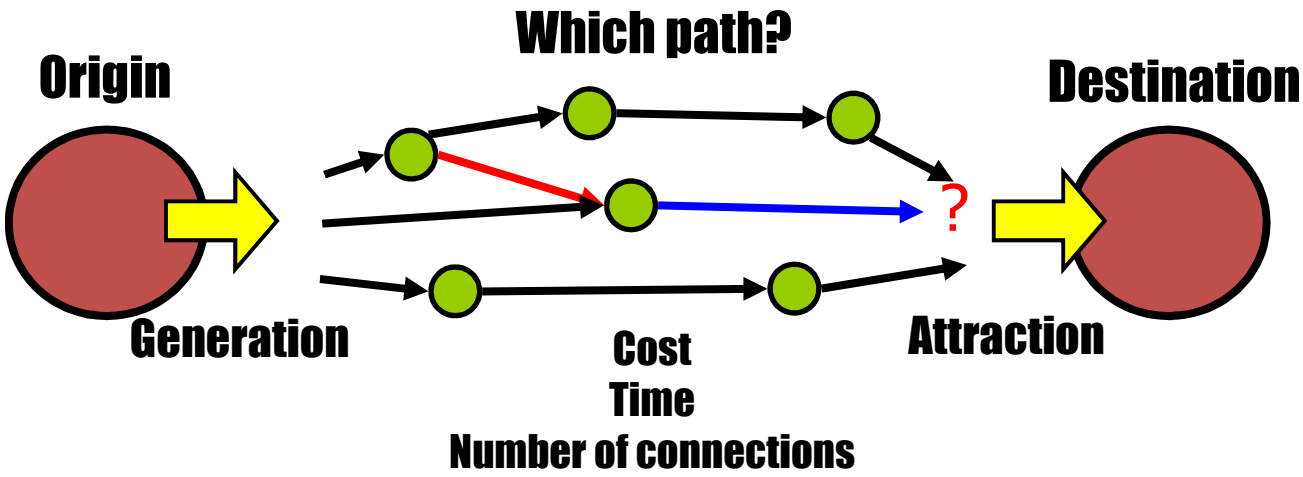

Grid-based Street Network
Magee, MS Pop. 4200
Simpson County
Legend
Highway 49 Transportation Corridor
Secondary Streets and Highways
Railroad Tracks
Town - Corridor Interface Comprised of Automobile-Oriented Strip Development*
0 0.25 0.5 1 Miles
N
*Within the context of this report strip-development is defined as single-use zoned, low-density automobile-oriented economic development characterized by chain restaurants and retailers.

# Mississippi Highway 49

| | Florence | D'Lo | Mendenhall | Magee |
|---|---|---|---|---|
| Population <5000 | X | X | X | X |
| By-Passed by Hwy 49 | X | X | X | X |
| Grid-Based Street Network | | X | X | X |
| Intersected by Railroad | X | X | X | X |
| Strip Development along Corridor | X | | | X |
| No Development along Corridor | | X | X | |
| Part of larger Metro sprawl pattern | X | | | |

# Environmental Conflict

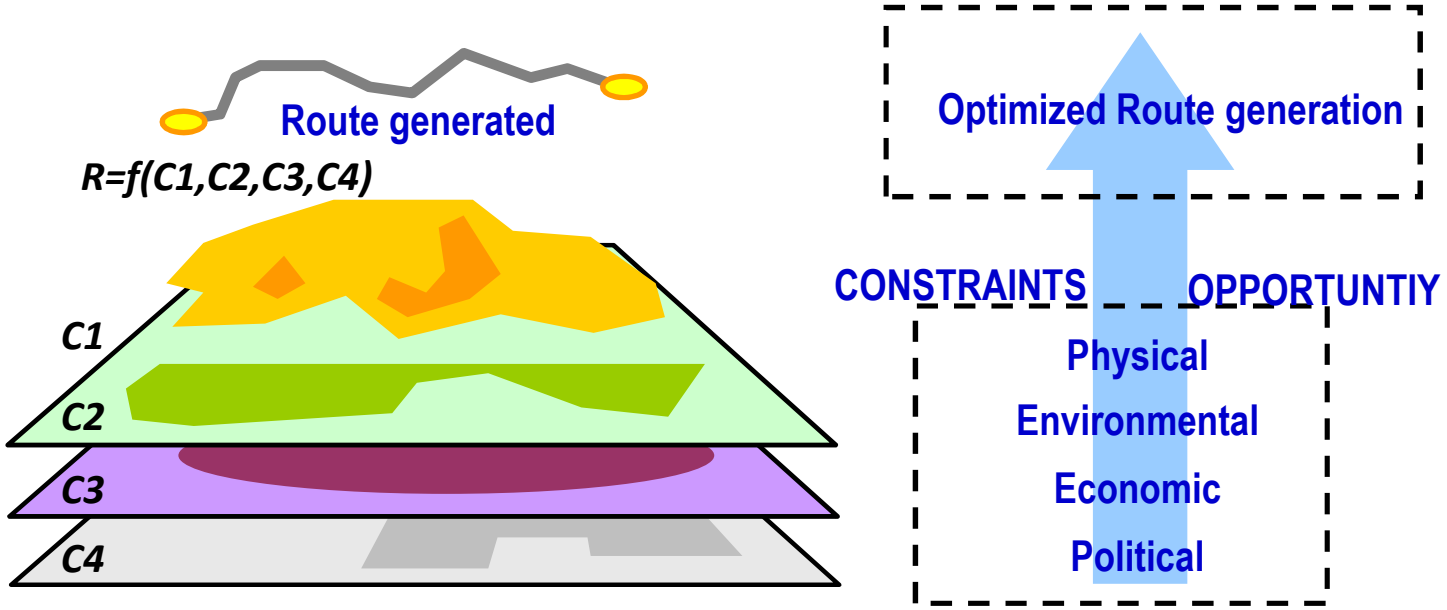
# Environmental Conflict



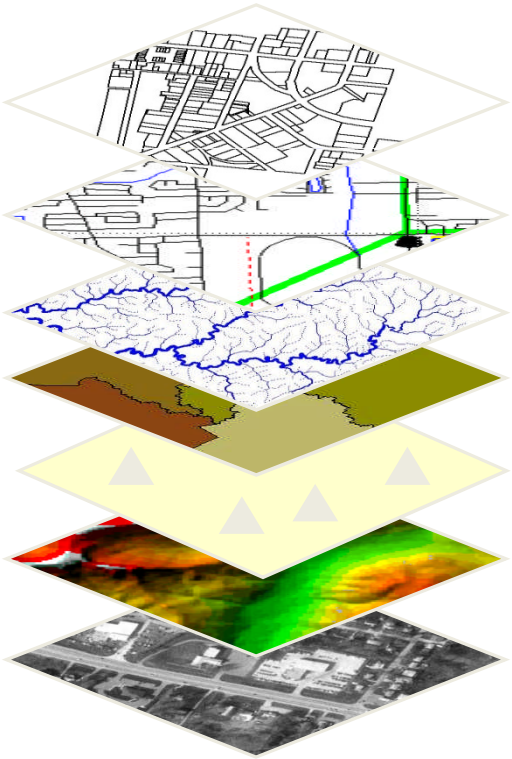
# Least Cost-Path Methods

- Generation of cost-of-passage surface grid where cells are given weights using multi-criteria decision analysis to calculate the least cost paths
- Creation of accumulated-cost-surface grid from a cost-of-passage where friction values are stored
- Weights represent the resistance, friction or difficulty in crossing the cell which is expressed as cost
- Generation of path of least cost from the accumulated-cost-surface

# Route Generation



# Data



Land Ownership

Transportation

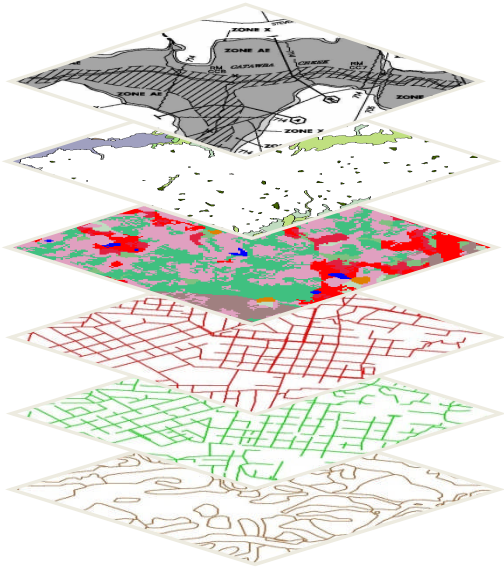
Surface Waters

Landuse

Cities or Towns

Elevation

Imagery



Flood Zones

Demographics

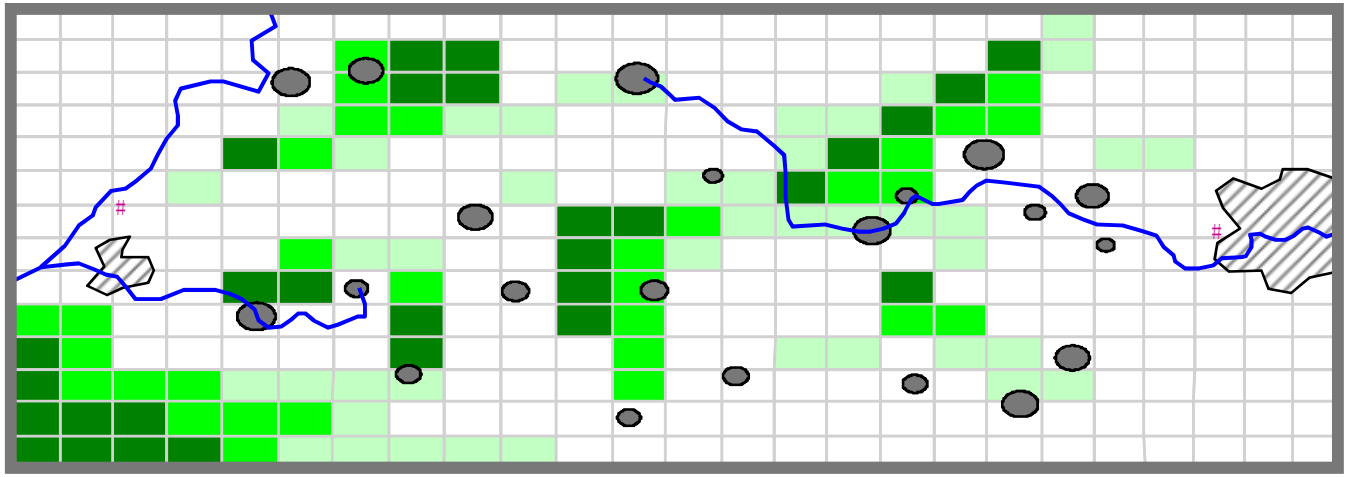
Power Grid

Water Lines

Sewer Lines

Gas Lines

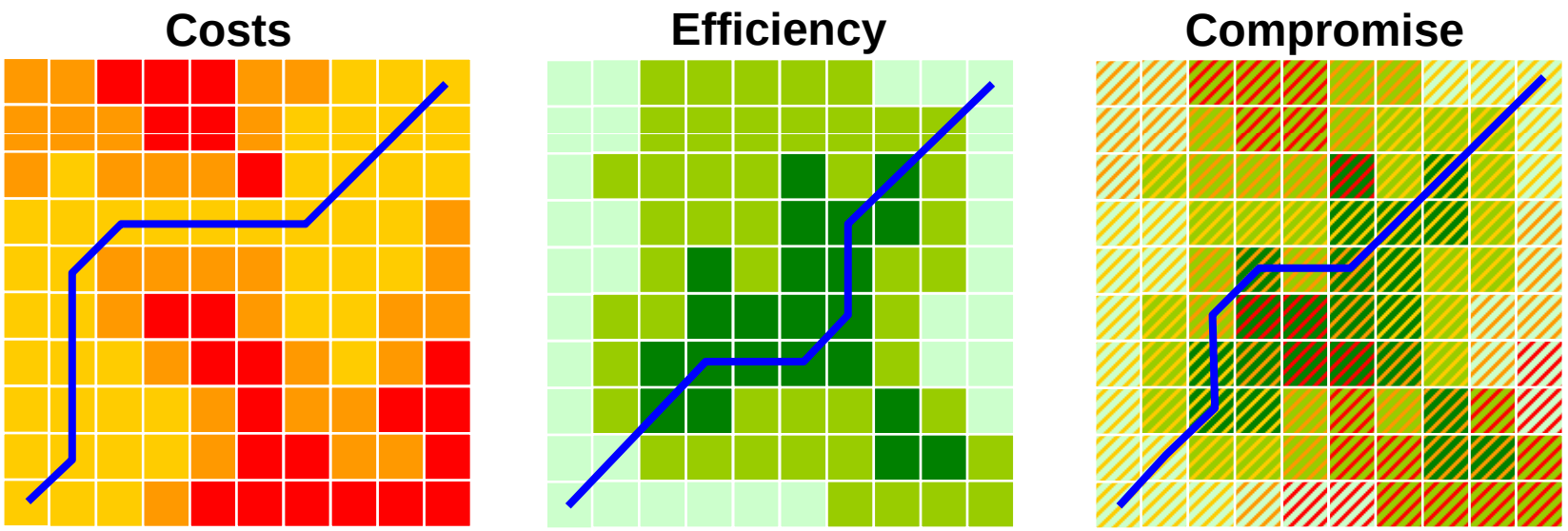
# Environmental Constraints



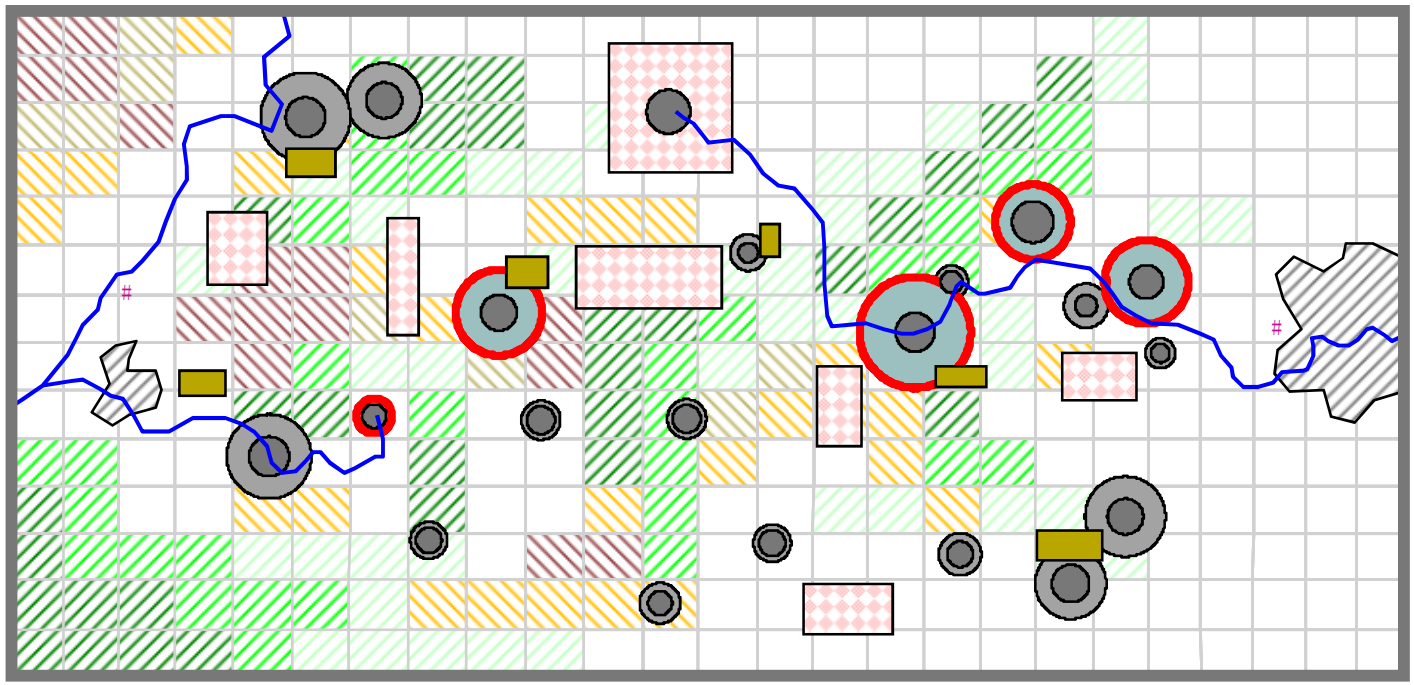
Low Cost Value - No Environmental damage (like rivers water bodies etc)

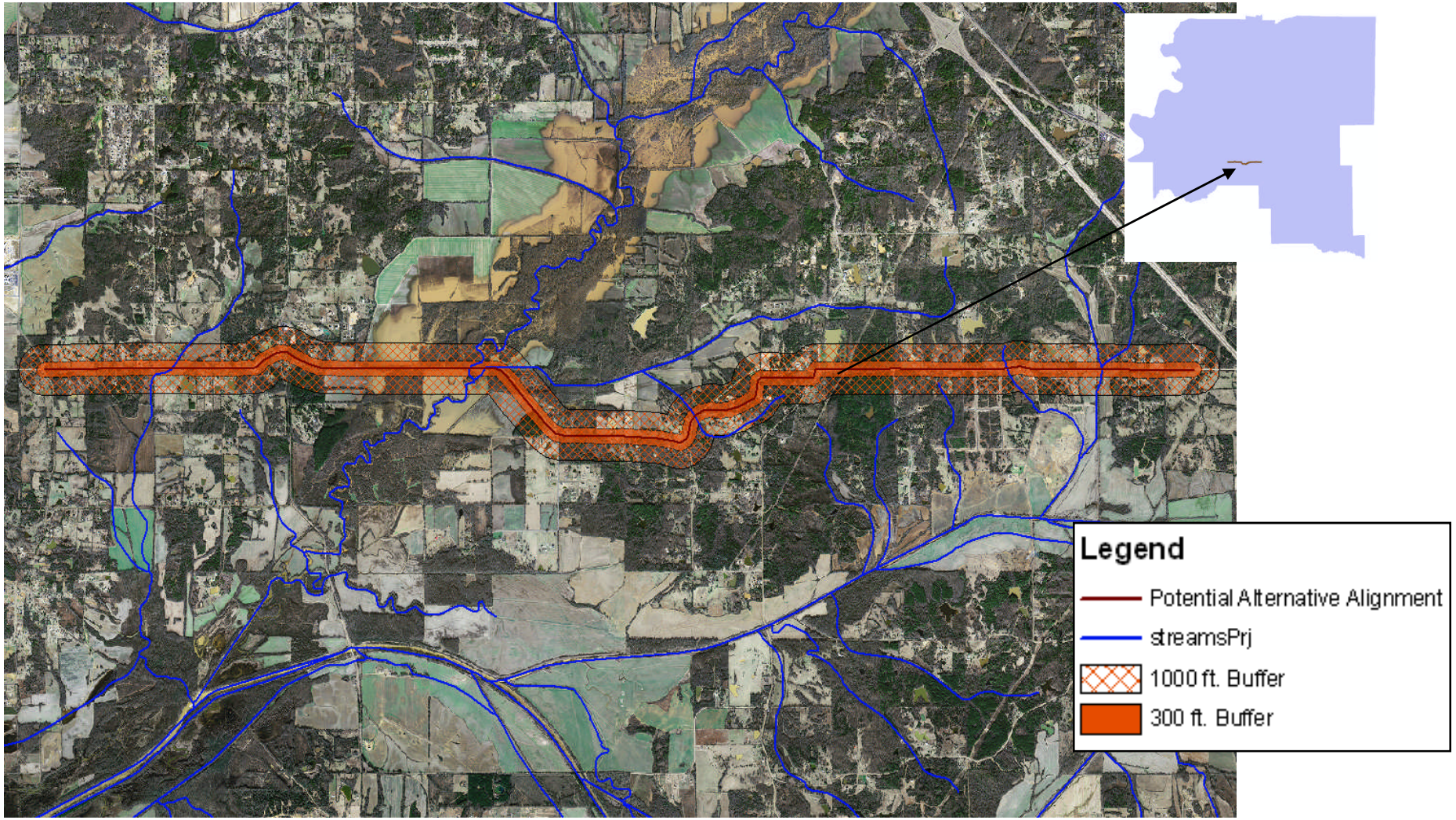
High Cost Value - Environmental damage

# Cost-Path Optimization

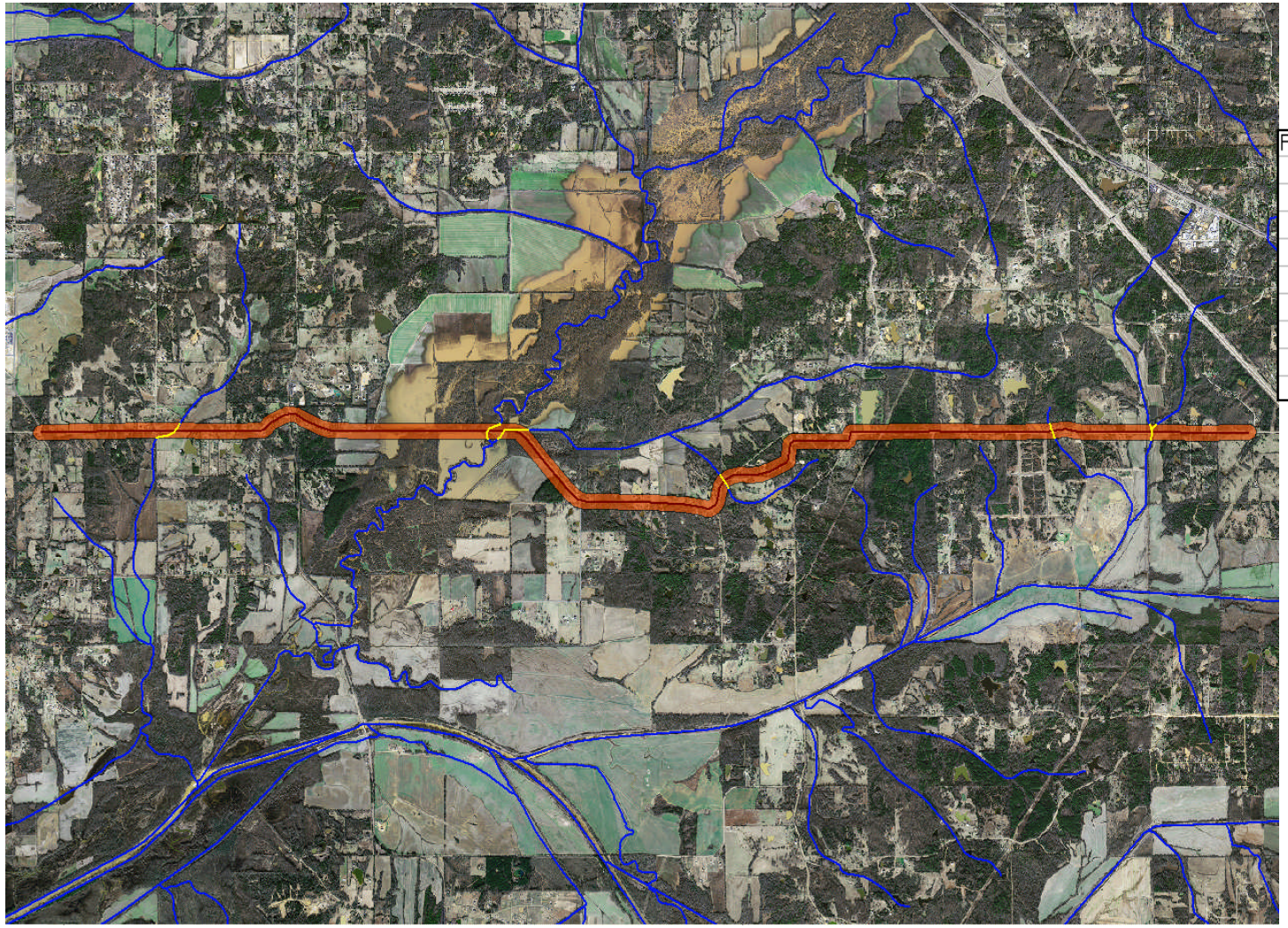


# Composite Map




Legend
Potential Alternative Alignment
streamsPrj
1000 ft. Buffer
300 ft. Buffer

# Streams Selected Within 300 Feet Buffer



**Summary Attribute Table**

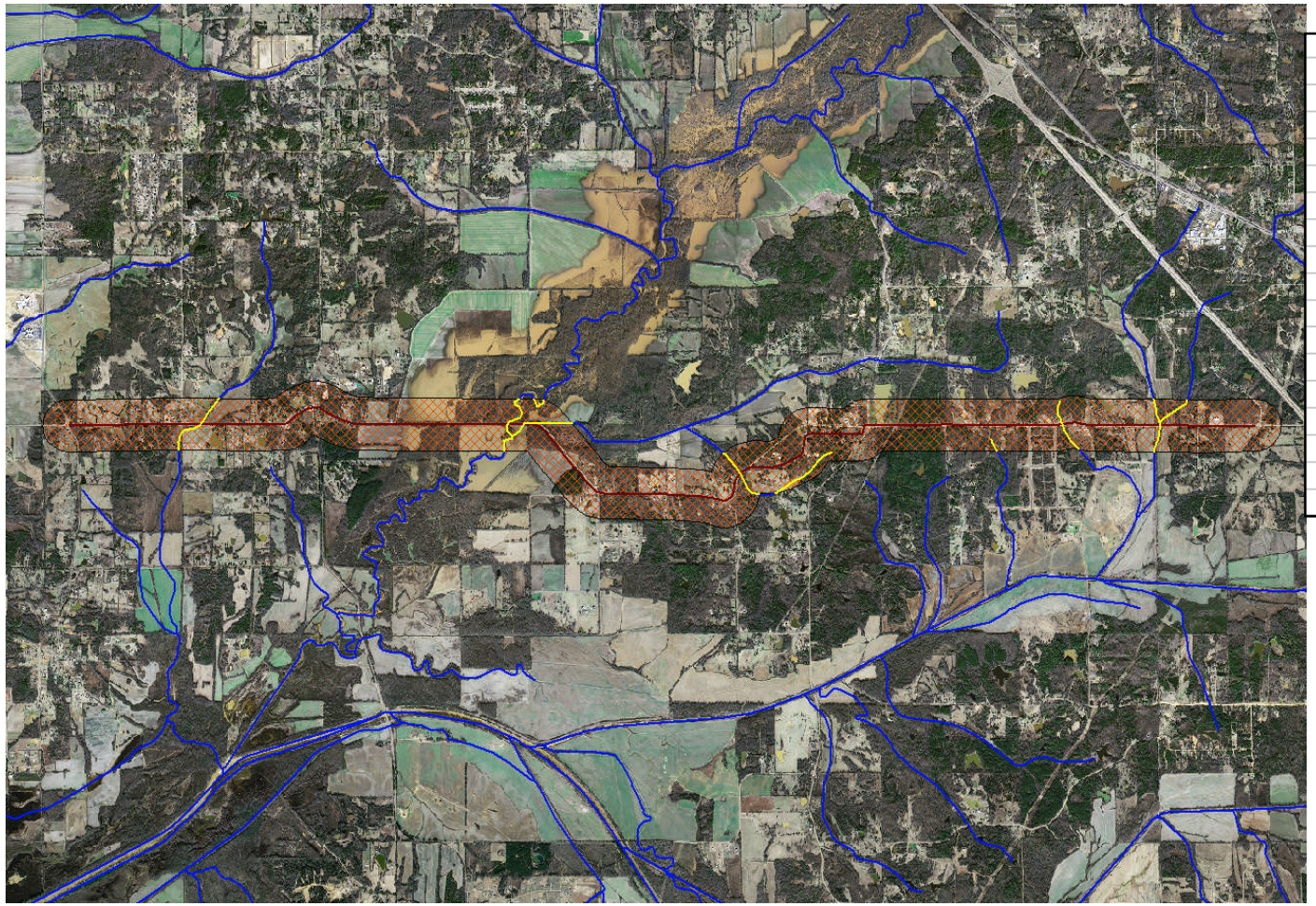
| FID | LENGTH | Name |
|---|---|---|
| 0 | 912.30000 | Coldwater River |
| 1 | 250.40000 | N/A |
| 2 | 187.00000 | N/A |
| 3 | 1126.00000 | N/A |
| 4 | 1342.00000 | N/A |
| 5 | 421.00000 | N/A |
| 6 | 646.60000 | N/A |
| 7 | 629.10000 | N/A |
| 8 | 912.00000 | Coldwater River |

Total Length: 6426.4 ft

**Legend**

- Potential Alternative Alignment
- streams
- 300 ft. Buffer

# Streams Selected Within 1000 Feet Buffer



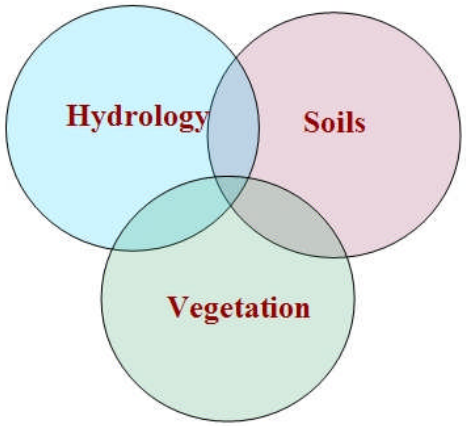
**Summary Attribute Table**

| FID | LENGTH | Name |
|---|---|---|
| 0 | 3588.70000 | Coldwater River |
| 1 | 831.30000 | Coldwater River |
| 2 | 516.70000 | N/A |
| 3 | 84.30000 | N/A |
| 4 | 1412.10000 | N/A |
| 5 | 317.50000 | N/A |
| 6 | 2406.00000 | N/A |
| 7 | 2483.00000 | N/A |
| 8 | 729.00000 | N/A |
| 9 | 301.70000 | N/A |
| 10 | 354.10000 | N/A |
| 11 | 2444.30000 | N/A |
| 12 | 125.90000 | N/A |
| 13 | 2121.10000 | N/A |
| 14 | 506.80000 | N/A |
| 15 | 3588.70000 | Coldwater River |
| 16 | 832.00000 | Coldwater River |

Total Length: 22643.2 ft

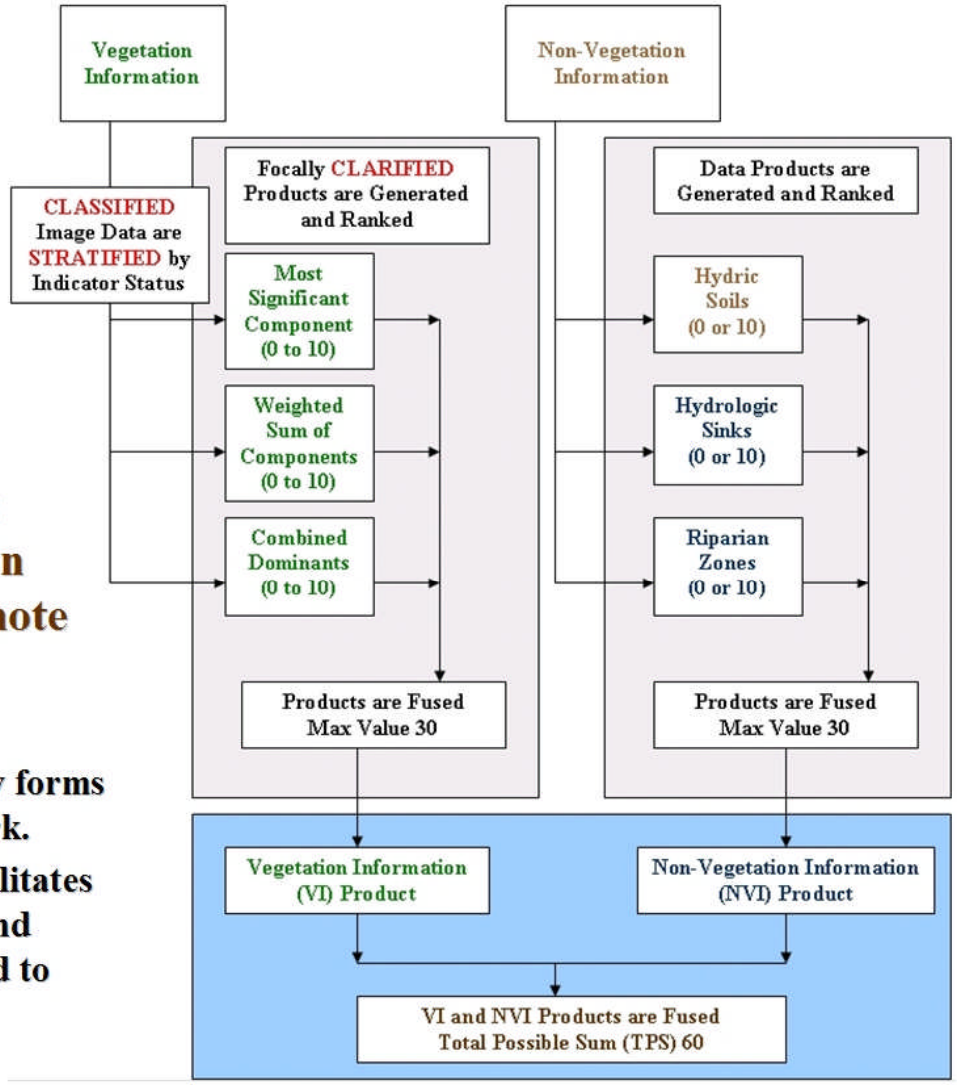
**Legend**

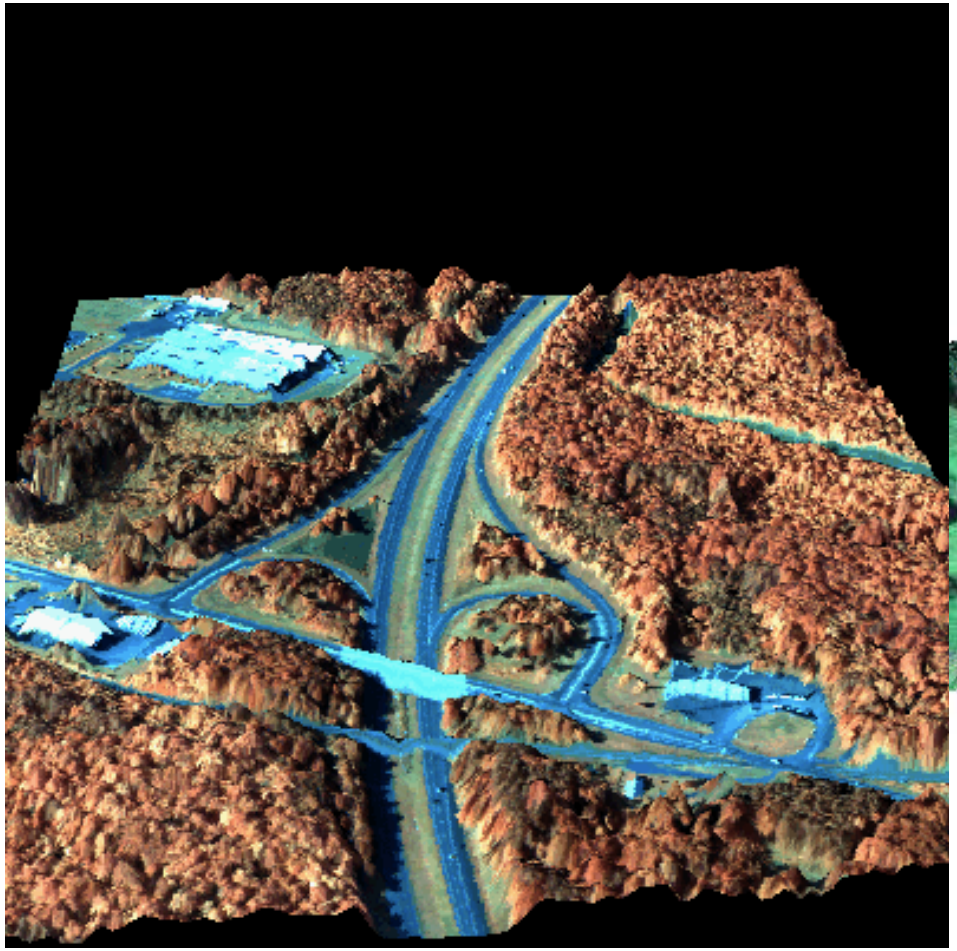
- Potential Alternative Alignment
- streams
- 1000 ft. Buffer



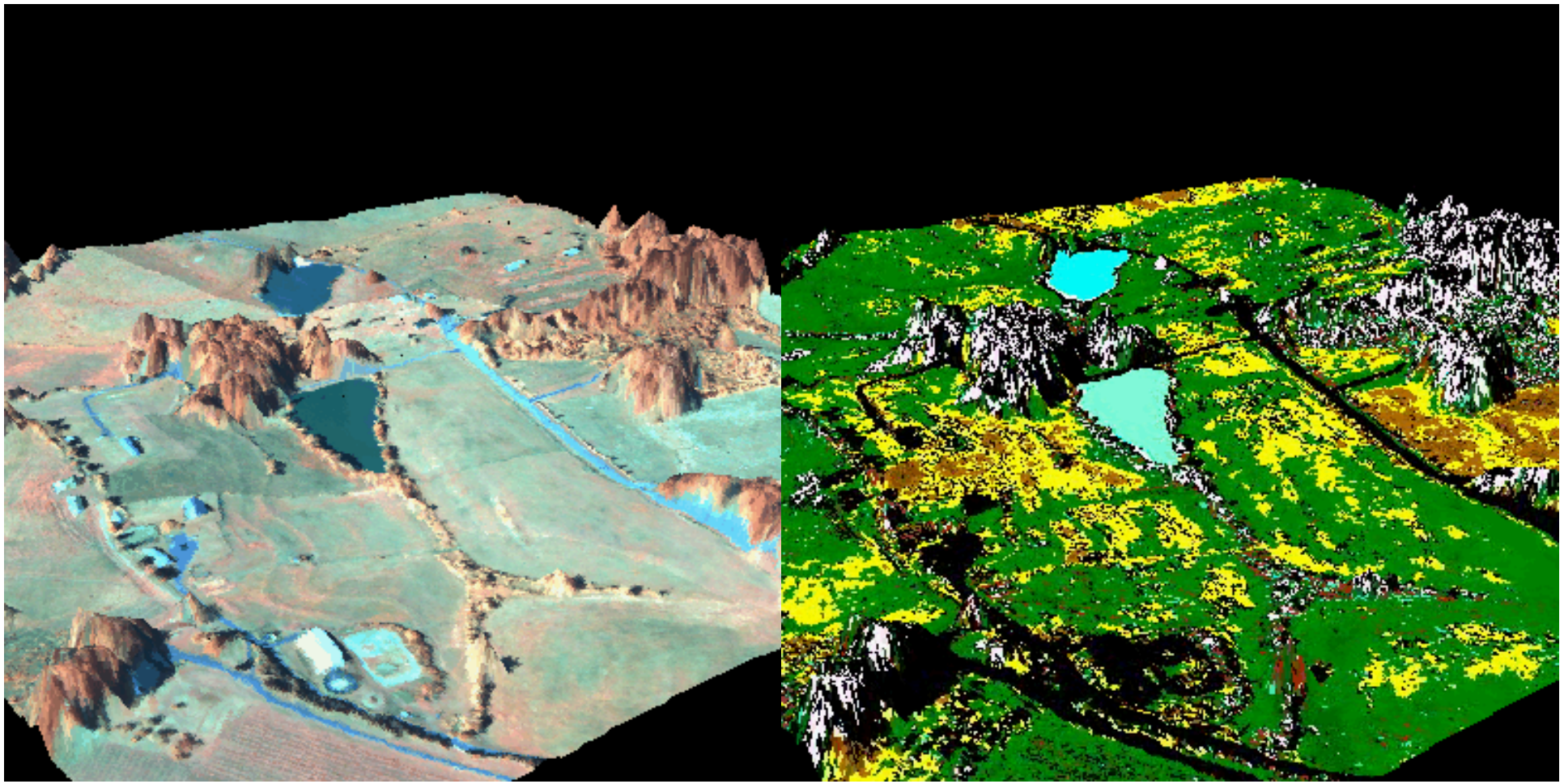

# New Data and Enhanced Analysis: Wetland Mapping Analysis Based on Surrogate Representations From Remote Sensing Data Processing

- **The assessment of vegetation, soils, and hydrology forms the basis of standard wetlands field assessment work.**
- **Determining how those assessments are made facilitates the development of surrogate processes using RS and geospatial technologies within algorithms developed to produce similar analytical map-based results.**





**Combining high-resolution image data with LIDAR digital surface models provided means of creating excellent views of areas of interest on the landscape!**



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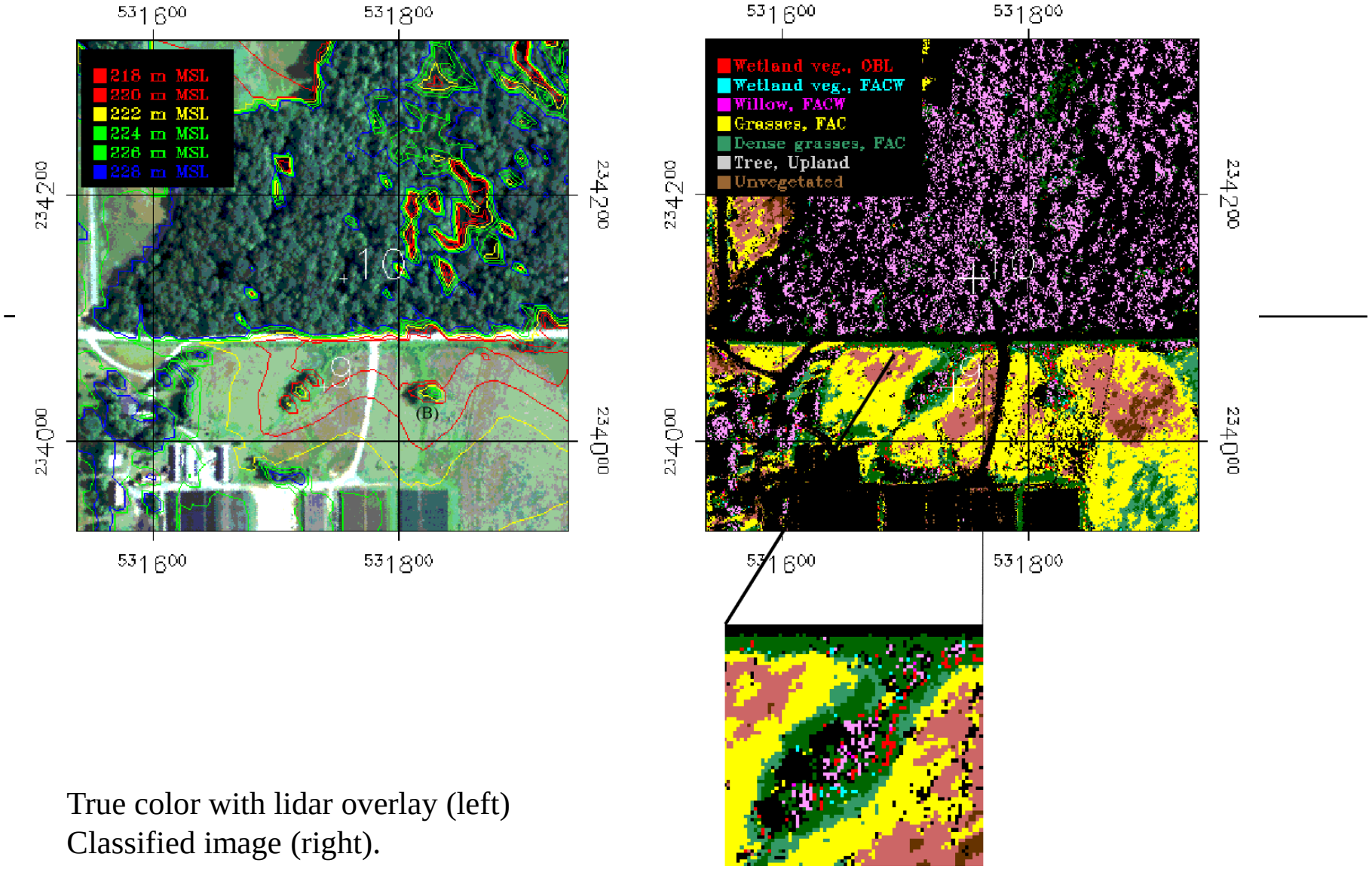


True color with lidar overlay (left)
Classified image (right).
Red = Obligate wetland

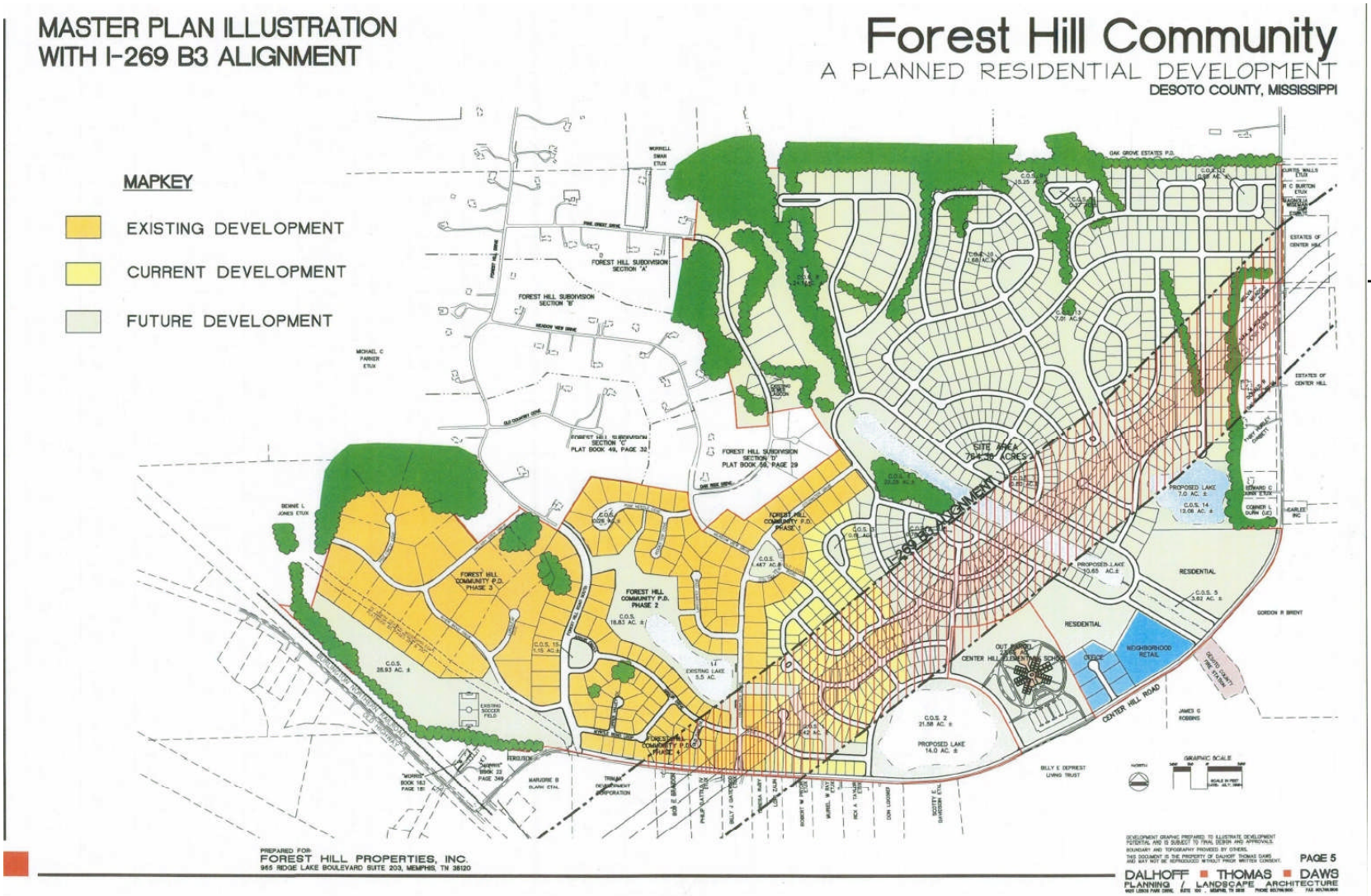
MASTER PLAN ILLUSTRATION
WITH I-269 B3 ALIGNMENT
Forest Hill Community
A PLANNED RESIDENTIAL DEVELOPMENT
DESOTO COUNTY, MISSISSIPPI
MAPKEY
EXISTING DEVELOPMENT
CURRENT DEVELOPMENT
FUTURE DEVELOPMENT
I-269 B3 ALIGNMENT
CENTER HILL ROAD
PROPOSED LAKE 14.0 AC. ±
PROPOSED LAKE 7.0 AC. ±
PROPOSED LAKE 10.65 AC.±
RESIDENTIAL
NEIGHBORHOOD RETAIL
OFFICE
CENTER HILL ELEMENTARY SCHOOL
FOREST HILL COMMUNITY P.D. PHASE 1
FOREST HILL COMMUNITY P.D. PHASE 2
FOREST HILL COMMUNITY P.D. PHASE 3
FOREST HILL SUBDIVISION SECTION 'A'
FOREST HILL SUBDIVISION SECTION 'B'
FOREST HILL SUBDIVISION SECTION 'C' PLAT BOOK 49, PAGE 32
FOREST HILL SUBDIVISION SECTION 'D' PLAT BOOK 56, PAGE 29
ESTATES OF CENTER HILL
OAK GROVE ESTATES P.D.
EXISTING SOCCER FIELD
EXISTING LAKE 5.5 AC.
GRAPHIC SCALE
PREPARED FOR:
FOREST HILL PROPERTIES, INC.
965 RIDGE LAKE BOULEVARD SUITE 203, MEMPHIS, TN 38120
PAGE 5
DALHOFF ■ THOMAS ■ DAWS
PLANNING / LANDSCAPE ARCHITECTURE

**TABLE I**

**SUMMARY OF ALTERNATIVES**

| Alternatives | A-1 | A-3 | B-1 | B-2 | B-3 | A-1/ B-1 | A-1/ B-2 | A-1/ B-3 | A-3/ B-1 | A-3/ B-2 | A-3/ B-3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Length (miles) | 15.2 | 15.3 | 28.6 | 30.6 | 26.6 | 43.8 | 45.8 | 41.8 | 43.9 | 45.9 | 41.9 |
| New Right-of-Way (acres) | 739 | 798 | 1479 | 1552 | 1406 | 2218 | 2291 | 2145 | 2277 | 2350 | 2204 |
| Family Displacements | 21 | 60 | 64 | 53 | 52* | 85 | 74 | 73* | 117 | 113 | 112* |
| Business Displacements | 2 | 5 | 6 | 6 | 1 | 8 | 8 | 3 | 11 | 11 | 6 |
| Non-Profit Displacements | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Farmland (acres) | 128 | 95 | 435 | 497 | 253 | 563 | 625 | 381 | 530 | 592 | 348 |
| Stream Crossings | 21 | 20 | 39 | 46 | 37 | 60 | 67 | 58 | 59 | 66 | 57 |
| Potential Linear Feet of Stream Impacts (feet) | 9,590 | 8,620 | 15,780 | 20,980 | 13,850 | 25,370 | 30,570 | 23,440 | 24,400 | 29,600 | 22,470 |
| Wetlands (acres) | 48 | 53 | 69 | 51 | 6 | 117 | 99 | 54 | 122 | 104 | 59 |
| Historic Properties Impacted | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Recorded Archaeological Sites | 11 | 9 | 20 | 22 | 15 | 31 | 33 | 26 | 29 | 31 | 24 |
| Hazardous Waste Sites | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| Landfill Sites | 3 | 4 | 0 | 0 | 0 | 3 | 3 | 3 | 4 | 4 | 4 |
| Impacted Noise Receptors | 3 | 29 | 70 | 68 | 43† | 73 | 71 | 46† | 99 | 97 | 72† |
| Construction Cost ($ million) | 233.4 | 264.9 | 416.5 | 462.0 | 368.8 | 649.9 | 695.4 | 602.2 | 681.4 | 726.9 | 633.7 |
| Right-of-Way Cost ($ million) | 38.4 | 43.6 | 68.6 | 76.1 | 60.7 | 107.0 | 114.5 | 99.2 | 112.2 | 119.7 | 104.4 |
| Utility Cost ($ million) | 2.8 | 3.1 | 4.9 | 5.4 | 4.3 | 7.7 | 8.2 | 7.1 | 8.0 | 8.6 | 7.5 |
| Total Cost ($ million) | 274.6 | 311.6 | 490.0 | 543.5 | 433.8 | 764.6 | 818.1 | 708.5 | 801.6 | 855.2 | 745.6 |

Impacts are based on a 300-foot wide corridor.
Cost data has been updated since the Draft EIS to reflect the most recent cost estimates.
* Because of the recent residential development along this alignment, B-3 has the potential to displace several hundred new homes in the Forest Hill Community subdivision.
† Does not include future noise impacted residences in the Forest Hill Community subdivision that is currently under construction.

# Summary

- How are environment conflicts avoided?
- Integrated planning
- Effective alternatives for public and resource agency involvement and engagement
- Design a process that moves from “56 house, 3 businesses, 45 acres of unavoidable acres of wetlands….. to more qualitative as well as quantitative context sensitive solutions.