GIS Tools and Techniques for Environmental Assessment of Pipeline Construction

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Environmental Assessment

- Pipeline construction or replacement
  ESIA/FERC projects

- GIS & GPS tools & techniques
  - Environmental field surveys
  - Data integration
  - Impacts analysis
  - Mapping
Data Collection

- Garbage in, Garbage out
- Know the Coordinate System for the project!
  - UTM? Stateplane?
  - Meters? Feet (International or U.S. feet?)
- Best available data / most practical data
GPS Field Data Collection

- Establish a protocol
- Sub-meter horizontal positioning
GPS Field Data Collection

- Establish a protocol
- Sub-meter horizontal positioning
- Standardized data dictionary
  - Must be identical for multiple crews
GPS Field Data Collection

- All features require a unique identifier
  8-12 character FEATURE_ID FNNCCXXX
  
  ● F = Feature Type
  ● NN = Team Number
  ● CC = County code
  ● XXX = Feature number (001-999 for each county)

Example: the FEATURE_ID for team #2B’s thirteenth wetland for Scotland County would be W2BSC013
<table>
<thead>
<tr>
<th>Flag Series</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Enter/Ingress</td>
</tr>
<tr>
<td>200</td>
<td>Exit/Egress</td>
</tr>
<tr>
<td>300</td>
<td>Side</td>
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<tr>
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<td>Inclusion</td>
</tr>
<tr>
<td>500</td>
<td>Transition</td>
</tr>
<tr>
<td>600</td>
<td>Single line where width&lt;10’ (i.e., ditch/stream)</td>
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<tr>
<td>700</td>
<td>Ancillary Facility (i.e., Access Roads, Pipeyard, Pump House, etc.)</td>
</tr>
</tbody>
</table>

Ancillary Facility (i.e., Access Roads, Pipeyard, Pump House, etc.)
GPS Field Data Review & Editing

- Data review & correction each day
- Biologist must review and approve all points, lines, and attributes
- Differential correction
- Editing
Post Processing

- Check data in Trimble Pathfinder Office
- Export to shape files
  - Check settings & coordinate system
  - Use the same settings every time
- Maintain a list of all GPS rover files received from the field crews
- Print maps of all raw data for team review
Post Processing

- Merge data sets
- Deliver data to project engineers

Conversion Tools
- From Raster
  - Add CAD Fields
  - Create CAD XData
- To CAD
  - Export to CAD
  - Set CAD Alias

Export to CAD

- Input Features
- Output Type
  - DXF_R2000
  - DGN_V8
  - DWG_R14
  - DWG_R2004
  - DXF_R14
  - DXF_R2000
  - DWG_R2004

- Append to Existing Files (optional)
- Seed File (optional)

Watershed Concepts
Prepare Engineering Data

Data required from project engineers:

- Centerline & mileposts
- Construction Right-of-way (ROW)
  - Permanent Workspace
  - Temporary Workspace
  - Additional Temporary Workspace (ATWS)
- Above Ground Facilities
  - Pipe yards, contractor yards, warehouses, meter stations, compressor stations
- Access Roads
- Aerial Photography
Load Engineering Data into ArcMap
Create a route from centerline
Prepare Engineering Data

- Construction ROW / Facility Boundaries

- Construction Workspace
  - Permanent
  - Temporary
  - ATWS
  - Facility
Impacts Analysis

- T&E (Threatened & Endangered) Species
- Water Crossings
- Wetlands
- Land Use
- Soils
- Geology
- Cultural Resources
- Protected/Conservation lands
Linear Referencing Tools
Problem:
- Determine milepost, distance and direction for all species locations along the pipeline.

Solution:
- Linear referencing tools in ArcMap
T&E Species Analysis

Route Events GeoProcessing Wizard

Choose a route event processing operation, then click the Next button to choose options.

- Intersect two route event layers
- Union two route event layers
- Dissolve/Concatenate route events
- Transform events from one route reference to another
- Locate point features along routes
- Locate polygon features along routes

About locating points along routes

This operation derives point events from point features by locating the point features along a route reference.

Input

Output

More About Locating Points
## T&E Species Analysis

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<th>C</th>
<th>D</th>
<th>E</th>
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Wetlands Analysis

Problem:
Calculate acres of wetlands impacted by proposed pipeline construction corridor within each county
Wetlands Analysis

- **Process Steps:**
  Conduct “Intersect” of Wetlands, Construction Workspace, and County layer
Wetlands Analysis

- **Process Steps**: Database file (DBF) of wetland polygons within corridor
## Wetlands Analysis

**Solution:** Load DBF file into Excel and create pivot table report

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<td>1.67</td>
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</tbody>
</table>
Soils Analysis

Problem: Report soil characteristics by milepost for entire pipeline route

- Mapping Unit
- Soil Series and Percent Component
- Drainage Class
- Surface Texture
- Range of Slopes
- Soil Erodibility Factor
- High Compaction Potential
- Hydric Soils
- Highly Erodible Soil
- Low Revegetation Potential
- Prime Farmland Soils
Soils Analysis

Solution: Microsoft Access & Model Builder
Mapping

Problem: Create maps along a 700 mile Pipeline Route on Aerial background.
Solution: Map Book Script
Mapping
Additional GIS work

- Initial route selection / desktop analysis
- Alternatives analysis
- Co-location statistics
- Land use
- Population & social impacts analysis
- Water resource studies & risk analysis
- Cultural resources
- Post construction monitoring
- Public outreach efforts
Questions?

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