

# Geospatial & Applied Technologies

Leveraging Enterprise GIS to improve NEPA environmental documents & Preliminary Engineering processes

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# Agenda



- Why do these processes need to work together
  - Concept of Needs
  - Problem Statement
- High-level functional requirements
- High-level benefits from approach
- System Architecture
- Data that is integrated together
- Processes & methods overview
- Samples

# Concept of Needs



- Allowing engineers & planners to work together
- Single common view of the data
- Single data version and archive history
- Support geographically disperse teams
- Scalable methods for infrastructure projects from \$200k to \$1B
- Achieve operational and performance efficiencies
- Web-based solution
- Utilize enterprise GIS as foundation

# Why should these processes work together?



- NEPA/Environmental Document Phases
  - Conceptual alternatives are prepared
  - Alternatives avoid, minimize and mitigate impacts
  - Analysis that is consistent, transparent and demonstrable
  - Record of Decision (ROD) to proceed based on data presented
- PE/Design phases
  - CAD and GIS data and processes did not meet or align
    - Alternatives refinement and revisions out of phase to document
    - Design often disconnected from impacts and environmental analysis
    - Design detail data forces new alignments
    - Design often impacting other features without knowledge previously
  - Design, build, bid vs. design, build
    - Difficult and expensive to track design changes against ROD/commitments
    - Knowing and proving what has changed and why – “transparency”

# High-level functional requirements



- Web-based GIS
- Central and common data management tools
- Central and common geodatabase & schema
- Self-service map production & datasets
- Self-service field data extract, update and import
- Template based map production/automation
- Manage as single repository for documentation, field data (environmental), design data (CAD), assets & attributes across project lifecycle
- Integrate DEIS & FEIS comments and responses (spatially, temporally and by topic)
- Integrate photos, reports and tech docs geospatially

# The benefits of the approach



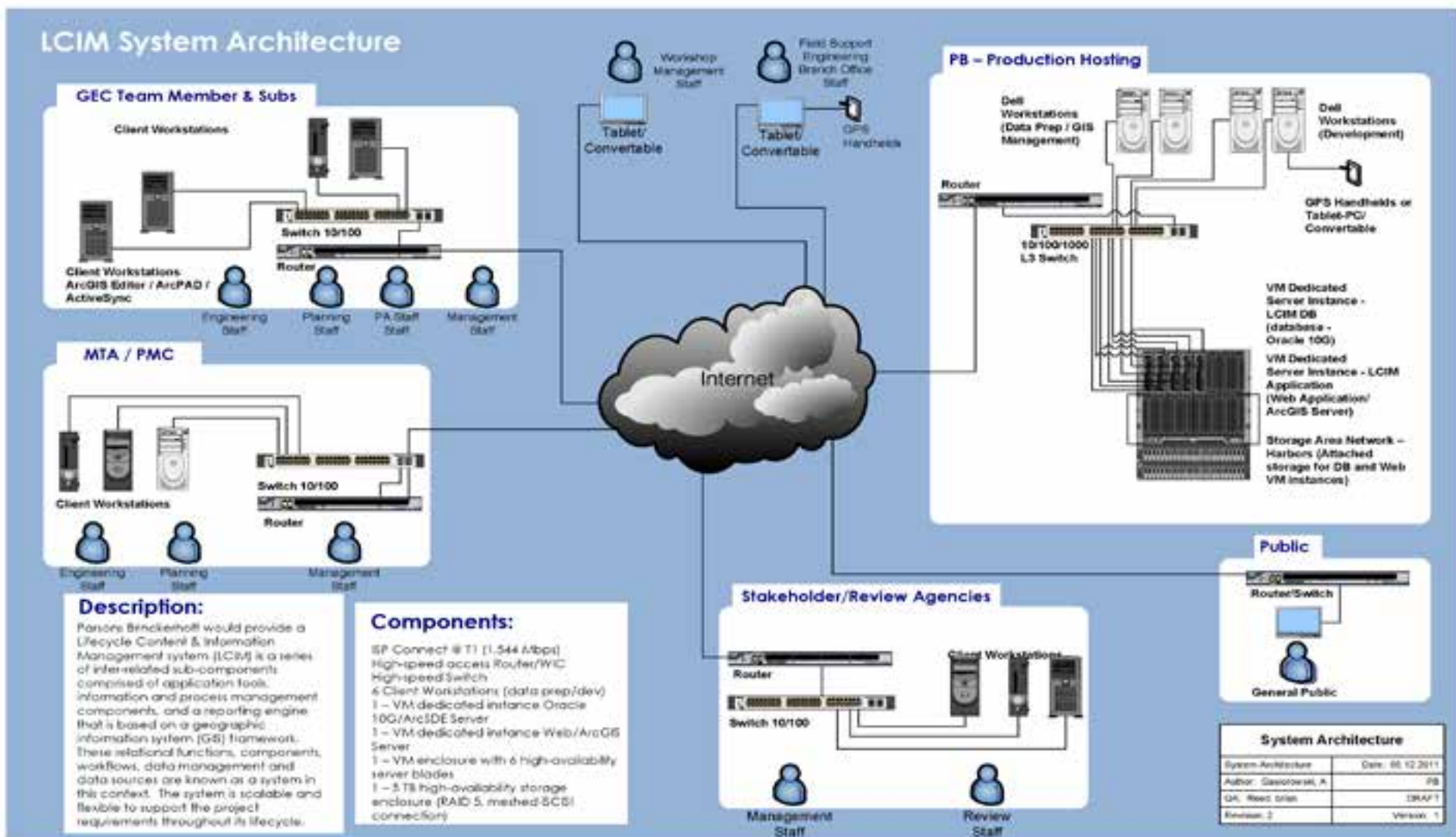
## Costs

- Reduction in re-work from missing pieces or not knowing changes
- Some things from concept will not work effectively
- Common set of data for stakeholders throughout lifecycle – stakeholder analysis in real-time
- More effective ROW analysis and costing
- Limit impacts and LOD
- Tools are developed to leverage on new projects

## Processes

- Marry the data to derive value (CAD and GIS)
  - Comments/Responses in real-time
  - Version control/single archive
- Single view of data improves quality and schedules
- Everyone can see change as it happens (in advance of milestones)
- Analysis in real-time
- ROW costs/impacts
- Resource impacts
- Ridership/Construction impacts

# System Architecture



# User Access to Data (Check-in/out & Automated Publishing)



**Layer Manager**

- ENVIRONMENTAL
  - Air Quality Monitoring
  - Noise Monitoring
  - Trails - Hike & Bike (City)
  - Bike & Ped (County)
- Natural
  - Species - 1999\_2012\_01\_...
  - Water Quality Monitoring
  - Wetlands\_2012\_09\_11
  - Wetlands\_R3\_04\_2012\_11\_...
  - Herpetiles\_2012\_08\_11
  - Forest Stands\_2012\_09\_11
  - Critical Areas\_Hatch\_08/09
  - Critical Areas\_Hatch\_08/09
  - Est. CM\_100x\_FP\_2010
  - Est. C13\_100x\_FP\_2010

**GIS Layers**

Check Out:  Checked Layers Only  
 All Available Layers

Select Layers:

- GIS Commercial Streams
- GIS Critical Areas
- GIS Floodplains
- GIS Forests

Buttons: Check Out, Download, Cancel

**Data Management**

To add project data, use the Check Out, Check In buttons.

For Check Out, navigate to the extent of features you would like to add. Click Check Out and then Download.



# Data, Data & more Data



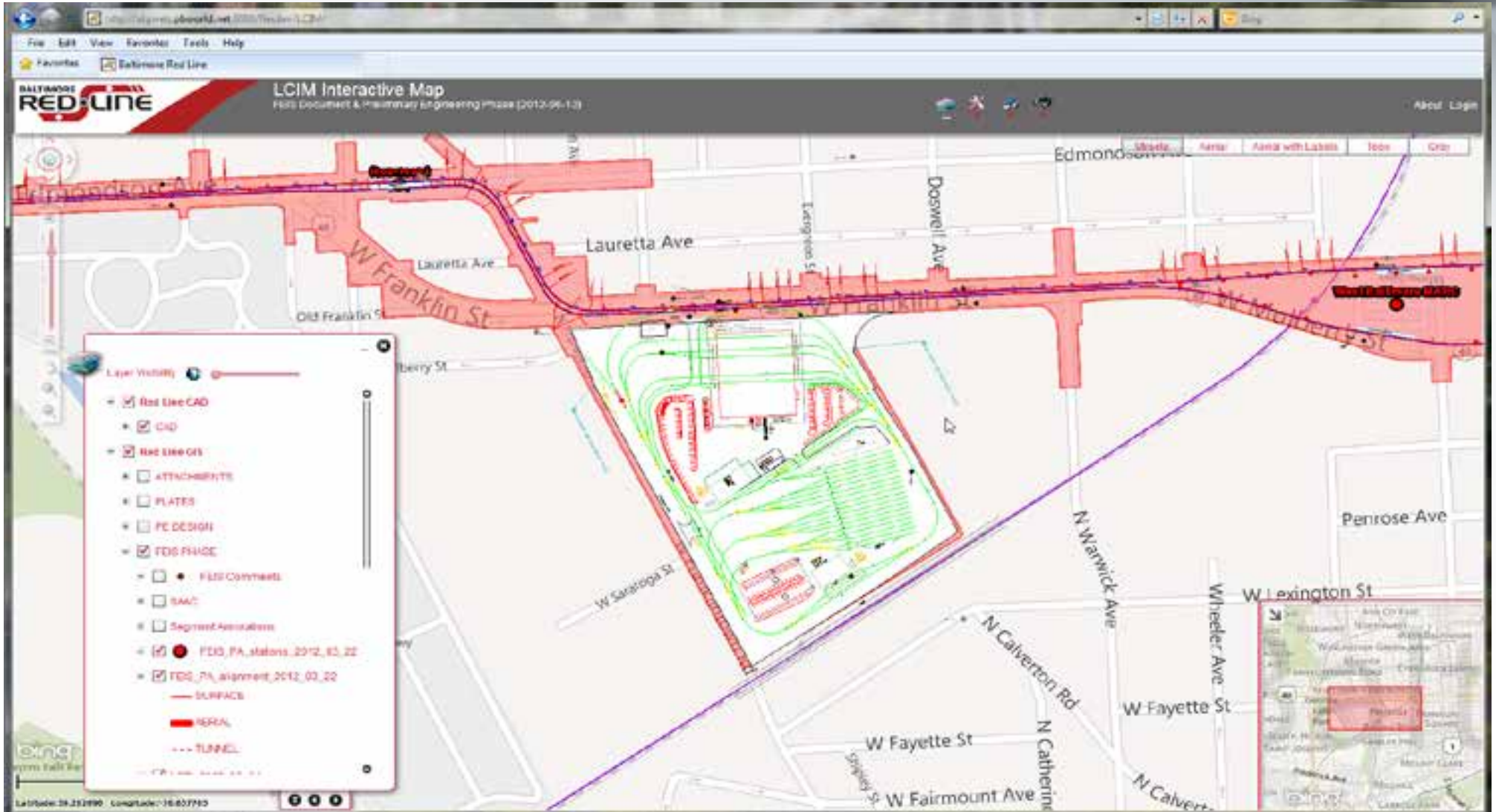
## Design - CAD

- Alignments, Alternatives, and Segments
- Surveys
- Business Access/Egress
- Construction Impacts/Staging
- Construction Zones/Phasing
- Design Data
  - Stormwater
  - Traction Power/Tie Breaker
  - Offsite improvements
  - Stations
  - Vents/Shafts/Access
  - Yard/Shop

## Environmental - GIS

- Environmental
  - Natural Resources
- Socio-Economic Resources
  - 4(f)
  - Disadvantaged/Social Justice
- Cultural/Historic Resources
- Ridership forecast
- Routes/Maintenance costs
- Soils
- Demographics
  - Census
  - Ridership
  - Services/Routes

# Data View (CAD/GIS Integration)



# Processes & Methods – Design Team



- Segment designers maintained common CAD files
  - Updates to content management portal (daily/weekly)
- Lead designer review of CAD submittals
  - Approved data for publication/team use
  - Central CAD file end to end
    - Referenced key segment files
  - LOD continues to evolve
  - Tracked and issued ROW impacts in CAD from segment designers and surveyors

# Processes & Methods – NEPA Team



- Environmental/Cultural team
  - Uploaded changes in resources/attributes
    - Resource features refined from baseline originals
    - Field teams posted direct edits from Mobile devices
  - Downloaded current datasets from analytics routines for document sections
- GIS team
  - Developed new tools & web mapping portal
  - Automated resource plate production
  - Managed data post and production release
  - Automated resource impacts tools and outputs to team
  - Supported ROW impact and cost analysis
  - Supported Ridership/Route impact and cost analysis

# Document & Photo - Geospatial



**Photo/Document Insert**

**Photo/Document Insert Form (sde.attachment\_points)**

Please fill-out the fields in this form and select the Submit Button when you finish your entries. To attach photos or documents please select the files for attachment through the Browse and then Upload Buttons.

Document Type: Report

Segment: West

Direction:

Topic:

- Access
- Air Quality
- Alignment/Route
- Construction

Discipline:

- Project Manager
- Project Administrator
- Civil Engineer
- Track/Rail Engineer

Title:

Caption:

Description:

File:

Name	Type	Date	Size

**FEIS Comment Submittal**

**Comment Submittal Form (sde.feis\_comments)**

Please fill-out the fields in this form and select the Submit Button when you finish your entries. If you would like to attach photos or documents to this comment, please select the Attachments Button and select the files for attachment through the Browse and then Upload Buttons.

\* First Name:

\* Last Name:

\* Address:

Address Line 1:

Street address, company name, PO box

Address Line 2:

Apartment, unit, suite, building, floor

\* City, State Zip:

\* Email:

Keyword:

Segment:

Topic:

- Access
- Air Quality
- Alignment/Route
- Construction

Comment:

# Field data collection - GeoEdit



# Meeting Event/Consulting Parties Tool



**Cancel Meeting Log Submittal**

**Event / Meeting Submittal Form (aka EventLog)**

Please fill out the fields in this form and select the Submit button when you finish. If you would like to add attachments, please select the Attachments button and use the Browse and Upload buttons to locate and upload files.

Meeting Type:

If Other, Please Specify:

Meeting Dates:  Anticipated  Actual

Meeting Date: 06/11/2014

Location:

Address:

City, State, Zip:

Meeting Purpose:

Authorized By:

Consulting Parties:

Name	Organization

**Add Event/Meeting**

Use the Address/Map/Mapbox to search for and add an event at a point's geographic location.

# Cultural Resources/ Historic Maps



**BALTIMORE RED LINE** LCIM Interactive Map  
FIS Document & Preliminary Engineering Phase (2013-05-16)

Layers Visibility

- CULTURAL
  - NHP Eligible Historic Property
  - NHP Listed Historic Property
  - NHP National Historic Landmark
  - Architectural Historic Area of Pale
- HISTORIC MAPS
  - Historic Map (Folk 1792)
  - Historic Map (Wagner Hanna 1879)
  - Historic Map (Lucas 1822-1830)
  - Historic Map (Cochran 1851)
  - Historic Map (USGS 1890)
  - Historic Map (Bell 1892)
  - Historic Map (Hall 1904)
  - Historic Map (USGS 1874)
- PARCELS

Map labels include: STREET, St. Peter's Ep. Ch., Bapt. Ch., Pres. Ch., Citizens' Bn., Depot Baltimore & Ohio R.R., PUBLIC LAND, WEARY STREET, S. CALVERT, CHEAPSIDE, WATER ST., and various street names like CALVERT, BALTIMORE, and WASHINGTON.



# Automated Resource Impacts Computation by Alt-Segment



LCIM Interactive Map  
PDS Document & Preliminary Engineering Phase (2013-05-10)

Please select the resource layers of interest and click 'Next' to see the cutting features.

Selected	Layer	Layer Alias
<input type="checkbox"/>	SOE Existing_MTA_Route_Harbor	
<input type="checkbox"/>	SOE FairPlay2	
<input checked="" type="checkbox"/>	SOE Forq	
<input type="checkbox"/>	SOE ForestalBelted-branchesAWC	
<input type="checkbox"/>	SOE Forest_Stands_2012_09_11	
<input type="checkbox"/>	SOE Geoprote_Locations	
<input type="checkbox"/>	SOE Gratings	
<input type="checkbox"/>	SOE Grt.Pillages	
<input type="checkbox"/>	SOE Grts	
<input type="checkbox"/>	SOE Inlet_Roads_2012_05_23	
<input type="checkbox"/>	SOE Hedgecrows_2012_09_11	
<input checked="" type="checkbox"/>	SOE HistoricBuildings-branchesAWC	
<input checked="" type="checkbox"/>	SOE HistoricBuildings-branchesAWC	
<input type="checkbox"/>	SOE ICE_EMAC_T42s	
<input type="checkbox"/>	SOE ICE_Canons_T42s	

Layer Visibility

- ENVIRONMENTAL
  - Air Quality Monitoring
  - Noise Monitoring
  - TRIS - H2O & B10 (CR)
  - Site & Ped Counts
  - Natural
    - Decomex\_Trees\_2012\_09
    - Water\_Quality\_Sampling
    - Wetlands\_2012\_09\_11
    - Streams\_RD\_R4\_2012\_11
    - Hedgecrows\_2012\_09\_11
    - Forest\_Stands\_2012\_09\_11
    - Critical\_areas\_mbr\_30s
    - Critical\_areas\_mbr\_30s
    - Dak\_Ctr\_103yr\_TP\_2012
    - Riv\_CO\_130w\_EP\_2012

# Automated & Self-Service Resource Plate Production



**BALTIMORE RED-LINE**  
LCIM Interactive Map  
FEIS Document 6 Preliminary Engineering Phase (2012-01-11)

Layers Visibility

- CAD
- BABELLE GIS
- ATTACHMENTS
- PLATES
- PE DESIGN
- FEIS PHASE
  - FEIS Comments
  - SAAC
  - Segment Annotations
  - Proposed Stations 09-2011
  - Proposed Alignment 10-2011
    - At Grade
    - Aerial Structure
    - Tunnel
  - LCO\_2011\_12\_27

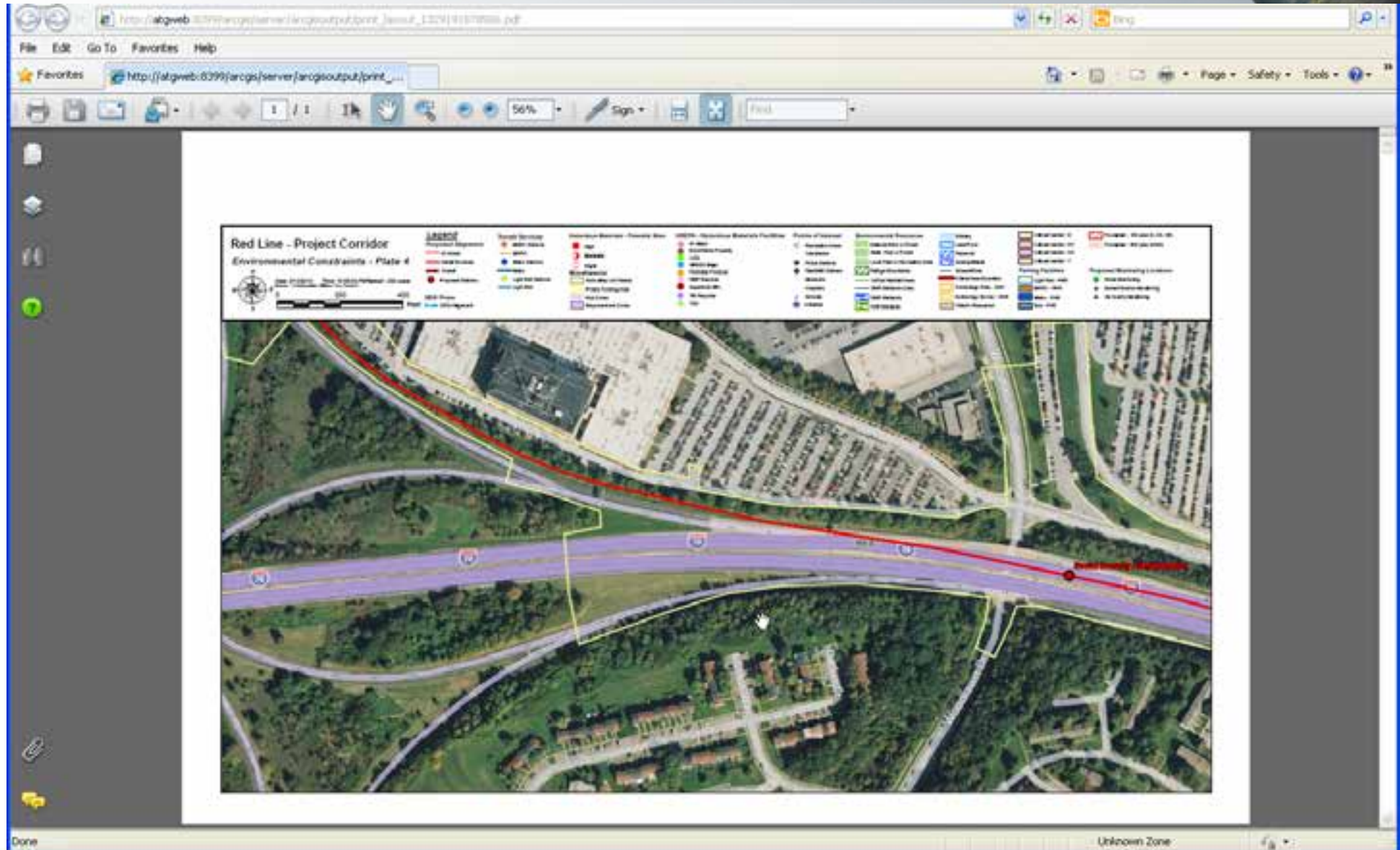
Select a map template from the pick list below to print a pdf version of selected data layers

Template: 200 Scale Plate Series

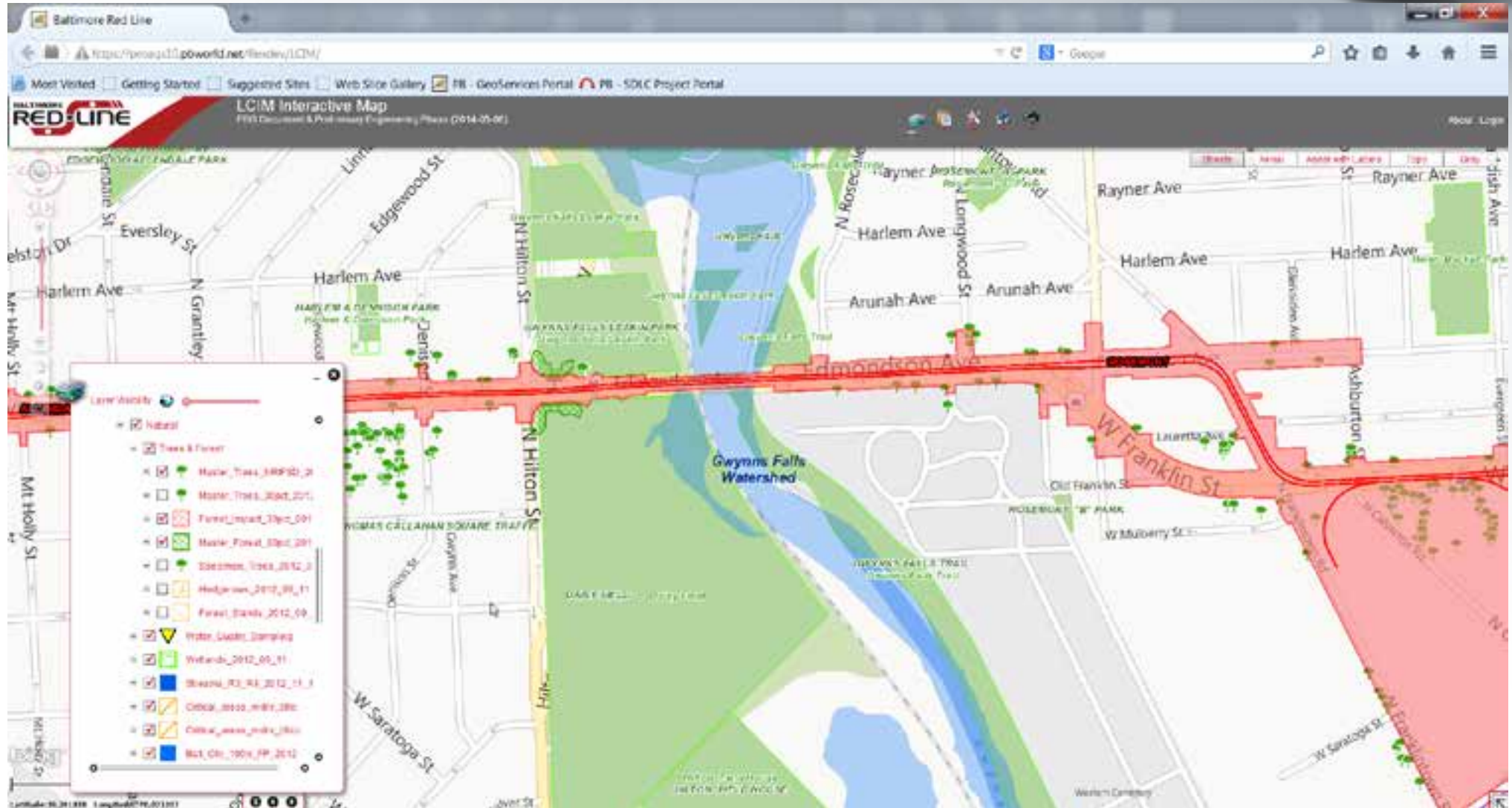
Plate:  
Plate 1  
Plate 2  
Plate 3  
Plate 4  
Plate 5  
Plate 6

Print

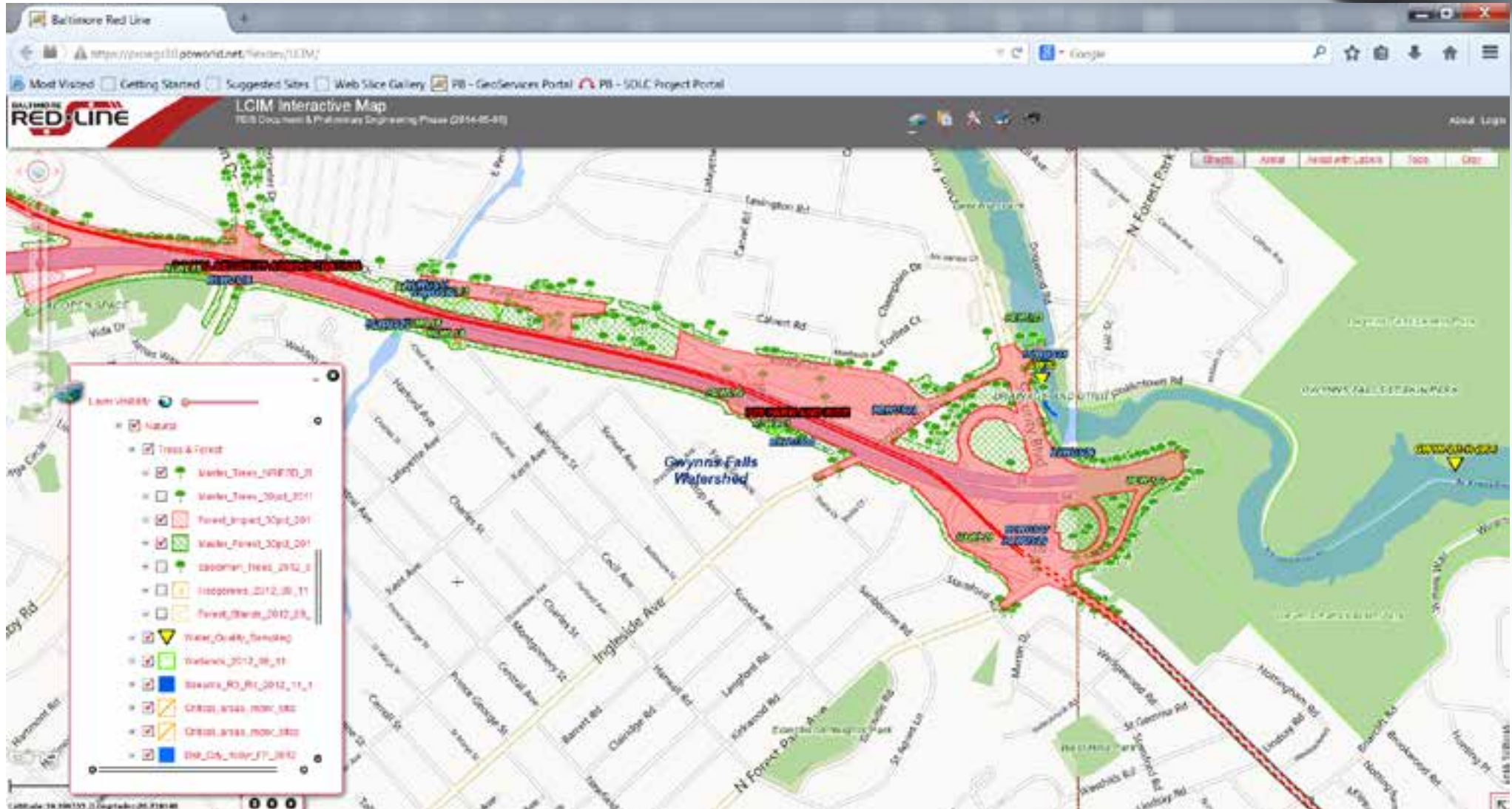
# Sample Map Template Output



# Environmental Data Integration



# Environmental Impacts Sample



# Parcel/ROW Search



**Baltimore RED LINE**  
LCIM Interactive Map  
P125 Document & Planning Engineering Phase (2012-08-13)

Map Layers Legend:

- RAE LRS CAD
- CAD
- RAE LRS GIS
- ATTACHMENTS
- PLATES
- PE DESIGN
- FDS PHASE
  - FDS Comments
  - SMC
  - Support Activities
  - FDS\_PA\_110001\_2012\_03\_22
  - FDS\_PA\_alignment\_2012\_03\_22
    - SURFACE
    - ADFL
    - TUNNEL
  - LOC\_2012\_01\_04

Search Dialog Box:

Target Layer: Baltimore City

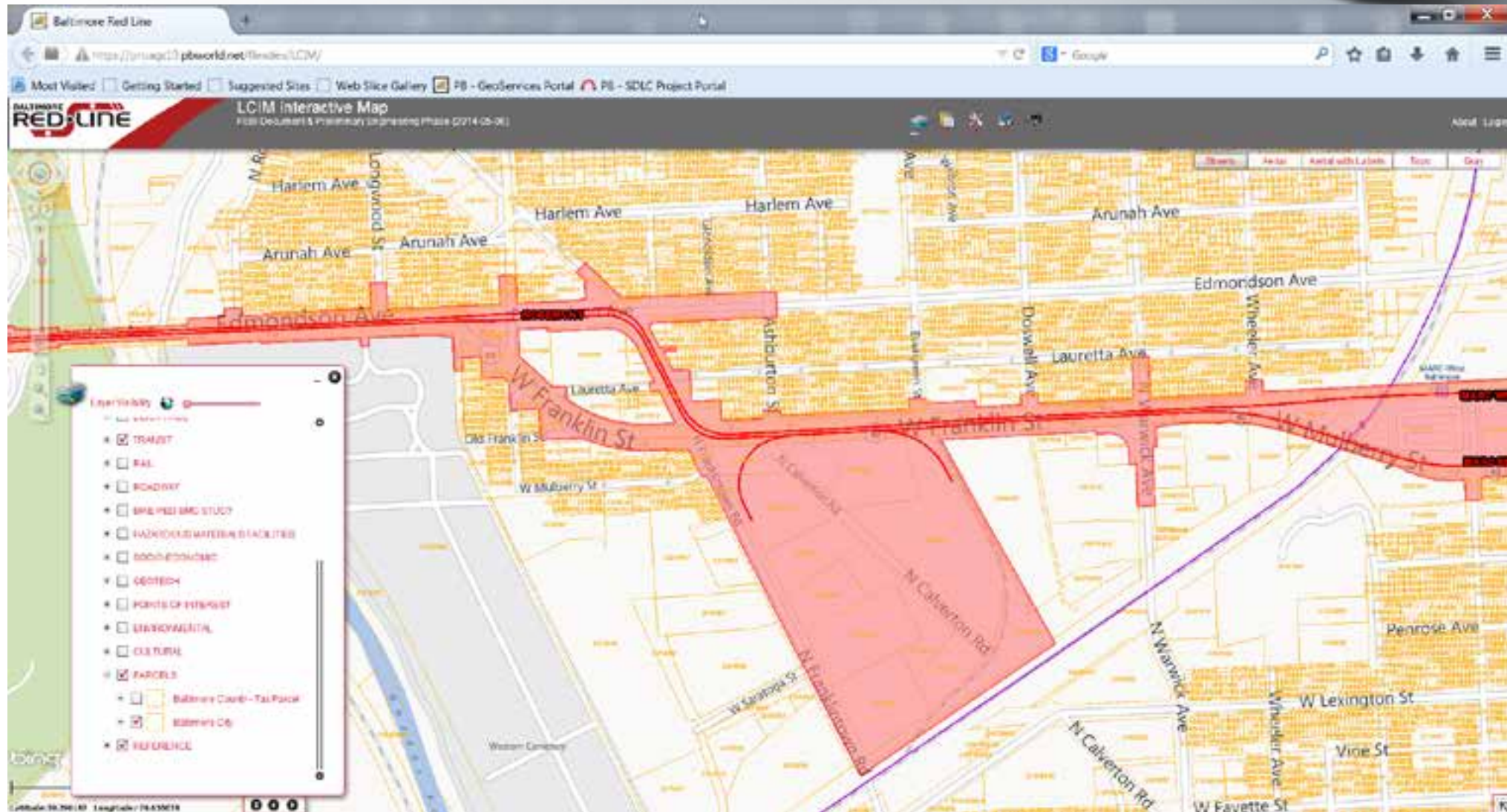
Fields: Parcel Number, FOLLOWUP

Operator: Value

SELECT FROM Baltimore City WRC:

Buttons: Clear, Select

# Parcel & ROW Impacts



# Q&A



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