CITY OF BERKELEY, CALIFORNIA

GIS MASTER PLAN

TABLE OF CONTENTS

MILESTONES 1-5

INTRODUCTION

GIS MASTER PLAN

The Scope of Services for this project identified the need to review and assess the enterprise GIS and then develop a strategic planning framework that outlines recommendations, methods, and strategies for achieving the GIS Program goals and objectives. The creation of goals for the framework document required an extensive amount of information gathering to understand current successes, needs, gaps, and opportunities. Based on the identified GIS needs at the City of Berkeley, an alternative system design was developed to better meet the City's geospatial needs and a corresponding five-year tactical plan developed that recommends items to be implemented each year along with associated costs.

The following sections describe the general findings of the five milestones developed for the City of Berkeley's GIS Master Plan. The five milestones include:

1. **Needs Assessment**
2. **Technology Readiness Assessment**
3. **Authoritative Data Source Assessment**
4. **Organizational Readiness Assessment**
5. **Five-Year Tactical Plan of Action**

In addition to this Master Plan document, the City has also been provided a separate Executive Summary document that summarizes key findings of the Master Plan.

TABLE OF CONTENTS

MILESTONE 1 – GIS NEEDS ASSESSMENT

EXECUTIVE SUMMARY

MILESTONE 1 – GIS NEEDS ASSESSMENT

Like most local governments in the United States, the City of Berkeley has been using a Geographic Information System (GIS) for a number of years. The core GIS Team is located in the Information Technology Department and provides support to GIS-using departments in the City. Though the City has a functioning GIS, it recognizes that it is not a true enterprise GIS and that improvements need to be made to both meet existing needs and to support the anticipated growth in number of GIS users.

This document is a collection of GIS Needs Assessments that were developed based on information collected by Geographic Technologies Group (GTG) during staff interviews conducted during October 31st – November 4th, 2016 and from documentation and data provided by the City. These assessments help determine where needs exist within the following categories:

- GIS Governance
- GIS Digital Data and Databases
- Procedures, Workflow, and Integration
- GIS Software
- Infrastructure
- GIS Training, Education, and Knowledge Transfer

Where needs are identified, recommendations are made on how to meet those needs. A compiled list of needs and recommendations will be provided in the "Milestone 5: GIS Implementation / Tactical Plan" document.

In addition to this Milestone 1 document, the following milestones will further enumerate needs and recommendations for the City of Berkeley:

- **Milestone 2: Technology Readiness Assessment** – evaluation of the readiness of the existing GIS infrastructure and its ability to meet current and future GIS needs

- **Milestone 3: Authoritative Data Assessment** – assessment of all existing GIS data and its ability to meet the needs of the enterprise, function as authoritative sources, and meet disaster planning needs

- **Milestone 4: Organizational Readiness Assessment** – develop a governance plan for the enterprise GIS as well as a GIS Training plan

- **Milestone 5: GIS Implementation/Tactical Plan** – based on information developed in previous milestones, develop a clear roadmap of how Berkeley's GIS will be improved

- **Milestone 6: Final Presentation** – presentation of the overall project findings and recommendations to the major GIS stakeholders

INTRODUCTION

MILESTONE 1 – GIS NEEDS ASSESSMENT

The Scope of Services for the City of Berkeley's GIS Master Plan identified the need to review and assess the enterprise GIS and then develop a strategic planning framework that outlines recommendations, methods, and strategies for achieving the GIS Program goals and objectives. The creation of goals for the framework document requires an extensive amount of information gathering to understand current successes, needs, gaps, and opportunities. Multiple methods were used to gather and analyze the needed background information to include:

- **An Online Voice of the Customer Questionnaire Instrument** – allowed Berkeley staff to answer a series of questions via an online questionnaire designed to illicit information about all aspects of the GIS.
    - On **October 25th**, the online questionnaire was distributed to all departments
    - **37 GIS users** took the online questionnaire from 11 different departments, with the majority of users coming from the Information Technology Department.

- **On-site Technical Workshop** – This workshop was conducted Monday afternoon October 31st at the City. The workshop included demos of GIS software apps pertinent to City of Berkeley Departments. This allowed staff to better understand what is possible with an enterprise GIS.

- **On-site Departmental Interviews** – multiple days in the first week of November were spent on-site interviewing departmental staff to get details on current uses and needs. An interview schedule can be found below:

City of Berkeley Departmental Interview Schedule

Mon 10/31		Tue 11/1		Wed 11/2		Thurs 11/3		Fri 11/4	
8		8		8		8		8	
8:30		8:30		8:30		8:30	Health, Housing &	8:30	
9		9		9		9	Community Services	9	
9:30		9:30	Public Works-	9:30		9:30	Interview	9:30	GIS Master Plan
10		10	Transportation Interview	10	Public Works-Streets	10		10	Debrief Meeting
10:30		10:30	Engineering	10:30	Interview	10:30	Finance	10:30	
11		11	Interview	11	Zero Waste	11	Interview	11	Interview City Clerk
11:30		11:30		11:30	Interview	11:30		11:30	
12		12		12		12		12	
12:30		12:30		12:30		12:30		12:30	
1	GIS Master Plan	1		1	Rent Board	1	Fire Department	1	
1:30	Kickoff	1:30		1:30	Interview	1:30	Interview	1:30	
2	Meeting	2		2		2		2	
2:30	IT	2:30		2:30		2:30	Planning	2:30	Police Department
3	Departmental	3	Parks, Recreation &	3	City Attorney	3	Department	3	Interview
3:30	Interview	3:30	Water Front	3:30	Interview	3:30	Interview	3:30	
4	GIS	4	Interview	4	City Manager	4		4	
4:30	Interview	4:30		4:30	Interview	4:30		4:30	
5		5		5		5		5	

The following individuals in each department were interviewed:

Information Technology:

Cristi Delgado, Business Applications, cdelgado@cityofberkeley.info

Richard Carrillo, Business Applications, RCarrillo@cityofberkeley.info

Michael Levy, Administration, mlevy@cityofberkeley.info

Rajesh Kewal, Business Applications, rkewal@cityofberkeley.info

Leon Salcedo, Business Applications, lsalcedo@cityofberkeley.info

Clifton Noble, Business Applications, cnoble@cityofberkeley.info

Rebecca Lowe, Business Applications, rlowe@cityofberkeley.info

Navdeep Mehta, Business Applications, nmehta@cityofberkeley.info

Greg Segraves, ERP, Gsegraves@cityofberkeley.info

City Clerk:

Marty McNulty, Administration, mmcnulty@cityofberkeley.info

Mark Numainville, Administration, mnumaunville@cityofberkeley.info

Rose Thomsen, Administration, rthomsen@cityofberkeley.info

Planning Department:

Jesse Bright, Building and Safety, Jbright@cityofberkeley.info

Lisa Cronin, Toxics, LCronin@cityofberkeley.info

Charles Enchill, Land Use, CEnchill@cityofberkeley.info

James Frank, Land Use, jfrank@cityofberkeley.info

Carol Johnson, Land Use, cjohnson@cityofberkeley.info

Alene Pearson, Land Use, Apearson@cityofberkeley.info

Fire:

David Brannigan, Special Operations, dbrannigan@cityofberkeley.info

Khin Chin, Special Operations, kchin@cityofberkeley.info

Steven Riggs, Fire Prevention, sriggs@cityofberkeley.info

Abraham Roman, Training, Aroman@cityofberkeley.info

David Sprague-Livingston, Suppression, Dsprague-livingston@cityofberkeley.info

HHCS:

Janet Berreman, Public Health, jberreman@cityofberkeley.info

Finance:

Melanie Bynes, Revenue Collection, MEB1@cityofberkeley.info

Roasrio Riche, Treasury, RRiche@cityofberkeley.info

The data gathered through these various methods was then compiled into four documents that comprise the first milestone of this project. The documents are as follows:

- **Chapter 1 – Online Questionnaire and Voice of the Customer (VOC) Survey** – this document is a compilation of the on-line VOC survey instrument, summary charts, and an analysis of the answers.

- **Chapter 2 – Departmental Needs Assessments** – detailed findings from the on-site interviews. Includes department overview, governance, hardware and software, GIS needs, GIS data layer inventory, GAP analysis chart, multi-tier recommendations, and departmental ROI.

- **Chapter 3** – **Benchmarking Analysis** – this document examines each of the six components of an enterprise, sustainable, enduring GIS, broken down by the key performance indicators (KPIs)

within each component. The City's current GIS gaps are identified, and an overall score for each category is recognized.

- **Chapter 4** – **Recommended Organizational and Departmental GIS Needs** – This document will include the vision, goals, objectives and tasks of the organization. It highlights the overall needs of the City within the six GIS components, while further categorizing the departmental needs found in Chapter 2.

These chapters have been grouped together to form Milestone One, and they provide background context for the recommendation documents that follow in Milestone 2, 3 and 4.

QUESTIONNAIRE

VOICE OF THE CUSTOMER (VOC) SURVEY

Berkeley has realized various successes in the process of developing a Geographic Information System (GIS) program. A solid foundation and tremendous opportunity exists for Berkeley to expand GIS further throughout the organization and to external customers.

A variety of departments use the technology for a diverse set of needs. It is important that the customers have a venue and a mechanism to share their needs, concerns, and opinions about the technology. Many GIS implementations do not reach full adoption and some even fail altogether because the customer's voice is not heard. Therefore, it is important that the City of Berkeley's GIS customers (internal and external) feel they have various mechanisms for being heard.

Voice of the Customer is used in business and information technology fields to describe the in-depth process of capturing a customer's expectations, preferences, and aversions. It is a market research tool to help identify needs and satisfaction so that priorities can be set to satisfy those needs. In this case, the market being researched is the market of current and prospective users

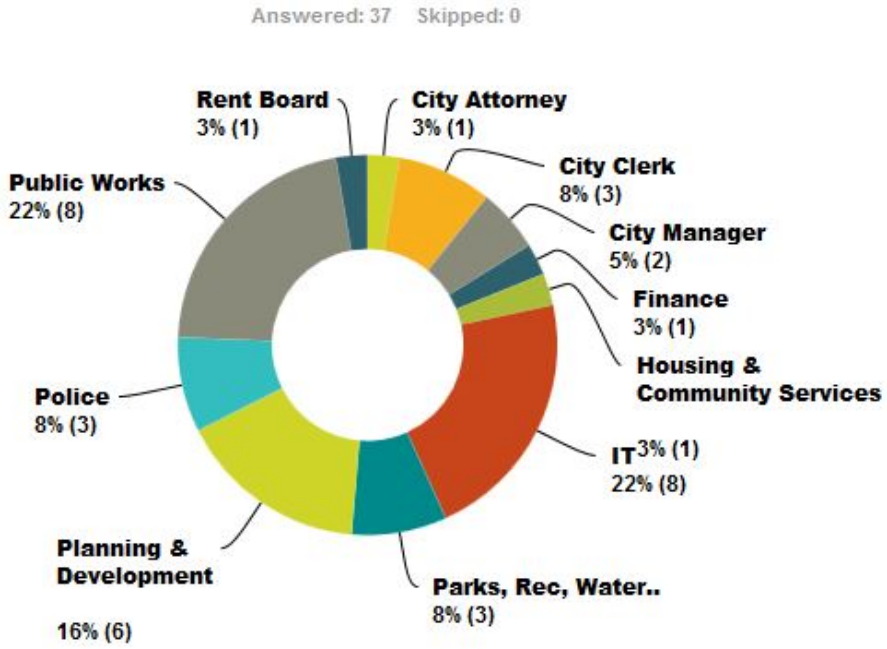
and beneficiaries of the City's GIS. The Voice of the Customer is optimally heard through various ongoing feedback mechanisms to include:

- Face-to-face interviews and discussions with users and prospective users
- Focus groups such as a GIS Steering Committee and GIS User's Group
- Customer feedback forms

As part of the GIS Strategic Planning initiative, a voice of the customer survey was administered as an on-line survey. The link was sent to a diverse group of users at the City and they were given a number of days in which to fill out the survey. The results and the on-site interviews serve as two very informative mechanisms to understand the customers. The following are the questions and the results of the online voice of the customer survey. Each of following include the question itself, a synopsis of the reason for the question (intended purpose), a short-analysis of the answers, charts summarizing the answers (if contextually appropriate), and the descriptive responses of the respondents (if applicable).

Question #1 - In which department do you work?

- **Intended purpose** – to determine the total number of respondents by department
- **Analysis of the answers** – a diverse number of departments responded, which gives a good cross-section of opinions. As would be expected, the heavier using departments and the larger departments had more respondents (IT, Public Works, Planning). Therefore, it is important to understand that the results are skewed towards the departments with the most respondents and have not been statistically normalized.



Question #2 – In which division of your department do you work?

1. Revenue Collections
2. Building and Safety
3. Admin
4. Zero Waste
5. Network
6. Office of Economic Development
7. Administration
8. NetOps
9. Records Unit
10. Operations
11. Current projects and landmarks
12. Business Applications
13. Admin
14. Business Applications

15. Toxics Management
16. Projects
17. policy
18. Admin
19. Capital Projects (Engineering/Transportation)
20. Engineering
21. Operations/Patrol
22. 311 Customer Service Center
23. Public Health
24. City Attorney
25. Building and Safety
26. Admin
27. Streets and Utilities
28. Transportation
29. ERP
30. Investigations
31. Business Application / Programmer - Portfolio Coordinator
32. Business Applications
33. Professional Standards
34. n/a
35. Waterfront
36. Engineering
37. Engineering

Question #3 - What are the main functions of your department/division?

- **Intended purpose** – to determine the specific background, division, and/or skill set of the respondent
- **Analysis of the answers** – there was a diverse background of respondents. This provides a set of answers that reflect many concerns, uses, and opinions. The responses below are best reviewed in context with their specific questionnaire/answers but are still illustrative apart from the survey instrument.
- **Specific responses from the respondents**:
    - The Finance Department provides direct services to the entire Berkeley community, which includes approximately 116,768 residents and more than 11,000 businesses. The Finance Department's mission is to conduct all of our responsibilities with integrity, warrant and receive the trust of colleagues and constituents, and to positively support the delivery of quality services to fulfill the City's mission and citywide priorities. Within the framework of full disclosure and quality customer

service, our principal obligations are to safeguard City assets, maximize revenues, manage the business of City programs, and provide accurate, timely, and complete financial information.

- Plan Check
- The Parks, Recreation, and Waterfront Department operates and maintains the parks and greenery on City property, and provides recreational programming to the public. The Dept. also manages grants for capital projects.
- Picking up household MSW and Recyclables. Running the Transfer Station
- Network/desktop support
- Data reporting, district/sector reports (for council work sessions and other public audiences), administer Business Improvement Districts, convene industry groups and merchant orgs, assist with real estate transactions, Civic Arts Program, Revolving loan fund etc.
- Assist the Executive Director Rent Board and other staff on related to Rent Stabilization Board programs and policy including administrative program responsibilities related to the budget, outreach, program analysis, and the staffing of Rent Board regular meetings and committee meetings.
- SRs and Projects
- Manage physical offsite storage, consultation on imaging, indexing and creating taxonomies for electronically stored information. Provide consultation and training on current Records Management, Imaging Requirements and Information Governance principles.
- Maintenance of City Assets including streets, storm drains, sewers, equipment, sidewalks, graffiti abatement, pressure washing and the removal of illegal dumping.
- Ensuring zoning compliance for ministerial and discretionary permits. Reviewing landmark designation applications/criteria, design review for signage and additions to landmarks.
- Procure, manage and update the City's business applications
- Overall management, fiscal and administrative management

- Sourcing and configuring software for client departments
- Keep records of hazardous materials and emergency response plans for Berkeley businesses, inspect facilities, monitor compliance and remediation, process soil boring and well permits, handle complaints and information requests from public and businesses.
- We process land use entitlements.
- Develop long range policies that guide development and determine appropriate land use.
- Technology Services for the City of Berkeley including Public Safety and GIS
- Planning, permitting, design, construction management of capital projects for streets, sidewalks, storm drain and green infrastructure and facilities.
- From the website: The Public Works Department provides a range of services that are integral to our community's life every day. Our mission is to provide quality services to the Berkeley community with pride, courtesy, and commitment. Developing and offering efficient, cost effective services, in partnership with our residents and businesses, will help us achieve our vision to make Berkeley a leading city in the country in providing outstanding public works services. Working towards Our Vision In September 2000, the Department was the first agency in California to be recognized as an accredited Public Works Agency by the American Public Works Association (APWA), and in April 2004, it became the first agency in California and the third in the United States to be awarded national re-accreditation. In doing so, our Department is recognized for "leadership in the field of public works and dedication to continuous improvement in search of excellence in government service to the public." The Department is now working on its current re-accreditation process. Our Zero Waste Division is participating in a groundbreaking National Pilot Project by the Environmental Protection Agency to test the value of environmental management systems for improving environmental compliance and performance. We completed construction of the Compressed Natural Gas Fueling Facility and expanded the alternative fuel fleet. Being a leader in disability issues,

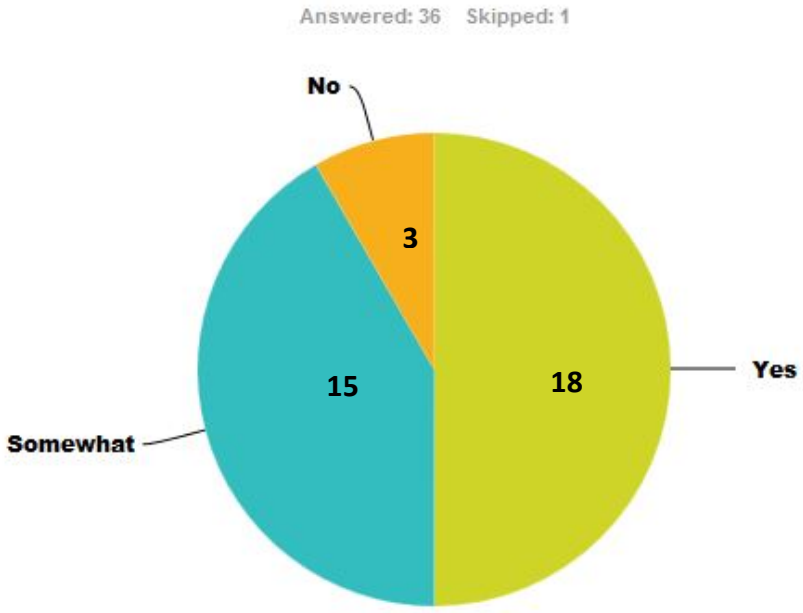
visitors and researchers from around the world come to Berkeley to see an exemplary model of an accessible community. We received national recognition from the Federal Emergency Management Authority for emergency preparedness. Cooperation, integrity, commitment, respect, accountability, and reliability are our values. We put Berkeley first: Community well-being is our reason for being. Did You Know? The Public Works Department is responsible for maintaining 216 miles of streets, 520 miles of sewer mains and laterals, 300 miles of sidewalk and pathways, 7,000 streetlights, 6,000 storm drain sewer facilities, 3,000 parking meters, 643 vehicles and equipment, and over 1 million SF of public building space. Each year: We replace or rehabilitate over 100,000 SF of sidewalks and pathways, 58,000 feet of sewers, and 10 miles of streets. To help beautify our neighborhoods we conduct 10 free cleanups. Our storm water is kept clean by sweeping up 3,000 tons of debris from the street that would have polluted the bay. We pick up over 3,500 tons of litter and remove over 148,000 SF of graffiti. Our crews patch over 2,300 potholes. Zero Waste Programs meet or exceed the 50% recycling goal by diverting over 27,000 tons of waste from the landfill. We respond to over 10,000 requests for service monthly.

- Police services to the community. My support role is in computer training and maintenance.
- 311 Customer Service Centers process Community members questions, concerns and requests for information. Including payments.
- Legal services
- Issuing permits Performing inspections Hazard mitigation programs
- Records Management/Legislative History of the City, Elections, Conflict of Interest, City Council Meetings and Agendas, Boards and Commissions, Campaign Finance, Customer Service
- Operations manages city infrastructure maintenance.
- Transportation Planning Traffic Engineering Parking Management
- ERP Project, Change Management

- Investigate crime: Identify and arrest the suspects responsible
- As Portfolio Coordinators, we are the dedicated technical resources for our respective client department. They would come to us when there is a gap in their business processes that a technology may be able to fill. Because we know our client's line of business, we are able to help them research, acquire and implement the solution.
- To provide tools to City employees that enable those employees to perform their functions optimally.
- Personnel, Training, Front Counter, Records, Jail, Property Room
- Council agenda packets, elections administration, redistricting, campaign finance, conflict of interest, records management
- Business operations of Marina, Economic Development of Waterfront, Parks Management, Lease Management of commercial locations, infrastructure oversight, public relations/graphic maps for PR.
- Maintain and improve City's owned infrastructures.
- Infrastructure CIP, Right of Way

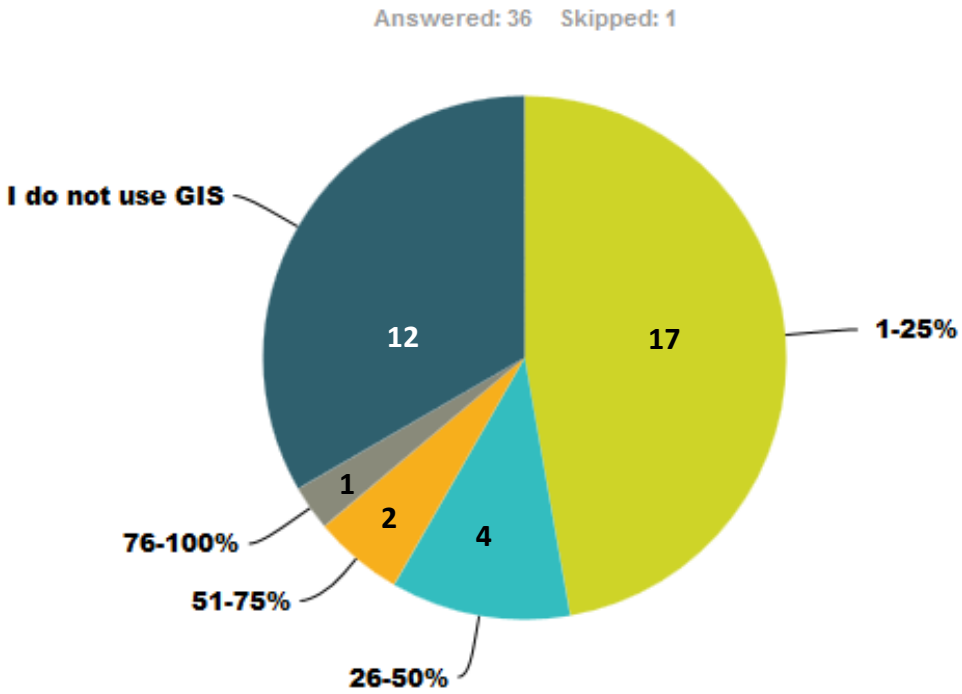
Question #4 – Do you have a thorough knowledge of what GIS is and what it can do to help improve your ability to carry out your job?

- **Intended purpose** – To determine the perspective of users as it relates to their understanding of GIS and how it can improve job performance.
- **Analysis of the answers** – The majority of the users who participated in the survey answered that they believe they have a moderate understanding of GIS and its capabilities. Very few answered no, which attests to the great job GIS staff has done on exposing users to GIS. This is in line with other survey responses related to training and usage of GIS. There is an opportunity to expand the knowledgebase of GIS within the organization.



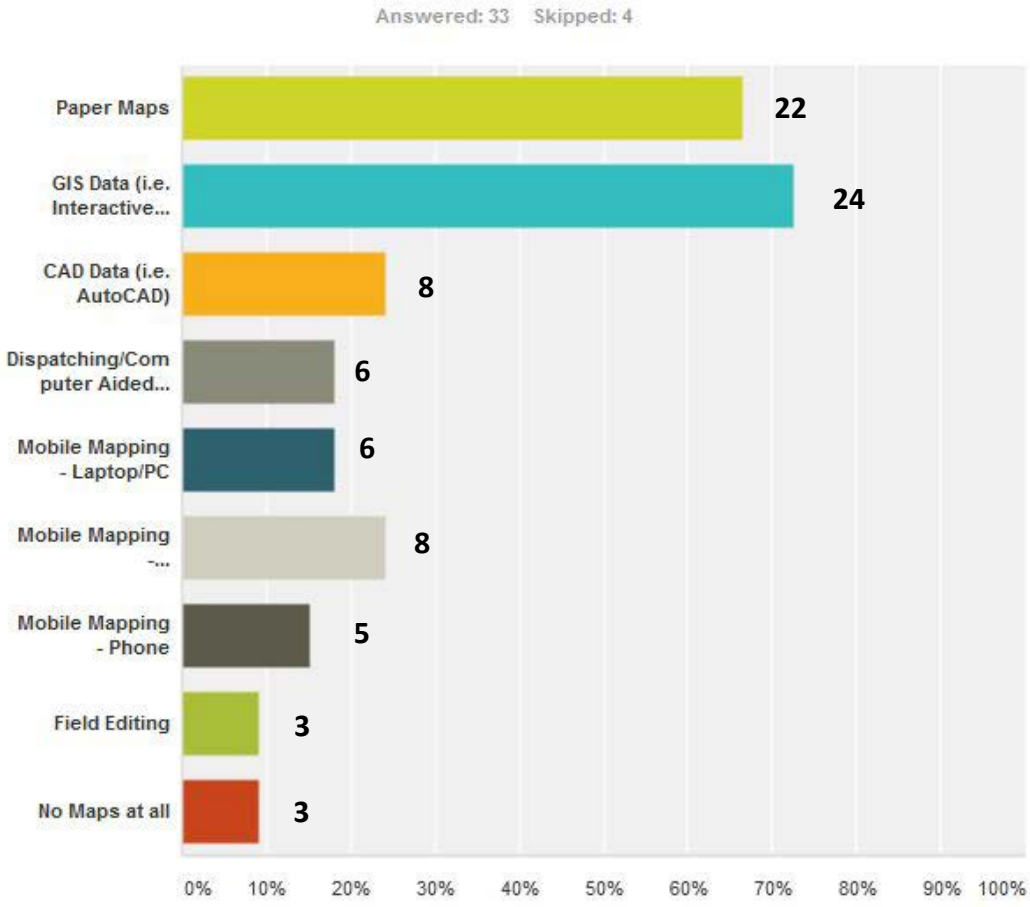
Question #5 - Do you use GIS? If so, what percentage of time do you spend using GIS?

- **Intended purpose** – To get an understanding of the intensity of use of GIS.
- **Analysis of the answers** – The City has a core group (less than 25% of respondents) that are frequent GIS users. The remaining users either don't use GIS or do so infrequently. In comparison to other organizations, the intensity of use could be higher and more diverse. Based on the departmental interviews, there is an opportunity to expand the user base at the City of Berkeley. This plan should increase the overall understanding of GIS and as a result an uptick of users should be expected.



Question #6 - What are the primary kinds of GIS/mapping activities your department/division is involved with? Please choose all that apply.

- **Intended purpose** – To understand how people are using GIS and mapping
- **Analysis of the answers** – Many staff still use paper maps over digital maps. Berkeley should anticipate an uptick in web users and a downtick in the need for some of those users to use paper maps moving forward.



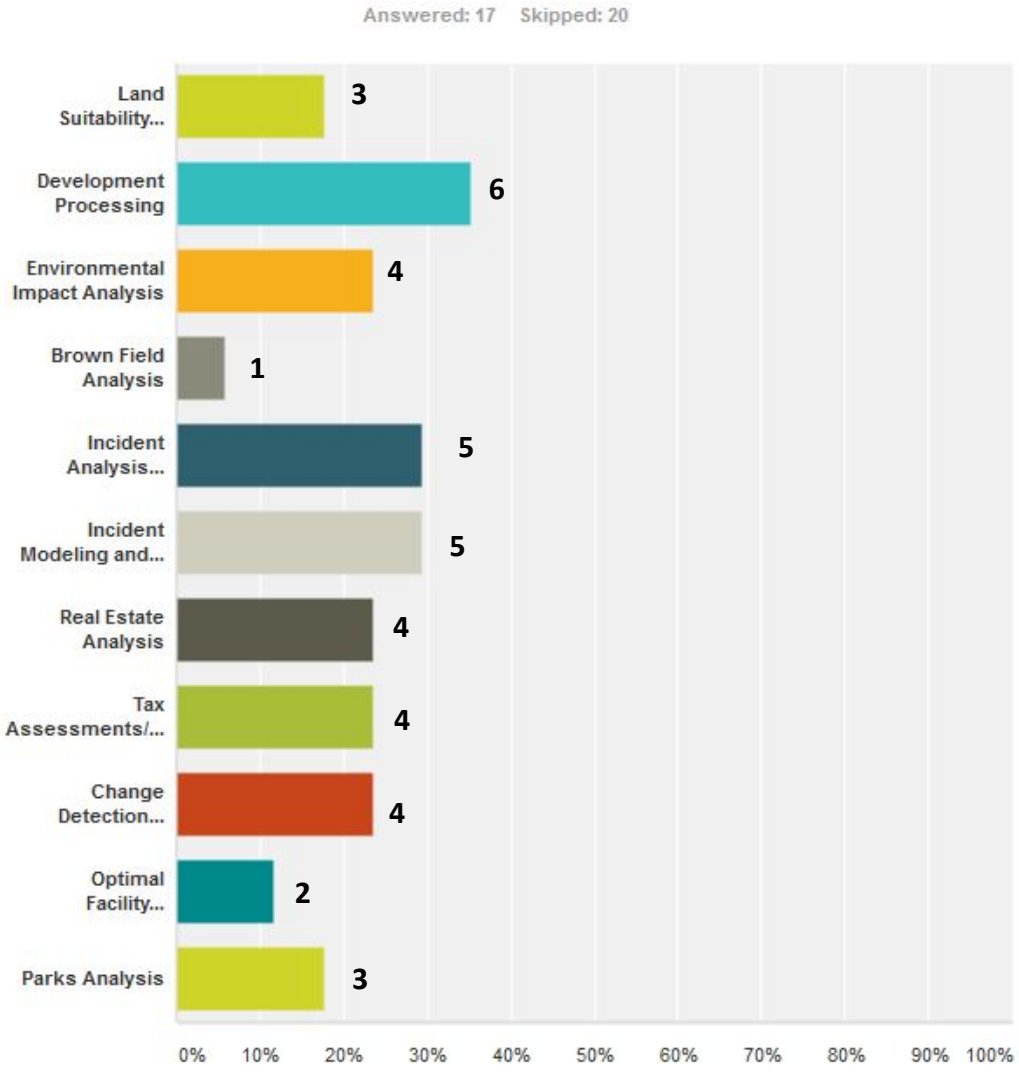
Comments from the respondents in regards to other ways they use GIS:

- We could always be doing more! And presentation quality stuff with mobile data collection features would really be good for us. Interfacing with the open data portal would be helpful too
- Government District Maps

- Create and manage ArcGIS Online site, web maps and Esri JavaScript applications 2. Manage hosted vendor GIS solution, Pictometry that has oblique photography, years of aerial photos for change detection, and 3D measuring tools (height, slope, etc.) 3. GIS integrations via map services with City applications for 311, permits, 911, licenses, etc.
- We're part of IT and provide GIS services to the City employees. There is great opportunity for us to take our GIS to next level and provide maps to Community for various needs including submitting service requests, searching for parks, data analytics and much more
- I also use the maps to do reports for back office divisions.
- Berkeley Municipal Code Zoning Maps. City Council Redistricting Maps. City Council District Locator (input address, Council district is returned)
- Prior to this job, I worked in planning, which had many uses for maps.

Question #7 - What analytical tasks does your department perform through the use of maps (e.g., land suitability analysis, tax assessments, etc.)?

- **Intended purpose** – To identify how people are using GIS from casual to analytical.
- **Analysis of the answers** – Again there is a diversity of use. A majority use GIS for development processing and incident analysis but several users also are using analysis for land management purposes.



Comments:

- We have occasional needs for GIS related analyses. In the past, we have used consultants for minor projects, but we have never had the capability for this in-house.
- Routing and sequencing of accounts

- We touch all of these things tangentially. Being able to view and mash up data from different sources is very helpful to us.
- None
- City Government Districts
- Vicinity of historic resources to proposed development.
- Districting (council redistricting, police beats, inspection areas, etc.) Proximity (school zone buffers, creek buffers, etc.) Geocoding
- We provide GIS layers for departments to conduct various analysis and there is so much room to grow specially with all new software we're installing such as CRM, Pay by Phone etc.. and 3-D GIS is already on the horizon
- locations of utilities and we will be using GIS for CMMS and EAM
- Look for City Assets and parcel information
- None
- Analysis of City Council redistricting proposals.
- Sewer CIP planning Cost estimate and budgeting Coordination with other program
- While we're not directly involved in the above, I'm pretty sure we've been consulted above at least some of them.
- Redistricting, elections maps
- CIP Planning, Asset Inventory, Asset Management, Property Notification

Question #8 - Please list the GIS software applications used in your department/division:

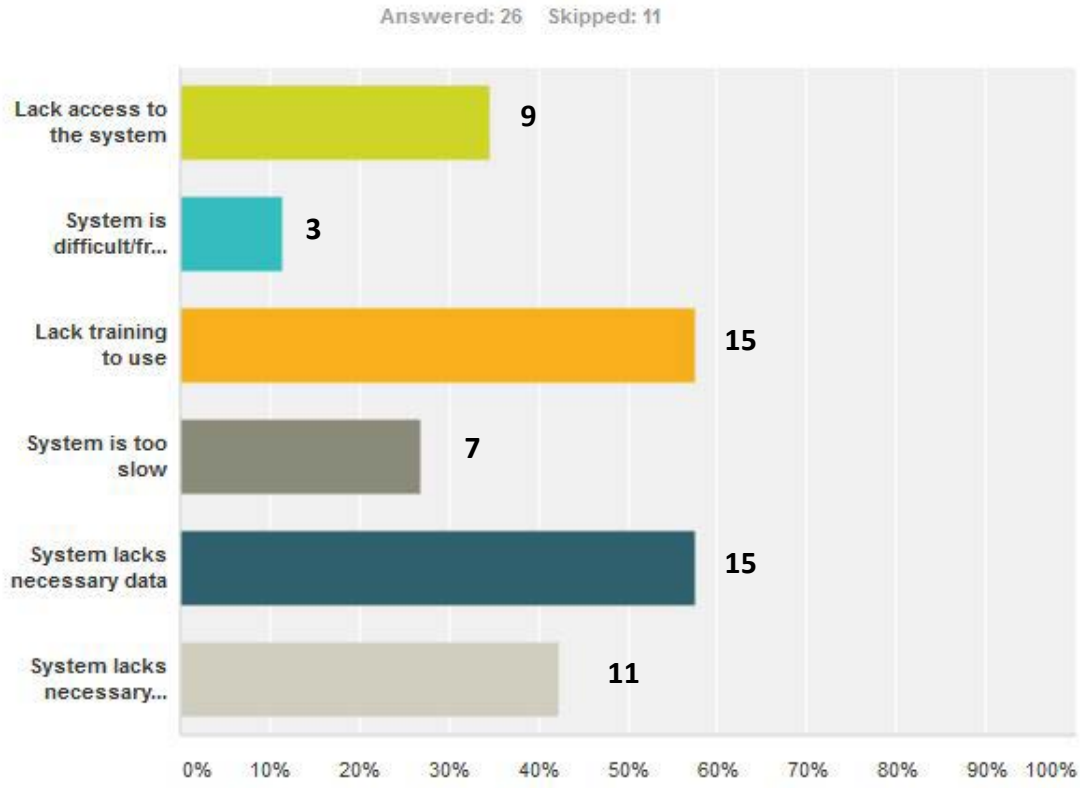
- **Intended purpose** – to identify GIS tools in use.
- **Analysis of the answers** – more education is needed so that people understand the types of tools they are using. However, it isn't a bad thing that they don't know. What it shows is that they are using GIS to get their job done but not forced to understand the intricacies of GIS (i.e. some people browse the web but have no idea which browser they are using). In that regard, this can be seen as a measure of the mainstreaming of GIS technology. The City has an ELA with ESRI essentially providing an unlimited number of server, desktop, and extension licenses. This is very beneficial in providing staff with the tools they need to accomplish their particular geoprocessing needs.

- ArcMap
- We tend to use GIS indirectly. It powers the tools we do use like the parcel popper or Accela.
- AutoCAD
- None
- ArcGIS server, desktop, sde, explorer, collector
- Business Analyst (new this year! we love it), Arc GIS Online, and regular Arc Map.
- Arc Map and Arc Catalog
- none
- None
- Accela
- ArcMap
- ArcGIS Desktop, ArcGIS Server, Pictometry, Google StreetView
- ArcMap, ArcGIS Server, RouteSmart
- ESRI ArcMap, ArcCatalog, and ArcGISOnline
- Google maps, connect explorer, most of the GIS maps the city offers.
- We are licensed for Enterprise version of ESRI
- See above
- I occasionally use Pictometry, and the quicklink maps for sewer, storm, et.c. infrastructure.
- ArcView?
- Community Services (It now has the PW detail in the Map, Parcel Conditions Open Data/GIS Maps
- None
- Not sure.

- I don't believe that we use any within the department.
- ArcMap
- Accela
- ArcMap 10.4
- n/a
- Spatial Analyst Spatial Statistics
- ArcCatalog and ArcMap
- COB GIS Map Room Portal
- ArcGIS, ArcView

Question #9 - **Specifically, what are the shortcomings of your existing mapping system?**

- **Intended purpose** – to get an idea of what the customers believe are ways that the experience can be improved.
- **Analysis of the answers** – Education and training is the glaring need as well as better accessibility to data. This is being addressed in the strategic plan Training chapter and the Data Assessment chapter. Additionally, some staff are requesting better access to GIS.



Comments

- Our main needs are to keep an inventory of parks assets (trees, irrigation systems, benches, play grounds, furniture, restrooms, boat docks, electrical systems, but we have never had the capability to input this info into an electronic system.
- More training and awareness will help us
- We get calls about latency
- Lack of staff resources - staff who are trained in ArcGIS Desktop or ArcGIS Online
- GIS is not integrated into the Department's work flow. Departments don't share information effectively. Resources not known by staff.
- Multiple data sources and data sets, No ownership of data layer updates, Restart GIS Governance
- I would like to manage the Sidewalk Program in GIS: track quantities, property owner information, APN, date of repair, cost estimate, etc., all tracked by each APN number and sub-tracked by block face (for properties adjacent to more than one street).
- We not have a specific person who is considered a subject matter expert with GIS.
- Am interested in potential opportunities for our dept. to use mapping systems.
- Not enough staff/staff time to fully utilize
- Ability to use active map during briefings
- Subject matter experts don't do enough data maintenance.
- easy .eps / .ai / .pdf graphic output.
- difficulty with data maintenance/updating difficulty with printing

Question #10 – GTG will identify three levels of GIS use within your department/division. Tier1 users are Flagship users who coordinate use for an entire department, edit GIS layers, and use GIS on a daily basis, Tier 2 users are users who routinely use GIS to analyze spatial data, and Tier 3 users are map browsers. How many users do you have in your department/division in each tier?

- **Intended purpose** – to help determine the types of users within the organization.
- **Analysis of the answers** – as is typical, there are a few more tier 3 users within the organization. However, there are also a fair number of tier 1 and 2 users that can assist in expanding GIS.

	0	1-6	7-15	16-25	26-40	>40	Total
Number of Tier 1 Users	48.39% 15	48.39% 15	3.23% 1	0.00% 0	0.00% 0	0.00% 0	31
Number of Tier 2 Users	26.67% 8	63.33% 19	10.00% 3	0.00% 0	0.00% 0	0.00% 0	30
Number of Tier 3 Users	5.88% 2	44.12% 15	26.47% 9	8.82% 3	8.82% 3	5.88% 2	34

Question #11 - On a scale from 1 to 10, how effective is the existing GIS at meeting the needs of your department/division? (1 = not effective; 10 = very effective)?

- **Intended purpose** – to gauge the user's perception of the effectiveness of GIS in meeting the needs of their departments.
- **Analysis of the answers** – Overall, the user base feels that GIS is meeting their needs. However, there is a group of respondents in the mid to low range that feel they could do more with GIS.

	1	2	3	4	5	6	7	8	9	10	N/A	Total	Weighted Average
Rating	8.33% 3	8.33% 3	11.11% 4	5.56% 2	27.78% 10	13.89% 5	2.78% 1	13.89% 5	2.78% 1	0.00% 0	5.56% 2	36	4.85

Respondent's Comments:

- The GIS data seems to be there but it appears to be inconsistently applied or accessed. We often can't trust the data we see and can't see the data that is useful.
- Our department uses the current GIS portal regularly for general inquiries and to create general planning diagrams for maintenance and capital projects, special events, and project descriptions for grant applications and agency permits. We use the current system to make general measurements of distances and areas. It would be nice to have all parks and public works assets, including underground conduits and pipes, to be contained in the database. At present, for example, the physical assets at the Marina (utilities, irrigation, electrical, etc..) are not contained in the City's GIS portal.
- Rent Board data is not geocoded - need to create custom data anytime we want to perform a GIS analysis.
- I think we could think of ways to leverage GIS data in our division, but we largely support other departments' use of GIS
- We cannot manipulate maps to show the data we need i.e. adding features to maps that can be printed out and used in the field. We need revised storm maps to show the locations of creeks, trash capture devices, problem areas, and trash racks.

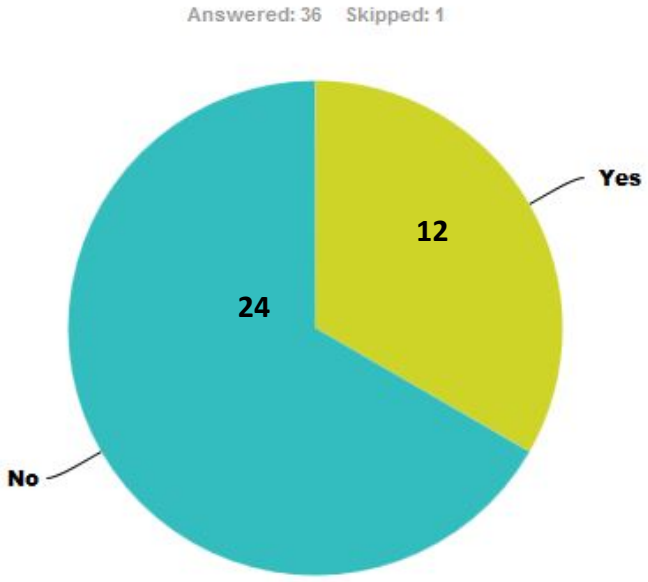
- GIS has been helpful with daily mapping with much of our department and divisions, but is severely lacking in permit processing. For example there are many instances when design review/landmarks staff is left out of the review of a permit. Part of this requires training for intake staff. Additionally, Accela could include a prompt when specific work is being proposed in particular zoning districts.
- We are unable to take better advantage of all our GIS tools and get them deployed timely to others because of a lack of dedicated GIS staff
- GIS is not currently the system of record for our addresses that are consumed in multiple systems/applications.
- There is no one GIS map that gives us the functionality that it would take to know everything in the city files about a particular piece of property. I want to be able to click on a parcel or address and be able to look up everything we have on that parcel. Right now, to even get basic info. I have to look at 4-5 different maps or web pages.
- We are using GIS as a basic tool and need to add more functionality for 3 D GIS, Interactive maps, Community facing website for GIS etc.. Increase GIS presence on Open Data Portal
- I can only speak from a limited perspective, but I feel confident in saying that our data is flat and does not have the vertical data to be used as a field tool with sub foot GPS for utility location and mapping, for CMMS, or EAM.
- As noted above I need information broken down by parcel, not blocks.
- The police department can benefit greatly with a subject matter expert in GIS. We have two people with basic knowledge. We are using a very old version of ArcView due to compatibility with our CAD/Records vendor. We should have at least one Tier 1 person and several Tier 2 people within the police department.
- I would like to have GIS support, but there is no one I can ask for assistance. It would have been hugely helpful to me when developing an application for a $3 million grant application. We laboriously looked up longitude and latitude, square footage and year built for over 400 buildings online and a variety of other information,

because we did not know how to use GIS. My peers in Oakland who were applying for the same grant were able to use GIS to speed up this research. We have now specifically hired a GIS intern to help with several projects: preparing paper maps for use following an earthquake, to be used by volunteer inspectors to inspect different sections of the City and setting up maps that can be adjusted as circumstances change; updating maps of hazardous buildings and creating a map of non-ductile concrete buildings in Berkeley;

- Currently, I believe that our department has very few and infrequent GIS needs, and only utilizes GIS for very specific purposes. The IT department has provided us with GIS support in those limited circumstances. Am interested in learning more about GIS capabilities and possible opportunities to take advantage of GIS in our department.
- From my understanding IT has a long list of projects and can only work on so much at one time based on current staffing. The ideas are there however the resources to implement are limited.
- Not having GIS as our system of record for land-based data is an increasing pain point.
- GIS would be more effective if field personnel had access
- As mentioned previously the data layers are out of date making mapping more complex.

Question #12 – Do you perform data maintenance with GIS?

- **Intended purpose** – to gauge the level of GIS data maintenance occurring within the organization.
- **Analysis of the answers** – maintenance of GIS data is currently handled by a small group of staff. This indicates that either there is strong centralization of GIS maintenance tasks or that data maintenance is limited in scope. It could show both are in fact true; that a small number of users are updating and maintaining a small amount of data.



Question #13 – What kinds of information would you like to see mapped and available via the GIS?

- **Intended purpose** – to directly hear from the end users as to what they believe would most impact the usefulness of GIS.
- **Analysis of the answers** – the results indicate there are a number of items to implement. In particular, data availability of numerous sources is key.

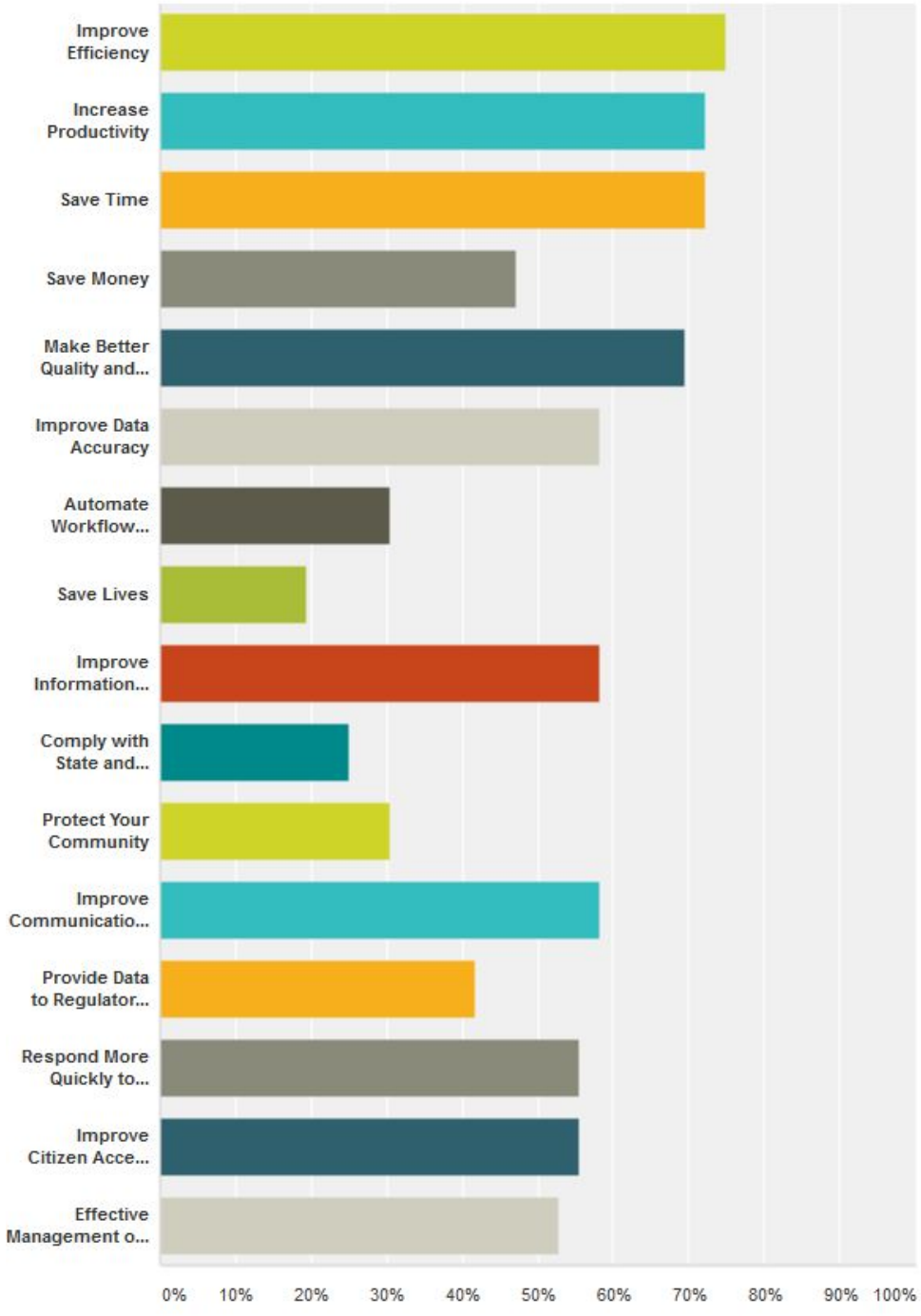
    - Property characteristics and history including pictures.
    - Parcel conditions
    - All of the City's physical infrastructure utilities (phone, gas, electric, irrigation, sanitary, water, telecomm, cable, methane, traffic signal. Also, the dimensions of all parks structures (buildings, sheds, play grounds, benches) and properties.
    - Coordinating with the Routing System, RouteSmart
    - business license data, construction valuation data, vacancy information, ground floor retail tenant information (by type), sales tax data, employment data
    - All Rent Board data - more Alameda County data.
    - IT assets, like networking equipment, City-owned fiber
    - Plans, Permits, Utilities, Toxics, Inspections, etc.
    - Hotspots - areas Map - there are repeat problems of any PW issue.
    - Capital projects, building footprints, survey monuments, parcel fabric, 3D buildings, real time event data, curb paintings
    - Pending zoning applications/construction and links to the parcels zoning district.
    - Infrastructure, e.g. Water meters and water lines
    - Transactional data, like licenses, permits, work orders, etc..
    - Need to update the following information in GIS: Sewer 50-Scale Map Parcel/Address Storm
    - Everything: from employees to assets, to service requests, to crime, to projects, etc.

- Business name and description, Chemical inventories, facility site maps, emergency contacts, well locations, environmental management areas
- I would like to see all of the digitally available information for a particular address come up when I click on a map.
- I would like current planners to be able to click on a parcel and see LU potential, permit history, dev standards. I would also like to be able to access info from HHCS, Transportation, Eco Dev., Rent Board.
- Asset information, Work Order System, Crime Mapping, Parks data and various other data sets we provide to all departments
- Utilities with object data such as: year of construction, type of material, depth, work order history, etc.; sidewalks in need of repair; capital projects.
- By individual parcel and block face: property owner name, mailing address, email/phone when available, APN (assessors parcel #), cost estimate, date of inspection, date of repair, quantity estimate of sidewalk, driveway, curb, contractor / CIP #, Lagan case ID (s), HTE Workorder # (s); date of grind, date of make-safe, etc.
- Crimes and incidents. Mental health related calls for service. Part I crimes throughout the city.
- Parks information Path information Bike Line Information Ride share Bike share, Bollards
- Not sure what Clerk Department-specific information would benefit from GIS mapping/analysis. Am interested in discussing to learn more about possibilities. I think that there are huge opportunities and benefits (that may already be in the works) for data from other departments. (Police, Fire, Planning, etc.)
- Property data, code compliance data, lease data
- Hazardous buildings
- Parking Restrictions
- Asset management.

- I would like to see us better leverage and understand the data we have to inform policy decisions. I think this could be easily done if folks understood and made use of spatial analysis.
- Real time traffic conditions would be great, especially given all the construction and protest activities here.
- population, voting precincts, income, age, ethnicity, voter turnout, council districts

Question #14 – What do you expect from GIS and can you give any specific Return on Investment (ROI) Examples?

- **Intended purpose** – to determine user's perception of how GIS can benefit them.
- **Analysis of the answers** – Users have identified a diversity of ROI with improving efficiency and productivity and saving time being the front runners.



Answer Choices	Responses	
Improve Efficiency	75.00%	27
Increase Productivity	72.22%	26
Save Time	72.22%	26
Save Money	47.22%	17
Make Better Quality and More Effective Decisions	69.44%	25
Improve Data Accuracy	58.33%	21
Automate Workflow Procedures	30.56%	11
Save Lives	19.44%	7
Improve Information Processing	58.33%	21
Comply with State and Federal Mandates	25.00%	9
Protect Your Community	30.56%	11
Improve Communication, Coordination, and Collaboration	58.33%	21
Provide Data to Regulators, Developers, and Other Interested Parties	41.67%	15
Respond More Quickly to Citizen Requests	55.56%	20
Improve Citizen Access to Government	55.56%	20
Effective Management of Assets and Resources	52.78%	19
Total Respondents: 36		

Comments:

- Data should be updated constantly because of the everyday changes that happens to properties and buildings being built and demolished. Save time as all the information are available in one place. Make my work easier with all these resources.
- We have the need for the following: Tree Inventory and work order system. Capital projects inventory system, Leases inventory system, Irrigation inventory system, Environmental assets inventory system (e.g., protected species, special habitats, especially at the Marina).
- it would help our internal workflows and products to stakeholders tremendously.

- All of the above. All documentation should be available to authorized City employees through a GIS map of a static address location whether it be a utility, location of a gas meter and its type, plan, permits, list of inspections, etc.
- Staff would have the information they need at their fingertips to make decisions. It would allow for better analysis of problem areas. We need to be able to make changes in real time to some of the asset information. I.E. we are installing new street lights and it would be great to add them as they go in.
- The City is phasing in a new tobacco retailers ordinance - tobacco cannot be sold within 600 feet of a school. In the planning phase, the HHCS department was able to map out different buffer sizes (1000'? 500'? 600'?) against existing retailer locations to understand impact and make an informed decision on the appropriate buffer size. In the implementation phase, we embedded an interactive map in the city's website with the city's schools, the 600' buffer overlay and a search by address tool to allow retailers/public to determine what retail locations are impacted
- Much of the information(uses permitted, development standards, etc) that we continually repeat to residents or take several minutes to draft emails for, could be far more efficient if accessed through a GIS interface that includes this general information. I believe we should spend time answering more refined questions, but general information should be accessible from a single link or GIS interface to the public.
- We use parcel/address layers to distribute public notice postcards. The database in these layers are very old and as a result hundreds of postcards were sent to incorrect owner addresses and vacant lots. If the database is accurate, we can save time/money. We use GIS for CIP planning. If GIS database within the department is up-to-date, communication/coordination/collaboration will be improved. We use GIS to look up our sewer record. If database is up-to-date, it will help us to address resident requests more quickly.
- GIS can be the system of record for a lot of things and therefore, can bring disparate systems together and promote consistency and efficiency.
- Emergency responders should have access to info collected by Toxics

- It takes so long to find out what is built on any given property b/c I have to look in so many different places (G:drive, web apps, etc). I do this at least 20-30 times a day and if there was one map that linked to all the info that is already digital, it would save the city a ton of money.
- Improved Community access to GIS data through Crime Analysis, Open Data, Community facing GIS website Public Safety, Land Management, Property Tax are separate data sets and need to centralize Improve Asset Management , Work Order system, CRM etc.. Map traffic lights, bike paths etc.. Use latest technologies such as Live and 3D mapping Currently there is lack of workflow approvals
- This is a very common tool used for all of the reasons above by large municipal public works and public utilities departments.
- 311 uses the reports regularly.
- While all of these checkboxes are true for GIS opportunities across the various departments, the boxes that I checked are relevant for Council District lookup and City Council redistricting. It would take countless staff hours to map the various redistricting proposals by hand, not to mention the increased opportunity for error. Using GIS makes the Council District lookup (previously looked up manually by staff), and the redistricting maps more accurate, accessible, and improves customer wait time.
- Management of assets. Detailed records of asset maintenance. Would improve communication to see what was done. Information improvement and could generate work.
- We use GIS mapping to help determine tactical responses
- My semi-educated guess is that maintaining multiple systems of record for land-based data costs the City about $500,000-$750,000 more per year than maintaining a single system of record.
- All of my responses are tied to the Police Dept's Operations Div (not mine). They specifically relate to changing from 14 beats to 16.
- Use automatic tools for changes to maps and data to eliminate manual processes. Maps available through the web for the public helps staff assist the public better.

Question #15 - What kinds of information would you like to see mapped and available via the GIS?

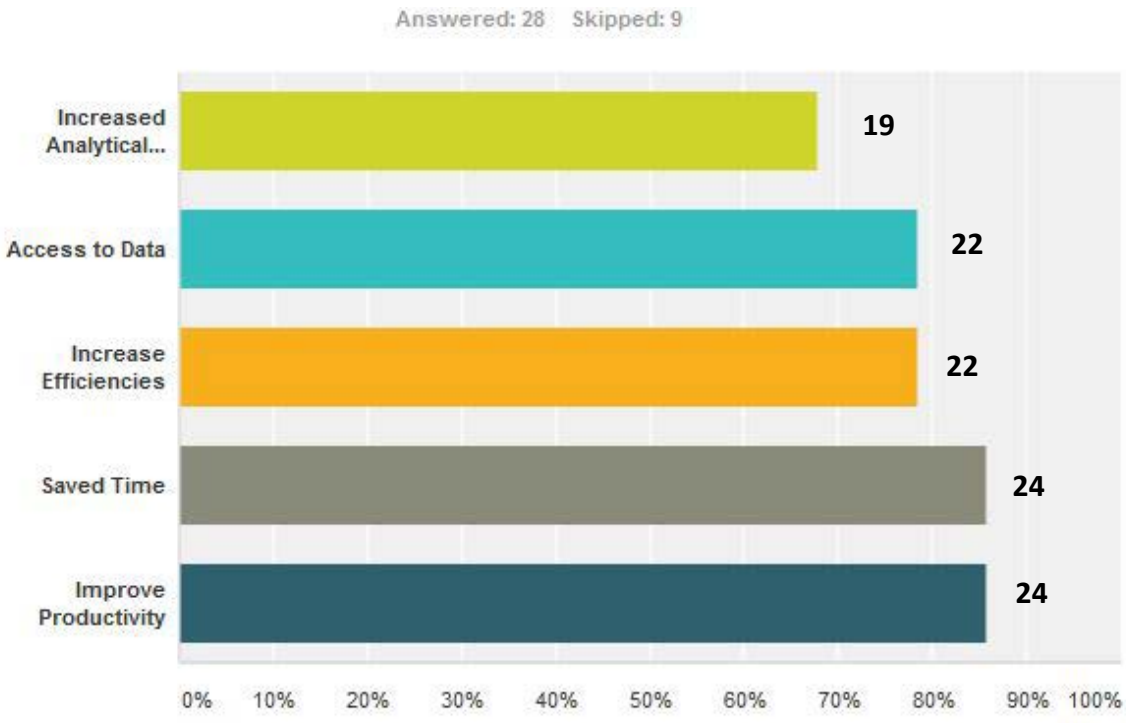
- **Intended purpose** – to directly hear from the end users as to what they believe would most impact the usefulness of GIS.
- **Analysis of the answers** – the results indicate there are a number of items to implement. In particular, data availability of numerous sources is key.

    - I would just like to improve and complete existing capabilities.
    - We are interested in basic functions of a GIS system. We do not have the need nor the staffing to do sophisticated analyses.
    - easier to make and share maps online with others in my dept. easy interface with simpler products like excel.
    - I would like to see all City data readily available in GIS format to allow for cross departmental data analysis.
    - Using GIS as the system of record for addresses Citywide.
    - 3d mapping similar to Smart Plant for different facilities in the city.
    - 3D mapping, real time event mapping, single sign on to ArcGIS Online, Esri Maps for Office on all staff desktops
    - New building permits/zoning permits that are submitted to the PSC readily viewable on GIS.
    - Faster layers, targeted trainings on how GIS can work for depts
    - 50-scale sewer map is frequently updated by the sewer group. This database should be mapped in the GIS.
    - Enhanced Search (similar and better than the eSearch created by Robert) capability in apps. Increase the number of datasets.
    - Want to manipulate data in field as well as desktop. Be able to print out department form letters and mail-merges (notifications, consent forms, billing). Communicate with Finance's system for invoicing and billing.

- Status maps of officers, in the field, mapped with AVL data. Crimes trends and heat maps.
- Will get back to you on this request. We would like to know whenever the layers are updated or features are added
- I would like for there to be someone in IT who would have the time available in their schedule to respond to occasional GIS requests from the Building and Safety Division within a two week turnaround time. Right now, my understanding is that the one GIS person is assigned to Public Works, so it is hard for her to provide support to other departments.
- In addition to the real time traffic conditions already mentioned, I know that community members have been clamoring for a subscription notification system. (For example, I want to receive a text message whenever there's about to be a street closure within 5 miles of my business address.) GIS should be a key piece of such a system.
- access for field personnel

Question #16 – What advantages would these capabilities offer from your perspective?

- **Intended purpose –** to identify specific ROI categories that would benefit the respondents.
- **Analysis of answers –** the responses indicate that the respondents see a diversity of ways that GIS will provide a return-on-investment. It is recommended that the GIS Team and GIS users track ROI and try to quantify ROI examples to be illustrative of the value of GIS.



Respondent's Comments:

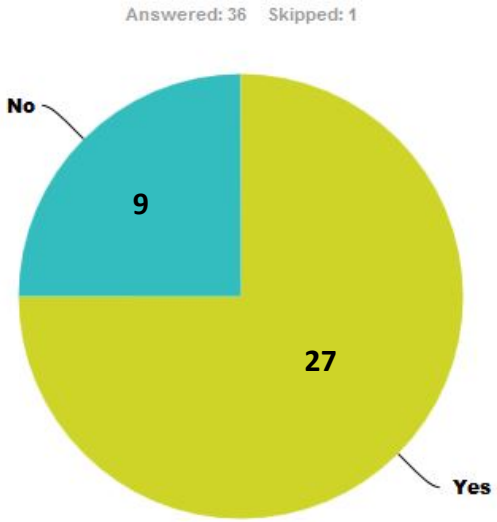
- Respond to inquiries for information about the City's park system (e.g., inventory of assets, playgrounds, basketball courts, tennis courts, soccer fields, etc).
- We currently have separate address databases, which leads to inefficiencies and inaccuracies of data.
- Save Lives
- 3D mapping will allow better planning tools such as shadow analysis, and underground visualizations. Single sign on and ESRI maps for Office would allow all staff access to geocoding and map making without having to leave their existing applications or log in

Question #17 – Who funds the GIS activities within your department?

- **Intended purpose –** to identify perceived funding sources
- **Analysis of answers –** some staff are unsure where GIS is funded within their department. Many see GIS as being funded from within IT. Most survey respondents were unaware of the GIS funding sources and others identified a few funding sources such as General Fund, Sewer Fund, Public Works, Parks Recreation and Waterfront, and Public Safety.

Question #18 – Have you received any GIS training?

- **Intended purpose** – to understand the respondent's background in GIS training and to gauge the overall training needs of the organization.
- **Analysis of the answers** – Most respondents indicate that they have received some level of GIS training. This clearly provides an opportunity in the organization to increase GIS knowledge and usage. However, there are some individuals that have not received any training or who desire additional training. Additional training opportunities will need to be made available to the organization.

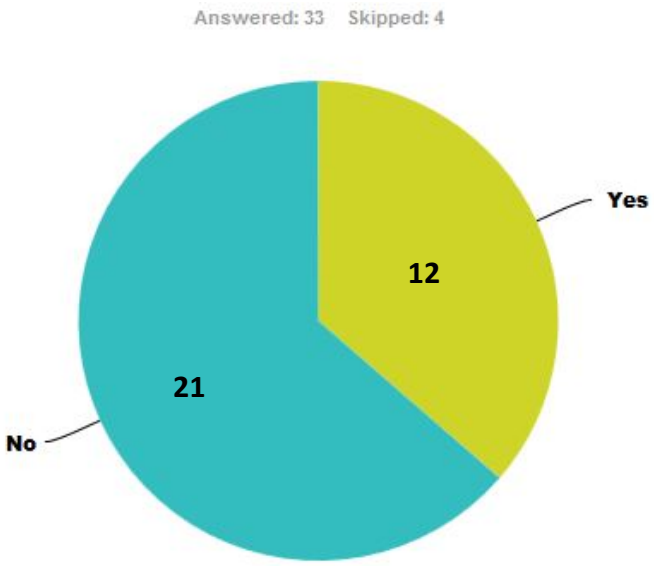


Respondent's Comments:

- Just the basics.
- Basic GIS training from IT Staff.
- GIS 101 in 2004.
- City of Berkeley classes with IT Staff
- Class for planners given by IT Staff - other online ARC GIS classes. College course on GIS
- GIS 101
- Migrating to ArcGIS Server 10 remote classroom and numerous ESRI self-paced online trainings. I trained and received an ArcGIS Desktop certificate before I worked at the City
- College courses Intro to GIS/Advanced Applications in GIS
- Graduate school - intro class
- ESRI classes
- ArcGIS Desktop I: Getting Started With GIS (10.0)
- Intro to GIS
- I've taken a few ARCH GIS classes, but I don't use it much anymore.
- Introductory use
- General maps, Open Data/GIS
- GIS 101(?): A GIS overview class offered by the IT Department.
- A 2 hour class taught by IT Staff.
- GIS Mapping
- The welcome to GIS class here. In college, I took a GIS class focused on GIS and the Social Sciences.
- ESRI Basic, beginning and intermediate levels of Crime Mapping specific training
- college.

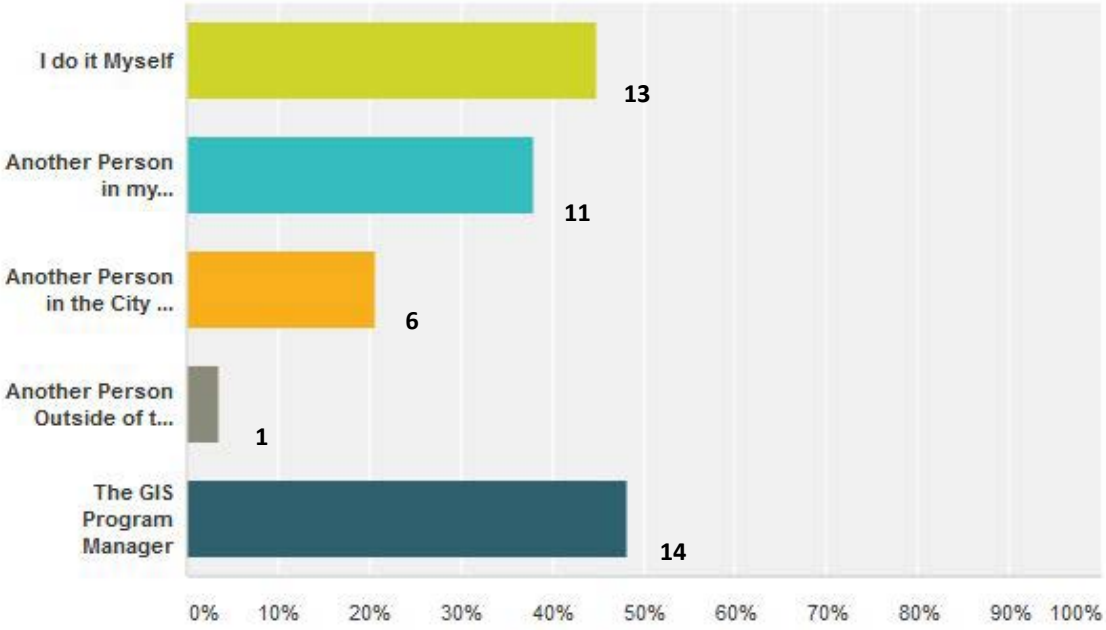
Question #19 – Do you feel that there are clear lines of responsibility regarding the GIS (Data Creation, Data Maintenance, etc.)?

- **Intended purpose** – to understand the respondent's perception related to the current GIS governance specifically related to data management.
- **Analysis of the answers** – Most respondents believe that there are not clear lines of responsibility in regards to data management. Recommendations will be made for improving governance and will clearly establish departmental responsibility for data creation and maintenance.



Question #20 – Who do you go to for your GIS/Mapping needs? Please choose all that apply.

- **Intended purpose** – used to determine how users get the GIS and Mapping products they need.
- **Analysis of the answers** – A large number of the respondents get the GIS/Mapping products from the IT department. This indicates that the City needs to disseminate tools for self-help. This should change as more user friendly tools are implemented.



Respondent's Comments:

- Most of the responses reflected that there is limited staff who can provide GIS training in the IT Department
- Senior Management Analyst
- There is no GIS Program manager and an analyst is responsible for all data
- Enterprise GIS & Open Data Coordinator, IT
- Now our intern. Previously, I did without GIS. IT occasionally updates the Division's building inspector area map. There is a long delay when this is needed, due to insufficient GIS staff capacity. Please hire someone to work with existing IT Staff.
- GIS Coordinator (there is only one GIS person in COB)

- Drafting Tech/Public Works, GIS Coordinator/IT

Question #21 – Is your organization's current GIS Governance effective? 1 = Not Effective; 10 = very Effective.

- **Intended purpose** – to understand the respondent's perception related to the current GIS governance overall.
- **Analysis of the answers** – The overall 'feeling' of the respondents is that GIS Governance is average or below average; meaning that it for the most part the GIS is not meeting the needs of the organization. Opportunity exists to modify the GIS Governance in order to more effectively serve a broader user group.

1	2	3	4	5	6	7	8	9	10	Total	Weighted Average
9.68% 3	12.90% 4	16.13% 5	12.90% 4	22.58% 7	6.45% 2	9.68% 3	3.23% 1	3.23% 1	3.23% 1	31	4.42

Question #22 – What changes in GIS Governance do you recommend?

- **Intended purpose** – to provide the respondents an opportunity to share their ideas regarding Governance.
- **Analysis of the answers** – Governance and lack of training top this list of responses to this question. In general, there seems to be a lack of GIS personnel and departmental training available to assist. Additionally, some departments would like access to a more user friendly GIS.
- **Respondent's Comments**:
    - Clarify the information currently stored in GIS and improve access to it.
    - The City's GIS functionality needs more resources
    - More support for departments that do not use GIS everyday. Development of a plan on how to use GIS to help the department meet its goals.
    - More people involved in long term strategy for GIS. Seems like a one-person show right now without a coordinated effort of all Citywide needs. Something we expect the GIS Master Plan to address!

- Unknown
- That each department knows who can update the information and that there is a realistic time frame to get new information in - not two years.
- Reenacting the GIS Steering Committee that fell apart when most of the members left city employment. The members need to be GIS analysts that are allowed to do GIS and the GIS Steering Committee as part of their job 2. Classroom trainings by ESRI for staff in desktop and ArcGIS Online
- Not familiar with the term.
- We need more people who can do more in the system.
- Restart GIS Governance Group with management involved. Currently there are 2 GIS Users group (one with all GIS Users) and second one is Power users
- Consolidation in IT and then department and division specific layers.
- We need a full time expert user and we need access and training to the latest software to best allow us to share information internally and externally to the public.
- I'm not familiar enough with the City's GIS Governance to accurately rate or recommend.
- Governance is not part of what we do at our level. Maybe that could be implemented.
- More clear lines of authority. More idea of amount resources expended vs potential ROI. Adequately resourcing GIS (need dedicated analysts!).
- More GIS specific support staff in the COB IT department.
- Lines of business need to own their spatial datasets, and SMEs within those units need to maintain their datasets.

Question #23 – Are there any sources of mapping or database information from other departments/divisions that you do not have access to, but would like to? Please list:

- **Intended purpose** – to gather information regarding data sharing needs.
- **Analysis of the answers** – In general, there seems to be a lack of GIS knowledge. Additionally, some departments would like access to additional GIS data layers.
- **Respondant's Comments**:
  - None
  - Not that I am aware.
  - I often have the need to review construction drawings and survey information from the City's Public Works Dept. I currently use Stellant Engineering Archives to look up older drawings. This system does not have drawings from about 2008 onward.
  - Zoning applications for demolition permits.
  - I don't even know what's out there to know what I don't have access to.
  - I don't know.
  - I'm sure there are, but I don't know what I don't know. I hope through this work/project, we will learn about other datasets that will prove to be useful.
  - Not sure.
  - We host the data so we have access to all data
  - Might be handy to have access to the data that Planning Uses to create their 300' mailing lists for Land Use projects.
  - Engineering
  - Not at this time
  - Theoretically, I have access to all the applicable data. But it would have to be extracted from multiple systems and combined in order to get the complete picture. It would be great to have the Rent Board's "illegal addresses", the PDs "common place names", and our disparate parcel attributes "all under one roof".
  - private development activity, location, status outside utility activity, location, status

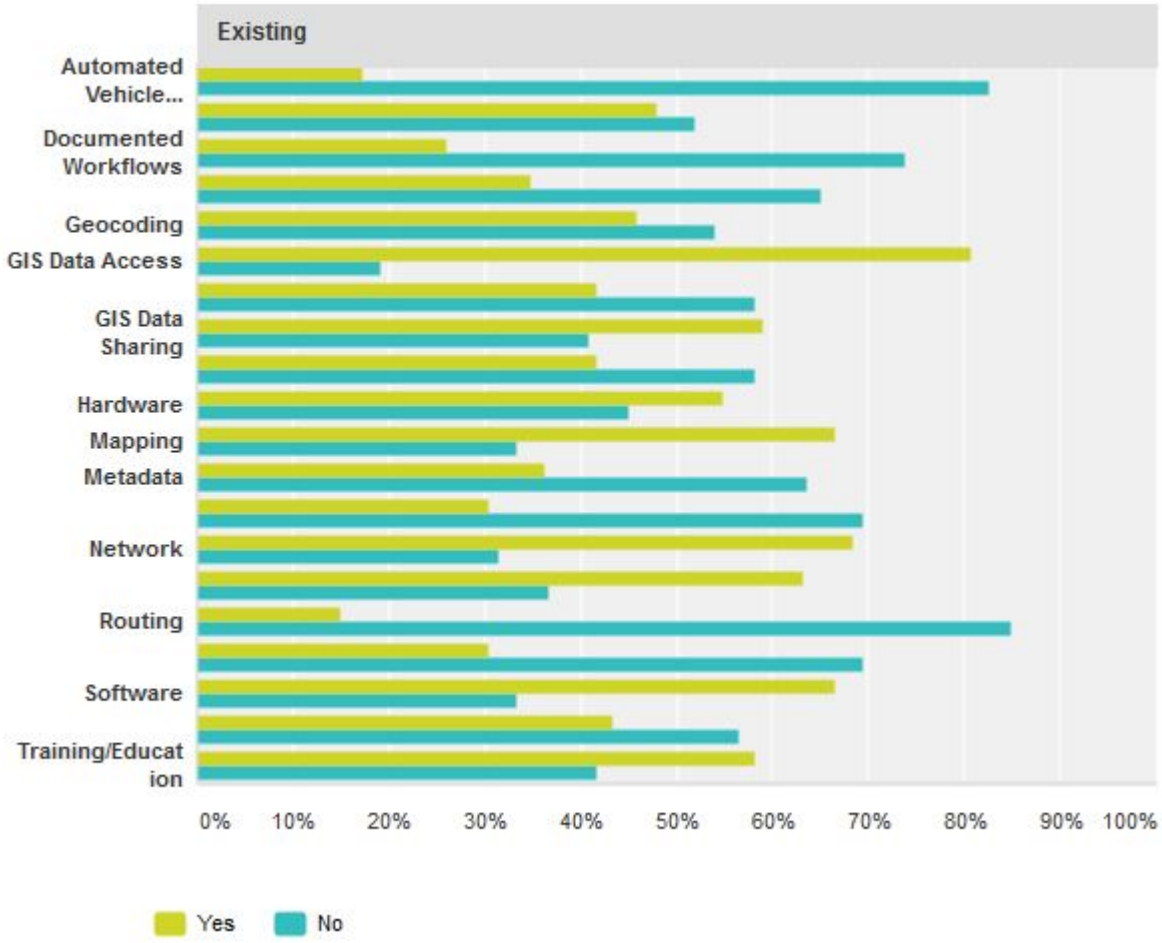
Question #24 – Are there any GIS data layers that you need, but do not currently have? Please list:

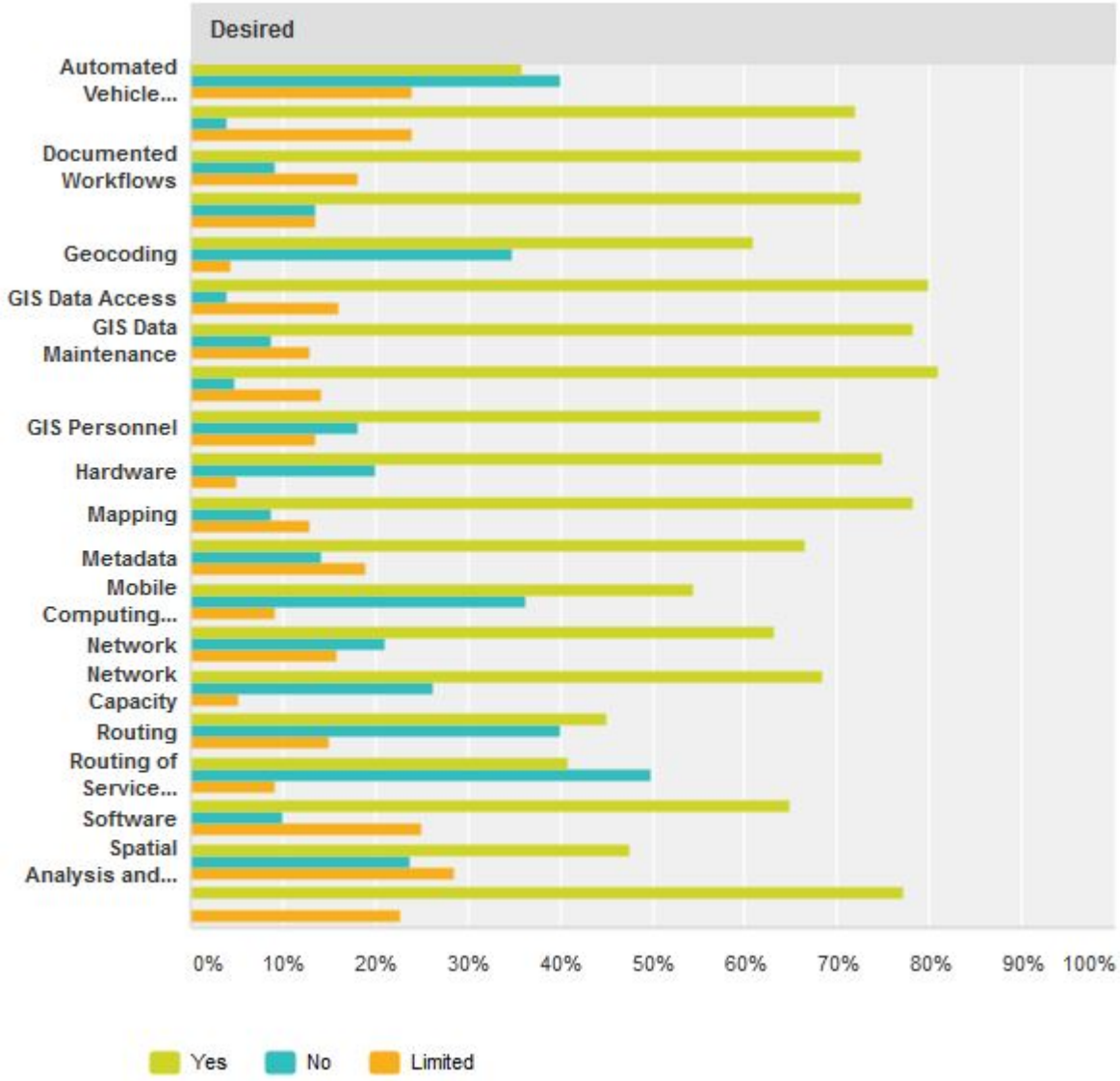
- **Intended purpose** – to gather information regarding data needs.
- **Analysis of the answers** – From the limited response to this question, it is difficult to provide an accurate analysis, but it seems that users feel they should have access to more GIS data that what they currently have. Perhaps, the issue is that users don't know where to go to access the data.
- **Respondent's Comments**:
    - None
    - Not that I am aware.
    - We often need to consult the RightofWay layer, the sanitary sewer, storm drain, electrical conduit, traffic signal, EBMUD water system, PG&E system (gas and electrical), the City's internal electrical conduit system, and the methane system at the Marina. For example, the Underground Service Alert system (USA) is required for any excavation activity in the City. However, the USA system only covers public utilities. When City staff need to respond to USA requests regarding internal City systems, the internal system is not ideal or effective, relies heavily on individual staff knowledge of the existing City lines, and can cause delays when individual staff are not available to mark existing lines.
    - It's more like mashing up other sources like our sales tax data to our current GIS base...
    - Layers with Rent Board data
    - accurate parcels, number of units per parcel, building footprints
    - Street Intersections.
    - I think yes, but we need to honestly take a hard look at what we can do.

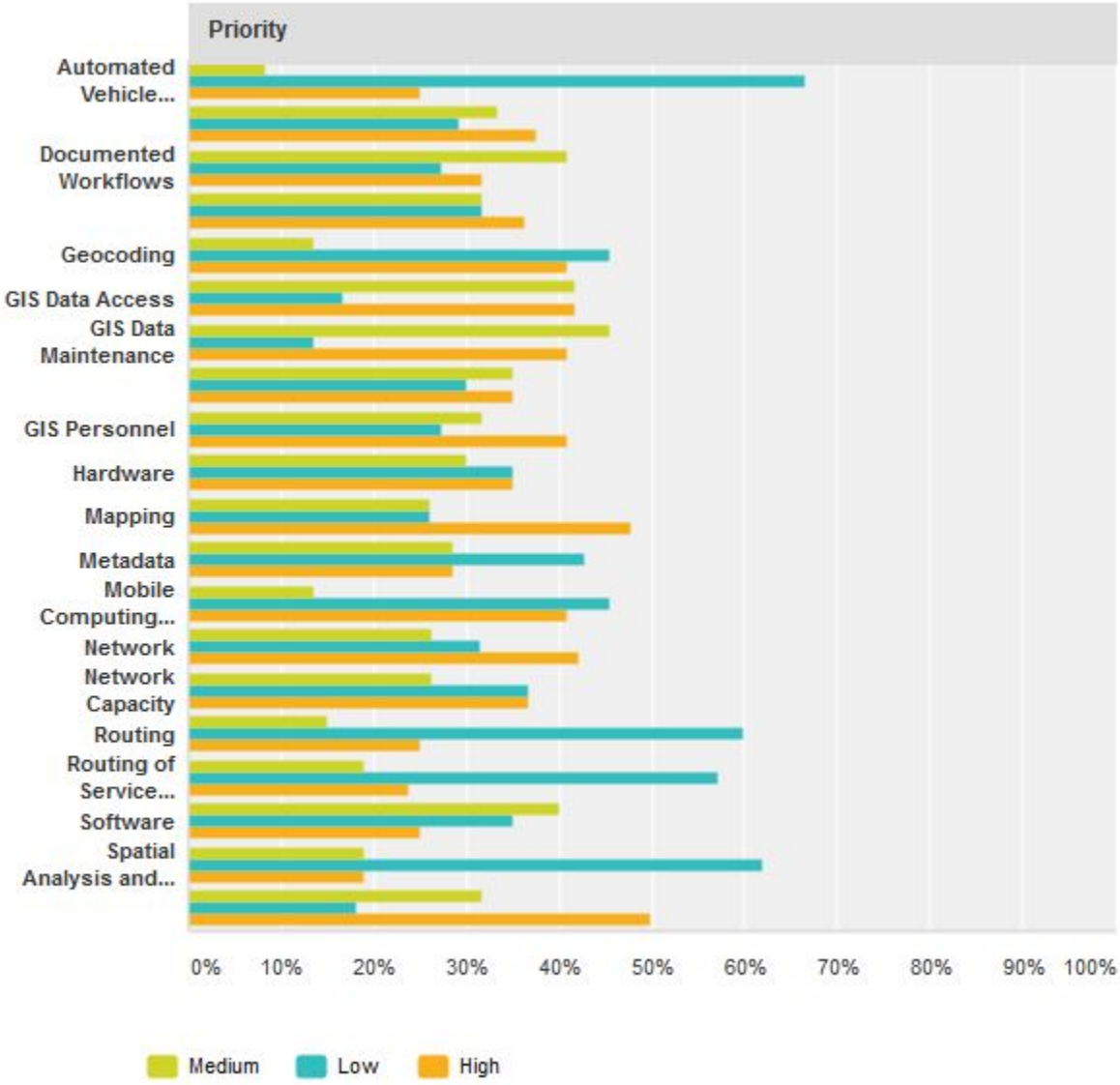
Question #25 – Please complete the matrix below to the best of your abilities and knowledge about GIS within your department/division. This matrix details those relevant components that will be analyzed and assessed as part of the Gap Analysis. Each item below needs to be evaluated as Existing (or not), Desired (Yes, No, Limited), and a Priority (Low, Medium, High)

- **Intended purpose** – to gather information regarding varying GIS components and if those items currently exist within the organization and the priority of those components to the organization.
- **Analysis of the answers** – Most of the components listed do exist in some form in the organization. This is great news and provides a foundation to expanding GIS. Additionally, almost everyone agrees that they would like to see and be able to utilize these components (of course at differing degrees).

Answered: 28 Skipped: 9




Desired
Automated Vehicle...
Documented Workflows
Geocoding
GIS Data Access
GIS Data Maintenance
GIS Personnel
Hardware
Mapping
Metadata
Mobile Computing...
Network
Network Capacity
Routing
Routing of Service...
Software
Spatial Analysis and...
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Yes
No
Limited

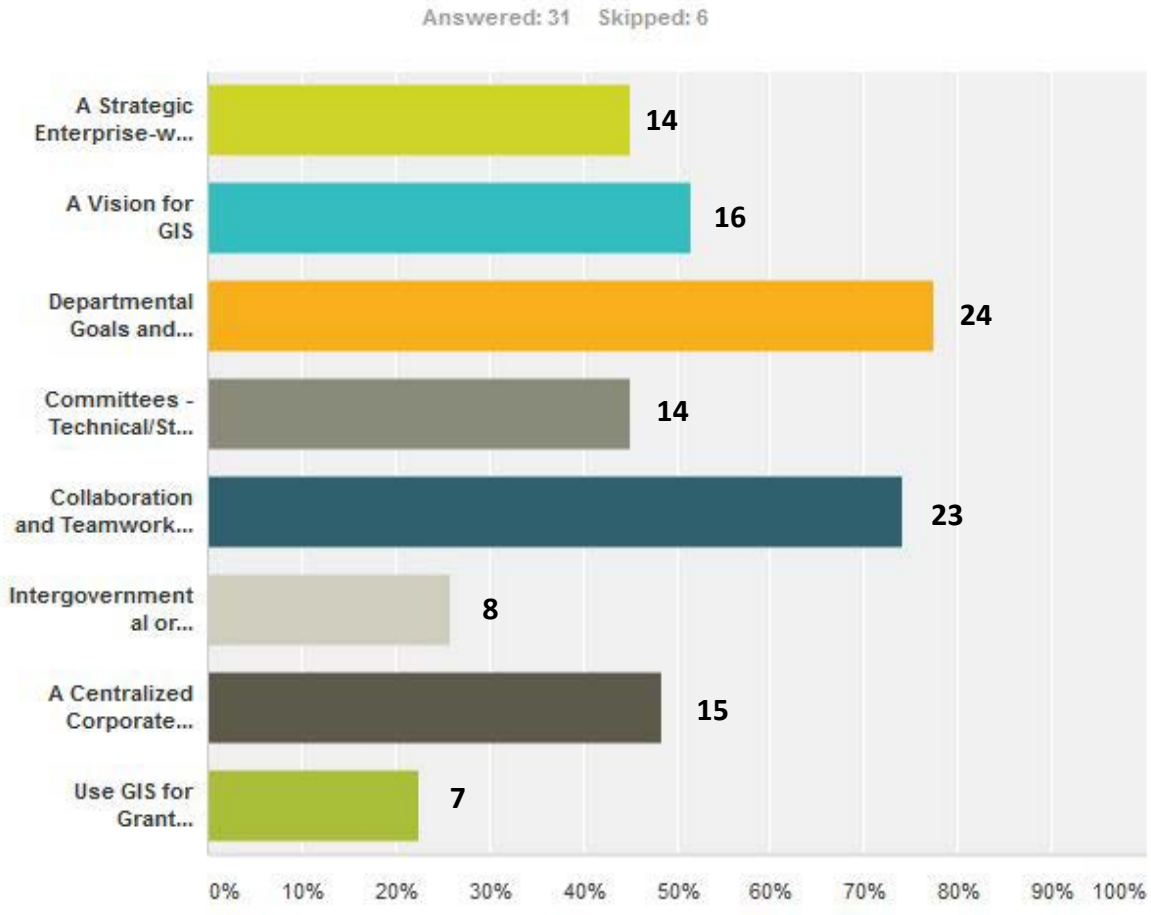


Comments:

- Filled out specific to the Clerk Department. Do not have, nor need, most of these functions. But there may be opportunities to utilize GIS that I haven't considered.
- It's not clear what distinguishes "Routing" from "Routing of Service Vehicles". My ratings of the former are blanks, as far as I'm concerned. My ratings of the latter are true ratings

Question #26 - The following is a list of strategic needs as related to GIS. Please select any needs that you feel apply to your department/division and your organization:

- **Intended purpose** – to understand the respondent's perception of strategic gaps in regards to the GIS program.
- **Analysis of the answers** – The needs identified most frequently were for goals and objectives followed by collaboration and teamwork, a vision for GIS, and a centralized corporate database. This strategic planning effort will help bridge these gaps by providing a foundation for collaboration through shared a shared vision and documented goals.



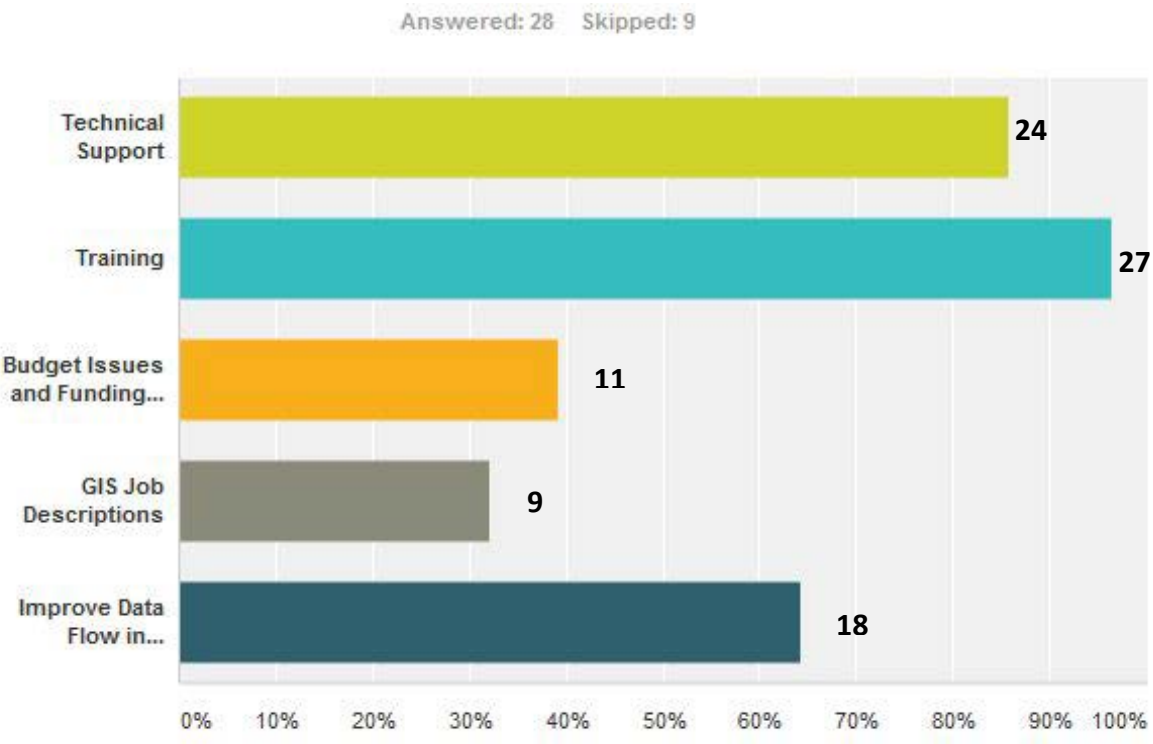
Comments:

- The City should also use GIS to respond to the State's Underground Service Alert System (USA) for any excavation project within the City.

- Regional committee of cities and the county is needed
- Emergency preparedness. We will have huge GIS needs if there is a big earthquake. How will we meet these?
- "Vision" is so overused. A truly strategic Enterprise-wide plan will by definition be visionary.

Question #27 - The following is a list of logistical needs as related to GIS. Please select any needs that you feel apply to your department/division and your organization:

- **Intended purpose** – to understand the respondent's perception of logistical gaps in regards to the GIS program.
- **Analysis of the answers** – Training and improving technical support are the two most pressing GIS needs.

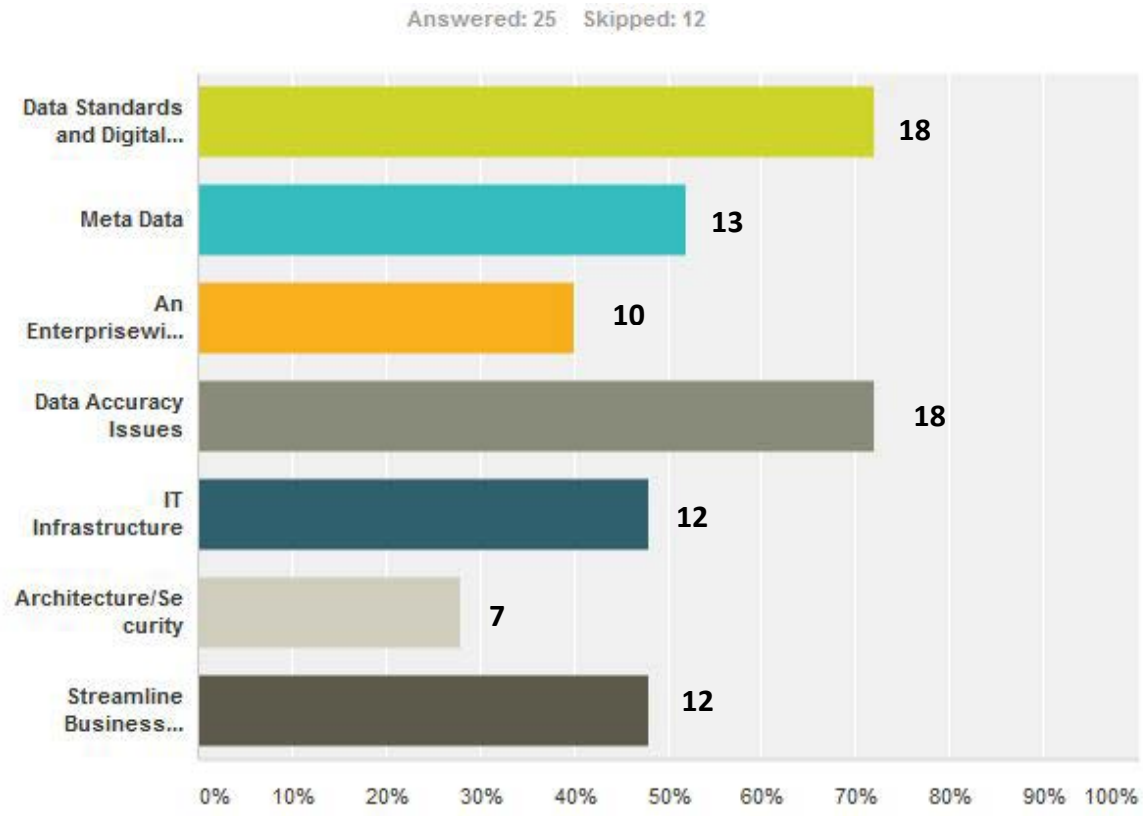


Comments:

- We do not currently have the staff to conduct GIS functions.
- More people in our (IT) department should be knowledgeable about GIS, but are not. Training will get us there.
- We need training and access to software

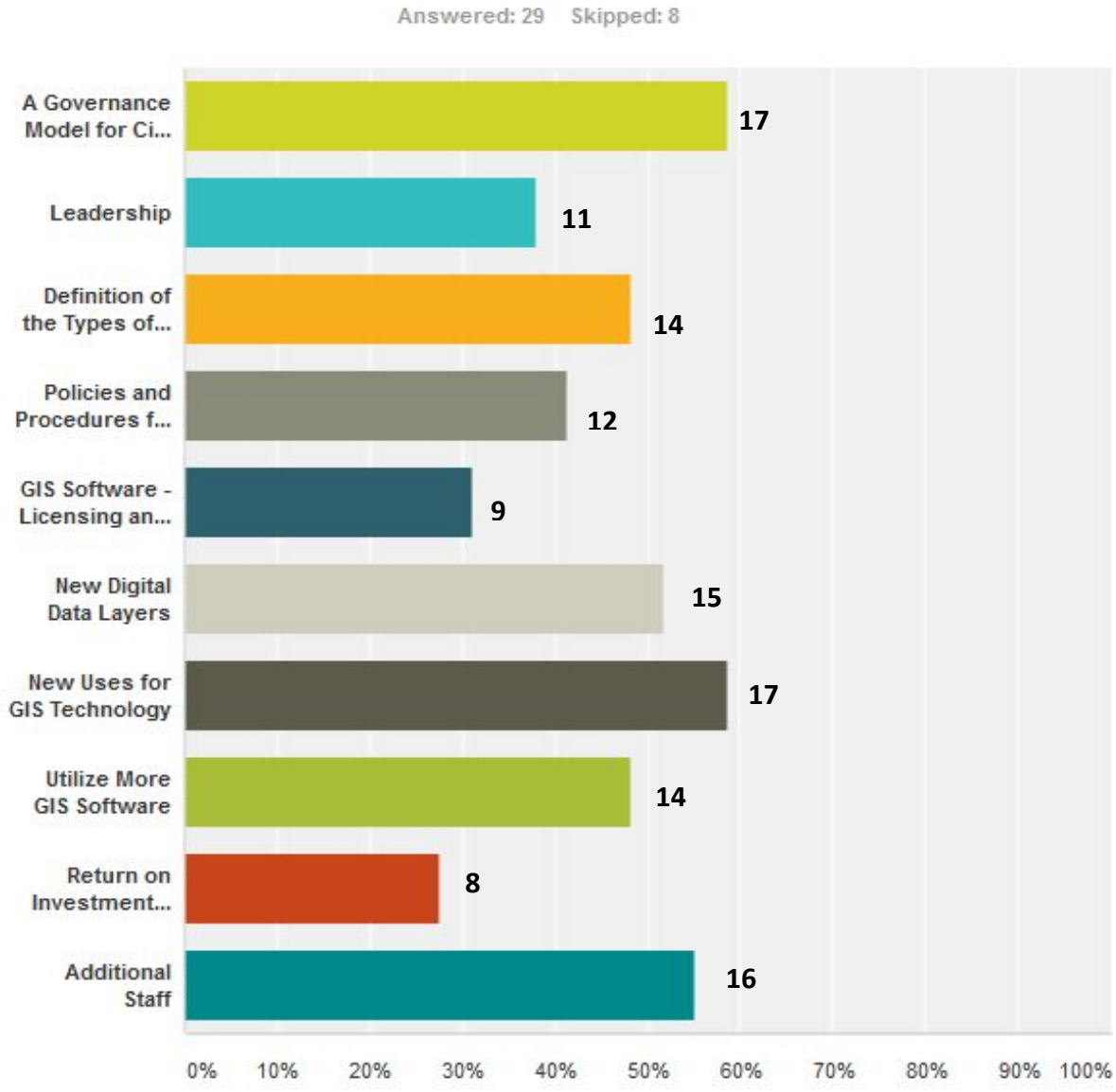
Question #28 - The following is a list of technical needs as related to GIS. Please select any needs that you feel apply to your department/division and your organization:

- **Intended purpose** – to understand the respondent's perception of technical gaps in regards to the GIS program.
- **Analysis of the answers** – leading technical gaps highlight the need for better data accuracy, data standards, and meta data.



Question #29 - The following is a list of tactical needs as related to GIS. Please select any needs that you feel apply to your department/division and your organization:

- **Intended purpose** – to understand the respondent's perception of tactical gaps in regards to the GIS program.
- **Analysis of the answers** – responses indicate a broad range of desires. Opportunities exist for better use of technology and for improved governance followed by a need for more data layers.



Comments:

- We currently only have Application Programmer Analyst II as our dedicated GIS professional. We need more staff to do what she does so that we can advocate GIS to all departments and have it be a part of their analytical works.
- The current GIS Coordinator has resisted expanding beyond her technical comfort zone. Perhaps that's acceptable for the organization. At some point, however, we'll need someone on the team who can develop and maintain integrations between GIS and disparate systems.
- Additional dedicated staff!!!!!!

Question #30 - Please give us any other feedback you deem important in regards to the use of GIS at your organization.

- **Intended purpose –** to provide one last opportunity to provide any more information or comments.

Respondent's Comments:

1. Pulling together most of the cities data and records into one central GIS interface.
2. We need resources/links/training documents that we can refer to when we forget what we learned in training. We need coordination across all divisions.
3. Currently the only GIS staff is me, the GIS Coordinator. This position need to be elevated to GIS Manager with at least one full time staff. The large departments need dedicated GIS analysts to create and maintain their data.
4. I hope GIS can be better integrated in our permit processing with this information available to the public.
5. IT needs staff/support to build a GIS network with GIS staffers in each department who collaborate and communicate intra-departmentally and help leverage the tools and promote city-wide GIS.
6. I was quite unsure how to answer many of the questions, because I represent a very specialized need within my department and division.
7. I think we can be doing much, much more in this area!

8. Interested in learning about opportunities to utilize GIS in the Clerk Department, and possibly accessing GIS info utilized by other departments.
9. If we had increased staff capacity with GIS skills, I think we would quickly find ways to use that information at the City of Berkeley. We have hired an intern who is a GIS minor at UC Berkeley, so I am just now having the opportunity to work closely with someone who knows about maps. While we have some specific projects for her to work on, I am also looking forward to hearing from her what it can do, because I don't know what it is capable of.
10. As part of this Master Plan process, I suggest addressing the "ESRI versus Open Source" question. Otherwise, at least a few key stakeholders will consider the omission conspicuous.
11. IT should have additional GIS personnel

Conclusion

Hearing from the users is critical to the ongoing success of GIS at any agency. Using Voice of the Customer surveys is a great mechanism to gather feedback. It is recommended that an annual online survey is used to gauge user satisfaction and ideas. This coupled with an ongoing VOC feedback program to include; one-on-one meetings, users groups, and technical and steering committees will ensure that user's needs and wishes are being identified and met where feasible. Additionally, it is critical that the GIS team receive this feedback constructively and use it as a means for identifying program priorities.

NEEDS ASSESSMENT

CITY ATTORNEY

CITY OF BERKELEY
CALIFORNIA
GIS Strategic Implementation Plan

SECTION OUTLINE

1

EXISTING CONDITIONS

DEPARTMENT OVERVIEW

The City Attorney's Office mission is, "to ensure that the City operates within legal constraints and minimizes its legal liability while accomplishing its goals as determined by the City Council and voters. The office strives to advance the City's legal interest by aggressively prosecuting and defending civil actions or by settling claims and suits, based on an impartial evaluation of their merits, and by giving impartial advice to staff." The Office provides legal services to the City for the following functions:

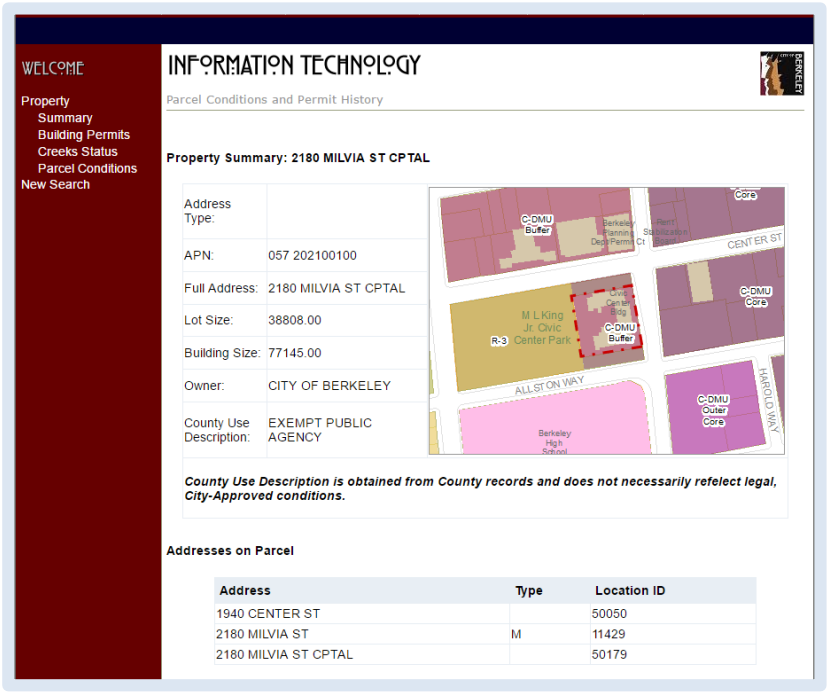
- Public Liability
- Police Liability
- Public Works
- Land Use (zoning permits, development projects, etc.)
- Code Enforcement
- Labor
- Employment
- Contract Review & Negotiations
- Election Law
- Public Records Act Responses
- Parks & Recreation & Waterfront
- Review Development Studies (Environmental Impact Report, Mitigation, etc.)

Staffing for the Department consists of eight attorneys, three assistants, and two paralegals. Each attorney has a practice/specialty area in which they focus. The following are the 2016/17 goals for the Office with comment as to GIS applicability:

- Successfully defend lawsuits – various cities use GIS to assist in litigation support through visualization and using GIS data to support a case
- Provide advice on tax and other revenue measures, and draft ballot measures for November 2016 election
- Work closely with Planning Department and provide timely support on major project applications and planning efforts – legal staff should have access to pertinent project data from all city departments via GIS with associated documents attached
- Develop medical marijuana cultivation ordinance and help implement dispensary licensing program – mapping of location of dispensary/cultivation sites and buffering them by proscribed distances from restricted areas such as schools (if applicable)
- Maintain high level of timely support for other departments with respect to programs and transactions
- Conduct regular trainings for staff concerning Brown Act, Public Records Act, subpoenas, enforcement, and other issues as needed
- Work with City Manager's Office and Planning Department to improve nuisance abatement/code enforcement – quick view of nuisance abatement cases and their disposition via GIS. Allows for pattern detection and easy visualization of statuses.
- Continue to support windup of Redevelopment Agency

GOVERNANCE OF GIS

The City Attorney's Office is not nor will be a major GIS user or contributor. However, many of the issues for which the Office has oversight have geographic components that lend themselves to mapping and visualization. Currently, the City Attorney's Office has access to and uses an internal GIS portal (Parcel Conditions Viewer a.k.a. Parcel Popper) that contains the following data about properties and associated GIS layers. Staff often need to view city owned properties and also reference an application that allows for the visualization of city trees. The Office needs to map, visualize, and analyze, trip and fall cases, tree claim cases, and other pertinent data.



Portal for Retrieving Property Related Information

There are generally three tiers of GIS users. A Tier 1 - Flagship GIS user typically conducts GIS administration and coordination at the enterprise level, has access to a fully functioning GIS toolset to create and maintain enterprise data, and manages the enterprise database. A Tier 2 - Analytical GIS user focuses on data analysis, complex querying and data modeling, along with department level data maintenance. A Tier 3 - Browser GIS user requires only general browsing GIS data functions to create reports, query standard data sets, create tasks like mailing labels, and produce maps.

The table below summarizes the current GIS staffing and or GIS usage in the City Attorney's Office. Type represents the current level of GIS experience based on job requirements and GIS usage can be categorized as Limited, Moderate, or High (i.e. frequency of use), and Primary Tools describes what tools, or how GIS is used, to carry out GIS functions.

Current GIS Staffing				
Type		Number of Users	GIS Usage	Primary Tools
	GIS Flagship (Tier 1)	0	N/A	None
	GIS Analytical (Tier 2)	0	N/A	None
	GIS Browser (Tier 3)	4	N/A	Intranet GIS Browser (Parcel Conditions Viewer and Tree Viewer)

HARDWARE AND SOFTWARE

The City Attorney's Office has personal computers for each of its employees. The table below summarizes the hardware in use for the City Attorney's Office:

Hardware Issues Summary	
Type	Notes
Personal Computers	One for each staff person
Laptops	Available as needed
Printers	Ample printers available for use
Plotters	None
GPS	None
MDTs	None
Scanners	None

The City Attorney's Office utilizes the following software applications that are pertinent to this study:

1. Microsoft Office– Office productivity
2. Intranet GIS Browser from GIS Team – lightweight GIS application (Parcel Conditions and Tree Viewers)
3. Accela – for viewing pertinent planning data and code enforcement cases

2
GIS NEEDS ASSESSMENT

GIS NEEDS

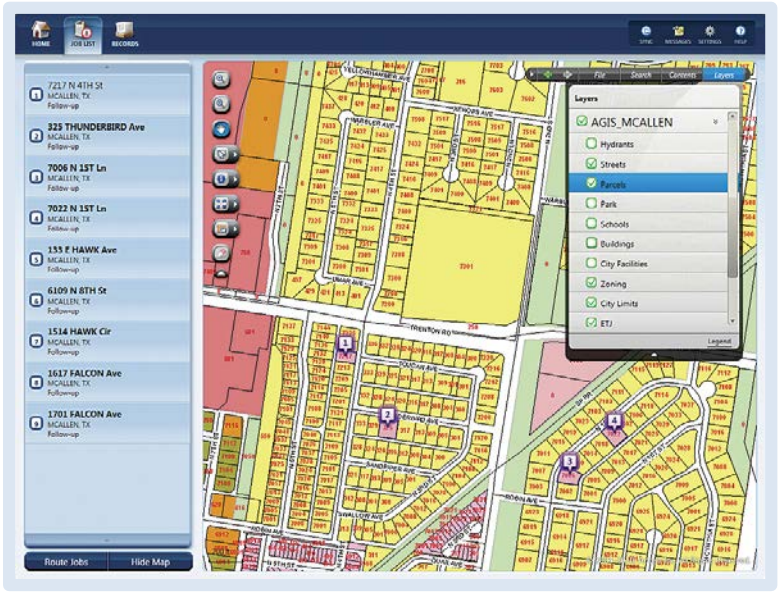
The City Attorney's Office should have expanded access to GIS and its complementary technologies. The department recognizes the benefit of using GIS, from plotting pending code enforcement locations and status changes, viewing violation photographs, visualizing trip and fall cases, and printing maps for hearing and court cases. City Attorney's Offices throughout the country have implemented GIS in varying capacities. After interviewing the City Attorney's Office, it was determined that the Department does have GIS needs. The table below summarizes the potential needs and how they are to be met:

GIS Need	*Method/Application to Meet Need*
Data Visualization	Intranet GIS Data Browser – need consolidated Portal
Provide Legal Counsel to City Staff in Relation to GIS	Expert Advice
GIS Education for Department Staff	Intranet GIS Data Browser Training

GIS NEED

Data Visualization

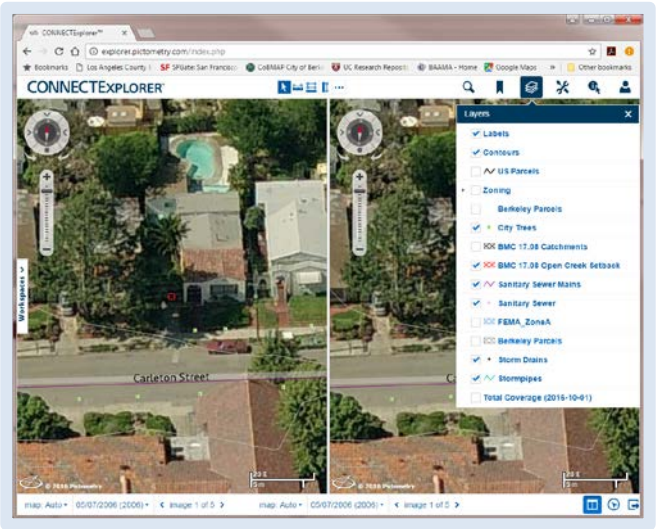
The GIS Team provides a few GIS portals used by City Attorney staff (Parcel Conditions and Tree Viewers). The City Attorney's Office has access to the intranet GIS data browser and uses it to conduct basic spatial analysis, to produce maps, and to assist in day-to-day activities. These applications are useful but don't meet all the GIS needs of the department. As the City GIS effort matures and additional staff resources are added it would be beneficial to create targeted portals for the various City departments. The GIS should be seen as a platform for staff to access a majority of their data needs. The idea is to break down data stovepipes that force staff to gather data from various sources. Ideally, the City Attorney's Office would have access to a browser based portal that contains specific data and functionality including:



Quick View of Important Data via GIS Code Enforcement Cases

- Identify property location and ownership
- Determine if a location is in or out of the City Limits
- Linked to documents containing metes and bounds information for property boundaries
- Linked to other available legal documents
- Review creek locations
- Map locations of Contracts
- Code Enforcement Case by status– derived from records within Accela
- Warrants
- Citations
- Speed Limit Zones

- School Zones with attributes of when the zone is active
- Stop signs and Stop Lights
- CIP Projects
- Judicial Boundaries
- Speeding Violations
- View and query existing infrastructure – water, sewer, storm water, and facilities
- Court cases
- Aerial imagery
- Oblique Aerial Imagery (Pictometry)
- Trip and fall cases
- Tree claim cases
- Sidewalks and sidewalk maintenance data
- City owned properties
- Development projects
- Various data within Accela
- Telecommunications data including tower locations (3-D viewsheds and shadow data)
- Police calls as they relate to code enforcement
- Blighted buildings
- Cannabis dispensaries
- Smoke shops and smoking ordinance related buffers and restricted sites
- Mini dorms
- AirBNB locations
- Public nuisance cases
- Housing data to include regulatory agreements and low income units
- E-3 balconies and their inspections
- Automated Vehicle Location data to support case work if needed
- Liquor licenses with a buffer
- Google Street View embedded in viewing application
- Tie contract locations to their geography

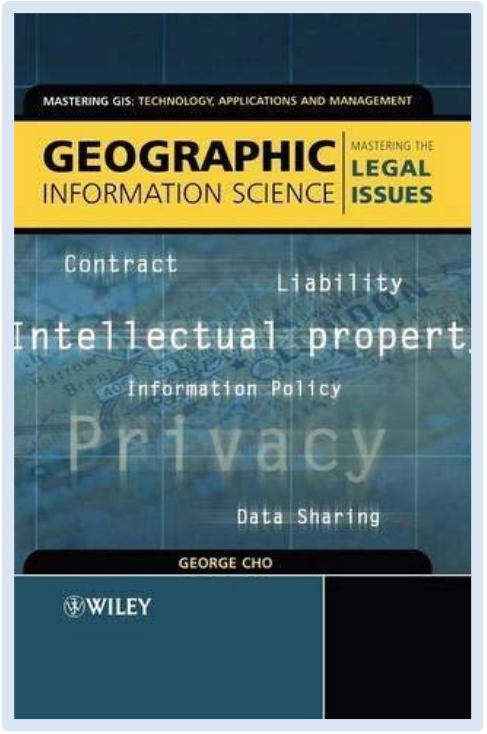


Attorney's Office Should Have Embedded Access to Oblique Aerial Photography

GIS NEED

Legal Counsel

As detailed in the previous need, the City Attorney's Office will be a consumer of data for visualization and analytical purposes. Additionally, the Office needs to provide legal counsel on the appropriate uses and distribution of GIS technology. These include:



- Public Access issues to include:
  - How does the Public Records Act (PRA) apply to the City's GIS data and derivative products?
  - How do other Open Records Acts affect GIS? How much public information do community members have the right to demand and can the City of Berkeley recover costs by selling public data?
- Liability issues to include:
  - Errors in data and uncorrected mistakes
  - Representations of error-free data – many users view GIS data and presume that the data is error-free. This is especially challenging as GIS inherently displays data of various derivation and accuracy juxtaposed together.
  - Flawed policy – faulty GIS data can lead to faulty policy decisions and associated legal ramifications
  - Unintended or inappropriate use – how should the City portray its data and promote appropriate use of the data?
- Other issues to include:
  - Privacy - A majority of the data collected by cities lends itself to geo-enablement. Some of this data is sensitive data and some of it is legally mandated to be protected and not shared. It is incumbent upon the City to understand the privacy issues as they relate to geo-enabled data.

- GIS Data as Evidence – GIS data is becoming widely used to support court cases. The City needs to understand when this data should be used and introduced in evidentiary capacities.
- Copyrights – GIS should be a portal into all of the data consumed by the City. Some of this data is acquired from third parties or electronically linked from external sources. It is necessary for City staff to understand the limits of use and not introduce copyright conflicts.

GIS NEED

GIS Training for Department Staff

It is important that City Attorney staff understand the basic uses of GIS and can use the intranet browser for various needs. Therefore, City Attorney staff should attend educational seminars offered by the City that deal with general topics like, "What is GIS". This will help them gain a basic understanding of GIS concepts. In addition, training on the use of the intranet browser and/or any City Attorney specific intranet browser that is developed, is also recommended.

3

GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY

City Attorney staff are not responsible for the maintenance of GIS data layers but do require access to existing GIS data. It is expected that once all departmental data is integrated, consolidated, and centrally stored, that staff will have access to all non-classified GIS data layers from other departments.

Legend

Data Layer	The data layer is the GIS thematic data that is being described. The name of the layer or description of the layer is placed in this column.
Creation Methodology	This column describes how the layer was or is anticipated being created.
Recommended Update Division or Individual	This field outlines the division or individual that is anticipated to maintain or develop the data layer during and after full implementation of the Citywide enterprise GIS. Development of new recommended layers will be prioritized for each year of the Strategic Implementation Plan.
Layer Status	Layer state of existence.
Existing	These layers currently exist within the City's GIS.
Recommended/ Desired	These layers are recommended for development or procurement, based on departmental and enterprise needs. These data layers will help support existing business procedures or will compliment other GIS data sets that are already existing and in use by the city. Costs associated for these recommended layers will be based on general estimates – actual cost may vary.
Partial	These layers currently exist in an incomplete or outdated state.

The following table lists those data layers that are important to the City Attorney's Office.

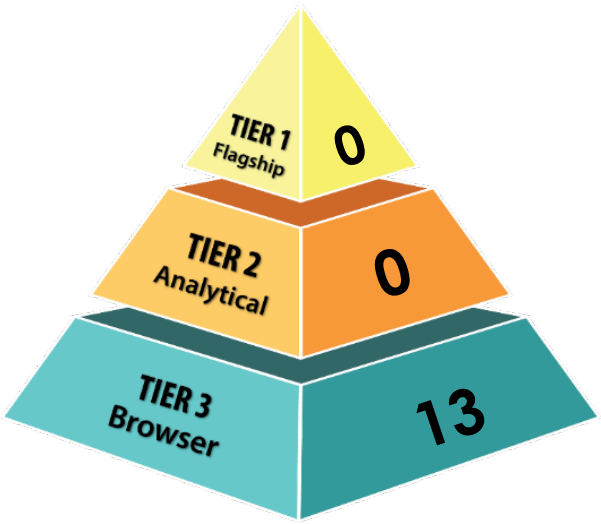
Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
City Attorney GIS Data			
Accela Data	Geocode	Automated	Recommended/Desired
AirBNB Locations	Geocode	GIS Team	Recommended/Desired
Automated Vehicle Location Data	Geocode	Automated	Recommended/Desired
E-3 Exterior Elevated Elements	Geocode	GIS Team	Recommended/Desired
Blighted Buildings	Extract from buildings layer	GIS Team	Recommended/Desired
Cannabis Dispensaries	Geocode	Automated	Recommended/Desired
Capital Improvement Projects	Digitize from Plan Documents	GIS Team	Recommended/Desired
Cell Towers	Geocode	GIS Team	Recommended/Desired
Citations	Geocode	Automated	Recommended/Desired
City Property	Extract from parcels and legal descriptions	GIS Team	Existing
Code Enforcement Case	Geocode	Automated	Recommended/Desired
Contract Locations	Geocode	GIS Team	Recommended/Desired
Creeks	Digitize from Aerials	GIS Team	Existing
Development Projects	Digitize from Plan Documents	GIS Team	Recommended/Desired
Election Streets	Extract from Road Centerlines. Identify sign posting locations and streets where signs are not allowed.	GIS Team	Recommended/Desired
Judicial Boundaries	Extract from parcels	GIS Team	Existing
Land Uses	Extract from parcels	Planning	Existing
Liquor Licenses	Geocode	Planning	Existing
Mini Dorms	Geocode	GIS Team	Recommended/Desired
Public Nuisance Cases	Geocode	Automated	Recommended/Desired
School Zones	Extract from parcels	GIS Team	Recommended/Desired
Sidewalk Inspections	Extract from Database	Automated	Recommended/Desired
Sidewalk Trip & Fall Locations	Extract from Database	Automated	Recommended/Desired
Sidewalks	GPS and digitizing from aerials	Public Works	Existing
Smoke Shops	Geocode	GIS Team	Recommended/Desired
Speed Limit Zones	Extract from centerlines	GIS Team	Recommended/Desired
Speeding Violations	Geocode	Automated	Recommended/Desired
Tree Claim Cases	Geocode	Automated	Recommended/Desired

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Tree Inventory	GPS	Parks & Rec & Waterfront	Existing
Utilities	Digitize from As-Builts	Public Works	Existing
Warrants	Geocode	Automated	Recommended/Desired
Zoning	Digitized on Screen	Planning	Existing
Citywide Base Data			
Property	Original tax parcels were digitized and rubber sheeted from scanned hard copy water quality maps circa 1999. Updated manually once a year by the GIS Team using County data for attributes and the County's Adobe PDF parcel maps for geometry changes. Migrated to the LGIM Tax Parcel schema in 2016.	The GIS Team	Existing
Aerial Photography	Current aerial data is delivered by Pictometry through an agreement with Alameda County. The most current data was captured in 2014 with the next flyover scheduled for Spring 2017. The County's current contract with Pictometry calls for one more flyover after the 2017 capture. Older imagery exists for 2006 (custom County flyover), 2009, and 2011 (USGS).	Static Map	Existing
Road Centerlines	Created by RMSI in 2010 from various sources including Alameda County data and pavement management system data (street width). Updated manually by the GIS Team occasionally. Migrated to the LGIM Road Centerline schema in 2016. Zero Waste has a copy that has been updated for routing purposes.	The GIS Team	Existing
Address Points	During the work day, an Analyst in the Finance Department updates/creates new addresses in the Land Management (LX) module in SunGard (FUND$). Address points are then created nightly from an ETL that extracts and geocodes (using parcel centroid coordinates) and joining to a parcel table to create the address points feature class.	Automated / Finance Department	Existing

4

MULTI-TIER GIS APPLICATION USE

The pyramid and table below outlines the anticipated "Tiers of GIS Use" within the City Attorney's Office. All are color coded by the level of desired GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions.



TIERS OF GIS USERS	
GROUP	ACTIVITY
Tier 1 Flagship	• GIS Administration • Data Maintenance • Data Conversion and Creation • Spatial Data Management • Technical Support • Coordination
Tier 2 Analytical	• Data Maintenance • Analytical Functions/Geoprocessing • Complex Queries • Modeling • Use of Desktop Extensions • High Quality Map Production
Tier 3 Browser	• Browsing/Look-Up • Standard Reports • Simple Query • Map Production

5

RETURN ON INVESTMENT (ROI)

The following table indicates specific Return on Investment opportunities for the City Attorney's Office. These specific examples show the true return on investment of the technology.

Return on Investment Opportunity City Attorney's Office	
Opportunity	**Explanation**
Save <u>Time</u> and <u>Respond</u> More Quickly to Community Requests	***Public access to accurate data:*** • The public should have Internet access to GIS data. GIS will allow users to find information much more quickly and in many cases on their own. This should save multiple staff hours a week in the City Attorney's Office. The internet access has to be really well-thought-out to fully realize the maximum savings. ***Staff access to accurate/updated data:*** • Staff should have access to current GIS data to better serve and provide information to the public and decision makers. This should save multiple staff hours a week in the City Attorney's Office.

Return on Investment Opportunity City Attorney's Office	
Opportunity	**Explanation**
Improve Data Accuracy	***Better GIS Data and Spatial Analysis:*** • Working with other departments and City agencies to update data with higher accuracy can improve the results when analyses are performed. By sending errors found in data to the data owners, errors can be corrected quickly.
Improve Public Access to Government	***Internet Browser:*** • The City Attorney's Office wants to share critical information with the public. This will allow the public to be more informed and make better decisions. This could also save the public many trips to the department, saving time, pollution, energy, frustration, and would empower the public with the ability to get the information they need.
Improve Access to Critical Data	***GIS Data Support for Court Cases:*** • Timely access to accurate GIS data will provide critical information in support of various court cases. This access can make the difference in determining the successful outcome of a legal decsion. For example, knowing that a sidewalk inspection shows that a sidewalk repair had occurred "before" a plaintiff claims to have tripped, could easily help decide a legal case in the City's favor.

Return on Investment Opportunity City Attorney's Office	
Opportunity	**Explanation**
Compliance with the Berkeley Municipal Code	***Visualization and Pattern Detection:*** • Working with the Planning Department and the City Manager's Office, view and analyze critical data via GIS to proactively assess nuisance abatement and code enforcement cases in support of efforts to reduce code violations.

NEEDS ASSESSMENT

CITY CLERK

CITY OF BERKELEY
CALIFORNIA
GIS Strategic Implementation Plan

SECTION OUTLINE

1

EXISTING CONDITIONS

DEPARTMENT OVERVIEW

The City Clerk Department is responsible for providing oversight for legislative proceedings and professional support to the City Council, City Manager, and City Staff. The City Clerk also administers the Citywide Records Management Program and administers municipal elections. The City Clerk Department has the following specific responsibilities:

- Prepares the City Council agendas and provides other support as needed to the Council
- Maintains the legislative history of the City, including the Charter and Municipal Code
- Provides information on how to access Public Information and Records
- Records Manager for the City
- Local Filing Officer for the State of California
- Administers the City's Elections

The Department currently employs 9 permanent staff.

GOVERNANCE OF GIS

There are generally three tiers of GIS users:

- Tier 1 - Flagship GIS user typically conducts GIS administration and coordination at the enterprise level, has access to a fully functioning GIS toolset to create and maintain enterprise data, and manages the enterprise database.
- Tier 2 - Analytical GIS user focuses on data analysis, complex querying and data modeling, along with department level data maintenance.
- Tier 3 - Browser GIS user requires only general browsing GIS data functions to create reports, query standard data sets, create tasks like mailing labels, and produce maps.

The table below summarizes the current GIS staff usage within the Department. Type represents the current level of GIS experience based on job requirements. GIS usage can be categorized as Limited, Moderate, or High (i.e. frequency of use), and Primary Tools describes what tools, or how GIS is used, to carry out GIS functions:

Current GIS Staffing				
Type		Number of Users	GIS Usage	Primary Tools
	GIS Flagship (Tier 1)	0	N/A	None
	GIS Analytical (Tier 2)	0	N/A	None
	GIS Browser (Tier 3)	9	N/A	Intranet GIS Browser (Parcel Popper)

HARDWARE AND SOFTWARE

The City Clerk Department uses personal computers for each of its staff. Printers are available for office use.

Hardware Issues Summary	
Type	Notes
Personal Computers	One for each staff person
Laptops	Select staff
Printers	Ample printers available for use
Plotters	None
GPS	None
MDTs	None
Scanners	None

- Microsoft Office is used to conduct office productivity tasks
- OnBase is used for Records Management
- Intranet GIS Browser from GIS Team – lightweight GIS application (Parcel Popper)

2
GIS NEEDS ASSESSMENT

GIS NEEDS

A majority of the City Clerk's GIS needs revolve around viewing GIS data. Staff require access to GIS data and the ability to query and perform analysis using elements of GIS data maintained by the City.

All of City Clerk staff will be **Tier 3 Browser level users** of an enterprise GIS. GIS implementation will require a certain level of application integration, data access, and data process implementation that would enable them to use various GIS client application functions. Access to information should be provided by several user-friendly applications, which will be discussed in detail, following each need if appropriate.

Based on this Needs Assessment, the City Clerk Department has several identified GIS needs. Where applicable each need will be followed by an application or method to meet that need, some applications/methods will meet several needs. A method or application is only described under one need if it applies to multiple needs refer to the previous need for a description. The following table summarizes these needs and how they are to be met.

GIS Need	*Method/Application to Meet Need*
Department-Wide Access to Geospatial Data	Intranet GIS Data Browser
Formal GIS Training for Department Staff	Training Classes
Enabling Existing Databases – Data Integration	Data Mining Application

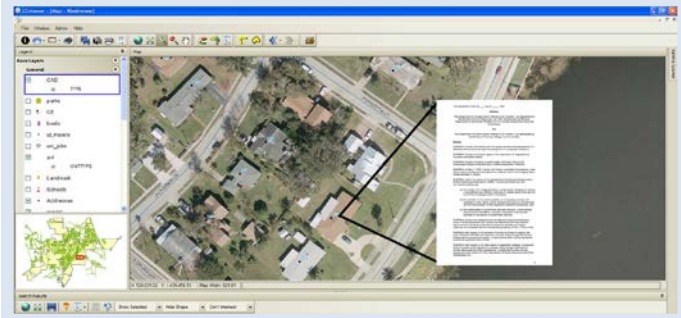
GIS NEED

Department-Wide Access to Geospatial Data

A key need identified by department personnel is access to shared GIS data within the City. This includes the most recent parcel, address, and street centerline data as well as high-resolution ortho-photography. Some of this need is currently met by the City's existing GIS browser (Parcel Popper) but the City Clerk has additional needs. Using the most recent, accurate GIS layers will provide staff with an invaluable tool for everyday tasks. City Clerk staff need the following capabilities in their GIS Browser:

- Viewing GIS enabled documents tied to properties detailing land related agreements
- Access linked documents such as permits, building plans, ordinances, resolutions, code appeals, contracts, and deeds
- Answer election questions
- Locate Council Districts
- View Census data
- View Redistricting data

Departmental staff will be able to utilize an intranet GIS data browser to conduct basic spatial analysis and to produce maps and to assist in day-to-day activities.



Viewing Linked Documents via a GIS Browser

GIS NEED

Formal GIS Training for Department Staff

As Tier 3 – Browser GIS client applications become available (e.g. Intranet and Internet GIS Data Browsers, etc.), departmental staff will require specific training tailored to the GIS interface that may support their workflows. Training is typically arranged by the user level and based on applications that will be deployed throughout the enterprise.

GIS NEED

Enabling Existing Databases – Data Integration

The City Clerk Department has various record documents stored in the OnBase electronic database that could be either spatially enabled via geocoding or hyperlinked to the GIS. Database records with associated addresses can be address-matched to a street centerline layer, tax parcel centroids, or address point layer. Address-matched features can be visualized within the GIS, and their attributes can be queried. It is recommended that information (tabular data) stored in paper or other types of hardcopy recording be entered into a database such as MS SQL Server. Once the above information is maintained as digital data, it can be spatially enabled for use in the City's GIS and used like any other GIS layer.

Other data that do not have associated addresses (e.g. contracts or building plans) cannot be geocoded but can be linked to a GIS layer based on other information. For instance, asbuilts could be linked to a subdivision layer (based on asbuilt ID number) and easements could be linked to a land records layer (based on an encumbrance ID number). Whether geocoding or hyperlinking, data residing in OnBase could become available to the end user via the GIS mapping interface.

A data mining application is an automated geocoding service that creates GIS data layers from non-spatial relational databases. The results of a successful geocoding effort will be stored in an industry standard relational database management system (SQL Server). The automated process is based completely on standard database statements and is customized to utilize a variety of stored location-based data (Parcel PIN, Address, Location-ID, etc.). A second function of the automated service is to generate GIS layers in an industry standard portable format (SDE layers) that could be utilized by a variety of applications. These GIS layers will be created to user specifications. X, Y coordinates will be utilized to display features in a GIS layer. The data would then be consumable within an intranet browser, web applications, mobile apps or more analytical tools such as ArcGIS.

3

GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY

City Clerk staff do not and will not create any GIS layers. Staff will benefit from access to several GIS data layers. It is expected that once all departmental data is integrated, consolidated, and centrally stored, that the staff will have access to all non-classified GIS data layers from other departments.

Legend

Data Layer	The data layer is the GIS thematic data that is being described. The name of the layer or description of the layer is placed in this column.
Creation Methodology	This column describes how the layer was or is anticipated being created.
Recommended Update of Division or Individual	This field outlines the division or individual that is anticipated to maintain or develop the data layer during and after full implementation of the Citywide enterprise GIS. Development of new recommended layers will be prioritized for each year of the Strategic Implementation Plan.
Layer Status	Layer state of existence.
Existing	These layers currently exist within the City's GIS.
Recommended/ Desired	These layers are recommended for development or procurement, which are based on departmental and enterprise needs. These data layers will help support existing business procedures or will compliment other GIS data sets that are already existing and in use by the City. Costs associated for these recommended layers will be based on general estimates – actual cost may vary.
Partial	These layers currently exist in an incomplete or outdated state.

The following table lists those data layers that are important for the City Clerk Department:

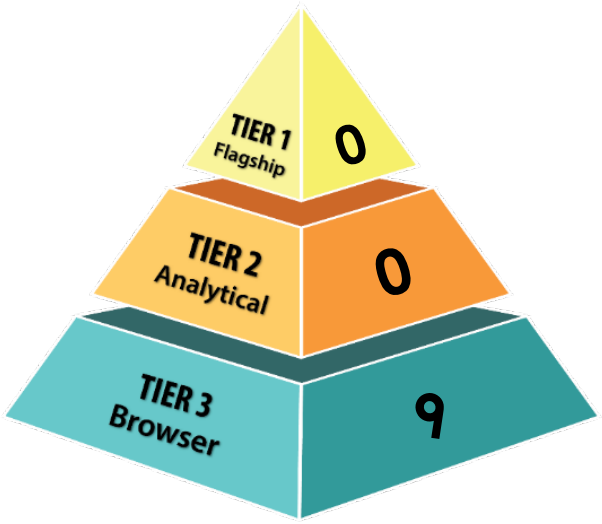
Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
City Clerk GIS Data			
County Precincts	Obtain from Alameda County	GIS Team	Existing
Election Boundaries and Polling Places	Digitized on Screen	GIS Team	Existing
Voting Location Sites by Availability	Geocode	GIS Team	Existing
City Voting Precincts	Extract from parcels	GIS Team	Existing
Congress	Obtain from State	GIS Team	Existing
Council Districts	Redistricting process every ten years after national census	GIS Team	Existing
County Commission	Obtain from Alameda County	GIS Team	Recommended/ Desired
Polling Places	Geocode	GIS Team	Recommended/ Desired
Redistricting	Extract from parcels / census data	GIS Team	Recommended/ Desired
State House Districts	Obtain from State	GIS Team	Recommended/ Desired
Voting	Extract from databases	GIS Team	Recommended/ Desired

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Citywide Base Data			
Property	Original tax parcels were digitized and rubber sheeted from scanned hard copy water quality maps circa 1999. Updated manually once a year by the GIS Team using County data for attributes and the County's Adobe PDF parcel maps for geometry changes. Migrated to the LGIM Tax Parcel schema in 2016.	The GIS Team	Existing
Aerial Photography	Current aerial data is delivered by Pictometry through an agreement with Alameda County. The most current data was captured in 2014 with the next flyover scheduled for Spring 2017. The County's current contract with Pictometry calls for one more flyover after the 2017 capture. Older imagery exists for 2006 (custom County flyover), 2009, and 2011 (USGS).	Static Map	Existing
Road Centerlines	Created by RMSI in 2010 from various sources including Alameda County data and pavement management system data (street width). Updated manually by the GIS Team occasionally. Migrated to the LGIM Road Centerline schema in 2016. Zero Waste has a copy that has been updated for routing purposes.	The GIS Team	Existing
Address Points	During the work day, an Analyst in the Finance Department updates/creates new addresses in the Land Management (LX) module in SunGard (FUND$). Address points are then created nightly from an ETL that extracts and geocodes (using parcel centroid coordinates) and joining to a parcel table to create the address points feature class.	Automated / Finance Department	Existing

4

MULTI-TIER GIS APPLICATION USE

The pyramid and table below outlines the "Tiers of GIS Use" within the City Clerk Department. All are color coded by the level of desired GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions. The City Clerk Department will consist of Tier 3 Users.



TIERS OF GIS USERS	
GROUP	ACTIVITY
Tier 1 Flagship	• GIS Administration • Data Maintenance • Data Conversion and Creation • Spatial Data Management • Technical Support • Coordination
Tier 2 Analytical	• Data Maintenance • Analytical Functions/Geoprocessing • Complex Queries • Modeling • Use of Desktop Extensions • High Quality Map Production
Tier 3 Browser	• Browsing/Look-Up • Standard Reports • Simple Query • Map Production

5

RETURN ON INVESTMENT (ROI)

The following table indicates specific Return on Investment opportunities for the City Clerk's Office. These specific examples show the true return on investment of the technology.

Return on Investment Opportunity City Clerk's Office	
Opportunity	**Explanation**
Save <u>Time</u> and <u>Respond</u> More Quickly to Community Requests	***Public access to accurate data:*** • The public should have Internet access to GIS data. GIS will allow users to find information much more quickly and in many cases on their own. This should save multiple staff hours a week in the City Clerk's Office. The internet access has to be really well-thought-out to fully realize the maximum savings. ***Staff access to accurate/updated data:*** • Staff should have access to current GIS data to better serve and provide information to the public and decision makers. This should save multiple staff hours a week in the City Clerk's Office.

Return on Investment Opportunity City Clerk's Office	
Opportunity	**Explanation**
<u>Improve</u> Data <u>Accuracy</u>	***Better GIS Data and Spatial Analysis:*** Working with other departments and City agencies to update data with higher accuracy can improve the results when analyses are performed. By sending errors found in data to the data owners, errors can be corrected quickly.
Improve <u>Public</u> Access to Government	***Internet Browser:*** • The City Clerk's Office wants to share critical information with the public. This will allow the public to be more informed and make better decisions. This could also save the public many trips to the department, saving time, pollution, energy, frustration, and would empower the public with the ability to get the information they need.

NEEDS ASSESSMENT

CITY MANAGER

CITY OF BERKELEY
CALIFORNIA
GIS Strategic Implementation Plan

SECTION OUTLINE

1

EXISTING CONDITIONS

DEPARTMENT OVERVIEW

The mission of the City Manager's Office is "to build and maintain, through sound management principles and community participation, an effective City government organization; to ensure the effective delivery of services; to provide the management direction and support for the planning, implementation, and evaluation of all city programs; and to ensure coordination and consistency in implementing policies and programs approved by the City Council." The Berkeley City Manager's Office consists of the following six divisions:

1. **Administration and Neighborhood Services** – consists of the City Manager and various other staff responsible for supporting the City Manager's office as well as the Mayor and Council. Also work with the Council, community, and external organizations on various neighborhood problems. An Administrative Hearing officer is responsible for responding to appeals on parking tickets and other administrative citations.

2. **Berkeley Animal Care Services** – provides field services for the cities of Berkeley and Albany, and shelters animals from Berkeley, Albany, Piedmont, and Emeryville. Enforce city ordinances related to animals.

3. **Code Enforcement** – responsible for the enforcement of violations of the Berkeley Municipal Code.

4. **Office of Budget and Fiscal Management** – responsible for the preparation, development, and management of the City's Budget as well as reviewing and analyzing all fiscal issues that impact the City.

5. **Office of Economic Development** – responsible for expanding business opportunities within the City and for generating new arts resources through the Civic Arts program.

6. **Police Review Commission** – nine member commission that ensures that Berkeley police officers act in a manner that conforms to community standards.

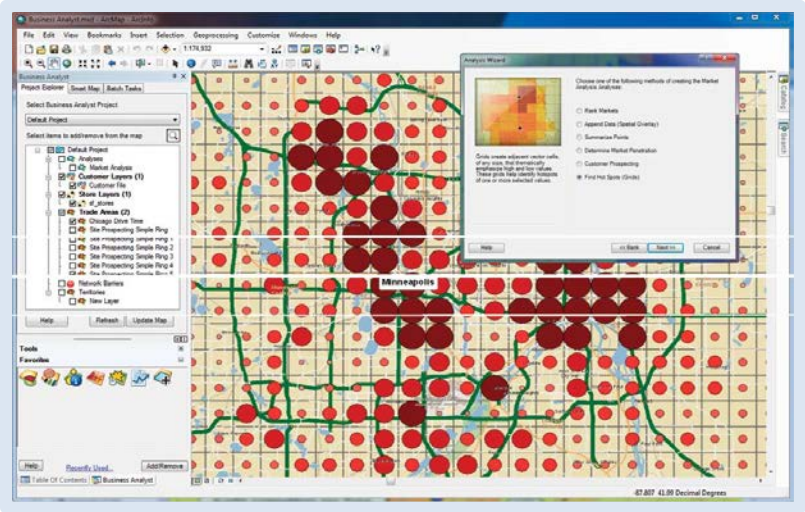
The City Manager's office and its six divisions have a total of 27 staff.

GOVERNANCE OF GIS

There are generally three tiers of GIS users. A Tier 1 - Flagship GIS user typically conducts GIS administration and coordination at the enterprise level, has access to a fully functioning GIS toolset to create and maintain enterprise data, and manages the enterprise database. A Tier 2 - Analytical GIS user focuses on data analysis, complex querying and data modeling, along with department level data maintenance. A Tier 3 - Browser GIS user requires only general browsing GIS data functions to create reports, query standard data sets, create tasks like mailing labels, and produce maps.

Currently, the City Manager's Office has access to and uses an internal GIS portal (Parcel Popper), several ArcGIS Server applications (Parcel Searcher, Planning, and Community Map) and also is using ArcGIS Desktop and the Business Analyst extension. Uses of GIS in the Department include the following:

- Short term rental maps
- Code Enforcement Analysis
- Address lookups
- Economic development research



ArcGIS Business Analyst

ArcGIS Desktop (Advanced License) is currently in use by the Department but the needs for this high level application should be reviewed to determine if most or all of the functionality could be provided instead via a browser based map portal.

The table below summarizes the current GIS staffing and or GIS usage in the City Manager's Office. Type represents the current level of GIS experience based on job requirements and GIS usage can be categorized as Limited, Moderate, or High (i.e. frequency of use), and Primary Tools describes what tools, or how GIS is used, to carry out GIS functions.

Current GIS Staffing				
Type		Number of Users	GIS Usage	Primary Tools
	GIS Flagship (Tier 1)	0	N/A	None
	GIS Analytical (Tier 2)	2	N/A	ArcGIS Desktop
	GIS Browser (Tier 3)	10	N/A	Intranet GIS Browser (Parcel Popper, Planning, Community Map)

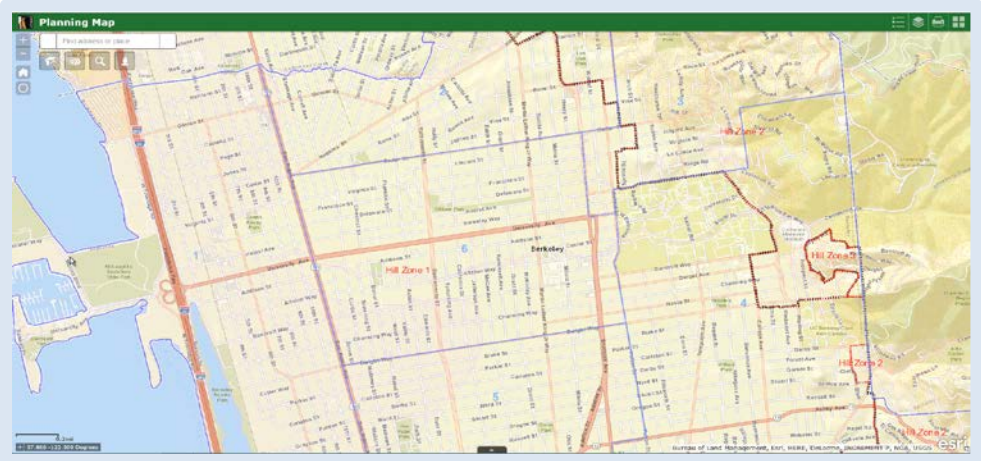
HARDWARE AND SOFTWARE

The City Manager's Office has personal computers for each of its employees. The table below summarizes the hardware in use for the City Manager's Office:

Hardware Issues Summary	
Type	**Notes**
Personal Computers	One for each staff person
Laptops	Available as needed
Printers	Ample printers available for use
Type	**Notes**
Plotters	None
GPS	None
MDTs	None
Scanners	None

The City Manager's Office utilizes the following software applications:

1. Microsoft Office– Office productivity
2. Intranet GIS Browser from GIS Team – lightweight GIS application (Parcel Popper)
3. ArcGIS Server Apps – Parcel Searcher, Planning, Community Map
4. ArcGIS Desktop – advanced GIS analysis and mapping
    a. Business Analyst – data visualization and market analysis
5. Chameleon – animal control database



Berkeley Planning Map

2

GIS NEEDS ASSESSMENT

GIS NEEDS

After interviewing the City Manager's Office, it was determined that the Department does have several GIS needs. The table below summarizes the potential needs and how they are to be met:

GIS Need	Method/Application to Meet Need
Department-Wide Access to Geospatial Data	Intranet GIS Data Browser – need consolidated Portal
Public Access to Geospatial Data	Story Maps
Economic GIS Web Portals	Story Maps Intranet GIS Data Browser
Enabling Existing Databases – Data Integration	Data Mining Application
Use GIS to Track Capital Projects	Intranet GIS Data Browser
Field Access to Geospatial Data	Tablets & Smartphones ArcGIS Online Collector App
GIS Education for Department Staff	Intranet GIS Data Browser Training ArcGIS Desktop Training

GIS NEED

Department-Wide Access to Geospatial Data

The GIS Team provides a GIS portal (Parcel Popper) for any employee to view pertinent GIS data. The City Manager's Office has access to the intranet GIS data browser and uses it to conduct basic spatial analysis, to produce maps, and to assist in day-to-day activities. Most if not all GIS functionality required by the Department could be provided in an intranet solution. Ideally, the City Manager's Office would have access to a browser based portal that contains specific functionality/data for the Department including:

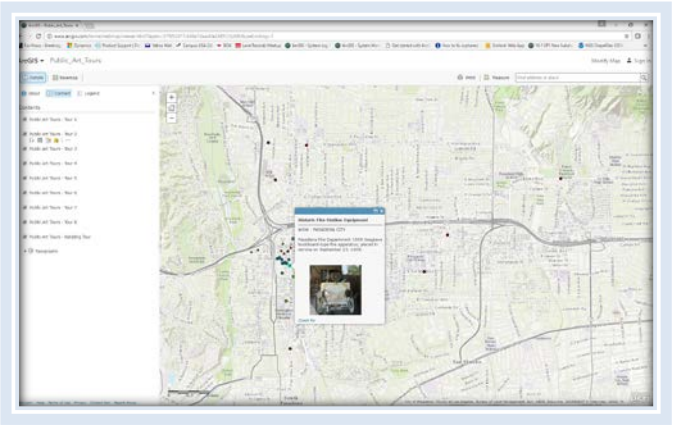
- Identify property location and ownership
- Determine if location is in or out of the City Limits
- Animal bite locations
- Animal DOA pickup locations
- Coyote siting locations
- Arts resources
- Police Review Commission Community Complaints
- Increases in Code Cases (Density Map/Hot Spots)
- Short Term Rentals
- Mini Dorm Locations
- Infrastructure (streets & sewers)
- CDBG (past, present, future)

GIS NEED

Public Access to Geospatial Data

Providing public access to GIS maps through the Internet provides information to the City of Berkeley's community. The City Manager's office should implement an ArcGIS Online based Internet GIS data browser to provide focused access to the community members for department related information including:

- **Animal Control**
  - Bite Locations
  - Rabies Locations
  - Coyote Sitings/Incidents
- **Police Review Commission**
  - Locations of Community Complaints
- **Civic Arts Program**
  - Art Districts
  - Walking Tour
- **Berkeley Project Day**
- **Public Events**



Public Art Tour Map

One of the most recent innovations in GIS for the public is Story Maps from Esri. Story maps are lightweight, open-source web applications. They combine web maps created using ArcGIS Online, Esri's cloud-based mapping system, with multimedia content - text, photos, video, and audio - to let you tell stories about services, events, and other items of interest.

GIS NEED

Economic GIS Web Portals

Story Map -

Example Story Map of Sites of Interest in Naples, FL

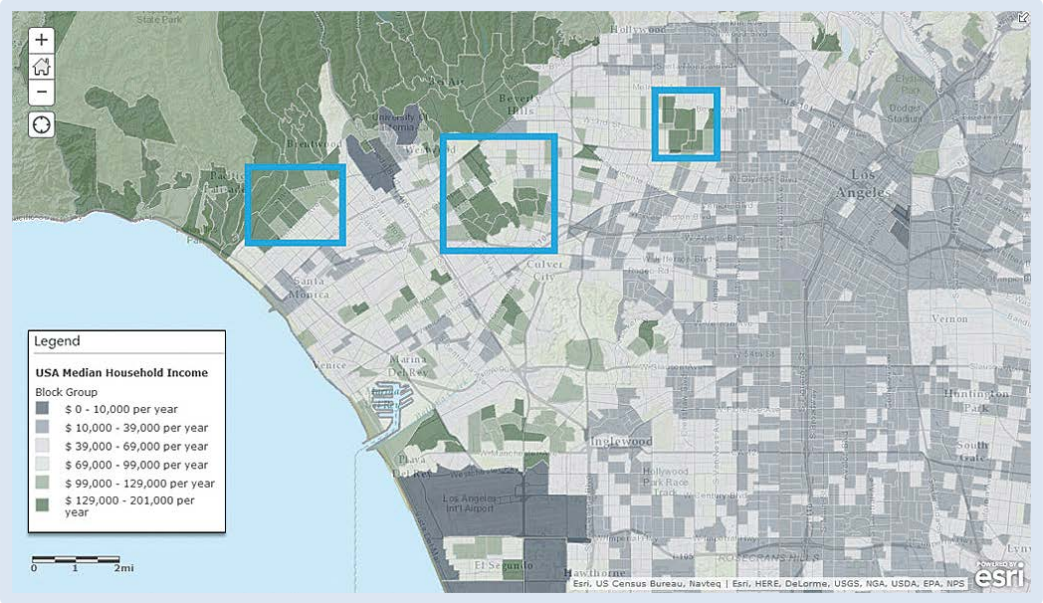
Economic Development's (OED) processes are inherently geographic. Economic development zones, potential sites, and other elements are selected based on their location and proximity to other locations or distributions of people. Maps can provide OED, developers, and businesses with information from which economic, demographic, and market patterns can be visualized in a way that written reports and statistical tables cannot.

Historically, public facing local government and OED GIS applications have been cumbersome and not as intuitive as other applications on the market, like Google Maps. Recently, the GIS industry has had a major push to overcome this dearth of user-friendly applications. The OED would benefit from offering Story Maps on their web-site. Story maps could be used to provide information on business, recreation opportunities, and a regional look at the area.

Intranet GIS Data Browser -

Economic Development also has various geospatial needs that would justify a dedicated internal portal for staff to access and research economic data and would provide the following capabilities:

- Storefronts mapped and viewable (in Excel now) Remap Business locations
- Remap vacant units (have done but out of date)
- Sales tax and employment data
- Business license data from Accela
- Business districts
- Employment (geo-enable once a year) – see change over time
- Fiber locations (have fiber permits)
- Streets moratorium
- When things are going to be repaved so they can share with local businesses
- Pavement schedule and plan from Public Works (notify people)



Median Household Income

GIS NEED

Enabling Existing Databases – Data Integration

Animal Control stores various data related to their group functions, including animal bite locations, rabies locations, etc., in the Chameleon cloud-based application/database. It would be very beneficial if this Animal Control data could be geo-enabled and displayed in GIS for mapping and analysis purposes. This can be accompmlished with a data mining application. Additionally, Economic Development would like to extract Employment and Tax data from the Accela database as well as establish a link to an external commercial listing service.

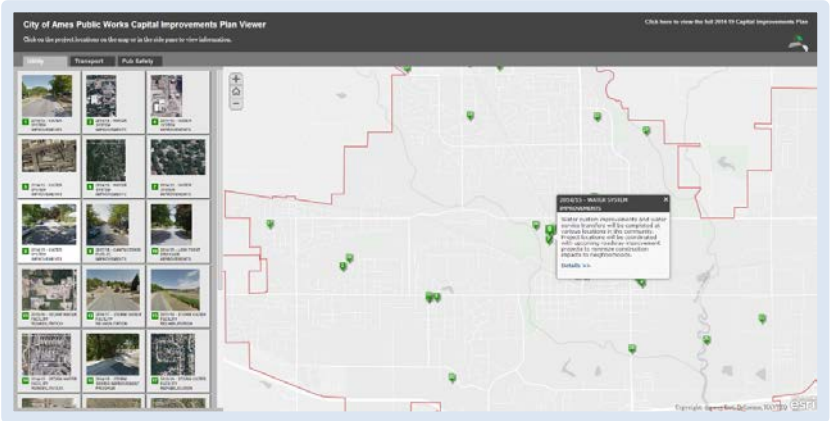
A data mining application is an automated geocoding service that creates GIS data layers from non-spatial relational databases. The results of a successful geocoding effort will be stored in an industry standard relational database management system (SQL Server). The automated process is based completely on standard database statements and is customized to utilize a variety of stored location-based data (Parcel PIN, Address, Location-ID, etc.). A second function of the automated service is to generate GIS layers in an industry standard portable format (SDE layers) that could be utilized by a variety of applications. These GIS layers will be created to user specifications. X, Y coordinates will be utilized to display features in a GIS layer. The data would then be consumable within an intranet browser, web applications, mobile apps or more analytical tools such as ArcGIS.

GIS NEED

Use GIS to Track Capital Projects

The City manages and oversees all capital projects. The Budget Office would benefit from having easy access to a capital projects map. Currently, staff has to go to multiple sources to pull together the information that they need. Additionally, there is no map layer which tracks historic, current, and future capital projects. This

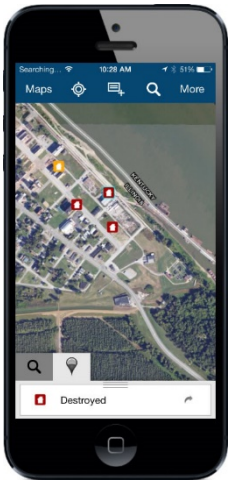
can lead to inefficiencies and duplication of work. A GIS layer should be created to track all capital projects. Some of the benefits of tracking these projects in GIS are the ability to quickly view and analyze where funds have been spent over a period of time, track road closures, and to notify the public of work in an area. Additionally, this will ensure that capital projects are coordinated to optimize resources and reduce duplication.



GIS NEED

Field Access to Geospatial Data

Code Enforcement would benefit from having mobile GIS capabilities for viewing and collecting GIS data, which can be done by providing users with mobile tablets, GIS software and/or ArcGIS Online access. Providing personnel with access to maps and GIS data while working in the field is an important part of maintaining an enterprise GIS. Through the use of hardware, software and data that are designed to be explored and manipulated away from the office, staff can realize benefits of GIS while away from their workstations.



A mobile data browser provides field personnel with all relevant layers, including base map layers and aerial photography. The smart phones/tablets should be set-up to synchronize wirelessly with the City's network as much as possible using mobile networking capability. Data can be provided to mobile computers by replicating data, or extracting updated data from the enterprise geodatabase when mobile networking is not available or is not plausible. The City of Berkeley could employ ArcGIS Online and/or Portal as their intranet, internet, and mobile solution. One benefit of using ArcGIS Online is the ability to harness pre-developed applications and maps. ArcGIS Online could also be utilized for field mobility including data collection. Since ArcGIS Online is an integral

part of the ArcGIS system, organizations can use it to extend the capabilities of ArcGIS for Desktop, ArcGIS for Server and other ArcGIS based applications.

Additionally, Code Enforcement should utilize the Collector application from Esri. Collector for ArcGIS should be used to improve the efficiency of field staff with the goal for improving the accuracy of your GIS. The application works on iOS or Android devices and is used to collect and update information in the field, whether connected or disconnected. The application can be used to collect any data.

GIS NEED

GIS Training for Department Staff

It is important that City Manager staff understand the basic uses of GIS and can use the intranet browser for various needs. Therefore, City Manager staff should attend educational seminars offered by the City that deal with general topics like, "What is GIS". This will help them gain a basic understanding of GIS concepts. Training on the use of the intranet browser and/or any City Manager specific intranet browser that is developed, is also recommended. In addition, more advanced training should be provided to the Tier 2 ArcGIS Desktop users covering analysis, desktop extensions, cartography, data conversion, and other related topics.

3

GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY

City Manager staff are not responsible for the maintenance of GIS data layers but do require access to existing GIS data. It is expected that once all departmental data is integrated, consolidated, and centrally stored, that staff will have access to all non-classified GIS data layers from other departments.

Legend

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Partial	These layers currently exist in an incomplete or outdated state.

The following table lists those data layers that are important to the City Manager.

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
City Manager GIS Data			
Animal Bite Locations	Extract from Chameleon Database	Automated	Recommended
Animal DOA Pickup Locations	Extract from Chameleon Database	Automated	Recommended
Art Districts	Digitize On Screen	GIS Team	Recommended
As-Built Data from Contractors	Obtain from Public Works	Public Works	Recommended
Blight Locations	GPS / Geocode	GIS Team	Recommended
Business Improvement Districts	Digitize On Screen	GIS Team	Existing
Code Enforcement Data	Extract from Accela	Automated	Recommended
Commercial Store Fronts	Extract from Accela	Automated	Recommended
Coyote Siting/Incident Locations	Extract from Chameleon Database	Automated	Recommended
Employment Data	Extract from Accela	Automated	Recommended
Hoarding Locations	Geocode	GIS Team	Recommended
Homeless Encampments	GPS	GIS Team	Recommended
Illegal Dumping	GPS	Public Works	Recommended
Paving Schedule	Extract from pavement management database	Public Works	Recommended
Police Review Commission Community Complaint Locations	Geocode	GIS Team	Recommended
Rabies Locations	Extract from Chameleon Database	Automated	Recommended
Short Term Rentals	Extract from Sungard	Automated	Recommended
Stray Animal Locations	Extract from Chameleon Database	Automated	Recommended
Streets Moratorium Data	Extract from pavement management database	Public Works	Existing
Student Move-Outs	GPS	Public Works	Recommended
Tax Data	Obtain from Alameda County	GIS Team	Existing
Vacant Properties	Extract from Accela	Automated	Recommended

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Citywide Base Data			
Property	Original tax parcels were digitized and rubber sheeted from scanned hard copy water quality maps circa 1999. Updated manually once a year by the GIS Team using County data for attributes and the County's Adobe PDF parcel maps for geometry changes. Migrated to the LGIM Tax Parcel schema in 2016.	The GIS Team	Existing
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MULTI-TIER GIS APPLICATION USE

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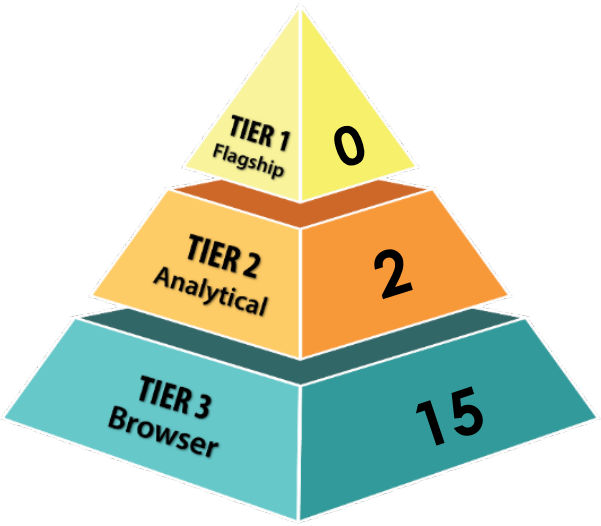

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GROUP	ACTIVITY
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Tier 2 Analytical	• Data Maintenance • Analytical Functions/Geoprocessing • Complex Queries • Modeling • Use of Desktop Extensions • High Quality Map Production
Tier 3 Browser	• Browsing/Look-Up • Standard Reports • Simple Query • Map Production

5

RETURN ON INVESTMENT (ROI)

The following table indicates specific Return on Investment opportunities for the City Manager's Office. These specific examples show the true return on investment of the technology.

Return on Investment Opportunity City Manager's Office	
Opportunity	**Explanation**
Save <u>Time</u> and <u>Respond</u> More Quickly to Community Requests	*Public access to accurate data:* • The public should have Internet access to GIS data. GIS will allow users to find information much more quickly and in many cases on their own. This should save multiple staff hours a week in the City Manager's Office. Proper design of the mapping site is critical. *Staff access to accurate/updated data* • Staff should have access to current GIS data to better serve and provide information to the public and decision makers. This should save multiple staff hours a week in the City Manager's Office.

Return on Investment Opportunity City Manager's Office	
Opportunity	**Explanation**
Save Time	*Easy access to GIS data:* • A department specific intranet GIS Data Browser should be used to generate high-quality maps depicting trends, community service information and project impacts.
Improve Data Accuracy	*Better GIS Data and Spatial Analysis:* • Working with other departments and City agencies to update data with higher accuracy can improve the results when analyses are performed. By sending errors found in data to the data owners, errors can be corrected quickly.
Improved Communication, Coordination and Collaboration and Responding More Quickly to Community Requests	*Internet Browser:* • The City Manager's Office wants to share critical information with the public. This will allow the public to be more informed and make better decisions. This could also save the public many trips to the department, saving time, pollution, energy, frustration, and would empower the public with the ability to get the information they need.

NEEDS ASSESSMENT

FINANCE

CITY OF BERKELEY
CALIFORNIA

GIS Strategic Implementation Plan

SECTION OUTLINE

1

EXISTING CONDITIONS

DEPARTMENT OVERVIEW

The Customer Service Division within Administrative Services Department is responsible for processing water bills, sanitation billing, parking citations, business tax receipts, and accounts receivable. They also issue dog licenses, register massage parlors, and sell bus tickets. In addition, the Division coordinates the activities of special event and location filming permits, business tax compliance programs, and cashiering activities at City Hall.

GOVERNANCE OF GIS

The Customer Service Division is not currently a consumer of GIS but has identified several potential opportunities for the use of the City's GIS. Currently, the Division regularly utilizes Google Earth to determine whether or not a parcel is located in the City or in Alameda County. GIS Staff within the City have worked with Customer Services to identify parcels that were not integrated in the billing software, resulting in the identification of $150,000 in uncollected revenue.

There are generally three tiers of GIS users. A Tier 1 - Flagship GIS user typically conducts GIS administration and coordination at the enterprise level, has access to a fully functioning GIS toolset to create and maintain enterprise data, and manages the enterprise database. A Tier 2 - Analytical GIS user focuses on data analysis, complex querying and data modeling, along with department level data maintenance. A Tier 3 - Browser GIS user requires only general browsing GIS data functions to create reports, query standard data sets, create tasks like mailing labels, and produce maps.

The table below summarizes the current GIS staffing and or GIS usage in the Customer Service Division. Type represents the current level of GIS experience based on job requirements and GIS usage can be categorized as Limited, Moderate, or High (i.e. frequency of use), and Primary Tools describes what tools, or how GIS is used, to carry out GIS functions.

Current GIS Staffing				
Type		Number of Users	GIS Usage	Primary Tools
	GIS Flagship (Tier 1)	0	N/A	None
	GIS Analytical (Tier 2)	0	N/A	None
	GIS Browser (Tier 3)	7	N/A	Google Earth

HARDWARE AND SOFTWARE

The Customer Service Division has personal computers for each of its employees. The table below summarizes the hardware in use for the Customer Service Division:

Hardware Issues Summary	
Type	**Notes**
Personal Computers	One for each staff person
Laptops	Available as needed
Printers	Ample printers available for use
Plotters	None
GPS	None
MDTs	None
Scanners	None

The Customer Service Division utilizes the following software applications that are pertinent to this study:

1. Microsoft Office– Office productivity
2. Google Earth – property locating

2
GIS NEEDS ASSESSMENT

GIS NEEDS

The Customer Service Division should have expanded access to GIS and its complementary technologies. The department recognizes the potential benefits of using GIS including integration with other databases, finding missing tax payments, mapping Capital Improvement Projects, and tracking home occupancy. The table below summarizes the potential needs identified by Customer Service Division staff and how they are to be met:

GIS Need	*Method/Application to Meet Need*
Mapping and Spatial Analysis of Finance/CIS Data	Intranet GIS Data Browser
Enabling Existing Databases – Data Integration	Data Mining Application
GIS as an Auditing Tool	Intranet GIS Data Browser
Finding Missing Revenue	Intranet GIS Data Browser
GIS Education for Department Staff	Intranet GIS Data Browser Training

GIS NEED

Mapping and Spatial Analysis of Finance/CIS Data

A key need identified by Custom Service Division staff is increased and improved access to shared GIS data within the City. This includes the most recent parcel, address, and street centerline data as well as high-resolution orthophotography. Using the most recent, accurate GIS layers provides staff members with an invaluable tool for everyday tasks.

Collaboration with several departments/divisions will be instrumental in establishing GIS as a complementary technology used to meet the Customer Service Division's objectives. Initial efforts should be aimed at increasing GIS awareness within the Customer Service Division, allowing staff to become familiar with the efficiencies that can be gained through the use of GIS for mapping, analyzing, and tracking information.

Quick View of Fixed Assets

The Customer Service Division should work with the GIS Staff and train division personnel in the use of GIS to gain quick successes based on mapping and analysis of growth trends, development forecasting, utility customers, utility billing, and usage. Most Customer Service Division staff should utilize an ArcGIS Online Intranet GIS data browser to conduct basic spatial analysis and to produce maps and to assist in day-to-day activities.

It is recommended that the intranet browser have a specific link for the Customer Service Division focused primarily on CIS and Billing. This application will integrate data from the previously-described data development initiatives, like utility customers, usage, assessment districts, and layers displaying sales tax and property tax information. Other key uses include:

- Fixed assets
- Transportation information
- Identify key businesses (massage parlors)
- Finding missing tax payments
- Matching business licenses to businesses to identify outliers
- Sanitary utility queries and calculations
- Track cost and depreciation
- Audit assets
- Identify home occupancy

GIS NEED

Enabling Existing Databases – Data Integration

The City stores various data that are of interest to Finance in the Accela (business licenses), SunGard (billing, receipts, accounting, land management, etc.) and eTIMS (parking permits and citations) enterprise databases. It would be very beneficial if this data could be geo-enabled and displayed in GIS for mapping and analysis purposes. This can be accompmlished with a data mining application.

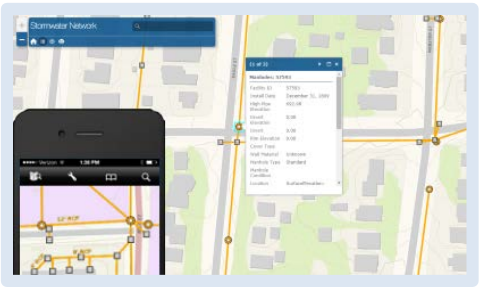
A data mining application is an automated geocoding service that creates GIS data layers from non-spatial relational databases. The results of a successful geocoding effort will be stored in an industry standard relational database management system (SQL Server). The automated process is based completely on standard database statements and is customized to utilize a variety of stored location-based data (Parcel PIN, Address, Location-ID, etc.). A second function of the automated service is to generate GIS layers in an industry standard portable format (SDE layers) that could be utilized by a variety of applications. These GIS layers will be created to user specifications. X, Y coordinates will be utilized to display features in a GIS layer. The data would then be consumable within an intranet browser, web applications, mobile apps or more analytical tools such as ArcGIS.

GIS NEED

GIS as an Auditing Tool

For many Financial Services Departments, auditing is a key issue for GIS-based analyses. Using the parcel data, GIS can be utilized to determine parcel-specific information. Examples include determining which parcels are tax-exempt, businesses with licensures, and performing audits on unimproved properties.

In order to make these audits viable, several new data layers (including fixed assets) will need to be created by extracting information from several databases, including the permitting database. The GIS Team can assist in data creation and complex spatial analyses; mapping and identification of utility service within parcels can be conducted by Finance personnel through use of an Intranet GIS application.



GIS NEED

Finding Missing Revenue

Finding missing sources of revenue is a common way for local governments to show a return on investment using GIS. Business licenses, permits, and various taxes are sources of revenue that could be analyzed to identify organizations or individuals that are not current on their financial obligations to Simi Valley. GIS can be used to pull revenue data from various sources (e.g. Excel spreadsheets, etc.) and map this data against parcel data, land use data, and other GIS layers to analyze and determine the data outliers. This information can then be used by the City to focus revenue collection efforts on the identified non-paying entities. This typically leads to a tangible return on investment that can be measured in real dollars as the City's revenue collections are increased. An intranet GIS data browser can be developed that will contain all relevant data for this process and provide various query tools for identifying the non-paying entities and for developing reports and maps of queried data.

GIS NEED

GIS Training for Department Staff

It is important that Finance staff understand the basic uses of GIS and can use the intranet browser for various needs. Therefore, Finance staff should attend educational seminars offered by the City that deal with general topics like, "What is GIS". This will help them gain a basic understanding of GIS concepts. In addition, training on the use of the intranet browser and/or any Customer Service Division specific intranet browser that is developed, is also recommended.

3

GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY

Finance staff are not responsible for the maintenance of GIS data layers but do require access to existing GIS data. It is expected that once all departmental data is integrated, consolidated, and centrally stored, that staff will have access to all non-classified GIS data layers from other departments.

Legend

Data Layer	The data layer is the GIS thematic data that is being described. The name of the layer or description of the layer is placed in this column.
Creation Methodology	This column describes how the layer was or is anticipated being created.
Recommended Update Division or Individual	This field outlines the division or individual that is anticipated to maintain or develop the data layer during and after full implementation of the Citywide enterprise GIS. Development of new recommended layers will be prioritized for each year of the Strategic Implementation Plan.
Layer Status	Layer state of existence.
Existing	These layers currently exist within the City's GIS.
Recommended/ Desired	These layers are recommended for development or procurement, based on departmental and enterprise needs. These data layers will help support existing business procedures or will compliment other GIS data sets that are already existing and in use by the city. Costs associated for these recommended layers will be based on general estimates – actual cost may vary.
Partial	These layers currently exist in an incomplete or outdated state.

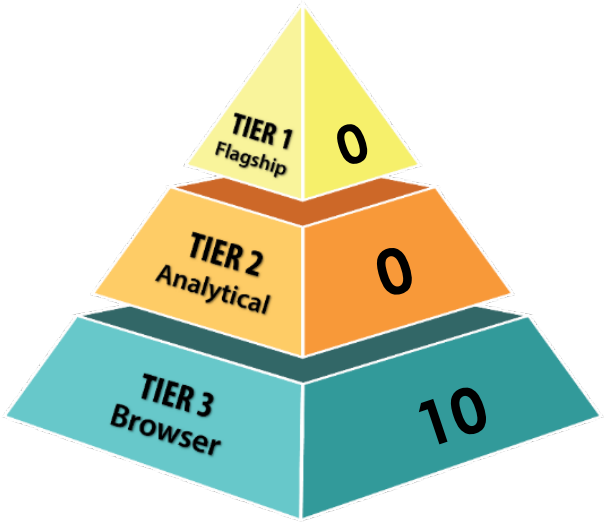
The following table lists those data layers that are important to Finance.

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Finance GIS Data			
Building Licenses	Accela Integration	Automated	Recommended
Business Improvement Districts	Digitized from source documents	The GIS Team	Recommended
Business Licenses	Accela Integration	Automated	Recommended
Capital Improvement Projects	Digitized from Plan Documents	The GIS Team	Recommended
Home Occupancy	Extracted from database	Automated	Recommended
Land Management	SunGard Integration	Automated	Recommended
Parking Permits & Citations	eTIMS Integration	Automated	Recommended
Short Term Dwelling Units	Extracted from database	Automated	Recommended
Stormwater Utilities	Digitized from as-builts / GPS	Public Works	Existing
Tax Payment Data	SunGard Integration	Automated	Recommended
Underground Utility Assessment Districts	Digitized from source documents	The GIS Team	Recommended
Various Taxes	SunGard Integration	Automated	Recommended
Citywide Base Data			
Property	Original tax parcels were digitized and rubber sheeted from scanned hard copy water quality maps circa 1999. Updated manually once a year by the GIS Team using County data for attributes and the County's Adobe PDF parcel maps for geometry changes. Migrated to the LGIM Tax Parcel schema in 2016.	The GIS Team	Existing
Aerial Photography	Current aerial data is delivered by Pictometry through an agreement with Alameda County. The most current data was captured in 2014 with the next flyover scheduled for Spring 2017. The County's current contract with Pictometry calls for one more flyover after the 2017 capture. Older imagery exists for 2006 (custom County flyover), 2009, and 2011 (USGS).	Static Map	Existing
Road Centerlines	Created by RMSI in 2010 from various sources including Alameda County data and pavement management system data (street width). Updated manually by the GIS Team occasionally. Migrated to the LGIM Road Centerline schema in 2016. Zero Waste has a copy that has been updated for routing purposes.	The GIS Team	Existing
Address Points	During the work day, an Analyst in the Customer Service Division updates/creates new addresses in the Land Management (LX) module in SunGard (FUND$). Address points are then created nightly from an ETL that extracts and geocodes (using parcel centroid coordinates) and joining to a parcel table to create the address points feature class.	Automated / Customer Service Division	Existing

4

MULTI-TIER GIS APPLICATION USE

The pyramid and table below outlines the anticipated "Tiers of GIS Use" within the Customer Service Division. All are color coded by the level of desired GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions.



TIERS OF GIS USERS	
GROUP	ACTIVITY
Tier 1 Flagship	• GIS Administration • Data Maintenance • Data Conversion and Creation • Spatial Data Management • Technical Support • Coordination
Tier 2 Analytical	• Data Maintenance • Analytical Functions/Geoprocessing • Complex Queries • Modeling • Use of Desktop Extensions • High Quality Map Production
Tier 3 Browser	• Browsing/Look-Up • Standard Reports • Simple Query • Map Production

5

RETURN ON INVESTMENT (ROI)

The following table indicates specific Return on Investment opportunities for the Customer Service Division. These specific examples show the true return on investment of the technology.

Return on Investment Opportunity Customer Service Division	
Opportunity	**Explanation**
Save Time and Respond More Quickly to Internal Data Requests	*Staff access to accurate/updated data* • Staff should have access to current GIS data to better serve and provide information to the public and decision makers. This should save multiple staff hours a week in the Customer Service Division.
Improve Data Accuracy	*Better GIS Data and Spatial Analysis:* • Working with other departments and City agencies to update data with higher accuracy can improve the results when analyses are performed. By sending errors found in data to the data owners, errors can be corrected quickly.
Increase Revenue	*Identify Missing Revenue:* • Mapping building permits and other financial obligations of residents may yield information on revenue not being collected.

NEEDS ASSESSMENT

FIRE DEPARTMENT

CITY OF BERKELEY

CALIFORNIA

GIS Strategic Implementation Plan

SECTION OUTLINE

1

EXISTING CONDITIONS

DEPARTMENT OVERVIEW

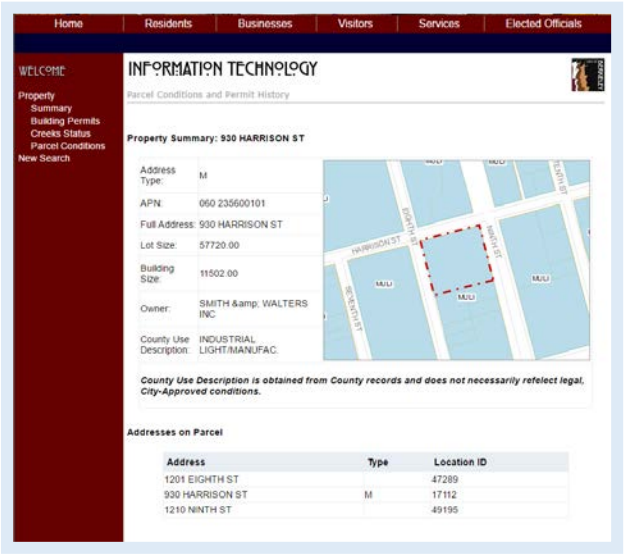
The Berkeley Fire Department consists of seven stations staffed by approximately 140 full-time personnel. The department has segmented the City into multiple fire zones for response and reporting. The department has a mix of paramedics, emergency medical technicians, and first responders serving the community members of the City. The Berkeley Fire Department provides 24 hour response to include fire suppression, medical emergencies,

hazardous materials events, and other life threatening situations. The Department also supports these efforts with a fire prevention, disaster preparedness, and public education programs, as well as on-going training for all Department staff. The department provides the Berkeley community with professional firefighting, community rescue services, and pre-hospital emergency medical care. Additionally, staff responds to hazardous materials incidents, urban search and rescue incidents, and general public assists. The Department has the following divisions/functions:

- Office of the Fire Chief - directs four division managers and provides overall direction and policy for the delivery of emergency and support services.
- Administrative and Fiscal Services - directs the department budget and fiscal policy, administrative systems and procedures, employee training and development.
- Fire Prevention - plans, organizes and implements all Fire Department prevention and inspection programs, including fire and arson investigations, vegetation management, hazard abatement, code enforcement, public fire safety education, plan checking, and evaluation and development of codes and ordinances.
- Fire Operations - provide emergency services in fire suppression, emergency medical and rescue response, emergency service response, hazardous materials response, fire alarm response, and all other emergency calls.
- Training and Safety - provides the required training necessary to comply with local, county, state, and federal mandates.
- Office of Emergency Services - guides City policy and implements disaster preparedness and response programs, outreach and education, and regional collaboration planning.
- Emergency Medical Services - provides Advanced Life Support and staff paramedic transport ambulance units.

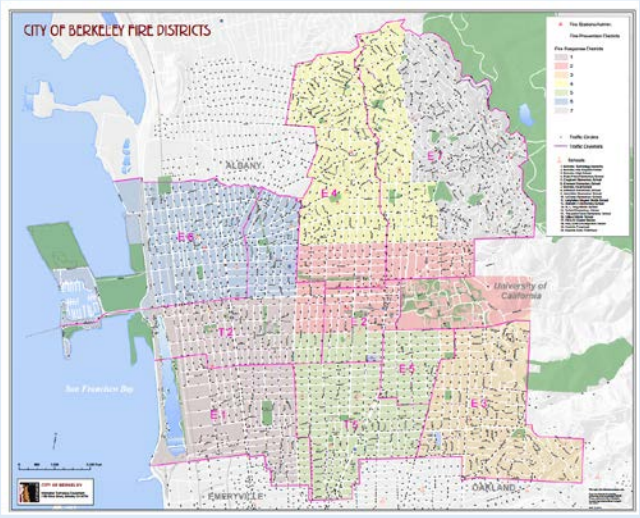
GOVERNANCE OF GIS

The Fire Department is one of the more advanced departments in the nation, having recently achieved an elite ISO rating of one. GIS services are provided by the GIS Team in IT. The GIS team has been responsible for assisting the department with a number of projects and providing data used within the New World Systems (NWS) dispatch, records, and mobile public safety systems. Staff in the Fire Department use an application provided by GIS for viewing properties and related information.



Parcel Conditions Viewer Application

Additionally, GIS is used in the EOC in the event of an emergency. GIS staff in IT support the mapping needs of the department. Alpine RedAlert is used as the record management system and mobile mapping is provided to each apparatus through NWS partner Data911. However, the mobile mapping is not used. In the past, GIS was used for the creation of call density maps but this has not been done recently. Staff use street maps to train new employees on the road system. Tom Tom GPS units are used for navigation. A fire-hydrant GIS layer is received from the local water utility.



Fire District Map

The table on the next page summarizes the current GIS staff usage within the Fire Department. Type represents the current level of GIS experience based on job requirements, GIS usage can be categorized as Limited, Moderate, or High (i.e. frequency of use), and Primary Tools describes what tools, or how GIS is used, to carry out GIS functions.

Current GIS Staffing				
Type		Number of Users	GIS Usage	Primary Tools
	GIS Flagship (Tier 1)	0	NA	NA
	GIS Analytical (Tier 2)	0	NA	NA
	GIS Browser (Tier 3)	20	Limited	Parcel Viewing Application

HARDWARE AND SOFTWARE

All staff within the Fire Department has access to a personal computer, some of which are shared. Each station has a personal computer. Mobile Data Computers (MDCs) are used on each apparatus. The MDCs use software from New World Systems for viewing active incidents. Automated Vehicle Location (AVL) technology is utilized to locate and track vehicles. Printers are available for office use.

Hardware Issues Summary	
Type	Notes
Personal Computers	Available to all staff
Laptops	A few available for management
Printers	Ample printers available for use
Plotters	None
GPS/AVL	AVL on vehicles
Tablets/PDA/MDTs	MDTs on each vehicle
Scanners	Available as needed

The Fire Department uses Alpine RedAlert for records management. Microsoft Office is used to conduct office productivity tasks. A host of other software applications are used and pertinent applications are as follows:

1. Microsoft Office– Used for office productivity
2. Alpine RedAlert – Records Management System and Inspections
3. New World Systems - Dispatch and Mobile
4. Data 911 – Mobile mapping (not used)
5. Parcel Conditions Viewer (Parcel Popper) – Property information
6. CodeRed – Reverse 911

2

GIS NEEDS ASSESSMENT

GIS NEEDS

Fire Departments throughout the United States have a common need to visualize key geographic features such as; aerial photography, addresses, streets, water systems, hazardous materials, building pre-plans, and a host of other data. Additionally, departments have the need to analyze all of their calls for service and incidents and emergency management. Fire Departments are always an integral part of any emergency response team. GIS is critical for pre and post-disaster planning, response, and recovery. In addition, Fire Departments use GIS for strategic objectives, using sophisticated analyses to improve decision-making, as well as potentially reducing response times. Because of the vast improvement in GIS technology, GIS can now be used as easily in the field as in the office opening up new uses of the technology for fire and EMS response, disaster recovery, and fire inspections.

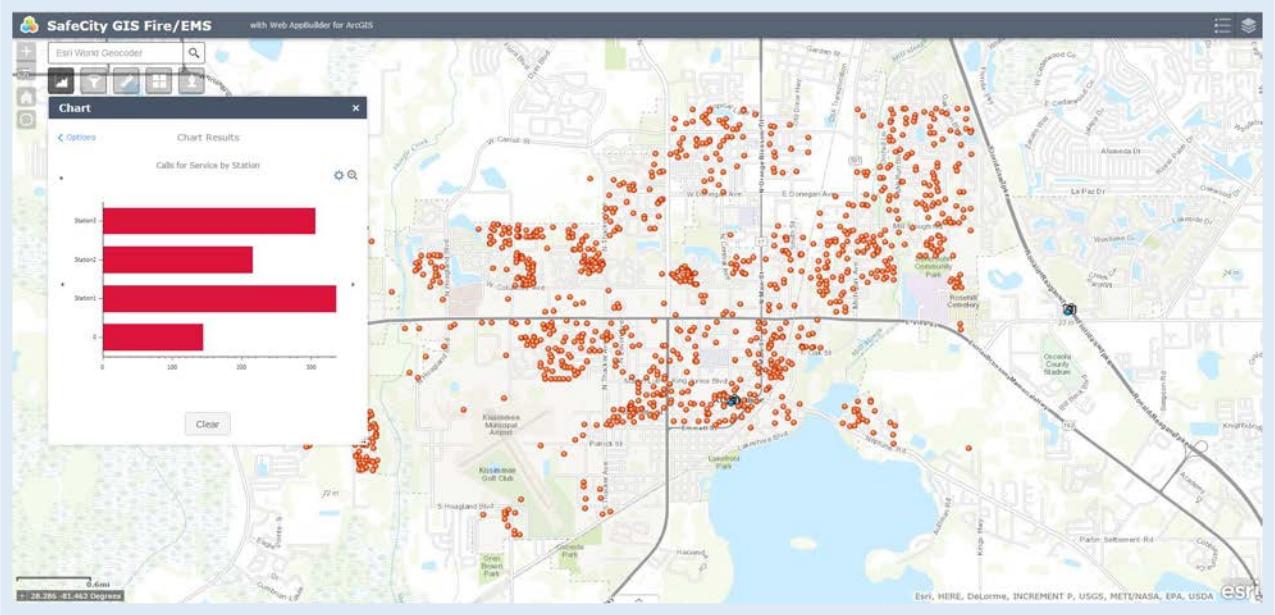
Based on this Needs Assessment, the Fire Department has several identified GIS needs. Where applicable, each need will be followed by an application or method to meet that need, some applications/methods will meet several needs. A method or application is only described under one need, if it applies to multiple needs refer to the previous need for a description. The table below summarizes these needs and how they are to be met:

GIS Need	Method/Application to Meet Need
☑ Mapping and Spatial Analysis of Fire Incidents and Inspections	Intranet GIS Data Browser
☑ Enable Decision Makers Via an Executive Dashboard	Esri Operations Dashboard
☑ Geospatial Data Creation and Integration	Data Mining Middleware
☑ Field Access to Geospatial Data	Mobile GIS Data Browser
☑ Emergency Operations – Disaster Response and Recovery	Disaster Recovery and Damage Assessment Application
☑ Enterprise Access to Digital Pre-plans and Hazardous Material Data	Data Creation and Integration
☑ Public Access to Selected GIS Data	Internet GIS Data Browser

GIS NEED

Mapping and Spatial Analysis of Fire Incidents and Inspections

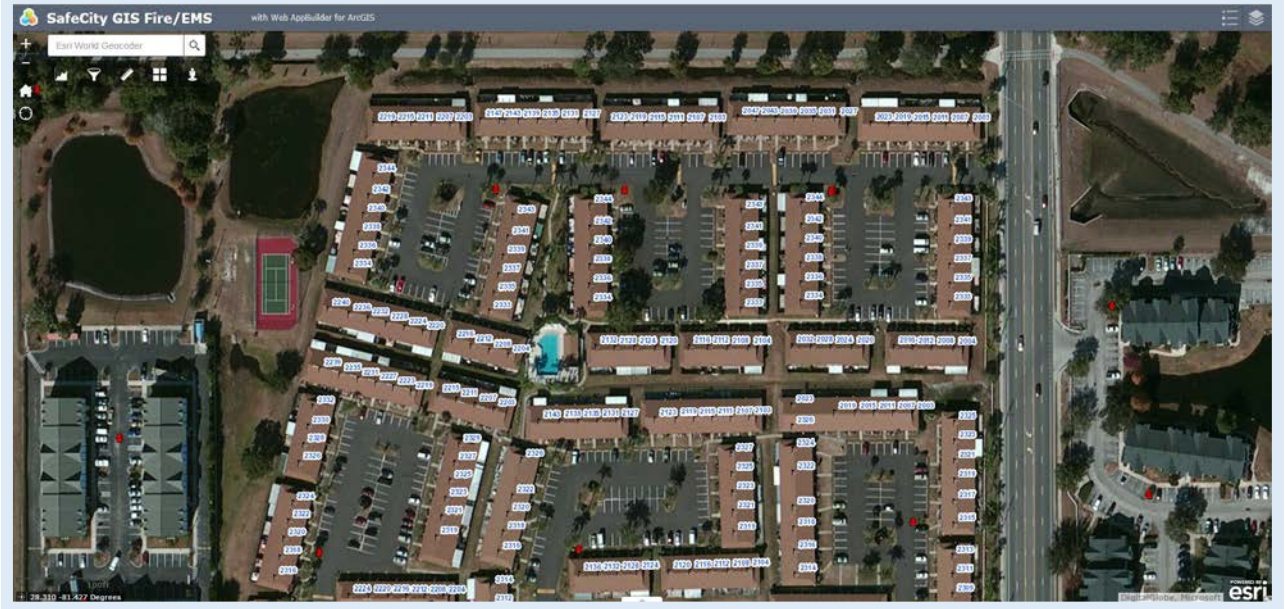
GIS staffin IT have provided GIS products and services for the Fire Department on an as-requested basis. RedAlert RMS is used for tracking key information about each Fire and EMS incident and Fire Inspections. Each record contains an address which makes the data ready for mapping. Every RMS



Fire Department Intranet Browser – Visualizing and Analyzing Fire and EMS Data

record should be mapped and made available to Department staff. As part of the City's investment in GIS technology, a wide variety of GIS viewing tools are available for use. One such tool is the Web AppBuilder. This is a JavaScript/HTML5 application that allows for easy customization and setup. What this means is that it is deployable and usable via any modern browser and as such works on traditional personal computers, laptops, tablets, and smart phones. It is recommended that this type of application is deployed and made available throughout the Fire Department. Additionally, it can be used in the vehicles for mobile viewing. Newer mobile GIS applications allow an employee to use the application in a connected and/or disconnected environment. That means if the device does not have connectivity or has slow connectivity back to the central office the application still functions. All Fire personnel should have access to a GIS intranet browser (ArcGIS Online) to view incidents, critical infrastructure, and other key data. Department staff should use an Intranet GIS Data Browser to conduct basic spatial analysis and to produce maps and to assist in day-to-day activities. An Intranet Browser should serve the entire City, and should have a specific link for the Fire Department. All RedAlert incident data and other key layers such as pre-plans and hazardous materials information will be accessible via this toolset. This application will allow staff to access incident information, as well as do routing and quickly determine areas affected by a spill or fire.

Another opportunity to use this Intranet GIS data browser exists with fire inspections conducted through the City. The Fire Department conducts inspections throughout the year. These inspections (tracked in RedAlert) could be made available to departmental personnel via desktop, tablets, and/or laptop computers, spatially linked to parcel, address, and street centerline data, as well has high-



Fire Department Intranet Browser – Visualizing and Analyzing Inspection Location and Status

resolution ortho-photography. Using the most recent, accurate GIS layers provides staff members with an invaluable tool for everyday tasks. For more advanced analysis and other tasks such as data creation, determining drive times, or finding the optimal location of a new fire station, Fire Department staff should work with the GIS Team in using advanced GIS software applications.

The Fire Department can use GIS to assist in several tasks including:

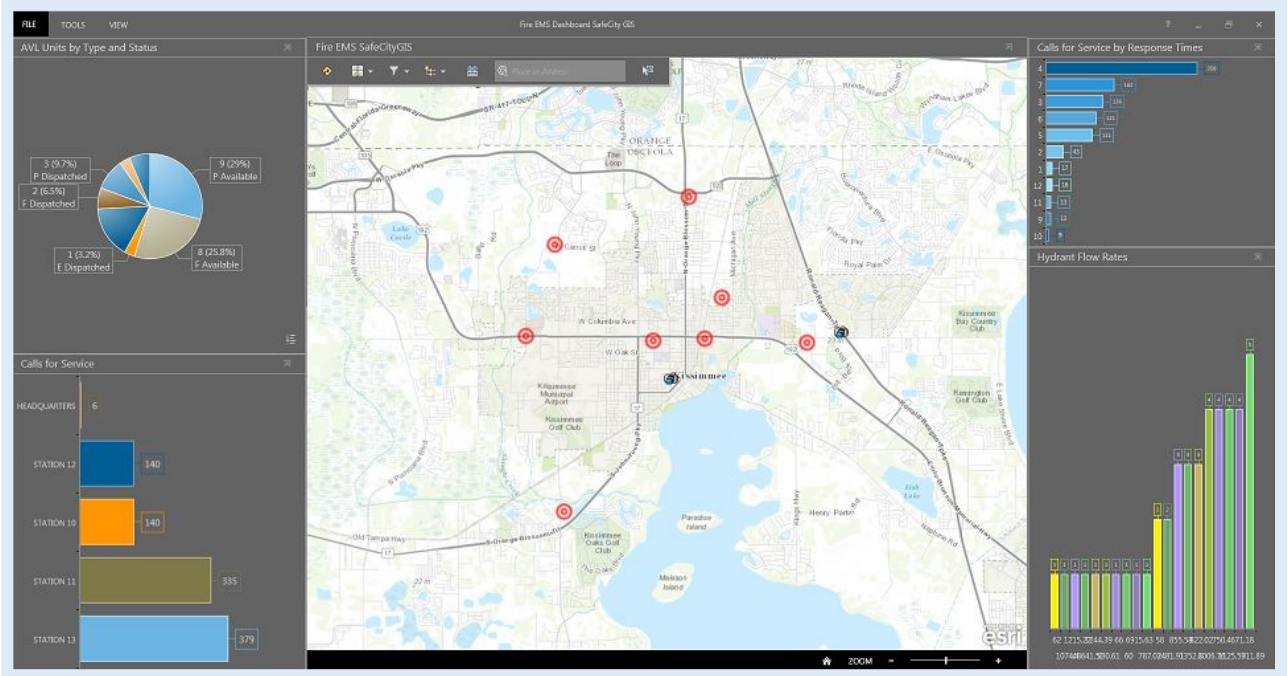
- Density analysis
- Track locations of vacant house fires
- Fire hydrant inspections tracking
- Ability to identify correct address of fires even late at night, and then using GIS to find ownership information and notifying the owner
- Identify resource allocation, i.e. what is in each station
- Accessing owner/occupant information
- Ability to see hydrants (color coded) by water main size/estimated flow rates
- Ability to plot priority inspections
- New station location analysis
- Tracking hazardous materials
- Optimizing and reducing response times
- Disaster response and recovery
- Optimal routing
- Optimal districting
- Resident information
- Incident pin mapping
- Inspections mapping and optimization
- Identify community risks using data such as census, rental properties, past incidents
- Smoke detector locations
- Arson fire mapping
- Drive-time studies
- Viewing alternate street routes
- Statistical analysis for budgetary preparations
- Optimal spill response – downstream and upstream tracing

- Evacuation route planning
- Using maps for training personnel
- Automatic aid and mutual aid maps
- Fire hazard severity zone mapping

GIS NEED

Enable Decision Makers via an Executive Dashboard – Operations Dashboard

Another tool that is now included in the City's Esri GIS investment is the Esri Executive Dashboard application. Organizations use Operations Dashboard to monitor various key metrics. For example, departments are using dashboards to view incidents by type, incidents within the last 30 days, inspections by inspector, incidents by zone, and any variable desired. It is recommended that the Fire Department in conjunction with the GIS Team in IT implement an Executive Dashboard for executive staff. This involves a process of deciding what should be viewed and then mining the data using a backend data mining toolset. The result is a live look at key metrics via user selected widgets and an interactive map.

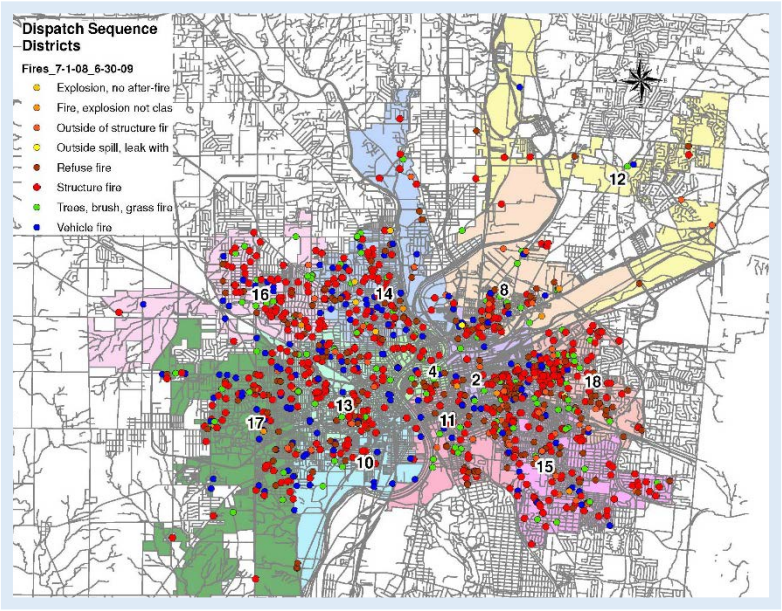


Executive Dashboard for Fire Decision Makers

GIS NEED

Geospatial Data Creation and Integration

As mentioned in the previous section, the fire incident, EMS incident and fire inspections data should be mapped. The Fire Department needs this data address matched and available on a continual basis. Therefore, it should be a priority to implement a process in which an automated process address matches/maps this data daily, hourly, or more frequently. The data in question is stored in electronic databases that have addresses as an attribute, therefore spatially enabling these databases will yield important datasets for Fire staff. These databases with associated addresses can be address-matched to a street centerline layer, tax parcel centroids, or address point layer. Existing databases may need to be formatted to facilitate address-matching functionality. Address-matched features can be visualized within the GIS, and their attributes can be queried. Fire and EMS incidents and inspections with their associated data should be available through the GIS as all times.

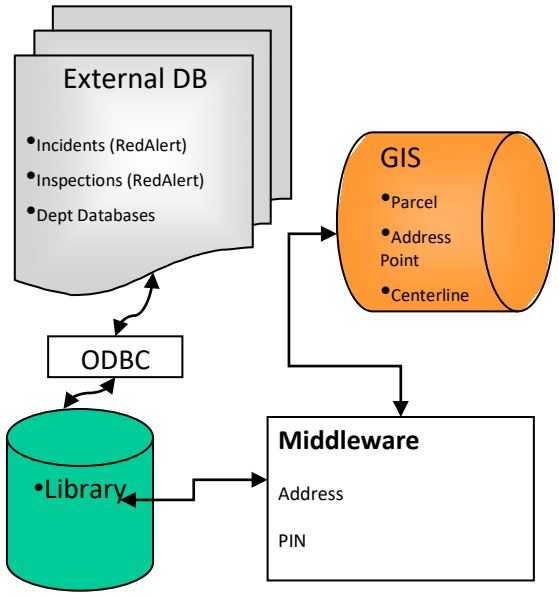


Example – Fire Incidents Geocoded to Address Points

Application to Meet Need

Data Mining Middleware

Fire Department databases with associated addresses can be address-matched to a

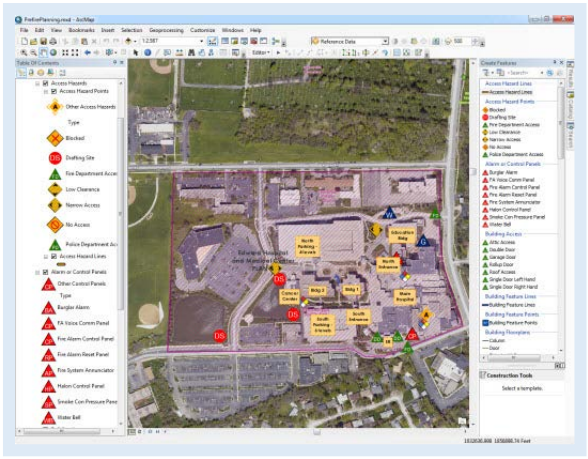


street centerline layer, tax parcel centroids, or address point layer. Existing databases may need to be formatted to facilitate address-matching functionality. Berkeley should use a data mining middleware application as an automated geo-coding service that creates GIS data layers from non-spatial relational databases. The automated process should be based on standard SQL statements and should use a variety of stored location-based data (Parcel PIN, Address, Location-ID, etc.). A second function of the automated service is to generate GIS layers in an industry standard portable format (shapefiles or SDE layers) that could be used by a variety of applications. These GIS layers will be created to user specifications. X, Y coordinates will be used to display features in a GIS layer. The graphic below shows the process of using data mining middleware to extract data.

GIS NEED

Field Access to Geospatial Data

Providing personnel with access to maps and GIS data while working in the field is an important part of maintaining an enterprise GIS. The Fire Department currently utilizes MDCs for mobile computer and has mapping from Data911. However, the mobile mapping tool is seldom used. As an alternative, the intranet mapping application discussed earlier can be used in the field and customized for the field usage. Fire Department staff could work with the GIS Team in IT to customize the tool to present pertinent data and functions. The mobile application could provide tools to perform address searches; query attributes of all information, such as schools, types of hazardous material stored at a location, link to digital building pre-plan drawings, and optimal routing.



Fire Data Available in the Field

GIS NEED

Emergency Operations – Disaster Response and Recovery

Fire Department staff are required to participate and lead the City in disaster response and recovery, as well as be in the field after a disaster; such as after a flood, fire, or a terrorist event. They are required to participate in damage assessments and report this information back to the City for reporting to the state and federal government and for recovery operations. It is recommended that Berkeley implement a disaster recovery tool that will enable staff with tablet computers to quickly assess and report the extent of a disaster. This application will allow users to enter the damage done on a site by site basis. Also, the computers are GPS enabled allowing for the location of each field representative and the path they have already traveled to be easily ascertained.

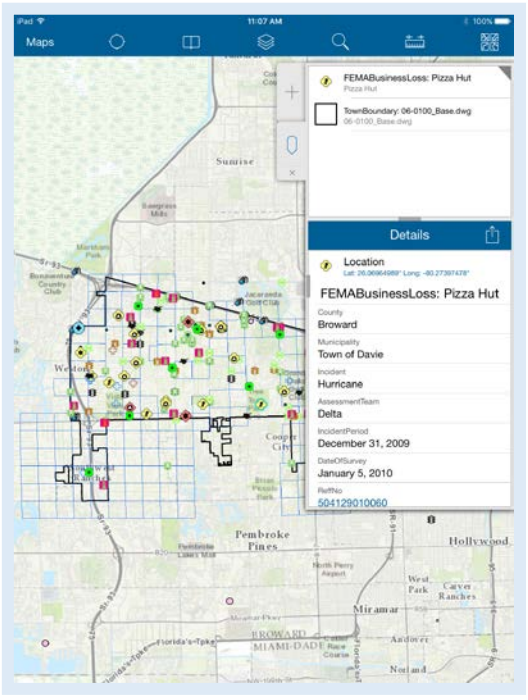
Additionally, staff should have access to a host of information within an EOC or a mobile disaster unit. These applications should allow for the following functionality:

- Hazardous Material Release Plume Analysis
    - Used output from current plume modeling for viewing within a Berkeley based EOC map to determine:
        - How many people are affected?
        - What critical infrastructure is affected?
        - What target properties (schools, nursing homes, etc.) are affected?
    - Ability to integrate the City's reverse dialing software to dial people within the plume
- Evacuation Planning
    - The goal would be to design an effective evacuation plan for a given incident or to change an existing evacuation due to dynamic conditions.
        - Determine street capacities to manage expected evacuation capacity – i.e. if the need to evacuate 15,000 people in 2 hours and the streets in area flow x vehicles per hour, how many streets do we need to designate as evacuation routes
        - Identify stop lights and other traffic control devices that will need to be controlled to assist with evacuation

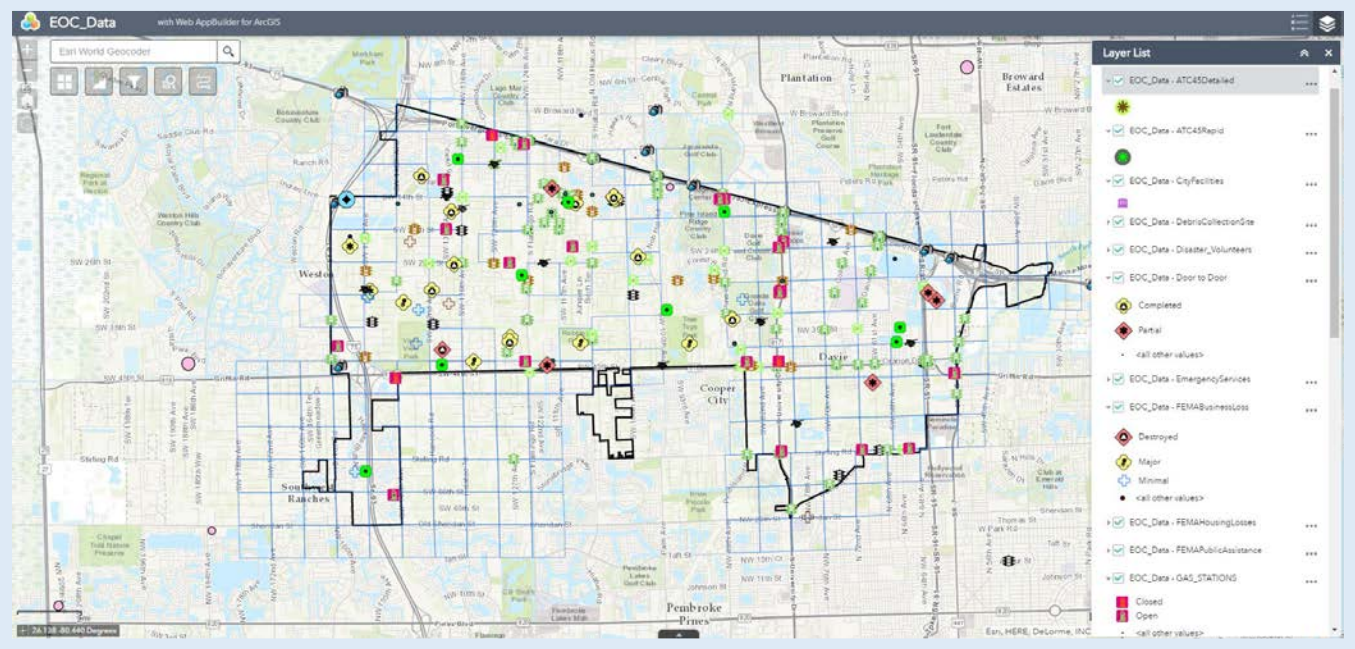
- Damage Assessment and Live EOC
    - Use mapping capabilities to view data from various sources
        - Internal Berkeley GIS data
        - Utility outage areas
        - Weather Service data
        - Public Health outbreaks and disease surveillance data
        - Where disaster recovery personnel are in the field
        - What damage has occurred where
        - Field collection tools to identify damage

Emergency Operations and Damage Assessment Applications

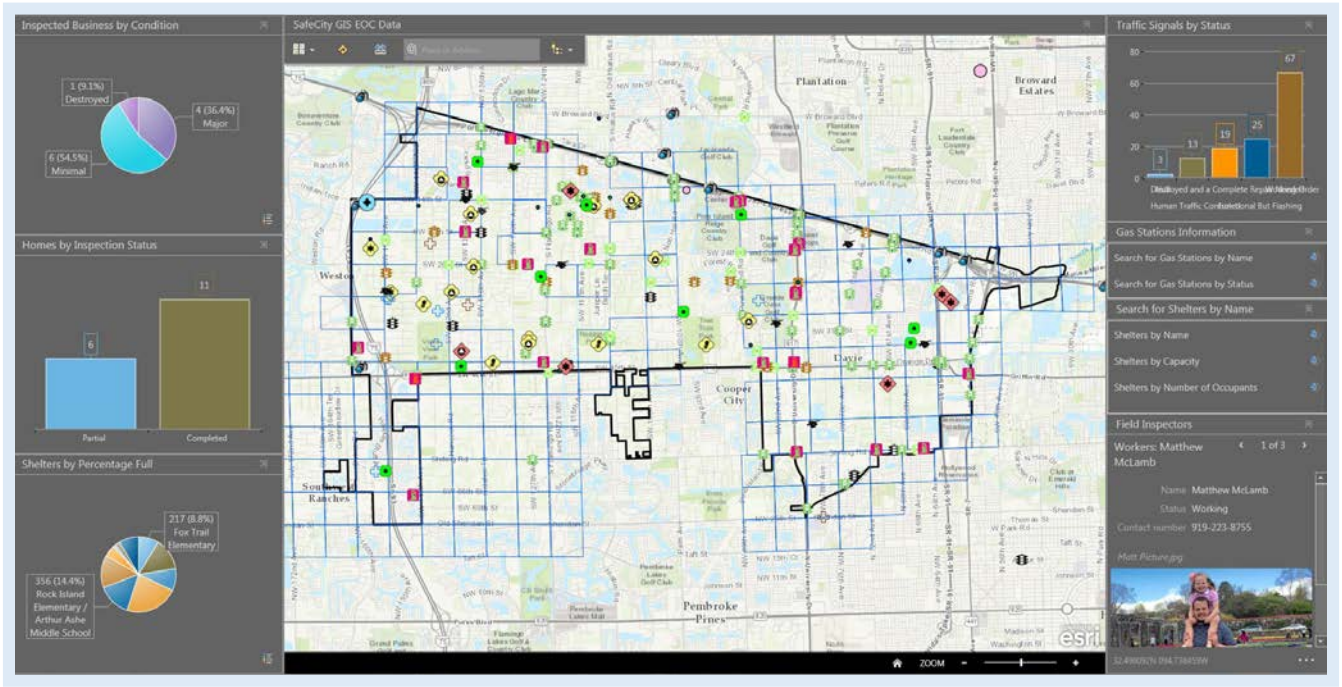
As discussed previously, the City owns a suite of GIS products. These products should be used Emergency Operations. An ArcGIS Online application should be available to show all of the data listed above. A mobile application (ESRI Collector Application) should allow users to rapidly and confidently enter field notes on a mobile form and then transmit the data back to a central location using a wireless connection. GPS enabled tablets are essential for the routing and tracking of staff during an event. This application should be tested annually to ensure that each of the components is in an operational state. Additionally, the intranet discussed earlier can be configured as a common operational picture (COP) application for an EOC event. This application would allow staff to view the status of the data being collected with the Collector application in a live environment and all of the other pertinent GIS layers to include externally shared data from other state and local agencies. Additionally, the Operation Dashboard can be configured to display critical disaster management metrics.



Mobile Application for Damage Assessment



Common Operational Picture (COP) GIS Application for EOC



Operations Dashboard Showing Critical Post Disaster Metrics in a Live Environment

GIS NEED

Enterprise Access to Digital Pre-plans, Hazardous Material Data and Other Supporting Data Sets

The Fire Department is responsible for creating pre-plans. A pre-plan shows the layout of critical facilities like industries, schools, hospitals, and government buildings. Exits, fire suppression devices, and other key features are noted on these pre-plans. Linking plans to GIS can add additional information and analysis capabilities. Pre-plans of critical facilities should be linked to a GIS Intranet application, the 911 mapping application, and a mobile data browser application. An icon will show up in the application if a pre-plan is available for a structure. Additionally, hazardous material information is being maintained by the Health Department. This data should be geo-enabled and linked to the GIS by address.

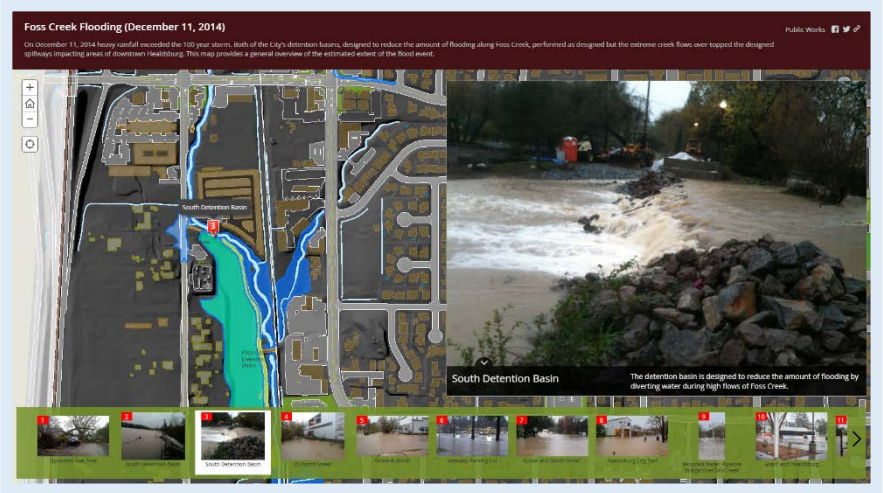
The modern mapping applications allow for integration with data from a wide variety of sources. This includes live traffic data, live camera feeds, and data from multiple sources. The Police Department should continue to review what data layers are available through an ongoing education effort. This will be one of the focus areas for the enterprise-wide GIS effort.

GIS Accessing Pre-Plans and Hazardous Materials Information

GIS NEED

Public Access to Selected GIS Data

It would be beneficial to push department data to the community via a web portal. Information such as station locations, closest hydrant to a property, fire incidents by location, and fire reports should be considered. It is recommended that the City use an ArcGIS Online based suite of targeted web applications and ESRI Story Maps to provide GIS data and services to the community. A portal should be considered to include pertinent information about fire, inspections and EOC activities and services. A public portal could include emergency information such as:

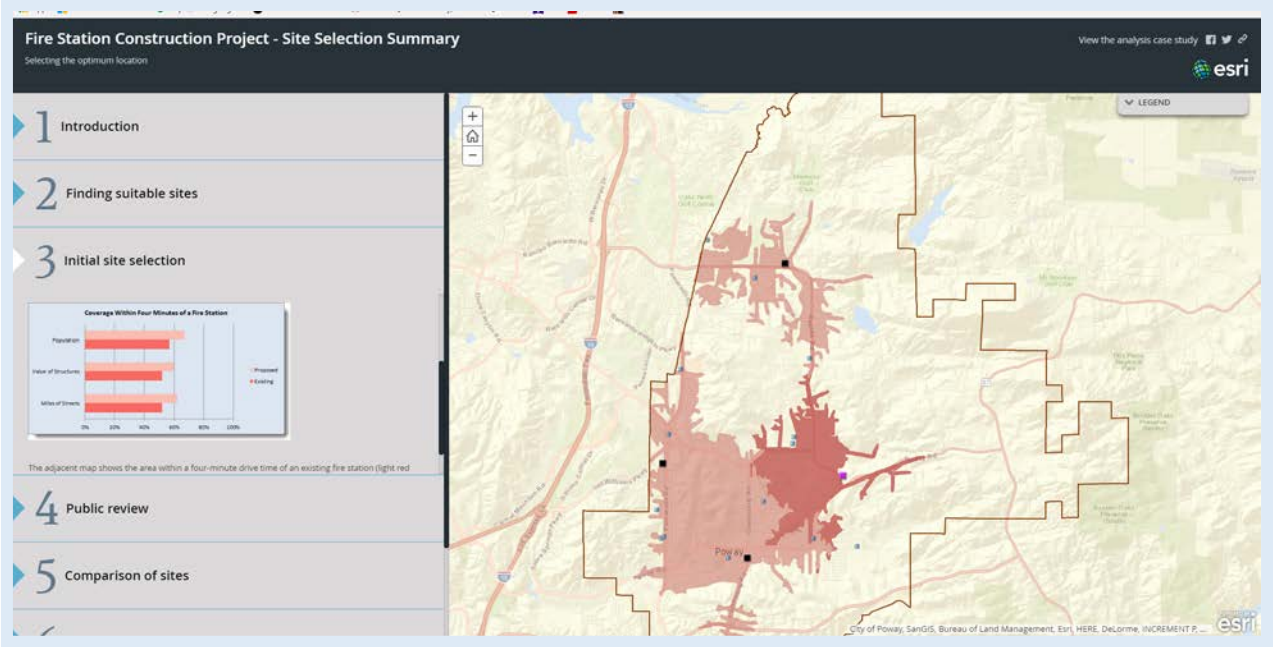


Use of a Story Map for Showing the Extent of a Natural Disaster

- Shelter locations
- Fire and police stations
- Road closures
- Damaged Areas
- Evacuation Routes
- Power outages

Additionally, the Fire Department can use StoryMaps to tell let the public know about a variety of topics:

- Location of educational opportunities
- New station construction
- An overview of each station, response area, and fire fighters
- Various duties of the department with associated incident maps



Story Map Telling a Fire Department Site Selection Story

3

GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY

The following are key data layers for the Fire Department. These data elements should be used as the baseline GIS data when developing an enterprise geodatabase. Inclusion of these datasets in the geodatabase will allow for the Fire Department to take advantage of the feature dataset capabilities, database topologies, table domains and viewing, and editing security features that are part an enterprise geodatabase. Many of the existing GIS data layers may be combined and organized into feature classes providing easy access to thematic data layers such as points, polygons, annotation, and topology.

Legend

Data Layer	The data layer is the GIS thematic data that is being described. The name of the layer or description of the layer is placed in this column.
Creation Methodology	This column describes how the layer was or is anticipated being created.
Recommended Update Division or Individual	This field outlines the division or individual that is anticipated to maintain or develop the data layer during and after full implementation of the citywide enterprise GIS. Development of new recommended layers will be prioritized for each year of the Strategic Implementation Plan.
Layer Status	Layer state of existence.

Existing	These layers currently exist within the City's GIS.
Recommended/ Desired	These layers are recommended for development or procurement, based on departmental and enterprise needs. These data layers will help support existing business procedures or will compliment other GIS data sets that are already existing and in use by the City. Costs associated for these recommended layers will be based on general estimates – actual cost may vary.
Partial	These layers currently exist in an incomplete or outdated state.

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Fire Department Data			
Accessory Dwelling Units	Extract from Planning Database	Automated extraction and Address Matching	Recommended
Arsons Locations	Extract from Fire and PD RMS Data	Automated extraction from RMS	Recommended
BART Access Points and Other BART Data	Various	Obtained from BART	Recommended
Community Emergency Response Team (CERT) Members	Address Match	Fire in conjunction with central GIS group	Recommended
Contaminated Sites	Geocode and link to existing database	Planning Toxics Management Division	Recommended
Day Care Facilities	Generate from Parcel Layer	Central GIS Group	Recommended
Emergency Cache Locations	Address Match	Fire in conjunction with central GIS group	Recommended
Evacuation Routes	Extract from Street Centerline Layer	Fire in conjunction with central GIS group	Recommended
EMS Incidents	Extract from RedAlert Fire Data	Automated extraction from RMS	Recommended
Fire Incidents	Extract from RedAlert Fire Data	Automated extraction from RMS	Recommended
Fire Hydrant Buffers	Create from Fire Hydrant Layer	Fire in conjunction with central GIS group	Recommended

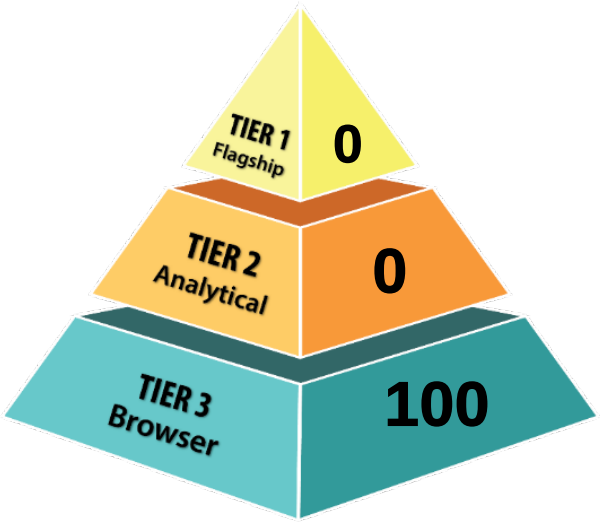
Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Fire Hydrants	GPS field collection	GIS Team in IT from local Water Company	Existing
Fire Inspections	Extract from RedAlert	Automated extraction from RMS	Recommended
Fire Station Locations	Geocoded and ortho-rectified	Fire in conjunction with central GIS group	Existing
Fire Zones and Quadrants	Digitizes On Screen	Fire in conjunction with central GIS group	Existing
Flood Zones	FEMA	Central GIS group	Existing
Gated Communities	Address Matched	Automated from Existing Database	Recommended
Knox Boxes	Address Matched	Automated from Existing Database	Recommended
Hazardous Materials Locations	Geocode and link to existing database	Planning Toxics Management Division Permits need to be Address Matched	Partial
Pre-Plan Data	Link Digital and Scanned Drawings	Fire in conjunction with central GIS group	Partial
Sprinklers, Alarms, Solar Panels	Extracted from Pre-Plans	Fire in conjunction with central GIS group	Recommended
Restaurants	Create from Inspection Records	Fire in conjunction with central GIS group	Recommended
Public Schools	Geocoded and ortho-rectified	Central GIS Group	Recommended
Special Needs Residents	Address Matched	From Meals on Wheels Team	Recommended
Utilities – PG&E	Various	Central GIS Group	Partial – Have Gas Need Electric
Citywide Base Data			
Property	Original tax parcels were digitized and rubber sheeted from scanned hard copy water quality maps circa 1999. Updated manually once a year by the GIS Team using County data for attributes and the County's Adobe PDF parcel maps for geometry changes. Migrated to the LGIM Tax Parcel schema in 2016.	The GIS Team	Existing

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Aerial Photography	Current aerial data is delivered by Pictometry through an agreement with Alameda County. The most current data was captured in 2014 with the next flyover scheduled for Spring 2017. The County's current contract with Pictometry calls for one more flyover after the 2017 capture. Older imagery exists for 2006 (custom County flyover), 2009, and 2011 (USGS).	Static Map	Existing
Road Centerlines	Created by RMSI in 2010 from various sources including Alameda County data and pavement management system data (street width). Updated manually by the GIS Team occasionally. Migrated to the LGIM Road Centerline schema in 2016. Zero Waste has a copy that has been updated for routing purposes.	The GIS Team	Existing
Address Points	During the work day, an Analyst in the Finance Department updates/creates new addresses in the Land Management (LX) module in SunGard (FUND$). Address points are then created nightly from an ETL that extracts and geocodes (using parcel centroid coordinates) and joining to a parcel table to create the address points feature class.	Automated / Finance Department	Existing

4

MULTI-TIER GIS APPLICATION USE

The pyramid and table below outlines the anticipated "Tiers of GIS Use" within the Fire Department. All are color coded by the level of desired GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions. Fire will consist of Tier 3 Users.



TIERS OF GIS USERS	
GROUP	ACTIVITY
Tier 1 Flagship	• GIS Administration • Data Maintenance • Data Conversion and Creation • Spatial Data Management • Technical Support • Coordination
Tier 2 Analytical	• Data Maintenance • Analytical Functions/Geoprocessing • Complex Queries • Modeling • Use of Desktop Extensions • High Quality Map Production
Tier 3 Browser	• Browsing/Look-Up • Standard Reports • Simple Query • Map Production

5

RETURN ON INVESTMENT (ROI)

The following table indicates specific Return on Investment opportunities for the Fire Department:

Return on Investment Opportunity Fire Department	
Opportunity	**Explanation**
Increase <u>Productivity</u>	***Intranet GIS Data Browser and Spatial Analysis:*** • Locate areas of high fire danger to concentrate fire prevention efforts in those areas of the city • Respond to emergencies and disasters in an optimal manner allow staff to be more productive
Save <u>Money</u>	***Intranet GIS Data Browser and Spatial Analysis:*** • Prevention of fires would lead to savings in insurance cost • After identifying areas of high fire dangers, concentrated efforts would make more efficient uses of limited resources • Maintaining Berkeley's low ISO rating will keep fire insurance premiums low • Quickly provide disaster data to FEMA allowing the City to fairly receive disaster funding
Improved <u>Efficiency</u>	***Intranet GIS Data Browser and Spatial Analysis:*** • Plan for new fire stations • Optimize fire inspections • Locate Fire Demand Zones ***Routing Software:*** • Find direct routes to calls for service

<u>Save</u> Lives	***Mobile GIS Data Browser and AVL:*** • Provides location of personnel and equipment at all times during a fire incident and disaster ***Better 911 mapping, Mobile GIS Data Browser and AVL:*** • Staff will be able to arrive at an incident more quickly thus potentially saving lives. ***Digital Availability of Pre-plans:*** • In the event of an emergency incident, proper staff will be able to immediately pull up vital data like exit points, fire extinguishers, and digital building schematics, which can prevent life threatening isolation and endangerment of personnel. ***Optimal placement of fire stations:*** • Using GIS technology to locate or re-locate fire stations decreases response times to fire incidents by placing stations in a more distributed fashion, as they relate to calls for service ***Hazardous materials location layer:*** • Having known locations of hazardous materials provides valuable information to personnel during a fire incident ***Pre and Post Disaster Response:*** • Enable staff to view and analyze critical disaster data potentially saving lives in a post disaster response and recovery

NEEDS ASSESSMENT

HEALTH, HOUSING AND COMMUNITY SERVICES (HHCS)

CITY OF BERKELEY
CALIFORNIA
GIS Strategic Implementation Plan

SECTION OUTLINE

1

EXISTING CONDITIONS

DEPARTMENT OVERVIEW

The following outlines the divisions within the Department of Health, Housing and Community Services (HHCS). Also listed below is the approximate number of staff within each division.

- Administration – 15
- Environmental Health Services – 15
- Mental Health Services – 50
- Public Health Services – 50
- Housing and Community Services – 20
- Aging Services – 20

Office of the Director and Administration

This office provides overall leadership, policy development, and management for the department; manages the Department's fiscal activities including budgeting, accounting, payroll, purchasing and billings to external funders; contract and personnel administration.

Environmental Health Services

This division provides disease prevention and control services with an emphasis on education and enforcement by conducting environmental health inspections at regulated facilities, abating public nuisances, and working with various partners to protect and improve the health and well-being of the community. Staff in this division also works with the public on special events held throughout the City.

Mental Health Services

The Mental Health division provides mental health treatment and prevention services with a focus on high-risk adults, transition age youth, children and families. Community based service supports are also provided and include coordination of housing, consumer and family services, and employment or vocational supports. Working closely with other City departments and community partners, the Division performs specialized services such as clinical case management, therapy, wellness and recovery groups, medication support, mobile crisis/emergency response, school-based mental health, homeless outreach, and disaster mental health response and recovery. The division also supports a number of community based organizations in their direct service and prevention efforts.

Public Health Services

The Public Health Division's goal is ensure that everyone in the Berkeley community has an opportunity to a long and healthy life, regardless of income, education, or racial/ethnic background. Public health provides community-wide protection against communicable diseases and emerging health threats; health services at the Berkeley High School Health Center and Berkeley Technology Academy; community-based health promotion and chronic disease prevention services; support for at-risk African American mothers and their infants; nursing case management services in the community; reproductive and sexual health services at the Public Health clinic; linkage and referrals to health care services; HIV testing and counseling; nutrition education and services including WIC; services and policy work addressing public health issues such as tobacco use, lead poisoning prevention, and oral health; and works closely with BUSD and the community to support healthy early childhood development and school-related health issues. Through these activities, the Division strives to eliminate health inequities in Berkeley.

Housing and Community Services

This division partners with local housing developers to increase funding for the development and rehabilitation of affordable housing in Berkeley by leveraging the Housing Trust Fund and monitors all

affordable housing developments and inclusionary housing units to assure compliance with federal, state and local regulations. The division also provides rehabilitation assistance to low-income senior and disabled homeowners, provides housing policy planning and refinement of housing regulatory measures; coordinates homeless policy planning activities for those who are homeless or at risk of homelessness and administers the Shelter Plus Care Program, The division coordinates the allocation and monitoring of funds to community agencies providing a broad range of housing and supportive services to low-income community members funded through General Fund and a variety of state and federal sources and administers the youth and adult employment services programs.

Aging Services

The Aging Services Division operates two daily activity senior centers and one service center, and provides support services to the community including: educational and recreational day trips, center based and home delivered meals, health, fitness and education classes and activities, socialization opportunities, technology access, volunteer opportunities, case management services, senior injury prevention interventions, and caregiver support and consultation. The division also administers the Berkeley Paratransit Services program for seniors and persons with disabilities.

GOVERNANCE OF GIS

The HHCS is not currently a substantial GIS user, but there is a compelling reason for most of the HCS specific data to be geo-enabled for use within the department and made available to the public. The Senior Health Management Analyst and an intern have ArcGIS for Desktop and use it for epidemiology and outbreak wall maps (mumps and measles) respectively. A majority of the GIS users in the Department will be Tier 3 GIS users and as such, they will be consumers of GIS data, supported by IT. There will be at least two (2) Tier 2 GIS users within the HHCS. The HHCS receives some funding from state grants.

The table below summarizes the current GIS staff usage within the HHCS. Type represents the current level of GIS experience based on job requirements, GIS usage can be categorized as Limited, Moderate, or High (i.e. frequency of use), and Primary Tools describes what tools, or how GIS is used, to carry out GIS functions.

Current GIS Staffing				
Type		Number of Users	GIS Usage	Primary Tools
	GIS Flagship (Tier 1)	0	N/A	None
	GIS Analytical (Tier 2)	2	Moderate	ArcGIS for Desktop
	GIS Browser (Tier 3)	0	None	None

HARDWARE AND SOFTWARE

Any hardware issues that were discussed during this Needs Assessment are summarized in the table below. Enterprise wide issues will be discussed in greater detail throughout later chapters of this Needs Assessment and GIS Strategic Plan.

Hardware Issues Summary	
Type	**Notes**
Personal Computers	Each staff person has a PC
Laptops	None
Printer	There are adequate printers for typical office use
GPS	None
Mobile Devices	None currently

The DOH uses the following software applications:

1. Microsoft Office – office productivity
2. ArcGIS for Desktop – analysis and wall map creation
3. CALREDIE – data warehouse hosted by the state
4. DECADE – restaurant inspections
5. ACCELA – inspection data
6. Access/Excel – outbreak data

2
GIS NEEDS ASSESSMENT

GIS NEEDS

While GIS has not fully been implemented in the HHCS as of yet, the department is very much aware of the efficiencies GIS can add to their work flow, thereby enhancing the services they provide to the community.

The following are the needs identified during the onsite interviews. Where applicable, each need listed below will be followed by an application or method to meet that need, some applications/methods will meet several needs. A method or application can fulfill more than one GIS need. The table below summarizes these needs and how they are to be met:

GIS Need	*Method/Application to Meet Need*
☑ Mapping and Spatial Analysis of Department Data	☐ Intranet GIS Data Browser
☑ Geospatial Data Creation and Integration	☐ Data Mining Middleware
☑ Database Design, Data Organization, and Metadata	☐ Governance Model ☐ ArcGIS
☑ Field Access to Geospatial Data	☐ Tablets, Smartphones, or Laptops ☐ ArcGIS Online
☑ Field Data Collection and Maintenance	☐ Esri Collector Application
☑ Public Access to Geospatial Data	☐ ArcGIS Online and Story Maps

GIS Need	Method/Application to Meet Need
☑ Additional Software and Functionality	☐ Network Analyst ☐ Esri Dashboard
☑ Redevelopment Analysis and Modeling	☐ Intranet/Desktop GIS Data Browser
☑ Specialized Online Mapping Themes	☐ ArcGIS Online and Story Maps
☑ Formal GIS Training for Department of Housing Staff	☐ DOH Specific Training

GIS NEED

Mapping and Spatial Analysis of Department Data

A key need identified by the HHCS personnel is increased and improved access to shared GIS data within the City. This includes the most recent parcel, address, and street centerline data, as well as high-resolution orthophotography. Using the most recent and accurate GIS layers provides staff members with an invaluable tool for everyday tasks such as mapping projects.

Collaboration with several departments will be instrumental in establishing GIS as a complementary technology and true enterprise technology used to meet the HHCS objectives. Initial efforts should be aimed at increasing GIS awareness within the department, allowing staff to become familiar with the efficiencies that can be gained through the use of GIS for mapping, analyzing, and tracking information.

One of the first significant benefits that the HHCS will realize from the implementation of GIS is increased and improved access to information. The department will be able to further understand relationships between different types of data in a spatial context, thereby improving decision-making. An ability to visualize where:

- Affordable housing is located in comparison to neighborhoods
- Correlation between affordable housing locations and career and job service needs
- Block grant funds are going
- Cluster analysis of Public and Environmental Health records

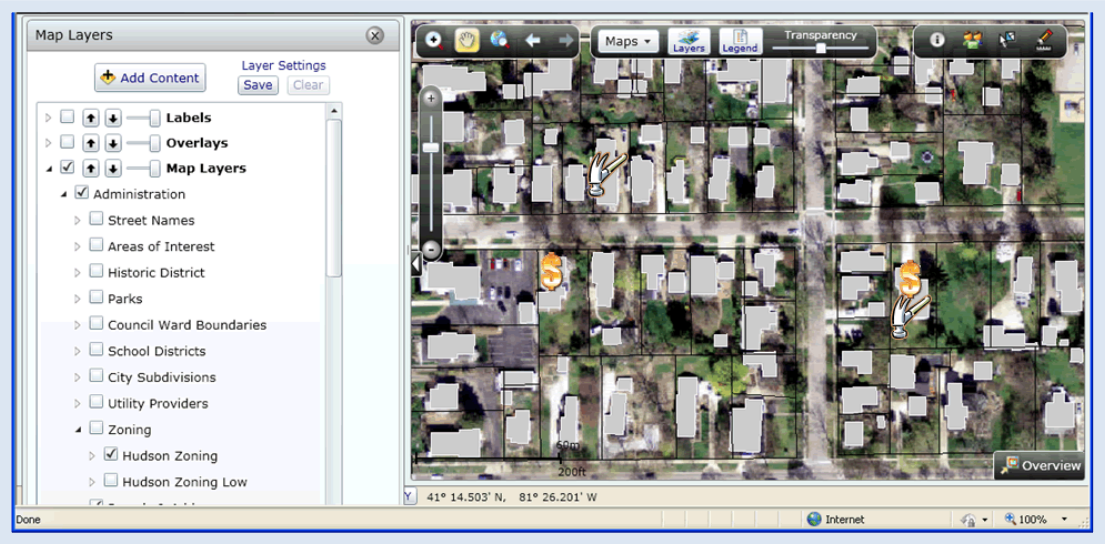
- Analysis of diseases and rates of occurrence for chronic and communicable conditions by geographic sub-region
- Ability to determine if someone or an incident is in or outside of the City Limits
- Rates of disease incidences
- Access to unhealthy foods – obesity prevention
- Geocoding of communicable disease locations to calculate rates of occurrence
- Analysis of hazardous material locations and disease
- Mosquito abatement analysis and tracking
- Inventory of facilities
- Prop 65 Notice visuals
- Proximity analysis
- Land suitability analysis
- Coastal zone proximity analysis
- Plume Modeling

To meet these needs, additional data layers must be made available to supplement the City's existing data repository. Some examples of these data layers include:

- First-time home buyers
- Developers for Rental Housing
- CDBG grant locations
- Rehab locations
- Foreclosures
- Census data (household income, owner occupied vs. rental)
- Child Welfare Data
- Political Boundaries
- 600' Buffers around Schools (tobacco free zones)
- Health Inspection Districts (to be developed using GIS)
- Meals on Wheels and Routes
- Users of Services (WIC, Immunization Clinics, HS Health Center, etc.)
- Additional Layers Identified in this Chapter in the Data Layer Section

To develop these GIS data layers, the HHCS must work with IT to develop necessary data layers, which are missing from the existing GIS data repository. The data development process is not difficult, but must be a coordinated effort to ensure the newly created GIS data layers meet the Department's needs.

The need to convert the department's Access, Excel, CALREDIE, DECADE, and ACCELA data into GIS data layers is a straightforward project. Each of these databases contains addresses. Any data record with an address can be spatially enabled – or geocoded – by linking the address fields to a GIS street centerline layer, tax parcel centroid, or address point layer. Existing databases may need to be reformatted to facilitate geocoding functionality. Address-matched features can be visualized within the GIS, and their attributes can be queried just like any other GIS data layer. For example, once geocoded, queries can be made regarding projects. Staff would be able to click a project on a map and view housing information from the housing database and run custom queries based on any information stored about a particular project.



Ability to View Housing Projects and Related Data on a Map

Most of the HHCS staff should use the City's intranet GIS data browser to conduct basic spatial analysis and to produce maps in day-to-day activities. This intranet browser will serve the entire City, but may have a specific link for the HHCS. This application will integrate data from the previously-described data development initiatives, like affordable housing, first-time home buyers, and projects. Staff will be able to view hot spots for projects and view data over a period of time. This information can be shared as needed with the County, Boards, and Advocacy Groups.

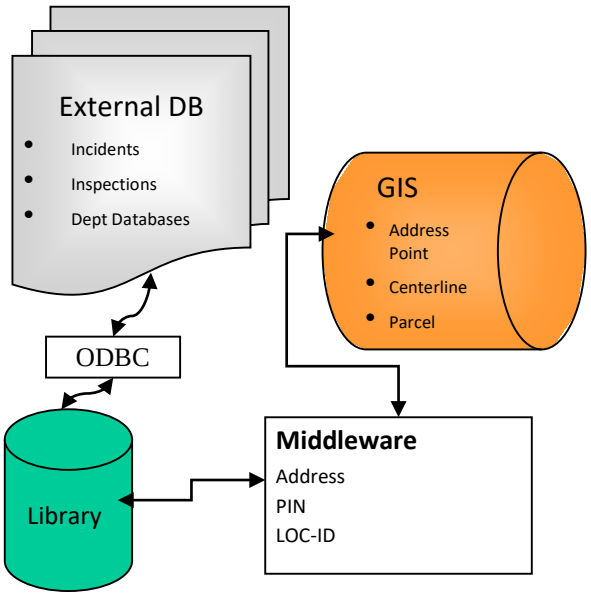
GIS NEED

Geospatial Data Creation and Integration

The HHCS stores much of its information in electronic databases that have addresses or parcel number as an attribute (Inspections, Public Health Data, outbreak data, mosquito control). Spatially enabling these databases will yield important datasets for the department. Any database with associated addresses can be address-matched to a street centerline layer, tax parcel centroids, or address point layer. Existing databases may need to be formatted to facilitate address-matching functionality. Address-matched features can be visualized within the GIS, and their attributes can be queried. It is recommended that information stored in paper or other type of hardcopy recording be entered into a database such as MS Access or MS SQL Server. Once the above information is maintained as digital data, it can be spatially enabled for use in the City's GIS and used like any other GIS layer. Existing databases may need to be formatted to facilitate address-matching functionality. Address-matched features can be visualized within the GIS, and their attributes can be queried.

Application to Meet Need

Data Mining Middleware



Databases with associated addresses can be address-matched to a street centerline layer, tax parcel centroids, or address point layer. Existing databases may need to be formatted to facilitate address-matching functionality. The City should use a data mining middleware application as an automated geo-coding service that creates GIS data layers from non-spatial relational databases. The automated process should be based on standard SQL statements and should use a variety of stored location-based data (Parcel PIN, Address, Location-ID, etc.). A second function of the automated service is to generate GIS layers in an industry standard portable format (shapefiles or SDE layers) that could be used by a variety of applications. These GIS

layers will be created to user specifications. X, Y coordinates will be used to display features in a GIS layer. This graphic shows the process of using data mining middleware to extract data.

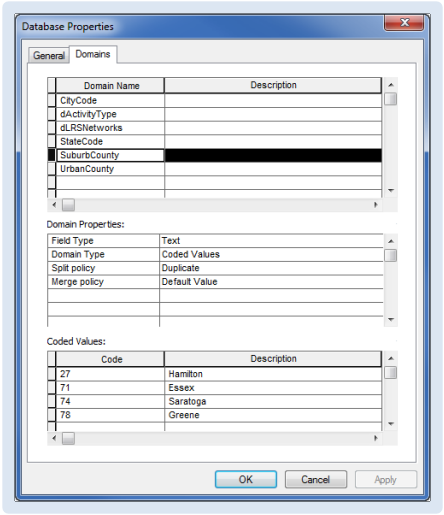
Practical Example

All database records related to a specific location can be mapped by linking each record to a spatial feature, such as an address point. The data mining middleware can generate and export the resulting GIS layer on a regularly scheduled basis. This allows for all pertinent data to be consumed via the Intranet browsers and ArcGIS as needed and even provided to the public where appropriate.

Optimally, as each record is assigned an X, Y coordinate, the coordinate pair is stored in a field within the primary application. That way each record has a validated x, y coordinate and can be mapped at any time. Additionally, those that do not have a valid x, y coordinate can be researched and assigned the appropriate geographic reference.

GIS NEED

Database Design, Data Organization, and Metadata

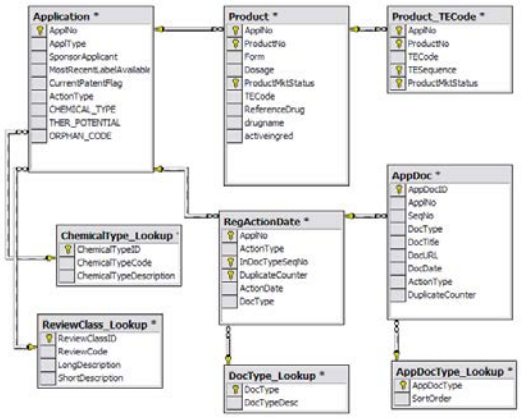


Due to the large variety of GIS data and GIS needs, it is recommended that the HHCS undergo a database design or organization project. Data has been created for various projects throughout the years and needs to be further organized for long term sustainability. The GIS staff in IT need to work closely with HHCS staff to create a database design that meets the needs of the department while adhering to all privacy laws and concerns. The following are the steps that need to take place for a database design and data organization project:

Step 1 – Review Existing Data – The first step is to review all existing data for completeness and viability to include:

- Documenting existing schema (feature classes, domains, subtypes, feature datasets)
- Identify non-standard or custom data
- Identify extraneous data

Step 2 – Create a HHCS Database Design – The second step is to create a database schema that incorporates all of the HHCS specific data layers and their schema. It is recommended that the City embrace the ESRI Local Government Information Model where it can. However, there is not much out-of-the box schema data for the Health System. Therefore the system can be modeled based on the needs of the department:



- Document and create optimal schema (feature classes, domains, subtypes, feature datasets, etc.)
- Review with HHCS staff
- Ensure that database incorporates viable existing data

Step 3 – Develop Mapping Document of Old Schema (Existing Data) to New Schema (Desired Database Design) – Create a mapping document that documents the migration of existing data into new database:

- Document mapping of old schema to new schema
- Can use software such as FME Workbench or do it manually

Step 4 – Migrate data from existing databases to new data model – Move existing data to new model using FME workbench or manual methods.

Step 5 – Create metadata – It is recommended that metadata is created for all City data. Why metadata is important:

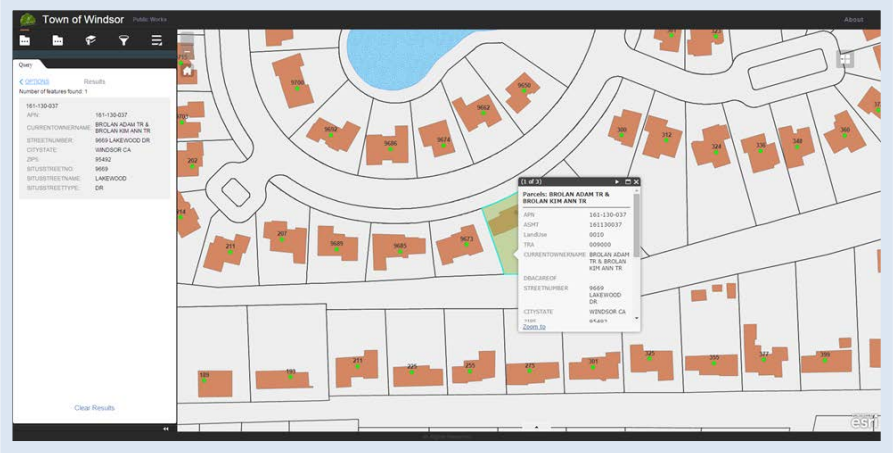
- Metadata helps to distribute information about the data produced.
- User can know description of your dataset.
- Tracks key elements such as accuracy, last time updated, content, source

Establishing a logically organized database and metadata will be of great value in ensuring that the GIS has long-term viability.

GIS NEED

Field Access to Geospatial Data

Providing personnel with access to maps and GIS data while working in the field is an important part of maintaining an enterprise GIS. Through the use of hardware, software and data that are designed to be interrogated and manipulated away from the office, HHCS staff can realize benefits of GIS while away from their office desk. Further implementing mobile computers, input devices, software and GIS data into the GIS enterprise will give HHCS staff tools to perform field data collection, know where services are located, where are restaurant inspections occurring, get notices of recalled foods (who may have them), site visits, routing capabilities, and interactive geographic data query and analysis.



Intuitive HTML5 Interface Example – Easy Data Viewing on Any Computer – In-house or in the Field

A GIS mobile data browser can be loaded on mobile computers, allowing the same capabilities offered by map books, coupled with the ability to conduct address searches; query attributes of all information, such as water pipe ID, types of hazardous material stored at a location; link to digital site plan images, optimal routing to events, and much more.

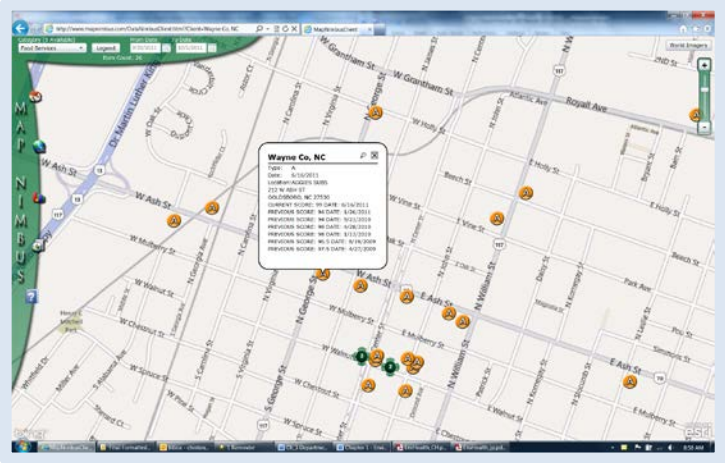
HHCS inspectors performing inspections at regulated facilities and well sites need immediate access to the various agency database systems to retrieve pertinent data related to the agency's activities. Field crew members may be in danger of unexpected health risks, traps or other potentially harmful situations during onsite visits. Access to geospatial data from the field will enable field personnel to map an inspection site's location. The HTML5 ArcGIS Online application mentioned earlier could readily be accessed in the field to view key HHCS data.

GIS NEED

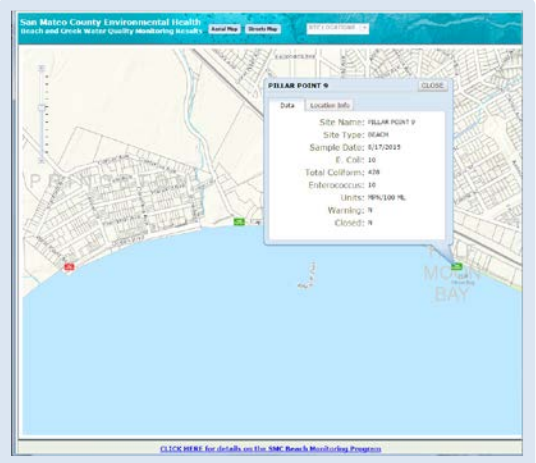
Public Access to Geospatial Information

Staff identified a number of possible public facing applications. Over the past few years, the ease-of-use of GIS has improved dramatically. ESRI has invested millions of dollars in improving the end-user experience. ArcGIS Online and ESRI StoryMaps should be used to show key information pertaining to HHCS. There are a number of potential applications, to include:

- Complaints locations – restaurant, swimming pools, hazmat, and other environmental issues
- Restaurant placarding
- Policy Advocacy
- Neighborhood Requests and Trends
- Licensing Data
- Vector Control (mosquito control)
- Community Events
- Heart to Heart in South Berkeley
- Points of Delivery (POD) Locations



Public Facing Application Showing Restaurant Sanitation Grades

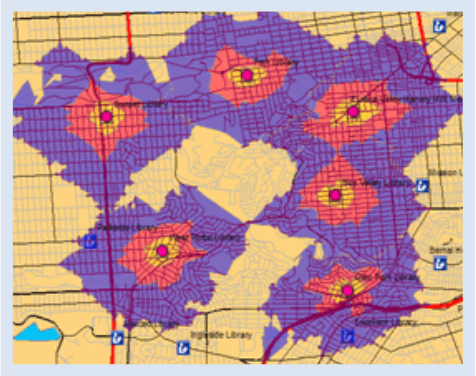


Existing Beach Monitoring Application

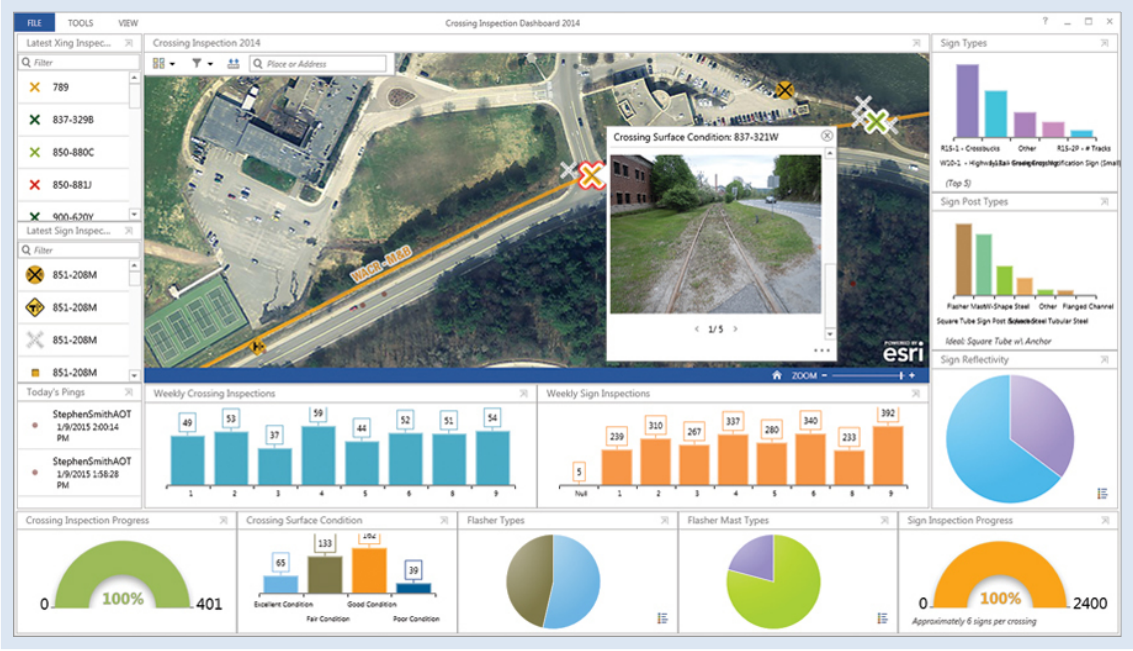
GIS NEED

Additional Software and Functionality

It is recommended that HHCS have access to ESRI's Network Analyst software to conduct drive-time analysis of access to services such as proximity to food services and other services. Additionally, staff should implement ESRI's dashboard application to view pertinent datasets via a dashboard and interactive map. The dashboard should be configured individually for HHCS concerns.



Access to Available Service Study Using Network Analyst



ESRI's Dashboard Should be configured with Pertinent Widgets and GIS Data

GIS NEED

Redevelopment Analysis and Modeling

Spatial analysis is the process of extracting or creating new information about a set of geographic features. Spatial analysis is useful for evaluating suitability and capability, for estimating and predicting, and for interpreting and understanding the relationship between phenomena that are spatially distributed. Spatial analysis is often referred to as modeling; however there are temporal components to modeling that are not necessarily present in spatial analysis. In GIS, there are four traditional types of spatial analysis:

- Spatial overlay and contiguity analysis
- Surface analysis
- Linear analysis
- Raster analysis

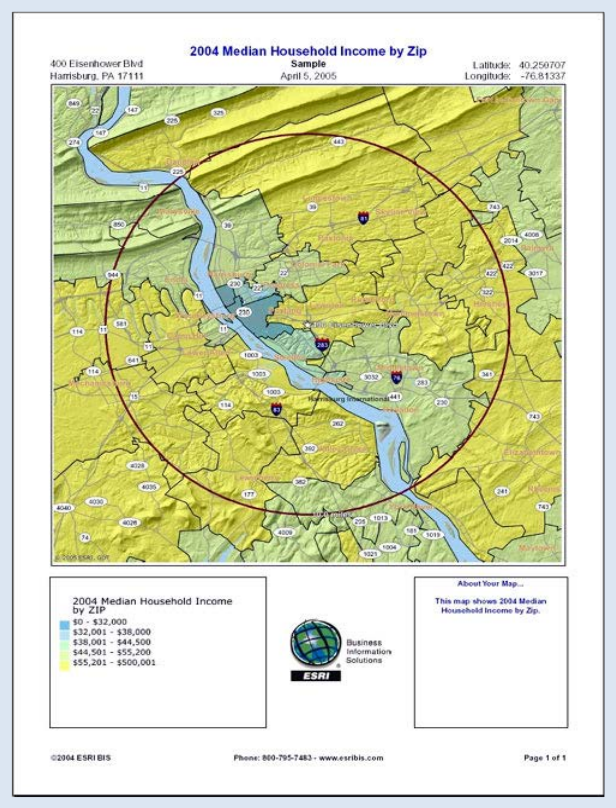
GIS is a powerful tool that can combine land, demographic, consumer and business data to support analyses that are critical to the HHCS's redevelopment planning. The database will provide information about available properties based upon a desired size and the use of the property. The system will be able to generate demographic and business reports for any area based on a specified radius. Examples of tasks well supported by GIS include:

- Land acquisition and assembly analysis
- Redevelopment scenario analysis, including rezoning and overlay planning
- Community economic base and business cluster analysis
- Business attraction and retention strategies
- Market analysis

Users will benefit from a consolidation of data sources that will enable spatial analysis. GIS would enable the quick preparation of reports on the following data:

- Population characteristics
- Household income and expenditure patterns
- Spatial patterns of business by category
- Available sites by size and use
- Non-conforming properties

- Property tax and market value
- Define customer-based or store trade areas
- Gravity models to forecast potential buying power of an area
- Community Profile
- Housing & Neighborhood Service Target Areas
- Utility Locations, Providers, and Rates
- School Locations – Elementary, Middle, High, College, Technical
- Climate
- Transportation Facilities – Road, Rail, Air, Sea, Transit
- Labor Force Data
- Accommodations
- Medical Services
- Tax Districts
- Major Employers



Example of a site-centered median income map

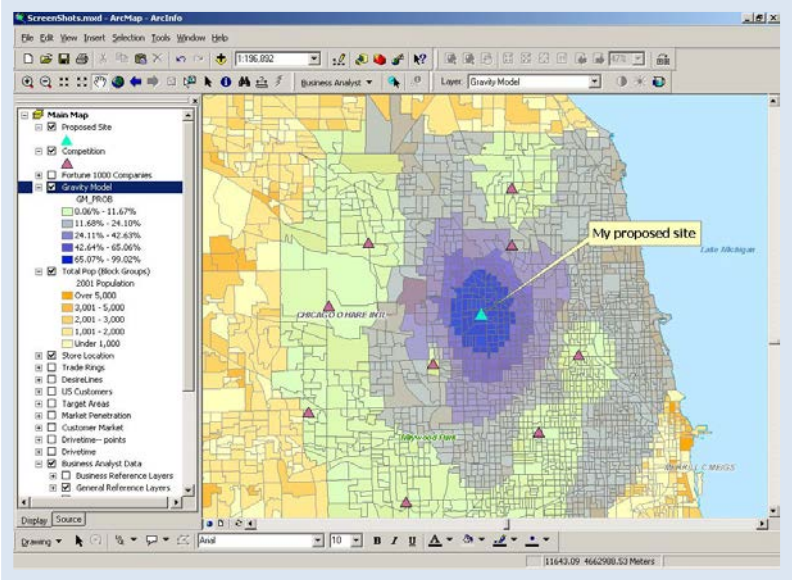
To produce maps, like that above, and conduct analysis, the HHCS will require further refinement of the City's intranet portals. An intranet or desktop data browser is an application that can be installed on any computer on the City's network or intranet. The application has access to pre-defined GIS data layers depending on the user's business process and workflow.

Analytical GIS applications may also require a specialized set of spatial analysis tools and functions that can provide specific spatial models for business development. Spatial analysis output requires significant GIS data and well-trained operators. The table below provides examples of spatial analysis that desktop GIS applications can provide:

GIS Analysis Application

Using a GIS application for spatial analysis, the Department can produce reports and maps that:

- Map proposed sites based on land-use or parcel designation
- Apply geoprocessing models to GIS data layers
- Conduct market and economic analysis



Example of GIS data browser with Business Analysis capabilities (e.g. gravity model)

Analysis tools should be used in tandem to assist with any of the following tasks:

- Identify available land/buildings for redevelopment opportunities
- Identify vacant land and structures
- Identify County/City owned properties and industrial parks with total available square footage
- Identify new permits and certificates of occupancy for new businesses
- Provide more detailed information to developers
- Ability to match zoning codes with potential projects
- Provide property information such as; zoning, id#, total square footage, ownership, image of land/area/buildings
- Mapping of projects and potential projects
- Identify real estate and building data for projects

Case Study: GIS Helps Laguna Niguel Use Federal Money More Effectively

One of the goals of local governments is not just obtaining sufficient funds, but being able to use those funds in the most beneficial way. The City of Laguna Niguel used the spatial analysis capabilities of ArcView GIS to decide how to administer funds from the Housing and Urban Development Department (HUD) in a way that maximized the number of areas that could qualify to receive funding.

Areas that qualify for CDBG funds with county administration.

Much larger area that would qualify for CDBG funds if the city administered the program.

Laguna Niguel is a study in doing a lot with a little and in little time.

Located in Southern California's Orange County, Laguna Niguel has a population of 56,000. City staffing is lean. Wade Kloos, an associate planner for Laguna Niguel for the past six years, and an intern, ARE the GIS Department. Kloos actually spends only about 20 percent of his time working on GIS projects. Though the City's parcel map was produced by a consultant using ArcInfo, Kloos uses ArcView GIS for all the City's GIS projects.

HUD's Community Development Block Grant (CDBG) programs promote sound community development through awarding grants to qualifying communities. Grants help cities provide public services, carry out neighborhood revitalization, and administer economic development programs.

Entitlement grant amounts are determined by a statutory formula that uses several objective measures of community need including poverty, population, housing overcrowding, age of housing, and growth lag. When Laguna Niguel's population passed 50,000, the City qualified as an entitlement city under HUD guidelines that allowed it to choose whether to continue to allow the County to administer the City's CDBG grants or to administer those monies itself.

What's the difference, you say? It hinges on the effect of HUD's qualifying threshold for the number of low to moderate households in any census block. If the County administered Laguna Niguel's CDBG program, HUD would use the County's median household income, and 36.4 percent of households within any census block would be required to be low to moderate income for that block to qualify. Under City administration using the City's median household income, only 16.8 percent of households in a census block would have to be categorized as low to moderate for that block to be eligible for funds. The City had to decide if the benefit to the community of expanding qualifying areas sufficiently offset the additional staff resources needed to administer the program.

In about two hours, Kloos created the census block themes, analyzed census blocks by income level, and generated thematic maps showing which areas would qualify under the County's threshold and under the City's threshold. Only two census blocks qualified under the County administration option, while seven census blocks qualified under the City administration option. Armed with these maps it was easy to demonstrate to the City Council that the City could significantly increase the benefit from the $335,000 in

CDBG funds through City administration of the program. City Manager Tim Casey opted to devote all CDBG funds to project work rather than charge staff time against CDBG funds.

After providing the spatial analysis information that supported the City's decision to administer the CDBG program, Kloos became the CDBG coordinator. Other projects Kloos has completed using ArcView GIS include a real property inventory that gave the City a record of all its real estate holdings. Kloos also used ArcView GIS to produce conceptual designs for proposed MetroLink stations, saving the City from hiring an engineering firm to complete the designs. "We are low tech and low budget. I like to think we are a model of what a small City can do," says Kloos.

**Case Study Courtesy of ESRI ArcUser Magazine*

GIS NEED

Training

The HHCS users will require introductory GIS and GIS data editing training (e.g. GIS concepts, terminology, data types). Staff will need to be self-sufficient with GIS for basic query and mapping tasks. Therefore, they will need continued access to the City's online intranet mapping tool and data repository. Staff will require introductory training in the use of these tools. Additionally, as intranet and Internet applications are further deployed, Department staff will require specific training tailored to the GIS interface that may support their specific workflow. Training is typically arranged at the user level and based on applications that will be deployed to the various levels of users. There is a desire to perform some data maintenance and analysis within the HHCS. To acquire analysis and data editing capabilities, the Department should send select personnel for higher-level training.

3

GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY

The Department will benefit from access to several other departmental GIS data layers. It is expected that once all departmental data is integrated, consolidated, and centrally stored that staff will have access to all non-classified GIS data layers from other City departments.

Legend

Data Layer	The data layer is the GIS thematic data that is being described. The name of the layer or description of the layer is placed in this column.
Creation Methodology	This column describes how the layer was or is anticipated being created.
Recommended Update Division or Individual	This field outlines the division or individual that is anticipated to maintain or develop the data layer during and after full implementation of the Citywide enterprise GIS. Development of new recommended layers will be prioritized for each year of the GIS Strategic Plan.
Layer Status	Layer state of existence.
Existing	These layers currently exist within the City's GIS.
Recommended/ Desired	These layers are recommended for development or procurement, based on departmental and enterprise needs. These data layers will help support existing business procedures or will compliment other GIS data sets that are already existing and in use by the City. Costs associated for these recommended layers will be based on general estimates – actual cost may vary.
Partial	These layers currently exist in an incomplete or outdated state.

The following are key data layers for the HHCS:

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
HHCS Data			
CDBG Grant Locations	Extract, cleanse, and geocode from database and/or utilize HUD data	HHCS	Recommended
Capital Improvement Projects	Digitize from base map data; aggregate layers as needed	Various overseen by IT	Recommended
Census Data	Download from Census Bureau	IT	Recommended
First-time Home Buyers	Extract, cleanse and geocode from database	HHCS	Recommended
Foreclosures	Acquire data from other databases	HHCS	Recommended
City/County Owned Property	Extracted from Parcel Layer	IT	Existing
Crime Data	Extract, cleanse, and automatically map from Police database	Automated from Police Department	Recommended
Easements	Digitize from base map data; aggregate layers as needed	Public Works	Partial
Flood Zones	Acquire from FEMA	IT	Existing
Historical Aerial Photography	Aerial Flyovers	IT	Existing
Hydrology (Natural Water Features)	Acquire from USGS	IT	Existing
Land Use	Created from parcels and aerial photography	Planning	Existing
Parks	Digitize from base map data; aggregate layers as needed	Parks Department	Recommended
Public Utilities	Field collection, digitization, and as-builts	Public Works	Existing
Sidewalks	GPS and digitizing from aerials	Public Works	Existing
Rights-of-Way	Site plans and other documents	Public Works	Existing
Schools	Digitize from base map data; GPS field work	IT	Existing
Sewer Base Map	Digitize on screen; existing CAD data; GPS field work	Public Works	Existing
Storm Base Map	Digitize on screen; existing CAD data; GPS field work	Public Works	Existing
Water Base Map	Digitize on screen; existing CAD data; GPS field work	Public Works	Existing
Zoning	Digitized on screen	Planning	Existing
Child Welfare Data	Acquire from county data, state data, and national data	IT and HHCS	Recommended

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Political Boundaries	Acquire from county, regional, and state data	IT	Recommended
CALREDY	Data integration	IT and HHCS	Recommended
600' School Buffers (Tobacco Free Zones)	Digitized on screen	IT	Recommended
Licensing	Automated from Accela and/or FUNDS	IT	Recommended
Health Inspection Districts	Digitized on screen (determine based on inspection geocoding and volume)	IT and HHCS	Recommended
Mosquito Control	Data integration	IT and HHCS	Recommended
Meals on Wheels and Routes	Data integration; digitize on screen	IT and HHCS	Recommended
Senior Center Bus Routes	Data integration; digitize on screen	IT and HHCS	Recommended
ParaTransit Usage	Data integration; digitize on screen	IT and HHCS	Recommended
Users of Service (WIC, Black Infant Health, Immunization Clinics, HS Health Center, Public Health Nursing Care Management, Emergency Management Upcoming Events, Tobacco Retail – Patterns of Retail, Food Density, Alcohol Retailers)	Data integration; digitize on screen	IT and HHCS	Recommended
Community Events	Digitize on screen	IT	Recommended
Points of Delivery (PODS) Locations	Digitize on screen	IT and HHCS	Recommended
Public Health NCT Incident Logs	Data integration; digitize on screen	IT and HHCS	Recommended
Service Locations	Digitize on screen	IT and HHCS	Partial
Emergency Shelters	Digitize on screen	Emergency Management	Recommended
Vulnerable Population	Digitize on screen	IT and HHCS	Recommended
Emergency Supply Caches	Digitize on screen	Fire	Existing
Pharmacies	Digitize on screen	State Open Data Center; HHCS Intern Update	Recommended
Housing Facilities	Digitize on screen	State Open Data Center; HHCS Intern Update	Recommended
Dialysis Centers	Digitize on screen	State Open Data Center; HHCS Intern Update	Recommended

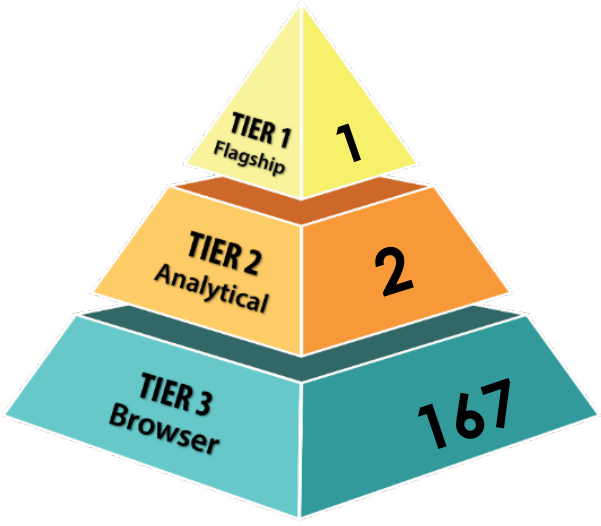
Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Urgent Care Centers	Digitize on screen	State Open Data Center; HHCS Intern Update	Recommended
Skilled Nursing	Digitize on screen	State Open Data Center; HHCS Intern Update	Recommended
Surgical Centers	Digitize on screen	State Open Data Center; HHCS Intern Update	Recommended
Homeless Encampments	Digitize on screen; field data collection	IT and HHCS	Recommended
HazMat Locations	Digitize on screen	Fire	Existing
Ambulance Calls	Data integration	Fire	Existing
Noise Ordinance Violations	Data integration	IT and HHCS	Recommended
Smoking Regulation Locations	Data integration	IT and HHCS	Recommended
Smoking Regulation Complaints	Data integration	IT and HHCS	Recommended
Community Agencies	Digitize on screen	IT and HHCS	Recommended
Where does Funding Go	Digitize on screen; data integration	IT and HHCS	Recommended
Police Data (Child abuse, bike accidents, domestic abuse, pedestrian accidents, traffic safety)	Data integration	Police	Existing
Industrial Waste Biohazard	Data integration	Planning	Existing
Air Quality Issues	Data integration; digitize on screen	IT and HHCS	Recommended
Bait Trap Locations (in sewer manholes)	Digitize on screen; field data collection	IT and HHCS	Recommended
Rapid Bat Bites	Data integration; digitize on screen	IT and HHCS	Recommended
Inspections (tobacco, kitchens, pools, tattoo and nail salons)	Data integration	IT and HHCS	Recommended
Citywide Base Data			
Property	Original tax parcels were digitized and rubber sheeted from scanned hard copy water quality maps circa 1999. Updated manually once a year by the GIS Team using County data for attributes and the County's Adobe PDF parcel maps for geometry changes. Migrated to the LGIM Tax Parcel schema in 2016.	The GIS Team	Existing

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Aerial Photography	Current aerial data is delivered by Pictometry through an agreement with Alameda County. The most current data was captured in 2014 with the next flyover scheduled for Spring 2017. The County's current contract with Pictometry calls for one more flyover after the 2017 capture. Older imagery exists for 2006 (custom County flyover), 2009, and 2011 (USGS).	Static Map	Existing
Road Centerlines	Created by RMSI in 2010 from various sources including Alameda County data and pavement management system data (street width). Updated manually by the GIS Team occasionally. Migrated to the LGIM Road Centerline schema in 2016. Zero Waste has a copy that has been updated for routing purposes.	The GIS Team	Existing
Address Points	During the work day, an Analyst in the Finance Department updates/creates new addresses in the Land Management (LX) module in SunGard (FUND$). Address points are then created nightly from an ETL that extracts and geocodes (using parcel centroid coordinates) and joining to a parcel table to create the address points feature class.	Automated / Finance Department	Existing
Property	Original tax parcels were digitized and rubber sheeted from scanned hard copy water quality maps circa 1999. Updated manually once a year by the GIS Team using County data for attributes and the County's Adobe PDF parcel maps for geometry changes. Migrated to the LGIM Tax Parcel schema in 2016.	The GIS Team	Existing

4

MULTI-TIER GIS APPLICATION USE

The graphic below graphically depicts the recommended GIS application use by the HHCS. The pyramid and table outlines the "Tiers of GIS Use" within the organization. All are color coded by the anticipated GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions.



TIERS OF GIS USERS	
GROUP	ACTIVITY
Tier 1 Flagship	• GIS Administration • Data Maintenance • Data Conversion and Creation • Spatial Data Management • Technical Support • Coordination
Tier 2 Analytical	• Data Maintenance • Analytical Functions/Geoprocessing • Complex Queries • Modeling • Use of Desktop Extensions • High Quality Map Production
Tier 3 Browser	• Browsing/Look-Up • Standard Reports • Simple Query • Map Production

5

RETURN ON INVESTMENT (ROI)

The following table indicates specific Return on Investment opportunities for the HHCS:

Return on Investment Opportunity Health, Housing and Community Services	
Opportunity	**Explanation**
Save <u>Time</u> and <u>Respond</u> More Quickly to Community Requests	***Public access to accurate data:*** • The public should have Internet access to GIS data. GIS will allow users to find information much more quickly and in many cases on their own. ***Staff access to accurate/updated data:*** • Staff should have access to current GIS data to better serve and provide information to the public and decision makers.
Save <u>Time</u>	***Easy access to GIS data:*** • An Intranet GIS Data Browser should be used to generate high-quality maps for HHCS programs and responses to general property inquiries.
<u>Improve</u> Data <u>Accuracy</u>	***Better GIS Data and Spatial Analysis:*** • With the creation of HHCS GIS data layers, the office staff will have much more accurate geographic information pertaining to their business functions. In return, this will allow them to do much of their work more efficiently and with better data providing more accurate mapping and spatial analysis.

Return on Investment Opportunity Health, Housing and Community Services	
Opportunity	**Explanation**
Increase <u>Productivity</u>	***Internal Executive Information System and GIS Portals:*** • Staff can quickly visualize and analyze the location of key data in the City. This optimizes data gathering and decision making
<u>Save Time and Improve Health</u>	***Mobile GIS Data Browser:*** • Allows inspectors to view data while in the field, thus optimizing time to find sites and find pertinent data. ***Epidemiology:*** • GIS analysis for epidemiology allows staff to quickly identify patterns and thus mitigate issues. This can lead to improvement of healthy living conditions and service optimization for community members of the city. ***Internal Executive Information System:*** • Staff can quickly visualize and analyze the location of key data sets throughout the City. The appropriate resources can then be deployed to mitigate any problems and to optimize services.
Better <u>Public Relations</u>	***Internet Viewers:*** • Providing data to the public through easy-to-use portals improves public relations.

NEEDS ASSESSMENT

INFORMATION TECHNOLOGY

CITY OF BERKELEY
CALIFORNIA
GIS Strategic Implementation Plan

SECTION OUTLINE

1

EXISTING CONDITIONS

DEPARTMENT OVERVIEW

The Information Technology Department's primary responsibilities are "to provide leadership in the delivery of innovative, secure, environmentally sound, and cost-effective technologies to support all City departments and facilitate civic participation." Following is a summary of the Department's business units:

Director and Administrative Services: Oversees strategic planning, IT Governance, policy and procedures, budget, technology procurement and contracts, vendor management, Council Reports, performance metrics, leadership and team building, e-Government initiatives, Service Level Agreements, Cyber Security Protocols, Public Records Act requests, audit reports, work plan prioritization, and project portfolio management, and performance management.

311 Customer Service: The first point of contact for community members for City services and information providing easy access and resolution for government services. 311 Customer Service receives 110,000 contacts per year from twelve (12) City phone lines, Online Service Center, E-Mail, and Voicemail, unit collects payments for all City departments, manages community contacts from Online Service Center, SeeClickFix mobile application, and manages correspondence sent to City of Berkeley Customer Service (CustomerService@CityofBerkeley.info) and helps to coordinate Citywide Customer Service protocols.

Network Operations and Helpdesk – oversees the City's network of 300 servers, routers, switches, and firewalls and provides 24x7 support.

Enterprise Applications: Provides administration, support, business analysis, project management to upgrade software and maintenance of the Enterprise (Citywide) Applications across a variety of technology platforms, including the City's financial/HR Payroll system (FUND$), Permitting system (Accela), Work Order System, Data Warehousing and Reporting and geographic information systems (GIS). The GIS Team is located within this business unit.

Business Applications: Provides project management and programming services and reviews each department's technology portfolio to help maximize interdepartmental workflow efficiencies. Portfolio Coordinators are responsible for helping each department maximize its return on technology investments.

Enterprise Resource Planning (ERP): The ERP Team (FUND$ Replacement) provides project management, change management and subject matter expertise to implement a new, fully integrated, public sector ERP system that meets the City's functional scope which includes Core Financials, Purchasing, Human Resources, Payroll, Budget Preparation, Time Entry, and Benefits Administration.

The Information Technology Department currently employs approximately 40 staff.

GOVERNANCE OF GIS

The GIS Team resides in the Information Technology Department and as such, the Department is considered a major user of GIS in the City. The one GIS staff person has a title of Applications Programmer Analyst II and also known as GIS and Open Data Coordinator (referred to as GIS Lead for the remainder of this document).

The GIS Lead is a career GIS professional and is responsible for ensuring that GIS advances throughout the organization. In 2008 an Enterprise GIS Team Charter was created. The charter documented the background and context of the GIS while documenting the following Mission, Goals, and Objectives for the enterprise-wide GIS.

Mission and Objectives

The goal of the City of Berkeley GIS team is to develop and maintain a system that integrates a wide range of data sets from a variety of different users, department and outside sources. Through GIS technology, multiple datasets may be integrated, tying one piece of information to another through commonalities including geographic location and feature descriptions.

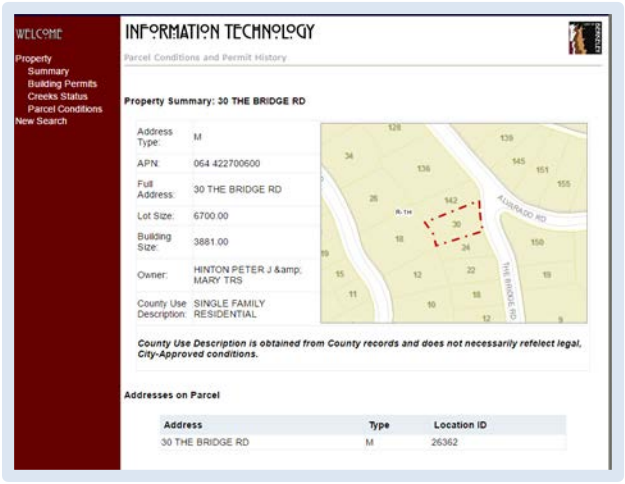
The team will effectively develop and communicate and efficient and effective set of best practices (BPs) and procedures for the GIS staff at the City of Berkeley. Open communication and participation from all staff will be encouraged and will define future phases of development and continue to define a model for continuous improvement.

Goals

- Integrate City of Berkeley IT best practices, procedures, and policies.
- Develop a set of concise procedures to develop, manage, distribute, and present project datasets to internal departments and external agencies.
- Improve GIS delivery capabilities by developing consistent work products at reduced cost.
- Develop the building blocks for an Enterprise GIS enabling staff to grow and take on exciting new challenges.
- Communicate best practices with all staff and encourage participation from everyone at the City of Berkeley.

This charter was established as a starting point to document a baseline for GIS best practices under the direction of a GIS Steering Committee. Additionally, it was written with the idea of having a core GIS team. However, due to organizational and economic conditions the core team is now one full-time position. Enterprise GIS teams at similar sized cities typically are comprised of a number of staff dividing duties between hosts of enterprise tasks and duties. The GIS Lead has done an outstanding job of maintaining a GIS program. She maintains the central GIS database, core GIS layers, provides a number of GIS portals, and provides technical service to a number of City departments.

There are generally three tiers of GIS users. A Tier 1 - Flagship GIS user typically conducts GIS administration and coordination at the enterprise level, has access to a fully functioning GIS toolset to create and maintain enterprise data, and manages the enterprise database. A Tier 2 - Analytical GIS user focuses on data analysis, complex querying and data modeling, along with department level data maintenance. A Tier 3 - Browser GIS user requires only general browsing GIS data functions to create reports, query standard data sets, create tasks like mailing labels, and produce maps. The following is a list of the GIS viewing/analytical portals provided by the GIS Lead. This alone is typically maintained and promoted by a GIS Specialist in comparable organizations.



Property Map Application

- Parcel Notifier
- Batch Geo-coding
- Solar mapping
- Parcel popper/ parcel conditions
- Planning app
- Community services app
- Storm and sanitary sewer networks mapping service
- Public works mapping service
- Alcohol license buffer app
- Census 2010 mapping service
- Fire map service
- Historic maps and photos
- Bicycle parking map
- Berkeley park highlights
- Pictometry explorer

Pictometry

For a City GIS to be an enterprise GIS one of the core components is access via easy-to-use portals. However, if is unreasonable to expect that one person can perform all of the necessary functions that are required for full enterprise-wide GIS adoption. The current GIS Lead is doing her best to provide the core

services but does not have time to refine these services, educate the organizations, and ensure full GIS value.

Additionally, the City has invested in Esri's Enterprise License Agreement (ELA). This allows the propagation of an unlimited amount of Esri tools within the enterprise and to the public. However, it is unreasonable to think that one person can educate and provision each department with the tools they should be using.

The table below summarizes the current GIS staffing and or GIS usage in the Information Technology Department. Type represents the current level of GIS experience based on job requirements and GIS usage can be categorized as Limited, Moderate, or High (i.e. frequency of use), and Primary Tools describes what tools, or how GIS is used, to carry out GIS functions.

Current GIS Staffing				
Type		Number of Users	GIS Usage	Primary Tools
	GIS Flagship (Tier 1)	1	N/A	GIS Lead using the ArcGIS Suite of Tools Through an Enterprise-wide License Agreement
	GIS Analytical (Tier 2)	0	N/A	None
	GIS Browser (Tier 3)	5	N/A	Various Story Maps & Park Locator App

HARDWARE AND SOFTWARE

Information Technology has personal computers available as needed for each of its employees. Staff provide help desk support to all City departments. An internal Gigabit fully switched network is used for network connectivity. A 20MB WAN connection is used between City buildings. The City has a 200MB connection to the Internet. City staff are outfitted with personal computers, which are on a 4 year replacement cycle. Some staff have workstation level computers which are equipped with more RAM and a higher end processor. City servers are virtualized using VMware and employ Microsoft's Active Directory structure for user security. Microsoft SQL Server is used for a majority of databases. IT supports a number of systems for various departments to include:

1. SunGard – ERP – general services, treasury, billing receipts, etc.
2. Accela – business licenses (also transitioning to new ERP)
3. Lagan- CRM
4. New World System – RMS/CAD
5. Crime View Community – public facing crime mapping
6. Red Alert – Fire inspections
7. ArcGIS Suite – GIS (Server, Desktop, Mobile) – Enterprise License Agreement
8. Code Red – Reverse 911
9. Data 911 – Public Safety
10. Alpine RedAlert
11. RealQuest
12. OnBase
13. Xerox eTIMS
14. Chameleon
15. Route Smart
16. AutoDesk Civil 3D
17. Street Saver
18. Cross Roads
19. Pacsoft
20. Quick Net
21. FastLook
22. DECADE
23. CALREADY
24. Active Net

2
GIS NEEDS ASSESSMENT

GIS NEEDS

The complexity and cost of managing the amount of services, which the City manages, has greatly increased the demand for GIS technology. GIS staff, adhering to IT best practices, should provide primary support and maintenance of the enterprise GIS. Additionally, cross departmental integration of databases will be required as needed for continued development of the enterprise GIS.

The GIS Lead, supported by the technical capabilities of IT staff, should provide GIS support to the City's departments. IT will continue to be a focal point for general technical support as the City expands and increases its use of GIS across the enterprise. The GIS Lead in consultation with IT will need to establish, configure, and support various types of technology infrastructure; including software, hardware, databases, networks, user accounts, and documentation.

The GIS Lead will work closely with IT staff to provide many of the recommendations of the City's GIS Implementation Plan. One of the key issues that IT will need to address is the short and long-term impact of enterprise-wide GIS implementation—support needs for each of the City's departments will quickly increase and continue to increase as personnel become further exposed to the technology and its benefits. The GIS Lead in coordination with IT will need to identify and devise strategies for ensuring that support is adequate in all aspects of the City's GIS effort; these strategies may entail procurement of new software, outsourcing of projects, additional staffing, and protocols and standards.

Based on this needs analysis, IT has responsibilities/needs in relation to GIS. Where applicable each need will be followed by an application or method to meet that need, some applications/methods will meet several needs. A method or application is only described under one need, if it applies to multiple needs refer to the previous need for a description. The table below summarizes these needs and how they are to be met:

GIS Need	*Method/Application to Meet Need*
☑ Focus on Improving GIS Governance	• Implement Hybrid GIS Governance Model • Additional Staffing • Subject Matter Experts within various City Departments
☑ Expand and Refine GIS Data	• ArcGIS Suite (Desktop, Collector) • Automated GeoCoding Service
☑ Corporate Mobile/Field GIS Access	• A shared, scalable solution for all departments • Viewing/Editing current data within central GIS database • Technology Evaluation
☑ Expedient Connectivity and Data Access	• Network Analysis Tools
☑ Training and Education	• Annual Training and Education Strategy
☑ Enterprise GIS Portals	• Intranet GIS Data Browser
☑ Public Access to Geospatial Data	• Story Maps • Maps and Apps from Esri
☑ Metadata	• ArcGIS Desktop

GIS NEED

Focus on Improving GIS Governance

The GIS Lead is tasked with providing a host of GIS services and attempting to maintain and promote enterprise-wide GIS. However, it is unreasonable to think that one person can accomplish all that is needed to maintain much less promote and expand an enterprise-wide GIS. Other similar sized organizations typically will have a number of GIS staff who divide responsibilities. This would typically include a GIS Lead (Coordinator/Manager), GIS Specialists/Analysts, and GIS Technicians. Without this cadre of experts, the City's GIS Lead is forced to focus on core items to include:

- Maintaining the central geodatabase – no time to improve and refine

- Maintaining core GIS layers - however many peripheral layers are out-of-date
- Maintain core GIS software – not able to promote its use nor enable departments to use the software in a targeted manner
- Create GIS portals – no time to improve, critique, and promote the portals. Nor time to combine and expand portals.
- Support users – now in the putting out fires mode instead of pushing the envelope with new and creative uses of the technology
- A variety of other duties to keep the existing GIS viable – no time for promotion and expansion of GIS as a core integrated technology

The bottom line is that the City **must hire additional staff as part of the central GIS Team** if GIS is to become an enterprise data viewing/analysis platform. Without additional staff the current GIS Lead is doing all she can and expansion of GIS is not practical. GIS Governance and Staffing will be covered in detail in the Governance Chapter of this Strategic Plan. However, when looking at successful enterprise-wide GIS implementations there are a number of core services that should be provided by a central GIS team. The following are GIS coordination tasks that should be provided both internally and externally and their current status:

City of Berkeley (Internal)

- Installation, maintenance, and upgrade of hardware and its operating systems – need being met currently
- Provision of training for users in each department – need not being fully met
- Establishment of database standards – need not being fully met
- Plans and procedures for effective integration or transfer of GIS data from various sources into usable databases – need not fully being met
- Establishment of mapping standards – further standardization and SOP needed
- Deployment of departmental portals (AGOL or others) – needs augmentation
- Establishment of metadata standards – need not being fully met
- Maintenance of data security and integrity – need not being fully met
- Primary contact for user problems and vendor support – need being met currently
- Complex spatial analyses – need being met currently but impacted by workload
- High-level cartography - need being met currently but impacted by workload

- Project management - need being met currently but impacted by workload
- Inter-departmental collaboration on GIS projects and initiatives - need being met currently but impacted by workload
- Increase awareness and use of GIS throughout the enterprise - need being met currently but impacted by workload
- Increase continuing education and training for the use of GIS tools - need being met currently but impacted by workload
- Increase the amount of data that is being tracked via GIS - need being met currently but impacted by workload
- Ensure GIS data is in compliance with standards – need not fully being met
- Integrate existing databases into GIS or establish linkages to leverage city information assets with spatial context – need being met for some systems but needs further expansion
- Maintain and continuously update current data – need being met in some cases and not fully being met in others. Departmental staffing and workloads has a big impact on this.
- Link images, photos, and other related information to geographic locations – need being met in some instances but needs further expansion and integration
- Improve the use of GIS in the field – mobile GIS has begun to be implemented and will grow quickly as tools have become easier to use.
- Ensure that the Information Technology computing and infrastructure environment is sufficient to handle the demands of staff and public access initiatives, now and in the future – need currently being met
- Unify a city-wide governance structure for GIS use, service provision, and areas of responsibility for funding of GIS software, training, data creation initiatives, imagery acquisition, etc. – need currently not being met
- Improved cooperation with external government entities and private companies - need being met currently but impacted by workload

External

- Collaboration with other local agencies, specifically the County and regional agencies - need being met currently but impacted by workload
- Frequent attendance and participation in local and regional GIS groups - need being met currently but impacted by workload
- Distribution and acquisition of geospatial data – need being met

Berkeley currently employs a hybrid GIS organizational structure. A hybrid model is one in which a core group of GIS experts guide and manage the overall City GIS efforts as is done now by IT GIS staff. Additionally, some departments have skilled GIS staff to accomplish many of their daily tasks. Berkeley has evolved into this hybrid governance model. However, it would be beneficial to formalize the model and implement the strategies to guide this type of governance, particularly about how to fund expansion of GIS, special data development initiatives, etc. A governance chapter later in this document will deal with this topic in detail. The City should agree on the existing governance structure and any needed changes thus formalizing the governance game plan.

The second vital piece to a successful hybrid GIS organizational structure is the establishment/formalization of satellite GIS "Subject Matter Experts" (SMEs) within the various power-user departments of the city. By identifying and enabling knowledgeable GIS staff within these departments, a mutually beneficial system will be in place. More GIS work can be identified and accomplished within heavy-use departments, and the GIS staff can focus more on the strategic management of the GIS program, like hardware, software, licensing, and server maintenance and upgrades. Though some departmental SMEs do exist, this role needs to be expanded to other heavy use departments.

The bottom line is that the City needs additional GIS staff in the central GIS Team. The City has invested many years and much money in establishing and nurturing GIS. GIS has evolved over the past five years with new tools and a new platform that enables staff to more readily use GIS in their daily activities. It is critical that the City take a very serious look at staffing levels. This topic will be covered in detail in the Governance Chapter of this Strategic Plan.

GIS NEED

Expand and Refine GIS Data

The City has been using GIS in various capacities over the past two decades. Over that time a large amount of money and time has been spent creating data layers. There are a number of ways that data has and is created to support the GIS to include:

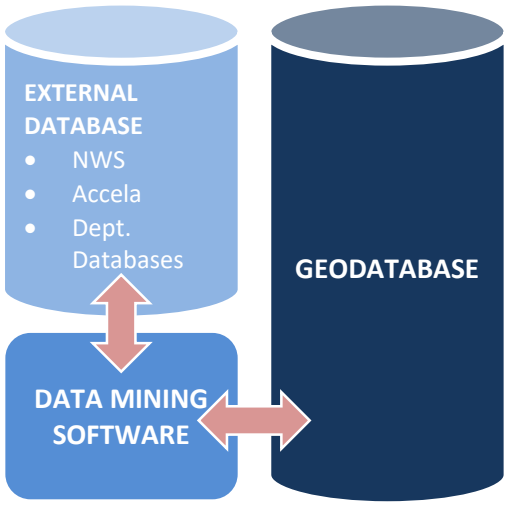
- Field data collection with GPS – infrastructure data for various departments
- Digitizing on screen – capturing data that can be readily discerned from aerial photography or that follows natural and/or man-made features
- Existing data from external sources – data from the county, state, or federal government. Also, data from private organizations.
- Geo-enabled data – data residing in existing databases that can be used to create GIS layers via address or parcel number (incident data, planning data, parks users, etc.)

After doing a full inventory of the existing, partial, or desired data, the City of Berkeley has hundreds of data layers. Each of these layers has a methodology of collection and maintenance. Identifying methods of maintaining data and tracking data maintenance via metadata is critical for the organization. Because of the lack of central GIS staff, GIS data is languishing. Many data layers are not being maintained. This is not because lack of need but because lack of staff resources and the lack of a game-plan for maintenance. Additionally, it is important that an ongoing education of departments be undertaken so they understand the importance of the data sets and are trained on how to maintain key data layers.

Also, there are a number of GIS layers that are needed that can be automated. Much of the data that is being managed in the existing IT systems (SunGard, Accela, New World Systems, etc.) should be data mined and made available as GIS layers. There are a number of software tools that exist that allow data extraction and geo-enablement. Any database with associated addresses can be address-matched to a street centerline layer, tax parcel centroids, or address point layer. Existing databases may need to be formatted to facilitate address-matching functionality. Address-matched features can be visualized within the GIS, and

their attributes can be queried. It is recommended that information stored on paper, or other hardcopy recording, be entered into a database. Once the above information is maintained as digital data, it can be spatially enabled for use in the City's GIS and used like any other GIS layer.

Various data mining applications exist. These applications use an automated geo-coding service that creates GIS data layers from non-spatial relational databases. The results of a successful geo-coding effort will be stored in an industry standard relational database management system (e.g. Microsoft SQL Server). The automated process is based completely on standard SQL statements and is customized to use a variety of stored location-based data (Parcel PIN, Address, Location-ID, etc.). A second function of the automated service is to generate GIS layers in an industry standard portable format (shapefiles or SDE layers) that could be used by a variety of applications. These GIS layers will be created to user specifications. X, Y coordinates will be used to display features in a GIS layer. The graphic to the right diagrams the process of using such an application to extract data.



GIS NEED

Corporate Mobile/Field GIS Access

Multiple City departments expressed interest in utilizing GIS in the field. In coordination with those interests, the selection and implementation of a shared, scalable solution/s should be a high priority. The application should allow for viewing of data and editing where appropriate. The use of the Collector application from Esri and HTML5/Javascript AGOL data viewers should become the City standard. Discussion of options will be detailed later in this plan. Additionally, some departments are reliant on third party mapping solutions (e.g. New World Systems) that aren't fully

leveraging the power of GIS. GIS staff in IT should work closely with these departments to push the vendors to provide fully functional software. IT is looking into a vendor evaluation process that would provide this type of feedback to vendors. Alternatively, the GIS team in IT should work with the department to implement tools such as ArcGIS Online as a fully functional solution. The City should undertake a thorough evaluation of options before implementing any mobile tools. The key is to avoid stovepipes of GIS functionality and implementing technology islands that require data conversion or that don't allow for the

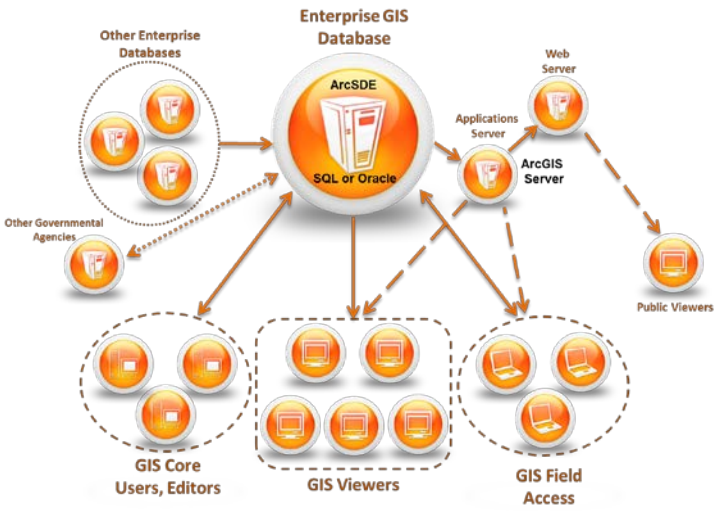
GIS NEED

full use of the enterprise GIS. Overall the City should create mobile GIS standards and keep these standards updated based on the every changing technology.

Expedient Connectivity and Data Access

As with any applications, it is imperative that users have access to needed data and that response time is very quick. Working closely with the GIS Lead, IT will continue to administer the City's network in support of GIS and its related components. IT will need to continually evaluate network infrastructure and configuration to facilitate data transfer and systems integration. The City has existing capacity to serve GIS data via the intranet and Internet. The GIS Lead will need to work closely with IT staff to diagnose and correct any speed and connectivity issues.

Security is a concern for many departments. Some datasets cannot be legally disseminated. As such, it is imperative that database security is addresses and the GIS database set up in such a way that ensure the security of data. The GIS Team and IT staff should administer an individual user permissions policy whereby each user is granted a specific level of access (e.g. read, write), based on assigned responsibility. This would serve to increase security, and in turn minimize risk of integrity compromise, for all data stored and delivered through the GIS enterprise.



GIS use in the field and untethered from a traditional personal computer has become expected. Therefore, it is important that the GIS Team in tandem with appropriate IT staff understand the underlying technology that is being used. Training classes on database management, database optimization, and mobility should be captured in an annual training plan. Requirements will inevitably change (i.e. demands will increase). The role of IT must be one sufficiently flexible to respond, anticipate, and change, in accord.

GIS NEED

Training and Education Strategy

The GIS Team in IT provides citywide training but is limited by staffing. The expanded IT GIS staff should setup and administer training. The GIS staff should be responsible for identifying appropriate classes and education materials for departmental staff. Training and education should be ongoing and based on the level of the user as follows:

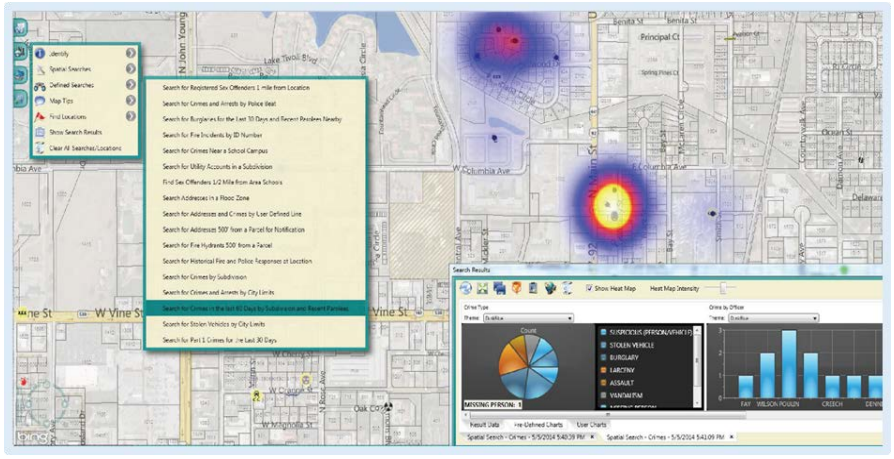
- Tier 1 Training – GIS editing and analytical training. Classes for GIS staff and GIS professionals. High level training based on specific needs and focus areas of Roseville staff. Most of these classes will require training at Esri facilities or online.
- Tier 2 Training – ArcView level classes. Optimally, GIS staff in IT will be able to conduct classes specific to the needs and workflows of the department. These can be one to two hour focused training sessions. This can be augmented by Esri training.
- Tier 3 Training – Training on AGOL, public facing portals, dashboards and other end-user tools. Training should be offered quarterly and should be very focused and last no more than one or two hours.

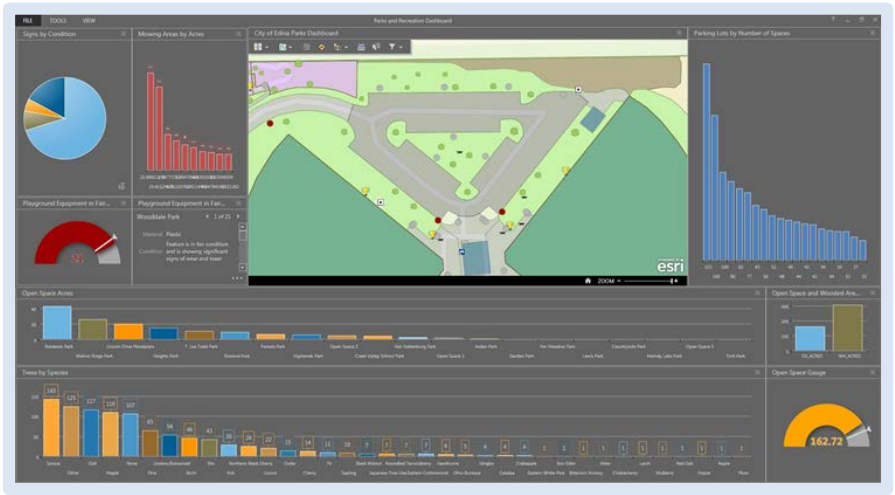
Much more detail will be provided in later chapters of this study in regards to a training and education plan. The Training and Education Chapter should become the basis for developing and maintaining and annual training and education plan.

GIS NEED

Enterprise GIS Portals

One of the litmus test of a successful GIS is the provisioning and use of internal GIS portals for departmental use. The City has consistently deployed solutions using the latest tools from Esri. Esri has spent millions on the development of their latest generation of enablement tools. Esri has released ArcGIS Online and a variety of targeted applications that allows users to use GIS through a very user friendly toolset. Many organizations have begun to use ArcGIS Online to implement targeted GIS portals for each department. It is recommended that the City leverage ArcGIS Online, Esri's WebApp builder, and Esri's dashboard in an effort to provide the next-generation portal experience. The IT GIS team is already putting this into place. The current applications use ArcGIS Server and ArcGIS Online and the GIS Team has provided various portals to City staff. Further refinement of these portals is recommended to provide department specific functionality to each user department. This is discussed in detail in the Software Chapter of this Strategic Plan.





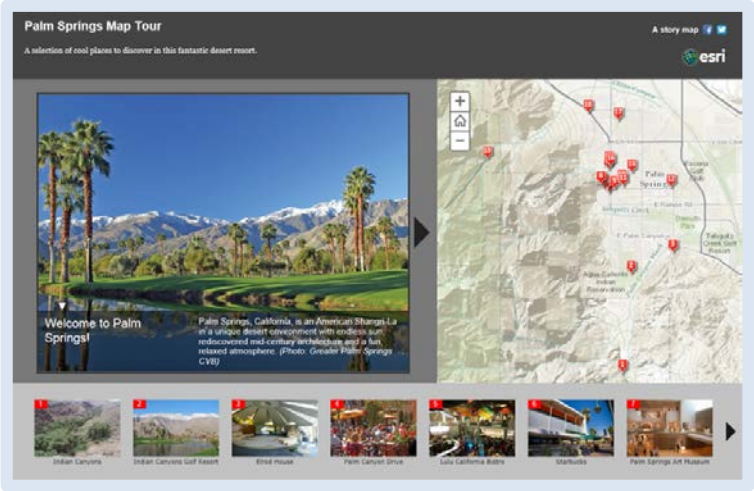
GIS NEED

Public Access to Geospatial Information

Providing a public right-of-entry through the Internet will greatly improve community access to City GIS data. A well-designed web-browser interface would allow those outside of city government to peer into the vast array of these data, permitting anyone to seek answers to relevant questions and self-fulfill requests for information, all with no intervention by the GIS Team in IT other than help files and metadata.

Staff members field numerous questions on a daily basis such as:

- What is the current/future land use of certain property?
- What is the zoning of certain property?
- What is allowed in the zoning?
- What is the maximum density or intensity?
- What block/lot number am I?
- Where is my nearest public utility line?
- Who are my utility providers?
- What is the assessed value of a particular lot or area?
- How much crime is in my neighborhood?
- What City services are available to me?
- What easements are near or on my property?
- What type, and how many rental properties exist?
- What is my evacuation route during a disaster?
- What are the parks and trails in the City?



Example – Public Facing Story Map

Every department interviewed expressed a need to share data with the public via GIS portals The City should implement targeted ArcGIS Online and Storymap applications to provide community members with access to the City's geospatial data. ArcGIS Server makes it relatively easy to deploy applications with differing configurations, functions, and look-and-feel. Targeted applications could be deployed specifically for some

departments (Construction Updates, Parks facilities, etc.), as well as a generic public query portal. With a number of departments interested in providing high-quality geospatial data and maps to the public, Internet GIS data portals should be a City-wide initiative. The City currently provides the "Parcel Popper" application to the public. End users should be surveyed to determine what additional functionally should be added to this application to better meet the needs of the public. Specific departmental portal needs are identified in departmental needs assessments.

GIS NEED

Metadata

GIS has matured in local governements. Most cities have been using GIS now for a few decades. Over time this results in the creation of numerous data layers. One of the cricitical components of a GIS is to maintina information about this data (metadata). Many organizations find over time that they do not know the derivation, accuary, or maintenance schedule of GIS layers. It is important that City staff have a full understanding of the spatial and temporal accuracy of the GIS data. In relation to that concern, focus should be put on creating metadata of the City's GIS data, as well as notification when data is updated. Simply put, Metadata is "data about data." Metadata gives detailed information about all aspects of geospatial data. This is critical in any GIS sustainability plan.

Metadata can give background information about:

- Source
- History
- Content
- Quality
- Condition
- Availability
- Processing
- Technical Details

As a City-wide standard, metadata should be a requirement for all GIS data layers within the central database repository. For the purposes of this GIS need, more focus will be placed on the automated data update notification process. Once all departments receive access to the City's centralized GIS data warehouse, an automated procedure and system of GIS data update notifications should be put in place, so that every city department knows exactly what and when important GIS data layers have been updated. A common communication medium for this task can be accomplished via email notifications to the affected city GIS users. One mistake many organizations make is trying to capture too much metadata. Many national organizations spell out innumerable elements that should be captured via metadata. It is recommended that only the critical elements are captured and tracked.

3

GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY

Information Technology GIS Staff are responsible for annual maintenance of the Parcels layer. Other GIS layers are maintained by other City Departments. However, the GIS Lead is expected to ensure data integrity and the expanded GIS team should begin to utilize tools like Esri's Data Reviewer annually against key datasets.

Legend

Data Layer	The data layer is the GIS thematic data that is being described. The name of the layer or description of the layer is placed in this column.
Creation Methodology	This column describes how the layer was or is anticipated being created.
Recommended Update Division or Individual	This field outlines the division or individual that is anticipated to maintain or develop the data layer during and after full implementation of the Citywide enterprise GIS. Development of new recommended layers will be prioritized for each year of the Strategic Implementation Plan.
Layer Status	Layer state of existence.
Existing	These layers currently exist within the City's GIS.
Recommended/ Desired	These layers are recommended for development or procurement, based on departmental and enterprise needs. These data layers will help support existing business procedures or will compliment other GIS data sets that are already existing and in use by the city. Costs associated for these recommended layers will be based on general estimates – actual cost may vary.
Partial	These layers currently exist in an incomplete or outdated state.

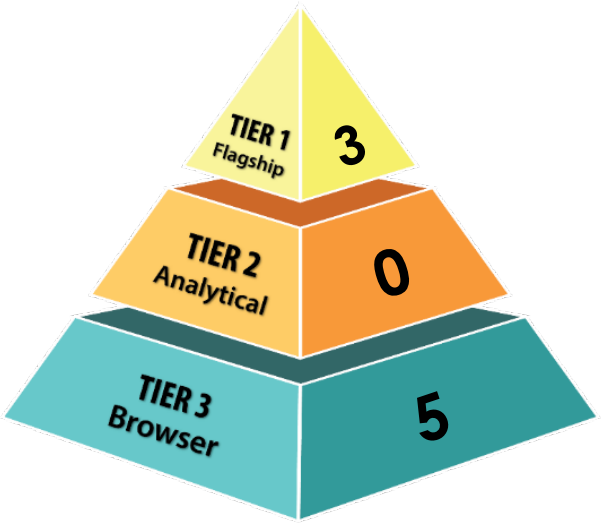
The following lists the City's critical Base Layers:

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Citywide Base Data			
Property	Original tax parcels were digitized and rubber sheeted from scanned hard copy water quality maps circa 1999. Updated manually once a year by the GIS Team using County data for attributes and the County's Adobe PDF parcel maps for geometry changes. Migrated to the LGIM Tax Parcel schema in 2016.	The GIS Team	Existing
Aerial Photography	Current aerial data is delivered by Pictometry through an agreement with Alameda County. The most current data was captured in 2014 with the next flyover scheduled for Spring 2017. The County's current contract with Pictometry calls for one more flyover after the 2017 capture. Older imagery exists for 2006 (custom County flyover), 2009, and 2011 (USGS).	Static Map	Existing
Road Centerlines	Created by RMSI in 2010 from various sources including Alameda County data and pavement management system data (street width). Updated manually by the GIS Team occasionally. Migrated to the LGIM Road Centerline schema in 2016. Zero Waste has a copy that has been updated for routing purposes.	The GIS Team	Existing
Address Points	During the work day, an Analyst in the Information Technology Department updates/creates new addresses in the Land Management (LX) module in SunGard (FUND$). Address points are then created nightly from an ETL that extracts and geocodes (using parcel centroid coordinates) and joining to a parcel table to create the address points feature class.	Automated / Information Technology Department	Existing

4

MULTI-TIER GIS APPLICATION USE

The pyramid and table below outlines the anticipated "Tiers of GIS Use" within the Information Technology Department. All are color coded by the level of desired GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions. The below pyramid reflects the need to expand GIS staff within IT as is detailed in the Governance Chapter of this Strategic Plan.



TIERS OF GIS USERS	
GROUP	ACTIVITY
Tier 1 Flagship	• GIS Administration • Data Maintenance • Data Conversion and Creation • Spatial Data Management • Technical Support • Coordination
Tier 2 Analytical	• Data Maintenance • Analytical Functions/Geoprocessing • Complex Queries • Modeling • Use of Desktop Extensions • High Quality Map Production
Tier 3 Browser	• Browsing/Look-Up • Standard Reports • Simple Query • Map Production

5

RETURN ON INVESTMENT (ROI)

The following table indicates specific Return on Investment opportunities for the Information Technology Department. These specific examples show the true return on investment of the technology.

Return on Investment Opportunity Information Technology Department	
Opportunity	**Explanation**
Save <u>Time</u> and <u>Respond</u> More Quickly to Internal Data Requests	***Staff access to accurate/updated data:*** • Staff should have access to current GIS data to better serve and provide information to the public and decision makers. This should save multiple staff hours a week in the Information Technology Department.
<u>Improve</u> Data <u>Accuracy</u>	***Better GIS Data and Spatial Analysis:*** • Working with other departments and City agencies to update data with higher accuracy can improve the results when analyses are performed. By sending errors found in data to the data owners, errors can be corrected quickly.

Return on Investment Opportunity Information Technology Department	
Opportunity	**Explanation**
Save <u>Money</u>	***Intranet GIS Data Browser and Spatial Analysis:*** • Data can be queried quickly, reducing time spent looking up records manually • Can find areas of high demand and adjust practices accordingly • Providing electronic copies of maps to customers reduces the printing costs of the department.
Increase <u>Productivity</u>	***Intranet GIS Data Browser and Spatial Analysis:*** • Use GIS to assist in production of maps and reports that are requested by various departments • The use of GIS analysis is much faster than completing the tasks manually.

NEEDS ASSESSMENT

PARKS, RECREATION & WATERFRONT

CITY OF BERKELEY
CALIFORNIA
GIS Strategic Implementation Plan

SECTION OUTLINE

1

EXISTING CONDITIONS

DEPARTMENT OVERVIEW

The Parks Recreation & Waterfront Department's (PR&W) mission is "to provide quality park, recreation and waterfront facilities, and related programs and services that are safe and functional while enhancing the urban environment." The Department consists of the following five divisions:

1. **Fiscal and Administrative Services** – provides overall management of departmental functions.

2. **Capital Projects Planning and Design** – plans and manages capital improvement projects at City-owned parks and waterfront facilities.

3. **Park Operations** – maintains and enhances the City's 52 parks and maintains over 40,000 public trees, as well as medians and pathways.

4. **Recreation and Youth Services** – provides a wide variety of recreational opportunities with a concentration on the City's youth.

5. **Waterfront** – maintains and operates the Berkeley Marina and its related facilities.

The Parks Recreation & Waterfront Department currently employs 148 staff in total.

GOVERNANCE OF GIS

The Parks Recreation & Waterfront Department is not currently a major consumer of GIS but has identified several potential opportunities for use of the City's GIS. Currently, like other departments, Parks Recreation & Waterfront has access to the City's intranet mapping applications, though the Department does not currently make any significant use of GIS other than Forestry staff using GIS to derive tree counts by zone and basic map browsing.

There are generally three tiers of GIS users. A Tier 1 - Flagship GIS user typically conducts GIS administration and coordination at the enterprise level, has access to a fully functioning GIS toolset to create and maintain enterprise data, and manages the enterprise database. A Tier 2 - Analytical GIS user focuses on data analysis, complex querying and data modeling, along with department level data maintenance. A Tier 3 - Browser GIS user requires only general browsing GIS data functions to create reports, query standard data sets, create tasks like mailing labels, and produce maps.

The table below summarizes the current GIS staffing and or GIS usage in the Parks Recreation & Waterfront Department. Type represents the current level of GIS experience based on job requirements and GIS usage can be categorized as Limited, Moderate, or High (i.e. frequency of use), and Primary Tools describes what tools, or how GIS is used, to carry out GIS functions.

Current GIS Staffing				
Type		Number of Users	GIS Usage	Primary Tools
	GIS Flagship (Tier 1)	0	N/A	None
	GIS Analytical (Tier 2)	0	N/A	None
	GIS Browser (Tier 3)	10	N/A	Intranet Map Browsers

HARDWARE AND SOFTWARE

The Parks Recreation & Waterfront Department has personal computers for each of its employees. The table below summarizes the hardware in use for the Parks Recreation & Waterfront Department:

Hardware Issues Summary	
Type	Notes
Personal Computers	One for each staff person
Laptops	Available as needed
Printers	Ample printers available for use
Plotters	None
GPS	None
MDTs	None
Scanners	None

The Parks Recreation & Waterfront Department utilizes the following software applications that are pertinent to this study:

1. Microsoft Office– Office productivity
2. Active Net – Online Registration System (being replaced by BlueRec)
3. FastLook – database containing as-builts and plans
4. Pacsoft – marina management software
5. Lagan – for tree damage reporting and work orders

2
GIS NEEDS ASSESSMENT

GIS NEEDS

Parks and Recreation Departments across North America have begun to realize the benefits of implementing GIS technology for their business function needs. To respond with the necessary means of maintaining public parks and recreational facilities, personnel must have a system that can provide the basis for sound decision-making and information processing that keeps pace with the increasing amount of demand for their services.

GIS users throughout the Department will benefit from access to GIS data and the ability to query, generate basic maps and perform elementary analysis using layers found in the City's GIS data. Additionally, integration with the department's in-house recreation management system (Active Net) and work order management system (Lagan) will be beneficial for continued development of the enterprise GIS. Eventually, the Department desires to have a full suite of GIS tools to include; intranet, executive dashboards, field data collection, editing, and a host of public facing tools. This is certainly an ambitious goal, but obtainable with steady progress and implementation of key data and applications.

The majority of the Department will be Tier 3 Browser level users of an enterprise GIS. GIS implementation will require a certain level of application integration, data access, and data process implementation that would enable them to use various GIS client application functions. Access to information should be

provided by several user-friendly applications, which will be discussed in detail following each need if appropriate.

The table below summarizes the potential needs identified by Parks Recreation & Waterfront Department staff and how they are to be met:

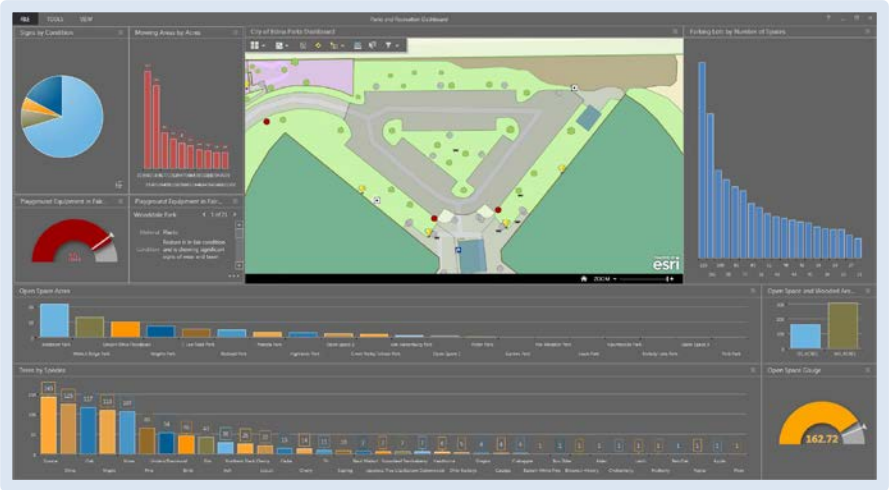
GIS Need	*Method/Application to Meet Need*
☑ Mapping and Spatial Analysis of Department Specific Data	▢ Intranet GIS Data Browser
☑ Use GIS to Track Capital Projects	▢ Intranet GIS Data Browser
☑ Enabling Existing Databases – Data Integration	▢ Data Mining Applications
☑ Specialized Online Mapping Themes	▢ Internet Applications, Park and Recreation Finder and/or Story Maps
☑ Field Access to Geospatial Data Incorporating Field Data Collection	▢ Collector Application ▢ Tablets
☑ Data Development and Management of Pertinent Data Layers	▢ ArcGIS Desktop ▢ Collector Application
☑ GIS Education for Department Staff	▢ Intranet GIS Data Browser Training ▢ Collector Application Training ▢ Executive Dashboard Training

GIS NEED

Mapping and Spatial Analysis of Department Specific Data

A key need identified by PR&W personnel is increased and improved access to shared GIS data within the City. This includes the most recent parcel, address, and street centerline data as well as high-resolution orthophotography. Users will benefit

from access to the base data (parcels, and parcel related data) as well as department-specific information. Upon further implementation of an enterprise GIS, Recreation Parks & Waterfront will be able to more effectively access data from other departments, use buffering to show nearby property owners, other associated data, and also to perform spatial analysis using a simple spatial selection.



It is recommended that an enterprise-wide ArcGIS Server (AGS) based Intranet GIS Data Browser tool be utilized to access pertinent spatial data, imaging and spatial analysis functionality. Each department would have their own portal that contains data, reports, and queries pertinent to their needs. The application must be fast and easy-to-use. This application will not only allow users to view GIS data but also data entered into Parks and Recreation system databases and data entered into legacy systems in other departments, as well. This application will serve as the primary GIS application for Recreation Parks & Waterfront and enable staff to accomplish about 90% of their GIS/mapping tasks. These tasks will include the quick query and search of data, as well as more intricate uses such as mass notifications and map production.

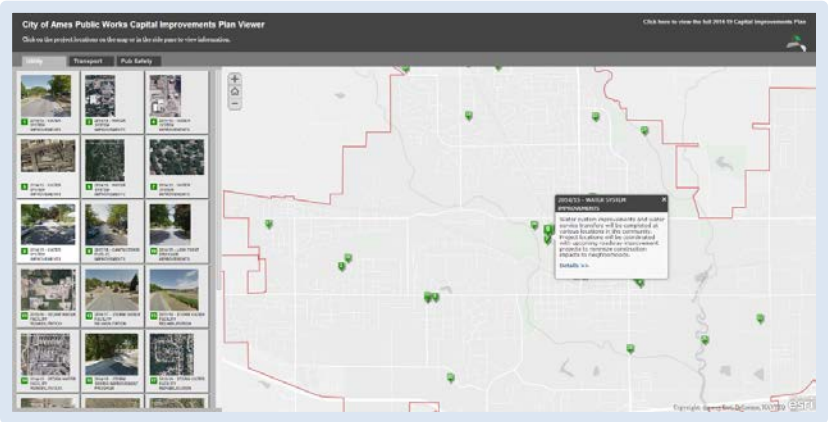
PR&W should work with the GIS Team in IT and train specific PR&W personnel in the use of GIS to gain quick successes based on improving existing layers (e.g. trees), mapping PR&W assets, and providing improved public access to online mapping. Most PR&W staff should utilize an ArcGIS Online Intranet GIS data browser to view and interact with pertinent departmental data, conduct basic spatial analyses, produce maps and assist in day-to-day activities.

The following would be key uses of the intranet application for the Recreation Parks & Waterfront Department:

- Viewing patron demographics (including parks, facilities, and users)
    - Querying customers by age
    - Targeting key demographics for specific services
    - Assisting customers with demographic-related questions
    - Viewing customer hotspots
- Performing tree analyses
- Developing mowing schedules
- Querying Park and Marina assets
- Identifying problem areas based on work orders completed
- Managing Capital Improvement Projects for Parks and the Marina
- Enabling staff to conduct informed Master Planning

GIS NEED

Use GIS to Track Capital Projects



Static Map of Berkeley Parks and Marina

PR&W needs the ability to manage all of its Capital Improvement Projects within GIS. Currently, staff has to go to multiple sources to pull together the information that they need. Additionally, there is no map layer which tracks historic, current, and future capital projects. This can lead to inefficiencies and duplication of work. A GIS layer should be created to track all capital projects that are within the jurisdiction of the Department. Some of the benefits of tracking these projects in GIS are the ability to quickly view and analyze where funds have been spent over a period of time and to notify the public of work occurring in a specific Park or at the Marina that may hinder or prevent public access. Additionally, this will ensure that capital projects are coordinated to optimize resources and reduce duplication.

GIS NEED

Enabling Existing Databases – Data Integration

The Parks Recreation & Waterfront Department has data stored in electronic databases (Active Net, FastLook, Pacsoft, Lagan) that have addresses as an attribute; therefore, spatially enabling these databases will yield important datasets for the GIS. Any database with associated addresses can be address-matched to a street centerline layer, tax parcel centroids, or address point layer. Address-matched features can be visualized within the GIS, and their attributes can be queried. It is recommended that information (tabular data) stored in paper or other types of hardcopy recording be entered into a database such as MS SQL Server. Once the above information is maintained as digital data, it can be spatially enabled for use in the city's GIS and used like any other GIS layer.

In order for the department's internal databases to be automated and spatially enabled, these databases need to be linked to a GIS data browser for maximum use of both systems. A data mining application is an automated geocoding service that creates GIS data layers from non-spatial relational databases. The results of a successful geocoding effort will be stored in an industry standard relational database management system (SQL Server). The automated process is based completely on standard database statements and is customized to utilize a variety of stored location-based data (Parcel PIN, Address, Location-ID, etc.). A second function of the automated service is to generate GIS layers in an industry standard portable format (SDE layers) that could be utilized by a variety of applications. These GIS layers will be created to user specifications. X, Y coordinates will be utilized to display features in a GIS layer. The data would then be consumable within an intranet browser, web applications, mobile apps or more analytical tools such as ArcGIS.

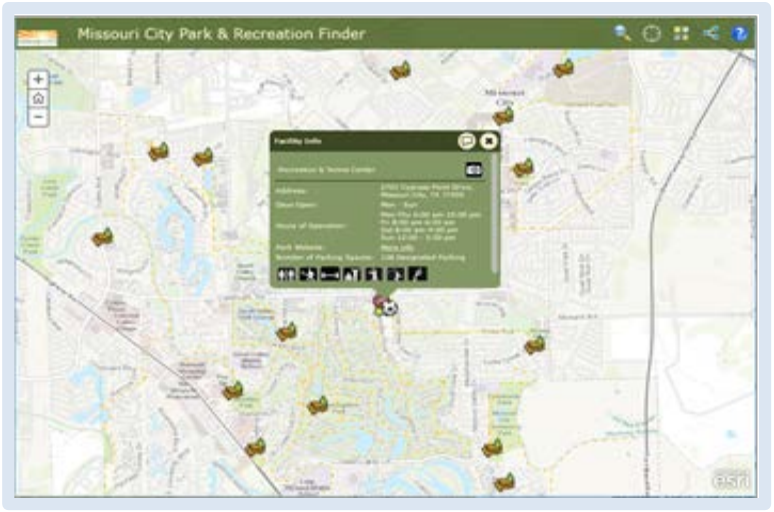
GIS NEED

Specialized Online Mapping Themes

PR&W staff expressed a need to develop online web mapping tools for public access with a focus on Parks Recreation and Marina facilities and amenities. Dynamic online maps with specific focuses on information, directions, and wayfinding for hiking trails, park locations, park amenities, marina amenities, and a host of other key data features put valuable information in a user-friendly environment for public consumption.

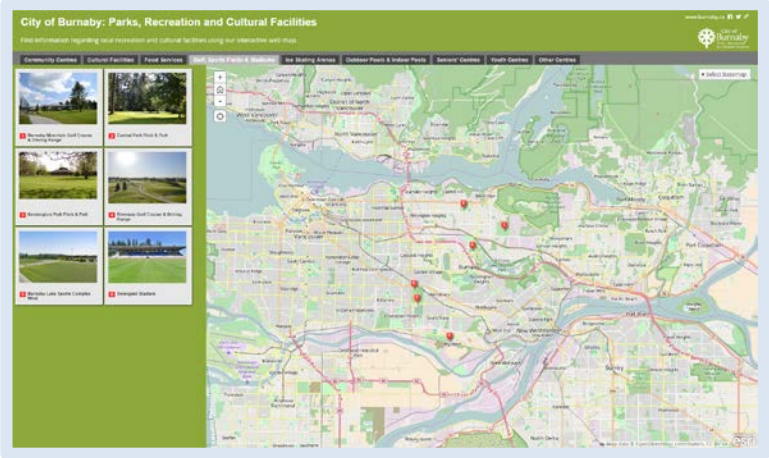
City residents would benefit from accurate Parks Recreation and Marina GIS layers and interactive mapping applications. As the City and the Department improve existing data layers and expand the data repository with new data layers, public access mapping tools will prove to be of more utility and value. Working with the GIS Staff, PR&W staff must help to define the general city data layers to present, as well as the Department specific layers. Map feature symbology, colors, functionality, security settings, and data content must be designed to be consistent with City standards.

The introduction of a public-facing Park and Recreation Finder would immediately put frequently-requested information into the hands of community. This application graphically engages the public through an interactive map of Department attractions, and provides supplemental information for each location. Giving community members the means to directly search for park and recreation opportunities by location, desired amenities, or proximity enables staff to work on more pressing tasks and initiatives.



Existing Park and Recreation Finder

One of the most recent innovations in GIS for the public is Story Maps from Esri. Story maps are lightweight, open-source web applications that combine web maps created using ArcGIS Online, Esri's cloud-based mapping system, with multimedia content - text, photos, video, and audio - to let you tell stories about services, events, and other items of interest. Story Maps lend themselves well to parks and recreation, and offer exciting and visually pleasing ways to engage community members. A number of story map ideas were discussed during the needs assessment interviews to include:



Parks and Recreation Story Map

- Park and Marina facilities and amenities
- Park and Marina event planning
- Parking locator and nearby attractions
- City maintained Trees and Landscaping

GIS NEED

Field Access to Geospatial Data Incorporating Field Data Collection

Another identified need by PR&W personnel is to have field access to mapping data. Mobile devices coupled with Esri's Collector Application should be utilized in the field to allow access to park and marina data, the ability to conduct address searches, and the capability to update the location and attribution of all department features configured for editing. Linked attachments, images, asset documentation, scanned forms, etc. would also be readily accessible in the field through this application. Weekly staff inspections conducted with a GPS-enabled tablet and geospatial information would enable staff to do their inspections via

electronic forms tied to each asset. This same type of application could be used for sports field management. Information regarding amenities, lights, fertilizer application history, grass feed, etc. could be tracked and updated via the mobile Collector Application.

GIS NEED

Data Development and Management of Pertinent Data Layers

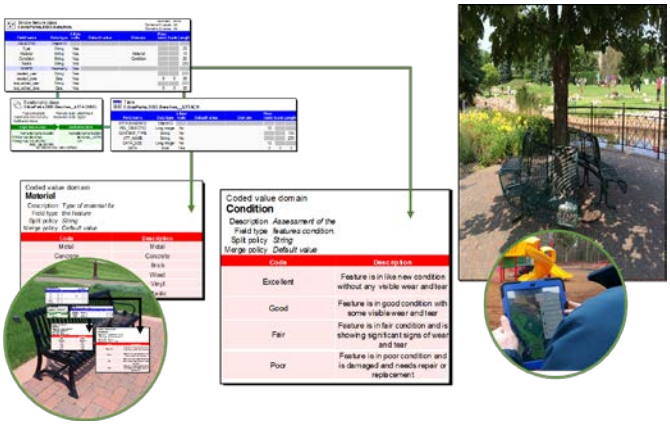
PR&W personnel expressed interest in using of GIS data and software in a more comprehensive manner. In coordination with those interests, GIS data development and administration should be a high priority for the PR&W GIS implementation. In conjunction with GIS staff in Public Works, staff within PR&W should work to author and create any required and requested data layers. These layers are identified in the GIS Data Layer Inventory section further below. As stated in that section, all data layers should be integrated, consolidated, and centrally stored in the central GIS database.

PR&W will benefit from GIS as long as the assets, facilities, and buildings can be represented and displayed within the GIS. The parks (boundaries) layer has been created. Next, the assets should be located on GIS layers (e.g. irrigation systems, benches, trees). For a GIS to be an effective management and mapping tool the assets that PR&W maintain and manage must be represented in data layers. A field inventory should be conducted of all PR&W assets. A photo should be taken of each asset. Each of these photos should be linked geographically to their GIS asset. During the field inspection process, each asset should be given a rating and a color code based on this rating. For instance, an asset given a bad rating receive a color code of red in the database, those in moderate condition receive a yellow, and those in good condition receive a green color code. The GIS data layer/s should be created, and an update application should be released to staff.

The following is a list of assets that should be represented in the GIS; the parentheses identify the data type each asset would be represented by:

- Trees (points) – currently exists
- Paths and trails (segments)
- Park locations and boundaries (polygons, points) – currently exists
- Parks and recreation facility locations (points)

- Playing fields and amenities (polygons, points, lines)
- Park lights (points)
- Parking lots (polygons, points)
- Parking meter locations (points)
- Picnic areas (points, polygons)
- Shelters and buildings (polygons)
- Play structures (points, polygons, lines)
- Golf and Disc Golf Course Features
    - Bunkers (polygons)
    - Fairway (polygons)
    - Putting Greens (polygons)
    - Tee Areas (polygons)
    - Water Hazards (polygons)
    - Scenic Pictures of each Hole for Story Map
- Utility infrastructure within City parks and the marina (points, polygons, lines)
    - Irrigation lines (segments) and heads (points)
    - Phone lines (segments)
    - Electric lines (segments)
    - Gas lines (segments)
    - Sewer lines (segments)
    - Septic systems
    - Water lines (segments and points)
    - Storm sewer infrastructure (segments and points)

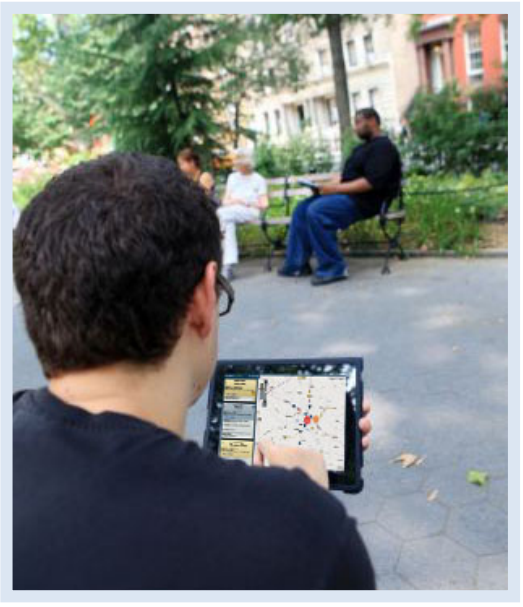


It is recommended that a full database design be performed for PR&W in conjunction with the GIS Team in IT or a consultant. This database design will require PR&W staff to sit down and discuss the assets that need to be inventoried within the park system and at the marina. The list above should be used as a starting point, but further refined and added to - based on the unique needs of the City of Berkeley. Each asset should then be further qualified and additional attributes identified. For example, for a bench, what does the City want to see regarding each bench? Such as, the material, manufacturer, if it has a plaque on it, and

the condition of the bench. These details should be part of the database design process, which will ultimately be the base for the PR&W GIS.

Once the locations of these assets are known, PR&W will be able to track and manage activities at an individual asset level such as:

- path light / field light repairs
- pesticide / herbicide / fertilization application
- playground equipment repairs / construction
- park structure repairs / construction
- trail and path repairs / maintenance
- field repairs
- irrigation
- landscaping
- tree maintenance / blow down
- grass cutting



The complete collection of capital asset data typically requires a large investment of time and money. However, that investment will quickly lose its value if newly created datasets are not maintained. All new features that are installed or constructed, as well as changes to existing infrastructure and asset inspections, must be reflected in the digital database; spatial and attribute information must be captured immediately.

GIS NEED

GIS Training for Department Staff

It is important that Parks Recreation & Waterfront staff understand the basic uses of GIS and can use the applications discussed above for their various needs. Therefore, PR&W staff should attend educational seminars offered by the City that deal with general topics like, “What is GIS?” This will help them gain a basic understanding of GIS concepts. Since the Department will be responsible for maintaining several PR&W specific GIS layers, training for editors will be required. In addition, training on the use of the intranet browser and/or any PR&W specific applications that are deployed, is also recommended.

3

GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY

The following are key data layers for PR&W. Parks Recreation & Waterfront staff are not currently responsible for the maintenance of GIS data layers but it is recommended in this report that they take on a data maintenance role for various Department specific layers. In addition, PR&W also requires access to existing GIS data. It is expected that once all departmental data is integrated, consolidated, and centrally stored, that staff will have access to all non-classified GIS data layers from other departments.

Legend

Data Layer	The data layer is the GIS thematic data that is being described. The name of the layer or description of the layer is placed in this column.
Creation Methodology	This column describes how the layer was or is anticipated being created.
Recommended Update Division or Individual	This field outlines the division or individual that is anticipated to maintain or develop the data layer during and after full implementation of the Citywide enterprise GIS. Development of new recommended layers will be prioritized for each year of the Strategic Implementation Plan.
Layer Status	Layer state of existence.
Existing	These layers currently exist within the City's GIS.
Recommended/ Desired	These layers are recommended for development or procurement, based on departmental and enterprise needs. These data layers will help support existing business procedures or will compliment other GIS data sets that are already existing and in use by the city. Costs associated for these recommended layers will be based on general estimates – actual cost may vary.
Partial	These layers currently exist in an incomplete or outdated state.

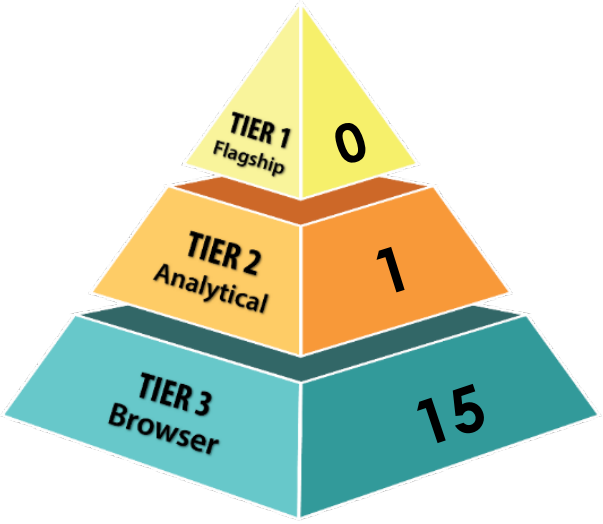
The following table lists those data layers that are important to PR&W.

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Parks Recreation & Waterfront GIS Data			
Capital Improvement Projects	Digitize from Plan Documents	PR&W	Recommended
Irrigation	Digitize from Plan Documents	PR&W	Recommended
Marina Facilities & Assets	GPS / Digitize from Aerials	PR&W	Recommended
Mowing Areas	Digitize from Aerials	PR&W	Recommended
Park Facilities & Assets	GPS / Digitize from Aerials	PR&W	Recommended
Park Boundaries	Extract from Parcels	GIS Team	Existing
Planting Sites	Digitize from Aerials	PR&W	Existing
Stumps	GPS	PR&W	Existing
Trees	GPS	PR&W	Existing
Citywide Base Data			
Property	Original tax parcels were digitized and rubber sheeted from scanned hard copy water quality maps circa 1999. Updated manually once a year by the GIS Team using County data for attributes and the County's Adobe PDF parcel maps for geometry changes. Migrated to the LGIM Tax Parcel schema in 2016.	The GIS Team	Existing
Aerial Photography	Current aerial data is delivered by Pictometry through an agreement with Alameda County. The most current data was captured in 2014 with the next flyover scheduled for Spring 2017. The County's current contract with Pictometry calls for one more flyover after the 2017 capture. Older imagery exists for 2006 (custom County flyover), 2009, and 2011 (USGS).	Static Map	Existing
Road Centerlines	Created by RMSI in 2010 from various sources including Alameda County data and pavement management system data (street width). Updated manually by the GIS Team occasionally. Migrated to the LGIM Road Centerline schema in 2016. Zero Waste has a copy that has been updated for routing purposes.	The GIS Team	Existing
Address Points	During the work day, an Analyst in the Parks Recreation & Waterfront Department updates/creates new addresses in the Land Management (LX) module in SunGard (FUND$). Address points are then created nightly from an ETL that extracts and geocodes (using parcel centroid coordinates) and joining to a parcel table to create the address points feature class.	Automated / Parks Recreation & Waterfront Department	Existing

4

MULTI-TIER GIS APPLICATION USE

The pyramid and table below outlines the anticipated "Tiers of GIS Use" within the Parks Recreation & Waterfront Department. All are color coded by the level of desired GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions.



TIERS OF GIS USERS	
GROUP	ACTIVITY
Tier 1 Flagship	• GIS Administration • Data Maintenance • Data Conversion and Creation • Spatial Data Management • Technical Support • Coordination
Tier 2 Analytical	• Data Maintenance • Analytical Functions/Geoprocessing • Complex Queries • Modeling • Use of Desktop Extensions • High Quality Map Production
Tier 3 Browser	• Browsing/Look-Up • Standard Reports • Simple Query • Map Production

5

RETURN ON INVESTMENT (ROI)

The following table indicates specific Return on Investment opportunities for the Parks Recreation & Waterfront Department. These specific examples show the true return on investment of the technology.

Return on Investment Opportunity Parks Recreation & Waterfront Department	
Opportunity	**Explanation**
Improved <u>Efficiency</u>	***Intranet GIS Data Browser and Spatial Analysis:*** • Better quality and quicker decision making for park and marina planning • Focused marketing • Improved and quicker provision of background data for park and marina construction projects to consultants ***Field Access to Geospatial Data Incorporating Field Data Collection:*** • Allows for doing the weekly inspections electronically as well as accessing plans in the field.

Return on Investment Opportunity Parks Recreation & Waterfront Department	
Opportunity	**Explanation**
Improve Data Accuracy	***Better GIS Data and Spatial Analysis:*** • Working with other departments and City agencies to update data with higher accuracy can improve the results when analyses are performed. By sending errors found in data to the data owners, errors can be corrected quickly.
Improve Communications	***Intranet GIS Data Browser and Spatial Analysis:*** • Much improved communication and coordination with other departments when it comes to planning for events, traffic control issues, and planning of assets and infrastructure. • More focused communication with patrons based on location and data. • Provide interactive mapping applications to better serve community
Save Time and Improve Customer Service	***Public Access to Geospatial Information:*** • Staff can respond rapidly to customer issues • Improving park user experience
Effective Management of Assets and Resources	***Intranet GIS Data Browser and Spatial Analysis:*** • Staff can better maintain natural assets along with maintenance of park and marina infrastructure such as signage and utilities.

NEEDS ASSESSMENT

PLANNING DEPARTMENT

CITY OF BERKELEY

CALIFORNIA

GIS Strategic Implementation Plan

SECTION OUTLINE

1

EXISTING CONDITIONS

DEPARTMENT OVERVIEW

The Planning Department employs approximately 81 full-time equivalent staff and is comprised of five divisions: Land Use Planning, Office of Energy and Sustainable Development (OESD), Building and Safety, Permit Service Center, and Toxics Management. The department is responsible for providing services related to land development, sustainability, and strives to streamline the permit process while preserving and enhancing the quality of life in Berkeley. The following summarizes functions of each division:

- **Building and Safety Division** - reviews proposed construction documents for conformance to the building and other applicable codes; approves building, plumbing, mechanical and electrical permits; inspects construction projects to ensure conformance with the approved plans and code provisions, investigates work done without permits, and provides code information and interpretation to the public and other city agencies.

- **Land Use Planning Division -** responsible for developing and implementing land use policy for the City of Berkeley. The Special Projects Team prepares area plans, such as the Downtown Area Plan and the Adeline Corridor Plan, develops amendments to existing area plans, the Zoning Ordinance, the General Plan, and updates the Housing Element. The Current Projects Team processes land use development applications to ensure conformance with the Zoning Ordinance and the General Plan, and conducts environmental review of proposed development projects in conformance with the California Environmental Quality Act (CEQA).

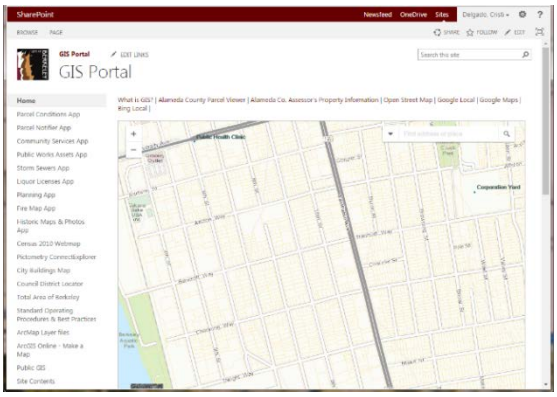
- **Office of Energy and Sustainable Development** - develops policies and implements programs to promote sustainable resource practices and reduce energy and water use and the associated greenhouse gas emissions in both City operations and the Berkeley community.

- **Permit Service Center** - issues building permits and routes plans to the various reviewing City departments, providing a one-stop service to the public for development applications.

- **Toxics Management Division** - State-Certified Unified Program Agency (CUPA), responsible for implementing, inspecting and enforcing California Environmental Protection Agency (Cal EPA) and hazardous materials codes associated with the Governor's Office Emergency Services (Cal OES) and State Fire Marshall within the City of Berkeley. TMD conducts industrial inspections, data gathering and enforcement regulations on: chemical storage; accidental releases; hazardous waste generation (including universal wastes); hazardous waste treatment; pollution prevention; petroleum aboveground storage tanks; underground storage tanks; and household hazardous waste.

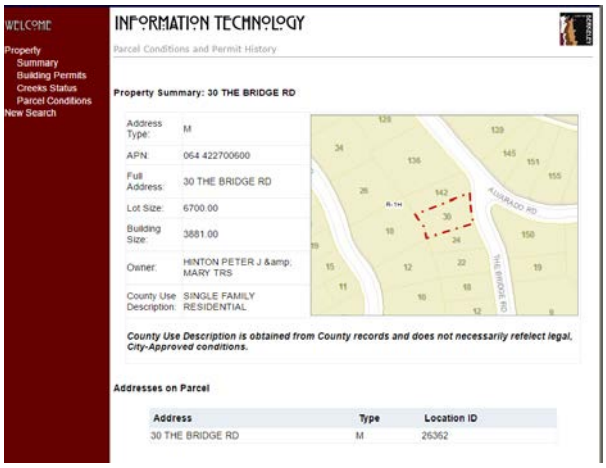
GOVERNANCE OF GIS

Planning Departments inherently need GIS as a majority of their work deals with land related items that lend themselves to mapping and analysis. Planning cannot carry out its functions efficiently without GIS technology. Planning relies on GIS staff in IT for various GIS services and products. Staff use various tools and services as follows:



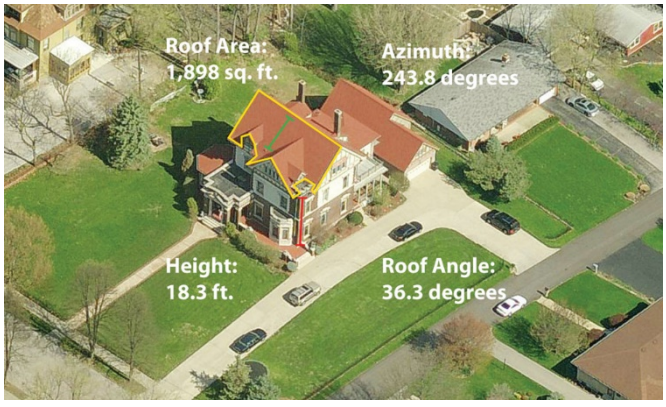
Planning Map Application

- Planning Map – this is an internal application that provides key planning related data and allows for some data downloads. The application was created by using Esri's Web AppBuilder. The Web AppBuilder uses JavaScript and HTML5 which makes the resultant applications platform neutral (work on PCs, tablets, phones).



Property Map Application

- Parcel Information (Parcel Popper) – this application is used by multiple divisions within Planning to view property related information. In some cases, this data is then entered in Accela.
- Pictometry – the city has access to oblique aerial photography from Pictometry. Pictometry comes with a viewer that allows you to view and analyze the photography.
- Mailing label Application – this application is used for creating public notifications. It is currently being replaced with a more modern application that uses the Esri Web AppBuilder
- Accela Map – Accela comes with an internal mapping application for viewing selected information within Accela



Pictometry Imagery

- The department is considering Civic Insight or Building Eye which have mapping components. These applications will be used for public interaction.
- GeoTracker – an application from the state that contains the location of underground storage tanks, incidents, and spills

It is important that staff within Planning continue to expand their GIS capabilities. Staff should be equipped to maintain some of their own core data sets (following best practices for editing and maintain data) and utilize GIS tools to create a majority of their mapping needs.

The table below summarizes the current GIS capable staffing within the Planning Department. Type represents the current level of GIS experience based on job requirements, GIS usage can be categorized as Limited, Medium, or High (or frequency of use), and Primary Tools describes what tools, or how GIS is used, to carry out GIS functions.

Current GIS Staffing				
Type		Number of Users	GIS Usage	Primary Tools
	GIS Flagship (Tier 1)	None	NA	None
	GIS Analytical (Tier 2)	1	Low	ArcMap for Editing Some Limited Data Sets
	GIS Browser (Tier 3)	40	Medium	Various GIS portals for viewing data

HARDWARE AND SOFTWARE

Any hardware issues that were discussed during this Needs Assessment are summarized in the table below. Enterprise wide issues will be discussed in greater detail throughout later chapters of this Needs Assessment and GIS Strategic Implementation Plan.

Hardware Issues Summary	
Type	Notes
Personal Computers	Personal computers are available for all staff
Laptops	A few available to staff
Mobile Devices	None being used for GIS
Printers	Available to office staff
Plotters	None
GPS	None
Scanners	Available for use

The Planning Department utilizes the following software applications:

1. Microsoft Office– Used for office productivity
2. Accela – Enterprise land management system
3. GIS Portals – Viewing Planning and property related data
4. Pictometry – Oblique aerial photography
5. GeoTracker - State of California hazardous materials viewer
6. Open Data Portal – Accessing key data layers
7. Public Notifications Tool – Custom developed

2
GIS NEEDS ASSESSMENT

GIS NEEDS

The Planning Department would like to further implement and embrace GIS and its complementary technologies. From planning project information to data within Accela to in-house GIS data management, the department could leverage and further integrate existing investments in its technology infrastructure to develop an effective solution for its particular mapping and spatial analysis needs.

Similar agencies across the country have implemented GIS in varying capacities, and Planning is well positioned to further implement GIS technology. Keys to a comprehensive GIS effort will be the implementation of mapping and spatial analysis applications throughout the various divisions of the department, an increase in educational opportunities, public facing GIS portals, as well as dynamic, real-time data editing and maintenance.

Based on this Needs Assessment, Planning has several identified GIS needs. Where applicable, each need will be followed by an application or method to meet that need, some applications/methods will meet several needs. A method or application is only described under one need, if it applies to multiple needs refer to the previous need for a description. The following table summarizes these needs and how they are to be met.

GIS Need	Method/Application to Meet Need
☑ Data Layer Design, Creation, and Enhancement	• ArcGIS for Desktop (Standard) • ArcGIS Online • Data Mining/Geocoding Application
☑ Increase GIS Skills, Training, and Staffing	• ArcGIS Desktop • Training Classes • Additional Staffing
☑ Department-Wide Access to Geospatial Data	• Internet and Intranet GIS Data Browser • ArcGIS Online
☑ Public Access to Geospatial Data	• Internet GIS Data Browser • ESRI Story maps • ArcGIS Online • Mobile GIS Data Browser
☑ Field Access to Geospatial Data	• Mobile GIS Data Browser • Tablet Computers • ArcGIS Online
☑ Advance Analysis Tools	• ESRI Extensions

GIS NEED

Data Layer Design, Creation, and Enhancement

The most expensive, yet important aspect of the Planning GIS initiative is the creation and management of complete and accurate GIS data sets. A number of Planning layers and related data residing in business systems (e.g. Accela) has already been created. Continuing to create and maintain this data is a critical component for success. However, the primary need identified during the Needs Assessment interviews was the need for data. Some staff indicated that they don't use GIS as much as they could because of missing data. The following are the data layers that were identified as needed or in need of updating:

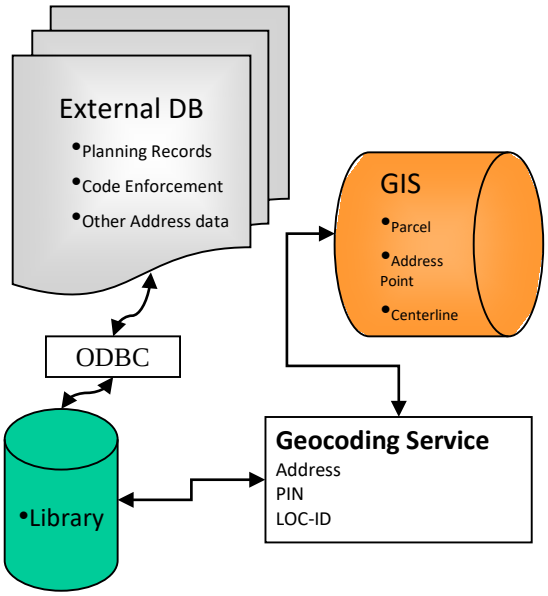
- Landmarks layer – has been created but needs to be updated. Currently, tracked in a database and then geo-enabled.
- Environmental buffers along creeks
- Setbacks and variances
- Liquefaction data

- Fire hazard zones
- Schools
- Alcohol licenses – in database at the state, needs to be acquired and geo-coded
- Storm water runoff buffers
- Data within Accela geo-enabled
- Special projects layer
- Properties with unreinforced masonry, soft stories, building stock, E-3 balconies (most in Accela)
- Fully built out solar installation layer
- Private sewer laterals
- Micro-grids
- Sustainability related data and layers – sea level rise, climate action plan, greenhouse gas data
- Geo-enable toxics database
    - There are 450 sites in Berkeley regulated under BMC Title 15. A wealth of data has been tracked about these sites. Other departments like Fire and Police need access to this data.
    - Contaminated sites – approximately 150 of those. Tracking data such as its CEQA status.
    - Well locations – monitoring wells for contaminated sites. Some are semi-permanent, others are managed for a few years and forgotten but still pose a nuisance.
- Underground storage tanks from the State
- Soil borings
- Archaeological shell mounds
- Below market rate units
- Accessible dwelling units

The above list is just a subset of all of the possible data layers needed by Planning. Staff will never fully benefit from GIS unless their needed data is readily available. The biggest impediment to the creation and maintenance of this data is staffing (this will be discussed in the next need).

Where possible it is recommended that Planning discontinue tracking data in Microsoft Access databases or Microsoft Excel spreadsheets for data that could be better managed in GIS. These files should be geo-enabled and converted into GIS layers. Moving forward, staff should be given the training to update this data via the GIS instead of in Excel or Access. Any needed reports should be generated using Microsoft SQL Server Reporting Services, or through canned reports via the GIS.

Some of the aforementioned data stored in external databases (e.g. Accela) will require more than just linking, but creation of feature classes (e.g. permits). These databases contain an address field making them a candidate for spatial enablement. Any database with associated addresses can be address-matched to a street centerline layer, tax parcel centroids, or address point layer. This data can be geo-enabled through an automated geocoding service that creates GIS data layers from non-spatial relational databases. The results of a successful geo-coding effort will be stored in an industry standard relational database management system (SQL Server, Oracle, etc.). The automated process is based completely on standard SQL statements and is customized to utilize a variety of stored location-based data (Parcel PIN, Address, Location-ID, etc.). A second function of the automated service is to generate GIS layers in an industry standard portable format (SDE layers) that could be utilized by a variety of applications. These GIS layers will be created to user specifications. X, Y coordinates will be utilized to display features in a GIS layer. The graphic below shows the process of using a geocoding service to extract data. Once the above information is maintained as digital data, it can be spatially enabled for use in the City's GIS and used like any other GIS layer for viewing, reporting, analyzing, etc.



Practical Example

Planning needs to view the location of permits along with code enforcement cases from Accela. Customer records related to an address can be mapped by linking each record to a spatial feature such as an address point. The geocoding service can generate and export the resulting GIS layer on a regularly scheduled basis.

GIS NEED

Increase GIS Skills, Training, and Staffing

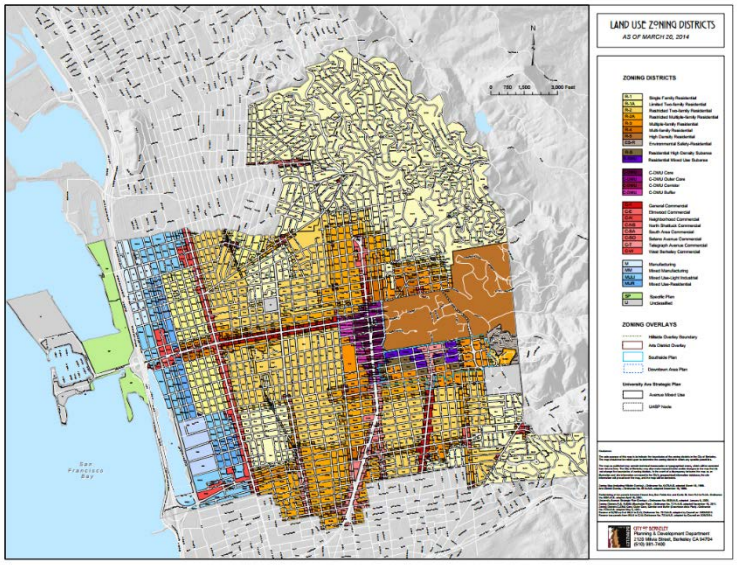
Accomplishing the previous need is not possible today based on staff availability and expertise. The City currently has only one full-time staff to support GIS in the central GIS group in IT. Additionally, Planning has no staff dedicated to GIS. There have been attempts to enable Planning staff to assist with GIS data management. Over the last year a data owner/maintenance schedule was established in coordination with the GIS Lead in IT and Planning staff. However, most of these staff identified to assist were interns and have left the City. Administrative staff in Planning does some data updates for solar installations and alcohol licenses and have been trained to use ArcMap. However, overall there is very little data creation and maintenance occurring for Planning. Planning will never realize the power of GIS unless more resources are dedicated to GIS. The following are recommendations to assist in expanding GIS within the department:

- Hire more GIS staff – the City of Berkeley is understaffed in regards to GIS as compared to comparable cities. The City should consider hiring a GIS Technician and/or Specialist that has a focus on land management related items. This person could be a part of the central GIS team in IT or in Planning. This topic will be detailed in Chapter 2 of this Strategic Plan (Governance).
- Train existing staff – Existing Planning staff should be given more training and should commit to developing GIS skills. Some of the GIS layers should be maintained by Planning staff since they are the subject matter experts. This will require training on how to manage and maintain specific layers. Additionally, a number of staff should learn how to use ArcGIS Standard (ArcView) so that they can perform more analytical tools than are available via the intranet web browser applications. A training regime will be developed and will be included in the Training Chapter of this Strategic Plan.

The expansion of skills will allow staff to begin to use GIS analytics. Planning will be able to further understand relationships between different types of data in a spatial context, thereby improving decision-making.

The Planning Department already uses GIS for many tasks, however an improved, more user-friendly and integrated system could enable staff, particularly those not currently taking full advantage of widely-available GIS capabilities, to complete many tasks in a fraction of the time some of them currently take, such as:

- Viewing and analyzing city demographic information for federal and state reporting and funding applications and/or for local policy studies and plans
- Identifying vacant and underutilized land for City projects
- Environmental Assessment (EA) for federal grant-funded projects
- Cost Benefit Analysis (CBA) for projects



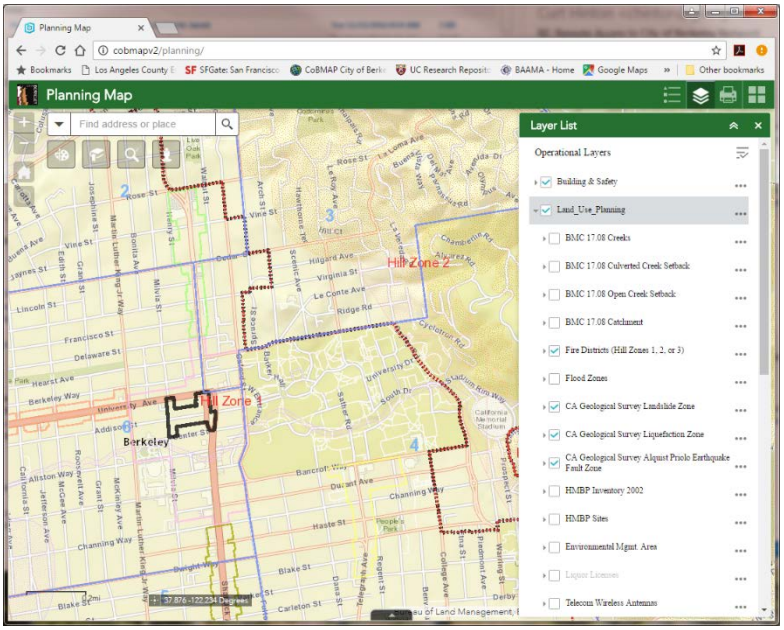
- Viewing and analyzing data for specific plans
- General land use, current development, and infrastructure mapping and analysis
- Community education and outreach
- Statistical analysis for various departmental tasks and efforts
- Review land use and subdivision permitting
- Reviewing active construction sites
- Many other tasks not listed here

More staff of the Planning Department will be better able to derive valuable spatially-driven information on key issues and in less time than currently possible. Among these analyses, GIS can provide support for project impact analyses, such as mapping estimated noise or traffic impacts for concerned neighbors of a development proposal, and allow better analysis of current demographics in relation to important resources such as transit, schools, parks, services and jobs, and tracking of available or underutilized land for various Planning studies or plans. However, staff need to commit to and participate in a long-term, ongoing training and education regimen.

GIS NEED

Department-Wide Access to Geospatial Data

Providing users with the ability to view spatial data in a quick and intuitive manner is important for local government agencies and is critical within the enterprise. Web-based data browsers allow quick viewing and printing of map data and can be configured either for use solely within Planning, or as a website available to all internal City departments.



Intranet GIS data Browser

Departmental Intranet GIS Data Browser solutions are GIS applications that provide data dissemination services by departmental function through web-based technology. Intranet browsers represent a step forward in enterprise-wide GIS technology as it offers a "right-sized" set of spatial analysis tools, geographical viewing and map production tools, as well as external database links. The departmental browser should include:

- Advanced Search Criteria
- Automated Mailing Labels
- Customized Departmental Query Control
- On-Line Help and Tutorial
- Buffer Analysis
- Printing
- Enhanced Text Placement
- Link to external Databases
- Easy-to-Use interface
- Advanced Graphic Design
- Markup Tools

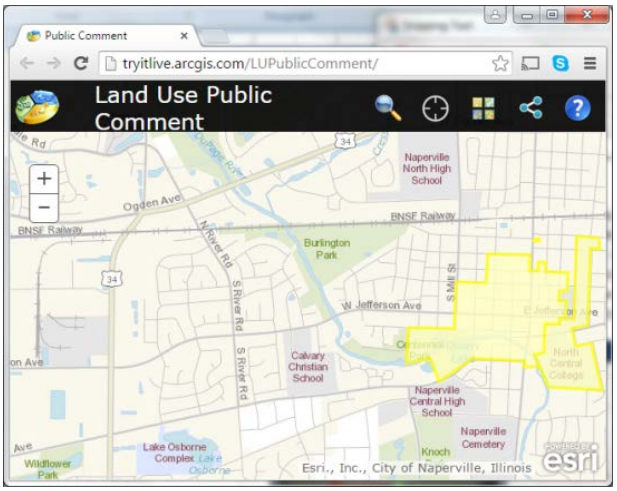
The GIS Team in IT has provided a number of portal for users and a specific portal for Planning. The Planning intranet site should be further configured to present users with pertinent GIS data and custom defined queries for easy end-user interaction. It is recommended that Planning portal continued to be expanded with configuration specific to their needs. For example, Planning needs access to demographic data, permits

and applications, projects, land use, zoning, property ownership, and a variety of other data. Integrating data from various business systems (Accela) is instrumental in making GIS more effective for Planning.

GIS NEED

Public Access to Geospatial Information

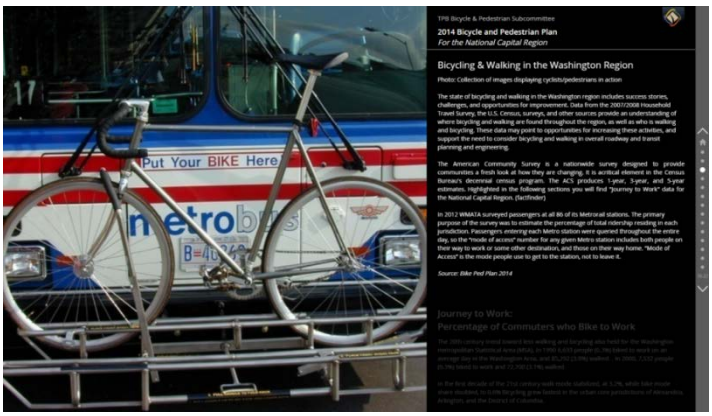
Providing public access to GIS maps through the Internet provides information to Planning customers. Through an Internet GIS Data Browser and focused web maps and apps, the data specific to Planning can be provided to the public through intuitive and easy to use interfaces. The City currently provides static maps and ArcGIS Online applications for its community members. However, the Planning Department identified a number of public facing portals that were of interest.



Interactive Applications that Allow for Public Comment

In addition to providing public access to existing parcel and land use data, and other data used by the department, as appropriate, a public GIS portal could allow residents, businesses, city officials, and developers the ability to better understand what zoning and land use policies apply to properties of interest to them, without the need to call staff necessarily. Additionally, the public could see where development and/or major projects have been proposed or approved, or are under construction, to facilitate greater community awareness and participation in the development review and/or long-range planning process.

The City should further implement an ArcGIS Server (AGS)-based Internet GIS data browser to provide the public with access to Berkeley's geospatial data. One possible solution is to deploy ArcGIS Online for Organizations. The deployment would include extremely focused



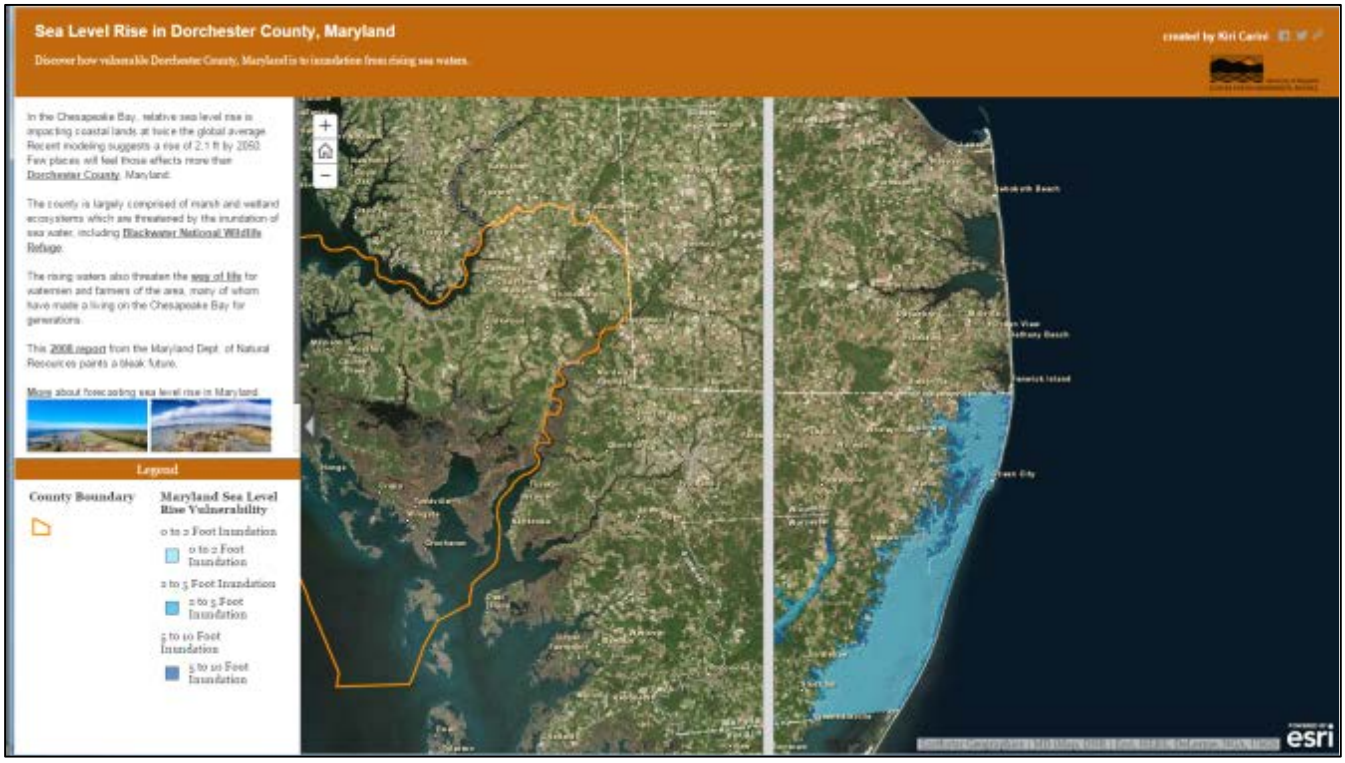
applications specific to the various department needs and allow for different configurations and different looks. Targeted applications can also be paired with a generic public query portal that would provide varying functionality. With a number of departments interested in providing high-quality geospatial data and maps to the public, an internet GIS data Browser will be a City initiative, including Planning as a stakeholder in its provisioning.

City of Carson, CA – Development Project Status Story Map

Providing maps and other visuals of projects with information important to residents and other stakeholders can enhance community relations. Esri has introduced Story Maps, which is designed to allow users to find information in a very intuitive and user friendly fashion. Story Maps are targeted and are designed to be easy-to-use. The goal with Story Maps is to present key data sets to the public without the need for training and to be able to get to pertinent data within a few clicks. Planning would benefit from offering Story Maps on their web-site and could easily enhance many of their static maps and initiatives by providing the information through a Story Map. Story maps could be used to provide further information on business, public projects, and other information related to public awareness. Through the use of Esri's Story Map template, staff can publish their plan data with live maps. The example above shows a Plan with dynamic graphics and live mapping.

Story Maps Can be Used to Create Dynamic Planning Documents

Climate Action Plan Story Map – The City of Berkeley currently has a climate action plan. An innovative way to share this information with the public is through the use of a Story Map. This would allow the City to share key findings with the public in an intuitive manner.



Climate Action Plan via GIS

GIS NEED

Field Access to Geospatial Data Solutions

The Planning Department stated the desire to utilize GIS in the field. Some staff may need access to geographic data while conducting their duties in the field (Also, when working from home or telecommuting). Accordingly, providing personnel with remote access to maps and GIS data while working in the field is an important part of

maintaining an enterprise GIS. Through the use of hardware, software and data that are designed to be accessed and manipulated away from the office, the Planning staff can realize benefits of GIS while in the field. Integrating with mobile computers, input devices, software and GIS data into the GIS enterprise will give Planning tools to perform field data collection, site visits, routing capabilities, and interactive geographic data query and analysis.

Many public agencies have moved away from expensive laptops for field access towards tablets. It is recommended that the City update its mobile strategy and consider the implementation of tablet based GIS access and markup. Planning staff performing visits to sites may need immediate access to the various department/division database systems to retrieve records and documents, history, or any other pertinent data related to the department's activities. Access to geospatial data from the field will enable field personnel to look up relevant project related documents, map a project site's location, and make necessary project notes which will prove to be helpful in monitoring project status, and required environmental mitigation measures, or conditions of approval. Free data viewing applications exist from Esri as well as applications that allow staff to augment data in the field. This application, Collector for ArcGIS, provides robust and intuitive tools for viewing maps, collecting and updating data, getting driving directions, and tracking and reporting areas visited. Collector operates through ArcGIS Online and with the newest release allows the ability for working offline. Collector is designed to work with iPhone and Android smartphones, but can also be used on tablets running iOS or Android. Collector is a simple way to expedite a mobile GIS solution that allows users from across the organization to have the power of GIS in their hands. Similarly, Esri also has two other Apps for smartphones and tablets: ArcGIS App and Windows 8 App.

GIS NEED

Advanced Analysis Tools

Fully mature and enterprise-wide implementations allow for users to move to more advanced toolsets. Advanced analysis is often impossible within municipal governments because the needed data is unavailable. As the GIS effort at Berkeley matures and more data is readily available, Planning should consider implementing some advanced tools and functions. Advanced extensions to ArcGIS such as 3-D Analyst and Spatial Analyst will allow Planning staff to extend their capabilities as needed. ArcGIS Spatial Analyst provides a range of spatial modeling and analysis tools. ArcGIS Spatial Analyst could allow the City of Berkeley to:

- Create, query, map, and analyze cell-based raster data.
- Perform integrated raster/vector analysis.
- Derive new information from existing data.
- Query information across multiple data layers.
- Shadow impact analysis and building information modelling (e.g. heights, floor space)
- Fully integrate cell-based raster data with traditional vector data sources.

Examples of the types of analysis that Planning could do with ArcGIS Spatial Analyst include:

- Find suitable locations for Planning projects and/or planning efforts.
- Perform land-use and housing-related analyses.
- Identify areas prone to hazards such as fire, liquefaction, or flood zones.
- Analyze transportation corridors in relation to land use planning or housing efforts.
- Map pollution levels overlaid with residential zones or other sensitive receptors.
- Perform demographic analysis.
- Conduct risk assessments.

3-D Analyst allows for the use of existing 2D GIS datasets to create 3D scenarios that can be stored, viewed, and edited in 2D or 3D. Users can use attributes, such as elevation, to display the data at a present height; or use attributes to extrude the data.

Planning staff should also consider using the following technologies:

- Network Analyst – Esri tool for analyzing drive times, optimal location analysis, services areas and other networking problems. Since Planning is the data steward for street centerlines, the use of Network Analyst will allow them to test the routing readiness of the streets. Also, Planning staff does a variety of planning tasks that could benefit from Network Analyst.
- ModelBuilder - ModelBuilder has been called a visual programming language or a tool to make "visual scripts." ModelBuilder is as a tool to map a workflow, and a model as a workflow map.
- Business Analyst Online – Esri tool for location analysis with a focus on businesses and people

3

GIS GAP **ANALYSIS**

GIS DATA LAYER INVENTORY

The Planning Department will benefit from access to almost all data layers created and obtained for the City. It is expected that once all departmental data is integrated, consolidated, and centrally stored, that staff will have access to all non-classified GIS data layers from other City departments and other public agencies or data providers. The following legend describes the data layer table below.

Legend

Data Layer	The data layer is the GIS thematic data that is being described. The name of the layer or description of the layer is placed in this column.

Creation Methodology	This column describes how the layer was, or is anticipated being created.
Recommended Update Division or Individual	This field outlines the division or individual that is anticipated to maintain or develop the data layer during and after full implementation of the Citywide enterprise GIS. Development of new recommended layers will be prioritized for each year of the Strategic Implementation Plan.
Layer Status	Layer state of existence.
Existing	These layers currently exist within the City's GIS.
Recommended/ Desired	These layers are recommended for development or procurement, based on departmental and enterprise needs. These data layers will help support existing business procedures or will compliment other GIS data sets that are already existing and in use by the City. Costs associated for these recommended layers will be based on general estimates – actual cost may vary.
Partial	These layers currently exist in an incomplete or outdated state.

The following is a list of desired layers by the Planning Department:

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Planning GIS Data			
Accela Data (See Database Design, Creation, and Enhancement Need Earlier in this Chapter)	Extract, cleanse and geocode from database	Planning Department - Automated	Recommended
Accessible Dwelling Units and Below Rate Unties	Extract, cleanse and geocode from database	Planning Department - Automated	Recommended
Alcohol Licenses	Extract, cleanse and geocode from database	State of California	Recommended
Archeological Shell Mounds	Digitized on screen	Planning and GIS Team in IT	Recommended
Capital Improvement Projects	On-Screen Digitization	Various	Recommended
Crime Data	Extract, cleanse, and automatically map from Police database	Automated from Police Department	Recommended
Census Data	Download from Census Bureau	Planning and GIS Team in IT	Recommended
Code Enforcement	Extract from Code Enforcement database, cleanse and geocode from database	Planning Department - Automated	Recommended
Contaminated Sites	Geocode and link to existing database	Planning Toxics Management Division	Recommended

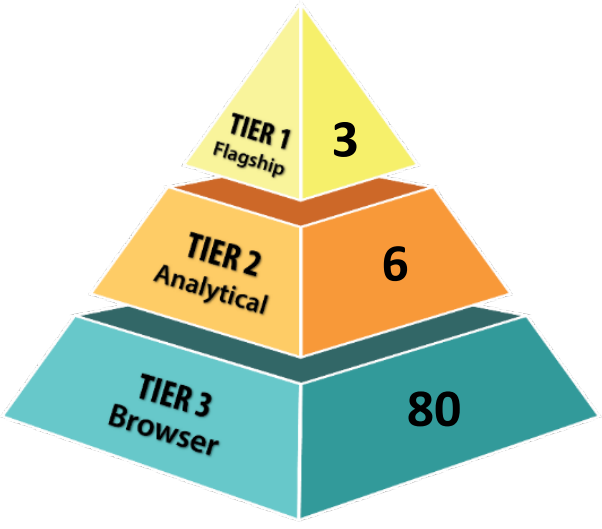
Contaminated Sites – Monitoring Wells	GPS	Planning Toxics Management Division	Recommended
Development Agreements	Digitized	Planning Department	Partial
Environmental Buffers	Derived using existing layers	Planning in Coordination with GIS Team in IT	Recommended
Fire Hazard Zones	Digitized on Screen	Fire and Planning in Coordination with GIS Team in IT	Recommended
Hazardous Materials Locations	Geocode and link to existing database	Planning Toxics Management Division Permits need to be Address Matched	Partial
Landmarks	Extract, cleanse and geocode from database	Planning Department	Existing
Liquefaction Data	Various	Planning in Coordination with GIS Team in IT	Recommended
Specific Plan Areas	Digitized	Planning Department	Recommended
General Plan Land Use	Digitized	Planning Department	Existing
Data Layer	**Creation Methodology**	**Recommended Update Division or Individual**	**Existing or Recommended?**
Traffic Analysis Zones	Digitized	Public Works	Existing
Flood Zones	Acquire from FEMA	GIS Team in IT	Existing
Neighborhood Associations	Digitized	GIS Team in IT	Existing
Parks	Extract, cleanse and geocode from database	Parks	Existing
Projects Layer	Digitized on Screen	Planning in Coordination with GIS Team in IT	Recommended
Public Utilities	Field collection, digitization, and as-builts	Public Works & External Utilities	Partial
Setbacks and Variances	Tied to property data in Accela	Automated	Recommended
Sidewalks	GPS and digitizing from aerials	Public Works	Partial
Schools	Digitize/Geocode	Schools	Existing
Solar Installation Layer	Digitized on Screen	Planning in Coordination with GIS Team in IT	Recommended
Storm Water Runoff Buffers	Buffered from other data sets	Public Works and Planning in Coordination with GIS Team in IT	Recommended

Sustainability Data – sea level rise, climate action plan, greenhouse gas data	Various	Planning in Coordination with GIS Team in IT	Recommended
Toxics Data – BMC Title 15, contaminated sites, soil boring, and well locations	Various	Planning in Coordination with GIS Team in IT	Recommended
Underground Storage Tanks	Geocode by Address	State of California	Recommended
Zoning	Digitized on screen	Planning Department	Existing
Citywide Base Data			
Property	Original tax parcels were digitized and rubber sheeted from scanned hard copy water quality maps circa 1999. Updated manually once a year by the GIS Team using County data for attributes and the County's Adobe PDF parcel maps for geometry changes. Migrated to the LGIM Tax Parcel schema in 2016.	The GIS Team	Existing
Data Layer	**Creation Methodology**	**Recommended Update Division or Individual**	**Existing or Recommended?**
Aerial Photography	Current aerial data is delivered by Pictometry through an agreement with Alameda County. The most current data was captured in 2014 with the next flyover scheduled for Spring 2017. The County's current contract with Pictometry calls for one more flyover after the 2017 capture. Older imagery exists for 2006 (custom County flyover), 2009, and 2011 (USGS).	Static Map	Existing
Road Centerlines	Created by RMSI in 2010 from various sources including Alameda County data and pavement management system data (street width). Updated manually by the GIS Team occasionally. Migrated to the LGIM Road Centerline schema in 2016. Zero Waste has a copy that has been updated for routing purposes.	The GIS Team	Existing
Address Points	During the work day, an Analyst in the Finance Department updates/creates new addresses in the Land Management (LX) module in SunGard (FUND$). Address points are then created nightly from an ETL that extracts and geocodes (using parcel centroid coordinates) and joining to a parcel table to create the address points feature class.	Automated / Finance Department	Existing

4

MULTI-TIER GIS APPLICATION USE

The pyramid and table below outlines the recommended "Tiers of GIS Use" within the department. It is important to note that this is not indicating that each of these staff should be GIS professions. It is pointing out that staff within the department should be given access and training to use these tools. All are color coded by the level of desired GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions. The Planning Department will consist Tier 1, Tier 2 and Tier 3 Users. The ability to edit and maintain some of their own GIS layers will merit some Tier 1 training.



TIERS OF GIS USERS	
GROUP	ACTIVITY
Tier 1 Flagship	• GIS Administration • Data Maintenance • Data Conversion and Creation • Spatial Data Management • Technical Support • Coordination
Tier 2 Analytical	• Data Maintenance • Analytical Functions/Geoprocessing • Complex Queries • Modeling • Use of Desktop Extensions • High Quality Map Production
Tier 3 Browser	• Browsing/Look-Up • Standard Reports • Simple Query • Map Production

5

RETURN ON INVESTMENT (ROI)

The following table indicates specific Return on Investment opportunities for the Planning Department. These specific examples show the true return on investment of the technology.

Return on Investment Opportunity Planning Department	
Opportunity	**Explanation**
Save <u>Time</u> and <u>Respond</u> More Quickly to Community Requests	***Public access to accurate data:*** • The public should have Internet access to GIS data. GIS will allow users to find information much more quickly and in many cases on their own. This should save multiple staff hours a week in Planning. The internet access has to be really well-thought-out to fully realize the maximum savings. ***Staff access to accurate/updated data:*** • Staff should have access to current GIS data to better serve and provide information to the public and decision makers. This should save multiple staff hours a week in Planning.

Return on Investment Opportunity Planning Department	
Opportunity	**Explanation**
Improve Data Accuracy	***Better GIS Data and Spatial Analysis:*** • Working with other departments and City agencies to update data with higher accuracy can improve the results when analyses are performed. By sending errors found in data to the data owners, errors can be corrected quickly.
Improve Public Access to Government	***Internet Browser:*** • Planning wants to share critical information with the public. This will allow the public to be more informed and make better decisions. This could also save the public many trips to the department, saving time, pollution, energy, frustration, and would empower the public with the ability to get the information they need.
Compliance with State/Federal Mandates	***Internet Browser:*** • Maps needed to satisfy reporting requirements for state mandates and/or grants.
Improved Information Processing	• Planning would expect GIS to increase the complexity of analysis opportunities. Increasing demand for impact analysis for new developments or land use or housing policy proposals should propel methods for faster processing of information frequently requested.

NEEDS ASSESSMENT

POLICE DEPARTMENT

CITY OF BERKELEY

CALIFORNIA

GIS Strategic Implementation Plan

SECTION OUTLINE

1

EXISTING CONDITIONS

DEPARTMENT OVERVIEW

The Berkeley Police Department's primary mission is to reduce crime - property crime, violent crime and traffic collisions, to provide professional, courteous and respectful service with every contact and to be open, transparent and accountable for their behavior and their work. The Department is comprised of a number of divisions and goals to include:

Office of the Chief

- Provides overall leadership and administrative oversight
- Includes the Chief of Police, the Internal Affairs Bureau, the Public Information Officer and Fiscal Services

Professional Standards

- Bring the Department in line with national standards and best practices
- Streamline procedures
- The Division includes Policy, Audit, Personnel and Training, Records, Court Liaison, Property Room and the Jail

Operations

- Responsible for the response to calls for service, conducting initial criminal investigations, making arrests, issuing citations, providing crimeprevention services and proactive police problem solving to improve the quality of life in the community as well as facilitating Police and Fire responses throughoutthe community through the Emergency 911Communications Center.

Investigations

- The Detective Bureau is responsible for follow-up investigations of homicides, felony assaults, robberies, sexual assaults, domestic violence incidents, sexual assaults on children and minors, residential and commercial burglaries, identity theft, fraud, forgery, elder abuse, among other offenses.
- The Investigations Division is comprised of the following units: Special Enforcement; Crimes against Persons (Homicide and Robbery), Special victims (Youth and Family Services, Sex Crimes and Domestic Violence), Crimes against Property (Burglary, Fraud and Auto Theft), Crime Analysis; Traffic Bureau (Traffic and Parking Enforcement); Warrant Unit and Crime Scene Unit.

Support Services

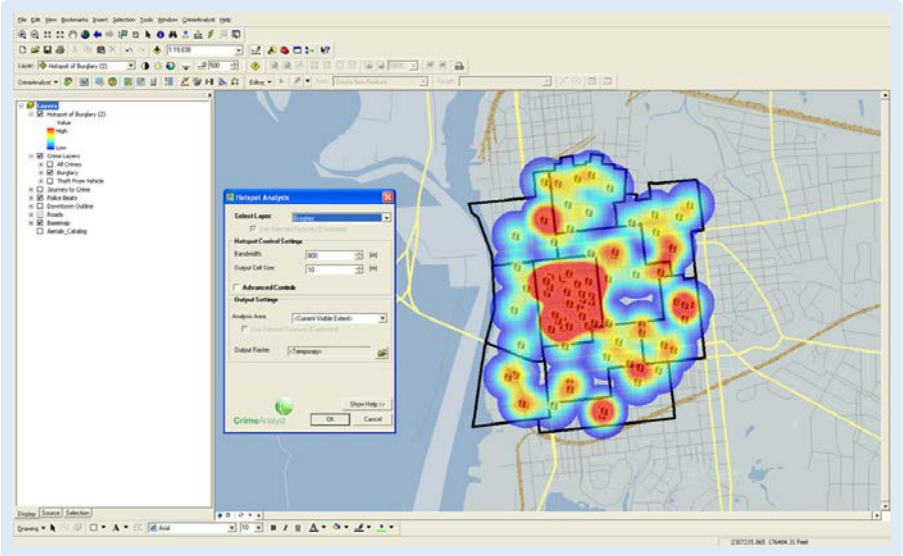
- Manage the Property and Evidence Unit
- Management and operation of the Public Safety Communications Center and the Public Safety Building
- Locating outstanding arrest warrants, preparing reports and other material for review by the District Attorney's Office

There are approximately 70,000 calls for service annually with about 7,000 of those resulting in cases. Police operate in 16 beats and four dispatch areas. The Department is comprised of 178 sworn officers.

GOVERNANCE OF GIS

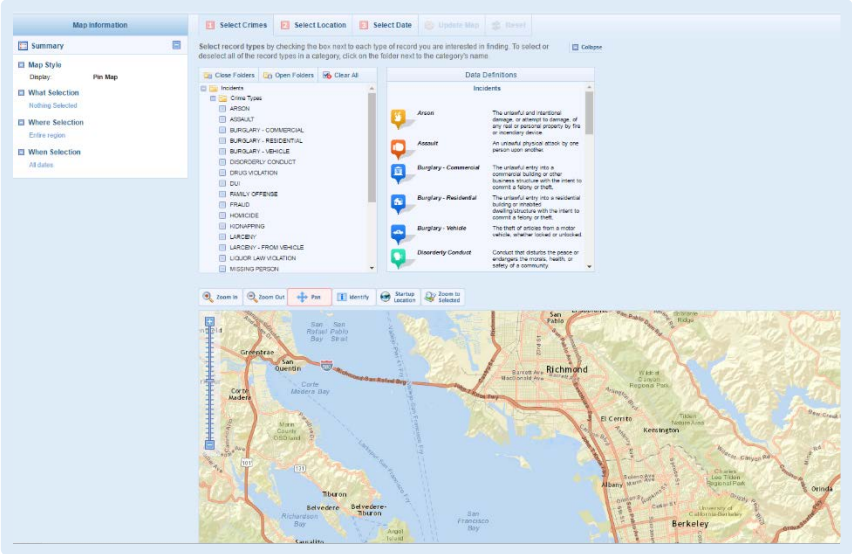
There are generally three tiers of GIS users. A Tier 1 - Flagship GIS user typically conducts GIS administration and coordination at the enterprise level, has access to a fully functioning GIS toolset to create and maintain enterprise data, and manages the enterprise database. A Tier 2 - Analytical GIS user focuses on data analysis, complex querying and data modeling, along with department level data maintenance. A Tier 3 - Browser GIS user requires only general browsing GIS data functions to create reports, query standard data sets, create tasks like mailing labels, and produce maps. The Police Department is and should continue to be comprised primarily of Tier 3 users.

The Police Department uses GIS in a variety of capacities to include internal crime mapping, and community access to crime mapping. The Department employs a Crime Analyst who uses GIS for mapping and analytical purposes. The City utilizes the New World Systems (NWS) public safety software suite. Dispatchers utilize the NWS mapping to view calls for service via address matching against geo-referenceable data layers (street centerlines and address points). Each call for service is stored as data within the NWS database. Calls that result as an incident/reportable case are further detailed within the NWS records management system (RMS) database. This data is then extracted by the Crime Analyst for analytical purposes. She uses ArcGIS to address match the RMS data which results as a GIS layer containing the RMS data. This resultant GIS layer is used to conduct crime analysis, print reports, identify hotspots, map creation, and a number of other project related purposes. The Crime Analyst creates static maps showing crime locations and hotspots. The Analyst sends information to the Police electronic bulletin board, creates weekly PDFs of incidents/hotspots, and presents as the weekly crime analysis meeting. Meetings and supporting GIS products focus on Part 1 Crimes, robbery heat maps, bike thefts, auto burglaries, auto thefts, day vs. night thefts, and other pertinent data views.



Hotspot Mapping within GIS

CrimeView Community is used for sharing crime information with the public via a map. This application allows users to view all incidents and get notified when an incident occurs in a user selected geography. GIS staff in Information Technology (GIS Lead and Interns) provides the Police Department critical base layer data for use in the NWS GIS applications. NWS requires a separate instance of ArcGIS for Server to be used for their applications. Currently, the version in use is ArcGIS for Server 9.3 which is a number of versions behind the latest Esri release (ArcGIS 10.4). Vehicles are equipped with mobile mapping from NWS. However, the application is seldom used because it is not as high quality and informative as is needed by officers.



CrimeView Community
Public Facing Incident Mapping

The nature of law enforcement agencies is to inherently rely very heavily on spatial data on a daily basis. Crime pin-mapping, both historical and current, provides detailed insight into where crime occurs and where crime is likely to occur. The Police Department should use GIS as a primary information tool. The majority of GIS users in the Police Department will be Tier 3 GIS users; however, some GIS use within the Police Department does involve more complex GIS data analysis, mapping, and some geospatial data creation, such as that of Tier 2 GIS users – for example staff in Crime Analysis should be considered a Tier 2 GIS Analytical user.

Making quick and accurate decisions is critical in policing—GIS can assist in making these decisions. Cities throughout the world are finding that GIS can save lives, time, and money. The use of GIS has been heralded as having contributed to the nationwide drop in the crime rate over the past few years. GIS can help depict patterns in criminal behavior that are impossible to visualize with traditional methods.

The table below summarizes the current GIS staffing within the Police Department. Type represents the current level of GIS experience based on job requirements, GIS usage can be categorized as Limited,

Moderate, or High (i.e. frequency of use), and Primary Tools describes what specific software tools are used to carry out GIS functions.

Current GIS Staffing				
Type		Number of Users	GIS Usage	Primary Tools
	GIS Flagship (Tier 1)	0	NA	NA
	GIS Analytical (Tier 2)	2	High	Esri Tools (ArcGIS) for mapping and Crime Analysis. Crime Analyst and Officer.
	GIS Browser (Tier 3)	20	Moderate	In car mapping and 911 dispatch

HARDWARE AND SOFTWARE

All staff within the Police Department has access to a personal computer. Mobile data terminals (MDTs) are being used in the field. Officers use the MDTs to fill out field reports and occasionally view GIS data. Printers are available for office use.

Hardware Issues Summary	
Type	Notes
Personal Computers	Available to all staff
Laptops	In the vehicles
Printers	Ample printers available for use
Plotters	One in crime analyst's office
GPS	Utilized for AVL in the Vehicles
PDA/Tablets	Not widely used
Scanners	Available as needed

The NWS Public Safety Suite is used for 911 and records management. CrimeView Community is used for public crime mapping. ArcGIS is used for data management and crime analysis. Microsoft Office is used to conduct office productivity tasks. The following are the pertinent software packages (for this report) used by the Police Department:

1. Microsoft Office– used for office productivity
2. RMS – CAD, RMS, JMS, and mobile
3. Forum – electronic bulletin board
4. CrimeView Community – public crime mapping
5. Google Maps/Earth – visualization

6. ArcGIS Desktop – used for crime analysis and GIS data maintenance

2

GIS NEEDS ASSESSMENT

GIS NEEDS

GIS is one of the most effective tools for fighting crime and delivering public safety services quickly and effectively. A majority of information tracked by Police Departments have a locational component. Additionally, it has been well documented that criminal activity occurs within predictable parameters. Many of these parameters are geographic in nature. Therefore, geographic visualization and analysis should be an inherent tool in all facets of public safety. The Berkeley Police Department uses GIS in dispatch and policing and should continue to implement GIS and its complementary technologies.

The GIS industry has changed radically over the past few years. Software companies have spent hundreds of millions of dollars improving their end-user experience. Intranet, Internet and mobile tools have become much easier to use and much more targeted in their purpose. Historically, most Police Departments have been satisfied using the GIS tools provided by their 911/RMS vendor. However, in many cases these tools are not using the latest toolset and are not as comprehensive as they should be. Therefore, it is highly recommended that the Berkeley Police Department consider all of the tools now available on the market – many of which are already owned by the City.

Based on this Needs Assessment, the Police Department has several GIS identified needs. Where applicable each need will be followed by an application or method to meet that need, some

applications/methods will meet several needs. A method or application is only described under one need, if it applies to multiple needs refer to the previous need for a description. The table below summarizes these needs and how they are to be met:

GIS Need	*Method/Application to Meet Need*
Mapping and Spatial Analysis of Criminal Activity, Incidents, and Accidents – Crime Analysis	Crime Analysis GIS Toolset ArcGIS
Enable Decision Makers via an Executive Dashboard	Esri Operations Dashboard
Officer Access to Mapping	Intranet Data Browser Mobile Computers with Mobile GIS Data Browsers
Enterprise Access to Digital Pre-plans. Hazardous Material Data, and other supporting datasets	Data Creation and Integration
Development of Standard Operating Procedures	Analysis and Documentation
Public Access to GIS Data	CrimeView Community Publically Accessible Esri Applications

GIS NEED

Mapping and Spatial Analysis of Criminal Activity, Incidents, and Accidents – Crime Analysis

A primary need for the Police Department is to improve the tools available to the Crime Analyst and to provide organization-wide access to GIS-based mapping and spatial analysis. This includes the most recent parcel, address, and street centerline data as well as high-resolution orthophotography. Users in every division will benefit from access to the City's base data as well as department-specific information. Using the most recent, accurate GIS layers provides staff members with an invaluable tool for everyday tasks.

The Police Department should consider additional tools for crime analysis and visualization. Additional toolsets should be considered to include a robust and easy-to-use crime analysis application, a data viewer

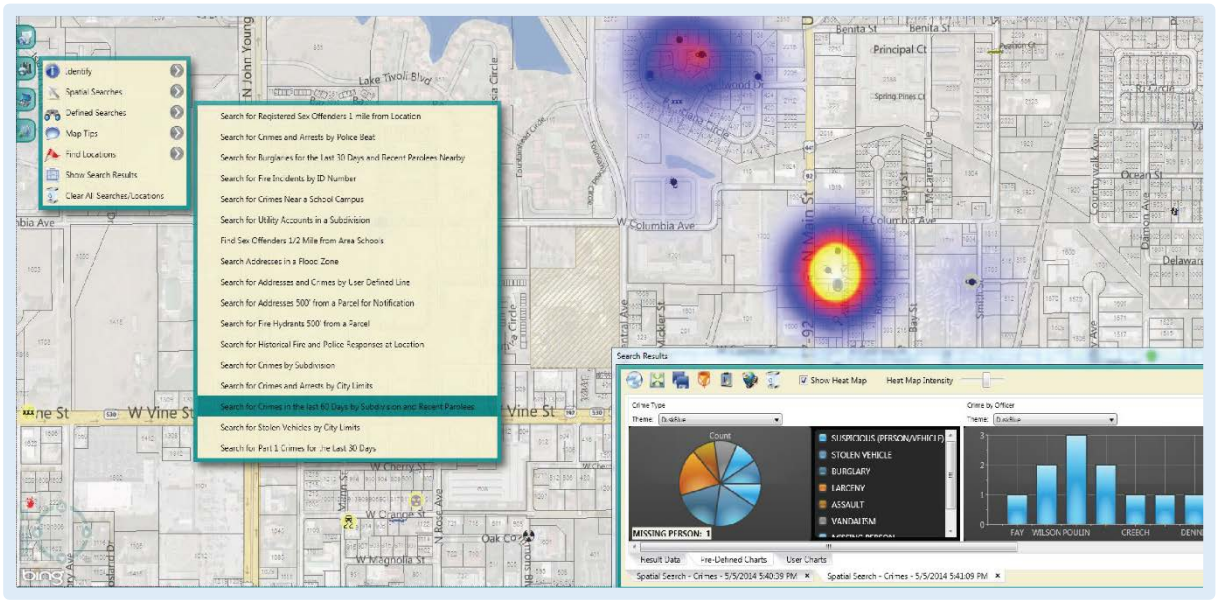
for officers, and an executive dashboard for decision makers. The Police Department should be able to conduct the following types of mapping and analysis:

- Incident analysis – with ArcGIS and a crime analysis package
- Mapping E-911 Calls – from NWS
- Crisis management – schools and banks with data in cruisers
- Mapping home bound community members
- Mapping sex offenders, parolees, probationers, persons with warrants
- View and query existing infrastructure – water, sewer, storm water, and facilities
- View and query utility customers
- Weekly PIN map and Hot Spot Analysis
- Court case support for detectives
- Logistical support (i.e. planning for a raid)
- Tracking drug free zones around schools
- Creation of new response areas
- Maintain GIS data layers
- Staffing analyses – what is happening when
- View aerial imagery for drug raids and traffic accident analysis
- Assisting in evacuation during disasters
- Mobile access with an easy-to-use data browser
- Traffic collision intersection studies
- Crime scene diagrams
- Tracking locations of the homeless/mentally ill and their encampments
    - Track history of individuals via an aggregate database
- Viewing and analyzing of parking complaints
- High volume of officers on a given call
- Track average speed of vehicles
- Know location of speed zones, survey zones, etc.
- Regional crime analysis
- Situational and operational awareness including a common operating picture
- Mapping where public and private video cameras are focused

Application to Meet Need

Crime Analysis

The Berkeley Police Department should continue to upgrade their suite of GIS tools. The department should use GIS to create high quality maps for presentation and analytical purposes to include crime scene mapping, summary data, and specific crime information as needed. Additionally, the department should be using tools to create an internal portal for personnel to view a pin map and do some basic analysis. The Department has analyzed crime analysis tools in the past to include CrimeView and Bair Analytics. However, the toolsets were either too expensive or did not meet the needs of the department. The department should re-analyze the tools available on the market and consider a package that automates many of the time consuming tasks that are consuming the Crime Analyst's time. This would free staff up to do more in depth analysis and analytics. Additionally, the department in tandem with the GIS Team in IT should identify a tool that automates the download and address matching of case data. Tools exist that can be setup to automatically map data from NWS for use within the various GIS applications.

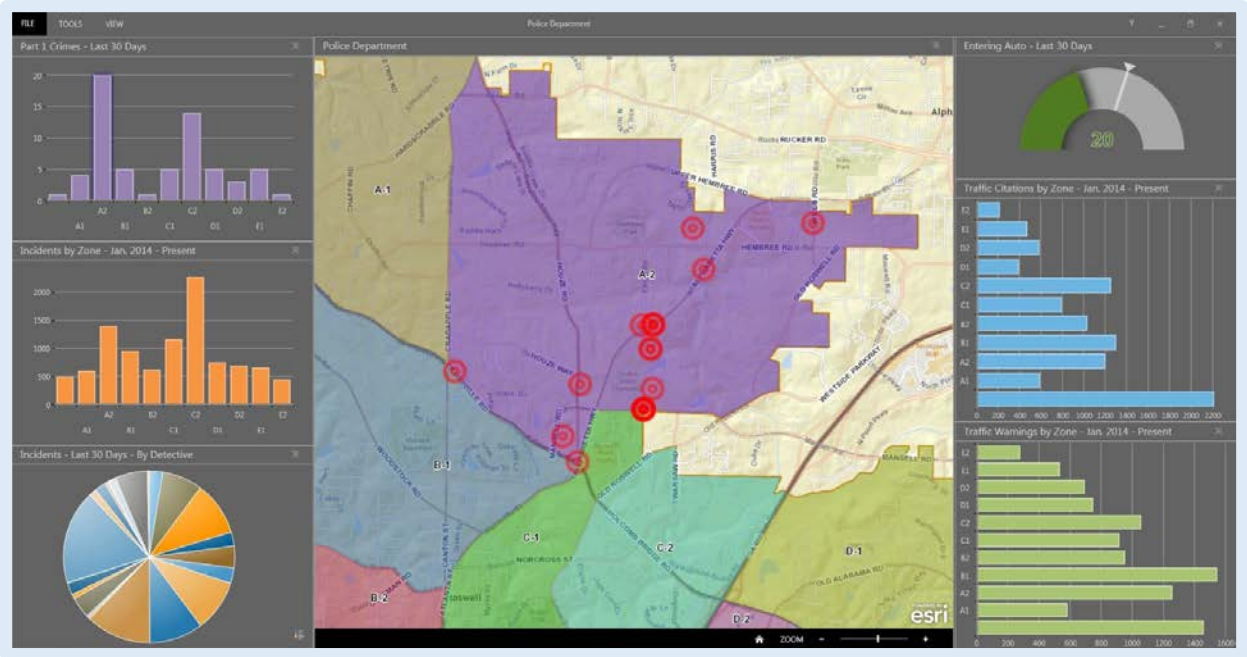


The Police Department Should Consider an Off-the-shelf Analysis Package

GIS NEED

Enable Decision Makers via an Executive Dashboard – Operations Dashboard

Another tool that is now included in the City's Esri GIS investment is the Esri Executive Dashboard application. Organizations use Operations Dashboard to monitor various key metrics. For example, departments are using dashboards to view incidents by type, incidents within the last 30 days, incidents by officer, incidents by beat, traffic accidents, and any variable desired. It is recommended that the Police Department in conjunction with the GIS Team in IT implement an Executive Dashboard for command staff. This involves a process of deciding what should be viewed and then mining the data using the aforementioned backend data mining toolset. The result is a live look at key metrics via user selected widgets and an interactive map.



Executive Dashboard for Police Decision Makers

GIS NEED

Officer Access to Mapping

The 911 center and police vehicles are outfitted with NWS mapping. However, for the most part the mapping provided to the officers is not being used. The City should consider an upgrade to the officer mapping as soon as is practicable. Effective policing requires that the front line officers have easy, fully integrated access to mission critical data including property ownership, utility accounts, aerial photography, crime trends in an area, and building pre-plans. The latest GIS tools provide easy access to a wealth of data. The City should expect to have high-quality mobile access on their personal computers, MDTs, iPhones, iPads, Android smartphones and tablets.

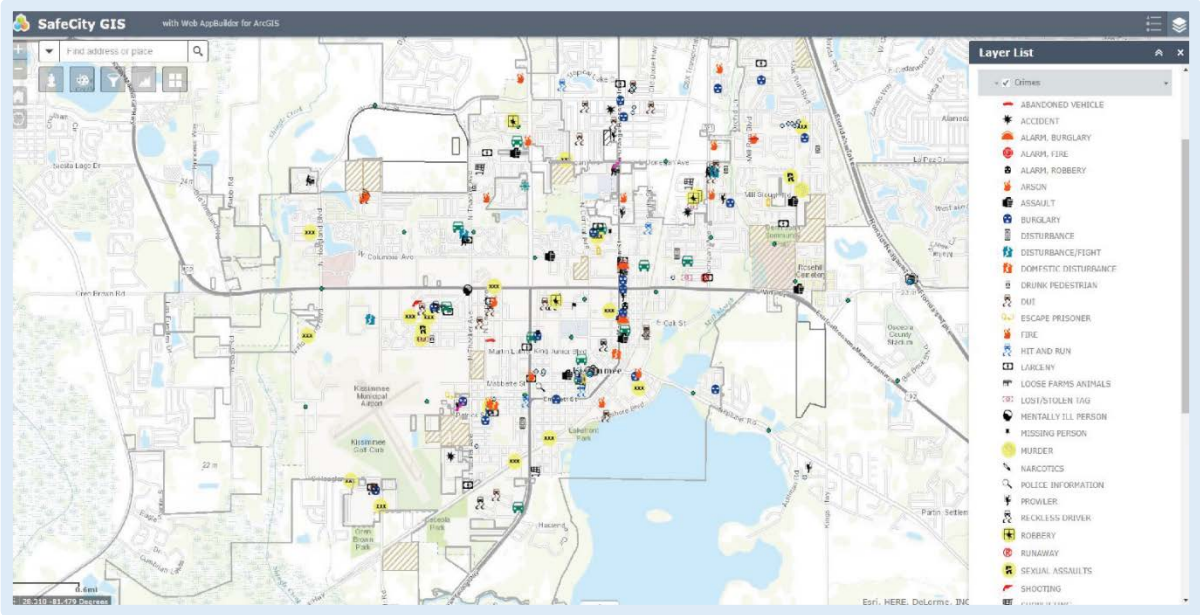
Many Police Departments have stopped at having a person or two doing crime analysis. They rely solely on the Crime Analyst to provide GIS products and reports. However, many departments are now enabling all officers with the ability to quickly view incident data and other key data layers. This does not in any way affect the role of the Crime Analyst. Conversely, it will make their job more impactful. They will be able to spend more time doing analysis and less time doing pin mapping. Additionally, GIS enabled officers will begin to identify trends that will necessitate a closer analysis by the Crime Analysts.

Application to Meet Need

Intranet Browser

As part of the City's investment in GIS technology, a wide variety of GIS viewing tools are available for use. One such tool is the Web AppBuilder. This is a JavaScript/HTML5 application that allows for easy customization and setup. What this means is that it is deployable and usable via any modern browser and as such works on traditional personal computers, laptops, tablets, and smart phones. It is recommended that this type of application is deployed and made available throughout the Police Department. Additionally, it can be used in the vehicles for mobile viewing. The City should expect their mobile application to utilize the GPS signal of the device to present an officer-centered interactive map display on which incident activity, persons-of-interest and other relevant data within a specified proximity of their current location. Newer mobile GIS applications allow an officer to use the application in a connected and/or disconnected

environment. That means if the officer does not have connectivity or has slow connectivity back to the central office the application still operates well on their device.



Esri Based Software for Officer Incident Visualization

GIS NEED

Enterprise Access to Digital Pre-plans, Hazardous Material Data and Other Supporting Data Sets

The Fire Department is responsible for creating pre-plans. A pre-plan shows the layout of critical facilities like industries, schools, hospitals, and government buildings. Exits, fire suppression devices, and other key features are noted on these pre-plans. The Police Department should work in cooperation with the Fire Department and GIS staff to access this important data. Linking plans to GIS can add additional information and analysis capabilities. Pre-plans of critical facilities should be linked to a GIS Intranet application, the 911 mapping application, and a mobile data browser application. An icon will show up in the application if a pre-plan is available for a structure. Additionally, hazardous material information is being maintained by the Health Department. This data should be geo-enabled and linked to the GIS by address.

The modern mapping applications allow for integration with data from a wide variety of sources. This includes live traffic data, live camera feeds, and data from multiple sources. The Police Department should

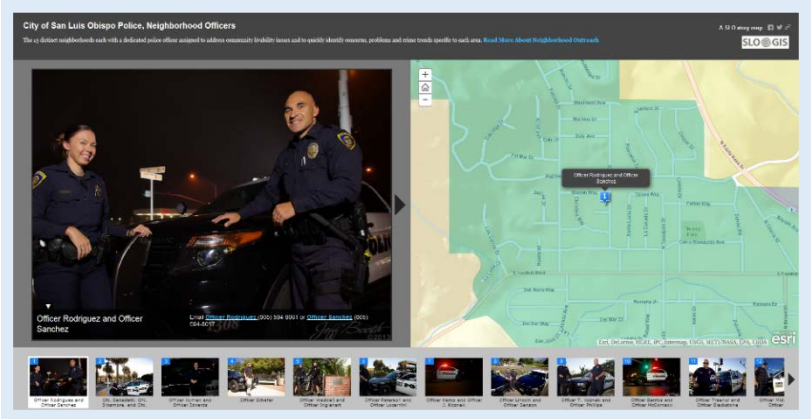
continue to review what data layers are available through an ongoing education effort. This will be one of the focus areas for the enterprise-wide GIS effort.

GIS Accessing Pre-Plans and Hazardous Materials Information

GIS NEED

Public Access to Crime Data

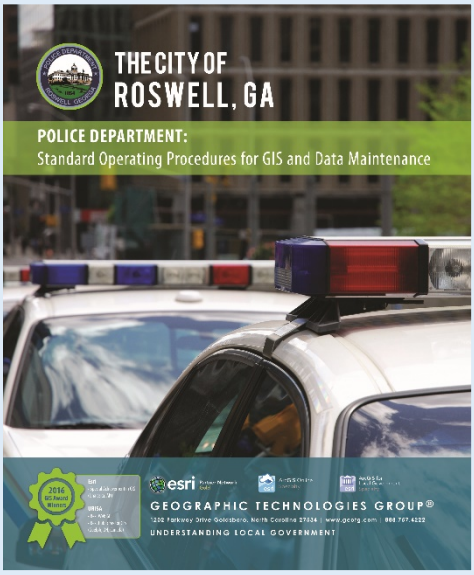
As mentioned earlier in this needs assessment, the Police Department is already sharing crime data on the web via public access pin mapping applications. This provides the community with salient crime information by geographic location. Additionally, the Police Department staff felt that the new Esri Technology called Story Maps would add additional value. Staff felt that sharing information about community watch areas via a Story Map would be very beneficial to the community. The application would have a map of each neighborhood watch area. The user would be able to click on a neighborhood watch polygon and get pertinent information about the area such as; the current neighborhood watch leader, phone number, web site, meeting times, meeting notes, and other pertinent information. Other communities are using Story Maps for community outreach to introduce officers to the community.



GIS NEED

Development of Standard Operating Procedures

This needs assessment has recommended a number of ways to expand GIS use within the Department. Key to this expanded use of GIS was interfacing and/or mining data from the NWS records management system and E911 system. However, for this to work effectively accurate address matching of records from NWS is essential. Most departments cannot effectively use GIS because the source data is not accurate enough to result in accurate mapping. Therefore, it is recommended that the department use a consultant to analyze their data entry and data collection processes and their data to create standard operating procedures (SOPs) that will ensure accurate data entry and mapping. These SOPs may include the following:



Example SOP Document for Police

- **Standard Operating Procedure:**
    1. Geocoding Standard Operating Procedures (SOP) - Develop an SOP for exporting, geocoding and address matching NWS crime records to a reliable digital data layer, namely address points, street centerlines, and parcels.
    2. Data Entry SOP - Develop SOP's for data entry into the NWS RMS software. This includes specific recommendations on how to fix issues with address that are not matching from NWS, intersections, and apartments.
    3. Software and Related Databases Evaluation – evaluate the possibility of interfacing with other third party products in use at the PD and other associated databases such as the ANI/ALI and Master Street Address Guide (MSAG).

3

GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY

The Crime Analyst will be creating data sets for analysis purposes. However, the department will consist mostly of Tier 3 GIS users who are interested in using GIS data layers for browsing, basic spatial analysis, and mobile applications. The Police Department will benefit from access to other GIS data base layers as well as department-specific layers. It is expected that once all departmental data is integrated, consolidated, and centrally stored, the Police Department staff will have access to all non-classified GIS data layers from other City departments.

Legend

The following legend describes the data layer table below:

Data Layer	The data layer is the GIS thematic data that is being described. The name of the layer or description of the layer is placed in this column.
Creation Methodology	This column describes how the layer was or is anticipated being created.
Recommended Update Division or Individual	This field outlines the division or individual that is anticipated to maintain or develop the data layer during and after full implementation of the Citywide enterprise GIS. Development of new recommended layers will be prioritized for each year of the Strategic Implementation Plan.
Layer Status	Layer state of existence.
Existing	These layers currently exist within the City's GIS.

Recommended/ Desired	These layers are recommended for development or procurement, based on departmental and enterprise needs. These data layers will help support existing business procedures or will compliment other GIS data sets that are already existing and in use by the City. Costs associated for these recommended layers will be based on general estimates – actual cost may vary.
Partial	These layers currently exist in an incomplete or outdated state.

Police Department personnel expressed that access to the following GIS data layers would be beneficial.

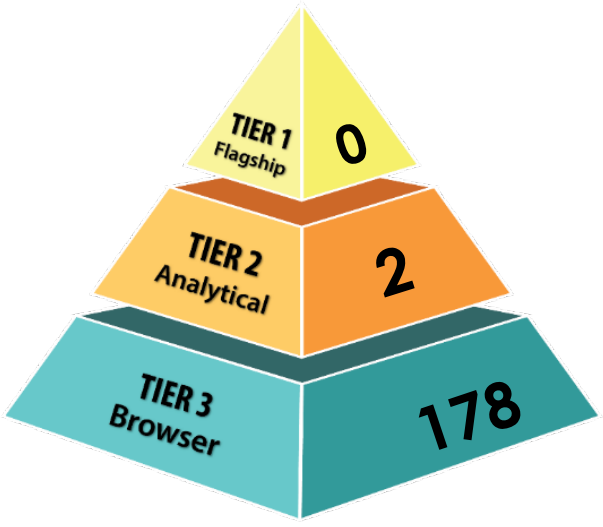
Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Police Department Requested Data			
Policing Beats and Response Zones	Originated from Police drawing on paper maps, then digitized into GIS by IT GIS staff.	Police	Existing
Calls for Service	Extract, cleanse and automatically map from dispatch databases.	Automated	Recommended
CCTV Data	Tied by unique number to a GIS layer and viewable within applications	Police in conjunction with GIS Staff	Recommended
Crime Data	Extract, cleanse and automatically map from RMS	Automated	Existing but needs to be automated
Arrests and Citations	Extract, cleanse and automatically map from RMS.	Automated	Partial
Drug free zones around schools and churches	Buffer appropriate properties.	Police	Recommended
Hazardous Materials	Fire Department MSDS Sheets Scanned and Linked to Site	Health Department and GIS Staff	Recommended
Liquor Licenses / Bars	Geocoded	State of California and Business License Data	Recommended
Neighborhood Watch Districts	Digitized On Screen	Police	Recommended
Offenders on Probation	Extract, cleanse and automatically map from City, County, and/or State Data.	Automated	Recommended
Offenders on Parole	Extract, cleanse and automatically map from State and/or County Data.	Automated	Recommended
Homeless and Mentally Ill Individuals and Encampments	Tracked in a database then geo-enabled	Automated	Recommended
Parking Violations	Extract, cleanse and automatically map from RMS.	Automated	Partial

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Pre Plan Data (Buildings)	Scanned and Visio	Fire and GIS Staff	Recommended
Social Media	Automatically linked via software	Automated	Recommended
Sex Offenders	From State	Automated	Recommended
Special Needs Residents	Extract and map from CAD/RMS data.	Automated	Recommended
Traffic Accidents	Extract, cleanse, geocode, and map from database	Police	Partial
Utility Systems	As-builts and GPS collections	Various	Partial
Warrants	Extract, cleanse and automatically map cityom RMS.	Automated	Recommended
Citywide Base Data			
Property	Original tax parcels were digitized and rubber sheeted from scanned hard copy water quality maps circa 1999. Updated manually once a year by the GIS Team using County data for attributes and the County's Adobe PDF parcel maps for geometry changes. Migrated to the LGIM Tax Parcel schema in 2016.	The GIS Team	Existing
Aerial Photography	Current aerial data is delivered by Pictometry through an agreement with Alameda County. The most current data was captured in 2014 with the next flyover scheduled for Spring 2017. The County's current contract with Pictometry calls for one more flyover after the 2017 capture. Older imagery exists for 2006 (custom County flyover), 2009, and 2011 (USGS).	Static Map	Existing
Road Centerlines	Created by RMSI in 2010 from various sources including Alameda County data and pavement management system data (street width). Updated manually by the GIS Team occasionally. Migrated to the LGIM Road Centerline schema in 2016. Zero Waste has a copy that has been updated for routing purposes.	The GIS Team	Existing
Address Points	During the work day, an Analyst in the Finance Department updates/creates new addresses in the Land Management (LX) module in SunGard (FUND$). Address points are then created nightly from an ETL that extracts and geocodes (using parcel centroid coordinates) and joining to a parcel table to create the address points feature class.	Automated / Finance Department	Existing

4

MULTI-TIER GIS APPLICATION USE

The pyramid and table below outlines the projected "Tiers of GIS Use" within the Police Department. All are color coded by the level of desired GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions. Police will consist of Tier One and Tier Two Users.



TIERS OF GIS USERS	
GROUP	ACTIVITY
Tier 1 Flagship	• GIS Administration • Data Maintenance • Data Conversion and Creation • Spatial Data Management • Technical Support • Coordination
Tier 2 Analytical	• Data Maintenance • Analytical Functions/Geoprocessing • Complex Queries • Modeling • Use of Desktop Extensions • High Quality Map Production
Tier 3 Browser	• Browsing/Look-Up • Standard Reports • Simple Query • Map Production

5

RETURN ON INVESTMENT (ROI)

The following table indicates specific Return on Investment opportunities for the Police Department:

Return on Investment Opportunity POLICE DEPARTMENT	
Opportunity	**Explanation**
Increase <u>Productivity</u>	***Internal Executive Information System:*** • Staff can quickly visualize and analyze the location of crime in the city. Decisions can be made quickly in roll call. Detectives have information in one place that was impossible or very time consuming to compile previously.

Return on Investment Opportunity POLICE DEPARTMENT	
Opportunity	**Explanation**
Save <u>Time,</u> <u>Lives and Property</u>	***Mobile GIS Data Browser and AVL:*** • Can prevent life threatening situations where officers locations are unknown during an emergency situation • Awareness of the location of disabled persons during an evacuation • Will reduce time required to locate pre-plans in the field. Particularly important in instances where potential safety hazards may not be readily visible ***Better 911 mapping, Mobile GIS Data Browser and AVL:*** • Officers will be able to arrive at an incident more quickly, thus potentially saving lives. • Officers will have access to information about previous criminal activity, allowing them to be more aware of life threatening situations ***Internal Executive Information System:*** • Staff can quickly visualize and analyze the location of crime in the city. The appropriate resources can then be deployed to mitigate the problems.
<u>Better</u> Decisions	***Optimal Response Area Analysis:*** • Will allow public safety resources to respond more quickly to calls for service and may result in saved lives and less crime. Management staff will be able to better calculate and analyze the department's abilities to respond to any particular emergency incident.
Better <u>Public Relations</u>	***Internet Viewer:*** • The public has access to selected incidents. This allows them to be more informed and improves relations. Also, the story maps will relay critical information.

NEEDS ASSESSMENT

PUBLIC WORKS

CITY OF BERKELEY
CALIFORNIA
GIS Strategic Implementation Plan

SECTION OUTLINE

1

EXISTING CONDITIONS

DEPARTMENT OVERVIEW

"The Public Works Department delivers programs and services to all City residents, businesses and property owners, visitors and travelers, and to all City Departments." These services include:

- Refuse collection
- Transportation planning
- Management of core infrastructure
- Operation of City radio communications equipment
- Electrical service for all City owned properties and facilities
- Maintenance for all City buildings
- Management of leased real property

Public Works consists of the following 8 divisions:

Office of the Director - provides Department-wide leadership, management oversight, and policy direction to the Public Works divisions.

Administrative & Fiscal Services – responsible for budget and fiscal oversight and compliance and reporting.

Engineering – implements the City's capital improvement programs, manages contracts for major construction projects, and oversees the condition of the City's infrastructure.

Zero Waste – operates or manages contracts for all City refuse and recycling services and manages the City's transfer station.

Transportation – develops and implements the City's transportation plans and policies.

Facilities Management – maintains 900,000 square feet of public service facilities and maintains traffic signals, street lights, and pedestrian control devices.

Streets & Utilities – maintains and repairs the City's 653 miles of streets, 388 miles of sanitary sewers, 78 miles of storm water system, and 300 miles of sidewalks and pathways, including oversight of the Clean City Program.

Equipment Maintenance – manages the City's fleet of 716 vehicles.

The Public Works Department currently employs 292 staff in total.

GOVERNANCE OF GIS

The Public Works Department is currently a major consumer of GIS in several of its Divisions. For the purpose of this Needs Assessment, the following Divisions were interviewed:

- Engineering
- Streets & Utilities
- Transportation
- Zero Waste

There are generally three tiers of GIS users. A Tier 1 - Flagship GIS user typically conducts GIS administration and coordination at the enterprise level, has access to a fully functioning GIS toolset to create and maintain enterprise data, and manages the enterprise database. A Tier 2 - Analytical GIS user focuses on data analysis,

complex querying and data modeling, along with department level data maintenance. A Tier 3 - Browser GIS user requires only general browsing GIS data functions to create reports, query standard data sets, create tasks like mailing labels, and produce maps.

The table below summarizes the current GIS staffing and/or GIS usage in the Public Works Department. Type represents the current level of GIS experience based on job requirements and GIS usage can be categorized as Limited, Moderate, or High (i.e. frequency of use), and Primary Tools describes what tools, or how GIS is used, to carry out GIS functions.

Current GIS Staffing				
Type		Number of Users	GIS Usage	Primary Tools
	GIS Flagship (Tier 1)	1	N/A	None
	GIS Analytical (Tier 2)	5	N/A	None
	GIS Browser (Tier 3)	34	N/A	None

HARDWARE AND SOFTWARE

The Public Works Department has personal computers for each of its employees. The table below summarizes the hardware in use for the Public Works Department:

Hardware Issues Summary	
Type	Notes
Personal Computers	One for each staff person
Laptops	Available as needed
Printers	Ample printers available for use
Plotters	Two large format
GPS	None
MDTs	None
Scanners	One large format

The Public Works Department utilizes the following software applications that are pertinent to this study:

1. Microsoft Office– Office productivity
2. SunGard – Work Orders
3. Accela – Work Orders
4. eTIMS – Parking meter work orders and permits
5. Pictometry – aerial photography
6. Lagan – customer complaints
7. AutoDesk Civil 3D – computer aided design
8. ArcGIS Desktop – advanced desktop GIS
9. StreetSaver – pavement management
10. RouteSmart – vehicle routing
11. Synchro – traffic modeling
12. Cross Roads – collision database
13. Quick Net – signal management

2
GIS NEEDS ASSESSMENT

GIS NEEDS

The Public Works Department should have expanded access to GIS and its complementary technologies. The department recognizes the potential benefits of using GIS including integration with other databases, sewer maintenance, grant applications, routing, modeling, and other uses. The table below summarizes the potential needs identified by Public Works Department staff and how they are to be met:

GIS Need	*Method/Application to Meet Need*
Mapping and Spatial Analysis in Support of Public Works Operations	Desktop GIS Intranet GIS Browser ArcGIS Online - Mobile
Data Creation, Management, Mapping and Enabling Existing Databases, and Integration with Third Party Systems	ArcGIS Intranet GIS Browser Data Mining and Geo-enabled data
Field Access to Geospatial Data	Mobile Laptops/Tablets ArcGIS Online
Department-wide Access to GIS Data	Intranet GIS Browser
Expand Public Access to Geospatial Information	Internet GIS Browser
GIS Education for Department Staff	Intranet GIS Data Browser Training

GIS NEED

Mapping and Spatial Analysis in Support of Public Works Operations

GIS, aerial photography and address information, when used together, can assist in analyzing and updating various City owned infrastructure, and mapping landscaping areas. GIS reduces the time needed for map production, revisions, and information storage while allowing for the combination of data "layers" and the timely analysis of spatial variables. Staff should be utilizing GIS technology to accomplish analytical tasks as follows:

- Asset management (e.g. where are the assets, when were they last inspected, etc.)
- Data extraction by geographic region analysis
- Work Order mapping and planning
- Track history of community concerns/complaints as they relate to Public Works
- Perform analysis for future transportation system needs
- Track assets and their condition and integrate into work order system
- Complete mapping of all assets
- Pavement management and sidewalk analysis
- Mapping of parking lots and parking spaces
- Sewer & Stormwater maintenance
- Mapping for grant applications

In addition to utilizing the Intranet GIS data browser, desktop GIS can be used as a tool to provide more advanced capabilities for users who will perform map production and spatial analysis. The information in the existing GIS layers can be viewed with desktop GIS to perform network routing, proximity analysis, and cartographically complex maps. Desktop GIS can be used to assist in plan review, tracking trouble spots, and analyzing condition of assets.

Using mobile GIS data browsers (ArcGIS Online), Public Works can provide field crews with maps of facilities, streets, signs, signals, aerial photographs, and any pertinent assets. This will provide field crews with quick access to information that is needed to do routine maintenance, inspection, repairs and other field work.

GIS NEED

Data Creation, Management, Mapping and Enabling Existing Databases

The majority of Public Works tasks have a geographic component. Staff and community need to be able to visualize and understand the dispersion of assets within the City. To that end, a number of data layers have been created in conjunction with the base map layers. Department staff currently maintain the sewer utilities data. However, staff pointed out that they desire some additional data. The following are key data sets that will need to be created/updated for Public Works:

- Street sweeping routes
- Storm inlets
- Parking meters
- Curb markings
- Pavement markings
- Litter can inventory
- Potholes
- Illegal dumping
- Service location bins & carts (solid waste)
- Road construction and road closure alerts
- Survey monuments
- Sidewalk repair locations
- Speed zones
- Traffic volumes
- Pavement conditions

Mapping and spatial analysis are key tasks that will enable Public Works to improve management, operations, administration, and maintenance of the department's infrastructure. Mapping data such as work orders, service requests, pavement ratings, etc. can often reveal patterns and relationships that would otherwise go unnoticed. Geo-enabling this type of data offers a host of analysis applications. Some of this data exists in databases and should be geo-enabled.

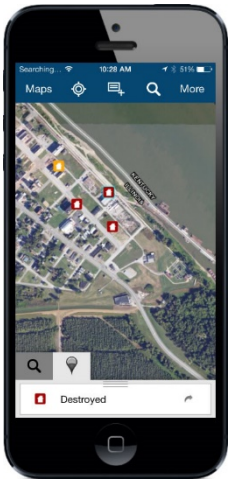
Any database with associated addresses can be address-matched to a street centerline layer, tax parcel centroids, or address point layer. This data can be geo-enabled through an automated geocoding service that creates GIS data layers from non-spatial relational databases. The results of a successful geo-coding effort will be stored in an industry standard relational database management system (SQL Server, Oracle, etc.). The automated process is based completely on standard SQL statements and is customized to utilize a variety of stored location-based data (Parcel PIN, Address, Location-ID, etc.). A second function of the automated service is to generate GIS layers in an industry standard portable format (SDE layers) that could

be utilized by a variety of applications. These GIS layers will be created to user specifications. X, Y coordinates will be utilized to display features in a GIS layer. The geocoding service can generate and export the resulting GIS layer on a regularly scheduled basis.

GIS NEED

Field Access to Geospatial Data

Many opportunities exist for the Public Works department to take advantage of technology to improve usage and access to GIS data in the field. By combining mobile laptops and/or tablets with a GIS data browser, Public Works can provide field personnel with tools necessary to complete their daily tasks. Many municipalities throughout the country are utilizing mobile laptops/tablets in conjunction with a mobile data browser to view, update, and log changes to existing infrastructure. A mobile data browser can be loaded on mobile computing devices, allowing the ability to conduct address searches, query attributes of features, and link to digital images such as photographs or drawings. An added benefit is that updates to GIS data can be made available quickly.



A mobile data browser provides field personnel with all relevant layers, including base map layers and aerial photography. The laptops/tablets should be set-up to synchronize wirelessly with the City's network as much as possible using mobile networking capability. Data can be provided to mobile computers by replicating data, or extracting updated data from the enterprise geodatabase when mobile networking is not available or is not plausible. The City of Berkeley currently is using ArcGIS Online for web mapping and for mobile purposes (limited). One benefit of using ArcGIS Online is the ability to harness pre-developed applications and maps. ArcGIS Online could also be utilized for field mobility including data collection. Since ArcGIS Online is an integral part of the ArcGIS system, organizations can use it to extend the capabilities of ArcGIS for Desktop, ArcGIS for Server and other ArcGIS based applications.

Pavement Marking Inventory

Additionally, Public Works should utilize the Collector application from Esri. Collector for ArcGIS should be used to improve the efficiency of field staff with the goal for improving the accuracy of your GIS. The application works on iOS or Android devices and is used to collect and update information in the field, whether connected or disconnected. The application can be used to collect any data.

GIS NEED

Department-Wide Access to Geospatial Data

Intranet applications (Parcel Popper, Public Works, Storm Sewers) have been made available for Public Works staff. This in conjunction with ArcMap are the primary ways that staff can view GIS data. However, the use of ArcMap is slow and is more complex than what is needed for quick data viewing and analysis. It is recommended that the use of intranet mapping applications is expanded to more robust intranet viewers with more data and functionality.

One of the keys to GIS success in local government is deploying user-friendly tools. If the tools are not easy-to-use, they will not be used. The Esri HTML5 viewer is user-friendly and intuitive. With minimal training (less than one-hour), users will be able to perform queries, analyze bar charts and pie charts, and print their own maps.

Intuitive HTML5 Interface Example Easy Access to GIS, Public Works, and Other Data

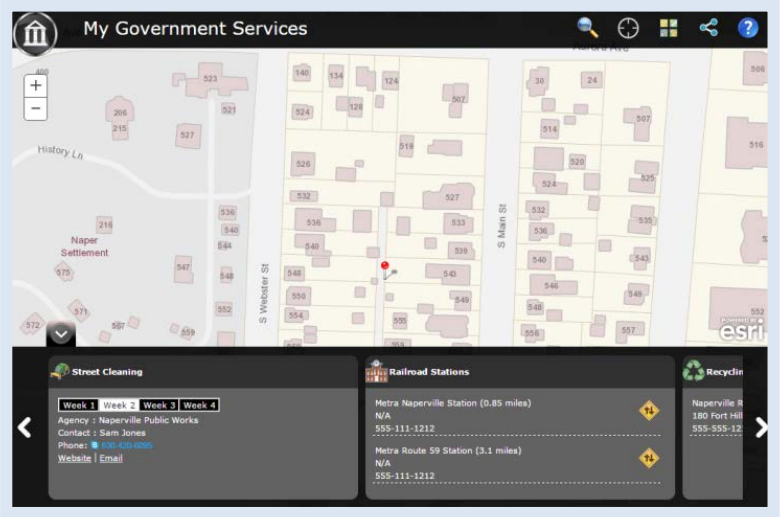
The following are other uses, functionality and/or data that staff expressed they would like to see in the Intranet browser:

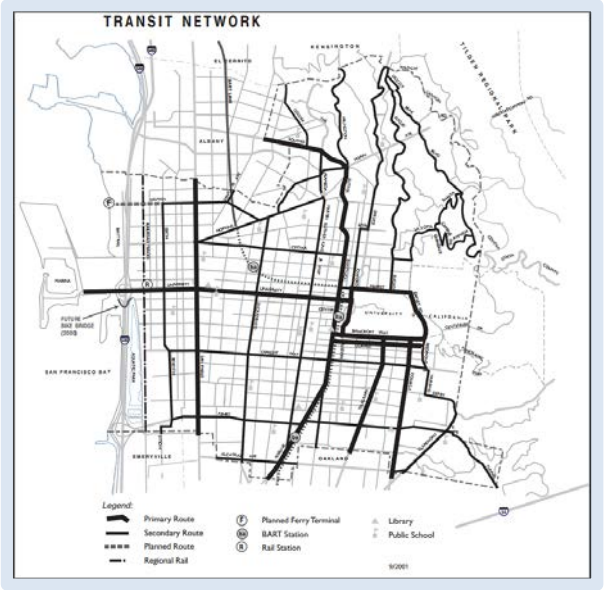
- Inclusion of facilities data
- Links to building plans
- More control of what layers can be turned on/off
- Links to Google Street View
- Charts (pie, bar, etc.)
- Viewing of Asset Management data
- Measurement tools
- Viewing of sidewalk data and pavement management plan data through time
- Viewing of work orders and repair history

GIS NEED

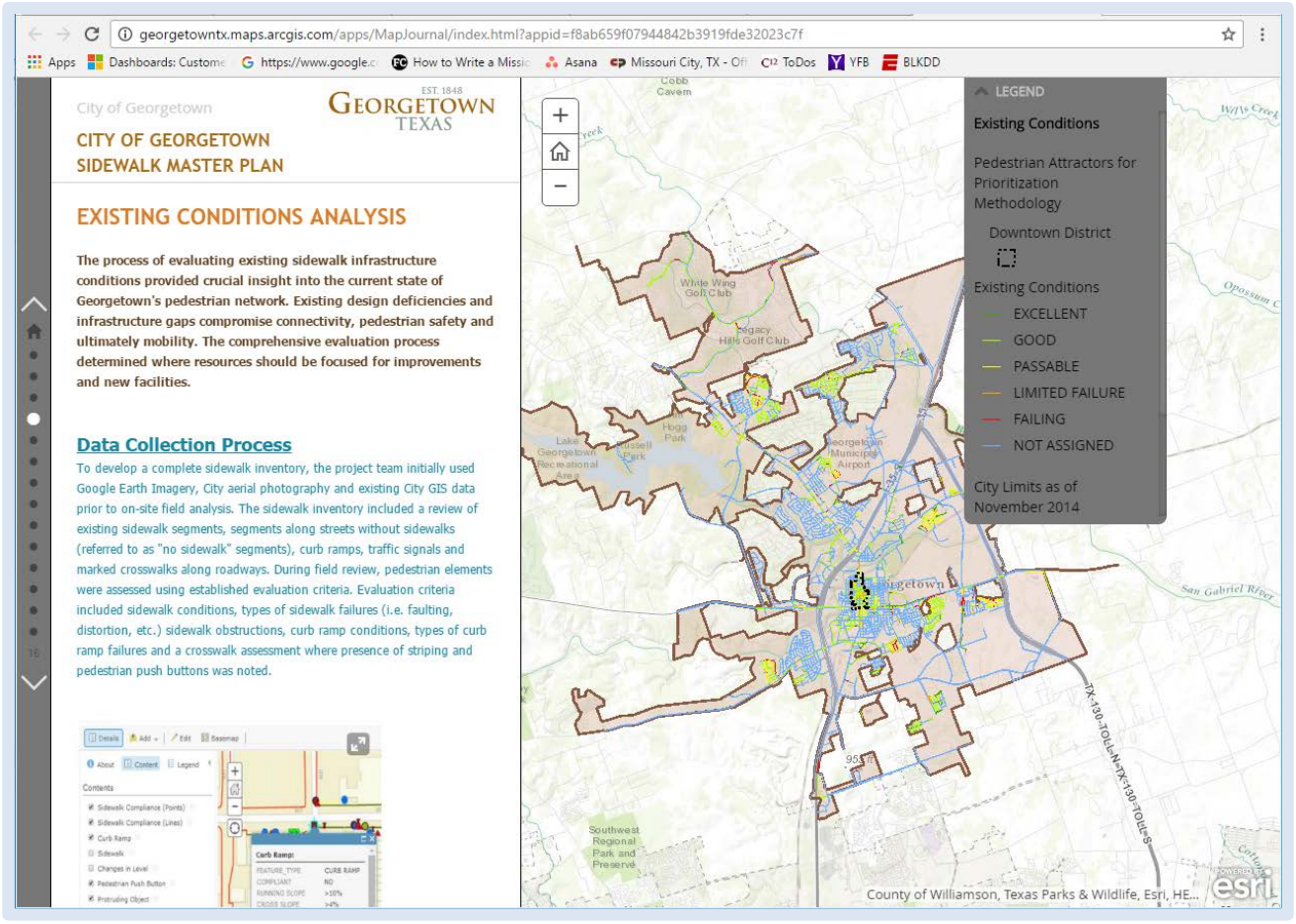
Expand Public Access to Geospatial Information

Providing public access to GIS maps through the Internet provides information to the City's community members. Currently, Public Works offers community members both static maps to view. Static maps include: transit network, vehicular circulation, bicycle network and parking, residential permit parking, truck route system, and emergency access and evacuation network. Providing the public with dynamic, interactive maps is the next step and Public Works should pursue efforts to develop these online dynamic maps in conjunction with the GIS Team. These maps may include pavement projects, my government services (can show for any location street sweeping schedule, waste pickup, nearest bus stop, leaf pickup, etc.). and many others. Through dynamic web maps and apps, the data specific to Public Works can be provided to the public through intuitive and easy to use interfaces. Staff identified the desire to use the following applications; Esri's Swipe Map (internal and external) to show change over time, My Government Services, a public facing mowing map, and Story Maps that present plans like the City's transportation networks (roads, sidewalks, bicycle) or garbage and recycling pickup schedules.





Existing Transit Network Map



Example Story Map – Sidewalk Master Plan

GIS NEED

GIS Education for Department Staff

The City of Berkeley should develop a GIS Training Plan and Public Works should participate and provide input to ensure their needs are being met. Staff that will be performing more advanced GIS analysis and mapping should participate continually in foundational and advanced GIS skills training. Public Works staff should participate in any enterprise-wide ArcGIS training that is made available. Various divisions expressed their desire to utilize GIS more extensively. Training should be provided on utilizing GIS for analysis and data maintenance. Tier three training should be provided on tools, as they are made available and throughout the year.

3

GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY

Public Works staff are responsible for the maintenance of GIS data layers (sewer utilities) with the expectation that they will be responsible for more maintaining other layers in the future. It is expected that once all departmental data is integrated, consolidated, and centrally stored, that staff will have access to all non-classified GIS data layers from other departments.

Legend

Data Layer	The data layer is the GIS thematic data that is being described. The name of the layer or description of the layer is placed in this column.
Creation Methodology	This column describes how the layer was or is anticipated being created.
Recommended Update Division or Individual	This field outlines the division or individual that is anticipated to maintain or develop the data layer during and after full implementation of the Citywide enterprise GIS. Development of new recommended layers will be prioritized for each year of the Strategic Implementation Plan.
Layer Status	Layer state of existence.
Existing	These layers currently exist within the City's GIS.
Recommended/ Desired	These layers are recommended for development or procurement, based on departmental and enterprise needs. These data layers will help support existing business procedures or will compliment other GIS data sets that are already existing and in use by the city. Costs associated for these recommended layers will be based on general estimates – actual cost may vary.
Partial	These layers currently exist in an incomplete or outdated state.

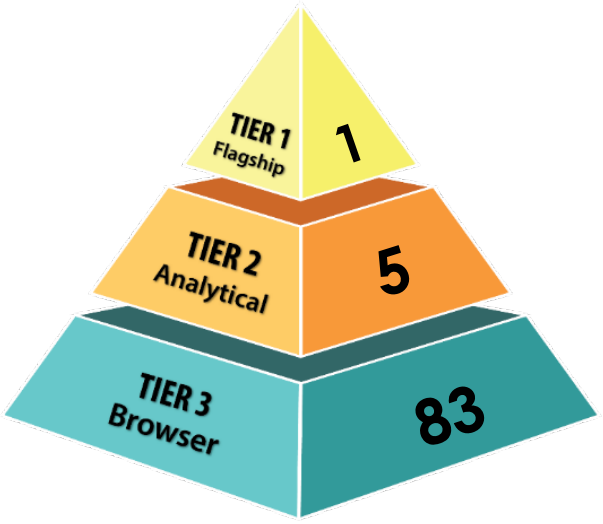
Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended ?
Public Works GIS Data			
Buildings	Digitize on screen	GIS Team	Existing
Bulk Waste Pickup Locations	Geocode	Public Works	Recommended
Capital Improvement Projects	Digitize from plan documents	GIS Team	Recommended
Clean City	Digitize on screen	Public Works	Recommended
Construction Parking Permits	Geocode from database	Automated	Recommended
Cross Walks	Digitize from plan documents	GIS Team	Recommended
Curb Markings	GPS	Public Works	Recommended
Easements	Digitize from plat maps / COGO	GIS Team	Recommended
Electrical	Digitize from source documents	GIS Team	Recommended
Illegal Dumping	GPS	Public Works	Recommended
Landscaping	GPS	Public Works	Recommended
Litter Can Inventory	GPS / Geocode	Public Works	Recommended
Make Safes	GPS / Geocode	Public Works	Recommended
Parking Meters	Extract from eTIMS	Automated	Recommended
Pavement	Extract from StreetSaver	Automated	Recommended
Pavement Markings	GPS	Public Works	Recommended
Potholes	GPS	Public Works / 311	Recommended
Road Construction and Closure Alerts	Geocode	Automated	Recommended
Sewer Utilities	Digitize from as-builts / GPS	Public Works	Existing
Sewer Videos	Link to GIS	Public Works	Existing
Sidewalk Repairs	GPS	Public Works	Recommended
Sidewalks	Digitize on screen	Public Works	Recommended
Signage	GPS	Public Works	Recommended
Solid Waste Bin & Cart Locations	Geocode	Public Works	Recommended
Stormwater Utilities	Digitize from as-builts / GPS	Public Works	Existing
Street Furniture	GPS	Public Works	Recommended
Street Lights	GPS	Public Works	Recommended
Street Sweeping Routes	Digitize onscreen	Public Works	Recommended
Survey Monuments	Import from AutoCAD	Public Works	Recommended
Traffic Data	Synchro Integration	Automated	Recommended
Trees	GPS	Parks & Rec & Waterfront	Existing

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended ?
Citywide Base Data			
Property	Original tax parcels were digitized and rubber sheeted from scanned hard copy water quality maps circa 1999. Updated manually once a year by the GIS Team using County data for attributes and the County's Adobe PDF parcel maps for geometry changes. Migrated to the LGIM Tax Parcel schema in 2016.	The GIS Team	Existing
Aerial Photography	Current aerial data is delivered by Pictometry through an agreement with Alameda County. The most current data was captured in 2014 with the next flyover scheduled for Spring 2017. The County's current contract with Pictometry calls for one more flyover after the 2017 capture. Older imagery exists for 2006 (custom County flyover), 2009, and 2011 (USGS).	Static Map	Existing
Road Centerlines	Created by RMSI in 2010 from various sources including Alameda County data and pavement management system data (street width). Updated manually by the GIS Team occasionally. Migrated to the LGIM Road Centerline schema in 2016. Zero Waste has a copy that has been updated for routing purposes.	The GIS Team	Existing
Address Points	During the work day, an Analyst in the Public Works Department updates/creates new addresses in the Land Management (LX) module in SunGard (FUND$). Address points are then created nightly from an ETL that extracts and geocodes (using parcel centroid coordinates) and joining to a parcel table to create the address points feature class.	Automated / Public Works Department	Existing

4

MULTI-TIER GIS APPLICATION USE

The pyramid and table below outlines the anticipated "Tiers of GIS Use" within the Public Works Department. All are color coded by the level of desired GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions.



TIERS OF GIS USERS	
GROUP	ACTIVITY
Tier 1 Flagship	• GIS Administration • Data Maintenance • Data Conversion and Creation • Spatial Data Management • Technical Support • Coordination
Tier 2 Analytical	• Data Maintenance • Analytical Functions/Geoprocessing • Complex Queries • Modeling • Use of Desktop Extensions • High Quality Map Production
Tier 3 Browser	• Browsing/Look-Up • Standard Reports • Simple Query • Map Production

5

RETURN ON INVESTMENT (ROI)

The following table indicates specific Return on Investment opportunities for the Public Works Department. These specific examples show the true return on investment of the technology.

Return on Investment Opportunity Public Works Department	
Opportunity	**Explanation**
Save Time and Respond More Quickly to Internal Data Requests	***Staff access to accurate/updated data*** • Staff should have access to current GIS data to better serve and provide information to the public and decision makers. This should save multiple staff hours a week in the Public Works Department.
Improve Data Accuracy	***Better GIS Data and Spatial Analysis:*** • Working with other departments and City agencies to update data with higher accuracy can improve the results when analyses are performed. By sending errors found in data to the data owners, errors can be corrected quickly.

Return on Investment Opportunity Public Works Department	
Opportunity	**Explanation**
Improved <u>Efficiency</u>	***Desktop GIS:*** • GIS can assist in tracking inventory of pavement markings and signage making staff more efficient in finding assets and replacing them as needed ***Mobile GIS:*** • Providing field personnel with laptops reduces the time spent in the office preparing for assignments. It may reduce their downtime as they wait for record drawings to be located. • Quicker location of infrastructure
<u>Compliance with Regulatory Requirements</u>	• GIS is utilized to comply with required reports and laws. • Mapping of the various data in conjunction with work orders will allow the Public Works Department to better respond to field needs
<u>Ability to Respond More Quickly to Community Requests / Improved Access to Government</u>	• Providing electronic maps to outside consultants allows the users to quickly fulfill requests through e-mail, without having the engineer visit the department. • Maps with accurate spatial locations of infrastructure would enable the users to respond more quickly to emergencies and community requests. • Provide up-to-date information to residents and businesses about Public Works projects and services
<u>Effective Management of Assets and Resources and Save Money</u>	• Asset management systems tied into GIS will allow Public Works to identify problematic areas based on the age of the system, the number of service calls to an area, or the repair history. • Optimize work order assignment by location • Target areas to perform work and services. • Become more responsive to community requests • Economize routine maintenance and scheduling based on spatial location. • Reduce labor costs by reducing field time - for looking up data and drawings within the GIS • React more quickly to issues with roads and associated features

NEEDS ASSESSMENT

RENT BOARD

CITY OF BERKELEY
CALIFORNIA
GIS Strategic Implementation Plan

SECTION OUTLINE

1 EXISTING CONDITIONS

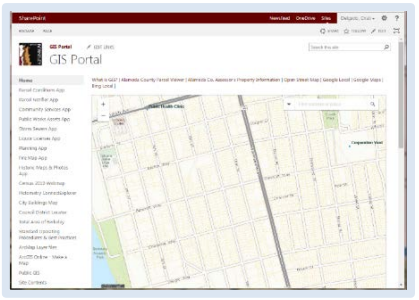
DEPARTMENT OVERVIEW

The Rent Board employs approximately 20 full-time equivalent staff and is comprised of five divisions: Legal Advice Compliance and Litigation, Administration, Petitions and Hearings, Registration, and Public Information. The department is responsible for executing the Rent Stabilization and Eviction for Good Cause Ordinance. The main purpose and mission of the Rent Board is to regulate residential rent increases and protect community members against unwarranted rent increases and evictions. The Rent Board is required to perform these duties while providing a fair return to property owners. Additionally, the Rent Board works

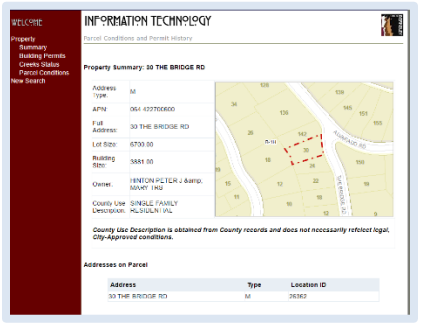
to ensure compliance with legal obligations related to rental housing and to preserve housing opportunities for low and fixed income persons, minorities, students, disabled and senior residents.

GOVERNANCE OF GIS

Rent Boards inherently needs GIS as a majority of their work deals with land related items that lend themselves to mapping and analysis As such, Rent Board cannot carry out its functions efficiently without GIS technology. Rent Board relies on GIS staff in IT for various GIS services and products. Staff use various tools and services as follows:



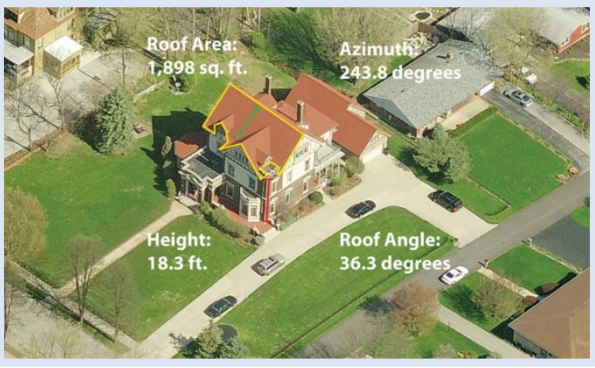
- Web Browser Map – this is an internal application that provides data. The application was created by using Esri's Web AppBuilder. The Web AppBuilder uses JavaScript and HTML5 which makes the resultant applications platform neutral (work on PCs, tablets, phones).



- Parcel Information (Parcel Popper) – this application is used to view property related information related to investigations.
- ARCGIS Online – used for mapping locations of certain types of evictions to analyze their geographical pattern.

In addition to the above applications, Rent Board could utilize the following applications that are available via other City Departments.

- Pictometry – the city has access to oblique aerial photography from Pictometry. Pictometry comes with a viewer that allows you to view and analyze the photography.



- Mailing Label Application – this application is used for creating public notifications. It is currently being replaced with a more modern application that uses the Esri Web AppBuilder
- Accela Map – Accela comes with an internal mapping application for viewing selected information within Accela

It is important that staff within Rent Board continue to expand their GIS capabilities. Staff should be equipped to maintain some of their own core data sets (following best practices for editing and maintaining data) and utilize GIS tools to create a majority of their mapping and analytical needs.

The table below summarizes the current GIS capable staffing within the Rent Board. Type represents the current level of GIS experience based on job requirements, GIS usage can be categorized as Limited, Medium, or High (or frequency of use), and Primary Tools describes what tools, or how GIS is used, to carry out GIS functions.

There are generally three tiers of GIS users. A Tier 1 - Flagship GIS user typically conducts GIS administration and coordination at the enterprise level, has access to a fully functioning GIS toolset to create and maintain enterprise data, and manages the enterprise database. A Tier 2 - Analytical GIS user focuses on data analysis, complex querying and data modeling, along with department level data maintenance. A Tier 3 - Browser GIS user requires only general browsing GIS data functions to create reports, query standard data sets, create tasks like mailing labels, and produce maps.

Currently, Rent Board utilizes a few GIS tools. ArcGIS for Desktop is used for data analysis, data creation, and data visualization. Also, staff have access and utilize a web browser based GIS for property identification. The table below summarizes the current GIS staff usage within the division. Type represents the current level of GIS experience based on job requirements, GIS usage can be categorized as Limited, Moderate, or High (i.e. frequency of use), and Primary Tools describes what tools, or how GIS is used, to carry out GIS functions.

Current GIS Staffing				
Type		Number of Users	GIS Usage	Primary Tools
	GIS Flagship (Tier 1)	0	N/A	None
	GIS Analytical (Tier 2)	1	N/A	ArcMap for Editing Some Limited Data Sets
	GIS Browser (Tier 3)	10	N/A	Various GIS portals for viewing data

HARDWARE AND SOFTWARE

Any hardware issues that were discussed during this Needs Assessment are summarized in the table below. Enterprise wide issues will be discussed in greater detail throughout later chapters of this Needs Assessment and GIS Strategic Implementation Plan.

Hardware Issues Summary	
Type	**Notes**
Personal Computers	Personal computers are available for all staff
Laptops	One older unit is available to staff
Mobile Devices	None being used for GIS
Printers	Available to office staff
Plotters	None
GPS	None
Scanners	Available for use

The Rent Board utilizes the following software applications:

1. Rent Tracking System – custom web-based database
2. Microsoft Office– Used for office productivity
3. Constant Contact – for emailing contacts
4. Case Management – access database
5. Accela – Enterprise land management system
6. GIS Portals – Viewing property related data

2
GIS NEEDS ASSESSMENT

GIS NEEDS

The Rent Board would like to further implement and embrace GIS and its complementary technologies - from better analysis of rent data to building synergies with other departments (e.g. Planning, Housing and Finance). The department could leverage and further integrate existing investments in its technology infrastructure to develop an effective solution for its particular mapping and spatial analysis needs.

Similar agencies across the country have implemented GIS in varying capacities, and Rent Board is well positioned to further implement GIS technology. Keys to a comprehensive GIS effort will be the implementation of mapping and spatial analysis applications throughout the various divisions of the department, standardization and joining of datasets across city departments, an increase in educational opportunities, public facing GIS portals, as well as dynamic, real-time data editing and maintenance.

Based on this Needs Assessment, Rent Board has several identified GIS needs. Where applicable, each need will be followed by an application or method to meet that need, some applications/methods will meet several needs. A method or application is only described under one need, if it applies to multiple needs refer to the previous need for a description. The following table summarizes these needs and how they are to be met:

GIS Need	Method/Application to Meet Need
☑ Data Layer Design, Creation, and Enhancement	• ArcGIS for Desktop (Standard) • ArcGIS Online • Data Mining/Geocoding Application
☑ Increase GIS Skills, Training, and Staffing	• ArcGIS Desktop • Training Classes • Additional Staffing
☑ Department-Wide Access to Geospatial Data	• Internet and Intranet GIS Data Browser • ArcGIS Online
☑ Public Access to Geospatial Data	• Internet GIS Data Browser • Esri Story maps • ArcGIS Online • Mobile GIS Data Browser
☑ Field Access to Geospatial Data Solutions	• Mobile GIS Data Browser • Tablet Computers • ArcGIS Online

GIS NEED

Data Layer Design, Creation, and Enhancement

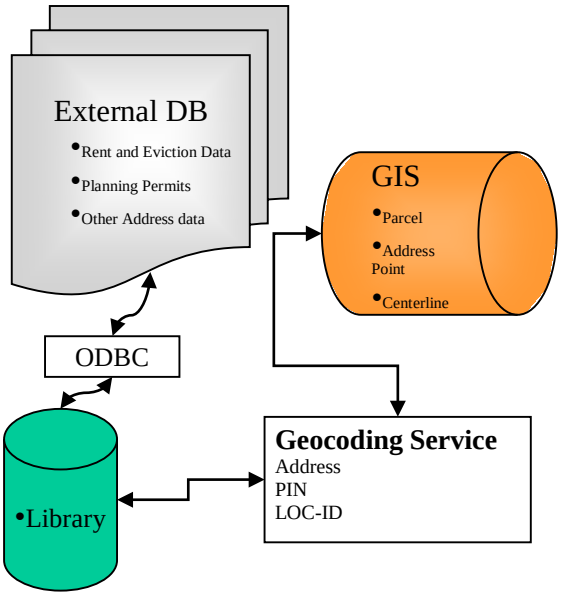
The most expensive, yet important aspect of the Rent Board GIS initiative is the creation and management of complete and accurate GIS data sets. A number of Rent Board layers and related data residing in business systems (e.g. Rent Tracking System) have already been created. Continuing to create and maintain this data is a critical component for success. However, the primary need identified during the Needs Assessment interviews was the need for data. Some staff indicated that they don't use GIS as much as they could because of missing data. The following are the data layers that were identified as needed or in need of updating:

- Buildings – building outlines/footprints
- Geocode rent and eviction data
- Overlap of callers to 311 versus Rent Board case management system – need better integration
- Capture of all residential units in the City
- Rent ceilings, start date, rental status
- Building address points (move address points from center of parcel to center of buildings)

- Data within Rent Tracking System geo-enabled and better integration with Accela GIS to validate addresses
- Rental properties after 1980
- Below market rate units
- Accessible dwelling units

The above list is just a subset of all of the possible data layers needed by Rent Board. Staff will never fully benefit from GIS unless their needed data is readily available. As GIS usage increases, staff will discover new data needs to enhance their services. The biggest impediment to the creation and maintenance of this data is staffing (this will be discussed in the next need).

Where possible it is recommended that Rent Board discontinue tracking data in Microsoft Access databases or Microsoft Excel spreadsheets for data that could be better managed in GIS. These files should be geo-enabled and converted into GIS layers. Moving forward, staff should be given the training to update this data via the GIS instead of in Excel or Access. Any needed reports should be generated using Microsoft SQL Server Reporting Services, or through canned reports via the GIS.



Some of the aforementioned data stored in external databases (e.g. Rent Tracking System) will require more than just linking, but creation of feature classes (e.g. evictions, rent data). These databases contain an address field making them a candidate for spatial enablement. Any database with associated addresses can be address-matched to a street centerline layer, tax parcel centroids, or address point layer. This data can be geo-enabled through an automated geocoding service that creates GIS data layers from non-spatial relational databases. The results of a successful geo-coding effort will be stored in an industry standard relational database management system (SQL

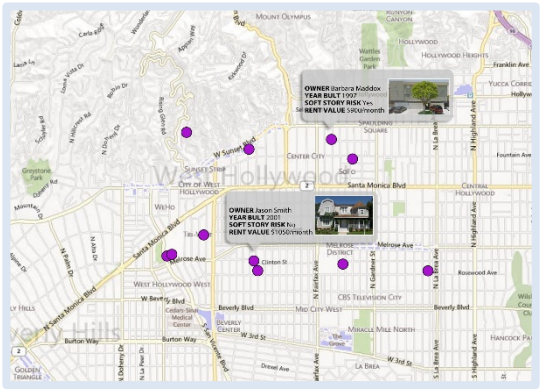
Practical Example

Rent Board needs to view the location of rent data from the Rent Tracking System along with permits from Accela. Customer records related to an address can be mapped by linking each record to a spatial feature such as an address point. The geocoding service can generate and export the resulting GIS layer on a regularly scheduled basis.

Server, Oracle, etc.). The automated process is based completely on standard SQL statements and is customized to utilize a variety of stored location-based data (Parcel ID, Address, Location-ID, etc.). A second function of the automated service is to generate GIS layers in an industry standard portable format (SDE layers) that could be utilized by a variety of applications. These GIS layers will be created to user specifications. X, Y coordinates will be utilized to display features in a GIS layer. The graphic above shows the process of using a geocoding service to extract data. Once the above information is maintained as digital data, it can be spatially enabled for use in the City's GIS and used like any other GIS layer for viewing, reporting, analyzing, etc.

GIS NEED

Increase GIS Skills, Training, and Staffing



Accomplishing the previous need is not possible today based on staff availability and expertise. The City currently has only one full-time staff person to support GIS in the central GIS group in IT. Additionally, Rent Board currently has one staff person trained to perform GIS analysis using ArcGIS for Desktop but has limited time to dedicate to GIS since it is not part of their regular job assignment, there is interest to have one more staff person assisting with these duties. There is also a lack of buy-in from management on expanding GIS use in the Rent Board since the Rent Tracking System data is not geocoded. For a GIS program to subsist, management, and staff at all levels will need to participate in the care and maintenance of the data.

Train existing staff – Existing Rent Board staff should be given more training and should commit to developing GIS skills. Some of the GIS layers should be maintained by Rent Board staff since they are the subject matter experts. This will require training on how to manage and maintain specific layers. Additionally, a number of staff should learn how to use ArcGIS for Desktop Standard so that they can perform more analytical tools than are available via the intranet web browser applications. A training regime will be developed and will be included in the Training Chapter of this Strategic Plan.

The expansion of skills will allow staff to begin to use GIS analytics. Rent Board will be able to further understand relationships between different types of data in a spatial context, thereby improving decision-making.

The Rent Board already uses GIS for many tasks, however an improved, more user-friendly and integrated system could enable staff, particularly those not currently taking full advantage of widely-available GIS capabilities, to complete many tasks in a fraction of the time some of them currently take, such as:

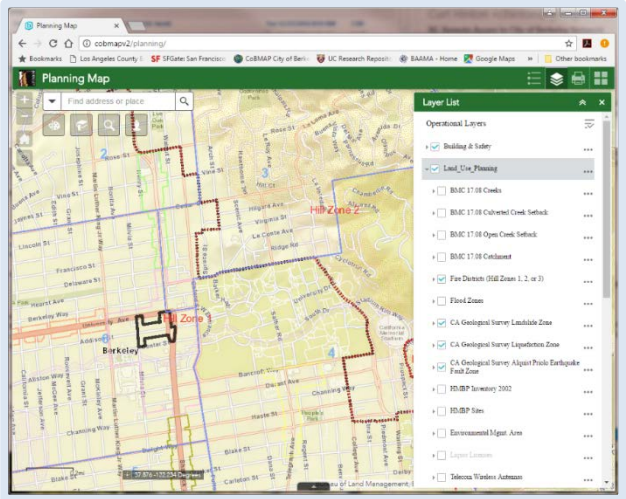
- Viewing and analyzing city demographic information for federal and state reporting and funding applications and/or for local policy studies and plans
- Rent trending by area
- Community education and outreach
- Statistical analysis for various departmental tasks and efforts
- Heat mapping of Rent Controlled Units
- Many other tasks not listed here

More staff in Rent Board will be better able to derive valuable spatially-driven information on key issues and in less time than currently possible. Among these analyses, GIS can provide support for project impact analyses, such as mapping rent controlled units, and allow better analysis of current demographics in relation to rentals. However, staff need to commit to and participate in a long-term, ongoing training and education regimen.

GIS NEED

Department-Wide Access to Geospatial Data

Providing users with the ability to view spatial data in a quick and intuitive manner is important for local government agencies and is critical within the enterprise. Web-based data browsers allow quick viewing and printing of map data and can be configured either for use solely within Rent Board, or as a website available to all internal City departments.



Intranet GIS data Browser

Departmental Intranet GIS Data Browser solutions are GIS applications that provide data dissemination services by departmental function through web-based technology. Intranet browsers represent a step forward in enterprise-wide GIS technology as they offer a "right-sized" set of spatial analysis tools, geographical viewing and map production tools, as well as external database links. The departmental browser should include:

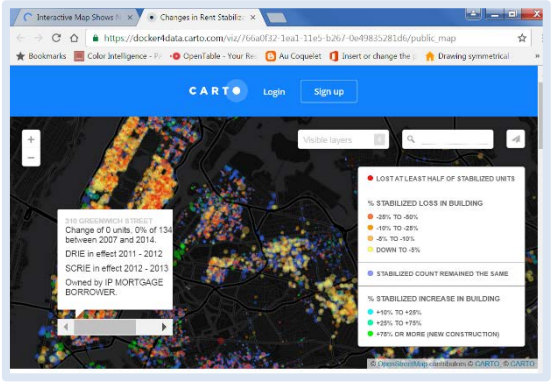
- Advanced Search Criteria
- Automated Mailing Labels
- Customized Departmental Query Control
- On-Line Help and Tutorial
- Buffer Analysis
- Printing
- Enhanced Text Placement
- Link to external Databases
- Easy-to-Use interface
- Advanced Graphic Design
- Markup Tools

The GIS Team in IT has provided a portal for users within Rent Board but does not include Rent Board data from the Rent Tracking System. The Rent Board intranet site should be further configured to present users with pertinent GIS data and custom defined queries for easy end-user interaction. It is recommended that a Rent Board portal continue to be expanded with configuration specific to their needs. For example, Rent Board needs access to demographic data, rent data, permits and applications, land use, zoning, property ownership, and a variety of other data. Integrating data from various business systems (Accela and the Rent Tracking System) is instrumental in making GIS more effective for Rent Board.

GIS NEED

Public Access to Geospatial Information

Providing public access to GIS maps through the Internet provides information to Rent Board customers and can provide opportunities for education and resources while reducing calls to the department. Through an Internet GIS Data Browser and focused web maps and apps, the data specific to Rent Board can be provided to the public



through intuitive and easy to use interfaces. The Rent Board identified a number of public facing portals that were of interest. These applications are generally focused on providing community members with specific information related to Rent Control and Eviction Protections.. For example, a web mapping application can show changes in rent stabilization over a period of time while also providing current rental unit information to potential renters. Another application may help a renter verify if a unit is under rent control and also provide a mechanism for learning more.

The City should further implement an ArcGIS Server (AGS)-based Internet GIS data browser to provide the public with access to Berkeley's geospatial data. One possible solution is to deploy ArcGIS Online for Organizations. The deployment would include extremely focused applications specific to the various department needs and allow for different configurations and different looks. Targeted applications can also be paired with a generic public query portal that would provide varying functionality. With a number of departments interested in providing high-quality geospatial data and maps to the public, an internet GIS data Browser will be a City initiative, including Rent Board as a stakeholder in its provisioning.

GIS NEED

Field Access to Geospatial Data Solutions

The Rent Board stated the desire to utilize GIS in the field. Some staff may need access to geographic data while conducting their duties in the field (Also, when working from home or telecommuting). Accordingly, providing personnel with remote access to maps and GIS data while working in the field is an important part of maintaining an enterprise GIS. Through the use of hardware, software and data that are designed to be accessed and manipulated away from the office, the Rent Board staff can realize benefits of GIS while in the field. Integrating with mobile computers, input devices, software and GIS data into the GIS enterprise will give Rent Board tools to perform field data collection, site visits, routing capabilities, and interactive geographic data query and analysis.

Many public agencies have moved away from expensive laptops for field access towards tablets. It is recommended that the City update its mobile strategy and consider the implementation of tablet based GIS access and markup. Rent Board staff performing visits to sites for investigations may need immediate access to the various department/division database systems to retrieve records and documents, history, or any other pertinent data related to the department's activities. Access to geospatial data from the field will enable field personnel to look up relevant property related data/documents, and make necessary project notes which will prove to be helpful in monitoring progress of cases. Free data viewing applications exist from Esri as well as applications that allow staff to augment data in the field. This application, Collector for ArcGIS, provides robust and intuitive tools for viewing maps, collecting and updating data, getting driving directions, and tracking and reporting areas visited. Collector operates through ArcGIS Online and with the newest release allows the ability for working offline. Collector is designed to work with iPhone and Android smartphones, but can also be used on tablets running iOS or Android. Collector is a simple way to expedite a mobile GIS solution that allows users from across the organization to have the power of GIS in their hands.

3

GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY

The Rent Board will benefit from access to almost all data layers created and obtained for the City. It is expected that once all departmental data is integrated, consolidated, and centrally stored, that staff will have access to all non-classified GIS data layers from other City departments and other public agencies or data providers. The following legend describes the data layer table below:

Legend

Data Layer	The data layer is the GIS thematic data that is being described. The name of the layer or description of the layer is placed in this column.
Creation Methodology	This column describes how the layer was, or is anticipated being created.
Recommended Update Division or Individual	This field outlines the division or individual that is anticipated to maintain or develop the data layer during and after full implementation of the Citywide enterprise GIS. Development of new recommended layers will be prioritized for each year of the Strategic Implementation Plan.
Layer Status	Layer state of existence.
Existing	These layers currently exist within the City's GIS.
Recommended/ Desired	These layers are recommended for development or procurement, based on departmental and enterprise needs. These data layers will help support existing business procedures or will compliment other GIS data sets that are already existing and in use by the City. Costs associated for these recommended layers will be based on general estimates – actual cost may vary.
Partial	These layers currently exist in an incomplete or outdated state.

The following is a list of desired layers by the Rent Board:

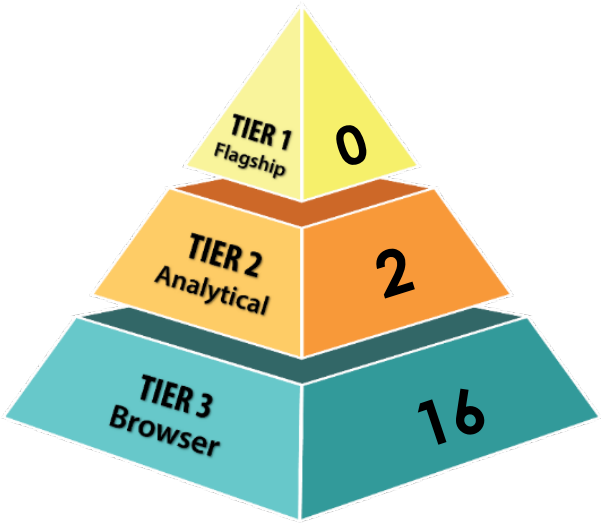
Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Rent Board GIS Data			
311 Calls, Rent Board Case Management	Extract, cleanse and geocode from database	Automated	Desired
Accela Data	Extract, cleanse and geocode from Accela database	Automated	Desired
Accessible Dwelling Units and Below Rate Unties	Extract, cleanse and geocode from database	Automated	Recommended
Building Outlines	Purchase from County or Pictometry	GIS Team in IT	Recommended
General Plan Land Use	Digitized	Rent Board	Existing
Neighborhood Associations	Digitized from various sources	Planning, CMO and GIS Team in IT	Existing
Parks	Extract, cleanse and geocode from database	Parks	Existing
Rent Data and Eviction Data from Rent Tracking System	Extract, cleanse and geocode from database	Automated	Desired
Rental Properties after 1980	Extract from databases	Plan Board	Desired
Residential Units	Use Code data and field survey	GIS Team in IT with Plan Board	Desired
Schools	Digitize/Geocode	GIS Team in IT	Existing
Zoning	Digitized on screen	Planning	Existing
Citywide Base Data			
Property	Original tax parcels were digitized and rubber sheeted from scanned hard copy water quality maps circa 1999. Updated manually once a year by the GIS Team using County data for attributes and the County's Adobe PDF parcel maps for geometry changes. Migrated to the LGIM Tax Parcel schema in 2016.	The GIS Team	Existing
Aerial Photography	Current aerial data is delivered by Pictometry through an agreement with Alameda County. The most current data was captured in 2014 with the next flyover scheduled for Spring 2017. The County's current contract with Pictometry calls for one more flyover after the 2017 capture. Older imagery exists for 2006 (custom County flyover), 2009, and 2011 (USGS).	Static Map	Existing

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
Road Centerlines	Created by RMSI in 2010 from various sources including Alameda County data and pavement management system data (street width). Updated manually by the GIS Team occasionally. Migrated to the LGIM Road Centerline schema in 2016. Zero Waste has a copy that has been updated for routing purposes.	The GIS Team	Existing
Address Points	Analyst in the Finance Department updates/creates new addresses in the Land Management (LX) module in SunGard (FUND$). Address points are then created nightly from an ETL that extracts and geocodes (using parcel centroid coordinates) and joining to a parcel table to create the address points feature class.	Automated / Finance Department	Existing

4

MULTI-TIER GIS APPLICATION USE

The pyramid and table below outlines the recommended "Tiers of GIS Use" within the department. It is important to note that this is not indicating that each of these staff should be GIS professions. It is pointing out that staff within the department should be given access and training to use these tools. All are color coded by the level of desired GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 Browser user requires only general browsing GIS data functions. The Rent Board will consist of Tier 2 and Tier 3 Users. The ability to edit and maintain some of their own GIS layers will merit some Tier 2 training.



TIERS OF GIS USERS	
GROUP	ACTIVITY
Tier 1 Flagship	• GIS Administration • Data Maintenance • Data Conversion and Creation • Spatial Data Management • Technical Support • Coordination
Tier 2 Analytical	• Data Maintenance • Analytical Functions/Geoprocessing • Complex Queries • Modeling • Use of Desktop Extensions • High Quality Map Production
Tier 3 Browser	• Browsing/Look-Up • Standard Reports • Simple Query • Map Production

5

RETURN ON INVESTMENT (ROI)

The following table indicates specific Return on Investment opportunities for the Rent Board. These specific examples show the true return on investment of the technology.

Return on Investment Opportunity Rent Board	
Opportunity	**Explanation**
Save Time and Respond More Quickly to Community Requests	***Public access to accurate data:*** • The public should have Internet access to GIS data. GIS will allow users to find information much more quickly and in many cases on their own. This should save multiple staff hours a week in Rent Board. The internet access has to be really well-thought-out to fully realize the maximum savings. ***Staff access to accurate/updated data:*** • Staff should have access to current Rent Board data in GIS to better serve and provide information to the public and decision makers. This should save multiple staff hours a week in Rent Board.

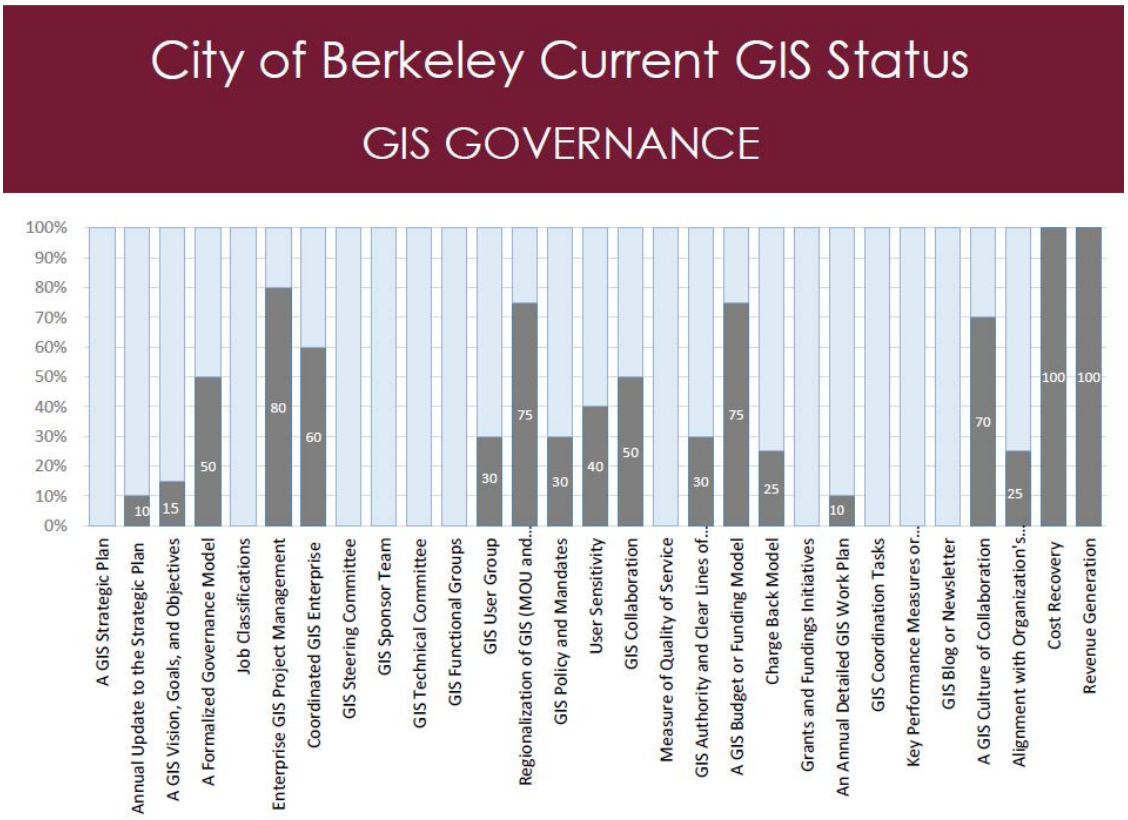
Return on Investment Opportunity Rent Board	
Opportunity	**Explanation**
Improve Data Accuracy	***Better GIS Data and Spatial Analysis:*** • Working with other departments and City agencies to update data with higher accuracy can improve the results when analyses are performed. By sending errors found in data to the data owners, errors can be corrected quickly. Standardization and joining of datasets across city departments would also limit errors and improve data accuracy.
Improve Public Access to Government	***Internet Browser:*** • Rent Board wants to share critical information with the public. This will allow the public to be more informed and make better decisions. This could also save the public many trips to the department, saving time, pollution, energy, frustration, and would empower the public with the ability to get the information they need.
Improved Information Processing	• Rent Board would expect GIS to increase the complexity of analysis opportunities.

BENCHMARKING ANALYSIS

MILESTONE 1 – GIS NEEDS ASSESSMENT

Benchmarking is an important step in marking a City's overall GIS readiness using the six main categories that make-up an enterprise, sustainable and enduring GIS. The City of Berkeley's current GIS status has been benchmarked using the following six categories, and the current gaps in the GIS are addressed below:

GOVERNANCE



A GIS Master Plan

A sound GIS strategic implementation plan (GIS SIP) provides the game plan for the City's development of a successful relationship with geospatial technology. The City has components of a plan started in 2008, but does not have a full GIS Master Plan.

Annual update to the Master Plan

The Master Plan should be updated annually. The City's roles, vision, and functions constantly evolve. The Master Plan should be updated to stay relevant to Berkeley's vision and the practical aspects of implementation.

A GIS vision, goals, and objectives

The larger vision of the City must be broken down into concrete goals. The vision, goals, and objectives of GIS technology must align with the City's vision and have measurable objectives. The City currently has not updated its GIS vision, goals and objectives since 2008, and should consider revisiting and possibly updating those visions, goals, and objects to align with the current environment.

A formalized governance model

The term governance model refers to the constellation of relationships between individuals and departments within the City. A governance model lays out lines of responsibility and the hierarchy of decision making power within the City. These lines connect executives, managers, and staff, or more broadly the stakeholders. A stakeholder is any individual directly affected by the City's activities. Formalizing a governance model allows the City to maximize accountability and efficiency. It designates the tasks each organizational entity must accomplish. The City has a 2008 Enterprise GIS Team Charter that may act as a starting point for discussion about a new governance model.

Job classifications

The various positions within the City should be classified according to the formalized governance model. These job classifications denote the skill set, financial worth, decision-making power, hierarchical standing, and overall responsibilities of a given position within the City. The City does not have a GIS job classification structure. The GIS Coordinator or Manager's existing job description is Application Programmer and Analyst II

Coordinated GIS enterprise

A coordinated GIS enterprise refers to a situation where the City's GIS governance model allows for a GIS coordinator to oversee and coordinate all GIS projects as if they were part of the enterprise. That is to say, all GIS projects are managed to a lesser or greater extent by a centralized group. Though they interact with other divisions on a daily basis, the GIS coordination's division holds the ultimate responsibility for administering, monitoring, and developing the larger organization's geospatial technologies.

GIS steering committee

A GIS steering committee is a group that is composed of top level organizational leaders and GIS specialists. A coherent GIS steering committee is crucial for a smooth implementation process, as it allows direct interfacing between executive decision makers and GIS experts. The City of Berkeley has a GIS steering committee, but they have not met in the last few years.

GIS sponsor team

The GIS sponsor team is composed of executive leadership or an executive leader. This person is responsible for championing the GIS cause, resource acquirement, and budgeting that is related to the GIS implementation process. The sponsor team also mediates the relationship between GIS directives and the City's larger vision. The City currently does not have a sponsor team.

GIS technical committee

As the name implies, the GIS technical committee oversees all of the technical challenges of deploying an enterprise GIS. It sets standards for ways that GIS data are gathered, managed, and shared in the City. Most of what this committee does is related to systems architecture and IT infrastructure. The City does not currently have a GIS technical committee.

GIS functional groups

GIS functional groups are specialized teams within the City responsible for discussing and overseeing key focus areas, including public safety, land management, administration, and utilities. These groups essentially divide the task of the GIS steering committee up into management components. They are, by their nature, narrow in focus and require some degree of expertise from their members. The City currently has no GIS functional groups.

GIS user group

A GIS user group is a cohort of stakeholders who share information and compare experiences with GIS technology for the benefit of all members. A GIS user group is managed by the GIS coordinator and meets frequently, often every month or each quarter. Currently, the City has an ad hoc GIS user group that typically meets only twice per year.

Regionalization of GIS

Regionalization is a formalized agreement between parties or entities to cooperate. In relation to geospatial technologies, regionalization is the sharing of data, resources, applications, training, and education and more between disparate groups of GIS users in the region seeking to pool their resources and achieve similar goals. Often, memorandums of understanding (MoUs) guide the regionalization of GIS technologies, where multiple organizations, grouped by geography, share data with one another. The City has MOU with County of Alameda to share the GIs data for Ortho and Oblique images. The City has more of an informal way of data sharing, where users are typically asking IT's Enterprise GIS and Open Data Coordinator for access to data.

GIS policy and mandates

Policies refer to procedural codes of conduct that are ratified and enforced by organizational authorities. These policies are internally imposed and guide everything from data and resource sharing within the GIS initiative, to personal and financial concerns for the City at large. The City of Berkeley has developed the following Standard Operating Procedures:

- Generating Metadata
- Standard Directory Structure
- Strategic Data Standards
- GIS Naming Convections

User sensitivity

User sensitivity refers to the capabilities of a particular GIS technology to fluidly respond to a user's request for information. User sensitivity is an important measure of the relative benefits of implementing GIS technology. The City can manage user sensitivity by using questionnaires, one-on-one interviews, GIS user group feedback, and more.

GIS collaboration

GIS collaboration refers to the productive cooperation between individuals and entities facilitated by the implementation of GIS technology. High levels of GIS collaboration let the City, derive maximal benefits from enterprise GIS technologies. The City currently has some GIS collaboration, but should consider broadening that collaboration to include all departments. The City has GIS wall maps that promote conversation and collaboration, including:

- Census 2010 Redistricting Data by Census Tract
- City of Berkeley Historic Resources

Measure quality of service

Measuring quality of service refers to the City's capacity to gather feedback data about the efficacy of its geospatial technologies. The City's quality of service can be examined through questionnaires and interviews or metrics that are related to user interface and objective goals.

GIS authority and clear lines of responsibility

A line of responsibility describes the vertical chain of liability and authority in the City. In common-sense terms, a line of responsibility formally lays out who is responsible for what and to whom. The City's GIS users typically rely on IT staff to do their work for them, whereas this should not always be the case. The City should consider creating clear roles and responsibilities and notifying all GIS users of those roles and responsibilities.

A GIS budget or funding model

A funding model is a methodical and institutionalized approach to building a reliable revenue base to support the City's core programs and services. In our context, the City's funding model explains, in formal financial terms, how the geospatial technology initiative will be funded. A GIS budget does currently exist within the City's overall IT budget.

Chargeback model

Instead of paying for an initiative from a centralized GIS budget, in a chargeback model, individual departments pay for the GIS services that they utilize. A chargeback model can often stifle growth and is not seen as an optimum solution. The City has no chargeback model currently in place.

Grants and funding initiatives

A funding initiative allows a government organization to diversify the funding for its GIS initiative. The City does not currently have any grants or funding initiatives in use.

An annual detailed GIS work plan

A work plan proposes the schedule and budgeting for a specific project. The work plan associated with a GIS initiative should be updated on an annual basis to reflect the evolving needs and priorities of a GIS enterprise organization. Essentially, it lays out a work plan for the GIS team as it relates to the priorities of the GIS steering committee and each department. The City has an existing work plan in place that could be improved within the GIS Master Plan.

GIS coordination tasks

The GIS coordinator must coordinate and participate in all the GIS tasks within the City. Objective-driven assignments are given to each department or individual within the City. The GIS coordinator supports and manages each GIS project.

Key performance measures or indicators

Key performance measures or key performance indicators (KPIs) are organizationally ratified metrics that gauge whether and how specific goals are met by the City. These objectives, numeric representations of success or failure are crucial when comparing the costs and benefits of the GIS initiative.

GIS blog or newsletter

A GIS blog or digital newsletter is produced by the City in order to increase communications around a GIS initiative. It provides transparency and accountability by keeping stakeholders and community members in the loop through easily accessible media. The City currently has no GIS blog or newsletter being produced.

A GIS culture of collaboration

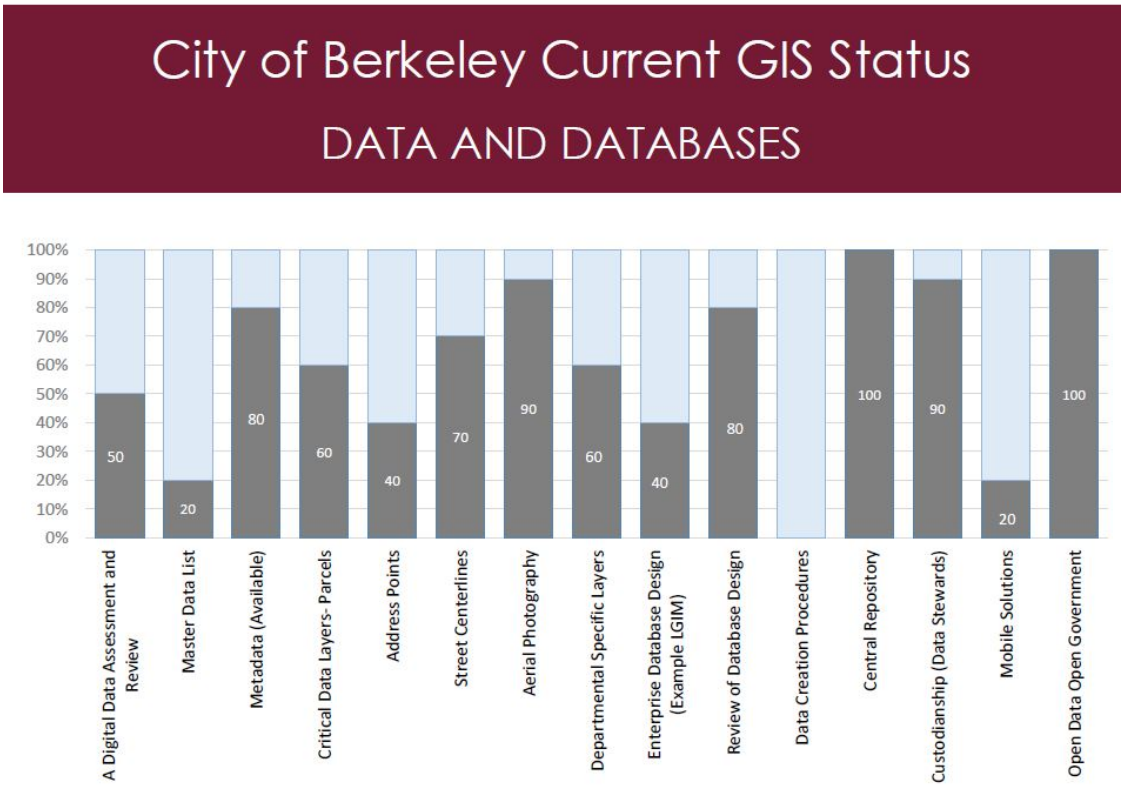
A culture of collaboration refers to an attitude that is expressed by stakeholders in their relationships to one another, as it pertains to an enterprise GIS. Berkeley currently has a good standing GIS culture of

collaboration, but enhancements can still be made to improve the overall collaborative culture in regards to its enterprise GIS.

Alignment with organization's vision, goals, and objectives

The enterprise GIS needs to be aligned with the City's vision, goals, and objectives; otherwise, it serves no purpose. This is necessary from the ground up. Simplistically, the vision of the City may be to improve life for its community. Enterprise GIS supports this vision by identifying areas that need improvement and giving decision makers the capacity to set realistic, data-backed goals (such as the improved emergency service response time). These goals would then be broken down into objectives to be measured by KPIs. The City of Berkeley is currently in the process of re-branding its GIS, but still has some work to do before completion.

DATA AND DATABASES



A digital data assessment and review

A digital data assessment examines the completion and breadth of the City's existing data layers. It evaluates the accuracy, completeness, and overall health of the existing digital data layers within the City. Once the data are assembled, gaps and weaknesses are identified and subsequently improved.

Master data list

The master data list (MDL) enumerates all of the data sets that the City needs for enterprise GIS implementation. The various data sets should be detailed by type and source, and assessed in terms of their quantities, accessibility, and formats.

Metadata

Metadata describes the collective characteristics of data. In short, metadata are data about data. Metadata details how, when, and where data has created or collected its documents scale, accuracy, resolution and other properties. The City has existing Metadata SOPs, but are not easily enforced.

Critical data layers

In the context of geospatial technology, a data layer is the visual expression of accumulated data of a particular type. Elevation, city limits, or railway lines are all examples of data layers. Critical data layers refer to the data layers that are central to the GIS initiative.

Parcels – 60% accurate

A parcel is a legally defined area of land for tax purposes.

Address points – 40% accurate

An address point is a location that is marked by its position relative to a physical structure. An address point is not necessarily the same as a street address. It is a data point that is assigned to a mapped location according to parameters that may or may not coincide with a street address.

Street centerline – 70% accurate

The street centerline is a linear data layer that correlates to the center of the roadway.

Aerial photography – 90% accurate

Aerial photography describes a bird's-eye-view style of photographic data that are gathered from a plane-, drone-, or helicopter-mounted camera. Because aerial photography produces an actual image of the mapped terrain, it improves the comprehensibility of practical details.

Departmental specific layers

Department-specific layers are mapped representations of data that correlate to the goals and objectives of a single department. Each layer can often be very specific to a department. Some of the City's current department-specific layers are not current, and should be updated.

Enterprise database design

Enterprise database design refers to the way that the City crafts a data repository in order to meet objectives and further the goals of the City. Enterprise database design usually includes focusing on the data, the use of data models (ESRIESRI's Local Government Information Model [LGIM]), and integration strategies. The design specifies how the City will collect, share, and act upon the various data to produce the desired information products.

Review of database design

This is the task of reviewing the City's current database design and considering a migration to standardized models. The review should examine the breadth and efficacy of current technology.

Data creation procedures

Data creation procedures are the standardizing guidelines by which the City's data are collected, cataloged, and turned into information products. This is an important set of procedures, as it protects against redundancy and needless work, both of which reduce overall cost-effectiveness.

Central repository

A central repository is the City's aggregated collection of new and existing GIS data, gathered from all information resources. Pooling data in this manner allows for ease of maintenance, monitoring, and collection of metadata. A central repository of GIS data is a characteristic of an enterprise solution. The City currently maintains a central repository.

Custodianship (data stewards)

Data stewards are responsible for the administration and upkeep of specific digital data layers. They are custodians in that they monitor the accuracy as well as the security of departmental data. The City's departments each edit their own data.

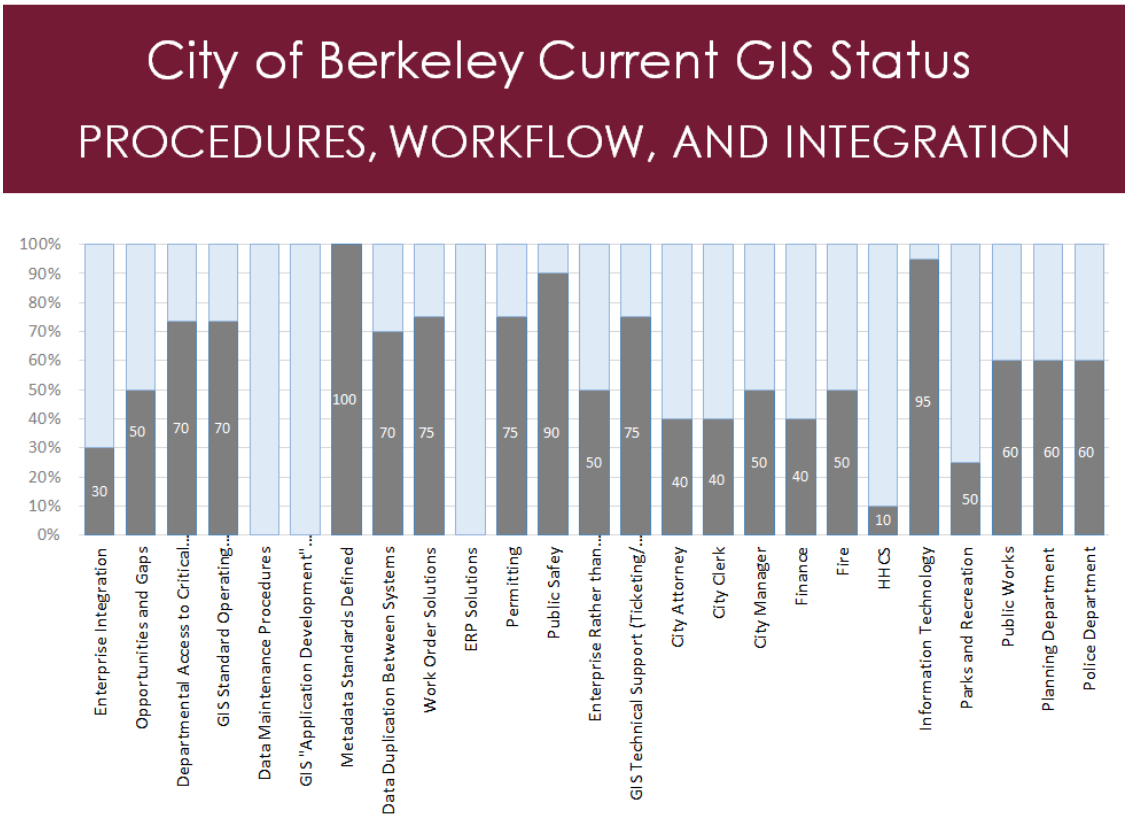
Mobile solutions

Mobile solutions refer to GIS applications that are made available to users via a mobile device. In this day and age, mobile solutions are generally geared toward tablet and smartphone users.

Open data/open government

Open data and open government describe an increasingly prevalent policy that allows residents, stakeholders, and non-stakeholders access to the City's GIS-based data and data layers. Taxpaying community members can see the results of a GIS initiative. Thus, a more transparent, open government is the end goal of this policy.

PROCEDURES, WORKFLOW AND INTEGRATION



Enterprise integration

Enterprise integration describes the process whereby smaller disparate systems are integrated into the corporate initiative. The City has some enterprise integration, but could benefit from expansion.

Opportunities and gaps

Gaps in the enterprise and integrated GIS solution need to be identified and documented. It could include public safety data, permitting data, work order data, or crowdsourcing information. Opportunities are those databases that can effectively be incorporated into the enterprise GIS initiative.

Departmental access to critical data layers

Critical departmental data layers are crucial to the GIS enterprise. Departmental access refers to the ease with which various organizational departments may access these layers. Departmental accessibility is a critical component for success. The City has developed 15 targeted web applications that serve the enterprise, but the City requires a more robust intranet solution.

GIS standard operating procedures

Standard operating procedures (SOPs) are the City's formally ratified blueprint for actions to be taken in pursuit of a desired objective. They are step by step, formulaic, and repeatable. In the geospatial context, SOPs prevent redundancy in data compilation and unnecessary effort. Adoption of SOPs also decreases organizational liability. The City has created SOPs for the procedures below:

- GIS Naming Convections
- Generating Metadata
- Strategic Data Standards
- Standard Directory Structure

Data maintenance procedures

Data maintenance procedures are a subset of SOPs that designate how to monitor and keep current the massive amounts of data that are collected in an enterprise GIS. The City has no data maintenance procedures or SOP documents in place.

GIS application acquisition/development procedures

GIS application acquisition/ development procedures are a subset of SOPs detailing the ways in which GIS technologies are to be manipulated in order to meet user needs. Currently, the City does not have any GIS application development procedure in place, and should consider defining them and making them available to users.

Metadata standards defined

It is critically important to define metadata standards. Metadata raise political as well as practical issues for enterprise GIS. Clear lines of accountability and quality control for the gathering, storage, and application of metadata should be ratified by the City. Fortunately, the City currently has a Standard Operating Procedure document available for Metadata standards.

Data duplication between systems

Data duplication is the actual duplication of data layers. The most common GIS data layers that are duplicated in local government are street centerlines, address points, parcels, and, to a lesser extent, boundary layers.

Level of integration and interoperability

The level of integration and interoperability measures how easily technological systems can share, interpret, and present data. An effective and enterprise GIS should integrate all databases and offer extensive interoperability. Interoperability means the ability of the GIS to work with other systems within and across organizational boundaries. The City is successfully integrating GIS with existing systems, but opportunities still exist – see Task 1: An enterprise integration strategy and deployment.

Work order solutions

As the name indicates, work order solutions manage, process, and maintain data about work orders and work that is performed. Work order solutions embrace asset management and GIS-centric solutions. The current Work Order Solutions used by the City are:

- SunGard THE
- Kana Lagan
- Accela Asset Management

Enterprise Resource Planning solutions

Enterprise Resource Planning (ERP) solutions are integrative software applications that automate various functions that are related to planning, permitting, finance, and administration.

Public safety

Public safety solutions are the software applications that are used in computer-aided dispatch, records management system, and other database and analysis tools. The City is using New World Systems as it's primary public safety software solution.

Enterprise rather than departmental silos

Departmental silos are databases that are exclusively maintained by a single department. They are full of information and, like actual silos, vertically orientated but spread out over the terrain of the City. For example, in a situation with departmental silos, the department of public safety may be the only department that keeps data on crime statistics. In an enterprise situation, however, all organizational departments have access to crime statistics via the central database that integrates all departmental data into a single master database. The City should ensure that all departments have access to enterprise data.

GIS technical support (ticketing/help desk)

Like users of any IT, GIS users often need help or encounter problems while navigating GIS technologies. The team responsible for the City's GIS technical support will walk users through issues and provides readily available troubleshooting information. The City of Berkeley current has only one person available for GIS technical support. The City of Berkeley current has a ticketing solution, but only one person available for GIS technical support.

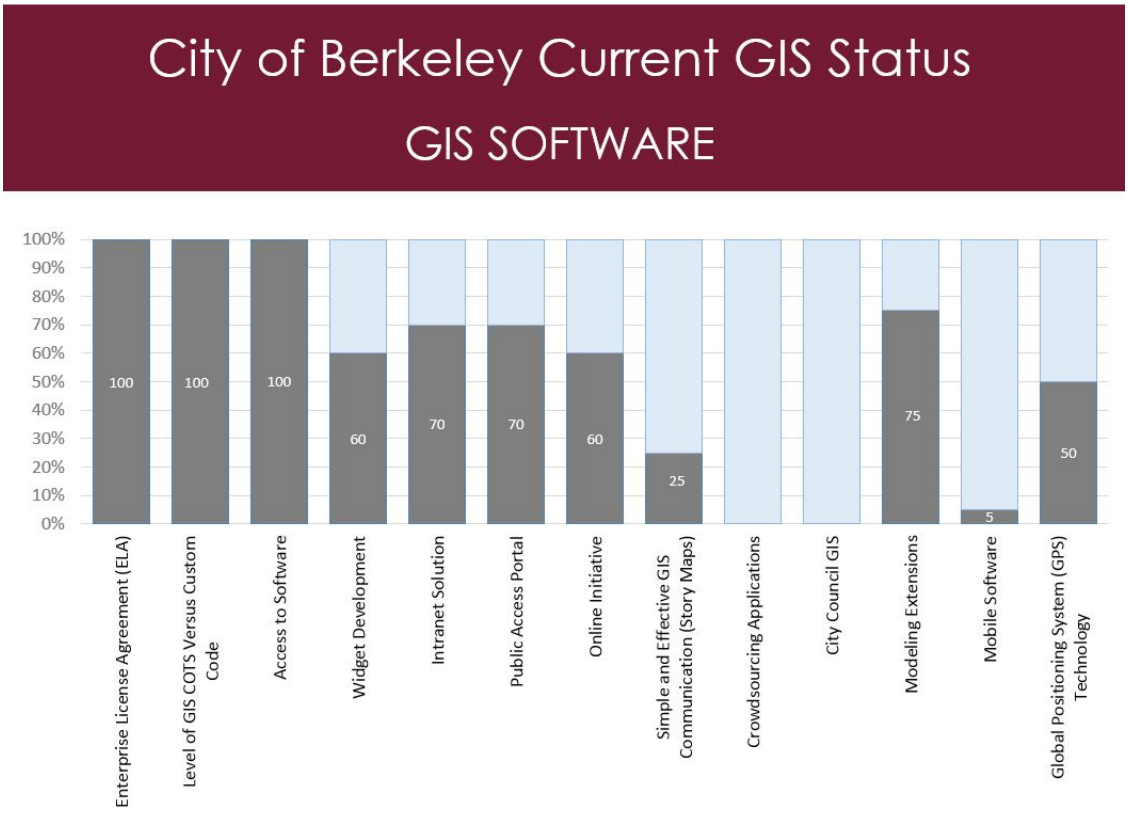
Departmental use of GIS

This is the actual utilization of GIS within all departments of local government. In the context of geospatial technology, departmental use implies a decentralized implementation of GIS technologies. This component should examine how effectively the departments are deploying the technology for different ends.

- City Attorney – 40%
- City Clerk – 40%

- City Manager – 50%
- Finance – 40%
- Fire – 50%
- HHCS – 10%
- Information Technology – 95%
- Parks, Recreation and Waterfront – 25%
- Planning Department – 60%
- Police Department – 60%
- Public Works – 60%

GIS SOFTWARE



Enterprise License Agreement (ELA)

An Enterprise License Agreement (ELA) permits the deployment of a software program that is both organization-wide and ceiling-less in terms of user, data, or hardware restrictions. The City currently has an ESRI ELA which allows the City extensive use of all ESRI software, training, education and conferences. The annual cost of the 3 year ESRI ELA is $57,000 for year 1 then $75,000 for years 2 and 3 totaling $207,000

Level of GIS commercial off-the-shelf versus custom code

Commercial off-the-shelf (COTS) GIS software is an important strategic direction for the City of Berkeley. GIS COTS can be supplemented with strategic business productivity widgets.

Access to software

Access to software describes who can interact with what software, and to what extent. The objective is to evaluate how much access there is to GIS software within the City. While the City's users all have access to their software, opportunities exist for improving the way in which GIS data is made available to the departments.

Public Access Portal

A public access portal is a Website where members of the public are able to interact with GIS information, informing and enabling community members. The City has four (4) public access portals in use.

Widget development

A widget is a term for a small software program that augments the functionality of a larger software program. GIS widgets provide a way to customize applications in accordance with the specific needs and circumstances of the City.

Online initiative

An online initiative is a program that is established to plan, design, and deploy cloud-based GIS solutions. The City should develop a state of the art online initiative to ensure enterprise GIS success.

Simple and effective GIS communication (story maps)

Simple and effective Web-based maps that tell a story of an event, history, or occasion within local government can have a powerful effect on the community. Many City departments would benefit from custom story maps to display information to the public.

Crowdsourcing applications

Crowdsourcing applications are software programs that facilitate the interaction between organizations and the online community.

City council GIS

City council GIS refers to the use of GIS technology by elected officials to view geographic information about the various issues that are related to the City.

Modeling extensions

A modeling extension is similar to a widget, in that it is a specialized software that helps organizations with specific business and operational needs. A modeling extension is larger in scale than a widget and enhances the overall representative capabilities of a program. An example would be a routing and scheduling algorithm modeling extension.

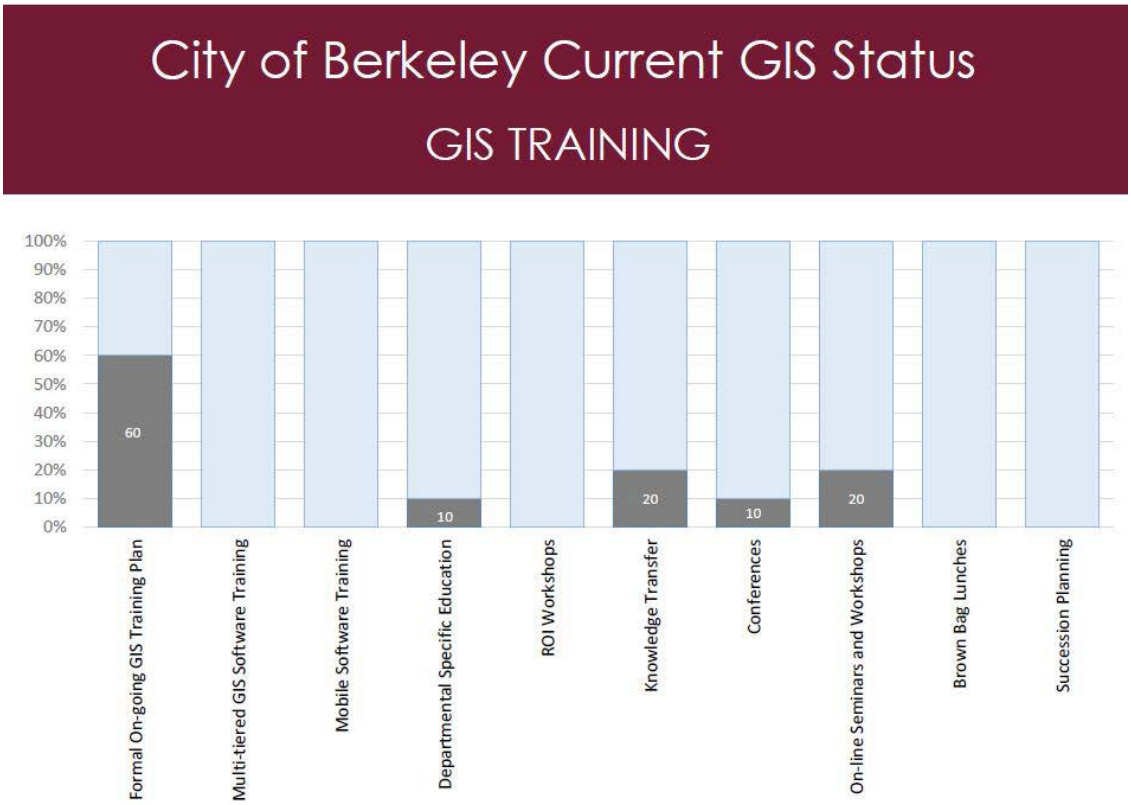
Mobile software

Mobile software refers to GIS applications that are designed for mobile use on a tablet or a smartphone. The mobility of GIS is a critical component of any successful enterprise GIS. The City does not currently utilize mobile software, but would benefit from its implementation.

Global Positioning System technology

Global Positioning System (GPS) technology is a navigational system that is enabled by a network of satellites orbiting the earth. The City has some use of GPS technology, but could further their usage for better GIS results.

GIS TRAINING, EDUCATION, AND KNOWLEDGE TRANSFER



Formal ongoing GIS training plan

A formal ongoing GIS training plan is a ratified outline of steps, schedules, and costs for continuing to train the City's employees. It is important to have an ongoing training plan, considering that GIS is a rapidly evolving technology, and organizational needs are ever changing. The City has an informal training plan in place, and should deploy a formal training plan, updated regularly (Milestone 4 – Step 14).

Multi-tiered GIS software training

The formal training plan must include multi-tiered GIS software training using a standardized process for training employees in the use of GIS technology.

Mobile software training

Mobile software training is the process of teaching users how to engage with GIS technology on their mobile device. The formal training plan must include mobile software training.

Departmental-specific education

Departmental-specific education provides specialized training procedures according to a department's specific needs. The City should ensure that all departmental GIS users have the appropriate training to carry out the GIS functions necessary to enable them to do their job.

ROI workshops

ROI workshops are specific workshops that are related to the value and ROI that GIS offers the City. Each department is an important component in the success of an enterprise GIS. The City should provide ROI workshops for each department.

Knowledge transfer

Knowledge transfer refers to the process of communicating the GIS know-how and knowledge among different entities in the City. Knowledge transfer is the art of transferring knowledge from one part of the City to another.

Conferences

Conferences are gatherings of the GIS community that provide a smorgasbord of opportunities for furthering employee GIS education. Talks, lectures, lessons, and socialization with other industry professionals are ways to advance an understanding of geospatial technologies and keep abreast of new developments. IT's Enterprise GIS and Open Data Coordinator attends some workshops, but that is the extent of the City's participation (See Milestone 4 Step 14 training plan for a list of recommended conferences).

Online seminars and workshops

Online seminars and workshops are online programs that are implemented by a variety of organizations that further GIS education among employees. IT Staff attends some workshops, but that is the extent of the City's participation.

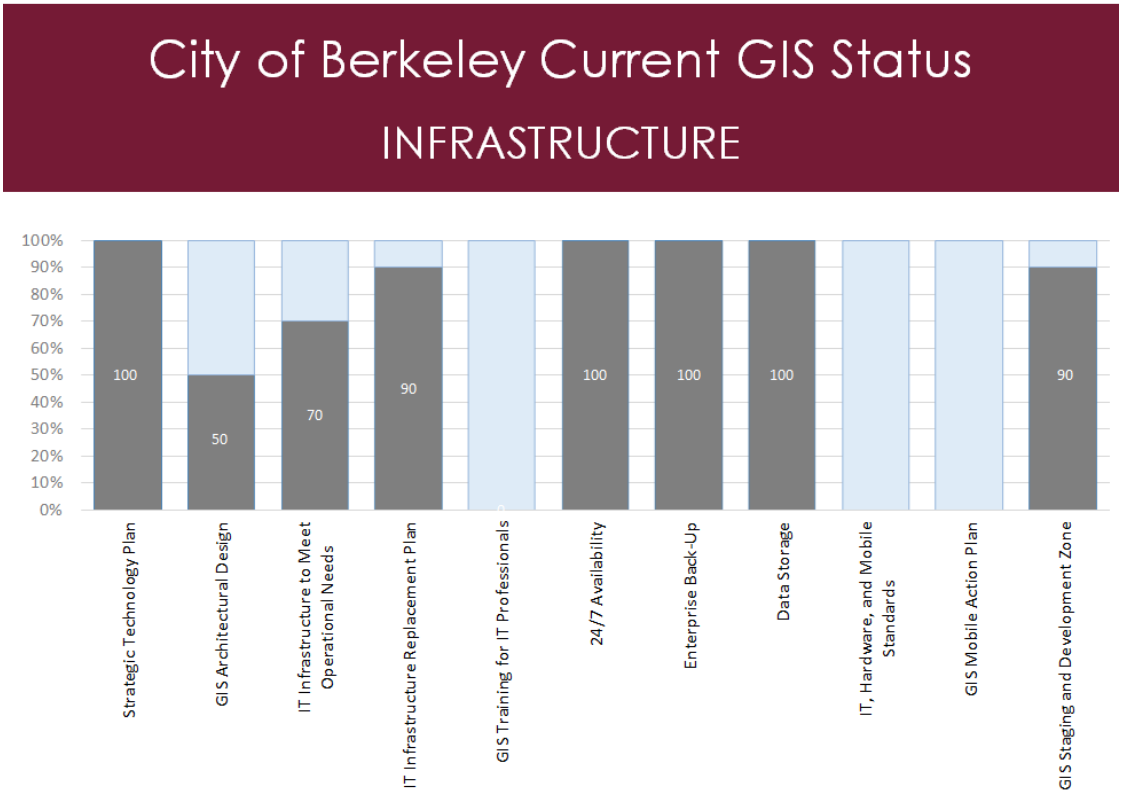
Brown bag lunches

This term refers to a free-and-easy meeting, generally held over a meal, where employees can discuss concerns with GIS in a social setting. The City of Berkeley does not currently have any type of brown bag lunch plan for GIS in place.

GIS succession planning

Succession planning refers to the City's strategy for filling essential but vacant positions with experienced employees. The City should ensure a formal GIS succession plan is in place.

INFRASTRUCTURE



Strategic technology plan

A strategic technology plan describes the City's current and future relationship with technology and outlines how this technology will further the goals of the City. The City currently has a Digital Strategic Plan and Roadmap, which will incorporate the GIS Master Plan initiative.

GIS architectural design

GIS architectural design is the plan that addresses GIS software technology, capacity performance, and IT infrastructure including hardware, network communications, software architecture, enterprise security, backup, platform performance, and data administration.

IT infrastructure

IT infrastructure refers to a dynamic web of processes, networks, hardware, and software resources that support the activities of an integrated IT department.

IT replacement plan

An IT replacement plan is a formal plan for updating hardware and software resources in the future. Budgetary concerns, goals, and long-term objectives are taken into account. The City currently has an effective IT replacement plan in place.

GIS training for IT professionals

In order for IT professionals to assist the City with many GIS activities including but not limited to crowdsourcing or tech support, they need a proficiency in GIS technologies.

24/7 availability

The term 24/7 availability refers to the availability of IT infrastructure and GIS technology at all hours of the day, every day of the week. The City has a 24/7 availability for IT.

Enterprise backup

Enterprise backups are a protective measure that preserves the City's centralized data through off-site cloud-based daily backup procedures. The City already maintains an enterprise backup procedure.

Data storage

Data storage refers to the digital information storage locally and on the enterprise network and in the cloud. The City currently maintains its data storage.

IT, hardware, and mobile standards

IT, hardware, and mobile standards refer to the formalized set of guidelines and requirements that are required by the City to support an enterprise GIS.

GIS mobile action plan

A mobile action plan is an outline of the tactics that the City will deploy in order to increase GIS accessibility on tablets and smartphones. The City should deploy a mobile action plan that reflects the current GIS and IT environment.

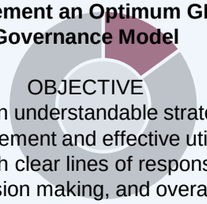
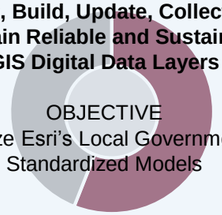
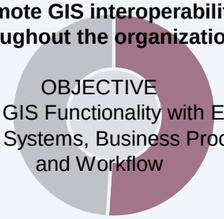
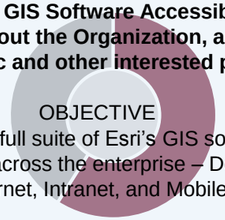
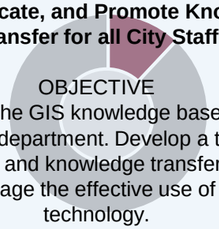
GIS staging and development zone

A development zone is a site where newly developed GIS application are tested and tweaked. A staging zone is a site where GIS applications are given full-trial runs. The City currently has a staging and development zone in use.

CITY OF BERKELEY

Develop an enterprise, scalable, and sustainable and enduring GIS that promotes effective and innovative use of geospatial technology, supported by good GIS governance and coordination, standards, and on-going training and education.

CITY OF BERKELEY GOALS

Goal A	Goal B	Goal C	Goal D	Goal E	Goal F
GOVERNANCE **Implement an Optimum GIS Governance Model**	**DATA AND DATABASES** **Design, Build, Update, Collect, and Maintain Reliable and Sustainable GIS Digital Data Layers**	**PROCEDURES AND WORKFLOW** **Promote GIS interoperability throughout the organization**	**GIS SOFTWARE** **Make GIS Software Accessible throughout the Organization, and to the Public and other interested parties**	**GIS TRAINING** **Train, Educate, and Promote Knowledge Transfer for all City Staff**	**INFRASTRUCTURE** **Build and Maintain IT Infrastructure to support an Enterprise, Scalable and Sustainable GIS**
 OBJECTIVE Develop an understandable strategy for the management and effective utilization of GIS with clear lines of responsibility, decision making, and overall governance.	 OBJECTIVE Utilize Esri's Local Government Standardized Models	 OBJECTIVE Integrate GIS Functionality with Existing Database Systems, Business Processes, and Workflow	 OBJECTIVE Deploy a full suite of Esri's GIS software solutions across the enterprise – Desktop, Internet, Intranet, and Mobile.	 OBJECTIVE Improve the GIS knowledge base within each City department. Develop a training, education, and knowledge transfer plan to encourage the effective use of GIS technology.	 OBJECTIVE Continually evaluate the IT architecture to support enterprise GIS growth and change

CITY OF BERKELEY GIS NEEDS, TASKS, & OBJECTIVES

Task 1: Adopt a New Hybrid GIS Governance Model and Staffing Plan by Hiring Two New GIS Staff within IT and changing operations.
The City of Berkeley needs to change its existing weak hybrid governance model to a true enterprise hybrid model that will enable more staff to take custodianship of data, perform more sophisticated analysis, and take advantage of more business applications. At the moment the number of GIS users within the organization is relatively high (Approximately 160 Browser users, 13 Analytical Users and 2 Career GIS Specialists). This high number of users is solely due to the deployment of an extensive portfolio of Web App Builder applications. This approach is a very clever, efficient, and an ingenious way of one key individual choreographing a strategy for sharing GIS data and information throughout the organization. The City is still underutilizing GIS and requires a more solid foundation for success. The foundation is found in these 26 tasks.

We can conclude that the City of Berkeley has the look and feel of a hybrid GIS model but lacks the depth of a true enterprise and sustainable hybrid model. The Enterprise GIS and Open Data Coordinator must focus their attention on all 26 tasks listed in Governance.

Recommended Assignment
•Information Technology (IT) Director

Task 1: Perform a "deeper dive" detailed digital data assessment of all GIS layers
A digital data assessment examines the completion and breadth of the City's existing data layers. It evaluates the accuracy, completeness, and overall health of the existing digital data layers within the City. Once the data are assembled, gaps and weaknesses are identified and subsequently improved.

Task 2: Improve the existing Master Data List (MDL)
Acquire/develop all "recommended" layers in the MDL.

Task 3: Fully implement metadata for all GIS data
Metadata describes the collective characteristics of data. In short, metadata is data about data. Metadata details how, when, and where data has created or collected its documents scale, accuracy, resolution and other properties. The City has existing Metadata SOPs, but are not easily enforced.

Task 4: Implement the recommendations for improving the authoritative data source layers In the context of geospatial technology, a data layer is the visual expression of accumulated data of a particular type. Elevation, city limits, or railway lines are all examples of data layers. Critical data layers refer to the data layers that are central to the GIS initiative.

Task 1: Develop an enterprise integration strategy and deployment
Enterprise integration describes the process whereby smaller disparate systems are integrated into the corporate initiative. The City has some existing enterprise integration, but could benefit from expansion. The following software solutions could benefit from improved GIS integration:

- New World Systems
- OnBase
- Chameleon
- Sungard
- Pacsoft (marina software)
- Fast Look
- Decade
- Cal Ready (hosted)
- Acrive NET
- Alpine Red
- Lagan
- AutoDesk Civil 3D
- Street Saver
- QuickNet
- Cross Roads
- Synchro

Task 2: Continue to identify opportunities and gaps for using GIS to improve procedures, and workflow.
Gaps in the enterprise and integrated GIS solution need to be identified and documented. It could include public safety data, permitting data, work order data, or crowdsourcing information. Opportunities are those databases that can effectively be incorporated into the enterprise GIS initiative**.**

Task 1: Evaluate the City's Enterprise License Agreement and Software Usage
An Enterprise License Agreement (ELA) permits the deployment of a software program that is both organization-wide and ceiling-less in terms of software. The City currently has an Esri ELA which allows the City extensive use of all Esri software, training, education and conferences.
The annual cost of the 3 year Esri ELA is $57,000 for year 1, then $75,000 for years 2 and 3 totaling $207,000.

Task 2: Continue to use commercial off-the-shelf GIS solutions versus custom code
Commercial off-the-shelf (COTS) GIS software is an important strategic direction for the City of Berkeley. GIS COTS can be supplemented with strategic business productivity widgets.

Task 3: Continue to promote access to software through a variety of solutions
Access to software describes who can interact with what software, and to what extent. The objective is to evaluate how much access there is to GIS software within the City. While the City's users all have access to GIS software, opportunities exist for improving the way in which GIS data is made available to the departments.

Task 1: Develop a formal ongoing GIS training plan
A formal ongoing GIS training plan is a ratified outline of steps, schedules, and costs for continuing to train the City's employees. It is important to have an ongoing training plan, considering that GIS is a rapidly evolving technology, and organizational needs are ever changing.
The City has an informal training plan in place, and should deploy a formal training plan, updated regularly *(Milestone 4 – Step 14).*

- ✓ **City Attorney**
- ✓ **City Clerk**
- ✓ **City Manager**
- ✓ **Finance**
- ✓ **Fire**
- ✓ **HHCS**
- ✓ **Information Technology**
- ✓ **Parks, Recreation and Waterfront**
- ✓ **Planning Department**
- ✓ **Police Department**
- ✓ **Public Works**

Task 2: Conduct Multi-tiered GIS software training
The formal training plan must include multi-tiered GIS software training using a standardized process for training employees in the use of GIS technology.

Task 3: Conduct Mobile software training
Mobile software training is the process of teaching users how to engage with GIS technology on their mobile device. The formal training plan must include mobile software training.

Task 1: Incorporate the existing Strategic Technology Plan into the GIS Master Plan initiative
A strategic technology plan describes the City's current and future relationship with technology and outlines how this technology will further the goals of the City.

Task 2: Develop an enterprise GIS architectural design
GIS architectural design is the plan that addresses GIS software technology, capacity performance, and IT infrastructure including hardware, network communications, software architecture, enterprise security, backup, platform performance, and data administration.

Task 3: Continue to review IT infrastructure as it pertains to the GIS initiative
IT infrastructure refers to a dynamic web of processes, networks, hardware, and software resources that support the activities of an integrated IT department.

Task 4: Continue to review the IT replacement plan annually as it relates to the GIS initiative
Existing desktop workstation technology exceeds minimum requirements.
Continue to update workstation technology per the IT Replacement Plan.

CITY OF BERKELEY GIS NEEDS, TASKS, & KPIs CONTINUED

GOAL A GOVERNANCE

Task 2: Update Annually the Enterprise GIS Master Plan
The Master Plan should be updated annually. The City's roles, vision, and functions constantly evolve. The strategic master plan should be updated to stay relevant to Berkeley's vision.

Recommended Assignment
•Enterprise GIS and Open Data Coordinator

Task 3: Develop a GIS vision, goals, and objectives
The larger vision of the City must be broken down into concrete goals. The vision, goals, and objectives of GIS technology must align with the City's vision and have measurable objectives. The City should update its visions, goals, and objects to align with the current environment.

Recommended Assignment
•Consultant and Enterprise GIS and Open Data Coordinator

Task 4: Define GIS job descriptions
The various positions within the City should be classified according to the formalized governance model. The City should adopt a GIS job classification structure. This will include developing job descriptions for new GIS Technicians.

Recommended Assignment
•IT Director, HR Department and Enterprise GIS and Open Data Coordinator

Task 5: Develop a coordinated GIS Enterprise
A coordinated GIS enterprise refers to a situation where the City's GIS governance model allows for the Enterprise GIS and Open Data Coordinator to oversee and coordinate all GIS projects as if they were part of the enterprise. The GIS Coordinator should develop and coordinate all GIS activity within the City of Berkeley. This includes a "dual accountability" strategy for the entire organization. This means that all

GOAL B DATA AND DATABASES

1. Parcels – 60% accurate
A parcel is a legally defined area of land for tax purposes.

2. Address points – 40% accurate
An address point is a location that is marked by its position relative to a physical structure. An address point is not necessarily the same as a street address. It is a data point that is assigned to a mapped location according to parameters that may or may not coincide with a street address.

3. Street centerline – 70% accurate
The street centerline is a linear data layer that correlates to the center of the roadway.

4. Aerial photography – 90% accurate
Aerial photography describes a bird's-eye-view style of photographic data that are gathered from a plane-, drone-, or helicopter-mounted camera. Because aerial photography produces an actual image of the mapped terrain, it improves the comprehensibility of practical details.

Task 5: Improve departmental-specific layers – 60% accurate
Some of the City's current department-specific layers listed in the MDL are not current, and should be updated. An ongoing task is to continually improve all data layers.

Task 6: Complete the migration of GIS data to the Local Government Information Model
Enterprise database design refers to the way that the City crafts a data repository in order to meet objectives and further the goals of the City. Enterprise database design usually includes focusing on the data, the use of data models (Esri's Local Government Information Model [LGIM]), and integration strategies. The design specifies how the City will collect, share, and act upon the various data to produce the desired information products.

GOAL C PROCEDURES AND WORKFLOW

Task 3: Improve departmental access to critical data layers
Critical departmental data layers are crucial to the GIS enterprise. Departmental access refers to the ease with which various organizational departments may access these layers. Departmental accessibility is a critical component for success. The City has developed 15 targeted web applications that serve the enterprise, but the City requires a more robust intranet solution.

Task 4: Develop Standard Operating Procedures for major IT/GIS functions
Standard operating procedures (SOPs) are the City's formally ratified blueprint for actions to be taken in pursuit of a desired objective. They are step by step, formulaic, and repeatable. In the geospatial context, SOPs prevent redundancy in data compilation and unnecessary effort. Adoption of SOPs also decreases organizational liability.

Task 5: Develop GIS data maintenance procedures
Data maintenance procedures are a subset of SOPs that designate how to monitor and keep current the massive amounts of data that are collected in an enterprise GIS. The City has no data maintenance procedures or SOP documents in place.

Task 6: Develop a structured GIS application acquisition/development procedure
GIS application acquisition/ development procedures are a subset of SOPs detailing the ways in which GIS technologies are to be manipulated in order to meet user needs. Currently, the City does not have a GIS application development procedure in place, and should consider defining how the City develops custom software applications.

GOAL D GIS SOFTWARE

Task 4: Continue to promote GIS widget development
A widget is a term for a small software program that augments the functionality of a larger software program. GIS widgets provide a way to customize applications in accordance with the specific needs and circumstances of the City. The following departments have requested widget development:

- ✓ **Parks and Recreation**
- ✓ **City Clerk** – data mining tool
- ✓ **Finance Department** – integration tool

Task 5: Develop new departmental Intranet solutions – 70%
An Intranet is a web-based GIS solution that is accessible only to the City's employees. A GIS Intranet solution is housed on a local government private network, accessible only to the City's staff. The City has 11 web applications designed in-house. The following is a list of departments that need a new Intranet solution:

- ✓ **City Attorney** – browser based portal for viewing various City data
- ✓ **City Clerk** – GIS browser access to geospatial data
- ✓ **City Manager** – GIS browser access to geospatial data
- ✓ **Finance**
- ✓ **Fire** – digital pre-plans, hazardous materials
- ✓ **HHCS**
- ✓ **Parks, Recreation and Waterfront**
- ✓ **Planning Department** - – GIS browser access to geospatial data
- ✓ **Police Department** - digital pre-plans, hazardous materials
- ✓ **Public Works**

GOAL E GIS TRAINING

Task 4: Conduct departmental-specific education
Departmental-specific education provides specialized training procedures according to a department's specific needs. The City should ensure that all departmental GIS users have the appropriate training to carry out the GIS functions necessary to enable them to do their job.

Task 5: Conduct ROI workshops
ROI workshops are specific workshops that are related to the value and ROI that GIS offers the City. Each department is an important component in the success of an enterprise GIS.

Task 6: Implement knowledge transfer techniques
Knowledge transfer refers to the process of communicating the GIS know-how and knowledge among different entities in the City. Knowledge transfer is the art of transferring knowledge from one part of the City to another.

Task 7: Attend conferences
Conferences are gatherings of the GIS community that provide a smorgasbord of opportunities for furthering employee GIS education. Talks, lectures, lessons, and socialization with other industry professionals are ways to advance an understanding of geospatial technologies and keep abreast of new developments. While IT's Enterprise GIS and Open Data Coordinator attend Esri conferences, it would benefit the City for additional users to attend as well *(See Milestone 4 Step 14 training plan for a list of recommended conferences).*

Task 8: Take advantage of online seminars and workshops
Online seminars and workshops are online programs that are implemented by a variety of organizations that further GIS education among employees. IT's Enterprise GIS and Open Data Coordinator attend some workshops, but that is the extent of the City's participation *(See Milestone 4 Step 14 training plan for a list of recommended seminars and workshops).*

GOAL F INFRASTRUCTURE

Task 5: GIS Training should be provided to IT Professionals to allow them to better support the enterprise GIS
In order for IT professionals to assist the City with many GIS activities including but not limited to crowdsourcing or tech support, they need a proficiency in GIS technologies. The City should develop specific training for all IT professionals for GIS. *(See Milestone 4 – Step 14).*

Task 6: Continue to track 24/7 IT availability for the GIS program
The term 24/7 availability refers to the availability of IT infrastructure and GIS technology at all hours of the day, every day of the week.

Task 7: Continue to use the City's existing enterprise backup procedures and protocols
Enterprise back-ups currently created in the Barracuda Cloud. Continue this process on a daily basis to ensure that disaster recovery needs for GIS data can be met.

Task 8: Continue to use the City's existing data storage solutions
Data storage refers to the digital information storage locally and on the enterprise network and in the cloud. The City currently maintains its data storage.

Task 9: Review IT, hardware, and mobile standards
IT, hardware, and mobile standards refer to the formalized set of guidelines and requirements that are required by the City to support an enterprise GIS.

Task 10: Develop GIS mobile action plan
A mobile action plan is an outline of the tactics that the City will deploy in order to increase GIS accessibility on tablets and smartphones. The City should deploy a mobile action plan that reflects the current GIS and IT environment.

CITY OF BERKELEY GIS NEEDS, TASKS, & KPIs CONTINUED

GOAL A GOVERNANCE

GIS users work closely with the Enterprise GIS and Open Data Coordinator on all things related to GIS.

Recommended Assignment
•IT Director, GIS Steering Committee and Enterprise GIS and Open Data Coordinator

Task 6: Create and enforce new GIS steering committee
A GIS steering committee is a group that is composed of top level organizational leaders and GIS specialists. A coherent GIS steering committee is crucial for a smooth implementation process, as it allows direct interfacing between executive decision makers and GIS experts. The City of Berkeley should create a GIS Steering Committee comprised of directors from each department, as well as develop a strategy for the Steering committee's goals and objectives. A Steering Committee is very important to ratify the "dual accountability" environment.

Recommended Assignment
•IT Director, Department Directors and Enterprise GIS and Open Data Coordinator

Task 7: Consider a GIS sponsor team approach – Optional Task
The GIS sponsor team is composed of executive leadership or an executive leader. This person is responsible for championing the GIS cause, resource acquirement, and budgeting that is related to the GIS implementation process. The sponsor team also mediates the relationship between GIS directives and the City's larger vision.

Recommended Assignment (optional)
•Enterprise GIS and Open Data Coordinator

GOAL B DATA AND DATABASES

Task 7: Enterprise and departmental review of database design
This is the task of reviewing the City's current database design and considering a migration to standardized models. The review should examine the breadth and efficacy of current technology.

Task 8: Develop, formalize, and enforce standardized GIS data creation procedures across the enterprise
Data creation procedures are the standardizing guidelines by which the City's data are collected, cataloged, and turned into information products. This is an important set of procedures, as it protects against redundancy and needless work, both of which reduce overall cost-effectiveness.

Task 9: Continue to use and enforce a GIS central repository – corporate style data warehouse
A central repository is the City's aggregated collection of new and existing GIS data, gathered from all information resources. Pooling data in this manner allows for ease of maintenance, monitoring, and collection of metadata. A central repository of GIS data is a characteristic of an enterprise solution.

Task 10: Complete the departmental custodianship (data stewards) documentation
Data stewards are responsible for the administration and upkeep of specific digital data layers. They are custodians in that they monitor the accuracy as well as the security of departmental data. The City's departments each edit their own data.

Task 11: Develop a GIS Mobile Plan to guide the development of Mobile Solutions in City
Mobile solutions refer to GIS applications that are made available to users via a mobile device. In this day and age, mobile solutions are generally geared toward tablet and smartphone users. Mobile solutions will be used for collecting and maintaining digital data.

GOAL C PROCEDURES AND WORKFLOW

Task 7: Continue to use the defined metadata standards
It is critically important to define metadata standards. Metadata raise political as well as practical issues for enterprise GIS. Clear lines of accountability and quality control for the gathering, storage, and application of metadata should be ratified by the City. Fortunately, the City currently has a Standard Operating Procedure document available for Metadata standards.

Task 8: Eliminate data duplication between systems
Data duplication is the actual duplication of data layers. The most common GIS data layers that are duplicated in local government are street centerlines, address points, parcels, and, to a lesser extent, boundary layers.

Task 9: Improve the level of GIS integration and interoperability – 30%
The level of integration and interoperability measures how easily technological systems can share, interpret, and present data. An effective and enterprise GIS should integrate all databases and offer extensive interoperability. Interoperability means the ability of the GIS to work with other systems within and across organizational boundaries. The City is successfully integrating GIS with existing systems, but opportunities still exist – *see Task 1: An enterprise integration strategy and deployment.*

Task 10: Continue to monitor GIS integration with the City's work order solutions
As the name indicates, work order solutions manage, process, and maintain data about work orders and work that is performed. Work order solutions embrace asset management and GIS-centric solutions. The current Work Order Solutions used by the City are:

- SunGard HTE
- Kana Lagan
- Accela Asset Management

GOAL D GIS SOFTWARE

Task 6: Develop new internet public access portal
A public access portal is a website where members of the public are able to interact with GIS information, informing and enabling the community. There are 4 public access portals in use. The following is a list of departments that need public access portals:

- ✓ **Information Technology**
- ✓ **Planning Department**
- ✓ **Fire Department**

Task 7: Continue with the Esri AGOL initiative – including the Collector Application, and Dashboard solutions.
Expand the use of ArcGIS Online services as base map content for public facing services. All departments expressed an interest in AGOL:

- ✓ **City Attorney**
- ✓ **City Clerk**
- ✓ **City Manager**
- ✓ **Finance**
- ✓ **Fire**
- ✓ **HHCS**
- ✓ **Information Technology**
- ✓ **Parks, Recreation and Waterfront**
- ✓ **Planning Department**
- ✓ **Police Department**
- ✓ **Public Works**
- ✓ ***Public Engagement***

The following departments requested the integration of Esri's Dashboard with specific databases:

- ✓ **Fire**
- ✓ **Police Department**

Task 8: Deploy simple and effective GIS communication (story maps)
Simple and effective Web-based maps that tell a story of an event, history, or occasion within local government can have a powerful effect on the community. There are specific departments requiring the deployment of Esri Story Maps, including:

- ✓ **Finance**
- ✓ **Fire**
- ✓ **Planning Department –** Existing Project
- ✓ **Police Department**

GOAL E GIS TRAINING

Task 9: Conduct brown bag lunches
This term refers to a free-and-easy meeting, generally held over a meal, where employees can discuss concerns with GIS in a social setting. The City of Berkeley does not currently have any type of brown bag lunch plan for GIS in place. The EGOD Coordinator should conduct monthly brown bag lunches.

Task 10: Establish GIS succession planning
Succession planning refers to the City's strategy for filling essential but vacant positions with experienced employees. The City should develop a formal GIS succession plan.

-END OF TRAINING TASKS-

GOAL F INFRASTRUCTURE

Task 11: Deploy a GIS staging environment (sand box) that replicates the GIS server site
A development zone is a site where newly developed GIS applications are tested and tweaked. A staging zone is a site where GIS applications are given full-trial runs. The City currently has a staging and development zone in use.

Task 12: Build a central services infrastructure which exposes appropriate services end-points for transactional editing, analysis, and viewing, based on a variety of clients
The GIS Team should continue to develop various maps services on ArcGIS Server that support browser mapping (internal and public facing), mobile solutions (Collector for data viewing and editing in the field using tablets or smart phones), and Desktop GIS

Task 13: Continue periodic monitoring of the LAN/WAN network to ensure it is functioning at optimal levels
Frequent monitoring of network performance is critical. At least 100mb connectivity to GIS user sites is recommended.

-END OF INFRASTRUCTURE TASKS-

CITY OF BERKELEY GIS NEEDS, TASKS, & KPIs CONTINUED

GOAL A GOVERNANCE	GOAL B DATA AND DATABASES	GOAL C PROCEDURES AND WORKFLOW	GOAL D GIS SOFTWARE	GOAL E GIS TRAINING	GOAL F INFRASTRUCTURE
Task 8: Create a GIS technical committee – *Optional Task* As the name implies, the GIS technical committee oversees all of the technical challenges of deploying an enterprise GIS. It sets standards for ways that GIS data are gathered, managed, and shared in the City. Most of what this committee does is related to systems architecture and IT infrastructure. Berkeley does not currently have a GIS technical committee. This committee may depend on any large GIS related initiatives. **Recommended Assignment** **•Enterprise GIS and Open Data Coordinator** **Task 9: Formalize a City GIS user group** A GIS user group is a cohort of stakeholders who share information and compare experiences with GIS technology for the benefit of all members. The proposed GIS Steering Committee in coordination with the Enterprise GIS and Open Data Coordinator should select who participates in the GIS User Group and develop a strategy for the GIS User Groups goals and objectives. **Recommended Assignment** **•Enterprise GIS and Open Data Coordinator** **Task 10: Regionalization of GIS** Regionalization is a formalized agreement between parties or entities to cooperate. In relation to geospatial technologies, regionalization is the sharing of data, resources, applications, training, and education and more between disparate groups of GIS users in the region seeking to pool their resources and achieve similar goals. The City should adopt memorandums of understanding (MoUs) to guide the regionalization of GIS technologies. **Recommended Assignment** **•Enterprise GIS and Open Data Coordinator**	**Task 12: Continue with the City's existing open data/open government strategy** Open data and open government describe an increasingly prevalent policy that allows the community, stakeholders, and non-stakeholders access to the City's GIS-based data and data layers. The taxpaying community can see the results of a GIS initiative. Thus, a more transparent, open government is the end goal of this policy. https://data.cityofberkeley.info/ **Task 13: Upgrade the existing GIS servers to a modern better performing technology and deploy the City's public facing GIS server in the Amazon EC2 Cloud** This task will increase platform capacity (transactions per hour) by 66% and reduce response times for map services by 300% **Task 14: Implement ArcGIS for Local Governments browser-based applications for intranet users** This task will include free maps and apps that work with LGIM and ArcGIS Server and deploy focused mapping applications. **Task 15: Follow the recommendations for creating or improving the disaster planning GIS layers** Identify layers critical to disaster response extracted from MDL. **-END OF DATA & DATABASES TASKS-**	**Task 11: Develop a plan to integrate GIS with the City's Enterprise resource planning (ERP) solution** Enterprise resource planning (ERP) solutions are integrative software applications that automate various functions that are related to planning, permitting, finance, and administration**.** The City uses **SunGard HTE**, but is in the RFP stage for a new solution. **Task 12: Develop a plan to improve GIS integration with New World Systems (public safety solutions)** Public safety solutions is the software application that is used in computer-aided dispatch, records management system, and other database and analysis tools**.** **Task 13: Monitor enterprise rather than departmental silos – 50%** Departmental silos are databases that are exclusively maintained by a single department. They are full of information and, like actual silos, are vertically orientated but spread out over the terrain of the City. For example, in a situation with departmental silos, the department of public safety may be the only department that keeps data on crime statistics. In an enterprise situation, however, all organizational departments have access to crime statistics via the central database that integrates all departmental data into a single master database. The City should ensure that all departments have access to enterprise data. **Task 14: Continue to use and improve the City's existing GIS technical support (ticketing/help desk) strategy – with supplemented staff** Like users of any IT, GIS users often need help or encounter problems while navigating GIS technologies. The team responsible for the City's GIS technical support will walk users through issues and provide readily available troubleshooting information. The City of Berkeley currently has a ticketing solution, but only one person available for GIS technical support**.**	**Task 9: Develop a GIS-centric crowdsourcing application** Crowdsourcing applications are software programs that facilitate the interaction between organizations and the online community. Currently, the City does not maintain any crowdsourcing applications. • Integration of GIS with the online 311 service center **Task 10: Utilize GIS for City council meetings** City council GIS refers to the use of GIS technology by elected officials to view geographic information about the various issues that are related to the City. The City should ensure that all elected officials have access to the appropriate GIS data to carry out their positions. **Task 11: Identify additional modeling extensions for use by each department** A modeling extension is similar to a widget, in that it is a specialized software that helps organizations with specific business and operational needs. A modeling extension is larger in scale than a widget and enhances the overall representative capabilities of a program. An example would be a routing and scheduling algorithm modeling extension. The City is using Business Analyst and Community Analyst – Demographic Data modeling extensions. The following departments require modeling extensions: ✓ **Fire –** Emergency Operations and Damage Assessment Application ✓ **Planning Department** – ArcGIS Pro ✓ **Police Department –** Crime Analysis Toolset ✓ **Public Works**		

CITY OF BERKELEY GIS NEEDS, TASKS, & KPIs CONTINUED

GOAL A GOVERNANCE	GOAL B DATA AND DATABASES	GOAL C PROCEDURES AND WORKFLOW	GOAL D GIS SOFTWARE	GOAL E GIS TRAINING	GOAL F INFRASTRUCTURE
Task 11: GIS policy and mandates Policies refer to procedural codes of conduct that are ratified and enforced by organizational authorities. The City should establish a set of standards and procedures for the development and maintenance of geospatial data including Office-to-Field--Field-to-Office procedures, GPS Quality Standards, Versioning, CAD Standards, Digital Submission Standards, Cartographic Standards, and GIS Business Integration (Refer to Milestone 2 Technology Readiness and Architecture Assessment for SOP development best practices). **Recommended Assignment** **•Enterprise GIS and Open Data Coordinator** **Task 12: Measure user sensitivity** User sensitivity refers to the capabilities of a particular GIS technology to fluidly respond to a user's request for information. User sensitivity is an important measure of the relative benefits of implementing GIS technology. User sensitivity can be managed by using questionnaires, one-on-one interviews, GIS user group feedback, and more. **Recommended Assignment** **•Enterprise GIS and Open Data Coordinator** **Task 13: Improve GIS collaboration** GIS collaboration refers to the productive cooperation between individuals and entities facilitated by the implementation of GIS technology. High levels of GIS collaboration let the City, derive maximal benefits from enterprise GIS technologies. The GIS Coordinator and Steering committee should ensure that GIS collaboration is present between all City staff and departments. **Recommended Assignment** **•Enterprise GIS and Open Data Coordinator**		**Task 15: Improve departmental use of GIS** This is the actual utilization of GIS within all departments of local government. In the context of geospatial technology, departmental use implies a decentralized implementation of GIS technologies. This component should examine how effectively the departments are deploying the technology for different ends. • **City Attorney – 40%** • **City Clerk – 40%** • **City Manager – 50%** • **Finance – 40%** • **Fire – 50%** • **HHCS – 10%** • **Information Technology – 95%** • **Parks, Recreation and Waterfront – 25%** • **Planning Department – 60%** • **Police Department – 60%** • **Public Works – 60%** **-END OF PROCEDURES & WORKFLOW TASKS-**	**Task 12: Utilize mobile GIS software** Mobile software refers to GIS applications that are designed for mobile use on a tablet or a smartphone. The mobility of GIS is a critical component of any successful enterprise GIS. The City does not currently utilize mobile software, but would benefit from its implementation. ✓ **Fire** ✓ **Planning Department** ✓ **Police Department** **Task 13: Continue to use and identify where Global Positioning System GPS technology could be used.** Global Positioning System (GPS) technology is a navigational system that is enabled by a network of satellites orbiting the earth. The City has some use of GPS technology (predominantly in Public Works), but could further their usage for better GIS results. **-END OF GIS SOFTWARE TASKS-**		

CITY OF BERKELEY GIS NEEDS, TASKS, & KPIs CONTINUED

GOAL A
GOVERNANCE (Continued)

Task 14: Measure quality of service
Measuring quality of service refers to the City's capacity to gather feedback data about the efficacy of its geospatial technologies. The Enterprise GIS and Open Data Coordinator should measure satisfaction levels annually using an online questionnaire and feedback at User group meetings. This should be reported to the Steering committee.

Recommended Assignment
•Enterprise GIS and Open Data Coordinator

Task 15: Identify GIS authority and clear lines of responsibility
A line of responsibility describes the vertical chain of liability and authority in the City. In common-sense terms, a line of responsibility formally lays out who is responsible for what and to whom. The City's GIS users typically rely on its Enterprise GIS and Open Data Coordinator to do their work for them, whereas this should not always be the case. The City should create clear roles and responsibilities, notifying all GIS users of those roles and responsibilities.

Recommended Assignment
•Enterprise GIS and Open Data Coordinator

Task 16: Continue to use the City's existing GIS budget or funding model
A GIS budget does currently exist within the City's overall IT budget, and should be maintained by the Enterprise GIS and Open Data Coordinator.

Recommended Assignment
•Enterprise GIS and Open Data Coordinator

Task 17: Explore GIS grants and funding initiatives for the City of Berkeley
A funding initiative allows a government organization to diversify the funding for its GIS initiative. The Enterprise GIS and Open Data Coordinator must pursue grants for GIS software, data, training, and staff.

Recommended Assignment
•Enterprise GIS and Open Data Coordinator

Task 18: Develop an annual detailed GIS work plan
A work plan proposes the schedule and budgeting for a specific project. The work plan associated with a GIS initiative should be updated on an annual basis to reflect the evolving needs and priorities of a GIS enterprise organization. The Enterprise GIS and Open Data Coordinator should create and maintain an annual GIS work plan that details all departmental support.

Recommended Assignment
•Enterprise GIS and Open Data Coordinator

Task 19: GIS coordination tasks
The GIS Enterprise GIS and Open Data Coordinator must coordinate and participate in all the GIS tasks within the City. Objective-driven assignments are given to each department or individual within the City. The GIS Coordinator should support and manage each GIS project.

Recommended Assignment
•Enterprise GIS and Open Data Coordinator

Task 20: Develop Key Performance Indicators (KPIs) for the GIS initiative
Key performance measures or key performance indicators (KPIs) are organizationally ratified metrics that gauge whether and how specific goals are met by the City. These objectives, numeric representations of success or failure are crucial when comparing the costs and benefits of the GIS initiative.

Recommended Assignment
•Consultant and Enterprise GIS and Open Data Coordinator

Task 21: Create a GIS blog or newsletter
A GIS blog or digital newsletter is produced by the City in order to increase communications around a GIS initiative. It provides transparency and accountability by keeping stakeholders and the community in the loop through easily accessible media. The City currently has no GIS blog or newsletter being produced.

Recommended Assignment
•Enterprise GIS and Open Data Coordinator

Task 22: Create and maintain a GIS culture of collaboration among stakeholders
A culture of collaboration refers to an attitude that is expressed by stakeholders in their relationships to one another, as it pertains to an enterprise GIS. The City of Berkeley currently has a good standing GIS culture of collaboration, but improvements can still be made to improve overall collaborative.

Recommended Assignment
•Enterprise GIS and Open Data Coordinator

Task 23: Alignment with City's overall vision, goals, and objectives (Resilience Strategy)
The enterprise GIS needs to be aligned with the City's vision, goals, and objectives; otherwise, it serves no purpose. The Enterprise GIS and Open Data Coordinator should align all GIS activity and initiatives with the City's overall vision, goals, and objectives (outlined in the City of Berkeley's Resilience Strategy).

Recommended Assignment
•Enterprise GIS and Open Data Coordinator

Task 24: Develop enterprise and departmental Service Level Agreements (SLAs)
The parameters of an SLA are defined by the KPIs that are relevant to the technologies in question. The City should develop both an enterprise and departmental SLAs.

In terms of GIS, Service Level Agreements (SLAs) are formal, binding agreements that outline what stakeholders can expect from an enterprise GIS. These agreements can document how the GIS group will support each department within the City of Berkeley. SLAs can also describe the scope of services enterprise GIS will provide to department users, as well as any limitations to be noted.

The City of Berkeley has no existing SLAs within the enterprise or its departments. It is recommended that SLAs be created for both the enterprise as a whole, as well as between individual departments and the GIS Enterprise GIS and Open Data Coordinator, to document how GIS support and responsibilities will be handled.

Enterprise SLAs will document how the City and those responsible for maintaining the geo-spatial systems will interact. Roles and responsibilities for both the City and its stakeholders (both internal and external) and the GIS will be detailed and agreed upon.

Departmental SLAs will document how City departments and the GIS group will interact. This will include agreements concerning data maintenance, technical support, and data accessibility. Detailing roles and responsibilities and solidifying them using these SLAs will maintain a coordinated effort for the effective use of GIS within the City of Berkeley.

These SLA documents should be signed by the department head and the Enterprise GIS and Open Data Coordinator, binding the agreement set forth within the SLA document in formal manner, thus confirming greater adhesion to the guidelines stated.

Recommended Assignment
•Consultant and Enterprise GIS and Open Data Coordinator

Task 25: Develop a New Staffing Plan
The City's staffing plan should reflect a Hybrid governance model approach and promote enterprise GIS users.

Recommended Assignment
•Consultant and Enterprise GIS and Open Data Coordinator

Task 26: Training Plan
The City should develop a training plan that promotes GIS education, and knowledge transfer between departments for all user tiers.

Recommended Assignment
•Consultant and Enterprise GIS and Open Data Coordinator

-END OF GOVERNANCE TASKS-

MILESTONE 2

TECHNOLOGY READINESS AND ARCHITECTURE ASSESSMENT

CITY OF BERKELEY

CALIFORNIA

GIS Strategic Implementation Plan

Table of Contents

1.0 Executive Summary

This report reviews technology readiness and provides the design specification for an enterprise GIS appropriate to the business needs of the City of Berkeley. The needs of the City were identified during interviews conducted during October 31st – November 4th. Those needs emphasized the importance of creating a centralized system of shared GIS resources, improving geospatial and analytical capabilities, and providing best of class system performance to GIS users.

The primary goals and objectives of this report are as follows:

- Provide a sustainable platform for future system expansion
- Implement a reliable high availability system
- Leverage best of class technology and hardware platform
    - Increase data access performance
- Recommend a robust enterprise relational database and standardized geodatabase design in support of GIS to perform the following functions:
    - Reduce data duplication
    - Improve the currency and accuracy of information used in decision making
- Determine the viability of developing a hybrid premise/cloud based infrastructure
- Provide industry Best Practices for improving the performance and efficiency of the GIS architecture

<u>Central Server and Service-Oriented Infrastructure Approach</u>

The proposed enterprise system design will take advantage of the City's existing successes with GIS technology. It will consider enhancing the existing technology with an upgraded central server-based, services-oriented infrastructure. In addition to being the most cost-effective way of meeting the stated objectives of the project, the central server infrastructure will allow the City to extend the benefit of its GIS technology and assets to more business processes and non-GIS professionals in a variety of business units.

This reports strategy includes an investment in upgraded server resources and the migration of all remaining GIS data into the City's existing Local Government Information Model (LGIM). In addition, it recommends the adoption of ArcGIS Online for public facing services.

The key recommendations are:

1. Upgrade the existing GIS servers to a modern better performing technology and deploy the City's public facing GIS server in the Cloud
    a. Deploy a GIS staging environment (sand box) that replicates the GIS server site
2. Build a central services infrastructure which exposes appropriate services end-points for transactional editing, analysis, and viewing, based on a variety of clients
3. Complete the migration of GIS data to the Local Government Information Model
4. Further implement ArcGIS for Local Governments browser-based applications for intranet users
5. Expand the use ArcGIS Online services as base map content for public facing services

The main body of the report will further define the City's GIS business requirements and make recommendations on how to address those technology needs through system architecture design.

2.0 Methods, Constraints, & Acknowledgements

2.1 Purpose & Methodology

The purpose of this document is to communicate the architectural observations and recommendations for the City of Berkeley's enterprise GIS. Inputs to this document include information received from the City, industry best practices, and a series meetings held at the City. GTG uses our collective experience along with the aforementioned inputs to develop our recommendations. Our design process, and this report, is based upon The Open Group Architecture Framework (TOGAF), a standard framework for system architecture.

2.2 Assumptions & Constraints

The approach and system architecture recommendations made in this document take into consideration the following assumptions and constraints:

- As appropriate, existing hardware will be considered for inclusion as part of a new or updated GIS architecture. The City has a current policy of replacing the Server hardware every 5 years.
- "User requirements" are defined as those related to total users, concurrent users, user locations, and user workflows. The term does not refer to user application or software functional requirements.
- The target time frame for the designs in this report is a three year period. Capacity calculations are based on estimates of the peak user activity that could occur in that time frame. As such, they do not represent typical system loads; they represent peak loads that the system should be designed to handle.

2.3 Acknowledgements

GTG would like to thank and acknowledge City of Berkeley staff for providing valuable, detailed information that served as a basis for the system architecture review and this document. This includes detailed information regarding the current IT infrastructure, GIS system architecture, and the current GIS applications and their use.

3.0 Architecture Vision

The City of Berkeley envisions a common system of GIS capabilities and resources that support the needs of a growing number of departments that use GIS in their operations. Shared resources, including enterprise data warehousing, data, services, and applications should be centrally provisioned and available throughout the City's network.

At the same time, most departments will continue to maintain resources, particularly data resources that are specific to them. The system must provide flexibility to end-user departments to use the client-side technologies of their choosing (e.g. desktop applications, browser-based applications, mobile applications, etc.).

Finally, the system must provide flexibility to support new operations/workflows and new business units over time.

The diagram below illustrates the conceptual design relative to the business units that are currently known and actively using GIS.

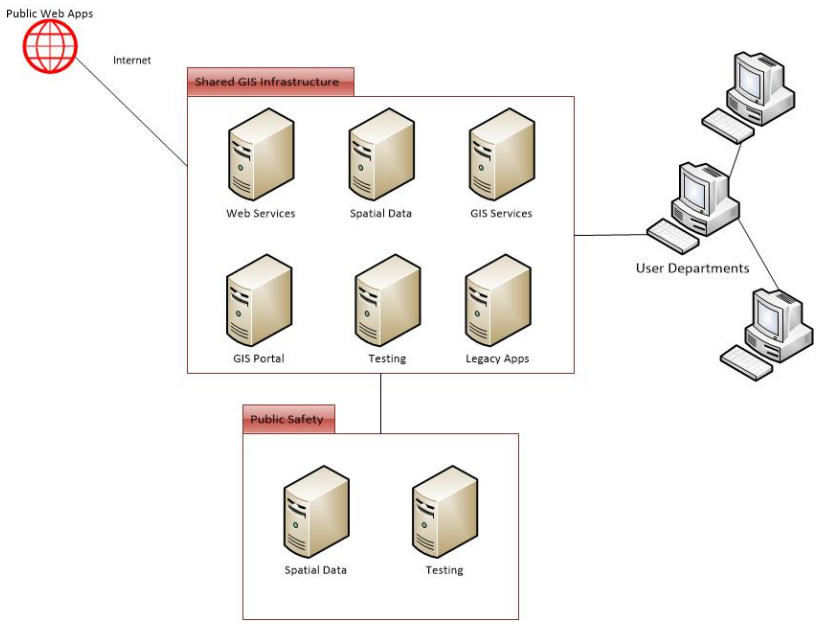


Figure 1: Conceptual Overview of System

4.0 Business Architecture

This section describes the business requirements and preferences that guide the design presented in this report. The design will allow the integration of new needs and new business units over time. However, it is based on the specific requirements described by the departments that participated in the planning meetings:

- City Attorney
- City Clerk
- City Manager
- Finance
- Housing and Community Services
- Information Technology
- Parks, Recreation and Waterfront
- Public Works
- Planning
- Rent Board
- Fire
- Police

3.1 Business Requirements

The following business requirements were identified during the planning meetings as important motivators for the creation and design of an enterprise GIS.

No.	Item	Description
1	Improve GIS performance and provide a sustainable platform for future expansion	Aging server architecture has led to degraded GIS system performance and a new solution is needed that will scale as needed
2	Reduce data duplication	Currently some GIS data is stored in the Local Government Information Model (LGIM) but some data is still scattered and needs to be consolidated
3	Use standard operating procedures	Using standards for GIS administration, data development, and databases will improve the effectiveness of the enterprise GIS
4	Deploy standardized geodatabase using a robust enterprise relational database	GIS data not currently in the LGIM needs to be mapped and migrated to the Local Government Information Model on the MS SQL Server platform
5	Accommodate integration with various 3rd party applications	Design solution needed that will integrate well with other enterprise applications including New World Systems, OnBase, SunGard, Chameleon, Lagan, Synchro, etc.
6	Maximize ArcGIS Server performance	Provide strategies (e.g. process configuration, cached map services, memory configuration) to ensure maximum performance of ArcGIS Server

3.2 IT Standards & Policies

The City's IT staff stated that there are currently not any formal IT Standards & Polices in place. GTG recommends that the following categories be considered for standards and policies:

- Hardware Virtualization
- Application Virtualization
- Cloud Computing
- Development Platform
- Database
- Hardware
- WAN Technology
- Off-premises Wireless
- Internet Access
- Authentication/Authorization

5.0 Technology Architecture

This section will document the existing Technology architecture in place at the City of Berkeley that supports the enterprise GIS. Applications, hardware, and network communications will be reviewed and their relevance to the overall system design will be documented.

5.1 Applications

5.1.1 Server

ArcGIS Server is the cornerstone of the City's enterprise GIS and its primary role is providing map services to browser based, desktop, and mobile mapping applications. The City currently has it deployed on its application server. The ArcSDE application that enables the usage of Microsoft SQL Server for the storage of spatial data in the form of geodatabases is located on the database server. SQL Server functions as the data repository for the enterprise GIS and is also located on the database server. The City has a public facing web server (http://www.ci.berkeley.ca.us/maproom/) for browser based mapping applications and uses the ArcGIS Web Adaptor to integrate with the City's existing web server, to forward requests to the GIS servers, and to provide security technology. Figure 2 lists the ArcGIS Server REST services that are currently in use.

Figure 2: Existing Map Services

The City is also using the ArcGIS Online product which consumes map services from ArcGIS Server to run various browser based mapping applications at the City including:

- Parcel Conditions
- Parcel Notifier
- Community Services
- Public Works Assets

- Storm Sewers
- Liquor Licenses
- Planning
- Fire
- Public GIS

ArcGIS Server and ArcSDE can require significant server resources. Multiple processors and substantial memory is recommended to support multiple map services and large geodatabases.

The City has an Enterprise License Agreement (ELA) with Esri and is able to essentially deploy as many server and desktop licenses as needed to support its GIS and the extent of the current licensing can be seen in Figure 3.

City of Berkeley Departments	Tier 1	Tier 2	Tier 3	ArcGIS Enterprise	o ArcGIS Desktop (Basic)	o ArcGIS Desktop (Standard)	o ArcGIS Desktop (Advanced)	o Extensions	§ Advanced Analysis	§ Data and Workflows	§ Industry Focused	§ No Cost Add-ons	ArcGIS Pro	Drone2Map for ArcGIS	ArcGIS Online	o Web AppBuilder for ArcGIS	§ Internet	Parcel Notifier	Bicycle Parking Map	Berkeley Park Highlights	Parcel Conditions/Parcel Popper	§ Intranet	Batch Geo-Coding	Solar Mapping	Planning App	Community Services App	Storm & Sanitary Sewer Networks Mapping Service	Public Works Mapping Service	Alcohol License Buff App	Census 2010 Mapping Service	Fire Map Service	Historic Maps & Photos	o Operations Dashboard for ArcGIS	o Insights for ArcGIS	o ArcGIS Open Data	o Collector for ArcGIS	§ Navigator for ArcGIS	o Workforce for ArcGIS	§ Navigator for ArcGIS	o Esri Story Maps	o ArcGIS Maps for Office	o 3D Scene Viewer	o Esri Crowdsource Solutions	o Esri Business Analyst/Community Analyst	o Other Maps, Apps, and Industry Solutions
City Attorney's Office			4	4																	4																							
City Clerk's Office			9	9																	9																							
City Manager's Office		2	10	12			2														5				5																			
Finance			4	4																	2																							
Fire			20	20																	20																							
Housing and Community Services*		2		2			2																																					
Information Technology	1			1			1																																					
Parks, Recreation and Waterfront			10	10																3	4					3													✓					
Planning and Development		1	40	41			1											2	2	2	10			2	4	2			2	2		2												
Police Department		2	20	22			2																																					
Public Works	1	5	34	40			5																																					
Rent Board		1	10	11			1																																					
Total Users	2	13	161	176	0	0	14	0	0	0	0	0	0	0	0	0	0	2	2	5	54	0	0	2	9	5	0	0	2	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 3. Existing GIS Licensing by Department

5.1.2 Desktop

ArcGIS Desktop provides a rich set of analytical and data maintenance capabilities for the trained GIS professional. ArcGIS Desktop software is designed for LAN environments with relatively high bandwidth, low latency network connections to data sources. The City uses the ArcGIS Desktop product

for cartography, editing, and for performing spatial analysis. The City's ELA allows it to have unlimited installations of ArcGIS Desktop (Basic, Standard, or Advanced) and unlimited licenses of the various Desktop extensions including:

- Spatial Analyst –advanced spatial analysis
- 3D Analyst – manage and analyze data using a realistic 3D perspective
- Network Analyst – routing, closest facility, and location-allocation analysis
- Publisher – publish and share maps
- Data Interoperability – advanced data conversion capabilities

Due to its direct access of potentially large amounts of data from the GIS database server, Desktop requires that both server performance and network performance be at optimal levels in order to ensure that Desktop is performing well.

5.1.3 Mobile

Mobile GIS is the expansion of GIS technology from the office into the field. A mobile GIS enables field-based personnel to capture, store, update, manipulate, analyze, and display geographic information. Mobile GIS integrates one or more of the following technologies:

- Mobile devices (smart phones, tablets, laptops)
- GPS
- Wireless Internet GIS access

The City currently has some limited use of mobile GIS products including the Esri Collector application and the City has a desire to expand its capabilities.

Mobile GIS consumes map services from ArcGIS Server. The increased use of Mobile GIS will have a direct effect on server resources and will require that proper sizing of a new sever infrastructure is performed to ensure that adequate resources are available.

5.2 Hardware

5.2.1 Server

The server is typically the most critical component of GIS architecture, being the workhorse that must process the numerous demands from various desktop, mobile, and browser based clients. It is therefore imperative that GIS architecture provide substantial server resources to support the varied needs of both casual and power users alike.

The City's current server technology is aging, exhibiting performance issues, and failing to fully meet the needs of the enterprise GIS. The City uses VMware for server virtualization and the underlying server hardware that supports VMware is approximately 5 years old (Xeon E5-2670 processor initial launch date was the first quarter of 2012) and should be replaced in the near future. Following are the specifications of the physical server that supports the virtualized servers in the current GIS production server environment:

CPU:	Dual 2.60 GHZ Intel Xeon – E5-2670 (2 sockets / 8 cores each)
Memory:	256 GB
Network Card:	1 GB Ethernet
OS Version:	Windows 2008 R2

The current server environment is virtualized using VMware. VMware is the most commonly used server virtualization software in the world and provides the following benefits:

- Improved security model
- Minimized downtime
- Increased productivity for IT staff
- Centralized management
- Reduced capital and operating costs

5.2.2 Desktop

The performance of desktop hardware is important when supporting ArcGIS Desktop users. Increased processing power better supports CPU intensive functions like spatial analysis and working with large data sets. The City's current Power User desktop is a Dell Optiplex 7020 (Core i7 processor, 16GB memory) which meets the following minimum requirements to run ArcGIS Desktop 10.x:

- 2.2 GHz processor
- 2 GB System Memory
- 256 MB Video Memory
- 1024 x 768 Screen Resolution
- 500 MB Swap Space
- 2.4 GB Disk Space

5.2.3 Mobile

The limited number of staff that are currently using Esri Collector in the field are doing so with tablet computers. The need to develop a citywide Mobile GIS Plan was identified during strategic planning. Once this plan is developed, the City will be able to, among other things, standardize what mobile hardware platform is used for field data collection.

5.3 Network Communications

The City currently has a very robust Local Area Network (LAN) and Wide Area Network (WAN) in use. The LAN is 1GB copper from servers to desktops and provides a substantial amount of bandwidth to GIS applications. The WAN consists of 2GB connectivity while the City's connection to the Internet is 150MB. The logical diagram in Figure 4 depicts the existing GIS network infrastructure and Berkeley Wide Area Network.

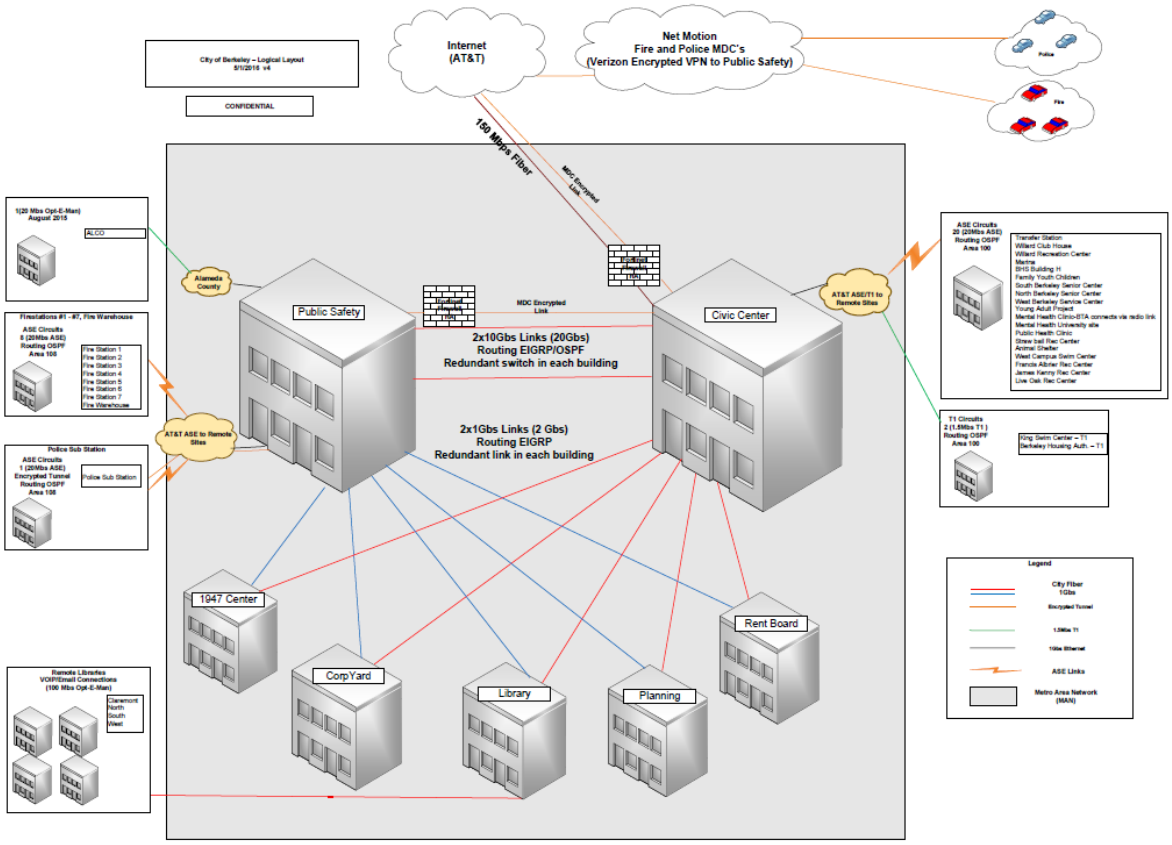


Figure 4. GIS Infrastructure and Berkeley Wide Area Network (graphic provided by Berkeley IT Dept.)

6.0 System Architecture Design

System architecture design is the process of aligning business needs with technology infrastructure to ensure that the business requirements are being adequately met. This section will address various aspects of the design process and develop recommendations for a system design that will meet the needs of the City of Berkeley for the next several years.

6.1 Platform Sizing

During the system design process, GTG will make use of the Esri 2016 Capacity Planning Tool (CPT) (Figure 5) for the purpose of properly sizing the GIS server environment and for developing recommendations for the LAN/WAN configuration. The CPT is an Excel spreadsheet that contains logic for translating user workflow needs into specific network and platform capacity requirements. Output from the CPT will be provided to quantify and justify the recommended system architecture.

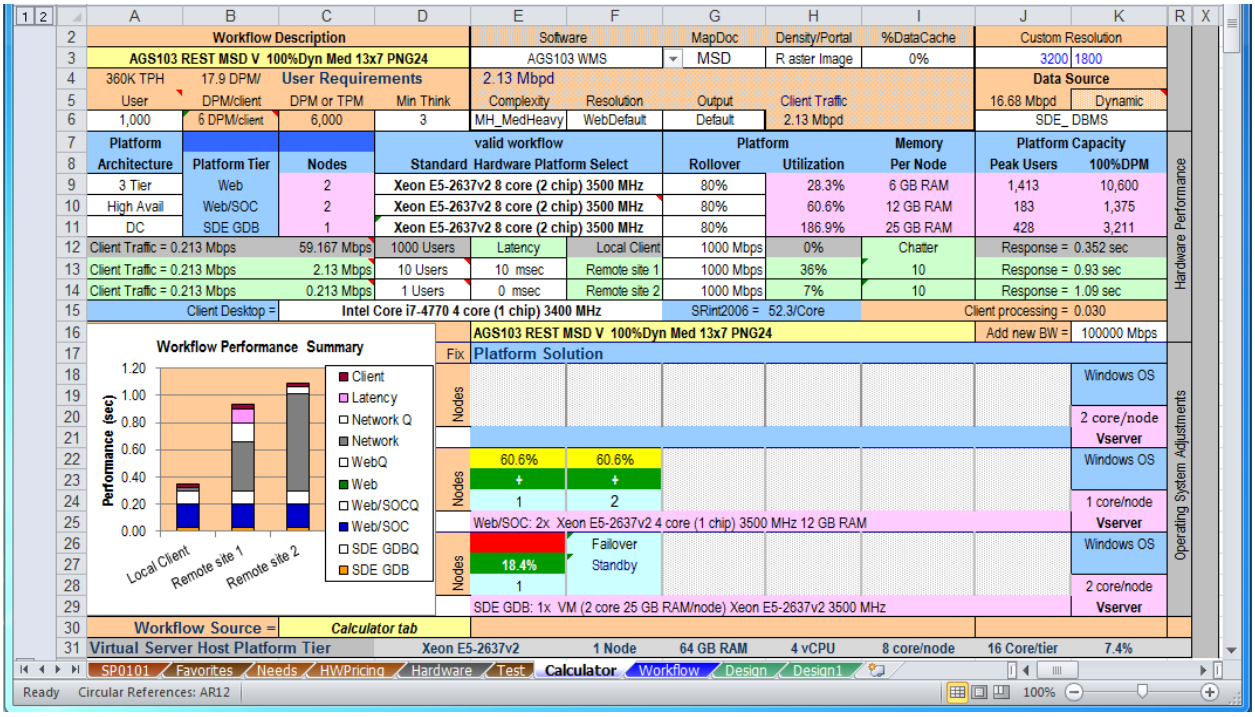


Figure 5. Capacity Planning Tool

6.2 Server Software Performance

Within an enterprise GIS, the server technology deployed to support the GIS is often the most critical hardware/software component. The City currently maintains a server based GIS environment implementing the ArcGIS Server and ArcSDE products.

Increasingly, many GIS users are turning to server based architectures (Figure 6) for disseminating spatial data. ArcGIS Server, via map services, can provide spatial content through browser technology and circumvent the need to install software on user's local desktops. ArcGIS Server offers enterprise level functionality, which directly addresses Single Use and Concurrent Use license limitations by offering unlimited GIS application usage via a web browser.

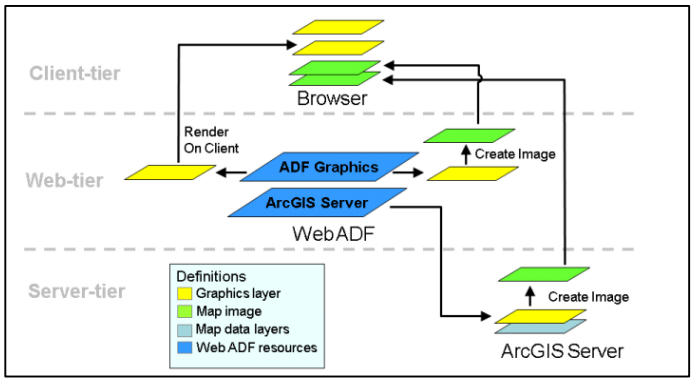


Figure 6. ArcGIS Server Tiered Environment

The implications for the City are that end users accessing GIS resources in a web browser will more actively utilize GIS enterprise-wide, become more proficient users, and be able to perform more complex GIS tasks. *That is, if the web browser based application is fully functional and used regularly by staff.*

By incorporating this level of GIS access into an organization, the City will realize an increased return on investment (ROI) based on steady increases of internal and external GIS usage, developing server based applications and eliminating costs for desktop licensing.

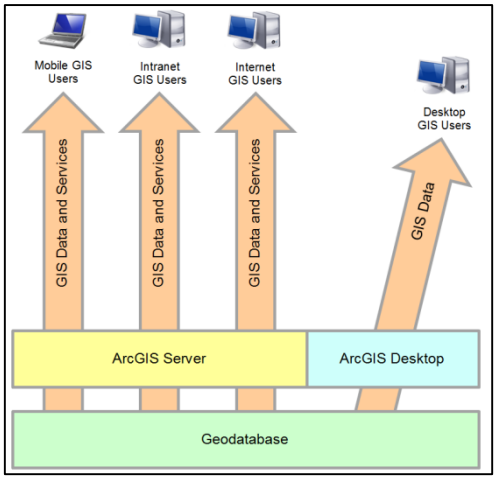


Figure 7. GIS Server Based Architecture

It is recommended that the City continue to develop a client-server based GIS architecture that is centered on the geodatabase and ArcGIS Server. As the graphic illustrates (Figure 7), the City's centrally managed system houses all GIS data and applications. In turn, data and applications specific to the needs of each department will be made available to the end users through various applications.

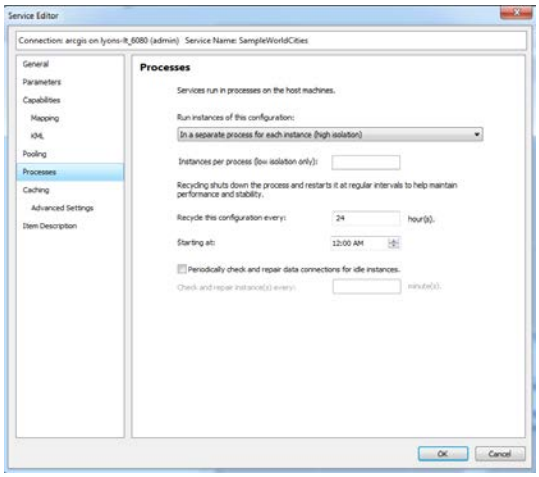
The existence of the centrally-located enterprise geodatabase is the cornerstone component in the City's GIS program. The geodatabase is currently accessed directly through multiple desktop GIS applications, as well as various Esri ArcGIS Services.

The GIS server's performance is critical to meeting the business requirements of an organization. Server software performance tuning can ensure that the ArcGIS Server software is operating at optimal levels.

The following establishes configuration settings that should be used to optimize ArcGIS Server performance.

6.2.1 Process Configuration

ArcGIS Server has two settings for process configuration, high isolation and low isolation. These processes are a component of the Server Object Container, or SOC. These process isolations are set when publishing an ArcGIS Server map service. The isolation determines how the server manages ArcSOC processes:

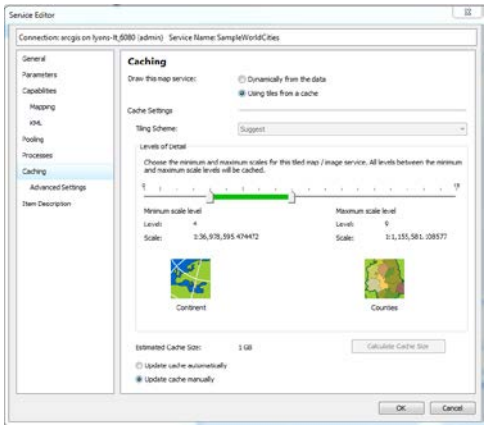


- Each process represents a unique map service
- High isolation results in a single threaded service
- Low isolation results in multiple threads (up to 256)
- High isolation is more stable
- Low isolation can result in more efficient instance capacity adjustments

Best Practice: High isolation is more stable and the better choice for typical map services.

6.2.2 Cached Map Services

ArcGIS Server provides map cache services to help improve the display of spatial data layers. The cached map service consists of a pyramid of pre-processed vector data or image data. The number of pyramid levels can be specified to allow for caching of the source data at various scales and resolutions. Properly establishing the map cache settings can greatly improve the display performance for GIS clients.



Best Practices:

- Using cached tiles provides a highly scalable static map service
- Develop high quality base maps – they display just as quickly as simple tiles
- Use preconfigured Caching Tool instances when generating map cache

6.2.3 Memory Configuration

Sufficient memory resources are critical to the proper functioning and performance of ArcGIS Server. As the number of map services increases, so does the corresponding need for memory. If insufficient memory is available, map services will begin to fail due to:

- Increased memory paging
    - Active processes will crash when swapped to memory during execution

Following are the recommendations for ArcGIS Server in a virtualized server environment:

- Minimum of 4GB per core

- Large data file (imagery) will likely require more memory
- Additional memory will typically improve data throughput performance
- Additional memory will allow for more map services

Best Practices:

- Having sufficient physical memory is critical to having a stable system and for providing the best performance
- On average, have no more than 10 map service instances per CPU core
- Do not have extraneous or unnecessary map services deployed on the server

6.3 GIS Data Administration

How GIS data is managed is critical to the success of an enterprise GIS. Storage methods have changed dramatically over the past decade being driven mostly by technology. Choosing how to manage, access, and organize these data resources is very important to the system architecture design.

6.3.1 ArcSDE Geodatabase

The geodatabase is the native storage format for ArcGIS. The ArcSDE application geo-enables enterprise relational databases (e.g. MS SQL Server, Oracle, etc.) allowing for the storage and retrieval of spatial GIS data. The enterprise geodatabase consists of an application tier (ArcObjects and ArcSDE) and a data storage tier (the relational database). The responsibility for managing geographic data in an enterprise geodatabase is shared between ArcGIS and whichever RDBMS is used.

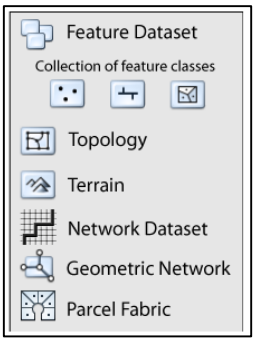
ArcSDE supports long transactions using versions of the database. This is referred to as “versioning” in the ArcGIS environment. Thousands of concurrent versions can be accommodated in a single database. The “default” version represents the primary GIS data, while the versions represent potential changes to that data.

Geodatabase versioning allows multiple editors to access the same database and edit data concurrently. A process is provided for each editor to "reconcile" and "post" their edits back to the geodatabase's default version. In a typical editing environment, numerous edits are being made to the database on a daily basis increasing the size of the version state tree. This process increases the size of the Add and Delete tables (A&D) in the database. As the A&D tables grow, they can eventually cause system performance degradation. It is important to compress the database on a regular basis to reduce the number of states and reduce the size of the A&D tables.

Best Practices:

- Use a versioned geodatabase when managing multiple edit sessions
- Database compression should be conducted on a scheduled basis to reduce the existing database states

Local Government Information Model



Proper design of the enterprise GIS database is critical to effectively support organizational data needs, applications, data maintenance and update, data security, etc. The City currently maintains GIS data in the SDE environment using the LGIM. The LGIM data model standardizes the storage of GIS data.

It is recommended that the majority of standalone feature classes be placed in feature datasets. A feature dataset is a collection of related feature classes that share a common coordinate system. Feature datasets are used to spatially or thematically integrate related feature classes. Their primary purpose is for organizing related feature classes into a common dataset for building:

- a topology
- a network dataset
- a terrain dataset
- a geometric network
- a parcel fabric

Additionally, feature datasets can be used to:

- Organize thematically related feature classes
- Organize data access based on database privileges
- Organize features classes for data sharing

As mentioned, the City is currently using the LGIM data model to store the majority of its GIS data layers and should endeavor to migrate any remaining GIS data into the LGIM. The LGIM contains a variety of logically defined feature datasets and feature classes that are common to most local government's spatial data needs.

The LGIM connects silos of information in an organization and integrates processes across typical government departments. It helps provide for more effective operations, better communication, saves time and money, and engages community members in more meaningful ways. In addition, it also supports data sharing between local governments and regional, state, and federal agencies. Following are the feature datasets defined by the LGIM:

- Address
- Administrative Area
- Assessment Information
- Cadastral Reference
- Capital Planning
- Community Service
- Demography
- Election Administration
- Election Results
- Elevation
- Emergency Operations
- Facilities Streets
- Field Crew
- Infrastructure Operations
- Land Use Operations
- Land Use Planning
- Parcel Editing
- Parcel Publishing
- Raster Data
- Public Safety Planning
- Reference Data
- Sewer Stormwater
- Stormwater
- Water Distribution

Best Practices:

- Use geodatabase versioning in the edit environment to allow multi-user editing and to promote quality control
- Perform scheduled database compressions to clean out the A&D tables and ensure optimal database performance
- Fully implement the LGIM and migrate any remaining standalone GIS data into the standardized data model
- The LGIM provides a standard data model for improved integration with third party applications and databases

6.3.2 GIS Imagery Data Architecture

Image data has become one of the most useful layers available in GIS. Imagery today is typically very accurate spatially and provides a snapshot of real world conditions. It can be used to understand real world relationships of terrestrial features more readily than other GIS data. Imagery, however, has very high storage requirements and can require significant bandwidth on LANs and WANs.

In ArcGIS, imagery can be accessed in a variety of ways:

- Direct access by ArcGIS Desktop
- ArcGIS Server image services
- Direct access to preprocessed imagery cache tiles

Imagery caching is an important tool for providing potentially large improvements with image retrieval and display performance. Image caching creates a preprocessed pyramid of imagery tiles configured at a range of scales. This greatly improves display times for clients since the preprocessed cached tiles are sent to the client without future processing. Following is a recommended image caching workflow:

- Create mosaic dataset
- Serve image services to key users
- Create map cache
- Maintain mosaic dataset
- Update cache

Imagery, whether stored in native file format or as raster data in an ArcSDE geodatabase, can consume a large amount of storage space. In some organizations, due to the storage requirements of imagery, upwards of 75% of the storage needs of the enterprise GIS can be attributed to image data. This mandates that the organization pay particular attention to its selected storage architecture to ensure that it is adequately designed.

Best Practices:

- If an image service will not have its properties modified by users and it will be used as a basemap, use caching to increase display performance and improve scalability
- Due to large storage requirements of image data, proper planning of the storage architecture is very important

6.3.3 Storage Architecture Options

The modern data center typically relies on the Storage Area Network (SAN) for its enterprise storage needs. The SAN is a high-speed network of storage devices that also connects those storage devices with servers. It provides block-level storage that can be accessed by the applications running on any networked servers.

SANs typically use high speed fiber for connectivity resulting in the elimination of data transmission bottlenecks. Also, because SANs usually offer multiple connections to and from the data center's servers, they also improve availability. In addition, separating the storage from the servers frees up the computing resources on the servers for other tasks not related to storage.

SANs are particularly helpful in backup and disaster recovery settings. Within a SAN, data can be transferred from one storage device to another without interacting with a server. This speeds up the backup process and eliminates the need to use server CPU cycles for backup.

The SAN is comprised of any number of hard disk drives (HDD) or solid state drives (SSD) that are typically in a RAID configuration. RAID is a technology for striping data across multiple drives to improve data redundancy or performance or sometimes both. The type of RAID configuration selected is an important consideration when looking at the GIS system architecture.

The most common RAID configuration used with enterprise GIS for data storage is RAID 5 which offers the following capabilities:

- Consists of block level striping with distributed parity
- If one disk fails, the parity bit on the parity disk can be used to restore the missing data
- Provides optimum disk utilization and near optimum performance

Relational databases like SQL Server store data files, index tables, and log files, all of which are associated with a specific database. While RAID 5 is commonly used for the large data files associated with a database, it is recommended that RAID 1/0 be used instead for the index tables and log files. RAID 1/0 provides both mirroring of data and high performance data access. It is also the highest cost solution effectively cutting in half the available disks. Following is a recommended relational database storage configuration:

- Data Storage Files (vector data) – RAID 5 volume (1)
- Data Storage Files (raster data) – RAID 5 volume (2)
- Index Tables and Log Files (vector data) – RAID 1/0 volume (1)
- Index Tables and Log Files (raster data) – RAID 1/0 volume (2)

The above configuration would result in four volumes being created on the SAN of an appropriate size to accommodate the database requirements. This would result in an optimized database environment that would provide optimal performance to the enterprise GIS.

Best Practices:

- The SAN is a best of class storage solution for an enterprise GIS
- Database index and log files should be stored on RAID 1/0 volumes
- Database files storing GIS vector and raster data should be placed on RAID 5 volumes resulting in minimum performance impact
- Monitor disk I/O performance to identify when disk contention is causing performance issues
- Configuring a SAN with Solid State Drives would provide best of class performance (Berkeley has recently upgraded both of their data center SANs to SSD technology)

6.4 Network Communications

An enterprise GIS is one of the heaviest contributors to network traffic in a LAN/WAN environment. This is in large part due to the graphic intense experience that GIS provides the end user and to potentially large data files (e.g. aerial photography) being transmitted across the network. The capacity and performance of the network is therefore a very important component of the system architecture design.

6.4.1 Capacity & Performance

As depicted in Figure 4, the City has a very robust 1GB LAN supporting its enterprise GIS. As expected from a well configured network, user feedback provided by City staff indicates that the City's LAN provides excellent performance and a good user experience.

The City's network has excellent bandwidth available but care should be taken to recognize any new latency that may occur in network communications. Network latency is the round-trip travel time for a single packet of data. Various things can create latency such as aging and/or defective switches or routers. Increased latency results in a GIS user having to wait longer for a screen to refresh or for a process to complete and has a detrimental impact on the user experience.

Round-trip travel time within the City's GIS network was tested using the "ping" tool. Numerous desktops and servers were pinged from the City's VPN server and round-trip times on average did not exceed 1ms. Often multiple round-trips are required by a GIS application and this is referred to as "chatter". Total latency delay is the product of latency and chatter.

For design purposes:

- Typical complexity SDE/file chatter = 200
- Web client chatter = 10

Total latency delay:

SDE > 0.001 sec X 200 trips = 0.2 sec

Web > 0.001 sec x 10 trips = 0.01 sec

The above total latency delay should be the maximum amount of delay that any GIS user would experience on the City's LAN. This indicates a network that is performing in an optimal state. As previously stated, the City's LAN should be continually monitored to ensure that optimal performance is maintained and that network latency does not become an issue.

6.4.2 Suitability Analysis

It is typical for network administrators to benchmark and maintain performance metrics on their networks. The peak bandwidth needs of the network must first be understood by reviewing site traffic workflows and summing their bandwidth requirements. This can be accomplished using the Esri CPT Design tab. Figure 8 is an example of this tool being used to plan for a potential build-out of GIS users at the City exceeding 700 with some estimated user counts.

Workflow Labels	Requirements Analysis Types of Workflows	User Environment Peak Concurrent Users	TPH	Network Mbps	Network Bandwidth Mbps Data {TPH}	NW %Cap Traffic Mbpd	Wkflow Chatter Latency msec	Display Response Time (sec)
<Name>	Standard							
LAN	LAN_Local Clients		Services		1000 Mbps	18%		
S DeskEdit	S DeskEdit_ArcGIS Desktop Editor	6		10.000	DB {3,600}	10.000	200	0.40
S DeskView	S DeskView_ArcGIS Desktop Viewer	20		33.333	DB {12,000}	10.000	200	0.40
S WebMap	S WebMap_Web Mapping Service	680		136.000	DB {244,800}	2.000	10	0.52
Internet	Internet_Clients				150 Mbps	40%		
S WebMap	S WebMap_Web Mapping Service	100	73,000	60.556	DB {109,000}	2.000	10	0.53
					1.5 Mbps		0 msec	

Figure 8. CPT - Network Suitability Analysis

In the "LAN_Local_Clients" network configurations, it can be seen that the City's existing 1GB network infrastructure is more than up to the task of supporting network traffic for the enterprise GIS. The 150 Mbps connection for the internet connection is also more than adequate. It is a best practice to design the network to support double the anticipated traffic. That would equate to the following design needs:

- LAN/WAN > 358 Mbps
- Internet > 120 Mbps

These requirements leave substantial bandwidth for other enterprise applications on the 1 GB network resulting in best of class performance for GIS applications.

Best Practice: The LAN/WAN should be periodically monitored to ensure latency does not increase on the network

6.5 Platform Performance

The performance of GIS applications was discussed in Section 5 and in this section the importance of hardware technology will be the focus. Selecting the right hardware will provide greater performance, improve efficiencies, and provide a better return on investment.

6.5.1 Performance Baseline

The performance of computer hardware that supports GIS has increased dramatically over time. Platform per core performance is now 5.3 times faster than it was 10 years ago. The trend has been faster hardware and lower platform cost. For the purpose of measuring ArcGIS software performance, Esri has established a benchmark hardware system each year to identify the best available platform for GIS. Platform performance is measured using SPEC performance benchmarks. The Standard Performance Evaluation Corporation (SPEC) was established in 1988 by a small number of workstation vendors for the purpose of creating an industry recognized realistic benchmark of computer

hardware performance. Esri specifically uses the "SPECrate_int2006" per core benchmark baseline for measuring hardware performance of various systems (Figure 9).

SPECrate_int2006 is a process intensive benchmark that stresses a system's processor, memory subsystem, and compiler and provides an accurate and consistent gauge of a system's performance.

	A	B	C	D	E	G	H	N	O	P	R
1	Vendor (SPEC link)	System	# Cores	# Chips	# Cores/ Chip	Processor	MHz	Baseline	Base/ core	HW Avail	CPU
2	IBM Corporation	IBM Power E880 (4.35 GHz, 64 core, RHEL)	64	8	8	POWER8	4359	4170	65.2	Nov-14	POWE
3	IBM Corporation	IBM Power E880 (4.35 GHz, 64 core)	64	8	8	POWER8	4359	4130	64.5	Nov-14	POWE
4	IBM Corporation	IBM Power E870 (4.19 GHz, 80 core)	80	8	10	POWER8	4192	4830	60.4	Nov-14	POWE
5	Hewlett-Packard Comp	Proliant BL460c Gen9 (3.50 GHz, Intel Xeon E5-2637 v3)	8	2	4	Intel Xeon E5-2637 v3	3500	459	57.4	Sep-14	Inte
6	Cisco Systems	Cisco UCS B200 M4 (Intel Xeon E5-2637 v3 @ 3.50GHz)	8	2	4	Intel Xeon E5-2637 v3	3500	457	57.1	Sep-14	Inte
7	Dell Inc.	PowerEdge T630 (Intel Xeon E5-2637 v3, 3.50 GHz)	8	2	4	Intel Xeon E5-2637 v3	3500	457	57.1	Sep-14	Inte
8	Hewlett-Packard Comp	ProLiant DL380 Gen9 (3.50 GHz, Intel Xeon E5-2637 v3)	8	2	4	Intel Xeon E5-2637 v3	3500	457	57.1	Sep-14	Inte
9	Cisco Systems	Cisco UCS C240 M4 (Intel Xeon E5-2637 v3 @ 3.50GHz)	8	2	4	Intel Xeon E5-2637 v3	3500	456	57.0	Sep-14	Inte
10	Dell Inc.	PowerEdge M630 (Intel Xeon E5-2637 v3, 3.50 GHz)	8	2	4	Intel Xeon E5-2637 v3	3500	456	57.0	Dec-14	Inte
11	NEC Corporation	Express5800/GT110g-S (Intel Core i3-4350)	2	1	2	Intel Core i3-4350	3600	114	57.0	Jul-14	Inte
12	NEC Corporation	Express5800/T110g-E (Intel Core i3-4350)	2	1	2	Intel Core i3-4350	3600	114	57.0	Jul-14	Inte
13	Dell Inc.	PowerEdge FC630 (Intel Xeon E5-2637 v3, 3.50 GHz)	8	2	4	Intel Xeon E5-2637 v3	3500	455	56.9	Dec-14	Inte
14	Dell Inc.	PowerEdge R630 (Intel Xeon E5-2637 v3, 3.50 GHz)	8	2	4	Intel Xeon E5-2637 v3	3500	455	56.9	Sep-14	Inte
15	Dell Inc.	PowerEdge R730 (Intel Xeon E5-2637 v3, 3.50 GHz)	8	2	4	Intel Xeon E5-2637 v3	3500	455	56.9	Sep-14	Inte
16	Hewlett-Packard Comp	ProLiant DL360 Gen9 (3.50 GHz, Intel Xeon E5-2637 v3)	8	2	4	Intel Xeon E5-2637 v3	3500	453	56.6	Sep-14	Inte
17	Huawei	Huawei CH121 V3 (Intel Xeon E5-2637 v3)	8	2	4	Intel Xeon E5-2637 v3	3500	452	56.5	Sep-14	Inte
18	Huawei	Huawei CH222 V3 (Intel Xeon E5-2637 v3)	8	2	4	Intel Xeon E5-2637 v3	3500	452	56.5	Sep-14	Inte
19	Huawei	Huawei RH2288 V3 (Intel Xeon E5-2637 v3)	8	2	4	Intel Xeon E5-2637 v3	3500	452	56.5	Sep-14	Inte
20	NEC Corporation	Express5800/T110g-S (Intel Core i3-4360)	2	1	2	Intel Core i3-4360	3600	113	56.5	Jul-14	Inte
21	Sugon	Sugon I620-G20 (Intel Xeon E5-2637 v3)	8	2	4	Intel Xeon E5-2637 v3	3500	448	56.0	Sep-14	Inte
22	Cisco Systems	Cisco UCS C220 M4 (Intel Xeon E5-2643 v3 @ 3.40GHz)	12	2	6	Intel Xeon E5-2643 v3	3400	671	55.9	Sep-14	Inte
23	Dell Inc.	PowerEdge R730 (Intel Xeon E5-2643 v3, 3.40 GHz)	12	2	6	Intel Xeon E5-2643 v3	3400	669	55.8	Sep-14	Inte
24	Hewlett-Packard Comp	ProLiant BL460c Gen9 (3.40 GHz, Intel Xeon E5-2643 v3)	12	2	6	Intel Xeon E5-2643 v3	3400	669	55.8	Sep-14	Inte
25	Dell Inc.	PowerEdge R630 (Intel Xeon E5-2643 v3, 3.40 GHz)	12	2	6	Intel Xeon E5-2643 v3	3400	668	55.7	Sep-14	Inte
26	Dell Inc.	PowerEdge T630 (Intel Xeon E5-2643 v3, 3.40 GHz)	12	2	6	Intel Xeon E5-2643 v3	3400	668	55.7	Sep-14	Inte
27	Cisco Systems	Cisco UCS B200 M4 (Intel Xeon E5-2643 v3 @ 3.40GHz)	12	2	6	Intel Xeon E5-2643 v3	3400	667	55.6	Sep-14	Inte
28	Dell Inc.	PowerEdge M630 (Intel Xeon E5-2643 v3, 3.40 GHz)	12	2	6	Intel Xeon E5-2643 v3	3400	667	55.6	Dec-14	Inte
29	Fujitsu	PRIMERGY RX100 S8, Intel Core i3-4330, 3.50 GHz	2	1	2	Intel Core i3-4330	3500	111	55.5	Sep-13	Inte
30	Fujitsu	PRIMERGY RX1330 M1, Intel Core i3-4330, 3.50 GHz	2	1	2	Intel Core i3-4330	3500	111	55.5	Jul-14	Inte
31	Fujitsu	PRIMERGY TX1330 M1, Intel Core i3-4330, 3.50 GHz	2	1	2	Intel Core i3-4330	3500	111	55.5	Jul-14	Inte
32	Fujitsu	PRIMERGY TX140 S2, Intel Core i3-4330, 3.50 GHz	2	1	2	Intel Core i3-4330	3500	111	55.5	Sep-13	Inte
33	IBM Corporation	IBM System x3100 M5 (Intel Xeon E3-1281 v3, 3.70 GHz)	4	1	4	Intel Xeon E3-1281 v3	3700	222	55.5	Jun-14	Inte
34	IBM Corporation	IBM System x3250 M5 (Intel Core i3-4330, 3.50 GHz)	2	1	2	Intel Core i3-4330	3500	111	55.5	Dec-13	Inte
35	Intel Corporation	ASUS H97M-PLUS Motherboard (Intel Core i3-4360)	2	1	2	Intel Core i3-4360	3700	111	55.5	Jun-14	Inte

Figure 9. Esri SPEC Performance Table

The Esri CPT makes extensive use of the SPEC performance values to gauge how well an existing or potential hardware platform should perform. Using these performance values in conjunction with defined user workflows provides the CPT with necessary information to properly size a recommended hardware platform to meet the needs of an organization's enterprise GIS.

6.5.2 Platform Performance

The increasingly more powerful hardware platforms that have become available over time, have led to the development of a broad range of powerful software solutions. System processing capacity is important but system availability and

scalability even more so for the support and optimal performance of an enterprise GIS.

The processors at the heart of most desktops and servers in use today are Intel based with desktop workstations and servers using the Intel Xeon line of processors. There are some AMD and Sun SPARC processors in use but they only occupy a very small portion of the server technology segment. Following are several processors showing how performance has gained over time:

Processor	Year	Cores	SPEC Rating
Intel Xeon E3-1270v3	2014	4	53
Intel Xeon E3-1280v2	2013	4	48
Intel Xeon E5-2637	2012	4	47
AMD Opteron - best performance	2012	#	22

As seen in the table, the Intel processors have steadily gained in performance while the AMD processor has less than half the performance of the corresponding Intel processor.

Faster processors reduce the processing time of a server or workstation and provide for increased system throughput. It is important to note that ArcGIS Server licensing is based on a per core licensing model (physical and virtual cores are treated the same). By deploying fewer and faster cores, ArcGIS Server licensing costs will be less with minimal loss of performance. Dual and Quad core configurations provide the highest per-core performance. Configurations with more cores, on the other hand, can support more virtual servers in a virtualized environment. The decision on which processor configuration to deploy will be based on cost versus required performance dictated by business requirements.

6.5.3 ArcGIS Server Platform Selection and Sizing

As noted previously in Figure 3, there are currently 176 GIS users at the City and a potential build out over the next three years to 706 GIS users plus 100 public

access users. Following are CPT designs based on these user counts along with the recommended hardware solution and estimated costs. The solution provided (Figure 10) is for a full build out of the recommended infrastructure. Specifications and pricing are for the physical server architecture that would be supporting the City's VMware virtual environment.

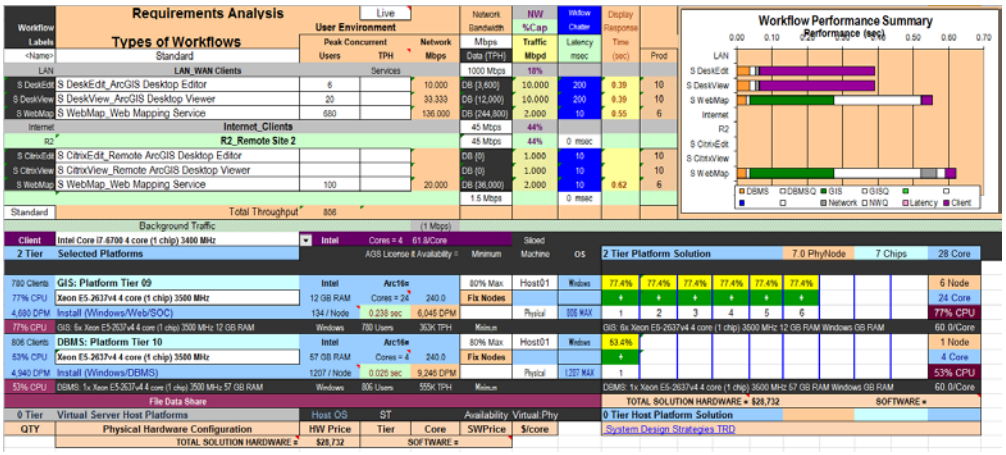


Figure 10. System Design - Full Build Out

Based on the CPT System Design results and following industry best practices, the following physical server architecture is recommended to support the total 806 users as follows:

- 8 – Xeon E5-2637v4 Processor Nodes (4 cores each)
- 168 GB Memory

This would result in the following virtual server configurations:

- Database (MS SQL Server)
  - 1 - Xeon E5-2637v4 Processor Node (4 cores each)
  - 64GB Memory
- Application (ArcGIS Server / Map Services / SOC)
  - 6 - Xeon E5-2637v4 Processor Nodes (4 cores each)
  - 96GB Memory
- Web (not included in Figure 11) (ArcGIS Web Adaptor)
  - 1 - Xeon E5-2637v4 Processor Nodes (4 cores each)
  - 8GB Memory
  - *Option: Deploy the Web Server in the Cloud*

Best Practice: Selecting the best physical server platform to support a virtualized environment is important. Physical host processor performance has a direct correlation to virtual server performance and scalability.

6.5.4 Premise vs Cloud Based Resources

Historically the GIS server architecture at Berkeley has been premise based with physical server platforms being located in the City's technology data center. In recent years, an alternative to this paradigm has emerged known as cloud computing. The cloud provides off-premise technology capabilities that are available on-demand, delivered as a service via the internet, and based on server technology that is typically not owned by the consumer – it is rented. There are three significant differences that distinguish cloud computing from traditional computing models:

1. Procurement – Consumers no longer need to buy assets to build their computing infrastructure. Instead, off-premise services are consumed via the internet.
2. Accessibility – Cloud services are only available through standard Internet protocols.
3. Technical - Instead of a single-use, dedicated, static system with underutilized capacity built for a maximum load, cloud computing supports dynamically scalable, "elastic" systems. The ability to dynamically scale up and/or down improves IT's ability to rapidly provision its systems based on traffic and demand - system capacity can be increased or reduced as needed.

Cloud Computing Advantages and Disadvantages

The capabilities, weaknesses, and strengths of cloud computing must be understood by an organization in order to make an informed decision on whether to implement cloud computing or not. Following is a list of the common advantages and disadvantages.

Advantages

- Storage and Scalability
  - Access to unlimited storage capability and scalability
- Backup and Disaster Recovery
  - Most cloud providers offer comprehensive backup and recovery solutions
- Mobility
  - Global access as longs as an internet connection is available
- Cost Efficiency
  - Cost reduction in storage and infrastructure, managing or updating applications, staffing, and energy
- Reliability
  - With a managed service platform, cloud computing is much more reliable and consistent than in-house IT infrastructure. Most providers offer a Service Level Agreement which guarantees 24/7/365 and 99.99% availability.

Disadvantages

- Control and Reliability
  - Giving up the in-house control of a traditional IT department and relying on a third party vendor
- Security, Privacy, and Compliance
  - Securing data or meeting compliance standards to protect the privacy of confidential data can be a concern. Some data may need to be maintained in a private cloud.
- Compatibility
  - Ensuring that all existing tools, software, and computers are compatible with a Web based service. Giving up some control over integration and compatibility.

- Downtime
    - If for any reason the cloud service goes down, there will be no access to applications in the cloud
- Contracts and Vendor Lock-in
    - The cloud service provider has total control of upsizing, downsizing, contracting, etc. of the IT infrastructure. Vendor lock-in could result in cost and performance disadvantages.
- Network Latency
    - Network latency is the round-trip travel time for a single packet of data. By using an off-site cloud provider latency time will increase. It is a question of "how much?" and is it acceptable for the intended use?

Considering the identified advantages and disadvantages of cloud computing, the City may wish to consider the implementation of a "hybrid cloud" for the enterprise GIS.

A hybrid cloud places some of the server infrastructure in the public cloud and other server infrastructure (to meet security and/or compliance needs) in the private cloud. Adopting this approach could make it easier for the City to meet its business requirements for security, integration, and customizations while placing part of its enterprise GIS in the cloud. Sensitive and proprietary data, applications, and services would continue to be hosted on premises within a private cloud.

For instance, a single server hosting ArcGIS Server and web services could be located in the cloud for public access while other GIS servers would remain premise based. Example: Cost of on-demand Window's servers that could support ArcGIS Server and public web access through one of the more popular cloud providers for hosting ArcGIS Server is as follows:

Type: Windows on r3.2xlarge

- 8 CPU cores
- 61GB memory
- 160GB SSD Local Disk
- High Network I/O option

Approximate Cost: $803/ month, $9,636/year

Using the above approach would allow the City to conservatively test the use of cloud computing for its enterprise GIS while maintaining its security and privacy requirements.

7.0 GIS Architecture Recommendations

The following recommendations are based on the system design process, on industry best practices, and on the combined experience of GTG's technical staff. If followed, these recommendations will provide Berkeley with a world class enterprise GIS that will exceed the expectations of its users.

GIS Server Platform

Migrate the public facing web server to the Cloud (Figure 11) and upgrade the Database and Application servers to newer technology.

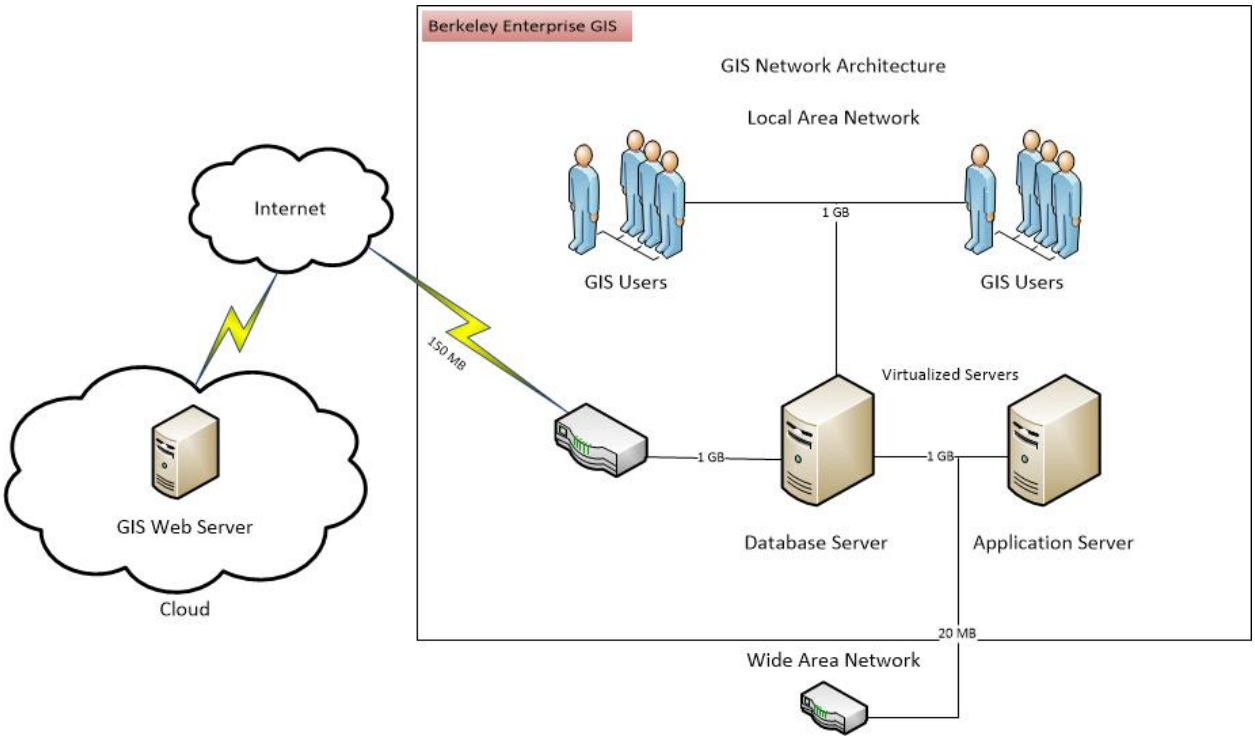


Figure 11. Proposed GIS Network

Suggested Server Configurations:

(At minimum deploy suggested or equivalent configurations.)

Premise Based Physical Server

Following is an example Physical Server configuration based on the above specifications. This cost estimate is provided for reference only and the City will need to verify the necessary hardware configuration, compatibility with existing systems, and obtain a current quote from their selected vendor. The following recommended server would increase platform capacity (transactions per hour) by 66% and would reduce typical server response times for GIS map services by 300%.

Physical Rackmount Server (Quantity 2)

- Dual Xeon E5-2637v4 Processors
- 128GB Memory
- 3 – 800GB Solid State Drives – RAID 5
- Gigabit Ethernet Controller
- SAN Controller (not included in price)
- Estimated Cost: $7,992 x 2 = $15,984

The City will need to obtain exact pricing from their selected hardware vendor based on the server specifications provided above with the possible substitution of newer Xeon processors as they become available.

Premise Based Storage Area Network (SAN)

The City currently has the following SAN configuration that will meet the needs of the enterprise GIS for the next 3 years:

- Dell Compellent SC8000
    - 92TB of SSD storage
    - 52TB of Hard Drive storage
    - 16GB Fiber Connectivity
    - Year Deployed/Upgraded: 2016

Sample Cloud Based Public Facing Web Server

- Windows Server (m4.xlarge configuration)
  - 4 processor cores
  - 16GB memory
  - High Network I/O option
  - Two Elastics IPs
  - Estimated Cost: $382/month ($4,584/year)

Staging Environment

The City should also consider the development of a staging environment for its GIS server site. The staging tier is an environment that is, as much as possible, identical to the production environment. The purpose of the staging environment is to simulate as much of the production environment as possible. The staging environment can also double as a demonstration/training environment. This environment is often referred to as a testing or sand box environment where all new software, processes, and configurations can first be tested before deploying to a production environment. Virtualized server sites are ideal for deploying a staging environment since new hardware does not need to be purchased and new servers can be deployed and replicated quickly without additional purchasing costs.

Desktop Platform

(At minimum deploy suggested or equivalent configurations.)

Power User

- Tower Workstation
  - Intel Xeon Processor E5-1650v3
  - 16GB Memory
  - 500GB Local Disk
  - NVIDIA Quadro K2200 4GB Video Card
  - 24" Display
  - Estimated Cost: $2,888
    - Recommended Software
      - ArcGIS Desktop 10.3.1 (Advanced or Standard) or newer

Casual User

- City's Standard Desktop
  - Recommended Software
    - ArcGIS Desktop 10.3.1 (Basic), or
    - Browser Based Mapping

Mobile Platform

The City needs to develop a citywide Mobile GIS Plan. Business requirements that are documented will determine the type of mobile hardware that will best meet the City's needs. The use of the Esri Collector application and other ArcGIS Online mobile applications is highly recommended.

Network Communications

The City's existing 1GB LAN/WAN is a best of class network infrastructure that is more than adequate to support the enterprise GIS. Periodic monitoring of network performance is recommended to ensure peak performance and to prevent issues like latency from causing performance issues. If the City decides to expand GIS access to other remote sites on the WAN, it is recommended that those additional sites participate in the 1GB fiber network.

Best Practices

Numerous best practices are enumerated throughout this document and it's recommended that the City adhere to these practices to maintain a peak performing GIS architecture.

Standard Operating Procedures (SOP)

The development of clear and concise Standard Operating Procedures to fully document all major technology functions is critical to the success of the enterprise GIS. These SOP documents should be heavily documented and contain step-by-step directions with numerous graphics guiding the user through each step of a given procedure. Ease of use, clear and concise steps, and thorough documentation should be the standard for these SOPs. The follow six-step procedure should be used when developing the SOPs.

1. Name the SOP using descriptive action words. For example, "Performing Data Maintenance", "Configuring Permissions and Security using Active Directory", etc.

2. Write a scope for the SOP answering the following questions:
    a. Which specific procedures will be covered?
    b. Which procedures are not covered?
    c. Who is the target audience for the SOP?
3. Develop the overall task description and include staff required for the task, what software (licensing) is needed, and the required staff skill level.
4. Describe each task in detail and include:
    a. Specific order of tasks
    b. Required software
    c. References to other SOPs
5. Use a team-based approach to developing SOPs.

    Successful SOP development and implementation typically requires that all people who are affected by a SOP be involved in a team-based SOP development and problem solving process. To achieve that:

    - Key City staff will need to be involved in drafting the initial SOP
    - Key City staff will need to check the written procedures against actual practices before implementation.
    - Revise as needed
6. Establish a process to monitor the SOPs regularly. This will ensure that if procedures change over time, the SOPs will be maintained and updated to reflect the change in procedures.

It is important to realize that developing useful and effective SOPs requires time and commitment from all management and employee levels. Once the SOP development is complete, three important steps still remain.

1. Educate employees about the new SOP
2. Control “procedural drift” by ensuring that the SOP is followed consistently over time
3. Establish an evaluation and review system to be certain that over time all the steps of an SOP are still correct and appropriate for the production system

MILESTONE 3

DATA SOURCE ASSESSMENT

CITY OF BERKELEY

CALIFORNIA

GIS Strategic Implementation Plan

Table of Contents

1.0 Executive Summary

This report reviews the current state of geospatial data at the City of Berkeley and makes recommendations for improving existing data, acquiring new data, and for assigning data maintenance responsibilities. The City's geospatial data needs were in part determined during staff interviews conducted during October 31st – November 4th. In addition, data needs were also determined based on industry best practices and GTG's collective local government experience. The City understands that geospatial data is core to a successful enterprise GIS and that fully developing its GIS data library will in part help ensure a successful GIS implementation.

The following are the goals and objectives of this report:

- Fully document existing GIS data and future GIS data needs
- Recommend data storage locations in the enterprise GIS database
- Recommend data maintenance responsibilities and update frequency
- Perform Quality Assurance and a Gap Analysis on authoritative data source layers and provide recommendations for improving
    - Tax Parcels
    - Street Centerlines
    - Address Points
- Perform an Assessment of Disaster Planning GIS layers and provide recommendation for improving

The key recommendations in this report are:

- Complete the migration of GIS data to the LGIM
- Fully implement ArcGIS for Local Government
- Acquire/develop all "recommended" layers in the MDL
- Implement the recommendations for improving the authoritative data source layers – tax parcels, street centerlines, and address points
- Follow the recommendations for creating or improving the disaster planning GIS layers

The main body of this report will provide a detailed analysis of geospatial data and provide numerous recommendations for further developing Berkeley's GIS data library in support of its enterprise GIS implementation.

2.0 Introduction

Berkeley has created, acquired and/or is interested in obtaining a host of GIS data layers. This chapter makes recommendations as to data update and maintenance and analyzes key data and base map layers. Base map data are geospatial data that represent key geographic features within a specific area; these features are the foundation upon which other geospatial data can be overlain. A base map can be defined differently, depending on organizational needs. For some organizations, a base map may be simply land ownership boundaries, while for other organizations it may be a multi-layered compilation of geospatial data including various layers such as roads, rivers, lakes, wetlands, topographic contours, land use, land cover, land ownership boundaries, and other geographic, demographic, and political boundary information. For local governments, such as Berkeley, a base map typically is comprised of several primary base map layers as follows:

Berkeley primary base layers:

1. Tax Assessment Parcels
2. OrthoPhotography
3. Street Centerlines
4. Address Points

Additionally, a number of secondary layers are sometimes developed that are referential and/or are important to many departments. These secondary layers vary by organizations and may include:

Secondary base layers:

1. Various Utility Systems
2. Neighborhoods
3. Points of Interest
4. Water Bodies
5. Various Political Boundaries

These layers can be used to create a variety of maps for both organizational and public use. In addition, these layers can be used in GIS applications to effectively manage and coordinate several City functions, including land use management and planning, transportation routing, emergency management services, public works/utility operations, and a variety of other applications that rely on these layers for reference and spatial analysis.

The successful deployment of comprehensive base map datasets requires careful planning and consideration of both proposed and anticipated uses. Technological developments and advanced applications that can affect these considerations include:

- Controlled digital aerial imagery
- Planimetric feature overlays (rivers and lakes, utility features, sidewalks and roadway edge-of-pavement, building footprints, etc.)
- Cadastral data layers (parcels, rights-of-way, zoning, easements and other encumbrances)
- Emergency vehicle location and routing through real-time GPS tracking

Subsequent attempts to accommodate unanticipated data and/or application needs, which are dependent upon or associated with the quality and accuracy of the original base map, can be extraordinarily time-consuming and cost-prohibitive. As such, issues related to base map dataset accuracy, precision, currency and resolution must be thoughtfully planned and implemented.

The focus of the remaining portions of this chapter will be the analysis of all the data sets in regards to update responsibilities. This chapter will also take a closer look at GIS data that should be represented as "authoritative source data" within the City. Specifically, tax parcels, street centerlines, and address points will be reviewed and recommendations made for improving this data to the point that it is recognized as authoritative reliable data. Lastly, specific layers that are critical to Disaster Planning will be assessed.

3.0 Data Layer Maintenance & Organization

Included below is a Master Data List (MDL). The MDL is a compilation of data gathered during the Needs Analysis questionnaire documentation, on-site interview phase, and document review process. This MDL represents GIS data layers that are, or should be, available to City departments via the City-wide enterprise GIS.

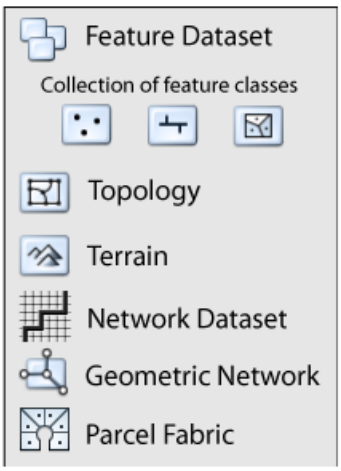
Various departments have the potential for being responsible for maintaining one or several GIS layers for the entire enterprise GIS. Careful consideration should be given to current shared roles and responsibilities of maintaining current data layers. Coordination of future GIS data custodial duties should be managed through GIS staff. The MDL has been further expanded to identify who should maintain the data sets and the recommended frequency of these database updates. Also, there is a recommended

data grouping category in the table. This column suggests a logical grouping of data into major categories to simplify data storage and retrieval.

Database Design

Proper design of the enterprise GIS database is critical to effectively support organization data needs, applications, data maintenance and updates, and data security. The City currently maintains GIS data in the SDE environment and has migrated much of its GIS data into the Local Government Information Model (LGIM).

The LGIM has established logical groupings (feature datasets) for typical local government data layers. A feature dataset is a collection of related feature classes that share a common coordinate system. Feature datasets are used to spatially or thematically integrate related feature classes. Their primary purpose is for organizing related feature classes into a common dataset for building the following:



- Topology
- A network dataset
- A terrain dataset
- A geometric network
- A parcel fabric

Additionally, feature datasets can be used to:

- Organize thematically related feature classes
- Organize data access based on database privileges
- Organize features classes for data sharing

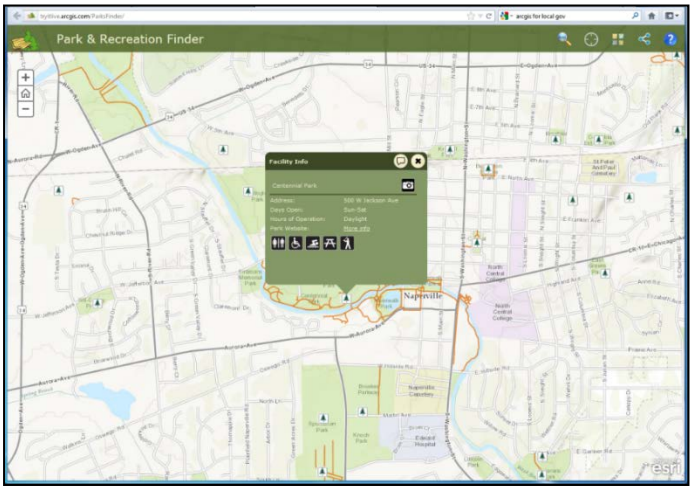
The feature datasets recommended for use in the MDL are those provided by an ESRI database design named the LGIM. The LGIM contains a variety of logically defined feature datasets and feature classes that are common to most local government's spatial data needs. A data layer has the potential of being logically assigned to more than one feature dataset; for example, TIGER roadways from the Census Bureau could be potentially assigned to either the 'Facilities Streets' dataset or to the 'Demography' dataset. However, GIS layers that are migrated into the LGIM should be matched as closely as possible to the representative feature class in the LGIM design (LGIM metadata is useful in making this determination).

This is especially important when using the LGIM in conjunction with ArcGIS for Local Government. Berkeley has already migrated much of its data to the LGIM and should continue to populate the LGIM with any remaining GIS data to the extent possible.

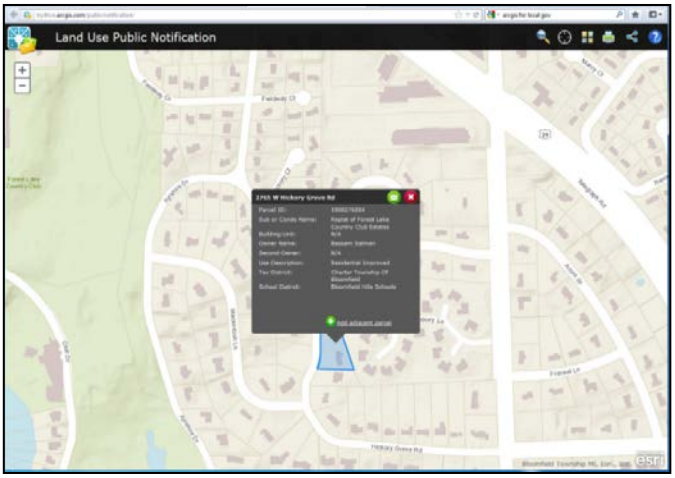
The LGIM connects silos of information in an organization and integrates processes across typical government departments. It helps provide for more effective operations, better communication, saves time and money, and engages community in more meaningful ways. In addition, it also supports data sharing between local governments and regional, state, and federal agencies. Following are the feature datasets defined by the LGIM:

- Address
- Administrative Area
- Assessment Information
- Cadastral Reference
- Election Results
- Elevation
- Emergency Operations
- Executive Reporting
- Facilities Streets
- Field Crew
- Fire Service Operations
- Infrastructure Operations
- Land Use Operations
- Land Use Planning
- Capital Planning
- Community Service
- Demography
- Election Administration
- Law Enforcement Operations
- Parcel Editing
- Parcel Publishing
- Public Safety Planning
- Reference Data
- Sewer Stormwater
- Stormwater
- Telemetry
- Water Distribution

ArcGIS for Local Government



ArcGIS for Local Government (AG4LG) is the name of an initiative and resource that allows organizations to rapidly deploy and exploit GIS technologies in support of their daily government activities. AG4LG contains a set of predefined GIS schema (the LGIM), data dictionaries, base maps and applications (desktop, mobile and web), all built on a common data model and designed to work together, among and between departments and agencies, and across an assortment of platforms. In addition to the deployment efficiencies, the ArcGIS for Local Government maps, applications and information model are available at no cost to ArcGIS users.



The key to AG4LG's efficiency is its central information model. The LGIM supports a series of foundation layers and enterprise information tables which support streamlining government operations, encouraging efficient communications and collaboration. The centralized and standardized data model design fosters rapid deployment, business process integration, and data sharing. It is recommended that Berkeley implement the ArcGIS for Local Government Information Model and begin to utilize AG4LG applications. This will require a thorough database design process that examines each of the existing layers to determine the best path for them to be ported to the LGIM. **Additionally, the implementation of the LGIM and AG4LG helps the City in regards to sustainability. If there is staff turnover, new staff will be able to quickly understand the data model and data thus preserving the GIS investment.**

Master Data List

The following is the MDL table. Each layer listed was derived from information shared by the City. The legend below describes each of the columns in the MDL table. The MDL takes the list of existing and

desired data layers and recommends their logical location within the LGIM. Additionally, it addresses who should be the data custodian/data maintainer.

Legend

The following describes the suggested grouping of the data layers identified in the needs assessment and summarized in the MDL table:

Data Layer	This column identifies the data layer by name. The data layer is the GIS thematic data that is being described. The name of the layer or description of the layer is placed in this column.
Creation Methodology	This column describes how the layer was, or is, anticipated being created.
Recommended Update Division or Individual	This field outlines the division or individual that is anticipated to maintain or develop the data layer during and after full implementation of the City-wide enterprise GIS. Development of new recommended layers will be prioritized for each year of the Strategic Implementation Plan.
Layer Status	Layer state of existence defined as follows:
Existing	These layers currently exist within the City's GIS.
Recommended	These layers are recommended for development or procurement, based on departmental and enterprise needs. These data layers will help support existing business procedures or will compliment other GIS data sets that are already existing and in use by the City. Costs associated for these recommended layers will be based on general estimates – actual cost may vary.
Partial	These layers currently exist in an incomplete or outdated state

Recommended Grouping	This field outlines logical grouping of layers "features" into different feature datasets within the Enterprise Database. These groupings are based on the data structure defined by ESRI's **Local Government Information Model** (LGIM). A system like this should be used for the Published Enterprise Database.
Address	This dataset contains point address features such as the site address and other feature classes required for the administration of address information.
Administrative Area	This dataset contains municipal, school and other related administrative or jurisdictional boundaries.
Assessment Information	This dataset contains a series of assessment operational layers derived from the integration of GIS and CAMA/Tax systems including tax districts.
Cadastral Reference	This dataset contains a series of features used to describe the cadastral reference system (PLSS, Control, etc.).
Capital Planning	This dataset contains a series of features derived during the capital planning process. Model results are stored within this feature dataset and used as inputs to the capital planning process.
Community Service	This dataset contains a series of features (service requests, parcel markups, etc.) collected by community through focused community engagement applications.
Demography	This dataset contains a collection of features used to report information about human geography including census blocks and tracts.
Election Administration	This dataset contains a collection of features used to administer elections and publish elected representatives including polling places and voting precincts.
Election Results	This dataset contains a collection of features created from precinct geography and the results of specific election contests. These layers will be updated at regular intervals on election night and used to publish results in focused web applications.
Elevation	This dataset contains a collection of features that describe the physical terrain including spot elevations and elevation contours.
Emergency Operations	Support data including evacuation areas, damage assessments, access points, etc.
Executive Reporting	Collection of features used in management reporting by executives and management staff.
Facilities Streets	Various facilities associated with streets including streets, buildings, curbs, ramps, guard rails, poles, trees, etc.
Field Crew	This dataset contains a series of features used to manage field crews with ArcGIS Mobile.

Fire Service Operations	Collection of features used by fire service professionals to preserve life, property, and promote public safety.
Infrastructure Operations	This dataset contains a collection of features used to capture public infrastructure operations information.
Land Use Operations	Data includes code violations, permits, work orders, and code violation cases.
Land Use Planning	This dataset contains a collection of features used to inventory land use patterns including flood zones, current and proposed land uses, and zoning.
Law Enforcement Operations	This dataset contains a collection of features used by law enforcement professionals to protect life, property, and promote public safety.
Parcel Editing	This dataset contains a series of features used to manage land records information. Subs, condos, lots, tax parcels, and encumbrances are managed in a parcel fabric.
Parcel Publishing	Published parcel data including tax parcels, encumbrances, and blocks.
Raster Data	External to the LGIM and stored in a separate geodatabase. Raster imagery such as aerial photography, satellite imagery and LiDAR, and GIS grids and surfaces.
Public Safety Planning	Data including emergency facility locations, special events, and historic damage assessments.
Reference Data	This dataset contains a collection of features that provide geographic context in a community including building footprints, street centerlines, soils, vegetation, and water bodies.
Sewer Stormwater	This dataset contains a collection of features that represent the separated and combined sewer features in a community including gravity mains, manholes, lateral lines, clean outs, etc.
Stormwater	This dataset contains a collection of features that represent the stormwater network in a community including gravity mains, inlets, culverts, manholes, etc.
Telemetry	This dataset contains vehicles, stationary devices, and other assets that allow remote measurement and reporting of information from the field.
Water Distribution	This dataset contains a collection of features that represent the water distribution network in a community including pressurized mains, valves, hydrants, etc.
Custom FD	Custom Feature Dataset that is not included with the standard LGIM data model. Necessary to support data not normally found in the LGIM.
MultiSpeak Data Model	ESRI developed data model that supports electric utilities and conforms to the industry-standard MultiSpeak specification.

*	An asterisk denotes an existing Custom Feature Dataset
Recommended Update Frequency	This Column provides a recommended minimum of how often these data layers should be updated. In order to have an accurate and up to date GIS, layers must be updated on a set schedule. This is provided as a guideline on updating the listed data layers.
Daily	These layers should be updated on a Daily basis; mostly these are automated layers from other databases or applications.
Weekly	These layers are recommended to be updated or checked for updates on a Weekly basis.
Monthly	These layers are recommended to be updated or checked for updates on a Monthly basis.
Quarterly	These layers are recommended to be updated or checked for updates on a Quarterly basis.
Yearly	These layers are recommended to be updated or checked for updates on a Yearly basis. All layers that are not updated within a year should be checked for updated or updated at least once a year.
As Needed	These layers are updated based on an "As Needed" basis. Many of these layers maybe updated daily or weekly. Many of these layers are high use layers.
Automated	This layer will be mined out of an existing database.

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
Citywide Base Data					
Property	Original tax parcels were digitized and rubber sheeted from scanned hard copy water quality maps circa 1999. Updated manually once a year by the GIS Team using Alameda County data for attributes and the County's Adobe PDF parcel maps for geometry changes. Migrate d to the LGIM Tax Parcel schema in 2016.	The GIS Team	Existing	**Parcel Editing**	**Daily**
Aerial Photography	Current aerial data is delivered by Pictometry through an agreement with Alameda County. The most current data was captured in 2014 with the next flyover scheduled for Spring 2017. The County's current contract with Pictometry calls for one more flyover after the 2017 capture. Older imagery exists for 2006 (custom County flyover), 2009, and 2011 (USGS).	Static Map	Existing	**Raster**	**Yearly**

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
Road Centerlines	Created by RMSI in 2010 from various sources including Alameda County data and pavement management system data (street width). Updated manually by the GIS Team occasionally. Migrated to the LGIM Road Centerline schema in 2016. Zero Waste has a copy that has been updated for routing purposes.	The GIS Team	Existing	**Reference Data**	**Weekly**
Address Points	During the work day, an Analyst in the Finance Department updates/creates new addresses in the Land Management (LX) module in SunGard (FUND$). Address points are then created nightly from an ETL that extracts and geocodes (using parcel centroid coordinates) and joining to a parcel table to create the address points feature class.	Automated / Finance Department	Existing	**Address**	**Daily**

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
Departmental Layers					
311 Calls	Extract, cleanse and geocode from database	Automated	Desired	Law Enforcement Operations	Automated
600' School Buffers (Tobacco Free Zones)	Digitized on screen	GIS Team	Recommended	Law Enforcement Operations	Yearly
AC_Transit	Digitized on screen	GIS Team	Existing	Transportation*	As Needed
Accela Data	Extract, cleanse and geocode from Accela database	Automated	Desired	Various	Automated
Accessible Dwelling Units and Below Rate Unties	Extract, cleanse and geocode from database	Automated	Recommended	Land Use Planning	Automated
Air Quality Issues	Data integration; digitize on screen	IT and HHCS	Recommended	Reference Data	As Needed
AirBNB Locations	Geocode	GIS Team	Recommended/ Desired	Land Use Planning	Monthly
Alcohol Licenses	Extract, cleanse and geocode from database	State of California	Recommended	Land Use Planning	Automated
Ambulance Calls	Data integration	Fire	Existing	Fire Service Operations	Automated
Animal Bite Locations	Extract from Chameleon Database	Automated	Recommended	Public Safety Planning	Automated
Animal DOA Pickup Locations	Extract from Chameleon Database	Automated	Recommended	Public Safety Planning	Automated
AquaticParkBathymetry	Obtain from Contractor	Parks & Rec & Waterfront	Existing	Parks*	Yearly
Aquatics	GPS / Extract from Aerials	Parks & Rec & Waterfront	Existing	Parks*	As Needed
Archeological Shell Mounds	Digitized on screen	Planning and GIS Team	Recommended	Reference Data	As Needed
Areas	Digitized on screen	GIS Team	Existing	UCBerkeley*	As Needed
Arrests and Citations	Extract, cleanse and automatically map from RMS.	Automated	Partial	Law Enforcement Operations	Automated

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
Arsons Locations	Extract from Fire and PD RMS Data	Automated extraction from RMS	Recommended	Law Enforcement Operations	Automated
Art Districts	Digitize On Screen	GIS Team	Recommended	Land Use Planning	Yearly
As-Built Data from Contractors	Obtain from Public Works	Public Works	Existing	Various	Weekly
Automated Vehicle Location Data	Geocode	Automated	Recommended/ Desired	Various	Automated
B-3 Balconies	Geocode	GIS Team	Recommended/ Desired	Land Use Planning	Monthly
Bait Trap Locations (in sewer manholes)	Digitize on screen; field data collection	IT and HHCS	Recommended	Reference Data	As Needed
BART	Various	Obtained from BART	Existing	Transportation*	Monthly
BayTrail_Paths	GPS / Extract from Aerials	Public Works	Existing	Parks*	Yearly
BFDQuadrants	Digitize on screen	Public Works	Existing	Fire Services Operations	Yearly
BID_Downtown	Digitize on screen	Public Works	Existing	EconomicDev*	As Needed
BID_NorthShattuck	Digitize on screen	Public Works	Existing	EconomicDev*	As Needed
BID_Telegraph	Digitize on screen	Public Works	Existing	EconomicDev*	As Needed
BikeCorral	Digitize on screen	Public Works	Existing	Transportation*	Yearly
BikeLocker	GPS	Public Works	Existing	Transportation*	Yearly
BikeRacks	GPS	Public Works	Existing	Transportation*	Yearly
BikeStation	GPS	Public Works	Existing	Transportation*	Yearly
Blight Locations	GPS / Geocode	GIS Team	Recommended	Land Use Planning	Monthly
Blocks	Extract from Parcels	GIS Team	Existing	Parcel Editing	Yearly
Building Licenses	Accela Integration	Automated	Recommended	Land Use Planning	Automated
Building Outlines	Purchase from County or Pictometry	GIS Team	Recommended	Reference Data	Yearly

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
BuildingInspectionAreas	Digitize on screen	Planning	Existing	Land Use Planning	Yearly
Buildings	Digitize on screen	GIS Team	Existing	UCBerkeley*	Yearly
Bulk Waste Pickup Locations	Geocode	Public Works	Recommended	ZeroWaste*	As Needed
Business Improvement Districts	Digitized from source documents	GIS Team	Recommended	Land Use Planning	Yearly
Business Licenses	Accela Integration	Automated	Recommended	Land Use Planning	Automated
CalFireFireHazSeverityZone	Obtain from State	GIS Team	Existing	Fire Services Operations	As Needed
Calls for Service	Extract, cleanse and automatically map from dispatch databases.	Automated	Recommended	Emergency Operations	Automated
CALREDY	Data integration	IT and HHCS / Automated	Recommended	Reference Data	Automated
Cannabis Dispensaries	Geocode	Automated	Existing	Reference Data	Automated
Capital Improvement Projects	Digitize from Plan Documents	GIS Team	Recommended/ Desired	Reference Data	As Needed
CCTV Data	Tied by unique number to a GIS layer and viewable within applications	Police in conjunction with GIS Staff	Recommended	Law Enforcement Operations	Automated
CDBG Grant Locations	Extract, cleanse, and geocode from database and/or utilize HUD data	HHCS	Recommended	Land Use Planning	As Needed
Cell Towers	Geocode	GIS Team	Recommended/ Desired	Reference Data	Yearly

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
CensusBlock	Download from Census Bureau	Planning and GIS Team	Existing	Demography	Yearly
CensusBlockGroup	Download from Census Bureau	Planning and GIS Team	Existing	Demography	Yearly
CensusTract	Download from Census Bureau	Planning and GIS Team	Existing	Demography	Yearly
CharterCouncilDistricts1986	Digitize on Screen	GIS Team	Existing	Election Administration	Yearly
Child Welfare Data	Acquire from county data, state data, and national data	GIS Team and HHCS	Recommended	Reference Data	As Needed
ChipperAreas	GPS	Parks & Rec & Waterfront	Existing	Parks*	As Needed
Citations	Geocode	Automated	Recommended/ Desired	Law Enforcement Operations	Automated
City Property	Extract from parcels and legal descriptions	GIS Team	Existing	Reference Data	Monthly
City Voting Precincts	Extract from parcels	GIS Team	Existing	Election Administration	Yearly
Clean City	Digitize on screen	Public Works	Recommended	Reference Data	As Needed
Code Enforcement Data	Extract from Accela	Automated	Existing	Land Use Operations	Automated
Commercial Store Fronts	Extract from Accela	Automated	Recommended	Reference Data	Automated
CommercialDistricts	Digitize on screen	GIS Team	Existing	EconomicDev*	Yearly
Community Agencies	Digitize on screen	GIS Team and HHCS	Recommended	Reference Data	Yearly
Community Emergency Response Team (CERT) Members	Geocode	Fire in conjunction with GIS Team	Recommended	Fire Service Operations	As Needed
Community Events	Digitize on screen	GIS Team	Recommended	Reference Data	As Needed
CommunityCenter	Digitize on screen	Planning	Existing	Reference Data	Yearly

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
Condos	Digitize on screen	GIS Team	Existing	Parcel Editing	Monthly
ConduitFiber	Extract from as-builts	Public Works	Existing	PubWorks*	As Needed
Congress	Obtain from State	GIS Team	Existing	Election Administration	Yearly
Construction Parking Permits	Geocode from database	Automated	Recommended	Reference Data	Automated
Contract Locations	Geocode	GIS Team	Recommended	Capital Planning	Weekly
Council Districts	Extract from parcels	GIS Team	Existing	Election Administration	Yearly
County Boundary	Obtain from Alameda County	GIS Team	Existing	Administrative Area	Yearly
County Commission	Obtain from Alameda County	GIS Team	Existing	Election Administration	Yearly
County Precincts	Obtain from Alameda County	GIS Team	Existing	Election Administration	Yearly
Coyote Siting/Incident Locations	Extract from Chameleon Database	Automated	Recommended	Reference Data	Automated
Creeks	Digitize from Aerials	GIS Team	Existing	Reference Data	Yearly
Crime Data	Extract, cleanse, and automatically map from Police database	Automated from Police Department	Recommended	Law Enforcement Operations	Automated
Crosswalk	Digitize from plan documents	GIS Team	Existing	Facilities Streets	As Needed
Curb Markings	GPS	Public Works	Recommended	Facilities Streets	As Needed
CurbRamp	GPS	Public Works	Existing	Facilities Streets	As Needed
Curbs	Digitize from plan documents	Public Works	Existing	Facilities Streets	As Needed
Day Care Facilities	Generate from Parcel Layer	Central GIS Group	Recommended	Reference Data	Yearly
Development Agreements	Digitized	Planning Department	Partial	Land Use Planning	Monthly
Development Projects	Digitize from Plan Documents	GIS Team	Recommended/ Desired	Land Use Planning	Monthly

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
Dialysis Centers	Digitize on screen	State Open Data Center; HHCS Intern Update	Recommended	Reference Data	Yearly
Dimensions	Digitize on screen	Planning	Existing	Land Use Planning	As Needed
DowntownAreaPlan	Digitize on screen	Planning	Existing	Land Use Planning	As Needed
Drug free zones around schools and churches	Buffer appropriate properties.	Police in conjunction with GIS Team.	Recommended	Law Enforcement Operations	Yearly
Easements	Digitize from base map data; aggregate layers as needed	Public Works / GIS Team	Partial	Parcel Publishing	Weekly
EducationFacility	Digitize from aerials	GIS Team	Existing	Reference Data	Yearly
EighteenInchContour	Obtain from Contractor	GIS Team	Existing	Elevation	Yearly
Election Boundaries and Polling Places	Digitized on Screen	GIS Team	Existing	Election Administration	Yearly
Election Streets	Extract from Road Centerlines. Identify sign posting locations and streets where signs are not allowed.	GIS Team	Recommended/ Desired	Election Administration	Yearly
Electrical	Digitize from source documents	GIS Team	Recommended	MultiSpeak	Monthly
Emergency Cache Locations	Address Match / GPS	Fire in conjunction with GIS Team	Recommended	Emergency Operations	Yearly
Emergency Shelters	Digitize on screen	Fire in conjunction with GIS Team	Recommended	Emergency Operations	Yearly
EmergencyAccessEvacuation	Digitize on screen	GIS Team	Existing	Emergency Operations	Yearly
Employment Data	Extract from Accela	Automated	Recommended	Reference Data	Automated

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
EMS Incidents	Extract from RedAlert Fire Data	Automated extraction from RMS	Recommended	Emergency Operations	Automated
Environmental Buffers	Derived using existing layers	Planning in Coordination with GIS Team	Recommended	Land Use Planning	As Needed
EnvironmentalMgmt Area	Derived using existing layers	Planning in Coordination with GIS Team	Existing	Land Use Planning	As Needed
Evacuation Routes	Extract from Street Centerline Layer	Fire in conjunction with GIS Team	Recommended	Emergency Operations	Yearly
FacilitySite	Extract from Parcels	GIS Team	Existing	Reference Data	As Needed
FacilitySitePoint	Geocode / GPS	GIS Team	Existing	Reference Data	As Needed
FEMAFloodZone	Obtain from FEMA	GIS Team	Existing	Land Use Planning	Yearly
Fire Hazard Zones	Digitized on Screen	Fire and Planning in Coordination with GIS Team in IT	Recommended	Fire Service Operations	Yearly
Fire Hydrant Buffers	Create from Fire Hydrant Layer	Fire in conjunction with GIS Team	Recommended	Fire Service Operations	As Needed
Fire Hydrants	GPS field collection	GIS Team from local Water Company	Existing	Water Distribution	Monthly
Fire Incidents	Extract from RedAlert Fire Data	Automated extraction from RMS	Recommended	Fire Service Operations	Automated
Fire Inspections	Extract from RedAlert	Automated extraction from RMS	Recommended	Fire Service Operations	Automated
Fire Station Locations	Geocoded and ortho-rectified	Fire in conjunction with GIS Team	Existing	Reference Data	Yearly
Fire Zones and Quadrants	Digitized on Screen	Fire in conjunction with GIS Team	Existing	Fire Service Operations	Yearly
FireBoundary	Digitized on Screen	Fire in conjunction with GIS Team	Existing	Fire Service Operations	Yearly

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
First-time Home Buyers	Extract, cleanse and geocode from database	HHCS	Recommended	Reference Data	Monthly
Foreclosures	Acquire data from other databases	HHCS	Recommended	Reference Data	Monthly
ForestryMgmtAreas	Extract from parcels	Parks & Rec & Waterfront	Existing	Parks*	Yearly
Gated Communities	Address Matched	Automated from Existing Database	Recommended	Emergency Operations	Automated
General Plan Land Use	Digitized	Planning	Existing	Land Use Planning	Monthly
GreenArea	Digitized	GIS Team	Existing	UCBerkeley*	As Needed
Hazardous Materials	Fire Department MSDS Sheets Scanned and Linked to Site	Health Department and GIS Staff	Recommended	Fire Service Operations	As Needed
Hazardous Materials Locations	Geocode and link to existing database	Planning Toxics Division Permits need to be Address Matched	Partial	Reference Data	Weekly
Health Inspection Districts	Digitized on screen (determine based on inspection geocoding and volume)	GIS Team and HHCS	Recommended	Administrative Area	Yearly
HillsideOverlay	Digitize on screen	GIS Team	Existing	Land Use Planning	As Needed
Historical Aerial Photography	Aerial Flyovers	GIS Team	Existing	Raster	As Needed
HistoricResources	Extract from source documents	Planning	Existing	Land Use Planning	As Needed
Hoarding Locations	Geocode	GIS Team	Recommended	Reference Data	As Needed
Home Occupancy	Extracted from database	Automated	Recommended	Reference Data	Automated
Homeless and Mentally Ill Individuals and Encampments	Tracked in a database then geo-enabled	Automated	Recommended	Reference Data	Automated
HouseWorship	Geocode	GIS Team	Existing	Reference Data	Yearly

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
Housing Facilities	Digitize on screen	State Open Data Center; HHCS Intern Update	Recommended	Reference Data	Monthly
Hydrology (Natural Water Features)	Acquire from USGS	GIS Team	Existing	Reference Data	Yearly
Illegal Dumping	GPS	Public Works	Recommended	Reference Data	As Needed
Industrial Waste Biohazard	Data integration	Planning	Existing	Emergency Operations	Automated
Inspections (tobacco, kitchens, pools, tattoo and nail salons)	Data integration	GIS Team and HHCS	Recommended	Land Use Operations	Automated
JetFuel	Digitize on screen	Public Works	Existing	PubWorks*	As Needed
Judicial Boundaries	Extract from parcels	GIS Team	Existing	Election Administration	Yearly
Knox Boxes	Address Matched	Automated from Existing Database	Recommended	Public Safety Planning	Automated
Land Management	SunGard Integration	Automated	Recommended	Land Use Planning	Automated
Land Uses	Extract from parcels	Planning	Existing	Land Use Planning	Monthly
LandBase	Extract from parcels	Planning	Existing	Reference Data	Monthly
Landmarks	Extract, cleanse and geocode from database	Planning	Existing	Reference Data	Monthly
Landscaping	GPS	Public Works	Recommended	Reference Data	Monthly
LawBoundary	Extract from parcels	Police	Existing	Law Enforcement Operations	Yearly
Library	Geocode	GIS Team	Existing	Reference Data	Yearly
Licensing	Automated from Accela and/or FUNDS	GIS Team	Recommended	Land Use Planning	Automated
Liquefaction Data	Various	Planning in Coordination with GIS Team	Recommended	Land Use Planning	Monthly
Liquor Licenses	Geocode	Planning	Existing	Land Use Planning	Monthly
LitterCans	GPS / Geocode	Public Works	Existing	ZeroWaste*	Monthly

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
LocalDistrict	Extract from parcels	GIS Team	Existing	Election Administration	Yearly
MajorStreets	Extract from Street Centerline Layer	GIS Team	Existing	Reference Data	Yearly
Make Safes	GPS / Geocode	Public Works	Recommended	Reference Data	Weekly
Marina Facilities & Assets	GPS / Digitize from Aerials	Parks & Rec & Waterfront	Recommended	Custom	As Needed
Meals on Wheels and Routes	Data integration; digitize on screen	GIS Team and HHCS	Recommended	Reference Data	Weekly
MedicalFacility	Geocode	GIS Team	Existing	Reference Data	Yearly
Mini Dorms	Geocode	GIS Team	Recommended/ Desired	Land Use Planning	Monthly
Mosquito Control	Data integration	GIS Team and HHCS	Recommended	Reference Data	Automated
Mowing Areas	Digitize from Aerials	Parks & Rec & Waterfront	Recommended	Parks*	Monthly
MunicipalBoundary	Extract from parcels	GIS Team	Existing	Administrative Area	As Needed
Neighborhood Associations	Digitized from various sources	Planning, CMO and GIS Team	Existing	Law Enforcement Operations	Monthly
Neighborhood Watch Districts	Digitized On Screen	Police Department and GIS Staff	Recommended	Law Enforcement Operations	Monthly
Neighborhoods	Extract from parcels	Planning	Existing	Land Use Planning	Monthly
NodesWestBerk	Digitize on screen	Planning	Existing	Land Use Planning	As Needed
Noise Ordinance Violations	Data integration	GIS Team and HHCS	Recommended	Land Use Operations	As Needed
Offenders on Parole	Extract, cleanse and automatically map from State and/or County Data.	Automated	Recommended	Law Enforcement Operations	Automated
Offenders on Probation	Extract, cleanse and automatically map from City, County, and/or State Data.	Automated	Recommended	Law Enforcement Operations	Automated
OneWayStreets	Attribute street centerlines	GIS Team	Existing	Transportation*	As Needed

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
ParaTransit Usage	Data integration; digitize on screen	GIS Team and HHCS	Recommended	Reference Data	As Needed
ParcelLines	Extract from parcels	GIS Team	Existing	Parcel Editing	As Needed
ParcelPopperMain	Extract from parcels	GIS Team	Existing	Parcel Editing	As Needed
Parcels 2011-2015	Obtain from Alameda County	GIS Team	Existing	Parcel Archive*	As Needed
ParcelsWithinHalfMile	Create from parcels	GIS Team	Existing	Parcel Editing	As Needed
Park Facilities & Assets	GPS / Digitize from Aerials	PR&W	Recommended	Parks*	As Needed
Parking Meters	Extract from eTIMS	Automated	Recommended	Facilities Streets	Automated
Parking Permits & Citations	eTIMS Integration	Automated	Recommended	Law Enforcement Operations	Automated
Parking Violations	Extract, cleanse and automatically map from RMS.	Automated	Partial	Law Enforcement Operations	Automated
ParkingPayStation	GPS	Public Works	Existing	Facilities Streets	Monthly
Parks	Extract, cleanse and geocode from database	Parks	Existing	Parks*	Yearly
ParksBUSD	Obtain from BUSD	Parks & Rec & Waterfront	Existing	Parks*	Yearly
ParksCOB	Extract from parcels	Parks & Rec & Waterfront	Existing	Parks*	Yearly
ParksRegional	Obtain from regional government	Parks & Rec & Waterfront	Existing	Parks*	Yearly
Pavement	Extract from StreetSaver	Automated	Recommended	Facilities Streets	Automated
Pavement Markings	GPS	Public Works	Recommended	Facilities Streets	Monthly
PavementMoratorium	Digitize on screen	Public Works	Existing	Infrastructure Operations	As Needed
Paving Schedule	Extract from pavement management database	Public Works	Recommended	PubWorks*	Yearly

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
Paving5yr	Extract from pavement management database	Public Works	Existing	PubWorks*	Yearly
PGEgasPipelines	Obtain from PGE	GIS Team	Existing	Fire Service Operations	Yearly
Pharmacies	Digitize on screen	State Open Data Center; HHCS Intern Update	Recommended	Public Safety Planning	Monthly
Planting Sites	Digitize from Aerials	PR&W	Existing	Reference Data	Monthly
Points of Delivery (PODS) Locations	Digitize on screen	IT and HHCS	Recommended	Reference Data	Weekly
Police Data (Child abuse, bike accidents, domestic abuse, pedestrian accidents, traffic safety)	Data integration	Police	Existing	Law Enforcement Operations	As Needed
Police Review Commission Community Complaint Locations	Geocode	GIS Team	Recommended	Law Enforcement Operations	As Needed
Policing Beats and Response Zones	Originated from Police drawing on paper maps, then digitized into GIS.	Police in conjunction with GIS Team.	Existing	Law Enforcement Operations	Yearly
Political Boundaries	Acquire from county, regional, and state data	GIS Team	Recommended	Administrative Area	Yearly
Potholes	GPS	Public Works / 311	Recommended	Facilities Streets	Weekly
PreventionDistrict	Extract from parcels	GIS Team	Existing	Fire Service Operations	Yearly
Public Health NCT Incident Logs	Data integration; digitize on screen	GIS Team and HHCS	Recommended	Public Safety Planning	Weekly
Public Nuisance Cases	Geocode	Automated	Recommended/ Desired	Law Enforcement Operations	Automated
PublicWork	Geocode	GIS Team	Existing	Reference Data	As Needed
Rabies Locations	Extract from Chameleon Database	Automated	Recommended	Public Safety Planning	Automated

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
Railroad	Digitize from aerials	GIS Team	Existing	Reference Data	Yearly
RailroadStation	Digitize from aerials	GIS Team	Existing	Reference Data	Yearly
Rabid Bat Bites	Data integration; digitize on screen	GIS Team and HHCS	Recommended	Public Safety Planning	As Needed
Redistricting	Extract from parcels / census data	GIS Team	Existing	Election Administration	Yearly
Rent Data and Eviction Data	Extract, cleanse and geocode from database	Automated	Desired	Land Use Planning	Automated
Rental Properties after 1980	Extract from databases	Planning	Desired	Land Use Planning	Monthly
Residential Units	Use Code data and field survey	Planning	Desired	Land Use Planning	Monthly
ResidentialParkingPermit	Geocode from database	GIS Team	Existing	Transportation*	Weekly
Restaurants	Create from Inspection Records	Fire in conjunction with GIS Team	Recommended	Reference Data	Monthly
Right_of_Way	Site plans and other documents	Public Works	Existing	Parcel Publishing	Weekly
Road Construction and Closure Alerts	Geocode	Automated	Recommended	Infrastructure Operations	Automated
RoadCenterline	Planimetrics from contractor	GIS Team	Existing	UCBerkeley*	Yearly
Roofprints	Obtain from Contractor	GIS Team	Existing	Reference Data	Yearly
RoutePlantDebris	Create from street centerlines	Public Works	Existing	ZeroWaste*	As Needed
RouteRecycle	Create from street centerlines	Public Works	Existing	ZeroWaste*	As Needed
RouteRefuse	Create from street centerlines	Public Works	Existing	ZeroWaste*	As Needed
RRCrossing	Digitize from aerials	GIS Team	Existing	Facilities Streets	Yearly
School Zones	Extract from parcels	GIS Team	Existing	Administrative Area	Yearly
Schools	Digitize/Geocode	GIS Team	Existing	Reference Data	Yearly
SeismicHazEarthquake	Digitize from source documents	Planning	Existing	Land Use Planning	As Needed
SeismicHazLandslide	Digitize from source documents	Planning	Existing	Land Use Planning	As Needed

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
SeismicHazLiquefaction	Digitize from source documents	Planning	Existing	Land Use Planning	As Needed
Senior Center Bus Routes	Data integration; digitize on screen	IT and HHCS	Recommended	Reference Data	Monthly
Service Locations	Digitize on screen	IT and HHCS	Partial	Reference Data	Weekly
Setbacks and Variances	Tied to property data in Accela	Automated	Recommended	Land Use Planning	Automated
Sewer Utilities	Digitize from as-builts / GPS	Public Works	Existing	Sewer Stormwater	Weekly
Sewer Videos	Link to GIS	Public Works	Existing	Sewer Stormwater	Automated
Sex Offenders	From State	Automated	Recommended	Law Enforcement Operations	Automated
Short Term Dwelling Units	Extracted from database	Automated	Recommended	Land Use Planning	Automated
Sidewalks	GPS and digitizing from aerials	Public Works	Existing	Facilities Streets	Weekly
Sidewalk Inspections	Extract from Database	Automated	Existing	Reference Data	Automated
Sidewalk Repairs	GPS	Public Works	Recommended	Facilities Streets	As Needed
Sidewalk Trip & Fall Locations	Extract from Database	Automated	Existing	Reference Data	Automated
SidewalkCenterline	Extract from sidewalks layer	Public Works	Existing	Facilities Streets	Monthly
Sign	GPS	Public Works	Existing	Facilities Streets	Monthly
Signal	GPS	Public Works	Existing	Facilities Streets	Monthly
Skilled Nursing	Digitize on screen	State Open Data Center; HHCS Intern Update	Recommended	Public Safety Planning	Monthly
Smoke Shops	Geocode	GIS Team	Recommended/ Desired	Reference Data	Monthly
Smoking Regulation Complaints	Data integration	Automated	Recommended	Reference Data	Automated
Smoking Regulation Locations	Data integration	Automated	Recommended	Reference Data	Automated
Social Media	Automatically linked via software	Automated	Recommended	Various	Automated

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
SolanoTunnel	Extract from source documents	Public Works	Existing	PubWorks*	As Needed
SolarInstallations	Digitized on Screen	Planning in Coordination with GIS Team	Existing	Land Use Planning	Monthly
Solid Waste Bin & Cart Locations	Geocode	Public Works	Recommended	Reference Data	As Needed
SouthSidePlan	Extract from source documents	Planning	Existing	Land Use Planning	As Needed
Special Needs Residents	Extract and map from CAD/RMS data.	Automated	Recommended	Public Safety Planning	Automated
Specific Plan Areas	Digitized	Planning Department	Recommended	Land Use Planning	Monthly
Speed Limit Zones	Extract from centerlines	GIS Team	Existing	Reference Data	Monthly
Speeding Violations	Geocode	Automated	Recommended/ Desired	Law Enforcement Operations	Automated
Sprinklers, Alarms, Solar Panels	Extracted from Pre-Plans	Fire in conjunction with GIS Team	Recommended	Public Safety Planning	Weekly
State House Districts	Obtain from State	GIS Team	Existing	Election Administration	Yearly
StatutoryCreeks	Extract from source documents	GIS Team	Existing	Reference Data	Yearly
StatutoryCreeksSetback	Generate from creeks layer	GIS Team	Existing	Reference Data	Yearly
StopsPlantDebris	Geocode	Public Works	Existing	ZeroWaste*	Weekly
StopsRecycle	Geocode	Public Works	Existing	ZeroWaste*	Weekly
StopsRefuse	Geocode	Public Works	Existing	ZeroWaste*	Weekly
Storm Water Runoff Buffers	Buffered from other data sets	Public Works and Planning in Coordination with GIS Team	Recommended	Reference Data	As Needed
Stormwater Utilities	Digitize from as-builts / GPS	Public Works	Existing	Stormwater	Weekly
Stray Animal Locations	Extract from Chameleon Database	Automated	Recommended	Public Safety Planning	Automated

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
StreetBikeLane	Digitize from aerials	Public Works	Existing	Facilities Streets	As Needed
StreetFurniture	GPS	Public Works	Existing	Facilities Streets	Monthly
StreetIntersection	Extract from Street Centerline Layer	GIS Team	Existing	Facilities Streets	As Needed
StreetLabels	Digitize on screen	GIS Team	Existing	Reference Data	As Needed
Streetlight	GPS	Public Works	Existing	Facilities Streets	As Needed
Streets Moratorium Data	Extract from pavement management database	Public Works	Recommended	Reference Data	As Needed
StreetSweepRoute	Digitize onscreen	Public Works	Existing	PubWorks*	Monthly
Student Move-Outs	GPS	Public Works	Recommended	Reference Data	As Needed
Stumps	GPS	Parks & Rec & Waterfront	Existing	Reference Data	As Needed
Surgical Centers	Digitize on screen	State Open Data Center; HHCS Intern Update	Recommended	Emergency Operations	Yearly
Survey Monuments	Import from AutoCAD	Public Works	Recommended	Cadastral Reference	Monthly
Sustainability Data – sea level rise, climate action plan, greenhouse gas data	Various	Planning in Coordination with GIS Team	Recommended	Reference Data	As Needed
Tax Payment Data	SunGard Integration	Automated	Recommended	Reference Data	Automated
TelecomWirelessAntenna	Geocode	Planning	Existing	Land Use Planning	Yearly
Toxics Data – BMC Title 15, contaminated sites, soil boring, and well locations	Various	Planning in Coordination with GIS Team	Recommended	Reference Data	Monthly
Traffic Accidents	Extract, cleanse, geocode, and map from database	Police	Partial	Law Enforcement Operations	Daily
Traffic Analysis Zones	Digitized	Public Works	Existing	Reference Data	As Needed

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
Traffic Data	Synchro Integration	Automated	Recommended	Reference Data	Automated
Trail	GPS / Digitize from Aerials	Public Works	Existing	Facilities Streets	Monthly
TrashRacks	Digitize on screen	Public Works	Existing	PubWorks*	Monthly
Tree Claim Cases	Geocode	Automated	Recommended/ Desired	Reference Data	Automated
Trees	GPS	Parks & Rec & Waterfront	Existing	Facilities Streets	Weekly
TwentyFootContour	Obtain from Contractor	GIS Team	Existing	Elevation	Yearly
Underground Storage Tanks	Geocode by Address	State of California	Recommended	Reference Data	Yearly
UndergroundUtilityDistricts	Digitized from source documents	Public Works	Existing	PubWorks*	Yearly
UniversityAveStrategicPlan	Digitized from source documents	Planning	Existing	Land Use Planning	As Needed
UnreinforcedMasonryBuildings	Digitized from source documents	Planning	Existing	Land Use Planning	Yearly
Urgent Care Centers	Digitize on screen	State Open Data Center; HHCS Intern Update	Recommended	Emergency Operations	Yearly
Users of Service (WIC, Black Infant Health, Immunization Clinics, HS Health Center, Public Health Nursing Care Management, Emergency Management Upcoming Events, Tobacco Retail – Patterns of Retail, Food Density, Alcohol Retailers)	Data integration; digitize on screen	IT and HHCS	Recommended	Land Use Planning	As Needed
Utilities – PG&E	Various	GIS Team	Partial – Have Gas Need Electric	Various	As Needed
Vacant Properties	Extract from Accela	Automated	Recommended	Land Use Planning	Automated

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?	Recommended Data Grouping (Feature Dataset)	Recommended Update Frequency
Various Taxes	SunGard Integration	Automated	Recommended	Reference Data	Automated
Voting	Extract from databases	Automated	Existing	Election Administration	Automated
Voting Location Sites by Availability	Geocode	GIS Team	Existing	Election Administration	Yearly
VotingPrecinct	Extract from parcels	GIS Team	Existing	Election Administration	Yearly
Vulnerable Population	Digitize on screen	IT and HHCS	Recommended	Reference Data	Monthly
Warrants	Extract, cleanse and automatically map from RMS.	Automated	Recommended	Law Enforcement Operations	Automated
Waterbody	Obtain from regional government	GIS Team	Existing	Reference Data	Yearly
Watersheds	Obtain from regional government	GIS Team	Existing	Reference Data	Yearly
Where does Funding Go	Digitize on screen; data integration	IT and HHCS	Recommended	Reference Data	As Needed
wHydrant	Digitize on screen; existing CAD data; GPS field work	Public Works	Existing	Water Distribution	Weekly
wMain	Digitize on screen; existing CAD data; GPS field work	Public Works	Existing	Water Distribution	Weekly
WoodFramedSoftStory	Digitize from source documents	Planning	Existing	Land Use Planning	Monthly
Zipcodes	Obtain from Fed	GIS Team	Existing	Reference Data	Yearly
ZoningDistrict	Digitized on screen	Planning	Existing	Land Use Planning	Monthly

4.0 Authoritative Data Source Assessment

The above MDL lists the multitude of GIS data layers that are existing or recommended for the City of Berkeley. Specific data layers are critical to the City and need to be complete and accurate so that end users have 100% confidence in the quality of the data allowing it to be considered "authoritative". A component to any successful government entity is the accuracy and accessibility of its authoritative data. The City of Berkeley needs a parcel and address database that is not only reliable with an easy-to-use interface, but can also be easily maintained to keep crucial land management data accurate and up to date. This section analyzes key parcel and address layers to determine completeness and accuracy. Recommendations on how best to improve each layer are included.

4.1 Quality Assurance and Gap Analysis

The following sections will review the parcel, street centerline+, and address point data to determine gaps in quality, completeness, and usability. Recommendations will be provided for improving the data to establish it as a reliable authoritative data source for the City of Berkeley. The final section will provide the Gap Analysis Results and Recommendations.

4.2 Tax Parcels

For municipal governments, the use, management, and integration of an accurate and up-to-date parcel base map is arguably the centerpiece of a GIS effort. Tax parcels represent a core component layer for modeling land use within Berkeley and provide a substantial basis for developing other base map layers.

Several immediate and long-lasting benefits normally derived from parcel base map layer integration include:

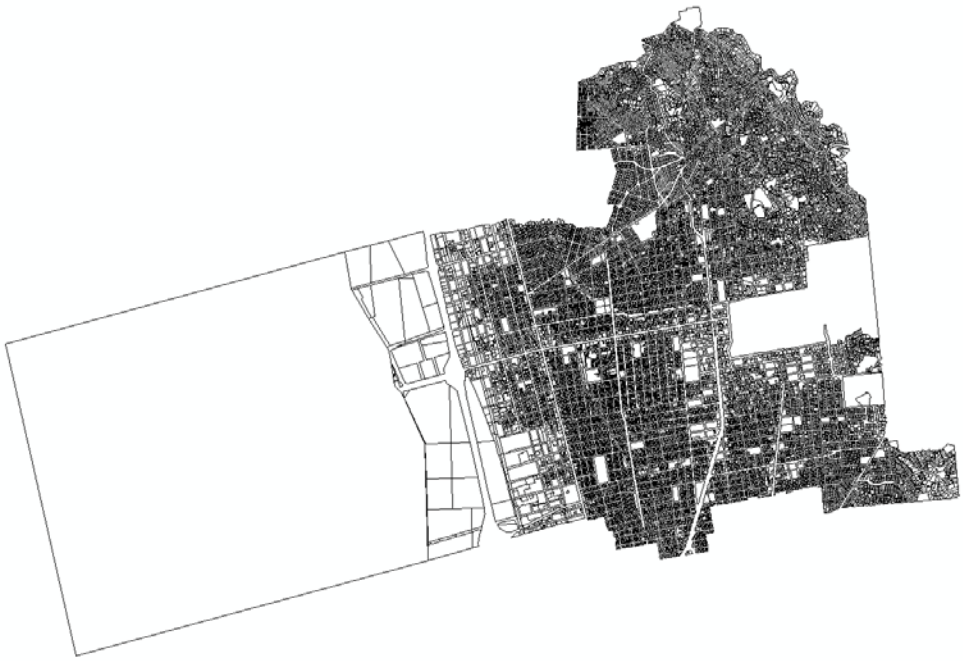
- A comprehensive inventory and accounting of all taxable land
- Comparisons of deeded and calculated (actual) acreage
- Inventory and determination of Government-owned lands and conveyances
- Verification of tax rolls and incorporation of annexations, providing checks-and balances of appraisal entity records
- Provides a strong foundation for control of future growth, zoning, business licensing, land development, and population forecasting
- Fosters closer cooperation with other local governmental entities

Some of the more tangible and practical benefits emerging from the parcel base map layer include:

- Mailing lists and affected property owner notifications
- Improved Public Safety response and emergency evacuation planning
- Readily available property ownership information
- Property valuations and City service expansion/prioritization
- Floodway management and building code enforcement
- Creation of map books and atlases

History and Current Status

Berkeley obtains an update to its parcels data once a year from Alameda County. The GIS Team is responsible for all parcel updates.



City of Berkeley Parcels Data

Parcel Geometry

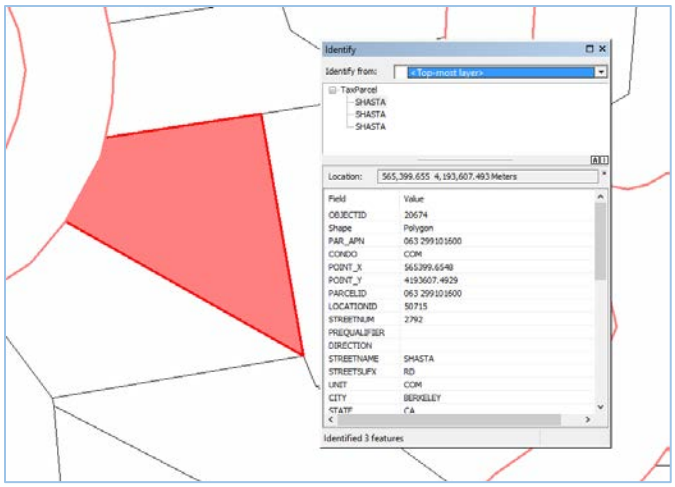
The parcel data provided by the City for review consists of 28,869 polygons and was first checked for geometry errors. The summarized results are as follows:

- Horizontal accuracy issues detected (parcel lines going through buildings, etc.)
- Topology build revealed numerous "gaps" and "overlaps" that will need further review. Many of the overlaps are resulting from "stacked" polygons built to accommodate multi-ownership

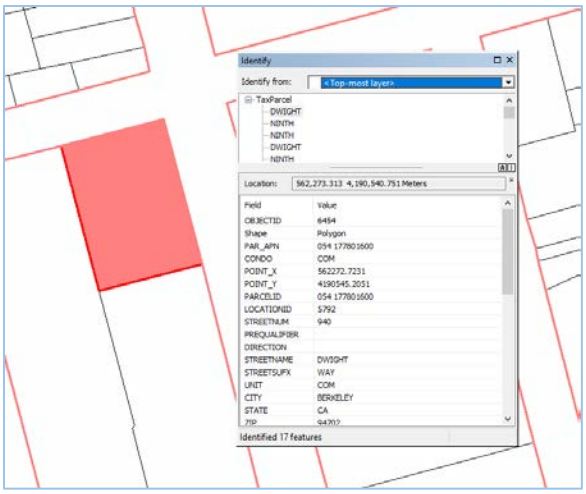
parcels (condos, etc.). Best practice is to remove all stacked polygons and setup 1-to-many relationship with database table.

- ArcGIS Data Reviewer results:
  - 3 invalid geometries detected
  - 18 multipart polygons detected
  - 0 unnecessary polygon boundaries detected

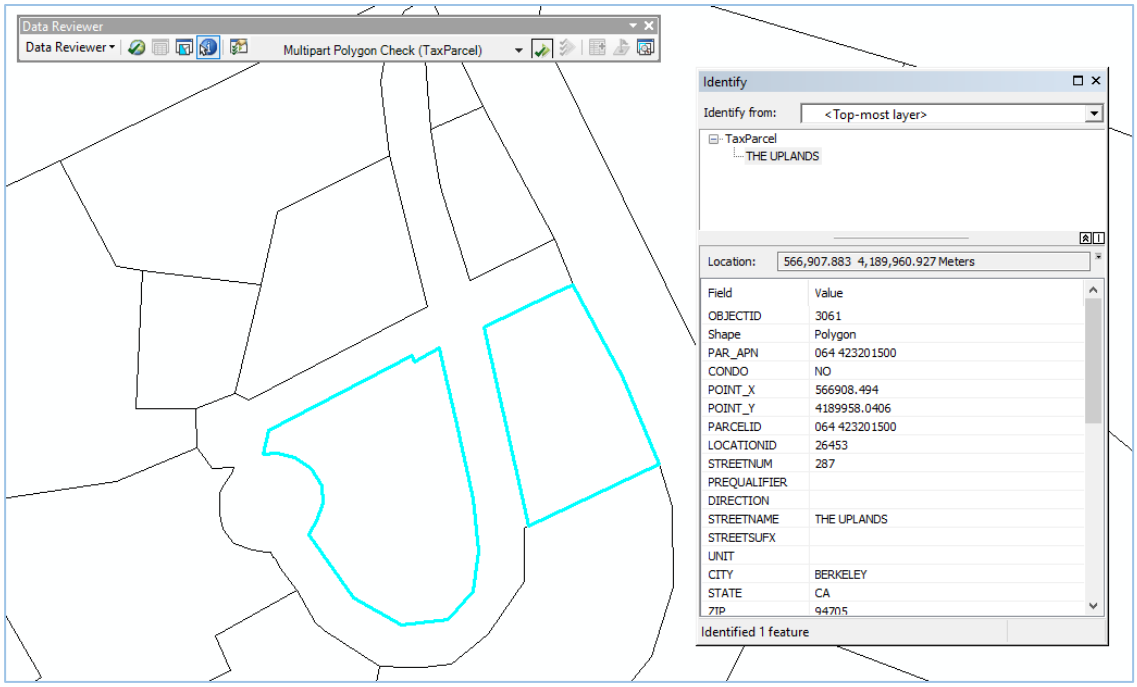
Examples of Parcel boundary alignment issues



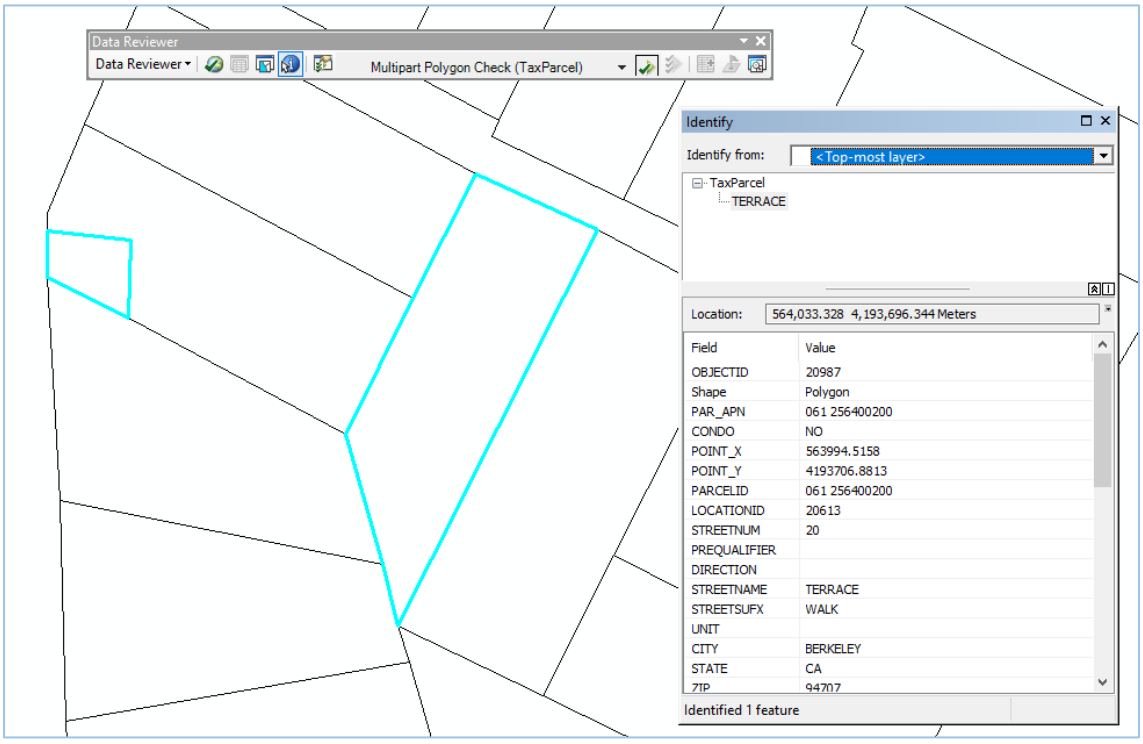
Multi-Ownership Property – 3 stacked polygons



Multi-Ownership Property – 17 stacked polygons



Example of Multi-Part Polygon

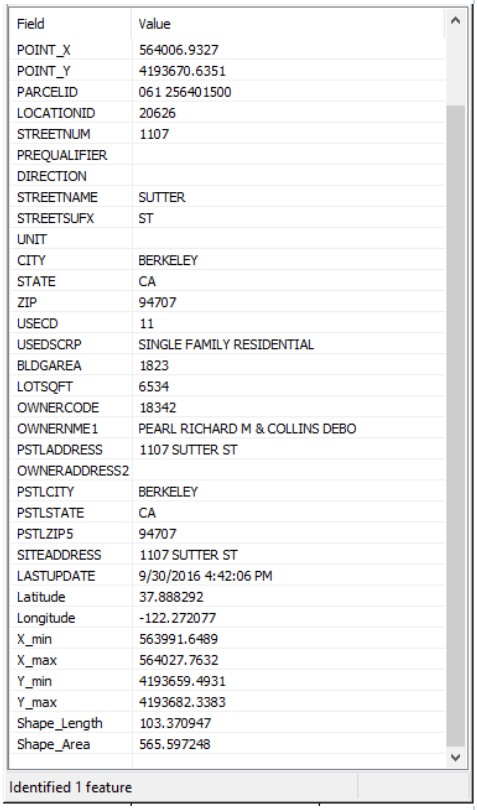


Example of Multi-Part Polygon

Parcel Attribution

Parcel attributes were next reviewed for relevancy and completeness. The parcel data does include the following key attributes:

- PARCELID – unique parcel identification number that provides link to CAMA data
- STREETNUM – property address number
- STREETNAME – property address street name
- STREETSUFX – property address street name suffix
- CITY – property address City
- STATE – property address State
- ZIP – property address ZIP code
- USEDSCRP – property use description
- OWNERNME1 – Owner(s) Name
- PSTLADDRESS – street mailing address of owner
- PSTLCITY – mailing address City of owner
- PSTLZIP5 – mailing address ZIP code of owner



Field	Value
POINT_X	564006.9327
POINT_Y	4193670.6351
PARCELID	061 256401500
LOCATIONID	20626
STREETNUM	1107
PREQUALIFIER	
DIRECTION	
STREETNAME	SUTTER
STREETSUFX	ST
UNIT	
CITY	BERKELEY
STATE	CA
ZIP	94707
USECD	11
USEDSCRP	SINGLE FAMILY RESIDENTIAL
BLDGAREA	1823
LOTSQFT	6534
OWNERCODE	18342
OWNERNME1	PEARL RICHARD M & COLLINS DEBO
PSTLADDRESS	1107 SUTTER ST
OWNERADDRESS2	
PSTLCITY	BERKELEY
PSTLSTATE	CA
PSTLZIP5	94707
SITEADDRESS	1107 SUTTER ST
LASTUPDATE	9/30/2016 4:42:06 PM
Latitude	37.888292
Longitude	-122.272077
X_min	563991.6489
X_max	564027.7632
Y_min	4193659.4931
Y_max	4193682.3383
Shape_Length	103.370947
Shape_Area	565.597248

Identified 1 feature

The above key attributes were reviewed and determined to be complete with no missing data. Other data available from the Alameda County Assessor's CAMA system can be joined to the parcel data using the parcel id as a common link.

Recommendations

Based on the data assessment, following are the key recommendations for improving the parcel data layer:

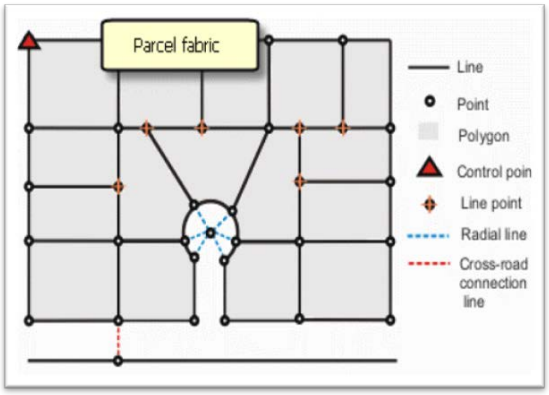
- The City should consider taking full ownership of the parcels data including the ongoing update and maintenance of the parcels. This will provide the City with total control over the quality and content of this critical data layer.
- Perform a spatial adjustment of the parcel data using published control points and recent aerial photography to improve horizontal accuracy of the data.
- Remove all stacked polygons and build related tables (one-to-many relationship) for multi-ownership properties.

- Correct any remaining topological errors.
- Reconcile property addresses in the parcels data with addresses in street centerlines, address points, and the MSAG (Master Street Addressing Guide).
- Consider migrating the parcel data into the ESRI Parcel Fabric.

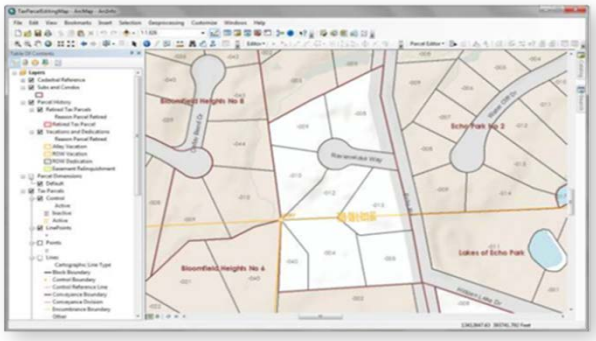
Parcel Fabric

The ESRI Parcel Fabric is a database design for storing land records data with the following characteristics:

- Provides a continuous fabric of interconnected data
- ESRI based solution that is included with ArcGIS Desktop
- Provides various tools for parcel editing
- Allows for the improvement of horizontal accuracy using published control points
- Based on the Local Government Information Model



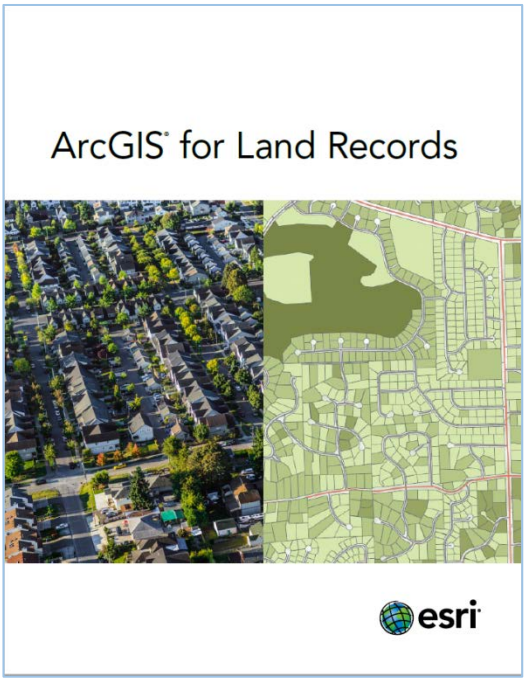
In addition, the Parcel Fabric contains a set of tools for maintaining land records data and provides the following benefits:



- Data Integrity – six topological rules are enforced by the Parcel Fabric to ensure spatial integrity
- History – all edits that occur in the fabric are maintained as "history" allowing users to see the changes that have occurred to an area over time
- Recorded Measurements – data is input using COGO (coordinate geometry) tools to accurately reflect a legal description
- Stacked Geometry – lots and subdivision boundaries can connect to the same points as parcels. If data is adjusted, it all adjusts together
- Parcel Workflows – wizard-like workflows for major parcel editing tasks (splits, combines, boundary adjustments, etc.). Only enabled if using the Local Government Information Model.
- Spatial Accuracy – can be improved by importing published control points
- Parcel Editor Toolbar – contains all the tools needed to edit the parcel fabric

- Legal Start/End Dates – dates recorded to track parcel creation process
- Plans – can be used to group parcels (e.g. subdivision) and allow you to specify unit of measure and accuracy of the associated parcels
- ArcGIS for Land Records – the Parcel Fabric is a component. Includes various apps available to Parcel Fabric users that can be deployed on ArcGIS Server or ArcGIS Online:
    - Tax Parcel Editing
    - Deed Drafter
    - Tax Parcel Viewer
    - Collector for ArcGIS

If the City chooses to maintain its own copy of the parcel data and move to the Parcel Fabric, it will need to first develop a Parcel Fabric Migration Plan that will detail the steps required to migrate existing land records data into the Parcel Fabric environment and which will document the level of effort involved as well as a schedule for the data migration effort.



Additional training for staff that will be maintaining the fabric is very important as is the development of Standard Operating Procedures (SOP) that clearly document all the procedures needed for parcel maintenance.

4.3 Street Centerlines

Street centerlines rank second only to tax parcels in their versatility for supporting local government operations. Generally, the centerlines represent the center of a roadway. Some divided highways may be depicted by two centerlines – one for each direction of travel. Each street is broken up into segments starting and ending at roadway intersections. At each intersection, multiple line segments may meet from multiple streets. Each segment contains additional information (attributes) such as the name of the street and the address ranges along that street. Many other attributes may also be stored with this data. Street centerlines may support a number of important functions within the GIS:

- Road name labels
- Road classification (highway, arterial, surface, etc.) support symbology
- Address ranges support geocoding
- Linear Referencing System (LRS) support mile marker geocoding

- Vehicle routing, when one way roadways are attributed
- Drive-time modeling, when speed limits are integrated

History and Current Status

The street centerline data was originally created by RMSI in 2010 from various sources including Alameda County. It is maintained by City staff and contains typical address fields as well as speed limit data, and width, and is suitable for geocoding and routing functions. The City migrated the street centerlines to the LGIM schema in 2016.

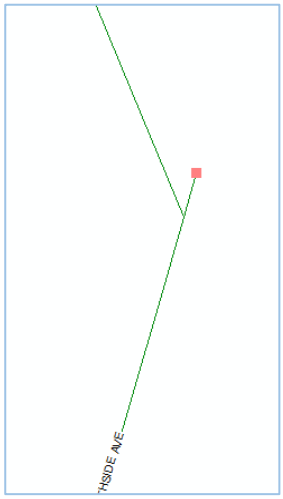
Street Centerline Geometry

The street centerline data provided by the City for review consists of 6,969 street segments and was first checked for geometry errors. The summarized results are as follows:

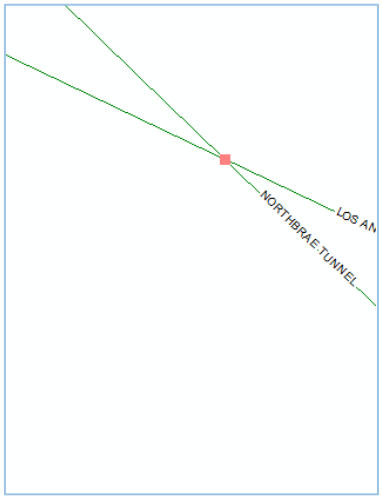
- Horizontal accuracy issues detected (some line work not in center of road)
- Streets are digitized in the proper direction based on address ranges
- The centerlines were created so that they are continuous from intersection to intersection. For example, the 100 block of Main St. should be a continuous line until it reaches the next intersection and becomes the 200 block.
- 44 street segments have a length less than 1 foot. These should be investigated as potential fragments.
- Topology was created and 21 intersections along with 524 dangle nodes were detected. Many of the dangle nodes are legitimate since they occur at the end of a street but some were actual errors
- ArcGIS Data Reviewer results:
    - 0 invalid geometries detected
    - 1 multipart line detected

City of Berkeley Street Centerlines

Example of Dangle Nodes that are errors and need correction



Dangle Node error – overshoot



Intersection error

Examples of horizontal alignment issues

Street Centerline Attributes

Street centerline attributes were reviewed and the following key attributes are present in the data:

- FROMLEFT – Left side from address
- TOLEFT – Left side to address
- FROMRIGHT – Right side from address
- TORIGHT – Right side to address
- FULLNAME – Concatenated street name
- ONEWAYDIR – Direction of one-way street
- ROADCLASS – Road classification
- MUNITLEFT – Left side municipality
- MUNIRIGHT – Right side municipality
- ZIPLEFT – Left side ZIP code
- ZIPRIGHT – Right side ZIP code
- SPEED – Speed limit
- PAV_WIDTH_RD – Pavement width

Field	Value
OBJECTID	1772
Shape	Polyline Z
CENTERLINEID	1772
FROMLEFT	1139
TOLEFT	1199
FROMRIGHT	1140
TORIGHT	1198
FULLNAME	MARIN AVE
FEDROUTE	<null>
FEDRTETYPE	<null>
AFEDRTE	<null>
AFEDRTETYPE	<null>
STROUTE	<null>
STRTETYPE	<null>
ASTRTE	<null>
ASTRTETYPE	<null>
CTYROUTE	<null>
ONEWAYDIR	
ROADLEVEL	<null>
INWATER	<null>
ROADCLASS	MAJOR
MTFCC	<null>
OWNEDBY	<null>
MAINTBY	<null>
MUNILEFT	Albany
MUNIRIGHT	Albany
STATELEFT	<null>
STATERIGHT	<null>
ZIPLEFT	94706
ZIPRIGHT	94706
MSAGLEFT	<null>
MSAGRIGHT	<null>
ESNLEFT	<null>
ESNRIGHT	<null>
LASTUPDATE	<null>
LASTEDITOR	<null>
STREET_NAME	MARIN
STREET_TYPE	AVE
NET_CFCC	A35
PAV_WIDTH_RD	<null>
CFCC	A35
METERS	73.519794
SPEED	35
F_ZLEV	0
T_ZLEV	0
FT_MINUTES	0.078314
TF_MINUTES	0.078314
FT_MINUTES_PEDESTRIAN	1.522769
TF_MINUTES_PEDESTRIAN	1.522769
RMSI_ID	101998
block_addr	1142 block of Marin Ave
U_mid_X	561939.060965
U_mid_Y	4193526.487062
Shape_Length	73.519455

Based on the review of the above attributes, the following observations were made:

- A large number of streets do not have complete address ranges. The majority are outside the City boundary. If these outside areas fall within Public Safety response zones, then efforts should be made to complete the addressing.
- A large number of the fields have not been populated with data
- Travel time attributes have been created for both vehicular and pedestrian travel
- Overall the data within City limits is in relatively good condition and is suitable for geocoding and routing functions

Recommendations

Overall the street centerline data layer appears to have been well designed initially, but will need additional editing to correct various horizontal accuracy

issues and some other minor issues as noted. Based on the data assessment, the following are the recommendations for improving the street centerline data:

- Using current aerial photography, spatially adjust the streets to the true centerline of the roadway.
- Correct all dangle node and intersection errors.
- Correct any other topological errors identified.
- Review all the “less than 1 foot” street segments and determine if they should be merged.
- Review and edit all existing populated attributes to ensure completeness.
- Review all currently unused fields in the database, determine which ones would prove useful to the City, and populate them with data.
- Reconcile addresses in the street centerlines data with addresses in parcels, address points, and the MSAG (Master Street Addressing Guide).
- Edit streets outside the City boundary that fall within a Public Safety zone (Police & Fire) to ensure they will be suitable for geocoding and routing function.

4.4 Address Points

For years, municipalities and counties all over the country have been using table database structures to update and maintain addresses. Organizations often had many disparate address datasets feeding multiple computer applications. Often entry of this data was not regulated. Therefore, addresses were being entered free form without any standards. Instead of clean, valid addresses – an addressing nightmare was created. One example is that someone can enter the address for the mall in their city from 98 different ways. This old world method is often cumbersome, allows for error in data entry, and causes difficulty in enforcing data standards.

Problem with free-form data entry and lack of standards:

Street #	Street Prefix	Street Name	Street Type	St Post Qualifier	Unit #
315	N	Wackerly	St	Suite	6
315		North Wackerly	Street		STE 6
315-325	N	Wackerly	St	Ste	6
315	N	Wackerly Street			Suite 6
315	North	Wackerly	Street	Suite 6	
315-317	N	Wackerly St		Ste 6	
315		N Wackerly	St	Ste	6
315	N	Wackerly	Str	Suite	6
315	North	Wackerly St	St	Ste 6	

Example of <u>one</u> Address entered incorrectly <u>ten</u> different ways

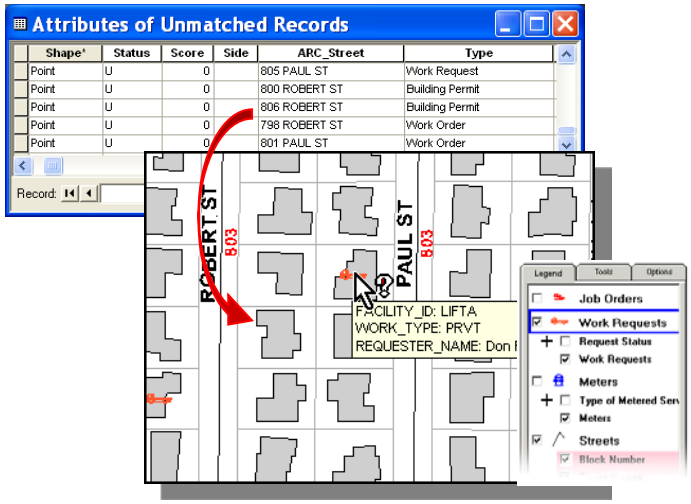
Street #	Street Prefix	Street Name	Street Type	St Post Qualifier	Unit #
315	N	Wackerly	St	Ste	6

Example of the same address entered correctly using data standards

Are accurate address points and street centerlines really that important?

Why do we need address points that are so accurate? Why are we so concerned with cleaning up the address database? An organization is often faced with the challenge of accurately mapping the location of work orders, emergency dispatch, work requests, building permits, and outage calls throughout a city or county. If an accurate address point layer does not exist, unfavorable results will occur when trying to map building permits and work requests against that address. Lack of an accurate address point layer will often result in unmatched records. Your organization will then need to invest additional time and resources attempting to determine the location of the work orders – or building permits, or outages – manually.

Why aren't my work orders matching correctly?



Example of Unmatched Work Orders and Building Permits Due to Inaccurate GIS Address Data

If we have good street centerline data, why do we need an address point layer?

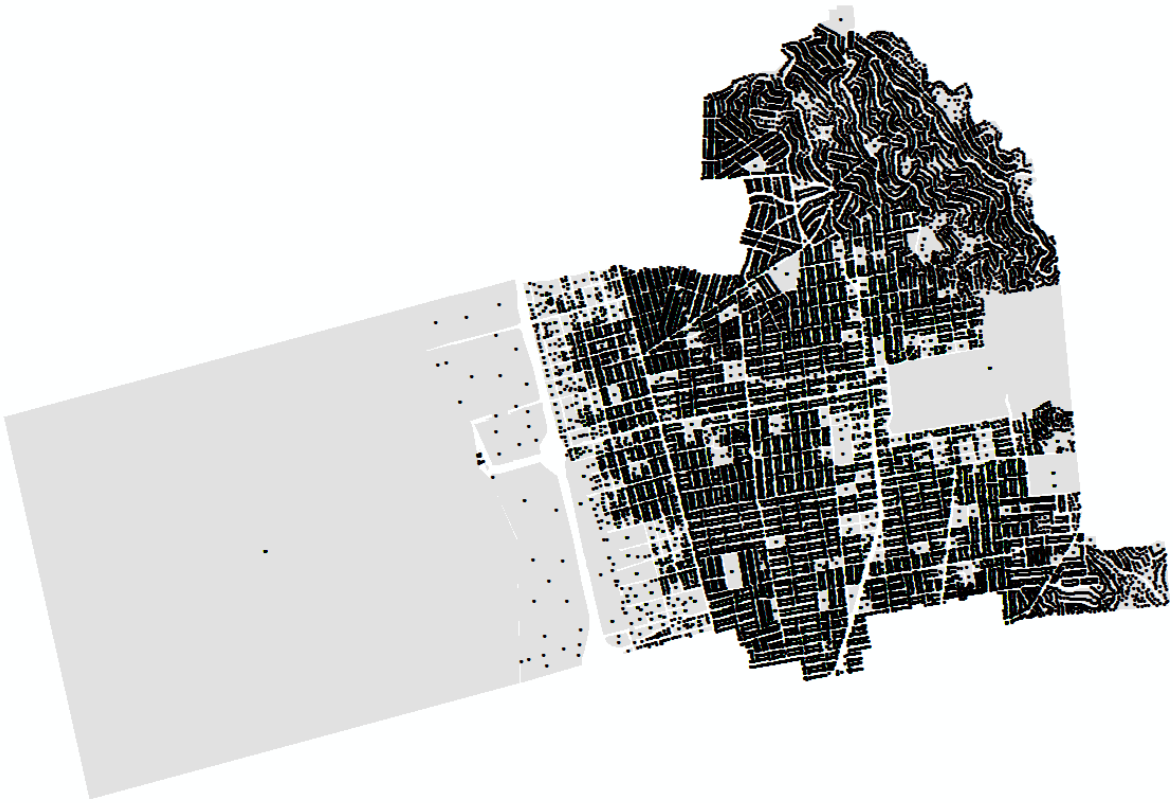
Having an accurate street centerline layer is vital, but relying solely on street centerline data to map addresses has some limitations. The geocoding (address matching) process with street centerlines use a mathematical algorithm to place addresses at an offset along the street centerlines proportionate to the attributed address range. This results in address points that may or may not be placed next to the correct structure. If, however, an accurate address point layer is used to match addresses, a much more accurate placement will be realized.

Addresses Matched to Street Centerlines (less accurate)

Addresses Matched to Address Point Layer (very accurate)

History and Current Status

The address point data consists of 63,710 points and is created nightly by an automated routine that extracts address data from SunGard and then geocodes the addresses to parcel centroids. During the work day, an Analyst updates/creates new addresses in the SunGard Land Management module.

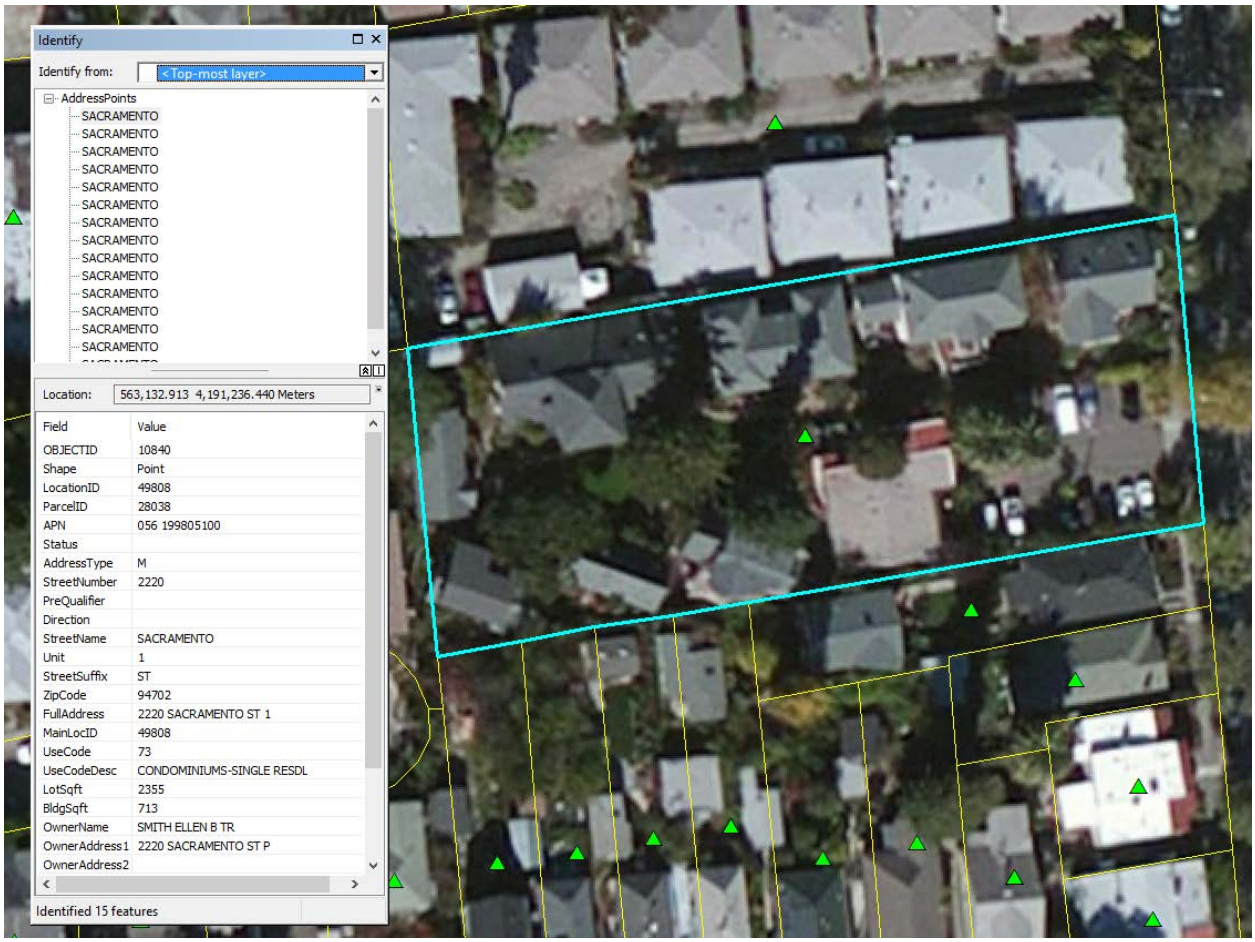


City of Berkeley Address Points

Address Point Geometry

- Address points occasionally placed at center of building but not consistently. This is due to the fact that they are created based on the location of the parcel centroid – not the building location.
- Multi-dwelling unit (MDU) structures are represented with stacked points. Stacked points need to be separated and placed on corresponding units within MDU.
- Address point data is not NENA (National Emergency Number Association) compliant
- Data Reviewer:
    - 0 invalid geometries detected

Examples of Address Points not located on building correctly



15 Stacked address points representing a condominium complex

Address Point Attributes

Address point attributes were reviewed and the following key fields were identified in the data:

- ParcelID – parcel ID number
- APN – Assessor parcel number
- StreetNumber – address building number
- StreetName – address street name
- Unit – address unit number
- StreetSuffix –address street name suffix
- ZipCode – address ZIP code
- FullAddress – full concatenated street address

Field	Value
OBJECTID	10852
Shape	Point
LocationID	49820
ParcelID	28050
APN	056 199806300
Status	
AddressType	M
StreetNumber	2220
PreQualifier	
Direction	
StreetName	SACRAMENTO
Unit	13
StreetSuffix	ST
ZipCode	94702
FullAddress	2220 SACRAMENTO ST 13
MainLocID	49820
UseCode	73
UseCodeDesc	CONDOMINIUMS-SINGLE RESDL
LotSqft	2355
BldgSqft	713
OwnerName	ZOELLER MARY E
OwnerAddress1	2220 SACRAMENTO ST A
OwnerAddress2	
OwnerCity	BE
OwnerState	CA
OwnerZip	94702
U_X	563132.805315
U_Y	4191236.72534
InDbDate	11/2/2016 11:41:09 PM

Other fields exist for property use description and owner information but are not critical to geocoding functions.

Base on the review of the key attributes, the following observations were noted:

- 684 address points have no address number. These all appear to be legitimate as they are primarily vacant land.
- Other address attributes are fully populated

Recommendations

Overall, the address point data appears to be complete with good attribution. Based on the data assessment, the following is recommended for improving the data:

- Address points should be placed at the center of the building they represent. The City's current automated process places them at the parcel centroid. This address placement policy can create confusion and can increase response times of Public Safety First Responders. The City should manually edit the address point data and place all address points at the center of the associated building. A process can then be developed to keep the GIS address point layer in sync with the SunGard Land Management database.
- How about recommending that the Address Point data should reside in ESRI and the Land management database should be transferred to Accela with ERP replacement

- Especially for large multi-dwelling units, knowing the exact location of the address is of huge benefit to First Responders. Stacked address points on MDUs should be separated and placed as close as possible to the actual location for each address. This could be on separate buildings in a condominium complex or on separate units within a single building.
- Reconcile addresses in the address point data with addresses in parcels, street centerlines, and the MSAG (Master Street Addressing Guide)
- Remove extraneous data fields
- The address point data should be standardized to be NENA (National Emergency Number Association) compliant.

Active maintenance of the address point layer to maintain a high level of quality is recommended as is prompt development of new address points as new addressable structures are created. The address layer itself is missing some necessary fields that are typical for a NENA compliant database and should be updated per the following table:

Recommended Address Data Components					
	Attribute Field Description	**Example Input**	**Field Type**	**Field Width**	**Field Name**
1	Primary Address Number	325	Numeric	5	HouseNum
2	House Number Suffix	½	String	4	HouseSuf
3	Prefix Directional	N	String	2	Prefix
4	Street Name	Main	String	35	Name
5	Street Type	St	String	4	Type
6	Suffix Directional	E	String	2	Suffix
7	Secondary Address Identifier	Apt	String	4	Unit
8	Secondary Address Range	12	String	4	UnitNum
9	City / Town	Columbia	String	25	City
10	State	SC	String	2	State
11	Zipcode	29201	Numeric	5	Zipcode
12	Plus Four code	1284	Numeric	4	Plus4
13	Mailing Address	PO Box 503	String	40	MailAdd
14	Mailing Community	Lexington	String	25	MailCity
15	Mailing State	SC	String	2	MailState
16	Mailing Zipcode	29027	Numeric	5	MailZip
17	Mailing Plus Four Code	1867	Numeric	4	MailPlus4
18	Rural Route	234	String	25	Reside
19	Data Entry / Modify	3-6-2012	String	10	Date

Based on the assessment of these key data layers, the following section analyzes the gaps in the data and will provide recommendations for its improvement.

4.5 Gap Analysis Results

Gap Analysis involves the comparison of what is actual versus what is needed. If gaps exist, then full potential will not be realized. Based on feedback from City staff and on the data assessment of the land management data layers, GTG has determined gaps that exist within the data. This section will document those gaps and make recommendations for resolving the gaps.

The following table lists potential gaps and the existence of a gap for a specific layer is identified with a checkmark.

	GAPS								
Data Layer	Spatial Accuracy Issues	Topology Issues	Missing Spatial Data	Missing Attribute Data	Additional Spatial Coverage Needed	Additional Attribute Fields Needed	Enterprise Integration Gaps	City Staff Needs Not Being Met	Public User Needs Not Being Met
Tax Parcels	✓	✓		✓		✓	✓	✓	
Street Centerlines	✓	✓		✓			✓	✓	
Address Points	✓			✓	✓	✓	✓	✓	

Based on the identified gaps, specific gap resolutions are provided in the following table along with methods to resolve the gaps and an associated cost. Following the provided recommendations will greatly improve the accuracy of the land management data layers, increase user confidence in the data, and allow the data to return more meaningful and accurate analysis results. Ultimately, following the provided recommendations will result in these land management data layers being considered the Authoritative Data Source for the City of Berkeley land management data.

Layer	Gap Resolution		Method to Resolve Gap		Cost
Tax Parcels	The City should consider taking full ownership of the parcels data including the ongoing update and maintenance of the parcels. This will provide the City with total control over the quality and content of this critical data layer		Assign/hire one-half FTE GIS Technician to maintain data		$23,000
	Perform a spatial adjustment of the parcel data using published control points and recent aerial photography to improve horizontal accuracy of the data		ArcMap and City or Consultant staff		$10,000
	Remove all stacked polygons and build related tables (one-to-many relationship) for multi-ownership properties.		ArcMap and City staff		$5,000
	Correct any remaining topological errors		ArcMap and City staff		$5,000
	Reconcile property addresses in the parcels data with addresses in street centerlines, address points, and the MSAG (Master Street Addressing Guide)		Consultant		$20,000
	Consider migrating the parcel data into the Esri Parcel Fabric		Consultant		$25,000
	Expand enterprise integration of parcel data with other systems		Consultant		$5,000
Street Centerlines	Using current aerial photography, spatially adjust the streets to the true centerline of the roadway		Consultant		$5,000
	Correct all dangle node and intersection errors		ArcMap and City staff		$1,000
	Correct any other topological errors identified		ArcMap and City staff		$500
	Review all the “less than 1 foot” street segments and determine if they should be merged		ArcMap and City staff		$500
	Review and edit all existing populated attributes to ensure completeness		ArcMap and City staff		$1,000
	Review all currently unused fields in the database, determine which ones would prove useful to the City, and populate them with data		ArcMap and City or Consultant staff		$10,000
	Reconcile addresses in the street centerlines data with addresses in parcels, address points, and the MSAG (Master Street Addressing Guide)		Accomodated in Tax Parcels section		$0
	Edit streets outside the City boundary that fall within a Public Safety zone (Police & Fire) to ensure they will be suitable for geocoding and routing function		Consultant		$10,000
	Expand enterprise integration of parcel data with other systems		Consultant		$5,000
Address Points	Address points should be placed at the center of the building they represent. The City’s current automated process places them at the parcel centroid. This address placement policy can create confusion and can increase response times of Public Safety First Responders. The City should manually edit the address point data and place all address points at the center of the associated building. A process can then be developed to keep the GIS address point layer in sync with the SunGard Land Management database.		Consultant		$10,000
	Especially for large multi-dwelling units, knowing the exact location of the address is of huge benefit to First Responders. Stacked address points on MDUs should be separated and placed as close as possible to the actual location for each address. This could be on separate buildings in a condominium complex or on separate units within a single building.		Consultant		$10,000
	Reconcile addresses in the address point data with addresses in parcels, street centerlines, and the MSAG (Master Street Addressing Guide)		Accomodated in Tax Parcels section		$0
	The address point data should be standardized to be NENA (National Emergency Number Association) compliant.		ArcMap and City or Consultant staff		$2,500
	Expand enterprise integration of parcel data with other systems		Consultant		$5,000
		Total Gap Resolution Cost			**$153,500**

5.0 GIS Layers Assessment for Disaster Planning

Another important category of data are those layers import for Disaster Planning. For the purposes of Disaster Planning, those layers that are typically deemed critical to Public Safety Planning operations were identified, extracted from the MDL, and listed in the following table. Disaster Planning uses are listed and the status of the data layer is also listed. This information can be used by the City to determine which data layers need to be updated or created in an effort to improve the City's disaster planning capabilities.

Disaster Planning GIS Layers

Data Layer	Existing or Recommended	Disaster Planning Use	Data Status / Issues
Address Points	Existing	Geocoding, routing, and locating structures	See the Data Source Assessment
Aerial Photography	Existing	General mapping and location of features	Excellent quality 2014 data. Next data collection 2017.
Ambulance Calls	Existing	Track call activity	Live feed from emergency dispatch
Automated Vehicle Location	Recommended	Track the location of emergency vehicles	Data is recommended and AVL should be deployed on all First Responder vehicles
Building Outlines	Recommended	Identify location of destroyed structures	Data is recommended and could be obtained from Pictometry
Creeks	Existing	Could represent location of flood hazard	Static dataset of creek locations
Electrical	Recommended	Location of electrical hazards or to identify location of destroyed utilities	Data is recommended and City should hire a contractor to create
Emergency Access Evacuation	Existing	Subset of street centerlines that represent emergency access and evacuation routes	Created in 2011 and should be updated
Emergency Cache locations	Recommended	Locations of emergency supplies	Data is recommended and locations should be collected with GPS
Emergency Shelters	Recommended	Locations where the public can take shelter	Data is recommended and locations should be geocoded
Evacuation Routes	Recommended	Emergency evacuation routes	Data is recommended and should be extracted from the Street Centerline data
FEMA Flood Zones	Existing	Areas with a potential for flooding	Current FEMA flood zone data. Obtain updates annually from FEMA or use their Map Service

Data Layer	Existing or Recommended	Disaster Planning Use	Data Status / Issues
Fire Hazard Zones	Recommended	Areas with a higher potential for fires	Data is recommended
Fire Hydrants	Existing	Hydrant locations needed by Fire Dept	Data appears to be complete. Review for spatial alignment issues and correct.
Fire Station Locations	Existing	Locations of First Responders	Accurate locations of 7 fire stations
Hazardous Material Locations	Partial	Hazardous materials that could pose additional threat during disaster	Data has been partially developed and needs to be completed
Knox Boxes	Existing	Lock box locations for accessing various facilities	Must update this layer frequently to ensure currency
Medical Facilities	Existing	Location of facilities to medically treat the injured	4 Hospital locations
PGE Gas Pipelines	Existing	Potential hazard	Locations of PGE gas pipelines in City. Coordinate with PGE to keep current.
Property	Existing	Property boundary locations	See the Data Source Assessment
Road Centerlines	Existing	Street centerlines for geocoding and routing emergency vehicles	See the Data Source Assessment
Schools	Existing	Location of all schools for possible evacuation or shelters	Locations of Elementary, Middle, and High Schools
Seismic Hazard Earthquake	Existing	Data for areas of potential earthquake activity	Locations of previous or potential earthquake activity (2003). Keep current with California Geological Survey.
Seismic Hazard Landslide	Existing	Data for areas of potential landslide activity	Locations of previous or potential landslide activity (2003). Keep current with California Geological Survey.
Seismic Hazard Liquefaction	Existing	Data for areas of potential soil liquefaction	Locations of previous or potential ground displacement activity (2003). Keep current with California Geological Survey.
Signs	Existing	Locations of street signs, used for evacuations, could also be used for sign replacement after disaster	GPS location of street signs maintained by Public Works

Data Layer	Existing or Recommended	Disaster Planning Use	Data Status / Issues
Special Needs Residents	Recommended	Location of special needs residents to be used during evacuation	Data is recommended and locations should be geocoded and maintained frequently
Stormwater Utilities	Existing	Location of stormwater utilities that could represent potential areas of flooding	Accurate location of utilities maintained by Public Works
Surgical Centers	Recommended	Surgery locations for the injured	Data is recommended and locations should be geocoded

6.0 Conclusion & Recommendations

Existing GIS data at Berkeley is an important and valuable City asset. These data layers assist all City departments in decision making, asset tracking, visualization, analysis, and various other functions. This project has identified the need for a number of additional layers and improvements to many existing layers. It will be important that the City budget for the creation of some of the missing data layers and for the completion/update of other enterprise-wide layers (e.g. parcels, street centerlines, address points, etc.) Following is a summary of recommendations for this chapter:

- **Complete the migration of GIS data to the LGIM.**
- **Fully implement ArcGIS for Local Government.**
- **Acquire/develop all "recommended" layers in the MDL.**
- **Implement the recommendations for improving the authoritative data source layers – tax parcels, street centerlines, and address points.**
- **Follow the recommendations for creating or improving the disaster planning GIS layers.**

MILESTONE 4

ORGANIZATIONAL READINESS ASSESSMENT

CITY OF BERKELEY

CALIFORNIA

GIS Strategic Implementation Plan

Table of Contents

1.0 EXECUTIVE SUMMARY

GIS governance is a social and political process, and the aggregated experiences of local government organizations prove that achieving an operational GIS does not guarantee its use. Correct implementation of an appropriate governance model can give rise to positive and beneficial characteristics in an organization. Conversely, selecting and/or implementing a poorly suited governance model that does not follow the implementation principles can have negative consequences. The ultimate success of an enterprise-wide GIS will depend on the ability to govern and manage GIS in an evolving multi-departmental environment. The strengths of the existing GIS governance model and the City of Berkeley's Enterprise GIS and Open Data Coordinator have included:

- Maintaining all GIS data in a central repository and supporting over 100 GIS users throughout various City departments.
- The creation of an annual GIS work plan
- The development of a Master Data List (MDL)
- Coordinating the deployment of multiple Internet and Intranet GIS solutions
- Providing GIS technical support to all users, as well as, maintaining a culture of collaboration across City departments.
- Supporting multiple GIS initiatives as documented in the List of key documents.
- Managing the LGIM migration
- Developing GIS Wall maps
- An Enterprise GIS Team Charter
- The development of multiple Standard Operating Procedures (SOPs) pertaining to the creation and maintenance of Metadata and Naming Convections. Some of these initiatives have essentially died or have been forgotten.

The most significant success and good business practice the has accomplished is the assortment of "Web AppBuilder" applications Ms. Delgado has planned, designed and published for the City departments and the public. This is a showcase for the City of Berkeley.

GIS Governance Gaps – Existing Weaknesses

After collecting data from the Online GIS Needs Assessment Questionnaire and conducting departmental interviews within the City, the following GIS governance weaknesses were identified:

- Lack of a GIS Strategic Plan
- Lack of Job Classifications
- No GIS Steering Committee
- No GIS Sponsor Team
- No GIS Functional Groups
- Lack of a Measure of Quality of Service
- No Grants and Funding Initiatives
- No GIS Coordination Tasks
- Lack of Key Performance Indicators
- No GIS Blog or Newsletter Published

Additionally, a number of GIS governance items (below) already existed within the City, but could be improved:

- A GIS Vision, Goals and Objectives
- A formalized governance model
- GIS User Groups
- GIS Policy and Mandates
- User Sensitivity
- GIS Authority and clear lines of responsibility
- An annual detailed GIS Work Plan
- Alignment with Organization's overall Vision, Goals and Objectives

Desired GIS Governance Outcomes

By combining results from the online questionnaire, departmental interviews, and information provided by the Enterprise GIS and Open Data Coordinator, Cristi Delgado, the following major GIS needs were identified within the City of Berkeley:

- Departmental goals and objectives
- Better GIS governance and lines of responsibility
- More technical support options
- Better data accuracy
- More GIS training
- Better access to GIS data
- Better utilization of GIS as a whole

The following twenty-six (26) key recommendations include:

- Task 1: Adopt a New Hybrid GIS Governance Model and Staffing Plan by Hiring Two New GIS Staff within IT and changing operations.
- Task 2: Annually update the Enterprise GIS Master Plan
- Task 3: Develop a GIS vision, goals, and objectives
- Task 4: Define GIS job descriptions
- Task 5: Develop a coordinated GIS Enterprise
- Task 6: Create and enforce new GIS steering committee
- Task 7: Consider a GIS sponsor team approach – *Optional Task*
- Task 8: Use the Technical Governance Committee as the de-facto GIS Governance/Technical Committee
- Task 9: Formalize a City GIS user group
- Task 10: Regionalization of GIS
- Task 11: GIS policy and mandates
- Task 12: Measure user sensitivity
- Task 13: Improve GIS collaboration
- Task 14: Measure quality of service
- Task 15: Identify GIS authority and clear lines of responsibility
- Task 16: Continue to use the City's existing GIS budget or funding model
- Task 17: Explore GIS grants and funding initiatives for the City of Berkeley
- Task 18: Develop an annual detailed GIS work plan
- Task 19: GIS coordination tasks
- Task 20: Develop Key Performance Indicators (KPIs) for the GIS initiative

- Task 21: Create a GIS blog or newsletter
- Task 22: Create and maintain a GIS culture of collaboration among stakeholders
- Task 23: Alignment with City's overall vision, goals, and objectives (Resilience Strategy)
- Task 24: Develop enterprise and departmental Service Level Agreements (SLAs)
- Task 25: Develop a Staffing Plan
- Task 26: Develop a Training Plan

2.0 INTRODUCTION TO GIS GOVERNANCE

Definitions and Concepts

GIS Governance refers to all of the processes and actions required to manage the planning, design, implementation, and on-going maintenance of GIS technology. Governance is integrated throughout all components of the GIS. GIS governance is the management of an integrated solution that serves an entire organization by offering levels of geo-spatial functionality, uniform standards, good management, reliable digital data and databases, workflow procedures, training education and knowledge transfer, and a backbone for architecture and infrastructure.

GIS governance is a social and political process, and the aggregated experiences of local government organizations prove that achieving an operational GIS does not guarantee its use. Correct implementation of an appropriate governance model can give rise to positive and beneficial characteristics in an organization. Conversely, selecting and/or implementing a poorly suited governance model that does not follow the implementation principles can have negative consequences. The ultimate success of an enterprise-wide GIS will depend on the ability to govern and manage GIS in an evolving multi-departmental environment.

Geographic Information Systems (GIS) technology provides a framework for organization-wide cooperation by using geography as a common frame of reference, allowing individuals and departments to share information about "location". An enterprise GIS promotes interoperable technologies, standards, and methods, thus facilitating a more efficient and effective use of the technology. Coordinating GIS efforts within an organization will promote better and more effective use of the analytical capabilities of GIS technology. It results in less staff time spent searching for, compiling, and integrating GIS data.

GIS is unique within information technology because of the relatively high start-up costs, data integration expenses, and longer pay-back periods. Therefore, the challenges associated with governing a GIS are unique and require governance principles and rules, in addition to the information technology principles and specific local government principles. For a government to maximize the return on investment while improving business productivity, GIS best practices and principles need to be recognized in the following ways:

GIS information is highly valuable and as such it must be integrated with technology initiatives.

The goal is to develop the data once and to re-use it multiple times and for many different purposes. By pooling resources and reducing expenses, sharing the base information lowers the overall start-up and maintenance costs. The organization becomes more productive because working collaboratively is less expensive than working as individual business units. In contrast, it is particularly expensive if each business unit or business system attempts to develop GIS information independently.

There is a longer payback and return on investment because it takes multiple years to implement a GIS. Extensive data acquisition efforts are required to build a GIS. Initial data gathering is typically conducted using aerial photography known as "a fly-over". The government issues a Request for Proposals (RFP) and contracts with an aerial photography company to fly the area and capture photographic images that are then geo-referenced to known ground control points. The film or data is processed and used to digitize the land base features. The fly-over process and data creation process can last from 1 to 3 years depending on the area's geographic size and the technology deployed. Parcel and tax map layers require an additional 1 to 3 years of field work, deed research and boundary compilation. Networks for water, sewer, and storm water could require additional physical surveys and extensive site and construction plan research. These surveys can take an additional 1 to 3 years. Each listed process could cost several million dollars, in addition to the cost of specialized GIS software. As a result, the government may invest heavily in a GIS implementation even before the first map is produced. The longer timeframe for return on investment (ROI) can make it difficult to maintain momentum and encourage participation during implementation efforts.

Special software and modules are required for GIS integration. The need for specialized software that bridges the gap between file databases and dynamic geospatial information results in higher integration costs for GIS. For example, the software allows Utility Engineers to visualize which water network

segments are at risk for breakage by overlaying the water distribution network layer with a layer that depicts increases in water usage. To perform this analysis, the GIS needs to communicate with the water billing system. GIS software bridges the communication gap, but it has a higher cost of ownership than a billing system alone. The return on this investment results from preventing a water main break, wasted release of treated drinking water, customers being out of service, and avoiding the risk of flood damage to adjoining property.

GIS information is critical to the enterprise, and as such, it is universal and complete and enables the public decision making process.

GIS is often used to enable strategic decision and policy making and in providing information for regulatory compliance. GIS supports engineering modeling functions, planning, analysis and operations. GIS is used to dispatch emergency services and to enhance public safety. Each outcome is very important to the organization's mission and greatly enhances service. GIS enables an organization to save time, money and lives. To support these outcomes, GIS must be easy to integrate with existing and future information systems and made available to the entire enterprise. Regardless of ownership, GIS operational functions must be aligned with appropriate resources and implemented by professional and dedicated GIS staff. Timely, high-quality GIS information is necessary to support desired GIS outcomes.

GIS information is largely public information (information that can be collected from the public right-of-way or from the public airways). This information is used for determining public policy, and appropriate information should be openly accessible and used to facilitate public knowledge and meet public expectations for service.

Public information and its spatial components should be made available to communities to increase awareness about the government decision making process. GIS can identify potential hazards, indicate where services are located, and promote economic vitality opportunities. GIS information supports economic development and tourism opportunities by providing location data in relationship to desired amenities. Demographic analysis enables businesses to relocate or to target advertising to a particular market. Information about the locations of public bus routes, schools, and municipal buildings are important to the public, particularly for newer residents and visitors. Mapping health hazards, flood zones, evacuation zones, zoning districts, and public easements are very valuable, especially when selecting properties for homes, sites for buildings or emergency shelters. GIS analysis and maps are often used to support

decision making and to develop policy. Providing repeatable analysis and information helps citizens understand the decision making process and enables them to provide informed input. The public has the right to inspect public records. Citizens should have open access to examine how their real estate properties are being assessed in comparison to similar properties in the jurisdiction. Open inspection of records can detect clerical or process errors quickly. The public has the right to be aware of the occurrence and location of crimes in order to support a safe community. They should be informed of new construction projects and re-zonings or zoning variances to help maintain a quality physical environment. Access should be provided universally in a format that promotes accessibility with little to moderate costs. Dissemination strategies should balance the public's right to know with the public's right to privacy. GIS applications should meet the same standards and expectations as other public-access applications. They should be fast, attractive and easy to use. GIS applications should be an integral part of government services and information provided via the Internet, enabling citizens to gather information from work or at home and to minimize the need to visit government offices or call 311.

GIS Initiatives are aligned with business processes and functions.

A well designed GIS product universally enables the business process. GIS applications, like other information technologies, are implemented to improve organizational productivity. The ultimate GIS system is a system that is universal and seamless. People with little or no experience can utilize the technology without training. The technology itself is transparent to the end-user. GIS improves productivity because it enables people to locate resources, assets, and features that otherwise are hidden deep within the complex layers of corporate databases. GIS information must be available and current so that it can be used within the business process to support business decisions.

GIS provides the core functionality and basic map interfaces needed to locate and identify global positions. GIS data can be integrated with any database, regardless of format, as long as a common link such, as address, exists in both systems. Once the link is established, users can easily join database tables to generate extended information about locations. GIS spatial analysis tools and the ability to visualize information on maps enable the end-user to identify spatial relationships that are otherwise obscured by overwhelming amounts of tabular data. However, in order to support spatial analysis, data integrity rules are required to ensure that the linkages between databases are maintained. Metadata ("data about data") is very important to GIS because it documents database properties and lets the end-user know what information is available for analysis. It should contain documentation of the workflows and

procedures used to create data. In addition to providing users with valuable information, end-users can review the metadata to help maintain data integrity and to prevent programming errors, bugs, and flawed logic. Metadata also enables developers to focus on solutions that improve business processes so they can develop appropriate solutions that meet business needs. A good system development life cycle starts with understanding end-user needs and then soliciting their input throughout the entire planning and implementation period. Consent agreements with GIS end-users reduce costs and improve data sharing at a universal level. GIS is not an island unto itself but, rather, a bridge that spans the gap between traditional information processing and real world spatial business process need.

A GIS Governance Model is an organizational structure and process that facilitates GIS technology growth and use. Governance model implementation can be complex and problematic, but the right governance model is critical for effective technology diffusion. If the aim of implementing geo-spatial technologies is to improve organizational effectiveness and efficiency, then selecting a governance strategy is a critical key to success. The appropriate governance model is even more important when considering multi-departmental/shared GIS resources.

Collective organization experiences prove that achieving an operational GIS application does not guarantee its use. Implementation is largely a social and political process which has to be nurtured and cajoled rather than imposed and controlled. The selection, therefore, and implementation of the right governance model (one that follows the GIS implementation principles) could give rise to positive and beneficial characteristics. Alternatively, the selection and/or implementation of a poorly suited governance model (one that does not follow the implementation principles) can have negative consequences. The following table contrasts the results of good GIS governance against that of misguided GIS governance:

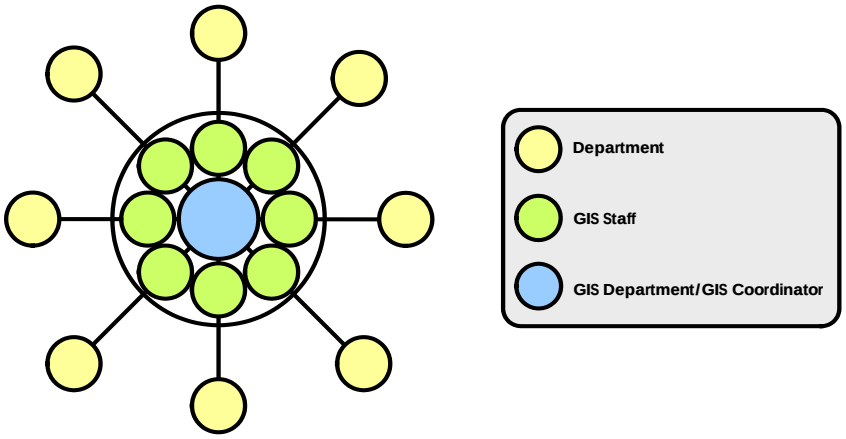
Good GIS Governance Results:	**Misguided or Lack of GIS Governance Results:**
• Effective strategic decision making • Organization-wide resource planning • Seeing GIS information as a public resource • Project and process management • Prioritized resource control • Clear lines of roles, responsibility and accountability • Easy geographic information exchange • Timely response to internal & community GIS	• Assumption based decision making • Empire building • Misinformed public • Data and process duplication • Variations in priorities • Constant internal competition over funding projects and resources • Information hording or missing information • Inability to locate critical or timely

requests and questions • End-user participation • Stakeholder consent building • Increased productivity • Accurate information, map data, and statistical reports • Working as a team	information • Insensitivity to users' needs • Insufficient prevention and response • Inefficient decision making • Poor training and education • Poorly maintained, misplaced and stale information • Everyone going their own way

The ultimate success of an enterprise-wide GIS will depend on the ability to govern and manage GIS in this evolving and complex multi-departmental environment. There are two primary organizational structures or governance models used to implement GIS in organizations. A third structure can be argued but is essentially a combination of the two primary models.

Enterprise-wide Organizational Models

There are two primary organizational structures used to implement enterprise-wide GIS within organizations throughout the United States. The first type is a centralized structure. A centralized organizational structure maintains a central department or division that is responsible for all GIS services. In this type of structure, GIS often has its own dedicated department or is a division of an Information Technology (IT) or Technology Services department. The GIS department/division employs a cadre of management, analysts, technicians, and programmers tasked with hardware, software, application development, planning, and training. Data are created and maintained by this group, or outsourced to contractors. All other participants are characterized as end-users, with only the capability to view, query, and analyze spatial data.



Centralized GIS Organizational Structure

Business units use the data for day-to-day operations or detailed analysis. Feedback is channeled through the chain-of-command to the GIS information officer with oversight coming from a steering committee and end-user groups. Bureaucracy and duplication of effort are minimized since there is a central command and control and a single budget source. GIS functions are split into teams that are responsible for each function and requests for services.

This model can be compared to the military model or the water works model. The end-user of the service relies on the central GIS business unit to provide clean GIS information. The end-user just has to turn on the faucet and out flows the GIS information. The end user does not need to be aware of the effort or processes that produce the information; similarly, a person at the end of the water faucet does not have to worry about the infrastructure and management process required to provide clean drinking water. The centralized model is very efficient, and as such, is typically utilized by single departments, large government agencies, the military, and business corporations.

When a well-planned **Centralized** GIS organizational structure is implemented, the government can expect:

- Clearly defined roles from a central chain and command
- Standard software and maintenance procedures
- Shared overhead costs
- Decisive and straight forward direction
- Solutions to operational problems that are implemented from the top down
- Greater operational efficiency for staff throughout the organization
- Reduction in data duplication
- Many integration opportunities with other business systems
- Central access point for data sharing
- Team based processes in which critical functions are beyond one person deep
- Spatial information maintenance that improves because users are well trained and devoted to specialized tasks.

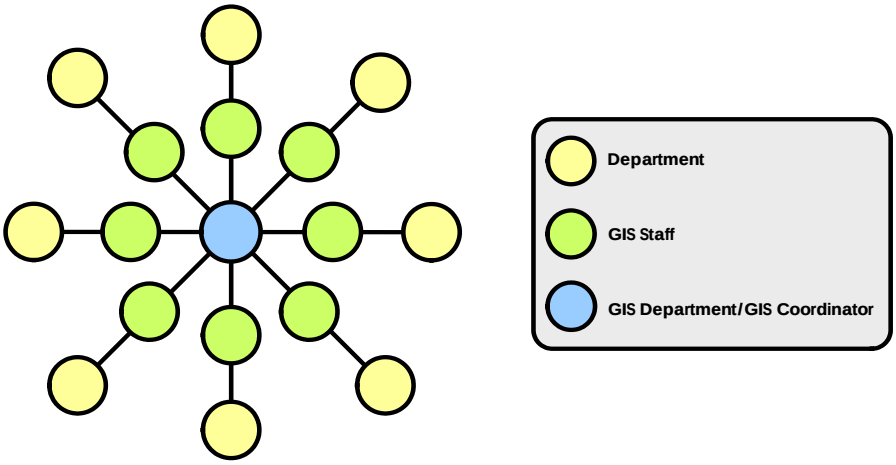
If the **Centralized** model is applied, then the governance authority must be aware of and avoid issues such

as:

- Inflexible decision making
- Maintenance procedures and standards becoming too rigid
- Poorly funded implementations or budget cuts disrupting the whole system (all the eggs are in one basket)
- Lack of end-user input and design in the planning process
- Smaller agency may not know what to ask for from the central agency since they don't have any GIS experience
- Poor centralized leadership or direction, with the top down design, could lead to undesired results.

The major strength of the centralized model is a well-structured and defined universal GIS system that is highly efficient and effective for the entire enterprise. The weakness of this model is that it can become too rigid or inflexible for stakeholders. If this model is used, the City of Berkeley would benefit from a well-run efficient machine with few redundant processes, but the City must be careful not to isolate stakeholders. Many cities usually shy away from the centralized model, since it has a comparatively higher start-up cost than the other models. However, a mature GIS that already has a strong GIS investment, could benefit from this model and show an immediate return.

The second type of model for GIS governance is a **decentralized** structure. A decentralized organizational structure divides GIS responsibilities throughout various departments. Decentralized organizational structures may still have a GIS section/division, operating independently or under the jurisdiction of another department. This approach divides system and data maintenance between the GIS section/division and departmental end-users. During their course of daily business, users update an enterprise database (e.g., using Arc Editor to edit data). All users share responsibility for maintaining the GIS, and users within each department maintain specific data according to their thematic disciplines and specialties. This type of organizational structure enables the GIS section/division to focus on hardware and software maintenance, data exchange and distribution, application/data design and development, user training and support, community extension, and technology innovation, instead of devoting time to the creation and maintenance of data.



Decentralized GIS Organizational Structure

When a **Decentralized** GIS organizational structure is implemented properly, benefits include:

- Ability for departments to guide GIS activity independently from organizational initiatives
- Bottom-up decision making
- Line departments that are more sensitive to user needs since they are in close proximity to the developers
- Clear lines of responsibility within the department
- Facilitation of multi-tasking
- Multiple funding sources for large projects and initiatives
- Shared resources and costs between two departments or sub-divisions
- Willingness for staff to help each other.

When not implemented properly, the difficulties associated with a **Decentralized** model include:

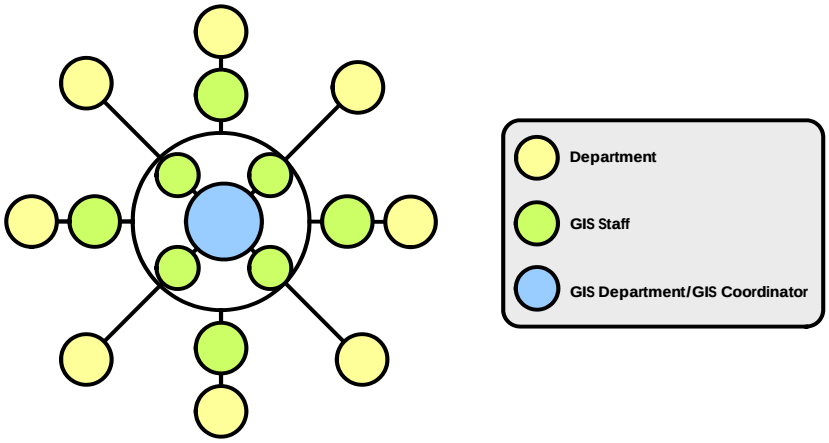
- Requires strong communications, paper work and bureaucracy to forge agreements between multiple departments
- Redundant roles and functions existing between departments
- Guided by individuals rather than by teams
- Multiple GIS and applications
- Databases and skills that are often fragmented throughout the enterprise
- Overhead costs that are not shared and often much higher
    - redundant effort in multiple departments
    - multiple copies of data being edited and stored in several locations
- Difficulty in standardizing software

- Poor data sharing and isolated databases
- Staff wearing multiple hats and sacrificing GIS competency to day-to-day departmental operations or tasks unrelated to the GIS field
- Staff competing with each other for funding or recognition instead of working together.

This model is often used in governments that do not have a strong GIS competency in a central location, especially smaller governments and those that initially begin using GIS. Small jurisdictions or single departments that have a low volume of GIS work depend on this model, especially when workers have to multi-task with departmental operational duties (i.e. wearing multiple hats). It also has a lower start-up cost for the departments and smaller jurisdictions that make it more attractive for first-time users.

The benefit of a decentralized model is a defined structure where stakeholders pool their resources and work together to build a GIS. The model is flexible and ensures that stakeholder needs are addressed. However, the risk is that it can become difficult to coordinate and negotiate. It requires strong communications and leadership to hold the system together. Redundant data capture, staff, funding, and initiatives often occur in this model. If used, the City would need to be aware and implement many teams and committees to serve as a check and balance to the divergent needs.

Many local governments utilize a **hybrid** GIS organizational structure, based on centralized and decentralized organizational models. This type of structure provides the benefits of both organizational models in scenarios where full implementation of either organizational structure cannot be readily attained.



Hybrid or Matrix GIS Organizational Structure

A Hybrid/Matrix model uses dual accountability along functional lines. Each particular GIS function is listed in a matrix. The matrix is divided among the stakeholders who are grouped into functional teams. The teams can exist either in a single department or serve multiple departments. Each stakeholder team is assigned a role that is closely related to their business function. Over time the individual team members become very competent at managing their smaller implementation piece. If a team member leaves or is on extended leave, then the function continues because the other team members in the matrix pick up the slack. The Hybrid model works very well in large organizations that can devote the time and money to fund the teams and to coordinate from a central group or business unit responsible for overseeing GIS while stakeholders focus on GIS related business requirements.

When successfully implemented, the Hybrid model can benefit organizations in many ways, such as through:

- Shared costs
    - database management and maintenance
    - network and server resources
    - highly specialized GIS staff
- Improved efficiency
    - integrated multi-departmental solutions can be implemented
    - central data warehouse
    - team based processes (critical functions are no longer one person deep)
    - improved data quality
    - departmental ownership of relevant datasets is maintained
    - automated validation routines
    - real-time distribution of data
    - Improved end-user support (Feedback from users is immediate since each team sits in close proximity to the work. They can hear and see firsthand what needs to be fixed.)

If not implemented successfully, the Hybrid model can be difficult for several reasons:

- Roles are not clearly defined, making expectations unclear.
- Unnecessary bureaucracy from too many standards or too many agreements and negotiations.
- No clear direction from leadership. Stakeholders end-up setting their own priorities and looking out for their own needs.

- Insufficient funding. Critical functions could be cut by a single department, hurting the remainder of the enterprise.
- Smaller departments with small staffs may be left out of the planning process and miss out on opportunities to participate.

The major benefit from the Hybrid model is its flexibility. Stakeholders actively participate in the design and project planning stages. Stakeholders work together while dividing and sharing the GIS functions. The GIS central body is responsible for overall professional direction, career development, GIS system architecture, applications, license pools, and delegating project work. The intra-departmental stakeholder teams are responsible for data capture, data edits, quality control and cartographic output. Stakeholders pool resources and cross-train team members from different departments. Redundancy is reduced, since there is a central command structure made up of a GIS Coordinator and key GIS technical staff. Flexibility and departmental expertise are ensured, since the stakeholder team's work within the departmental structure on specific end-user functions. If funding or leadership is lacking in a single department, then the other departments compensate. Smaller departments are involved since they have equal share in the decision making process and they are supported by intra-departmental teams.

The Hybrid model risk is that if there is no clear direction and agreement among participants concerning roles and responsibilities, it may devolve into the decentralized model and redundant processes will emerge. There is a risk that too many formal agreements and formal meetings will make decision making confusing and hamper productivity. People may not understand the system and may make up their own systems just to be functional. Strong communications, GIS knowledge, and leadership are required to make it run. The City of Berkeley would benefit from the Hybrid model since it is a mature system with extremely competent and well educated professional GIS staff. The City of Berkeley would see an immediate return if this model was adopted.

Definitions Summary of Organizational Structures

Centralized Organizational Structure:
All GIS tasks, except data viewing and analysis, are handled by a central GIS department or division. All GIS staff are located within the central GIS department or division.

Decentralized Organizational Structure:
GIS data updating and maintenance responsibilities are assigned to individual GIS-participating departments. Departments have their own GIS staff members.

Hybrid Organizational Structure:
GIS tasks may be handled centrally or at the department level, depending on the needs and available GIS staff at individual departments.

GTG interviewed nine similar city based GIS initiatives to get an understanding of how they are governing and managing their GIS. The cities were chosen based on similar characteristics. City staff was asked to provide a list of candidate cities to interview and a few additional cities outside of this list were included. Phone interviews and questionnaires were employed to garner the needed information. The table on the following pages summarizes the findings of nine case studies and illustrates that the preferred model for the management and governance of GIS is the "hybrid" model.

Industry Best Practices

GTG interviewed nine comparable cities in regards to their governance and best practices. From the interviews of the nine comparable city GIS implementations, it is possible to get a sense of what implementation practices lead to success. Additionally, experience with cities and counties across the United States has allowed for the identification of best practices that lead to successful enterprise-wide GIS success. The following items are considered to be best practices that lead to GIS success:

- Executive Champion - Communities that have been successful in their GIS have had this individual at the highest levels of the organization and have been able to bring parties together to develop a shared vision of the benefits a GIS can bring to the community. An Executive Champion is typically a Mayor, City Manager, CIO, or Councilperson. In some cases, it was noted that this was a group of individuals.

- Steering Committee – Almost all of the communities surveyed utilized a Steering Committee in the formative period of GIS implementation. The Steering Committee typically shapes the funding for and the direction and policy of the initial project. While in some cases the Steering Committee would disband after the initial implementation, it was also noted that the Steering Committee was reformed when a second or updated Strategic Plan was undertaken.

- GIS Organization – In analyzing GIS growth and ability to permeate the enterprise, it was apparent from the interview process that communities that have moved to a Hybrid model of GIS governance have had the most success. These are the communities that have been able to provide GIS services as a back-office support and application development functionality. These same organizations have put the tools for data development and maintenance into the hands of the departments that have the subject matter experts (SME) and expertise. This has helped these organizations with further integration of the GIS at the disparate database level, such as integrating with customer databases, permit databases, etc.

- Awareness, Training, and Access – During the survey it was noted that successful implementations did a good job of making the user community aware of the GIS through the Steering Committee and/or User Groups. A greater measure of success was also noted where communities were able to provide access to their departments and the general public to the developed data.

On the flip side are those organizations that, while having some success with their GIS implementation, have been unable to fully integrate GIS into the enterprise and the daily workflow of their departments.

One example of this is a community where GIS is decentralized in its implementation. While the community has a GIS Manager and there are departments within the organization utilizing GIS, the Coordinator only works with a few departments. The other departments utilizing GIS are developing their own data and managing it on a central server, but only for their own departmental needs. This has led to minimal awareness and a limited utilization of GIS within the community. For the interviewed cities, the status of the above key elements is summarized in the chart below.

Table 1: Summary of Comparable Organizations Governance and GIS Management Strategies

	Woodland, California	Glendale, California	Hoover, Alabama	Guelph, Ontario Canada	Roswell, Georgia	Carlsbad, California	Burbank, California	Columbus Consolidated Government, Georgia	Walnut Creek, California	Los Angeles, California	Douglas, Nebraska	Santa Monica, California	Greenville, South Carolina	Pasadena, California	Culver City, California	Woodland, California	Sunnyvale, California	Roseville, California	West Hollywood, California	Grand Rapids, Michigan	BEST PRACTICES
How many years has the GIS department been established?	15	22	15	5	27	15	20	19	9	11	12	17	29	11		10	4	12	0	20	14
Was the GIS department spearheaded by an executive champion/group?	✓	X	X	✓	✓	X	✓	X	✓	✓	✓	✓	✓	✓	✓	X	X	✓	✓	✓	✓
GIS Steering Committee at start of GIS Division?	✓	✓	X	✓	X	✓	X	X	X	✓	✓	X	X	✓	✓	✓	X	✓	X	X	Even
Currently have a GIS steering committee	✓	In Progress	✓	✓	✓	X	X	✓	✓	✓	✓	Proposed	X	X	X	X	X	✓	X	✓	✓
Is there a user's group in place?	✓	In Progress	✓	✓	✓	✓	✓	✓	✓	✓	✓	Proposed	X	X	✓	✓	X	✓	X	✓	✓
Where is GIS?	IT	IT	Information Reporting Systems	IT	Community Development	IT	IT	IT	IT	CIO	Stand Alone Dept.	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT
How many full-time GIS staff?	7	7	1	2	4	1	3	5	2	15	4	1	5	3	4	1	2	6	1	4	4
Is the GIS centralized, decentralized, or hybrid (both)?	Hybrid	Centralized	Hybrid	Hybrid	Hybrid	Hybrid	Centralized	Hybrid	Decentralized	Hybrid	Hybrid	Decentralized	Centralized	Hybrid	Centralized	Hybrid	Hybrid	Hybrid	Centralized	Hybrid	Hybrid
Who currently maintains the GIS data?	Responsible Depts.	Responsible Depts.	Responsible Depts.	Responsible Depts.	GIS Division; Some Depts.	Responsible Depts.	Responsible Depts.	Responsible Depts.	Responsible Depts.	Responsible Depts. Make changes, GIS reconciles	Responsible Depts.	Responsible Depts.	Central GIS Group	Responsible Depts.	Responsible Depts.	Responsible Depts.	IT & Responsible Depts.	IT & Responsible Depts.	IT	Responsible Depts.	Responsible Depts.
How up-to-date is your data? 1 – 10; 1 – much of the data is out of date. 10 – all data is up-to-date always	9	8	9	8	6	7	9	5	8	8	8	7	9	7	9	7	6	9	8	9	8
Level of data integrity? 1 – 10; 1 – not good, 10 – perfect	9	9	9	7	7	7	9	6	9	8	7	7	9	9	9	7	6	9	9	8	8
GIS Software Vendor?	Esri	Esri	Esri	Esri	Esri	Esri	Esri	Esri	Esri	Esri	Esri	Esri	Esri	Esri	Esri	Esri	Esri	Esri	Esri	Esri	Esri

	Woodland, California	Glendale, California	Hoover, Alabama	Guelph, Ontario Canada	Roswell, Georgia	Carlsbad, California	Burbank, California	Columbus Consolidated Government, Georgia	Walnut Creek, California	Los Angeles, California	Douglas, Nebraska	Santa Monica, California	Greenville, South Carolina	Pasadena, California	Culver City, California	Woodland, California	Sunnyvale, California	Roseville, California	West Hollywood, California	Grand Rapids, Michigan	BEST PRACTICES
Do you have a GIS Strategic Plan?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X	✓	✓	✓	X	✓	X	✓	✓
How aware of the GIS is staff? 1 – not at all, 10 – pervasive knowledge	9	5	9	8	7	8	9	6	7	6	5	9	5	9	7	7	5	9	3	9	7
How aware of the GIS is the general public? 1 – not at all, 10 – pervasive knowledge	2	7	7	7	2	2	2	5	4	6	4	4	5	4	6	2	3	5	2	5	4
How is the GIS funded?	IT/Utility	Different Depts.	Information Reporting Systems/Utility	IT/Utility	General Funds/ Depts.	IT/Utility	IT/Water & Power	General Fund/Depts.	IT	Dept. Subscriptions	County & City of Omaha, Local Planning Agencies	IT & Minimal from other Depts. Using GIS	IT	Established Budget from City	Capital Improvement & IT	IT & Public Works	IT	IT, Electric, & Public Works	IT	General Funds	IT
Approximate annual GIS budget (including salaries)?	$750,000	$750,000	$750,000	$350,000	$425,000	$750,000	$300,000	$300,000	$250,000	$2,100,000	$350,000	$41,000	$600,000	$700,000	$400,000	$200,000	$300,000	$1,000,000	$150,000	$280,000	$537,300
What are some of your most successful GIS projects?	Web Browser/Field Tools	CityWorks. ArcFM, Web Mapping	Web Browser, Field Tools, LGIM	Mobile Solutions	Field Tools, Web Viewer, Story Maps	Web Browser, Field Tools	GIS Viewer, Story Maps	Esri Parcel Fabric	Story Maps, Tree Inventory	Solar Map App, Plan & Zone, App, Address Verification, App, Data Download Portal	Public GIS tools & Snow Removal App	Online bicycle maps, Crime Data Analysis	Internal Web Maps	Imap Implement-ation	Utilities data layer mapping with hyperlinking	Public Works GIS based work order system	Data Layer	Base Layers, Intranet Work Order System	None, just Story Telling	Pothole App & Citizen Notify	Web Browser, Story Maps
Do you integrate GIS with other IT systems?	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	X	✓	✓
Do you pull data from other IT systems into your GIS?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	X	✓	✓
Heavy using departments?	Utilities, Planning, Public Works	Electric, Water, Public Works, Planning	Utilities, Planning, Public Works, City Clerk, Public Safety	Engineering, Planning, Solid Waste Resources	Environmental/ Public Works, Transportation, Parks & Rec.	Utilities, Public Works, Planning	Police, Fire, Planning, Public Works, Water and Power	Planning, Engineering, Public Works, Utilities, Fire, Police	Planning/ Building, Police	Planning. Public Works, Assessor, Fire, Sheriff, EMS, Parks, Family Services	Public Works, Planning, County Assessor, Engineering	Public Safety, Utilities, Planning		Water, Power, Planning, Police, Transportation, Public Works	Engineering, Public Safety, Community Development	Public Works, Planning	Dev. Services, Public Safety	Electric, Public Works, Fire, Police, Dev. Services	Just Starting	Public Safety, Planning, Public Works, Utilities	Public Works, Planning, utilities, Public Safety
Biggest challenges your city faces?	Organizational Governance, Alignment of Goals	Departmental Data Silos	Staffing & IT Structure	Crowd-sourcing App	Development Standards	Alignment of organization goals	Database Solutions	Data Integrity, Maintaining Governance Model	Improve Traffic, Security Cameras/Public Safety/License Plate Readers	Efficiency with government & public communication & collaboration among depts.	Staff awareness of available tools & resources, Lack of personnel	Asset management	Commitment from depts., missed opportunities, lack of communication	Breaking down data silos	Large amount of IT/GIS work with limited funding & resources	Enterprise-wide adoption issues, lack of funding	Buy-in from depts.	Work-load & prioritization	Implement ation	GIS to become more cost effective, managing data relative GASB	Lack of Funding

Industry Best Practices		City of Berkeley, CA
Hybrid	Compared to	Light

70% of respondent's have a hybrid GIS governance model. It is recommended that the City migrate from a centralized model to a more sustainable hybrid model.

Average # of Staff – 4	Compared to	1

The average number of full-time GIS staff was 4. It is recommended that the City fill the vacant GIS Manager position and re-evaluate additional GIS Technicians or interns to fill gaps in the future as needed.

90% house GIS in IT	Compared to	GIS housed in IT

90% of respondent's house GIS within IT. The City should continue with the current trend.

70% HAVE GIS Steering Committee	Compared to	DO NOT HAVE GIS Steering Committee

70% of respondents have a GIS Steering Committee. The City should move forward with establishing a GIS Steering Committee within the existing IT Executive Committee.

75% HAVE GIS User Group	Compared to	Ad-Hoc

100% of respondents have a GIS User Group. The City should establish a GIS User Group made up of key GIS users across all departments. This group should meet monthly, but at least quarterly.

90% rely on departments to maintain data	Compared to	90%

90% of the respondents rely on each department to maintain their own data. The central GIS group provides oversight, but the departments have ownership of their own data.

Industry Best Practices		City of Berkeley, CA
Esri	Compared to	Esri

All respondents use Esri as the de facto GIS software of choice. The City should continue to leverage Esri for key GIS software.

70% Knowledgeable of GIS	Compared to	50%

70% of respondents felt their user base were knowledgeable in regards to GIS and how it benefits their day-to-day operations. The City should ensure a GIS training plan is established and followed which will educate staff on the benefits of GIS within each of their respective departments.

$537,300 Avg. GIS Annual Budget	Compared to	$200,000

The average annual budget for GIS amongst the respondents was $537,300. The City should consider all GIS components when preparing the GIS budget each year.

95% HAVE Enterprise GIS	Compared to	50%

95% of the respondents have an integrated and interoperable enterprise GIS. Most of the organizations push GIS data into enterprise systems and/or pull data from enterprise systems into GIS. The City should follow the recommendations of this plan to integrate GIS and enterprise IT systems with each other moving forward.

80% Data Accuracy	Compared to	60%

The average confidence level regarding data accuracy was 80%. The City is in a good place currently, but should continue to improve each of the data layers as deemed a priority. A nearby organization leveraged several high-level GIS interns over a period of time to update key GIS data layers. This may be an item of consideration for the City moving forward.

Table 2: Governance Model Comparison

The table below ranks the potential benefits for each governance model. Additionally, it ranks the typical challenges that are faced when implementing a governance structure. Thumbs up and thumbs down icons are used to represent how each model performs for each element.

City of Berkeley, California Governance Model Comparison Chart			
Potential Benefits to the Organization:	Centralized Model	Decentralized Model	Hybrid Model
• Clearly Defined Roles Reducing Conflicts or Confusion About Service • Enterprise Level Direction and Goals • Central Chain of Command (Top-Down Solutions) • Clear and Straight Forward (I need a map) • Quick and Fully Informed Decision Making • Predictable Format	👍👍	👍	👍👍
• Shared Costs Reduced • Database Management and Maintenance • Network and Server Resources • Highly Specialized GIS Staff	👍👍👍	👍	👍👍👍
• Achieving Stakeholder Needs • Departments Contribute GIS Input and Resources • Sensitive to Department and User Needs	👍	👍👍	👍👍
• Reduction Duplication • Data (Multiple Copies of Data) • Effort (Data Creation and Maintenance) • Project Initiatives and Expenses	👍👍👍	👍	👍👍👍
• Improved Data Sharing/Integration with Other Business Systems • Enterprise Systems • Multi-Departmental Solutions • Central Access Point	👍👍	👍	👍👍👍
• Institutional Legacy • Team-Based Processes • Cross-training of Employees • Fail-Safe Critical GIS Functions and Tasks (beyond one person deep)	👍👍👍	👍👍	👍👍👍

• Clear Departmental Expectations • Responsibilities • Participation • End-user knowledge			
Expected Challenges to the Organization	**Centralized Model**	**Decentralized Model**	**Hybrid Model**
• Potential for Too Many Standards (formal agreements proliferate) • Too many meetings and committees • May Require Extensive Negotiations • Difficult to understand			
• Potential for too Rigid Standards (more time is devoted to following standards and the letter of the law and less to the original purpose of the program)			
• Funding Risks (if funding is suddenly cut) • All the eggs are in one basket			
• Exclusion of Smaller Departments (if everyone is not equal) • Funding • Service • Technology			
• Risk for Departmental System Isolation (everyone does their own thing) • Solo Initiatives • Lack Enterprise Cooperation • Risk of pull outs or refusals to participate			

3.0 EXISTING GIS GOVERNANCE CONDITIONS

The following section summarizes the existing governance conditions of the City as seen from the "Voice of the Customer." The Online GIS Needs Assessment Questionnaire, completed by 37 City staff in 11 different departments, revealed a wealth of information about the existing GIS governance within the City. Most users who participated in the survey believed they had a moderate understanding of GIS and its capabilities, however, those users actually used GIS less than 25% of the time, or in some cases not at all. Most staff reported using paper maps, and did not maintain GIS data. It was also revealed that 50% of staff did not feel that the existing GIS governance was working, and that there were no clear lines of responsibility and communication regarding GIS within the City. Over half of the users surveyed went to the GIS Program Manager for their GIS and mapping needs. A lack of training and education was shown in several answers.

LIST OF KEY DOCUMENTS

- 2011 WATERSHIP MANAGEMENT PLAN
- 2009 CLIMATE ACTION PLAN
- EXAMPLES OF GIS MAPPING FOR RENT CONTROLLED HOUSING
- IT STRATEGIC PLAN SPREADSHEET
- PICTOMETRY PROPOSAL
- JOB DESCRIPTIONS- SEE LIST
- WALL MAPS (GIS)
- TRANSPORATION PLAN (2015)
- GIS WORK PLAN
- GIS STEERING COMMITTEE (AGENDA) 2013
- RESILIENCE STRATEGY
- DIGITAL STRATEGIC PLAN AND ROADMAP 2016 THIRD WAVE
- STANDARD DIRECTORY STRUCTURE (SOP)
- GENERATING METADATA (SOP)
- STRATEGIC DATA STANDARDS (SOP)
- GIS NAMING CONVECTIONS (SOP)
- GIS 101 – TRAINING POWER POINT
- ON-LINE GIS CLASSES (FREE)
- ETL OVERVIEW DOCUMENT
- ARCHITECTURAL DIAGRAMS
- PARCEL POPPER (2012) SYSTEM DOCUMENTATION
- GIS INFORMATION PRODUCTS GUIDE
- IMAGES OF THE FOLLOWING
  - GIS PORTAL
  - PLANNING MAP
  - CONNECT EXPLORER
- LGIM FEATURE CLASS
- CUSTODIANSHIP OF DATA LAYERS
- APPLICATION INFORMATION (SENATE BILL SB 272 COMPLIANCE
- PROJECT COST FY16 THROUGH FY19
- IT MASTER PLAN FY2009 - 2011
- ENTERPRISE GIS TEAM CHARTER

The Strengths of the Enterprise GIS and Open Data Coordinator

Ms. Cristi Delgado is the City's Enterprise GIS and Open Data Coordinator. Ms. Delgado's success has included:

1. Maintaining all GIS data in a central repository and supporting over 100 GIS users throughout various City departments.
2. The creation of an annual GIS work plan
3. The development of a Master Data List (MDL)
4. Coordinating the deployment of multiple Internet and Intranet GIS solutions
5. Providing GIS technical support to all users, as well as, maintaining a culture of collaboration across City departments.
6. Supporting multiple GIS initiatives as documented in the List of key documents.
7. Managing the LGIM migration
8. Developing GIS Wall maps

9. and much more

Prior to beginning the GIS Needs Assessments (Milestone 1), Ms. Delgado provided a list of key documents (above), giving insight into the existing GIS structure within the City and demonstrating that the City of Berkeley had a strong GIS foundation. Ms. Delgado was also successful in creating an Enterprise GIS Team Charter, as well as multiple Standard Operating Procedures (SOPs) pertaining to the creation and maintenance of Metadata and Naming Convections. Some of these initiatives have essentially died or have been forgotten.

The most significant success and good business practice the has accomplished is the assortment of "Web App Builder" applications Ms. Delgado has planned, designed and published for the City departments and the public. This is a showcase for the City of Berkeley.

GIS Governance Gaps – Existing Weaknesses

After collecting data from the Online GIS Needs Assessment Questionnaire and conducting departmental interviews within the City, the following GIS governance weaknesses were identified:

- Lack of a GIS Strategic Plan
- Lack of Job Classifications
- No GIS Steering Committee
- No GIS Sponsor Team
- No GIS Technical Committee
- No GIS Functional Groups
- Lack of a Measure of Quality of Service
- No Grants and Funding Initiatives
- No GIS Coordination Tasks
- Lack of Key Performance Indicators
- No GIS Blog or Newsletter Published

Additionally, a number of GIS governance items (below) already existed within the City, but could be improved:

- A GIS Vision, Goals and Objectives
- A formalized governance model
- GIS User Groups
- GIS Policy and Mandates
- User Sensitivity
- GIS Authority and clear lines of responsibility
- An annual detailed GIS Work Plan
- Alignment with Organization's overall Vision, Goals and Objectives

Desired GIS Governance Outcomes

By combining results from the online questionnaire, departmental interviews, and information provided by the Enterprise GIS and Open Data Coordinator, Cristi Delgado, the following major GIS needs were identified within the City of Berkeley:

- Departmental goals and objectives
- Better GIS governance and lines of responsibility
- More technical support options
- Better data accuracy
- More GIS training
- Better access to GIS data
- Better utilization of GIS as a whole

Existing Governance Model

The term governance model refers to the constellation of relationships between individuals and departments within the City. A governance model lays out lines of responsibility and the hierarchy of decision making power within the City. These lines connect executives, managers, and staff, or more broadly the stakeholders. Formalizing a governance model allows the City to maximize accountability and efficiency. It designates the tasks each organizational entity must accomplish.

The City of Berkeley is currently operating with a weak hybrid governance model, shown below. The Information Technology department is the central department, maintaining all GIS responsibilities, where users are ultimately relying on the Enterprise GIS and Open Data Coordinator Ms. Cristi Delgado for their GIS needs.

A stronger hybrid approach is recommended for the City of Berkeley's enterprise GIS, and will be further discussed later in the Training Plan and Staffing section of this document.

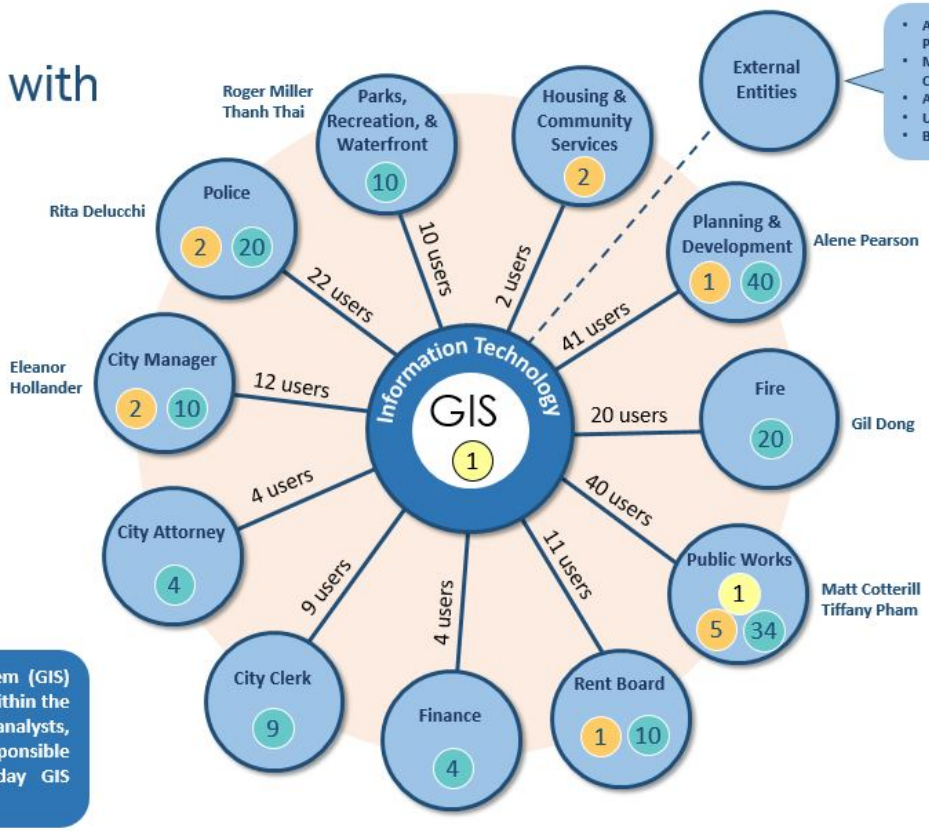
GOVERNANCE MODEL
City of Berkeley: Existing GIS Governance

A **Weak Hybrid Governance Model** with Corporate-Wide GIS Users

Existing

The City of Berkeley Geographic Information System (GIS) hardware, software, data, and policy are managed within the Information Technology Department. GIS analysts, distributed throughout several departments, are responsible for maintaining data and meeting the day-to-day GIS business needs of departments.

<u>Existing</u> ELA Price Per Seat
$1,176



- Alameda County – Cost Sharing Pictometry Agreement
- Metropolitan Transportation Commission
- Association of Bay Area Governments
- Utility Companies- Gas and Water
- BayGeo (Ended)

3RD Party Software

- ✓ **Accela**
- ✓ **Sungard**
- ✓ **New World Systems**
- ✓ Code Red
- ✓ Data 911
- ✓ Alpine RedAlert
- ✓ RealQuest
- ✓ OnBase
- ✓ Xerox eTIMS
- ✓ Chameleon
- ✓ Lagan
- ✓ **Route Smart**
- ✓ AutoDesk Civil 3D
- ✓ **Street Saver**
- ✓ Cross Roads
- ✓ Pacsoft
- ✓ Quick Net
- ✓ FastLook
- ✓ DECADE
- ✓ CALREADY
- ✓ Active Net

City of Berkeley Esri 3 year ELA License = $207,000

4.0 TWENTY-SIX SPECIFIC BEST INDUSTRY BEST GIS GOVERNANCE PRACTICES AND RECOMMENDATIONS

The following tasks are recommendations based on best GIS business practices in local government, and GTG's understanding of the key factors for deploying an enterprise and scalable solution that will sustain City of Berkeley well into the future.

City of Berkeley GIS Organizational Structure

How ready is the City of Berkeley for an enterprise, sustainable, and enduring GIS? The answer to this question must be organized around how effective is the City's existing management strategy and how can the City change the way it operates to meet the future demands of all departments for GIS technology?

GIS governance is the first and critical step in creating and maintaining an enterprise, sustainable and enduring GIS. Without good GIS governance and a good governance model within an organization, there is a lack of cohesion and authority as well as clear lines of communication, and accountability. Good GIS governance creates a vision, and goals and objectives, and ensures GIS usage that is both attainable and beneficial for all departments. A good governance model is essential ingredient in building a true enterprise, sustainable and enduring GIS.

If the aim of implementing geo-spatial technologies is to improve organizational effectiveness and efficiency, then selecting a governance strategy is a critical key to success.

26 Specific Governance Tasks:

In order to meet the objective above, the following 26 tasks are recommended for the City of Berkeley:

Task 1: Adopt a New Hybrid GIS Governance Model and Staffing Plan by Hiring Two New GIS Staff within IT and changing operations.

The City of Berkeley needs to change its existing weak hybrid governance model to a true enterprise hybrid model that will enable more staff to take custodianship of data, perform more sophisticated analysis, and take advantage of more business applications. At the moment the number of GIS users within the organization is relatively high (Approximately 160 Browser users, 13 Analytical Users and 2 Career GIS Specialists). This high number of users is solely due to the deployment of an extensive portfolio of We App Builder applications. This approach is a very clever, efficient, and an ingenious way

of one key individual choreographing a strategy for sharing GIS data and information throughout the organization. The City is still underutilizing GIS and requires a more solid foundation for success. The foundation is found in these 24 tasks.

We can conclude that the City of Berkeley has the look and feel of a hybrid GIS model but lacks the depth of a true enterprise and sustainable hybrid model. The Enterprise GIS and Open Data Coordinator must focus their attention on all 24 tasks listed in this assessment. Please see Staffing Plan in Section D.

Recommended Assignment

- Information Technology (IT) Director

Task 2: Annually update the Enterprise GIS Master Plan

The GIS Strategic Master Plan should be updated annually. The City's roles, vision, and functions constantly evolve. The GIS Master Plan should be updated to stay relevant to Berkeley's vision, goals and objectives, as well as the practical aspects of implementation.

Recommended Assignment

- Enterprise GIS and Open Data Coordinator

Task 3: Develop a GIS vision, goals, and objectives

The larger vision of the City must be broken down into concrete goals. The vision, goals, and objectives of GIS technology must align with the City's vision and have measurable objectives. The City should update its visions, goals, and objects to align with the current environment.

Recommended Assignment

- Consultant and Enterprise GIS and Open Data Coordinator

Task 4: Define GIS job descriptions

The various positions within the City should be classified according to the formalized governance model. The City should adopt a GIS job classification structure. This will include developing job descriptions for new GIS Technicians.

Recommended Assignment

- IT Director, HR Department and Enterprise GIS and Open Data Coordinator

Task 5: Develop a coordinated GIS Enterprise

A coordinated GIS enterprise refers to a situation where the City's GIS governance model allows for the Enterprise GIS and Open Data Coordinator to oversee and coordinate all GIS projects as if they were part of the enterprise. The GIS Coordinator should develop and coordinate all GIS activity within the City of Berkeley. This includes a "dual accountability" strategy for the entire organization. This means that all GIS users work closely with the Enterprise GIS and Open Data Coordinator on all things related to GIS.

Recommended Assignment

- IT Director, GIS Steering Committee and Enterprise GIS and Open Data Coordinator

Task 6: Create and enforce new GIS steering committee

A GIS steering committee is a group that is composed of top level organizational leaders and GIS specialists. A coherent GIS steering committee is crucial for a smooth implementation process, as it allows direct interfacing between executive decision makers and GIS experts. The City of Berkeley should create a GIS Steering Committee comprised of directors from each department, as well as develop a strategy for the Steering committee's goals and objectives. A Steering Committee is very important to ratify the "dual accountability" environment.

Recommended Assignment

- IT Director, Department Directors and Enterprise GIS and Open Data Coordinator

Task 7: Consider a GIS sponsor team approach – *Optional Task*

The GIS sponsor team is composed of executive leadership or an executive leader. This person is responsible for championing the GIS cause, resource acquirement, and budgeting that is related to the GIS implementation process. The sponsor team also mediates the relationship between GIS directives and the City's larger vision.

Recommended Assignment (optional)

- Enterprise GIS and Open Data Coordinator

Task 8: Use the Technical Governance Committee as the de-facto GIS Governance/Technical Committee

As the name implies, the GIS governance/technical committee oversees all of the governance and technical challenges of deploying an enterprise GIS. It sets standards for governance and for ways that GIS data are gathered, managed, and shared in the City. Most of what this committee does is related to systems architecture and IT infrastructure. Berkeley does not currently have a GIS governance/technical committee but will performing these functions using the existing Technical Governance Committee. This committee may depend on any large GIS related initiatives.

Recommended Assignment

- Enterprise GIS and Open Data Coordinator

Task 9: Formalize a City GIS user group

A GIS user group is a cohort of stakeholders who share information and compare experiences with GIS technology for the benefit of all members. The proposed GIS Steering Committee in coordination with the Enterprise GIS and Open Data Coordinator should select who participates in the GIS User Group and develop a strategy for the GIS User Groups goals and objectives.

Recommended Assignment

- Enterprise GIS and Open Data Coordinator

Task 10: Regionalization of GIS

Regionalization is a formalized agreement between parties or entities to cooperate. In relation to geospatial technologies, regionalization is the sharing of data, resources, applications, training, and education and more between disparate groups of GIS users in the region seeking to pool their resources and achieve similar goals. The City should adopt memorandums of understanding (MoUs) to guide the regionalization of GIS technologies.

Recommended Assignment

- Enterprise GIS and Open Data Coordinator

Task 11: GIS policy and mandates

Policies refer to procedural codes of conduct that are ratified and enforced by organizational authorities. The City should establish a set of standards and procedures for the development and maintenance of

geospatial data including Office-to-Field--Field-to-Office procedures, GPS Quality Standards, Versioning, CAD Standards, Digital Submission Standards, Cartographic Standards, and GIS Business Integration (Refer to Milestone 2 Technology Readiness and Architecture Assessment for SOP development best practices).

Recommended Assignment

- Enterprise GIS and Open Data Coordinator

Task 12: Measure user sensitivity

User sensitivity refers to the capabilities of a particular GIS technology to fluidly respond to a user's request for information. User sensitivity is an important measure of the relative benefits of implementing GIS technology. User sensitivity can be managed by using questionnaires, one-on-one interviews, GIS user group feedback, and more.

Recommended Assignment

- Enterprise GIS and Open Data Coordinator

Task 13: Improve GIS collaboration

GIS collaboration refers to the productive cooperation between individuals and entities facilitated by the implementation of GIS technology. High levels of GIS collaboration let the City, derive maximal benefits from enterprise GIS technologies. The GIS Coordinator and Steering committee should ensure that GIS collaboration is present between all City staff and departments.

Recommended Assignment

- Enterprise GIS and Open Data Coordinator

Task 14: Measure quality of service

Measuring quality of service refers to the City's capacity to gather feedback data about the efficacy of its geospatial technologies. The Enterprise GIS and Open Data Coordinator should measure satisfaction levels annually using an online questionnaire and feedback at User group meetings. This should be reported to the Steering committee.

Recommended Assignment

- Enterprise GIS and Open Data Coordinator

Task 15: Identify GIS authority and clear lines of responsibility

A line of responsibility describes the vertical chain of liability and authority in the City. In common-sense terms, a line of responsibility formally lays out who is responsible for what and to whom. The City's GIS users typically rely on its Enterprise GIS and Open Data Coordinator to do their work for them, whereas this should not always be the case. The City should create clear roles and responsibilities, notifying all GIS users of those roles and responsibilities.

Recommended Assignment

- Enterprise GIS and Open Data Coordinator

Task 16: Continue to use the City's existing GIS budget or funding model

A GIS budget does currently exist within the City's overall IT budget, and should be maintained by the Enterprise GIS and Open Data Coordinator.

Recommended Assignment

- Enterprise GIS and Open Data Coordinator

Task 17: Explore GIS grants and funding initiatives for the City of Berkeley

A funding initiative allows a government organization to diversify the funding for its GIS initiative. The Enterprise GIS and Open Data Coordinator must pursue grants for GIS software, data, training, and staff.

Recommended Assignment

- Enterprise GIS and Open Data Coordinator

Task 18: Develop an annual detailed GIS work plan

A work plan proposes the schedule and budgeting for a specific project. The work plan associated with a GIS initiative should be updated on an annual basis to reflect the evolving needs and priorities of a GIS enterprise organization. The Enterprise GIS and Open Data Coordinator should create and maintain an annual GIS work plan that details all departmental support.

Recommended Assignment

- Enterprise GIS and Open Data Coordinator

Task 19: GIS coordination tasks

The GIS Enterprise GIS and Open Data Coordinator must coordinate and participate in all the GIS tasks within the City. Objective-driven assignments are given to each department or individual within the City. The GIS Coordinator should support and manage each GIS project.

Recommended Assignment

- Enterprise GIS and Open Data Coordinator

Task 20: Develop Key Performance Indicators (KPIs) for the GIS initiative

Key performance measures or key performance indicators (KPIs) are organizationally ratified metrics that gauge whether and how specific goals are met by the City. These objectives, numeric representations of success or failure are crucial when comparing the costs and benefits of the GIS initiative.

Recommended Assignment

- Consultant and Enterprise GIS and Open Data Coordinator

Task 21: Create a GIS blog or newsletter

A GIS blog or digital newsletter is produced by the City in order to increase communications around a GIS initiative. It provides transparency and accountability by keeping stakeholders and citizens in the loop through easily accessible media. The City currently has no GIS blog or newsletter being produced.

Recommended Assignment

- Enterprise GIS and Open Data Coordinator

Task 22: Create and maintain a GIS culture of collaboration among stakeholders

A culture of collaboration refers to an attitude that is expressed by stakeholders in their relationships to one another, as it pertains to an enterprise GIS. The City of Berkeley currently has a good standing GIS culture of collaboration, but improvements can still be made to improve overall collaborative.

Recommended Assignment

- Enterprise GIS and Open Data Coordinator

Task 23: Alignment with City's overall vision, goals, and objectives (Resilience Strategy)

The enterprise GIS needs to be aligned with the City's vision, goals, and objectives; otherwise, it serves no purpose. The Enterprise GIS and Open Data Coordinator should align all GIS activity and initiatives with the City's overall vision, goals, and objectives (outlined in the City of Berkeley's Resilience Strategy).

Recommended Assignment

- Enterprise GIS and Open Data Coordinator

Task 24: Develop enterprise and departmental Service Level Agreements (SLAs)

The parameters of an SLA are defined by the KPIs that are relevant to the technologies in question. The City should develop both an enterprise and departmental SLAs.

In terms of GIS, Service Level Agreements (SLAs) are formal, binding agreements that outline what stakeholders can expect from an enterprise GIS. These agreements can document how the GIS group will support each department within the City of Berkeley. SLAs can also describe the scope of services enterprise GIS will provide to department users, as well as any limitations to be noted.

The City of Berkeley has no existing SLAs within the enterprise or its departments. It is recommended that SLAs be created for both the enterprise as a whole, as well as between individual departments and the GIS Enterprise GIS and Open Data Coordinator, to document how GIS support and responsibilities will be handled.

Enterprise SLAs will document how the City and those responsible for maintaining the geo-spatial systems will interact. Roles and responsibilities for both the City and its stakeholders (both internal and external) and the GIS will be detailed and agreed upon.

Departmental SLAs will document how City departments and the GIS group will interact. This will include agreements concerning data maintenance, technical support, and data accessibility. Detailing roles and responsibilities and solidifying them using these SLAs will maintain a coordinated effort for the effective use of GIS within the City of Berkeley. These SLA documents should be signed by the department head and the Enterprise GIS and Open Data Coordinator, binding the agreement set forth within the SLA document in formal manner, thus confirming greater adhesion to the guidelines stated.

Recommended Assignment

- Consultant and Enterprise GIS and Open Data Coordinator

Task 25: Develop a New Staffing Plan

The City's staffing plan should reflect a Hybrid governance model approach and promote enterprise GIS users.

Recommended Assignment

- Consultant and Enterprise GIS and Open Data Coordinator

Task 26: Develop a GIS Training Plan

The training plan should include the existing five year GIS budget and all existing IT support services that are an important part of the success of an enterprise GIS, as well as funds for annual GIS consulting services.

Recommended Assignment

- Consultant and Enterprise GIS and Open Data Coordinator

5.0 TRAINING AND STAFFING PLAN

Recommended GIS Governance Model – A Hybrid Approach

As discussed earlier, a GIS Governance Model is an organizational structure and process that facilitates GIS technology growth and use within an organization. Governance model implementation can be complex and problematic, but the right governance model is critical for effective technology diffusion. The appropriate governance model is even more important when considering multi-departmental/shared GIS resources.

It is recommended that the City of Berkeley use a true hybrid model approach with the optimum staffing plan. An example of what the hybrid model will look like within the City is shown below:

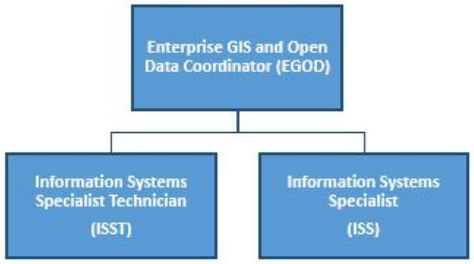
GOVERNANCE MODEL

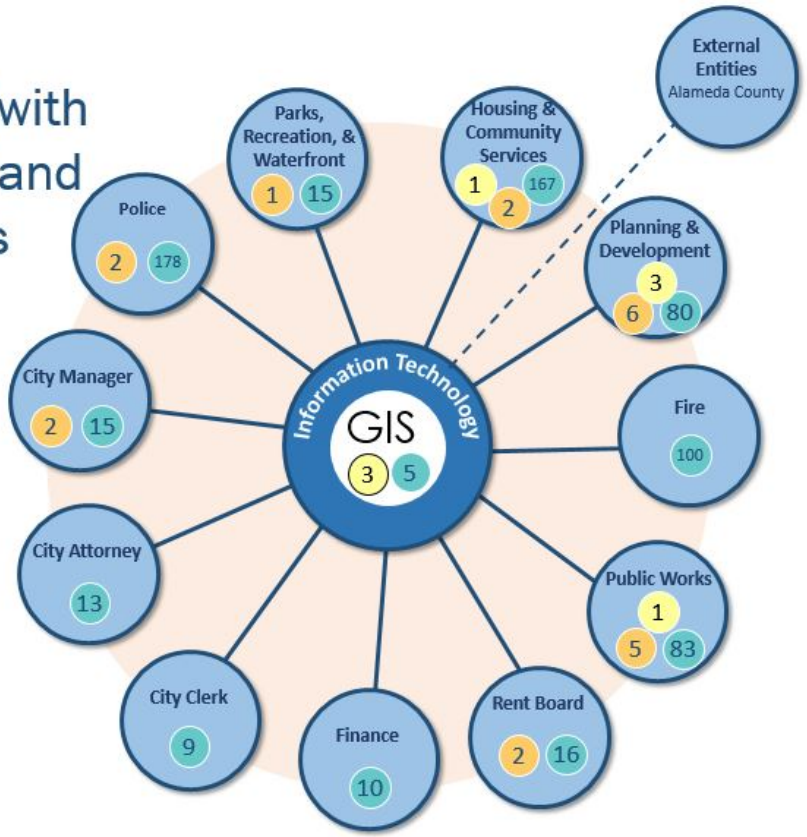
City of Berkeley: Future GIS Governance

A Recommended **Strong Hybrid Governance Model** with Additional GIS Staff and Enterprise GIS Users

Future

GIS Division





Future ELA Price Per Seat
$293

HYBRID GOVERNANCE MODEL

ENTERPRISE SUSTAINABLE OPTION

Pros

1. Enables all departments
2. Increase GIS Users
3. Enterprise solution
4. Sustainable
5. Enduring
6. Emphasis on Training and Education

Weaknesses

1. More departmental training
2. More software
3. More Governance
4. Increase impact of departments

2017 – 2022 GIS Staffing Plan

The following figures illustrate the recommended staffing plan for the City. It considers the existing five year GIS budget and all existing IT support services that are an important part of the success of an enterprise GIS, as well as funds for annual GIS consulting services. The plan reflects the fact that the City will not be hiring any new GIS staff for the next two years. It does not include Software or Hardware costs associated with the five year GIS initiative.

- Year One GIS Staffing Plan
  A. Enterprise GIS and Open Data Coordinator

  Note: This will include IT Support (Application Development, Systems Administration, Technical Ticketing Support), and GIS Outsourcing - Consulting Support (Not to Exceed $200,000 a year) for all GIS activity detailed in the 2017 GIS Strategic plan.

- Year Two GIS Staffing Plan
  A. Enterprise GIS and Open Data Coordinator

  Note: This will include IT Support (Application Development, Systems Administration, Technical Ticketing Support), and GIS Outsourcing - Consulting Support (Not to Exceed $200,000 a year) for all GIS activity detailed in the 2017 GIS Strategic plan.

- Year Three GIS Staffing Plan
  A. Enterprise GIS and Open Data Coordinator
  B. GIS Technician ($75,000 to $90,000) – IT/GIS
  C. GIS Technician ($75,000 to $90,000) – IT/GIS
  D. GIS Technician ($75,000 to $90,000) - Planning
  E. GIS Technician ($75,000 to $90,000) – Public Works

  Note: This will include IT Support (Application Development, Systems Administration, Technical Ticketing Support), and GIS Outsourcing - Consulting Support (Not to Exceed $200,000 a year) for all GIS activity detailed in the 2017 GIS Strategic plan.

- Year Four GIS Staffing Plan

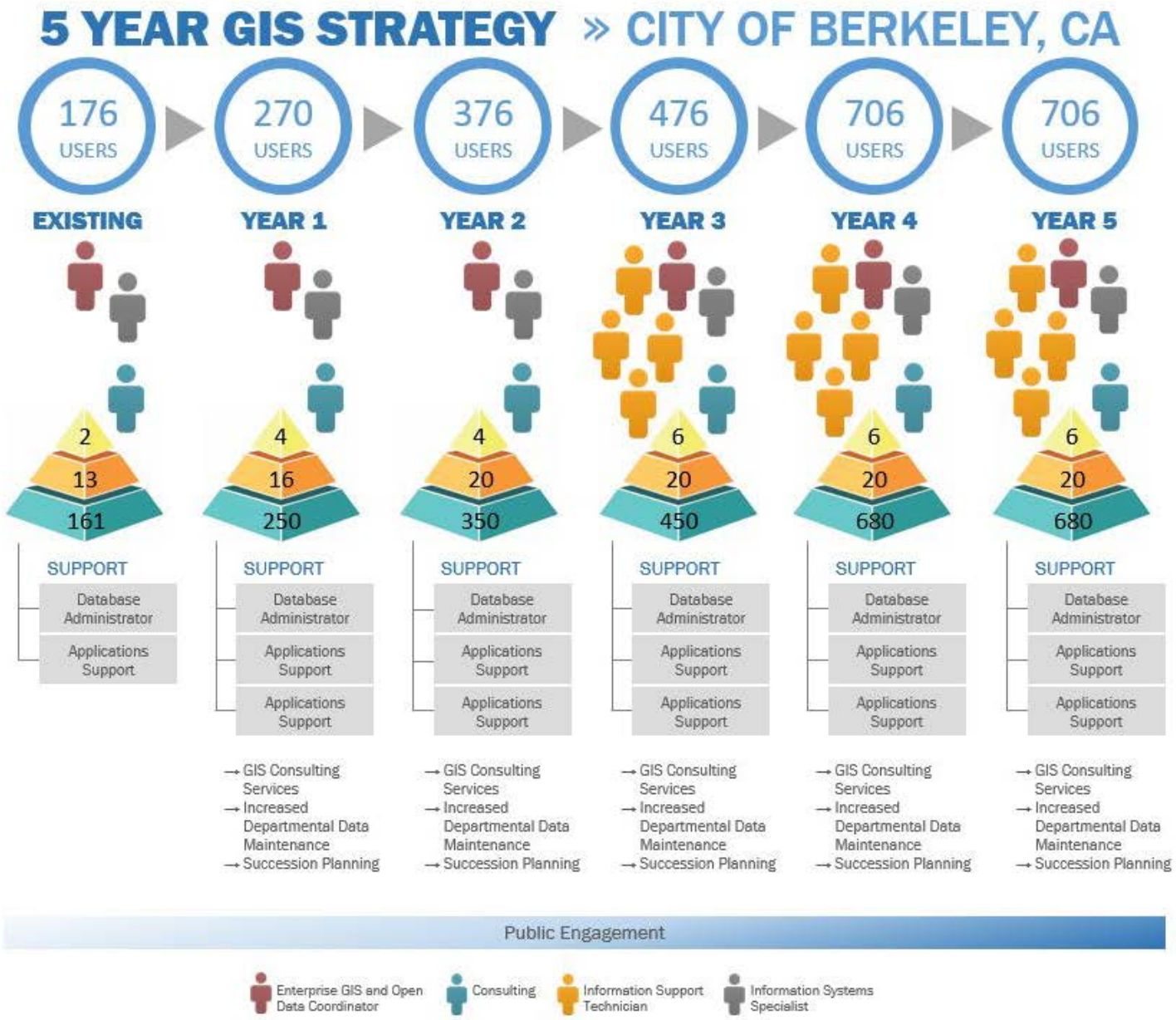
    A. Enterprise GIS and Open Data Coordinator
    B. GIS Technician ($75,000 to $90,000) – IT/GIS
    C. GIS Technician ($75,000 to $90,000) – IT/GIS
    D. GIS Technician ($75,000 to $90,000) - Planning
    E. GIS Technician ($75,000 to $90,000) – Public Works

    Note: This will include IT Support (Application Development, Systems Administration, Technical Ticketing Support), and GIS Outsourcing - Consulting Support (Not to Exceed $200,000 a year) for all GIS activity detailed in the 2017 GIS Strategic plan.

- Year Five GIS Staffing Plan

    A. Enterprise GIS and Open Data Coordinator
    B. GIS Technician ($75,000 to $90,000) – IT/GIS
    C. GIS Technician ($75,000 to $90,000) – IT/GIS
    D. GIS Technician ($75,000 to $90,000) - Planning
    E. GIS Technician ($75,000 to $90,000) – Public Works

    Note: This will include IT Support (Application Development, Systems Administration, Technical Ticketing Support), and GIS Outsourcing - Consulting Support (Not to Exceed $200,000 a year) for all GIS activity detailed in the 2017 GIS Strategic plan.


5 YEAR GIS STRATEGY » CITY OF BERKELEY, CA
176 USERS
270 USERS
376 USERS
476 USERS
706 USERS
706 USERS
EXISTING
YEAR 1
YEAR 2
YEAR 3
YEAR 4
YEAR 5
2
13
161
4
16
250
4
20
350
6
20
450
6
20
680
6
20
680
SUPPORT
Database Administrator
Applications Support
SUPPORT
Database Administrator
Applications Support
Applications Support
SUPPORT
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Applications Support
SUPPORT
Database Administrator
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Applications Support
SUPPORT
Database Administrator
Applications Support
Applications Support
SUPPORT
Database Administrator
Applications Support
Applications Support
→ GIS Consulting Services
→ Increased Departmental Data Maintenance
→ Succession Planning
→ GIS Consulting Services
→ Increased Departmental Data Maintenance
→ Succession Planning
→ GIS Consulting Services
→ Increased Departmental Data Maintenance
→ Succession Planning
→ GIS Consulting Services
→ Increased Departmental Data Maintenance
→ Succession Planning
→ GIS Consulting Services
→ Increased Departmental Data Maintenance
→ Succession Planning
Public Engagement
Enterprise GIS and Open Data Coordinator
Consulting
Information Support Technician
Information Systems Specialist

Training and Education

The following section summarizes the existing training conditions and departmental comments. This section also included a comprehensive and detailed Training Plan and Model.

Existing GIS Training, Education and Knowledge Transfer– Departmental Comments

Most respondents indicate that they have received some level of GIS training. This clearly provides an opportunity in the organization to increase GIS knowledge and usage. However, there are some individuals that have not received any training or who desire additional training. Additional training opportunities will need to be made available to the organization.

City of Berkeley Training and Education Findings
Some basic GIS education and training from City staff – more is desired
Minimal use of Esri's free virtual training courses
Some crime mapping specific training
No formal GIS training and education plan

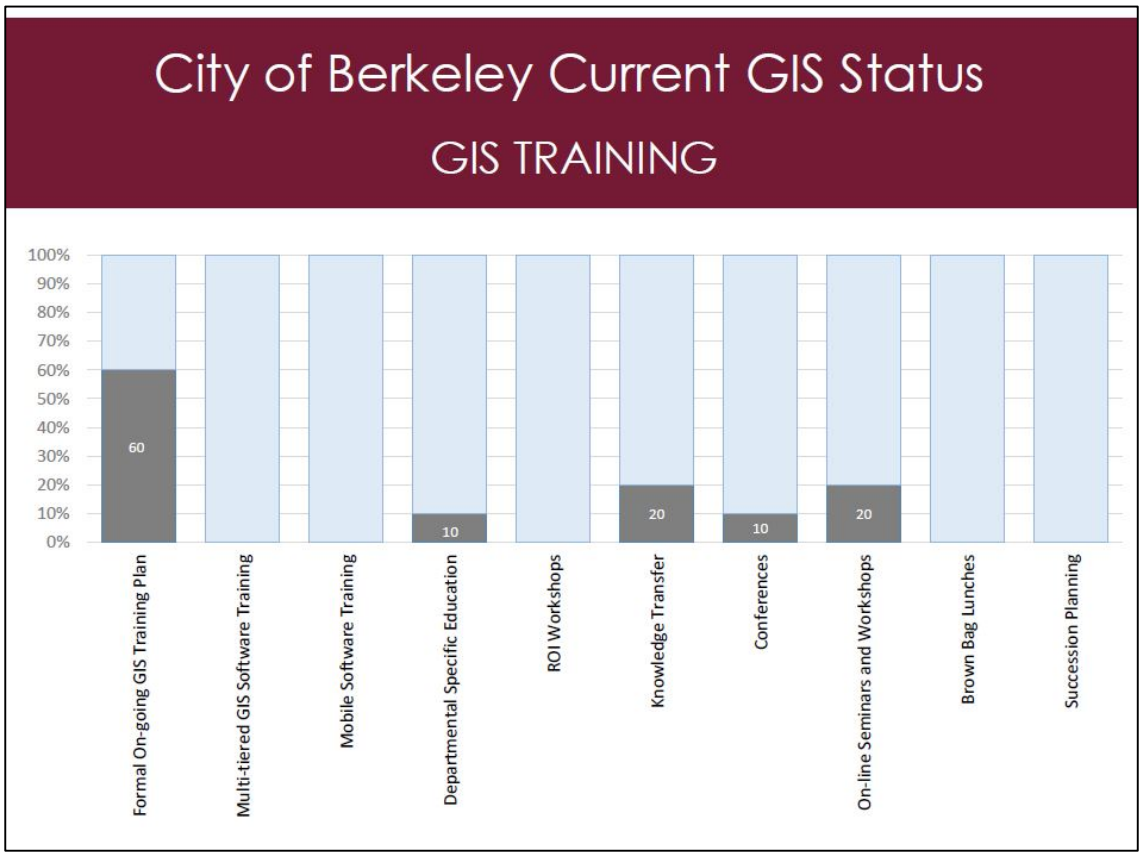
The Vision

Train, Educate, and Promote Knowledge Transfer for all the City Staff

The Goal

Improve the GIS knowledge base within the City departments. Develop a training, education, and knowledge transfer plan. Encourage the effective utilization of GIS technology.

City of Berkeley's Existing GIS Training and Education



GIS TRAINING MODEL

Training will be an integral part of the City's continuing GIS implementation strategy and should revolve around a model that includes external training, internal training, and continuing education offerings. The training model should follow the same tiers of GIS users as outlined in previous sections:

- A Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset including editing and complex analysis. Tier 1 users are those that use the entire ArcGIS suite, GIS data managers, and/or career GIS professionals.
- A Tier 2 Analytical user focuses on data analysis, in addition to general browsing capabilities. Tier 2 users conduct analytical tasks above and beyond what is offered at the Tier 3 level. They need

a tool that allows for robust flexibility and a host of analytical tools such as provided by ArcGIS Desktop Basic.

- A Tier 3 Browser user requires only general browsing, simple cartographic output and basic GIS data query functions. Generally, Tier 3 users can have most of their GIS needs met by Internet and/or Intranet browser based map applications.

The Enterprise GIS and Open Data Coordinator will play a prominent role in the training model. In addition to enhancing their own technical skills, it is recommended that the Enterprise GIS and Open Data Coordinator is proficient in GIS training to a degree that they can carry on training with other City employees. Discussed later in this section, the Enterprise GIS and Open Data Coordinator should use a "train the trainer" model to propagate their GIS skills to other City GIS users.

ArcGIS Training Recommendations

It is important to note that the following recommendations do not account for existing expertise. For example, staff with a GIS diploma or equivalent knowledge may not need some of these courses. Additionally, staff may have already taken classes or achieved a level of expertise on certain software products or functions precluding their need for certain classes. However, the following is a holistic look at what is needed. If a person already has the needed expertise they do not need to take the class unless they desire a refresher.

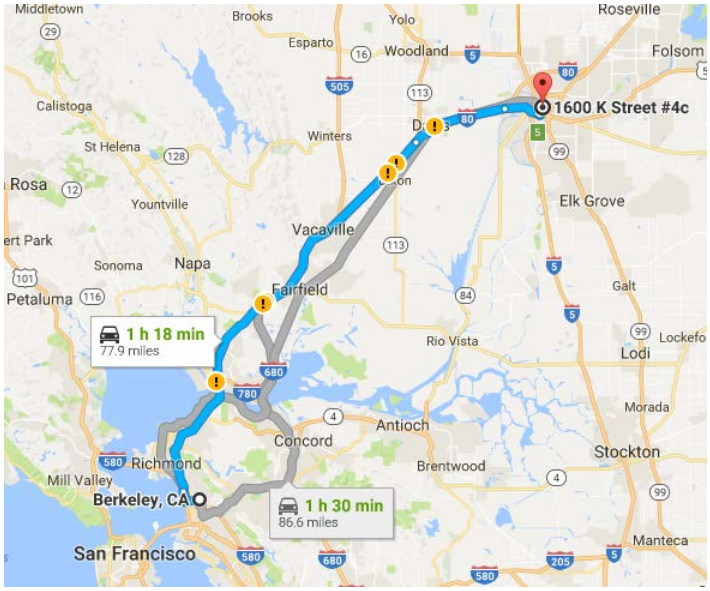
Tier 1 users – those GIS users responsible for the creation/maintenance of GIS databases – should take ArcGIS classes (ArcGIS II and ArcGIS III). These ArcGIS classes teach functionality, tools, workflows, and analysis for ArcGIS Desktop (Advanced, Standard, and Basic editions). ArcGIS II and ArcGIS III classes can be provided on-site by Esri or Esri Authorized Instructors. In addition to the ArcGIS class, Tier 1 GIS users that will have technical responsibilities with ArcGIS Server should also take the ArcGIS for Server "Sharing GIS Content on the Web" and "Building Geodatabases" classes. The Enterprise GIS and Open Data Coordinator should also take "Configuring and Managing the Multiuser Geodatabase" and "ArcGIS for Server: Site Configuration and Administration" to understand the use and storage of data in the ArcSDE environment. It is expected that 8 staff will need to take these courses.

Tier 2 users should be provided, at a minimum, with the multi-day ArcGIS II training class. This will include an introduction to the base functionality and tools of the software, from data management to desktop level analysis. Additionally, Tier 2 users should also take the ArcGIS III class. Students can either travel to an Esri office for this training, or hire an Esri Authorized Instructor to teach ArcGIS II on-site, or use a City staff member (recommended – more cost efficient). It is expected that 20 staff will need to take these courses.

Tier 3 users will receive customized training sessions on each individual end-user application that is developed. These applications are generally very intuitive and user-friendly with integrated contextual help. Half-day training sessions on each application will be sufficient. This training can be delivered through existing staff to achieve cost savings. It is expected that 691 staff will need to take these courses.

City of Berkeley Training Alternatives

GIS training is mission-critical to the success of GIS within the City and there are many alternatives for GIS training. Esri offers a host of GIS classes and has a training center in Sacramento, CA and numerous free self-paced courses available on-line. Additionally, there are other vendors who provide certified Esri product training. Certified Esri trainers can be found at: http://www.esri.com/training/atp/locator/index.html. There are local colleges that offer courses as well as books and other media forms of training. Esri courses are changed on a yearly or bi-yearly basis, depending on versioning, and offerings should be reevaluated regularly.



Nearby Esri Training Center – Sacramento, CA

In considering the City's long term training needs, it would be very beneficial and cost effective to have the City's GIS staff conduct the City's GIS basic training. To accomplish this, GTG recommends that the Enterprise GIS and Open Data Coordinator and other key staff conduct internal GIS training.

In the past, Esri has offered an Authorized Trainer Program (ATP). This allowed non-Esri employees to become certified Esri trainers and would give them access to Esri training materials and order training books. However, in 2011 Esri discontinued to their Certified Training Professional (CTP) program. Due to the cost of training programs, combined with the increasing volume of training needed by the City, it is recommended that the Enterprise GIS and Open Data Coordinator and the Manager of Enterprise Applications become trainers (non-Esri certified) for the City and be able to train staff in other departments to be GIS trainers.

The Enterprise GIS and Open Data Coordinator and Manager of Enterprise Applications should take the Esri courses pertinent to the classes for which they will teach. They then should tailor a course to the City's GIS end-users. Esri courses cover a wide range of topics, some of which are not pertinent to City of Berkeley's GIS users. Therefore, the GIS Trainers should customize each in-house course to focus on relevant topics tailored to the needs of the City's GIS end-user community. These classes need not be the same duration as the Esri courses as the City's training material should be more concise and targeted.

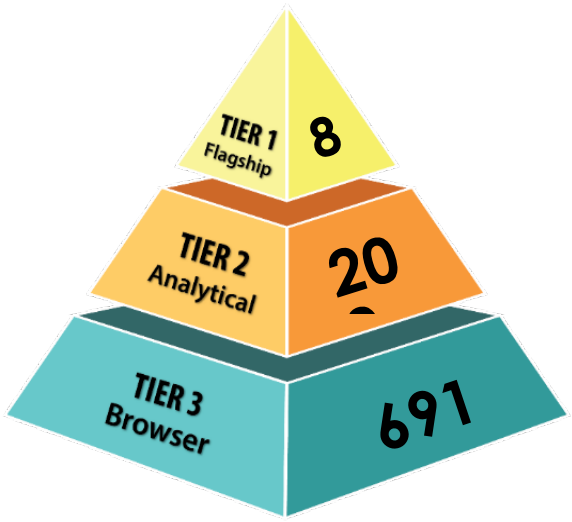
Projected GIS Software Tier-Level Users by Department

The following table summarizes the recommended GIS Software Tier-Level Users by Department. This table provides a snapshot of the level of training that will be necessary per each Department.

Projected GIS Software Tier-Level Users by Department				
City of Berkeley Departments	Tier 1 Flagship Users	Tier 2 Analytical Users	Tier 3 Browser Users	Total Projected GIS Users
City Attorney	0	0	13	13
City Clerk	0	0	9	9
City Manager	0	2	15	17
Finance	0	0	10	10
Fire Department	0	0	100	100
HHCS	1	2	167	170
Information Technology	3	0	5	8
Parks, Recreation & Waterfront	0	1	15	16
Planning	3	6	80	89
Police Department	0	2	178	180
Public Works	1	5	83	89
Rent Board	0	2	16	18
	8	**20**	**691**	**719**

Tier-Level Training Summary:

The following pyramid summarizes the total number of users needing training based on tiers of GIS use. The table on the right describes typical GIS activities by level of user.



TIERS OF GIS USERS	
GROUP	ACTIVITY
Tier 1 Flagship	• GIS Administration • Data Maintenance • Data Conversion and Creation • Spatial Data Management • Technical Support • Coordination
Tier 2 Analytical	• Data Maintenance • Analytical Functions/Geoprocessing • Complex Queries • Modeling • Use of Desktop Extensions • High Quality Map Production
Tier 3 Browser	• Browsing/Look-Up • Standard Reports • Simple Query • Map Production

GIS Training Matrix

Several Esri courses have been identified which would be of benefit to continued GIS growth and professional development.

The following table summarizes the recommended training class regimen for the City. The table includes the class, trainer, course length, recommended participants, and initial offering plan year.

Class	Site	Trainer	Days	Year of Training – Based on this five year plan	Recommended Participants
ArcGIS I: Introduction to GIS (10.x)	On	Esri	2	1,3,5	Tier Two GIS Users
ArcGIS II: Essential Workflows (10.x)	On	Esri Authorized Trainer	3	1,3,5	Tier One and Two GIS Users

Class	Site	Trainer	Days	Year of Training – Based on this five year plan	Recommended Participants
ArcGIS III: Performing Analysis (10.x)	On	Esri Authorized Trainer	2	1,3,5	Tier One and select Tier Two GIS Users
Building Geodatabases	Off	Esri	3	1,4	Tier One and Two GIS Users
Creating and Maintaining Metadata Using ArcGIS Desktop	On	Web Course	3 Modules Self-Paced	1,4	Tier One and Two GIS Users
Configuring and Managing the Multiuser Geodatabase	Off	Esri	3	1	Tier One and select Tier Two GIS Users
System Architecture Design Strategies	Off	Esri	3	1	Enterprise GIS and Open Data Coordinator
Introduction to ArcGIS Server	Off	Esri	2	1	Enterprise GIS and Open Data Coordinator
ArcGIS for Server: Site Configuration and Administration	Off	Esri	3	1,4	Enterprise GIS and Open Data Coordinator
ArcGIS for Server Sharing GIS Content on the Web	Off	Esri	2	1,3,5	Enterprise GIS and Open Data Coordinator
Tier 3 Applications	On	Internal	1	1,2,3,4,5	Various

GIS Training Offerings per Plan Year

The following table lists the recommended training class and recommended number of classes per plan year.

Class	FYI	FY2	FY3	FY4	FY5
ArcGIS Training Classes					
ArcGIS I: Introduction to GIS (10.x)	1	0	1	0	1
ArcGIS II: Essential Workflows (10.x)	1	0	1	0	1

Class	FYI	FY2	FY3	FY4	FY5
ArcGIS III: Performing Analysis (10.x)	1	0	1	0	1
Building Geodatabases	1	0	0	1	0
Creating and Maintaining Metadata Using ArcGIS	1	0	0	1	0
Configuring and Managing the Multiuser Geodatabase	1	0	0	0	0
System Architecture Design Strategies	1	0	0	0	0
Introduction to ArcGIS Server	1	0	0	0	0
ArcGIS for Server: Site Configuration and Administration	1	0	0	1	0
ArcGIS for Server Sharing GIS Content on the Web	1	0	1	0	1
Tier 3 Applications					
Tier 3 Applications	1	1	1	1	1

Additional Training

Esri recently made much of their online training courses available for no cost. These courses should be used to further GIS knowledge throughout City users. In addition, the following are additional training courses which would be of benefit to continued GIS growth and professional development to the City's GIS users.

- Intro to Python Scripting Introduction to Geoprocessing Scripts Using Python
- Implementing Versioned Workflows in a Multiuser Geodatabase (10.x)
- ArcGIS API for JavaScript
- Sharing GIS Content Using an ArcGIS Online Subscription
- Creating a Common Operational Picture with ArcGIS management (EOC)
- GIS for Managers

The following table lists all the recommended training courses along with user tier and prerequisites. Comments give a brief description of course contents. Detailed course descriptions can be found after this table. The courses are listed in a logical flow and recommended sequence.

Class	Enterprise GIS and Open Data Coordinator	Tier 1	Tier 2	Tier 3	Suggested Prerequisites	Comments
ArcGIS I: Introduction to GIS		●	●	●	None	Basic level ArcGIS course teaching how to create maps, analyze data, and how to use various tools.
ArcGIS II: Essential Workflows		●	●		ArcGIS I: Introduction to GIS	Builds on content learned in ArcGIS I and adds training on how to author, share, and use geographic information in ArcGIS.
ArcGIS III: Performing Analysis		●	●		ArcGIS II: Essential Workflows	Building on ArcGIS I & II, learn how to efficiently solve spatial problems using various ArcGIS tools and vector, raster, and temporal data.
Building Geodatabases		●	●		ArcGIS I: Introduction to GIS	Learn how to build geodatabases, add data, and model real world relationships.
Creating and Maintaining Metadata Using ArcGIS		●	●		ArcGIS I: Introduction to GIS	Learn how to properly create and maintain metadata.
Configuring and Managing the Multiuser Geodatabase	●				ArcGIS II: Essential Workflows	Course prepares you to successfully deploy a multiuser geodatabase to manage critical geographic assets.
System Architecture Design Strategies	●				Review: www.esri.com/systemdesign	Covers GIS system architecture design strategies. Learn how to plan and select the right system architecture for your organization.
Introduction to ArcGIS Server	●				ArcGIS II: Essential Workflows	Obtain skills to share GIS content on the web or across the enterprise.
ArcGIS for Server: Site Configuration and Administration	●				Introduction to ArcGIS Server	Learn how to install, configure, and manage an ArcGIS for Server system.
ArcGIS for Server: Sharing GIS Content on the Web	●				Introduction to ArcGIS Server	Learn how to publish professional map services that will provide spatial data to colleagues and non-GIS audiences.

Class	Enterprise GIS and Open Data Coordinator	Tier 1	Tier 2	Tier 3	Suggested Prerequisites	Comments
Tier 3 Applications		●	●	●	None	Learn the basic capabilities and tools of the intranet/Internet/mobile applications.

Training Classes – Tier 1 and Tier 2

The following are the classes recommended for the City of Berkeley staff. Some classes in the Tier 1 level may coincide with classes recommended for staff classified in the Tier 2 level. These classes are noted.

ArcGIS I: Introduction to GIS

Recommended Attendees

All Tier 1 and 2 users

Overview

This course teaches what a GIS is and what you can do with it. Working with various components of the ArcGIS system, you will create GIS maps, explore and analyze the data behind the maps, and apply methods to easily share your maps. By the end of the course, you will have a solid understanding of how GIS maps and ArcGIS tools are used to visualize real-world features, discover patterns, obtain information, and communicate that information to others.

Audience:

Individuals who do not have any prior GIS education or workplace experience with GIS.

Goals:

- Quickly create and share a GIS map using ArcGIS web-based tools and content.
- Find and organize geographic data and other GIS resources for a mapping project.
- Accurately display features on a GIS map and efficiently access information about them.
- Analyze a GIS map to identify where features that meet specific criteria are located.
- Share GIS maps and analysis results so they can be viewed using desktop applications, websites, and mobile devices.

Course Length

Two Days

Course Cost

$1,010 per student. Reduced rates may apply for onsite training.

Recommended Instructor\Location

City of Berkeley Trainer, On-site or Consultant

ArcGIS II: Essential Workflows

Recommended Attendees

All Tier 1 and select Tier 2 users

Overview

In this course, you will acquire fundamental skills needed to author, share, and use geographic information and maps across the ArcGIS system. You will learn how to efficiently find, explore, manage, and analyze geographic data and create informative maps that showcase your work. The course covers a variety of techniques to effectively share GIS maps and resources with decision makers, stakeholders, and the public.

Audience:

GIS professionals and others who have an introductory-level knowledge of GIS concepts and limited ArcGIS experience.

Goals:

- Use ArcGIS software and content to create high-quality maps that combine data from different sources.
- Organize, create, and edit geographic data so that it is accurate and up to date.
- Manage, symbolize, and label map layers to support visualization and data exploration.
- Design an attractive page layout for maps that will be printed.
- Apply a standard workflow to analyze GIS data and solve spatial problems.
- Deliver maps and analysis results to multiple platforms so they are accessible to other ArcGIS users and to non-GIS users.
- Create presentation-quality maps and graphs.

Course Length

Three Days

Course Cost

$1,515 per student. Reduced rates may apply for onsite training.

Recommended Instructor\Location

City of Berkeley Trainer, On-site or Consultant

ArcGIS III: Performing Analysis

Recommended Attendees

All Tier 1 Users and select Tier 2 Users doing day-to-day data editing

Overview:

Advance your foundational ArcGIS skills by learning how to obtain reliable results from different types of GIS analysis. You will apply a standard workflow to efficiently solve spatial problems using a variety of ArcGIS tools and vector, raster, and temporal data. Techniques to effectively share your analysis workflows and results are covered. This course is taught using ArcGIS for Desktop Advanced and some course exercises use tools provided in the ArcGIS Spatial Analyst extension.

Audience:
GIS analysts, specialists, and others who manage or conduct GIS analysis projects.

Goals:

- Choose appropriate data, methods, and tools to plan, execute, and document a given analysis project.
- Automate analysis tasks using geoprocessing models.
- Create a weighted suitability model to select the optimal location for a new site.
- Apply spatial statistics to examine distribution patterns and identify hot spots.
- Model temporal data to analyze and visualize change over time.
- Share analysis results so they are accessible and repeatable.

Course Length
Two Days

Course Cost - $1,010 per student. Reduced rates may apply for onsite training.

Prerequisites
ArcGIS II: Performing Analysis

Recommended Instructor\Location
City of Berkeley Trainer, On-site or Consultant

Building Geodatabases

Recommended Attendees
Select Tier 1 and select Tier 2 users

Overview:
This course teaches the essential concepts and skills needed to efficiently create a geodatabase, add data to it, and realistically model the real-world spatial relationships inherent to your data. You will learn about unique geodatabase features that help ensure data integrity over time and why the geodatabase is the preferred format for storing and managing geographic data. Course concepts apply to file-based and multiuser ArcSDE geodatabases. This course is taught using ArcGIS for Desktop Advanced.

Audience:
This course is for spatial data Coordinators who have a basic understanding of ArcGIS desktop applications and are ready to use the geodatabase. New and existing data Coordinators waiting to migrate to the geodatabase will benefit from this course.

Goals:

- Load data into the geodatabase from a variety of formats
- Set spatial reference and spatial domain
- Build a topology in the geodatabase
- Apply the appropriate topological rules for data
- Use the appropriate attribute rules for data with subtypes and domains
- Edit topological data
- Generate relationship classes

- Create and use rules for relationship classes and attribute data entry
- Produce and edit annotation

Course Length – 3 days

Course Cost

$1,515 per student. Reduced rates may apply for onsite training.

Recommended Instructor\Location

City of Berkeley Trainer, On-site or Consultant

Creating and Maintaining Metadata Using ArcGIS

Recommended Attendees

GIS Team who then train internal staff

Overview:

Metadata, the key information that documents a dataset, has emerged as a powerful tool for safeguarding an organization's investment in spatial data. Documenting datasets allows people to efficiently find them, evaluate their usefulness for a particular project, and share them with others. This course shows how metadata supports efficient management and use of spatial data and teaches practical strategies for creating and maintaining metadata using ArcGIS Desktop software. Students learn how to write proper metadata using tools in ArcCatalog and how to automate metadata workflows using templates.

Audience:

This course is designed for experienced ArcGIS users who work with, create, edit, or manage spatial data.

Goals:

- Describe the benefits of creating and maintaining metadata.
- Explain the advantages of adhering to a metadata standard.
- Implement an appropriate metadata standard.
- Search metadata to find datasets.
- Evaluate datasets using metadata.
- Plan metadata content.
- Write proper metadata.
- Create templates and use sample code to streamline metadata production.
- Identify various ways to share metadata.

Course Length

3 Modules

Course Cost

$96 per student.

Recommended Instructor\Location

Web Course

Configuring and Managing the Multiuser Geodatabase

Recommended Attendees

Enterprise GIS and Open Data Coordinator

Overview:

This course prepares you to successfully deploy a multiuser geodatabase to manage your organization's critical geographic data assets. You will learn about the multiuser geodatabase architecture and installation options, and how to configure the geodatabase for efficient data storage and delivery of data access and editing capabilities to many users. Although course exercises use the enterprise geodatabase, many course concepts also apply to workgroup geodatabases.

Audience:

Spatial database administrators and GIS data managers who need to create, configure, and manage a multiuser ArcSDE geodatabase.

Goals:

- Install ArcSDE technology and configure it for your relational database management system.
- Create and connect to a multiuser geodatabase.
- Efficiently load and update data in a multiuser geodatabase.
- Configure storage settings to support your organization's data management workflows.
- Set up user roles and permissions to provide secure data access.
- Apply best practices to optimize geodatabase performance.

Course Length

Three Days

Course Cost

$1,515 per student. Reduced rates may apply for onsite training.

Recommended Instructor\Location

Esri – Off-site

System Architecture Design Strategies

Recommended Attendees

Enterprise GIS and Open Data Coordinator

Overview:

This course covers GIS system architecture design strategies and infrastructure architecture alternatives that support successful enterprise operations. You will learn comprehensive guidelines for planning and selecting the right system solution to meet your organization's needs. This course also covers performance validation and system capacity planning techniques for enterprise GIS deployments.

Audience:

This course is designed for senior staff including Senior Architecture and Software Architects, IT and System Administrators, GIS Managers, and Software Developers who need to understand enterprise system design, system architecture, hardware capacity planning and to troubleshoot performance problems.

Goals:

- Identify and collect user workflow requirements for an enterprise GIS system.
- Describe architecture alternatives for each identified user workflow.
- Recognize factors that impact GIS software performance and scalability.
- Identify network bandwidth requirements.
- Apply best practices for incorporating security throughout system design and deployment.
- Understand how platform technology affects ArcGIS performance and capacity.
- Develop a target enterprise hardware design to support capacity-planning needs.

Course Length

Three Days

Course Cost

$1,515 per student. Reduced rates may apply for onsite training.

Recommended Instructor\Location

Esri, Off-site

Introduction to ArcGIS Server

Recommended Attendees

Enterprise GIS and Open Data Coordinator

Overview:

ArcGIS Server provides a complete server-based GIS system that supports the use of centrally managed spatial data for mapping and analysis. This course introduces ArcGIS Server and teaches how to install, configure, and use the product as administrators and consumers of GIS services. Students learn how to publish maps, globes, and geoprocessing models that are optimized for performance. Students also create out-of-the-box Web applications using Coordinator and learn how to use GIS services in both Web applications and ArcGIS Explorer.

Audience:

This course is designed for those new to ArcGIS Server who want to learn about its architecture, capabilities, and client applications.

Goals:

- Understand the client and server components of the ArcGIS Server architecture.
- Configure the ArcGIS Server system.
- Administer the GIS Server and GIS services.
- Optimize the performance of GIS services.
- Build Web applications that consume GIS services.
- Utilize ArcGIS Explorer to work with GIS services.

Course Length

Two Days

Course Cost
$980 per student. Reduced rates may apply for onsite training.

Recommended Instructor\Location
Esri, Off-site

ArcGIS for Server: Site Configuration and Administration

Recommended Attendees
Enterprise GIS and Open Data Coordinator

Overview
In this course students will learn how to successfully install, configure, and manage an ArcGIS Server system that enables the sharing of GIS content across the enterprise. The ArcGIS Server architecture will be learned and recommended workflows will be taught for the configuration of ArcGIS Server sites. Best practices for system performance and security are emphasized.

Audience:
IT administrators, system administrators, GIS administrators, and others responsible for installing, managing, or supporting an ArcGIS for Server system.

Goals:

- Successfully install ArcGIS for Server and create an ArcGIS Server site.
- Configure the Web Adaptor component to integrate your ArcGIS server with a web server.
- Publish services that have the capabilities required for your applications.
- Plan, create, and update a cache for high-performing map and image services.
- Tune and monitor services to ensure high performance.
- Implement security for your site and services that meets the needs of your organization.

Course Length
Three Days

Course Cost
$1,515 per student. Reduced rates may apply for onsite training.

Recommended Instructor\Location
Esri, Off-site

ArcGIS for Server Sharing GIS Content on the Web

Recommended Attendees

Enterprise GIS and Open Data Coordinator

Overview:

This course teaches how to deliver geographic information so that it can be effectively used by colleagues, decision-makers, and non-GIS audiences. You will learn how to share your professional maps, data, and workflows by creating and publishing high-performing GIS services that can be accessed from desktop computers, web browsers, and mobile devices.

Audience:

- GIS analysts, specialists, and other experienced ArcGIS users who want to share GIS resources in web maps and web-mapping applications.
- Developers who want to incorporate GIS services and web maps into custom applications.

Goals:

- Author and publish map services to share your authoritative GIS data.
- Create and publish image services to provide fast access to imagery.
- Design and build a map cache to maximize map service performance.
- Publish a geoprocessing service to share your GIS models and analysis results.
- Publish a feature service to enable data editing in a web application.
- Share GIS resources as stand-alone services and in web maps and web-mapping applications.

Course Length

Two Days

Course Cost

$1,010 per student. Reduced rates may apply for onsite training.

Recommended Instructor\Location

Esri, Off-site

Training Classes – Tier 3

Tier 3 users will need training specific to the GIS Intranet Data Browser, Mobile and/or Field applications, Work Order management, Routing, and other browser and analytical based applications. These training classes can be handled on-site on an as needed basis by the Enterprise GIS and Open Data Coordinator and/or selected consultants. The cost of all Tier 3 applications includes training for selected personnel. Enterprise-wide training of Tier 3 applications can be conducted by GIS Analysts or another technical staff person.

Tier 3 application training should cover the following topics/functionality:

- Brief overview of GIS
- Zoom and pan functionality
- Map extents
- Feature identification
- Map production/printing
- Reports (as needed)
- Spatial queries (as needed)
- Exporting maps
- Saving projects

In addition to the aforementioned topics/functionality, Tier 3 users should receive additional training specific to individual workflows or modules, such as work order request mapping and tracking or public notification via mapping module.

Continuing Education

An important part of professional GIS education is not only formal training classes, but also attending GIS conferences, being active in professional organizations, and joining area or regional user groups.

In addition to their regional and national users' conferences, GIS professional associations offer important peer-to-peer connections, professional journals and technical publications, training and other learning forums, and opportunities to form local, regional and national policy by serving on select committees and special interest groups. The two largest and best known professional GIS associations are:

- Geospatial Information Technology Association (GITA) – is the professional association and leading advocate for anyone using geospatial technology to help operate, maintain, and protect the infrastructure, which includes organizations such as utilities, telecommunication companies, and the public sector. Through industry-leading conferences—along with research initiatives, chapters, membership, and other programs—GITA provides education and professional best practices. (See www.gita.org for more information.)

- **Urban and Regional Information Systems Association** (URISA) – is a multidisciplinary association where professionals from all parts of the spatial data community come together to share concerns and ideas. URISA strives to provide exceptional educational experiences, a vibrant and connected community, and the essential resources needed for a successful career. (See www.usrisa.org for more information.)

GIS conferences allow registrants to attend workshops and seminars (some free, some at additional cost), and to interact with other GIS professionals from around the region, state, country, and world. The City of Berkeley should budget every year for conference attendance. The International Esri User Conference is the premier GIS learning experience and should be attended if possible.

Important conferences that should be attended by City of Berkeley staff (at the Enterprise GIS and Open Data Coordinator's discretion, and within budgetary limitations) include:

Esri International User Conference, San Diego, California

http://www.esri.com/events/index.html

Who Should Attend?

The Esri User Conference is open to all Esri software users including:

• New Users	• Experienced Users
• User Group Members	• Supervisors
• Programmers	• Specialists
• Analysts	• Technicians
• Local, Regional, National, and International Committee Members	• Management Information Services and Industry Solutions Supervisors
• Project Coordinators	• Department Heads
• Division Chiefs	• Executive Directors
• Faculty	• Elected Officials
• Board Members	• Chairpersons
• NGO Representatives	• First Responders

Why Attend

- Find out everything you need to know about ArcGIS 10.x, from productivity and sharing to spatial analysis and imagery.
- See how to best leverage your current GIS investments.
- Learn from people like you who are tackling challenges like your own.
- Get updates and direction that will help your organization make better decisions.
- Gain tips, tricks, and tools to launch, update, and enhance your GIS projects.
- Connect with Esri staff including product and industry specialists, instructors, and the technical support experts.
- Hear straight from Jack Dangermond, Esri President.
- Be part of an inspired global community striving to design a better world.

Urban and Regional Information Systems Association (URISA)

http://www.urisa.org/education-events/gis-pro-annual-conference/

The URISA Annual Conference offers a unique multidisciplinary approach, with sessions led by industry leaders, powerful keynote presentations, panels, roundtable discussions and networking meetings you won't find anywhere else.

This conference is vital to professionals concerned with the effective application of management information services in all state and local government agencies, including:

- Community & Economic Development
- Emergency Services/Public Safety
- Environmental Management
- Land Records
- Public Works
- Tax Assessment
- Transportation Planning
- Urban Planning & Design
- Utilities

Communication Plan

Education is as important as formal training. GIS must be understood and the organization must be educated as to the benefits and uses of GIS technology. This can be accomplished through several methods. The City of Berkeley must make a conscious effort to continually educate the organization. Therefore, it is important to have a communication/education plan. The purpose of a communication plan is to help an organization communicate with internal and external audiences. It is critical that GIS is communicated in an organized and deliberate fashion at the City. Some of the reasons for the City to communicate regarding GIS are as follows:

- Keep stakeholders informed about City GIS activities
- Provide ongoing project updates
- Distribute major reports and findings
- Educate GIS users as to approved standards
- Educate people about the benefits of GIS
- Make people aware of the City's GIS activities and the impact they are having
- Solicit and acquire input related to City GIS activities
- Understand the needs of the GIS user community
- Provide sound policy advice to decision makers
- Promote programs that the City thinks are critical to sound GIS development
- Promote the use of GIS in meeting objectives of key stakeholders

This communication plan is meant as a guide for the City's GIS development efforts. It describes the audiences that should be hearing from the City and ways to reach them. Additionally, it talks about ways for getting feedback as well as receiving communication from key audiences. The City should incorporate numerous ways to communicate with its audience. Following are the audiences that would typically be included in the communications plan:

- GIS Users Group – users that need to be kept in the loop on pertinent City directed GIS activities
- City Leaders – decision makers need to understand GIS and why it is being used
- General Public – typically peripherally aware of technology; need events and stories in the media to better inform
- Local and Regional Governments – potential users of the City's GIS; need to educate on what the City must offer
- Surveyors – could support improving accuracy standards and modernization of data

Communication Methods

Various methods exist that will allow the City to communicate its GIS message both internally and externally. Some methods, like email, brochures, newsletters, City web site, and council meetings, are always available and easily accessible. Other methods require significant effort and cost to create and distribute. These include publication articles, annual reports, participation at GIS conferences, and developing or updating strategic plans. The City will need to review the various communication methods available and decide which methods would best suit its needs. The following is a bulleted list of suggested communication methods, their frequency and costs:

- GIS Steering Committee
    - Should meet quarterly at a minimum
    - Serves to keep decision makers informed and guide GIS implementation and priorities
    - Cost- $0
- GIS User's Group
    - Should meet quarterly at a minimum
    - Serves to keep GIS users apprised of technology changes, city standards, and GIS direction
    - Cost - $0
- GIS Day
    - November of every year
    - Opportunity to share GIS successes with the organization and public
    - Nominal cost – booth and various displays
    - Should participate and promote each year
- Annual User Satisfaction Survey and Report
    - January of each year
    - Users should be given an anonymous survey that allows them to give candid feedback as to how well GIS is meeting their needs
    - Data should be compiled in a report and shared with the City
    - Cost- $0
- Annual Strategic Plan Update
    - March of each year
    - The strategic plan should be a living document. It should identify successes, changes in technology, and reprioritize GIS needs/expenditures each year.

- One-on-one Meetings
    - Monthly
    - The Enterprise GIS and Open Data Coordinator and/or consultant should meet one-on-one with key decision makers each month to apprize them on how GIS is progressing to meet their needs. Also, this is a great way to educate decision makers on other ways their department can use the technology.
    - Cost - $0
- Presentations to City Council
    - Annually
    - High level presentation to Council detailing how GIS is improving the City and expanding services
    - Cost - $0
- Blogs, email, and social media
    - As pertinent
    - GIS staff should establish several conduits for disseminating pertinent information, sharing ideas, and making announcement. Various digital mediums should be leveraged for this. Internal and external customers should be provided with various information conduits.
    - Cost - $0
- Newspapers and television
    - As pertinent but at least once a year
    - GIS staff should leverage the press. As exciting projects are completed, the story should be shared with media outlets. In most cases, they are looking for interesting stories and will gladly work with the City to publicize GIS successes.
    - Cost - $0
- Brochures, newsletters, and other marketing efforts
    - Throughout the year
    - GIS staff should try to market successes and services. Brochures describing what GIS services, newsletters, the City web site, and other methods should be used to promote GIS throughout the City
    - Cost - $0 unless a professional firm is used to create an identity or brochure

- Seminars
    - Throughout the year
    - Formal software training is needed. However, these should be augmented with seminars that discuss GIS in a broader context. Seminars such as a GIS Manager's Workshop or Return-on-Investment with GIS are great ways to share how GIS can benefit an organization. These can be conducted by internal staff. However, a budget should exist to bring in outside speakers for key topics.
    - Cost - $5,000 annually

As the City continues to develop and grow its enterprise GIS, it is becoming increasingly necessary that strong and consistent communications are maintained with all GIS stakeholders internally and externally. The implementation of a pervasive communication plan will help to establish and formalize those lines of communications which in the long run will help the City of Berkeley further improve the enterprise GIS, while providing maximum value to its stakeholders.

MILESTONE 5

FIVE-YEAR TACTICAL PLAN OF ACTION

CITY OF BERKELEY

CALIFORNIA

GIS Strategic Implementation Plan

Table of Contents

1.0 INTRODUCTION

This chapter focuses on a tactical plan of action for implementing the key elements that have been identified and detailed in the previous project milestone documents. A tactical plan refers to a plan of action designed to identify a series of maneuvers or stratagems for obtaining a specific goal or result. In this case, the desired result is to utilize GIS as an enterprise-wide tool which enables staff to more effectively and efficiently serve the residents of the City of Berkeley.

This plan defines the necessary tasks and procedures for the City of Berkeley to plan and implement the recommendations outlined in this report. This five-year phased tactical plan, if implemented, will provide the City of Berkeley with a cost effective solution that allows the City to further utilize GIS in an enterprise-wide fashion.

2.0 FIVE- YEAR TACTICAL PLAN

The table beginning on page 12 documents all of the tactical elements needed to further implement enterprise-wide GIS over a five-year period. Initially the efforts will be focused on governance and data normalization efforts. Next, the focus is on the expansion of the user base with Internet, Intranet, and targeted applications. An early primary objective is to gain several "quick successes" in terms of application implementation, data development and integration, data maintenance procedures, and education. It is important to note that these recommendations are predicated on the adoption of this plan and the adoption of the recommended governance strategy during the first year of this project. There are a number of data layers identified in this plan. Some layers like parcels, address points, and centerlines are a city-wide resource, while other layers are specific to individual departments. Layers that do not exist or are in need of refinement should be created internally or through outsourcing as funding will accommodate.

Tactical Plan

The following tactical plan identifies each activity and expense that has been identified in the previous project milestones. Each activity is divided into descriptive columns as follows:

Task – a descriptive title of the item

Department – the department that was identified to have a need for the item

Task Type

- OT = one-time non-repeating task
- MT = task that will be repeated multiple times
- OG = task that is on-going
- D = department/division task funded by the departments as needed

Notes – comments and/or notes about the item

Year 1 – 5 Costs – cost approximation of the item. Some items have numbers that are exact. Others will depend heavily on what type of technology is used to implement them. Some will require an RFP to determine the actual cost, although a best estimate has been given based on industry knowledge.

Tactical Plan Tasks

The following are each of the tactical plan tasks by major category, a brief description, and any task dependencies.

 Denotes a task with dependency.

 Denotes an official decision point.

<u>Category 1 – Governance</u>

- **Adopt a New Hybrid GIS Governance Model and Staffing Plan by Hiring Two New GIS Staff within IT and changing operations -** Adoption of the governance strategy by the GIS Steering Committee

   *GIS Steering Committee Quarterly Meetings*
- **Update Annually the Enterprise GIS Master Plan -** Document successes, priorities, and budget
- **Develop a GIS vision, goals, and objectives -** Creation of new vision, goals, and objectives by GIS steering Committee.  *GIS Steering Committee Quarterly Meetings*
- **Define GIS job descriptions –** City should adopt a GIS Job classification structure based on the formalized governance model
- **Develop a coordinated GIS Enterprise –** Coordination of all GIS projects within the enterprise by the GIS Lead
- **Create and enforce new GIS steering committee -**  GIS Steering Committee should be officially established based on recommendations in Milestone 4. GIS Steering Committee will guide GIS priorities

- **Consider a GIS sponsor team approach – Optional Task –** Executive leadership that will champion the GIS cause
- **Formalize a City GIS user group –** a group of GIS users that share information about the use of the technology
- **Regionalization of GIS - T**he sharing of data, resources, applications, training, and education and more between disparate groups of GIS users in the region
- **GIS policy and mandates –** Establish a set of standards and procedures for the development and maintenance of geospatial data *GIS Steering Committee Quarterly Meetings*
- **Measure user sensitivity –** Via the use of questionnaires, one-on-one interviews, GIS user group feedback, etc.
- **Improve GIS collaboration –** GIS Lead should ensure that collaboration exists between all City staff and departments
- **Measure quality of service –** GIS Lead should measure satisfaction levels using an online questionnaire and through feedback at User group meetings
- **Identify GIS authority and clear lines of responsibility -** The City should create clear roles and responsibilities, notifying all GIS users of those roles and responsibilities. *GIS Steering Committee Quarterly Meetings*
- **Continue to use the City's existing GIS budget or funding model –** The existing GIS budget that exists in the overall IT budget should be maintained by the GIS Lead
- **Explore GIS grants and funding initiatives for the City of Berkeley -** The GIS Lead must pursue grants for GIS software, data, training, and staff

Category 2 – Infrastructure

- **Upgrade the existing GIS servers to a modern better performing technology and deploy the City's public facing GIS server in the Cloud –** Deploy the recommended server configurations to upgrade the GIS architecture providing greater performance and responsiveness
- **Deploy a GIS staging environment (sand box) that replicates the GIS server site –** Deploy a virtualized server environment that is identical to the production environment to allow application testing
- **Enterprise back-ups currently created in the Barracuda Cloud. Continue this process on a daily basis to ensure that disaster recovery needs for GIS data can be met**

- **Existing desktop workstation technology exceeds minimum requirements. Continue to update workstation technology per the IT Replacement Plan**
- **Develop a GIS Mobile Plan to guide the development of Mobile Solutions in the City.** – Standardized mobile solutions within the enterprise
- **Continue periodic monitoring of the LAN/WAN network to ensure it is functioning at optimal levels.**
- **Build a central services infrastructure which exposes appropriate services end-points for transactional editing, analysis, and viewing, based on a variety of clients.** - Includes the integration of other enterprise systems with GIS
- **Complete the migration of GIS data to the Local Government Information Model (LGIM). –** Migration mostly done but need to migrate last remaining data.
- **Implement ArcGIS for Local Governments browser-based applications for intranet users. –** Suite of free applications from Esri that work with the LGIM
- **Expand the use of ArcGIS Online for public facing applications. –** Already in use but need to further expand
- **Implement best GIS practices detailed in the GIS master plan. –** Best practices will improve performance and reliability of enterprise GIS
- **Incorporate the existing Strategic Technology Plan into the GIS Master Plan initiative. -** Need to keep similar recommendations between two plans synchronized
- **The City's existing IT Replacement Plan should be reviewed and updated annually. -** Keeping GIS technology infrastructure current is critical to performance
- **GIS Training should be provided to IT Professionals to allow them to better support the enterprise GIS.**
- **Develop Standard Operating Procedures for major IT/GIS functions. –** SOPs are essential to repeatability of major processes and to sustainability

Category 3 – Maintenance

- **Esri Software –** Core GIS software for the enterprise. Annual ELA (Enterprise License Agreement) cost.
- **Pictometry –** Aerial oblique data obtained through the County
- **Data Mining Middleware –** Annual maintenance on middleware product

Category 4 – Services and Data

- **Review the database design of the city's LGIM implementation and determine if it can be improved –** Assess the current state of the LGIM deployment and determine if changes are needed to improve data access and to better support ArcGIS for Local Government.
- **Fully implement metadata for all GIS data –** Review all GIS layers and create/update metadata
- **Perform a detailed data assessment of all GIS layers –** Use the ArcGIS Data Reviewer and other tools to more thoroughly assess the state of GIS data
- **Develop, formalize, and enforce standardized GIS data creation procedures across the enterprise -** Establish and enforce procedures that will add consistency to data creation.
- **Some of the city's current department-specific layers listed in the MDL are not current, and should be updated –** Review and prioritize layers in the MDL to be updated either internally or with consultants.
- **Acquire/develop all "recommended" layers in the MDL -** Obtain recommended layers from other government sources, create internally, or create with the use of consultants.
- **Complete the migration of GIS data to the LGIM –** Document any remaining data and migrate this data to the LGIM.
- **Implement ArcGIS for Local Government –** Review and deploy targeted ArcGIS for Local Government application.
- **Implement the recommendations for improving the authoritative data source layers – tax parcels, street centerlines, and address points -** Follow the detailed recommendations provided in Milestone 3 to improve the accuracy and integrity of the authoritative data source layers.
- **Create and/or improve hazard mitigation and disaster planning critical GIS data layers –** Follow the detailed recommendations provided in Milestone 3 to improve the data layers critical to disaster planning.
- **GIS Consulting Services –** Annual fund to utilize outside expertise on an as needed basis.
- **Database Design, Development, and Cleanup –** It is recommended that City of Berkeley will complete the migration of all GIS data into the Local Government Information Model. A consultant can be used to finalize this process.
- **Data Mining –** Using a data mining software package, systematically begin data mining from each of the existing *IT* systems used by the departments including SunGard, Accela, Lagan, New World Systems, RedAlert, Crime View Community, Chameleon, etc. This will require extensive knowledge of SQL nomenclature and the data mining tool.

- **Collection of Parks Data –** Full collection of all Parks infrastructure using the Collector applications
- **Setup of Esri Suite for Parks, Recreation & Waterfront –** To include the Esri WebAppBuilder, Executive Dashboard, Collector, Parks Finder, and Overall Parks Story Map
- **Disaster Recovery Tool (Fire) –** Tablet based solution to allow staff to quickly assess and report the extent of a disaster
- **Departmental Data Layers -** This strategic plan has identified hundreds of data layers. Some of which exist, some of which need augmentation, and some of which do not exist. The GIS Team is responsible for maintaining some core GIS layers. However, departments will need to consider funding the creation and/or augmentation of other needed data. The GIS Team will consult with departments annually to discuss needed GIS layers and methods for creation/augmentation.
- **Setup of Departmental Intranet GIS Data Browser for City Attorney –** Specific departmental setup of Intranet GIS Data Browser. Should use Esri's Web App Builder.
- **Setup of Departmental Intranet GIS Data Browser for City Clerk –** Specific departmental setup of Intranet GIS Data Browser. Should use Esri's Web App Builder.
- **Setup of Departmental Intranet GIS Data Browser for City Manager –** Specific departmental setup of Intranet GIS Data Browser. Should use Esri's Web App Builder.
- **Setup of Intranet GIS Data Browser for Finance– A**nalysis of Finance/CIS data, auditing, and for finding missing revenue. Should use Esri's Web App Builder.
- **Setup of Departmental Intranet GIS Data Browser for Health, Housing and Community Services –** Specific departmental setup of Intranet GIS Data Browser for data access and redevelopment and modeling. Should use Esri's Web App Builder.
- **Cleanup Master Addressing Data** – Review of authoritative address data to normalize, verify, and replace missing data. Develop Standard Operating Procedures.
- **Database Design for HHCS** – Organize various project data into comprehensive GIS database design
- **Setup of Departmental Intranet GIS Data Browser for Parks Recreation & Waterfront –** Specific departmental setup of Intranet GIS Data Browser. Should use Esri's Web App Builder.
- **Setup of Departmental Intranet GIS Data Browser for Public Works –** Specific departmental setup of Intranet GIS Data Browser. Should use Esri's Web App Builder.
- **Setup of Departmental Intranet GIS Data Browser for Planning –** Specific departmental setup of Intranet GIS Data Browser. Should use Esri's Web App Builder.
- **Setup of Departmental Intranet GIS Data Browser for Rent Board –** Specific departmental setup of Intranet GIS Data Browser. Should use Esri's Web App Builder.

- **Setup of Departmental Intranet GIS Data Browser for Fire –** Specific departmental setup of Intranet GIS Data Browser for fire incidents and inspections. Should use Esri's Web App Builder
- **Digital Pre-Plans and Hazardous Material Data (Fire & Police)** – Consolidate pre-plan and hazardous material data for enterprise access
- **Setup Executive Dashboard for Fire** - Application to track key metrics. Use Esri's Executive Dashboard.
- **Setup Executive Dashboard for Police** - Application to track key metrics. Use Esri's Executive Dashboard.
- **Setup of Departmental Intranet GIS Data Browser for Police –** Specific departmental setup of Intranet GIS Data Browser. Should use Esri's Web App Builder
- **Public Facing Applications**
    - **Animal Control Incidents, Locations of Resident Complaints, Civic Arts Program, Public Events, Berkeley Data (City Manager)** – Use Story Maps
    - **Economic Development Story Map (City Manager) –** Telling the Economic Development Story of the City
    - **Capital Project Story Map (City Manager) –** Locations of all capital improvement projects in the City
    - **Complaint Locations, Restaurant Placarding, Policy Advocacy, Licensing Data, Vector Control (mosquito), etc. (HHCS)** – Use Story Maps
    - **Parks Recreation & Waterfront Story Maps –** Location of all facilities and their associated amenities
    - **My Government Services & Story Maps (Public Works) –** Provide access to information about various services, maps of transportation data, and street sweeping and garbage collection schedules
    - **Land Use Public Comment Application (Planning) –** Application that can be used to solicit public comment on land use or zoning changes
    - **General Plan Story Map (Planning)** – Story Map showcasing key elements of the City's Comprehensive Plan
    - **Climate Action Plan Story Map (Planning) –** Share key findings from the City's Climate Action Plan with the Public
    - **Disaster Planning Story Map (Fire) –** Provide shelter locations, locations of fire and police stations, evacuation routes, etc.
    - **Public Access to Crime Data (Police) –** Crime View Community and Story Maps

- **Home Owner's Association Story Map –** Requested by the Police Department
- **Fire Department Story Map –** Highlighting Each Station and Key Functions
- **Swipe Map –** How the City has changed over time
- **Public Works Plan –** Use a Story Map to tell the story of one of Public Works planning documents (i.e. Sidewalk Master Plan)
- **Events Story Map –** Story Map showing all of the events around the City for the year
- **Land Use Public Comment –** Should be used on an as-needed basis for public comment about various items around the City
- **Public Art Walking Tour Story Map**
- **Historic District Walking Tour Story Map**
- **Setup and Training of Golf Course Story Map** – Requested by Parks and Recreation
- **Public Access to Rent Board data –** Rent control, eviction protections, and rent stabilization.

Category 5 – Software

- **Intranet Application –** Primary data viewing and analysis portal. More portals and additional functionality. Use of existing HTML5/JavaScript WebAppBuilder
- **Public Access Internet Applications –** Various public use portals identified by staff. This line item contains funds for various Internet applications. ArcGIS Online and Story Maps
- **Mobile Data Applications –** Collector Application. Departments will be responsible for acquiring their own hardware as needed. Recommend budgeting money bi-annually for the ever changing devices
- **ArcGIS for Local Government –** Continue implementation of off-the-shelf applications to include Resident Service Request, and My Municipal Government Services applications
- **ArcGIS Data Reviewer –** Single use license for reviewing data sets for completeness and data integrity
- **3D Analyst** – for Development Services and GIS Team. Should include internal workshop on possible uses
- **Spatial Analyst** - for Development Services and GIS Team. Should include internal workshop on possible uses
- **Network Analyst –** for HHCS to conduct drive-time analysis and proximity analysis
- **Crime Analysis Tools –** Upgrade existing suite of software tools to include more crime analysis capabilities

Category 6 – Training and Education

- **ArcGIS I – Introduction to GIS**
- **ArcGIS II – Essential Workflows** *ArcGIS Desktop 1 or have commensurate skills*
- **ArcGIS III – Performing Analysis** *Students should have taken ArcGIS Desktop 1 and 2 or have commensurate skills*
- **Building Geodatabases -** *Students should have taken ArcGIS Desktop 1-3 or have commensurate skills*
- **Creating and Maintaining Metadata Using ArcGIS**
- **Configuring and Managing the Multiuser Geodatabase**
- **System Architecture Design Strategies**
- **Introduction to ArcGIS for Server**
- **ArcGIS for Server Site Configuration and Administration**
- **ArcGIS for Server: Sharing Content on the Web**
- **Tier 3 Applications –** Conducted by GIS Team
- **Training on Collector for Parks and Recreation –** To update Parks data
- **General Training on Use of Collector in the Field –** Various departments
- **Intro to Geo-Processing Scripts Using Python**
- **Implementing Versioned Workflows and Multiuser Geodatabase**
- **Introduction to Web Development Using ArcGIS API for Javascript**
- **Creating and Sharing GIS Content Using ArcGIS Online**
- **Creating a Common Operational Picture with ArcGIS Management (EOC)**
- **GIS for Managers**
- **ESRI Regional Conferences/Workshops**
- **Communication Strategy** – The following are items not addressed in the previous sections:
    - **GIS Steering Committee** – Quarterly meeting for decision makers
    - **GIS User's Group** – Quarterly meeting for GIS users
    - **GIS Day –** November of every year
    - **Annual User Satisfaction Survey and Report –** Anonymous survey for candid feedback
    - **Annual Strategic Plan Update –** Identify successes and changes needed
    - **One-on-one Meetings –** Monthly meetings with key decision makers and department heads

- **Presentations to City Council –** Annual high level presentation to Council detailing how GIS is improving the City and expanding services
- **Seminars –** Throughout the year
- **Implementation of Blogs, Email and Social Media –** For communications
- **Newspapers and Television –** Share exciting GIS projects with the media
- **Brochures, newsletters, and other marketing efforts –** Market success and services

3.0 GIS SUSTAINABILITY

GIS is an enterprise asset that should become indispensable for departments and the organization. However, its indispensability does not guarantee its permanence and sustainability. Due to budget constraints, lack of visibility, lack of education, and/or other factors, some organizations have found their GIS budgets shrinking and in some extreme cases their GIS program has been eliminated. This strategic plan has identified the desire and need for expansion of GIS throughout the organization and to external customers. What can the City of Berkeley do to safeguard their GIS investment and guarantee sustainability? One strategy is the diversification of funding. Some organizations have made the mistake of centralizing all GIS expenditures to include enterprise and departmental GIS needs. This results in a large budget line item that is more susceptible to budget cuts. Additionally, a centralized budget does not adequately reflect the diversified and pervasive needs that include department specific GIS uses. Therefore, it is recommended that the GIS is funded through various budgets. A baseline budget should exist for GIS. This should be a baseline number that ensures the propagation of the enterprise-wide GIS assets such as the core Esri software, base data layers, and enterprise-wide end user tools. IT should budget for traditional IT items such as servers and other hardware items. Lastly, individual departments should budget for department specific software, hardware, and data.

Another key strategy in regards to sustainability is education. It is all too common that organizations have great success with GIS but don't educate the organization about these successes. The Milestone 4 Chapter of this plan identifies a number of education items that are instrumental to the sustainability of GIS. This includes documentation and dissemination of return-on-investment examples, education opportunities for all staff, elected officials, and the public, as well as, leveraging internal and external media opportunities (television, newspaper, social media, etc.). Additionally, strong leadership and guidance from the GIS Steering Committee will ensure that GIS is aligned with the overall goals, priorities, and mission of the City of Berkeley which in turn will be instrumental in ensuring continued GIS success.

It is important to note that the following tactical plan is not an all or nothing strategy. Depending on actual budget allocation, the plan can change and be reprioritized. It is important that the Steering Committee assist the GIS Lead in prioritizing tasks based on the actual budget each year. Each of the items in the tactical plan were prioritized based on the extensive staff interview process, analysis of the system design chapters, and the criticality of items that are necessary for the success of other items. This document and tactical plan should be updated annually based on funding available and changing priorities. The entire plan should be redone in totality every five years. The following tactical plan has a criticality ranking (Ranking column in the following chart). This will help the organization decide on priorities if there is a budget shortfall. The ranking is as follows:

- A – Mandatory item. Without this item other items cannot be accomplished and the project as a whole will be jeopardized.
- B – Important item. The program can still function in the near term if this item is delayed. However, the item is needed and should be considered a high priority.
- C – Desired item. This item is desired but if it is not implemented it will not adversely affect other items. In some cases, this is a departmental item and its importance is departmental.

Outsourcing will be considered the default in the following pricing chart. However, some items can be done with internal resources as staff time allows.

The chart on the following page contains all of the 5-year tactical plan items sorted by task type (Governance, Infrastructure, Maintenance, Services/Data, Software, and Training/Education). **Does not include salaries for existing staff.

In the following table:

* = Costs for Staff and Software Licensing not shown in the table below

= When the task is occurring

Five Year Tactical Plan of Action Schedule									
GOVERNANCE									
Task	**Department/Division/Agency**	**Task Type**	**Ranking**	**Notes**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Adopt a New Hybrid GIS Governance Model and Staffing Plan by Hiring Two New GIS Staff within IT and changing operations, Hiring a New GIS Staff Person in Public Works, Hiring a New GIS Staff Person in HHCS, and having a GIS Power User in the Planning Department.	GIS Steering Committee	OG	A	Adoption of the governance strategy by the GIS Steering Committee			*	*	*
Update Annually the Enterprise GIS Master Plan	GIS Steering Committee / Consultant	MT	A	Document success, priorities and budget					
Develop a GIS vision, goals and objectives	GIS Steering Committee	MT	A	Creation of new vision, goals and objectives by GIS Steering Committee					
Define GIS job descriptions	All	MT	A	City should adopt a GIS job classification structure based on the formalized governance model					
Develop a coordinated GIS Enterprise	GIS Team and IT	OG	A	Coordination of all GIS projects within the enterprise by the GIS Lead					
Create and enforce new GIS Steering Committee	GIS Team	OG	A	GIS Steering Committee should be officially established based on recommendation sin Milestone 4. GIS Steering Committee will guide GIS priorities					
Consider a GIS sponsor team approach [Optional task]	GIS Team	OG	B	Executive leadership that will champion the GIS cause					
Formalize a City GIS User Group	GIS Team	OG	A	A group of GIS Users that share information about the use of the technology					
Regionalization of GIS	All	OG	A	The sharing of data, resources, applications, training, and education, and more between disparate groups of GIS users in the region					
Measure user sensitivity	GIS Lead	MT	A	Via the use of questionnaires, one-on-one interviews, GIS User Group feedback, etc.					
Improve GIS collaboration	GIS Lead	OG	A	GIS Lead should ensure that collaboration exists between all City staff and departments					
Measure quality of service	GIS Lead	MT	A	GIS Lead should measure satisfaction levels using an online questionnaire and through feedback at User group meetings					
Identify GIS authority and clear lines of responsibility	GIS Steering Committee	OT	A	The City should create clear roles and responsibilities, notifying all GIS users of those roles and responsibilities					
Continue to use the City's existing GIS budget or funding model	GIS Team and IT	OG	A	The existing GIS budget that exists in the overall IT budget should be maintained by the GIS Lead					
Explore GIS grants and funding initiatives for the City of Berkeley	GIS Lead	OG	B	The GIS Lead must pursue grants for GIS software, data, training and staff					
Grand Total by Year for Governance – (* Does not include salaries for existing staff)					$ -	$ -	$ -	$ -	$ -
INFRASTRUCTURE									
Task	**Department/Division/Agency**	**Task Type**	**Ranking**	**Notes**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Upgrade the existing GIS servers to a modern better performing technology and deploy the City's public facing GIS server in the Cloud	GIS Team and IT	OT	A	Deploy the recommended server configurations to upgrade the GIS architecture providing greater performance and responsiveness		$ 20,568			
Deploy a GIS staging environment (sand box) that replicates the GIS server site	GIS Team and IT	OT	B	Deploy a virtualized server environment that is identical to the production environment to allow application testing					
Enterprise back-ups currently created in the Barracuda Cloud. Continue this process on a daily basis to ensure that disaster recovery needs for GIS data can be met.	GIS Team and IT	OG	A	Good solution currently in place					
Existing desktop workstation technology exceeds minimum requirements. Continue to update workstation technology per the IT Replacement Plan.	GIS Team and IT	MT	A	Current technology meets minimum specs. Workstations are funded as part of Technology Infrastructure fund .					
Develop a GIS Mobile Plan to guide the development of Mobile Solutions in the City.	GIS Team / Consultant	OT	A	Standardized mobile solutions within the enterprise			$ 25,000		
Continue periodic monitoring of the LAN/WAN network to ensure it is functioning at optimal levels.	Power Users	OG	A	Good solution currently in place					
Build a central services infrastructure which exposes appropriate services end-points for transactional editing, analysis, and viewing, based on a variety of clients	GIS Team	OG	A	Continue the existing development of ArcGIS Server services					
Complete the migration of GIS data to the Local Government Information Model (LGIM)	GIS Team	OT	B	Migration mostly done but need to migrate last remaining data.					
Implement ArcGIS for Local Governments browser-based applications for intranet users	GIS Team / Consultant	OG	A	Suite of free applications from Esri that work with the LGIM			$ 15,000		
Expand the use of ArcGIS Online for public facing applications	GIS Team / Consultant	OG	A	Already in use but need to further expand	$ 20,000				
Implement best GIS practices detailed in the GIS master plan	GIS Team and IT	OG	A	*Best practices will improve performance and reliability of enterprise GIS*					
Incorporate the existing Strategic Technology Plan into the GIS Master Plan initiative	GIS Team and IT	MT	A	Need to keep similar recommendations between two plans synchronized					
The City's existing IT Replacement Plan should be reviewed and updated annually.	IT	MT	B	Keeping GIS technology infrastructure current is critical to performance					
Grand Total by Year for Infrastructure					$ 20,000	$ 20,568	$ 40,000	$ -	$ -

MAINTENANCE									
Task	**Department/Division/Agency**	**Task Type**	**Ranking**	**Notes**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Esri Software	All	OG	A	Core GIS software for the enterprise. Annual ELA (Enterprise License Agreement) cost	$ 75,000	$ 75,000	$ 75,000	$ 75,000	$ 75,000
Pictometry	All	OG	A	Agreement with County	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Data Mining Middleware	All	OG	A	Annual maintenance on middleware product that will provide data integration with other enterprise databases	*	*	*	*	*
Grand Total by Year for Maintenance					$ 80,000	$ 80,000	$ 80,000	$ 80,000	$ 80,000
TRAINING AND EDUCATION									
Task	**Department/Division/Agency**	**Task Type**	**Ranking**	**Notes**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Design and Develop an Enterprise GIS Training, Education, and Knowledge Transfer Program	All	OG	A	Enterprise-wide Training Program	$ 30,000				
ArcGIS I – Introduction to GIS	Tier 2 Users	OG	B	Entry level GIS course		$ 1,130			
ArcGIS II – Essential Workflows	Tier 1 & 2 Users	OG	B	ArcGIS Desktop 1 or have commensurate skills		$ 1,695			
ArcGIS III – Performing Analysis	Tier 1 & 2 Users	OG	B	Students should have taken ArcGIS Desktop 1 and 2 or have commensurate skills			$ 1,130		
Building Geodatabases	Tier 1 & 2 Users	OT	B	Students should have taken ArcGIS Desktop 1-3 or have commensurate skills			$ 1,695		
GIS Training should be provided to IT Professionals to allow them to better support the enterprise GIS	GIS Team and IT	MT	B	Will allow IT staff to better support GIS users		$ 5,000	$ 5,000		
Creating and Maintaining Metadata Using ArcGIS	Tier 1, 2, & 3 Users	OT	B	Metadata development critical to the GIS					
Configuring and Managing the Multiuser Geodatabase	GIS Team	OT	B	Needed to better support SDE database		$ 1,130			
System Architecture Design Strategies	GIS Team and IT	OT	B	Needed to ensure minimum system architecture in place		$ 1,695			
Introduction to ArcGIS for Server	GIS Team and IT	OT	B	Core Server course					
ArcGIS for Server Site Configuration and Administration	GIS Team and IT	OT	B	Deploying an ArcGIS Server site			$ 1,695		
ArcGIS for Server: Sharing Content on the Web	GIS Team and IT	OT	B	Sharing map service data to the web			$ 1,695		
Tier 3 Applications	Tier 3 Users	MT	A	Conducted by GIS Team					
Training on Collector for Parks and Recreation	Parks Recreation & Waterfront	OT	A	To update Parks data					
General Training on Use of Collector in the Field	Tier 3 Users	OT	A	Various departments					
Intro to Geo-Processing Scripts Using Python	Tier 1 & 2 Users	OT	B	Develop abilities to automate repetitive tasks					
Implementing Versioned Workflows and Multiuser Geodatabase	GIS Team	OT	B	Setting up versioning for the editing environment					
Introduction to Web Development Using ArcGIS API for JavaScript	GIS Team and IT	OT	B	Use of JavaScript to develop map sites					
Creating and Sharing GIS Content Using ArcGIS Online	GIS Team	OT	B	ArcGIS Online basics					
GIS for Managers (Getting Started with GIS)	Various	MT	A	High level overview of GIS					
ESRI Regional Conferences/Workshops	GIS Team	MT	B	Networking with other GIS users and attending workshops					
Communication Strategy - The following are items not addressed in the previous sections:									
GIS Steering Committee	GIS Team and Managers	OG	A	Quarterly meeting for decision makers					
GIS User's Group	GIS Team and GIS Users	OG	A	Quarterly meetings for GIS Users					
GIS Day	All	MT	B	November of every year					
Annual User Satisfaction Survey and Report	GIS Team	MT	A	Anonymous survey for candid feedback					
Annual Strategic Plan Update	GIS Team / Consultant	MT	A	Identify successes and changes needed					
One-on-One meetings	GIS Lead and Others	OG	B	Monthly meeting with key decision makers and department heads					
Presentations to City Council	GIS Lead	MT	A	Annual high level presentation to Council detailing how GIS is improving the City and expanding services					
Seminars	Various	MT	B	Throughout the year					
Implementation of Blogs, Email and Social media	GIS Team	OG	B	For Communications					
Newspapers and Televisions	GIS Team	OG	B	Share exciting GIS projects with the media					
Brochures, newsletters and other marketing efforts	GIS Team	OG	B	Market success and services					
Grand Total by Year for Training and Education					$ 30,000	$ 10,650	$ 11,215	$ -	$ -

SERVICES AND DATA									
Task	**Department/Division/Agency**	**Task Type**	**Ranking**	**Notes**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Review the database design of the City's LGIM implementation and determine if it can be improved	GIS Team / Consultant	OT	A	Access the current state of the LGIM deployment and determine if changes are needed to improve data access and to better support ArcGIS for Local Government	$ 11,532				
Fully implement metadata for all GIS data	GIS Team	OG	A	Review and all GIS layers and create/update metadata					
Perform a detailed data assessment of all GIS layers	Consultant	OT	A	Use the ArcGIS Data Reviewer and other tools to more thoroughly assess the state of GIS data	$ 30,000				
Develop GIS Service Level Agreements(SLA) , Policies, Procedures, Standard Operating Procedures(SOP) and a 2017 Work Plan	Consultant	OT	A	Establish effective SLAs, Policies, Procedures, and SOPs and 2017 Work Plan	$ 20,000				
Some of the city's current department-specific layers listed in the MDL are not current, and should be updated	Consultant	OT	A	Review and prioritize layers in the MDL to be updated either internally or with consultants			$ 15,000	$ 15,000	$ 5,000
Acquire/develop all "recommended" layers in the MDL	Consultant	OT	A	Obtain recommended layers from other government sources, create internally, or create with the use of consultants		$ 17,567	$ 27,500	$ 27,500	$ 12,500
Complete the migration of GIS data to the LGIM	GIS Team	OT	B	Document any remaining data and migrate this data to the LGIM					
Implement ArcGIS for Local Government	GIS Team	OG	A	Review and deploy targeted ArcGIS for Local Government application					
Implement the recommendations for improving the authoritative data source layers – tax parcels, street centerlines, and address points	Consultant	OT	A	Follow the detailed recommendations provided in Milestone 3 to improve the accuracy and integrity of the authoritative data source layers	$ 45,484	$ 45,484			
Create and/or improve hazard mitigation and disaster planning critical GIS data layers	Consultant	OT	A	Follow the detailed recommendations provided in Milestone 3 to improve the data layers critical to disaster planning. No cost since this will be accommodated in other tasks.					
GIS Consulting Services	Consultant	OG	A	Annual fund to utilize outside expertise on an as needed basis	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000
Database Design, Development, and Cleanup	GIS Team	OT	B	It is recommended that City of Berkeley will complete the migration of all GIS data into the Local Government Information Model.					
Data Mining	Consultant	OG	A	Using a data mining software package, systematically begin data mining from each of the existing *IT* systems used by the departments including SunGard, Accela, Lagan, New World Systems, RedAlert, Crime View Community, Chameleon, etc. This will require extensive knowledge of SQL nomenclature and the data mining tool		$ 15,000			
Collection of Parks Data	Consultant	OG	A	Full collection of all Parks infrastructure using the Collector applications. Funded by Parks Grant.					
Setup of Esri Suite for Parks, Recreation & Waterfront	Consultant	OG	A	To include the Esri WebAppBuilder, Executive Dashboard, Collector, Parks Finder, and Overall Parks Story Map		$ 10,000			
Disaster Recovery Tool (Fire)	Consultant	OT	A	Tablet based solution to allow staff to quickly assess and report the extent of a disaster		$ 10,000			
Setup of Departmental Intranet GIS Data Browser for City Attorney	GIS Team / Consultant	OT	B	Specific departmental setup of Intranet GIS Data Browser. Should use Esri's Web App Builder.			$ 5,000		
Setup of Departmental Intranet GIS Data Browser for City Clerk	GIS Team / Consultant	OT	B	Specific departmental setup of Intranet GIS Data Browser. Should use Esri's Web App Builder.			$ 5,000		
Setup of Departmental Intranet GIS Data Browser for City Manager	GIS Team / Consultant	OT	B	Specific departmental setup of Intranet GIS Data Browser. Should use Esri's Web App Builder.			$ 5,000		
Setup of Intranet GIS Data Browser For Finance	GIS Team / Consultant	OT	B	Analysis of Finance/CIS data, auditing, and for finding missing revenue. Should use Esri's Web App Builder.			$ 5,000		
Setup of Departmental Intranet GIS Data Browser for Health, Housing and Community Services	GIS Team / Consultant	OT	B	Specific departmental setup of Intranet GIS Data Browser for data access and redevelopment and modeling. Should use Esri's Web App Builder.			$ 5,000		
Cleanup Master Addressing Data	GIS Team / Consultant	OT	A	Review of authoritative address data to normalize, verify, and replace missing data. Develop Standard Operating Procedures.		$ 25,000			
Database Design for HHCS	GIS Team / Consultant	OT	B	Organize various project data into comprehensive GIS database design				$ 7,500	
Setup of Departmental Intranet GIS Data Browser for Parks Recreation & Waterfront	GIS Team / Consultant	OT	B	Specific departmental setup of Intranet GIS Data Browser. Should use Esri's Web App Builder.			$ 5,000		
Setup of Departmental Intranet GIS Data Browser for Rent Board	GIS Team / Consultant	OT	B	Specific departmental setup of Intranet GIS Data Browser. Should use Esri's Web App Builder.			$ 5,000		
Setup of Departmental Intranet GIS Data Browser for Fire	GIS Team / Consultant	OT	B	Specific departmental setup of Intranet GIS Data Browser for fire incidents and inspections. Should use Esri's Web App Builder			$ 5,000		
Digital Pre-Plans and Hazardous Material Data (Fire & Police)	Consultant	OG	A	Consolidate pre-plan and hazardous material data for enterprise access		$ 25,000			

SERVICES AND DATA (Continued)									
Task	**Department/Division/Agency**	**Task Type**	**Ranking**	**Notes**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Setup Executive Dashboard for Fire	Consultant	OT	B	Application to track key metrics. Use Esri's Executive Dashboard			$ 5,000		
Setup Executive Dashboard for Police	Consultant	OT	B	Application to track key metrics. Use Esri's Executive Dashboard			$ 5,000		
Setup of Departmental Intranet GIS Data Browser for Police	GIS Team / Consultant	OT	B	Specific departmental setup of Intranet GIS Data Browser. Should use Esri's Web App Builder			$ 5,000		
Public Facing Applications									
Animal Control Incidents, Locations of Resident Complaints, Civic Arts Program, Public Events, Berkeley Data (City Manager)	GIS Team / Consultant	OT	B	use Story Maps				$ 5,000	
Economic Development Story Map (City Manager)	GIS Team / Consultant	OT	B	Telling the Economic Development Story of the City					
Capital Project Story Map (City Manager)	GIS Team / Consultant	OT	B	locations of all capital improvement projects in the City				$ 5,000	
Complaint Locations, Restaurant Placarding, Policy Advocacy, Licensing Data, Vector Control (mosquito), etc. (HHCS)	GIS Team / Consultant	OT	B	use Story Maps				$ 5,000	
Parks Recreation & Waterfront Story Maps	GIS Team / Consultant	OT	B	location of all facilities and their associated amenities				$ 5,000	
My Government Services & Story Maps (Public Works)	GIS Team / Consultant	OT	B	Provide access to information about various services, maps of transportation data, and street sweeping and garbage collection schedules				$ 5,000	
Land Use Public Comment Application (Planning)	GIS Team / Consultant	OT	B	Application that can be used to solicit public comment on land use or zoning changes					$ 5,000
General Plan Story Map (Planning)	GIS Team / Consultant	OT	B	Story Map showcasing key elements of the City's Comprehensive Plan					$ 5,000
Climate Action Plan Story Map (Planning)	GIS Team / Consultant	OT	B	share key findings from the City 's Climate Action Plan with the Public					$ 5,000
Disaster Planning Story Map (Fire)	GIS Team / Consultant	OT	B	provide shelter locations, locations of fire and police stations, evacuation routes, etc.					$ 5,000
Public Access to Crime Data (Police)	GIS Team / Consultant	OT	B	Crime View Community and Story Maps					$ 5,000
Home Owner's Association Story Map	GIS Team / Consultant	OT	B	Requested by the Police Department					$ 5,000
Fire Department Story Map	GIS Team / Consultant	OT	B	Highlighting Each Station and Key Functions					$ 5,000
Swipe Map	GIS Team / Consultant	OT	B	How the City has changed over time					$ 5,000
Public Works Plan	GIS Team / Consultant	OT	B	Use a Story Map to tell the story of one of Public Works planning documents (i.e. Sidewalk Master Plan)					$ 5,000
Events Story Map	GIS Team / Consultant	OT	B	Story Map showing all of the events around the City for the year					$ 5,000
Land Use Public Comment	GIS Team / Consultant	OT	B	Should be used on an as-needed basis for public comment about various items around the City					$ 5,000
Public Art Walking Tour Story Map	GIS Team / Consultant	OT	B	Provide public access to public art locations					$ 5,000
Historic District Walking Tour Story Map	GIS Team / Consultant	OT	B	Provide public access to historical points of interest					$ 5,000
Public Access to Rent Board data	GIS Team / Consultant	**OT**	B	Rent control, eviction protections, and rent stabilization.					$ 5,000
Grand Total by Year for Services & Data					$ 122,016	$ 163,051	$ 112,500	$ 90,000	$ 102,500
SOFTWARE									
Task	**Department/Division/Agency**	**Task Type**	**Ranking**	**Notes**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Intranet Application	All	OG	A	Primary data viewing and analysis portal. More portals and additional functionality. Use of existing HTML5/JavaScript WebAppBuilder					
Public Access Internet Applications	Public	OG	A	Various public use portals identified by staff. This line item contains funds for various Internet applications. ArcGIS Online and Story Maps.					
Mobile Data Applications	All	OT	A	Collector Application. Departments will be responsible for acquiring their own hardware as needed. Already own Collector application.					
ArcGIS for Local Government	All	OG	B	Continue implementation of off-the-shelf applications to include Resident Service Request, and My Municipal Government Services applications.					
ArcGIS Data Reviewer	GIS Team	OT	B	Single use license for reviewing data sets for completeness and data integrity.					
3D Analyst	Various Departments	OT	B	For Development Services and GIS Team. Should include internal workshop on possible uses.					
Spatial Analyst	Various Departments	OT	B	For Development Services and GIS Team. Should include internal workshop on possible uses.					
Network Analyst	Various Departments	OT	B	For HHCS to conduct drive-time analysis and proximity analysis.					
Crime Analysis Tools	Police	OT	A	Upgrade existing suite of software tools to include more crime analysis capabilities.		$ 10,000			
Grand Total by Year for Software					$ -	$ 10,000	$ -	$ -	$ -
Yearly Totals					**$ 252,016**	**$ 284,269**	**$ 243,715**	**$ 170,000**	**$ 182,500**

4.0 TACTICAL PLAN OF ACTION SCHEDULE

The following project schedule lists each of the above tactical items by year.

Normal Task | Repeated Each Year | As Needed | Official Decision Point

Berkeley Five Year Tactical Plan of Action Schedule

Tactical Item	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
GOVERNANCE																				
Adopt a New Hybrid GIS Governance Model and Staffing Plan by Hiring Two New GIS Staff within IT and changing operations, Hiring a New GIS Staff Person in Public Works, Hiring a New GIS Staff Person in HHCS, and having a GIS Power User in the Planning Department.	▲								■	■	■	■	■	■	■	■	■	■	■	■
Update Annually the Enterprise GIS Master Plan								■				■				■				■
Develop a GIS vision, goals and objectives	▲																			
Define GIS job descriptions	■	■																		
Develop a coordinated GIS Enterprise	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Create and enforce new GIS Steering Committee	▲	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Consider a GIS sponsor team approach [Optional task]	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Formalize a City GIS User Group	▲	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Regionalization of GIS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Measure user sensitivity				■				■				■				■				■
Improve GIS collaboration	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Measure quality of service	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Identify GIS authority and clear lines of responsibility	▲																			
Continue to use the City's existing GIS budget or funding model			■				■				■				■				■	
Explore GIS grants and funding initiatives for the City of Berkeley			■				■				■				■				■	
INFRASTRUCTURE																				
Upgrade the existing GIS servers to a modern better performing technology and deploy the City's public facing GIS server in the Cloud					■															
Deploy a GIS staging environment (sand box) that replicates the GIS server site		■																		
Enterprise back-ups currently created in the Barracuda Cloud. Continue this process on a daily basis to ensure that disaster recovery needs for GIS data can be met.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Existing desktop workstation technology exceeds minimum requirements. Continue to update workstation technology per the IT Replacement Plan.									■				■							
Develop a GIS Mobile Plan to guide the development of Mobile Solutions in the City.									■	■	■	■								
Continue periodic monitoring of the LAN/WAN network to ensure it is functioning at optimal levels.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Build a central services infrastructure which exposes appropriate services end-points for transactional editing, analysis, and viewing, based on a variety of clients	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Complete the migration of GIS data to the Local Government Information Model (LGIM)	■																			
Implement ArcGIS for Local Governments browser-based applications for intranet users									■	■	■									
Expand the use of ArcGIS Online for public facing applications	■	■	■																	
Implement best GIS practices detailed in the GIS master plan	■	■	■																	
Incorporate the existing Strategic Technology Plan into the GIS Master Plan initiative	■					■				■				■				■		
The City's existing IT Replacement Plan should be reviewed and updated annually.				■				■				■				■				■
MAINTENANCE																				
Esri Software		■				■				■				■				■		
Pictometry		■				■				■				■				■		
Data Mining Middleware		■				■				■				■				■		
Tactical Item	**Year 1**				**Year 2**				**Year 3**				**Year 4**				**Year 5**			
	Q1	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
TRAINING AND EDUCATION																				
Design and Develop an Enterprise GIS Training, Education, and Knowledge Transfer Program	■																			
ArcGIS I – Introduction to GIS					■															
ArcGIS II – Essential Workflows						■														
ArcGIS III – Performing Analysis									■											
Building Geodatabases									■											
GIS Training should be provided to IT Professionals to allow them to better support the enterprise GIS					■	■	■	■	■	■	■	■								

Tactical Item	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
TRAINING AND EDUCATION (continued)																				
Creating and Maintaining Metadata Using ArcGIS																				
Configuring and Managing the Multiuser Geodatabase																				
System Architecture Design Strategies																				
Introduction to ArcGIS for Server																				
ArcGIS for Server Site Configuration and Administration																				
ArcGIS for Server: Sharing Content on the Web																				
Tier 3 Applications																				
Training on Collector for Parks and Recreation																				
General Training on Use of Collector in the Field																				
Intro to Geo-Processing Scripts Using Python																				
Implementing Versioned Workflows and Multiuser Geodatabase																				
Introduction to Web Development Using ArcGIS API for Javascript																				
Creating and Sharing GIS Content Using ArcGIS Online																				
GIS for Managers (Getting Started with GIS)																				
ESRI Regional Conferences/Workshops																				
GIS Steering Committee																				
GIS User's Group																				
GIS Day																				
Annual User Satisfaction Survey and Report																				
Annual Strategic Plan Update																				
One-on-One meetings																				
Presentations to City Council																				
Seminars																				
Implementation of Blogs, Email and Social media																				
Newspapers and Televisions																				
Brochures, newsletters and other marketing efforts																				
SERVICES AND DATA																				
Review the database design of the City's LGIM implementation and determine if it can be improved																				
Fully implement metadata for all GIS data																				
Perform a detailed data assessment of all GIS layers																				
Develop GIS Service Level Agreements(SLA) , Policies, Procedures, Standard Operating Procedures(SOP) and a 2017 Work Plan																				
Some of the city's current department-specific layers listed in the MDL are not current, and should be updated																				
Acquire/develop all "recommended" layers in the MDL																				
Complete the migration of GIS data to the LGIM																				
Implement ArcGIS for Local Government																				
Implement the recommendations for improving the authoritative data source layers – tax parcels, street centerlines, and address points																				
Create and/or improve hazard mitigation and disaster planning critical GIS data layers																				
GIS Consulting Services																				
Database Design, Development, and Cleanup																				
Data Mining																				
Collection of Parks Data																				
Setup of Esri Suite for Parks, Recreation & Waterfront																				
Disaster Recovery Tool (Fire)																				
Setup of Departmental Intranet GIS Data Browser for City Attorney																				
Setup of Departmental Intranet GIS Data Browser for City Clerk																				
Setup of Departmental Intranet GIS Data Browser for City Manager																				
Setup of Intranet GIS Data Browser For Finance																				
Setup of Departmental Intranet GIS Data Browser for Health, Housing and Community Services																				
Cleanup Master Addressing Data																				

Normal Task | Repeated Each Year | As Needed | Official Decision Point

Tactical Item	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
SERVICES AND DATA (continued)																				
Database Design for HHCS																				
Setup of Departmental Intranet GIS Data Browser for Parks Recreation & Waterfront																				
Setup of Departmental Intranet GIS Data Browser for Rent Board																				
Setup of Departmental Intranet GIS Data Browser for Fire																				
Digital Pre-Plans and Hazardous Material Data (Fire & Police)																				
Setup Executive Dashboard for Fire																				
Setup Executive Dashboard for Police																				
Setup of Departmental Intranet GIS Data Browser for Police																				
Animal Control Incidents, Locations of Resident Complaints, Civic Arts Program, Public Events, Berkeley Data (City Manager)																				
Economic Development Story Map (City Manager)																				
Capital Project Story Map (City Manager)																				
Complaint Locations, Restaurant Placarding, Policy Advocacy, Licensing Data, Vector Control (mosquito), etc. (HHCS)																				
Parks Recreation & Waterfront Story Maps																				
My Government Services & Story Maps (Public Works)																				
Land Use Public Comment Application (Planning)																				
General Plan Story Map (Planning)																				
Climate Action Plan Story Map (Planning)																				
Disaster Planning Story Map (Fire)																				
Public Access to Crime Data (Police)																				
Home Owner's Association Story Map																				
Fire Department Story Map																				
Swipe Map																				
Public Works Plan																				
Events Story Map																				
Land Use Public Comment																				
Public Art Walking Tour Story Map																				
Historic District Walking Tour Story Map																				
Public Access to Rent Board data																				

Tactical Item	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
SOFTWARE																				
Intranet Application																				
Public Access Internet Applications																				
Mobile Data Applications																				
ArcGIS for Local Government																				
ArcGIS Data Reviewer																				
3D Analyst																				
Spatial Analyst																				
Network Analyst																				
Crime Analysis Tools																				

Normal Task | Repeated Each Year | As Needed | Official Decision Point

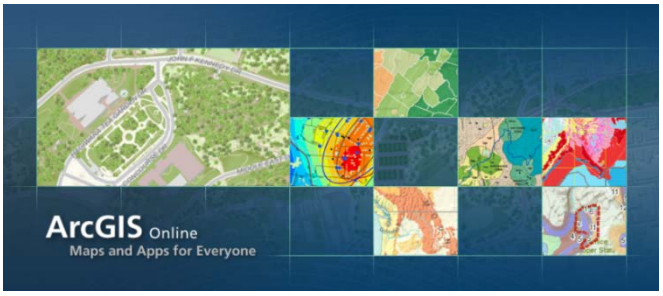
5.0 TEN YEAR FORECAST OF TRENDS

GIS has evolved significantly since its inception. Radical changes in software, databases, hardware, data creation methodologies, and end-user demands are frequent. Therefore, it is incumbent upon local governments to keep an eye on the future. Many local governments fail to do so and find that they are utilizing technology that is antiquated and not delivering expected services. These agencies find that because they have not stayed current with their technology, they do not have a readily available path to implement the latest tools. Often, the expense of having to jump from old GIS technology to new is too onerous, and they are forced to continue with their antiquated tools. In some cases, the organization almost has to start over in order to modernize their GIS. The City of Berkeley should pay close attention to industry trends. The following are trends that are anticipated to become prevalent over the next decade:

- **GIS in the cloud and software as a service (SaaS)** - Oracle, Google, Amazon, Yahoo, and Salesforce.com have spearheaded the trend of enterprise grid computing using low cost hardware and software that enables virtualization and dynamic provisioning of resources. Google, for example, has shown that this infrastructure is excellent for building scalable, and highly available, geospatial services that provide a rich user experience. Esri has recently embraced this concept, having partnered with Amazon to make (the) ArcGIS Server available via Amazon's Compute Cloud (EC2). Instead of installing and maintaining local instances of ArcGIS Server on premises, customers can launch ArcGIS Server on EC2 instances with ArcGIS Server preconfigured for them. This is in its early adoption phase and has been slowed as Esri decides on how best to offer true SaaS solutions. It is anticipated that many organizations will move their GIS to the cloud over the next decade.

- **Web Services and Data Sharing** – Although already in existence, web services and data sharing are just in their infancy. The push in the GIS industry now is to make GIS data shareable and available. Esri's software currently allows users to consume data from external feeds. ArcGIS Online is a cloud-based geospatial content management system for storing and managing maps,

data, and other geospatial information. Built on Esri's cloud infrastructure, it gives users access to geographic content shared and registered by Esri and GIS users around the world. Other vendors, such as Microsoft, are providing similar tools. Over the next decade, GIS users will transparently be consuming data provided from any number of sources.



- **Enterprise Integration** – GIS, as the integration tool for local government, has been heralded for many years. The idea is that GIS becomes the portal into all databases within an organization (spatial and non-spatial). For instance, integration between GIS, work management, asset management, outage management, and customer information systems is a desire of local government. Another example is utilizing a GIS address layer as the de-facto address database serving all non-spatial applications. This has not been and will not be an overnight process. Strides have been made over the past few years. Local governments have begun to make integration a mandatory component of any new software system acquisition. Therefore, software vendors are upgrading their software to meet this demand. Over the next decade, this trend will continue. Local government will inch closer and closer to accessing all of their enterprise data through a GIS front-end.

- **Low cost spatial data collection tools and digital data** – The cost of data collection has plummeted over the past decade. Tools have advanced, giving the ability for local government to acquire or collect information. Data collection methods and data availability will continue to expand. Local government GIS staff will need to integrate the ever increasing volume of data to include: radio frequency identification (RFID), automated meter reading (AMR), digital imaging cameras, airborne and terrestrial LIDAR, and remote sensing satellites. An ever increasing volume of digital data will be consumed via the GIS.

- **Location based services and location tracking** – Public safety has led the way with regards to integrating customer location with the services provided. E-911 and Phase II regulations have allowed agencies to view the spatial location of any call for service (land line calls and cellular calls). Utilizing location based services (LBS) has become ubiquitous for smart phone users. Users can quickly locate their favorite restaurant, an ATM, or any desired services based on their current location and a GIS mapping application. Local governments are implementing automated vehicle location (AVL) to track their fleet. Over the next decade, this will become more prevalent for public and private use. Users will expect local governments to automatically provide LBS information on road closures, the location of the nearest park with desired amenities, the location of special events, parks and recreation offerings, availability of a book at a local library, and the location of the garbage truck that will be picking up their trash. Additionally, users will expect this data to be pushed to their mobile devices. For instance, the trash truck is within an hour of a house for pickup and the customer gets a message letting them know so they can move their trash and/or recycling can(s) to the curb.

- **Resident notification** – Akin to LBS, discussed in the last bullet, is resident notification. Public safety has led the way of late in implementing applications that will notify residents if a crime occurs within a certain distance of their houses, schools, places of worship, etc. Residents are beginning to expect this type of information to be emailed, texted, or automatically phoned to them. GIS is utilized as the method of geo-enabling an existing database and comparing the event in the database with the resident's location of concern. The demand for this type of information will continue to increase. It will be expected that a local government will notify residents when a change of any type is occurring nearby. For example, Wayne County, North Carolina provides its residents with geo-enabled crime, inspection, nuisance abatement, and school/restaurant sanitation grade information based on a user's geography.

- **Mobile GIS** – Mobile computing has exploded over the past few years. Tablets and smartphones like the iPad, iPhone and Android devices now have GIS applications available. The proliferation of smartphones will help increase the pressure on software companies to continue to produce mobile applications and as computing power and capability increases for such devices, so too will the number of software companies offering mobile solutions. Expect all GIS software companies to offer their core software on these mobile devices. Additionally, a majority of GIS end user applications will become untethered from the traditional personal computer.

6.0 CONCLUSION

It is clear that staff throughout the City need to and desire to continue to utilize GIS technology to conduct their daily tasks. GIS use in local government is going to become more pervasive. GIS will become the de-facto portal for managing and analyzing all data at the City (spatial and non-spatial). The spread of GIS tools has been significant over the past few years. Also, residents are equipped with an ever increasing array of GIS based tools. They have location aware phones and an assortment of mobile devices. Over the next decade, this will become more prevalent. Users will expect local governments to automatically provide location based service (LBS) information on road closures, the location of the nearest park with desired amenities, the location of special events, parks and recreation offerings, availability of a book at a local library, and the location of projects throughout the City. This can only be accomplished through the use of GIS. The City has invested in GIS and will continue to do so. The importance of GIS at the City will continue to increase. Therefore, it is critical to the success of the organization as a whole that the recommendations made in this report are adopted. This will ensure that the City's GIS investment will be viable and will be able to meet the ever increasing demand.

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