Building great web maps

ArcGIS Developer Summit

Clint Brown, ESRI

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Role of GIS Users in Your Organization

Build and share authoritative geographic information

- Your GIS users build and maintain critical sets of geographic information
  - Authoritative
  - Up-to-date
  - Mission-critical
- Web maps help GIS users leverage their information
  - Useable
  - Consumable
  - Actionable
- Your role
  - Help your GIS staff unlock and deploy this information on the web

Integrated collections of spatially related datasets

The Web means:

- Federated network architecture
- Simple and fast user experience
- Content is key
  - Rich
  - Authoritative
- Web programming models
- Participation in a larger “ecosystem”
- Power to aggregators
- “Cloud computing” paradigm

GIS professionals will continue to integrate the web into ArcGIS

Web 2.0 -- Second generation web tools

- **The web organizes access to rich digital information**
- **Specialized content has the potential to help certain communities get their work done, solve problems, communicate, etc.**
- **The web enables users to integrate multiple information sources**

Facilitates collaboration and sharing between users

Consumer maps like Google Earth and Microsoft Virtual Earth have defined a new user experience

Microsoft Virtual Earth

3D

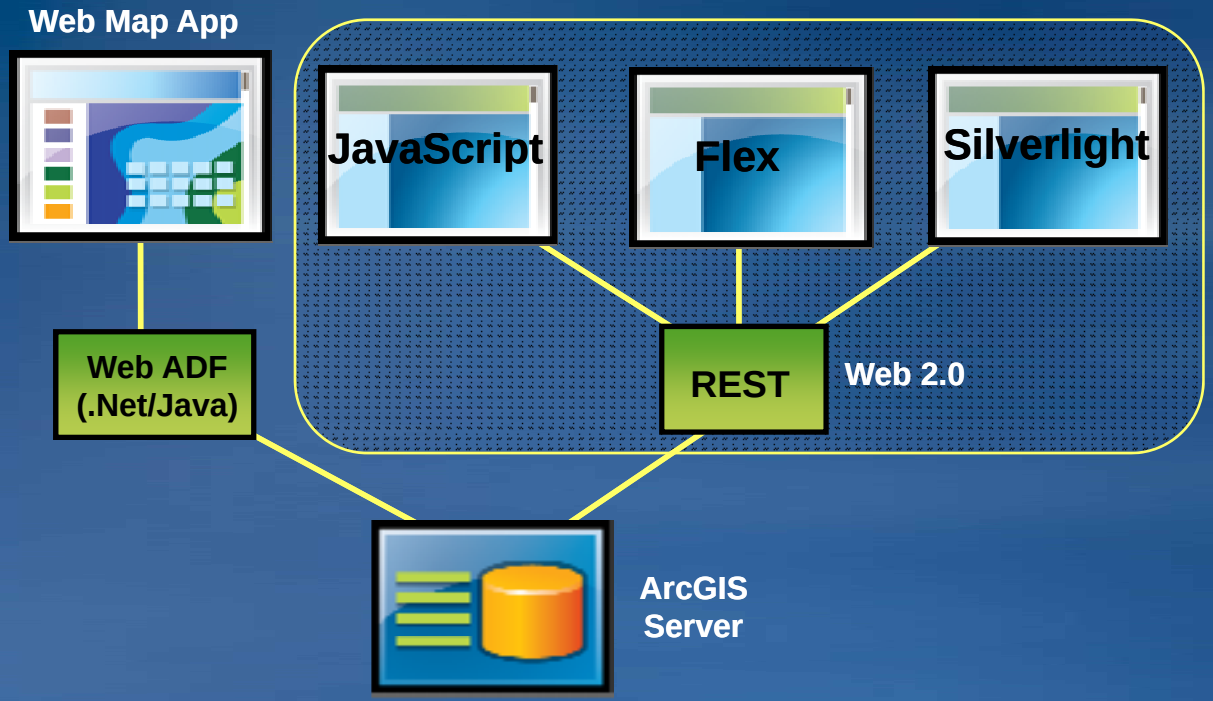
Google Maps

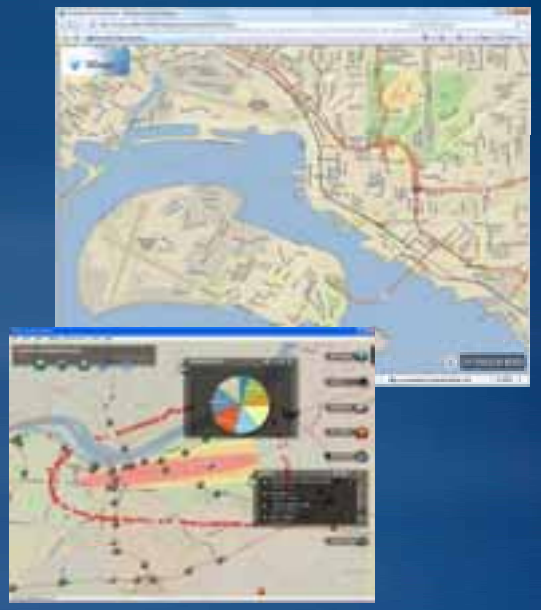
Google Earth

Most GIS applications will have to support this

ArcGIS Server 9.3 Supports New Web Clients

Rich Internet Applications. New at 9.3

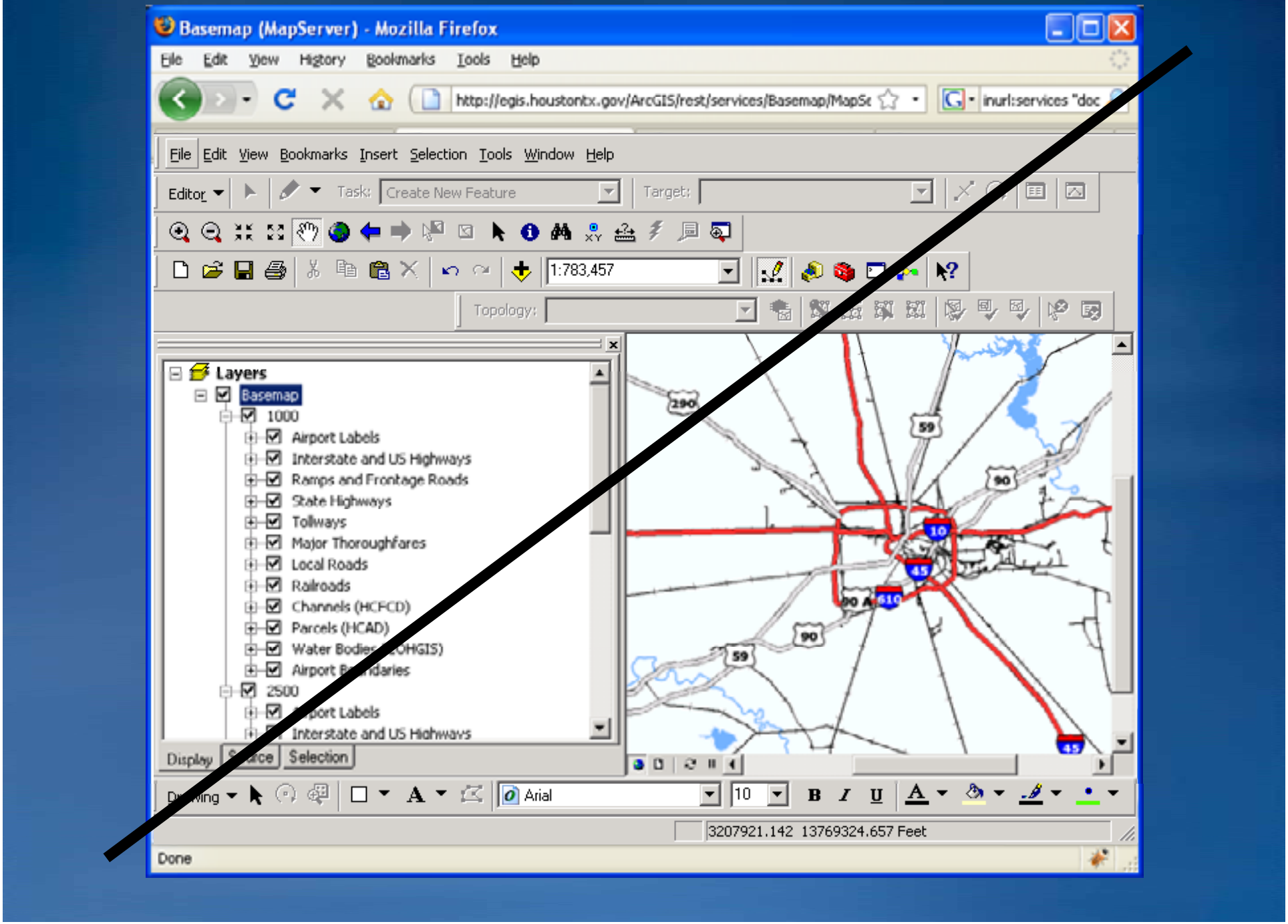




. . . Fast, Flexible, & Agile

What is a web map?

- One or more map services
- Integrated into a web application
- That users interact with
- To accomplish meaningful tasks

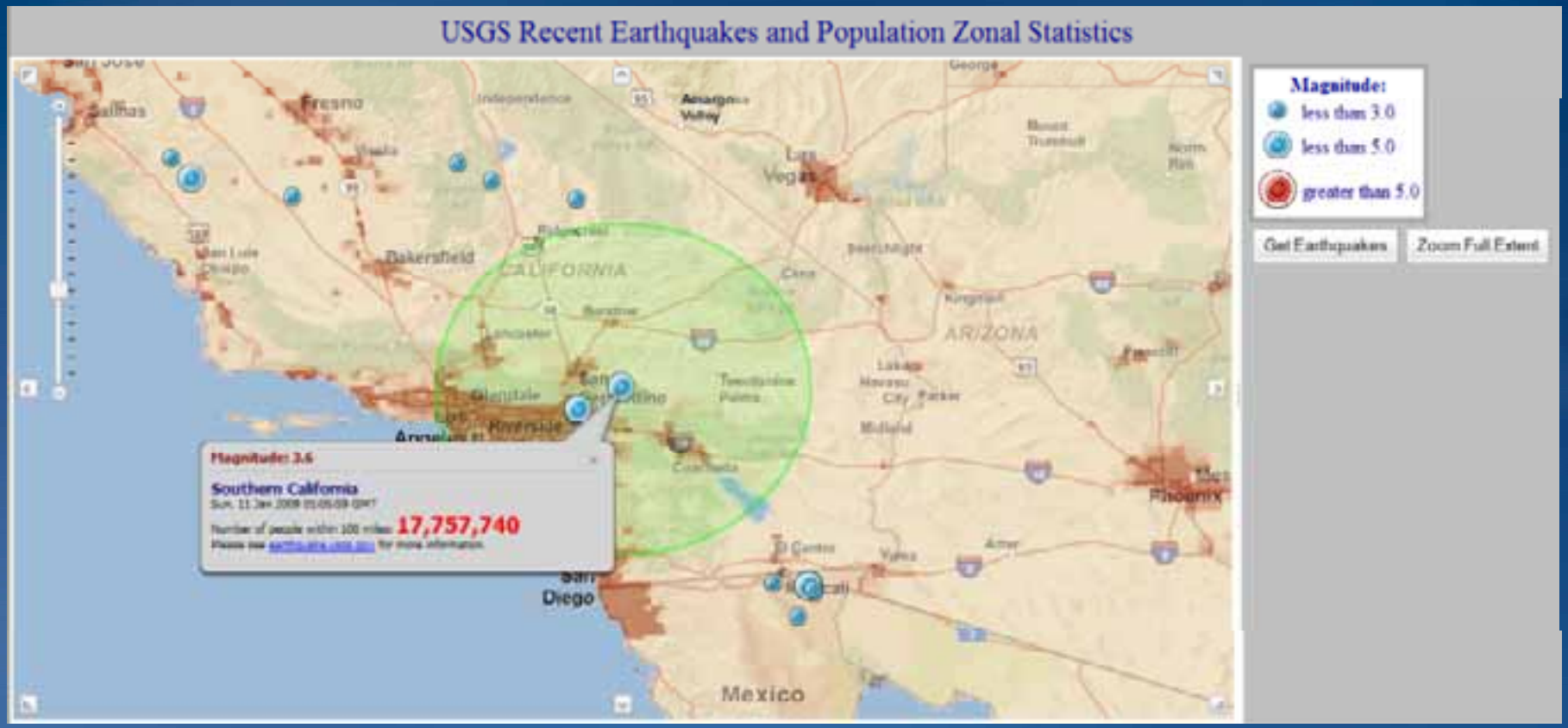

Basemap (MapServer) - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://egis.houstontx.gov/ArcGIS/rest/services/Basemap/MapSe
File Edit View Bookmarks Insert Selection Tools Window Help
Editor
Task:
Create New Feature
Target:
1:783,457
Topology:
Layers
Basemap
1000
Airport Labels
Interstate and US Highways
Ramps and Frontage Roads
State Highways
Tollways
Major Thoroughfares
Local Roads
Railroads
Channels (HCFCD)
Parcels (HCAD)
Airport Boundaries
2500
Interstate and US Highways
Display
Selection
290
59
90
10
45
610
Arial
10
3207921.142 13769324.657 Feet
Done

What makes a great web map?

- **Great cartography**
- **Multi-scale**
- **Fast**
- **Informative**
- **Easy-to-use**
- **Meets user's expectations**
- **Delivers the information that the user needs in an easy-to-understand form**
- **GIS user's view**
  - **Contains my authoritative information**
  - **Makes my information useable and useful**
  - **Up-to-date**
  - **Easy to deploy and maintain**

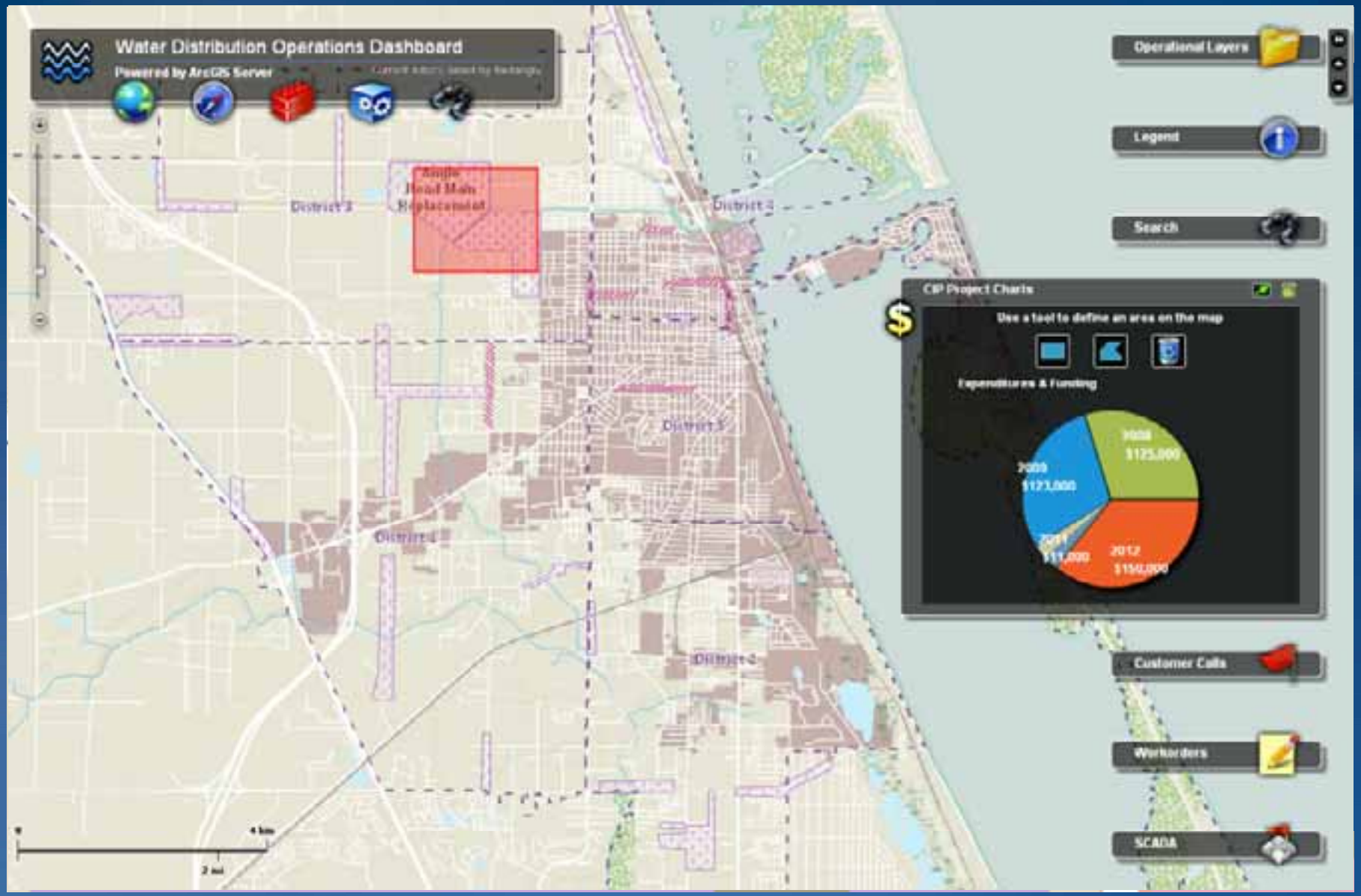
Web Map Examples

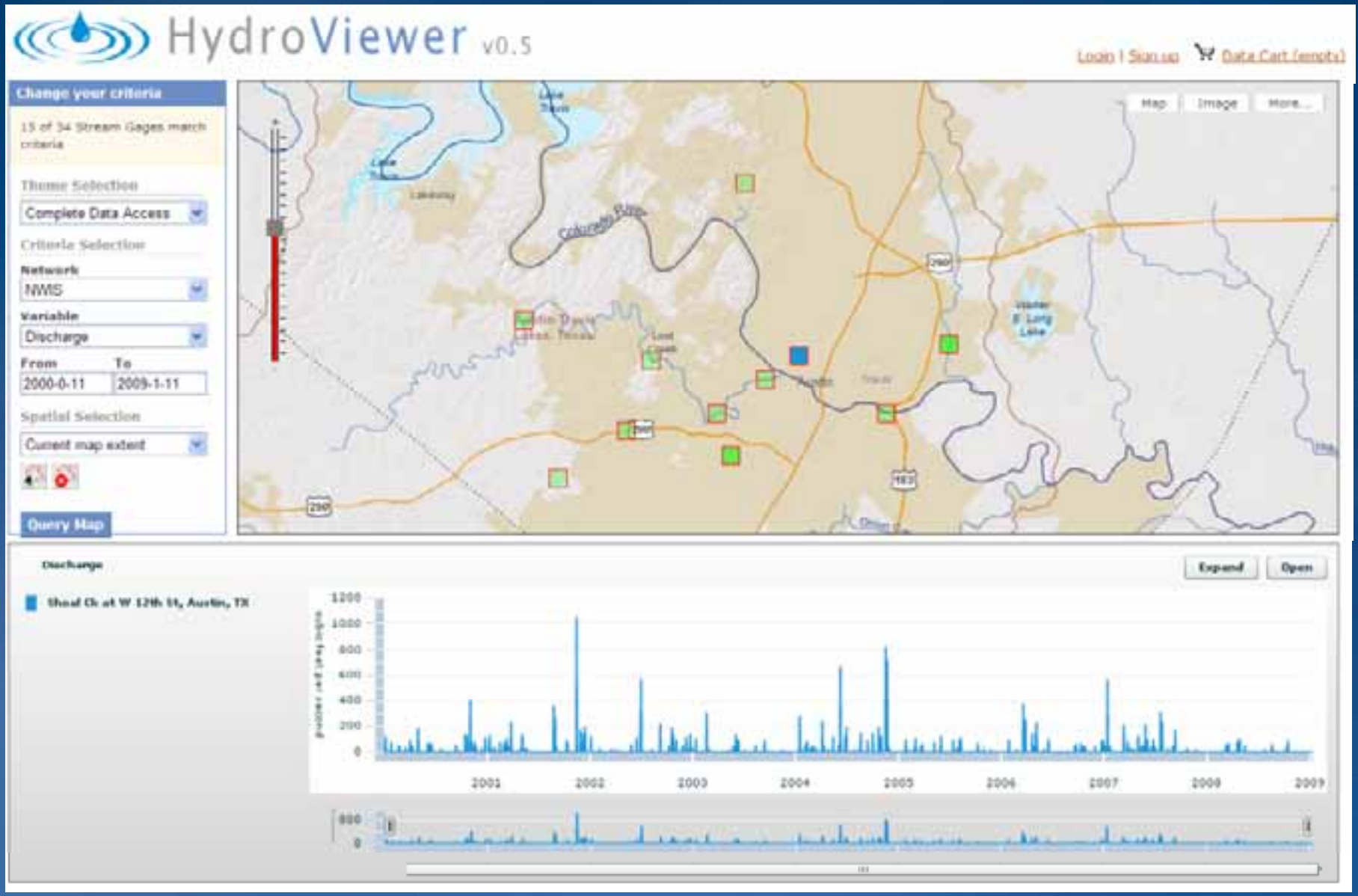
Reach "through" your map to other data, systems, services, . . .



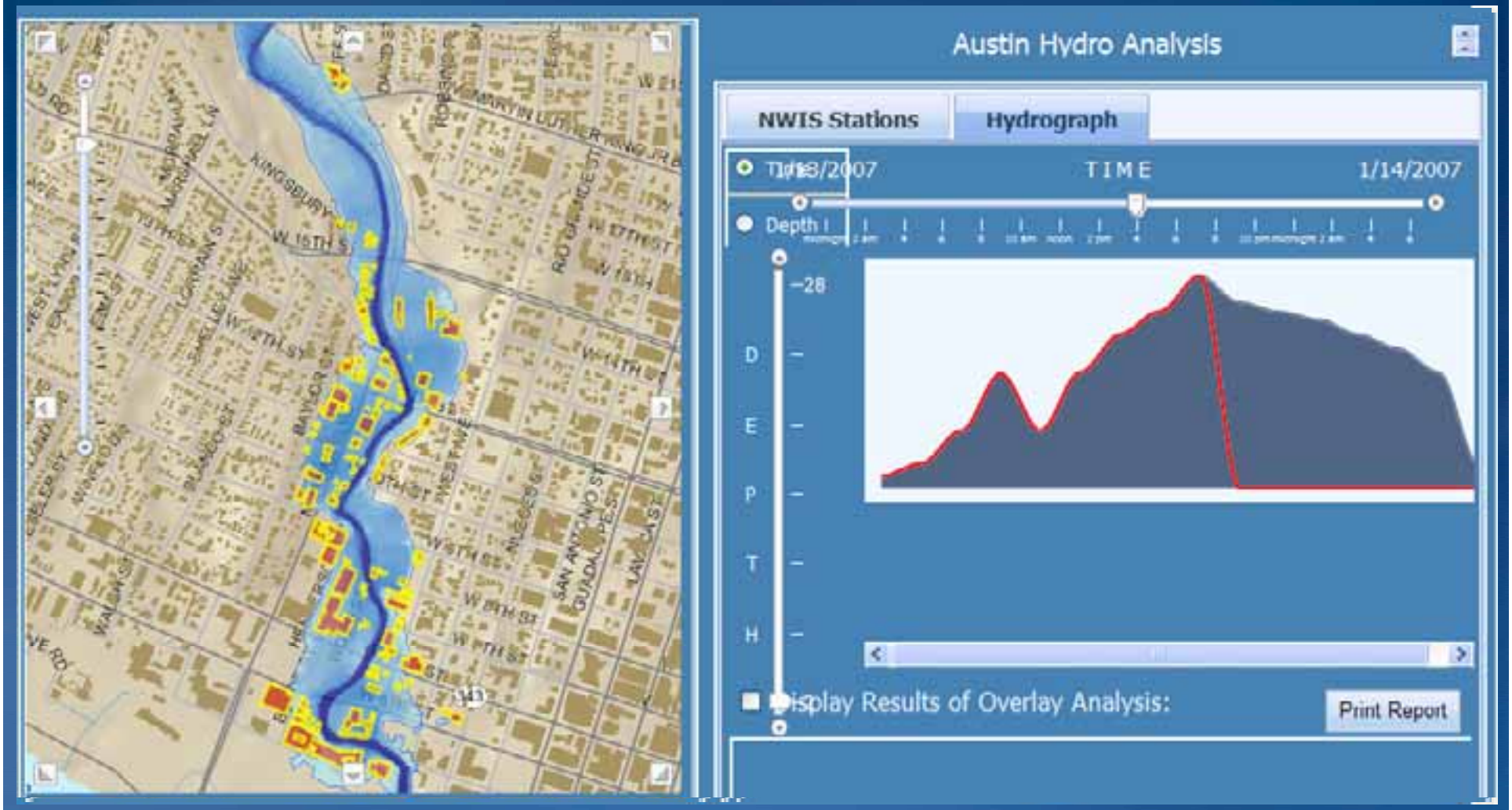
Access analytical operations through the map.

Popup feature attributes through the map


Water Distribution Operations Dashboard
Powered by ArcGIS Server
Operational Layers
Legend
Search
CIP Project Charts
Use a tool to define an area on the map
Expenditures & Funding
$125,000
$173,000
2012
$150,000
Customer Calls
Workorders
SCADA
District 1
District 2
District 3
District 4
District 5

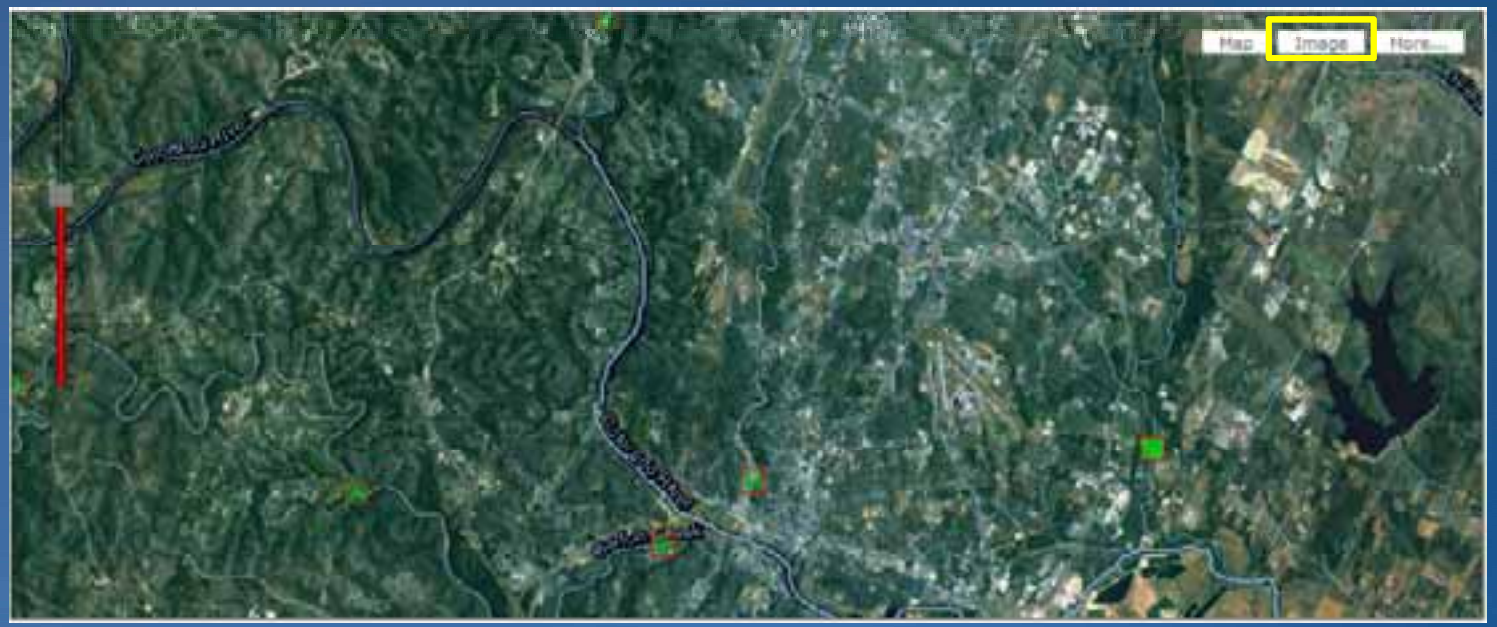


Access live web services (WSDL's) through the map



Use results of advanced analysis in the web map

Toggle between base maps



Web Map Patterns

Elements of a Web Map

1. **Multi-Scale Base Maps**
   - One or more base maps that provide a framework or context for displaying operational information layers
2. **Operational Layers**
   - Working layers
   - Feeds, observations, sensor, incidents
   - Query results
   - Model results
3. **Information Popups and Reports for Operational Layers**
   - Map layers as interactive reports
4. **Web Map Application**
   - Configure vs. program

Base Maps

Image Base Map

Land Base + Water Facilities

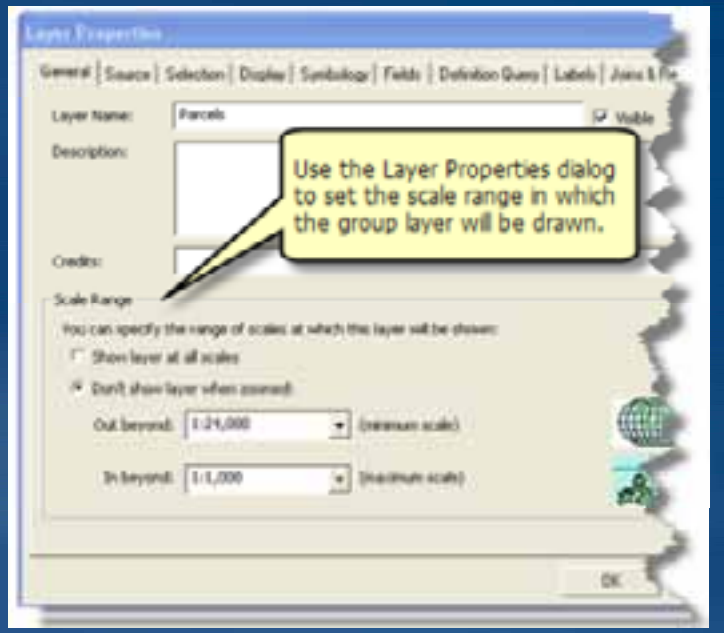
City Map

Hydro Base

Topo Map

Street Map

How to build a base map



Using ArcMap

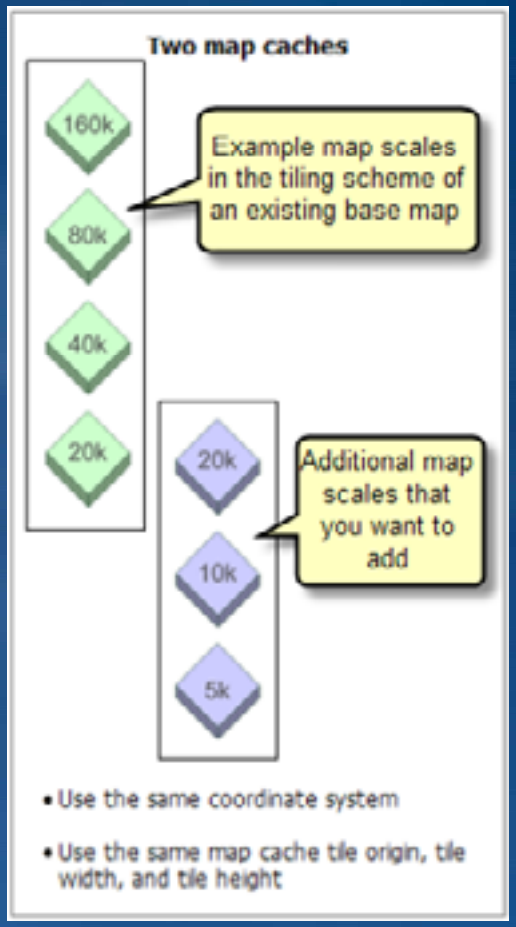
1. Define map scales
2. Build a map for each map scale (All layers)
3. Put the set of layers for each map scale in a group layer
4. Set scale-dependent drawing for each group layer
5. Generate a cached map service

Navigating and working with a base map

- All clients support Pan / Zoom
- Locators
  - ArcGIS Explorer Build 900
- Interactive feature reports (e.g., general reports in City Map)

Selecting the Coordinate System and Tiling Scheme for your Web Map

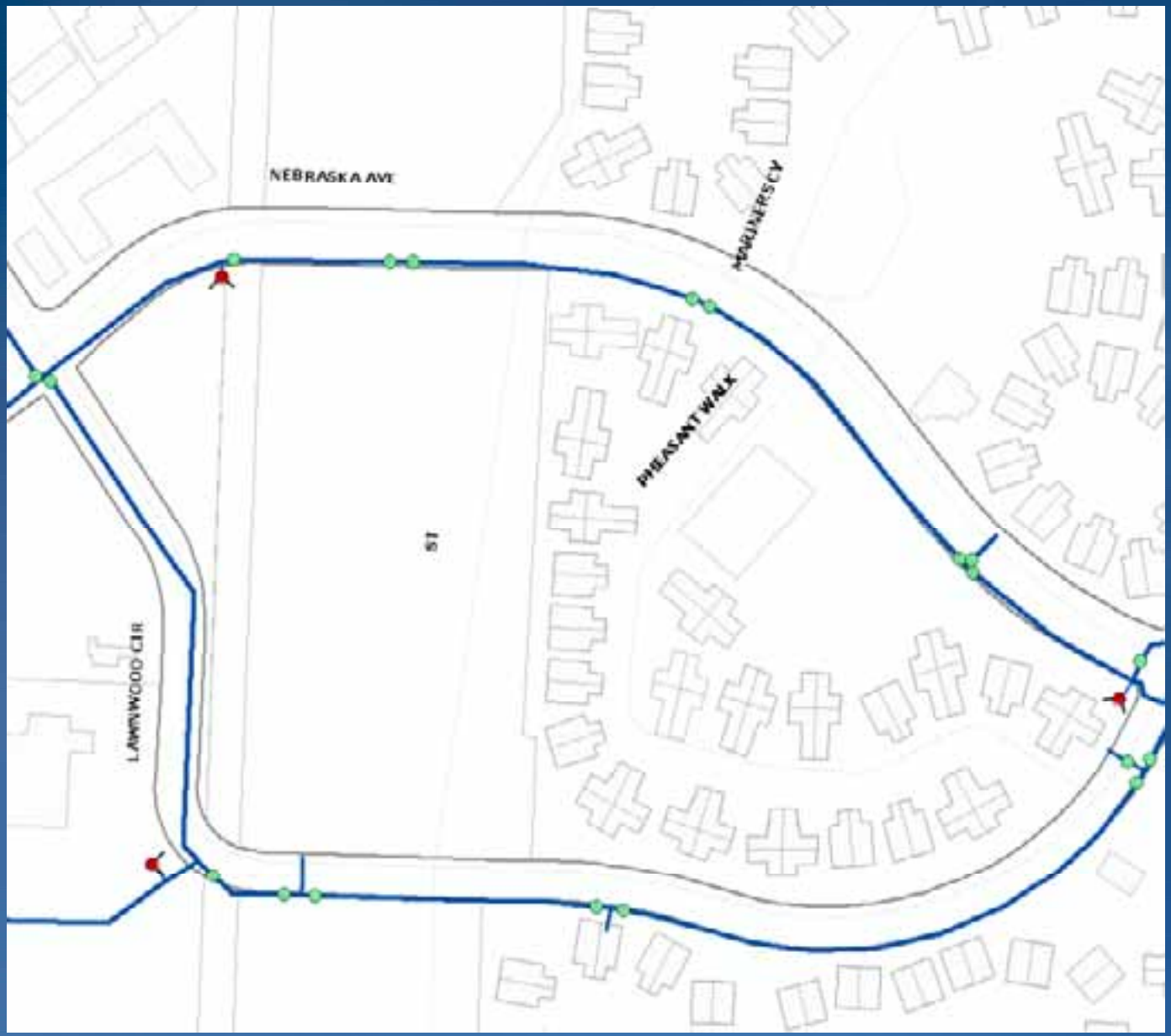
- You can extend an existing web map
  - ArcGIS Online
  - Microsoft Virtual Earth
  - Google Maps
- Use the same tiling scheme
  - Easy to set in ArcGIS Server
- Build maps for the set of desired map scales



Users do not have to "build it all."

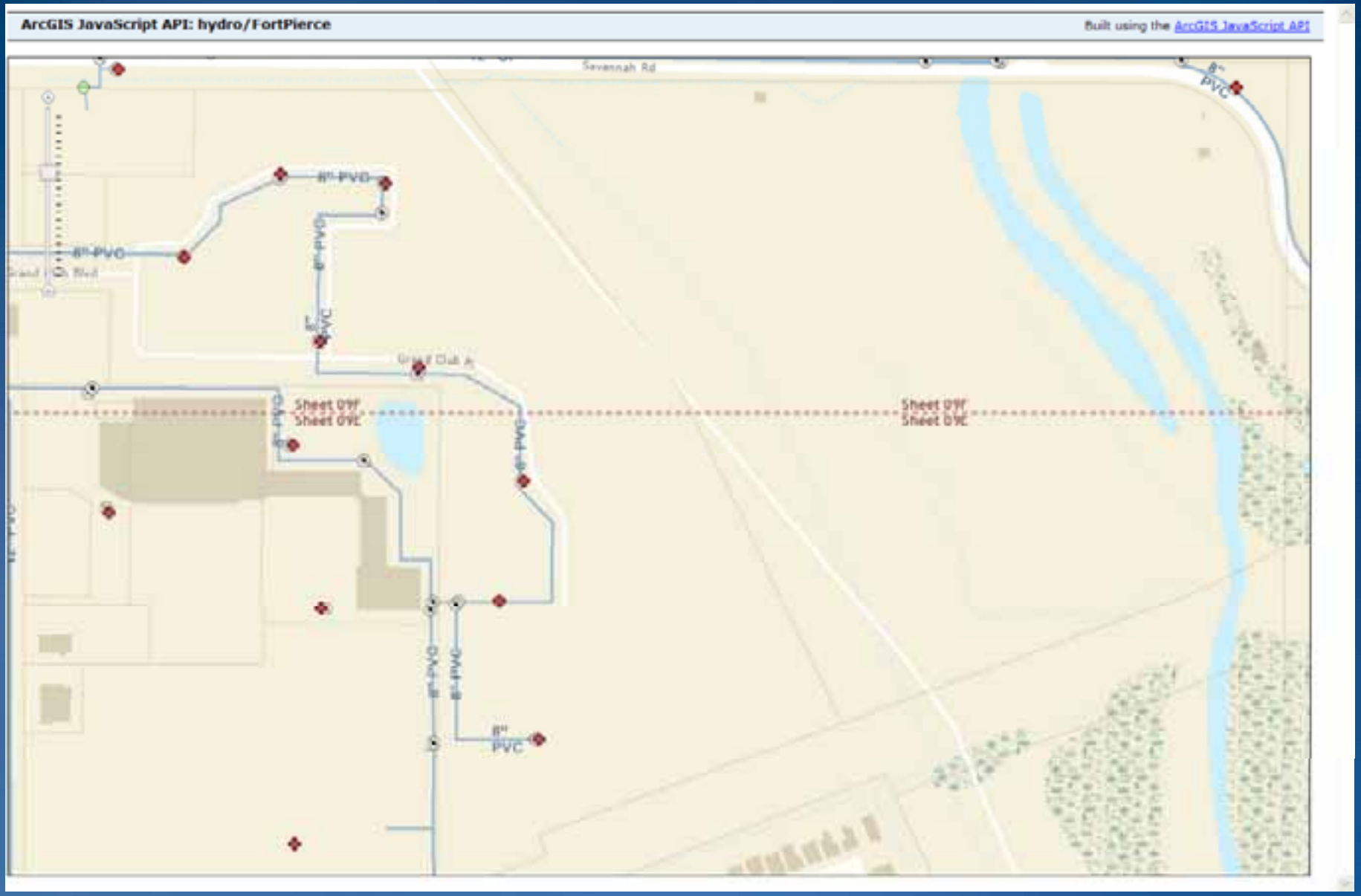
ESRI will build and share Base Map Templates

Great maps bring GIS information to life



Base Map Templates

Great maps bring GIS information to life

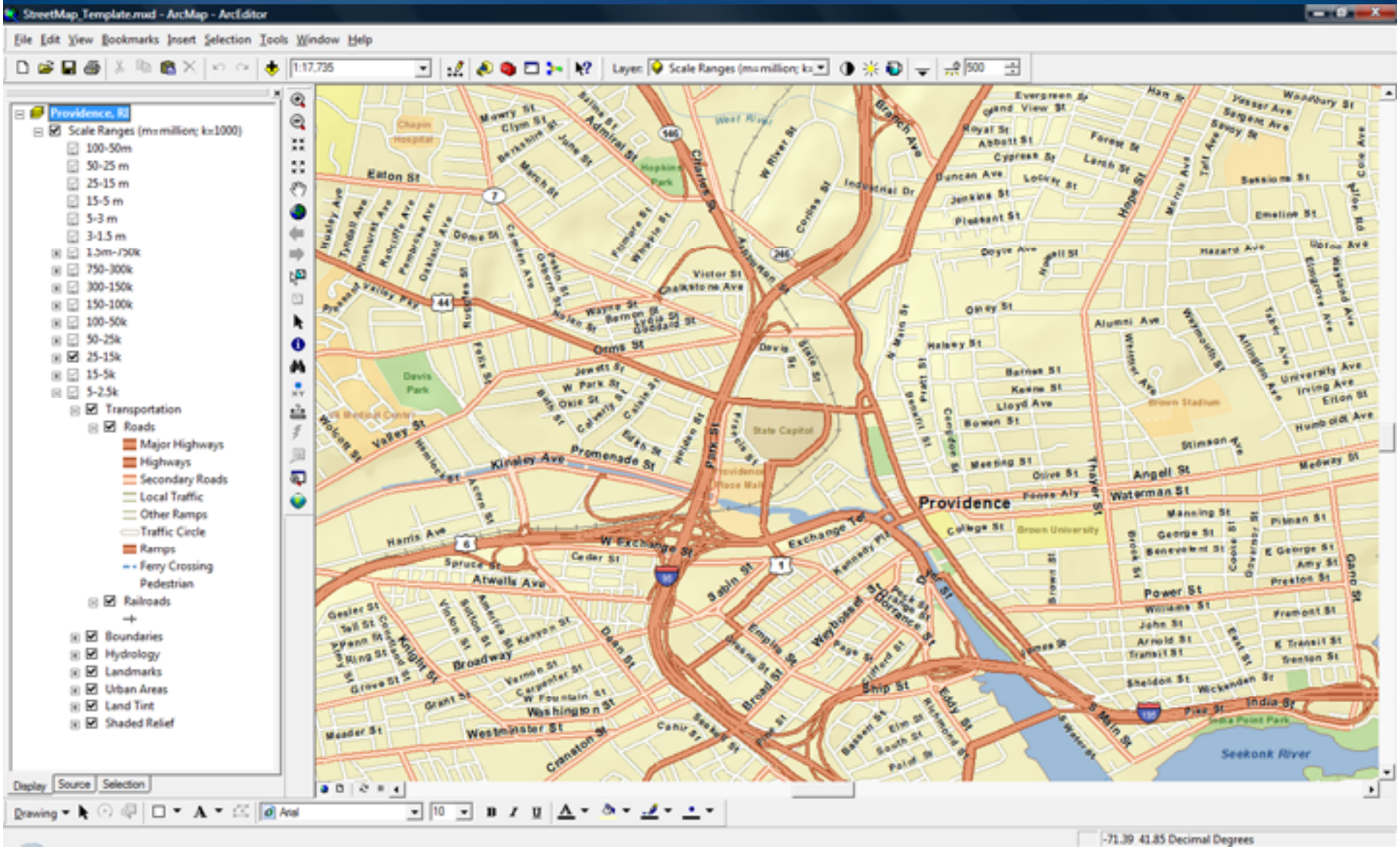


New Base Map Templates – ArcGIS Online

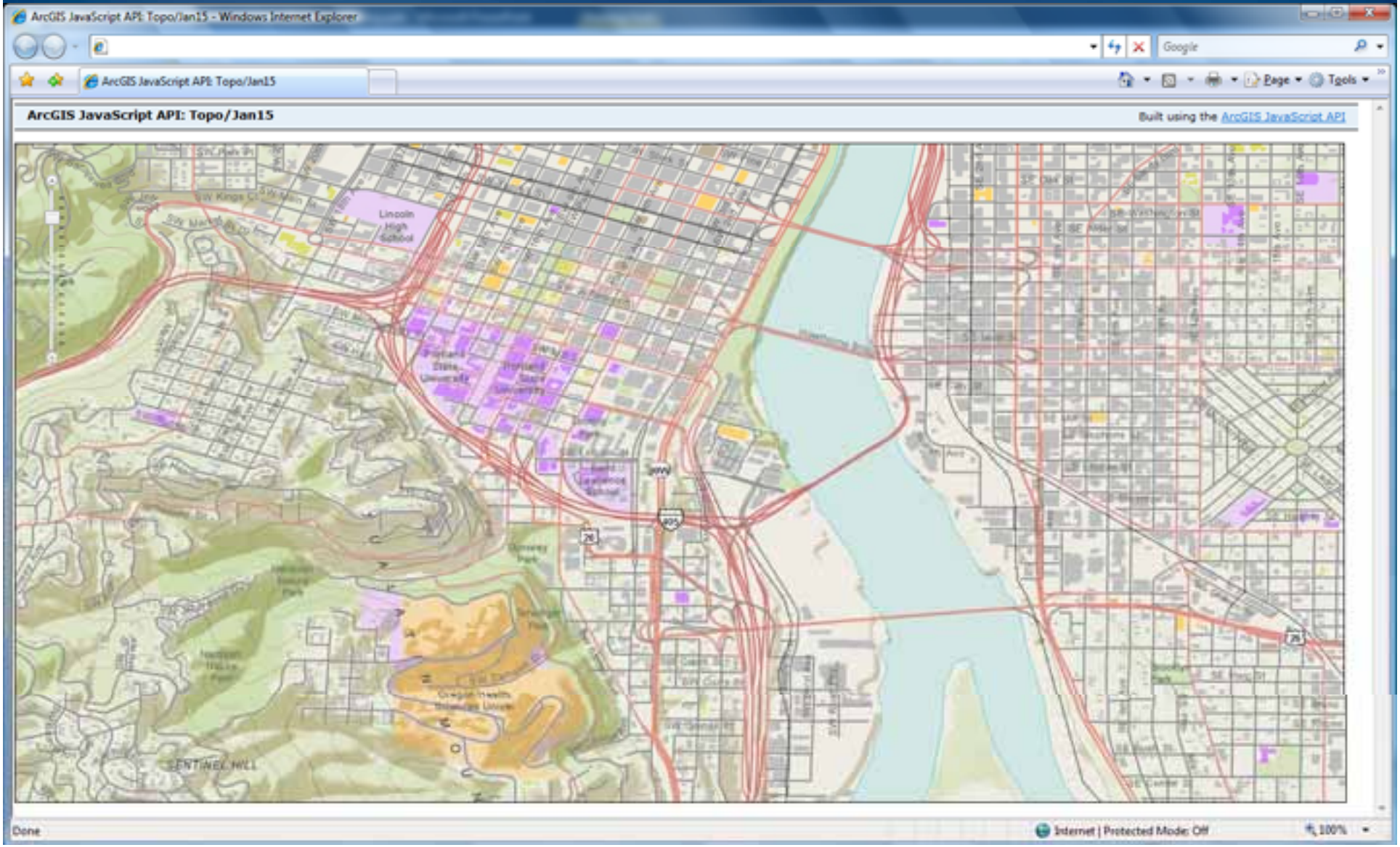
In Progress…

- Street Map
- Topographic Map
- Hydrographic Map
- Soils Map
- Geologic Map
- Parcel Map
- Demographic Maps
- User Maps

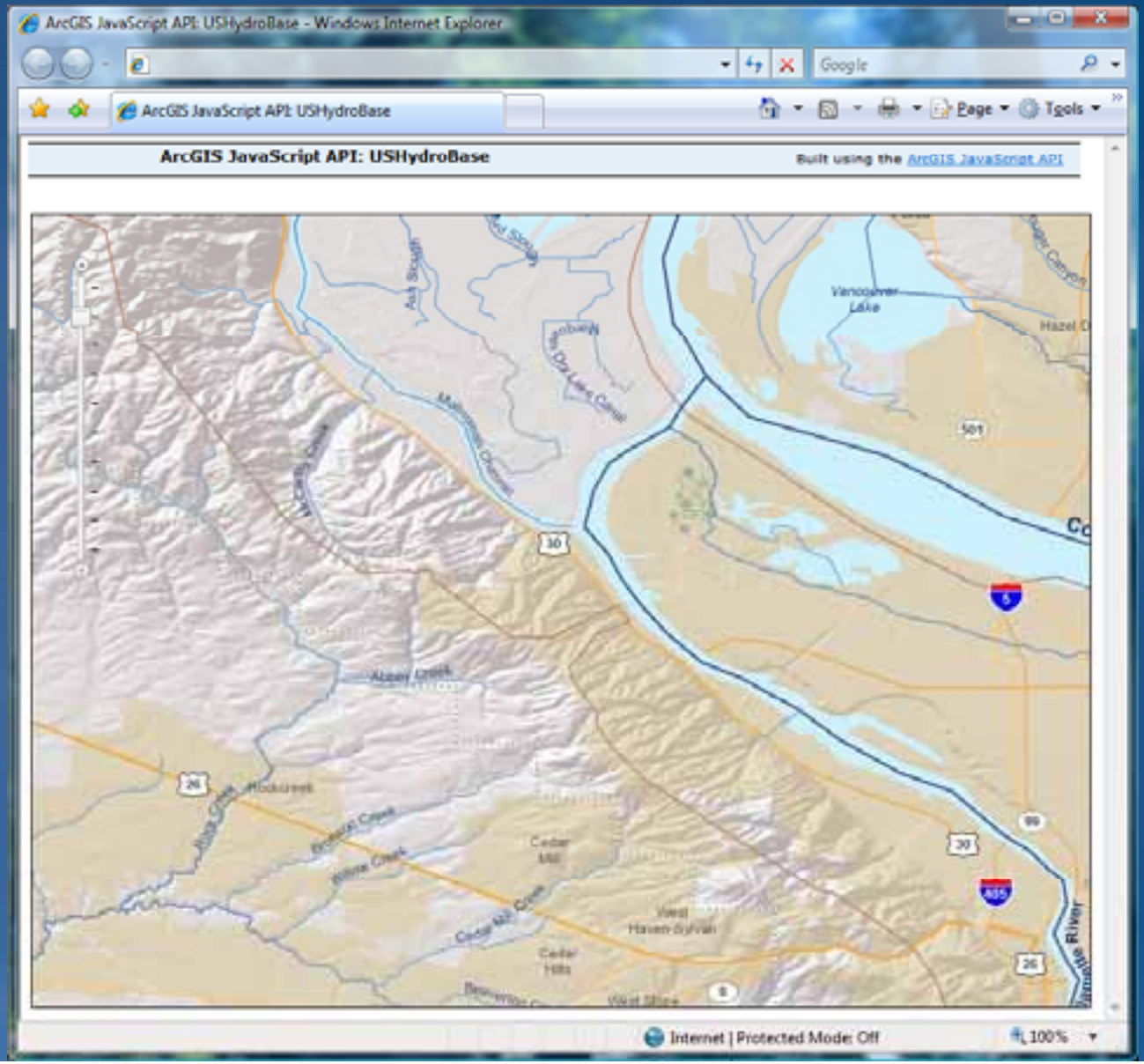
Street Map Template



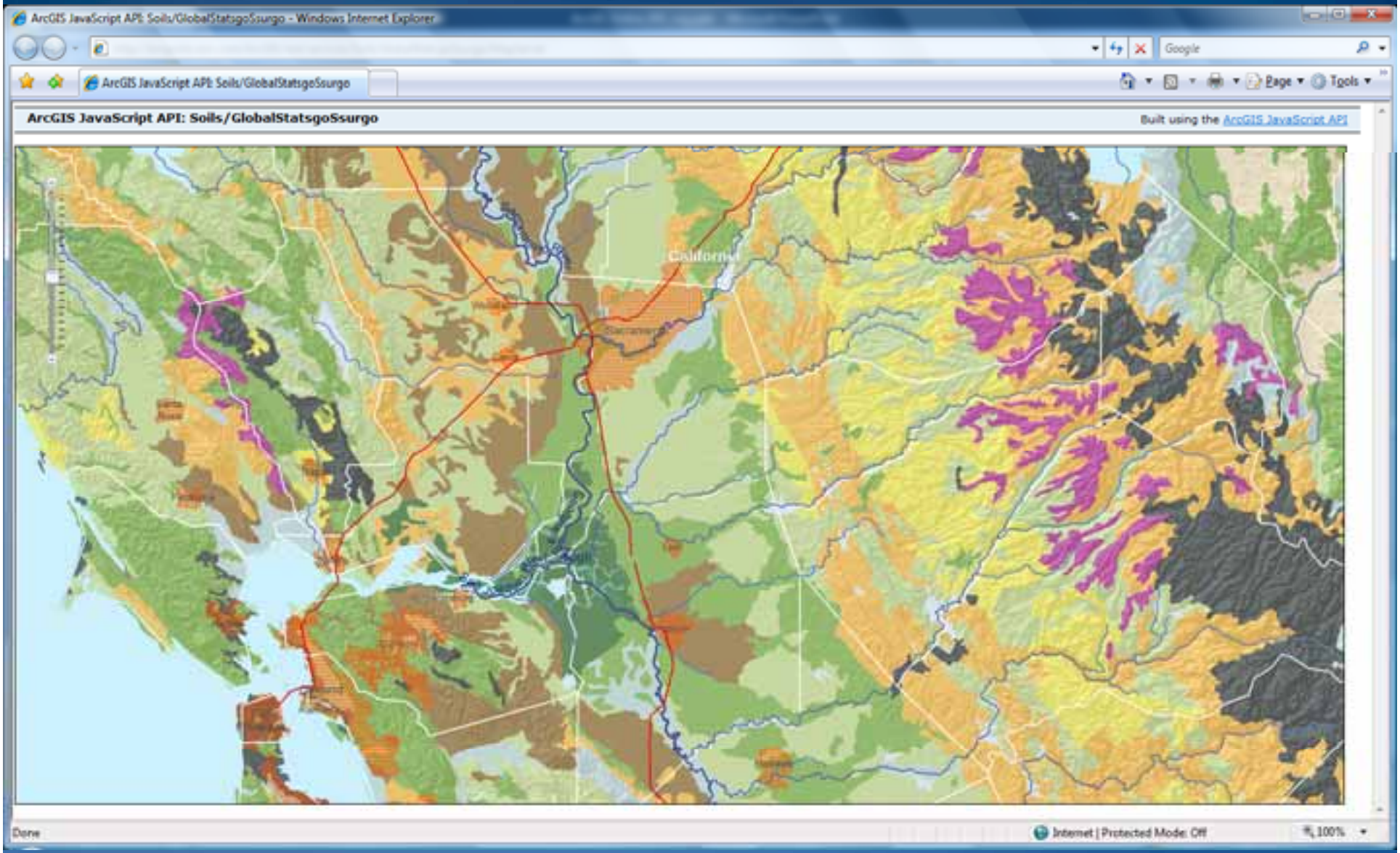
Topographic Base Map Template



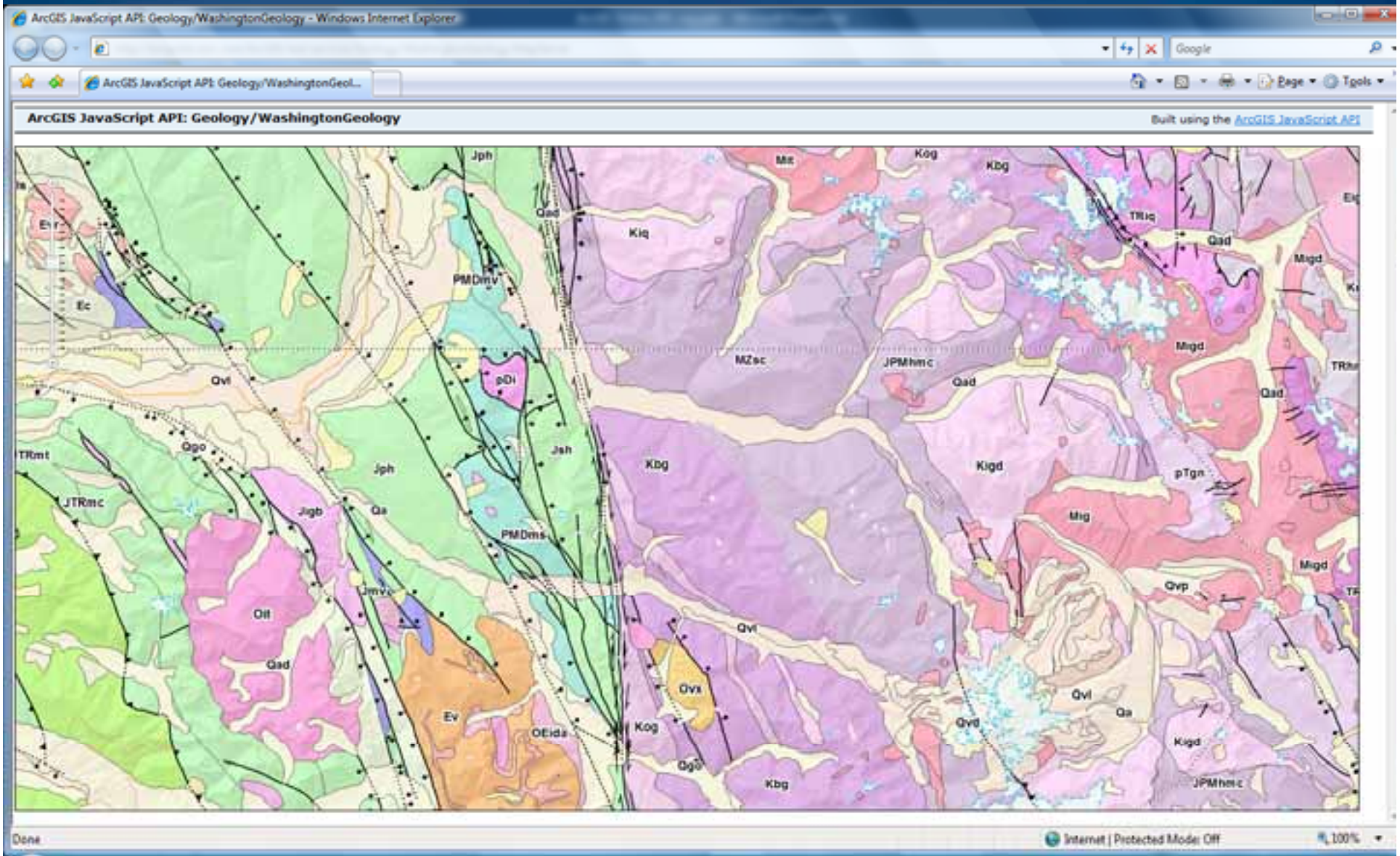
Hydrographic Map Template



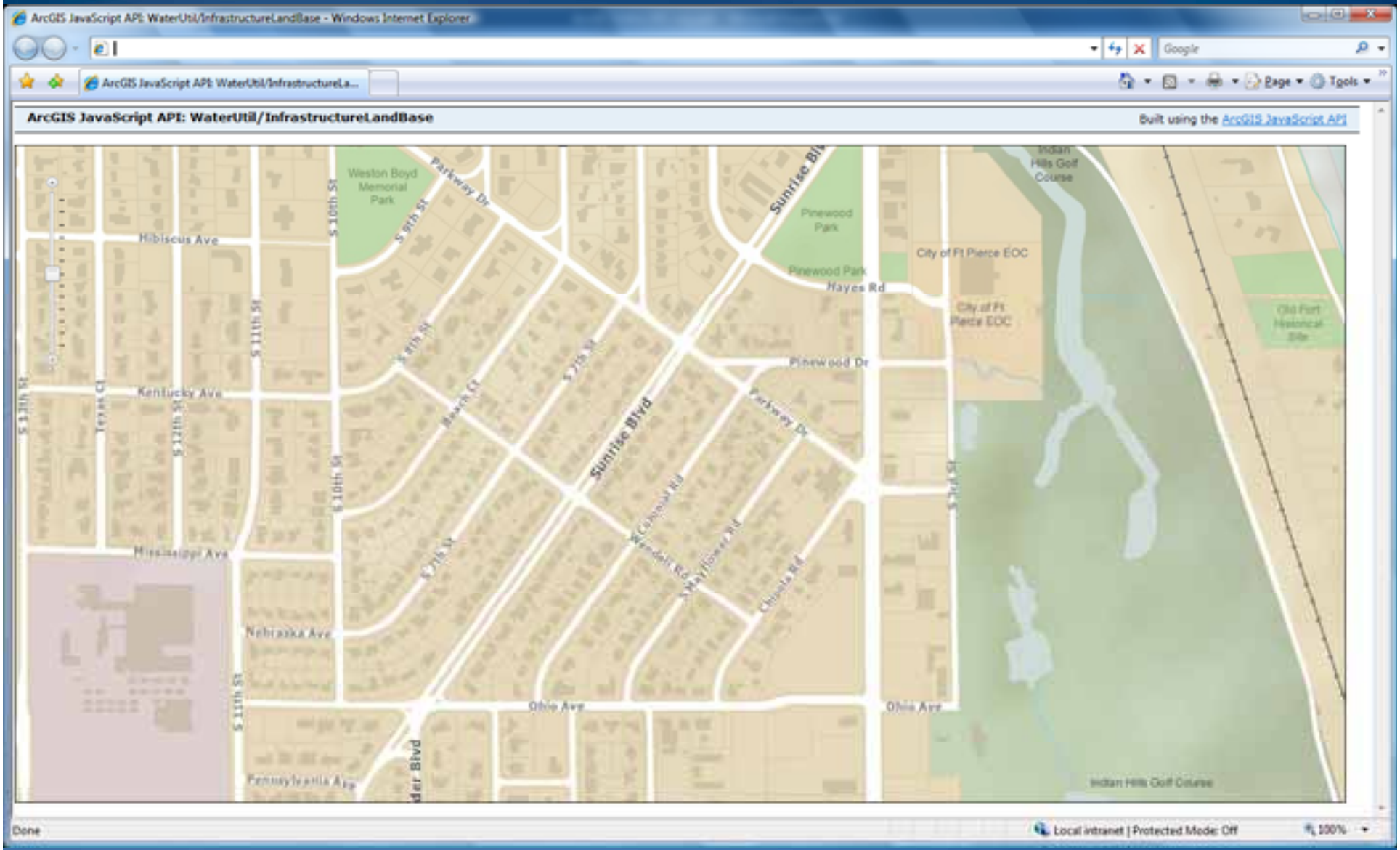
Soils Map Template



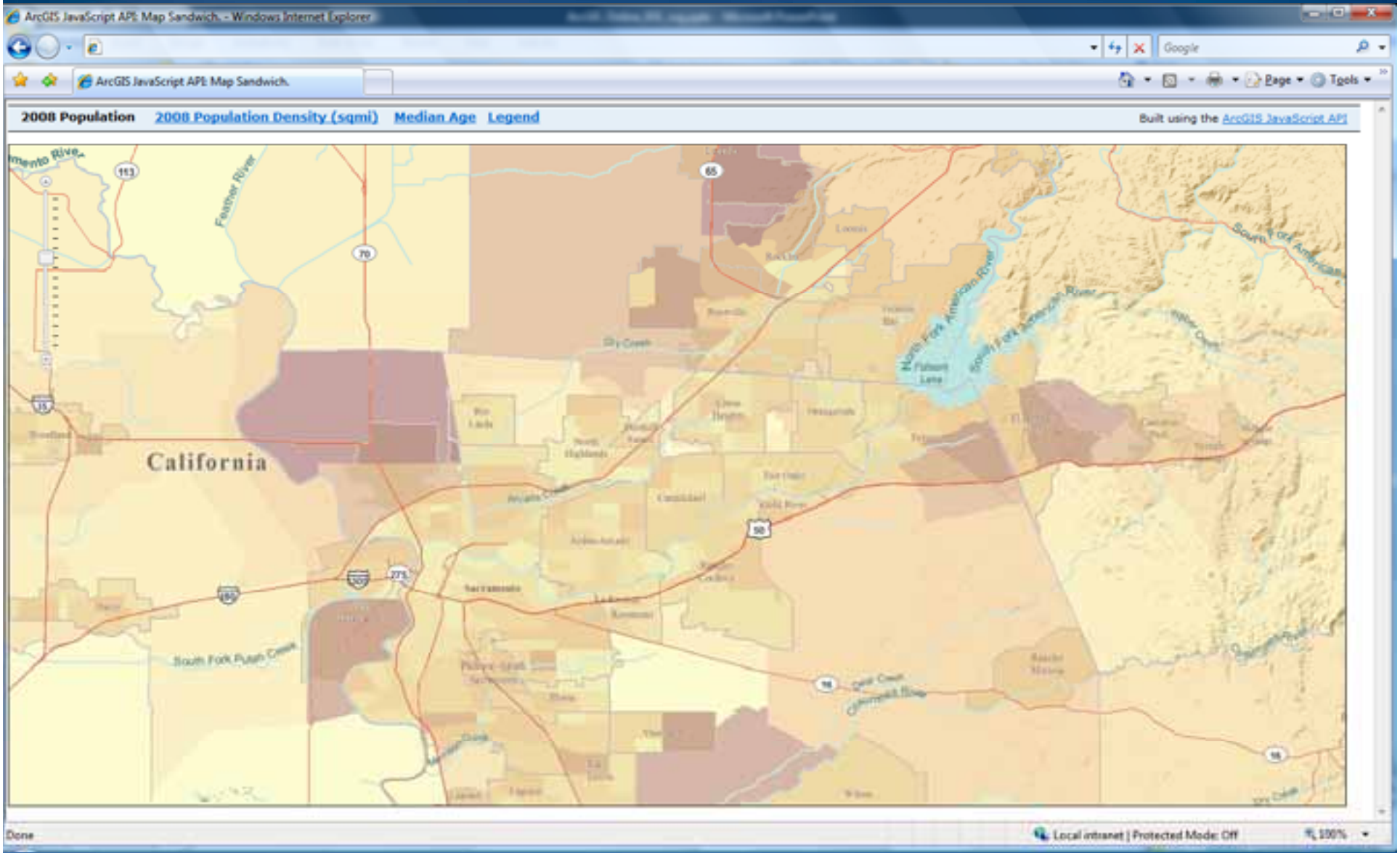
Geologic Map Template



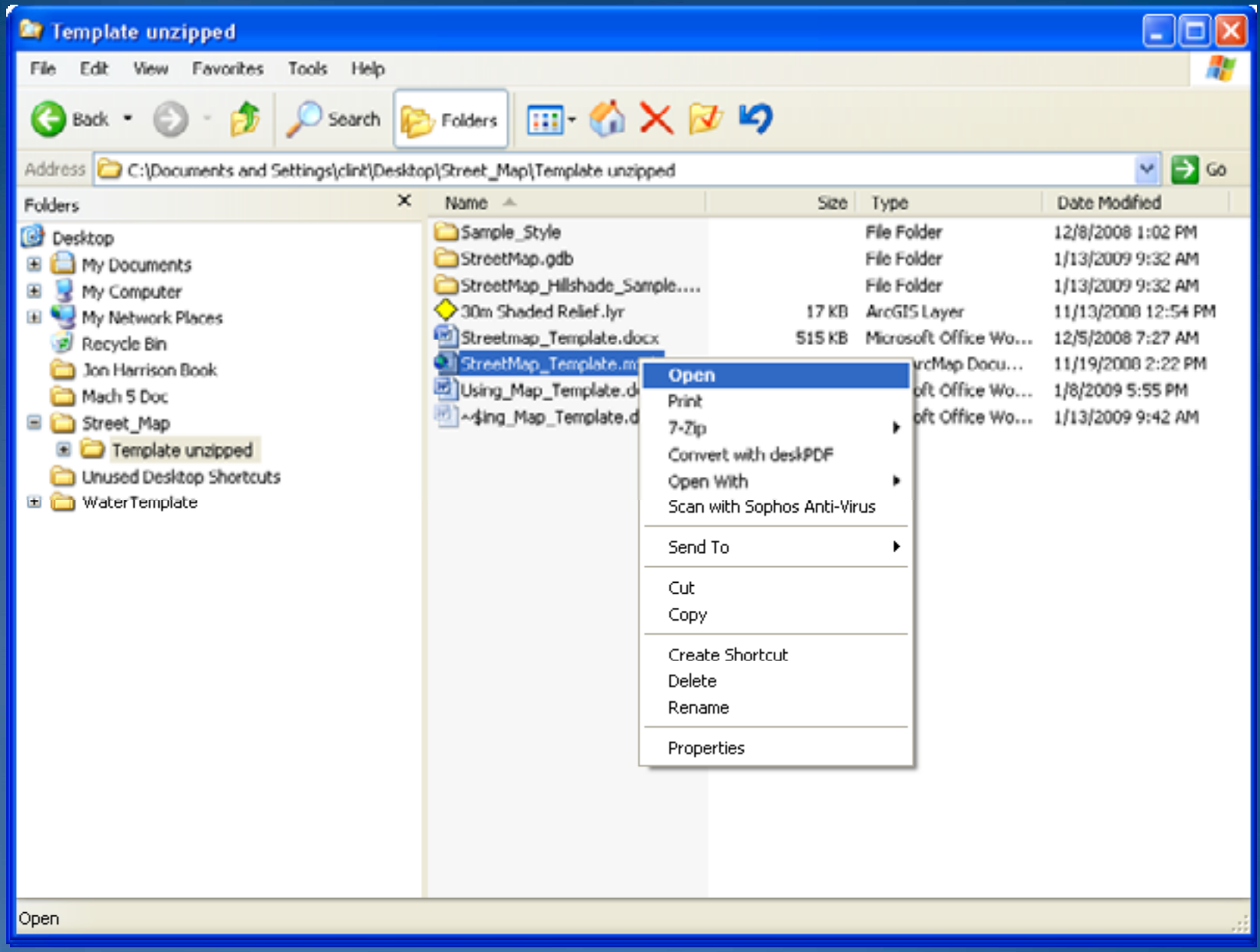
Parcel Base Map Template

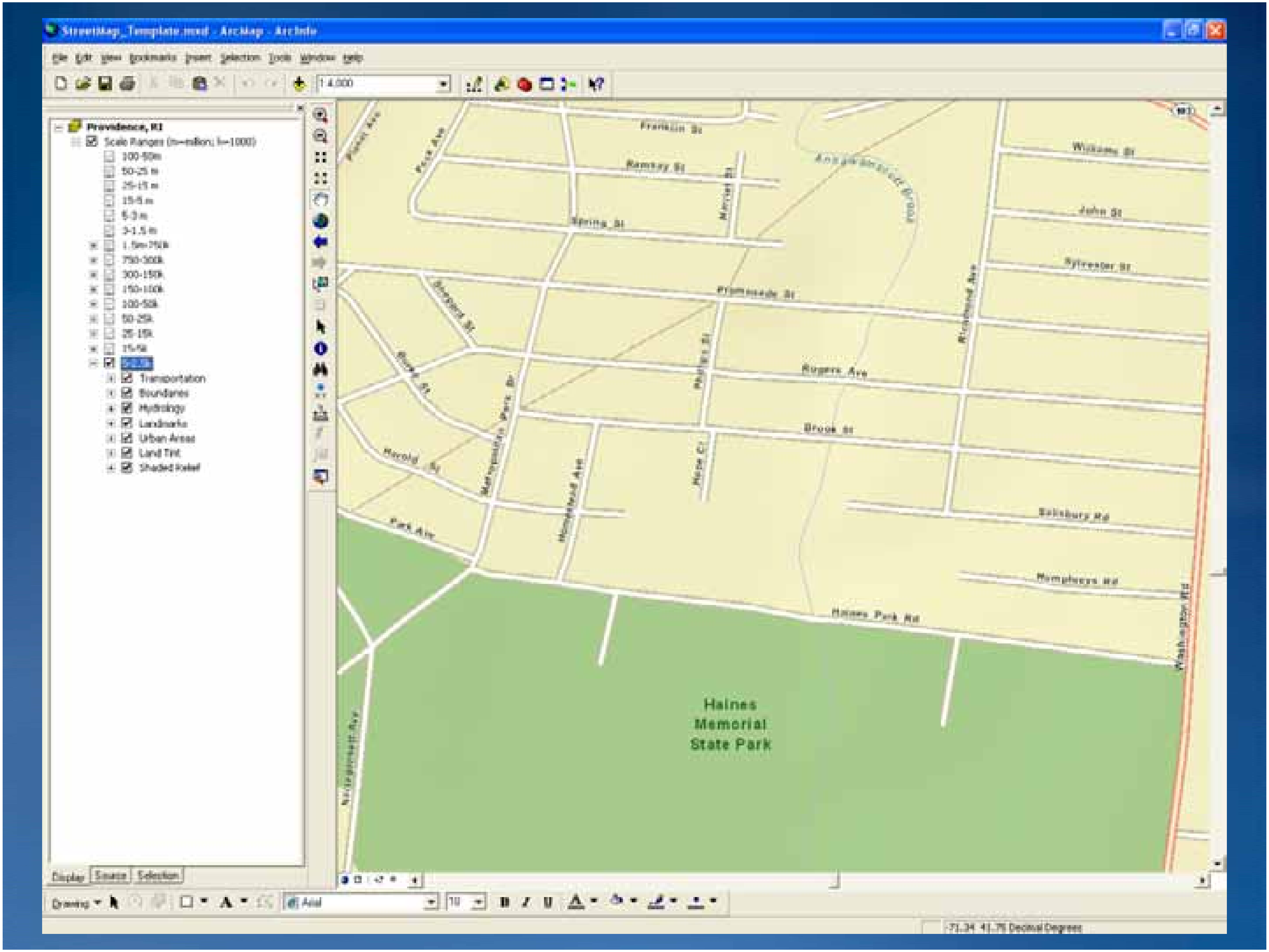


Demographic Templates



Example: StreetMap Template




StreetMap_Template.mxd - ArcMap - ArcInfo
File Edit View Bookmarks Insert Selection Tools Window Help
Providence, RI
Transportation
Boundaries
Hydrology
Landmarks
Urban Areas
Land Tint
Shaded Relief
Franklin St
Ramsay St
Spring St
Promenade St
Rogers Ave
Brook St
Harold St
Park Ave
John St
Haines Park Rd
Humphreys Rd
Haines
Memorial
State Park
Display
Source
Selection
Drawing
Arial
Decimal Degrees

Operational Layers

Operational Layers

The focused set of layers that users work with

- Editing and data access layers
- Observations, sensor feeds, incidents
- Query results
- Result layers that are derived from analytical models

Earthquakes

Inundation Areas & Affected Buildings

Incidents, Customer Calls, Work Orders

Operational Layers

The focused set of layers that users work with

- Like base maps, operational layers
  - Require strong cartography
  - Are scale-dependent
- They also know how to report themselves
  - Operational layers as interactive reports
- Examples

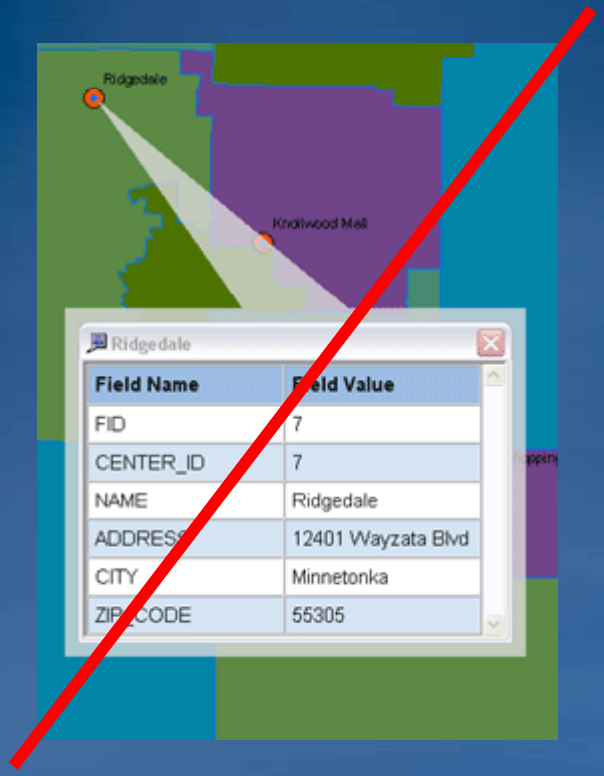
Earthquakes

Stream Flow

Water Utility Reports

Simplest Report is Information Popup

The most common layer report method



Information Reports

- Avoid use of
  - Feature and Object ID's
  - Abbreviated / technical field names
  - Code values
  - Poorly formatted real numbers
  - Etc.
- Make it easy
  - Add attribute columns and populate for each feature

Operational Layer Alternatives

- As client-side graphics (Result of a query or a geoprocessing operation)
- As a dynamic map service (MSD based map service at 9.3.1)
- As a cached map service

How to publish operational layers

- Options
  - Individual map layer as a map service
  - A Map Service with multiple layers
  - Client-side graphics
- See Blog Article at the ArcGIS Server Blog
  - Methods
  - Code samples

Operational Layers report themselves

Layers as interactive reports

- Information popups
- Client-side Graphics really shine
  - Select a subset and chart / display results
  - Great tools in JavaScript, Flex, and Silverlight
- Key is to target your audience

Identify the audience and focus on delivering information to help end users do their work

Operational Layers

Layers as interactive reports

- Operational Layers are multi-scale map layers too
- Interactive reports
  - Populate report attributes for each feature
  - Add information to specific result columns in your geodatabase
  - Use meaningful values

NOTES	IMAGE	LEAKEND
12"MAIN BREAK	Blob	4/3/2007
12"MAIN BREAK	Blob	11/7/2006
6"MAIN BREAK	Blob	6/15/2007
6" MAIN LINE BREAK	Blob	2/18/2005
6"MAIN BREAK	Blob	1/26/2007
6"MAIN BREAK	Blob	6/18/2007
6"MAIN BREAK	Blob	9/3/2006
6" MAIN LINE BREAK	Blob	1/9/2005
6" MAIN LINE BREAK	Blob	4/16/2005
6" MAIN LINE BREAK	Blob	5/20/2005
6" MAIN LINE BREAK	Blob	7/11/2005
12"MAIN BREAK	Blob	11/20/2006
6"MAIN BREAK	Blob	2/7/2007
12" MAIN LINE LEAK	Blob	2/2/2005
3" MAIN LINE BREAK	Blob	3/20/2005
6" MAIN LINE BREAK	Blob	6/26/2005
6" MAIN LINE BREAK	Blob	4/22/2005
6"MAIN BREAK	Blob	3/15/2007
6"MAIN BREAK	Blob	11/1/2005
3"MAIN BREAK	Blob	10/11/2005
6" MAIN LINE BREAK	Blob	3/22/2005
6" MAIN LINE BREAK	Blob	6/8/2005
6"MAIN BREAK	Blob	6/16/2006
6"MAIN BREAK	Blob	12/30/2005
12"MAIN BREAK	Blob	7/8/2006
6"MAIN BREAK	Blob	1/7/2006

Web Maps

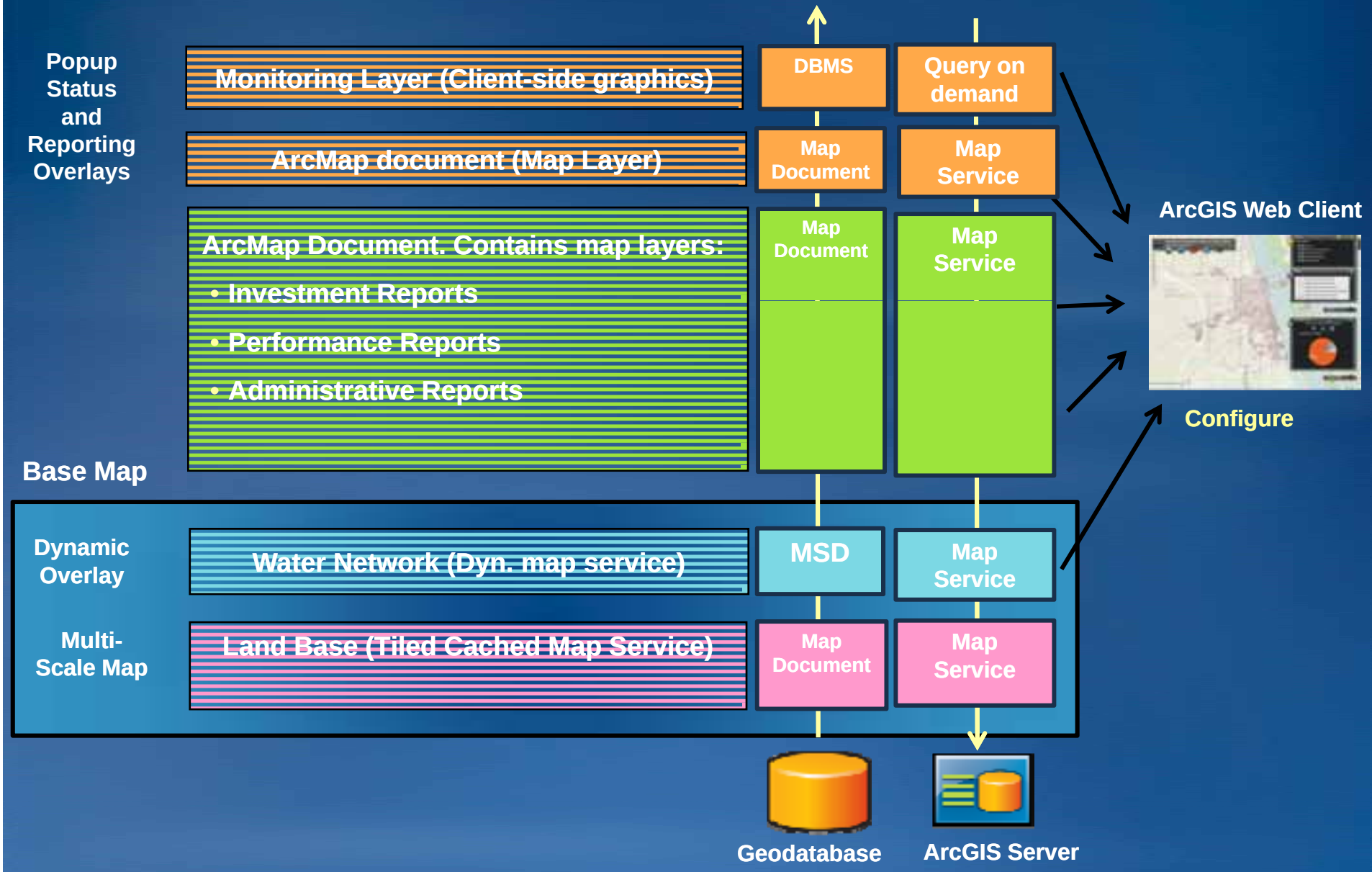
Design implications

Implementation Summary

- A web map is a set of web map layers.
- Each layer is based on a web map service.
- A web map service in ArcGIS is published as a map document.
- You author your web map layers as map documents in ArcMap and publish them as map services.
- You combine a set of web map layers from multiple services in your web map application.

Configure using web scripting

Dashboard Application's Map Services



Configuring your web map

- List your base maps
  - Name
  - URL to map service
- List your operational layers
  - Name
  - URL to map service
  - List of items and labels to report
  - Etc.
- Identify columns in the information popup
  - Enter captions for filed names and operational layers
- Define how to create results
  - Model
  - Query

Bring your geographic information to life on the web

Configuring your web app

Configuring Web App

```
function init() {
    USHydro = new esri.layers.ArcGISTiledMapServiceLayer("http://bmproto.esri.com/ArcGIS/rest/services/HISViewer_AGOL/MapServer");
    map = new esri.Map("mapDiv", { extent: USHydro.fullextent });
    dojo.connect(map, "onLoad", initFunctionality);
    map.addLayer(USHydro);

    portlandHydro = new esri.layers.ArcGISTiledMapServiceLayer("http://bmproto.esri.com/ArcGIS/rest/services/Portland_OR_Hydro/MapServer");
    map.addLayer(portlandHydro);
        portlandHydro.hide();

    austinHydro = new esri.layers.ArcGISTiledMapServiceLayer("http://bmproto.esri.com/ArcGIS/rest/services/Austin_AGOL/MapServer");
    map.addLayer(austinHydro);
        austinHydro.hide();

    gagesLayer = new esri.layers.ArcGISTiledMapServiceLayer("http://bmproto.esri.com/ArcGIS/rest/services/NWIS_Gauges_AGOL/MapServer");
    map.addLayer(gagesLayer);
        gagesLayer.hide();
```

Configuring Web App

```
//build infoTemplate
        infoTemplate = new esri.InfoTemplate();
        infoTemplate.setTitle("${SITE_NAME}");
        infoTemplate.setContent("Site Name : ${SITE_NAME}"
                + "<br /><a href=\"javascript:void(0)\"
    onclick=\"window.open('http://waterdata.usgs.gov/nwis/current?search_site_no=${SITE_NO}&search_si
    te_no_match_type=exact&index_pmcode_STATION_NM=1&index_pmcode_DATETIME=2&index_pmcod
    e_00072=3&metric_precipitation_interval=precip28d_va&index_pmcode_00045=4&precipitation_interval
    =precip28d_va&index_pmcode_45585=5&index_pmcode_00053=6&index_pmcode_62968=7&index_pmc
    ode_45587=9&format=station_list&sort_key=site_no&group_key=NONE&sort_key_2=site_no&html_tabl
    e_group_key=NONE&rdb_compression=file&list_of_search_criteria=search_site_no%2Crealtime_para
    meter_selection')\">Show NWIS Web Interface Custom Table</a>"
                + "<br />Site Code : ${SITE_CODE}"
                + "<br />FTYPE : ${FTYPE}"
                + "<br />COMID : ${COMID}");
      }
```

Goals for ArcGIS: Templates

Transform our approach for using and deploying ArcGIS

- Focus on key user communities
  - Local government
  - Image users
  - Water Utilities
  - Emergency Response
  - Etc.
- Develop and promote a Web GIS methodology throughout ESRI and our user community
- Provide useful example templates for how to configure ArcGIS

Templates

Vision: ArcGIS Templates provide useful examples that illustrate how users can successfully use ArcGIS to accomplish real work

Focused on industries / communities

Water Utilities Templates

- Includes
  - A Role-based Operations Dashboard (e.g., Executive dashboard).
    - A web application that shows systems status and operational awareness
    - Provides a Common Operational Picture for every day <emergency response | water utilities | parcel management | etc.>
  - An Editor for key data layers (e.g., Water distribution networks)
  - A Mobile Map application for your field workforce (e.g., a Tablet PC app)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Template Gallery
Template Gallery
Water Distribution Network Editing
The Water Distribution Network Editing Template is an industry-specific configuration of ArcGIS Desktop to update water distribution geodatabases. It aggregates relevant basemaps, an updated water utility data model, and a series of ArcGIS Desktop editing tools so as-built changes from CAD and other source documents can be added to the geodatabase efficiently.
(0 ratings)
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Author ScottOppmann
Date Submitted 01-11-2009
Date Last Upated 01-11-2009
Language Templates
Product/Version ArcGIS Desktop 9.3
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Summary

Use the common web map pattern

Assemble a web map in five steps

In ArcGIS Desktop

1. Build a base map (or use existing)
2. Build one or more operational overlays
3. Configure layer reporting (popups) by adding geodatabase columns and meaningful values
4. Build your web application and reporting for your operational layers
5. Configure your web application using 1 - 3

Final Thoughts

- Types of map layers used on the web
  - Multi-scale base map
    - Cached map service
    - Maybe with dynamic overlay
  - An individual operational map layer as a dynamic map service **
  - An individual operational map layer as a cached map service
  - A logical set of a few map services as a dynamic map service **
  - A layer used as client-side graphics
  - A layer as a dynamic map service using an ArcMap document (MXD) as the map source.

** Optimized using MSD at 9.3.1

Final Thoughts cont.

- Types of layer reports
  - Map labels
  - Information popup (like Identify)
  - HTML popup
  - Client-side charts (e.g., pie chart)
  - Run a small geoprocessing operation, return results

Final Thoughts cont.

- Thinking about tools in Web applications
  - Operations go with specific map layers (Not with the entire app)
    - Pan/zoom/navigation on the base map
    - Locate on the base map
    - Identify on an individual operational layer
    - Report on a selected set of features in an operational layers
- Information popups help to finesse many map labeling issues

Final Thoughts cont.

It's about bringing your information to life in your Web Maps.
Design for it.

- Frequently, your "publishing database" is different from your "production / compilation" database
- Publishing geographic information is more than the geodatabase. Also
  - Map layers
  - Special reporting fields (joined from related tables, specific text strings for reporting, etc.)
  - Folder with Photos
  - Etc.
- Be creative. Don't make the geodatabase a yoke around your neck. Use common web publishing practices

Web Maps

Design implications

- A web map is a set of web map layers.
- Each layer is based on a web map service.
- A web map service in ArcGIS is published using a map document.
- You author your web map layers as map documents in ArcMap and publish them as map services.
- You combine a set of web map layers from multiple services in your web map application.

Three rules for web applications

- Reduce network traffic where applicable
  - Scale-dependent display
  - Judicious use of client-side graphics
  - Performance matters, leverage analysis tools
- Pre-compute information results when you can do so
  - Cached map services
  - Pre-compute geoprocessing results
- Design for the Web
  - Web maps bring your information to life
  - New implementation pattern
  - Great cartography Great Web Maps

Reminders

1. **Most effective web maps have a common implementation pattern:**
   - **Base map**
   - **Operational overlays**
   - **Information popups and reporting of operational layers**
   - **Simple to configure web app**
2. **Existing GIS web maps (ArcIMS, etc.) do not follow this pattern.**
3. **Web maps are multi-scale.**
4. **Web maps have one or more base maps.**
5. **Base maps have excellent navigation (pan zoom, find/locate).**

Reminders (continued)

7. Web maps have operational overlays.
8. Operational overlays are multi-scale and most often relevant at a particular subset of map scales.
9. Operational layers are targeted to end users.
10. Operational layers know how to report themselves.
11. GIS web maps can have derived map layers (Geoprocessing Model Results).
12. Some web maps have query results that you can work with (e.g., features and their attributes downloaded into Flex).
13. Configure. Minimize programming. Avoid building the ultimate web mapping application if it distract. From authoring useful content (like great cartography, reporting, etc.)

Thanks

Please complete session evaluation forms