Upgrade Public Map Web Site for City of Garland

February 25, 2013

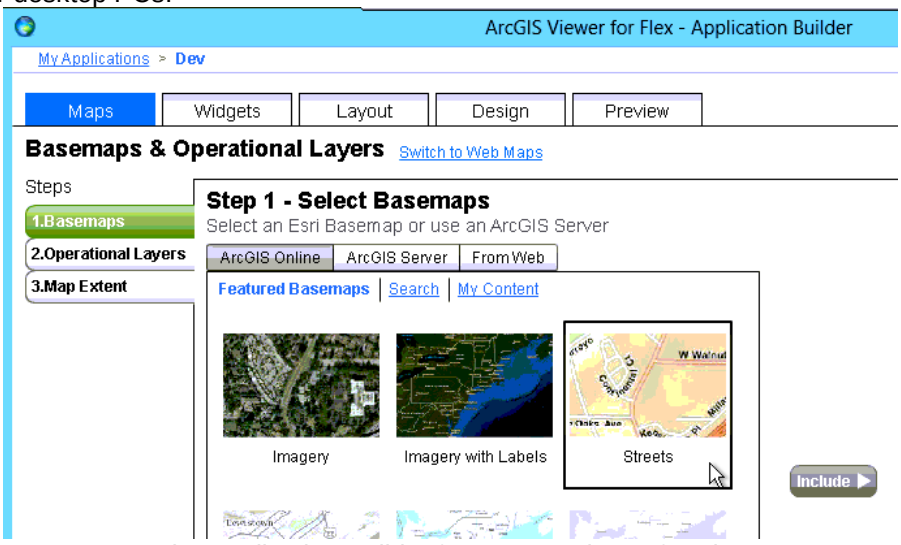
Section 1: Introduction

The City of Garland maintains a web site (http://www.garlandgis.com/) for the Public to explore the GIS data maintained by City staff. This site offers several interactive maps that allow citizens to locate City Council districts, parks and other City services. These online maps are created by ESRI ArcIMS using an interface created by GeoCortex. ESRI has deprecated ArcIMS and now offers their ArcGIS for Server software to produce online maps. The City has obtained licenses of ArcGIS for Server and is exploring the conversion of the public maps to this software. This document evaluates the features provided by the City's online maps for the public and estimates the effort to implement similar functionality using ArcGIS for Server.

ArcGIS for Server creates map services which can be displayed using client software or "APIs" for several platforms such as Flex, Silverlight, Javascript and iOS. Each of these APIs offer different strengths such as ease of development and the number of platforms supported by the API. This document will evaluate the ArcGIS Viewer for Flex and the Javascript API as the client software to display the City's public maps.

1.1 ArcGIS Viewer for Flex

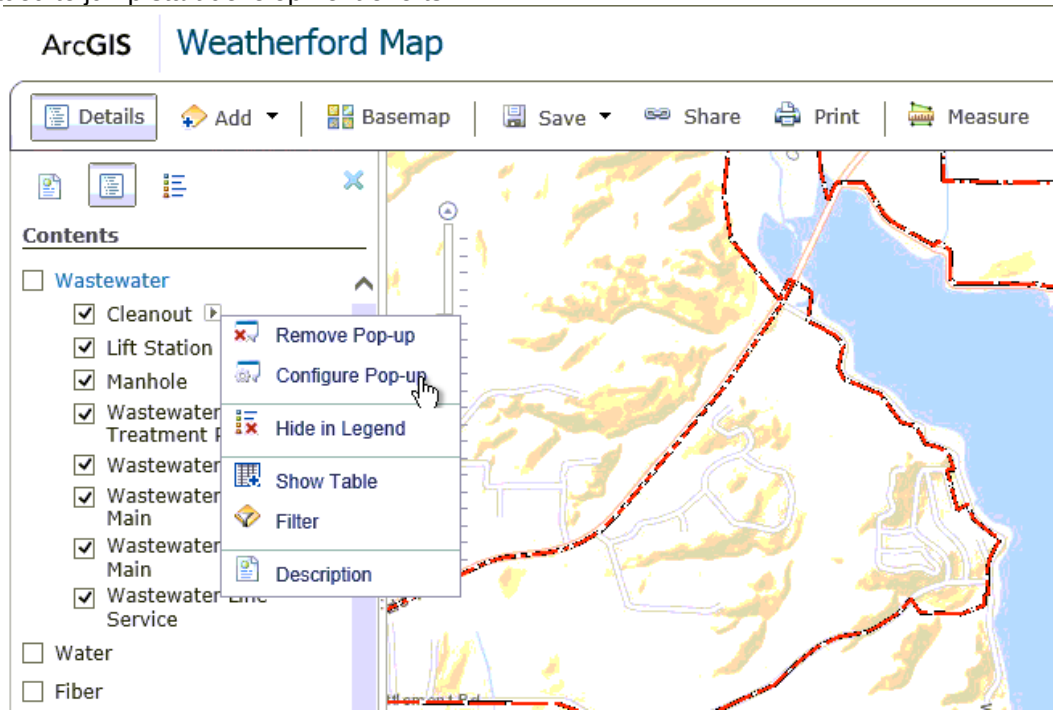
The ArcGIS Viewer for Flex is a configurable application template created by ESRI that displays maps on desktop PCs running the Windows, Mac or Linux OS and mobile devices running the Android OS. The ArcGIS Viewer for Flex offers an Application Builder that allows site administrators to create new sites without coding. Using the Application Builder, a site administrator can select the map layers to display, the tools available to the user and the appearance of the application. Because of its ease of creating and customizing sites, the ArcGIS Viewer for Flex has enjoyed wide acceptance by the user community who have created their own "widgets" that extend the functionality of the Viewer and are configurable by the Application Builder. The ArcGIS Viewer for Flex is an excellent choice for building web based map applications for desktop PCs.



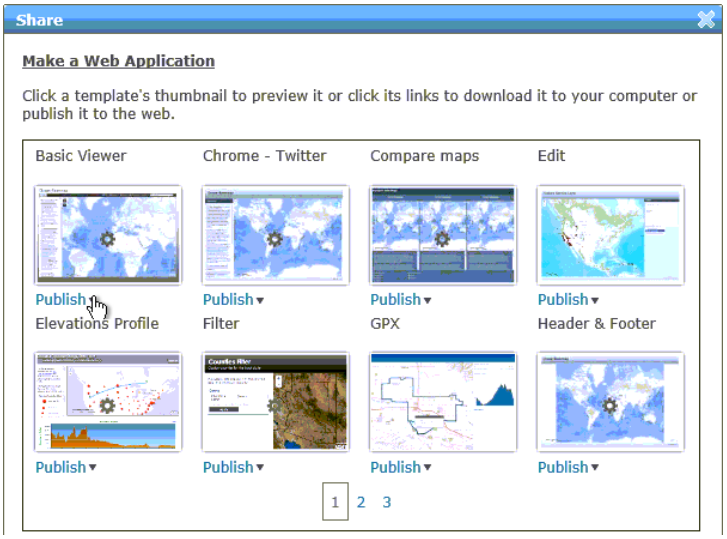
The Application Builder for ArcGIS Viewer for Flex

1.2 Javascript API

Since the Javascript API uses HTML and Javascript, it can display maps on all desktop PCs and most mobile devices including iPads, iPhones, Android phones and Windows phones. While the Javascript API has the broadest reach, it does not offer all the tools or an Application Builder similar to the ArcGIS Viewer for Flex. ArcGIS Online offers free tools to create a map and display it in an application template, but typically coding is required to produce the final application. Unlike the ArcGIS Viewer for Flex which offers a single application template, ArcGIS Online offers several application templates that may be downloaded to jump start development efforts.



Using ArcGIS Online to define the map content including information popups



Using ArcGIS Online to export a Javascript web application to host on your own web server.

Section 2: Map Functions

The City of Garland web site offers five online maps for use by the public: the Main GIS Map, City Council Map, City Parks Map, Sex Offenders Map and WNV Map. While they highlight different map content, each map contains same the functionality. This section describes the map functions that are common to all the online maps.

2.1 Map Navigation

To interact with the map, users must be able to pan and zoom the map to the area they are interested in. The current ArcIMS maps offers the following tools to navigate the map

Tool Name	Tool Icon	Description
Zoom In		User draws a box to zoom the map
Zoom Out		User clicks the map to zoom out
Full Extent		Clicking this tool will zoom the map to show the whole city
Zoom Previous		Returns the map to the previous extent
Pan		In pan mode, the user can drag the map to show a new area. Note that the map content is not fully displayed until the map refreshes
Pan by Direction		Users may click buttons around the map to zoom in that direction
Zoom to Scale		Zooms to the scale entered by the user
Zoom to Layer		Zooms to a layer on the map

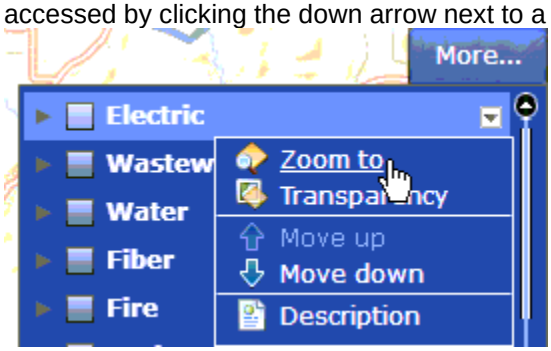
2.1.1 ArcGIS Viewer for Flex

The ArcGIS Viewer for Flex offers similar map navigation functions as in the current ArcIMS application as well as some additional tools which make map navigation easier. Like Google Maps, users may click and drag the map to pan and use the mouse scroll wheel to zoom in .

The map navigation controls allow the user to:

- Zoom in
- Zoom out
- Zoom to Full Extent
- Zoom to previous extent
- Pan the map
- Pan by Direction
- Zoom to Layer

Zoom to Layer is incorporated into the layer widget and may be accessed by clicking the down arrow next to a layer.



2.1.1.1 Custom Navigation Functions

The following map navigation functions are not present in the ArcGIS Viewer for Flex.

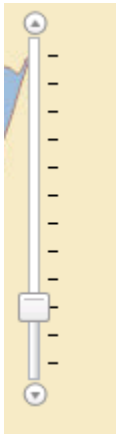
- Zoom to scale

While the ArcGIS Viewer for Flex does not provide a zoom to scale tool like ArcIMS, it does provide a zoom slider that allows the map to be zoomed to preset scales. If the City would like users to key in a specific scale to view the map, this may be added with custom code. Note that the print dialog offers the ability to print to scale.

2.1.2 Javascript API

The Javascript API offers tools for the following map navigation functions:

- Zoom in
- Zoom out
- Zoom to Full Extent
- Zoom to previous and next extent
- Pan the map



2.1.2.1 Custom Map Navigation

The following map navigation functions are possible but will require custom code

- Zoom to scale

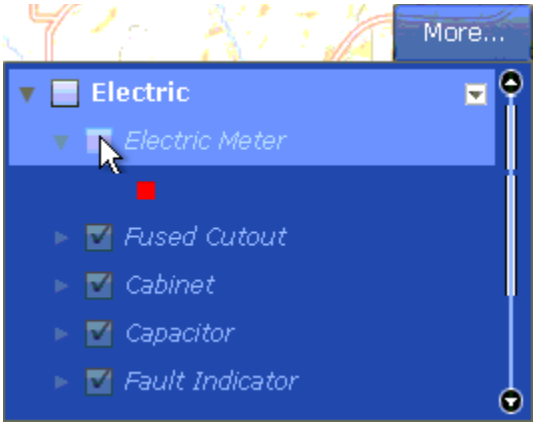
  A zoom slider bar widget is available to zoom to preset scales. If desired, a custom widget to zoom to user entered scales could be created.
- Zoom to Layer

2.2 Map Layers

The Map Layers control allows users to turn the display of individual map layers off or on. GeoCortex for ArcIMS includes additional functions in the layer control – such as setting an active layer - which do not apply to the ArcGIS Viewer for Flex or the Javascript API.

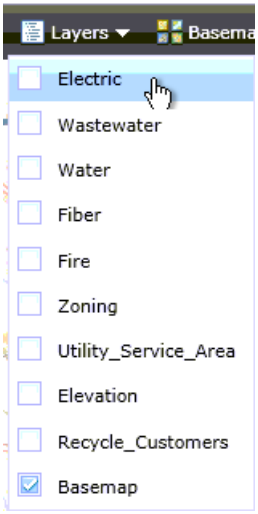
2.2.1 ArcGIS Viewer for Flex

The ArcGIS Viewer for Flex includes a built-in control to toggle layers off or on. Italics are used to indicate layers that are not visible at the current scale.

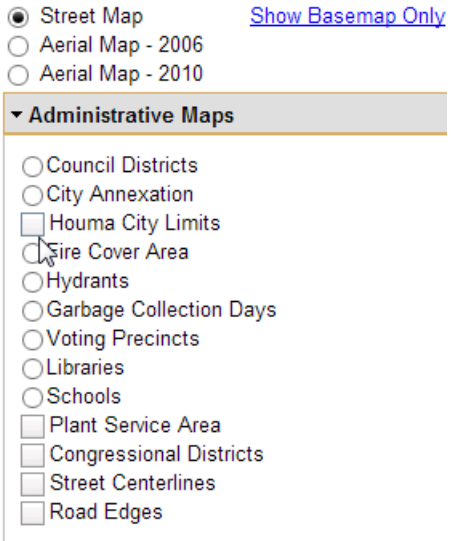


2.2.2 Javascript API

The Basic Viewer web application template built with the Javascript API includes a simple layer control.



A more complex layer control may be created with custom code.

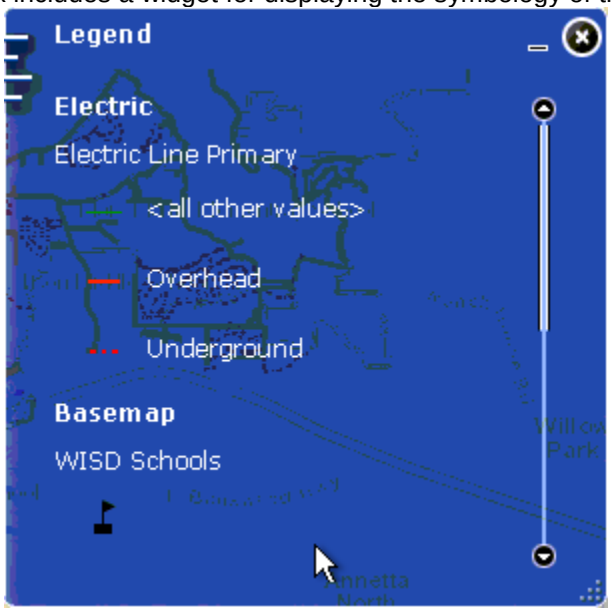


2.3 Map Legend

The Map Legend shows the symbols of map features displayed on the map. The legend should be automatically updated with the current feature symbology without having to manually create any legend images.

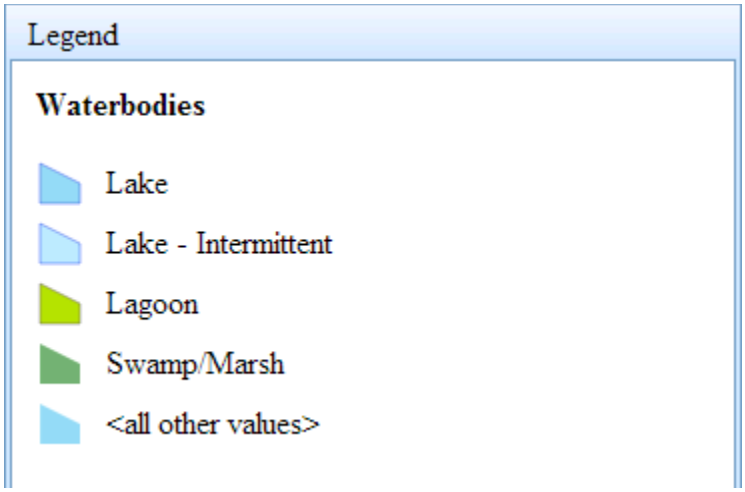
2.3.1 ArcGIS Viewer for Flex

The ArcGIS Viewer for Flex includes a widget for displaying the symbology of the current map layers.



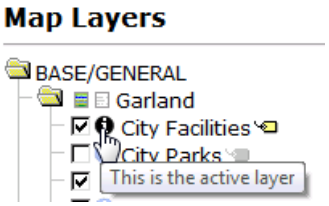
2.3.2 Javascript API

The Javascript API includes a legend widget which displays the current layer symbology.

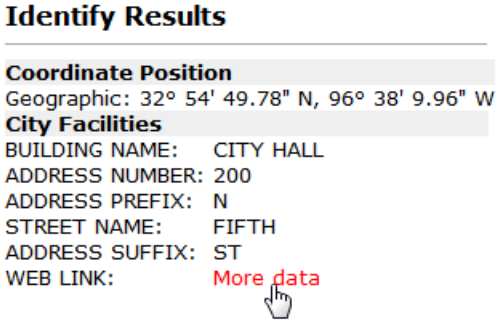


2.4 Layer Identify

In order to retrieve information about a feature displayed on the map, GeoCortex for ArcIMS offers an Identify tool. To use this tool, users must first select the “active layer” by clicking the icon in the layers list.



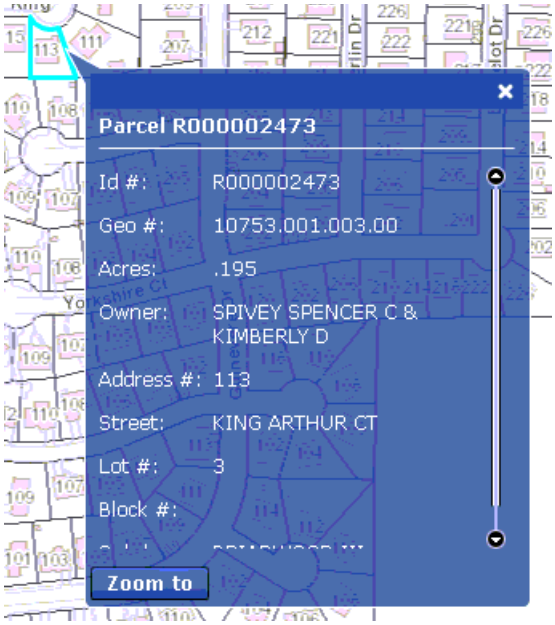
Users can then click on a feature in the active layer to display information about the feature in the size panel. This information may include a hyperlink.



There is also an option to display the information in a popup browser window instead of the side panel.

2.4.1 ArcGIS Viewer for Flex

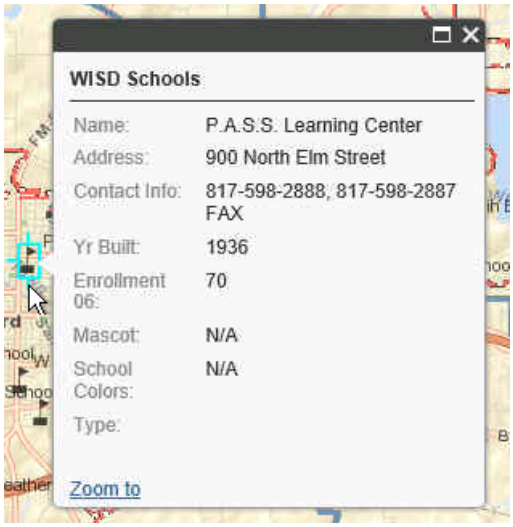
Using the Application Builder, the ArcGIS Viewer for Flex allows site administrators to define popup information windows to be displayed when users click on a feature in the map. These popups are displayed any time a user clicks on a map feature without having to activate a layer or tool. The contents of the popup are defined by the site administrator and may include field values, hyperlinks, charts and other information.



Note that the ArcGIS Viewer for Flex does not have the concept of an active map layer.

2.4.2 Javascript API

The Javascript API also offers popup info windows for features which can be defined in the map definition created by ArcGIS Online.



2.5 Hyperlink Tool

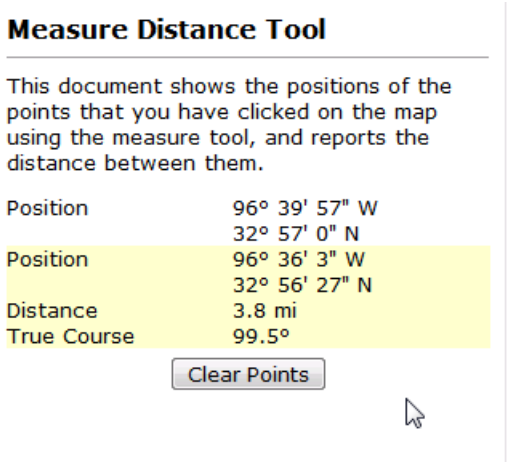
This tool allows users to click on a feature to display a related web page in a popup window. This is often used to display photos and other information about a feature in the active layer. Softwhere Solutions recommends that this tool be removed and the hyperlink content be included in the popup info windows offered by the ArcGIS Viewer for Flex and Javascript.

2.6 Select Features

The Select Features tool in the GeoCortex for ArcIMS interface allows the user to click a feature in the active map layer. The selected feature is then highlighted on the map and its information displayed in the site panel.
Since this tool performs similar actions to the Map Identify function , the select tool could be replaced by the popup info windows in the ArcGIS Viewer for Flex and the Javascript API.

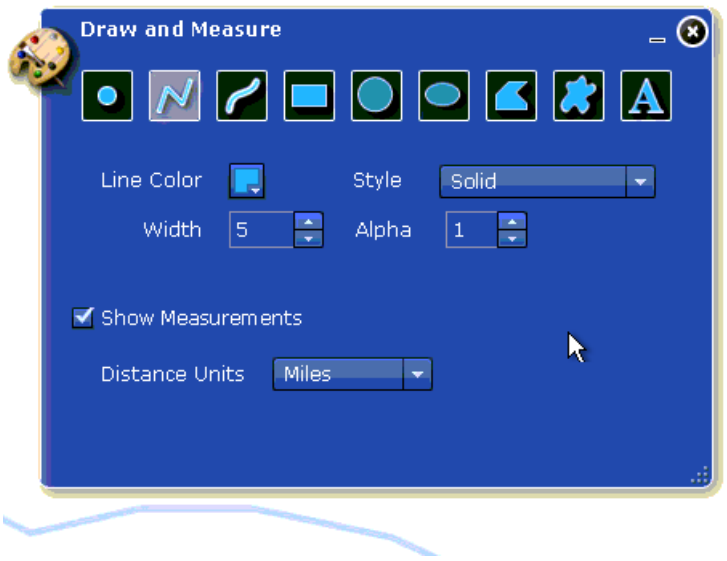
2.7 Measure Tools

The Measure Distance tool will calculate the distance along a line drawing by the user. The Measure Area tool measure the area of a closed shape drawn by the user.



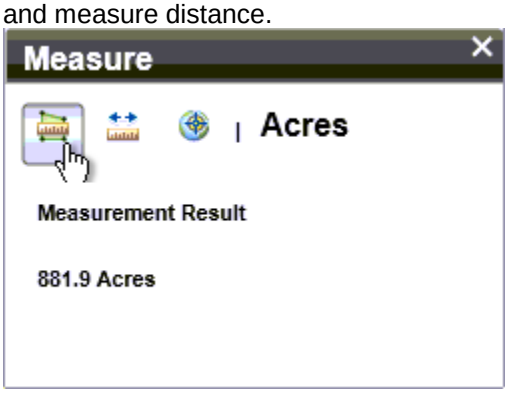
2.7.1 ArcGIS Viewer for Flex

The ArcGIS Viewer for Flex offers a combined Draw and Measure Tool which allows the user to measure distance and area.



2.7.2 Javascript API

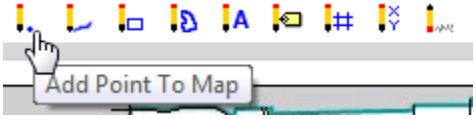
The Basic Viewer web application template built with the Javascript API includes tools to measure area and measure distance.



The measure widget also includes a tool that places a marker and lists the coordinate location.

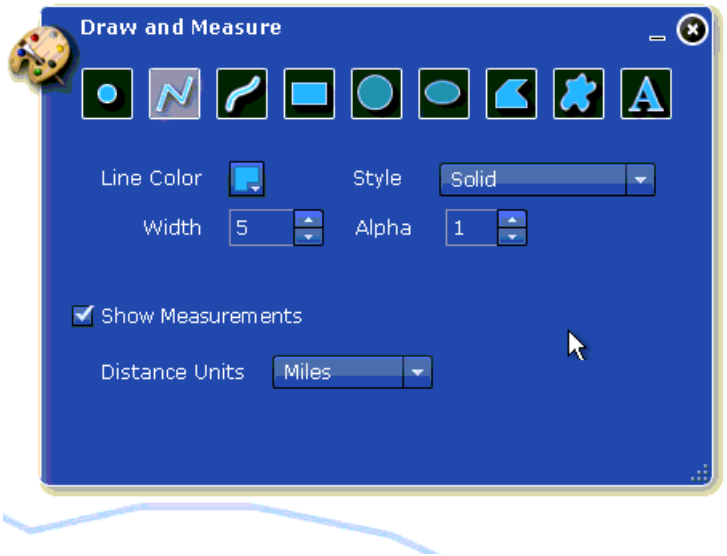
2.8 Draw

GeoCortex for ArcIMS offers several drawing tools



Tool Name	Tool Icon	Description
Point Markup		User may place a marker with Label Text
Line Markup		User may draw a polyline on the map
Rectangle Markup		Draws a rectangle on the map
Polygon Markup		Draws a polygon on the map
Text Markup		Adds text to the map
Label Markup		User selects a feature and generates a label from a database field value
Grid Markup		Displays a grid over the currently displayed map with user selected number of rows and columns
Location Markup		Adds a label with the geographic coordinate for a user selected location
Delete Markup		Removes the selected markup from the map display

2.8.1 ArcGIS Viewer for Flex



The ArcGIS Viewer for Flex offers many tools for drawing on the map and includes more control over the symbology than the GeoCortex ArcIMS interface.

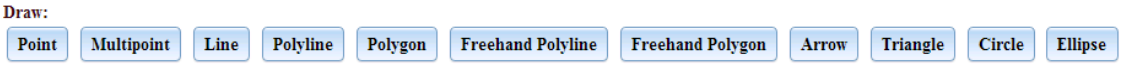
2.8.1.1 Custom Tools

The following tools would require custom code:

- Label Markup
- Grid Markup
- Location Markup
- Delete Markup
    - A tool is provided to clear all the drawings. However, no tool removes a single selected marker. Markup placed on the map may be moved.

2.8.2 Javascript API

The Javascript API provides a toolbar for drawing functions. Some work will be needed to symbolize the user interface for the tools and create the options for the line symbology.



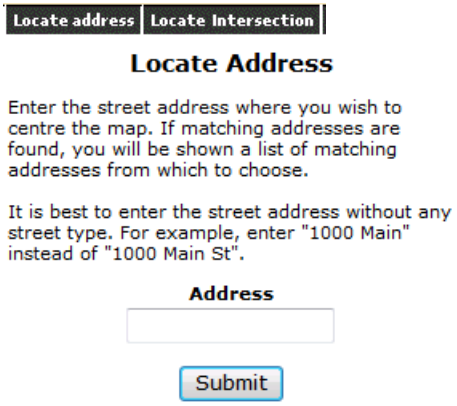
2.8.2.1 Custom Tools

The following tools would require custom code:

- Text Markup
- Label Markup
- Grid Markup
- Location Markup
    - The measure widget includes a tool that allows the user to click a point on the map to display the coordinate information. This would have to be adapted to label the map with the coordinate.
- Delete Markup

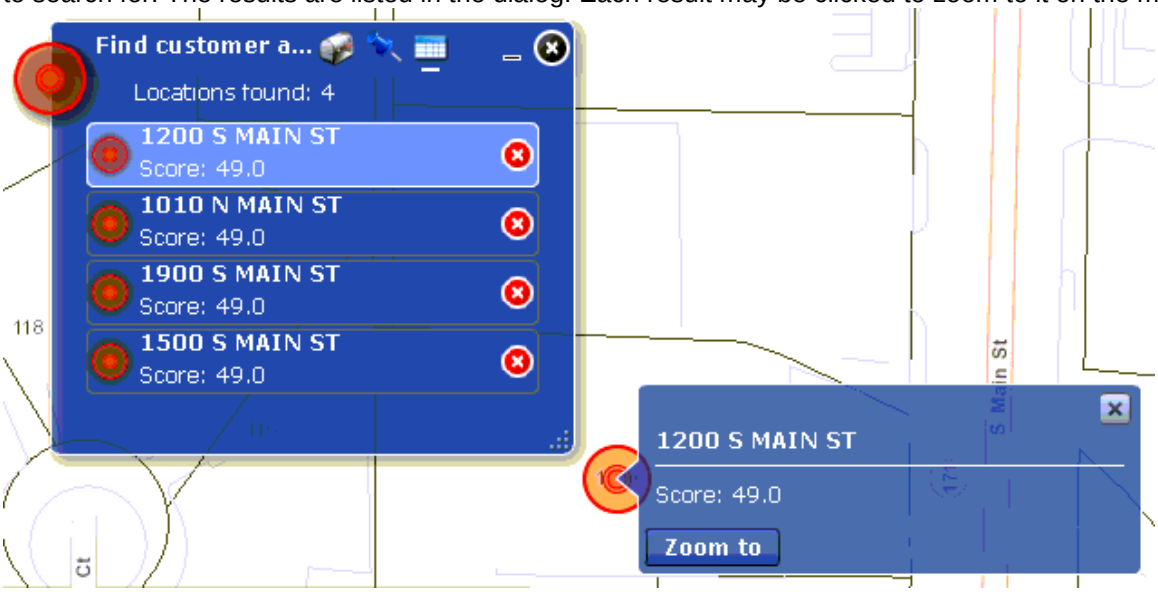
2.9 Locate Address

GeoCortex for ArcIMS offers tools to find a location by its street address or by an intersection of streets.



2.9.1 ArcGIS Viewer for Flex

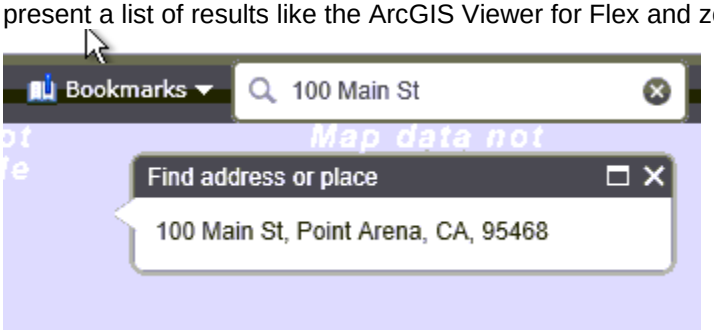
The ArcGIS Viewer for Flex includes two widgets that may be used for geocoding an address or intersection. The locate widget displays a dialog in which the user may enter the address or intersection to search for. The results are listed in the dialog. Each result may be clicked to zoom to it on the map.



The ArcGIS Viewer for Flex also offers a search location tool in the header area of the viewer.

2.9.2 Javascript API

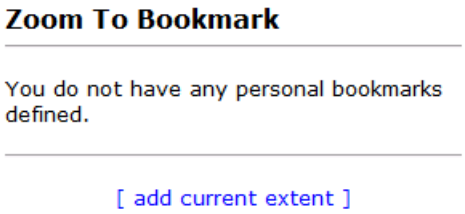
Similar to the ArcGIS Viewer for Flex, Javascript API offers a geocoding widget. This widget does not present a list of results like the ArcGIS Viewer for Flex and zooms directly to the top match.



Some additional user interface work will be needed to display the matching results.

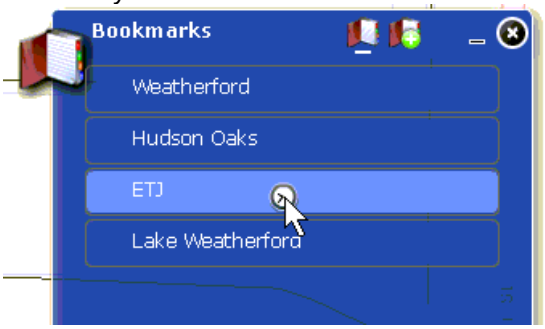
2.10 Bookmarks

The GeoCortex interface for ArcIMS offers a Bookmarks tool that allows users to define personal bookmarks that allow the user to quickly return to a saved map extent.



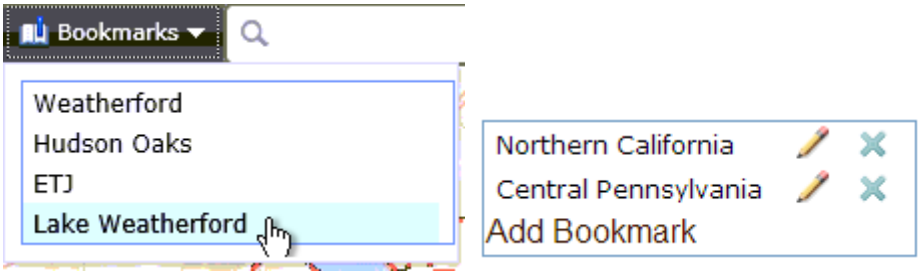
2.10.1 ArcGIS Viewer for Flex

The ArcGIS Viewer for Flex offers the Bookmark widget which allows users to zoom to bookmarks defined by the site administrator or to add their own bookmarks.



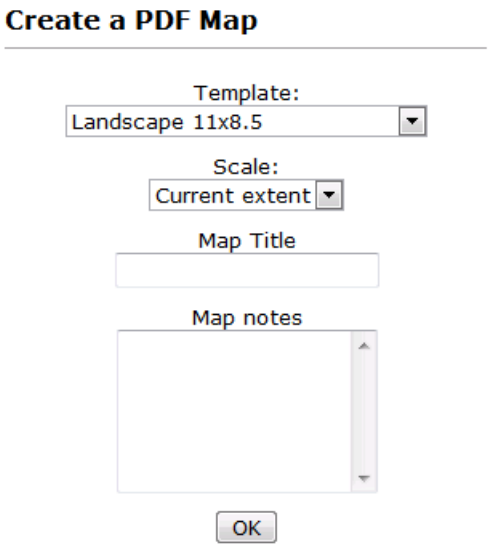
2.10.2 Javascript API

The Javascript API includes a Bookmarks widget that allows the user to select from a list of predefined bookmarks or to add bookmarks.



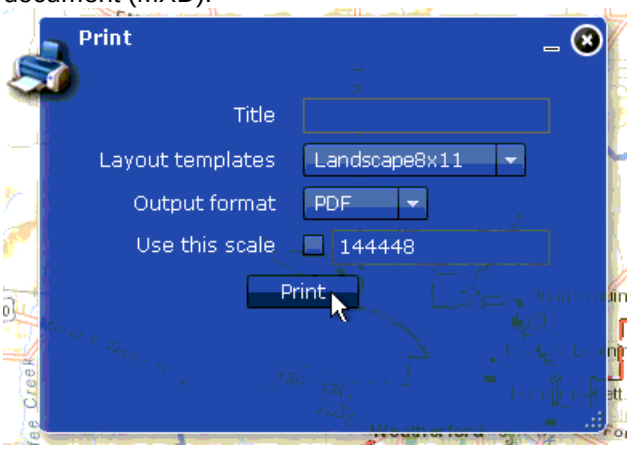
2.11 Printing

GeoCortex for ArcIMS allows users to print a map to PDF format using select template and scales.



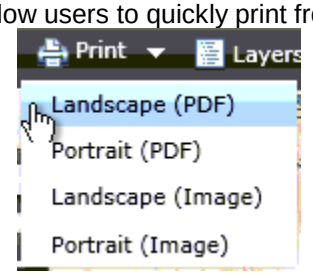
2.11.1 ArcGIS Viewer for Flex

ArcGIS Server 10.1 introduced a dedicated printing service which the ArcGIS Viewer for Flex can use to produce prints in a variety of formats such as PDF or PNG image files. The maps are printed in templates defined in an ArcGIS map document (MXD).



2.11.2 Javascript API

The Javascript API offers a widget to allow users to quickly print from preset templates.

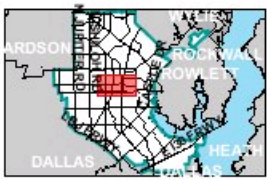


2.11.2.1 Custom Code for Printing

User interface elements would need to be created to allow the user to enter the title and map scale.

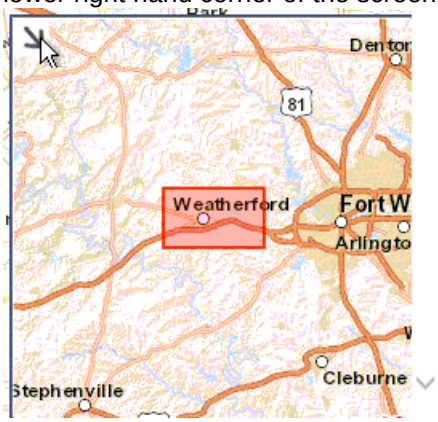
2.12 Key Map

The Key Map or overview map shows the location of the current map extent in the context of the surrounding area. In additional to showing the map extent, the overview map may be used to reposition the map extent at the current scale.



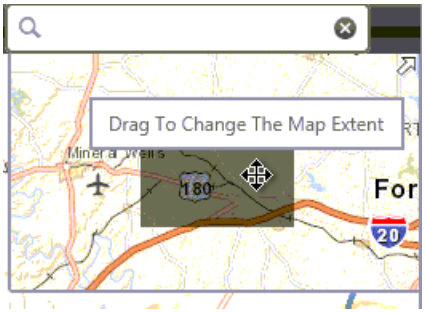
2.12.1 ArcGIS Viewer for Flex

The ArcGIS Viewer for Flex offers an overview map which can be displayed by clicking the arrow in the lower right hand corner of the screen. The user can drag the red box to reposition the current map view.



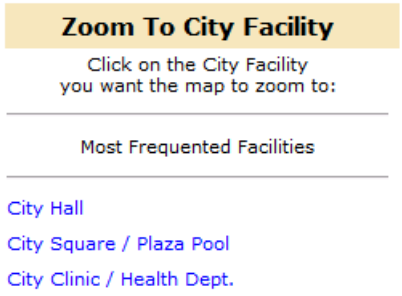
2.12.2 Javascript API

The Javascript API offers an overview map which can be displayed by clicking the arrow in the top right hand corner of the screen. The user can drag the box to reposition the current map view.



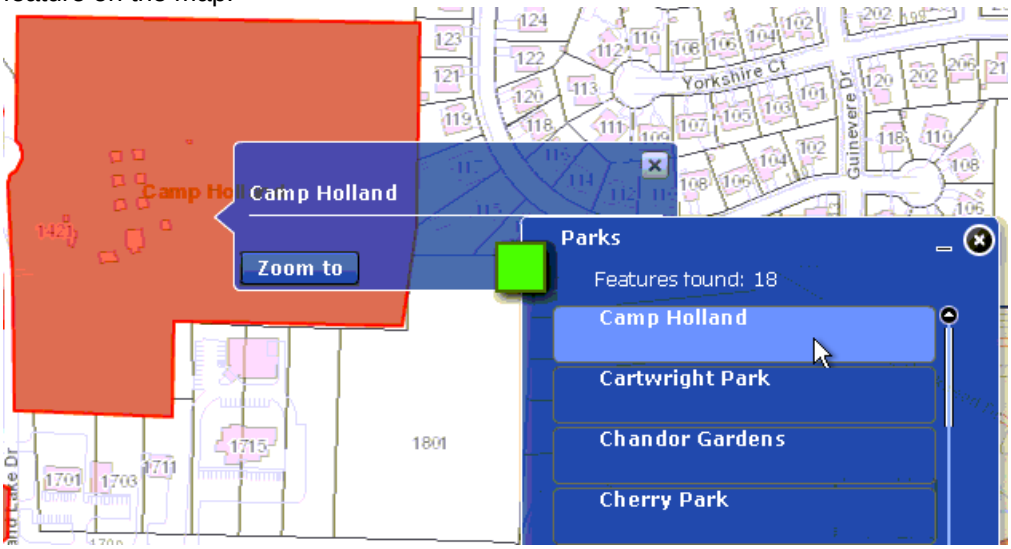
2.13 Zoom To City Facility

The Zoom to City Facility tool displays a list of facilities. Clicking a facility in the list will zoom to that area on the map. Other maps such as the Sex Offender map and Parks map include versions of this tool that list the sex offender names and park names respectively. While these tools show different content, they work in the same way.



2.13.1 ArcGIS Viewer for Flex

The ArcGIS Viewer for Flex includes the Query Widget which can be configured to display a list of features from a map service. Clicking an entry on the list will zoom the map to that area and highlight the feature on the map.

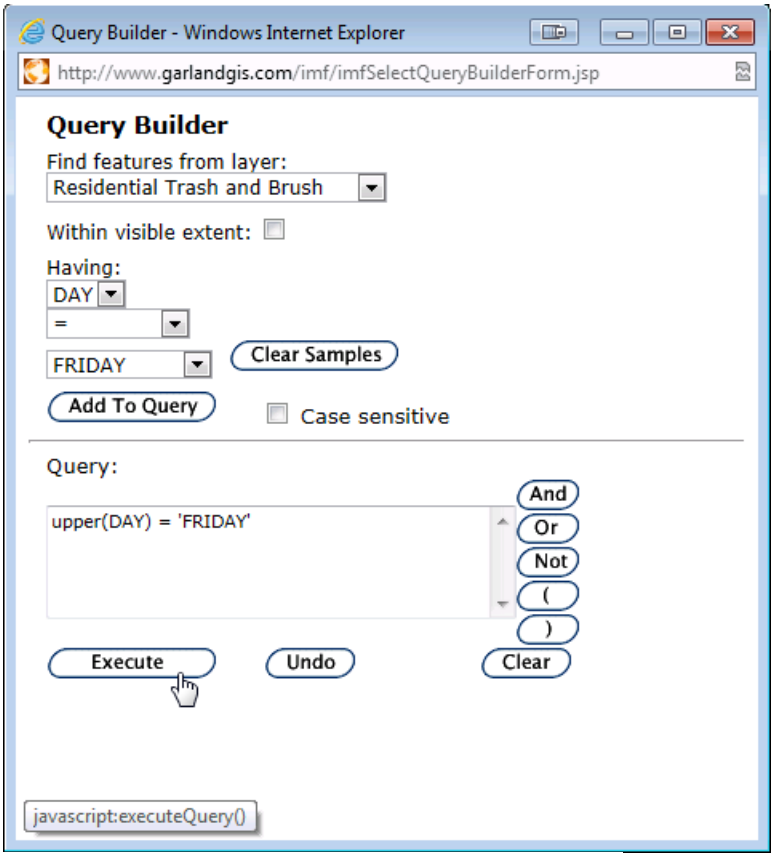


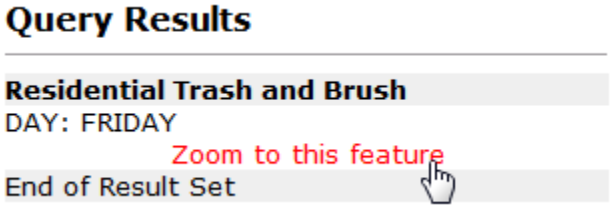
2.13.2 Javascript API

The Javascript API offers the functions to query map services and display the results as well as zooming and highlighting results. Custom code would be required to put these parts together to create a Zoom to City Facility tool using the Javascript API.

2.14 Query Builder

GeoCortex for ArcIMS offers a Query Builder tool that allows users to generate custom queries on map layers. The results are displayed on the map with a list of attributes in the side panel.

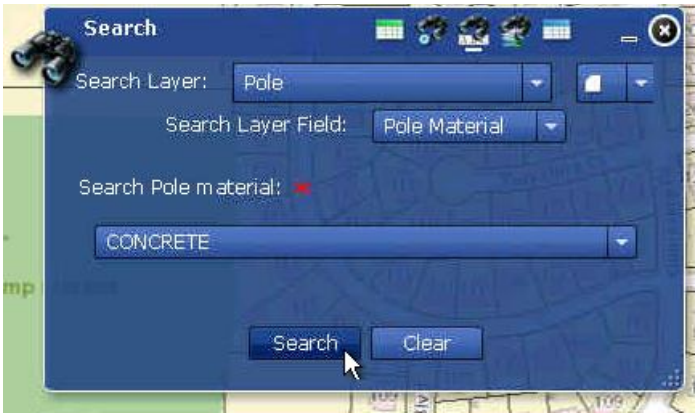




This tool allows advanced users to create complex queries containing multiple SQL clauses to display just the data desired.

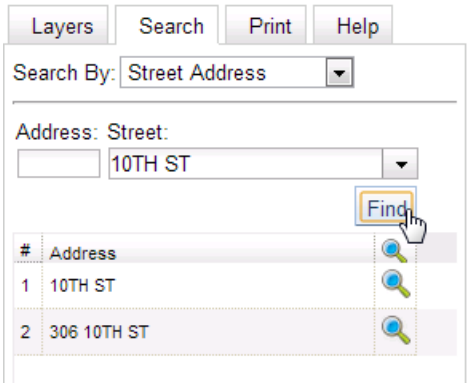
2.14.1 ArcGIS Viewer for Flex

The ArcGIS Viewer for Flex does not include a Query Builder but does include a Search Widget that allow the site administrator to predefine searches to be performed by the user. While the Search Widget does not allow the flexibility of the Query Builder, it does have a simpler interface for citizens that are not familiar with creating SQL queries. For example, users can search by selecting from a picklist of values.



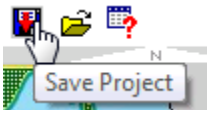
2.14.2 Javascript API

While it does include tools for creating user interfaces and performing queries, the Javascript API does not offer a Query Builder or Search Widget. Custom code will be required to create the searches available on the site.



2.15 Save Session

GeoCortex for ArcIMS allows users to save the current settings for a session to a file. This file can be loaded to return the map to the state of the session.



2.15.1 ArcGIS Viewer for Flex

Custom code would be required to implement the save and load session functionality in the ArcGIS Viewer for Flex.

2.15.2 Javascript API

Custom code would be required to implement the save and load session functionality in the Javascript API.

Section 3: Estimates

This section estimates the effort to create the missing functions in the ArcGIS Viewer for Flex and Javascript API. If the City determines that some of the missing tools are not required, the budget can be reduced.

3.1 ArcGIS Viewer for Flex

3.1.1 Custom Code Effort

This section estimates the level of effort to create the tools missing from the ArcGIS Viewer for Flex.

Function	Custom Code Effort
2.1 Map Navigation	Low
2.2 Map Layers	None
2.3 Map Legend	None
2.4 Layer Identify	Low
2.5 Hyperlink Tool	None
2.6 Select Tool	None
2.7 Measure Tools	Low
2.8 Draw Tools	High
2.9 Locate Address	None
2.10 Bookmarks	None
2.11 Printing	Low
2.12 Key Map	None
2.13 Zoom to City Facility	None
2.14 Query Builder	Medium
2.15 Save Session	Medium

Softwhere Solutions recommends a budget of **$9,500** for the custom development for the ArcGIS Viewer for Flex.

3.1.2 Configuration

Using the the ArcGIS Viewer for Flex updated with the new functions, Softwhere Solutions recommends a budget of **$4,000** to create a single web site with a budget of **$2,000** for each additional site. This task includes defining the appearance of the site, configuring the map layers, popup windows, search tools and other widgets using the Application Builder.

3.1.3 Training

While not required, Softwhere Solutions recommends budgeting **$2,000** for one day of onsite training on the ArcGIS Viewer for Flex.

3.2 Javascript API

3.2.1 Custom Code Effort

This section estimates the amount of effort to create the custom code to implement the tools missing from Basic Viewer Application using the Javascript API.

Function	Custom Code Effort
2.1 Map Navigation	Medium
2.2 Map Layers	High
2.3 Map Legend	None
2.4 Layer Identify	Low
2.5 Hyperlink Tool	None
2.6 Select Tool	None
2.7 Measure Tools	Low
2.8 Draw Tools	High
2.9 Locate Address	None
2.10 Bookmarks	None
2.11 Printing	Medium
2.12 Key Map	None
2.13 Zoom to City Facility	Medium
2.14 Query Builder	High
2.15 Save Session	Medium

Softwhere Solutions recommends a budget of **$20,000** for the custom development required to reproduce the GeoCortex tools for ArcIMS in the Javascript API for ArcGIS Server..

3.2.2 Configuration

The result of the custom code will be to create a configurable web application template. The map content for the application will be configured using the tools provided by ArcGIS Online. No part of the site will be hosted by ArcGIS Online, but the online tools will be used to create the configuration files for the map layers and info window popups.

Softwhere Solutions recommends a budget of **$5,000** to create a single web site with a budget of **$2,000** for each additional site. This task includes defining the appearance of the site, configuring the map layers, popup windows, search tools and other widgets.

3.2.3 Training

While not required, Softwhere Solutions recommends budgeting **$3,500** for 2 days of onsite training on the Javascript API.