

Standardized Web-Based Applications: Creating and Implementing Custom ArcIMS Templates

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Abstract

The City of Olathe (KS) relies on ArcIMS to provide convenient, cost-effective access to Geographic Information Systems (GIS) technology for employees and citizens. Employees use custom, web-based applications to support daily operations, within the organization. Citizens can access similar technology to learn about the city and find valuable information. The GIS division uses ArcIMS to build applications that focus on specific tasks and are easy to use. Through the creation of a standardized ArcIMS template, Olathe employees and citizens can access a consistent set of map layers and tools for working with spatial data. In addition, the standardized template facilitates application development. The Olathe ArcIMS template was developed by the GIS division, including employees from five city departments. This collaboration has produced an application template that incorporates functionality capable of supporting the majority of internal and external users.

Introduction

Olathe, Kansas is located approximately twenty miles southwest of downtown Kansas City, Missouri. With a population of more than 114,000, Olathe is the second largest community in Johnson County and the fifth largest city in the state. The population explosion has led to increases in city services and staff.

GIS technology was introduced to Olathe nearly ten years ago. Five years later, web-based applications came on the scene. While desktop applications generally offer a more robust set of tools and functionality, web-based applications tend to be more intuitive and can provide less experienced users with access to spatial information. More recently, there has been a growing demand for access to this type of information. In order to satisfy our users' needs and meet this demand, we determined that ArcIMS is the most cost-effective and efficient way to deliver spatial information. A standardized approach was needed for a solution that could effectively serve Olathe's staff and citizens. Through a collaborative effort, our GIS staff concluded that a customized template would meet this need. In this paper we will address the reasoning and methods used to arrive at our customized template solution.

Why IMS?

Our users' needs vary from viewing data, querying attribute information, making maps, and performing simple spatial queries. Desktop software products generally offer greater functionality and are geared toward experienced users. Web-based applications provide specific functionality and appeal to users with varying skill levels. The solution for the city is ArcIMS.

ArcIMS is an economical way to distribute GIS data to a large number of people. ArcIMS enables us to avoid purchasing and managing individual or pooled ArcGIS licenses for people who were only using a fraction of its functionality. ArcIMS is accessible from any place users have a connection to the internet. Because it uses a web browser and the internet, the tools and

interface are already somewhat familiar to users. ArcIMS, as with any of the GIS tools, provides the users with access to the most current data along with the ability to view many different types of data at once, which can be cumbersome with paper maps.

Why Use a Template?

Out-of-the-box, ArcIMS uses a template to create new web sites through the Designer application. This template is used to automate the web site creation process. Doing so allows individuals with little or no web development experience to create new ArcIMS applications quickly. Templates can also benefit experienced web developers by eliminating the need to recreate elements of an application each time a new application is requested. This saves time and provides consistency among the variety of applications that can exist within a single organization. Templates also establish a standard tool set that defines what functionality is made available to the user. The tools are carried from one application to the next, which allows users to quickly orient themselves. Zoom and Pan are examples of standard tools found in most, if not all, mapping applications.

Who was Involved?

At the City of Olathe, the GIS division is part of the Information Technology Services (ITS) department. The ITS department employs four GIS staff members. These staff members include the GIS Manager, GIS Analyst, GIS Programmer, and a GIS Database Administrator. The GIS Manager is responsible for the four ITS employees and shares responsibility for five other

GIS staff, in four departments. Development Services employs a GIS Analyst and a GIS Technician, both located in the Planning division. Municipal Services employs a GIS Analyst, Public Works employs a GIS Technician, and the Olathe Police Department (OPD) employs a GIS Programmer/Analyst.

The GIS Programmer from ITS serves as the ArcIMS administrator and is primarily responsible for developing the city's web-based mapping applications. The collaborative process that led to the creation of the Olathe IMS template involved GIS staff members from the departments listed above. Staff members met between August 2004 and January 2005 to discuss the base map, user needs, and functionality.

Timeline

The need for a new IMS template first became evident during the summer of 2004. It started with a request for additional functionality from the Municipal Services department. This request was relayed to other GIS staff members and we quickly realized that several of the divisions had same or similar needs. At the end of the summer the decision to develop a new template was made and work began shortly thereafter.

At the beginning of the development process the GIS staff met on several occasions to brainstorm about the creation of a template base map and improvements to the existing functionality. The goal of creating a template base map was to provide consistency from one application to the next. This is accomplished through the standardization of symbols and layers names that were agreed upon by all members of the development team, (see Figure 1.) In

addition, the base map layers were grouped according to use as part of the new organizational structure implemented in the Table of Contents. Requests for

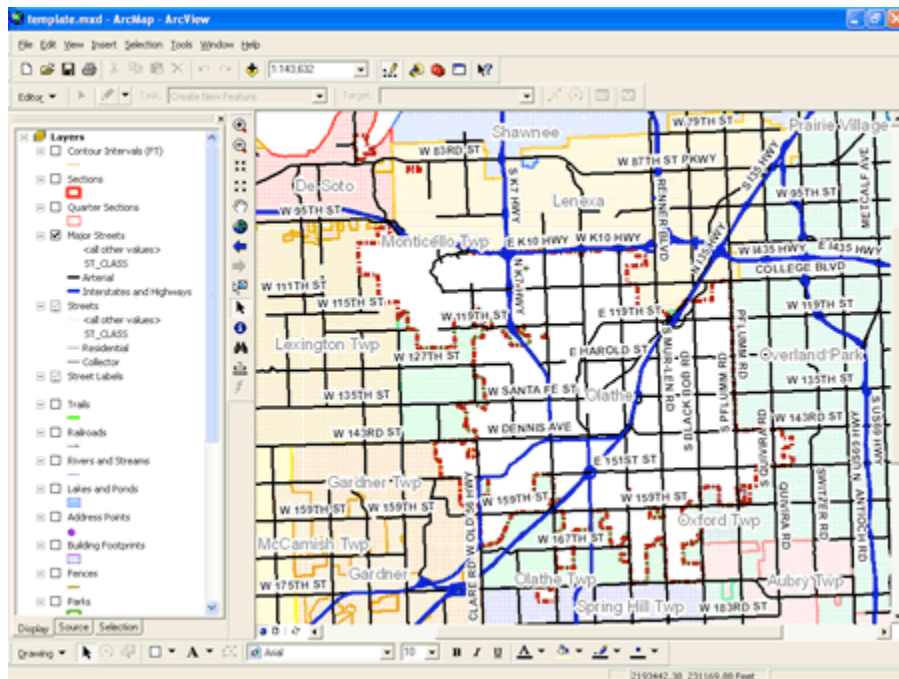


Figure 1. The base map template features a standard set of layers and symbols..

additional functionality were addressed by identifying the needs that were most common and determining how to provide functionality that would be beneficial to all users.

After the initial brainstorming sessions, the remaining meetings served as review sessions. In these sessions, the new layer symbolization and improved functionality was evaluated by the group. This stage of development preceded final acceptance of the template and allowed for adjustment or further enhancement. The template was made available to the GIS staff early in 2005, (see Figure 2.) At that time a meeting was scheduled to recap the improvements that were made and to provide instructions for implementing and using the new

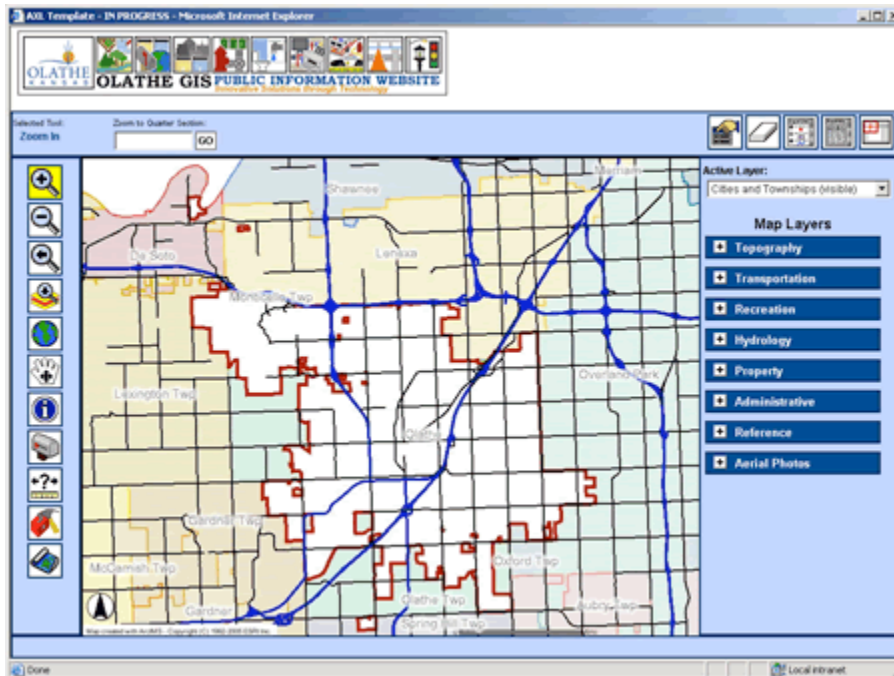


Figure 2. The Olathe IMS Template is the product of a collaborative effort between departments.

template. The following months were used to test the new applications and troubleshoot any unforeseen issues.

Resources

Building a custom template can be a daunting project, to say the least. As we outline the processes that led to the creation of the Olathe IMS template, we recognize that this type of project might not be practical for all organizations. Olathe's GIS division is fortunate to have the support of the ITS department and a staff that includes specialized positions, such as programming and database administration. That is not meant to imply that such a project should not be attempted in the absence of these things. This is just one criteria used in determining how the project should proceed.

Perhaps the most important question to ask is, "Do you really *need* a template?" Regardless of size, some organizations may not have a real need for

a customized template. Remember that one benefit of using a template is consistency. A template offers consistency to users when a single organization maintains several different web-based applications. Building a custom template may be development overkill for organizations that have only a single application. There may be other cases in which a single organization is responsible for maintaining several different sites, but a template is still not an option. An example would be an application that deals specifically with sponsored programs. Applications that are affiliated with a particular program may use logos or other specific layout designs that would not fit into a more general template.

Another important consideration is personnel and whether or not the expertise for completing this project is available. For example, performing customizations requires someone with at least a basic knowledge of web programming languages, or experience in other development environments as necessary. As you begin to define what functionality is required for your template, remember to factor in the abilities and other job responsibilities of your developer and everyone involved.

This brings us to another important consideration: time. The ITS GIS Programmer position is devoted to application development and maintenance, allowing this individual to allocate a considerable amount of time to this type of project. Time becomes a limiting factor if the developer has other responsibilities or is less experienced. Some of the more complex customizations may not be an option, if time is a limiting factor.

Limited access to personnel does not have to prevent an organization from developing a custom ArcIMS template. An organization that lacks expertise but demonstrates a need for a custom application has other options.

Unfortunately, many of these options require a significant financial investment.

Users' Needs

Identifying users' needs was an essential part of creating the template. This involved determining the types of tools that users of all skill levels could benefit from. Collaboration provided the opportunity for each staff member to express their users' needs. Also, the template had to be flexible enough to grow as users' needs changed.

Another concern facing the team was whether or not the time that was required for some modifications would significantly delay the release of the site. Generally, priority was given to elements where more than one user group had expressed a need. If a suggested functionality was not an immediate priority it became part of the second phase of development. Our goal was to develop an application that inexperienced users could operate as effectively as our more experienced users.

Some of the most significant user needs were: reference tools, map window size, improved labeling, map output, and mailing list creation. Team members agreed the template needed tools that would help users quickly reference themselves whether it was by a specific part of town, quarter section, address point, parcel address, parcel id, or intersection. Through modification of

existing tools and the creation of new functionality, we were able to provide users with these options.

Previously, users had complained that the map window was small and difficult to use, particularly for those who had worked with ArcView 3.2. In response, the team agreed to make the map window as large as possible. In spite of the large map size, the labels were still difficult to read. The sizes, colors, and fonts were adjusted so that the street labels would be legible at all scales.

Users had multiple needs with regard to map output. Some needed to have map elements such as a legend, title, and north arrow, (see Figure 3) while

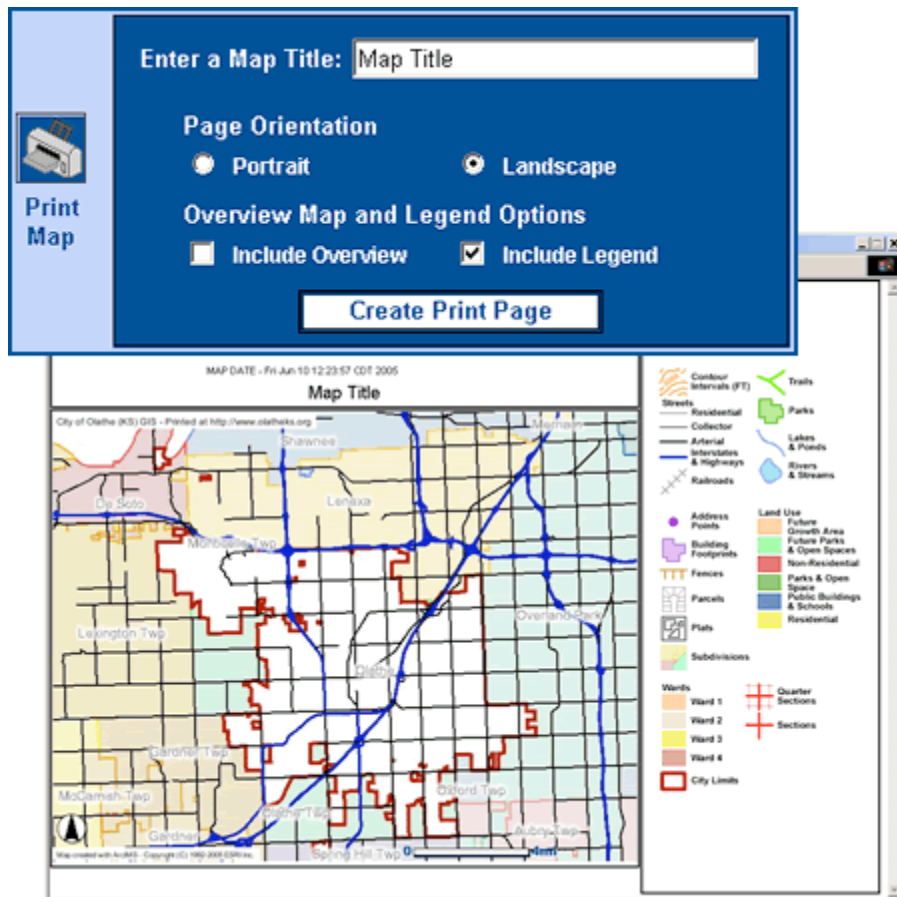


Figure 3. New options allow users to choose a page orientation and whether to include the overview map and legend.

others felt it was more important to have the map image fill as much of the page as possible, (see Figure 4.) We were able to accommodate everyone by providing both options on the print menu. Users had also expressed the need to



Figure 4. The Copy Map Image function allows users to print or download the map image in a variety of sizes.

be able to create their own mailing list. Functionality was added to create a mailing list from attribute information associated with the parcels or address points. All of the features listed above, as well as many others, have been critical in providing Olathe's GIS community with the flexibility needed to leverage the city's spatial data resources.

Viewer and Map File Options

ArcIMS developers have several viewer and map file options to consider when building a new site. Each of the viewer types use a different language or development environment to build the application interface and functionality. Choosing a viewer type depends on the application requirements and the intended audience. For example, the Java viewer offers built-in functionality that provides feature information through map tips and allows users to add layers to the map. However, the Java viewer requires users to download and install the viewer piece before they are able to view the maps. This process may take a very long time for public users with slow internet connections. If the application requires functionality that is available in the Java viewer but is intended for the general public, a viewer type that doesn't require additional downloads is a better choice. Other viewers may use a combination of Hypertext Markup Language (HTML) and JavaScript, Active Server Pages (ASP), Cold Fusion, Java Server Pages (JSP), or the Microsoft .NET framework. Many of these viewer types offer the same functionality while catering to the development experience or strengths of your developer. In cases where the desired functionality is not available, many developers can use their knowledge of a particular language or development environment to create something similar. The Olathe IMS template uses the HTML viewer because it is flexible enough to meet the needs of both internal and external users.

In addition to selecting the appropriate viewer type, there is also an option for creating the map file that defines which layers are included in a given

application. Map configuration files can be developed using the built-in Author application or using a standard ArcMap document. Author is provided with ArcIMS, easy to use, and the files that are created can be manipulated in a simple text editing program. However, ArcMap offers advanced symbolization and access to data types that are not recognized by Author. Staff members use both applications depending on how the data is stored and the symbology used.

Custom verses Out-of-the-Box

Out-of-the-box, ArcIMS uses a template to automate the creation of new sites through the Designer application. This template is designed to give users the ability to view and perform simple analysis of spatial data and other information. It features much of the same functionality found in desktop GIS software including basic map navigation and feature selection functionality. More advanced operations, such as editing and geoprocessing, are not available in the template. Given the availability of this existing template one might ask, "Why not take advantage of the resources that are provided rather than investing the time and money to develop something new?"

At the City of Olathe, ArcIMS development is driven by the needs of those employees that routinely access our GIS resources, with specific purposes in mind. Much of the motivation behind creating a new template with an improved set of tools and functionality comes from the need to support internal operations and specific tasks related to individual positions. Employees are given tools that enable them to more effectively serve the community and citizens can access many of the same tools for a better online experience. These may be enhanced

versions of tools found in the embedded ArcIMS template, or custom-built components that satisfy a requirement for which a tool did not previously exist. The tools in our custom template take into account the role of GIS in our organization and the unique characteristics of our GIS resources.

One of the most important data layers maintained by the Olathe GIS staff is an address point layer. ArcIMS has built-in geocoding functionality that produces an approximate location along a centerline. The City of Olathe's geocoding tool is actually a query tool that produces a more accurate match based on our address point layer, (see Figure 5.) This is an example in which

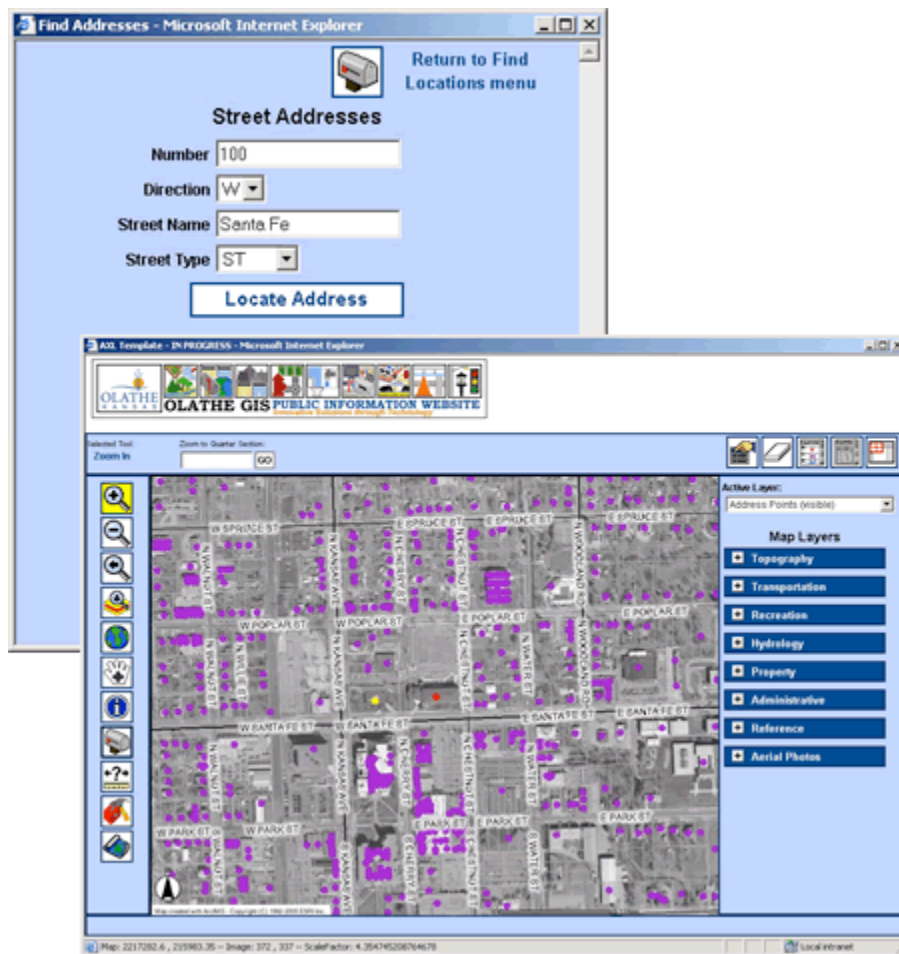


Figure 5. The Find Address tool searches the Address Point layer to find the specified address.

the unique characteristics of our data make the case for customization.

Several of the tools included with the out-of-the-box ArcIMS template provided adequate functionality for our users' needs. The basic map navigation tools (Zoom In, Zoom Out, Full Extent, and Pan) are examples of this. Their functionality is so fundamental that some form of these tools will be included in most applications. Our web-based mapping applications use these tools without modification.

Many of the enhancements in the Olathe IMS template are modifications to a tool's functionality or the manner in which users interact with it. The existing functionality has been augmented with additional inputs, more options, etc. Out-of-the-box, the Buffer tool allows users to specify the buffer distance in map units, the buffer selection layer, and whether or not the attributes of those features within the buffer will be displayed. Our modified control allows the user to select the measurement units (feet, meters, miles, kilometers, etc.) for the buffer distance. For example, if the user wants to enter a buffer distance of 500 feet and the map units are miles, he or she is able to select Feet and the distance is automatically converted by the tool.

Another example is the Print Map function. The ArcIMS template allows users to print a map, but does not provide the means for manipulating map elements and page characteristics. The only element a user has control over is the title. In the Olathe IMS template, users specify the map title and choose whether or not to display the overview map and legend. In addition, users can change the output page orientation to Portrait or Landscape, (see Figure 3.)

Some additional functionality needed to be added to the ArcIMS template in order to meet our users' needs. Examples from the Olathe IMS template include, but are not limited to, the Unselect tool, Active Layer pick list, and a new Table of Contents. The unselect functionality allows users to remove a feature from the selection set. Another addition is the Active Layer pick list, (see Figure 6.) It provides users with a more intuitive means of setting an active layer by selecting a name from a list of available layers. The new Table of Contents

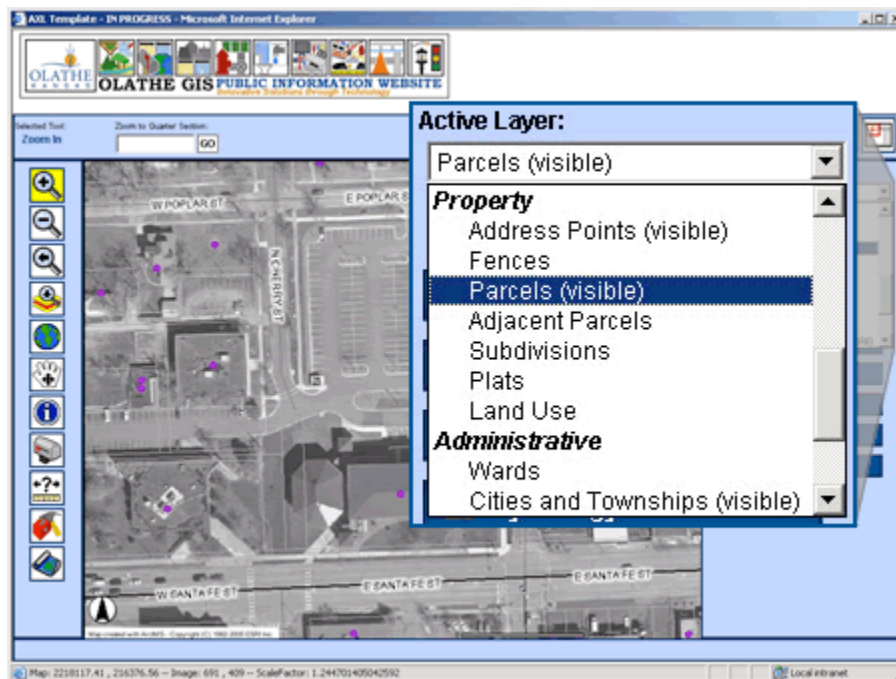


Figure 6. The Active Layer pick list provides users with a list of the layers that are available for selecting or identifying features.

combines out-of-the-box functionality with new elements. Layers are organized in expandable groups to manage long layer lists and help users navigate through the Table of Contents. In addition to grouping layers, new buttons were added to turn all layers in a group on or off with a single click, (see Figure 7.) The Update Map button has been modified to prompt users by blinking if they choose to turn layers on or off.

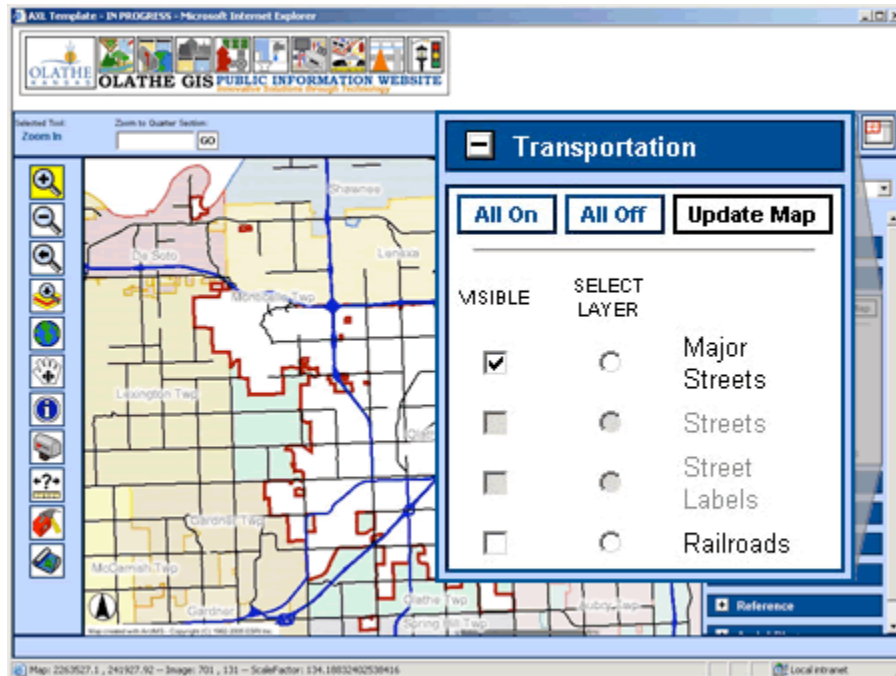


Figure 7. The new Table of Contents layout groups layers and provides the ability to turn layers on and off as a group.

Outcome

Were we successful? The answer is yes. For this project, we defined success based primarily on user acceptance. Users started buying into the new sites when they saw that the functionality they requested had been incorporated. We have gained backing from some of our toughest critics. The following example is one example of the feedback we have received:

"Very impressive, I think the boys down below are gonna love this...better yet, an old dog like myself really, really likes it!"

Another user said,

"The intranet site received the sewer group's approval. They were very happy with the size of the map window, printing, finding address by parcel (with highlighted parcel), using the query tool and more."

Our users have shown support and interest by helping others learn how to use the web sites. The sites also allowed us to reach out to potential users who did not have access to the information before.

Help documentation was provided in hard-copy and online to assist users after the training. We believe the project will continue to be a success because we will listen to our users' changing needs and make modifications as needed.

Summary

The City of Olathe chose ArcIMS because it is a cost-effective, efficient solution for distributing spatial data to a large number of users. Through a collaborative effort we were able to identify the needs of users throughout the community. This was critical to the successful creation and implementation of a standardized, custom template.

The template we created consisted of out-of-the-box, modified, and newly created tools and functionality. Many of the map navigation tools were used as-is. The modified and newly created elements were developed based on the unique characteristics of our data and specific user needs. Examples include, but are not limited to, the Buffer, Print Map, and Unselect tools, the Active Layer pick list, and the new Table of Contents. The tools and functionality in the Olathe IMS template satisfy the majority of our users' needs. This is what helped make our project a successful endeavor. Our users responded with supportive comments and encouraged others to use the applications. The project will continue to evolve as our users' needs change.

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