Mapping Institutional Knowledge: An Approach to Managing Assets

Sean C. Tabin

Masters of Science in Geographic Information Science (MSGISci)

Department of Geography, California State University, Long Beach

Introduction

The field of geographic information systems (GIS) has entered a period where GIS-based technology is now being consumed by non-technical individuals. Participatory GIS is an implementation that allows for individuals to have better access to information with optimized user-interfaces enabling the end-user to collect, view, and edit data more effectively and efficiently than ever before. At the City of Anaheim, GIS is becoming the centerpiece of technological changes and innovation, and has the ability to optimize asset management efforts that can be applied to landscape operations at the City.

A practice that I used to gather information is a technique that I will refer to as: mapping institutional knowledge. Mapping institutional knowledge is the engagement of GIS by non-technical staff or individuals with little to know knowledge of GIS. In this case, staff members participated in GIS by creating point data to identify spatial locations of landscape areas by highlighting their boundaries in a GIS.

My goals for this project is to create a robust dataset that is integrated into a map book, and made available through a mobile GIS and interactive web mapping application to improve landscape maintenance efforts.

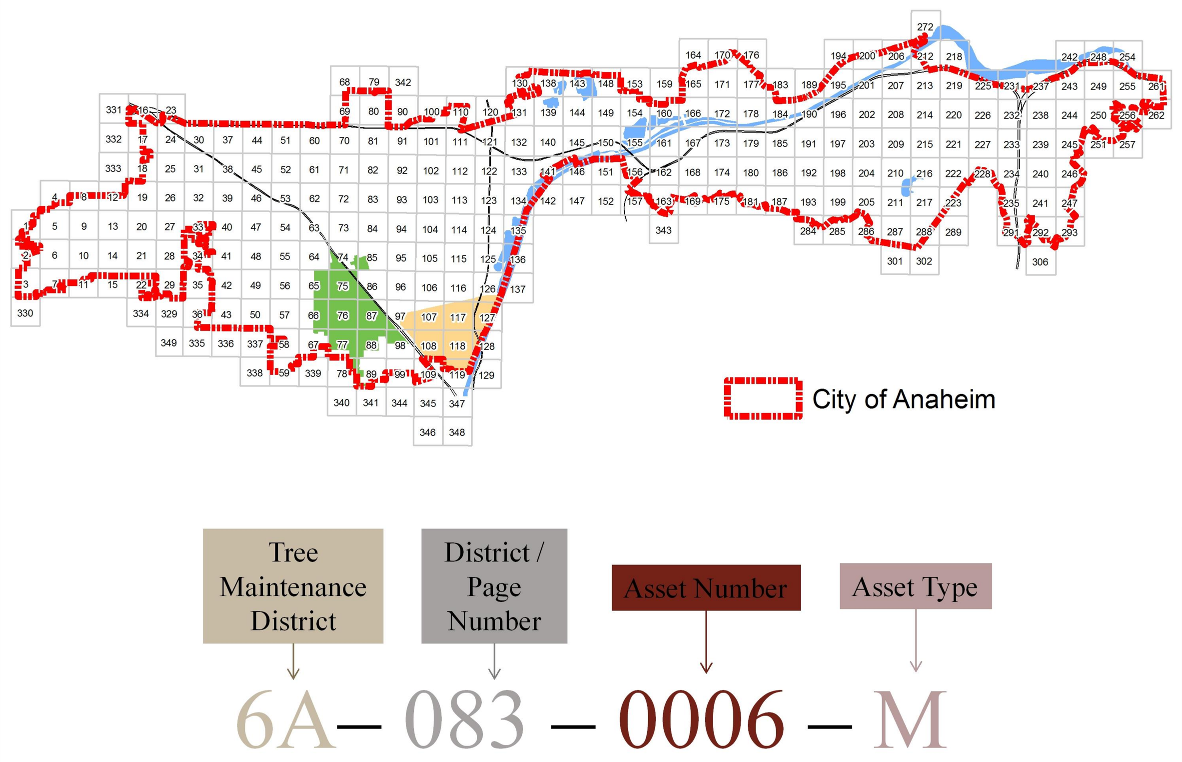

Figure 1. *This instructional diagram is important to understanding how to use the city district system with the use of a location-based unique identifier*

Data and Data Sources

The City of Anaheim has ownership of all the data obtained or developed for this project.

Table 1. *List of data and data sources used in the project*

NAME OF DATA	CONTENT	SOURCE
Aerial Imagery	3-in resolution	Eagle Aerial Solutions
Median_Parkway	Citywide parkways, medians, and tree wells	City of Anaheim
QualityInspection	Related table for job quality inspections of landscaping areas	City of Anaheim
Identify_Landscape	Identified landscape maintenance	City of Anaheim
AddressPoint	Building address	City of Anaheim
AssessedParcels	Land parcels	City of Anaheim
Schools	Public and private school locations	City of Anaheim
Parks	Park locations	City of Anaheim
Streets	Road network (arterial, interior, freeways, alleys)	City of Anaheim
TreeMaintenanceDistrict	Tree maintenance district	City of Anaheim
CityIndex	Utility grid system	City of Anaheim
ApparatusAccess	Roadway access	City of Anaheim
CityBoundary	City limits of project area	City of Anaheim

Methodology

Mapping institutional knowledge was conducted with the use of two key datasets: a 3-inch resolution aerial imagery and a identify landscape dataset. The identify landscape (Identify_Landscape) dataset is a point dataset that was created with the sole purpose of allowing a non-technical user to indicate the location of an asset by placing a point on the landscape area or denoting its boundaries.

Several quality control maps were compiled to allow staff members to verify asset locations. In many cases a staff member of the landscaping division would either review the asset locations in a GIS and/or make notes on a static map to signify missing or incomplete assets.

Significant time was required to model data in preparation to produce multi-functional data, or data that can be used in a wide variety of applications by both field and office staff. I designed the feature class attribute table with a location-based unique identifier for each asset. An example of this location-based unique identifier may have a structure similar to: 9D-109-1032-M (see Figure 1). The intelligible information received from this ID structure is that median asset number 1032 lives in power-line clearance 109 and can also be found in tree pruning district 9D. The powerline clearance grid is also the page number that a staff member can reference in the map book. The same ID is used to attach related records to the assets, and is used to reference assets in the mobile and web applications.

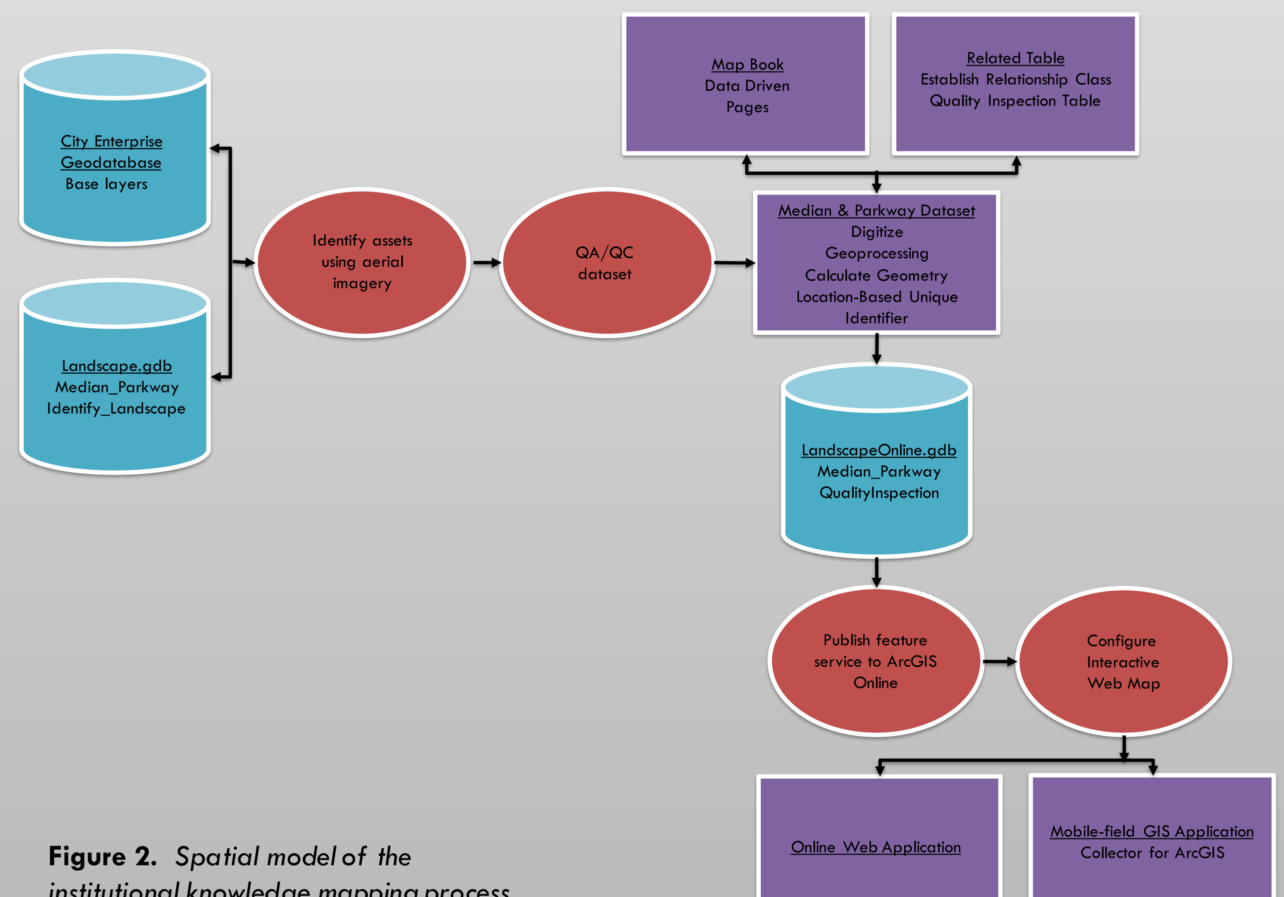

Figure 2. *Spatial model of the institutional knowledge mapping process*

Timeline

Much of the project work had been distributed throughout the course of the program.

Table 2. *My project timeline focused on the latter 10 weeks of the program*

PROJECT TIMELINE			
SCHEDULE	**DATE (2016)**	**PROJECT PHASE**	**PROJECT MILESTONE**
WEEK 1	May 30 - June 6	Planning	Complete research for the applied thesis project
WEEK 2	June 6 - June 13	Construction	Continue building median and parkway dataset
WEEK 3	June 13 - June 20	Construction	Finalize median and parkway dataset
WEEK 4	June 20 - June 27	Construction	Design and assemble map book
WEEK 5	June 27 - July 4	Construction	Construct index pages for map book
WEEK 6	July 4 - July 11	Construction	Develop related table and deploy in mobile application
WEEK 7	July 11 - July 18	Construction	Configure interactive web mapping application
WEEK 8	July 18 - July 25	Delivery	Compile and review applied thesis paper
WEEK 9	July 25 - Aug 1	Delivery	Design project poster and presentation
WEEK 10	Aug 1 - Aug 8	Delivery	Review final deliverables

Results

The identification of asset locations through the lens of city staff resulted in the digitization of 1,334 features to complete the median and landscape dataset.

The asset nomenclature is printed on the back of index pages to remind users of the intelligible information captured by the identifier, and how they can find a particular asset in the map book.

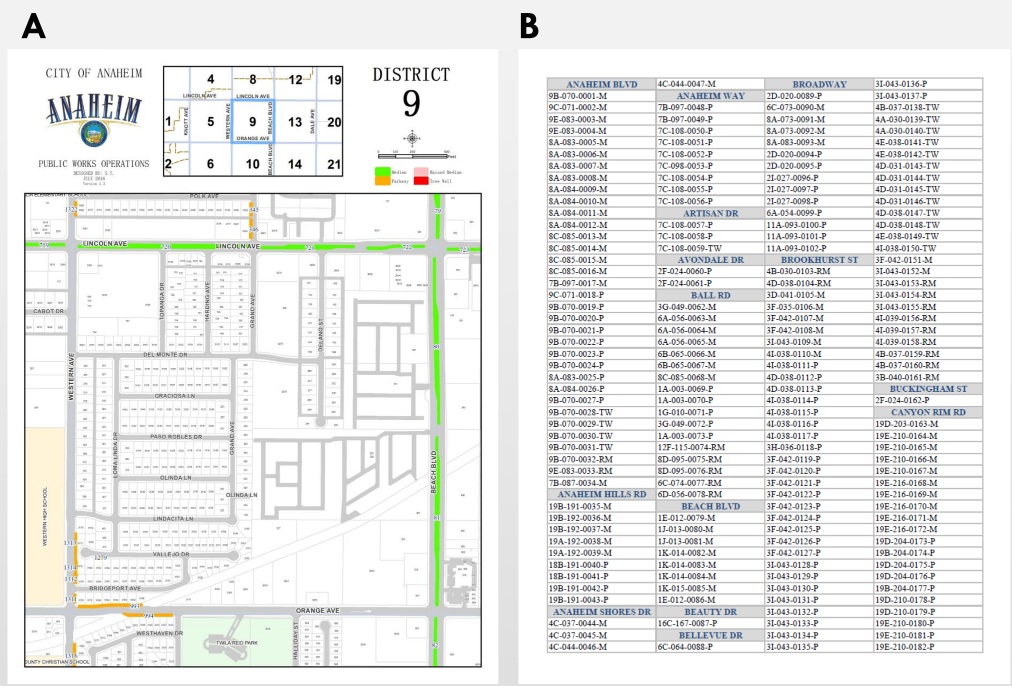

Figure 3A and B. *Assets in the map book can be reference using the index pages containing the location-based identifier*

Through the use of mobile smartphones and tables, field crew can collect quality inspection records, and can update maintenance statuses of landscape areas.

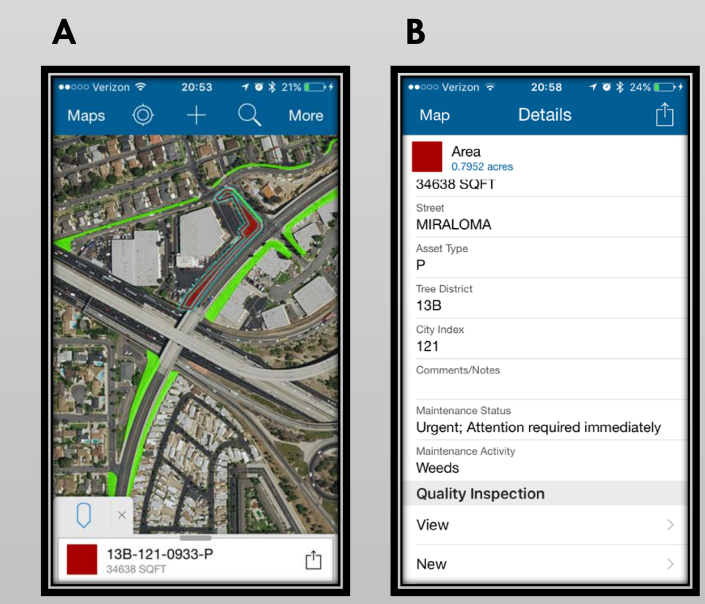

Figure 4A and B. *The Collector for ArcGIS application user-interface from an Apple iPhone 5 allows users to edit, view, and create inspection records*

A decision was made to add a print, measurement, and query tool to the WebApp Builder in ArcGIS Online. The print widget will enable end-users to format and print custom maps from the web application user-interface. The measurement tool will allow users to delineate distances, areas, or other quantities. The query tool is designed for users to have access to current maintenance statuses. The query tool will provide of list of assets that require attention which can be exported as an excel spreadsheet for further data dissemination to field crew.

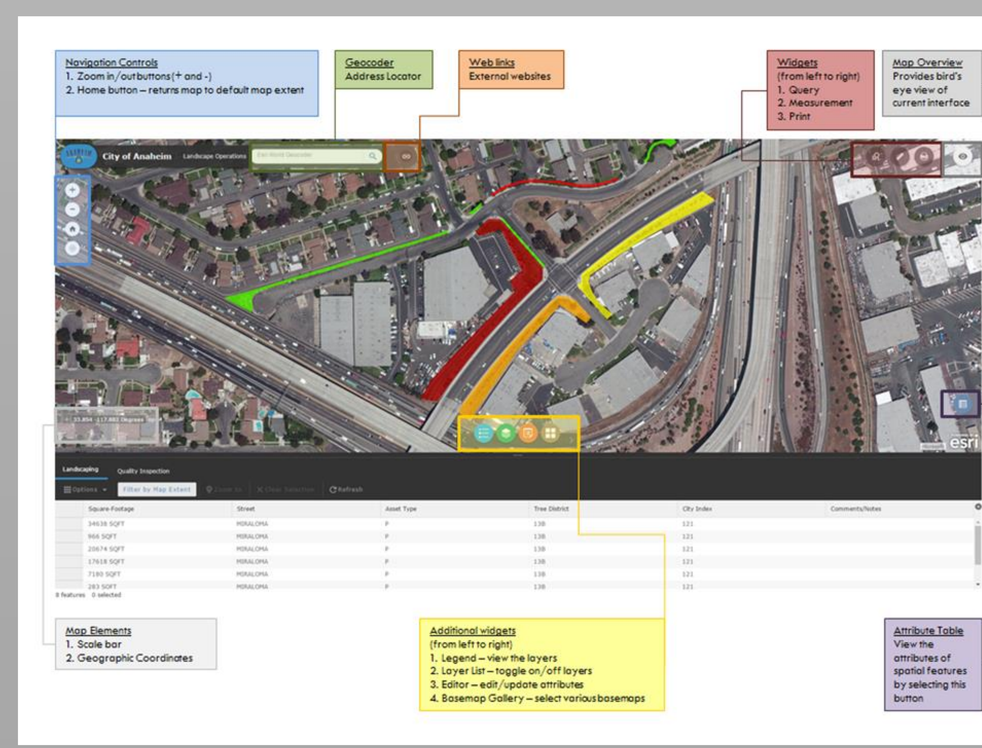

Figure 5. *Widgets provide functionality to the web mapping application*

Discussion

Web services can be deployed in a day's worth of work or less, provided that the data already exists. Therefore, planning and preparation in acquiring data are critical. Staff members were able to identify asset locations through the perspective of an aerial image, which allowed city staff to quickly cover more territory

The map book offers a good resource for inventorying median and parkway assets. City staff and third-party landscape services have a resource to communicate maintenance responsibilities. A downside of a static map book inherently means that the data are not dynamic, and will require periodic updating as assets are removed to or added from the dataset.

Collector for ArcGIS is a proven and easy to use mobile GIS application. The usefulness of the application allows for field crews to have access to the data from their smartphone or tablet. The Collector application was configured to enable staff members to view and record quality inspection records with minimal training. A disadvantage of the data collection process is that a user must select individual features to conduct an inspection record. This process cannot be performed in a batch process. Beyond its limitations, the application has more bells and whistles than the map book making the usefulness of the application more desirable.

The web application can be shared via a web link or URL. The web link can reveal its usefulness if attached to a bid document for data dissemination to potential landscape services if the city choses to use this application for production. The web map would allow third-party contractors to view maintenance requirements and obtain information of spatial data through pop-ups. The widgets deployed in the web application also address the need for reporting capability between the city and contractors.

Conclusion

The location-based unique identifier developed for each of the assets was instrumental to the success of this project. Effective asset management requires the use of unique identifiers. The intelligible identifiers can be referenced from the map book, to the mobile application, or to the web mapping application. The unique ID is necessary to attach related records to assets.

This method of mapping institutional knowledge can be used to identify additional assets beyond parkways and medians. Data edits made in the cloud platform are exclusive, meaning those changes are not reflected in the database originally used to publish the data. Instead of publishing data from a file geodatabase to the cloud, publishing and storing the data into a relational database will allow for edits or changes to be dynamic across web and mobile, and ArcMap environments. The use of mobile GIS applications for asset management yields high rewards and has the potential to assist field crews by helping them make their occupations easier.

Submitted in partial fulfillment of the requirements of the Masters of Science in Geographic Information Science(MSGISci), August 13, 2016.

For additional information please contact: Sean Tabin by email at sctabin@gmail.com or stabin@anaheim.net