environmental Risk Assessment & Management System (eRAMS)

A Web Technology for End-To-End Conservation Planning and Watershed Management

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Watershed Management

- Water Quantity
  - Flood control
  - Drought management
- Water Quality (Environmental) Criteria
  - Sediment
  - Nutrients
  - Pesticides
  - Metals
  - Pathogens
- Economic Criteria
  - Cost
  - Benefits
- Institutional Criteria

Nonpoint Source Pollution Control

- Implementation of conservation practices / BMPs
  - Prevent or minimize pollution rather than retrospectively respond to it.

- Current Approaches
  - Cost-sharing
  - Targeting

Photo courtesy of NRCS

Targeting Strategies

- Edge-of-field pollutant loadings (field-scale)
- Delivery to stream locations (watershed-scale)
  - Surface water transport pathways
    - Proximity to streams (stream order matters)
    - Overland and channel routing
  - Ground water transport pathways
- Stakeholder participation

What is eRAMS

- A collaborative framework for management of land, water and energy resources
  - Web-based (one-stop)
  - Cloud computing infrastructure (similar to OMS3/CSIP)
  - Platform independent and can be deployed on any mobile system
  - Open source
  - Geospatial tools
    - No ESRI products
    - All components are free and open source

eRAMS: Participatory Platform

- Facilitate collaboration and social networking
- Facilitate collecting, organizing and sharing data
- Integrate of data with modeling/analysis tools
- Turn information into insight

(IBM Architecture)

eRAMS Watershed Management

- Establish **benchmark conditions** for a field/watershed
  - Provided by local experts
  - On-the-fly simulation of benchmark conditions
- **Assessment**: costs and environmental benefits of a given set of management alternatives
  - Provided by local experts
  - Dynamic, real-time scenario creation and assessment of alternatives
- **Planning**: scenario analysis and system optimization for developing sound resource management alternatives

Data Collection and Sharing

- Identify problems
- Determine stakeholders' objectives, preferences and values
- Location and type of conservation practices
- Geospatial data
  - Extract from data warehouses: Climate, flow, WQ, soil, land cover, topography, hydrography, etc.
  - Upload user data
  - Digitize

Modeling Components

- Modules
  - Soil and Water Assessment Tool (SWAT): general watershed processes
  - APEX: agroecosystem
  - MODFLOW: ground water
  - HEC-RAS: channel processes
  - OMS3/RUSLE2
- Plug-in applications for diverse set of problems
- “Decentralized” group of users
- Incorporation of local expert knowledge

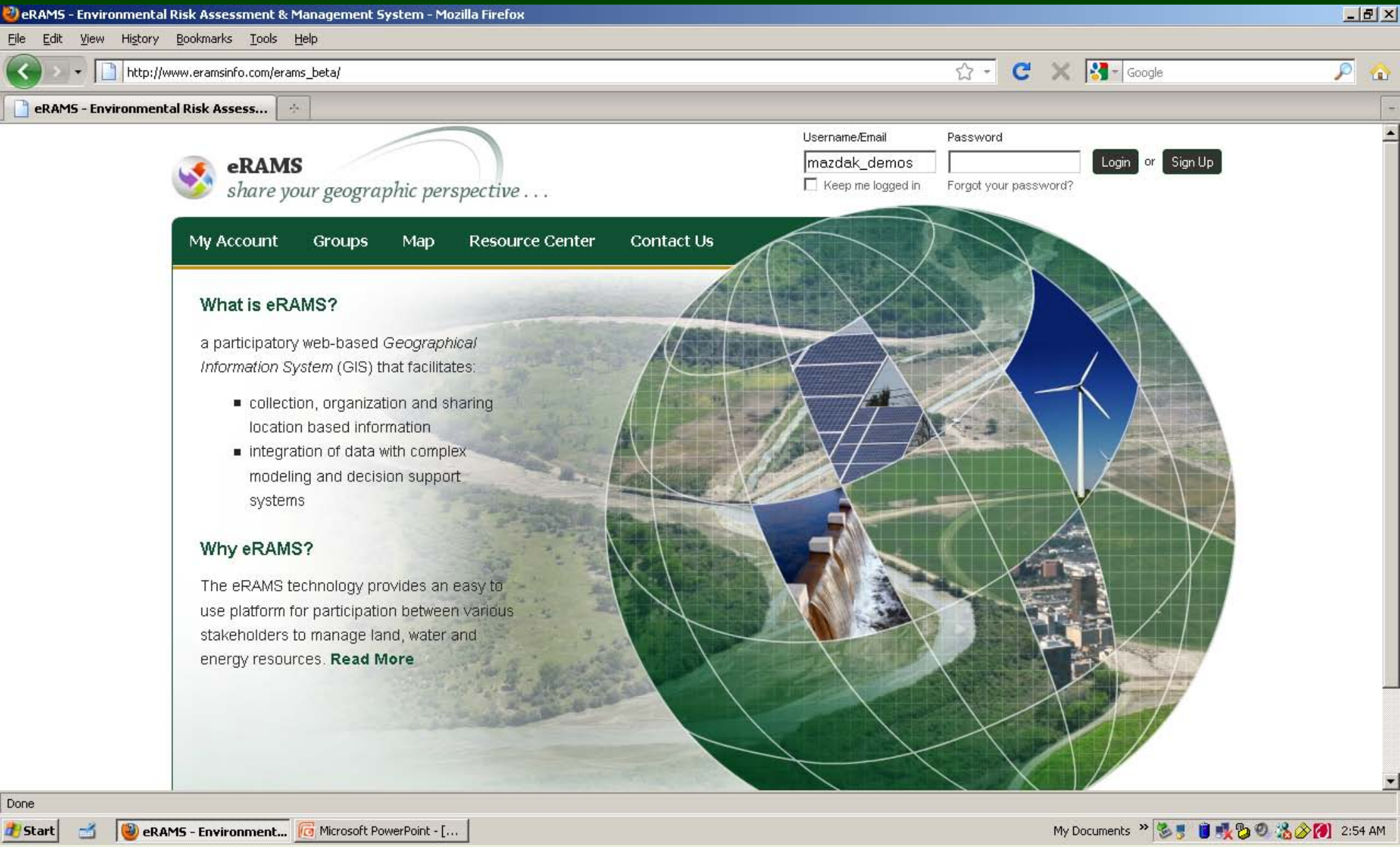
Technology Drivers

- No specific hardware or software requirements
  - Reduce training requirements
  - Eliminating the collection of duplicate data across agencies
  - Reduce long-term development and maintenance costs
  - Mobile system accessible, end-to-end, on the web
- Compatibility with existing databases/GIS technologies
  - Take advantage of readily available data

Technology Drivers

- Benefit from Google, Bing, and NASA products and other commonly-used internet technologies
  - Common “look and feel” interface
  - High resolution aerial photos, etc.
- Compatibility with long-term vision of institutions involved with management of natural resources
- Working across scales: field to watershed

www.erams.com



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- Collaborator 2
- Collaborator 3

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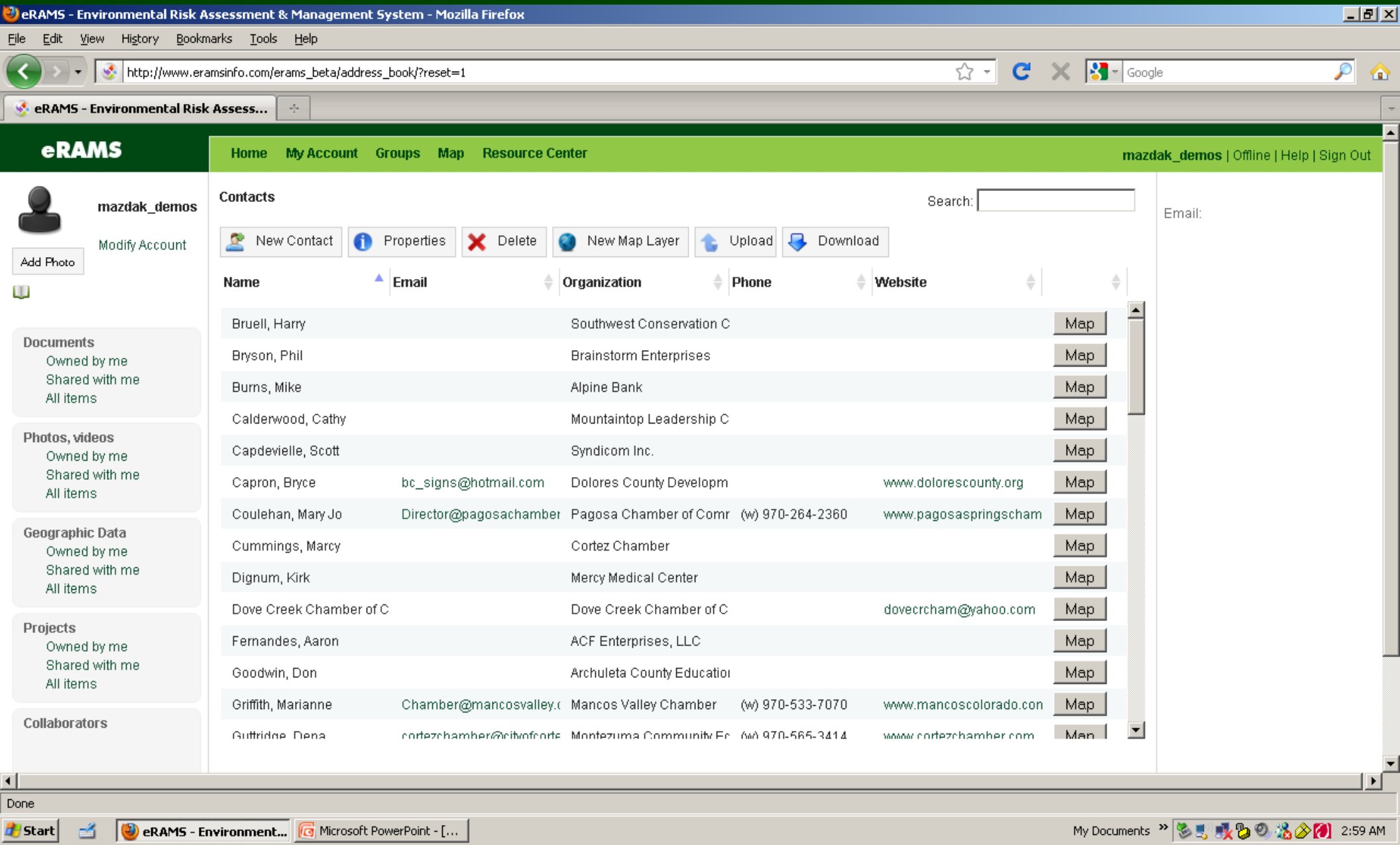
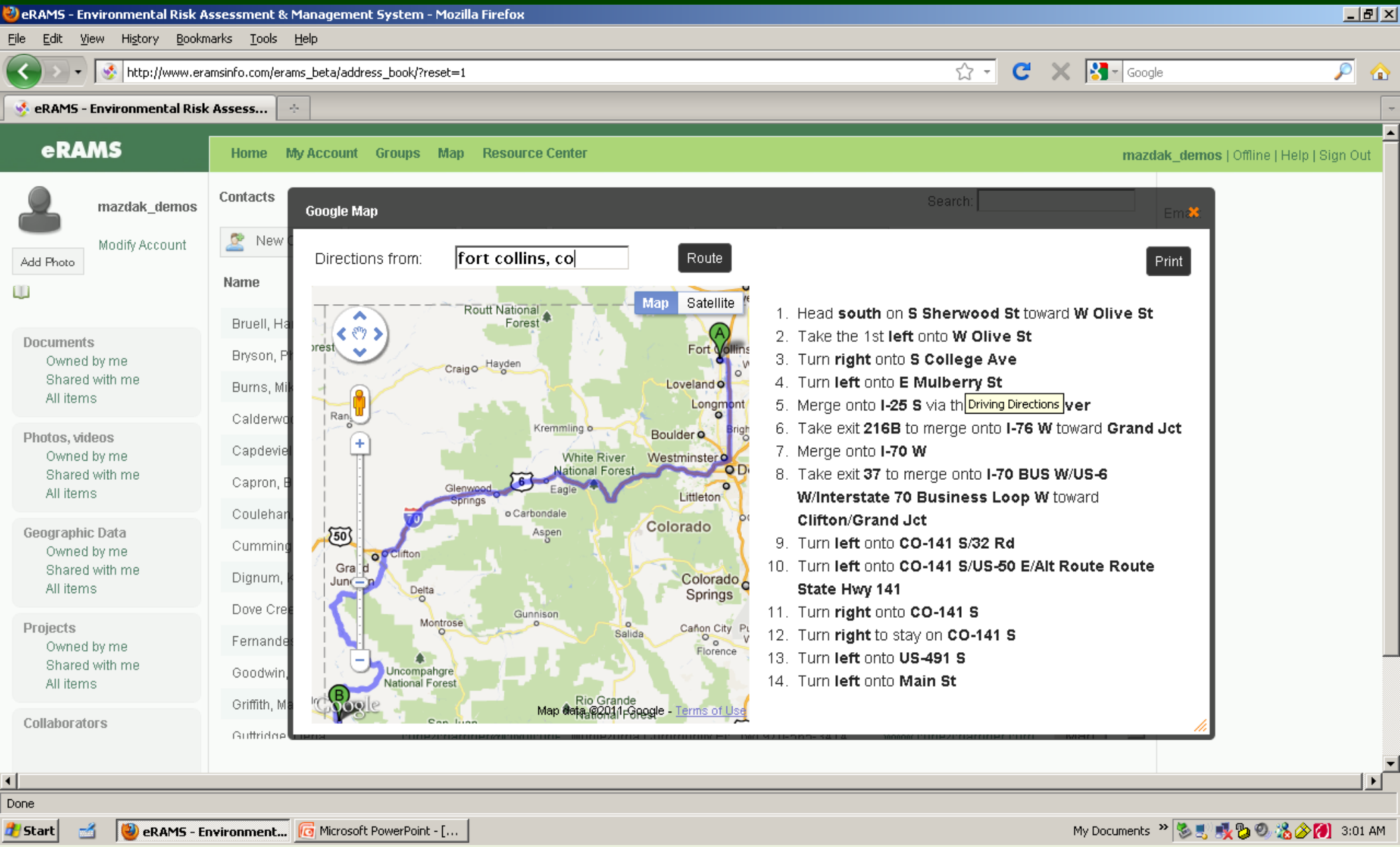
Contacts and Collaborators



Contacts and Collaborators



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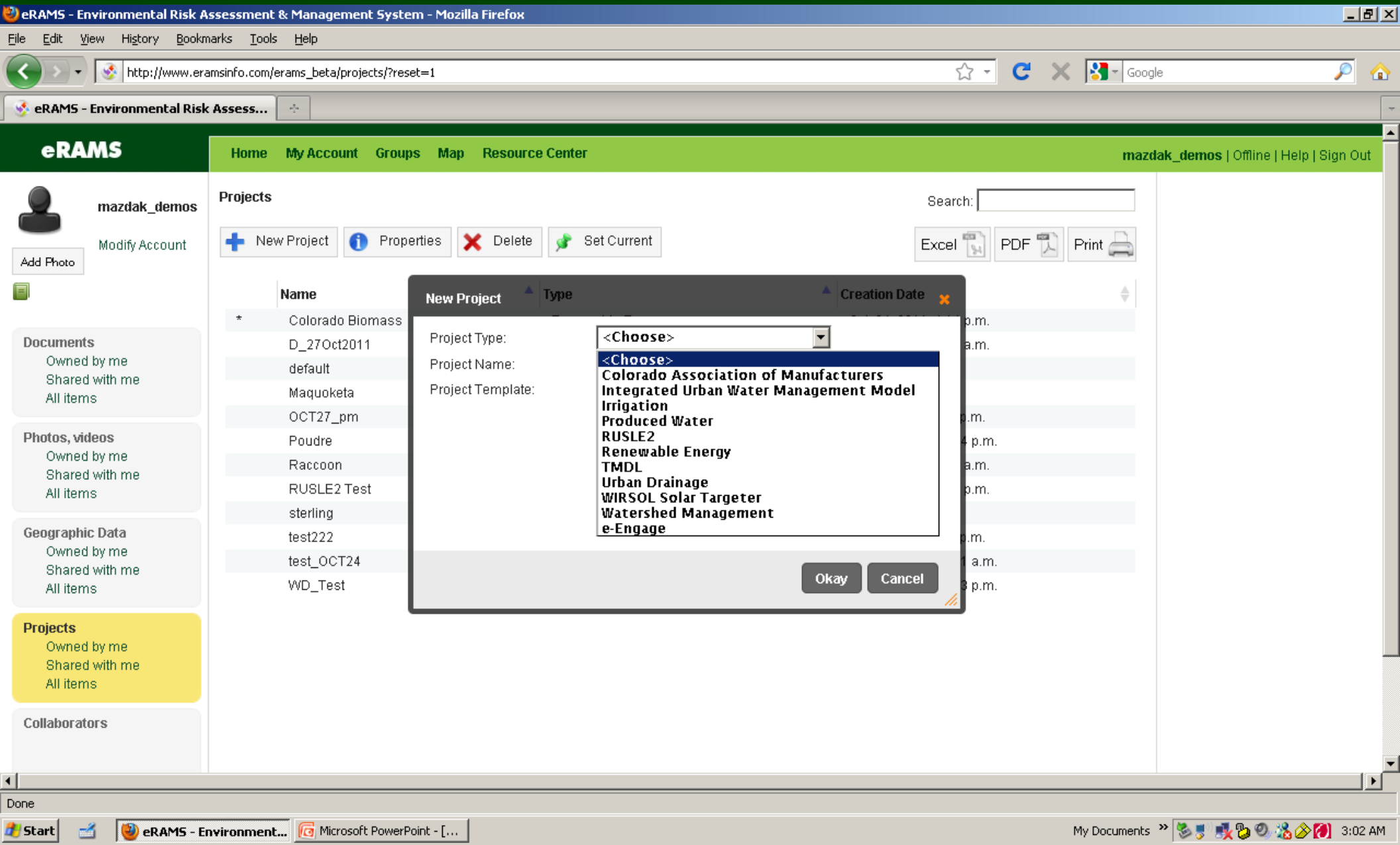
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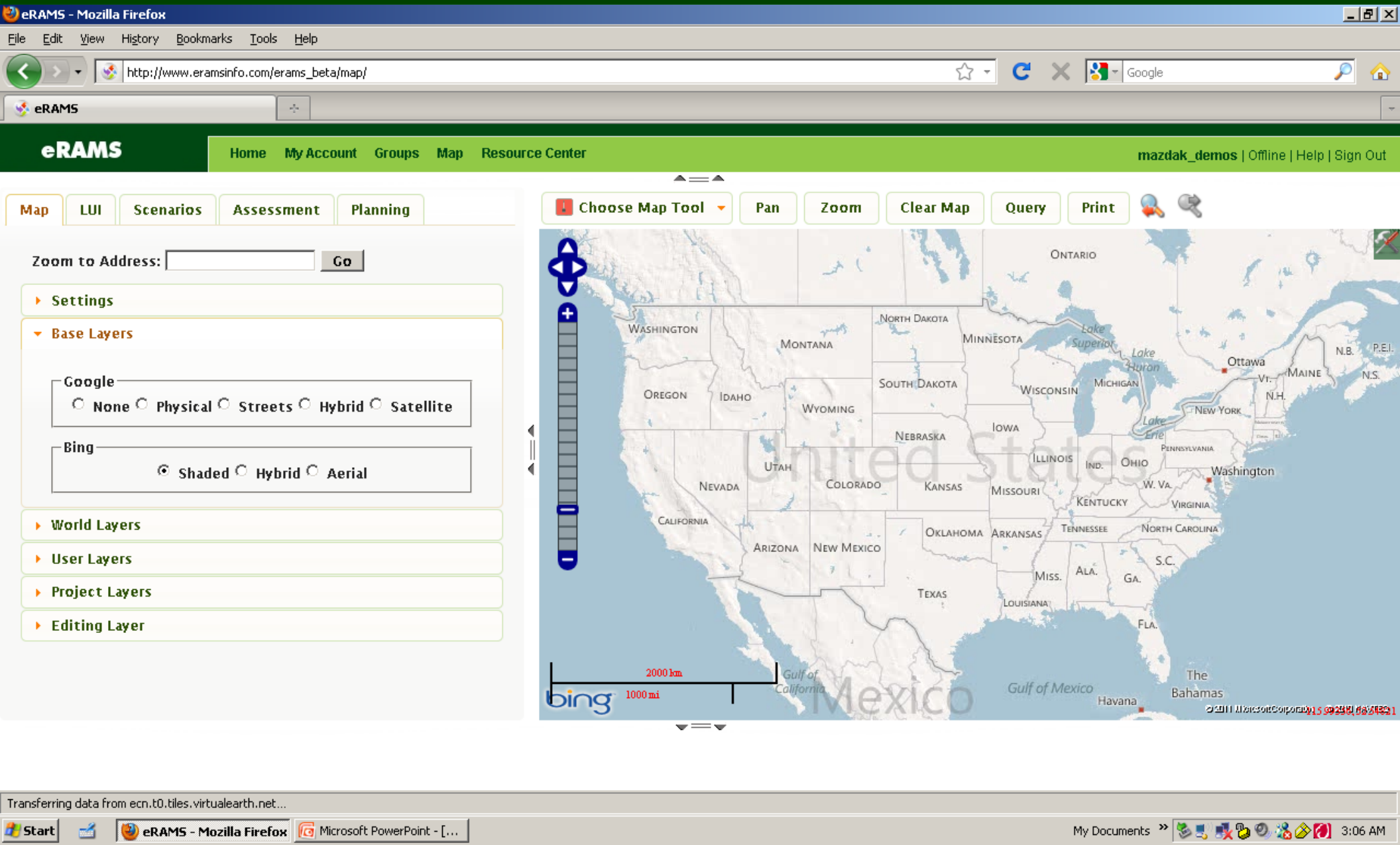
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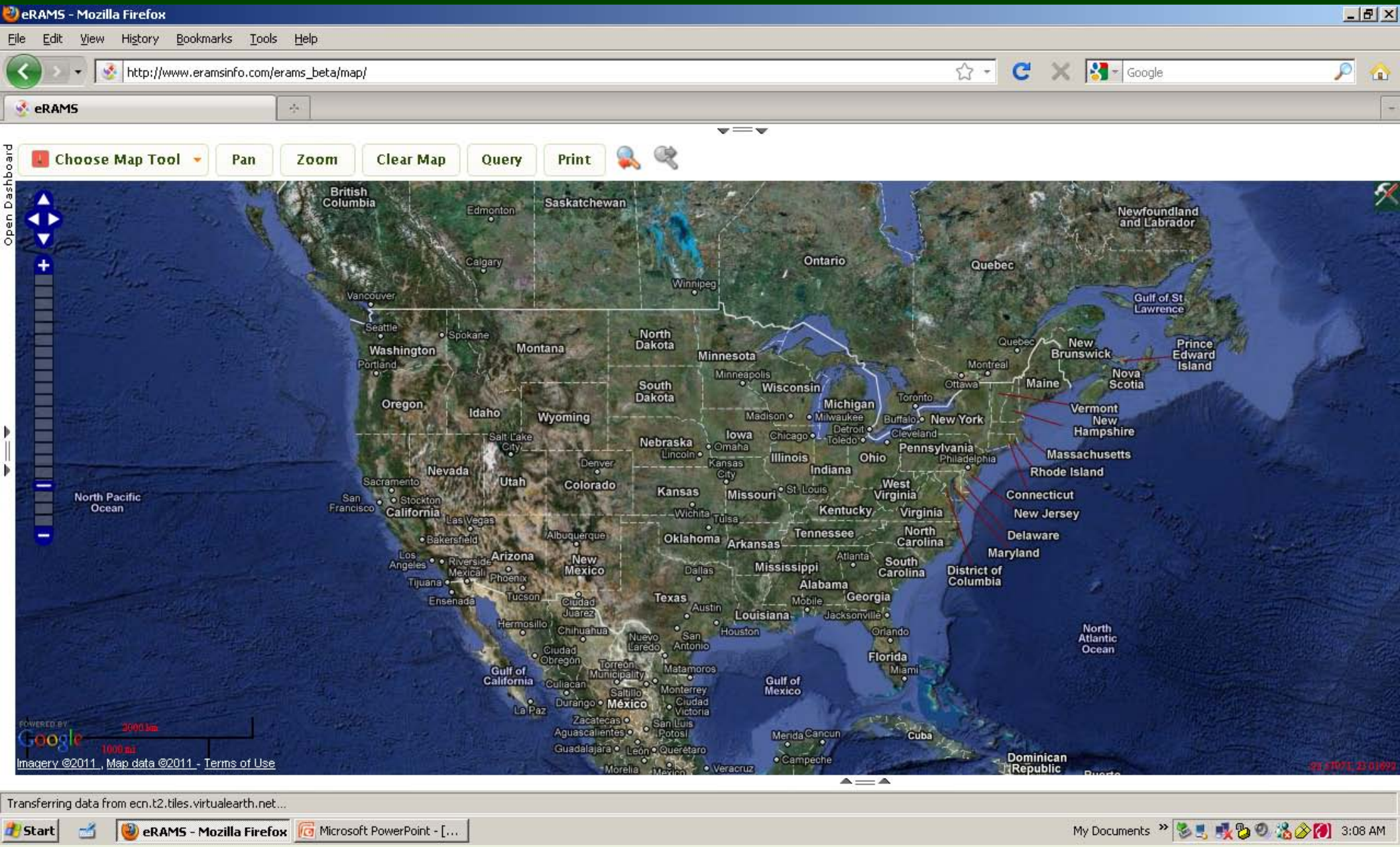
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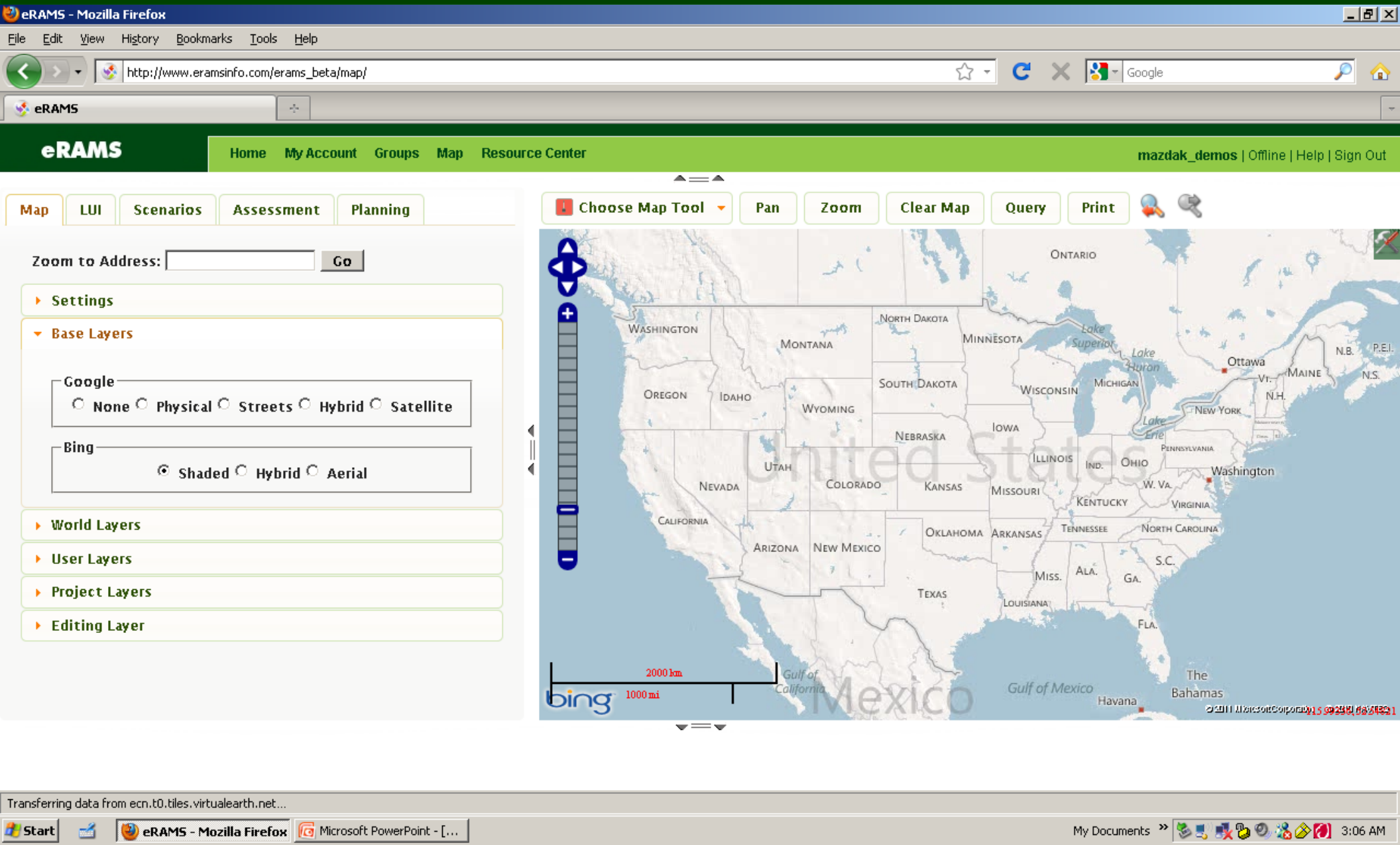
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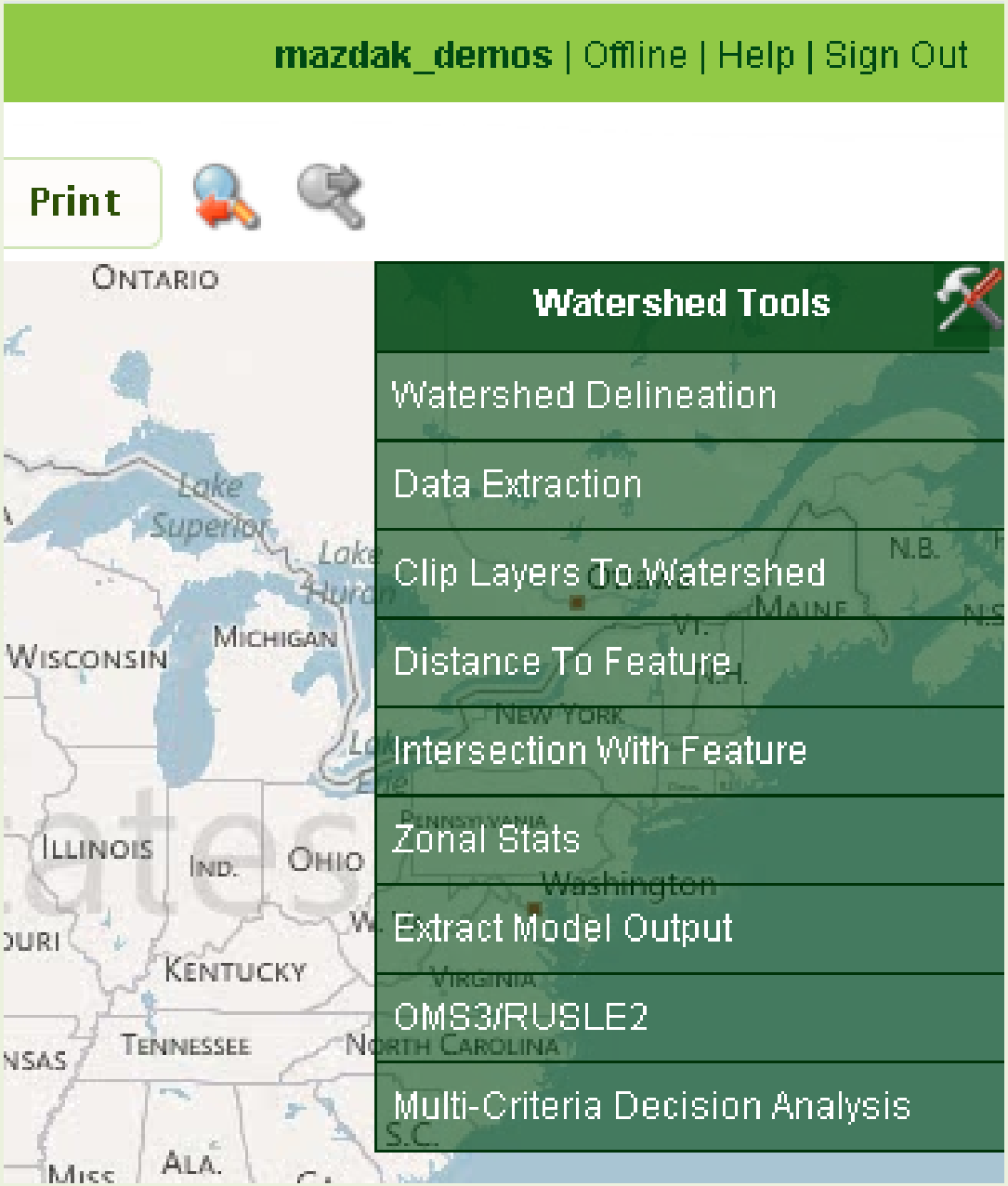
Watershed Management Tools



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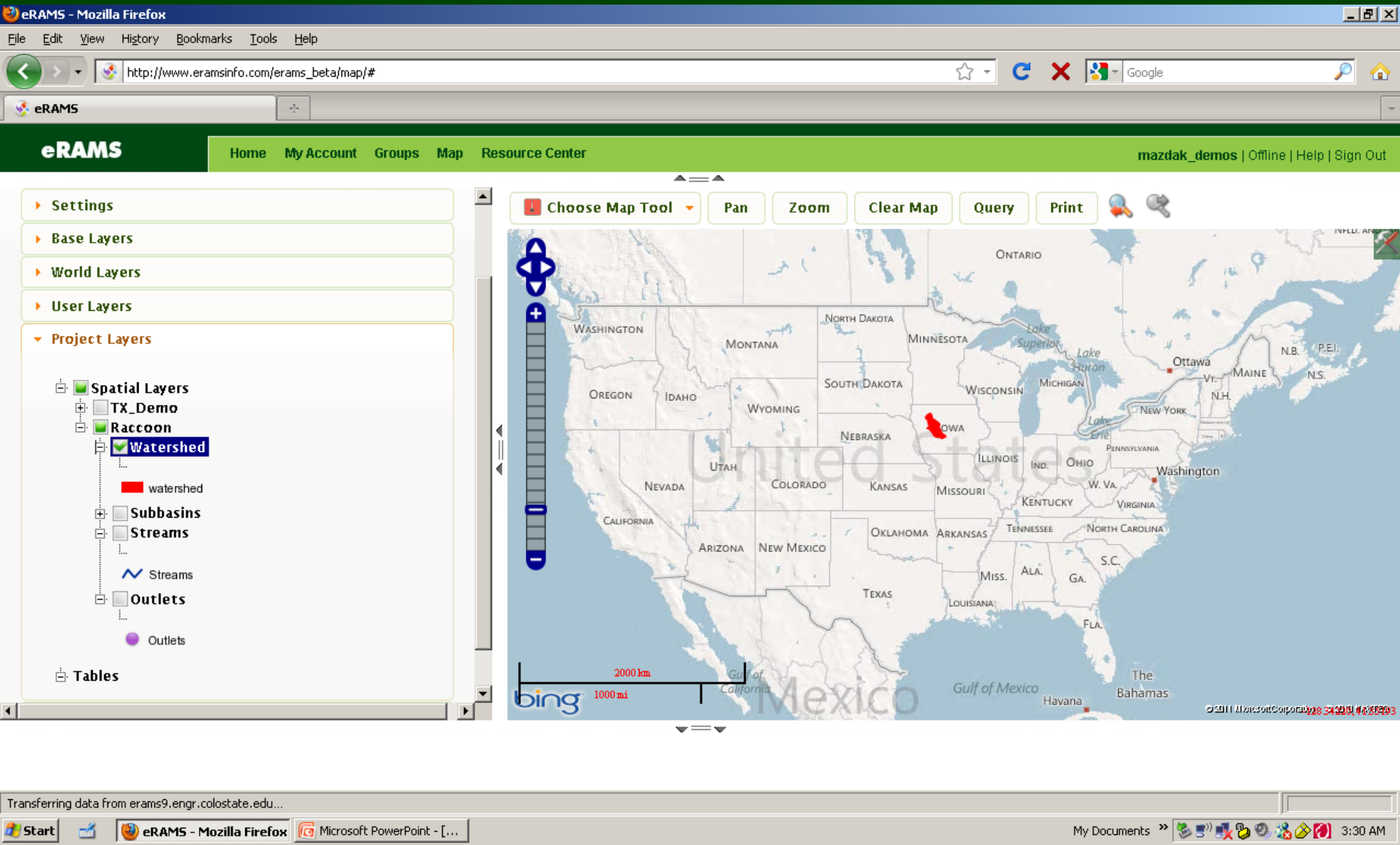
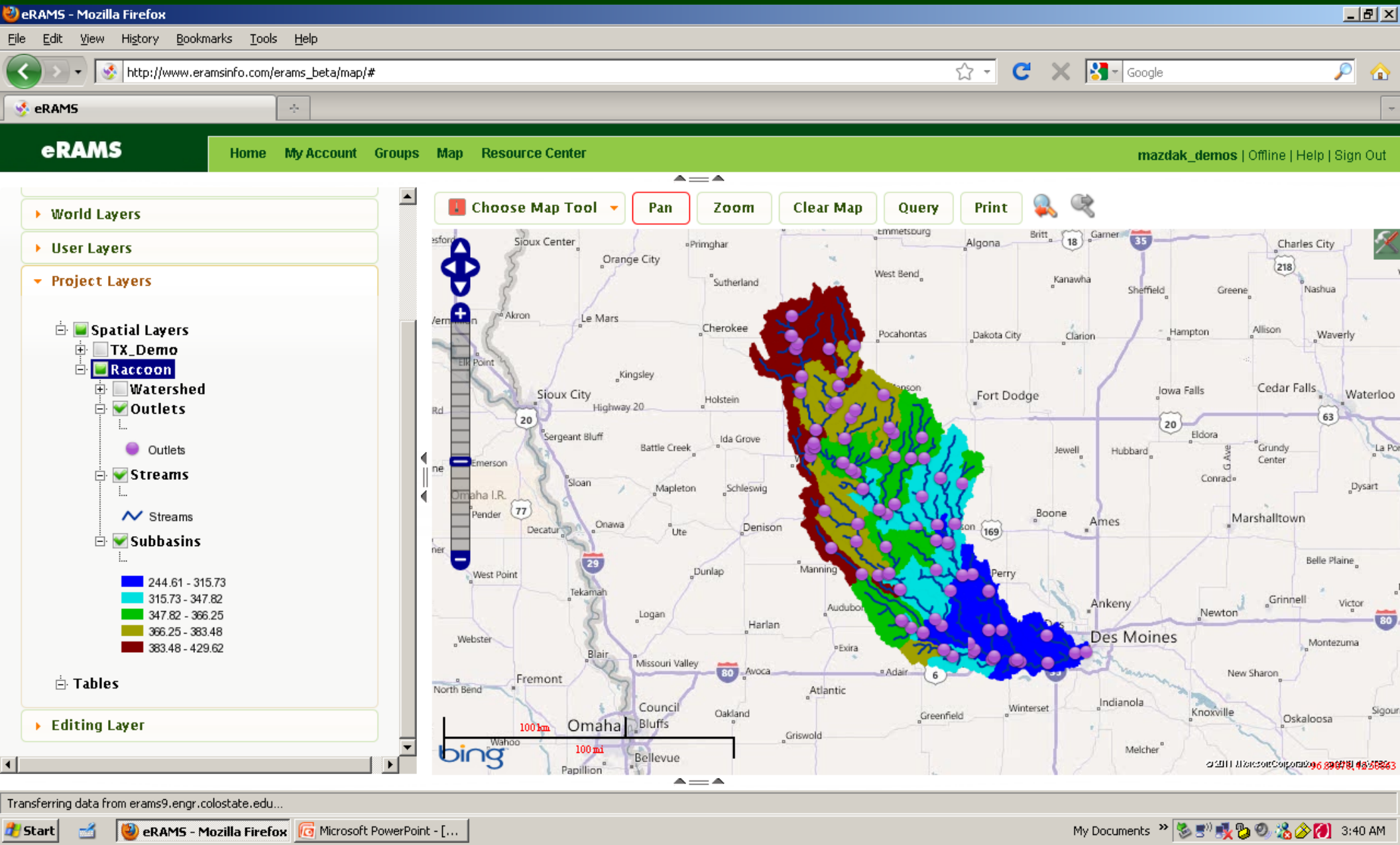
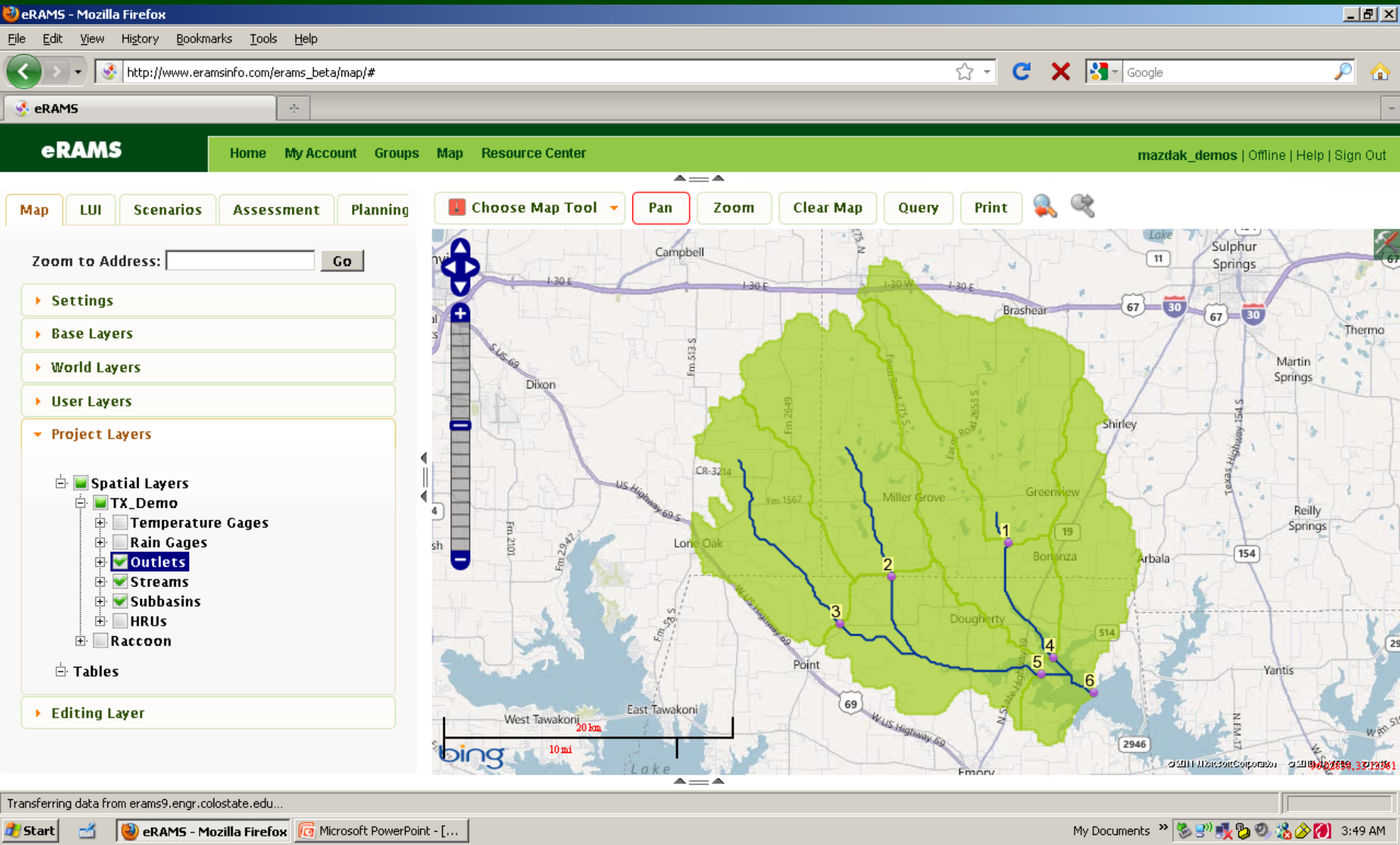


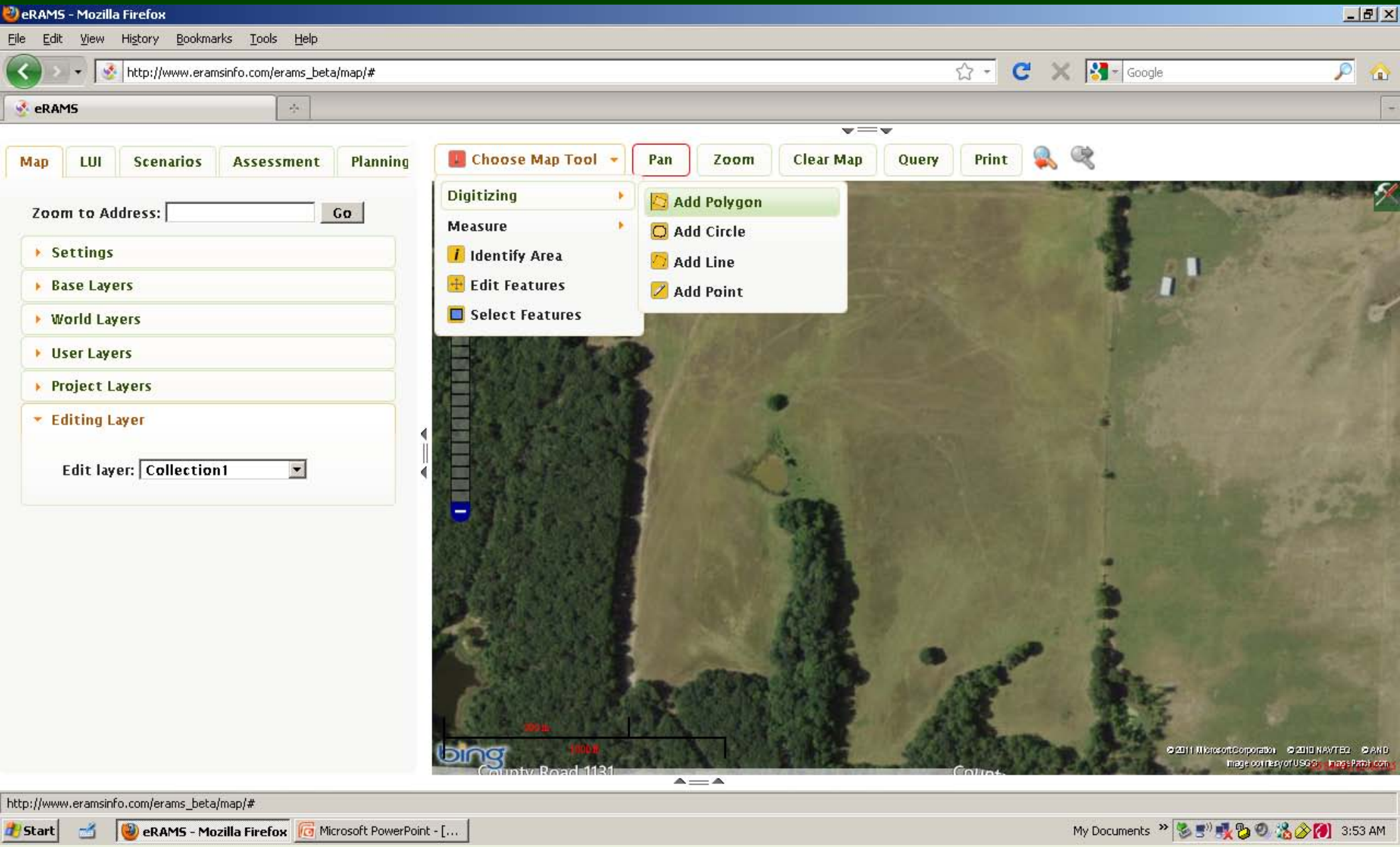
Symbology and Cartography



Geospatial Capacities



Heads-Up Digitizing



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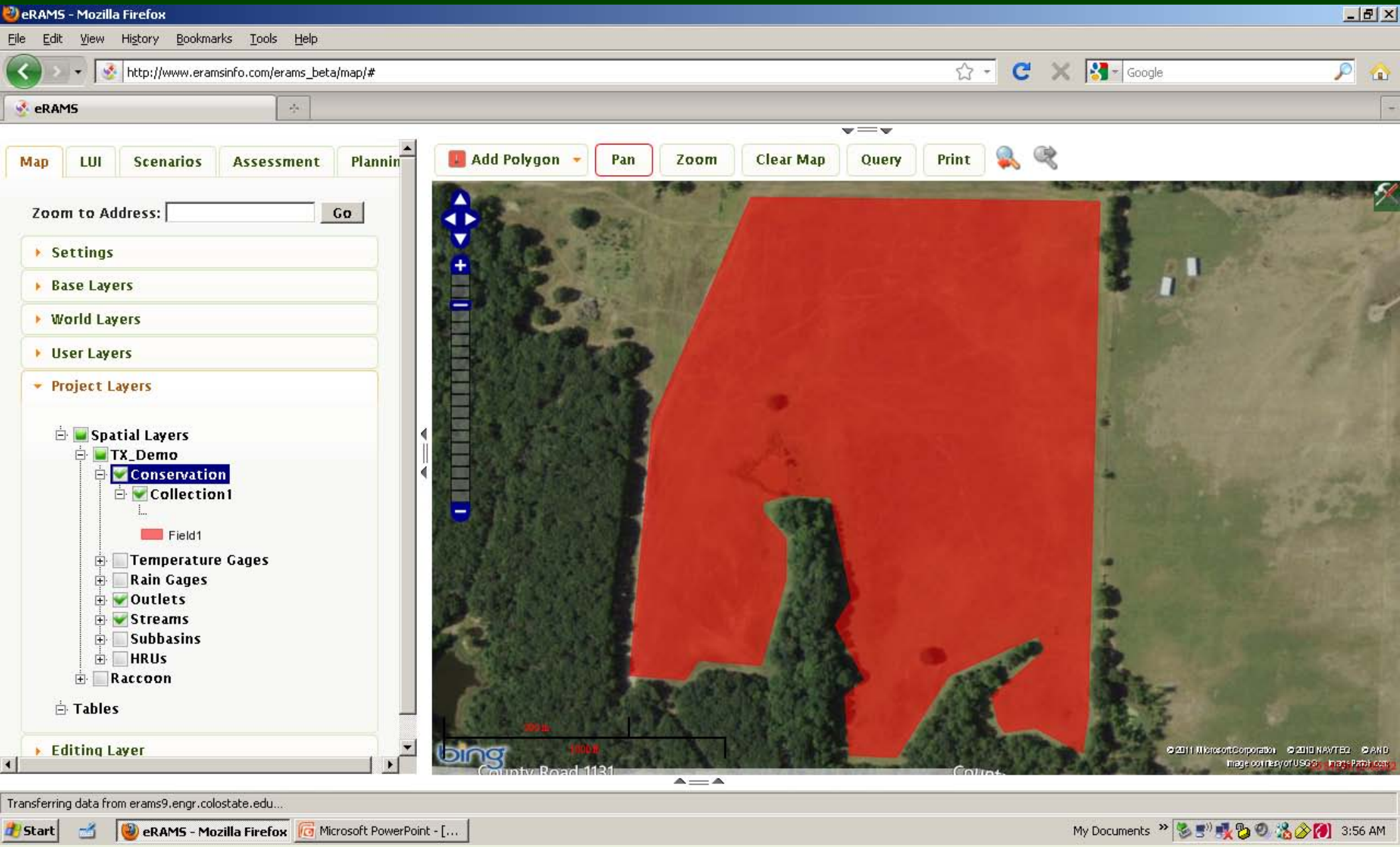
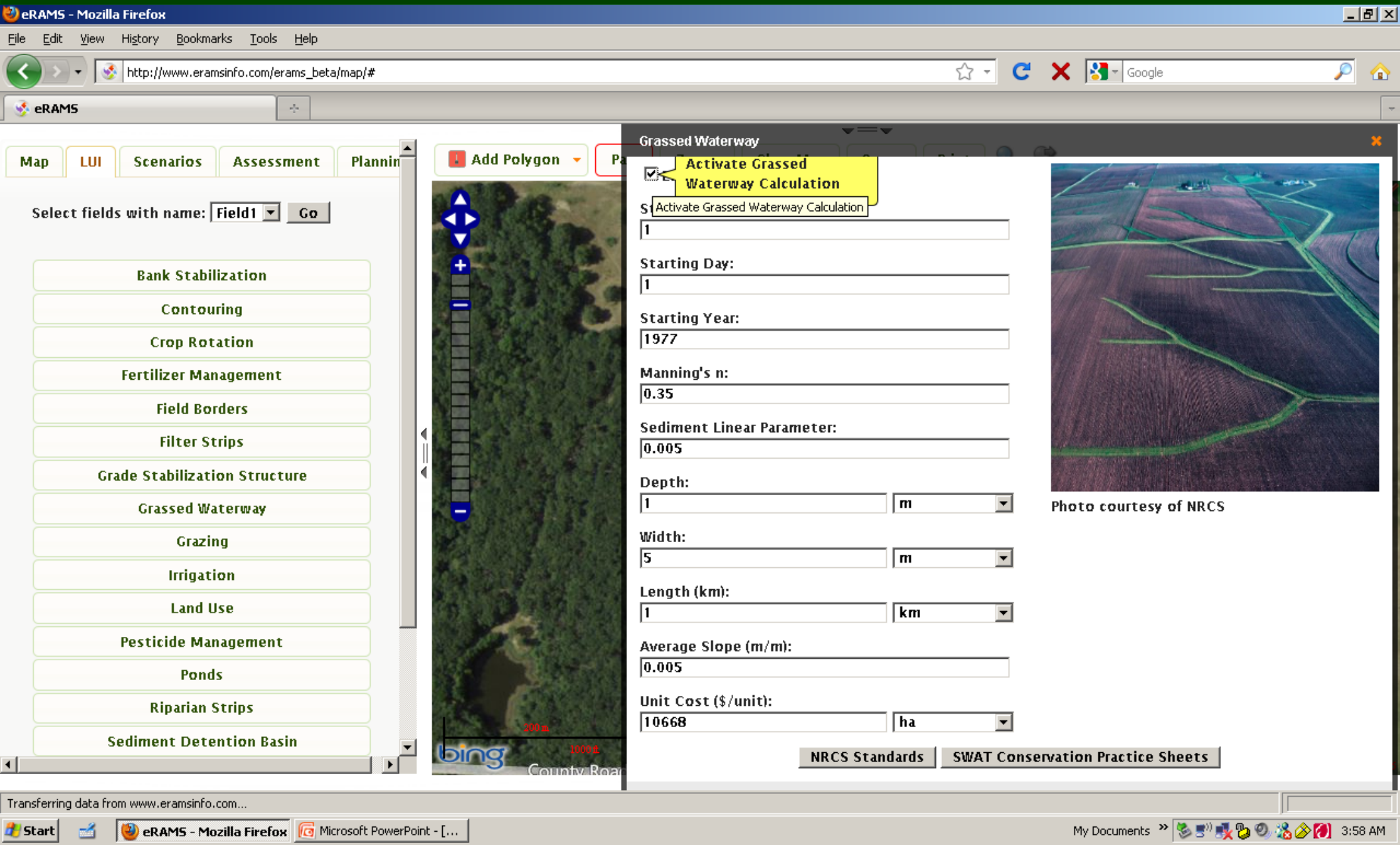


Conservation Practices



NRCS Handbook

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Waterway.pdf (application/pdf Object) - Mozilla Firefox

http://www.eramsinfo.com/media_erams_beta/eRAMS Practices/NRCS Standards/Waterway.pdf

412 - 1

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

GRASSED WATERWAY

(Ac.)

CODE 412

DEFINITION

A shaped or graded channel that is established with suitable vegetation to carry surface water at a non-erosive velocity to a stable outlet.

PURPOSE

- To convey runoff from terraces, diversions, or other water concentrations without causing erosion or flooding.
- To reduce gully erosion.
- To protect/improve water quality.

CONDITIONS WHERE PRACTICE APPLIES

In areas where added water conveyance capacity and vegetative protection are needed to control erosion resulting from concentrated runoff.

CRITERIA

General Criteria Applicable to All Purposes

Plan, design, and construct grassed waterways to comply with all Federal, State, and local laws and regulations.

Capacity. The minimum capacity shall convey the peak runoff expected from the 10-year frequency, 24-hour duration storm. Capacity shall be increased as needed to account for potential volume of sediment expected to accumulate in the waterway between planned maintenance activities. When the waterway slope is less than 1 percent, out-of-bank flow may be permitted if such flow will not cause excessive erosion. At a minimum, the design capacity shall remove the water before crops are damaged.

Stability. Determine the minimum depth and width requirements for stability of the grassed waterway using the procedures in the NRCS National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 7, Grassed Waterways; Agricultural Research Service (ARS) Agriculture Handbook 667, Stability Design of Grass-Lined Open Channels; or other equivalent method.

Width. Keep the bottom width of trapezoidal waterways less than 100 feet unless multiple or divided waterways or other means are provided to control meandering of low flows.

Side slopes. Keep the side slopes flatter than a ratio of two horizontal to one vertical. Accommodate the equipment anticipated to be used for maintenance and tillage/harvesting equipment that will cross the waterway in the designed width.

Depth. The capacity of the waterway must be large enough so that the water surface of the waterway is below the water surface of the tributary channel, terrace, or diversion that flows into the waterway at design flow.

Provide freeboard above the designed depth when flow must be contained to prevent damage. Provide freeboard above the designed depth when the vegetation has the maximum expected retardance.

Drainage. When needed to help or keep vegetation established on sites having prolonged flows, high water tables, or seepage problems, include Subsurface Drains (606), Underground Outlets (620), stone center waterways or other suitable measures in waterway designs.

NRCS, NHCP

Done

eRAMS

Map | LUI | Scenarios | Ass

Select fields with name: Field1

- Bank Stabilizatio
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- Crop Rotation
- Fertilizer Managem
- Field Borders
- Filter Strips
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- Irrigation
- Land Use
- Pesticide Managem
- Ponds
- Riparian Strips
- Sediment Detention

Photo courtesy of NRCS

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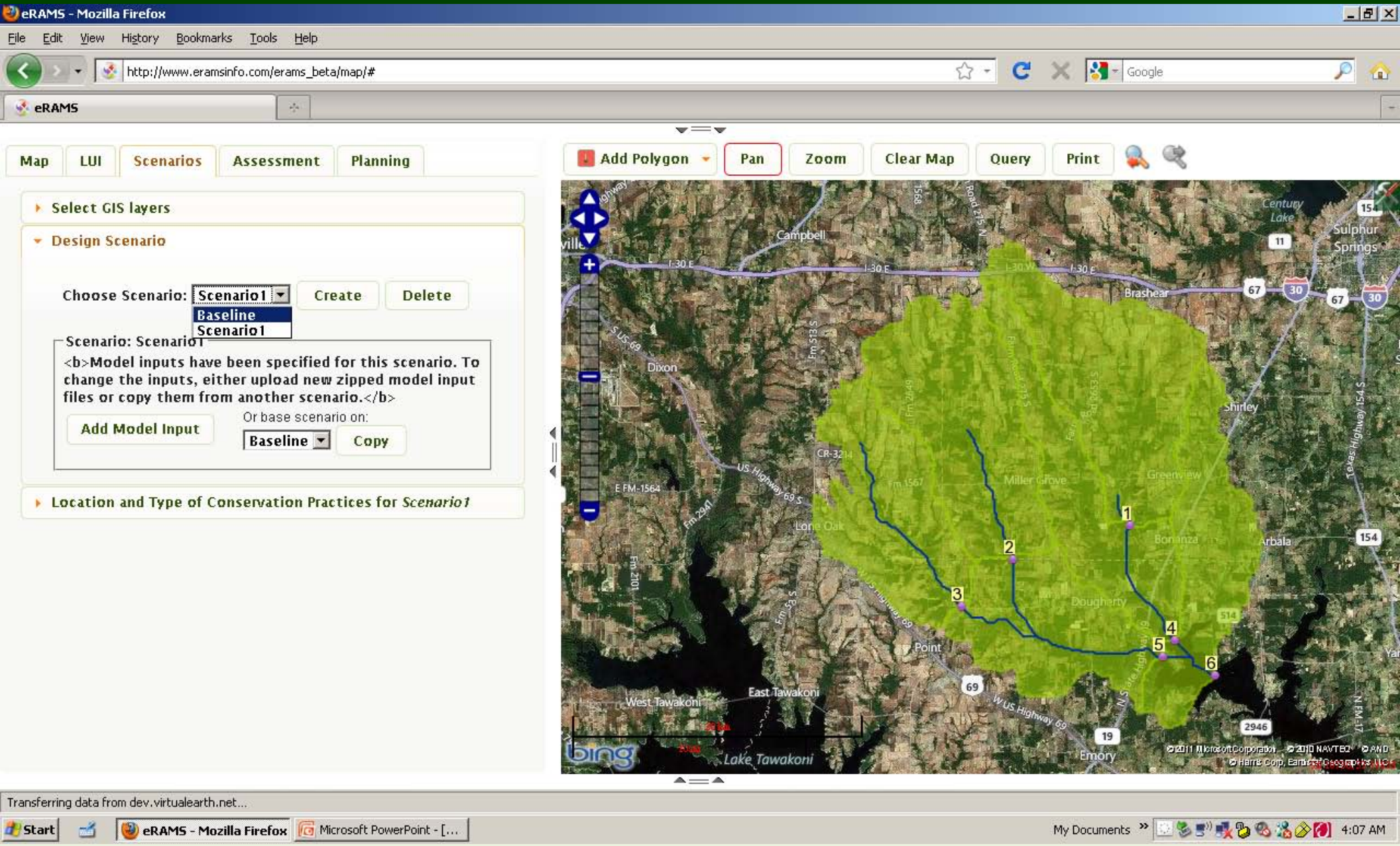
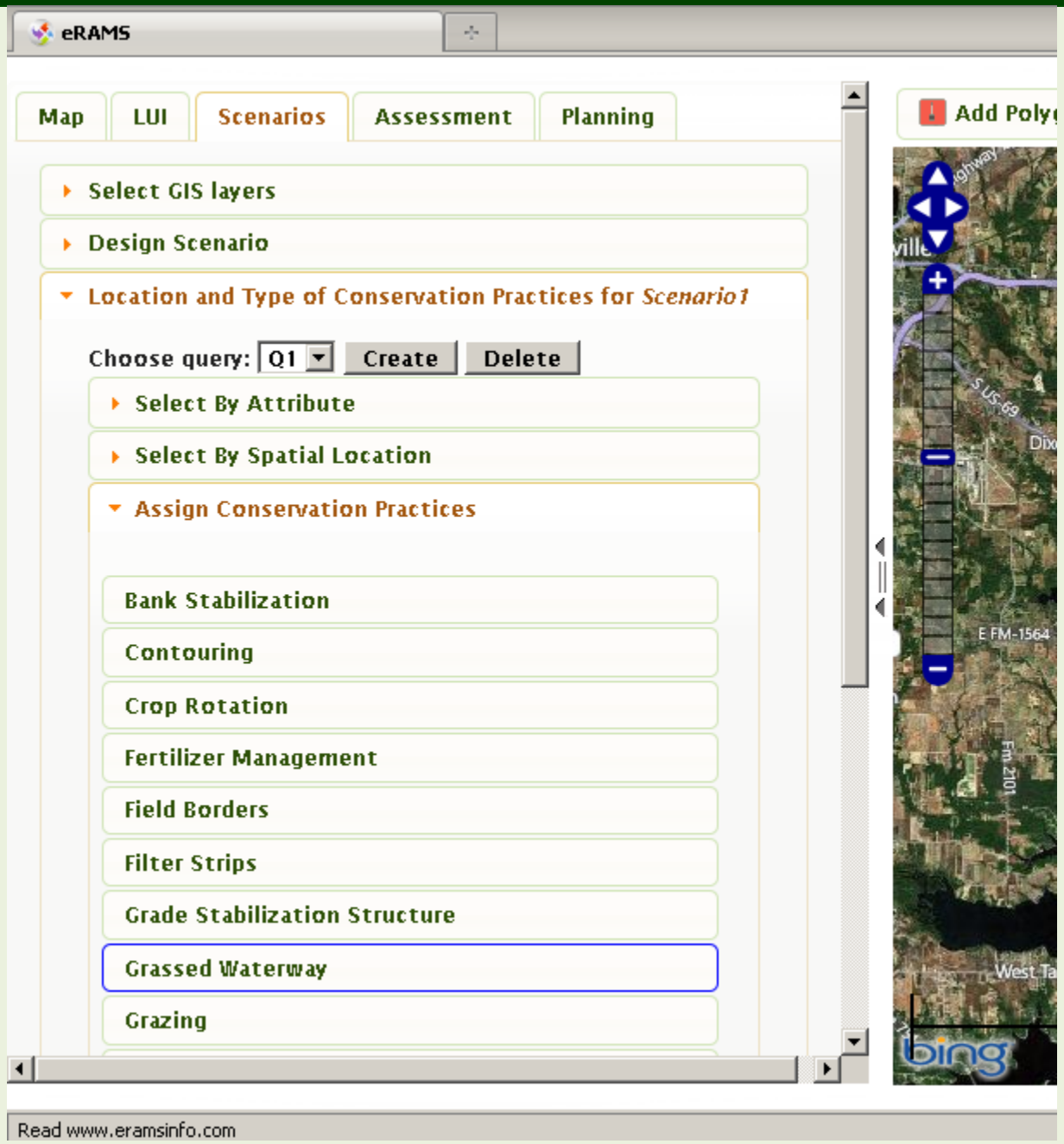
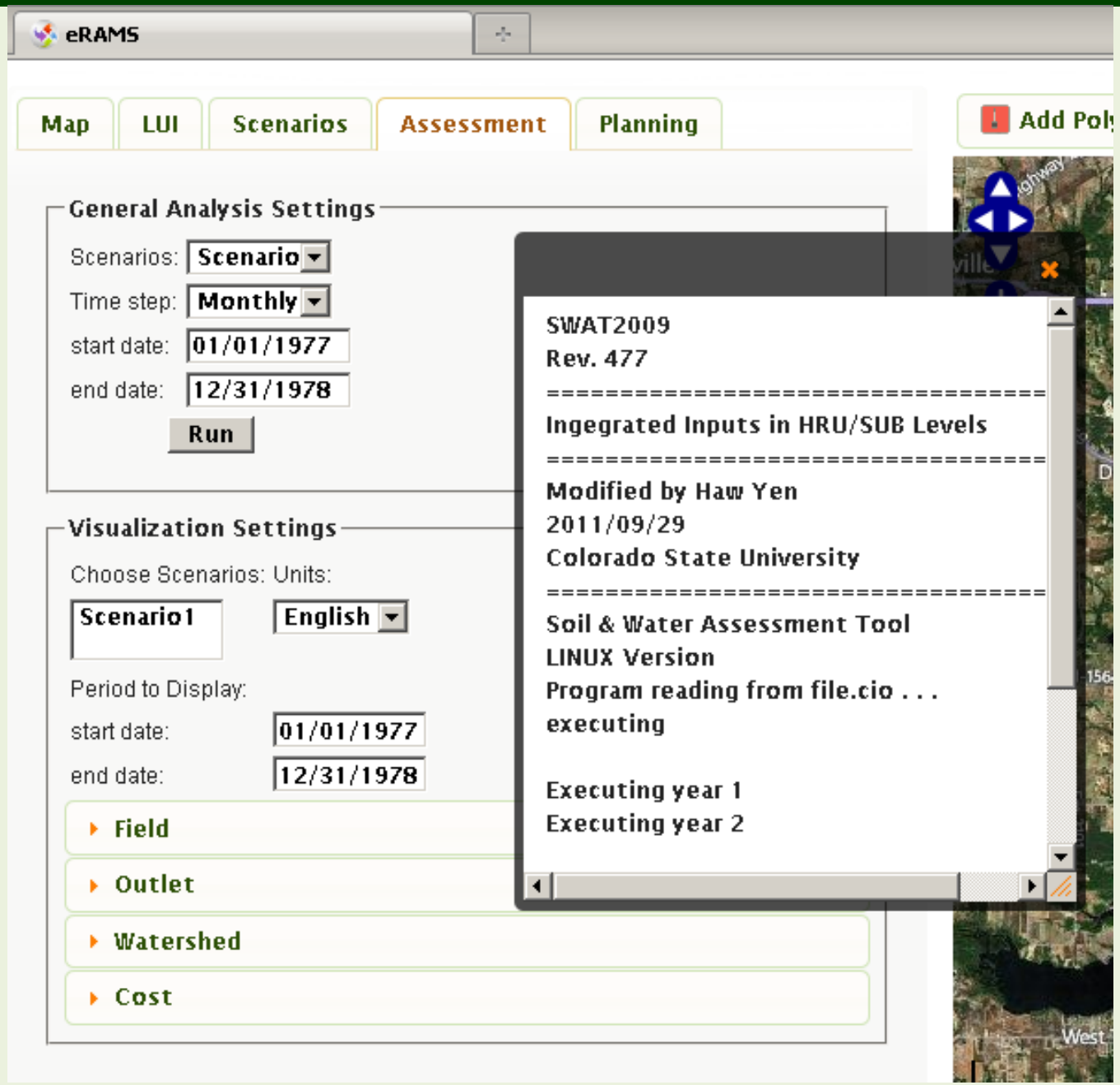
Scenario Builder



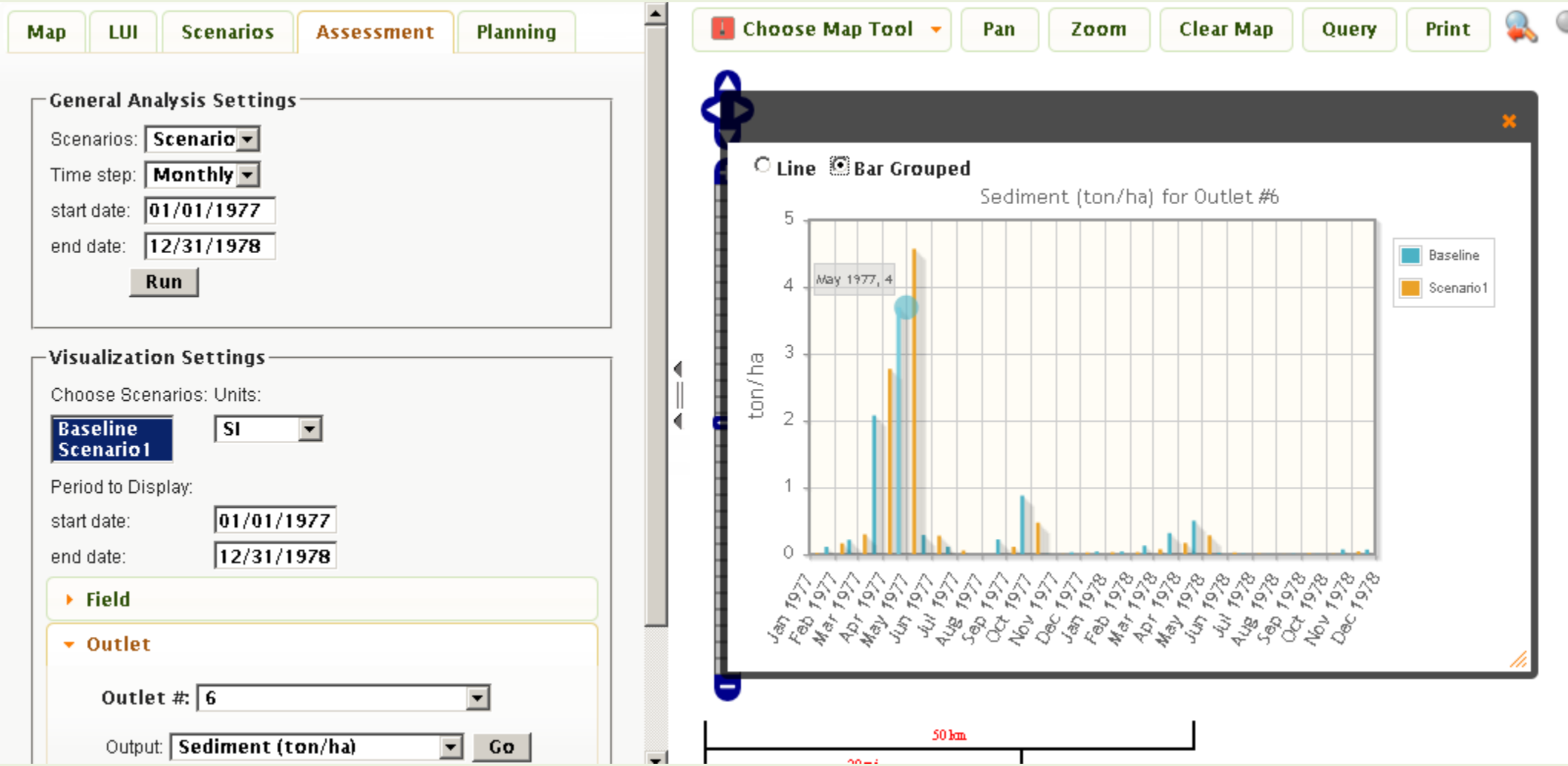
Locations to Implement Changes



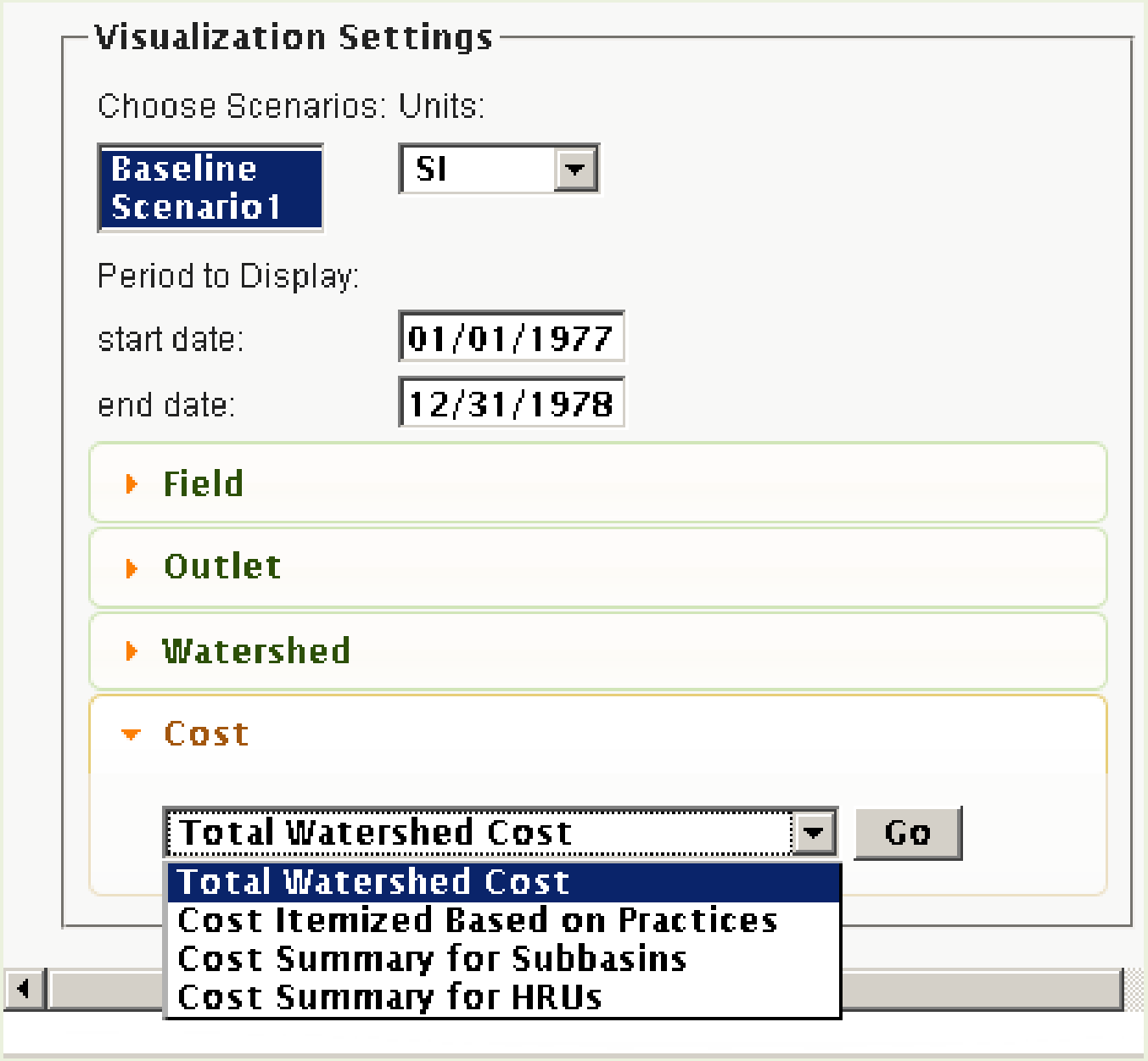
Dynamic Assessment of Scenarios



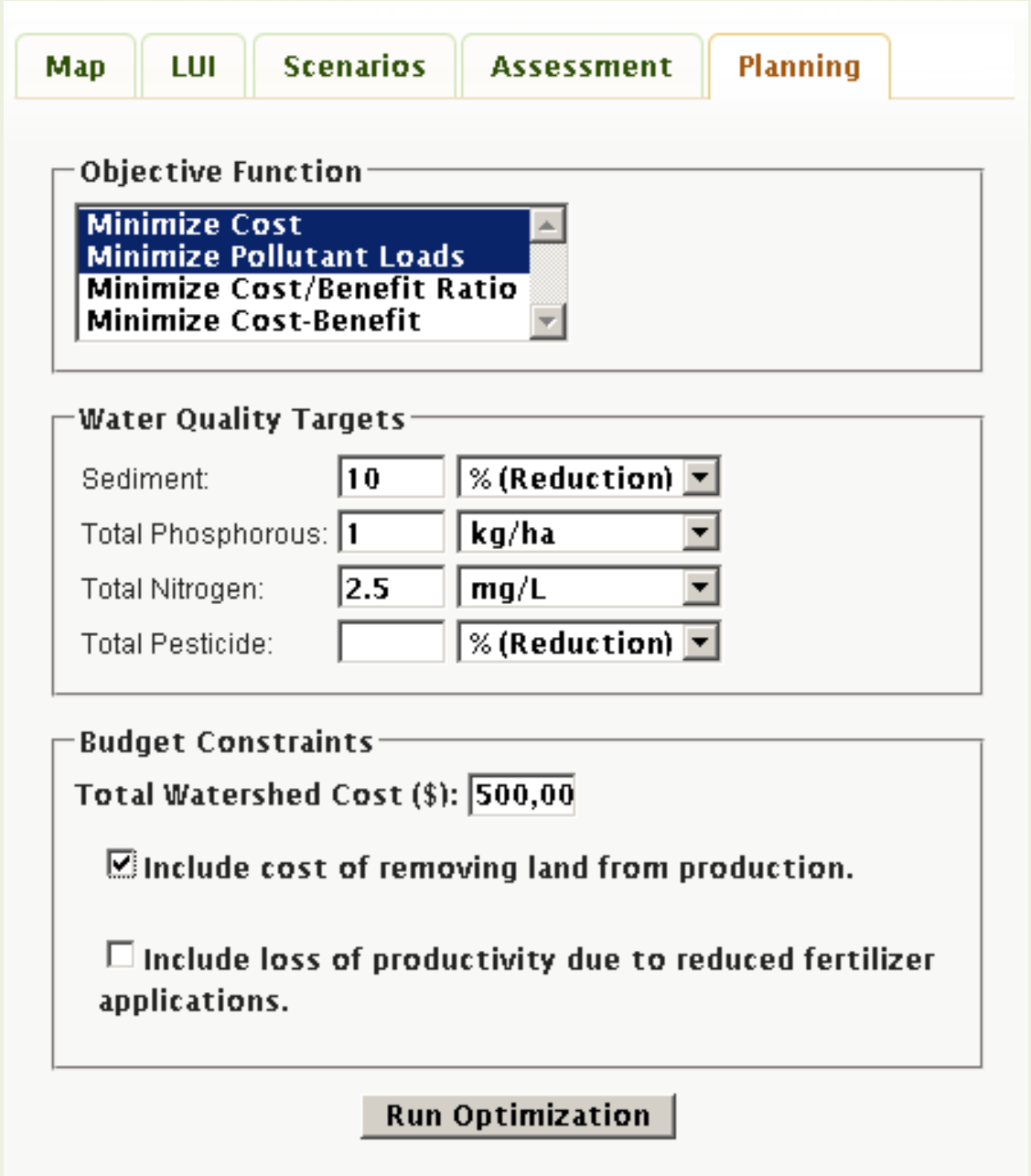
Visualization



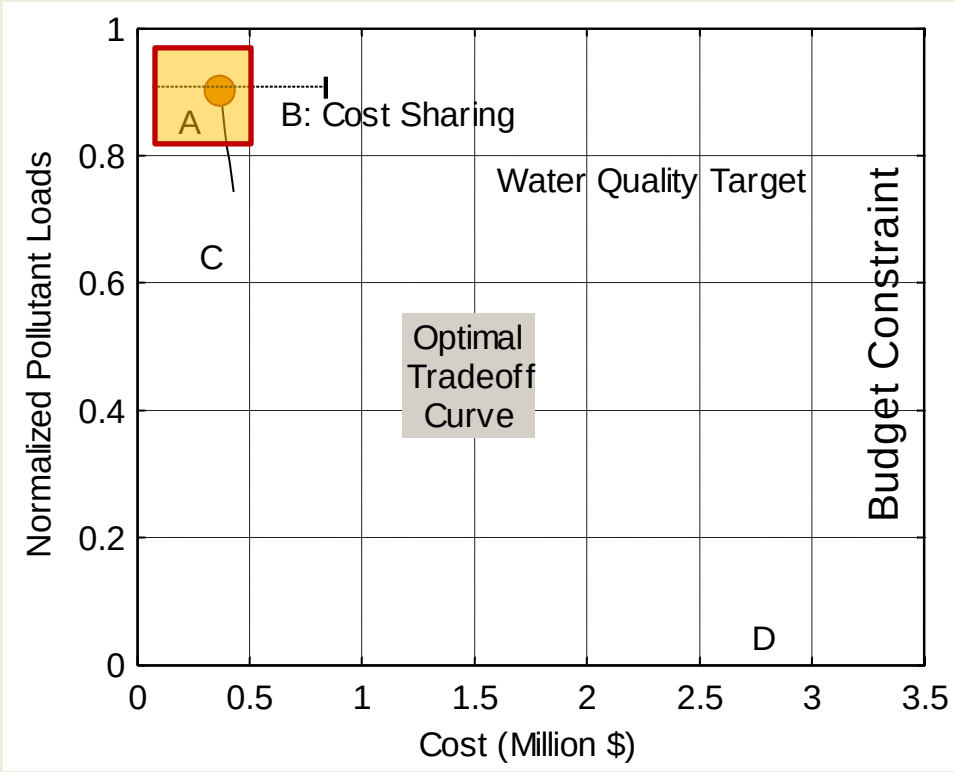
Cost Comparison

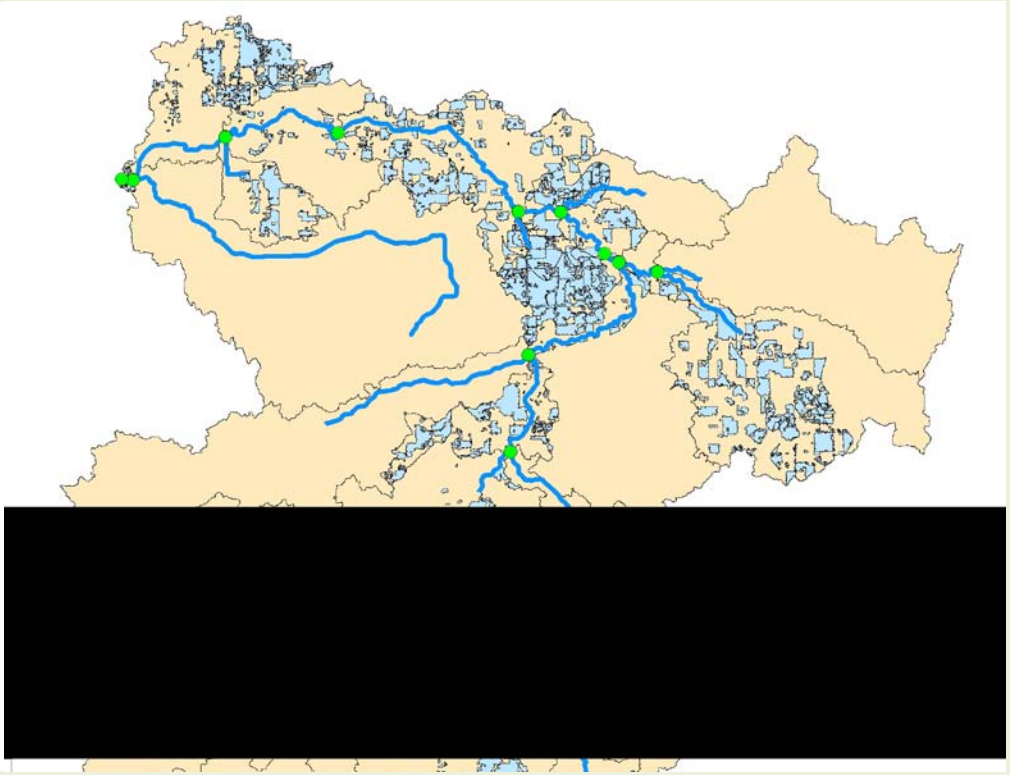


Optimization-Based Targeting

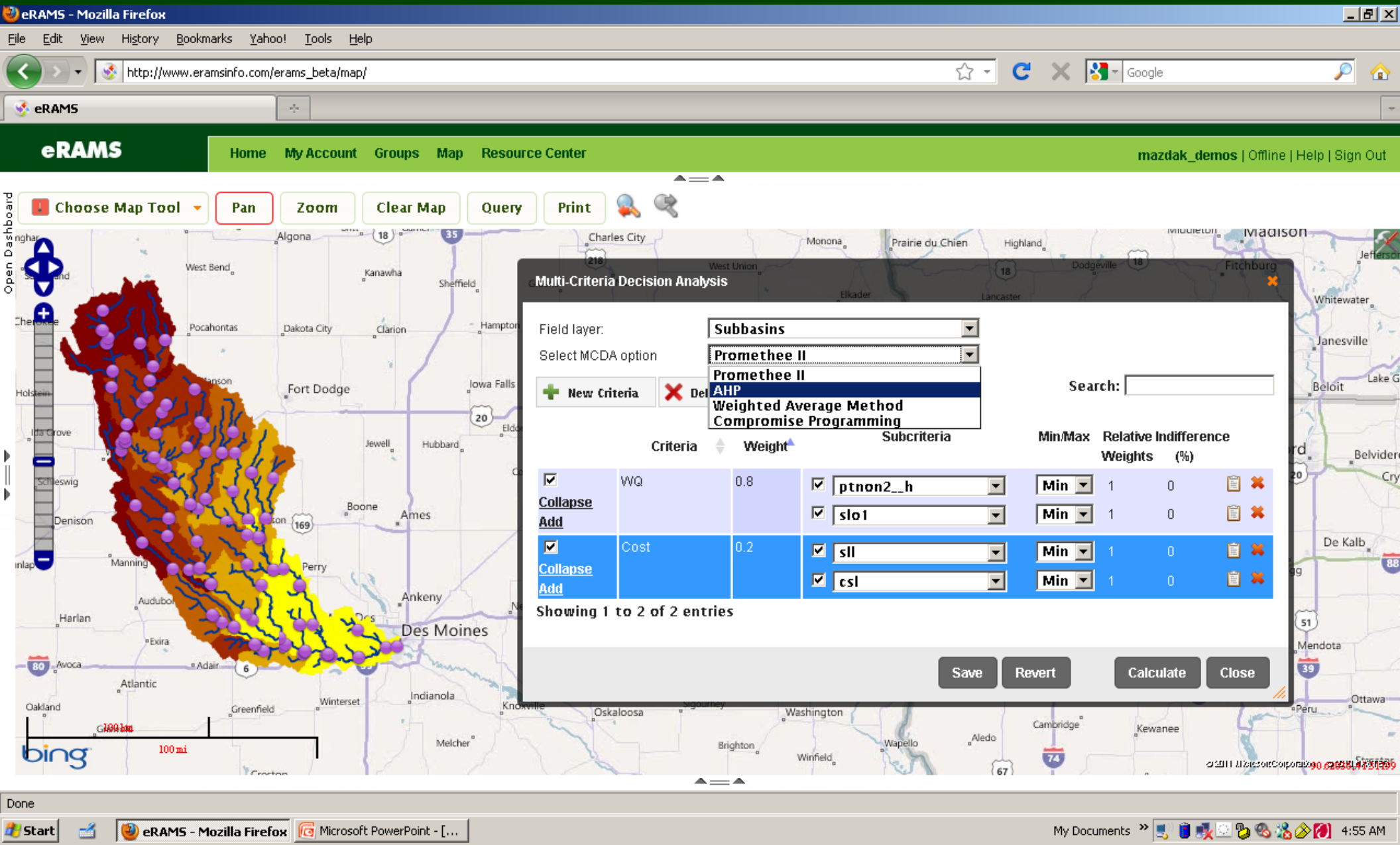


Optimization Module





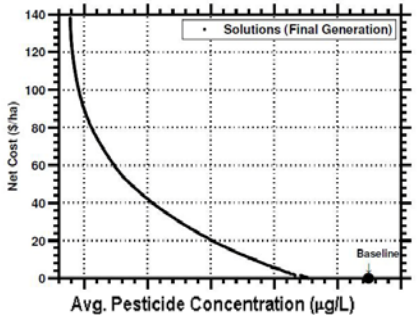
Multi-Criteria Decision Analysis



Efficient Communication

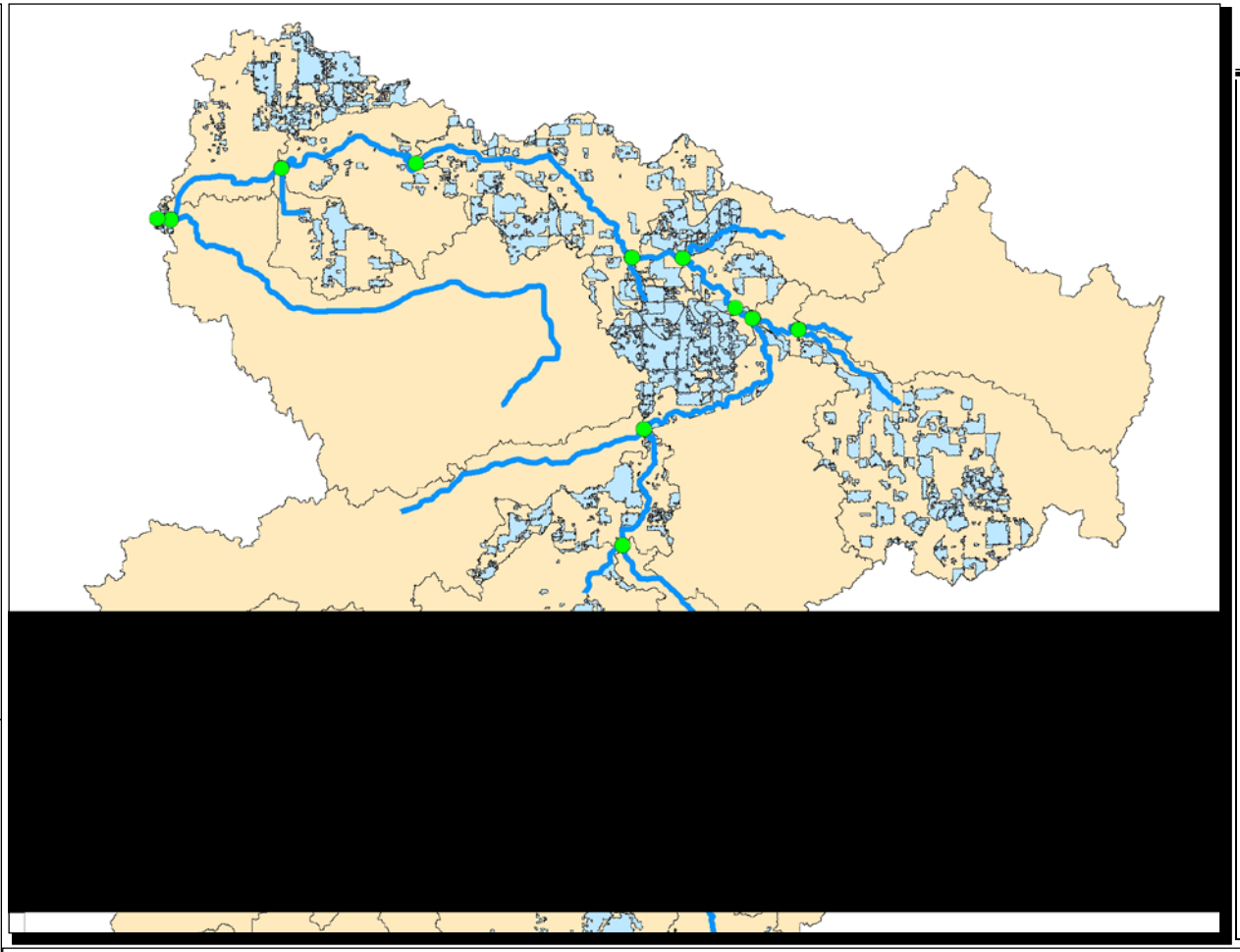
Economic Conservation Practice Placement to Reduce Atrazine Concentration Levels in the Wildcat Creek Watershed

Wildcat Creek Watershed Objective: reduction of atrazine loads into the Kokomo reservoir by 10% (Concentration reduction target from average 3.31 µg/L to 3.0 µg/L, EPA MCL).



Finding a balance between cost and environmental improvements.

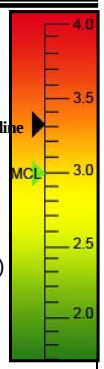
This recommendation on where to target conservation implementation (provided in the map to the right) is based on the above cost / benefit placement. As demonstrated by the curve, reducing pesticide concentration generally requires the increased cost of conservation practices installation. Choosing how to address water quality concerns is a unique decision for each community, and can be affected by a water quality improvement goal, or the budgetary resources available.



Cost Breakdown of Recommendation

Practice	Cost ($)
Pesticide Management	
Filter Strips	
Residue Management	
Tillage– No Till	
TOTAL COST ($)	$ xxxx.xx

Atrazine Concentrations and Targets



Source of Pollutant in Drinking Water
Runoff from herbicide used on row crops

Maximum Contaminant Level (MCL)
0.003 milligrams per Liter (mg/L) or 3 parts per billion (ppb)

Maximum Contaminant Level Goal (MCLG)
0.003 mg/L or 3 ppb

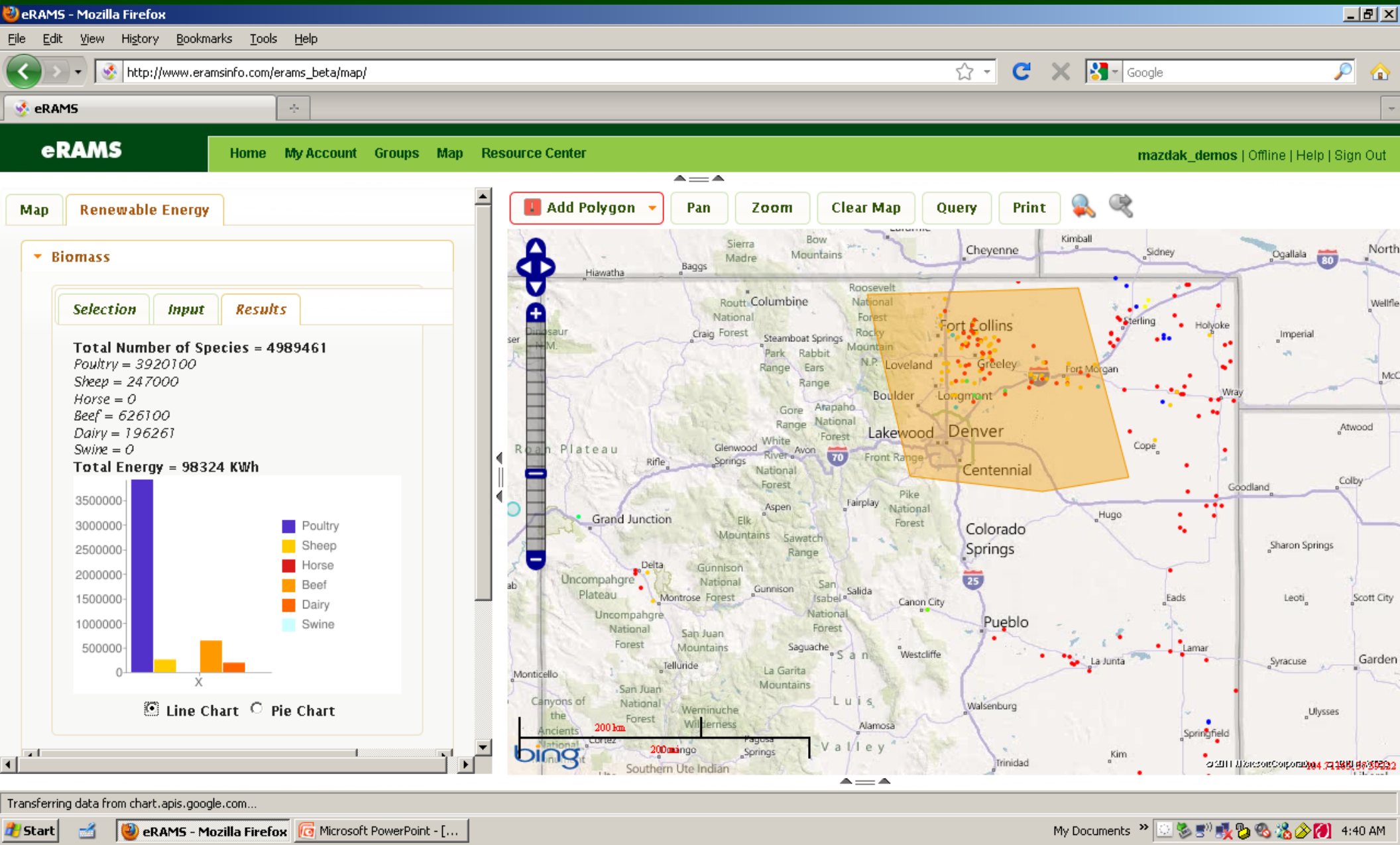
Health Effects
Some people who drink water containing atrazine in excess of the MCL over many years could experience problems with their cardiovascular system or reproductive difficulties.

More information
http://epa.gov/ogwdw/contaminants/basicinformation/atrazine.html#one

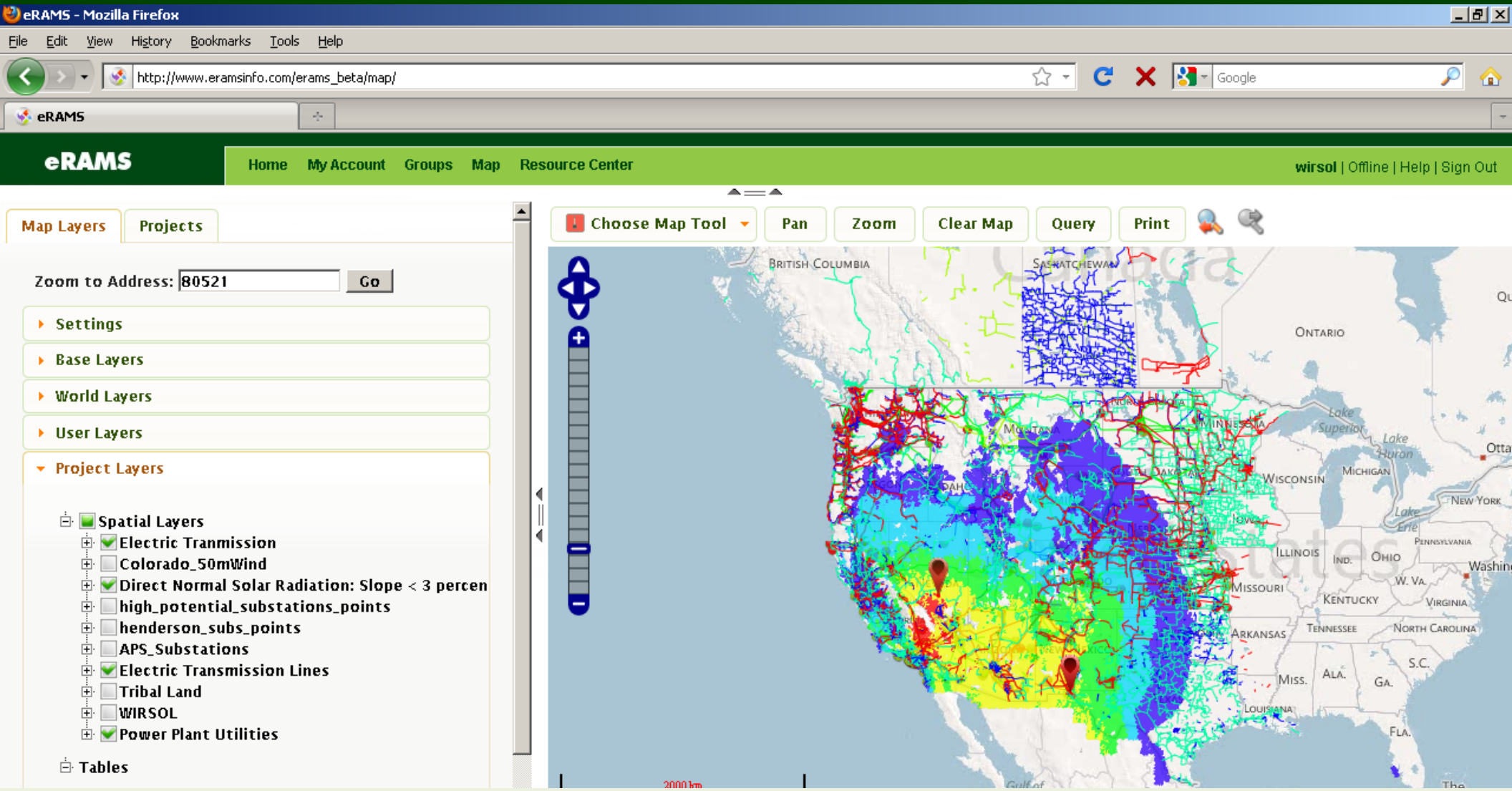
Targeted Conservation Practice Influences on Water Quality

Practice	Influence	Estimated Benefit(s) Across Watershed
Pesticide Management	Reduces application rates, etc.	xxx ug/L
Filter Strips	Filters surface	xxx ug/L
Residue Management/No Till	Reduces erosion	xxx ug/L

Biomass Energy



Solar Energy



eRAMS Applications

- Iowa NRCS
  - Watersheds
    - Raccoon River Watershed
    - Maquoketa River Watershed
    - Boone River Watershed
  - Analysis
    - Wide-area assessment
      - High-cut analysis
      - Rapid watershed assessment
      - Multi-criteria decision analysis
    - Design components
      - e.g., ponds

eRAMS Applications

- Arkansas NRCS
  - Watersheds
    - Three priority HUC8 watersheds within the MRBI
  - Analysis
    - Benefits of existing practices
    - Identifying suites of cost-effective practices

- California Fish and Wildlife Coop.
  - Three HUC8 Oregon watersheds
  - Benefits of wetlands
  - Priority areas for wetland restoration

Funding Agencies

- USDA NRCS
- USDA NIFA
- USDA AES
- US EPA
- NSF

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