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INTRODUCTION

In July 2016, the City of Concord selected Geographic Technologies Group (GTG) to conduct a GIS Needs Assessment and develop a Three-Year GIS Strategic Implementation Plan. The City expected the consultant to develop the GIS Strategic Plan to address all the key components for success including:

- Extending the reach of GIS throughout the organization
- A more structured expansion of GIS
- An optimum and effective governance model
- The use of GIS-based Industry Best Practices (IBP)
- An education, training, and knowledge transfer plan
- Securing buy-in from all stakeholders
- The identification of departmental GIS opportunities and gaps
- The development of a GIS Vision, Mission, and Goals and Objectives (Action Items)

The project also included a review of the staffing structure, vendor utilization, as well as detailing recommendations on how to grow the City’s GIS. The project approach and methodology contained a seven-step process, as follows, Step One: Online Questionnaire, Step Two: Kick-off Meeting and Technology Seminar, Step Three: Departmental Interviews, Step Four: GIS Needs Assessment Findings Presentation, Step Five: Alternative System Design Presentation, Step Six: Business Plan and ROI Analysis, and Step Seven: City of Concord Comprehensive GIS Plan (Plan of Action). The ultimate objective was to develop an enterprise, scalable and sustainable plan that embraces the City’s existing vision and goals and coordinates the technical, managerial and social aspect of GIS implementation.

The following departments were interviewed as part of this project:

- City Management
- Community and Economic Development
- Finance
- Human Resources
- Information Technology (IT)
- Naval Weapons Station Reuse Project
- Parks and Recreation
- Police
- Public Works
ONLINE QUESTIONNAIRE RESULTS

The following represents a summary of the results from the GIS Online Questionnaire, which was sent to all City staff, and completed by 49 staff members in July and August, 2016.

CITY OF CONCORD DEPARTMENTAL STRATEGIC NEEDS
The greatest strategic need is collaboration and teamwork across departments.

CITY OF CONCORD DEPARTMENTAL LOGISTICAL NEEDS
The greatest logistical need is training.

CITY OF CONCORD DEPARTMENTAL TECHNICAL NEEDS
The greatest technical need is data accuracy.

CITY OF CONCORD DEPARTMENTAL TACTICAL NEEDS
The greatest tactical need is data layers.

GENERAL FINDINGS
The following represents the general findings of the existing GIS conditions within the City of Concord:

1. There is a need for a GIS vision, goals, and objectives
2. There is a need for improved support and training
3. Many departments expressed a need for clear lines of responsibility
4. There is a need for mobile GIS
5. A new governance model needs to be considered for GIS
6. Standards, metadata, and improvements to the accuracy of data are required
7. There is a need for an ArcGIS Online (AGOL) initiative and public access to GIS (currently being implemented)
8. There is no Local Government Information Model (LGIM) standard currently in place (currently being implemented)
9. An evaluation of the existing system design and database structure is required for an optimum and efficient enterprise GIS (currently being reviewed/upgraded)
There are six main components of any successful GIS implementation. This study evaluated each one of the following:

A. GOVERNANCE FINDINGS

- Lacking a vision, goals and objectives
- Informal ad-hoc governance model
- No real enterprise and coordinated GIS Management
- No GIS committee structure within the organization (GIS Steering Committee will become a part of the existing IT Executive Committee)
- No GIS user group
- No regionalization of GIS
- Some GIS policy and mandates exist, but overall it is lacking
- No way to measure the quality of GIS service
- Little collaboration
- Lacking in clear lines of responsibility
- No real attempt to secure grants for GIS
- No GIS coordination of tasks
- No YouTube training channel
- Some alignment of GIS within the organization
B. IT INFRASTRUCTURE FINDINGS

- Need GIS mobile plan
- Excellent IT infrastructure to support enterprise GIS
- Need IT to be trained in GIS

C. DATA & DATA LAYERS FINDINGS

- Lack of standards
- Data layer accuracy is sub-standard (needs improvement)
- Mobile GIS
- No LGIM used (lack of understanding of LGIM)
- Need to improve data creation procedures across the enterprise
- No custodianship of data layers
- Duplication of key data layers (Street Centerlines)

D. SOFTWARE FINDINGS

- No Esri Enterprise License Agreement (ELA) (restricted)
- Lack of education, training, knowledge transfer to encourage GIS use
- No public access
  - Limited internal access
- No AGOL initiative
- No simple story maps
- Lack of Mobile GIS
- Lack of automated database extract

E. PROCEDURES AND WORKFLOW FINDINGS

- Need better solutions
- Need data standards - Metadata Standards
- Need to eliminate data duplication and ensure layers are made available
- Integrate GIS with all enterprise systems – one authoritative data source
- Expand GIS use amongst all departments
- Opportunities for increasing GIS usage by department
Lacking in GIS centric Standard Operating Procedures (SOP’s) and data maintenance procedures

Some of the existing enterprise solutions have GIS Integration, but all systems should be integrated with the central GIS data repository

F. TRAINING, EDUCATION & KNOWLEDGE TRANSFER FINDINGS

- Lack of GIS knowledge
- Lack of training
- Most people have not received adequate training

RECOMMENDATIONS

The following are the GIS recommendations for implementing a scalable, sustainable, and enterprise-wide GIS. The recommendations are split into six (6) goals with individual tasks assigned to reach each goal. The following is the recommended vision statement for the City of Concord GIS — “Develop an enterprise, scalable, and sustainable GIS that promotes effective and innovative use of geospatial technology, supported by good GIS governance and coordination, standards, and on-going training and education.”

GOAL A: GOVERNANCE RECOMMENDATIONS

A clear and understandable strategy for the management and effective use of GIS with clear lines of responsibility, decision making, and overall governance is a key component to the success of the City’s GIS.

Overall Governance Objective: The City of Concord should implement an Optimum GIS Governance Model that Centralizes Technology and Empowers Customers to take Ownership of their Data

- Task #1: COMPLETE THE MULTI-YEAR GIS STRATEGIC IMPLEMENTATION PLAN — The City needs to complete the three-year GIS Strategic Implementation Plan that details every task required to deploy a true enterprise solution, taking advantage of the latest technology and architecture. It should include a vision, and goals and objectives as well as Key Performance Indicators (KPI) for the GIS initiative.
• **Task #2: GIS AUTHORITY AND CONTROL** – The City of Concord should fill the GIS Manager position within the IT Department to oversee all GIS functions within the City. There is a distinct need for a GIS Manager within the IT department that supports all departments equally, and has the authority to direct GIS development across the enterprise. The GIS Manager position is currently vacant, and should be filled as soon as possible.

• **Task #3: ACCESSIBILITY TO DATA** – The City needs to improve accessibility to GIS software and GIS data to all City employees and any other interested parties. The existing AGOL solutions do not meet the needs of the stakeholders.

• **Task #4: ENTERPRISE STANDARD OPERATING PROCEDURES** – 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, Metadata Standards, Standard Naming Conventions, and GIS Business Integration

• **Task #5: GRANTS AND FUNDING** – The GIS Manager should encourage the pursuit of grants for GIS software, data, training, and staff.

• **Task #6: COORDINATED ENTERPRISE** – Develop and coordinate all GIS activity within the City of Concord.

• **Task #7: IT EXECUTIVE COMMITTEE** – Fold a GIS Steering Committee, comprised of directors from each department, into the existing IT Executive Committee. Develop a strategy for the Steering committee’s goals and objectives.

• **Task #8: DEVELOP GIS USER GROUP** – GIS users throughout the City should participate in the GIS User Group. Develop a strategy for the GIS User Groups goals and objectives.

• **Task #9: FORMALIZE AND RATIFY GIS GOVERNANCE MODEL** – Adopt a new governance model that includes the GIS Manager, technical staff in IT, a steering committee, and a GIS user Group. This should promote a culture of collaboration. If the City does not transition to Subject Matter Experts (SME) maintaining their own data within each department, City GIS will remain in its current state, and will not grow as desired.

• **Task #10: KEY PERFORMANCE MEASURES** – Establish enterprise and departmental GIS performance measures and Key Performance Indicators (KPI) as well as a Return on Investment (ROI) plan.

• **Task #11: PROMOTE GIS** – Promote GIS both internally and externally to showcase the City’s successes.
• **Task #12: ANNUAL UPDATE TO THE PLAN** – Update the GIS Strategic Plan on an annual basis using an online questionnaire and departmental interviews.

• **Task #13: GIS ANNUAL DETAILED WORK PLAN AND SERVICE LEVEL AGREEMENTS** – The GIS Manager should create an annual GIS work plan that details all departmental support. This may also include the development of SLAs between the IT-GIS and each department.

• **Task #14: ALIGNMENT OF GIS WITH THE CITY OF CONCORD’S VISION, GOALS, AND OBJECTIVES** – The GIS Manager should align all GIS activity and initiatives with the City’s overall vision, goals, and objectives.

• **Task #15: USER SENSITIVITY AND A MEASURE OF THE QUALITY OF GIS SERVICE** – The GIS Manager should measure satisfaction levels annually using an online questionnaire and feedback at User group meetings. This should be reported to the Steering committee.

**GOAL B: DATA AND DATA LAYERS RECOMMENDATIONS**

The City should focus on standardized data models and building and maintaining accurate, consistent, and reliable geographic data. The City should also improve access to GIS data.

**Overall Data and Database Objectives:** Design, Build, Collect, and Maintain Reliable and Sustainable GIS Digital Data Layers.

• **Task #1: CONDUCT A DIGITAL DATA ASSESSMENT** – Perform a comprehensive assessment of the quality, quantity, and completeness of all digital data layers with specific emphasis on the critical layers: Parcels, Street Centerlines, Address Points and Aerial Photography (2014)

• **Task #2: CONDUCT AN ENTERPRISE DATABASE DESIGN** – Establish and implement Esri’s LGIM – with opportunities for customization where needed.

• **Task #3: DATA CREATION** – Develop a plan to collect, update, and convert all required departmental digital data layers over an agreed upon period of time, including the list of required data layers detailed in the GIS Assessment.

• **Task #4: IMPROVE ACCESS TO CRITICAL FOUNDATION DATA LAYERS** – Develop a multi-tiered approach allowing all departments to view and access base map layers including parcels, address points, street centerlines, and aerial photography in real-time. The City of Concord should focus on the utilization of Esri’s ArcGIS Online tools.
• **Task #5: MASTER DATA LIST** – Create an updated and accurate Master Data List and maintain on a regular basis.

• **Task #6: CENTRAL REPOSITORY** – Continue to utilize Esri’s ArcSDE environment to house all City GIS data. This central repository is located within the IT Department.

• **Task #7: METADATA** – Establish and enforce standard operating procedures (SOP) for developing metadata standards.

• **Task #8: CUSTODIANSHIP** – Clearly define data custodianship roles within the enterprise governance model. This includes coordination between all departments. Each department should be responsible for specific digital data layers.

• **Task #9: MOBILE SOLUTIONS FOR VIEWING AND MAINTAINING DATA** – The City should plan, design, and deploy Esri’s ArcGIS Online as the mobile software solution. This should be supplemented by a continued effort to identify new, advanced, convenient, and easy-to-use mobile GIS and GPS field tools to collect, update, and maintain the GIS data repository. A uniform approach to using ArcGIS Online would benefit the City of Concord.

**GOAL C: PROCEDURES AND WORKFLOW RECOMMENDATIONS**

Promote the interoperability of GIS with the City’s existing business systems.

**Procedures and Workflow Objectives:** Integrate GIS Functionality with Existing Systems, Business Processes, and Workflow.

• **Task #1: INTEGRATION AND INTEROPERABILITY** – Continue to integrate GIS with the City’s existing business systems.

• **Task #2: IMPROVE DEPARTMENTAL USE OF GIS SOFTWARE:** The City should use the AGOL suite of products, including Intranet, Internet, Dashboard, Collector Application, and all free online Esri solutions to quickly and effectively improve departmental use of GIS software.

• **Task #3: IMPROVE DEPARTMENTAL ACCESS TO CRITICAL DATA**—The City should use AGOL Internet and Portal for ArcGIS Intranet solutions to quickly and effectively improve departmental use of GIS software.

• **Task #4: MOBILE SOLUTIONS**—Integrate ArcGIS Online Mobile into departmental workflow procedures.

• **Task #5: ELIMINATE DATA DUPLICATION** - Eliminate data duplication between systems.
- **Task #6: DEFINE META DATA STANDARDS** - Define the City’s Meta data requirements and establish and enforce Standard Operating Procedures (SOP) for developing metadata standards. See Data and Databases Section.

- **Task #7: GIS STANDARD OPERATING PROCEDURES (SOP)** - 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, Metadata Standards, Standard Naming Conventions, and GIS Business Integration. See Governance Section.

- **Task #8: GIS TECHNICAL SUPPORT (TICKETING AND SERVICE DESK)** - Enforce the use of the IT’s ticketing procedure for all GIS activity within the City.

- **Task #9: CUSTODIANSHIP OF DATA LAYERS** - Detail departmental custodianship of all data layers

**GOAL D: GIS SOFTWARE RECOMMENDATIONS**

The City should deploy a full suite of GIS software solutions across the enterprise – Desktop, Internet, Intranet, and Mobile. The City should also provide new technology for GIS data and GIS tools.

**GIS Software Objectives:** Make GIS Software Accessible throughout the Organization and to the Public.

- **Task #1: EFFECTIVE USE OF THE EXISTING ESRI LICENSING** – The City should use the existing Esri license agreement to effectively deploy the right tools to the right people.

- **Task #2: INTRANET SOLUTION** – Deploy a state of the art Intranet using the existing Esri licensing.

- **Task #3: ARCGIS ONLINE (AGOL) SOFTWARE INITIATIVE** – Plan, design, and deploy AGOL, including the setup, configuration, and effective use of the tools and applications available.


- **Task #5: INTERNET PUBLIC ACCESS PORTAL** – Use the AGOL solution to deploy a state of the art solution for the public.

- **Task #6: CROWDSOURCING** – Continue to engage and solicit input from citizens by promoting crowdsourcing applications. The City currently uses PublicStuff paired with Accela for crowdsourcing. Citizens can report potholes, graffiti, garbage, signage issues, and more.
• **Task #7: ELECTED OFFICIALS** – Use GIS as a tool to provide timely and accurate data to the elected officials.

• **Task #8: MODELING EXTENSIONS** – The City should take advantage of Esri’s modeling extensions for the desktop.

• **Task #9: MOBILE SOFTWARE SOLUTIONS** – Plan, design, and deploy Esri’s ArcGIS Online as the mobile software solution for the City of Concord.

• **Task #10: GREENCITYGIS** – Deploy GreenCityGIS for the Parks and Recreation department, integrated with Accela.

• **Task #11: FREE ESRI APPLICATION ONLINE** – After the migration of the City’s GIS to the LGIM the City should take advantage of all applications available online.

**GOAL E: GIS TRAINING RECOMMENDATIONS**

The City should improve the GIS knowledge base within City departments. The City should also promote training, education, and knowledge transfer, and improve the overall use of GIS.

**GIS Training Objectives:** Train, Educate, and Promote Knowledge Transfer for all City Staff.

• **Task #1: GOVERNANCE MODEL** – Implement a centralized or hybrid governance model that promotes ongoing training and education.

• **Task #2: SOFTWARE TRAINING** – Provide software GIS training and educational opportunities to all City staff on a regular basis. Utilize Esri’s Online Education and Training services through the existing licensing agreement. Provide formal classroom training for identified departmental staff, including: Desktop, Intranet, Internet, Mobile, GPS, ArcGIS Online and Story Maps, and Extensions.

• **Task #3: KNOWLEDGE TRANSFER** – Establish a GIS user group network within the organization to help facilitate growth. Establish quarterly GIS meetings.

• **Task #4: FORMAL ON-GOING TRAINING PLAN** – Implement a formal sustainable GIS Training Plan.

• **Task #5: MOBILE TRAINING** – As part of the formal training plan, develop a strategy for the effective use and training of mobile field devices.

• **Task #6: CONFERENCES** – Attend workshops and pre-conference seminars at the Esri International Users Conference and regional Esri California Conferences.

• **Task #7: ONLINE SEMINARS AND WORKSHOPS** – Use all available online training, education, and knowledge transfer workshops.
• **Task #8: SEMINARS AND WORKSHOPS** – The GIS Team will offer seminars and workshops tailored to specific departmental applications of GIS.

• **Task #9: DEPARTMENTAL SPECIFIC TRAINING** – Promote departmental specific GIS training.
  
  Encourage and promote targeted GIS training, including:
  
  o  General Executive Management Workshop
  o  Public Safety GIS Workshop
  o  Utilities Workshop
  o  The ROI of GIS in City Government

**GOAL F: INFRASTRUCTURE RECOMMENDATIONS**

The City of Concord should continue to utilize the IT Infrastructure to support an Enterprise, Scalable and Sustainable GIS.

**Infrastructure Objectives:** Continually evaluate the IT architecture initiative so it will sustain enterprise GIS growth and change.

• **Task #1: INFORMATION TECHNOLOGY (IT)** – Ensure the most optimum network and hardware is in place for the GIS initiative.

• **Task #2: IT SPECIFIC TRAINING** – GIS Staff within the IT Department should participate in GIS specific training including GIS System Administration, ArcSDE, Geodatabase Design, and SQL Server.

• **Task #3: 24/7 AVAILABILITY** – The IT Department should continue to provide network stability, security of data, and 24/7 availability to City staff.

• **Task #4: ENTERPRISE BACK-UP** – The IT Department should continue with GIS data back-up and database recovery solutions.

• **Task #5: DATA STORAGE** – The data storage and network speed for the enterprise GIS should continue to be administered by the IT Department.

• **Task #6: DEVELOP A CITYWIDE MOBILE GIS PLAN** – The City and IT Department should develop an integrated and enterprise tool for mobile operations that includes ArcGIS Online.
PROPOSED BUDGET

The following is the recommended three-year budget for the deployment of an enterprise, scalable, and sustainable GIS for the City of Concord. This budget includes changes to the City’s governance model, data and database reorganization and modification, as well as the creation and integration of GIS technology into the City’s existing business workflows, GIS software, GIS training and education, and the investment in IT infrastructure.

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PHASE I
DEPARTMENTAL NEEDS ASSESSMENTS
INTRODUCTION
INTRODUCTION

PHASE I – GIS NEEDS ASSESSMENT

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 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 Survey Instrument** – allowed Concord staff to answer a series of questions designed to illicit information about all aspects of the GIS.
- **On-site Technical Workshop** – the workshop included demos of GIS software apps pertinent to City of Concord Departments. This allowed staff to better understand what is possible with an enterprise GIS.
- **On-site Departmental Interviews** – multiple days were spent on-site interviewing departmental staff to get details on current uses and needs.

The data gathered through these various methods was then complied as the first phase of this project. This section, Phase I includes each departmental needs assessment. The Voice of the Customer (VOC) Survey document is located in the Appendix of this project document. The data gathered through these various methods was then compiled into three documents that comprise the first phase of this project. The documents are as follows:
• **Chapter 1 – 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.

This chapter has been compiled together to provide background context for the recommendation documents that follow in Phase II.
PHASE I
DEPARTMENTAL NEEDS ASSESSMENTS
DEPARTMENTAL NEEDS ASSESSMENTS

The City of Concord selected Geographic Technologies Group (GTG) to assess the current state of GIS within the City and recommend a strategy for moving forward. The ultimate goal of the project included:

1. Document the City’s existing GIS Conditions
2. Document the GIS needs of each department and the enterprise
3. Develop recommendations for an enterprise GIS
4. Benchmark other similar organizations
5. Develop an understandable Step by Step Plan of Action that includes a proposed budget


The scope of Phase One: GIS Needs Assessment included:

Step One: Remote Data Gathering
- June 11th – August 11th – Online GIS questionnaire

Step Two: Kick Off Presentation to GIS Technical Committee
- August 16th 10:00am-11:00am Kick-Off Presentation and Discussion
Step Three: Departmental Interviews

- August 16th Departmental Interviews
  1. Human Resources
  2. Finance
  3. Information Technology

- August 17th Departmental Interviews
  1. City Management
  2. Community and Economic Development
  3. Naval Weapons Station Reuse

- August 18th Departmental Interviews
  1. Public Works
  2. Parks and Recreation
  3. Police

Step Four: Presentation of Findings and Recommendations

- GTG On-site Presentation of Findings and Recommendations

Over 40 staff were asked to participate in the Departmental Interviews performed on August 16th – August 18th 2016; most of the following were interviewed.

City Management

Valerie Barone, City Manager Valerie.barone@cityofconcord.org
Jovan Grogan, Deputy City Manager Jovan.grogan@cityofconcord.org
Joelle Fockler, City Clerk joelle.fockler@cityofconcord.org

Community and Economic Development

Victoria Walker, Director of CED Services Victoria.walker@cityofconcord.org
Joan Ryan, Community Reuse Area Planner joan.ryan@cityofconcord.org
CORP Mario Camorongan, Senior Civil Engineer Mario.camorongan@cityofconcord.org
Robert Woods, Chief Building Official Robert.woods@cityofconcord.org
Ray Kuzbari, Transportation Manager ray.kuzbari@cityofconcord.org
CORP Bernard Enrile, Associate Civil Engineer Bernard.enrile@cityofconcord.org
Cathy Gaughan, Ltd Ser-Admin Support cathy.gaugham@cityofconcord.org
Brenda Kain, Program Manager Brenda.kain@cityofconcord.org
John Montagh, Redevelopment Housing Manager john.montagh@cityofconcord.org
Brian Nunnally, Economic Development Manager brian.nunnally@cityofconcord.org

Finance
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Suzanne McDonald, Financial Operations Manager Suzanne.mcdonald@cityofconcord.org
Karan Reid, Director of Finance karan.reid@cityofconcord.org

Human Resources
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Kristi Carter, Human Resources Analyst I Kristi.carter@cityofconcord.org
Teresa Fairbanks, Senior Human Resources Analyst Teresa.fairbanks@cityofconcord.org

Information Technology
Victoria Zaldua, GIS Program Analyst Victoria.Zaldua@cityofconcord.org
Matthew Bowley, Contractor Matthew.Bowley@cityofconcord.org
Jeff Lewis, Director of Information Technology Jeff.lewis@cityofconcord.org

Naval Weapons Reuse Station
Guy Bjerke, Director of Community Resource Planning guy.bierke@cityofconcord.org

Parks and Recreation
Steve Voorheis, Director of Parks and Recreation steve.voorheis@cityofconcord.org
Marla Parada, Program Manager marla.parada@cityofconcord.org
Police
Michael Raney, Senior Crimes Analyst Michael.raney@cityofconcord.org
Cheryl Owens, Administrative Services Manager Cheryl.owens@cityofconcord.org

Public Works
Darin Fitzpatrick, Public Works Supervisor darin.fitzpatrick@cityofconcord.org
Justin Ezell, Director of Public Works Justin.ezell@cityofconcord.org
Jeff Rogers, Infrastructure Maintenance Manager jeff.rogers@cityofconcord.org
Tyce Dekker, Public Works Supervisor tyce.dekker@cityofconcord.org
David Boatwright, Senior Administrative Analyst david.boatwright@cityofconcord.org
Robert Hardie, Facilities Maintenance Manager Robert.hardie@cityofconcord.org

The following sections give an overview of each department, and details the existing GIS conditions and future needs. Each section documents the number of existing GIS users and the anticipated number of future GIS users. The recommended specific software solution or application for each department is specifically listed as well.
PHASE I
DEPARTMENTAL NEEDS ASSESSMENTS
CITY MANAGEMENT
1. EXISTING CONDITIONS

DEPARTMENT OVERVIEW

The City of Concord’s City Management Department (CMD) manages the delivery of services through the City Manager’s Office, City Council Services, City Clerk’s Office, Records Management, Mail and Reception Services, Community Relations and Franchise Management, and Printing Services.

The City Clerk serves as the local Elections Official and administers democratic processes to assure all legislative actions are properly recorded and city records available to the public. The City Clerk acts as a
compliance officer for federal, state, and local statutes including the Political Reform Act, the Brown Act, and the Public Records Act.

The Community Relations Division conducts public affairs programs including public and internal communications, and community and media relations. They produce City News, other major publications, video productions, and cable programming. This division is responsible for managing special programs and the City’s Internet sites.

The Printing Services Division provides graphic design, printing, high-speed copying and bindery services, user consultation for composition and materials, and brokering services for outsourced printing.

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.

Minimal GIS is currently used within the CMD. The Information Technology Department’s GIS Division provides GIS products for the CMD on a needed basis. This consists of maps for public meetings, mailing labels for public hearings, recuse searches for Council Members, and other miscellaneous tasks. 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

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<td>N/A</td>
</tr>
<tr>
<td>(Tier 1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Custodian</strong></td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>(Tier 2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Analytical</strong></td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>(Tier 3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Browser</strong></td>
<td>2</td>
<td>Limited</td>
<td>City Intranet GIS Viewer, GIS Staff within IT</td>
</tr>
<tr>
<td>(Tier 4)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### HARDWARE AND SOFTWARE

The CMD uses personal computers for each of its staff. No GPS units are utilized by the CMD. Printers are available for office use.

**Hardware Issues Summary**

<table>
<thead>
<tr>
<th>Type</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal Computers</strong></td>
<td>One for each staff person</td>
</tr>
<tr>
<td>Laptops</td>
<td>Available for use</td>
</tr>
<tr>
<td>Printers</td>
<td>Ample printers available for use</td>
</tr>
<tr>
<td>Plotters</td>
<td>None</td>
</tr>
<tr>
<td>GPS</td>
<td>None</td>
</tr>
<tr>
<td>MDTs</td>
<td>None</td>
</tr>
<tr>
<td>Scanners</td>
<td>None</td>
</tr>
</tbody>
</table>

Microsoft Office is used to conduct office productivity tasks. OnBase is used for Document Management. The CMD utilizes the following software applications:

1. **Microsoft Office** – Office productivity
2. **OnBase** – Document Management
3. **SouthTech** – Conflict of Interest Forms for GIS

---

**OnBase** ➔ OnBase is used as the City’s Document Management System. Key documents are added digitally to OnBase and should be made available via links within the Intranet GIS Viewer.

**SouthTech** ➔ Staff within the CMD use SouthTech software for conflict of interest forms. Information populated within the forms should be generated from GIS as a starting point during the recuse process.
2. GIS NEEDS ASSESSMENT

GIS NEEDS

The enhanced ability to query, analyze, map, and share geographic information will improve operations within the CMD. Currently there is minimal GIS activity within the CMD. Much of what is done by the staff has a geographic component and can benefit from GIS within the department.

Recent interviews with City personnel identified some important themes with regard to GIS implementation. It was determined that GIS should be applied in a simple yet effective way. It should be integrated as fully as possible into the workflow of each department.

In regards to the CMD and the City in general, GIS currently assists and will continue to assist the City of Concord in achieving its mission. By following the recommendations in this implementation plan, the City will utilize GIS in innovative ways, enabling the City to be part of the top tier of City GIS implementations in the state of California. Citizens will have Internet access to GIS data as as well as improved infrastructure and services based on more effective City-wide use of GIS. A centralized data management and distribution model will provide staff with real-time access to detailed data that will enable them to do their jobs more efficiently and improve decision-making at various levels. In addition, GIS will continue to add value to existing systems, by allowing staff to view data in a user-friendly geographic context.
The City of Concord has the core competencies and interdisciplinary skills to use robust geo-spatial tools. An enterprise-wide implementation of GIS technology facilitates support, offering an opportunity to organize and distribute existing and future digital data created during this initiative. Organizing and centralizing data/databases from each department will eliminate data redundancy, thereby improving data integration and data quality. Improved data management will also assist with automation of analytical processes by providing rapid access to reliable, consistent, and valid data.

Each department must actively pursue new and exciting developments in the geo-spatial sciences. Emerging technologies and methodologies will assist in continuing to reduce liability, reduce operating costs, improve efficiency, and improve productivity.

The following needs are identified as essential to this GIS initiative, including:

- The need for support from the City Management and City Council Members
- The need to use GIS to identify the optimal and responsible way to manage utilities
- The need to use GIS to promote economic development
- The need for automated mapping and analysis applications
- The need to integrate and centralize existing data/databases for easy access and distribution of City-wide information
- The need to make this an enterprise-wide effort instead of departmental
- The need to show cost/benefit for implementing GIS among the City departments
- The need to design and develop user-friendly intranet-based GIS applications and tools
- The need to provide formal GIS training for staff
- The need to educate elected officials as to the benefits of GIS

The real and demonstrated application of GIS technology will guarantee success. The first year of implementation must demonstrate quantifiable and visible successes with GIS. Department heads as well as the City Management identified that the following items were important to the project:

GIS Used for Tracking Projects
• GIS should be used for centrally tracking all City projects
• GIS should be used to track and manage road condition data and re-paving priorities
• GIS should be used to track grant programs to include:
  o Neighborhood specific issues
  o What has been successful and what has not
  o What elements were utilized by area
• Easy-to-use GIS tools
• Ability to create mailing labels via an easy-to-use GIS interface
• Access to accurate and complete data
• Base mapping (including street centerlines, address points, tax parcels, and aerial photography)
• Access to crime statistics in a more automated fashion
• Asset mapping
• City demographics mapping and analysis
• Intergovernmental agreements with the County, other local governments, and regional organizations
• GIS should be a unifying technology that ties various technologies together in one common interface
• Formal GIS training for existing staff
• Access to accurate computerized maps of utility infrastructure
• Field access to GIS data
• Integration of existing IT investments

It is expected that City Management and City Council Members will support enterprise-wide GIS implementation. The City of Concord is poised to leverage existing investments in technology and personnel to improve Citywide decision-making, services, and products through the use of GIS. Continued leadership and strategic guidance will be necessary to ensure that the City’s GIS implementation is fulfilled in the long term.

Based on this Need Assessment, the CMD has several GIS needs. Where applicable each need will be followed by an application to meet that need, some applications will meet several needs:
<table>
<thead>
<tr>
<th>GIS Need</th>
<th>Method/Application to Meet Need</th>
</tr>
</thead>
<tbody>
<tr>
<td>Story Maps – Telling the City’s Story</td>
<td>Story Maps</td>
</tr>
<tr>
<td>Formal GIS Training for CMD Staff</td>
<td>CMD Specific Training</td>
</tr>
</tbody>
</table>

### GIS NEED

**Story Maps – Telling the City’s Story**

Historically, public facing local government 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. 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 apps 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. The CMD would benefit from offering Story Maps on their web-site. Story maps could be used to provide further information on business, recreation opportunities, and a regional look at the area. The following story maps would be beneficial to the City of Concord:

- Walking trails
- Art
- Historic downtown
- Economic development

It is important that any public facing applications integrate well into the existing city web-site design.

---

**Example Story Map of Sites of Interest in Naples, FL**

**Palm Springs, CA Story Map**
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 the CMD, or as a website available to all internal City departments.

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 CMD intranet site should be configured to present users with pertinent GIS data and custom defined queries for easy end-user interaction. It is recommended that the CMD have a configuration specific to their needs. For example, CMD needs access to real property areas based on council addresses, up-to-
date parcel data for mailing labels, links to the City’s document management system within the parcel data, OnBase, City projects, address lookups (in or out of City Limits) for elections, and a variety of other data. Integrating data from various business systems is instrumental in making GIS more effective for the CMD and the other City departments.

The City should seek to deploy a next generation web-based data browser or an internet application such as ArcGIS Online. ArcGIS Online will greatly improve efficiencies by eliminating the need to load updated data to laptops, while also ensuring all employees have access to current data, tools, and applications.

Since ArcGIS Online is easily configurable, each division or group can have a configuration(s) that is tailored to their needs. Also, specific applications can be created for focused needs. Further, because ArcGIS Online is an integrated part of the ArcGIS suite, it extends beyond browser base applications to the desktop and to mobile devices. Now, staff can access all of their needed GIS data from anywhere.

**Formal GIS Training for City Management Staff**

The CMD will benefit from formal training in GIS, specifically the City Clerk’s Office. An education strategy is being developed for the City of Concord that will include training on various software tools. It is anticipated that CMD staff will be included on GIS Intranet Viewer, ArcGIS Online, and Story Map training opportunities. Staff will be trained on how to use an updated version of the GIS Intranet Viewer (recommended) to create mailing labels based on a 500 ft. buffer.
3. GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY

The CMD will benefit from access to several 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 departments.

Legend

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creation Methodology</td>
<td>This column describes how the layer was or is anticipated being created.</td>
</tr>
<tr>
<td>Recommended Update of Division or Individual</td>
<td>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.</td>
</tr>
<tr>
<td>Layer Status</td>
<td>Layer state of existence.</td>
</tr>
<tr>
<td>Existing</td>
<td>These layers currently exist within the City’s GIS.</td>
</tr>
<tr>
<td>Recommended/Desired</td>
<td>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.</td>
</tr>
<tr>
<td>Partial</td>
<td>These layers currently exist in an incomplete or outdated state.</td>
</tr>
</tbody>
</table>
The following table lists those data layers that are important to the CMD:

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>Creation Methodology</th>
<th>Recommended Update Division or Individual</th>
<th>Existing or Recommended?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CMD GIS Data</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital Improvement Projects</td>
<td>Digitize from base map data; aggregate layers as needed</td>
<td>Various overseen by GIS staff at the City</td>
<td>Recommended</td>
</tr>
<tr>
<td>Easements</td>
<td>Digitized on screen</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Existing Businesses</td>
<td>Extracted from Accela</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td>Infrastructure Layers</td>
<td>Digitized and GPS</td>
<td>Public Works</td>
<td>Partial</td>
</tr>
<tr>
<td>Land Use</td>
<td>Digitized on screen/Extract from Accela</td>
<td>CED</td>
<td>Recommended</td>
</tr>
<tr>
<td>Permits</td>
<td>Extracted from Accela</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td>Zoning</td>
<td>Digitized on screen/Extract from Accela</td>
<td>CED</td>
<td>Recommended</td>
</tr>
<tr>
<td><strong>Citywide Base Data</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Property</td>
<td>Parcels were initially created by Contra Costa County. The GIS Division within IT maintain the parcels currently. Temporary ID’s are added to parcel data until the County assigns a permanent number.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Aerial Photography</td>
<td>The City obtains aerial photography every 2 – 4 years as the budget allows.</td>
<td>Static Map</td>
<td>Existing</td>
</tr>
<tr>
<td>Road Centerlines</td>
<td>There are currently two versions of the street centerline data that are maintained. One version is used for maps and cartographic purposes and the other version is used within TriTech for CAD purposes.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Address Points</td>
<td>Address points have been created based on parcel centroids. However, they are stacked for parcels with multi-tenant dwellings.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
</tbody>
</table>

**GAP ANALYSIS CHART**

As part of this Needs Assessment, a Gap Analysis has been conducted to determine an optimal environment and set of processes for the utilization of GIS. This analysis provides a baseline level of understanding for the existing status and desired status of major GIS components for the department.

The matrix below details those relevant components that have been analyzed and assessed as part of the Gap Analysis.
# LEGEND

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Desired</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>High</td>
</tr>
<tr>
<td>Existing</td>
<td>No</td>
<td>No</td>
<td>Medium</td>
</tr>
<tr>
<td>Limited/Partial</td>
<td>Limited</td>
<td>Limited</td>
<td>Low</td>
</tr>
</tbody>
</table>

## NOTES

- **Automated Vehicle Location (AVL)**
  - AVL can be used to track official vehicles; Using AVL conjunction with routing increases efficiency and can reduce fuel consumption, thereby decreasing costs. The CMD has no need for AVL at this time.

- **Documentation**
  - Some documentation on GIS data creation and workflow exists however there is a greater need for creation and standardization for documentation.

- **Enterprise Systems Integration**
  - Integration with existing databases is essential.

- **Geocoding**
  - Comprehensive geocoding will expand CMD’s mapping functionality. Geocoding is the method that will be used to link many data sets back to address points.
<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>STATUS</th>
<th>PRIORITY</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIS Data Access</td>
<td>Limited</td>
<td>High</td>
<td>The CMD would benefit from access to other departments data layers. GIS Data access is desired and should be addressed throughout the city.</td>
</tr>
<tr>
<td>GIS Data Maintenance</td>
<td>No</td>
<td>Low</td>
<td>The CMD will not maintain its own GIS data at this time.</td>
</tr>
<tr>
<td>GIS Data Sharing</td>
<td>No</td>
<td>Low</td>
<td>The CMD will not maintain its own GIS data at this time.</td>
</tr>
<tr>
<td>GIS Personnel</td>
<td>No</td>
<td>Low</td>
<td>The CMD does not need full-time GIS personnel.</td>
</tr>
<tr>
<td>Hardware</td>
<td>Yes</td>
<td>Low</td>
<td>The current hardware is sufficient for running the needed GIS software.</td>
</tr>
<tr>
<td>Mapping</td>
<td>No</td>
<td>Medium</td>
<td>The CMD will create maps and generate mailing labels using the recommended new GIS Intranet Viewer.</td>
</tr>
<tr>
<td>Metadata</td>
<td>No</td>
<td>High</td>
<td>The CMD needs to know the derivation of the data, its currency, and completeness.</td>
</tr>
<tr>
<td>Mobile Computing Resources</td>
<td>No</td>
<td>Low</td>
<td>It would be beneficial for CMD to have access to GIS data while in the field.</td>
</tr>
<tr>
<td>Network</td>
<td>Yes</td>
<td>High</td>
<td>High availability and fast access to GIS data will be important to the success of this initiative.</td>
</tr>
<tr>
<td>Routing</td>
<td>No</td>
<td>Low</td>
<td>GIS-based routing is not needed by CMD staff.</td>
</tr>
<tr>
<td>Software</td>
<td>Yes</td>
<td>High</td>
<td>CMD will need expanded use of GIS software to include Story Maps and a new Intranet GIS Viewer.</td>
</tr>
<tr>
<td>Spatial Analysis and Modeling</td>
<td>No</td>
<td>Low</td>
<td>The CMD will not perform spatial analysis or modeling at this time.</td>
</tr>
<tr>
<td>Training/Education</td>
<td>No</td>
<td>High</td>
<td>This component is considered a high priority for use of GIS within CMD</td>
</tr>
</tbody>
</table>
4. MULTI-TIER GIS APPLICATION USE

The pyramid and table below outlines the “Tiers of GIS Use” within the CMD. 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 and is considered professional GIS personnel. A Tier 2 user is considered an advanced GIS user who is a data custodian. A Tier 3 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 4 Browser user requires only general browsing GIS data functions. The CMD will consist of Tier 4 Users.

<table>
<thead>
<tr>
<th>TIERS OF GIS USERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>GROUP</strong></td>
</tr>
<tr>
<td>Tier 1 Flagship</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Tier 2 Custodian</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Tier 3 Analytical</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Tier 4 Browser</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
5. RETURN ON INVESTMENT (ROI)

The following table indicates specific Return on Investment opportunities for the CMD. These specific examples show the potential return on investment of the technology.

<table>
<thead>
<tr>
<th>Return on Investment Opportunity</th>
<th>Opportunity</th>
<th>Explanation</th>
</tr>
</thead>
</table>
|                                  | **Save Time and Respond More Quickly to Citizen 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 will free up resources for other matters.  
**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 Time – Efficient Use of Resources**        | **Easy access to GIS data:**  
  • GIS software should be used to generate mailing labels, determine if an address is in or out of the City limits for elections, and access OnBase documents. |
NEEDS ASSESSMENT
COMMUNITY AND ECONOMIC DEVELOPMENT

CITY OF CONCORD
CALIFORNIA
GIS Strategic Implementation Plan
SECTION OUTLINE

1. EXISTING CONDITIONS
   - Department Overview
   - Governance of GIS
   - Hardware and Software

2. GIS NEEDS ASSESSMENT
   - GIS Needs

3. GIS GAP ANALYSIS
   - GIS Data Layer Inventory
   - GAP Analysis Chart

4. MULTI-TIER GIS APPLICATION USE

5. DEPARTMENTAL RETURN ON INVESTMENT (ROI)

1. EXISTING CONDITIONS

DEPARTMENT OVERVIEW
The Community and Economic Development department works to efficiently deliver Building, Planning, Economic Development, Redevelopment, Housing, Engineering, and Transportation services for the City. The divisions under this department include:

1. Community and Economic Development (led by 1 Director)
   a. Planning (1 Planning Manager)
   b. Economic Development and Housing/Community Services (2 Economic Development Managers and 2 Program Managers) –
i. **Economic Division:** The San Francisco Bay Area provides a key gateway to the economies of California and the world. But doing business in just any Bay Area location is no longer sufficient. Today's unpredictable economy demands that organizations locate in a community offering easy access to the entire region, a stable, safe business environment and room for growth along with a high quality of life. As a result, businesses continue to discover the rewards of doing business in Concord. Within the City of Concord and available to citizens is the County Connection bus service and rail travel to Sacramento via an AMTRAK. The nearby Buchanan Field Airport offers executive jet and air taxi service.

c. **Building Division** (1 Chief Building official) - provides plan checking, permit administration, and inspection services for new construction, additions, and remodels of residential and non-residential projects within the City.

i. **Administrative Services**

   1. Responds to permit status inquiries and general questions about permit processes
   2. Records Management (imaging, researching, records requests, etc.)
   3. Plan review of small residential projects
   4. Fee collection and issuing refunds (e.g., security deposits)
   5. Permit initialization and Issuance (e.g., building permits, reroof permits, solar PV permits, pool permits, miscellaneous electrical, mechanical, or plumbing permits)
   6. Monitoring applicant’s submittals of external approvals (e.g., Fire District, Health, BAAQMD, School District, Special Inspection Final Reports, Final Waste Management Report)
   7. Permit application routing to all divisions
   8. Coordination of Consolidated Plan Review Comments from all divisions

ii. **Plan Review Services**

iii. **Inspection Services**

iv. **C&D Waste Management Services**

v. **Building Code Enforcement Services:**

vi. **Multi-Family Housing Inspection Program Services**

d. **Engineering Division** (2 Engineers and 2 Transportation Managers)
GOVERNANCE OF GIS

The Community and Economic Development Department (CEDD) utilizes GIS for many mission critical functions. CEDD have several GIS driven tasks that are completed via GIS staff within IT. CEDD have nine (9) Tier 3 staff mainly using Concord Prospector. One (1) staff person creates mailing labels using GIS tools through Accela, while most staff rely on GIS staff within IT for this service.

CEDD cannot carry out its functions efficiently without GIS technology and GIS capable staff. It is important that staff within CEDD continue to expand their GIS capabilities and develop Subject Matter Experts (SME) within the department. 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 needs.

The table below summarizes the current GIS capable staffing within the CEDD. 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.

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of Users</th>
<th>GIS Usage</th>
<th>Primary Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIS Flagship</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>(Tier 1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Custodian</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>(Tier 2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analytical</td>
<td>9</td>
<td>Medium</td>
<td>Concord Prospector and Intranet GIS Viewer</td>
</tr>
<tr>
<td>(Tier 3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Browser</td>
<td>15</td>
<td>Medium</td>
<td>Accela</td>
</tr>
<tr>
<td>(Tier 4)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Computers</td>
<td>Personal computers are available for all staff</td>
</tr>
<tr>
<td>Laptops</td>
<td>Available for use</td>
</tr>
<tr>
<td>Printers</td>
<td>Available to office staff</td>
</tr>
<tr>
<td>Plotters</td>
<td>One (1) Plotter in the CED Office</td>
</tr>
<tr>
<td>GPS</td>
<td>None</td>
</tr>
<tr>
<td>PDA/MDTs</td>
<td>10 iPad’s</td>
</tr>
<tr>
<td>Scanners</td>
<td>Available for use</td>
</tr>
</tbody>
</table>

The Community Development Department utilizes the following software applications:

1. Microsoft Office—Used for office productivity
2. City Intranet GIS Viewer
3. Web ArcGIS Viewer from Psomas (Clean Water)
4. Accela & Accela Automation
5. Collector App (future for Stormwater Inspections)
6. Google Maps
7. Google Earth
8. AutoCAD
9. Concord Prospector
10. Microsoft Project
11. OnBase
12. Crossroads (Collisions)
13. CoStar/LoopNet (Economic Development)
14. HDL (Business Licenses)
2. GIS NEEDS ASSESSMENT

The CEDD would like to further implement and embrace GIS and its complementary technologies, but has been limited in the past due to staff availability and software functionality. From planning project information to economic development 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 if adequate training and support is provided.

Similar agencies across the country have implemented GIS in varying capacities, and CEDD 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, ownership of the situs address point layer and other layers that may be needed, as well as dynamic, real-time data editing and maintenance. Access to information should be provided by several user-friendly applications which will be discussed in detail following each need, if appropriate.

During the interview process, key areas of concern for the CEDD staff members were:

- Some of the GIS data is in silos within CEDD
- The accuracy and completeness of select GIS data layers is questionable
- Planning overlays are not readily available in a GIS viewer
• Some digital data layers should be maintained within the CEDD (discussed later in this section)
• Need for web-based GIS application for residents, developers, Council and the public; particularly related to viewing CIP within the City
• Training on GIS for all staff
• Systems integration, access to existing GIS software and platforms (Accela, HDL)
• Access to interdepartmental and inter-divisional GIS data as well as timely access to County data, particularly assessor’s records and parcel boundaries
• Ability to create mailing labels within CEDD, quickly and easily

Based on this Needs Assessment, CEDD 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:

<table>
<thead>
<tr>
<th>GIS Need</th>
<th>Method/Application to Meet Need</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabling Existing Databases</td>
<td>Data Mining Application</td>
</tr>
<tr>
<td></td>
<td>Intranet GIS Data Browser</td>
</tr>
<tr>
<td>Mapping and Spatial Analysis of Department Data</td>
<td>ArcGIS for Desktop</td>
</tr>
<tr>
<td></td>
<td>Intranet GIS Data Browser</td>
</tr>
<tr>
<td>Department-Wide Access to Geospatial Data</td>
<td>Internet and Intranet GIS Data Browser</td>
</tr>
<tr>
<td>Tracking and Coordination of Capital Improvement Projects</td>
<td>ArcGIS</td>
</tr>
<tr>
<td></td>
<td>Esri’s Capital Improvement Planning Solution</td>
</tr>
<tr>
<td></td>
<td>Intranet GIS Browser</td>
</tr>
<tr>
<td>AutoCAD and GIS Conversion</td>
<td>ArcGIS</td>
</tr>
<tr>
<td></td>
<td>FME</td>
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<tr>
<td></td>
<td>AutoCAD Map 3D</td>
</tr>
<tr>
<td>Public Forum Neighborhood and Vicinity Mapping</td>
<td>Internet and Intranet GIS Data Browser</td>
</tr>
<tr>
<td>Cartographic Products for Grant Proposals</td>
<td>ArcGIS Desktop</td>
</tr>
<tr>
<td></td>
<td>Internet and Intranet GIS Data Browser</td>
</tr>
<tr>
<td>Public Access to Geospatial Information</td>
<td>Internet GIS Data Browser</td>
</tr>
<tr>
<td></td>
<td>Esri Story maps</td>
</tr>
</tbody>
</table>
### GIS Need

<table>
<thead>
<tr>
<th>GIS Need</th>
<th>Method/Application to Meet Need</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Access to Geospatial Data</td>
<td>Mobile GIS Data Browser</td>
</tr>
<tr>
<td></td>
<td>Tablet Computers</td>
</tr>
<tr>
<td>Automated Vehicle Location</td>
<td>AVL Vendor</td>
</tr>
<tr>
<td></td>
<td>Intranet GIS Browser</td>
</tr>
<tr>
<td>Site Selection and Business Analysis</td>
<td>Esri Business Analyst Online</td>
</tr>
<tr>
<td>Economic GIS Web Portals</td>
<td>Story Maps</td>
</tr>
<tr>
<td>Advanced Analysis Tools</td>
<td>ArcGIS Spatial Analyst</td>
</tr>
<tr>
<td>Formal GIS Training for Department Staff</td>
<td>Vendor Application Training</td>
</tr>
<tr>
<td></td>
<td>Third Party Application Training</td>
</tr>
</tbody>
</table>

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**Enabling Existing Databases**

The CEDD utilizes Accela, OnBase, and HDL to track and manage a variety of activities for the department. The databases track development applications and permits of all types, code enforcement cases, Planning commission hearings, appeals, planning notifications, historic files, etc. Most of those records within these databases rely on Assessor’s Parcel Number (APN) or address information as their geographic location base. As such, it is imperative that the city pursue the integration of these databases and GIS based on addresses and Assessor ID’s. It is vital that the address point layer be linked with the parcel data via the APN. The primary concern for CEDD is that the situs address being connected to the APN (i.e., an overall street address for the parcel, which may be a range) is consistent with the County Assessor’s / tax collector’s records. It is less important to track addresses of tenant spaces on the property (i.e. multiple offices or residential tenants in the same building), although that would be helpful as a secondary layer for some staff. It is imperative that there is integration between Accela and GIS for the provisioning of accurate information and for the efficient processing of entitlements.
**Applications to Meet Need**

**Data Mining Application**

In order for the department databases to be automated and spatially enabled, these external databases need to be linked to a GIS data browser for maximum use of both systems. The data mining application is 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 (SQL Server). 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 (shapefiles or 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 data mining application 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. A data mining application can generate and export the resulting GIS layer on a regularly scheduled basis.

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.
Mapping and Spatial Analysis of Department Data

One of the significant benefits that CEDD will realize from the continued implementation of GIS and complementary technologies is increased and improved access to information. CEDD will be able to further understand relationships between different types of data in a spatial context, thereby improving decision-making; maps will be used to provide the public with valuable housing and neighborhood information in a geographic context; and staff will be able to prepare maps required for funding applications to demonstrate that the project meets the grant’s criteria, such as proximity to a transit corridor. Dynamic maps and applications will allow citizens and other stakeholders to access information, data, and provide feedback using current data in real time. Additional training and software tools will be needed to accomplish all of the identified analytical needs of the department.

The CEDD 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
- Proposed City-assisted/initiated real estate project location analysis
- Identifying vacant and underutilized land for housing element updates and as needed for City projects
- Environmental Assessment (EA) for federal grant-funded projects
- Cost Benefit Analysis (CBA) for projects, programs
- Focus area (specific plans, PDAs or CDBG-eligible census tracts identification and evaluation
- General land use, current development, and infrastructure mapping and analysis
- Citizen education and outreach
- Statistical analysis for various departmental tasks and efforts
- Using maps to train personnel
- Review land use and subdivision permitting
- Reviewing active construction sites
- See active and previously-issued permits
• Review of projects approved years ago not yet developed
• Many other tasks not listed here

More staff of the CEDD 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, affordable housing locations in relation to important resources such as transit, schools, parks, services and jobs, and tracking of available or underutilized land for various CEDD studies or plans.

Some of the information that CEDD would be better able to visualize and analyze via an improved GIS interface includes:

• Long Range Planning: noise zones, housing analysis, growth scenarios, change detection, biological inventory, land use analysis, growth scenarios analysis, etc.
• Housing/Community Services: tracking vacant and underutilized land, location of current affordable housing resources, City-funded projects, possible project sites, easily showing zoning, transit, and other map layers on housing-related maps.
• Zoning: Overlay zoning maps with other geographic information in order to identify ideal sites for various city-sponsored projects, evaluate new development proposals, etc.
• Housing Affordability - (see figure at right): analyze affordability of local housing stock (rents and home prices) by zone (zip code area, census tract, zoning district, etc.).
• Environmental Assessment: conduct cost/benefit analysis in review of mitigation monitoring, condition compliance, NPDES storm water regulations, air quality, biological concerns, noise issues, traffic and EIR tracking.
• Code Enforcement: Map locations of enforcement complaints or cases to identify spatial patterns, identify areas of over-crowding, graffiti/vandalism, or other prevalent types of complaints. Use
information along with Census socio-economic data to target areas for rehabilitation or other neighborhood improvement or safety programs.

- Mapping organized neighborhood groups and planning areas for internal and public use.
- Parcel by Parcel Analysis: Track owners, use and configuration of parcel, identify under-utilized parcels.
- Tracking federal data associated with federal or state grant expenditures (HOME, CDBG, HRP).
- Map projects that were assisted with City-controlled federal or local funds.
- Mapping of neighborhood projects and who is responsible for upkeep (not city projects)
- Citizen complaint system and responses
- Map zoning amendments, variances, subdivisions, and other land use approvals
- More easily develop a “case history” at each address/parcel with all available city information: permitting, code enforcement, housing assistance, links to county assessor and tax collector records, etc.
- Use GIS to link to important documentation such as staff reports, site plans, city approvals or denials, general plan and zoning, specific plans, and ordinances
- Determine list of affected property owners for public noticing
- Develop a public online GIS portal to make available zoning, land use, and development project information, searchable by address or dynamic map selection

CEDD staff should be provided with an intuitive intranet portal to view and analyze key datasets. Additionally, CEDD staff should have access to a CEDD focused dashboard that tracts pertinent metrics and data. This dashboard should contain business license data, lease data, and other local datasets for analysis.
Department-Wide Access to Geospatial Data

It is recommended that the enterprise-wide ArcGIS Server (AGS) based Intranet GIS Data Browser tool be upgraded to use Esri’s Web AppBuilder to provide access to pertinent spatial data, imaging, and spatial analysis functionality. This application should not only allow users to view GIS data but data entered into other database systems as well. This may require reworking some of the current functionality and making additional layers accessible. It is recommended that CEDD have a configuration specific to their needs. For example, CEDD needs access to demographic data, permits and applications, CEDD capital projects, property tax, property ownership, and a variety of other data. Integrating data from various business systems is instrumental in making GIS more effective for CEDD and the other City departments.

A large amount of valuable data for CEDD resides in existing databases (Accela, HDL, OnBase) and could be mapped out with the assistance of an Intranet GIS Data Browser. In order for this process to be automated and spatially enabled, these databases need to be linked to a GIS Data Browser for maximum use of both systems.

This application will serve as the primary GIS application for CEDD and will enable general staff to accomplish about 90% of their GIS tasks. These tasks will include the quick query and search of data; as well as, more intricate uses such as public noticing, basic GIS analysis, and map production.

Tracking and Coordination of Capital Improvement Projects

CEDD coordinates, manages, and participates in a variety of developer instigated and capital public infrastructure projects. Staff needs to use GIS to find background information on a given project and produce supporting graphics. Currently, staff must utilize multiple sources to collect the information that they need.
Additionally, there is no map layer that tracks historic, current, and future capital projects. This can potentially lead to inefficiencies and duplication of work. A set of GIS layers 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 throughout time, track road closures, coordinate with other departments, 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.

Esri has provided a set of tools that can assist CEDD with this need. By downloading, installing, and configuring the Capital Improvement Planning (CIP) Solution, CEDD will have access to editing workflows, geoprocessing tools, and data layers to maintain their CIP. If CEDD chooses to use the CIP tool from Esri, they will need to incorporate the necessary tables and relationships that can be found in the Local Government Information Model (LGIM).

CEDD can also leverage drone technology to track CIP. Drones are perfectly suited for monitoring projects over a period of time. CEDD can quickly review an entire project site in real time from an aerial point of view. CEDD can get quick and live project updates in a matter minutes, instead of spending hours canvassing a project site.

Once this data is input and maintained, CEDD will have the ability to publish it through ArcGIS Online or an intranet GIS browser and make the information available to staff and the public. One excellent solution to making CIP information available to the public is to utilize Story Maps. To see a great example of how other cities are using Story Maps to share project information, visit:

http://cityofcarson.maps.arcgis.com/apps/MapTour/?appid=56bc03dad9714dcfa27d6ed177689bd1.
AutoCAD and GIS Conversion

Local Government has long relied upon CAD software for their engineering functions. Over the years, these same organizations invested in acquiring and developing GIS to serve their mapping and spatial analysis needs. Today, local governments recognize the value of employing these technologies and the importance of using both. However, integrating and sharing data between these systems has typically proven challenging for a variety of reasons. It is no wonder that these technologies generally remain separate both in function and management; CAD technicians and Engineers take advantage of the precision and accuracy of CAD to design new infrastructure, while GIS professionals maintain the overall “as-built” record of the utility. In recent years departments like CEDD have come to understand the inefficiency this causes. Among the most glaring is the duplication of effort and data entry. Most of CEDD’s CAD data is submitted by outside developer engineers.

Local Government Departments, especially those consisting of abundant engineering functions, realize that CAD and GIS are important for planning, operations, and management. During the planning and design phases of a project, it is critical for the designer to work in the CAD environment using the most current base map information from the GIS and other sources. Also, it is important that the relevant design data to be posted back to GIS at various stages, including the final as-built stage. This provides operations staff with engineering accurate data. Currently, many organizations manually re-digitize the CAD data for the GIS. This not only creates duplication of effort, but also introduces the potential of errors and delays in getting up-to-date data.

CAD-GIS integration can deliver the needs of the utility from design through operations. With the tools available today, departments can automate this process and improve accuracy and efficiency. Every CAD to GIS integration project is unique. Factors related to CAD type (dwg, dgn, dxf, dgn, etc.), projections, layering, consistency, etc., combine to make each project challenging. Therefore, every successful CAD to GIS integration project begins with solid CAD management practices and a deep understanding of those practices. CAD data management involves organizing, managing, and tracking the creation and modification of drawings through the design, engineering, and construction processes. Best practices help organizations determine how they should manage their respective CAD environments. The following 5 items are a must:
1. Discover and document workflow process
2. Develop and document CAD standards
3. Establish a single data repository for all CAD data
4. Implement change control
5. Provide robust and continual training

Understanding current CAD management is vital for determining the process and details of integration. Integration projects require the organization to know the layering and annotation methodologies, work flows, coloring, units of measure, and spatial reference, at a minimum. There are two general approaches to CAD/GIS integration: 1) a loose coupling of importing/exporting and 2) tight integration that allows for edit by edit, bidirectional transactions (Data/System Integration).

**Importing/Exporting**

Engineering Departments usually have vast amounts of data residing in hundreds or even thousands of CAD files. This data can greatly provide value to the GIS by improving accuracy and completeness. Likewise, the GIS has enormous amounts of data that can be useful for engineering designs and CAD users. Departments will often choose to utilize import and export processes to exchange data between systems.

**CAD to GIS**

In projects dealing with CAD sources lacking solid management practices, the need for extensive documentation and cleanup is likely. Documentation should include information related to spatial coordinate system of CAD file, layering scheme with descriptions, annotation, which layers will be represented as points, lines, polygons, etc. Once documentation is complete, the task of cleanup begins with the basic goal of attaining as much consistency as possible. With consistency, repeatability is possible, which makes automation possible. Organizations may find it helpful to group “like” files together to minimize cleanup efforts and simply handle the differences between groups with separate import scripts. Other organizations have chosen to use a “day forward” approach. This allows them to control/manage new CAD drawings and utilize the conversion process moving forward. This would be a likely scenario for CEDD, but more streamlined data conversion is desired.

After “clean” files are achieved there are many different options for converting CAD files into a geodatabase. Factors related to choosing the correct tool include:
1. Is CAD data migrating to empty feature class or into one already containing records?
2. Are there attributes that can be captured from the CAD data?
3. How well does the CAD data geo-reference with existing GIS features?
4. Is any transformation required?
5. How much CAD data is involved in the conversion?

Options include using geoprocessing tools available through ArcCatalog, creating data conversion models, using python scripts, simple copy and paste functions within ArcMap, and using off-the-shelf products. For example, converting small amounts of CAD data into an existing, populated feature class when CAD and GIS align well may best be performed using ArcGIS editing tools with a simple copy and paste. However, an initial conversion of large amounts of CAD data with a need for repetitive processing may benefit from an off-the-shelf product. See Suggested Tools section below for more details.

**GIS to CAD**

Utility designs often require base information like edge of pavement, building locations, parcels, and existing utilities. GIS data can often provide this information. Exporting and importing routines can provide the necessary data on project by project bases. The process is very similar to that of converting CAD to GIS, but there are some different considerations needed. One such consideration involves handling attribute information. For example, GIS stores data for pipe size, material, slope, etc. as attributes in the database. Typically, this information is notated in CAD files as text. This may require some preparation of the GIS data to annotate the features prior to export. In addition, the export must take into consideration the usage of AutoCAD blocks or Microstation cells. Care must be taken to rightly represent the data in the CAD format.

When exporting data from GIS to CAD the user must understand how the data is going to be utilized and what the desired output includes. Questions that need to be addressed include, but are not limited to:

1. Is the data for reference purposes only, or will it be modified as part of the design?
2. Will modifications need to make their way back to the GIS?
3. Do the GIS feature class require further delineation based on CAD layering schemes (e.g. different size water mains have different layers)?
4. Does the GIS data have attributes that need to be noted as text in the CAD file?
5. Are blocks or cells used?
6. Are there scale issues to consider?
7. Are spatial references and workspaces aligned between systems?
8. What is the status of other data being used in the CAD file (e.g. survey data)?
Once the requirements and usage are understood, many of the same options for moving data from CAD to GIS are available, including: geoprocessing tools in ArcGIS for Desktop, data conversion models, and off-the-shelf products.

**Data/System Integration**

Further efficiencies can be achieved through tight integration between CAD and GIS data and applications. Most of the best practices related to import/export of data remain true, however, CAD users interact directly with the GIS data for both viewing and updating feature classes. As a result, GIS users have direct access to more accurate, complete, and current data. The suggested tools section provides details on the particular tool used for integration. Those tools include AutoCAD Map 3D and ArcGIS for AutoCAD. However, there are some data management principals/practices that need to be addressed prior to integration.

With these types of CAD/GIS integrations the emphasis is really on the CAD user. The tools and interface of the CAD system doesn’t change (except for a few additional menus), making the transition relatively easy, however, the method of retrieving and storing data changes drastically. CAD users will need to understand the data schema of the GIS. This knowledge goes beyond knowing the type of asset represented in a feature class, but also understanding the attributes and subtypes of the GIS layer, since users may need to utilize queries to obtain the information they need from particular GIS layers. Given the direct interaction with the GIS database, it is a good idea that CAD users are provided an introduction to GIS training course.

As with any GIS data edits, a plan needs to be in place. Care must be taken to ensure edits to the GIS database are incorporated correctly and that proper permissions and data flows are established. This generally means that CAD users must have their own username in the GIS database and be included in the GIS versioning schema. Any connections made to the GIS database for editing purposes should follow the proper permissions/versioning policies. One best practice concerning versioning is to have a QA/QC version with SDE.DEFAULT as the parent (in combination of making SDE.DEFAULT private ensuring that direct edits are not allowed). Then versions can be created from QA/QC in various ways to allow CAD/GIS editors to make proposed updates.

**Suggested Tools**

The above discussion outlines some of the best practices and approaches to integrate CAD and GIS. The following tools will assist CEDD in achieving better efficiency and accuracy of GIS data updates. These tools
also allow for bidirectional consumption of CAD/GIS data using one or both of the approaches discussed above.

ArcGIS
ArcGIS allows users to interact with CAD data in a variety of ways. The simplest method allows ArcGIS for Desktop users to directly access the CAD files, overlaying the data with GIS. More advanced options allow users to export and import data between GIS and CAD. Esri has provided a great resource discussing the process and options of CAD/GIS at the following URL:


Some of the tools available include:

- Georeferencing CAD datasets
- Loading CAD data into GIS database
  - Convert CAD Feature Layer
  - Convert CAD Feature Dataset
  - Append
  - Merge
  - Object Loader
  - Simple Data Loader
- Loading CAD annotation
- Export to CAD Tool

These tools and options can be utilized with ModelBuilder to help streamline the process. ArcGIS is a great option for CEDD to successfully implement the import/export approach using tools already available and to consume CAD data in ArcGIS for Desktop for viewing purposes.

FME
Another excellent option for CEDD to streamline importing/exporting of CAD and GIS data is the use of Safe Software’s FME product. FME can be deployed as a desktop, server or cloud solution providing great flexibility. FME allows for customized configurations to perform data conversion and transformation workflows. With FME, CEDD can realize the following benefits:

- Simple data conversion
- Point and click interface
- Complex data conversion without the need of code development
- Ability to manipulate and structure data to fit specific requirements
• Handle both GIS attribution and CAD annotation
• Maintain symbology between systems
• Build repeatable data processes
• Data validation routines
• Reproject coordinate systems
• Integrate with Esri’s ModelBuilder

The power of FME is in the FME Workbench. The Workbench would allow CEDD to configure any type of data conversion workflow for sharing data between CAD and GIS. One result of using FME is the documentation of workflows.

**Data Interoperability Extension**

Available as an extension to ArcGIS for Desktop or Server and based on Safe Software’s FME technology, Data Interoperability provides the ability to directly read, import, and export over 100 standard spatial data formats. According to Esri, the Data Interoperability extension can:

- Directly read more than 100 spatial data formats, including GML, XML, WFS, Autodesk, DWG/DXF, MicroStation Design, MapInfo, MID/MIF and TAB, Oracle and Oracle Spatial, and Intergraph GeoMedia Warehouse, and export to more than 70 spatial data formats.
- Perform automated conversion between source and destination formats.
- Create, manipulate, and convert geometry and attributes using spatial ETL tools built with the Workbench application.
- Enjoy full integration with the ArcGIS geoprocessing environment including the ModelBuilder framework.

One downside of Data Interoperability is that imports of CAD occur only at the personal or file geodatabase level. As such, moving data into the enterprise geodatabase would require additional processing. However, this tool is a good option for quickly providing importing/exporting capabilities that extend beyond typical ArcGIS tools.

**ArcGIS for AutoCAD**

With ArcGIS for AutoCAD, CEDD can begin realizing tighter integration between CAD and GIS. The application consists of a plug-in for AutoCAD that allows users to gain access to enterprise GIS maps, map services, and feature services hosted by ArcGIS for Server. An additional benefit of ArcGIS for AutoCAD is the
ability to perform edits to the data residing in the GIS database directly from within AutoCAD. Some of the benefits include:

- Streamline information sharing between GIS and CAD groups.
- View live, rich cartographic GIS maps in AutoCAD.
- Include the results of GIS analysis in AutoCAD designs.
- Add imagery to your AutoCAD drawing.
- Create, manipulate, and define how CAD data is organized and attributed as GIS content so it can be used in ArcGIS for Desktop or AutoCAD.
- Navigate your AutoCAD session based on street address or place names.
- Edit Enterprise Geodatabases from within AutoCAD
  - Connect to ArcGIS for Server feature services and edit the features stored in a geodatabase using AutoCAD.
  - Connected and long transaction workflows supported.
  - Connect to read-only feature services to stream vector feature services into your AutoCAD session.
  - Extract your own local copy of geodatabase features from a feature service as AutoCAD entities.

- Create GIS-Ready AutoCAD Files
  - Select drawing entities by their GIS attribute values.
  - Add Esri industry standard data models into CAD workflows
  - Customize CAD mapping applications with ArcGIS for AutoCAD commands and AutoLISP tools
  - Manage the tabular attributes of features within your drawing using the provided attribute table viewer.

**AutoCAD Map 3D**

Full Data/System integration between CAD and GIS is achievable with AutoDesk’s AutoCAD Map 3D. With AutoCAD Map 3D, CEDD can take advantage of intelligent industry data models and tools. These tools allow for organizations to apply their specific standards to improve data quality and to support productivity while better managing their infrastructure. AutoCAD Map 3D allows direct access Esri geodatabases, greatly
reducing the need for data conversion. From within AutoCAD, CEDD users can directly view and edit GIS data using AutoCAD commands. This allows CEDD to utilize their CAD-trained workforce to create, edit, and maintain geospatial data, while using the power of ArcGIS to perform analysis. Also, AutoCAD Map 3D helps integrate field collected data (e.g. survey data) to more accurately update the system of record.

CAD/GIS integration isn’t as complex as many believe. The tools available today can make the process nearly seamless. The bulk of the work is in the details of the planning phase of the project. Integration may mean making changes to long held CAD or GIS standards. Layering schemas may need changed in one or both systems. However, careful planning and data flow processes can overcome many challenges and successfully navigate through the different system configurations. Taking time to understand both the CAD and GIS environments will pay great dividends in the final integration. Ultimately, CEDD will probably find they use both the export/import and data/system integration approaches in conjunction depending on the particular project/need.

**Public Forum Neighborhood and Vicinity Mapping**

CEDD conducts public forums and various meetings that could greatly benefit from a greater ability to provide staff-generated GIS and mapping products. This should be accomplished in two different ways depending on the nature of the meeting. If the meeting is addressing a specific topic, then a static map can be created to depict the issue at hand for the area of concern (Figure to the left). This can be accomplished by utilizing Esri ArcGIS Desktop and/or the Intranet Browser Solution.

This process can be automated to the point where a user can quickly zoom to the subject geographic area, select the desired data layers, and then print, using a standard departmental template for the quick production of maps geared towards public forums.
Alternatively, if the issue being discussed requires analyzing specific neighborhood factors in various areas, a live GIS viewing tool could also be utilized. This tool would allow the presenter to zoom into areas of concern and display key data layers, and then accomplish quick analysis such as selecting all the properties within 300 feet of an area of concern. The Intranet data browser should be deployed for this task. With a short learning curve this application would allow a user to display and analyze GIS data on-the-fly.

**Cartographic Products for Grant Proposals**

The CEDD staff, and ultimately the City, if funding applications are successful, could also benefit from the generation of cartographic products for use in grant proposals and applications. Several different products, such as base and thematic maps as well as visual simulations of proposed development projects and/or zoning changes, could be used, and are sometimes required, to enhance or complete grant proposals and applications. In addition, these products can be utilized to provide status updates to funding organizations and other stakeholders. Maps can also be used to educate the public at meetings and to provide training for city staff.

Many of the needed maps can be created by utilizing the Intranet GIS Data Browser application if all relevant data layers are included in the application’s query-able database. GIS personnel within CEDD can generate several map and visualization templates that can be used to quickly produce maps, but as noted earlier, GIS staff’s time is already in short supply and it would ease a bottleneck situation if a more user-friendly system enabled more staff to produce maps for their various purposes. An ultimate long-term goal is to develop automated mapping applications that can be used by any CEDD staff to quickly produce maps for various interest areas and assignments.
Cartographic products should incorporate other media, including CAD drawings, digital images and photographs, Census and other third-party data, current regional transit maps, and so on.

**GIS-Based Analysis of Ownership Rates in King City, WA**

**Reference Map Shows City of Austin, TX Neighborhood Planning Areas**
Public Access to Geospatial Information

Providing public access to GIS maps through the Internet provides information to CEDD customers. Through an Internet GIS Data Browser, the data specific to CEDD can be provided to the public through an intuitive and easy to use interface. The City would serve its internal and external customers better by offering focused, dynamic mapping applications.

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. Lastly, 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 the City’s geospatial data. One possible solution is to further 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 various 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 CEDD as a stakeholder in its provisioning.

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. CEDD would benefit from offering Story Maps on their web-site and could easily enhance their Development Updates 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.

**CASE STUDY: Expanding the Use of Internet GIS Applications – Bellevue, Washington**

Community Development staff throughout the City need to publish the current status of their permitting activities. Much time is spent hunting down an interested party’s permit, and its corresponding status. The City of Bellevue, Washington has a web-based system that details the status of a permit throughout the approval process, as outlined below:

**Construction Permitting** – Users can quickly view the status of their construction permit. An easy-to-use permitting portal makes it possible to apply, pay for, and receive electrical, low voltage, mechanical, plumbing, and re-roof permits from each of the participating jurisdictions. This is designed as a one-stop portal. The site also provides permit research and status information, construction tip sheets, inspection checklists, links to resources and contacts, and lists of upcoming events and seminars.

**Development Activity** – Mapping and reporting of development activity is available to the user.

**Neighborhood Projects** – status of special projects are available to the citizenry. To find information about the status of city users click on their neighborhood. Results cover improvements to streets, sidewalks, trails, parks and sewer and water main line upgrades. To learn about projects residents can select Neighborhood Enhancement and Neighborhood Match programs from the Neighborhood Outreach page.
Easy Access to Neighborhood Project Status via the Web Portal

Transportation Plans and Project Studies – All major plans and studies are available via the web portal.

Field Access to Geospatial Data

The CEDD 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 CEDD 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 CEDD 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. CEDD 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, Android, and Windows 10 devices. 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.
Automated Vehicle Location (AVL)

Cities throughout North America realize the benefits from Automated Vehicle Location (AVL) software and services. CEDD should be involved in future AVL discussions to align with the City’s direction. Enterprise solutions often make the best solution and increase both internal and external application support. Initially a staple of the emergency management and response communities, organizations that manage field crews and vehicles, are looking at AVL to increase their capabilities to respond to customer needs, perform task planning, dispatch closest vehicles and locate assets in the field.

CEDD would benefit from deploying an AVL application in its vehicles especially for optimization of resources and safety issues. Supervisors and command center staff should have access to the AVL feed. Through the use of AVL, CEDD as a whole could more easily react to an immediate need by finding the closest staff person with the resources or availability needed to complete a task. Through AVL technology, the department will realize fuel cost savings by reducing the number of miles driven while going to the job site (i.e. inspection routes). AVL technology will also allow staff to manage and monitor progress on work orders throughout the work day. A complete integration AVL with work orders throughout the City will provide a comprehensive operational picture for management and decision makers as well as provide efficiencies for field workers. Field crews working alone (Lone Workers) are more at risk than those working with a crew. In the event that an injury that incapacitates a field worker, there is currently no mechanism to accurately locate that worker. AVL would offer some protection for that worker because their last known location could be readily discerned.

Using GIS to Track Vehicles
Site Selection and Business Analysis

Currently CEDD uses CoStar for site analytics. Esri Business Analyst Online is another method of analyzing businesses and conducting site analysis. Esri Business Analyst Online provides users the following key functionality:

- Site Selection
- Smart Search – enter custom criteria for pinpointing locations
- Smart Mapping – thousands of variables allow users to create custom maps
- Report Generation – custom reports of key factors
- Geographic analytics – define distances, drive-time, and bands to limit selections

Esri uses a number of national data sources to compile data for Business Analyst Online to include:

- Demographics – includes current year estimates and US demographic data including population, households, income, age, housing, race, and ethnicity.
- Census and American Community Survey - data on poverty status, education, labor force, journey to work, marital status, languages spoken, age, home value, and more.
- Tapestry Segmentation – Esri compiled data analytics with a detailed description of US residential neighborhoods divided into 67 distinctive segments based on socioeconomic and demographic characteristics.
- Consumer Spending – Consumer expenditure surveys and Bureau of Labor statistics
- Market Potential - Data on products and services consumers use, need, and want to have. Expected number of consumers and Market Potential Index (MPI) data for goods, services, attitudes, and activities. Data from Esri and GfK MRI
- Retail marketplace – measures gap between supply and demand through Esri and Dun and Bradstreet data.
- Dun and Bradstreet business data
- Other key data – shopping centers, crime indexes, and traffic counts

Business Analyst Online requires an ArcGIS Online subscription (which the City has) and a Business Analyst Online license.

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**GIS NEED**

**Economic GIS Web Portals**

Economic Development’s 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 CEDD, 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.

![Example Story Map of Sites of Interest in Naples, FL](image)

Historically, public facing local government and CEDD 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. 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 new for training and to be able to get to pertinent data within a few clicks. The CEDD 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.
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 the City of Concord matures and more data is readily available, CEDD should consider implementing some advanced tools and functions. Advanced extensions to ArcGIS such as 3\D Analyst and Spatial Analyst will allow CEDD 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 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, NDVI, 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 CEDD could do with ArcGIS Spatial Analyst include:

- Find suitable locations for CEDD 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.

3D 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.

**INYH NEED**

**Formal GIS Training for Department Staff**

Staff that will be performing more advanced GIS analysis and mapping should participate in foundational GIS skills training. The CEDD should participate in any enterprise-wide Esri ArcGIS training that is made available. In addition, staff will need training in the use of advanced analysis tools like 3D Analyst and Spatial Analyst. CEDD should consider creating (or changing job descriptions) certain CEDD staff positions dedicated to core CEDD GIS functions.

As Tier 3 – Browser GIS client applications become available (e.g. Intranet and Internet GIS Data Browsers), the CEDD 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.
3. GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY

The CEDD 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

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creation Methodology</td>
<td>This column describes how the layer was, or is anticipated being created.</td>
</tr>
<tr>
<td>Recommended Update Division or Individual</td>
<td>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.</td>
</tr>
<tr>
<td>Layer Status</td>
<td>Layer state of existence.</td>
</tr>
<tr>
<td>Existing</td>
<td>These layers currently exist within the City’s GIS.</td>
</tr>
<tr>
<td>Recommended/Desired</td>
<td>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.</td>
</tr>
<tr>
<td>Partial</td>
<td>These layers currently exist in an incomplete or outdated state.</td>
</tr>
</tbody>
</table>
The following is a list of desired layers by the Community and Economic Development Department:

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>Creation Methodology</th>
<th>Recommended Update Division or Individual</th>
<th>Existing or Recommended?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permits and Certificates of Occupancy</td>
<td>Extract, cleanse and geocode from database/spreadsheets.</td>
<td>CEDD - Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td>Available Properties</td>
<td>Economic Development Records</td>
<td>CEDD</td>
<td>Recommended</td>
</tr>
<tr>
<td>Buildings with Site Plans</td>
<td>Scanned and linked to GIS</td>
<td>CEDD</td>
<td>Recommended</td>
</tr>
<tr>
<td>Capital Improvement Projects</td>
<td>Identify on parcel record in base map data (i.e. add new field to APN record); aggregate layers as needed</td>
<td>Various overseen by GIS staff within IT</td>
<td>Recommended</td>
</tr>
<tr>
<td>Crime Data</td>
<td>Extract, cleanse, and automatically map from TriTech</td>
<td>Automated from Police Department</td>
<td>Recommended</td>
</tr>
<tr>
<td>Census Data</td>
<td>Download from Census Bureau</td>
<td>CEDD and GIS staff within IT</td>
<td>Recommended</td>
</tr>
<tr>
<td>City Owned Property</td>
<td>Extracted from Parcel Layer</td>
<td>GIS staff within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Code Enforcement</td>
<td>Extract from Code Enforcement database, cleanse and geocode from database</td>
<td>CEDD - Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td>Shopping Centers</td>
<td>Digitized</td>
<td>CEDD</td>
<td>Recommended</td>
</tr>
<tr>
<td>Parking District</td>
<td>Digitized</td>
<td>CEDD</td>
<td>Recommended</td>
</tr>
<tr>
<td>Hotels</td>
<td>Digitized</td>
<td>CEDD</td>
<td>Recommended</td>
</tr>
<tr>
<td>Building Inspector Areas</td>
<td>Digitized</td>
<td>CEDD</td>
<td>Recommended</td>
</tr>
<tr>
<td>Affordable Home Project</td>
<td>Digitized</td>
<td>CEDD</td>
<td>Recommended</td>
</tr>
<tr>
<td>Future Land Use</td>
<td>Created from parcels and aerial photography</td>
<td>CEDD</td>
<td>Existing</td>
</tr>
<tr>
<td>Flood Zones</td>
<td>Acquire from FEMA</td>
<td>GIS staff within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Historical Aerial Photography</td>
<td>Aerial Flyovers</td>
<td>GIS staff within IT</td>
<td>Partial</td>
</tr>
<tr>
<td>Neighborhood Planning Areas</td>
<td>Digitized</td>
<td>CEDD</td>
<td>Recommended</td>
</tr>
<tr>
<td>Parks</td>
<td>Extract, cleanse and geocode from database</td>
<td>Parks &amp; Recreation</td>
<td>Existing</td>
</tr>
<tr>
<td>Public Utilities</td>
<td>Field collection, digitization, and as-builts</td>
<td>Public Works</td>
<td>Partial</td>
</tr>
<tr>
<td>Sidewalks</td>
<td>GPS and digitizing from aerials</td>
<td>Public Works</td>
<td>Existing</td>
</tr>
<tr>
<td>Rights-of-Way</td>
<td>Site plans and other documents</td>
<td>Public Works &amp; CEDD</td>
<td>Partial</td>
</tr>
<tr>
<td>Schools</td>
<td>Digitize from base map data; GPS field work</td>
<td>GIS staff within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Data Layer</td>
<td>Creation Methodology</td>
<td>Recommended Update Division or Individual</td>
<td>Existing or Recommended?</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>-------------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Sewer Base Map</td>
<td>Digitize on screen; existing CAD data; GPS field work</td>
<td>Public Works</td>
<td>Partial</td>
</tr>
<tr>
<td>Storm Base Map</td>
<td>Digitize on screen; existing CAD data; GPS field work</td>
<td>Public Works</td>
<td>Partial</td>
</tr>
<tr>
<td>Topography</td>
<td>Aerial Photography</td>
<td>GIS staff within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Water Base Map</td>
<td>Digitize on screen; existing CAD data; GPS field work</td>
<td>Contra Costa Water District</td>
<td>Existing</td>
</tr>
<tr>
<td>Zoning</td>
<td>Digitized on screen</td>
<td>CEDD</td>
<td>Partial</td>
</tr>
<tr>
<td>Sewer and Storm Plans Linked to Centerlines</td>
<td>Digital Linking</td>
<td>GIS staff within IT</td>
<td>Recommended</td>
</tr>
<tr>
<td>Trash Management Areas</td>
<td>Digitize on screen</td>
<td>CEDD</td>
<td>Recommended</td>
</tr>
<tr>
<td>Trash Capture Devices</td>
<td>Digitize on screen/Field inventory</td>
<td>CEDD</td>
<td>Recommended</td>
</tr>
<tr>
<td>Stormwater Inspections</td>
<td>Field inventory</td>
<td>CEDD/Coordinated County Program</td>
<td>Recommended</td>
</tr>
<tr>
<td>Curb Ramp Rehabilitation</td>
<td>Field inventory</td>
<td>CEDD</td>
<td>Recommended</td>
</tr>
<tr>
<td>Street Monuments (plus elevation)</td>
<td>Field inventory</td>
<td>CEDD</td>
<td>Recommended</td>
</tr>
<tr>
<td>Pavement Rehabilitation</td>
<td>Digitize on screen/Field inventory</td>
<td>CEDD</td>
<td>Recommended</td>
</tr>
<tr>
<td>Moratorium Streets</td>
<td>Digitize on screen</td>
<td>CEDD</td>
<td>Recommended</td>
</tr>
<tr>
<td>Sewer Rehabilitation</td>
<td>Field inventory</td>
<td>CEDD</td>
<td>Recommended</td>
</tr>
<tr>
<td>Bridges</td>
<td>Digitize on screen</td>
<td>CEDD</td>
<td>Recommended</td>
</tr>
<tr>
<td>Street Lights</td>
<td>Field inventory</td>
<td>Public Works</td>
<td>Partial</td>
</tr>
<tr>
<td>PG&amp;E Power Poles</td>
<td>Obtain from PG&amp;E</td>
<td>PG&amp;E</td>
<td>Recommended</td>
</tr>
<tr>
<td>Cabinets</td>
<td>Obtain from PG&amp;E</td>
<td>PG&amp;E</td>
<td>Recommended</td>
</tr>
<tr>
<td>Signs</td>
<td>Digitize on screen/Field inventory</td>
<td>Public Works</td>
<td>Existing</td>
</tr>
<tr>
<td>Collision Data</td>
<td>Extract from Crossroads Application</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
</tbody>
</table>

**Citywide Base Data**

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>Methodology</th>
<th>Division or Individual</th>
<th>Existing or Recommended?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property</td>
<td>Parcels were initially created by Contra Costa County. The GIS Division within IT maintain the parcels currently. Temporary ID’s are added to parcel data until the County assigns a permanent number.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Aerial Photography</td>
<td>The City obtains aerial photography every 2 – 4 years as the budget allows.</td>
<td>Static Map</td>
<td>Existing</td>
</tr>
<tr>
<td>Road Centerlines</td>
<td>There are currently two versions of the street centerline data that are maintained. One version is used for maps and cartographic purposes and the other version is used within TriTech for CAD purposes.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
</tbody>
</table>
The CEDD has a significant role in GIS for the City of Concord and will be a key contributor in the implementation of enterprise-wide GIS throughout the City. Key staff will need to be heavily involved in the optimal implementation of GIS technology at the enterprise level. As part of this Needs Assessment, a Gap Analysis has been conducted to determine an optimal environment and set of processes for the utilization of GIS. This analysis provides a baseline level of understanding for the existing status and desired status of major GIS components for the department.

The matrix below details those relevant components that have been analyzed and assessed as part of the Gap Analysis.

---

**LEGEND**

<table>
<thead>
<tr>
<th>Existing</th>
<th>Desired</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Yes</strong></td>
<td>GIS component currently exist within division.</td>
<td>Deemed desirable based on Needs Assessment.</td>
</tr>
<tr>
<td><strong>No</strong></td>
<td>GIS component does not currently exist within division.</td>
<td>Deemed to be not desirable based on Needs Assessment.</td>
</tr>
<tr>
<td><strong>Limited/Partial</strong></td>
<td>GIS component exist to a lesser degree.</td>
<td>Some applicability to divisional needs.</td>
</tr>
<tr>
<td><strong>High</strong></td>
<td>Takes precedent over other needs.</td>
<td></td>
</tr>
<tr>
<td><strong>Medium</strong></td>
<td>Secondarily important to divisional need.</td>
<td></td>
</tr>
<tr>
<td><strong>Low</strong></td>
<td>Can be met after higher needs are accomplished.</td>
<td></td>
</tr>
<tr>
<td>COMPONENT</td>
<td>STATUS EXISTING</td>
<td>STATUS DESIRED</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------</td>
<td>----------------</td>
</tr>
<tr>
<td>AVL</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Documentation</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Enterprise Systems Integration</td>
<td>Limited</td>
<td>Yes</td>
</tr>
<tr>
<td>Geocoding</td>
<td>Limited</td>
<td>Yes</td>
</tr>
<tr>
<td>GIS Data Access</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>GIS Data Maintenance</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>GIS Data Sharing</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>COMPONENT</td>
<td>EXISTING</td>
<td>DESIRED</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td>GIS Personnel</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Hardware</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Mapping</td>
<td>Limited</td>
<td>Yes</td>
</tr>
<tr>
<td>Metadata</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Mobile Computing Resources</td>
<td>Limited</td>
<td>Yes</td>
</tr>
<tr>
<td>Network</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Routing</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Software</td>
<td>Limited</td>
<td>Yes</td>
</tr>
<tr>
<td>Spatial Analysis and Modeling</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Training/Education</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
The pyramid and table below outlines the “Tiers of GIS Use” within the 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 and is considered professional GIS personnel. A Tier 2 users is considered an advanced GIS user who is a data custodian. A Tier 3 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 4 Browser user requires only general browsing GIS data functions. The CEDD will consist of Tier 2, 3, and 4 Users.
5.

RETURN ON INVESTMENT (ROI)

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

<table>
<thead>
<tr>
<th>Return on Investment Opportunity</th>
<th>Opportunity</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Save Time and Respond More Quickly to Citizen</strong></td>
<td><strong>Public access to accurate data:</strong></td>
</tr>
<tr>
<td></td>
<td>Requests</td>
<td>• The public should have Internet access to GIS data. GIS will allow users to find information more quickly and in many cases on their own. This should save multiple staff hours a week in CEDD. The internet access has to be really well-thought-out to fully realize the maximum savings.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Staff access to accurate/updated data</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 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 CEDD.</td>
</tr>
<tr>
<td></td>
<td><strong>Improve Data Accuracy</strong></td>
<td><strong>Better GIS Data and Spatial Analysis:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 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.</td>
</tr>
</tbody>
</table>
### Return on Investment Opportunity

#### Community and Economic Development Department

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve Public Access to Government</td>
<td><strong>Internet Browser:</strong>  &lt;br&gt;• CEDD 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.</td>
</tr>
<tr>
<td>Compliance with State/Federal Mandates</td>
<td><strong>Internet Browser:</strong>  &lt;br&gt;• Maps needed to satisfy reporting requirements for HOME, CDBG, state mandates and/or grants</td>
</tr>
<tr>
<td>Improved Information Processing</td>
<td>• CEDD 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.</td>
</tr>
<tr>
<td>Address Equity Considerations</td>
<td>Provide better public access to information about available affordable housing and other community resources (food banks, health clinics, etc.)</td>
</tr>
</tbody>
</table>
PHASE I
DEPARTMENTAL NEEDS ASSESSMENTS
FINANCE
1. EXISTING CONDITIONS

DEPARTMENT OVERVIEW

As per the City’s website, the Finance Department works to maintain high quality accounting standards, safeguards City’s assets, provides financial information in a timely manner, and provides positive customer service to both internal and external customers. The staff take pride in their work and are accountable and trusted to carry out their responsibilities with honesty and integrity. The sub-divisions under this department include:

1. **Finance** (1 Director)
   
   a. **Financial Analysis and Operations** (1 Financial Operations Manager)
b. **Revenue Generation** (1 Senior Financial Analyst)

c. **Purchasing and Materials Management** (1 Purchasing Manager)

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**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.

Finance is primarily a service agency and as such does not have a large need for GIS functionality. The department is not a current user of GIS. 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.

<table>
<thead>
<tr>
<th>Current GIS Staffing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>GIS Flagship (Tier 1)</td>
</tr>
<tr>
<td>Custodian (Tier 2)</td>
</tr>
<tr>
<td>Analytical (Tier 3)</td>
</tr>
<tr>
<td>Browser (Tier 4)</td>
</tr>
</tbody>
</table>
Finance uses personal computers for each of its staff. No GPS units are utilized by Finance. Printers are available for office use.

### Hardware Issues Summary

<table>
<thead>
<tr>
<th>Type</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Computers</td>
<td>One for each staff person</td>
</tr>
<tr>
<td>Laptops</td>
<td>Available for use</td>
</tr>
<tr>
<td>Printers</td>
<td>Ample printers available for use</td>
</tr>
<tr>
<td>Plotters</td>
<td>None</td>
</tr>
<tr>
<td>GPS</td>
<td>None</td>
</tr>
<tr>
<td>MDTs</td>
<td>None</td>
</tr>
<tr>
<td>Scanners</td>
<td>None</td>
</tr>
</tbody>
</table>

Microsoft Office is used to conduct office productivity tasks. HDL is used to track business licenses. Finance utilizes the following software applications:

1. Microsoft Office – office productivity
2. HDL – business licensing
3. Lawson – financials
4. Questica – budgeting
2. GIS NEEDS ASSESSMENT

GIS NEEDS

Finance can take advantage of GIS in support of various departmental functions. The following are the needs identified during needs assessment 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:

<table>
<thead>
<tr>
<th>GIS Need</th>
<th>Method/Application to Meet Need</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapping and Spatial Analysis of Department Data</td>
<td>Intranet GIS Data Browser</td>
</tr>
<tr>
<td>GIS as an Auditing Tool</td>
<td>Intranet GIS Data Browser</td>
</tr>
<tr>
<td>Use GIS to Track Capital Projects</td>
<td>Intranet GIS Data Browser</td>
</tr>
<tr>
<td>Formal GIS Training for Finance Staff</td>
<td>Finance Specific Training</td>
</tr>
</tbody>
</table>
Mapping and Spatial Analysis of Department Data

The Finance Department has expressed specific needs of converting business license locations into GIS data layers. HDL contains both billing and service 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 formatted to a city-standard address format to facilitate geocoding functionality. Address-matched features can then 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 upcoming business license renewals and the aggregate revenue a particular area generates.

A key need identified by Finance Department 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, 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 Finance Department’s objectives. Initial efforts should be aimed at increasing GIS awareness within the Finance Department, allowing staff to become familiar with the efficiencies that can be gained through the use of GIS for mapping, analyzing, and tracking information.

As stated above, the Finance Department should work with the central GIS staff within IT and train specific department personnel in the use of GIS to gain quick successes based on mapping and analysis of growth trends, development forecasting, GASB34 assets, utility customers, utility billing, and usage. Most Finance Department staff should utilize an 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 Finance Department. This application will integrate data from the previously-described data development initiatives, like business licenses. Other key uses include:
- Viewing business licensing
- Viewing heat maps of business license locations
- Use GIS for business license auditing
- Quick determination if an address is in or out of the city

All of the data associated with each record is then available via a GIS portal for viewing and analysis (hotspots, locations, etc.).

Finance Data (Business Licenses from HDL) Available Through GIS

GIS as an Auditing Tool

For many Finance 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 licences, permits, and performing audits on unimproved properties. Finance would be able to see the status of any building permits at a particular parcel to determine any possible use changes. In order to make these audits viable, several new data layers will need to be created by extracting information from several databases, including the licensing database (HDL). The central GIS staff within IT
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.

**Use GIS to Track Capital Projects**

The City manages and oversees all capital projects. Finance staff often needs to find background information on a given project and produce supporting graphics. 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.

**Formal GIS Training for Finance Staff**

All departments, including Finance, will benefit from formal training in GIS. For the immediate future, it is envisioned that all GIS users in Finance will be Tier 3 – Browser level. As such, only third-party training for the recommended GIS client applications such as Intranet GIS Data Browsers should be considered. Training is paramount to the success of the City’s enterprise-wide GIS implementation.
3. GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY
Finance staff does not and will not create any GIS layers. Finance will benefit from access to several 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 departments.

Legend

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creation Methodology</td>
<td>This column describes how the layer was or is anticipated being created.</td>
</tr>
<tr>
<td>Recommended Update of Division or Individual</td>
<td>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.</td>
</tr>
<tr>
<td>Layer Status</td>
<td>Layer state of existence.</td>
</tr>
<tr>
<td>Existing</td>
<td>These layers currently exist within the City’s GIS.</td>
</tr>
<tr>
<td>Recommended/Desired</td>
<td>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.</td>
</tr>
<tr>
<td>Partial</td>
<td>These layers currently exist in an incomplete or outdated state.</td>
</tr>
</tbody>
</table>
The following table lists those data layers that are important to Finance:

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>Creation Methodology</th>
<th>Recommended Update</th>
<th>Existing or Recommended?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Finance GIS Data</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital Improvement Projects</td>
<td>Digitize from base map data; aggregate layers as needed.</td>
<td>Various overseen by the GIS Staff in IT</td>
<td>Recommended</td>
</tr>
<tr>
<td>City Owned Property</td>
<td>Extracted from Parcel Layer</td>
<td>GIS Staff in IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Delinquent Payments</td>
<td>Extracted from database and geocoded</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td>Employee Residence Locations</td>
<td>Extracted from HR database – geographic dispersion of employees. Critical information post disaster</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td>Infrastructure Layers</td>
<td>Digitized and GPS</td>
<td>Public Works</td>
<td>Partial</td>
</tr>
<tr>
<td>Business Licenses</td>
<td>Extracted from database and geocoded (HDL)</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td>Zoning</td>
<td>Digitized on screen/Extracted from Accela</td>
<td>CED</td>
<td>Recommended</td>
</tr>
<tr>
<td><strong>Citywide Base Data</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Property</td>
<td>Parcels were initially created by Contra Costa County. The GIS Division within IT maintain the parcels currently. Temporary ID’s are added to parcel data until the County assigns a permanent number.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Aerial Photography</td>
<td>The City obtains aerial photography every 2 – 4 years as the budget allows.</td>
<td>Static Map</td>
<td>Existing</td>
</tr>
<tr>
<td>Road Centerlines</td>
<td>There are currently two versions of the street centerline data that are maintained. One version is used for maps and cartographic purposes and the other version is used within TriTech for CAD purposes.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Address Points</td>
<td>Address points have been created based on parcel centroids. However, they are stacked for parcels with multi-tenant dwellings.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
</tbody>
</table>

GAP ANALYSIS CHART
Finance will be a data consumer of GIS. As part of this Needs Assessment, a Gap Analysis has been conducted to determine an optimal environment and set of processes for the utilization of GIS. This analysis provides a baseline level of understanding for the existing status and desired status of major GIS components for the department.

The matrix below details those relevant components that have been analyzed and assessed as part of the Gap Analysis.
<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>STATUS</th>
<th>PRIORITY</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automated Vehicle Location (AVL)</td>
<td>No</td>
<td>No</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Finance does not have a need for AVL at this time.</td>
</tr>
<tr>
<td>Documentation</td>
<td>Limited</td>
<td>Yes</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Some documentation on GIS data exists. The GIS Staff in IT will mandate enterprise GIS documentation processes and procedures.</td>
</tr>
<tr>
<td>Enterprise Systems Integration</td>
<td>Limited</td>
<td>Yes</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Integration with HDL and other databases.</td>
</tr>
<tr>
<td>Geocoding</td>
<td>Limited</td>
<td>Yes</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Geocoding of HDL and other databases.</td>
</tr>
<tr>
<td>GIS Data Access</td>
<td>Limited</td>
<td>Yes</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Finance will need access to GIS layers as outlined throughout this document in an easy-to-use data browser.</td>
</tr>
<tr>
<td>GIS Data Maintenance</td>
<td>No</td>
<td>No</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Finance will be a data consumer. They will not create or maintain any GIS data.</td>
</tr>
<tr>
<td>GIS Data Sharing</td>
<td>No</td>
<td>Yes</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Some selected data sets will be shared internally and with the public.</td>
</tr>
<tr>
<td>COMPONENT</td>
<td>EXISTING</td>
<td>DESIRED</td>
<td>PRIORITY</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------</td>
<td>---------</td>
<td>----------</td>
</tr>
<tr>
<td>GIS Personnel</td>
<td>No</td>
<td>No</td>
<td>Low</td>
</tr>
<tr>
<td>Hardware</td>
<td>Yes</td>
<td>Yes</td>
<td>Low</td>
</tr>
<tr>
<td>Mapping</td>
<td>Yes</td>
<td>Yes</td>
<td>High</td>
</tr>
<tr>
<td>Metadata</td>
<td>No</td>
<td>No</td>
<td>Low</td>
</tr>
<tr>
<td>Mobile Computing Resources</td>
<td>No</td>
<td>No</td>
<td>Low</td>
</tr>
<tr>
<td>Network</td>
<td>Yes</td>
<td>Yes</td>
<td>High</td>
</tr>
<tr>
<td>Routing</td>
<td>No</td>
<td>No</td>
<td>Low</td>
</tr>
<tr>
<td>Software</td>
<td>No</td>
<td>Yes</td>
<td>High</td>
</tr>
<tr>
<td>Spatial Analysis and Modeling</td>
<td>No</td>
<td>No</td>
<td>Low</td>
</tr>
<tr>
<td>Training/Education</td>
<td>No</td>
<td>Yes</td>
<td>Medium</td>
</tr>
</tbody>
</table>
4. MULTI-TIER GIS APPLICATION USE

The pyramid and table below outlines the “Tiers of GIS Use” within the 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 and is considered professional GIS personnel. A Tier 2 users is considered an advanced GIS user who is a data custodian. A Tier 3 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 4 Browser user requires only general browsing GIS data functions. The Finance department will consist of Tier 4 Users.

<table>
<thead>
<tr>
<th>GROUP</th>
<th>ACTIVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 1 Flagship</td>
<td>• GIS Administration</td>
</tr>
<tr>
<td></td>
<td>• Data Maintenance</td>
</tr>
<tr>
<td></td>
<td>• Data Conversion and Creation</td>
</tr>
<tr>
<td></td>
<td>• Spatial Data Management</td>
</tr>
<tr>
<td></td>
<td>• Technical Support</td>
</tr>
<tr>
<td></td>
<td>• Coordination</td>
</tr>
<tr>
<td>Tier 2 Custodian</td>
<td>• Data Maintenance</td>
</tr>
<tr>
<td></td>
<td>• Data Conversion and Creation</td>
</tr>
<tr>
<td></td>
<td>• Spatial Data Management</td>
</tr>
<tr>
<td></td>
<td>• Metadata Creation and Maintenance</td>
</tr>
<tr>
<td>Tier 3 Analytical</td>
<td>• Analytical Functions/Geoprocessing</td>
</tr>
<tr>
<td></td>
<td>• Complex Queries</td>
</tr>
<tr>
<td></td>
<td>• Modeling</td>
</tr>
<tr>
<td></td>
<td>• Use of Desktop Extensions</td>
</tr>
<tr>
<td></td>
<td>• High Quality Map Production</td>
</tr>
<tr>
<td>Tier 4 Browser</td>
<td>• Browsing/Look-Up</td>
</tr>
<tr>
<td></td>
<td>• Standard Reports</td>
</tr>
<tr>
<td></td>
<td>• Simple Query</td>
</tr>
<tr>
<td></td>
<td>• Map Production</td>
</tr>
</tbody>
</table>
5. RETURN ON INVESTMENT (ROI)

The following table indicates specific Return on Investment opportunities for Finance. These specific examples show the potential return on investment of the technology.

<table>
<thead>
<tr>
<th>Return on Investment Opportunity Opportunity</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Save Time and Respond More Quickly to Citizen Requests</strong></td>
<td>Staff will have access to accurate/updated data from various databases, such as Business Licenses from HDL. Geographically viewing this data will save time and allow staff to respond better to citizen requests.</td>
</tr>
<tr>
<td><strong>Save Time</strong></td>
<td><strong>Data Access for Staff:</strong></td>
</tr>
<tr>
<td></td>
<td>• An Intranet GIS Data Browser should be used to generate high-quality maps and reports depicting infrastructure, and used in preparation of annual budgets</td>
</tr>
</tbody>
</table>
PHASE I
DEPARTMENTAL NEEDS ASSESSMENTS
HUMAN RESOURCES
NEEDS ASSESSMENT
HUMAN RESOURCES

CITY OF CONCORD
CALIFORNIA
GIS Strategic Implementation Plan
1.

EXISTING CONDITIONS

DEPARTMENT OVERVIEW
As per the City’s website, the Human Resources Department provides comprehensive and timely human resources services. HR staff have the responsibility for developing and implementing innovative strategies and programs. Their goal is to attract, develop, motivate and retain the best qualified employees whose diversity and skills contribute to and sustain the City as a quality organization. They anticipate each opportunity to interact with their client, both internal and external, giving quality customer service to all.

1. HR Interim Director (1)
   a. Senior HR Analysts (2)
   b. HR Analyst II (1)
c. HR Analyst I (1)  
d. HR Technician (2)

2. Labor Relations (category of HR) - Benefits, Job Descriptions, and Prior MOUs

a. Employee Benefits - The City provides exceptional benefits to attract and retain a qualified and highly skilled workforce.

b. Memorandum of Understanding (MOU) - Teamsters Local 856 (Administrative, Technical and Clerical/Field and Operations)

c. Safety Manual - The well-being of employees is very important to the City. A proactive program has been established to foster a safe and healthy work environment, with special emphasis placed on helping employees understand and follow safe work practices

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.

No GIS software is currently used within HR. 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.

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<td>Browser (Tier 4)</td>
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<th>Hardware Issues Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
</tr>
<tr>
<td>Personal Computers</td>
</tr>
<tr>
<td>Laptops</td>
</tr>
<tr>
<td>Printers</td>
</tr>
<tr>
<td>Plotters</td>
</tr>
<tr>
<td>GPS</td>
</tr>
<tr>
<td>Tablets</td>
</tr>
<tr>
<td>Scanners</td>
</tr>
</tbody>
</table>

Microsoft Office is used to conduct office productivity tasks.

HR utilizes the following software applications:

1. Microsoft Office – office productivity
2. Lawson – financials
2. GIS NEEDS ASSESSMENT

GIS will play a role in supporting specific HR functions. GIS is typically peripheral technology for Human Resources. However, HR can take advantage of GIS in support of various departmental functions. 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. HR will be instrumental in hiring GIS staff if they are merited. As such, HR will have a large role in the governance of GIS as well as updating and creating job descriptions to include GIS tasks and duties. The table below summarizes the needs and how they are to be met:

<table>
<thead>
<tr>
<th>GIS Need</th>
<th>Method/Application to Meet Need</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Resource Data Visualization</td>
<td>Intranet GIS Data Browser</td>
</tr>
<tr>
<td>Formal GIS Training for Department Staff</td>
<td>Training Classes</td>
</tr>
</tbody>
</table>
Human Resource Data Visualization

A key GIS need by HR is to create a GIS data repository and to provide access to 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 will provide HR with a useful tool for everyday tasks.

HR will be enabled to use an intranet GIS data browser to conduct basic spatial analysis, to produce maps, and to assist in day-to-day activities to include:

- Mapping employee residences in case of emergencies
- Mapping the spatial distribution of applicant locations
- Provisioning of a new-hire orientation map – locations of key sites around the city

This Intranet browser will serve the entire city, but will have a specific link for Human Resources.

Application to Meet Need

Intranet GIS Data Browser

It is recommended that an enterprise-wide ArcGIS Server (AGS) based intranet GIS data browser tool be used to access pertinent spatial and non-spatial data. This application will not only allow users to view GIS data, but also data entered into other database systems as well. For instance, HR staff should be able to view locations of city employee residents via the GIS in cases of
emergencies. This application will serve as the primary GIS application for HR and will enable staff to accomplish about 90% of their GIS tasks.

**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.), Human Resources will require specific training tailored to the GIS interface that supports their workflows. Although the intranet portal will have a common interface for each division; data, queries, and reporting will be setup for the specific needs of HR.
3. GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY

HR staff does not and will not create any GIS layers. HR 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 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/Denied**: 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 HR:

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>Creation Methodology</th>
<th>Recommended Update Division or Individual</th>
<th>Existing or Recommended?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HR GIS Data</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employee Locations</td>
<td>Extract from Existing Database</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td>Applicant Locations</td>
<td>Extract from Database</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td><strong>Citywide Base Data</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Property</td>
<td>Parcels were initially created by Contra Costa County. The GIS Division within IT maintain the parcels currently. Temporary ID’s are added to parcel data until the County assigns a permanent number.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Aerial Photography</td>
<td>The City obtains aerial photography every 2 – 4 years as the budget allows.</td>
<td>Static Map</td>
<td>Existing</td>
</tr>
<tr>
<td>Road Centerlines</td>
<td>There are currently two versions of the street centerline data that are maintained. One version is used for maps and cartographic purposes and the other version is used within TriTech for CAD purposes.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Address Points</td>
<td>Address points have been created based on parcel centroids. However, they are stacked for parcels with multi-tenant dwellings.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
</tbody>
</table>

**GAP ANALYSIS CHART**

HR will be a data consumer of GIS. As part of this Needs Assessment, a Gap Analysis has been conducted to determine an optimal environment and set of processes for the utilization of GIS. This analysis provides a baseline level of understanding for the existing status and desired status of major GIS components for the division.

The following matrix details those relevant components that have been analyzed and assessed as part of the Gap Analysis.
<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>STATUS</th>
<th>EXISTING</th>
<th>DESIRED</th>
<th>PRIORITY</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automated Vehicle Location (AVL)</td>
<td>No</td>
<td>No</td>
<td>Low</td>
<td></td>
<td>HR does not have a need for AVL at this time.</td>
</tr>
<tr>
<td>Documentation</td>
<td>Limited</td>
<td>Yes</td>
<td>Low</td>
<td></td>
<td>Provided by GIS staff in IT.</td>
</tr>
<tr>
<td>Enterprise Systems Integration</td>
<td>No</td>
<td>Yes</td>
<td>Medium</td>
<td></td>
<td>Integration between GIS and OnBase is desired</td>
</tr>
<tr>
<td>Geocoding</td>
<td>No</td>
<td>Yes</td>
<td>Medium</td>
<td></td>
<td>HR will need to geocode employee and applicant locations.</td>
</tr>
<tr>
<td>GIS Data Access</td>
<td>No</td>
<td>Yes</td>
<td>Medium</td>
<td></td>
<td>HR will need access GIS layers from other departments.</td>
</tr>
<tr>
<td>GIS Data Maintenance</td>
<td>No</td>
<td>No</td>
<td>Low</td>
<td></td>
<td>HR will be a data consumer. They will not create or maintain any GIS data.</td>
</tr>
<tr>
<td>GIS Data Sharing</td>
<td>No</td>
<td>No</td>
<td>Low</td>
<td></td>
<td>There is no need to share HR data with other departments.</td>
</tr>
<tr>
<td>GIS Personnel</td>
<td>No</td>
<td>No</td>
<td>Low</td>
<td></td>
<td>HR will be a data consumer. As such, they will use easy-to-use GIS data browsers. They will not need any GIS personnel.</td>
</tr>
<tr>
<td>Hardware</td>
<td>Yes</td>
<td>Yes</td>
<td>Low</td>
<td></td>
<td>The current personal computers will suffice for running the GIS data browser.</td>
</tr>
<tr>
<td>COMPONENT</td>
<td>STATUS</td>
<td>PRIORITY</td>
<td>NOTES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------</td>
<td>--------</td>
<td>----------</td>
<td>----------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mapping</td>
<td>No</td>
<td>Medium</td>
<td>Medium</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>All mapping should be attainable through the Intranet data browser.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metadata</td>
<td>No</td>
<td>No</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>HR is not overly concerned with the derivation of the GIS data.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobile Computing Resources</td>
<td>No</td>
<td>No</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>HR has no need for mobile GIS.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network</td>
<td>Yes</td>
<td>Yes</td>
<td>Medium</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>High availability and fast access to GIS data will be important to</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>the success of this initiative.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Routing</td>
<td>No</td>
<td>No</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>HR has no need for GIS based routing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Software</td>
<td>No</td>
<td>Yes</td>
<td>Medium</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>HR will need the Intranet GIS data browser only.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spatial Analysis and</td>
<td>No</td>
<td>No</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modeling</td>
<td></td>
<td></td>
<td>HR will mainly use GIS for data browsing, information retrieval, and</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>quick map production. Any high-level analysis will be done by a</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>central GIS resource on an as-needed basis.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training/Education</td>
<td>No</td>
<td>Yes</td>
<td>Medium</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>This component is considered a medium priority for use of GIS within</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>HR. Introductory training is needed at the browser user level for all</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>staff.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The pyramid and table below outlines the “Tiers of GIS Use” within the 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 and is considered professional GIS personnel. A Tier 2 user is considered an advanced GIS user who is a data custodian. A Tier 3 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 4 Browser user requires only general browsing GIS data functions. The HR department will consist of Tier 4 Users.

<table>
<thead>
<tr>
<th>GROUP</th>
<th>ACTIVITY</th>
</tr>
</thead>
</table>
| Tier 1 Flagship | • GIS Administration  
                      • Data Maintenance  
                      • Data Conversion and Creation  
                      • Spatial Data Management  
                      • Technical Support  
                      • Coordination |
| Tier 2 Custodian | • Data Maintenance  
                        • Data Conversion and Creation  
                        • Spatial Data Management  
                        • Metadata Creation and Maintenance |
| Tier 3 Analytical | • Analytical Functions/Geoprocessing  
                        • Complex Queries  
                        • Modeling  
                        • Use of Desktop Extensions  
                        • High Quality Map Production |
| Tier 4 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 HR. These specific examples show the potential return on investment of the technology.

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Increase Productivity</strong></td>
<td><strong>Intranet GIS Data Browser:</strong></td>
</tr>
<tr>
<td></td>
<td>• Will quickly be able to locate needed information, thus saving time.</td>
</tr>
<tr>
<td><strong>Improve Decision Making</strong></td>
<td><strong>Intranet GIS Data Browser:</strong></td>
</tr>
<tr>
<td></td>
<td>• Improves efficiency and decision making by optimizing the use of intranet based mapping solutions to determine employee and applicant locations.</td>
</tr>
</tbody>
</table>
PHASE I
DEPARTMENTAL NEEDS ASSESSMENTS
INFORMATION TECHNOLOGY
1. EXISTING CONDITIONS

DEPARTMENT OVERVIEW

The IT department’s mission is to ensure Concord's technology platform provides the appropriate set of tools required for delivering high-quality services to Concord residents, internal departments and other agencies in a consistent manner sustainable over the 10-year budget horizon.

Regarding California Senate Bill 272 Compliance: The City of Concord, in adherence with the latest amendment to the California Public Records Act (SB 272, 2015), has made available the list of enterprise systems currently in use (see website). The City will make every effort to publish a list of enterprise systems
that do not jeopardize network/system security. Protected Critical Infrastructure related to the City’s systems will not be listed.

1. **IT Director (1)**
   a. IT Operations Manager (1)
   b. IT Project Manager (1)

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**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.

Current staff in various departments use GIS applications for viewing GIS data. Information Technology is currently tasked with supporting software, hardware, databases, and networking associated with GIS. One central GIS staff person resides within Information Technology. The title of the position is GIS Program Analyst. The current job description encompasses all tasks of a GIS Analyst and is specifically tailored to GIS. The GIS Program Analyst is tasked with supporting GIS from a technical perspective. Many departments utilize her as their GIS resource. In these cases, she does GIS for these departments. In other cases, she supports departments with data and expertise. The GIS Program Analyst is tasked with making sure that the current GIS is functional and key data layers are kept up-to-date. She has not been tasked with the role of expanding the use of GIS and ensuring its adoption enterprise-wide. In local government, this role usually falls under the auspices of a GIS Manager. This position is currently vacant at the City of Concord. Optionally, this position could be supplemented using interns.

The following is a general list of tasks conducted by the GIS Program Analyst:

- Installing, configuring, and/or upgrading all GIS software in conjunction with IT
- Providing technical assistance to all GIS users
- Providing GIS products as requested from end-users
- Data layer creation and maintenance
- Creation of cartographic products for city staff, council, consultants, citizen groups and private industry
- Collaborate with the county for data acquisition and update

One of the GIS Program Analyst key tasks is supporting other departments. The GIS Steering Committee will be a part of the IT Executive Committee that is currently in place. There is not a GIS User’s Group at the City at this time.

Information Technology is a service department, in that their job duties are focused on support and helping other departments almost exclusively. IT will always play a key role in the success of GIS at the city. Their expertise in database administration, hardware, operating systems, and networking will always be needed throughout the life of GIS at the city. However, the current role of providing GIS services must be expanded to include GIS leadership. This will be discussed in detail in the Governance Chapter, later in this document.

The table below summarizes the current GIS staffing within the IT 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.

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of Users</th>
<th>GIS Usage</th>
<th>Primary Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIS Flagship (Tier 1)</td>
<td>1</td>
<td>High</td>
<td>ArcGIS Desktop</td>
</tr>
<tr>
<td>Custodian (Tier 2)</td>
<td>0</td>
<td>N/A</td>
<td>None</td>
</tr>
<tr>
<td>Analytical (Tier 3)</td>
<td>0</td>
<td>N/A</td>
<td>None</td>
</tr>
<tr>
<td>Browser (Tier 4)</td>
<td>0</td>
<td>N/A</td>
<td>None</td>
</tr>
</tbody>
</table>
HARDWARE AND SOFTWARE

The Information Technology Department has personal computers for each of its employees. The city contracts with a company to maintain and replace hardware as needed. Standard software includes the Microsoft Office suite and PDF applications (view and edit). Users have access to network printers throughout the city.

The City maintains three (3) servers for Esri software. The old server is running ArcGIS 10 Workgroup and SQL Express. The new GIS server (GIS1) is running ArcGIS 10.2.2. GIS services are run from this server, but access SQL Express on the old server. Lastly, there is a DMZ server that runs Esri’s Web Adaptor. This allows the services to be accessible outside of the network by Accela Mobile. NETAPP is where the “S Drive” is located which houses the GIS share data, such as standalone data, MXD’s, and PDF maps. The City uses NetBackup to backup GIS data to tape. The full server is backed up each weekend along with incremental backups during the week. The SQL Express database will be moved to a new server once the City moves to ArcGIS Enterprise in the near future. There is a failover in place between the servers hosted at Astound and the servers at the Police Department. If either location goes down, the other site can immediately pick up the processes needed to ensure there is no down time.

No GIS education plan regimen exists. The GIS Program Analyst provides some basic training for new users and hands-on training if requested. As new versions of software are released, Information Technology or departmental staff teaches new functionality on an as requested basis. For the most part, mobile computing is done via laptops. A few smartphones and tablets (iPad) are being used. The City is striving for a more transparent government, wanting to offer more services on-line. The following table is a summary of hardware utilized by IT.

<table>
<thead>
<tr>
<th>Type</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Computers</td>
<td>PCs available for staff.</td>
</tr>
<tr>
<td>Laptops</td>
<td>Available for some staff</td>
</tr>
<tr>
<td>Tablets</td>
<td>None for IT staff (in the process of obtaining iPad’s for some IT staff)</td>
</tr>
<tr>
<td>Printers</td>
<td>City standard</td>
</tr>
<tr>
<td>Plotters</td>
<td>HP Z6200 42”</td>
</tr>
<tr>
<td>GPS</td>
<td>Trimble 6000 GeoExplorer</td>
</tr>
<tr>
<td>PDA/MDTs</td>
<td>None</td>
</tr>
<tr>
<td>Scanners</td>
<td>Large Format Scanner Available</td>
</tr>
</tbody>
</table>
IT strives to acquire off-the-shelf software packages wherever feasible. IT supports the following software applications (not an inclusive list):

- Microsoft Office – Used for office productivity
- Microsoft SQL – Used as the standard database platform
- ArcGIS Suite – Used as the core GIS software suite for the City
- Accela – Multiple modules
- HDL – business licensing
- OnBase – Document Management
- FacilityDude – Facility Maintenance
- TriTech – CAD (future) and RMS for the Police Department

Currently, very little data is mined from these systems for use in GIS with the exception of some Accela processes and TriTech extractions.
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 and GPS technology. GIS staff, along with Information Technology staff, should provide primary support and maintenance to the enterprise GIS. Additionally, cross departmental integration of databases will be required as needed for continued development of the enterprise GIS.

The GIS staff, supported by the technical capabilities of other Information Technology staff, will be working to provide GIS support to the City’s departments. As aforementioned, Information Technology will continue to be a focal point for general technical support as the City expands and increases its use of GIS across the enterprise. Information Technology will need to establish, configure, and support various types of technology infrastructure; including software, hardware, databases, networks, user accounts, and documentation.

Key areas of concern for the IT team are:

1. Improve access to interdepartmental GIS layers
2. Increase continuing education and training for the use of GIS tools
3. Increase the amount of data that is being tracked via GIS
4. Ensure GIS data is in compliance with standards
5. Integrate existing databases into GIS or establish linkages to leverage city information assets with spatial context
6. Maintain and continuously update current data
7. Link images, photos, and other related information to geographic locations
8. Improve the use of GIS in the field
9. 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.
10. 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.
11. Improved cooperation with external government entities and private companies

The GIS staff will work closely with other Information Technology (Hereinafter referred to as 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 exposed to the technology and its benefits. The GIS staff 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 (filling the GIS Manager role), and protocols and standards

<table>
<thead>
<tr>
<th>GIS Need</th>
<th>Method/Application to Meet Need</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise GIS Coordination</td>
<td>- Implement Hybrid GIS Governance Model&lt;br&gt;- Subject Matter Experts within various City Departments</td>
</tr>
<tr>
<td>GIS User Support</td>
<td>- Organizational GIS Support</td>
</tr>
<tr>
<td>GIS Software Support</td>
<td>- Staffing</td>
</tr>
<tr>
<td>Centralized GIS Environment and Shared Esri Licensing Structure for the City</td>
<td>- Centralized Governance Model&lt;br&gt;- ArcGIS Desktop&lt;br&gt;- ArcGIS Server</td>
</tr>
<tr>
<td>Data Development and Management of Pertinent Data Layers</td>
<td>- ArcGIS Desktop</td>
</tr>
<tr>
<td>Corporate Mobile/Field GIS Access</td>
<td>- A shared, scalable solution for all departments&lt;br&gt;- Viewing/Editing current data within central GIS database&lt;br&gt;- Technology Evaluation</td>
</tr>
<tr>
<td>Geospatial Data Creation and Integration</td>
<td>- Data Mining Application</td>
</tr>
<tr>
<td>Citywide Training</td>
<td>- GIS Training Matrix</td>
</tr>
</tbody>
</table>
Based on this needs analysis, IT has several GIS needs identified. 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:

<table>
<thead>
<tr>
<th>GIS Need</th>
<th>Method or Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department-Wide Access to Geospatial Data</td>
<td>Intranet GIS Data Browser</td>
</tr>
<tr>
<td>Public Access to Geospatial Data</td>
<td>Internet GIS Data Browser</td>
</tr>
<tr>
<td>Completed Metadata and GIS Data Update</td>
<td>ArcGIS Desktop</td>
</tr>
<tr>
<td>Notification</td>
<td></td>
</tr>
<tr>
<td>Network Administration</td>
<td>ArcGIS Desktop, ArcGIS Server</td>
</tr>
<tr>
<td>Access to Fiber Network Location Geospatial Data</td>
<td>ArcGIS Desktop, ArcGIS Server</td>
</tr>
</tbody>
</table>

Enterprise GIS Coordination

Critical to the future success of the City’s enterprise-wide GIS program will be how it harmonizes best within the organization. Staff understands that an expanded centralized GIS program management system would be beneficial to the City. Data creation, maintenance, update notifications, desktop and extension licensing, GIS hardware, software, and servers, as well as metadata verification should be managed by a centralized, service-based agency within the organizational structure of the City.

The GIS Program Analyst should continue to provide consistent guidance and coordination in support of GIS and its related components. In general terms, the department will be responsible for providing technical support and guidance through the GIS Team. However, the role of IT in GIS should be expanded to include enterprise GIS Coordination. Enterprise GIS coordination encompasses a variety of tasks, processes, and procedures, all of which have a cross-functional context within the scope of GIS implementation planning—the GIS Team in IT will have frequent contact with staff from other departments as well as external entities.

The following are GIS coordination needs that should be provided both internally and externally.

City of Concord (Internal)
• Installation, maintenance, and upgrade of hardware and its operating systems
• Provision of training for users in each department
• Develop (in partnership with departments) database standards
• Plans and procedures for effective integration or transfer of GIS data from various sources into usable databases
• Develop (in partnership with departments) mapping standards
• Develop (in partnership with departments) metadata standards
• Develop (in partnership with departments) GIS Editing Procedures/Methodologies and associated communication strategies where needed
• Develop (in partnership with departments) GIS Data Quality Control Procedures
• Maintenance of data security and integrity
• Primary contact for user problems and vendor support
• Complex spatial analyses
• High-level cartography
• Project management
• Inter-departmental collaboration on GIS projects and initiatives

External
• Collaboration with other local agencies (Contra Costa County) and utilities (Contra Costa Water District)
• Frequent attendance and participation in local and regional GIS groups
• Distribution and acquisition of geospatial data
• Participation with Provincial and Federal agencies on GIS initiative
**GIS User Support**

GIS staff in IT will continue to provide GIS software support. Staff will be responsible for identifying, evaluating, and acquiring new GIS applications that may be beneficial for the City’s GIS. Optimally, additional staff members from IT may need to be trained on some GIS software, in order to provide redundancy in technical knowledge and serve as backup support should circumstances require support beyond that which can be provided solely by the GIS staff in IT. However, this is not practical with current stall levels due to the vertical alignment of IT staff with departments and systems.

**Organizational GIS Support**

The GIS Team (GIS Manager (open position) and GIS Program Analyst) in IT should implement three levels of departmental support, depending upon the level of GIS use and internal capabilities per department. They include:

- **Level 1** – The GIS Team in IT provides minimal support for department/division GIS activities, system and application support. The GIS Team in IT is used primarily for strategic and procedural support.
- **Level 2** – The GIS Team in IT provides partial support for department/division GIS activities. A Level 2 department/division will do most of its own data maintenance, but the GIS Team in IT will provide advanced support. The GIS Team in IT will also be responsible for advanced spatial analysis, as well as application development.
- **Level 3** – The GIS Team in IT provides all support for department/division GIS activities. The GIS Team in IT is responsible for data maintenance, complex data analysis, and cartographic products. Most of the non-technical departments will require continued support from the GIS Team in IT.

The GIS Team in IT should provide training and technical support for all enterprise-wide GIS applications. All GIS software training should be coordinated through the GIS Team in IT to ensure maximum consistency, efficiency, and effectiveness at a minimum cost.

Not every department in the city that wants to use GIS is able to hire or convert staff to effectively handle the tasks of data analysis and data maintenance. The GIS Team in IT will assist these departments with their GIS needs. However, as usage of GIS in these departments grows, the GIS Team in IT must encourage and
facilitate the acquisition of appropriate resources to handle data maintenance responsibilities for these departments.

**GIS Software Support**

The GIS staff will be primarily responsible for GIS software support. It is recommended that the GIS staff work in conjunction with IT staff on GIS software installation and support (GIS software installation could be assigned to the existing IT Service Desk). The GIS staff in conjunction with IT will be responsible for identifying, evaluating, and acquiring new GIS applications that may be beneficial for the City’s GIS implementation.

A user should know exactly where to call or email for GIS support, to report a data problem, or for technical assistance. A GIS service desk ticket should be opened for each request. The user should be emailed automatically and given a case number. Once the case is closed, the user should be emailed as to the resolution. This is very critical to ensure that users feel that they are being heard and supported.

**Centralized GIS Environment and Shared Esri Licensing Structure for the City**

It is in the best interest of the City to manage a central repository of GIS licenses and resources. All City personnel need access to GIS data maintained by various departments. As part of the City’s enterprise wide GIS implementation, all department data should eventually be stored in a single repository where each department has access to up-to-date spatial layers. This sharing of information will greatly assist all City departments in fulfilling their GIS management roles and allow personnel to more effectively respond to citizen requests.
It is recommended that ArcGIS should continue to serve as the central GIS platform throughout the City. Working from the same GIS platform will greatly simplify data sharing and access for all the participating departments.

Contemporary Esri technology embedded within ArcGIS 10.x now allows for a centralized server-based data storage, map distribution, and licensing management system. Instead of a decentralized, or “stovepipe”, style of GIS system warehousing where little or no sharing of data and licensing occurs, one or more dedicated GIS servers can effectively manage all GIS assets, including a license manager product. This model should be used by the City of Concord to include the concepts of a corporate geodatabase.

The City currently has an ArcSDE server with SQL Express as their GIS database server and an ArcGIS server as their map service server. However, most ArcGIS users still use the GIS shapefiles or standalone data on the “S Drive.”

Application to Meet Need

ArcGIS Server

ArcGIS Server is a server-based product that provides a scalable framework for distributing GIS services and data over the Web. ArcGIS Server should be used as a platform to serve data for a City Intranet GIS Data Browser.

ArcGIS Server provides Web publishing of GIS maps, data, and metadata for access by many users both inside the organization and outside on the World Wide Web. ArcGIS Server enables Web sites to serve GIS data, interactive maps, metadata catalogs, and focused GIS applications. In addition, ArcGIS Server services can be accessed using many different clients including ArcGIS Desktop, custom applications created using ArcGIS Engine, ArcReader, ArcPad, ArcGIS Server, and a wide variety of mobile and wireless devices.

ArcGIS is recommended as the primary GIS application to be used by the City; Internet and Intranet applications will require ArcGIS Server, which IT will be responsible for configuring, updating, and upgrading.
Data Development and Management of Pertinent Data Layers

Multiple City departments expressed interest in further advancing their functional use of GIS data and software. In coordination with those interests, GIS data development and administration should be the absolute highest priority for the GIS staff to promote GIS implementation enterprise wide.

Based on interviews, each department identified numerous data layers that would be highly beneficial for viewing and analyzing. Some of these layers should be created by mining and geocoding data from existing databases. Strong coordination must be taken between each department, the GIS staff, and IT during this data creation and maintenance phase.

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. Discussion of options will be discussed in detail in the applications chapter of this strategic plan. The City should undertake a thorough evaluation of options before acquisition.

Geospatial Data Creation and Integration

Again, many departments store much of their information in electronic databases that have addresses as an attribute; therefore spatially enabling these databases will yield important datasets for the enterprise GIS.
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.

**Application to Meet Need**

**Automated Geocoding Service**

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. In order for the permitting process to be automated and spatially enabled, external databases need to be linked to a GIS data browser for maximum use of both systems.

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 (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 below shows the process of using such an application 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 application can generate and export the resulting GIS layer on a regularly scheduled basis.

Automated Service Settings

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.
**Citywide Training**

City employees will require training on new GIS applications as they are implemented. The IT GIS staff (including the GIS Manager position) in IT should setup and administer training. The GIS staff will be responsible for identifying appropriate classes and education materials for departmental staff. Preliminary recommendations are provided in the following table:

<table>
<thead>
<tr>
<th>Class</th>
<th>Site</th>
<th>Trainer</th>
<th>Days</th>
<th>Year of Training - based on this five year plan</th>
<th>Participants</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creating and Maintaining Metadata Using ArcGIS Desktop</td>
<td>On</td>
<td>Web Course</td>
<td>3 Modules</td>
<td>1</td>
<td>Various</td>
<td>$96</td>
</tr>
<tr>
<td>ArcGIS 2: Essential Workflows</td>
<td>On</td>
<td>Esri Authorized Trainer</td>
<td>2</td>
<td>1,2</td>
<td>Various</td>
<td>$5,000</td>
</tr>
<tr>
<td>ArcGIS 3: Performing Analysis</td>
<td>On</td>
<td>Esri Authorized Trainer</td>
<td>2</td>
<td>1,2</td>
<td>Various</td>
<td>$5,000</td>
</tr>
<tr>
<td>ArcGIS for Server: Site Configuration and Administration</td>
<td>Off</td>
<td>Esri</td>
<td>3</td>
<td>1,2</td>
<td>Various</td>
<td>$1,515</td>
</tr>
<tr>
<td>Building Geodatabases</td>
<td>Off</td>
<td>Esri</td>
<td>3</td>
<td>1</td>
<td>Various</td>
<td>$1,515</td>
</tr>
<tr>
<td>Configuring and Managing the Multiuser Geodatabase</td>
<td>Off</td>
<td>Esri</td>
<td>3</td>
<td>1</td>
<td>Various</td>
<td>$1,515</td>
</tr>
<tr>
<td>Tier 3 Applications</td>
<td>On</td>
<td>Internal</td>
<td>1</td>
<td>1,2,3</td>
<td>Various</td>
<td>Varies</td>
</tr>
</tbody>
</table>
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 governments and is critical within the enterprise. Web-based data browsers allow quick viewing and printing of map data and can be configured for all internal City departments. Historically, this has been accomplished by using an ArcIMS GIS Portal and more recently an ArcGIS Online Web Map.

ArcIMS has given way to ArcGIS Server. The City currently has one portal, an ArcGIS Online web map. The City should further implement ArcGIS Server-based intranet GIS data browsers (Esri’s Web AppBuilder) for its employees to provide mapping and analysis capabilities for all personnel. This GIS data browser has the ability for staff to view updated department-specific information as well as the City’s base GIS data layers. The current browser is missing key functionality and completeness in regards to the data layers provided. Many organizations have begun to use ArcGIS Online to implement targeted GIS portals for each department. It is recommended that the city analyze off-the-shelf browsers and ArcGIS Online in an effort to provide the next-generation portal experience.

Public Access to Geospatial Information

Providing a public right-of-entry through the Internet will greatly improve citizen 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. This could include the ability to download shapefiles and/or data layers.

A Public GIS Viewer could answer common public questions, 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?

Application to Meet Need

Internet GIS Data Browser

The City should implement targeted ArcGIS Server based Internet GIS and/or ArcGIS Online applications to provide citizens 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 (CIP, 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. Specific departmental portal needs are identified in departmental needs assessments.

**Metadata and GIS Data Update Notification**

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.

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.
**GIS STRATEGIC IMPLEMENTATION PLAN**

**NEEDS ASSESSMENT**

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**Application to Meet Need**

**ArcGIS Desktop 10.x**

ArcGIS Desktop 10.x is recommended for use by Tier 1 – Flagship GIS users and Tier 2 – Analytical GIS users. The ArcCatalog software application within the ArcGIS 10.x desktop software suite empowers these GIS data authoring users the ability to also write and maintain metadata for all GIS data layers.

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**GIS NEED**

**Network Administration**

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.

IT should continue to 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 serves to increase security, and in turn minimize risk of integrity compromise, for all data stored and delivered through the GIS enterprise.

An ArcGIS Server (AGS) solution will impact an organization’s IT infrastructure. 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.

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**GIS NEED**

**Access to Fiber Network Location Geospatial Data**

IT personnel have the following GIS needs or requirements:

1. Ability to locate, update, and map all fiber network data
2. Ability to locate, update, and manage IT asset locations
IT utilizes fiber to connect its various buildings and this will expand in the near future. Managing and mapping fiber requires a fair amount of GIS and fiber network expertise to produce meaningful results. The current fiber network should be mapped and maintained via GIS. As with any infrastructure, it is important to know its location and details about each feature. Additionally, IT is looking at expanding the use of the fiber assets. GIS is a logical tool for managing the fiber network and services. The IT Department has obtained GIS based software to maintain their fiber network and will be implementing this solution in the near future.
3.
GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY

GIS staff in Information Technology primary role should not be the maintenance of GIS layers. For the most part, this is and should be the responsibility of end-user departments. The recommended expanded GIS staff should coordinate and have oversight of other GIS core base-layers, as well as department-specific layers (to include layers that involve maintenance and those that do not). Optimally, these layers should be stored and managed in a central corporate database managed by IT/GIS. It is expected that once all departmental data is integrated, consolidated, and centrally stored, IT staff, and all others in the Citywide GIS Community, will have access to all non-classified GIS data layers from other City departments.

GIS staff in IT should be responsible for establishing and maintaining the corporate GIS database (not individual layers). As new data layers are created, the GIS staff will need to ensure that each layer is at an acceptable accuracy level and that a data update methodology has been established. GIS staff will work closely with each department to ensure that they have the appropriate training and skills to maintain their own GIS layers where appropriate.

As the City moves forward with its GIS implementation, geospatial data management and maintenance needs will grow, and the need to distribute data to various departments (as well as the public) will increase. There are several alternatives that the City may wish to pursue in terms of geospatial data management in
the context of a database. Given the diverse and stratified workflows for data management inherent within each City department, the possibility of maintaining a decentralized environment, wherein geospatial data is managed as flat files (i.e., Shapefile and CADD) as well as in a database, is feasible. However, such an environment presents some limitations in terms of the ability to leverage the relational and distributed capabilities of an enterprise database. It is expected that the City will implement a definitive and centralized geodatabase environment during the first year of this GIS expansion. It is also expected that a majority of the City’s geospatial data will reside in an enterprise SDE geodatabase within the first year of this GIS implementation. MS-SQL Server should continue to be used as the relational data-base management system.

All geospatial data that City departments create, maintain, and edit are vitally important to the success of the City’s enterprise GIS. These layers of data should be made available to the citywide enterprise GIS upon full completion of the migration to an enterprise geodatabase and the implementation of a GIS based Intranet Data Browser. The negative ramifications of not maintaining these geodatabases would directly affect the success of the City’s GIS implementation, both in the short-term and the long-term.

The following table lists the core GIS layers currently under construction, in service, and/or are recommended for inclusion within the City.

**Legend**

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creation Methodology</td>
<td>This column describes how the layer was or is anticipated being created.</td>
</tr>
<tr>
<td>Recommended Update Division or Individual</td>
<td>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.</td>
</tr>
<tr>
<td>Layer Status</td>
<td>Layer state of existence.</td>
</tr>
<tr>
<td>Existing</td>
<td>These layers currently exist within the City’s GIS.</td>
</tr>
<tr>
<td>Recommended/Desired</td>
<td>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.</td>
</tr>
<tr>
<td>Partial</td>
<td>These layers currently exist in an incomplete or outdated state.</td>
</tr>
</tbody>
</table>
The following table lists critical base data layers:

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>Creation Methodology</th>
<th>Recommended Update Division or Individual</th>
<th>Existing or Recommended?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Property</strong></td>
<td>Parcels were initially created by Contra Costa County. The GIS Division within IT maintain the parcels currently. Temporary ID’s are added to parcel data until the County assigns a permanent number.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
<tr>
<td><strong>Aerial Photography</strong></td>
<td>The City obtains aerial photography every 2 – 4 years as the budget allows.</td>
<td>Static Map</td>
<td>Existing</td>
</tr>
<tr>
<td><strong>Road Centerlines</strong></td>
<td>There are currently two versions of the street centerline data that are maintained. One version is used for maps and cartographic purposes and the other version is used within TriTech for CAD purposes.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
<tr>
<td><strong>Address Points</strong></td>
<td>Address points have been created based on parcel centroids. However, they are stacked for parcels with multi-tenant dwellings.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
</tbody>
</table>
4. MULTI-TIER GIS APPLICATION USE

The pyramid and table below outlines the “Tiers of GIS Use” within the 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 and is considered professional GIS personnel. A Tier 2 users is considered an advanced GIS user who is a data custodian. A Tier 3 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 4 Browser user requires only general browsing GIS data functions. The IT department will consist of Tier 1 and 4 Users.

<table>
<thead>
<tr>
<th>TIER</th>
<th>GROUP</th>
<th>ACTIVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Flagship</td>
<td>• GIS Administration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Data Maintenance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Data Conversion and Creation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Spatial Data Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Technical Support</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Coordination</td>
</tr>
<tr>
<td>2</td>
<td>Custodian</td>
<td>• Data Maintenance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Data Conversion and Creation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Spatial Data Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Metadata Creation and Maintenance</td>
</tr>
<tr>
<td>3</td>
<td>Analytical</td>
<td>• Analytical Functions/Geoprocessing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Complex Queries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Modeling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use of Desktop Extensions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• High Quality Map Production</td>
</tr>
<tr>
<td>4</td>
<td>Browser</td>
<td>• Browsing/Look-Up</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Standard Reports</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Simple Query</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Map Production</td>
</tr>
</tbody>
</table>
PHASE I
DEPARTMENTAL
NEEDS ASSESSMENTS
NAVAL WEAPONS
STATION REUSE
NEEDS ASSESSMENT
NAVAL WEAPONS STATION REUSE PROJECT

CITY OF CONCORD
CALIFORNIA
GIS Strategic Implementation Plan
1. EXISTING CONDITIONS

DEPARTMENT OVERVIEW

New uses for the Concord Naval Weapons Station will provide many positive, long-lasting benefits for the people of Concord. After the base was closed in 2005, residents, stakeholders and the City came together over several years to decide how the property should be developed. After seven years of meetings and public workshops, and with the oversight of a 21-member advisory committee, the Concord Community Reuse Project Area Plan was adopted in 2012.

The overarching project goals agreed upon by the community are:

- Identity as a World Class Project
- A Balanced Approach to Conservation and Development
- Economically Viable and Sustainable Development
- High Quality of Life for all Residents of Concord
GOVERNANCE OF GIS

The Naval Weapons Station Reuse Project (NWSRP) is not a heavy user of GIS, but due to the nature of the tasks involved in the NWSRP, many GIS layers are being generated. These GIS layers should be gathered and provided to City of Concord GIS staff within IT for inclusion in the central database repository. It is not expected that NWSRP will become a heavy user of GIS at the City, but continue to utilize consultants and provide GIS data to the City.

The table below summarizes the current GIS staffing within the NWSRP. 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.

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of Users</th>
<th>GIS Usage</th>
<th>Primary Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIS Flagship (Tier 1)</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Custodian (Tier 2)</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Analytical (Tier 3)</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Browser (Tier 4)</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Type</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Computers</td>
<td>Personal computers are available for all staff</td>
</tr>
<tr>
<td>Laptops</td>
<td>None</td>
</tr>
<tr>
<td>Printers</td>
<td>Available to office staff</td>
</tr>
<tr>
<td>Plotters</td>
<td>None</td>
</tr>
<tr>
<td>GPS</td>
<td>None</td>
</tr>
<tr>
<td>PDA/MDTs</td>
<td>None</td>
</tr>
<tr>
<td>Scanners</td>
<td>None</td>
</tr>
</tbody>
</table>
2. GIS NEEDS ASSESSMENT

GIS NEEDS

Based on this Needs Assessment and as discussed previously, NWSRP will primarily generate GIS data layers, rather than use GIS layers within the department. 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:

<table>
<thead>
<tr>
<th>GIS Need</th>
<th>Method/Application to Meet Need</th>
</tr>
</thead>
</table>
| Mapping and Spatial Analysis of Department Data        | 🎈 ArcGIS for Desktop  
|                                                        | 🎈 Intranet GIS Data Browser                                        |
| Tracking and Coordination of Capital Improvement      | 🎈 ArcGIS  
| Projects                                              | 🎈 Esri’s Capital Improvement Planning Solution  
|                                                        | 🎈 Intranet GIS Browser                                             |
| AutoCAD and GIS Conversion                            | 🎈 ArcGIS  
|                                                        | 🎈 FME  
|                                                        | 🎈 AutoCAD Map 3D                                                   |
| Public Forum Neighborhood and Vicinity Mapping        | 🎈 Internet and Intranet GIS Data Browser                            |
GIS Need

<table>
<thead>
<tr>
<th>GIS Need</th>
<th>Method/Application to Meet Need</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Access to Geospatial Information</td>
<td>Internet GIS Data Browser</td>
</tr>
<tr>
<td></td>
<td>Esri Story maps</td>
</tr>
<tr>
<td>Site Selection and Business Analysis</td>
<td>Esri Business Analyst Online</td>
</tr>
<tr>
<td>Economic GIS Web Portals</td>
<td>Story Maps</td>
</tr>
</tbody>
</table>

Mapping and Spatial Analysis of Department Data

One of the significant benefits that the City will realize from the continued implementation of GIS and complementary technologies is increased and improved access to information. The City of Concord will be able to further understand relationships between different types of data in a spatial context, thereby improving decision-making; maps will be used to provide the public with valuable housing and neighborhood information in a geographic context; and staff will be able to prepare maps required for funding applications to demonstrate that the project meets the grant’s criteria, such as proximity to a transit corridor. Dynamic maps and applications will allow citizens and other stakeholders to access information, data, and provide feedback using current data in real time. Additional training and software tools will be needed to accomplish all the identified analytical needs of the City with the use of NWSRP data.

Tracking and Coordination of Capital Improvement Projects

The NWSRP will coordinate, manage, and participate in a variety of developer instigated and capital public infrastructure projects as development and planning begins. Staff, in conjunction with CEDD, needs to use GIS to find background information on a given
project and produce supporting graphics. A set of GIS layers 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 throughout time, coordinate with other departments, 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. The NWSRP should work closely with CEDD and other City departments to fully take advantage of the recommended CIP tools and data layers.

AutoCAD and GIS Conversion
Local Government has long relied upon CAD software for their engineering functions. Over the years, these same organizations invested in acquiring and developing GIS to serve their mapping and spatial analysis needs. Today, local governments recognize the value of employing these technologies and the importance of using both. However, integrating and sharing data between these systems has typically proven challenging for a variety of reasons. It is no wonder that these technologies generally remain separate both in function and management; CAD technicians and Engineers take advantage of the precision and accuracy of CAD to design new infrastructure, while GIS professionals maintain the overall “as-built” record of the utility.

Local Government Departments, especially those consisting of abundant engineering functions, realize that CAD and GIS are important for planning, operations, and management. During the planning and design phases of a project, it is critical for the designer to work in the CAD environment using the most current base map information from the GIS and other sources. Also, it is important that the relevant design data to be posted back to GIS at various stages, including the final as-built stage. This provides operations staff with engineering accurate data. Currently, many organizations manually re-digitize the CAD data for the GIS. This not only creates duplication of effort, but also introduces the potential of errors and delays in getting up-to-date data.

CAD-GIS integration can deliver the needs of the utility from design through operations. With the tools available today, departments can automate this process and improve accuracy and efficiency. Every CAD to GIS integration project is unique. Factors related to CAD type (dwg, dgn, dxf, dgn, etc.), projections, layering,
consistency, etc., combine to make each project challenging. Therefore, every successful CAD to GIS integration project begins with solid CAD management practices and a deep understanding of those practices. CAD data management involves organizing, managing, and tracking the creation and modification of drawings through the design, engineering, and construction processes. Best practices help organizations determine how they should manage their respective CAD environments. The following 5 items are a must:

1. Discover and document workflow process
2. Develop and document CAD standards
3. Establish a single data repository for all CAD data
4. Implement change control
5. Provide robust and continual training

Understanding current CAD management is vital for determining the process and details of integration. Integration projects require the organization to know the layering and annotation methodologies, work flows, coloring, units of measure, and spatial reference, at a minimum. There are two general approaches to CAD/GIS integration: 1) a loose coupling of importing/exporting and 2) tight integration that allows for edit by edit, bidirectional transactions (Data/System Integration).

**Importing/Exporting**

Local Government Departments usually have vast amounts of data residing in hundreds or even thousands of CAD files. This data can greatly provide value to the GIS by improving accuracy and completeness. Likewise, the GIS has enormous amounts of data that can be useful for engineering designs and CAD users. Departments will often choose to utilize import and export processes to exchange data between systems.

**CAD to GIS**

In projects dealing with CAD sources lacking solid management practices, the need for extensive documentation and cleanup is likely. Documentation should include information related to spatial coordinate system of CAD file, layering scheme with descriptions, annotation, which layers will be represented as points, lines, polygons, etc. Once documentation is complete, the task of cleanup begins with the basic goal of attaining as much consistency as possible. With consistency, repeatability is possible, which makes automation possible. Organizations may find it helpful to group “like” files together to minimize cleanup efforts and simply handle the differences between groups with separate import scripts. Other organizations have chosen to use a “day forward” approach. This allows them to control/manage new CAD
drawings and utilize the conversion process moving forward. This would be a likely scenario for CEDD, but more streamlined data conversion is desired.

After “clean” files are achieved there are many different options for converting CAD files into a geodatabase. Factors related to choosing the correct tool include:

1. Is CAD data migrating to empty feature class or into one already containing records?
2. Are there attributes that can be captured from the CAD data?
3. How well does the CAD data geo-reference with existing GIS features?
4. Is any transformation required?
5. How much CAD data is involved in the conversion?

Options include using geoprocessing tools available through ArcCatalog, creating data conversion models, using python scripts, simple copy and paste functions within ArcMap, and using off-the-shelf products. For example, converting small amounts of CAD data into an existing, populated feature class when CAD and GIS align well may best be performed using ArcGIS editing tools with a simple copy and paste. However, an initial conversion of large amounts of CAD data with a need for repetitive processing may benefit from an off-the-shelf product. See Suggested Tools section below for more details.

GIS to CAD
Utility designs often require base information like edge of pavement, building locations, parcels, and existing utilities. GIS data can often provide this information. Exporting and importing routines can provide the necessary data on project by project bases. The process is very like that of converting CAD to GIS, but there are some different considerations needed. One such consideration involves handling attribute information. For example, GIS stores data for pipe size, material, slope, etc. as attributes in the database. Typically, this information is notated in CAD files as text. This may require some preparation of the GIS data to annotate the features prior to export. In addition, the export must take into consideration the usage of AutoCAD blocks or Microstation cells. Care must be taken to rightly represent the data in the CAD format.

When exporting data from GIS to CAD the user must understand how the data is going to be utilized and what the desired output includes. Questions that need to be addressed include, but are not limited to:

1. Is the data for reference purposes only, or will it be modified as part of the design?
2. Will modifications need to make their way back to the GIS?
3. Do the GIS feature class require further delineation based on CAD layering schemes (e.g. different size water mains have different layers)?
4. Does the GIS data have attributes that need to be noted as text in the CAD file?
5. Are blocks or cells used?
6. Are there scale issues to consider?
7. Are spatial references and workspaces aligned between systems?
8. What is the status of other data being used in the CAD file (e.g. survey data)?

Once the requirements and usage are understood, many of the same options for moving data from CAD to GIS are available, including: geoprocessing tools in ArcGIS for Desktop, data conversion models, and off-the-shelf products.

**Data/System Integration**

Further efficiencies can be achieved through tight integration between CAD and GIS data and applications. Most of the best practices related to import/export of data remain true, however, CAD users interact directly with the GIS data for both viewing and updating feature classes. Thus, GIS users have direct access to more accurate, complete, and current data. The suggested tools section provides details on the tool used for integration. Those tools include AutoCAD Map 3D and ArcGIS for AutoCAD. However, there are some data management principals/practices that need to be addressed prior to integration.

With these types of CAD/GIS integrations the emphasis is on the CAD user. The tools and interface of the CAD system doesn’t change (except for a few additional menus), making the transition relatively easy, however, the method of retrieving and storing data changes drastically. CAD users will need to understand the data schema of the GIS. This knowledge goes beyond knowing the type of asset represented in a feature class, but also understanding the attributes and subtypes of the GIS layer, since users may need to utilize queries to obtain the information they need from GIS layers. Given the direct interaction with the GIS database, it is a good idea that CAD users are provided an introduction to GIS training course.

As with any GIS data edits, a plan needs to be in place. Care must be taken to ensure edits to the GIS database are incorporated correctly and that proper permissions and data flows are established. This generally means that CAD users must have their own username in the GIS database and be included in the GIS versioning schema. Any connections made to the GIS database for editing purposes should follow the proper permissions/versioning policies. One best practice concerning versioning is to have a QA/QC version with SDE.DEFAULT as the parent (in combination of making SDE.DEFAULT private ensuring that direct edits
are not allowed). Then versions can be created from QA/QC in various ways to allow CAD/GIS editors to make proposed updates.

**Suggested Tools**
The above discussion outlines some of the best practices and approaches to integrate CAD and GIS. The following tools will assist the NWSRP (in conjunction with CEDD and GIS staff within IT) in achieving better efficiency and accuracy of GIS data updates. These tools also allow for bidirectional consumption of CAD/GIS data using one or both approaches discussed above.

**ArcGIS**
ArcGIS allows users to interact with CAD data in a variety of ways. The simplest method allows ArcGIS for Desktop users to directly access the CAD files, overlaying the data with GIS. More advanced options allow users to export and import data between GIS and CAD. Esri has provided a great resource discussing the process and options of CAD/GIS at the following URL:


Some of the tools available include:

- **Georeferencing CAD datasets**
- **Loading CAD data into GIS database**
  - Convert CAD Feature Layer
  - Convert CAD Feature Dataset
  - Append
  - Merge
  - Object Loader
  - Simple Data Loader
- **Loading CAD annotation**
- **Export to CAD Tool**

These tools and options can be utilized with ModelBuilder to help streamline the process. ArcGIS is a great option for CEDD to successfully implement the import/export approach using tools already available and to consume CAD data in ArcGIS for Desktop for viewing purposes.

**FME**
Another excellent option to streamline importing/exporting of CAD and GIS data is the use of Safe Software’s FME product. FME can be deployed as a desktop, server or cloud solution providing great flexibility. FME allows for customized configurations to
perform data conversion and transformation workflows. With FME, the following benefits can be realized:

- Simple data conversion
- Point and click interface
- Complex data conversion without the need of code development
- Ability to manipulate and structure data to fit specific requirements
- Handle both GIS attribution and CAD annotation
- Maintain symbology between systems
- Build repeatable data processes
- Data validation routines
- Reproject coordinate systems
- Integrate with Esri’s ModelBuilder

The power of FME is in the FME Workbench. The Workbench would allow staff to configure any type of data conversion workflow for sharing data between CAD and GIS. One result of using FME is the documentation of workflows.

Data Interoperability Extension

Available as an extension to ArcGIS for Desktop or Server and based on Safe Software’s FME technology, Data Interoperability provides the ability to directly read, import, and export over 100 standard spatial data formats. Per Esri, the Data Interoperability extension can:

- Directly read more than 100 spatial data formats, including GML, XML, WFS, Autodesk, DWG/DXF, MicroStation Design, MapInfo, MID/MIF and TAB, Oracle and Oracle Spatial, and Intergraph GeoMedia Warehouse, and export to more than 70 spatial data formats.
- Perform automated conversion between source and destination formats.
- Create, manipulate, and convert geometry and attributes using spatial ETL tools built with the Workbench application.
- Enjoy full integration with the ArcGIS geoprocessing environment including the ModelBuilder framework.

One downside of Data Interoperability is that imports of CAD occur only at the personal or file geodatabase level. As such, moving data into the enterprise geodatabase would require additional processing. However, this tool is a good option for quickly providing importing/exporting capabilities that extend beyond typical ArcGIS tools.
ArcGIS for AutoCAD

With ArcGIS for AutoCAD, the City can begin realizing tighter integration between CAD and GIS. The application consists of a plug-in for AutoCAD that allows users to gain access to enterprise GIS maps, map services, and feature services hosted by ArcGIS for Server. An additional benefit of ArcGIS for AutoCAD is the ability to perform edits to the data residing in the GIS database directly from within AutoCAD. Some of the benefits include:

- Streamline information sharing between GIS and CAD groups.
- View live, rich cartographic GIS maps in AutoCAD.
- Include the results of GIS analysis in AutoCAD designs.
- Add imagery to your AutoCAD drawing.
- Create, manipulate, and define how CAD data is organized and attributed as GIS content so it can be used in ArcGIS for Desktop or AutoCAD.
- Navigate your AutoCAD session based on street address or place names.
- Edit Enterprise Geodatabases from within AutoCAD
  - Connect to ArcGIS for Server feature services and edit the features stored in a geodatabase using AutoCAD.
  - Connected and long transaction workflows supported.
  - Connect to read-only feature services to stream vector feature services into your AutoCAD session.
  - Extract your own local copy of geodatabase features from a feature service as AutoCAD entities.
- Create GIS-Ready AutoCAD Files
  - Select drawing entities by their GIS attribute values.
  - Add Esri industry standard data models into CAD workflows
  - Customize CAD mapping applications with ArcGIS for AutoCAD commands and AutoLISP tools
  - Manage the tabular attributes of features within your drawing using the provided attribute table viewer.
AutoCAD Map 3D

Full Data/System integration between CAD and GIS is achievable with AutoDesk’s AutoCAD Map 3D. With AutoCAD Map 3D, staff can take advantage of intelligent industry data models and tools. These tools allow for organizations to apply their specific standards to improve data quality and to support productivity while better managing their infrastructure. AutoCAD Map 3D allows direct access Esri geodatabases, greatly reducing the need for data conversion. From within AutoCAD, users can directly view and edit GIS data using AutoCAD commands. This allows staff (specifically within CEDD and GIS staff within IT) to utilize their CAD-trained workforce to create, edit, and maintain geospatial data, while using the power of ArcGIS to perform analysis. Also, AutoCAD Map 3D helps integrate field collected data (e.g. survey data) to more accurately update the system of record.

CAD/GIS integration isn’t as complex as many believe. The tools available today can make the process nearly seamless. The bulk of the work is in the details of the planning phase of the project. Integration may mean making changes to long held CAD or GIS standards. Layering schemas may need changed in one or both systems. However, careful planning and data flow processes can overcome many challenges and successfully navigate through the different system configurations. Taking time to understand both the CAD and GIS environments will pay great dividends in the final integration.

Public Forum Neighborhood and Vicinity Mapping

The NWSRP conducts public forums and various meetings that could greatly benefit from a greater ability to provide staff-generated GIS and mapping products. This should be accomplished in two different ways depending on the nature of the meeting. If the meeting is addressing a specific topic, then a static map can be created to depict the issue at hand for the area of concern (Figure to the left). This can be accomplished by utilizing Esri ArcGIS Desktop and/or the Intranet Browser Solution, with assistance from consultants and/or GIS staff within IT.
This process can be automated to the point where a user can quickly zoom to the subject geographic area, select the desired data layers, and then print, using a standard departmental template for the quick production of maps geared towards public forums.

Alternatively, if the issue being discussed requires analyzing specific neighborhood factors in various areas, a live GIS viewing tool could also be utilized. This tool would allow the presenter to zoom into areas of concern and display key data layers, and then accomplish quick analysis such as selecting all the properties within 300 feet of an area of concern. The Intranet data browser should be deployed for this task. With a short learning curve this application would allow a user to display and analyze GIS data on-the-fly.

Public Access to Geospatial Information

Providing public access to GIS maps through the Internet provides information to NWSRP interested citizens and businesses. Through an Internet GIS Data Browser, the data specific to the NWSRP can be provided to the public through an intuitive and easy to use interface. The City would serve its internal and external customers better by offering focused, dynamic mapping applications.

In addition to providing public access to proposed parcel and land use data, and other data used by the department (utilities, fiber access, residential areas, etc.), 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. Lastly, 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 the City’s geospatial data. One possible solution is to further 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 various functionality. With several departments interested in providing high-quality geospatial data and maps to the public, an internet GIS data Browser will be a City initiative, including the NWSRP as a stakeholder in its provisioning.

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. The NWSRP would benefit from offering Story Maps on their web-site and could easily enhance their progress reports by providing the information through a Story Map. Story maps could be used to provide further information on business, projects, and other information related to public awareness.

**GIS NEED**

**Site Selection and Business Analysis**

Currently the City uses CoStar for site analytics. Esri Business Analyst Online is another method of analyzing businesses and conducting site analysis. Esri Business Analyst Online provides users the following key functionality:

- Site Selection
- Smart Search – enter custom criteria for pinpointing locations
- Smart Mapping – thousands of variables allow users to create custom maps
• Report Generation – custom reports of key factors
• Geographic analytics – define distances, drive-time, and bands to limit selections

Esri uses several national data sources to compile data for Business Analyst Online to include:
• Demographics – includes current year estimates and US demographic data including population, households, income, age, housing, race, and ethnicity.
• Census and American Community Survey - data on poverty status, education, labor force, journey to work, marital status, languages spoken, age, home value, and more.
• Tapestry Segmentation – Esri compiled data analytics with a detailed description of US residential neighborhoods divided into 67 distinctive segments based on socioeconomic and demographic characteristics.
• Consumer Spending – Consumer expenditure surveys and Bureau of Labor statistics
• Market Potential - Data on products and services consumers use, need, and want to have. Expected number of consumers and Market Potential Index (MPI) data for goods, services, attitudes, and activities. Data from Esri and GfK MRI
• Retail marketplace – measures gap between supply and demand through Esri and Dun and Bradstreet data.
• Dun and Bradstreet business data
• Other key data – shopping centers, crime indexes, and traffic counts

Business Analyst Online requires an ArcGIS Online subscription (which the City has) and a Business Analyst Online license.

Economic GIS Web Portals
Economic Development’s 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 the NWSRP, 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 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. 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. The City and NWSRP would benefit from offering Story Maps on their web-site. Story maps could be used to provide information on business, recreation opportunities, new residential areas, and a regional look at the area.

Palm Springs, CA Story Map
3. GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY

The NWSRP will generate numerous data layers that will be beneficial to many departments at the City of Concord. 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

<table>
<thead>
<tr>
<th>Layer Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>These layers currently exist within the City’s GIS.</td>
</tr>
<tr>
<td>Recommended/Desired</td>
<td>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.</td>
</tr>
<tr>
<td>Partial</td>
<td>These layers currently exist in an incomplete or outdated state.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creation Methodology</td>
<td>This column describes how the layer was, or is anticipated being created.</td>
</tr>
<tr>
<td>Recommended Update Division or Individual</td>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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</tr>
<tr>
<td>Partial</td>
<td>These layers currently exist in an incomplete or outdated state.</td>
</tr>
</tbody>
</table>
The following is a list of desired layers by the NWSRP:

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>Creation Methodology</th>
<th>Recommended Update Division or Individual</th>
<th>Existing or Recommended?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available Properties</td>
<td>Economic Development Records</td>
<td>NWSRP Consultants</td>
<td>Recommended</td>
</tr>
<tr>
<td>Buildings with Site Plans</td>
<td>Scanned and linked to GIS</td>
<td>NWSRP Consultants</td>
<td>Recommended</td>
</tr>
<tr>
<td>Capital Improvement Projects</td>
<td>Identify on parcel record in base map data (i.e. add new field to APN record); aggregate layers as needed</td>
<td>Various overseen by GIS staff within IT</td>
<td>Recommended</td>
</tr>
<tr>
<td>Census Data</td>
<td>Download from Census Bureau</td>
<td>GIS staff within IT</td>
<td>Recommended</td>
</tr>
<tr>
<td>City Owned Property</td>
<td>Extracted from Parcel Layer</td>
<td>GIS staff within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Shopping Centers</td>
<td>Digitized</td>
<td>NWSRP Consultants</td>
<td>Recommended</td>
</tr>
<tr>
<td>Parking District</td>
<td>Digitized</td>
<td>NWSRP Consultants</td>
<td>Recommended</td>
</tr>
<tr>
<td>Hotels</td>
<td>Digitized</td>
<td>NWSRP Consultants</td>
<td>Recommended</td>
</tr>
<tr>
<td>Building Inspector Areas</td>
<td>Digitized</td>
<td>GIS staff within IT</td>
<td>Recommended</td>
</tr>
<tr>
<td>Future Land Use</td>
<td>Created from parcels and aerial photography</td>
<td>CEDD</td>
<td>Recommended</td>
</tr>
<tr>
<td>Flood Zones</td>
<td>Acquire from FEMA</td>
<td>GIS staff within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Neighborhood Planning Areas</td>
<td>Digitized</td>
<td>CEDD</td>
<td>Recommended</td>
</tr>
<tr>
<td>Parks</td>
<td>Extract, cleanse and geocode from database</td>
<td>Parks &amp; Recreation</td>
<td>Existing</td>
</tr>
<tr>
<td>Public Utilities</td>
<td>Field collection, digitization, and as-builts</td>
<td>Public Works</td>
<td>Partial</td>
</tr>
<tr>
<td>Sidewalks</td>
<td>GPS and digitizing from aerials</td>
<td>Public Works</td>
<td>Existing</td>
</tr>
<tr>
<td>Rights-of-Way</td>
<td>Site plans and other documents</td>
<td>Public Works &amp; CEDD</td>
<td>Partial</td>
</tr>
<tr>
<td>Sewer Base Map</td>
<td>Digitize on screen; existing CAD data; GPS field work</td>
<td>Public Works</td>
<td>Partial</td>
</tr>
<tr>
<td>Storm Base Map</td>
<td>Digitize on screen; existing CAD data; GPS field work</td>
<td>Public Works</td>
<td>Partial</td>
</tr>
<tr>
<td>Topography</td>
<td>Aerial Photography</td>
<td>GIS staff within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Water Base Map</td>
<td>Digitize on screen; existing CAD data; GPS field work</td>
<td>Contra Costa Water District</td>
<td>Existing</td>
</tr>
<tr>
<td>Zoning</td>
<td>Digitized on screen</td>
<td>CEDD</td>
<td>Partial</td>
</tr>
<tr>
<td>Sewer and Storm Plans Linked to Centerlines</td>
<td>Digital Linking</td>
<td>GIS staff within IT</td>
<td>Recommended</td>
</tr>
<tr>
<td>Bridges</td>
<td>Digitize on screen</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Street Lights</td>
<td>Field inventory</td>
<td>Public Works</td>
<td>Partial</td>
</tr>
<tr>
<td>Citywide Base Data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Property</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signs</td>
<td>Digitize on screen/Field inventory</td>
<td>Public Works</td>
<td>Existing</td>
</tr>
<tr>
<td>Aerial Photography</td>
<td>The City obtains aerial photography every 2 – 4 years as the budget allows.</td>
<td>Static Map</td>
<td>Existing</td>
</tr>
<tr>
<td>Road Centerlines</td>
<td>There are currently two versions of the street centerline data that are maintained. One version is used for maps and cartographic purposes and the other version is used within TriTech for CAD purposes.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Address Points</td>
<td>Address points have been created based on parcel centroids. However, they are stacked for parcels with multi-tenant dwellings.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
</tbody>
</table>
PHASE I
DEPARTMENTAL NEEDS ASSESSMENTS
PARKS & RECREATION
1. EXISTING CONDITIONS

DEPARTMENT OVERVIEW
The City’s Parks and Recreation mission is to create community through people, parks and programs. They engage their citizens, build collaborative relationships and responsibly manage their resources. The extensive park system has playgrounds, ballfields, swimming pools, picnic areas and scenic hiking trails. Concord has numerous facilities for residents and visitors alike, from ballfields to skate parks to meeting rooms, or that special event. Just a few hours from the Bay Area, Camp Concord at South Lake promotes fun and unique opportunities for the whole family.
1. **P&R (1 Director)**

   a. **Senior Adult and Special Recreation Services** – 1 Senior Program Manager - To provide and facilitate health, wellness and independence through the collaborative delivery of programs, services, special events and activities.

   b. **Adult Sports, Facilities, Registration and Camp Concord** - 1 Program Manager - To manage and support the delivery of programs and services in the areas of Adult Sports, Facilities, Registration and Camp Concord and to engage the community to improve quality of life, health and well-being.

   c. **Facilities, After School Program, Marketing** – 1 Program Manager - To provide support and management of facilities, and marketing to improve citizen’s awareness of programs and services through community and neighborhood outreach.

**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 PRD is not currently using GIS software or accessing GIS data. 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.

<table>
<thead>
<tr>
<th>Current GIS Staffing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
</tr>
<tr>
<td>GIS Flagship (Tier 1)</td>
</tr>
<tr>
<td>Custodian (Tier 2)</td>
</tr>
<tr>
<td>Analytical (Tier 3)</td>
</tr>
<tr>
<td>Browser (Tier 4)</td>
</tr>
</tbody>
</table>
HARDWARE AND SOFTWARE

The PRD uses personal computers for each of its staff. No GPS units are used by the PRD. Printers are available for office use.

<table>
<thead>
<tr>
<th>Type</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Computers</td>
<td>Available for all staff</td>
</tr>
<tr>
<td>Laptops</td>
<td>Available for use</td>
</tr>
<tr>
<td>Printers</td>
<td>Ample printers available for use by staff</td>
</tr>
<tr>
<td>Plotters</td>
<td>None</td>
</tr>
<tr>
<td>GPS</td>
<td>None</td>
</tr>
<tr>
<td>PDA/MDTs</td>
<td>None</td>
</tr>
<tr>
<td>Scanners</td>
<td>None</td>
</tr>
</tbody>
</table>
2. GIS NEEDS ASSESSMENT

Based on this needs assessment, the PRD has several 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. The table below summarizes these needs and how they are to be met.

<table>
<thead>
<tr>
<th>GIS Need</th>
<th>Method/Application to Meet Need</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabling Existing Databases – Geospatial Data</td>
<td>Data Mining Application&lt;br&gt; Intranet GIS Data Browser</td>
</tr>
<tr>
<td>Creation and Integration</td>
<td></td>
</tr>
<tr>
<td>Mapping and Spatial Analysis of Department Data</td>
<td>ArcGIS Desktop&lt;br&gt; Intranet GIS Data Browser</td>
</tr>
<tr>
<td>Data Development and Management of Pertinent Data Layers</td>
<td>ArcGIS Desktop&lt;br&gt; GPS Field Collection</td>
</tr>
<tr>
<td>Field Access to Geospatial Data Incorporating Field Data Collection</td>
<td>ArcGIS Online&lt;br&gt; Tablets</td>
</tr>
<tr>
<td>Specialized Online Mapping Themes</td>
<td>Internet Applications or ArcGIS Online</td>
</tr>
<tr>
<td>Mapping Ad Hoc Events</td>
<td>ArcGIS</td>
</tr>
<tr>
<td>Formal GIS Training for PRD Staff</td>
<td>Tier 3 Third Party Application Training</td>
</tr>
</tbody>
</table>
Enabling Existing Databases – Geospatial Data Creation and Data Integration

The PRD have begun to store information in electronic databases (recreation user data) 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 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 type application or more analytical tools such as ArcGIS.
Mapping and Spatial Analysis of Department Data

The PRD staff need the ability to perform mapping and spatial analysis on interdepartmental data to make connections with seemingly unrelated data. A need for the PRD to provide users with enterprise-wide access to GIS based mapping and spatial analysis. Users will benefit from access to the base data (parcels, and parcel related data) as well as department-specific information. Upon further implementation on an enterprise GIS, PRD 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. It is recommended that the City implement an intranet solution. 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 PRD databases and data entered into legacy systems in other departments, as well. This application will serve as the primary GIS application for the PRD 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.

The PRD can use GIS to view, modify, and generate maps and data that display focus areas, project areas, and potential “customers.” Some enterprise databases can be spatially enabled by using patron addresses to create data layers as mentioned previously. This data can be viewed in a spatial context to assess patterns in recreation user activity sign-ups, delinquency, and facility usage. In conjunction with census data, these patterns can then be used to increase marketing efforts to citizens that do not use PRD services.

Select all park users within a mile of a facility
as well as to ascertain whether park locations and offerings fulfill the needs of patrons and potential patrons. As an example of this analysis, the PRD could determine that some patrons consistently miss activity sign-ups due to their distance from park and recreation sites.

Non-sensitive data from the PRD can be used to create a GIS data layer of patrons. The city-wide Intranet data browser could then be used to view members, non-members, delinquency, and other pertinent data views. Geographic questions such as, what sport is most popular in a particular neighborhood and where should we locate a facility could be queried.

Once data from PRD have been geonabled, this data could be overlaid with each other to find commonalities. This will allow the PRD staff to see relations between the two divisions that may not be known at this time because it is not visible on a map. Additionally, census data can be used to create informed marketing campaigns based on criteria determined by PRD staff. Attributes tied to each of these database records can also be used to create informed decisions. For example, PRD staff could quickly query the recreation user database to see who is spending the most money for recreation activities. This information could then be used to send targeted mailings to them and their neighborhood.

The PRD could also perform additional spatial analysis with other departmental data in conjunction with their data. An example would be viewing a time lapse map to see a heat map of crimes in the area and how that changes once the park closes.

**GIS NEED**

**Data Development and Management of Pertinent Data Layers**

The PRD personnel expressed interest in using of GIS data and software. In coordination with those interests, GIS data development and administration should be a high priority for PRD GIS implementation. In conjunction with city GIS staff and Public Works Park staff, staff within Parks and Recreation 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.
PRD will benefit from GIS as long as the assets, facilities, and buildings can be represented and displayed within the GIS. The park boundaries should exist as a GIS layer. Next, the assets should be located on a GIS layer (e.g. irrigation systems, benches, trees). For a GIS to be an effective management and mapping tool the assets that PRD maintain and manage must be represented in data layers. A field inventory should be conducted of all Parks and Recreation 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 - existing)
- Paths and trails (segments)
- Playing fields and amenities (polygons, points, lines)
- Park lights (points)
- Picnic areas (points, polygons)
- Shelters and buildings (polygons)
- Play structures (points, polygons, lines)
- Utility infrastructure within City parks (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)
Once the locations of these assets are known, PRD 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**

**Field Access to Geospatial Data Incorporating Field Data Collection**

Another identified need is to have field access to mapping data. ArcGIS Online and tablets can be utilized in the field, allowing access to park data, coupled with the ability to conduct address searches; query attributes of all information, such as infrastructure, assets, parks, link to digital site plan images, and more. A GPS enabled tablet and mapping information would enable staff to perform inspections via electronic forms tied to each park. Additionally, the application should have red-lining capabilities. This would allow staff to mark up the digital map for additions and/or corrections. This same
type of application could be used for sports field management. Information such as amenities, lights, fertilizer application history, and grass feed, etc. could be tracked via a tablet-based application. It should be noted that highly accurate geo-spatial data is required for the successful implementation of such a solution.

The complete collection and conversion of capital assets data typically requires a large investment in 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, must be reflected in the digital database; spatial and attribute information must be captured immediately. All of this can be accomplished by utilizing a mobile application on a tablet computer.

**GIS NEED**

**Specialized Online Mapping Themes**

It is recommended that the PRD develop online web mapping tools for public access with a focus on PRD services. Online maps, with specific focuses on information, directions, and wayfinding for hiking trails, park locations, park amenities, street-level views to supplement aerial imagery, and a host of other key data features. City residents would benefit from an accurate trail network layer and an interactive mapping application. People should be able to create their own mini-trail guides. The website should describe accessibility issues, length, slope, and permitted uses. Additionally, crowd-sourcing features such as commenting on trails and suggestions from the public would be a desired addition. As the City, Public Works, and PRD improve existing data layers and expand the data repository with new data layers (see previous GIS needs), the public access mapping tool will prove to be of more utility and value. Working with the GIS team, PRD staff must help to define the general city data layers to present, as well as the PRD specific layers. Map feature symbology, colors functionality, security settings, and data content must be designed to be consistent with City standards.
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. Story Maps lend themselves well to Parks and Recreation. A number of story map ideas were discussed during the needs assessment interviews to include:

- Parks and Facilities
- Local events tied to a registration portal
- Amenities and sports offered – click on sport type and show all opportunities for that sport. I.E. click on tennis and all tennis facilities are shown.
- Ability for citizens to see if they are in the city limits for recreation purposes
- Layer showing where Wi-Fi is located near facilities
Mapping Ad Hoc Events

It is recommended that PRD work with GIS staff within IT to map the location of special incidents such as criminal activity reported on or near city properties. “Pin Mapping” allows users to quickly and efficiently identify incident hot spots and trends over time. Law enforcement agencies have long used pin maps to perform spatial analysis. Different color pins were used to denote different crimes or incidents, and their grouping used to identify hot spots of activity. The advent of digital data and its processing has not only led to the automation of this type of spatial analysis, but the combination of this type of data with GIS has led to the ability to identify additional areas with similar characteristics.

PRD have a wide range of data in electronic databases that have addresses as an attribute. Any data record with associated addresses 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 formatted 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.

Pin mapping is often the initial GIS function undertaken to visualize incidents, whereby incident locations can be represented as pinpoints on a map. A prominent example of this form of mapping is crime mapping, which displays crime locations, types of crime, crime "hot spots," and other relevant information. These visual presentations are useful and highly effective since it permits staff to immediately identify, discuss, and explore trends and patterns as well as solutions. A pin map, or dot density map, has the problem of overlaying dots at the same location, obscuring the true density. Density surface mapping is a type of contour mapping with shaded contours linking points of approximately equal density. Using a color gradient to display increasing density (e.g. darker reds), it is easier to see the true density of any area. This hot spot mapping should be embedded in the intranet application.
Formal Training for PRD Staff
The PRD staff will require basic GIS conceptual training and specific training addressing the use of a deployed application, such as Intranet and Internet GIS Data Browsers.

Method to Meet Need

Tier 3 Applications Training
As intranet and Internet applications are deployed, staff will require specific training tailored to the GIS interface that support their workflows and enable them to support the public. Training is typically arranged at the user level and based on applications that will be deployed to the various levels of users. Enterprise-wide training of Tier 3 applications can be conducted by an outside vendor or the GIS staff.

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

Case Study –
GIS a Tool To Locate New Park and Recreation Services
Parks & Recreation, by Bob Lee, Alan Graefe

Where is the best location to set up a new recreation facility such as a waterpark for a city? Who are the people living nearby and who may come to use it? Is it maximally accessible to all residents? How many minutes, on average, does it take residents living within a mile radius to walk to the facility? How long do residents living five miles away need to drive there? What volume of transportation will be added to the area? In what zoning district will it be situated, and so on? Recreation and park administrators have so many questions and uncertainties to be answered in the process of making such a decision.

Over the years, recreation and park administrators and managers have come a long way in searching for effective tools for planning and managing park and recreation facilities and resources. Geographic information systems (GIS) have recently
emerged as a helpful and accountable vehicle to fulfill the mission of providing sufficient and equitable park and recreation services. GIS can be used to measure geographic, environmental and socioeconomic attributes in relation to an existing or planned park or recreational facility, to describe the spatial distribution of socio-demographic attributes in a given residential area, to discover potential market segments, to examine spatial relationships between existing recreational or natural resources and distances traveled from origins of potential visitors, to use network analysis to minimize traveling time and find an optimal route, to derive new variables (e.g., population density) from existing datasets, or to track concealed damage of a forest fire in a national park.

GIS, as defined by Burrough, is an information system used to capture, store, manipulate, integrate and display geographic information. More specifically, GIS is a computer-supported information system that enables storage, transmission, retrieval, processing and description of geographical-referenced information. For instance, a creek can be described as a line, a fishing pier as a point, and a park as an area. All of those can be represented either in the form of the “raster” data structure that describes space in small units (a series of geometric shapes, often called “grid cells”), or the “vector” data structure that treats space as a continuous surface. GIS is technically both a database system and a set of operations for describing geographical properties. GIS has two major operational capacities: spatial information, stressing a large database inventory; and spatial analysis, stressing functionality and a wide range of data modeling.

Historically, GIS originated from cartographic techniques of drawing maps with a pencil and board. Limited by the capabilities of manual activities, cartography mainly focused on map-producing techniques rather than analyzing and integrating technologies. It was the adoption of computer technology that allowed GIS to evolve as a georeferenced dynamic information system. Today, GIS has emerged as a multidisciplinary instrument that links such disciplines as geography, computer science, remote sensing, civil engineering, statistics, marketing, and other social and behavioral sciences including park and recreation management.

The Early Use of GIS

Literature on the applications of GIS first appeared in the journals of park, recreation and leisure research back in the late 1960s. Lentnek, Van Doren and Trail (1969) conducted a survey of recreational boaters' spatial behaviors on inland lakes in the state of Ohio. GIS was used to display and analyze how those water resources were spatially distributed, and how far the visitors traveled to access them, in order to test the "distance decay function.” Namely, as distance increased, the cost of traveling to the place increased and the rate of recreation participation by people traveling from the distance origin will decrease. GIS helped the researchers to learn that travel distance was related to trip purpose in recreational boating. For instance, sailors and water skiers traveled short distances while non-specialized boaters traveled longer distances.

Hodges and Van Doren evaluated disparities in urban recreational opportunities with an early version of a GIS tool (SYMAP). The study tried to demonstrate how to use the mapping technique to assist in planning new recreational centers in the Dallas, Texas, metropolitan area. A set of maps displayed population density, service radii of selected recreation centers, and a potential mobility index based on ownership of automobiles in each census tract. Maps helped to establish specific criteria for planning a new recreational facility. Accordingly, two new sites were identified as high priority locations based on the criteria:

1. large populations living about three miles away from an existing center,
2. A relatively mobile population, and
3. A trend of population expansion and movement.

In the following 30 years, adoption of GIS technologies in parks and recreation services slowly emerged into two channels: outdoor recreation management and urban park and recreation administration. Applications of GIS in outdoor recreation have focused on resource location, spatial patterns of distribution, distance measurement and other statistical analyses. The use of GIS in urban parks and recreation administration focuses on facility allocation, service planning and issues of accessibility and disparity.

GIS and Outdoor Recreation

GIS was frequently used to describe the characteristics of recreational sites aimed at satisfying certain needs of visitors (Confer & Graefe, 1994; Hecock, 1970; Kim, Mutter, & Westphal, 1997; Lee, 2004). Hecock (1970) created GIS maps to describe the spatial correlation between recreational sites and visitors’ occupations, which revealed that site preferences of visitors in different occupations were associated with the character of the nearby lodge facilities. People with high socio-economic status characteristics appeared to be drawn to sites with lodge facilities having above average aesthetic qualities. GIS was also used to depict the proportion of visitors hosted by each site at a given time. Confer and Graefe (1994) studied boaters' attitudes and activity patterns regarding recreation sites. GIS technology was used to display sites that were "most enjoyed" and "least enjoyed" by visitors. In this study, GIS helped the management team improve services by locating clusters of problematic areas. Lee and Graefe (2004) incorporated GIS to identity sites preferred by different age groups of visitors. Through a terrain analysis,
it was found that younger visitors preferred sites with higher elevation and steeper slopes.

Integrating GIS with statistics enables users to quantify the quality of surfaces. For instance, in spatial statistics, the "kriging" method is often used to perform surface analyses. Kriging is an interpolation method dealing with continuous data. Explicitly, through the kriging method, users can collect data from sampled points and assign values to the area between the points. For example, if a park ranger wants to determine annual precipitation in a forest, with a series of sample points, kriging will enable him/her to measure precipitation in inches.

Another form of spatial analysis is a spatial regression model, which rests the correlation of measured variables (e.g. household income or residents' ethnicity background) and locations of visiting sites. In practice, Tarrant and Cordell, Porter, and Tarrant incorporated census block group data within a GIS database to determine the relationship between outdoor recreational sites and social economic status of local residents. GIS has also helped to identify disparity issues of environmental justice. Lee, Graefe and Burns (2003) integrated County level census data with GIS to analyze demographic segments of local residents along the Columbia River Gorge National Scenic Area in Oregon. They found a relationship between the fees paid and the level of education and family composition. Persons with a higher educational background, with children aged 16 and younger spent more. They also found that age differences and marital stances might determine which particular sites residents may visit.

Measuring distance with GIS is pervasive in leisure research. Distance is an important factor influencing visitors' recreational behaviors. Gitelson and Crompton found that repeat visitors are usually those living closer to the facility. Debbage used distance to predict visitors' participation behaviors: the farther they traveled, the longer they intend to stay, and the more they wanted to see and do. Fesenmaier, Goodchild, and Lieber tested the distance decay model with GIS. A series of 3-D maps described outdoor recreation participants' travel distance, both visually and spatially in miles and in travel time. Zawachi and Marsinko used GIS to calculate the travel cost of trips to South Carolina recreation areas.

GIS in Urban Paths and Recreation
Applications of GIS in urban parks and recreation are still in their infancy; Devine and Kuo noted "extremely little has been done in urban recreation analysis in applications of GIS except straightforward applications for displaying location of facilities and plotting general respondents to a survey". GIS technology adoption has remained relatively low. However, previous studies have laid the groundwork for exploration of GIS for urban park and recreation services.

Wicks, Backman, Allen, and Blaricom were the first to thoroughly discuss trends of GIS applications in the field of parks and recreation management. They summarized prevalent uses of GIS as follows:

**Recreation facilities**
- Area mapping and reporting about parks and recreation sites
- Tracking and analyzing facility development trends
- Managing maintenance at recreation facilities such as fields, courts and pools
- Selecting a location for new facilities
- Land development, updating lot boundaries and displaying land record data
- Land use, displaying and analyzing land use data

**Users**
- Documenting demographic patterns and trends
- Population segmentation analyses, market area identification
- Tracking attitudes and interest survey data and displaying it spatially

The authors also illustrated how to assess planning and policy issues in urban settings with a GIS tool. A series of maps were produced showing the needs for recreation development from the perspective of physical size and the distribution of existing parks versus other social economic factors. GIS showed that areas with high levels of poverty had the most need for leisure services.

Nicholls and Shafer adopted GIS technology in urban parks and recreation services to assess accessibility and equity in a local park system. The authors used radii buffer techniques, which involve drawing a line around a feature at a given distance, to find out the number of facilities and proportion of the population in the selected area. The authors also performed a network analysis to calculate actual travel distance along streets to a local park. Network analysis is one of the cornerstones of GIS functionality and is a necessary technique in measuring travel distance. The technique takes geographical constraints into account, and instead of measuring straight-line distance; it bases its data on geographic factors and gives the actual route distances. Network analysis allows seeking an optimal route and minimizing travel time between two locations.
GIS application in parks and recreation is not a new phenomenon, but, coupled with the powers of advanced computer technologies, the use of GIS is stepping into a new era. GIS has a great potential to play an important role in managing, planning, marketing and evaluating park and recreation services. However, “useful” technology does not necessarily mean “useable” technology. The improvement of end-user-friendly interface platform designs and the perception and willfulness of parks and recreation administrative agencies in adopting GIS are crucial for the extensive use of GIS. Regardless, Goodchild predicted, eventually, GIS would change in the meaning of the "S" word, from "system" evolving into “science.” Namely, a geographic information science everyone call use.

*Case Study Courtesy of National Recreation and Park Association Magazine*
3. GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY

The PRD 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 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 Department or Individual | This field outlines the Department 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 PRD:

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>Creation Methodology</th>
<th>Recommended Update Department or Individual</th>
<th>Existing or Recommended?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parks and Recreation GIS Data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ball Fields</td>
<td>Delineated from Aerial Photography</td>
<td>PRD Staff in Coordination with GIS Staff and Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Recreation User Records</td>
<td>Address Matching</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td>Building Schematics</td>
<td>Scanned from Floor Plans</td>
<td>PRD Staff in Coordination with GIS Staff and Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>City Limits</td>
<td>Digitized On-Screen – Staff need to know inside or outside of city limits</td>
<td>GIS Staff within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>City Owned Properties</td>
<td>Delineated from Aerial Photography</td>
<td>GIS Staff within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Flood Hazard Areas</td>
<td>Digitized</td>
<td>FEMA</td>
<td>Existing</td>
</tr>
<tr>
<td>Grass Cutting/Turf Data, Mowing Areas</td>
<td>Delineated from Aerial Photography</td>
<td>PRD Staff in Coordination with GIS Staff and Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Hotels and Restaurants – for Story Maps</td>
<td>Address Matched from Database</td>
<td>PRD Staff in Coordination with GIS Staff</td>
<td>Recommended</td>
</tr>
<tr>
<td>Horticulture Features – Beds, Plants, Mulch Areas, etc.</td>
<td>Delineated from Aerial Photography and Field Inventory</td>
<td>PRD Staff in Coordination with GIS Staff and Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Parks and Recreation Assets</td>
<td>Field inventory; digitize on screen</td>
<td>PRD Staff in Coordination with GIS Staff and Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Parks and Recreation Infrastructure</td>
<td>Field data collection</td>
<td>PRD Staff in Coordination with GIS Staff and Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Parks and Recreation Parking Lots</td>
<td>Digitize from parcel data and other sources</td>
<td>PRD Staff in Coordination with GIS Staff and Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Parks and Recreation Signs Inventory</td>
<td>Field data collection</td>
<td>PRD Staff in Coordination with GIS Staff and Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Pools – public and private</td>
<td>Digitized On-screen</td>
<td>PRD Staff in Coordination with GIS Staff and Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Trails</td>
<td>Field data collection</td>
<td>PRD Staff in Coordination with GIS Staff and Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Park Utility Inventory</td>
<td>Field data collection</td>
<td>PRD Staff in Coordination with GIS Staff and Public</td>
<td>Recommended</td>
</tr>
<tr>
<td>Data Layer</td>
<td>Creation Methodology</td>
<td>Recommended Update Department or Individual</td>
<td>Existing or Recommended?</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----------------------------------------------------------</td>
<td>------------------------------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Parks</td>
<td>Digitize from parcel data and other sources</td>
<td>PRD Staff in Coordination with GIS Staff and Public Works</td>
<td>Existing</td>
</tr>
<tr>
<td>Population Projections and Population Data and other Census Data</td>
<td>Obtain from external sources</td>
<td>GIS Staff within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Schools</td>
<td>Digitize on screen</td>
<td>GIS Staff within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Topography</td>
<td>Utilize existing data</td>
<td>GIS Staff within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Trees in Parks Inventory</td>
<td>Field data collection</td>
<td>Public Works</td>
<td>Existing</td>
</tr>
<tr>
<td>Turf Areas</td>
<td>Digitize from parcel data and other sources</td>
<td>PRD Staff in Coordination with GIS Staff and Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Vandalism</td>
<td>Extract, cleanse, geocode, and map from relational databases; other map sources as required</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td>Water bodies in Parks</td>
<td>Digitize from parcel data and other sources</td>
<td>PRD Staff in Coordination with GIS Staff and Public Works</td>
<td>Partial</td>
</tr>
<tr>
<td>Crimes</td>
<td>Extract, cleanse, geocode, and map from relational databases; other map sources as required</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
</tbody>
</table>

**Citywide Base Data**

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
<th>Department or Individual</th>
<th>Existing or Recommended?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property</td>
<td>Parcels were initially created by Contra Costa County. The GIS Division within IT maintain the parcels currently. Temporary ID’s are added to parcel data until the County assigns a permanent number.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Aerial Photography</td>
<td>The City obtains aerial photography every 2 – 4 years as the budget allows.</td>
<td>Static Map</td>
<td>Existing</td>
</tr>
<tr>
<td>Road Centerlines</td>
<td>There are currently two versions of the street centerline data that are maintained. One version is used for maps and cartographic purposes and the other version is used within TriTech for CAD purposes.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
</tbody>
</table>
Data Layer | Creation Methodology | Recommended Update Department or Individual | Existing or Recommended?
--- | --- | --- | ---
Address Points | Address points have been created based on parcel centroids. However, they are stacked for parcels with multi-tenant dwellings. | GIS Division within IT | Existing

**GAP ANALYSIS CHART**

The PRD will be a data consumer and creator of GIS. As part of this Needs Assessment, a Gap Analysis has been conducted to determine an optimal environment and set of processes for the utilization of GIS. This analysis provides a baseline level of understanding for the existing status and desired status of major GIS components for the Department.

The matrix below details those relevant components that have been analyzed and assessed as part of the Gap Analysis.

<table>
<thead>
<tr>
<th>LEGEND</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Existing</strong></td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Limited/Partial</td>
</tr>
<tr>
<td><strong>Desired</strong></td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Limited</td>
</tr>
<tr>
<td><strong>Priority</strong></td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td>Medium</td>
</tr>
<tr>
<td>Low</td>
</tr>
<tr>
<td>COMPONENT</td>
</tr>
<tr>
<td>-------------------------------</td>
</tr>
<tr>
<td>AVL</td>
</tr>
<tr>
<td>Documentation</td>
</tr>
<tr>
<td>Enterprise Systems Integration</td>
</tr>
<tr>
<td>Geocoding</td>
</tr>
<tr>
<td>GIS Data Access</td>
</tr>
<tr>
<td>GIS Data Maintenance</td>
</tr>
<tr>
<td>GIS Data Sharing</td>
</tr>
<tr>
<td>GIS Personnel</td>
</tr>
<tr>
<td>Hardware</td>
</tr>
<tr>
<td>Mapping</td>
</tr>
<tr>
<td>Metadata</td>
</tr>
<tr>
<td>Mobile Computing Resources</td>
</tr>
<tr>
<td>Network</td>
</tr>
<tr>
<td>Routing</td>
</tr>
<tr>
<td>Software</td>
</tr>
<tr>
<td>COMPONENT</td>
</tr>
<tr>
<td>---------------------------</td>
</tr>
<tr>
<td>Spatial Analysis and Modeling</td>
</tr>
<tr>
<td>Training/Education</td>
</tr>
</tbody>
</table>
4. MULTI-TIER GIS APPLICATION USE

The pyramid and table below outlines the “Tiers of GIS Use” within the 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 and is considered professional GIS personnel. A Tier 2 users is considered an advanced GIS user who is a data custodian. A Tier 3 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 4 Browser user requires only general browsing GIS data functions. The Parks and Recreation department will consist of Tier 2 and 4 Users.

<table>
<thead>
<tr>
<th>GROUP</th>
<th>ACTIVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 1 Flagship</td>
<td>• GIS Administration</td>
</tr>
<tr>
<td></td>
<td>• Data Maintenance</td>
</tr>
<tr>
<td></td>
<td>• Data Conversion and Creation</td>
</tr>
<tr>
<td></td>
<td>• Spatial Data Management</td>
</tr>
<tr>
<td></td>
<td>• Technical Support</td>
</tr>
<tr>
<td></td>
<td>• Coordination</td>
</tr>
<tr>
<td>Tier 2 Custodian</td>
<td>• Data Maintenance</td>
</tr>
<tr>
<td></td>
<td>• Data Conversion and Creation</td>
</tr>
<tr>
<td></td>
<td>• Spatial Data Management</td>
</tr>
<tr>
<td></td>
<td>• Metadata Creation and Maintenance</td>
</tr>
<tr>
<td>Tier 3 Analytical</td>
<td>• Analytical Functions/Geoprocessing</td>
</tr>
<tr>
<td></td>
<td>• Complex Queries</td>
</tr>
<tr>
<td></td>
<td>• Modeling</td>
</tr>
<tr>
<td></td>
<td>• Use of Desktop Extensions</td>
</tr>
<tr>
<td></td>
<td>• High Quality Map Production</td>
</tr>
<tr>
<td>Tier 4 Browser</td>
<td>• Browsing/Look-Up</td>
</tr>
<tr>
<td></td>
<td>• Standard Reports</td>
</tr>
<tr>
<td></td>
<td>• Simple Query</td>
</tr>
<tr>
<td></td>
<td>• Map Production</td>
</tr>
</tbody>
</table>
The following table indicates specific Return on Investment opportunities for the PRD. These specific examples show the true return on investment of the technology.

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase Productivity</td>
<td><strong>Intranet and Internet GIS Data Browser and Spatial Analysis:</strong></td>
</tr>
<tr>
<td></td>
<td>• Quickly assist patrons in finding answers to their spatially related questions (i.e. length of trails, nearest park, etc.)</td>
</tr>
<tr>
<td>Improved Public Service</td>
<td><strong>Intranet GIS Data Browser and Spatial Analysis:</strong></td>
</tr>
<tr>
<td></td>
<td>• Determine underserved areas</td>
</tr>
<tr>
<td></td>
<td>• Optimally locate services</td>
</tr>
<tr>
<td>Reduces Cost/Saves Money</td>
<td>• The location and need for future parks and facilities will be driven by GIS. Optimal location will eventually save money as service can be optimized.</td>
</tr>
</tbody>
</table>
## Return on Investment Opportunity
Parks and Recreation Department

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Improved Efficiency</strong></td>
<td><strong>Intranet GIS Data Browser and Spatial Analysis:</strong></td>
</tr>
<tr>
<td></td>
<td>1. Estimating projects for budgeting purposes without leaving the office.</td>
</tr>
<tr>
<td></td>
<td>2. Better quality and quicker decision making for park and trail planning.</td>
</tr>
<tr>
<td></td>
<td>3. Improved and quicker provision of background data for park and trail construction projects to consultants</td>
</tr>
<tr>
<td><strong>Field Access to Geospatial Data Incorporating Field Data Collection:</strong></td>
<td>4. Allows for doing weekly inspections electronically as well as accessing plans in the field.</td>
</tr>
<tr>
<td><strong>Improve Communications</strong></td>
<td><strong>Intranet GIS Data Browser and Spatial Analysis:</strong></td>
</tr>
<tr>
<td></td>
<td>Much improved communication and coordination with other departments when it comes to planning for events, traffic control issues, and planning of assets and infrastructure.</td>
</tr>
<tr>
<td><strong>Save Time and Improve customer service</strong></td>
<td><strong>Public Access to Geospatial Information:</strong></td>
</tr>
<tr>
<td></td>
<td>1. Staff can respond rapidly to customer issues or reports of items that require maintenance in Parks and Recreation</td>
</tr>
<tr>
<td></td>
<td>2. Improving park user experience</td>
</tr>
<tr>
<td></td>
<td>3. Improving citizen engagement in park and trail planning</td>
</tr>
</tbody>
</table>
PHASE I

DEPARTMENTAL NEEDS ASSESSMENTS

POLICE
NEEDS ASSESSMENT
POLICE

CITY OF CONCORD
CALIFORNIA
GIS Strategic Implementation Plan
1. EXISTING CONDITIONS

DEPARTMENT OVERVIEW

The Concord PD is dedicated to providing the highest quality police services in order to enhance community safety, protect life and property, and reduce crime. To do this, they pledge to develop a partnership with the community, lead a community commitment to resolve problems, and improve the safety and quality of life in the City. The Police Chief regularly reports to the City Council on the department’s efforts to ensure public safety. He also writes a monthly column for the Concord Pioneer...
publication. Additionally, the department has a presence on Facebook and Twitter, and offer access to Nixle, a text alert system to provide the citizens a way to receive community safety alerts. Divisions include:

1. **Field Operations** - Provide effective and efficient police services to the City of Concord 24 hours a day including: protection of life and property, maintenance of order, investigation of criminal events, prevention of crime, and an orderly flow of vehicles in the City. Specific units include:
   a. Community Service Desk
   b. Jail Operations
   c. K-9 Program
   d. Traffic Motorcycle Unit
   e. Watch Commanders
   f. Patrol

2. **Investigation Division** - provides essential support services by efficiently and effectively conducting follow-up into criminal matters with the goal of successful prosecution or case closure. Specific units include:
   a. Investigations
   b. Crime Scene Investigations (CSI)
   c. Major Crime Unit (MSU)
   d. Special Victims Unit (SVU)
   e. Financial Crimes Until (FCU)

3. **Administrative Services**

4. **Code Enforcement Division** - This is a division of the Concord Police Department. The Unit is responsible for quality of life matters having to do with blight, property safety, public nuisances and property maintenance. The purpose of the division is to preserve and enhance the quality of the community through implementation of the Neighborhood Partnership Program and a host of other services such as organization and coordination of City services to neighborhoods. The “code” pertains to numerous ordinances (or laws) in Concord that pertain to property maintenance. Most of these have been enacted to protect and preserve the basic character and quality of life in residential neighborhoods. They are typically designed to control accumulations of junk, trash, refuse, and vehicles, which are abandoned, unregistered or in disrepair. The Code Enforcement Unit is staffed by four Code Enforcement Officers, a Recycling Theft Prevention Specialist, and a Police Corporal. The unit is supervised by a police sergeant.

5. **Professional Standards Unit (Internal Affairs)** - responsible for initiating, investigating and concluding investigations of alleged misconduct in a timely and expedient manner, based on complaints made internally or externally to the police department. Their contact info is available online. Internal Affairs has more specific information in the following areas:
   a. Investigations Statistics
   b. Citizen Report Procedure
6. **Major Crimes Unit (MCU)** - Crimes investigated by MCU include homicide, robbery, felony and misdemeanor assault, weapons violations and missing persons’ cases.

7. **Special Victims Unit (SVU)** - focuses on family violence, youth crime, elder abuse, and intervention. Investigators also manage a group of registered sexual assault offenders to ensure that they are in compliance with the law and are correctly listed in the Megan's Law web site.

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**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 citizen access to crime mapping. The Department employs a Crime Analyst who uses GIS for mapping and analytical purposes. The City utilizes the TriTech public safety software suite. Dispatchers utilize TriTech mapping to view calls for service via street centerline matching against geo-referencable data layers (street centerlines). Each call for service is stored as data within an in-house database. Calls that result as an incident/reportable case are further detailed within the TriTech records management system (RMS) database. The City is moving to the TriTech CAD system in the near future. This data is then extracted by the Crime Analyst for analytical purposes. He currently extracts the data into Excel, imports it into ArcGIS, geocoding it against the street centerline data which results in 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 key PD staff, creates PDFs of incidents/hotspots, and presents at multiple crime analysis meetings.

CrimeMapping.com is being implemented to share 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 IT provide the Police Department critical base layer data for use in the TriTech GIS applications.

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of Users</th>
<th>GIS Usage</th>
<th>Primary Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIS Flagship (Tier 1)</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Custodian (Tier 2)</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Analytical (Tier 3)</td>
<td>1</td>
<td>High</td>
<td>Esri Tools (ArcGIS) for mapping and Crime Analysis.</td>
</tr>
<tr>
<td>Browser (Tier 4)</td>
<td>5</td>
<td>Moderate</td>
<td>911 dispatch</td>
</tr>
</tbody>
</table>

### 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.

<table>
<thead>
<tr>
<th>Type</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Computers</td>
<td>Available to all staff</td>
</tr>
<tr>
<td>Laptops</td>
<td>In the vehicles</td>
</tr>
<tr>
<td>Printers</td>
<td>Ample printers available for use</td>
</tr>
<tr>
<td>Plotters</td>
<td>None</td>
</tr>
<tr>
<td>GPS</td>
<td>Utilized for AVL in the Vehicles</td>
</tr>
<tr>
<td>PDA/Tablets</td>
<td>Not widely used</td>
</tr>
<tr>
<td>Scanners</td>
<td>Available as needed</td>
</tr>
</tbody>
</table>

The TriTech Public Safety Suite is used for 911 and records management. CrimeMapping.com 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. TriTech – CAD (future), RMS, and mobile
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 Concord 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 Concord 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:

<table>
<thead>
<tr>
<th>GIS Need</th>
<th>Method/Application to Meet Need</th>
</tr>
</thead>
</table>
| 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                                              | CrimeMapping.com  
 Story Maps |

**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 TriTech
- Crisis management – schools and banks with data in cruisers
- Mapping home bound citizens
- 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
- 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 Concord 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. 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 staff in IT should identify a tool that automates the download and address matching of case data. There will be greater accuracy if the records are address matched versus being matched against the street centerlines as they are currently. Tools exist that can be setup to automatically map data from TriTech for use within the various GIS applications.
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 staff 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. The PD is implementing CrimeView at this time which will include a dashboard for executives.

Executive Dashboard for Police Decision Makers

Officer Access to Mapping

The 911 center and police vehicles are outfitted with TriTech mapping. However, the mapping provided to the officers can be used more frequently. 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. As mentioned previously, the PD is currently deploying CrimeView which will be used for viewing incidents and crime statistics.

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.

Enterprise Access to Digital Pre-plans, Hazardous Material Data and Other Supporting Data Sets
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 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 should be geo-enabled and linked to the GIS by address.

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.
Public Access to Crime Data
As mentioned earlier in this needs assessment, the Police Department is in the process of sharing crime data on the web via public access pin mapping applications (CrimeView). This will provide citizens with salient crime information by geographic location. Additionally, it is believed that the new Esri Technology called Story Maps would add additional value. Sharing information about community watch areas via a Story Map would be very beneficial to the citizens. 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.
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 TriTech records management system and E911 system. However, for this to work effectively accurate address matching of records from TriTech 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:

- **Standard Operating Procedure:**
  1. **Geocoding Standard Operating Procedures (SOP)** - Develop an SOP for exporting, geocoding and address matching TriTech 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 TriTech RMS software. This includes specific recommendations on how to fix issues with address that are not matching from TriTech, 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:

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creation Methodology</td>
<td>This column describes how the layer was or is anticipated being created.</td>
</tr>
<tr>
<td>Recommended Update Division or Individual</td>
<td>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.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>Creation Methodology</th>
<th>Recommended Update Division or Individual</th>
<th>Existing or Recommended?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policing Beats and Response Zones</td>
<td>Digitize on screen</td>
<td>Police in conjunction with GIS staff within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Calls for Service</td>
<td>Extract, cleanse and automatically map from dispatch databases.</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td>CCTV Data</td>
<td>Tied by unique number to a GIS layer and viewable within applications</td>
<td>Police in conjunction with GIS Staff within IT</td>
<td>Recommended</td>
</tr>
<tr>
<td>Crime Data</td>
<td>Extract, cleanse and automatically map from RMS</td>
<td>Automated</td>
<td>Existing but needs to be automated</td>
</tr>
<tr>
<td>Arrests and Citations</td>
<td>Extract, cleanse and automatically map from RMS.</td>
<td>Automated</td>
<td>Existing but needs to be automated</td>
</tr>
<tr>
<td>Drug free zones around schools and churches</td>
<td>Buffer appropriate properties.</td>
<td>Police in conjunction with GIS Staff within IT</td>
<td>Recommended</td>
</tr>
<tr>
<td>Hazardous Materials</td>
<td>MSDS Sheets Scanned and Linked to Site</td>
<td>GIS Staff within IT</td>
<td>Recommended</td>
</tr>
<tr>
<td>Liquor Licenses / Bars</td>
<td>Geocoded</td>
<td>State of California and Business License Data</td>
<td>Recommended</td>
</tr>
<tr>
<td>Neighborhood Watch Districts</td>
<td>Digitized On Screen</td>
<td>Police Department and GIS Staff within IT</td>
<td>Recommended</td>
</tr>
<tr>
<td>Offenders on Probation</td>
<td>Extract, cleanse and automatically map from City, County, and/or State Data.</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td>Offenders on Parole</td>
<td>Extract, cleanse and automatically map from State and/or County Data.</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td>Homeless and Mentally Ill Individuals and Encampments</td>
<td>Tracked in a database then geo-enabled</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td>Data Layer</td>
<td>Creation Methodology</td>
<td>Recommended Update Division or Individual</td>
<td>Existing or Recommended?</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------------------------------------------------------</td>
<td>-------------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Parking Violations</td>
<td>Extract, cleanse and automatically map from RMS.</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td>Pre Plan Data (Buildings)</td>
<td>Scanned and Visio</td>
<td>GIS Staff within IT</td>
<td>Recommended</td>
</tr>
<tr>
<td>Social Media</td>
<td>Automatically linked via software</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td>Sex Offenders</td>
<td>From State</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td>Special Needs Residents</td>
<td>Extract and map from CAD/RMS data.</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
<tr>
<td>Traffic Accidents</td>
<td>Extract, cleanse, geocode, and map from database</td>
<td>Police</td>
<td>Existing</td>
</tr>
<tr>
<td>Utility Systems</td>
<td>As-builts and GPS collections</td>
<td>Public Works</td>
<td>Partial</td>
</tr>
<tr>
<td>Warrants</td>
<td>Extract, cleanse and automatically map from RMS.</td>
<td>Automated</td>
<td>Recommended</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Citywide Base Data</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Property</td>
<td>Parcels were initially created by Contra Costa County. The GIS Division within IT maintain the parcels currently. Temporary ID’s are added to parcel data until the County assigns a permanent number.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Aerial Photography</td>
<td>The City obtains aerial photography every 2 – 4 years as the budget allows.</td>
<td>Static Map</td>
<td>Existing</td>
</tr>
<tr>
<td>Road Centerlines</td>
<td>There are currently two versions of the street centerline data that are maintained. One version is used for maps and cartographic purposes and the other version is used within TriTech for CAD purposes.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Address Points</td>
<td>Address points have been created based on parcel centroids. However, they are stacked for parcels with multi-tenant dwellings.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
</tbody>
</table>
4. MULTI-TIER GIS APPLICATION USE

The pyramid and table below outlines the “Tiers of GIS Use” within the 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 and is considered professional GIS personnel. A Tier 2 user is considered an advanced GIS user who is a data custodian. A Tier 3 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 4 Browser user requires only general browsing GIS data functions. The Police department will consist of Tier 2 and 4 Users.

<table>
<thead>
<tr>
<th>TIER OF GIS USERS</th>
<th>GROUP</th>
<th>ACTIVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tier 1</td>
<td>• GIS Administration</td>
</tr>
<tr>
<td></td>
<td>Flagship</td>
<td>• Data Maintenance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Data Conversion and Creation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Spatial Data Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Technical Support</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Coordination</td>
</tr>
<tr>
<td></td>
<td>Tier 2</td>
<td>• Data Maintenance</td>
</tr>
<tr>
<td></td>
<td>Custodian</td>
<td>• Data Conversion and Creation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Spatial Data Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Metadata Creation and Maintenance</td>
</tr>
<tr>
<td></td>
<td>Tier 3</td>
<td>• Analytical Functions/Geoprocessing</td>
</tr>
<tr>
<td></td>
<td>Analytical</td>
<td>• Complex Queries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Modeling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use of Desktop Extensions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• High Quality Map Production</td>
</tr>
<tr>
<td></td>
<td>Tier 4</td>
<td>• Browsing/Look-Up</td>
</tr>
<tr>
<td></td>
<td>Browser</td>
<td>• Standard Reports</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Simple Query</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Map Production</td>
</tr>
</tbody>
</table>
5. RETURN ON INVESTMENT (ROI)

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

<table>
<thead>
<tr>
<th>Return on Investment Opportunity</th>
<th>Police Department</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| Increase Productivity            |                   | **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. |
| Better Public Relations          |                   | **Internet Viewer:**  
<p>|                                  |                   | • 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. |</p>
<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| **Save Time, Lives and Property**   | **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  |
| **Better Decisions**                | **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.  
**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. |
PHASE I
DEPARTMENTAL NEEDS ASSESSMENTS
PUBLIC WORKS
NEEDS ASSESSMENT
PUBLIC WORKS

CITY OF CONCORD
CALIFORNIA
GIS Strategic Implementation Plan
1. EXISTING CONDITIONS

**DEPARTMENT OVERVIEW**

Public Works strives to develop and provide a variety of customer driven maintenance services and programs to protect the City's investment of infrastructure and public facilities and ensure the health and safety of Concord's community in the most efficient and cost effective manner.
1. **Staff:** Director of Public Works Maintenance Services (1)
   a. Senior Administrative Analyst (1)
   b. Fleet Manager (1)
   c. Facilities Maintenance Manager (1)
   d. Infrastructure Maintenance Manager (1)
   e. Parks Manager (1)

2. **Public Works Services:**
   a. **Facility Operations and Programs**
      i. **Building Maintenance** - Deliver building maintenance services to 156 buildings and 738,210 square feet of building area which preserve and protect the City’s investment in public facilities and meet the needs of internal and external customers for safe, functional, and presentable public facilities.
      ii. **Custodial Services** - Provide custodial services for a healthy and safe environment to our diverse customer base in the most cost effective and efficient manner.
      iii. **Graffiti Removal** - Provide an environment of zero tolerance for graffiti to illustrate Concord’s uniqueness and define Concord as California’s premier community.
      iv. **Fleet Management** - Provide efficient and timely maintenance of City vehicles to ensure staff has vehicles available when necessary.
      v. **Lease Management** - Provide Lease Management services for City/Agency to meet program goals by obtaining necessary property rights, within agreed upon time frames.
   b. **Parks**
      i. **Parks Services** - Provide safe, aesthetically pleasing parks designed and maintained to meet the diverse needs for active and passive recreation and leisure activities.
      ii. **Street Trees, Medians and Open Space** - Provide a variety of programs to maintain streetscapes; including street trees and traffic medians, open space areas and public right-of-way in an aesthetically pleasing condition and achieve mandated requirements for public safety in the most cost effective and efficient manner.
      iii. **Landscape Maintenance** - Concord Landscape Maintenance Districts provide the highest quality service level to landscaped areas as specified in maintenance contract specifications and annual budget documents.
c. Streets
   i. **Curbs, Gutters and Sidewalk Maintenance** - Maintain curbs, gutters, and sidewalks to ensure safe walking surfaces and efficient surface runoff on the 875 curb miles of City frontage improvements.
   ii. **Street Maintenance** - Provide preventative maintenance programs to ensure rehabilitation/reconstructs are at the optimal program level on the City's 305 street miles per year.
   iii. **Street Sweeping** - Maintain a regular Street Sweeping Program to provide clean streets minimizing the amount of debris entering the City's storm drain system. Ensure that the City's 875 curb miles are swept.

d. Traffic and Transportation
   i. **Citywide Street Lighting District**: Provide citywide street lighting services including electrical costs, street light repair and replacement, capital improvements, and Assessment District proceedings through the Citywide Street Lighting Assessment District.
   ii. **Traffic Operations**: Coordinate and facilitate the safe movement of motorists, pedestrians, bicyclists, and goods by providing efficient and effective traffic control devices, and addressing citizen requests with traffic concerns.
   iii. **Traffic Signals and Street Lighting**: Provide cost-effective maintenance and repair of all traffic signals and traffic signal systems.
   iv. **Transportation Signs and Markings**: Install and maintain all roadway signs and markings. The signs and markings provide direction, guidance and specific requirements for drivers, pedestrians and bicyclists.

e. Sewer/Stormwater
   i. **Sewer Collection System**: Perform preventive maintenance and make routine repairs to the pump station and the sewer collection system to provide a safe and healthy environment in the cities of Clayton and Concord in an efficient cost-effective manner.
   ii. **Storm Drainage Management**: Provide maintenance of storm drainage facilities including creeks, channels, and piped storm drainage system.
Creek maintenance: Property owners with a creek on their property, or property owners fronting a creek, must maintain the creek and abutting vegetation, including removal of any trash accumulated by the creek. Creek maintenance information.

iii. Stormwater Program: Prevent pollution in stormwater runoff through construction site planning, design, maintenance and inspection; on-site inspection of commercial and industrial activities; public education and industrial outreach; wet weather monitoring; and special studies. Concord is one of 21 agencies that form the Contra Costa Clean Water Program.

GOVERNANCE OF GIS

The complexity and cost of managing the vast amounts of infrastructure (i.e. public roads, bridges, signals, signage, parks, etc.), which the Public Works Department manages, has greatly increased the demand for geographic information systems (GIS) and global positioning system (GPS) technology. Public Works staff understands that it is essential to have an up-to-date and accurate digital representation of infrastructure within the City. The Public Works Department provides the physical infrastructure essential to social and economic development, which is indispensable to community, commerce and industry; while protecting the City’s natural resources.

The Public Works Department currently utilizes GIS in some operations but expansion of the GIS system is desired. GIS layers do exist but access is difficult and cumbersome. Many needs exist for additional layers. GPS data and CAD databases exist that need to be imported into GIS. The City’s IT department provides the primary support for GIS services with data maintenance being performed by consulting firms and some data creation/maintenance being shifted in-house. Optimally, Public Works needs to establish a GIS Technician/Specialist to assist with their voluminous GIS needs. Better governance of GIS both City and department-wide will allow the benefits of GIS to be realized.

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of Users</th>
<th>GIS Usage</th>
<th>Primary Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIS Flagship (Tier 1)</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Custodian (Tier 2)</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Analytical (Tier 3)</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Browser (Tier 4)</td>
<td>14</td>
<td>Medium</td>
<td>Accela, Intranet GIS Viewer</td>
</tr>
</tbody>
</table>
The table above summarizes the current GIS staffing within the Public Works 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.

### 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.

<table>
<thead>
<tr>
<th>Type</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Computers</td>
<td>All office staff have access to a PC</td>
</tr>
<tr>
<td>AVL/GPS</td>
<td>Transportation and Traffic have two Trimble Juno devices.</td>
</tr>
<tr>
<td>Plotters</td>
<td>Available</td>
</tr>
<tr>
<td>Tablets/Laptops</td>
<td>Limited iPad’s available for use</td>
</tr>
</tbody>
</table>

The Public Works Department utilizes the following software applications:

- Intranet GIS Viewer
- Accela
- Facility Dude
- IT Pipes (Pipe Inspections/CCTV)
- Street Saver (Pavement Management)
- iTrac (Street Signs)
- Google Maps
- West Coast Arborist (Tree Inventory and Maintenance)
- Concord Prospector
- Fleet Management
- Public Stuff
- Microsoft Office
2. GIS NEEDS ASSESSMENT

The Public Works Department should expand their GIS capabilities in order to enhance productivity and functionality. By incorporating advanced GIS methods, the ability to track, analyze and evaluate data within the department will be enhanced.

The Public Works Department has many distinct needs related to GIS. The ability to geo-enable assets, match pavement IDs in GIS to StreetSaver, fully integrate Accela with GIS, flood plain mapping, implement an improved intranet GIS data browser, need traffic infrastructure maps, view building floor plans, and perform training at all levels within the department are of immediate importance and concern. Public Works agencies throughout the country have implemented GIS in varying capacities, and the Department of Public Works is well positioned to implement GIS more comprehensively and effectively. Keys to a comprehensive GIS effort will be the implementation of mapping and spatial analysis applications throughout the various divisions of Public Works, an increase in educational opportunities, better use of GPS for data acquisition and entry, as well as dynamic, real-time data editing and maintenance. Public Works is beginning to collect new data within various divisions. The use of GIS will enhance the ability to automate procedures such as asset inventory and inspections within the Public Works Department. Access to information should be provided by several user-friendly applications which will be discussed in detail following each need, if appropriate.
Key areas of concern for the Public Works Department staff members were:

1. Develop/Enhance/Update GIS layers (e.g. storm/sewer infrastructure, park assets, street lights, signs, parking, development projects, etc.)
2. Mobile solutions for inventory and inspection of various assets
3. Develop a GPS field data collection to GIS import process
4. Implement an improved intranet GIS data browser
5. Data sharing between various departments and divisions
6. Enhanced GIS data access
7. Provide public facing applications to better inform citizens and stakeholders
8. Full Accela and GIS integration
9. Acquire GIS and data collection training at all tiers within the department
10. AVL to view vehicles in the field and assign work according to proximity and availability

Based on this Needs Assessment, the Public Works Department has multiple GIS needs. Where applicable, each need will be followed by an application or method recommended 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:

<table>
<thead>
<tr>
<th>GIS Need</th>
<th>Method/Application to Meet Need</th>
</tr>
</thead>
<tbody>
<tr>
<td>映射和空间分析，支持公用事业操作</td>
<td>Desktop GIS&lt;br&gt;                       Intranet GIS Browser&lt;br&gt; ArcGIS Online - Mobile</td>
</tr>
<tr>
<td>数据创建、管理和映射，启用现有数据库</td>
<td>ArcGIS&lt;br&gt;                              Intranet GIS Browser&lt;br&gt; Data Mining and Geo-enabled data&lt;br&gt; Local Government Information Model (LGIM)&lt;br&gt; ArcGIS Workflow Manager&lt;br&gt; ArcGIS for AutoCAD</td>
</tr>
<tr>
<td>现场访问地理空间数据</td>
<td>Mobile Laptops/Tablets&lt;br&gt; ArcGIS Online</td>
</tr>
<tr>
<td>GIS 基于工作订单系统</td>
<td>ArcGIS&lt;br&gt;                              Specialized GIS Browser</td>
</tr>
<tr>
<td>部门级访问 GIS 数据</td>
<td>Intranet GIS Browser</td>
</tr>
<tr>
<td>公众访问地理空间信息</td>
<td>Internet GIS Browser</td>
</tr>
<tr>
<td>接口到空间 enabled As-Builts, CAD Drawings, and Documents - 链接数字文档到 GIS</td>
<td>Desktop GIS&lt;br&gt;                       Intranet GIS Browser</td>
</tr>
<tr>
<td>自动化车辆定位</td>
<td>AVL Vendor&lt;br&gt;                          Intranet GIS Browser</td>
</tr>
<tr>
<td>GIS 培训为部门员工</td>
<td>ArcGIS Training&lt;br&gt;                    Third Party Application Training</td>
</tr>
</tbody>
</table>
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, viewing water quality areas, mapping landscaping areas and City owned infrastructure. 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 citizen concerns/complaints
- Perform analysis for future transportation system needs
- Track assets and their condition and integrate into work order system
- Mapping of all traffic signals, sidewalks, signs, pavement markings, and street light locations
- Ability to view building elevations and floor plans
- Continued mapping and management of city’s tree inventory
- Linking drawings/documents to spatial data
- Mapping of parking lots and parking spaces
- Mapping of all capital projects past and future
- Query bridge inspections and determine last inspection date
- Improving the spatial accuracy of all Public Works data
- Ensure all Public Works data adheres to the City’s data standards (recommended)
- Generate mailing labels for public notifications

Many opportunities exist for Public Works to use an enhanced Intranet GIS data browser to assist in data mapping and lookup. The current viewer is not providing adequate functionality or data access for Public Works. Therefore, the current viewer either needs major updates and modifications or replacement. Also, a configuration specific to Public Works should be available. An intranet GIS browser can reduce the amount of time used to manually look up records by linking them to physical features which are commonly used as an
identifier for data. Additionally, scanned documents, as-builts or digital plans can be referenced to streets, addresses, or assets, which can provide the same level of efficiency when staff would like to view technical information regarding infrastructure.

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. With completion of the infrastructure GIS data layers, the information in these 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. In addition, Desktop GIS in conjunction with AVL data can perform route optimizations of street sweep routing, saving both time and money for the department.

Using mobile GIS data browsers (ArcGIS Online), Public Works can provide field crews with maps of facilities, streets, signs, signals, parks, trees, 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.

Although eliminating the use of all paper and PDF maps is unrealistic, having digital GIS layers available through these tools can greatly reduce their use and will keep users apprised of changes more quickly. This will inevitably lead to better data and decision making with reduced labor and file management.
**GIS STRATEGIC IMPLEMENTATION PLAN**

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**Needs Assessment**

**Data Creation, Management, Mapping and Enabling Existing Databases**

The majority of Public Works tasks have a geographic component. Staff and citizens need to be able to visualize and understand the dispersion of assets within the City. To that end, a number of data layers need to be created/updated in conjunction with the base map layers that will be made available to all departments. Any needed reports should be generated through canned reports via the GIS database. The following are some of the key data sets that will need to be created/updated/maintained for Public Works:

- Street and Traffic Signs
- Flood Plain – Ability to audit, perform elevation certification, and view permit info for FEMA auditing
- Parking Lots – maintained by City
- Building Layout of City maintained facilities—Ability to click on a building to see layout
- CIP locations and details
- Inspection Locations and details
- Traffic Infrastructure – Fiber, conduits, signals, and pavement markings
- Street Lights – inventory needs to be updated
- Work Orders – process can be automated using Data Mining tools (extracted from Accela)
- Customer Requests - process can be automated using Data Mining tools (extracted from Accela)
- Trees – GIS layer created and integrated with tree management system (West Coast Arborist)
- Park Assets – picnic table, BBQ, play sets, shelters, etc.
- Ramps
- Signal Equipment
- Poles
- Private Development Projects
- Encroachment Permits
- Right-of-Way
- Easements
- Sewer assets, including inspections
- Stormwater assets, including inspections
- Catch basin cleaning/inspections
- Bike Racks
- Bag Locations
- Dog Parks
- Maintenance Zones
- Curb gutter
- Sidewalks
- Irrigation heads and valves within parks
- Sewer levy buffers (200 ft. buffer of sewer mains)
Any database with associated addresses can be address-matched to a street centerline layer, tax parcel centroids, or address point layer. This data can 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. The graphic at right shows the process of using a geocoding service to extract data.

Development and Management goes beyond the creation of GIS layers. Many considerations must be made as to data capture, structure, maintenance, reporting, visualization, and analysis. Several solutions exist to assist Public Works with these areas.

Esri has developed and provides free of charge the Local Government Information Model (LGIM) as a robust data model for storing GIS and related data. The LGIM contains a variety of logically defined feature datasets and feature classes that are common to most local government’s spatial data needs. 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.

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 citizens in more meaningful ways. In addition, it also supports data sharing between local governments and regional, state, and federal agencies.

Capturing accurate data (both location and attributes) is vital to any successful GIS implementation. Through ArcGIS Solutions there are a number of applications available. Perhaps the new “flag ship” of Esri mobile, 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. Recently, the Collector App was made available on Windows 10 devices as well. 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.

Another major component of Data Management involves establishing and using standard operating procedures (workflows). Esri’s Workflow Manager (WFM) assists organizations in developing and enforcing standard, repeatable GIS workflows. PWD can greatly improve their GIS operations and the productivity of teams, including contractors, with the implementation of WFM. WFM is available for both Desktop and Server. Using the information generated during the creation of the data management strategy, Public Works can use WFM to model business processes using visual tools and enhance the assignment of work and communication.

Public Works could benefit in the following ways:

- Improve productivity by automating common activities
- Ensure standardization and consistency at the point of data input
- Track and report workflow statuses
- Manage versions

These benefits are well worth the effort of implementation and also assist in the documentation process of standards and workflows.
Public Works requires the ability to share and manage GIS data with AutoCAD. With ArcGIS for AutoCAD, Public Works can begin realizing tighter integration between CAD and GIS. The application consists of a plug-in for AutoCAD that allows users to gain access to enterprise GIS maps, map services, and feature services hosted by ArcGIS for Server. An additional benefit of ArcGIS for AutoCAD is the ability to perform edits to the data residing in the GIS database directly from within AutoCAD. Some of the benefits include:

- Streamline information sharing between GIS and CAD groups.
- View live, rich cartographic GIS maps in AutoCAD.
- Include the results of GIS analysis in AutoCAD designs.
- Add imagery to your AutoCAD drawing.
- Create, manipulate, and define how CAD data is organized and attributed as GIS content so it can be used in ArcGIS for Desktop or AutoCAD.
- Navigate your AutoCAD session based on street address or place names.
- Edit Enterprise Geodatabases from within AutoCAD
  - Connect to ArcGIS for Server feature services and edit the features stored in a geodatabase using AutoCAD.
  - Connected and long transaction workflows supported.
  - Connect to read-only feature services to stream vector feature services into your AutoCAD session.
  - Extract your own local copy of geodatabase features from a feature service as AutoCAD entities.
- Create GIS-Ready AutoCAD Files
  - Select drawing entities by their GIS attribute values.
  - Add Esri industry standard data models into CAD workflows
  - Customize CAD mapping applications with ArcGIS for AutoCAD commands and AutoLISP tools
  - Manage the tabular attributes of features within your drawing using the provided attribute table viewer.

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.
Field Access to Geospatial Data

Public Works can benefit from having mobile GIS capabilities, 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. Implementing mobile computers, software and GIS data into the GIS enterprise will give staff tools to perform address searches; query attributes of all information, such as infrastructure features, inspection data, work orders, as well as view links to digital plans and drawings.

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, provide accurate driving directions, 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 Concord 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.

Public Works should consider 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, Android, and Windows 10 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-Based Work Order Management System

Public Works manages work orders via multiple systems (iTrac, West Coast Arborist, Facility Dude, etc.). Work orders are being entered into the various systems and distributed to the appropriate crews. However, changes that are being done in the field are not being noted within the GIS and degrade the accuracy of GIS data. It is suggested that all work orders note work performed in the field and that a work order cannot be officially closed until it has been reviewed and the appropriate data entered into the data set. A GIS-based work order management system will also allow staff to quickly input specific information about a task and then print out a paper work order with an accompanying map. This process can be enhanced by providing mobile tools to allow staff to view, modify, and create work orders in the field. The work order closeout procedures will also be recorded and linked to spatial features. In addition, to assisting with tracking of work orders, the GIS will allow supervisors to view open work orders by type and location. This location information can allow supervisors to create priority areas and allocate resources efficiently. Management may also utilize these links to perform activity based costing or costing by area to determine if different management techniques or procedures need to be performed. The continual stewardship of GIS data through work order management will reduce the degradation effects of changes in the field on the GIS data.
GIS data will continually improve because of corrections made in the field and will reflect a very accurate depiction of what is in the field.

The City has invested in the various software applications listed above and GIS. Public Works should commit to integrating these solutions to allow users to harness the benefits of both GIS and these databases along with providing simple access to current asset information, work orders, and customer service request.

In addition, the City should explore options to expose this browser application to the web making the application available to field operations using a laptop or windows tablet with a wireless connection (e.g. ArcGIS Online). Enabling this application for Internet use would allow field crews to view and edit work orders/service request with information about what has been done in the field. This will then automatically be posted and accessible to GIS staff to review and make changes to the appropriate data layers.

**GIS NEED**

**Department-Wide Access to Geospatial Data**

One major theme recited from staff in Public Works involved the lack of access to geospatial data. It seems that a lot of data resides in IT, but Public Works doesn’t feel they have the access, tools, and training they need to utilize the data. 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. This application should not only allow users to view GIS data but data entered into other database systems as well.

A large amount of valuable data for Public Works resides in existing databases and could be mapped out with the assistance of an Intranet GIS Data Browser. In order for this process to be automated and spatially
enabled, these databases need to be linked to a GIS Data Browser for maximum use of both systems. Also, Public Works needs access to other departments and organizations data. A configuration specific to Public Works will allow staff to easily and quickly review vital information.

This application will serve as the primary GIS application for the Public Works Department, and will enable general staff to accomplish about 90% of their GIS tasks. These tasks will include the quick query and search of data; as well as, more intricate uses such as citizen notifications, basic GIS analysis, and map production.

GIS NEED

**Public Access to Geospatial Information**

Providing public access to GIS maps through the Internet provides information to the City of Concord’s citizens. Through an Internet GIS Data Browser, the data specific to Public Works can be provided to the public through an intuitive and easy to use interface. The City of Concord would serve its citizens well by offering focused, dynamic mapping applications.

In addition to providing public access to existing data, Public Works could develop Reverse Lookups to allow citizens, businesses, and developers the ability to determine what they can do and where. They would also be able to determine any variances or special use permits that would be required based on a property. Lastly, citizens, businesses, and developers could determine where development and/or major projects will occur for planning and participation.

The City should further implement an ArcGIS Server (AGS) based Internet GIS data browser to provide citizens with access to the City’s geospatial data. One possible solution is to further implement ArcGIS Online for Organizations. The deployment would include extremely focuses 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 various functionality. With a number of

Typical Permit Center for a Public Community Planning Agency
departments interested in providing high-quality geospatial data and maps to the public, an internet GIS data Browser will be a City initiative, including Public Works as a stakeholder in its provisioning.

Providing maps of projects with information important to citizens and business can enhance communication efforts. 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. Public Works would benefit from offering Story Maps on their web-site and could easily enhance communication concerning Capital Improvement Plans, Transportation, Parks, and others 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. Below are some examples used in other cities.

**GIS NEED**

**Access to Spatially Enabled As-Builts, CAD Drawings, and Documents - Linking Digital Documents to GIS**

Any digital document can be linked to its associated feature on the earth’s surface. Many of the documents stored and reviewed by the Public Works can be linked to spatial data features, thereby creating the potential to utilize the GIS as a look up tool for these documents. Linking documents to GIS features can be performed by creating hyperlink fields in the GIS data, creating data tables containing links to documents or by linking to a document management system. Establishing links between digital documents and spatial data will reduce time spent locating documents in map drawers, managing historical drawings, and inefficiencies caused by viewing paper documents.
The process of establishing GIS to document links has four general phases:

1. **Identifying Candidate Documents**
   - The process of identifying candidate document requires analysis of existing data and performing deterministic analysis on the document’s content for its relevancy to the department’s spatial data and its business procedures. Documents must have some spatial element to them in order to have a logical link (i.e. address, street name, tie in point, etc.)

2. **Scanning and Attributing Documents**
   - The process of scanning and attributing documents consists of actually creating digital copies of paper maps. The process can result in a variety of digital document formats ranging from simple images to images that indexed using Optical Character Recognition (OCR). During this phase the document and the elements that can be used to locate the document are captured and stored.

3. **Geo-referencing and Spatial Indexing**
   - The geo-referencing and spatial indexing step of the process involves the physical linking of the drawing to spatial data or to bounding coordinates. Through geo-referencing, the documents can be viewed against actual spatial data in the map. Spatial indexing is creating a physical link between the document and a geographic feature. During this phase, the method of presenting documents is determined and created.

4. **Process Documenting and Metadata**
   - The final phase of the linking procedure is to document the digitization and spatial referencing processes. Metadata should be created during this phase that outlines the digitization process, source data and creation date. Documenting the procedure in this manner allows for users to view and understand the history and development of the data being viewed.

Establishing the link between the GIS and digital documents can be accomplished by storing the data on shared file storage, in a database or within a document management system. Public Works will realize more efficient retrieval of spatially related documents, permanent document storage and easier dissemination of the data held within these linked documents.
The following are possible documents that could be linked to GIS to include:

- Excavation and Flood Plain Permits
- Building, Sidewalk, and Bridge Inspections
- As-Builts
- Record Drawings and Plans
- Development Plans and Permits
- Building Layouts
- Land Use Documents
- Exhibits

The following is a case study on the use of GIS integrated with a document management system.

**Case Study - Integrated GIS/Document Management System - City of Richardson, TX**

**Implementation Services Based on ESRI Technology**

Redlands, California--The city of Richardson, Texas, is deploying an integrated ArcGIS/document management system as its enterprise geographic information system (GIS) environment, automating and streamlining how it manages, disseminates, and uses information. GIS Technology, Inc. (GTI) is providing software and implementation services based on ESRI technology. GTI was initially contracted to install a FileNET-based integrated document management system and link it to the city's GIS in September of 2001. The city has now entered the implementation phase of the system.

"The city has recognized the advantages of integrating GIS with document management," says Jeff Hecht, chief executive officer, GTI. "It will be able to spatially enable documents that, up until now, have resided in a manual storage system with limited access and consuming valuable floor space. The city is going to have a unique capability here that few cities can match."
"Our city hall is limited in space, and we were faced with the prospect of losing even more space to document storage," says Sylvia Kendra, GIS project manager, city of Richardson. "We needed to solve the space problem, but more importantly we wanted to change the way we do business. The ArcGIS/integrated document management (IDM) integration enabled us to accomplish both goals."

"The city of Richardson showed tremendous leadership and vision in outlining the solution it wanted," says Amy Thorson, corporate alliance representative, ESRI. "GTI is a leader in providing integrated ESRI and FileNET solutions. ESRI's relationships with best-of-breed solution providers like GTI help us focus on providing the best technology possible while leveraging the industry expertise of other organizations."

GTI supplied the city with FileNET’s Panagon software solution as the preferred document management system as well as provided IDM for ArcGIS and IDM for ArcIMS middleware solutions. IDM for ArcGIS includes powerful tools for creating and manipulating connections between the two information sources. IDM for ArcIMS extends integrated access to GIS and document information to remote locations via the Web. In addition, the city of Richardson has retained GTI to design the document repository, recommend adjustments to the existing GIS database, train staff, and design and implement the integration of the GIS/document management system.

The integrated ArcGIS-FileNET solution will replace paper and manual document management and indexing methods including hanging file folders and microfiche machines. Faster, more efficient data management will significantly reduce the number of hours spent retrieving information, whether for planning and zoning, economic development, property assessment, or a myriad of other government application areas. The new solution also provides remote data access, meaning users from various offices can digitally retrieve information rather than having to physically visit one site for submitting information requests.

The city of Richardson has completed the pilot stage of the project and is currently loading documents. Planning documents, as-built drawings, plats, building inspection records, and ordinances are being incorporated into the document repository and linked to the city’s existing GIS. With completion of the database design, the city of Richardson will be undertaking a pilot test of the system that will involve three of the city’s departments. Use of the integrated GIS/document management system will then be extended throughout the city. The city will be integrating both thick and thin clients in this Internet-enabled solution. A large number of users will access the system via the Internet and a thin client, while a smaller number of users will be utilizing thick clients on a limited number of desktops.

Case Study Provided By: ESRI

Press Information: Jesse Theodore, ESRI
Tel.: 909-793-2853, extension 1-1419
Automated Vehicle Location (AVL)

Cities throughout North America realize the benefits from Automated Vehicle Location (AVL) software and services. Public Works should be involved in future AVL discussions to align with the City’s direction. Enterprise solutions often make the best solution and increase both internal and external application support. Initially a staple of the emergency management and response communities, organizations that manage field crews and vehicles, are looking at AVL to increase their capabilities to respond to customer needs, perform task planning, dispatch closest vehicles and locate assets in the field.

Public Works would benefit from deploying an AVL application in its vehicles especially for optimization of resources and safety issues. Supervisors and command center staff should have access to the AVL feed. Through the use of AVL, Public Works as a whole could more easily react to an immediate need by finding the closest vehicle with the equipment or parts needed to complete a task. Through AVL technology, the department will realize fuel cost savings by reducing the number of miles driven while going to the job site. AVL technology will also allow staff to manage and monitor progress on work orders throughout the work day. A complete integration AVL with work orders throughout the City will provide a comprehensive operational picture for management and decision makers as well as provide efficiencies for field workers. Field crews working alone (Lone Workers) are more at risk than those working with a crew. In the event that an injury that incapacitates a field worker, there is currently no mechanism to accurately locate that worker. AVL would offer some protection for that worker because their last known location could be readily discerned.
**Formal GIS Training for Staff**

Staff that will be performing more advanced GIS analysis and mapping should participate in foundational GIS skills training. The Public Works Department staff should participate in any enterprise-wide ArcGIS training that is made available.

As Tier 3 – Browser GIS user intranet, desktop or Internet applications are deployed, the Public Works Department 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.
3.

GIS GAP ANALYSIS

GIS DATA LAYER INVENTORY

The Public Works Department will benefit from access to almost all data layers created and obtained for the municipality. 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 municipal departments. The following is a list of desired layers for the Public Works Department:

Legend

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creation Methodology</td>
<td>This column describes how the layer was, or is anticipated being created.</td>
</tr>
<tr>
<td>Recommended Update Division/ Department</td>
<td>This field outlines the Department 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.</td>
</tr>
<tr>
<td>Layer Status</td>
<td>Layer state of existence.</td>
</tr>
<tr>
<td>Existing</td>
<td>These layers currently exist within the City’s GIS.</td>
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</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>Creation Methodology</th>
<th>Recommended Update Division or Individual</th>
<th>Existing or Recommended?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Public Works Department GIS Data</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Street and Traffic Signs</td>
<td>GPS collection in the field</td>
<td>Public Works</td>
<td>Partial</td>
</tr>
<tr>
<td>Bike Racks</td>
<td>GPS collection in the field</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Sand Bag Location</td>
<td>GPS collection in the field</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Dog Parks</td>
<td>Digitize on screen</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Schools</td>
<td>Digitize on screen</td>
<td>Public Works</td>
<td>Existing</td>
</tr>
<tr>
<td>Trees</td>
<td>GPS collection in the field</td>
<td>Public Works</td>
<td>Existing</td>
</tr>
<tr>
<td>Irrigation Heads and Valves</td>
<td>GPS collection in the field</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Street Light and Traffic Signals</td>
<td>GPS collection in the field</td>
<td>Public Works</td>
<td>Partial</td>
</tr>
<tr>
<td>Traffic Fiber, Signal Equipment, and Conduit</td>
<td>GPS collection in the field</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Pavement Markings</td>
<td>GPS collection in the field</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Flood Plain Mapping</td>
<td>Via FEMA shape file</td>
<td>Public Works</td>
<td>Existing</td>
</tr>
<tr>
<td>City-owned Property</td>
<td>Extract from Tax Parcels and Aerials</td>
<td>IT Staff</td>
<td>Existing</td>
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<tr>
<td>Parking Lots</td>
<td>Digitize on screen</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Subdivision Plats</td>
<td>Link to GIS</td>
<td>Public Works</td>
<td>Recommended</td>
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<tr>
<td>Building Layout</td>
<td>Link to GIS</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>CIP Locations</td>
<td>Digitize on screen</td>
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<td>Recommended</td>
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<tr>
<td>Inspection Locations</td>
<td>Geoenable from database</td>
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<td>Recommended</td>
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<tr>
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<td>GPS and/or Digitize on screen</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Data Layer</td>
<td>Creation Methodology</td>
<td>Recommended Update Division or Individual</td>
<td>Existing or Recommended?</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>-------------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Work Orders</td>
<td>Process can be automated using Data Mining tools</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Customer Requests</td>
<td>Process can be automated using Data Mining tools</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Park Assets</td>
<td>Digitize From Source Documents then augment with GPS collection in the field</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Private Development Projects</td>
<td>Digitize or geocode</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Right-of-Way</td>
<td>Digitize</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Easements</td>
<td>Digitize from source documents</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Contours</td>
<td>Import from aerials</td>
<td>County GIS</td>
<td>Existing</td>
</tr>
<tr>
<td>Storm Water System</td>
<td>Digitize From As-Builts and other Source Documents</td>
<td>Public Works</td>
<td>Partial</td>
</tr>
<tr>
<td>Catch Basins</td>
<td>GPS collection in the field</td>
<td>Public Works</td>
<td>Partial</td>
</tr>
<tr>
<td>Pavement</td>
<td>Digitize on screen</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Trees</td>
<td>Digitize on screen</td>
<td>Public Works</td>
<td>Existing</td>
</tr>
<tr>
<td>Curb Ramps</td>
<td>GPS collection in the field</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Bike Lanes</td>
<td>Digitize on screen</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Open Spaces</td>
<td>Digitize on screen</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
<tr>
<td>Encroachment Permit</td>
<td>Digitize from records</td>
<td>GIS staff within IT</td>
<td>Recommended</td>
</tr>
<tr>
<td>Sidewalks</td>
<td>GPS and digitizing from aerials</td>
<td>Public Works</td>
<td>Partial</td>
</tr>
<tr>
<td>Service Requests</td>
<td>Geoenable from CRM</td>
<td>Public Works</td>
<td>Recommended</td>
</tr>
</tbody>
</table>

### Citywide Base Data

<table>
<thead>
<tr>
<th>Property</th>
<th>Creation Methodology</th>
<th>Recommended Update Division or Individual</th>
<th>Existing or Recommended?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property</td>
<td>Parcels were initially created by Contra Costa County. The GIS Division within IT maintain the parcels currently. Temporary ID’s are added to parcel data until the County assigns a permanent number.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Aerial Photography</td>
<td>The City obtains aerial photography every 2 – 4 years as the budget allows.</td>
<td>Static Map</td>
<td>Existing</td>
</tr>
<tr>
<td>Data Layer</td>
<td>Creation Methodology</td>
<td>Recommended Update Division or Individual</td>
<td>Existing or Recommended?</td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>-------------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Road Centerlines</td>
<td>There are currently two versions of the street centerline data that are maintained. One version is used for maps and cartographic purposes and the other version is used within TriTech for CAD purposes.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
<tr>
<td>Address Points</td>
<td>Address points have been created based on parcel centroids. However, they are stacked for parcels with multi-tenant dwellings.</td>
<td>GIS Division within IT</td>
<td>Existing</td>
</tr>
</tbody>
</table>

**GAP ANALYSIS CHART**

The Public Works Department has a significant role in GIS for the City of Concord and will be a key contributor in the implementation of enterprise-wide GIS throughout the City. Key staff will need to be heavily involved in the optimal implementation of GIS technology at the enterprise level. As part of this Needs Assessment, a Gap Analysis has been conducted to determine an optimal environment and set of processes for the utilization of GIS. This analysis provides a baseline level of understanding for the existing status and desired status of major GIS components for the Department.

The matrix below details those relevant components that have been analyzed and assessed as part of the Gap Analysis.

<table>
<thead>
<tr>
<th>LEGEND</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>GIS component currently exist within Department.</td>
</tr>
<tr>
<td>No</td>
<td>GIS component does not currently exist within Department.</td>
</tr>
<tr>
<td>Limited/Partial</td>
<td>GIS component exist to a lesser degree.</td>
</tr>
<tr>
<td>Desired</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>Deemed desirable based on Needs Assessment.</td>
</tr>
<tr>
<td>No</td>
<td>Deemed to be not desirable based on Needs Assessment.</td>
</tr>
<tr>
<td>Limited</td>
<td>Some applicability to Departmental needs.</td>
</tr>
<tr>
<td>COMPONENT</td>
<td>STATUS</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>AVL</td>
<td>No</td>
</tr>
<tr>
<td>Documentation</td>
<td>Limited</td>
</tr>
<tr>
<td>AVL can be used to track vehicles; Using AVL conjunction with routing increases efficiency and can reduce fuel consumption, thereby decreasing costs.</td>
<td></td>
</tr>
<tr>
<td>Documentation</td>
<td>Limited</td>
</tr>
<tr>
<td>Little documentation on GIS data creation and workflow exists in the Public Works Department however there is a greater need for creation and standardization for documentation Citywide.</td>
<td></td>
</tr>
<tr>
<td>Enterprise Systems Integration</td>
<td>Limited</td>
</tr>
<tr>
<td>Integration of data within an enterprise system is desirable but only if data creation from all departments/division adhere to the same data and metadata standards. Centralized data servers and data sharing are critical to the enterprise-wide success of this project.</td>
<td></td>
</tr>
<tr>
<td>Geocoding</td>
<td>No</td>
</tr>
<tr>
<td>Geocoding will be needed for mapping work orders, permits, inspections and other address based features.</td>
<td></td>
</tr>
<tr>
<td>GIS Data Access</td>
<td>Limited</td>
</tr>
<tr>
<td>Current databases used within the Public Works Department have data that could be beneficial Citywide and the Public Works Department would benefit from access to other departments data layers. GIS Data access is desired and should be addressed throughout the City.</td>
<td></td>
</tr>
<tr>
<td>GIS Data Maintenance</td>
<td>Limited</td>
</tr>
<tr>
<td>Significant GIS data editing and analysis will occur within the Public Works Department. Future creation of departmental layers will need to meet with Citywide data standards set by the GIS staff within IT in order to facilitate confident data sharing and usage between departments.</td>
<td></td>
</tr>
<tr>
<td>GIS Data Sharing</td>
<td>Limited</td>
</tr>
<tr>
<td>There are many layers that need to be shared within the organization.</td>
<td></td>
</tr>
<tr>
<td>COMPONENT</td>
<td>STATUS EXISTING</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>GIS Personnel</td>
<td>Limited</td>
</tr>
<tr>
<td>Hardware</td>
<td>Limited</td>
</tr>
<tr>
<td>Mapping</td>
<td>Limited</td>
</tr>
<tr>
<td>Metadata</td>
<td>Limited</td>
</tr>
<tr>
<td>Mobile Computing</td>
<td>Limited</td>
</tr>
<tr>
<td>Resources</td>
<td></td>
</tr>
<tr>
<td>Network</td>
<td>Yes</td>
</tr>
<tr>
<td>Routing</td>
<td>No</td>
</tr>
<tr>
<td>Software</td>
<td>Yes</td>
</tr>
<tr>
<td>Spatial Analysis and</td>
<td>Limited</td>
</tr>
<tr>
<td>Modeling</td>
<td></td>
</tr>
<tr>
<td>Training/Education</td>
<td>Yes</td>
</tr>
</tbody>
</table>
4. MULTI-TIER GIS APPLICATION USE

The pyramid and table below outlines the “Tiers of GIS Use” within the 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 and is considered professional GIS personnel. A Tier 2 users is considered an advanced GIS user who is a data custodian. A Tier 3 Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 4 Browser user requires only general browsing GIS data functions. The Public Works department will consist of Tier 2, 3, and 4 Users.

<table>
<thead>
<tr>
<th>Tiers of GIS Users</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 1 Flagship</td>
<td>• GIS Administration</td>
</tr>
<tr>
<td></td>
<td>• Data Maintenance</td>
</tr>
<tr>
<td></td>
<td>• Data Conversion and Creation</td>
</tr>
<tr>
<td></td>
<td>• Spatial Data Management</td>
</tr>
<tr>
<td></td>
<td>• Technical Support</td>
</tr>
<tr>
<td></td>
<td>• Coordination</td>
</tr>
<tr>
<td>Tier 2 Custodian</td>
<td>• Data Maintenance</td>
</tr>
<tr>
<td></td>
<td>• Data Conversion and Creation</td>
</tr>
<tr>
<td></td>
<td>• Spatial Data Management</td>
</tr>
<tr>
<td></td>
<td>• Metadata Creation and Maintenance</td>
</tr>
<tr>
<td>Tier 3 Analytical</td>
<td>• Analytical Functions/Geoprocessing</td>
</tr>
<tr>
<td></td>
<td>• Complex Queries</td>
</tr>
<tr>
<td></td>
<td>• Modeling</td>
</tr>
<tr>
<td></td>
<td>• Use of Desktop Extensions</td>
</tr>
<tr>
<td></td>
<td>• High Quality Map Production</td>
</tr>
<tr>
<td>Tier 4 Browser</td>
<td>• Browsing/Look-Up</td>
</tr>
<tr>
<td></td>
<td>• Standard Reports</td>
</tr>
<tr>
<td></td>
<td>• Simple Query</td>
</tr>
<tr>
<td></td>
<td>• Map Production</td>
</tr>
</tbody>
</table>
The following table indicates specific Return on Investment opportunities for the Public Works Department:

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| **Save Time** | *Decrease in time spent on tasks come from better automated map/route production, data updates/maintenance, and data access.*  
- Access to departmental data (spatial and non-spatial)  
- Process and tools for timely and standardized map/feature updates.  
- Automated tools to capture field data and update assets  
- Automated route planning tools  
- Enterprise data access via browser based viewing tools  
- Optimize work order assignment by location  
- Locate infrastructure in the field  
- Target areas to perform work and services.  
- Become more responsive to citizen requests  
- Quicker location of infrastructure  
- Determine the needs of the field crews (quantities and types) in the office before going out into the field  
- The review of planning applications with readily available/easily accessible data saving 100s of hours per year  
- Field access to data will reduce trips to the office for data saving 100s of hours per year |
<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| **Increase Productivity**           | **Intranet GIS Data Browser and Spatial Analysis:**  
• Use GIS to assist in production of maps and reports that are submitted to State and Federal agencies  
• The use of GIS analysis, for locating record drawings, or calculating flow direction, and identifying problem areas, is much faster than completing the tasks manually. |
| **Save Money**                      | **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. |
| **Improved Efficiency**             | **Intranet GIS Data Browser and Spatial Analysis:**  
• Mapping demand can help manage asset inventory.  
• Tracking all hot spots will allow for staff to better plan for site inspections  
**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 |
| **Compliance with Regulatory Requirements** | **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 and meet regulated response times. |
<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| **Ability to Respond More Quickly to Citizen Requests / Improved Access to Government** | • 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 citizen requests. |
| **Effective Management of Assets and Resources and Save Money** | • 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 citizen 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 |
| **Improved Communication, Coordination, and Collaboration** | • The users work closely with CEDD - Engineering and outside engineering consultants and contractors on capital improvement projects. Accurate mapping (including thorough and accurate attribute data) is essential to collaborate on such projects. |
PHASE I
ADDITIONAL OPPORTUNITIES
City Attorney Office

A department that was not interviewed during this GIS Strategic Plan is the City Attorney Office (CAO). Although they were not interviewed, there are some use cases for GIS within the department. One of the most significant benefits that staff will realize from the implementation of GIS and complementary technologies is increased and improved access to information. Staff will be able to further understand relationships between different types of data in a spatial context, thereby improving decision-making.

CAO personnel should have access to the following data, which can be met by utilizing the City’s intranet GIS data browser:

1. View photos of the current state of the property, address information, existing violations, pending permits/citations, owner/resident history, deed restrictions, liens or other title impairment, and aerial photography as evidence
2. View property data to include:
   a. Sales information
   b. Owner history
   c. Permits associated with a property
3. City addressing data
4. Permitting information
5. Inspections data

The CAO must work with the GIS staff in IT to access necessary data layers. A key recommendation for the CAO 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.

As stated above, CAO staff should work with the GIS staff and train specific department personnel in the use of GIS to gain quick successes based on mapping and analysis of address, code enforcement, and property related issues. Most CAO staff should use an intranet GIS data browser to conduct basic spatial analysis, to produce maps, and to assist in day-to-day activities.
Many organizations utilize GIS products in support of court cases. Maps are used to visualize an event or occurrence. Examples include:

- **Sidewalk tripping hazards** – Clearly display reported tripping hazards and events to include the City’s mitigation efforts and the efficiency of the work order system.

- **Traffic incidents** – A Laredo, Texas police officer rear-ended a private vehicle. The driver sued the City, stating that the police officer was driving on a rural street well more than the speed limit. However, the City used mapped automated vehicle location (AVL) data to show that the officer was going below the speed limit. It became evident that the driver was trying to obtain insurance money from the City and the case was dismissed.

- **Criminal prosecution** – The City of Wilson, North Carolina uses map products frequently in court case support. In one case a homicide was witnessed at night. The defense claimed that it was too dark to make a positive identification. However, a map displaying the crime location juxtaposed with street lighting was used to show that enough light was available for a positive identification.
PHASE II
CONCEPTUAL
SYSTEM DESIGN
INTRODUCTION

PHASE II – CONCEPTUAL SYSTEM DESIGN

The following sections describe the general findings of the six main components of an enterprise GIS. The six components include:

1. Governance
2. Data and Databases
3. Procedures, Workflow and Integration
4. GIS Software
5. Training and Education and Knowledge Transfer
6. Infrastructure

This is supported by a recommended vision, and goals and objectives for that specific component. Each component has a table that illustrates the quantifiable measurement of key Performance Indicators as it relates to the component. This table will help the City measure improvement over the three year implementation period.

This section of the GIS Strategic Plan is also supplemented by a more detailed analysis of the City of Concord’s digital data layers, and the development of an Architectural Assessment and enterprise GIS design.
CONCEPTUAL SYSTEM DESIGN

GOVERNANCE

CITY OF CONCORD

CALIFORNIA

GIS Strategic Implementation Plan
The following section summarizes the existing governance conditions and departmental comments. This section also includes the City’s existing governance model and three governance options.

<table>
<thead>
<tr>
<th>City of Concord Governance Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lacking a vision, goals and objectives</td>
</tr>
<tr>
<td>Informal ad-hoc governance model</td>
</tr>
<tr>
<td>No real enterprise and coordinated GIS Management</td>
</tr>
<tr>
<td>No GIS committee structure within the organization (GIS Steering Committee will become a part of the existing IT Executive Committee)</td>
</tr>
<tr>
<td>No GIS user group</td>
</tr>
<tr>
<td>No regionalization of GIS</td>
</tr>
<tr>
<td>Some GIS policy and mandates exist, but overall it is lacking</td>
</tr>
<tr>
<td>No way to measure the quality of GIS service</td>
</tr>
<tr>
<td>Little collaboration</td>
</tr>
<tr>
<td>Lacking in clear lines of responsibility</td>
</tr>
<tr>
<td>No real attempt to secure grants for GIS</td>
</tr>
<tr>
<td>No GIS coordination of tasks</td>
</tr>
<tr>
<td>No YouTube training channel</td>
</tr>
<tr>
<td>Some alignment of GIS within the organization</td>
</tr>
</tbody>
</table>

The following recommendations are 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 Concord well into the future.
GOVERNANCE RECOMMENDATIONS

THE VISION
The City of Concord should implement an Optimum GIS Governance Model that Centralizes Technology and Empowers Customers to take Ownership of their Data.

THE GOAL
The City requires an understandable strategy for the management and effective utilization of GIS with clear lines of responsibility, decision making, and overall governance.

Task #1: COMPLETE THE MULTI-YEAR GIS STRATEGY IMPLEMENTATION PLAN – The City needs to complete the three-year GIS Strategic Plan that details every task required to deploy a true enterprise solution that takes advantage of the latest technology and architecture. It should include a vision, and goals and objectives as well as Key Performance Indicators (KPI) for the GIS initiative.

Task #2: GIS AUTHORITY AND CONTROL – The City of Concord should fill the GIS Manager position within the IT Department to oversee all GIS functions within the City. There is a distinct need for a GIS Manager within the IT department that supports all departments equally, and has the authority to direct GIS development across the enterprise. There is currently a vacant GIS Manager position. This should be filled as soon as possible.

Task #3: ACCESSIBILITY TO DATA – The City needs to improve accessibility to GIS software and GIS data to all City employees and all other interested parties. The existing AGOL solutions do not meet the need of the stakeholders.

Task #4: ENTERPRISE STANDARD OPERATING PROCEDURES – 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, Metadata Standards, Standard Naming Conventions, and GIS Business Integration.

Task #5: GRANTS AND FUNDING – The GIS Manager should encourage the pursuit of grants for GIS software, data, training, and staff.

Task #6: COORDINATED ENTERPRISE – Develop and coordinate all GIS activity within the City of Concord.

Task #7: IT EXECUTIVE COMMITTEE – Fold a GIS Steering Committee, comprised of directors from each department, into the existing IT Executive Committee. Develop a strategy for the Steering committee’s goals and objectives.

Task #8: DEVELOP GIS USER GROUP – GIS users throughout the City should participate in the GIS User Group. Develop a strategy for the GIS User Groups goals and objectives.

Task #9: FORMALIZE AND RATIFY GIS GOVERNANCE MODEL – Adopt a new governance model that includes the GIS Manager, technical staff in IT, a steering committee, and a GIS user Group. This should promote a culture of collaboration. If the City does not transition to Subject Matter Experts (SME) maintaining their own data within each department, GIS will remain as it is currently and will not grow as desired.

Task #10: KEY PERFORMANCE MEASURES – Establish enterprise and departmental GIS performance measures and Key Performance Indicators (KPI) as well as a Return on Investment (ROI).

Task #11: PROMOTE GIS – Promote GIS both internally and externally to showcase the successes.

Task #12: ANNUAL UPDATE TO THE PLAN – Update the GIS Strategic Plan on an annual basis using an online questionnaire and departmental interviews.

Task #13: GIS ANNUAL DETAILED WORKPLAN AND SERVICE LEVEL AGREEMENTS – The GIS Manager should create an annual GIS work plan that details all departmental support. This may also include the development of SLA between the IT-GIS and each department.
Task #14: ALIGNMENT OF GIS WITH THE CITY OF CONCORD’S VISION, GOALS, AND OBJECTIVES – The GIS Manager should align all GIS activity and initiatives with the City’s overall vision, goals, and objectives.

Task #15: USER SENSITIVITY AND A MEASURE OF THE QUALITY OF GIS SERVICE – The GIS Manager should measure satisfaction levels annually using an online questionnaire and feedback at User group meetings. This should be reported to the Steering committee.

City of Concord’s Existing GIS Governance Conditions
Job Description for GIS Manager

The findings of the 2017 Enterprise and Sustainable GIS Strategic Implementation Plan strongly recommends that the City retain a GIS Manager within the Information Technology (IT) Department. This recommendation is based on best business practices and is critical to the success and sustainability of the GIS program. A GIS Manager within IT is the core ingredient in the proposed Hybrid governance model recommended for the City. The roles and responsibilities of this GIS Manager are extensive and requires specific technical and scientific training, education and experience. This detailed training, education and knowledge is found more in the City’s Systems and Programming Manager’s job description.

The City’s HR Department has two job classifications that could be used to describe the vacant GIS Manager position. A comparison of the job descriptions of the Program Manager verses the Systems and Programming Manager indicates that the best course of action is for the City to reclassify the vacant GIS Manager’s position from a Program Manager to a Systems and Programming Manager. The compelling reason includes the required knowledge of the GIS Manager to understand database design, application programming, system’s administration, and have an overall scientific background.

Recommendation: Reclassify the GIS Manager’s position in IT using the Systems and Programming Manager’s job description.

The following charts illustrate two (2) governance model options for the City of Concord. The first graphic depicts the current and limited centralized GIS governance model. The following graphic is the recommended governance model – Option A. The final graphic depicts an optional model in which the City remains in a centralized environment, but hires additional staff within IT/GIS to support the City’s growing GIS needs. This option, Option B, is not a recommended solution based on departmental interviews and discussions with City staff.
RECOMMENDED GOVERNANCE OPTIONS

Existing Governance Situation

THE CITY OF CONCORD GIS - WHERE ARE WE NOW?

A Limited Centralized Governance Model

Existing Characteristics

- Governance
  - Lacking a vision, goals and objectives
  - Informal ad-hoc governance
  - No GIS committee structure within the organization
  - No Regionalization of GIS
  - Little Policy or Mandates
  - No Way to Measure Quality of GIS Service
  - Lacking Coordination, clear lines of responsibility

- Data and Databases
  - Lack of Standards
  - Data Duplication
  - Need to improve data creation standards
  - No custodianship of layers
  - No mobile GIS

- Procedures and Workflow
  - Need Better Workflow Solutions
  - Could increase GIS usage by department
  - Lack GIS-centric SOPs
  - More GIS Integration

- GIS Software
  - No ELA
  - No Public Access
  - Lack of automated database extracts
  - Lack of Software Training

- GIS Training & Education
  - Lack of GIS Knowledge
  - Lack of Adequate Training

- IT Infrastructure
  - Need GIS training for IT Department
  - Greater IT infrastructure for enterprise GIS
  - Need mobile GIS

2017 GIS PROJECTS
1. GIS Multi-Year Strategic Plan
2. LGI M Data Migration
3. ArcGIS Enterprise Deployment
4. Intranet Deployment
5. Internet Deployment

40 Users
$70,000 Initial Purchase
$15,000 Annual Maintenance
$7,727 Per User

Centralized Governance Model

Existing Limited Solution

Parks and Recreation No GIS
Community & Economic Development

Police
No GIS

City Manager
No GIS

IT

Finance
No GIS

Public Works
Human Resources
No GIS

Naval Weapons Station
Reve No GIS

Outside Consulting Services

External Entities: State, Federal, Local
Future Governance Model

THE CITY OF CONCORD GIS – WHERE COULD WE BE?

A Recommended Hybrid Governance Model with Additional Software and Users

OPTION A

HYBRID GOVERNANCE MODEL
ENTERPRISE SUSTAINABLE OPTION

133+ Users
$70,000 Initial Purchase
$25,000 Annual Maintenance
$714 Per User

*increasing with more public use

2017 GIS PROJECTS
1. GIS Multi-Year Strategic Plan
2. LGIM Data Migration
3. ArcGIS Enterprise Deployment
4. Intranet Deployment
5. Internet Deployment

1 GIS Manager
1 GIS Analyst

Pros
1. Enables all departments
2. Increase GIS Users from 40 to 133+
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

Pros
1. Enables all departments
2. Increase GIS Users from 40 to 133+
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
Future Governance Model

**THE CITY OF CONCORD GIS – WHERE COULD WE BE?**

A Centralized Governance Model with Additional Staff to Support the Enterprise

**OPTION B**

Centralized Governance Model

Centralized Supported Solution

132+ Users
$70,000 Initial Purchase
$15,000 Annual Maintenance
$644 Per User

Pros
1. Centralize all GIS work
2. Less departmental training and education needed
3. Zero impact on City departments

Weaknesses
1. Increase Salary
2. Most expensive option
3. Stifles creativity in department
4. Less governance needed
5. Not enterprise
6. Less sustainable
7. Required succession planning

2017 GIS Projects
1. GIS Multi-Year Strategic Plan
2. LGIM Data Migration
3. ArcGIS Enterprise Deployment
4. Intranet Deployment
5. Internet Deployment

1 GIS Manager
1 GIS Analyst
2 GIS Technicians
INDUSTRY BEST PRACTICES

GTG interviewed ten comparable organizations in regards to their governance and best practices. From the interviews of the ten comparable 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. For the interviewed organizations, the status of the above key elements is summarized in the charts on the following pages.

**AVERAGE GOVERNANCE**

70% of respondents have a hybrid GIS governance model. It is recommended that the City migrate from a centralized model to a more sustainable hybrid model.

90% of respondents have GIS housed within IT. The City should continue with the current trend.

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.

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% 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.

**CONCORD, CA GOVERNANCE**

All respondents use Esri as the de facto GIS software of choice. The City should continue to leverage Esri for key GIS software.

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.

The average annual budget for GIS amongst the respondents was $37,300. The City should consider all GIS components when preparing the GIS budget each year.

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.

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.
| Woodland, California | Sacramento, California | Stockton, California | Rancho Cordova, California | Clovis, California | Modesto, California | Merced County, California | Los Angeles, California | San Diego, California | San Francisco, California | San Jose, California | Santa Barbara, California | San Luis Obispo, California | San Benito, California | Santa Cruz, California | Monterey, California | San Francisco, California | Marin County, California | Santa Cruz, California |
|---------------------|-----------------------|----------------------|-----------------------------|-------------------|---------------------|------------------------|--------------------------|-----------------------|------------------------|-----------------------|------------------------|------------------------|------------------------|----------------|------------------------|----------------------|------------------------|
| How many years has the GIS department been established? | 15 | 22 | 15 | 5 | 27 | 15 | 20 | 19 | 9 | 11 | 12 | 17 | 20 | 11 | 10 | 4 | 12 | 0 | 20 | 14 |
| Was the GIS department spearheaded by an executive champion/group? | ✓ | X | X | ✓ | ✓ | X | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| GIS Steering Committee at start of GIS Division? | ✓ | ✓ | ✓ | X | ✓ | X | X | X | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Currently have a GIS steering committee? | ✓ | In Progress | ✓ | ✓ | ✓ | X | X | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Proposed | X | X | X | X | X | ✓ | ✓ | ✓ |
| Effort a user's group in place? | ✓ | In Progress | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Proposed | 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 | 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 | Centralized | Hybrid | Centralized | Hybrid | Centralized | Hybrid | Hybrid | Hybrid | Centralized | Hybrid | Centralized | Hybrid | Hybrid | Centralized | Hybrid | Hybrid | Hybrid |
| 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 STRATEGIC IMPLEMENTATION PLAN | CONCEPTUAL SYSTEM DESIGN | 233**
GIS STRATEGIC IMPLEMENTATION PLAN | CONCEPTUAL SYSTEM DESIGN

| 234


CONCEPTUAL SYSTEM DESIGN
DATA AND DATABASES

CITY OF CONCORD
CALIFORNIA
GIS Strategic Implementation Plan
The following section summarizes the existing data and database conditions and departmental comments. This section also included a comprehensive digital data assessment.

<table>
<thead>
<tr>
<th>City of Concord Data and Database Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of standards</td>
</tr>
<tr>
<td>Accuracy of data layers</td>
</tr>
<tr>
<td>Duplication of key data layers (Street Centerlines)</td>
</tr>
<tr>
<td>No LGIM used (lack of understanding of LGIM)</td>
</tr>
<tr>
<td>Need to improve data creation procedures across the enterprise</td>
</tr>
<tr>
<td>No custodianship of data layers</td>
</tr>
<tr>
<td>Mobile GIS</td>
</tr>
</tbody>
</table>

**DATA AND DATABASES**

**THE VISION**

The City should Design, Build, Update, Collect, and Maintain Reliable and Sustainable GIS Digital Data Layers.

**THE GOAL**

The City should use Esri’s Local Government Information Model (LGIM) as the standardized data model for future growth. A modified or enhanced LGIM should be used to build and maintain accurate, consistent, and reliable geographic data.

**Task #1: CONDUCT A DIGITAL DATA ASSESSMENT** – Perform a comprehensive assessment of the quality, quantity, and completeness of all digital data layers with specific emphasis on the critical layers:

- Parcels
- Address Points
- Street Centerline
- Aerial Photography (2014)

**Task #2: CONDUCT AN ENTERPRISE DATABASE DESIGN** – Establish and implement Esri’s LGIM – with opportunities for customization where needed.
Task #3: DATA CREATION – Develop a plan to collect, update, and convert all required departmental digital data layers over an agreed upon period of time including the list of required data layers detailed in the GIS Assessment.

Task #4: IMPROVE ACCESS TO CRITICAL FOUNDATION DATA LAYERS – Develop a multi-tiered approach allowing all departments to view and access base map layers including parcels, address points, street centerlines, and aerial photography in real-time. The City of Concord should focus on the utilization of Esri’s ArcGIS Online tools.

Task #5: MASTER DATA LIST – Create an updated and accurate Master Data List and maintain on a regular basis.

Task #6: CENTRAL REPOSITORY – Continue to utilize Esri’s ArcSDE environment to house all City GIS data. This central repository is located within the IT Department.

Task #7: METADATA – Establish and enforce standard operating procedures (SOP) for developing metadata standards.

Task #8: CUSTODIANSHIP – Clearly define data custodianship roles within the enterprise governance model. This includes coordination between all departments. Each department should be responsible for specific digital data layers.

Task #9: MOBILE SOLUTIONS FOR VIEWING AND MAINTAINING DATA – The City should plan, design, and deploy Esri’s ArcGIS Online as the mobile software solution. This should be supplemented by a continued effort to identify new, advanced, convenient, and easy-to-use mobile GIS and GPS field tools to collect, update, and maintain the GIS data repository. A uniform approach to using ArcGIS Online would benefit the City of Concord.
City of Concord’s Existing GIS Data and Database Conditions

City of Concord Current GIS Status
Data and Databases

- 49%
DIGITAL DATA ASSESSMENT

INTRODUCTION

GTG performed an analysis of the four key digital data layers (address points, parcels, street centerlines, and orthophotography) in regard to existing condition, layer health, and update responsibilities and recommendations. A detailed breakdown of these layers will be given, including their history and current status, as well as recommendations for future use with regards to the City of Concord’s GIS initiative. Issues related to base map dataset quality, content, completeness, and resolution must be thoughtfully analyzed, planned, and implemented. Fundamentally, these parameters encompass all functional GIS data layers (base and auxiliary), and specifically pertain to spatial accuracy, geometric accuracy, and attribution within these given layers.

EXISTING DIGITAL DATA LAYERS

Base Data Layers

GIS data within the local government environment can generally be categorized into two separate roles, base and auxiliary. Base map layers, both primary and secondary, are critical to the local government’s GIS enterprise, and will provide the foundation that most GIS functions and applications are built from. For local governments, such as the City of Concord, a base map typically is comprised of four primary base map layers:

<table>
<thead>
<tr>
<th>City of Concord Primary Base Layers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Address Points</td>
</tr>
<tr>
<td>2. Tax Assessment Parcels</td>
</tr>
<tr>
<td>3. Street Centerlines</td>
</tr>
<tr>
<td>4. Orthophotography</td>
</tr>
</tbody>
</table>

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,
and a variety of other applications that rely on these layers for reference and spatial analysis. It is crucial for these base layers to be spatially accurate, completely attributed, and consisting of all necessary fields, as auxiliary data layers will need to be overlaid upon these foundational base layers.

**Auxiliary Data Layers**

Auxiliary data layers serve important functions within local government GIS enterprises, but are often department-specific and related to a particular task as opposed to being incorporated citywide or interacted with on a day-to-day basis. When enacted, these layers are overlaid on base map layers to provide supplemental information, functions, and extensions. Auxiliary data layers for the City of Concord include:

- Bridges
- Bicycle Facilities
- Bus Routes
- Counties
- Neighborhoods
- School Zones
- Sidewalks
- Trails
- Street Lights
- Waterbodies

**GIS DIGITAL DATA ASSESSMENT**

The following table includes each of the key data layers for the City of Concord, how each layer should be created/maintained, who should be responsible for the update/creation of that layer, the existing condition of the layer, and how often it should be updated.
### Legend

| **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 Citywide enterprise GIS. Development of new recommended layers will be prioritized for each year of the Implementation Plan. |
| **Layer Status** | Layer state of existence defined as follows: |
| **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. |
| **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. |
| **Quarterly** | These layers are recommended to be updated or checked for updates on a Quarterly basis. |
| **Annually** | 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. These layers maybe updated daily/weekly. Many of these layers are high use layers. |
| **Every 2 to 4 Years** | These layers are recommended to be updated or checked for updates every 2 to 4 years. |
| **Every 10 years** | These layers are recommended to be updated or checked for updates on 10 year basis. |
| **Historical** | These layers are kept for historical purposes and should not be updated. |
| **Automated** | These layers are automatically updated. |
### Core Data Layers

<table>
<thead>
<tr>
<th>Layer</th>
<th>Creation Methodology</th>
<th>Recommended Update Division or Individual</th>
<th>Existing or Recommended?</th>
<th>Recommended Update Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parcels</td>
<td>Parcels were initially created by Contra Costa County. The GIS Division within IT maintain the parcels currently. Temporary ID’s are added to parcel data until the County assigns a permanent number.</td>
<td>GIS Staff within IT</td>
<td>Existing</td>
<td>Daily</td>
</tr>
<tr>
<td>Orthophotography</td>
<td>The City obtains aerial photography every 2 – 4 years as the budget allows.</td>
<td>Static Map</td>
<td>Existing</td>
<td>Every 2 To 4 Years</td>
</tr>
<tr>
<td>Street Centerlines</td>
<td>There are currently two versions of the street centerline data that are maintained. One version is used for maps and cartographic purposes and the other version is used within TriTech for CAD purposes.</td>
<td>GIS Staff within IT</td>
<td>Existing</td>
<td>Weekly</td>
</tr>
<tr>
<td>Address Points</td>
<td>Address points have been created based on parcel centroids. However, they are stacked for parcels with multi-tenant dwellings.</td>
<td>CED</td>
<td>Existing</td>
<td>Daily</td>
</tr>
</tbody>
</table>

### Auxiliary Data Layers

<table>
<thead>
<tr>
<th>Data Layer</th>
<th>Creation Methodology</th>
<th>Recommended Update Division or Individual</th>
<th>Existing or Recommended?</th>
<th>Recommended Update Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affordable Home Project</td>
<td>Digitized</td>
<td>CED</td>
<td>Recommended</td>
<td>As Needed</td>
</tr>
<tr>
<td>Applicant Locations</td>
<td>Extract from Database</td>
<td>Automated</td>
<td>Recommended</td>
<td>Automated</td>
</tr>
<tr>
<td>Arrests and Citations</td>
<td>Extract, cleanse and automatically map from RMS.</td>
<td>Automated</td>
<td>Existing but needs to be automated</td>
<td>Automated</td>
</tr>
<tr>
<td>Sand Bag Location</td>
<td>GPS collection in the field</td>
<td>Public Works</td>
<td>Recommended</td>
<td>Annually</td>
</tr>
<tr>
<td>Bike Lanes</td>
<td>Digitize on screen</td>
<td>Public Works</td>
<td>Recommended</td>
<td>Annually</td>
</tr>
<tr>
<td>Bike Racks</td>
<td>GPS collection in the field</td>
<td>Public Works</td>
<td>Recommended</td>
<td>Annually</td>
</tr>
<tr>
<td>Bridges</td>
<td>Digitize on screen</td>
<td>CED</td>
<td>Recommended</td>
<td>As Needed</td>
</tr>
<tr>
<td>Building Inspector Areas</td>
<td>Digitized</td>
<td>CED</td>
<td>Recommended</td>
<td>As Needed</td>
</tr>
<tr>
<td>Building Layout</td>
<td>Link to GIS</td>
<td>Public Works</td>
<td>Recommended</td>
<td>Quarterly</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-------------</td>
<td>--------------</td>
<td>-------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Buildings with Elevators</td>
<td>Digitized on screen</td>
<td>Various</td>
<td>Recommended</td>
<td>Annually</td>
</tr>
<tr>
<td>Business Licenses</td>
<td>Extracted from database and geocoded (HDL)</td>
<td>Automated</td>
<td>Recommended</td>
<td>Automated</td>
</tr>
<tr>
<td>Cabinets</td>
<td>Obtain from PG&amp;E</td>
<td>PG&amp;E</td>
<td>Recommended</td>
<td>Annually</td>
</tr>
<tr>
<td>Calls for Service</td>
<td>Extract, cleanse and automatically map from dispatch databases.</td>
<td>Automated</td>
<td>Recommended</td>
<td>Automated</td>
</tr>
<tr>
<td>Capital Improvement Projects</td>
<td>Digitize from base map data; aggregate layers as needed.</td>
<td>Various overseen by the GIS Staff in IT</td>
<td>Recommended</td>
<td>Automated</td>
</tr>
<tr>
<td>Catch Basins</td>
<td>GPS collection in the field</td>
<td>Public Works</td>
<td>Partial</td>
<td>Annually</td>
</tr>
<tr>
<td>CCTV Data</td>
<td>Tied by unique number to a GIS layer and viewable within applications</td>
<td>Police in conjunction with GIS Staff within IT</td>
<td>Recommended</td>
<td>Automated</td>
</tr>
<tr>
<td>City Owned Property</td>
<td>Extracted from Parcel Layer</td>
<td>GIS Staff in IT</td>
<td>Existing</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Collision Data</td>
<td>Extract from Crossroads Application</td>
<td>Automated</td>
<td>Recommended</td>
<td>Automated</td>
</tr>
<tr>
<td>Contours</td>
<td>Import from aerals</td>
<td>County GIS</td>
<td>Existing</td>
<td>Every 2 – 4 Years</td>
</tr>
<tr>
<td>Crime Data</td>
<td>Extract, cleanse and automatically map from RMS</td>
<td>Automated</td>
<td>Existing but needs to be automated</td>
<td>Automated</td>
</tr>
<tr>
<td>Curb Ramp Rehabilitation</td>
<td>Field inventory</td>
<td>CEDD</td>
<td>Recommended</td>
<td>Weekly</td>
</tr>
<tr>
<td>Curb Ramps</td>
<td>GPS collection in the field</td>
<td>Public Works</td>
<td>Recommended</td>
<td>Annually</td>
</tr>
<tr>
<td>Customer Requests</td>
<td>Process can be automated using Data Mining tools</td>
<td>Public Works</td>
<td>Recommended</td>
<td>Automated</td>
</tr>
<tr>
<td>Delinquent Payments</td>
<td>Extracted from database and geocoded</td>
<td>Automated</td>
<td>Recommended</td>
<td>Automated</td>
</tr>
<tr>
<td>Dialysis Centers</td>
<td>Digitized on screen</td>
<td>Various</td>
<td>Recommended</td>
<td>Annually</td>
</tr>
<tr>
<td>Dog Parks</td>
<td>Digitize on screen</td>
<td>Public Works</td>
<td>Recommended</td>
<td>As Needed</td>
</tr>
<tr>
<td>Drug free zones around schools and churches</td>
<td>Buffer appropriate properties.</td>
<td>Police in conjunction with GIS Staff within IT</td>
<td>Recommended</td>
<td>As Needed</td>
</tr>
<tr>
<td>Easements</td>
<td>Digitize from source documents</td>
<td>Public Works</td>
<td>Recommended</td>
<td>As Needed</td>
</tr>
<tr>
<td>Employee Locations</td>
<td>Extract from Existing Database</td>
<td>Automated</td>
<td>Recommended</td>
<td>Automated</td>
</tr>
<tr>
<td>Employee Residence Locations</td>
<td>Extracted from HR database – geographic dispersion of employees. Critical information post disaster</td>
<td>Automated</td>
<td>Recommended</td>
<td>Automated</td>
</tr>
<tr>
<td>Encroachment Permit</td>
<td>Digitize from records</td>
<td>GIS staff within IT</td>
<td>Recommended</td>
<td>Annually</td>
</tr>
<tr>
<td>Evacuation Routes</td>
<td>Digitized on screen</td>
<td>Police</td>
<td>Recommended</td>
<td>Annually</td>
</tr>
<tr>
<td>Category</td>
<td>Description</td>
<td>Responsible Party</td>
<td>Frequency</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------------</td>
<td>------------------</td>
<td></td>
</tr>
<tr>
<td>Evacuation/Shelter Locations</td>
<td>Digitized on screen</td>
<td>Police</td>
<td>Annually</td>
<td></td>
</tr>
<tr>
<td>Existing Businesses</td>
<td>Extracted from Accela</td>
<td>Automated</td>
<td>Recommended</td>
<td></td>
</tr>
<tr>
<td>Flood Plain Mapping</td>
<td>Via FEMA shape file</td>
<td>Public Works</td>
<td>Existing As Needed</td>
<td></td>
</tr>
<tr>
<td>Flood Zones</td>
<td>Acquire from FEMA</td>
<td>GIS staff within IT</td>
<td>Existing As Needed</td>
<td></td>
</tr>
<tr>
<td>Future Land Use</td>
<td>Created from parcels and aerial photography</td>
<td>CEDD</td>
<td>Recommended</td>
<td></td>
</tr>
<tr>
<td>Hazardous Materials</td>
<td>MSDS Sheets Scanned and Linked to Site</td>
<td>GIS staff within IT</td>
<td>Recommended</td>
<td></td>
</tr>
<tr>
<td>Historical Aerial Photography</td>
<td>Aerial Flyovers</td>
<td>GIS staff within IT</td>
<td>Partial As Needed</td>
<td></td>
</tr>
<tr>
<td>Homeless and Mentally Ill Individuals and Encampments</td>
<td>Tracked in a database then geo-enabled</td>
<td>Automated</td>
<td>Recommended</td>
<td></td>
</tr>
<tr>
<td>Hotels</td>
<td>Digitized</td>
<td>CEDD</td>
<td>Recommended</td>
<td></td>
</tr>
<tr>
<td>Infrastructure Layers</td>
<td>Digitized and GPS</td>
<td>Public Works</td>
<td>Partial Weekly</td>
<td></td>
</tr>
<tr>
<td>Inspection Locations</td>
<td>Geoenable from database</td>
<td>Public Works</td>
<td>Recommended</td>
<td></td>
</tr>
<tr>
<td>Irrigation Heads and Valves</td>
<td>GPS collection in the field</td>
<td>Public Works</td>
<td>Recommended</td>
<td></td>
</tr>
<tr>
<td>Land Use</td>
<td>Digitized on screen/Extract from Accela</td>
<td>CED</td>
<td>Recommended</td>
<td></td>
</tr>
<tr>
<td>Liquor Licenses / Bars</td>
<td>Geocoded</td>
<td>State of California and Business License Data</td>
<td>Recommended Automated</td>
<td></td>
</tr>
<tr>
<td>Moratorium Streets</td>
<td>Digitize on screen</td>
<td>CEDD</td>
<td>Recommended</td>
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<td>Neighborhood Watch Districts</td>
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<td>Police Department and GIS Staff within IT</td>
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<td>Offenders on Parole</td>
<td>Extract, cleanse and automatically map from State and/or County Data.</td>
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<td>Recommended</td>
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<td>Open Spaces</td>
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<tr>
<td>Park Assets</td>
<td>Digitize From Source Documents then augment with GPS collection in the field</td>
<td>Public Works</td>
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<td>Recommended</td>
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<td>Parking Lots</td>
<td>Digitize on screen</td>
<td>Public Works</td>
<td>Recommended</td>
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<tr>
<td>Parking Violations</td>
<td>Extract, cleanse and automatically map from RMS</td>
<td>Automated</td>
<td>Recommended</td>
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**GIS STRATEGIC IMPLEMENTATION PLAN | CONCEPTUAL SYSTEM DESIGN | 244**
<table>
<thead>
<tr>
<th>Category</th>
<th>Activity Description</th>
<th>Responsible Agency</th>
<th>Frequency</th>
</tr>
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<tbody>
<tr>
<td>Parks</td>
<td>Extract, cleanse and geocode from database</td>
<td>Parks &amp; Recreation</td>
<td>As Needed</td>
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<tr>
<td>Pavement</td>
<td>Digitize on screen</td>
<td>Public Works</td>
<td>Annually</td>
</tr>
<tr>
<td>Pavement Markings</td>
<td>GPS and/or Digitize on screen</td>
<td>Public Works</td>
<td>Annually</td>
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<tr>
<td>Pavement Rehabilitation</td>
<td>Digitize on screen/Field inventory</td>
<td>CEDD</td>
<td>Quarterly</td>
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<td>Permits</td>
<td>Extracted from Accela</td>
<td>Automated</td>
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<td>PG&amp;E Power Poles</td>
<td>Obtain from PG&amp;E</td>
<td>PG&amp;E</td>
<td>Annually</td>
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<td>Policing Beats and Response Zones</td>
<td>Digitize on screen in conjunction with GIS staff within IT</td>
<td>Police in conjunction with GIS staff within IT</td>
<td>As Needed</td>
</tr>
<tr>
<td>Pre Plan Data (Buildings)</td>
<td>Scanned and Visio</td>
<td>GIS Staff within IT</td>
<td>Quarterly</td>
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<td>Private Development Projects</td>
<td>Digitize or geocode</td>
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<td>Annually</td>
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<td>Public Utilities</td>
<td>Field collection, digitization, and as-buils</td>
<td>Public Works</td>
<td>Weekly</td>
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<td>Rights-of-Way</td>
<td>Site plans and other documents</td>
<td>Public Works &amp; CEDD</td>
<td>Quarterly</td>
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<tr>
<td>Schools</td>
<td>Digitize from base map data; GPS field work</td>
<td>GIS staff within IT</td>
<td>As Needed</td>
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<tr>
<td>Service Requests</td>
<td>Geoenable from CRM</td>
<td>Public Works</td>
<td>Automated</td>
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<tr>
<td>Sewer and Storm Plans Linked to Centerlines</td>
<td>Digital Linking</td>
<td>GIS staff within IT</td>
<td>Annually</td>
</tr>
<tr>
<td>Sewer Base Map</td>
<td>Digitize on screen; existing CAD data; GPS field work</td>
<td>Public Works</td>
<td>Weekly</td>
</tr>
<tr>
<td>Sewer Rehabilitation</td>
<td>Field inventory</td>
<td>CEDD</td>
<td>Quarterly</td>
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<td>Sex Offenders</td>
<td>From State</td>
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<td>Automated</td>
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<tr>
<td>Sidewalks</td>
<td>GPS and digitizing from aerials</td>
<td>Public Works</td>
<td>Annually</td>
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<tr>
<td>Signs</td>
<td>Digitize on screen/Field inventory</td>
<td>Public Works</td>
<td>Quarterly</td>
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<td>Social Media</td>
<td>Automatically linked via software</td>
<td>Automated</td>
<td>Automated</td>
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<tr>
<td>Special Needs Residents</td>
<td>Extract and map from CAD/RMS data</td>
<td>Automated</td>
<td>Automated</td>
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<tr>
<td>Storm Base Map</td>
<td>Digitize on screen; existing CAD data; GPS field work</td>
<td>Public Works</td>
<td>Weekly</td>
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<tr>
<td>Storm Water System</td>
<td>Digitize From As-Buils and other Source Documents</td>
<td>Public Works</td>
<td>Weekly</td>
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<tr>
<td>Stormwater Inspections</td>
<td>Field inventory</td>
<td>CEDD</td>
<td>Weekly</td>
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<tr>
<td>Street Light and Traffic Signals</td>
<td>GPS collection in the field</td>
<td>Public Works</td>
<td>Annually</td>
</tr>
</tbody>
</table>
The following are the findings and recommendations from the Digital Data Assessment.

**Parcels**

For city governments, the acquisition and integration of an accurate and up-to-date parcel base map is arguably the critical centerpiece of a GIS effort. Tax parcels represent a core component layer for modeling land use within the City 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 city annexations, providing checks-and-balances of appraisal entity records
Provides a strong foundation for control of future growth, land development, and population forecasting

Fosters closer cooperation with other local governmental entities

Among the more tangible and practical benefits emerging from the parcel base map layer:

- City mailing lists & affected property owner notifications
- Improved Police response and emergency evacuation
- Readily available property ownership information
- Property valuations and City service expansion/prioritization
- Floodway management & building code enforcement
- Creation of city map books and atlases

Parcels for the City of Concord are directly maintained by the City’s GIS staff after a final transfer from Contra Costa County. This procedure was put in place due to the poor geometry, upkeep, and update times provided when Contra Costa County were custodians. Despite the shift in responsibility, the staff have admitted that the data could be much better than the current state of affairs, including receiving ownership data from the County and making it available to enterprise systems such as Accela.

Although the county does not directly maintain the parcel geometry or attribution at this time, permanent pins for parcels are still generated from Contra Costa County. This process, accompanied by the City of Concord's temporary addition of temporary pins, convolutes the pin assignment responsibilities and workflow. This analysis, however, shows that the City of Concord has made distinct improvements from the final source data received from Contra Costa County several years ago.

The implementation of Esri’s parcel fabric would provide a boost to maintaining and updating the City of Concord’s parcel data. This new method for parcel management helps local governments by replacing manual editing of cadastral information with a geospatially integrated data model. The actual parcel fabric, a composite group layer, manages the spatial and topological relationship inherent in cadastral data. This data model conforms to a set of rules that continually refines existing parcel data and makes land information easier to edit, track, and share throughout the organization and with the public.
Orthophotography

The City of Concord currently has access to accurate, high resolution orthophotography. The latest aerial photography was obtained in 2014, with a resolution of 3 inches.

The City needs to continue acquiring high-resolution color orthophotography of the local area. Optimally, the City will be able to acquire this data every two years as funding permits. Obtaining the data from local counties or through shared purchases would lessen the financial burden of obtaining the aerial photography. It is recommended that the City continue to utilize orthophotography to derive and generate new GIS data layers through heads-up digitizing. Many features on the earth’s surface can be detected from the photography. This allows GIS staff to create and augment data layers in lieu of field work. In addition, it is recommended that the City perform change detection analysis, manually, using chronologically sequential digital orthophotographs. Change detection analysis can be used to assess and evaluate physical changes with regard to physical geography and land use.
Street Centerlines

The centerline data should also be thoroughly reviewed for proper connectivity and segmentation. Connectivity and proper segmentation is essential to support routing applications especially those in Public Safety. There are currently two versions of the street centerlines that are being maintained. One is used within TriTech at the Police Department and the other is used for cartographic purposes. Each version has to be updated when changes are needed, causing a duplication of effort. It is recommended that one street centerline file be maintained by the City to serve the needs of all apps and maps. As a note, the City maintains the street centerline data for the City of Clayton in addition to their own data. The street centerline data is populated with the appropriate attribution, such as, street name, suffix, address range, speed limit, and whether it is public or private. There are some instances, though, where the street centerline segments should be merged so that it flows intersection to intersection.

One area where street centerline accuracy could be improved (segmentation)
Address Points

The City currently possesses an address point layer but it is not yet fully built out. City of Concord staff have done a thorough job with address points and estimates are that the existing layer is fairly accurate spatially. It is recommended that this data be used as a starting point to complete a 100% accurate layer of all addresses in the City. Accurate address layers are of the utmost importance. An organization is often faced with the challenge of accurately mapping the location of work orders, work requests, building permits, and outage calls throughout the city. If an accurate address point layer does not exist, unfavorable results will occur when trying to map building permits (Accela), work requests (Accela), or incidents (TriTech) using an address. Lack of an accurate address point layer will often result in unmatched records. The City of Concord will then need to invest additional time and resources attempting to determine the location of the locations manually.

Generally, attribution within the address point layer were thorough, however records were found to have no address or attribution tied to them. These should be rectified and updated, or evaluated to see if they should be removed from the address layer. Efficiency and lack-of-waste are critical for maintaining and working with a functional addressing database. A full evaluation of records, fields, and attribution within the address point layer is recommended, and would go a long way in producing a complete layer.

Example of an area where addresses are stacked and should be placed on the building at their actual location
Spatial Accuracy
The majority of layers analyzed throughout the QA/QC process carried out for this data assessment were supported primarily by high levels of spatial accuracy. The importance of this cannot be understated, as the effectiveness and resulting accuracy of all geographic processes and analyses is rooted in the initial spatial accuracy of these layers. As referenced in the Auxiliary Data Layers matrix, there are certain layers that can be improved upon in this category. Heads-up digitizing, GPS data collection and verification, and receiving updated data from external sources are potential methods for spatially rectifying layers that have been tabbed as lacking in this department.

ArcGIS Data Reviewer – Geometric Accuracy
Geometric accuracy is critical when working with GIS layers to ensure vector layers (points, lines, and polygons) are error-free, efficient, and accurately portray the intended real-world phenomenon. The ArcGIS Data Reviewer can be used to gauge the current status of feature geometries, topologies, and relationships between the two. Through the provision of numerous data checks specific to vector data type, and also the ability to batch check layers, this ArcGIS extension supplies the means to analyze current layer status and monitor layer health and integrity moving forward.

The nature of potential errors is variable between feature classes, and certainly between data types (i.e. points, lines, polygons, etc.), but are typically characterized by general invalid geometries, the presence of dangle nodes, and duplicate vertices. To maintain efficient workflows, data integrity, and the inclusion of geometric networks it is highly suggested that these type of incidents be remedied, and the ArcGIS Data Reviewer delivers in this regard as well.

After the ArcGIS Data Reviewer identifies instances of geometric error, these incidents are then written to layer-specific reviewer tables for review and correction. These customizable and interactive tables give the framework for breaking down the error(s) by severity, check type, status of review, and last editor. In this scenario checks are performed manually through this extension, then updates are made and tracked through the reviewer tables. However, the ArcGIS Data Reviewer also has options for configuring routine automated checks for data layers that are prone to change and frequented by editors.
Attribution
Attribution within GIS data layers is crucial to providing supplemental information regarding layer features. This data is often used for querying, analysis, and maintaining assets and workflows. All necessary fields within functional data layers should be completely populated to avoid misinterpreted data, skewed queries, and inefficiencies when working with the data. During this digital data assessment, the attribute completeness of the key data layers was reviewed manually to provide an accurate view of the current state. The first step to correcting attribute incompleteness is to identify necessary, critical fields for each layer, as several layers contain unused fields or duplications. Certainly the accuracy should be improved upon with attribute rectification tagged as a priority moving forward.

Database Design
Proper design of the enterprise GIS database is critical to effectively support organization data needs, applications, data maintenance and update, data security, etc. The City currently maintains GIS data in the SDE environment and some of the data layers are stored in feature datasets which allows for better data organization and allows for the creation of topology and geometric networks. There are still a large number of layers being stored as standalone shapefiles or geodatabases on the “S Drive.”

It is recommended that all key standalone feature classes be placed in feature datasets within the central database. 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.
The feature datasets recommended for use in the MDL are those provided by an Esri database design named the Local Government Information Model (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. It would also be possible to classify a bicycle trail in either the ‘Facilities Streets’ dataset or the ‘Administrative Area’ 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.

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 citizens 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
- Citizen 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
Esri’s Local Government Information Model

ArcGIS for Local Government (AG4LG) is the name of an initiative and resource that allows cities, counties and other local agencies – of any size – 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. Esri has evolved its corporate strategy to embrace both AG4LG and ArcGIS OnLine (AGOL). Therefore, there will be a continued trend towards adoption within local government and an expanding base of available applications and inherent functions.
PHASE II
CONCEPTUAL SYSTEM DESIGN
PROCEDURES & WORKFLOWS
The following section summarizes the existing procedures and workflow conditions and departmental comments.

<table>
<thead>
<tr>
<th>City of Concord Procedures and Workflow Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need better solutions</td>
</tr>
<tr>
<td>Need data standards - Metadata Standards</td>
</tr>
<tr>
<td>Need to eliminate data duplication and ensure layers are made available</td>
</tr>
<tr>
<td>Integrate GIS with all enterprise systems – one authoritative data source</td>
</tr>
<tr>
<td>Expand GIS use amongst all departments</td>
</tr>
<tr>
<td>Opportunities for increasing GIS usage by department</td>
</tr>
<tr>
<td>Lacking in GIS centric SOP’s and data maintenance procedures</td>
</tr>
<tr>
<td>Some of the existing enterprise solutions have GIS Integration, but all systems should be integrated with the central GIS data repository</td>
</tr>
</tbody>
</table>

The following recommendations are 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 Concord well into the future:

**PROCEDURES AND WORKFLOW**

**THE VISION**

Promote the interoperability of GIS with the City’s existing business systems.

**THE GOAL**

Integrate GIS functionality with existing database systems, business processes, and workflow.

**Task #1: INTEGRATION AND INTEROPERABILITY** – Continue to integrate GIS with the City’s existing business systems.
Task #2: IMPROVE DEPARTMENTAL USE OF GIS SOFTWARE – The City should use the AGOL suite of products, including Intranet, internet, dashboard, collector application, and all free online Esri solutions to quickly and effectively improve departmental use of GIS software.

Section A.

<table>
<thead>
<tr>
<th>City Management</th>
<th>Communication and Economic Development</th>
<th>Finance</th>
<th>IT Departments</th>
<th>Naval Weapons Re-use</th>
<th>Parks and Recreation</th>
<th>Police</th>
<th>Public Works</th>
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<tr>
<td>Intranet</td>
<td>Intranet</td>
<td>AGOL</td>
<td>Entire Esri Suite</td>
<td>Parcel Fabric</td>
<td>AGOL</td>
<td>Desktop</td>
<td>Intranet</td>
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<td>Park Finder</td>
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<td>Intranet</td>
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<td>Internet</td>
<td>Story Maps</td>
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</tbody>
</table>

Task #3: IMPROVE DEPARTMENTAL ACCESS TO CRITICAL DATA – The City should use AGOL Internet and Portal for ArcGIS Intranet solutions to quickly and effectively improve departmental use of GIS software.

Task #4: MOBILE SOLUTIONS – Integrate ArcGIS Online Mobile into departmental workflow procedures.

Task #5: ELIMINATE DATA DUPLICATION – Eliminate data duplication between systems.

Task #6: DEFINE META DATA STANDARDS – Define the City’s Meta data requirements and establish and enforce Standard Operating Procedures (SOP) for developing metadata standards. See Data and Databases Section.

Task #7: GIS STANDARD OPERATING PROCEDURES (SOP) – 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, Metadata Standards, Standard Naming Conventions, and GIS Business Integration. See Governance Section.

**Task #8: GIS TECHNICAL SUPPORT (TICKETING AND SERVICE DESK)** – Enforce the use of the IT’s ticketing procedure for all GIS activity within the City.

**Task #9: CUSTODIANSHIP OF DATA LAYERS** – Detail departmental custodianship of all data layers

City of Concord’s Existing GIS Procedures and Workflow Conditions
PHASE II
CONCEPTUAL
SYSTEM DESIGN
GIS SOFTWARE
CONCEPTUAL SYSTEM DESIGN
GIS SOFTWARE

CITY OF CONCORD
CALIFORNIA
GIS Strategic Implementation Plan
The following section summarizes the existing GIS software conditions and departmental comments. This section also includes the Existing and Future GIS Software User Matrix.

<table>
<thead>
<tr>
<th>City of Concord Software Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>No ELA (restricted)</td>
</tr>
<tr>
<td>Lack of education, training, knowledge transfer to encourage GIS use</td>
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<tr>
<td>No public access</td>
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<tr>
<td>No AGOL initiative</td>
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<tr>
<td>No simple story maps</td>
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<tr>
<td>Lack of Mobile GIS</td>
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<tr>
<td>Lack of automated database extracts</td>
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</tbody>
</table>

GIS SOFTWARE

THE VISION
Make GIS Software Accessible throughout the Organization, and to the Public and other interested parties

THE GOAL
Deploy a full suite of Esri GIS software solutions across the enterprise – Desktop, Internet, Intranet, and Mobile.

Task #1: EFFECTIVE USE OF THE EXISTING ESRI LICENSING – The City should use the existing Esri license agreement to effectively deploy the right tools to the right people.

Task #2: INTRANET SOLUTION – Deploy a state of the art Intranet using the existing Esri licensing.

Task #3: ARCGIS ONLINE (AGOL) SOFTWARE INITIATIVE – Plan, design, and deploy AGOL, including the setup, configuration, and effective use of the tools and applications available.

Task #5: INTERNET PUBLIC ACCESS PORTAL – Use the AGOL solution to deploy a state of the art solution for the public.

Task #6: CROWDSOURCING – Continue to engage and solicit input from citizens by promoting crowdsourcing applications. The City currently uses PublicStuff paired with Accela for crowdsourcing. Citizens can report potholes, graffiti, garbage, signage issues, and more.

Task #7: ELECTED OFFICIALS – Use GIS as a tool to provide timely and accurate data to the elected officials.

Task #8: MODELING EXTENSIONS – The City should take advantage of Esri’s modeling extensions for the desktop.

Task #9: MOBILE SOFTWARE SOLUTIONS – Plan, design, and deploy Esri’s ArcGIS Online as the mobile software solution for the City of Concord.

Task #10: FREE ESRI APPLICATION ONLINE – After the migration of the City’s GIS to the LGIM the City should take advantage of all applications available online.
City of Concord’s Existing GIS Software
Table 1: Esri software solutions that should be used by each department in the future.

<table>
<thead>
<tr>
<th>Esri Software Solutions Future</th>
<th>City Management</th>
<th>Community/Econ Development</th>
<th>Finance</th>
<th>Human Resources</th>
<th>IT</th>
<th>Park &amp; Recreation</th>
<th>Police</th>
<th>Public Works</th>
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<td>Desktop GIS</td>
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<tr>
<td>Global Positioning System (GPS)</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Automated Vehicle Location (AVL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>ArcGIS Online</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Intranet Map Viewer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Internet Map Viewer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Mobile Field Data Collector</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Operations Dashboard</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Story Maps</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Free AGOL Applications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic Database Integration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Third-party Esri Solution</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Third-party Software</td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2: Existing and Future Departmental Software Users

<table>
<thead>
<tr>
<th>Department</th>
<th>Desktop</th>
<th>3rd Party GIS</th>
<th>Enterprise Integration</th>
<th>GIS Users</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Basic</td>
<td>Standard</td>
<td>Advanced</td>
<td>Extensions (Modeling)</td>
</tr>
<tr>
<td>City Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community and Economic Development</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Finance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human Resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information Technology</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Parks and Recreation</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Police</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Public Works</td>
<td>1</td>
<td>1</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
<td>133</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Accela Automation & Public Stuff
- TriTech
- Facility Dude
- Public Stuff
- Concord Prospector
- iTrac
- StreetSaver
- West Coast Arborist
- HDL
- Questica
PHASE II
CONCEPTUAL
SYSTEM DESIGN
TRAINING & EDUCATION
The following section summarizes the existing training conditions and departmental comments. This section also includes a comprehensive and detailed Training Plan and Model.

<table>
<thead>
<tr>
<th>City of Concord Training and Education Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of GIS knowledge</td>
</tr>
<tr>
<td>Lack of training</td>
</tr>
<tr>
<td>Most people have not received adequate training</td>
</tr>
</tbody>
</table>

The following recommendations are 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 Concord well into the future.

**GIS TRAINING AND EDUCATION**

**THE VISION**

Train, Educate, and Promote Knowledge Transfer for all Concord Staff

**THE GOAL**

Improve the GIS knowledge base within each City department. Develop a training, education, and knowledge transfer plan. Encourage the effective utilization of GIS technology.

**Task #1: GOVERNANCE MODEL** – Implement a centralized hybrid governance model that promotes ongoing training and education.

**Task #2: SOFTWARE TRAINING** – Provide software GIS training and educational opportunities to all City staff on a regular basis. Utilize Esri’s Online Education and Training services through the existing
licensing agreement. Provide formal classroom training for identified departmental staff – including Desktop, Intranet, Internet, Mobile, GPS, ArcGIS Online and Story Maps, and Extensions.

**Task #3: KNOWLEDGE TRANSFER** – Establish a GIS user group network within the organization to help facilitate growth. Establish quarterly GIS meetings.

**Task #4: FORMAL ON-GOING TRAINING PLAN** – Implement a formal sustainable GIS Training Plan.

**Task #5: MOBILE TRAINING** – As part of the formal training plan, develop a strategy for the effective use and training of mobile field devices.

**Task #6: CONFERENCES** – Attend workshops and pre-conference seminars at the Esri International Users Conference and regional Esri California Conferences.

**Task #7: ONLINE SEMINARS AND WORKSHOPS** – Use all available online training, education, and knowledge transfer workshops.

**Task #8: SEMINARS AND WORKSHOPS** – The GIS Team will offer seminars and workshops tailored to specific departmental applications of GIS.

**Task #9: DEPARTMENTAL SPECIFIC TRAINING** – Promote departmental specific GIS training.

Encourage and promote targeted GIS training, including:

1. General Executive Management Workshop
2. Public Safety GIS Workshop
3. Utilities Workshop
4. The ROI of GIS in City Government
City of Concord’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 the majority of their GIS needs met by Internet and/or Intranet browser based map applications.

The GIS Manager (to be filled) will play a prominent role in the training model. In addition to enhancing their own technical skills, it is recommended that the GIS Manager is proficient in GIS training to a degree that they are able to carry on training with other City employees. Discussed later in this section, the GIS Manager should use a “train the trainer” model to propagate their GIS skills to other City GIS users.

ArcGIS Training Recommendations

Numerous training courses are available via Esri’s Virtual Campus free of charge. Esri recently made all virtual campus courses free to the public. This should be taken advantage of by City of Concord staff.

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 GIS Manager 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 4 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 12 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 in an effort to achieve cost savings. It is expected that 110 staff will need to take these courses.

**City of Concord 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 low-cost and 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: [https://www.esri.com/training/instructor-led/locations/](https://www.esri.com/training/instructor-led/locations/). 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.
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 GIS Manager 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 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 GIS Manager be considered a trainer (non-Esri certified) for the City.

The GIS Team should take the Esri courses pertinent to the classes for which he/she 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 Concord’s GIS users. Therefore, the GIS Team 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.

<table>
<thead>
<tr>
<th>City of Concord Departments</th>
<th>Tier 1 Flagship Users</th>
<th>Tier 2 Custodian Users</th>
<th>Tier 3 Analytical Users</th>
<th>Tier 4 Browser Users</th>
<th>Total Projected GIS Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>City Management</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Community and Economic Development</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>20</td>
<td>27</td>
</tr>
<tr>
<td>Finance</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Human Resources</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>IT</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Parks and Recreation</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Police</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>50</td>
<td>51</td>
</tr>
<tr>
<td>Public Works</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2</strong></td>
<td><strong>4</strong></td>
<td><strong>10</strong></td>
<td><strong>117</strong></td>
<td><strong>126</strong></td>
</tr>
</tbody>
</table>
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.

![Tier Levels Pyramid](image)

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.

<table>
<thead>
<tr>
<th>Class</th>
<th>Site</th>
<th>Trainer</th>
<th>Days</th>
<th>Year of Training – Based on this three year plan</th>
<th>Recommended Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>ArcGIS I: Introduction to GIS (10.x)</td>
<td>On</td>
<td>Esri</td>
<td>2</td>
<td>1</td>
<td>Tier Two GIS Users</td>
</tr>
<tr>
<td>Class</td>
<td>Site</td>
<td>Trainer</td>
<td>Days</td>
<td>Year of Training – Based on this three year plan</td>
<td>Recommended Participants</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>------</td>
<td>---------</td>
<td>------</td>
<td>------------------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>ArcGIS II: Essential Workflows</td>
<td>On</td>
<td>Esri Authorized Trainer</td>
<td>3</td>
<td>1,2</td>
<td>Tier One and Two GIS Users</td>
</tr>
<tr>
<td>ArcGIS III: Performing Analysis (10.x)</td>
<td>On</td>
<td>Esri Authorized Trainer</td>
<td>2</td>
<td>1,2</td>
<td>Tier One and select Tier Two GIS Users</td>
</tr>
<tr>
<td>Building Geodatabases</td>
<td>Off</td>
<td>Esri</td>
<td>3</td>
<td>1</td>
<td>Tier One and Two GIS Users</td>
</tr>
<tr>
<td>Creating and Maintaining Metadata Using ArcGIS Desktop</td>
<td>On</td>
<td>Web Course</td>
<td>3 Modules Self-Paced</td>
<td>1,2</td>
<td>Tier One and Two GIS Users</td>
</tr>
<tr>
<td>Configuring and Managing the Multiuser Geodatabase</td>
<td>Off</td>
<td>Esri</td>
<td>3</td>
<td>1</td>
<td>Tier One and select Tier Two GIS Users</td>
</tr>
<tr>
<td>System Architecture Design Strategies</td>
<td>Off</td>
<td>Esri</td>
<td>3</td>
<td>1</td>
<td>GIS Manager</td>
</tr>
<tr>
<td>Introduction to ArcGIS Server</td>
<td>Off</td>
<td>Esri</td>
<td>2</td>
<td>1</td>
<td>GIS Manager</td>
</tr>
<tr>
<td>ArcGIS for Server: Site Configuration and Administration</td>
<td>Off</td>
<td>Esri</td>
<td>3</td>
<td>1,2</td>
<td>GIS Manager</td>
</tr>
<tr>
<td>ArcGIS for Server Sharing GIS Content on the Web</td>
<td>Off</td>
<td>Esri</td>
<td>2</td>
<td>1</td>
<td>GIS Manager</td>
</tr>
<tr>
<td>Tier 4 Applications</td>
<td>On</td>
<td>Internal</td>
<td>1</td>
<td>1,2,3</td>
<td>Various</td>
</tr>
</tbody>
</table>
GIS TRAINING OFFERINGS PER PLAN YEAR

The following table lists the recommended training class and recommended number of classes per plan year.

<table>
<thead>
<tr>
<th>Class</th>
<th>FY1</th>
<th>FY2</th>
<th>FY3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ArcGIS Training Classes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ArcGIS I: Introduction to GIS (10.x)</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>ArcGIS II: Essential Workflows</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>ArcGIS III: Performing Analysis (10.x)</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Building Geodatabases</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Creating and Maintaining Metadata Using ArcGIS</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Configuring and Managing the Multiuser Geodatabase</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>System Architecture Design Strategies</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Introduction to ArcGIS Server</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ArcGIS for Server: Site Configuration and Administration</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>ArcGIS for Server Sharing GIS Content on the Web</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Tier 4 Applications</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tier 4 Applications</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

ADDITIONAL TRAINING

Following are additional training courses which would be of benefit to continued GIS growth and professional development to the City’s GIS users.
<table>
<thead>
<tr>
<th>Class</th>
<th>Site</th>
<th>Trainer</th>
<th>Days</th>
<th>Years of Training – based on this three year plan</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intro to Python Scripting</td>
<td>On</td>
<td>Esri</td>
<td>3</td>
<td>1</td>
<td>Various</td>
</tr>
<tr>
<td>Introduction to Geoprocessing Scripts Using Python</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implementing Versioned Workflows in a Multiuser Geodatabase (10.x)</td>
<td>Off</td>
<td>Esri</td>
<td>3</td>
<td>1</td>
<td>Various</td>
</tr>
<tr>
<td>ArcGIS API for JavaScript</td>
<td>On</td>
<td>Esri</td>
<td>7 Modules</td>
<td>1</td>
<td>Various</td>
</tr>
<tr>
<td>Sharing GIS Content Using an ArcGIS Online Subscription</td>
<td>Off</td>
<td>Esri</td>
<td>1 Module</td>
<td>1</td>
<td>Various</td>
</tr>
<tr>
<td>Creating a Common Operational Picture with ArcGIS management (EOC)</td>
<td>Off</td>
<td>Esri and Internal</td>
<td>Training Seminar</td>
<td>1</td>
<td>Various</td>
</tr>
<tr>
<td>GIS for Managers</td>
<td>Off</td>
<td>Internal</td>
<td>Training Seminar</td>
<td>1</td>
<td>Various</td>
</tr>
</tbody>
</table>

The following table lists all of the recommended training courses along with user tier and prerequisites. Comments are provided that 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.

<table>
<thead>
<tr>
<th>Class</th>
<th>GIS Manager</th>
<th>Tier 1</th>
<th>Tier 2</th>
<th>Tier 3</th>
<th>Tier 4</th>
<th>Suggested Prerequisites</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>ArcGIS I: Introduction to GIS</td>
<td></td>
<td>✔</td>
<td></td>
<td>✔</td>
<td></td>
<td>None</td>
<td>Basic level ArcGIS course teaching how to create maps, analyze data, and how to use various tools.</td>
</tr>
<tr>
<td>ArcGIS II: Essential Workflows</td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td>✔</td>
<td>ArcGIS I: Introduction to GIS</td>
<td>Builds on content learned in ArcGIS I and adds training on how to author, share, and use geographic information in ArcGIS.</td>
</tr>
<tr>
<td>Class</td>
<td>Tier 1</td>
<td>Tier 2</td>
<td>Tier 3</td>
<td>Tier 4</td>
<td>Suggested Prerequisites</td>
<td>Comments</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>ArcGIS III: Performing Analysis</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td>None</td>
<td>Building on ArcGIS I &amp; II, learn how to efficiently solve spatial problems using various ArcGIS tools and vector, raster, and temporal data.</td>
<td></td>
</tr>
<tr>
<td>Building Geodatabases</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td></td>
<td>ArcGIS I: Introduction to GIS</td>
<td>Learn how to build geodatabases, add data, and model real world relationships.</td>
<td></td>
</tr>
<tr>
<td>Creating and Maintaining Metadata Using ArcGIS</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td></td>
<td>ArcGIS I: Introduction to GIS</td>
<td>Learn how to properly create and maintain metadata.</td>
<td></td>
</tr>
<tr>
<td>Configuring and Managing the Multiuser Geodatabase</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td>ArcGIS II: Essential Workflows</td>
<td>Course prepares you to successfully deploy a multiuser geodatabase to manage critical geographic assets.</td>
<td></td>
</tr>
<tr>
<td>System Architecture Design Strategies</td>
<td></td>
<td></td>
<td></td>
<td>✔️</td>
<td>Review: <a href="http://www.esri.com/systemdesign">www.esri.com/systemdesign</a></td>
<td>Covers GIS system architecture design strategies. Learn how to plan and select the right system architecture for your organization.</td>
<td></td>
</tr>
<tr>
<td>Introduction to ArcGIS Server</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td>ArcGIS II: Essential Workflows</td>
<td>Obtain skills to share GIS content on the web or across the enterprise.</td>
<td></td>
</tr>
<tr>
<td>ArcGIS for Server: Site Configuration and Administration</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td>Introduction to ArcGIS Server</td>
<td>Learn how to install, configure, and manage an ArcGIS for Server system.</td>
<td></td>
</tr>
<tr>
<td>ArcGIS for Server: Sharing GIS Content on the Web</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td>Introduction to ArcGIS Server</td>
<td>Learn how to publish professional map services that will provide spatial data to colleagues and non-GIS audiences.</td>
<td></td>
</tr>
<tr>
<td>Tier 4 Applications</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>None</td>
<td>Learn the basic capabilities and tools of the intranet/Internet/mobile applications.</td>
<td></td>
</tr>
</tbody>
</table>
The following are the classes recommended for the City of Concord 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 Concord Trainer, On-site or Consultant

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**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 Concord 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 Concord 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 Concord 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
GIS Manager

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
GIS Manager

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
Esri, Off-site

Introduction to ArcGIS Server

Recommended Attendees
GIS Manager

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
Esri, Off-site

ArcGIS for Server: Site Configuration and Administration

Recommended Attendees
GIS Manager

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

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**ArcGIS for Server Sharing GIS Content on the Web**

**Recommended Attendees**
GIS Manager

**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 & 4

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 GIS Manager and/or selected consultants. The cost of all Tier 4 applications includes training for selected personnel. Enterprise-wide training of Tier 4 applications can be conducted by GIS Analysts or other technical staff person.

Tier 4 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. GIS staff should pursue the acquisition of their GISP from the GIS Certification Institute (https://www.gisci.org/) as well as Esri specific certifications (https://www.esri.com/training/certification/).

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.urisa.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 Concord should budget every year for conference attendance. The International Esri User Conference is the premier GIS learning experience and should be attended if at all possible.

Important conferences that should be attended by City of Concord staff (at the GIS Manager’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:

<table>
<thead>
<tr>
<th>New Users</th>
<th>Experienced Users</th>
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<tbody>
<tr>
<td>User Group Members</td>
<td>Supervisors</td>
</tr>
<tr>
<td>Programmers</td>
<td>Specialists</td>
</tr>
<tr>
<td>Analysts</td>
<td>Technicians</td>
</tr>
<tr>
<td>Local, Regional, National, and International Committee Members</td>
<td>Management Information Services and Industry Solutions Supervisors</td>
</tr>
<tr>
<td>Project Coordinators</td>
<td>Department Heads</td>
</tr>
<tr>
<td>Division Chiefs</td>
<td>Executive Directors</td>
</tr>
<tr>
<td>Faculty</td>
<td>Elected Officials</td>
</tr>
<tr>
<td>Board Members</td>
<td>Chairpersons</td>
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<tr>
<td>NGO Representatives</td>
<td>First Responders</td>
</tr>
</tbody>
</table>

It is recommended that City of Concord Executives/Managers and other GIS staff attend the Esri UC each year. There are a host of benefits for staff to attend the Esri UC, which are listed below.

**Why Attend**
- Learn from people like you who are tackling challenges like your own
- Get updates and direction that will help your organization make better decisions
• Broaden the knowledge of GIS in the local government arena through networking opportunities
  o Attend the GIS Manager’s Open Summit to see how other organizations are leveraging GIS
• Attend paper presentations, sponsored events, and special interest groups geared specifically for GIS staff
• Expand interest, enthusiasm, and support for GIS at the City of Concord
• 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
• 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)**


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 a number of methods. The City of Concord 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 has to 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 (folded into the existing IT Executive 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 (refer to the Voice of the Customer chapter)**
  - 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
  o Monthly
  o The GIS Manager 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.
  o Cost - $0

• Presentations to City Council
  o Annually
  o High level presentation to Council detailing how GIS is improving the City and expanding services
  o Cost - $0

• Blogs, email, and social media
  o As pertinent
  o GIS staff should establish a number of 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.
  o Cost - $0

• Newspapers and television
  o As pertinent but at least once a year
  o 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.
  o Cost - $0

• Brochures, newsletters, and other marketing efforts
  o Throughout the year
  o GIS staff should make an effort 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
  o Cost - $0 unless a professional firm is used to create an identity or brochure
• Seminars
  o Throughout the year
  o 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.
  o 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 further improve the enterprise GIS while providing maximum value to its stakeholders.
PHASE II
CONCEPTUAL
SYSTEM DESIGN
INFRASTRUCTURE
The following section summarizes the existing infrastructure conditions and departmental comments. This section also included an Architecture Assessment and Enterprise GIS Design.

<table>
<thead>
<tr>
<th>City of Concord Infrastructure Findings</th>
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<tbody>
<tr>
<td>Need GIS mobile plan</td>
</tr>
<tr>
<td>Excellent IT infrastructure to support enterprise GIS</td>
</tr>
<tr>
<td>Need IT to be trained in GIS</td>
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</tbody>
</table>

The following recommendations are 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 Concord well into the future.

INFRASTRUCTURE

THE VISION

The City of Concord should continue to utilize the IT Infrastructure to support an Enterprise, Scalable and Sustainable GIS

THE GOAL

Continually evaluate the IT architecture initiative so it will sustain enterprise GIS growth and change

Task #1: INFORMATION TECHNOLOGY (IT) – Ensure the most optimum network and hardware is in place for the GIS initiative.

Task #2: IT SPECIFIC TRAINING – GIS Staff within the IT Department should participate in GIS specific training including GIS System Administration, ArcSDE, Geodatabase Design, and SQL Server.

Task #3: 24/7 AVAILABILITY – The IT Department should continue to provide network stability, security of data, and 24/7 availability to City staff.
Task #4: ENTERPRISE BACK-UP – The IT Department should continue with GIS data back-up and database recovery solutions.

Task #5: DATA STORAGE – The data storage and network speed for the enterprise GIS should continue to be administered by the IT Department.

Task #6: DEVELOP A CITYWIDE MOBILE GIS PLAN – The City and IT Department should develop an integrated and enterprise tool for mobile operations that includes ArcGIS Online.

City of Concord’s Existing GIS Infrastructure Conditions
ARCHITECTURE ASSESSMENT AND ENTERPRISE GIS DESIGN

This report provides the design specification for an enterprise GIS appropriate to the business needs of the City of Concord. The needs of the City were identified during interviews and research conducted the week of. 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
- Provide industry Best Practices for improving the performance and efficiency of the GIS architecture

Central Server and Service-Oriented Infrastructure Approach

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 strategy includes migration of existing GIS data into the Local Government Information Model (LGIM). In addition, it recommends the adoption of ArcGIS Online for public facing services.

The key recommendations are:

1. Build a central services infrastructure (in the process of updating) which exposes appropriate services end-points for transactional editing, analysis, and viewing, based on a variety of clients
2. Migrate existing GIS data to the Local Government Information Model
3. Implement ArcGIS for Local Governments browser-based applications for intranet users
4. Use ArcGIS Online services as base map content for public facing services

The content below will further define the City’s GIS business requirements and make recommendations on how to address those technology needs through system architecture design.

METHODS AND CONSTRAINTS

Purpose & Methodology
The purpose of this document is to communicate the architectural observations and recommendations for the City of Concord’s enterprise GIS. Inputs to this document include information received from the City, industry best practices, and a series of architecture design meetings held with 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.

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. Server hardware is assumed to be at the end of its production life cycle when it is 3 or more years old.

• “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 timeframe 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.

ARCHITECTURE VISION

The City of Concord 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. (Database connections and architecture not show since this is a "conceptual" diagram - not logical.)
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. It is based on the specific requirements described by the departments interviewed during strategic planning and specifically by information provided by the Information Technology Department related to system architecture.

Business Requirements

The following business requirements are motivators for the creation and design of an enterprise GIS at the City of Concord.
<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Maintain and improve GIS performance and provide a sustainable platform for future expansion</td>
<td>Ensure that the planned system architecture will support the future needs of the City’s enterprise GIS.</td>
</tr>
<tr>
<td>2</td>
<td>Reduce data duplication</td>
<td>Currently GIS data is not stored in a standardized schema and some data are scattered across the enterprise (S Drive)</td>
</tr>
<tr>
<td>3</td>
<td>Use standard operating procedures</td>
<td>Using standards for GIS administration, data development, and databases will improve the effectiveness of the enterprise GIS</td>
</tr>
<tr>
<td>4</td>
<td>Deploy standardized geodatabase using a robust enterprise relational database</td>
<td>Existing GIS data needs to be mapped and migrated to the Local Government Information Model on the MS SQL Server platform</td>
</tr>
<tr>
<td>5</td>
<td>Accommodate integration with various 3rd party applications</td>
<td>Design solution needed that will integrate well with other enterprise applications.</td>
</tr>
<tr>
<td>6</td>
<td>Maximize ArcGIS Server performance</td>
<td>Provide strategies (e.g. process configuration, cached map services, memory configuration) to ensure maximum performance of ArcGIS Server</td>
</tr>
</tbody>
</table>

**IT Standards and Policies**

GTG recommends that the following categories be considered for standards and policies within IT/GIS:

- Hardware Virtualization
- Application Virtualization
- Development Platform
- Database
- Hardware
- WAN Technology
- Internet Access
- Authentication/Authorization

**TECHNOLOGY ARCHITECTURE**

This section will document the existing Technology architecture in place at the City of Concord that supports the enterprise GIS. Applications, hardware, and network communications will be reviewed and their relevance to the overall system design will be documented and will occur in the sections that follow in the system design.
Applications

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 public facing web server. The ArcSDE application that enables the usage of Microsoft SQL Server for the storage of spatial data in the form of geodatabases is found on the database server (in the process of upgrading to Enterprise over SQL Express). SQL Server functions as the data repository for the enterprise 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.
## Existing GIS, Future GIS, and GIS Software Training Plan Recommendations

<table>
<thead>
<tr>
<th>Department</th>
<th>Desktop</th>
<th>ESRI NEW TOOLS AND AGOL</th>
<th>GIS Users</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Existing</td>
<td>Future</td>
<td>Existing</td>
</tr>
<tr>
<td>City Management</td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Community and Economic Development</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Finance</td>
<td></td>
<td></td>
<td>4</td>
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<tr>
<td>Human Resources</td>
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<tr>
<td>Information Technology</td>
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<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Parks and Recreation</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Police</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Public Works</td>
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<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>54</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Department</th>
<th>Existing</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ArcGIS Pro</td>
<td></td>
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<tr>
<td>ArcGIS Pro</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations Dashboard</td>
<td></td>
<td></td>
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<tr>
<td>Story Maps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GIS Users</td>
<td>9</td>
<td>27</td>
</tr>
</tbody>
</table>
1.1 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.

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.

1.2 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 is not currently using any mobile applications but does plan to make use of the Esri Collector application in the future for data collection in Public Works.

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.
1.3 Hardware

**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 current server environment is virtualized. Three servers make up the GIS server environment for the City, including a DMZ server, ArcGIS Server, and the database server.

**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 desktop hardware in use by the GIS Department is sufficient for the current GIS needs. Desktop power users would benefit from more powerful solutions configured with more current Xeon or Core i7 processors and 16GB of memory at a minimum.

**Mobile**

Mobile solutions are not currently in use at the City. The City needs to develop a comprehensive mobile plan. Once this plan is developed, the City will be able to, among other things, standardize what mobile hardware platform and software is used for field data collection.

1.4 Network Communications

The City currently has a very robust Local Area Network (LAN) and Wide Area Network (WAN) in use. Fiber connects each of the City buildings and speed in regards to GIS was not an issue during the departmental interviews.
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 Concord for the next several years.

1.5 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 2) 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.

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.

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 3), 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 minimal desktop GIS applications, as well as various Esri ArcGIS Services.

As previously mentioned, the server is the cornerstone of an enterprise GIS and its 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 are configuration settings that should be used to optimize ArcGIS Server performance.
1.5.1 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

1.5.2 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

1.5.3 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

1.6 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.
1.6.1 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 child 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 and D) in the database. As the A and 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 organization data needs, applications, data maintenance and update, data security, etc. The City currently maintains GIS data in the SDE environment and some of the data layers are stored as standalone feature classes or shapefiles on the “S Drive.” Some of the data layers are stored in feature datasets due to the need for topology or geometric networks but overall the database design is not standardized.

It is recommended that the majority of the 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.

The City’s GIS Strategic Plan recommends the adoption of the Esri Local Government Information Model to better organize and store the City’s GIS data. 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 citizens in more meaningful ways. In addition, it also supports data sharing between local governments and regional, state, and federal agencies. The following are the feature datasets defined by the LGIM:

- Address
- Administrative Area
- Assessment Information
- Cadastral Reference
- Capital Planning
- Citizen 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 (will require training for staff)
- Perform scheduled database compressions to clean out the A&D tables and ensure optimal database performance
- Implement the LGIM and migrate existing GIS data into the standardized data model
- The LGIM provides a standard data model for improved integration with third party applications

1.6.2 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:

- Compress images
- 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.

1.6.3 Storage Architecture Options

As with other technology, the City should have its storage solutions placed on a scheduled replacement cycle to maintain and provide top performing hardware in support of the enterprise.

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 (Redundant Array of Independent Disks) 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 commonly used 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. The 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

1.7 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 graphics-intense experience that GIS provides the end user and the 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.

1.7.1 Capacity & Performance
As discussed previously, the City has a very robust fiber LAN and WAN supporting its enterprise GIS. As expected from a well configured network, user feedback provided by City staff indicates that the City’s LAN/WAN 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.

1.8 Platform Performance
The performance of GIS applications was discussed previously 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.

1.8.1 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 workstation vendors for the purpose of creating an industry recognized realistic benchmark of computer hardware performance. Esri specifically uses the “SPECrate_int2006” for core benchmark baseline for measuring hardware performance of various systems (Figure 4). 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.

The Esri Capacity Planning Tool (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 a hardware platform to meet the needs of an organization’s
1.8.2 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 are 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 (Advanced Micro Devices) and Sun SPARC (Scalable Processor Architecture) 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:

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 for Year 2012.

<table>
<thead>
<tr>
<th>Processor</th>
<th>Year</th>
<th>Cores</th>
<th>SPEC Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel Xeon E3-1270v3</td>
<td>2014</td>
<td>4</td>
<td>53</td>
</tr>
<tr>
<td>Intel Xeon E3-1280v2</td>
<td>2013</td>
<td>4</td>
<td>48</td>
</tr>
<tr>
<td>Intel Xeon E5-2637</td>
<td>2012</td>
<td>4</td>
<td>47</td>
</tr>
<tr>
<td>AMD Opteron - best performance</td>
<td>2012</td>
<td>#</td>
<td>22</td>
</tr>
</tbody>
</table>

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 lower, 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.

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 Concord with a world class enterprise GIS that will exceed the expectations of its users.

GIS Server Platform

Although the existing system is meeting the current GIS needs of the City of Concord, the following recommended configuration will meet the peak performance requirements of the City’s enterprise GIS over the next 3 years.

Suggested Server Configuration:
(At minimum deploy suggested or equivalent configurations.)

Premise Based Physical Server

- Dell PowerEdge R430 Rack Server
  - Single Processor – Intel Xeon E5-2660 v3 (10 cores)
  - 128GB Memory
  - 1TB 7.2K RPM Local Disk
  - Estimated Cost: $4,563
    - Recommended Software
      - Windows Server 2012 R2
      - VMware 6.0
  - Virtual Servers
    - Database Server
- 4 processor cores
- 96GB Memory
  - Recommended Software
    - MS SQL Server 2012 R2 Standard or Enterprise
- Web (Application) Server
  - 6 processor cores
  - 32GB Memory
  - Recommended Software
    - ArcGIS Server 10.3.1

**Desktop Platform**

The City’s existing Desktop computers are currently meeting the needs of GIS users and should be replaced with new technology a maximum of every 3 years.

**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 LAN and 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 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 system architecture.
The following diagram illustrates the Conceptual Enterprise GIS Architecture for the City of Concord.
PHASE II
CONCEPTUAL
SYSTEM DESIGN
RECOMMENDED PROJECT STEPS
RECOMMENDED PROJECT STEPS
The following is a checklist of priority GIS tasks that need to be performed by the City and the GIS Manager (to be filled) in the very near future:

**Step 1: FORMALIZE THE GOVERNANCE MODEL** – The GIS Manager and staff would be supported and directed by a GIS Steering Committee. The City must also create an active GIS User Group. One of the most important keys to success is the authority of the GIS Manager. The GIS Manager will need to develop and orchestrate a multi-year GIS plan that solves all of the strategic, logistical, technical, tactical, and political challenges of GIS within the City of Concord. This governance model must also identify Subject Matter Experts (SME) within each department. SME’s are accountable to their department’s directors and the enterprise GIS Manager.

**Step 2: CONDUCT AN ENTERPRISE DATABASE DESIGN** – Conduct an enterprise database design by implementing Esri’s Local Government Information Model (LGIM). Many GIS data layers existing outside of the current SQL environment on the “S Drive.” Those layers should be reviewed and important/key layers included in the SQL environment as part of a migration to the LGIM. This will ensure all pertinent data layers are centrally located and accessible to all City staff as appropriate.

**Step 3: COORDINATED ENTERPRISE TRAINING PLAN** – Develop and coordinate an enterprise GIS training plan administered by the GIS Manager. This training plan will be organized around Esri’s suite of software solutions, including ArcGIS Online, ArcGIS Desktop, ArcGIS server and SDE. Training will use online services and classroom instruction.

**Step 4: CREATE A CITYWIDE ARCGIS ONLINE (AGOL) SOFTWARE INITIATIVE** – Plan, design, and deploy AGOL, including the setup, configuration, and effective use of the tools and applications available.

  o **Step 4a: INTRANET PUBLIC PORTAL** – It is recommended that the City of Concord use the Esri suite of software to plan, design and deploy Intranet solutions. The design and deployment of the intranet solution will be based on the requirements of each department. Portal for ArcGIS should be reviewed as the source for the City’s Intranet Solution.

  o **Step 4b: INTERNET PUBLIC PORTAL** – It is recommended that the City of Concord use the Esri suite of software to plan, design and deploy Internet solutions.
Step 5: **DEPARTMENTAL GIS PROJECTS**

Each department within the City of Concord has some specific GIS needs that will require consulting services, including but not limited to the following:

- City Management – Esri Suite
- Community and Economic Development – Data Custodian; Esri Suite
- Finance – Esri Suite
- Human Resources – Esri Suite
- Information Technology – LGIM Data Migration
- Naval Weapons Station Reuse – Esri Suite
- Parks and Recreation Department (Esri Suite & GreenCityGIS.com)
- Police Department – Automate extractions from TriTech; Geocode against address point data
- Public Works – Data Custodian; Esri Suite; Mobile Tools

Step 6: **PLAN, DESIGN AND DEPLOY GIS STORY MAPS** – Develop a sequence of the citywide story maps, including the following:

- City of Concord CIP
- Parks and Recreation (Park Information and Park Location)
- City of Concord Economic Development

Step 7: **ENTERPRISE STANDARD OPERATING PROCEDURES (SOP)**

Every enterprise GIS requires the development of procedures and protocols for tasks routinely performed by the organizations. Standard Operating Procedures (SOP) should include:

- Data Maintenance
- Addressing and Address Standards
- ArcGIS Versioning
  - Version Administration
  - Creation
  - Reconcile and Post
  - Add & Delete States
- Database Compression
- Database Transactions
• Active Directory
• Database Permissions and Security
• User Authentication
  o ArcGIS Server
  o Web Server
  o AGOL
• Geodatabase Design
  o Application requirements
  o Data Resources requirements
  o People and Staffing requirements
• Quality Assurance/Quality Control (QA/QC)
• Metadata

**Step 8: DATA COLLECTION, CREATION, AND CONVERSION** – Local governments routinely collect, inventory, and maintain GIS data. It is recommended that the City of Concord budget for annual data collection tasks. All data collection projects need to be coordinated and managed by the GIS Manager. New digital data layers include:
  • Easements
  • ROW
  • Public Works Assets

**Step 9: GIS INTEGRATION** - A true enterprise GIS needs to be seamlessly integrated with the key enterprise software solutions. It is recommended that the City integrate the Esri suite of products (HTML5 Browser, Dashboard, and Collector application) with:
  • Accela
  • TriTech
  • HDL
  • StreetSaver
  • iTrac
  • West Coast Arborist
  • Facility Dude

**Step 10: CROWDSOURCING OR COMPLAINT TRACKING APPLICATION** – It is recommended that the City consider a 311 solution that enables citizens to interact with the City regarding issues, problems, or concerns, including the location of potholes, graffiti, damaged infrastructure and more. A 311 is part of
an open and transparent government using “crowdsourcing” software applications.

**Step 11: MOBILE USE STRATEGY** – The City needs to develop a strategy for the effective use and training of mobile field devices. Mobile devices includes smart phones, iPads, Notebooks, and Androids. New Esri AGOL software and its suite of solutions is recommended for the City of Concord are hardware agnostic.

**Step 12: IT INFRASTRUCTURE IMPROVEMENTS AND UPGRADES** – GTG conducted an enterprise Architectural Assessment and concluded that some modest upgrades are required, specifically regarding servers. The City is in the process of making these upgrades. City staff should also ensure they have access to mobile hardware such as iPad’s, iPhone’s, Android tablets/phones, or Windows 10 devices. Ideally these devices will have a cellular connection built-in to allow real-time data collection and maintenance.

**Step 13: WORK ORDER SOLUTION** – The City of Concord should continue to leverage Accela as the work order solution of choice. It is important to understand Asset Management and Work Request/Work Order solutions as it relates to keeping GIS data layers up to date and current.

**Step 14: AVL – FLEET MANAGEMENT** – Fleet Management require an AVL solution to monitor in real time vehicles in the field. It is recommended that the city evaluate the top four AVL solutions and consulting services to evaluate the best option.

**Step 15: DEVELOP ANNUAL GIS DETAILED WORK PLAN FOR GIS MANAGER AND STAFF** – A new GIS governance model will require supporting documentation that details the departmental GIS support required by the GIS division. Tasks will include:

- GIS User Group
- Coordination
- Grant Applications
- Data Maintenance
- Training and Education
- GIS Newsletter
- Presentations
- GIS Collaboration
- Regionalization of GIS
City of Concord
Implementing an Enterprise GIS
The Next Steps

STEP 1
FORMALIZE THE GOVERNANCE MODEL

STEP 2
CONDUCT AN ENTERPRISE DATABASE DESIGN

STEP 3
COORDINATED ENTERPRISE TRAINING PLAN

STEP 4
CREATE A CITYWIDE ARCGIS ONLINE SOFTWARE INITIATIVE

STEP 5
DEPARTMENTAL GIS PROJECTS

STEP 6
PLAN, DESIGN AND DEPLOY GIS STORY MAPS

STEP 7
ENTERPRISE STANDARD OPERATING PROCEDURES (SOP)

STEP 8
DATA COLLECTION, CREATION, AND CONVERSION

STEP 9
GIS INTEGRATION

STEP 10
CROWD-SOURCING APPLICATION

STEP 11
MOBILE USE STRATEGY

STEP 12
IT INFRASTRUCTURE IMPROVEMENTS AND UPGRADES

STEP 13
WORK ORDER SOLUTION

STEP 14
AVL-FLEET MANAGEMENT

STEP 15
DEVELOP ANNUAL GIS DETAILED WORK PLAN
PHASE III
THREE YEAR TACTICAL PLAN
TACTICAL PLAN OF ACTION
INTRODUCTION

This chapter focuses on a tactical plan of action for implementing the key elements that have been identified and detailed throughout this plan. 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 citizens of the City of Concord.

This chapter defines the necessary tasks and procedures for the City of Concord to plan and implement the recommendations outlined in this report. This three-year phased tactical plan, if implemented, will provide the City of Concord with a cost-effective solution that allows the City to further utilize GIS in an enterprise-wide fashion.

THREE YEAR TACTICAL PLAN

The table beginning on page 384 documents all of the tactical elements needed to further implement enterprise-wide GIS over a three 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 (maintained by GIS within IT) 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 strategic plan. 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

**Funded By** – the group that will be responsible for funding this item

**Notes** – comments and/or notes about the item

**Year 1 – 3 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 and a brief description.

**CATEGORY 1 - GOVERNANCE**

- **Task #1: COMPLETE THE MULTI-YEAR GIS STRATEGY IMPLEMENTATION PLAN** – The City needs to complete the three-year GIS Strategic Plan that details every task required to deploy a true enterprise solution that takes advantage of the latest technology and architecture. It should include a vision, and goals and objectives as well as Key Performance Indicators (KPI) for the GIS initiative.

- **Task #2: GIS AUTHORITY AND CONTROL** – The City of Concord should fill the GIS Manager position within the IT Department to oversee all GIS functions within the City. There is a distinct need for a GIS Manager within the IT department that supports all departments equally, and has the authority to direct GIS development across the enterprise. There is currently a vacant GIS Manager position. This should be filled as soon as possible.

- **Task #3: ACCESSIBILITY TO DATA** – The City needs to improve accessibility to GIS software and GIS data to all City employees and all other interested parties. The existing AGOL solutions do not meet the need of the stakeholders.
• **Task #4: ENTERPRISE STANDARD OPERATING PROCEDURES** – 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, Metadata Standards, Standard Naming Conventions, and GIS Business Integration.

• **Task #5: GRANTS AND FUNDING** – The GIS Manager should encourage the pursuit of grants for GIS software, data, training, and staff.

• **Task #6: COORDINATED ENTERPRISE** – Develop and coordinate all GIS activity within the City of Concord.

• **Task #7: IT EXECUTIVE COMMITTEE** – Fold a GIS Steering Committee, comprised of directors from each department, into the existing IT Executive Committee. Develop a strategy for the Steering committee's goals and objectives.

• **Task #8: DEVELOP GIS USER GROUP** – GIS users throughout the City should participate in the GIS User Group. Develop a strategy for the GIS User Groups goals and objectives.

• **Task #9: FORMALIZE AND RATIFY GIS GOVERNANCE MODEL** – Adopt a new governance model that includes the GIS Manager, technical staff in IT, a steering committee, and a GIS user Group. This should promote a culture of collaboration. If the City does not transition to Subject Matter Experts (SME) maintaining their own data within each department, GIS will remain as it is currently and will not grow as desired.

• **Task #10: KEY PERFORMANCE MEASURES** – Establish enterprise and departmental GIS performance measures and Key Performance Indicators (KPI) as well as a Return on Investment (ROI).

• **Task #11: PROMOTE GIS** – Promote GIS both internally and externally to showcase the successes.

• **Task #12: ANNUAL UPDATE TO THE PLAN** – Update the GIS Strategic Plan on an annual basis using an online questionnaire and departmental interviews.

• **Task #13: GIS ANNUAL DETAILED WORK PLAN AND SERVICE LEVEL Agreements** – The GIS Manager should create an annual GIS work plan that details all departmental support. This may also include the development of SLA between the IT-GIS and each department.

• **Task #14: ALIGNMENT OF GIS WITH THE CITY OF CONCORD’S VISION, GOALS, AND OBJECTIVES** – The GIS Manager should align all GIS activity and initiatives with the City's overall vision, goals, and objectives.
• **Task #15: USER SENSITIVITY AND A MEASURE OF THE QUALITY OF GIS SERVICE** – The GIS Manager should measure satisfaction levels annually using an online questionnaire and feedback at User group meetings. This should be reported to the Steering committee.

**CATEGORY 2 – DATA & DATABASES**

• **Task #1: CONDUCT A DIGITAL DATA ASSESSMENT** – Perform a comprehensive assessment of the quality, quantity, and completeness of all digital data layers with specific emphasis on the critical layers: Parcels, Street Centerlines, Address Points and Aerial Photography (2014)

• **Task #2: CONDUCT AN ENTERPRISE DATABASE DESIGN** – Establish and implement Esri’s LGIM – with opportunities for customization where needed.

• **Task #3: DATA CREATION** – Develop a plan to collect, update, and convert all required departmental digital data layers over an agreed upon period of time including the list of required data layers detailed in the GIS Assessment.

• **Task #4: IMPROVE ACCESS TO CRITICAL FOUNDATION DATA LAYERS** – Develop a multi-tiered approach allowing all departments to view and access base map layers including parcels, address points, street centerlines, and aerial photography in real-time. The City of Concord should focus on the utilization of Esri’s ArcGIS Online tools.

• **Task #5: MASTER DATA LIST** – Create an updated and accurate Master Data List and maintain on a regular basis.

• **Task #6: CENTRAL REPOSITORY** – Continue to utilize Esri’s ArcSDE environment to house all City GIS data. This central repository is located within the IT Department.

• **Task #7: METADATA** – Establish and enforce standard operating procedures (SOP) for developing metadata standards.

• **Task #8: CUSTODIANSHIP** – Clearly define data custodianship roles within the enterprise governance model. This includes coordination between all departments. Each department should be responsible for specific digital data layers.

• **Task #9: MOBILE SOLUTIONS FOR VIEWING AND MAINTAINING DATA** – The City should plan, design, and deploy Esri’s ArcGIS Online as the mobile software solution. This should be supplemented by a continued effort to identify new, advanced, convenient, and easy-to-use mobile GIS and GPS field tools to collect, update, and maintain the GIS data repository. A uniform approach to using ArcGIS Online would benefit the City of Concord.
CATEGORY 3 – PROCEDURES AND WORKFLOW

- **Task #1: INTEGRATION AND INTEROPERABILITY** – Continue to integrate GIS with the City’s existing business systems.
- **Task #2: IMPROVE DEPARTMENTAL USE OF GIS SOFTWARE** – The City should use the AGOL suite of products, including Intranet, internet, dashboard, collector application, and all free online Esri solutions to quickly and effectively improve departmental use of GIS software.
- **Task #3: IMPROVE DEPARTMENTAL ACCESS TO CRITICAL DATA** – The City should use AGOL Internet and Portal for ArcGIS Intranet solutions to quickly and effectively improve departmental use of GIS software.
- **Task #4: MOBILE SOLUTIONS** – Integrate ArcGIS Online Mobile into departmental workflow procedures.
- **Task #5: ELIMINATE DATA DUPLICATION** – Eliminate data duplication between systems.
- **Task #6: DEFINE META DATA STANDARDS** – Define the City’s Meta data requirements and establish and enforce Standard Operating Procedures (SOP) for developing metadata standards. See Data and Databases Section.
- **Task #7: GIS STANDARD OPERATING PROCEDURES (SOP)** – 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, Metadata Standards, Standard Naming Conventions, and GIS Business Integration. See Governance Section.
- **Task #8: GIS TECHNICAL SUPPORT (TICKETING AND SERVICE DESK)** – Enforce the use of the IT’s ticketing procedure for all GIS activity within the City.
- **Task #9: CUSTODIANSHIP OF DATA LAYERS** – Detail departmental custodianship of all data layers

CATEGORY 4 – GIS SOFTWARE

- **Task #1: EFFECTIVE USE OF THE EXISTING ESRI LICENSING** – The City should use the existing Esri license agreement to effectively deploy the right tools to the right people.
- **Task #2: INTRANET SOLUTION** – Deploy a state of the art Intranet using the existing Esri licensing.
- **Task #3: ARCGIS ONLINE (AGOL) SOFTWARE INITIATIVE** – Plan, design, and deploy AGOL, including the setup, configuration, and effective use of the tools and applications available.

• **Task #5: INTERNET PUBLIC ACCESS PORTAL** – Use the AGOL solution to deploy a state of the art solution for the public.

• **Task #6: CROWDSOURCING** – Engage and solicit input from citizens by promoting crowdsourcing applications. Utilize a reliable database to house information gathered from the crowdsourcing application.

• **Task #7: ELECTED OFFICIALS** – Use GIS as a tool to provide timely and accurate data to the elected officials.

• **Task #8: MODELING EXTENSIONS** – The City should take advantage of Esri’s modeling extensions for the desktop.

• **Task #9: MOBILE SOFTWARE SOLUTIONS** – Plan, design, and deploy Esri’s ArcGIS Online as the mobile software solution for the City of Concord.

• **Task #10: GREENCITYGIS** – Deploy GreenCityGIS for P&R, integrated with Accela.

• **Task #11: FREE ESRI APPLICATION ONLINE** – After the migration of the City’s GIS to the LGIM the City should take advantage of all applications available online.

**CATEGORY 5 – GIS TRAINING AND EDUCATION**

• **Task #1: GOVERNANCE MODEL** – Implement a centralized hybrid governance model that promotes ongoing training and education.

• **Task #2: SOFTWARE TRAINING** – Provide software GIS training and educational opportunities to all City staff on a regular basis. Utilize Esri’s Online Education and Training services through the existing licensing agreement. Provide formal classroom training for identified departmental staff – including Desktop, Intranet, Internet, Mobile, GPS, ArcGIS Online and Story Maps, and Extensions.

• **Task #3: KNOWLEDGE TRANSFER** – Establish a GIS user group network within the organization to help facilitate growth. Establish quarterly GIS meetings.

• **Task #4: FORMAL ON-GOING TRAINING PLAN** – Implement a formal sustainable GIS Training Plan.

• **Task #5: MOBILE TRAINING** – As part of the formal training plan, develop a strategy for the effective use and training of mobile field devices.

• **Task #6: CONFERENCES** – Attend workshops and pre-conference seminars at the Esri International Users Conference and regional Esri California Conferences.
• **Task #7: ONLINE SEMINARS AND WORKSHOPS** – Use all available online training, education, and knowledge transfer workshops.

• **Task #8: SEMINARS AND WORKSHOPS** – The GIS Team will offer seminars and workshops tailored to specific departmental applications of GIS.

• **Task #9: DEPARTMENTAL SPECIFIC TRAINING** – Promote departmental specific GIS training.

  Encourage and promote targeted GIS training, including:
  - General Executive Management Workshop
  - Public Safety GIS Workshop
  - Utilities Workshop
  - The ROI of GIS in City Government

**CATEGORY 6 – INFRASTRUCTURE**

• **Task #1: INFORMATION TECHNOLOGY (IT)** – Ensure the most optimum network and hardware is in place for the GIS initiative.

• **Task #2: IT SPECIFIC TRAINING** – GIS Staff within the IT Department should participate in GIS specific training including GIS System Administration, ArcSDE, Geodatabase Design, and SQL Server.

• **Task #3: 24/7 AVAILABILITY** – The IT Department should continue to provide network stability, security of data, and 24/7 availability to City staff.

• **Task #4: ENTERPRISE BACK-UP** – The IT Department should continue with GIS data back-up and database recovery solutions.

• **Task #5: DATA STORAGE** – The data storage and network speed for the enterprise GIS should continue to be administered by the IT Department.

• **Task #6: DEVELOP A CITYWIDE MOBILE GIS PLAN** – The City and IT Department should develop an integrated and enterprise tool for mobile operations that includes ArcGIS Online.
GIS SUSTAINABILITY

GIS is an enterprise asset that has 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 Concord 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. 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 (YouTube, television, newspaper, social media, etc.). Additionally, strong leadership and guidance from the IT Executive Committee will ensure that GIS is aligned with the overall goals, priorities, and mission of the City of Concord 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 IT Executive Committee assist the GIS Manager and other GIS staff in prioritizing tasks based on the actual budget each year. Each of the items in the tactical plan were prioritized based on the 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 available funding and changing priorities. The entire plan should be redone in totality every three 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.
<table>
<thead>
<tr>
<th>Task</th>
<th>Department/Division/Agency</th>
<th>Task Type</th>
<th>Funded By</th>
<th>Ranking</th>
<th>Notes</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GOVERNANCE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete the Multi-Year GIS Strategy Implementation Plan</td>
<td>IT Executive Committee</td>
<td>OG</td>
<td>NA</td>
<td>A</td>
<td>The City needs to complete the three-year GIS Strategic Plan that details every task required to deploy a true enterprise solution that takes advantage of the latest technology and architecture. It should include a vision, and goals and objectives as well as Key Performance Indicators (KPI) for the GIS initiative.</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>GIS Authority and Control</td>
<td>IT Executive Committee</td>
<td>OT</td>
<td>NA</td>
<td>A</td>
<td>The City of Concord should fill the GIS Manager position within the IT Department to oversee all GIS functions within the City. There is a distinct need for a GIS Manager within the IT department that supports all departments equally, and has the authority to direct GIS development across the enterprise. There is currently a vacant GIS Manager position. This should be filled as soon as possible.</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessibility to Data</td>
<td>IT Executive Committee/GIS Manager</td>
<td>OT</td>
<td>NA</td>
<td>A</td>
<td>The City needs to improve accessibility to GIS software and GIS data to all City employees and all other interested parties. The existing AGOL solutions do not meet the need of the stakeholders.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enterprise Standard Operating Procedures</td>
<td>IT Executive Committee/GIS Manager</td>
<td>OT</td>
<td>NA</td>
<td>A</td>
<td>Establish a set of standards and procedures for the development and maintenance of geospatial data including Office-to-Field/Field-to-Office procedures, GIS Quality Standards, Versioning, CAD Standards, Digital Submission Standards, Cartographic Standards, Metadata Standards, Standard Naming Conventions, and GIS Business Integration.</td>
<td>$15,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grants and Funding</td>
<td>Various Departments</td>
<td>OG</td>
<td>NA</td>
<td>A</td>
<td>Develop and coordinate all GIS activity within the City of Concord.</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Coordinated Enterprise</td>
<td>IT Executive Committee</td>
<td>OT</td>
<td>NA</td>
<td>A</td>
<td>Fold a GIS Steering Committee, comprised of directors from each department, into the existing IT Executive Committee. Develop a strategy for the steering committee’s goals and objectives.</td>
<td>*</td>
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<td></td>
</tr>
<tr>
<td>IT Executive Committee</td>
<td>IT Executive Committee</td>
<td>OT</td>
<td>NA</td>
<td>A</td>
<td>The GIS Manager should encourage the pursuit of grants for GIS software, data, training, and staff.</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Develop GIS User Group</td>
<td>IT Executive Committee/GIS Team in IT</td>
<td>OT</td>
<td>NA</td>
<td>A</td>
<td>Develop a plan to collect, update, and convert all required departmental digital data layers over an agreed upon period of time including the list of required data layers detailed in the GIS Assessment.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formalize and Ratify GIS Governance Model</td>
<td>IT Executive Committee</td>
<td>OT</td>
<td>NA</td>
<td>A</td>
<td>Adopt a new governance model that includes the GIS Manager, technical staff in IT, a steering committee, and a GIS user Group. This should promote a culture of collaboration. If the City does not transition to Subject Matter Experts (SME) maintaining their own data within each department, GIS will remain as it is currently and will not grow as desired.</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Key Performance Measures</td>
<td>IT Executive Committee/GIS Team in IT</td>
<td>OG</td>
<td>NA</td>
<td>A</td>
<td>Establish enterprise and departmental GIS performance measures and Key Performance Indicators (KPI) as well as a Return on Investment (ROI).</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Promote GIS</td>
<td>IT Executive Committee/GIS Team in IT</td>
<td>OG</td>
<td>NA</td>
<td>A</td>
<td>Promote GIS both internally and externally to showcase the successes.</td>
<td>*</td>
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</tr>
<tr>
<td>Annual Update to the Plan</td>
<td>IT Executive Committee/GIS Team in IT</td>
<td>OG</td>
<td>IT</td>
<td>A</td>
<td>Update the GIS Strategic Plan on an annual basis using an online questionnaire and departmental interviews.</td>
<td>$5,000</td>
<td>$5,000</td>
<td></td>
</tr>
<tr>
<td>GIS Annual Detailed Work Plan and Service Level Agreements</td>
<td>GIS Manager</td>
<td>OG</td>
<td>NA</td>
<td>A</td>
<td>The GIS Manager should create an annual GIS work plan that details all departmental support. This may also include the development of SLA between the IT-GIS and each department.</td>
<td>*</td>
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<td></td>
</tr>
<tr>
<td>Alignment of GIS with the City of Concord’s Vision, Goals, and Objectives</td>
<td>IT Executive Committee/GIS Team in IT</td>
<td>OG</td>
<td>NA</td>
<td>A</td>
<td>The GIS Manager should align all GIS activity and initiatives with the City’s overall vision, goals, and objectives.</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>User Sensitivity and a Measure of the Quality of GIS Service</td>
<td>IT Executive Committee/GIS Team in IT</td>
<td>OG</td>
<td>NA</td>
<td>A</td>
<td>The GIS Manager should measure satisfaction levels annually using an online questionnaire and feedback at User group meetings. This should be reported to the Steering committee.</td>
<td>*</td>
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<td>*</td>
</tr>
<tr>
<td><strong>DATA AND DATABASES</strong></td>
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<td></td>
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</tr>
<tr>
<td>Conduct a Digital Data Assessment</td>
<td>GIS Team in IT</td>
<td>OT</td>
<td>IT</td>
<td>A</td>
<td>Perform a comprehensive assessment of the quality, quantity, and completeness of all digital data layers with specific emphasis on the critical layers – Parcels, Address Points, Street Centers, and Aerial Photography.</td>
<td>$15,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduct an Enterprise Database Design</td>
<td>GIS Team in IT</td>
<td>OT</td>
<td>IT</td>
<td>A</td>
<td>Establish and implement Esri’s LGIM – with opportunities for customization where needed.</td>
<td>$50,000</td>
<td></td>
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</tr>
<tr>
<td>Data Creation</td>
<td>Various Departments</td>
<td>OG</td>
<td>Various</td>
<td>A</td>
<td>Develop a plan to collect, update, and convert all required departmental digital data layers over an agreed upon period of time including the list of required data layers detailed in the GIS Assessment.</td>
<td>$156,000</td>
<td>$75,000</td>
<td>$75,000</td>
</tr>
<tr>
<td>Improve Access to Critical Foundation Data Layers</td>
<td>GIS Team in IT</td>
<td>OT</td>
<td>IT</td>
<td>A</td>
<td>Develop a multi-tiered approach allowing all departments to view and access base map layers including parcels, address points, street centers, and aerial photography in real-time. The City of Concord should focus on the utilization of Esri’s ArcGIS Online tools. **Funded through other tasks. This will be accomplished with a central data repository and Intranet Viewer deployment. **</td>
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<tr>
<td>Master Data List</td>
<td>GIS Team in IT</td>
<td>OT</td>
<td>IT</td>
<td>B</td>
<td>Create an updated and accurate Master Data List and maintain on a regular basis.</td>
<td>$2,000</td>
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<tr>
<td>Central Repository</td>
<td>GIS Team in IT</td>
<td>OT</td>
<td>IT</td>
<td>A</td>
<td>Continue to utilize Esri’s ArcGIS environment to house all City GIS data. This central repository is located within the IT Department.</td>
<td>$3,000</td>
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<tr>
<td>Metadata</td>
<td>Various Departments</td>
<td>OT</td>
<td>NA</td>
<td>B</td>
<td>Establish and enforce standard operating procedures (SOP) for developing metadata standards.</td>
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<tr>
<td>Custodianship</td>
<td>GIS Team in IT</td>
<td>OT</td>
<td>NA</td>
<td>B</td>
<td>Clearly define data custodianship roles within the enterprise governance model. This includes coordination between all departments. Each department should be responsible for specific digital data layers.</td>
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<tr>
<td>Mobile Solutions for Viewing and Maintaining Data</td>
<td>GIS Team in IT</td>
<td>OG</td>
<td>IT</td>
<td>B</td>
<td>The City should plan, design, and deploy Esri's ArcGIS Online as the mobile software solution. This should be supplemented by a continued effort to identify new, advanced, convenient, and easy-to-use mobile GIS and GPS field tools to collect, update, and maintain the GIS data repository. A uniform approach to using ArcGIS Online would benefit the City of Concord. $15,000</td>
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</tbody>
</table>

**PROCEDURES AND WORKFLOW**

| Integration and Interoperability | Various Departments | OG | IT | A | Continue to integrate GIS with the City's existing business systems. $17,500 |
| Improve Departmental Use of GIS Software | GIS Team in IT | OG | NA | A | The City should use the AGOL suite of products, including Intranet, internet, dashboard, collector application, and all free online Esri solutions to quickly and effectively improve departmental use of GIS software. **Funding covered in GIS Software.** |
| Improve Departmental Access to Critical Data | GIS Team in IT | OG | NA | A | The City should use AGOL Internet and Portal for ArcGIS Intranet solutions to quickly and effectively improve departmental use of GIS software. **Funding covered in GIS Software.** |
| Mobile Solutions | GIS Team in IT | OG | Various | A | Integrate ArcGIS Online Mobile into departmental workflow procedures. $10,000 |
| Eliminate Data Duplication | GIS Team in IT | OT | NA | A | Eliminate data duplication between systems. |
| Define Meta Data Standards | GIS Team in IT | OT | NA | B | Define the City’s Meta data requirements and establish and enforce Standard Operating Procedures (SOP) for developing metadata standards. |
| GIS Standard Operating Procedures (SOP) | GIS Team in IT | OG | NA | A | 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, Metadata Standards, Standard Naming Conventions, and GIS Business Integration. |
| GIS Technical Support (Ticketing and Service Desk) | GIS Team in IT | OG | IT | A | Enforce the use of the IT’s ticketing procedure for all GIS activity within the City. |
| Custodianship of Data Layers | GIS Team in IT | OG | NA | B | Detail departmental custodianship of all data layers. |

**GIS SOFTWARE**

| Effective Use of the Existing Esri Licensing | Various Departments | OG | IT | A | The City should use the existing Esri license agreement to effectively deploy the right tools to the right people. |
| Intranet Solution | GIS Team in IT | OG | IT | A | Deploy a state of the art Intranet using the existing Esri licensing. $10,000 |
| ArcGIS Online (AGOL) Software Initiative | GIS Team in IT | OG | IT | A | Plan, design, and deploy AGOL, including the setup, configuration, and effective use of the tools and applications available. Level 2 ArcGIS Online licensing. $5,000 |
| Internet Public Access Portal | Various Departments | OG | IT | A | Use the AGOL solution to deploy a state of the art solution for the public. $5,000 |
| Crowdsourcing | Various Departments | OG | Various | B | Engage and solicit input from citizens by promoting crowdsourcing applications. Utilize a reliable database to house information gathered from the crowdsourcing application. $10,000 |
| Elected Officials | Various Departments | OG | NA | B | Use GIS as a tool to provide timely and accurate data to the elected officials. |
| Mobile Software Solutions | Various Departments | OG | Various | A | Plan, design, and deploy Esri’s ArcGIS Online as the mobile software solution for the City of Concord. |
| GreenCityGIS | Parks and Recreation | OG | P&R | B | Deploy GreenCityGIS for P&R, integrated with Accela. $50,000 |
| Free Esri Application Online | Various Departments | OG | NA | B | After the migration of the City’s GIS to the LGIM the City should take advantage of all applications available online. |

**GIS TRAINING AND EDUCATION**

| Governance Model | IT Executive Committee | OT | NA | A | Implement a centralized hybrid governance model that promotes ongoing training and education. |
| Software Training | Various Departments | OG | IT | A | Provide software GIS training and educational opportunities to all City staff on a regular basis. Utilize Esri’s Online Education and Training services through the existing licensing agreement. Provide formal classroom training for identified departmental staff. $50,000 |

**Funding covered in GIS Software.**

**$**
| Knowledge Transfer | Various Departments | OG | NA | A | Establish a GIS user group network within the organization to help facilitate growth.
Establish quarterly GIS meetings. | $0 | $0 | $0 |
| Formal On-Going Training Plan | GIS Team in IT | OG | NA | A | Implement a formal sustainable GIS Training Plan. | $0 | $0 | $0 |
| Mobile Training | Various Departments | OG | NA | B | As part of the formal training plan, develop a strategy for the effective use and training of mobile field devices. | $0 | $0 | $0 |
| Conferences | GIS Team in IT | OG | IT | A | Attend workshops and pre-conference seminars at the Esri International Users Conference and regional Esri California Conferences. | $7,500 | $7,500 | $7,500 |
| Online Seminars and Workshops | GIS Team in IT | OG | NA | A | Use all available online training, education, and knowledge transfer workshops. | $0 | $0 | $0 |
| Seminars and Workshops | GIS Team in IT/Various Departments | OG | NA | A | The GIS Team will offer seminars and workshops tailored to specific departmental applications of GIS. | $0 | $0 | $0 |
| Departmental Specific Training | Various Departments | OG | Various | A | Promote departmental specific GIS training. Encourage and promote targeted GIS training, including:
1. General Executive Management Workshop
2. Public Safety GIS Workshop
3. Utilities Workshop
4. The ROI of GIS in City Government | $10,000 | $10,000 | $10,000 |

| INFORMATION TECHNOLOGY (IT) | IT | OT | IT | A | Ensure the most optimum network and hardware is in place for the GIS initiative. | $0 | $0 | $0 |
| IT Specific Training | IT | OG | IT | A | GIS Staff within the IT Department should participate in GIS specific training including GIS System Administration, ArcSDE, Geodatabase Design, and SQL Server. | $5,000 | $5,000 | $5,000 |
| 24/7 Availability | IT | OG | IT | A | The IT Department should continue to provide network stability, security of data, and 24/7 availability to City staff. | $0 | $0 | $0 |
| Enterprise Back-Up | IT | OG | IT | A | The IT Department should continue with GIS data back-up and database recovery solutions. | $0 | $0 | $0 |
| Data Storage | IT | OG | IT | A | The data storage and network speed for the enterprise GIS should continue to be administered by the IT Department. | $0 | $0 | $0 |
| Develop a Citywide Mobile GIS Plan | IT | OT | IT | A | The City and IT Department should develop an integrated and enterprise tool for mobile operations that includes ArcGIS Online. | $0 | $0 | $0 |

**Yearly Total**

| INFRASTRUCTURE | IT | OT | IT | A | | | |
| | | | | | | | | | $408,000 | $172,500 | $174,100 |
### TACTICAL PLAN OF ACTION SCHEDULE

This following project schedule lists each of the above tactical items by year.

<table>
<thead>
<tr>
<th>Tactical Item</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>GoVERNANCE</td>
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<tr>
<td>Complete the Multi-Year GIS Strategy Implementation Plan</td>
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<tr>
<td>GIS Authority and Control</td>
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<tr>
<td>Accessibility to Data</td>
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<tr>
<td>Enterprise Standard Operating Procedures</td>
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<tr>
<td>Grants and Funding</td>
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<tr>
<td>Coordinated Enterprise</td>
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<tr>
<td>IT Executive Committee</td>
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<tr>
<td>Develop GIS User Group</td>
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<tr>
<td>Formalize and Ratify GIS Governance Model</td>
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<tr>
<td>Key Performance Measures</td>
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<tr>
<td>Promote GIS</td>
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<tr>
<td>Annual Update to the Plan</td>
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<tr>
<td>GIS Annual Detailed Work Plan and Service Level Agreements</td>
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<tr>
<td>Alignment of GIS with the City of Concord's Vision, Goals, and Objectives</td>
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<tr>
<td>User Sensitivity and a Measure of the Quality of GIS Service</td>
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<tr>
<td>DATA AND DATABASES</td>
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<tr>
<td>Conduct a Digital Data Assessment</td>
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<tr>
<td>Conduct an Enterprise Database Design</td>
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<tr>
<td>Data Creation</td>
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<tr>
<td>Improve Access to Critical Foundation Data Layers</td>
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<tr>
<td>Master Data List</td>
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<tr>
<td>Central Repository</td>
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<tr>
<td>Metadata</td>
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<tr>
<td>Custodianship</td>
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<tr>
<td>Mobile Solutions for Viewing and Maintaining Data</td>
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<td></td>
</tr>
<tr>
<td>PROCEDURES AND WORKFLOW</td>
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<td></td>
</tr>
<tr>
<td>Integration and Interoperability</td>
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<tr>
<td>Improve Departmental Use of GIS Software</td>
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<tr>
<td>Improve Departmental Access to Critical Data</td>
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<tr>
<td>Mobile Solutions</td>
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<tr>
<td>Eliminate Data Duplication</td>
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<tr>
<td>Define Meta Data Standards</td>
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<tr>
<td>GIS Standard Operating Procedures (SOP)</td>
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<tr>
<td>GIS Technical Support (Ticketing and Service Desk)</td>
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<tr>
<td>Custodianship of Data Layers</td>
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</tr>
</tbody>
</table>

- **As Needed**: 1-time task
- **Repeated Each Year**: Cycles annually
- **Normal Task**: Performed each quarter

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
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<td>Q2</td>
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<td>Q3</td>
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<tr>
<td>Q4</td>
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</table>

The table above illustrates the quarterly tracking of each tactical item over a three-year period, highlighting the timing of each task within the plan.
## Three Year Tactical Plan of Action Schedule

<table>
<thead>
<tr>
<th>Tactical Item</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
</tr>
<tr>
<td><strong>GIS SOFTWARE</strong></td>
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<tr>
<td>Effective Use of the Existing Esri Licensing</td>
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<tr>
<td>Intranet Solutions</td>
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<tr>
<td>ArcGIS Online (AGOL) Software Initiative</td>
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<tr>
<td>Story Maps</td>
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<tr>
<td>Internet Public Access Portal</td>
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<tr>
<td>Crowdsourcing</td>
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<tr>
<td>Elected Officials</td>
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<tr>
<td>Modeling Extensions</td>
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<tr>
<td>Mobile Software Solutions</td>
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<tr>
<td>GreenCityGIS</td>
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<tr>
<td>Free Esri Application Online</td>
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<tr>
<td><strong>GIS TRAINING AND EDUCATION</strong></td>
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<tr>
<td>Governance Model</td>
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<tr>
<td>Software Training</td>
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<tr>
<td>Knowledge Transfer</td>
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<tr>
<td>Formal On-Going Training Plan</td>
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<td>Mobile Training</td>
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<tr>
<td>Conferences</td>
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<tr>
<td>Online Seminars and Workshops</td>
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<tr>
<td>Seminars and Workshops</td>
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<tr>
<td>Departmental Specific Training</td>
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<tr>
<td><strong>INFRASTRUCTURE</strong></td>
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<tr>
<td>Information Technology (IT)</td>
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<tr>
<td>IT Specific Training</td>
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<tr>
<td>24/7 Availability</td>
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<tr>
<td>Enterprise Back-Up</td>
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<tr>
<td>Data Storage</td>
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<tr>
<td>Develop a Citywide Mobile GIS Plan</td>
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RETURN ON INVESTMENT FOR THE CITY OF CONCORD

Geographic Technologies Group (GTG) administered an on-line questionnaire and conducted interviews with each of the nine departments that comprise the City of Concord. The following discussion represents a summary of the possible Return on Investment (ROI) opportunities and details benefits of GIS technology as it relates to the following departments:

- City Management
- Community and Economic Development
- Finance
- Human Resources
- Information Technology (IT)
- Naval Weapons Station Reuse Project
- Parks and Recreation
- Police
- Public Works

How can the City of Concord’s GIS investment benefit the City and its citizens? Why should the City of Concord invest in GIS and what will it do for the community? The following illustrates the possible benefits to the City:

- Provide A Safer City and Community
- Improve Efficiency and Provide Cost Savings in Infrastructure Management
- Provide Better Quality Parks and Recreation Services to The Community
- Stimulate the Economy and Promote Economic Vitality
- Engage and Notify Citizens
- Establish A City-Wide High-Tech Image
- Promote the City as A Good and Active Steward of Conservation
- Provide A Cleaner City
• Provide for A Well-Run City
• Allow Quick Dissemination of Information Between City Staff and Citizens
• Provide Citizen Access to City Data
• Allow the City to Provide Quality Public Service
• Empower Stakeholders to Make Informed Decisions

There are many benefits GIS can offer the City of Concord and its citizens if a Phased GIS Strategic Plan is adopted and implemented, including:

**SAVING MONEY**
Establishment of a formalized GIS results in cost savings and cost avoidance. Immediate savings can be seen through more informed decisions and increased productivity enterprise-wide. Cost avoidance becomes apparent as GIS helps organizations efficiently reduce and eliminate costs associated with day-to-day operations and projects.

**SAVING TIME**
The ability to have critical information in a timely matter when you need and want it saves staff resources and money. Furthermore, information can be made publicly available through an easy-to-use browser environment, ultimately reducing demands on staff.

**INCREASING PRODUCTIVITY**
Access to accurate, up-to-date information instantly reduces staff time searching for lost data or trying to rectify inaccurate data. Accurate digital and electronic GIS mapping can be easily accessed by and shared among all departments through a multitude of completely customizable ways.

**IMPROVING EFFICIENCY**
GIS helps organizations reduce and eliminate redundant steps in workflow processes. Cutting-edge GIS programs and applications greatly reduce workloads and facilitate new procedures and methods, resulting in increased productivity, efficiency, and creativity.

**IMPROVING DATA ACCURACY**
GIS creates maps from data; or paper maps can be digitized and translated into GIS. Maps can be derived from any location, at any scale, and can be configured to represent selected information to highlight specific characteristics. Precise GIS data enables users to generate accurate reports and produce quality maps instantly.
### MAKING BETTER DECISIONS
GIS is a critical tool to query, analyze, and map data. GIS can, for example, be used to choose a location for development that has minimal environmental impact, is in a low risk area, and is close to a population center.

### SAVING LIVES
In an emergency, when every second counts, GIS can lead rescuers quickly and accurately to the scene. The time saved in locating a citizen can be the difference between life and death.

### AUTOMATING WORK-FLOW PROCEDURES
The implementation of a formal GIS aids in task automation that expedites work-flow and enhances the ability to react efficiently during a crisis. GIS can automate routine analysis, map production, data creation and maintenance, reporting, and statistical analysis.

### IMPROVING INFORMATION PROCESSING
Enterprise-wide GIS streamlines the flow of information throughout the organization, leading to better accuracy, better access, and increased efficiency in every aspect of the organization.

### COMPLYING WITH STATE AND FEDERAL MANDATES
Digital inventories of utility infrastructure are becoming increasingly important in local governments. A complete GIS enterprise includes asset management, inventory control, and depreciation based on accurate and timely data including age, size, and construction materials; this allows managers to predict and schedule repairs and replacement.

### PROTECTING YOUR COMMUNITY
Safety officials, with the support of a functioning GIS, have the capability to develop emergency plans and respond to disasters more effectively than ever before. GIS provides tools to monitor conditions, recognize threats, predict consequences, and respond effectively and efficiently to man-made or natural disasters. GIS can also help officials deliver widespread information to citizens during an emergency, through public-facing notification systems and the Internet.

### IMPROVING COMMUNICATION, COORDINATION, AND COLLABORATION
The presence of organized communication is the key to running an effective organization. GIS helps staff and elected officials convey complex information in easy-to-understand and user-friendly formats.

### PROVIDING DATA TO REGULATORS, DEVELOPERS, AND OTHERS
GIS makes it easy to deliver information for complex political and regulatory requirements. Regulators and developers will can consider all pertinent data, which ultimately results in well-informed decisions and superior results.
RESPONDING MORE QUICKLY TO CITIZEN REQUESTS

With GIS data at arm’s reach, staff members can easily respond to citizen requests for information. Modern GIS provides maps that are inherently easy to understand, conveying traditionally complex statistics, graphs, and spatial phenomena in a clear and comprehensible environment.

IMPROVING CITIZEN ACCESS TO GOVERNMENT

Internet access to GIS information is the ultimate convenience for citizens. Citizens can now obtain GIS information from their home, office, or mobile devices; staff is then free to help citizens with more complicated requests, resulting in increased customer satisfaction.

EFFECTIVELY MANAGING ASSETS AND RESOURCES

Effective management starts with analyzing, tracking, managing, allocating, and conserving assets. GIS technology makes production and delivery quick and efficient with maximum benefits.

Citizen Benefits and Return on Investment

There are also be many benefits to the community, including:

- **ENHANCED PUBLIC SAFETY** – Use GIS to improve Public Safety operations, including (1) predicting where crime will occur, (2) changing patrol beats and operations by mapping patterns of crime, and (3) enhancing the dispatching and routing of vehicles. **A SAFER CITY AND COMMUNITY**.

- **ADVANCED ASSET AND WORK ORDER MANAGEMENT** – GIS, complete with stewardship practices, can be employed to keep an up-to-date record of all City asset’s including age, condition, and location. **BY BUILDING AND MAINTAINING A DIGITAL GIS MODEL OF AN ORGANIZATIONS ASSETS, THE ENTERPRISE WILL SEE IMPROVED EFFICIENCY AND COST SAVINGS**.

- **IMPROVED LAND AND PARKLAND MANAGEMENT** – Using GIS to inventory parks and park assets, as well as looking at patterns of recreation users, will improve operations and services. **PROVIDE QUALITY SERVICE TO THE COMMUNITY THROUGH GIS-MANAGED AND MAINTAINED PARKS AND IMPROVED OPERATIONAL DECISION MAKING**.
• **ENCOURAGE AND RETAIN ECONOMIC DEVELOPMENT** – The implementation of GIS in the economic sector of an enterprise can provide numerous benefits through gap analysis, information dissemination, and market evaluation. **GIS STIMULATES THE ECONOMY.**

• **IMPROVE THE WAY THE CITY INFORMS, ENGAGES, AND NOTIFIES THE COMMUNITY OF EVENTS** – GIS offers opportunities for voluntary citizen sign-ups so the community can be instantly e-mailed notifications of (1) crime occurring within 1 mile of their house or (2) building permits being issued within 2 miles of their house. **INNOVATIVE WAYS TO ENGAGE AND NOTIFY CITIZENS.**

• **ENABLE CITIZENS WITH ACCESS TO SPATIAL DATA ON-THE-GO** – Deploying mobile-friendly GIS applications will place public-facing information at citizens' fingertips. Mobile GIS is truly changing the way organizations operate not only internally, but with their citizens as well. **USE MOBILE GIS TOOLS TO CONNECT WITH CITIZENS.**

**Enterprise Issues and Program Cost Reductions / ROI**

GTG has identified the following possible program cost reductions based on departmental interviews during the Needs Assessment phase of this project. These program cost reductions are generalized for the entire enterprise, based on a specific department’s implementation of a GIS component, but an enterprise usage of that component. Hourly savings are based on enterprise usage and are a combination of multiple departments and multiple staff members using GIS technology on various levels. For example, not one department can be attributed with the implementation of a GIS Internet Data Browser, but, the entire City will realize an extreme and true ROI. The saving estimates is GTG’s interpretation of time or percentage of time savings based on the GIS interviews and discussions with staff at the City of Concord.
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<thead>
<tr>
<th>Recommended Task</th>
<th>Description</th>
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<tbody>
<tr>
<td>Complete the Multi-Year GIS Strategy Implementation Plan</td>
<td>The City needs to complete the three-year GIS Strategic Plan that details every task required to deploy a true enterprise solution that takes advantage of the latest technology and architecture. It should include a vision, and goals and objectives as well as Key Performance Indicators (KPI) for the GIS initiative.</td>
<td>IT Executive Committee</td>
<td>With the completion of this plan, the City of Concord will be well positioned to take their GIS to the next level. The time savings discussed in this section will attest to the benefit of this plan and the recommended tasks.</td>
</tr>
<tr>
<td>GIS Authority and Control</td>
<td>The City of Concord should fill the GIS Manager position within the IT Department to oversee all GIS functions within the City. There is a distinct need for a GIS Manager within the IT department that supports all departments equally, and has the authority to direct GIS development across the enterprise. There is currently a vacant GIS Manager position. This should be filled as soon as possible.</td>
<td>IT Executive Committee</td>
<td>There is a current GIS Manager position that is open which should be filled. Since this is currently a funded position there will not be an added cost to the City. It is expected, though, that approximately 25 hours of the current GIS Analysts time over the course of a year will be freed up by the GIS Manager taking on these responsibilities.</td>
</tr>
<tr>
<td>Accessibility to Data</td>
<td>The City needs to improve accessibility to GIS software and GIS data to all City employees and all other interested parties. The existing AGOL solutions do not meet the need of the stakeholders.</td>
<td>IT Executive Committee</td>
<td>See “Intranet Solution” and “Internet Public Access Portal”</td>
</tr>
<tr>
<td>Enterprise Standard Operating Procedures</td>
<td>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, Metadata Standards, Standard Naming Conventions, and GIS Business Integration.</td>
<td>IT Executive Committee</td>
<td>See “GIS Standard Operating Procedures (SOP)”</td>
</tr>
<tr>
<td>Grants and Funding</td>
<td>The GIS Manager should encourage the pursuit of grants for GIS software, data, training, and staff.</td>
<td>IT Executive Committee</td>
<td>There are a number of grants available for local governments relating to GIS. They range from Public Safety grants to Environmental grants to Public Works/Utility grants. As recommended in the plan, the City should take advantage of all available grant opportunities. It is expected that the City should be able to secure $75,000+ in grant funding for various GIS projects.</td>
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<tr>
<td>Coordinated Enterprise</td>
<td>Develop and coordinate all GIS activity within the City of Concord.</td>
<td>IT Executive Committee</td>
<td>See “GIS Authority and Control”</td>
</tr>
<tr>
<td>IT Executive Committee</td>
<td>Fold a GIS Steering Committee, comprised of directors from each department, into the existing IT Executive Committee. Develop a strategy for the Steering committee’s goals and objectives.</td>
<td>IT Executive Committee</td>
<td>Although there is not a large savings opportunity for this task, it will be the guiding group for the GIS initiative at the City of Concord, resulting in the successful deployment of this plan.</td>
</tr>
<tr>
<td>Develop GIS User Group</td>
<td>GIS users throughout the City should participate in the GIS User Group. Develop a strategy for the GIS User Groups goals and objectives.</td>
<td>IT Executive Committee</td>
<td>Like the IT Executive Committee, this group will be the driving force for GIS users within the City. Knowledge learned and gained through a successful GIS User Group will enable staff to be more productive and share new and innovative ways to perform GIS tasks. It is estimated that through this collaboration, staff will be 25% more efficient regarding GIS tasks.</td>
</tr>
<tr>
<td>Formalize and Ratify GIS Governance Model</td>
<td>Adopt a new governance model that includes the GIS Manager, technical staff in IT, a steering committee, and a GIS user Group. This should promote a culture of collaboration. If the City does not transition to Subject Matter Experts (SME) maintaining their own data within each department, GIS will remain as it is currently and will not grow as desired.</td>
<td>IT Executive Committee</td>
<td>See “GIS Authority and Control” and “Data Creation”</td>
</tr>
<tr>
<td>Key Performance Measures</td>
<td>Establish enterprise and departmental GIS performance measures and Key Performance Indicators (KPI) as well as a Return on Investment (ROI).</td>
<td>IT Executive Committee</td>
<td>The KPI’s outlined for each of the six GIS components should continue to be reviewed and updated annually along with a plan update. This will ensure the City is hitting/exceeding the mark in regards to the goals outlined in this plan.</td>
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<tr>
<td>Promote GIS</td>
<td>Promote GIS both internally and externally to showcase the successes.</td>
<td>IT Executive Committee</td>
<td>The internal and external user base will not grow if the City does not promote it. Staff should promote new data, apps, and tips/tricks to the appropriate users on a monthly or at least quarterly basis. This will ensure all users are kept up-to-date on what is happening and stay engaged. This will drive the user base of the GIS and help the program to mature.</td>
</tr>
<tr>
<td>Annual Update to the Plan</td>
<td>Update the GIS Strategic Plan on an annual basis using an online questionnaire and departmental interviews.</td>
<td>IT Executive Committee</td>
<td>Like the KPI task, the plan should be reviewed annually to update the status on each of the GIS tasks and ensure the upcoming tasks are still in line with the City’s goals and the GIS industry. This will be a cost to the City, but should lead to improved ROI opportunities.</td>
</tr>
<tr>
<td>GIS Annual Detailed Work Plan and Service Level Agreements</td>
<td>The GIS Manager should create an annual GIS work plan that details all departmental support. This may also include the development of SLA between the IT-GIS and each department.</td>
<td>IT Executive Committee</td>
<td>The GIS Manager should prioritize the work plan for each department annually and update it monthly or even weekly based on changing priorities and needs. It is estimated this will improve the efficiency of the current GIS by 15%. This will help streamline processes and to prioritize staff time. As documented in this section, many hours should be saved for the current GIS Analyst, resulting in time to work on more “Analyst” related tasks.</td>
</tr>
<tr>
<td>Alignment of GIS with the City of Concord’s Vision, Goals, and Objectives</td>
<td>The GIS Manager should align all GIS activity and initiatives with the City’s overall vision, goals, and objectives.</td>
<td>IT Executive Committee</td>
<td>See “GIS Annual Detailed Work Plan and Service Level Agreements”</td>
</tr>
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<tr>
<td>User Sensitivity and a Measure of the Quality of GIS Service</td>
<td>The GIS Manager should measure satisfaction levels annually using an online questionnaire and feedback at User group meetings. This should be reported to the Steering committee.</td>
<td>IT Executive Committee</td>
<td>See “GIS Annual Detailed Work Plan and Service Level Agreements”</td>
</tr>
<tr>
<td>Conduct a Digital Data Assessment</td>
<td>Perform a comprehensive assessment of the quality, quantity, and completeness of all digital data layers with specific emphasis on the critical layers – Parcels, Address Points, Street Centerlines, Aerial Photography</td>
<td>GIS Team in IT</td>
<td>The GIS Team in IT should evaluate or contract with someone to evaluate the status of key digital data layers. This will not only improve efficiency in maintaining these layers moving forward, but will increase user confidence in each of these layers. Although this is not tied directly to a time/cost savings, it will entrust confidence amongst the user base both internally and externally.</td>
</tr>
<tr>
<td>Conduct an Enterprise Database Design</td>
<td>Establish and implement Esri’s LGIM – with opportunities for customization where needed.</td>
<td>GIS Team in IT</td>
<td>By implementing Esri’s LGIM the current GIS Analyst will save time during data maintenance procedures, but also when creating new layers for staff. The LGIM comes pre-loaded with key data layer schemas for many layer needs within local government. The GIS Analyst will be able to leverage these existing layer schemas as a solid starting point for many layer requests. Additionally, layers are well organized within the LGIM environment and will allow other staff to quickly catch on to the data structure. The City will also be able to deploy free apps from Esri that are based on the LGIM out of the box. It is expected that the GIS Analyst will save 100 hours annually with the updated structure of the LGIM and the centralization of the data. Efficiency amongst other users will be improved as well as they come on board.</td>
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<tr>
<td>Data Creation</td>
<td>Develop a plan to collect, update, and convert all required departmental digital data layers over an agreed upon period</td>
<td>GIS Team in IT, CED, Finance, Parks and</td>
<td>Up-to-date GIS layers provide all departments with much needed levels of accuracy currently not in place. Correcting and</td>
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<td>of time including the list of required data layers detailed in the GIS Assessment.</td>
<td></td>
<td>Recreation, Public Works</td>
<td>maintaining base map layers will enhance multi-departmental efforts in a variety of fields. It is recommended that the City move away from maintaining their own parcel data layer and begin using the County provided layer. This will free up 208 hours of the current GIS Analysts time each year to perform other tasks. Additionally, each department should maintain their key data layers. It is estimated that once each department is maintaining their own datasets the GIS Analyst will have an additional 145 hours annually to devote to other tasks.</td>
</tr>
<tr>
<td>Improve Access to Critical Foundation Data Layers</td>
<td>Develop a multi-tiered approach allowing all departments to view and access base map layers including parcels, address points, street centerlines, and aerial photography in real-time. The City of Concord should focus on the utilization of Esri’s ArcGIS Online tools. **Funded through other tasks. This will be accomplished with a central data repository and Intranet Viewer deployment. **</td>
<td>GIS Team in IT</td>
<td>See “Intranet Solution”</td>
</tr>
<tr>
<td>Master Data List</td>
<td>Create an updated and accurate Master Data List and maintain on a regular basis.</td>
<td>GIS Team in IT</td>
<td>Having a master data list will save time and improve efficiency for not only the GIS staff in IT, but other GIS users City-wide. It is imperative that a definitive master data list is created and maintained that all staff can rely on. It is estimated that staff will save 140 hours annually by not having to research where the latest data layer is located. Additionally, staff can rely on the data for legal and exhibit purposes when they know it is correct.</td>
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<tr>
<td>Central Repository</td>
<td>Continue to utilize Esri’s ArcSDE environment to house all City GIS data. This central repository is located within the IT Department.</td>
<td>GIS Team in IT</td>
<td>Similar to having a master data list, having all of the City’s GIS data in one central location will save time and improve efficiency for all City GIS users. It is estimated a total of 175 hours will be saved annually across the City by having all data centrally located.</td>
</tr>
<tr>
<td>Metadata</td>
<td>Define the City’s Metadata requirements and establish and enforce Standard Operating Procedures (SOP) for developing metadata standards.</td>
<td>GIS Team in IT</td>
<td>Accurate “data about data” will save City staff valuable time in determining the source of the most recent data layers.</td>
</tr>
<tr>
<td>Custodianship</td>
<td>Clearly define data custodianship roles within the enterprise governance model. This includes coordination between all departments. Each department should be responsible for specific digital data layers.</td>
<td>GIS Team in IT</td>
<td>See “Data Creation”</td>
</tr>
<tr>
<td>Mobile Solutions for Viewing and Maintaining Data</td>
<td>The City should plan, design, and deploy Esri’s ArcGIS Online as the mobile software solution. This should be supplemented by a continued effort to identify new, advanced, convenient, and easy-to-use mobile GIS and GPS field tools to collect, update, and maintain the GIS data repository. A uniform approach to using ArcGIS Online would benefit the City of Concord.</td>
<td>GIS Team in IT</td>
<td>See “Mobile Software Solutions”</td>
</tr>
<tr>
<td>Integration and Interoperability</td>
<td>Continue to integrate GIS with the City’s existing business systems.</td>
<td>CED, GIS Team in IT, Parks and Recreation, Police, Public Works</td>
<td>Will reduce time required to access data in multiple systems (Accela, TriTech, other enterprise systems) by enabling it spatially within the GIS. Tabular data can be visualized in a spatial context.</td>
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<tr>
<td>Improve Departmental Use of GIS Software</td>
<td>The City should use the AGOL suite of products, including Intranet, internet, dashboard, collector application, and all free online Esri solutions to quickly and effectively improve departmental use of GIS software. **Funding covered in GIS Software. **</td>
<td>GIS Team in IT</td>
<td>See “Intranet Solution”</td>
</tr>
<tr>
<td>Improve Departmental Access to Critical Data</td>
<td>The City should use AGOL Internet and Portal for ArcGIS Intranet solutions to quickly and effectively improve departmental use of GIS software. **Funding covered in GIS Software. **</td>
<td>GIS Team in IT</td>
<td>See “Intranet Solution”</td>
</tr>
<tr>
<td>Mobile Solutions</td>
<td>Integrate ArcGIS Online Mobile into departmental workflow procedures.</td>
<td>GIS Team in IT</td>
<td>See “Mobile Software Solutions”</td>
</tr>
<tr>
<td>Eliminate Data Duplication</td>
<td>Eliminate data duplication between systems.</td>
<td>GIS Team in IT</td>
<td>See “Master Data List” and “Central Repository”</td>
</tr>
<tr>
<td>GIS Standard Operating Procedures (SOP)</td>
<td>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, Metadata Standards, Standard Naming Conventions, and GIS Business Integration.</td>
<td>CED, GIS Team in IT, NWSRP, Parks and Recreation, Police, Public Works</td>
<td>The time savings for this task will be realized once it is successfully implemented, but it is expected that efficiency of GIS data creation and maintenance will increase by over 30% with the successful development and deployment of SOP’s at the City. As more departments begin to maintain GIS data and the NWSRP begins to obtain more CAD/GIS data, it is imperative that SOP’s are well defined and adhered to across all departments and users.</td>
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<tr>
<td>GIS Technical Support (Ticketing and Service Desk)</td>
<td>Enforce the use of the IT’s ticketing procedure for all GIS activity within the City.</td>
<td>GIS Team in IT</td>
<td>The IT Department should continue providing a service desk for GIS users across the City. With an increase in the GIS user base expected, staff should continue to learn and grow with the GIS program at the City.</td>
</tr>
<tr>
<td>Custodianship of Data Layers</td>
<td>Detail departmental custodianship of all data layers.</td>
<td>GIS Team in IT</td>
<td>See “Data Creation”</td>
</tr>
<tr>
<td>Effective Use of the Existing Esri Licensing</td>
<td>The City should use the existing Esri license agreement to effectively deploy the right tools to the right people.</td>
<td>GIS Team in IT</td>
<td>Will streamline the process of accessing data throughout the City. Will remove duplication of efforts, thereby saving both time and money. More efficient data production will result from identifying key departments to maintain key data layers. Using the most efficient method to create and maintain data on one set of servers instead of multiple sets. Using the most up-to-date licensing structure will avoid duplicate software licenses. Using shared, or “concurrent” licenses should be the continued method for the City.</td>
</tr>
<tr>
<td>Intranet Solution</td>
<td>Deploy a state of the art Intranet using the existing Esri licensing.</td>
<td>All Departments</td>
<td>All City departments and staff will benefit from viewing GIS data. Will allow departments to generate mailing labels and other types of address-based information in a matter of seconds. This alone is estimated to save staff hours of time. For the GIS Analyst, it is estimated a total of 230 hours annually can be saved by enabling staff with an easy-to-use Intranet Solution and the ability to generate mailing labels on their own.</td>
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<tr>
<td>ArcGIS Online (AGOL) Software Initiative</td>
<td>Plan, design, and deploy AGOL, including the setup, configuration, and effective use of the tools and applications available.</td>
<td>CED, GIS Team in IT, Parks and Recreation, Police, Public Works</td>
<td>See “Intranet Solution” and “Internet Public Access Portal”</td>
</tr>
<tr>
<td>Internet Public Access Portal</td>
<td>Use the AGOL solution to deploy a state of the art solution for the public.</td>
<td>CED, GIS Team in IT, NWSRP, Parks and Recreation, Police, Public Works</td>
<td>Providing public access to data will save the City significant staff hours per week in responding to public requests for information. The time savings generated by these applications will grow as citizens become aware of and familiar with the technology. This will also enable the public with the ability to research questions normally asked of City staff. This can be promoted by staff to encourage the public to search for information to satisfy their requests and needs. Allowing the public to freely access information online will free up staff to perform other duties. An open data portal is a great way to disseminate information to interested parties. It is estimated that over 300 hours of staff time enterprise-wide will be saved by deploying the right tools and information to the public.</td>
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<tr>
<td>Crowdsourcing</td>
<td>Engage and solicit input from citizens by promoting crowdsourcing applications. Utilize a reliable database to house information gathered from the crowdsourcing application.</td>
<td>City Management, CED, GIS Team in IT, Parks and Recreation, Public Works</td>
<td>By implementing a crowdsourcing tool staff will free up secretary call taking. It is estimated that calls to each department for customer needs should reduce by 40 – 50%. This will allow those staff to do perform additional tasks within the department. There will always be a need, though, for staff to monitor the phone as some citizens will prefer calling the department directly.</td>
</tr>
<tr>
<td>Elected Officials</td>
<td>Use GIS as a tool to provide timely and accurate data to the elected officials.</td>
<td>CED, GIS Team in IT, NWSRP, Parks and Recreation, Police, Public Works</td>
<td>Staff will continue to use GIS to provide GIS results to Elected Officials. More users will come on board and be able to generate their own outputs from the GIS as needed. This will free up approximately 40 hours annually of the GIS Analysts time.</td>
</tr>
<tr>
<td>Modeling Extensions</td>
<td>The City should take advantage of Esri’s modeling extensions for the desktop.</td>
<td>CED, GIS Team in IT, Police, Public Works</td>
<td>GIS analysis tasks can be completed in a timely fashion using enterprise software. Eliminating the duplication of efforts across multiple departmental lines. For the short term, it is recommended that the GIS Analyst continue to perform tasks requiring Esri extensions. Based on the number of hours saved with several of the recommendations, the GIS Analyst will be able to assist more with “Analyst” type requests.</td>
</tr>
</tbody>
</table>
| Mobile Software Solutions | Plan, design, and deploy Esri’s ArcGIS Online as the mobile software solution for the City of Concord. | CED, GIS Team in IT, Parks and Recreation, Police, Public Works                | Reduce time required to locate assets in the field. Particularly important in instances where potential safety hazards may not be readily visible or instances in which infrastructure repairs are critical. Will save operations and field personnel time by identifying and reviewing work orders in the field. Additionally, new orders can be sent out to resources near existing work saving travel time and expense. Asset and operations data accuracy will increase because data entry and...
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<td>GreenCityGIS</td>
<td>Deploy GreenCityGIS for P&amp;R, integrated with Accela.</td>
<td>Parks and Recreation, Public Works</td>
<td>Processing is taking place at the time the error is found and corrected. Accurate collection of data will save time and resources. It is estimated that by deploying Mobile Software Solutions enterprise-wide the City will save over 1,000 hours across all departments annually.</td>
</tr>
<tr>
<td>Free Esri Application Online</td>
<td>After the migration of the City’s GIS to the LGIM the City should take advantage of all applications available online.</td>
<td>All Departments</td>
<td>The Parks and Recreation and Public Works Departments should deploy GreenCityGIS to save time and money on the upkeep and maintenance of their park assets. By integrating with Accela and other P&amp;R/Public Works systems, it is expected to increase efficiency in these departments by 25%. This will be accomplished through the accurate inventory of all assets linked to Accela as well as enabling field staff with this information. Staff will no longer need to visit or call the office for key information. They can pull it up on their device while on-site.</td>
</tr>
<tr>
<td>Governance Model</td>
<td>Implement a centralized hybrid governance model that promotes ongoing training and education.</td>
<td>IT Executive Committee</td>
<td>The GIS Analyst, along with the GIS Manager and other IT Staff, should identify and deploy free Esri apps. Time savings in other areas should allow the GIS department to focus on these apps and opportunities more moving forward.</td>
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<tr>
<td>Software Training</td>
<td>Provide software GIS training and educational opportunities to all City staff on a regular basis. Utilize Esri’s Online Education and Training services through the existing licensing agreement. Provide formal classroom training for identified departmental staff – including Desktop, Intranet, Internet, Mobile, GPS, ArcGIS Online and Story Maps, and Extensions.</td>
<td>All Departments</td>
<td>See “Formal On-going Training Plan”</td>
</tr>
<tr>
<td>Knowledge Transfer</td>
<td>Establish a GIS user group network within the organization to help facilitate growth. Establish quarterly GIS meetings.</td>
<td>All Departments</td>
<td>See “Formal On-going Training Plan”</td>
</tr>
<tr>
<td>Formal On-Going Training Plan</td>
<td>Implement a formal sustainable GIS Training Plan.</td>
<td>GIS Team in IT</td>
<td>Fully trained personnel will be empowered to work more efficiently. Once staff are trained to use the new Intranet GIS Viewer, they will free up at least 330 hours annually for the existing GIS Analyst (map creation, mailing label generation, and data layer creation/maintenance)</td>
</tr>
<tr>
<td>Mobile Training</td>
<td>As part of the formal training plan, develop a strategy for the effective use and training of mobile field devices.</td>
<td>CED, GIS Team in IT, Parks and Recreation, Police, Public Works</td>
<td>See “Formal On-Going Training Plan”</td>
</tr>
<tr>
<td>Conferences</td>
<td>Attend workshops and pre-conference seminars at the Esri International Users Conference and regional Esri California Conferences.</td>
<td>GIS Team in IT</td>
<td>Although this will be an added expense for the City, the knowledge and networking opportunities far outweigh the cost. Select Executives and GIS staff should attend the Esri UC each year to learn more about leveraging the City’s investment in GIS. This will allow staff to troubleshoot, brainstorm, and come up with new and innovative ways to do things and disseminate information.</td>
</tr>
<tr>
<td><strong>Recommended Task</strong></td>
<td><strong>Description</strong></td>
<td><strong>Department(s)</strong></td>
<td><strong>Possible Savings for the City of Concord</strong></td>
</tr>
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<tr>
<td><strong>Online Seminars and Workshops</strong></td>
<td>Use all available online training, education, and knowledge transfer workshops.</td>
<td>CED, GIS Team in IT, Parks and Recreation, Police, Public Works</td>
<td>See “Formal On-Going Training Plan”</td>
</tr>
<tr>
<td><strong>Seminars and Workshops</strong></td>
<td>The GIS Team will offer seminars and workshops tailored to specific departmental applications of GIS.</td>
<td>CED, GIS Team in IT, Parks and Recreation, Police, Public Works</td>
<td>See “Formal On-Going Training Plan”</td>
</tr>
<tr>
<td><strong>Information Technology (IT)</strong></td>
<td>Ensure the most optimum network and hardware is in place for the GIS initiative.</td>
<td>IT</td>
<td>Ensuring the users have continual and reliable access to the City’s GIS data and apps is imperative to the entire initiative. Providing this service ensures staff have access to the data and applications when they need it.</td>
</tr>
<tr>
<td><strong>IT Specific Training</strong></td>
<td>GIS Staff within the IT Department should participate in GIS specific training including GIS System Administration, ArcSDE, Geodatabase Design, and SQL Server.</td>
<td>GIS Team in IT</td>
<td>See “Formal On-Going Training Plan”</td>
</tr>
<tr>
<td>Recommended Task</td>
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<tr>
<td>24/7 Availability</td>
<td>The IT Department should continue to provide network stability, security of data, and 24/7 availability to City staff.</td>
<td>IT</td>
<td>See “Information Technology (IT)”</td>
</tr>
<tr>
<td>Enterprise Back-Up</td>
<td>The IT Department should continue with GIS data back-up and database recovery solutions.</td>
<td>IT</td>
<td>Ensuring a full backup is performed of the GIS database and servers will save time should there be a need to restore them at a later date.</td>
</tr>
<tr>
<td>Data Storage</td>
<td>The data storage and network speed for the enterprise GIS should continue to be administered by the IT Department.</td>
<td>IT</td>
<td>See “Information Technology (IT)”</td>
</tr>
<tr>
<td>Develop a Citywide Mobile GIS Plan</td>
<td>The City and IT Department should develop an integrated and enterprise tool for mobile operations that includes ArcGIS Online.</td>
<td>GIS Team in IT</td>
<td>See “Mobile Software Solutions”</td>
</tr>
</tbody>
</table>
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 Concord 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 smartphone 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.

- **Citizen notification** – Akin to LBS, discussed in the last bullet, is citizen notification. Public safety has led the way of late in implementing applications that will notify citizens if a crime occurs within a certain distance of their houses, schools, places of worship, etc. Citizens 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 citizen’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 citizens when a change of any type is occurring nearby. For example, Wayne County, North Carolina provides its citizens 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.

**CONCLUSION**

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, citizens 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.
Concord has realized several successes in the process of developing a Geographic Information System (GIS) program. A solid foundation and tremendous opportunity exist for Concord 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 Concord’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. Therefore, it is important to understand that the results are skewed towards the departments with the most respondents and have not been statistically normalized.

![Pie chart showing department distribution](image)

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

1. parks
2. Recreation
3. N/A
4. Engineering
5. Capital Improvements Program - Engineering
6. Admin
7. Parks
8. Engineering
9. Engineering
10. Engineering
11. Economic Development & Housing
12. Parking Services
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:**
  - Supervise work crews in Medians and Street trees. I manage and monitor computerized tree inventory and computerized irrigation watering systems.
- Provide recreational, wellness and lifelong learning opportunities to the community. Includes program marketing, direct mailing etc.
- Department Head
- To manage technology infrastructure and applications throughout the organization.
- execution of CIP projects
- Capital Improvements Program - Project Management; Customer Service; Consultant management for design or construction; Public interaction regarding Capital Projects; Interdepartment interaction regarding Capital Projects; Coordination with various government entities, utility providers, and public regarding Capital Projects.
- Public Works Admin Sewer Levy
- Oversee the Community Reuse Project at the former Concord Naval Weapons Station
- Park Supervisor
- I use GIS daily to verify sewer and storm drain lines and connections as well as creating GIS objects to show where work has been done in the ROW.
- Manage Current Development for Engineering Manage Stormwater program
- Manage FEMA floodplain compliance
- Evaluates development applications and environmental impact assessments. Issues encroachment permits for work in the public right of way as well as the site development. Provides information to the public on streets, sewers, storm drains, and grading.
- Attraction, Retention and Expansion of businesses and the creation and preservation of affordable housing
- To supervise the Parking Services Department and to oversee all aspects of parking citations, towed vehicles, citizen complaints, parking complaints, and the taxi and tow programs, etc.
- Maintaining city assets and infrastructure
- Implement design and construction of projects for Capital Improvement Program.

- Providing parks and recreation programs and services to the community through assets such as parks, swimming pools, community centers, events, etc.

- Promote and review development requests

- Accepting applications for Community Development Block Grant (CDBG), Child Care Developer Fee (CCDF), and Concord/Pleasant Hill Health Care District (CPHHCD) funds. Reviewing Applications. Working with Community Services Commission and the CPHHCD Grant Committee by having monthly meetings to review applications, etc. Review reporting from agencies that received funding. Send required reporting information to HUD for CDBG allocations. Part of the CDBG money goes to Housing Rehabilitation. So we work with another agency that helps us provide Grants and Loans to low-income individuals to repair or rehab their homes. CDBG clients need to be at least 51% low-income people from Concord.

- We do Capital Improvement Projects.

- Capital Improvement Program management (streets, sewers, sidewalks, bikeways, parks, facilities, etc) Current Development entitlement and plan review Issuance and inspection of grading, site development and encroachment permits Stormwater/Cleanwater Program management Sewer Enterprise fund management

- Oversee the daily operations of the Work Alternative Program, the city wide Pesticide Program, and the Landscape Median Maintenance Program.

- Providing first responder police services to the community.

- Benefits administration, recruitment, workers compensation, organizational training, labor relations

- Investigative follow-up, evidence collection and preservation.

- GIS, Network and Operations, PMO and Business Systems

- Run the City; Support the Council
- To provide and facilitate health, wellness and independence through the collaborative delivery of programs, services, special events and activities.
- Business attraction, retention and expansion
- Entitlements, zoning, current and long-range planning
- Assist captain with projects, manage staffing
- To repair vehicles and equipment
- Office of Emergency Services Volunteers in Police Services Community Emergency Response Teams Crime Prevention Event Planning
- Budget, coordination of Naval Weapons Station base usage for outside agencies, schedule meetings, provide support for the consultants/management, etc.
- Offer classes, camps and programs to members of all ages in the community. We also hold special events of all sizes.
- Maintain the City's infrastructure, ie: Street Lights, Traffic Signals, Curb Gutter and Sidewalks, Streets, Sewer and Storm Drain
- Development Review services: Manage and staff Plan Review and Inspection services; Manage and staff Permit Center; manage and operate Multi Family Rental Inspection Program. Collect revenues for building permitting process. Issue refunds or forfeitures for building permitting processes
- Current development project entitlements, Zoning, Specific Plans, General Plan and amendments, sustainability policies, design review board and planning commission staffing.
- I oversee facility rentals at Centre Concord.
- I am the stats guy for the police department. I analyze crime statistics which includes mapping them out to see the concentrated areas of the city. In addition I do a lot of intelligence analysis for the department which requires mapping.
- Facility maintenance, graffiti, custodial
- Planning
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 good mix of users. The chart reveals that there are a number of staff that use GIS often. Another group uses GIS on occasion. 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 Concord. 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. Concord should anticipate an uptick in web users and a downtick in the need for some of those users to use paper maps moving forward.

![](image)

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

- I am not currently involved in much of this, but really wish I had the knowledge on what GIS can do to help me out in my job. I am sure we could benefit from several of the above activities if we knew more about them.
- The IT Dept. (GIS Team) manages most of the GIS data throughout the organization. The GIS Team also manages the GIS Web Services and all of the GIS software. IT is a small
"consumer" of the GIS data or services, but does assist other Departments (e.g. Police Dept.) in using GIS to analyze data such as crime patterns or prepping GIS data sets for CAD/RMS address verification.

- Parcel/Owner/Tenant Information for addresses or Mailers; Right of way Information; Utility Information (Stormwater, Sewer, etc); Topographic Information; Aerial Photos for Displays
- Most of the GIS is used by outside consultants to assist the Navy with boundary and parcel identification - for remediation or environmental mitigation purposes.
- Demographic and parcel information
- This is not GIS per se, but we typically have a need for mailing lists within a specific radius and maps for our reports
- We need maps of the low income areas of Concord that include the block numbers above include current and needed
- We have an annual map we put together for our CERT program too.
- Addresses/Maps in specific areas
- My responses to questions 2 and 3 represent current usage. If GIS was more stable and accessible, the usage and applications on it would naturally increase from the levels indicated to be current.
- We have IT staff do GIS work for Planning and Community Development. It is not an appropriate use of time to have Planning staff conduct GIS work. They have other responsibilities.
**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 incident analysis but several users dive deeper for analytical uses.

![Bar chart showing various analytical tasks performed through the use of maps](image.png)

**Comments:**

- None that I am aware of, but I think several would benefit us in our planning and marketing of programs. Such as the Parks Analysis and the Real Estate Analysis possibly.
- The IT Department typically does not use GIS for itself but does assist other Departments with their mapping/analytical needs.
- Asset management, customer service, property owner information/verification
- Locating parcels for confirmation with sewer levy. Also, location of sewer mains and flow direction.
- Sewer and storm drain location
- If we are doing Development with CDBG money, we have to do an Environmental Report which may need the Environmental Impact Analysis. Usually, we only need a map with Concord Income levels
- Encroachment Permits, Capital Improvement Program project construction, master planning of facilities, street moratorium management, public notification, asset management, records research
- Parcel addresses
- The use of the City's GIS Program to determine the location of public/private property lines.
- Street sweeper routing
- ?
- Currently we utilize it to perform GIS look ups in Accela Automation for Sanitary District Service Areas, Fire Station 22 OSIP Fee applicability, Building Code Enforcement Beat Zones utilizing Police Beat Areas, and flood hazard zones; Creating objects in public right-a-way to allow creation of permits to be tagged to them and utilizing the longitude/latitude coordinates to locate them on relevant GIS maps
- Schedule infrastructure maintenance of streets, Storm Drain, and Sewer and would like to add Street Lights and Traffic Signals to the list.
- Question is unclear.
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.
- none that I am aware of. When I need something I usually call someone in that area and they take care of it.
- Don't know
- ArcGIS Desktop, ArcGIS Server, ArcGIS Spatial Analyst, Accela GIS, Accela Mobile GIS
- ARchGIS
- AutoCAD; Civil 3D; ArcGIS
- Accela; IT Pipes; Public Stuff; Tremble; iTrac Signs; Google maps
- Most of our GIS needs are provided by ARUP - our engineering/planning consultant.
- ESRI
- ArcGIS Accela GIS
- Accela Automation
- GIS Mapping concordprspector
- We frequently use the "Available Properties" function through the drop down menu on the City’s website, which is linked to Concord Prospector, my understanding is this is managed through a separate service, which may or may not interact with the City's GIS division.
- I have used the interactive GIS software.
- I don’t usually do the maps myself. We ask for them and someone else puts them together for us.
- City GIS, Accela GIS, ESRI On-Line w/ Collector App (Contra Costa Cleanwater Program), Google Earth/Maps, CCCounty GIS, Berkeley Traffic Incident Management System (TIMS), and other municipal/county sites, MTC Street Saver
- Google maps, Google Earth, City's GIS Data base.
- GIS and Prospector
- None
- None
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. This is being addressed in the strategic plan training chapter. Additionally, others want access to more data as well as an easy-to-use viewer. This was a common theme during the departmental interviews as well and is covered in this document.
Comments

- I don't even know if I have access.
- My feeling is that GIS at the City of Concord is just not very visible. There are a few core individuals that use it, but not to the extent that it should be used. Our current GIS web application lacks functionality, is difficult to use, and is not aesthetically pleasing.
- The GIS system will become increasingly important to the project as land transfers from the Navy to the City and the Specific Plan for Phase 1 moves forward.
- We also need to retype the information the system does not generate and repopulate from the inputted information.
- I don't even know if I have access to use GIS in the city.
- I am fine with the City’s current GIS mapping Program. I have no needs for any changes.
- Reliability and accuracy of GPS equipment.
- This relates to Permits Plus.
- Lack of staffing, even when two staff were available.
- Do we even have access to a mapping system?
- Pricing of Accela GIS licenses is a huge deterrent for its use. We struggle with insufficient number of licenses in CED overall; The use of multiple "accela" map sets (accela2, accel3, accel5) makes it very difficult to understand what is current and what is not current and which one should be used; the Accela GIS system is not configured properly for Accela Mobile Office; specific tweaking needs to be done to make the maps look and operate appropriately in Accela Mobile Office applications. The interface to Accela GIS is not intuitive and there is a lot of function that is available but not understood by IT staff or City users because little in-depth training has occurred. Accela GIS consistently opens very slowly in Accela Automation and in Accela Mobile Office applications. Users get discouraged about the time it takes to process a given record due to the slowness; GIS at the City has not been an area of concentration for development and thus it has not be fully leveraged yet. It is not only important to find out how it is used now, but how it can be used in the future to get the most out of it. Very little knowledgebase of Accela GIS usability and configuration exists at the City.
- System contains old outdated data which makes it difficult to map sometimes.
- We don’t have a mapping system because IT does GIS work for Planning.

**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.
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.

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<th>Rating</th>
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<td></td>
<td>3.03%</td>
<td>12.12%</td>
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<td>18.18%</td>
<td>0</td>
<td>18.18%</td>
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Respondent’s Comments:

- We don’t have knowledge of the system, so rating effectiveness is not possible. Also, the answer to #7 above is what I think we would have if we had knowledge, training and access to GIS.

- I’d say it is meeting IT’s needs, but that is because IT staffs the core GIS Team and therefore has all of the necessary tools and understands where the data is and how to use it.

- ArcGIS - The system is a little slow, specially when selecting parcels; exporting data is not simple;

- Most GIS work on the project is currently done by outside consultants for very specific purposes. As the project progresses - the GIS needs will primarily show up in the CED department, rather than Community Reuse Planning

- The system is slow. The available data is extremely limited. The quality of the data is often poor. The functionality to manipulate the data is very limited. Ideally, the GIS would include a robust source of integrated data, mapped to a high level of accuracy, which could be easily and quickly searched and required data extracted in a convenient format.

- I find the system confusing, slow and hard to work with.
• We contract with GIS Planning to provide Economic Development oriented GIS content through www.concordprospector.com
• Not aware of the abilities or software that we are using beyond concord prospector.
• Again, I don't personally use the existing GIS. Brenda Kain, my boss, may be using it.
• Prospector often doesn't seem up to date with the latest shape files.
• Again, I assume this means Permits Plus since GIS in Accela has only recently been implemented. Permits Plus map function was not supported and therefore I had to use other resources to generate maps.
• Currently we employ Concord prospector, however it does not give information such as land contours, zoning on surrounding parcels, historic properties, age of structure --- it is a tool more for Economic Development than Planning,
• We use GIS for the things we can.
• We literally have to go to the office and make a request.
• Currently we rarely utilize the GIS department, Victoria will print big maps for me and occasionally run a report.
• Accela GIS functionality and configuration is not well understood or known by City staff, including IT staff. Its usefulness has not been fully realized yet. The City currently struggles with even the most simple configuration issues because there is no one who truly understands its functionality or configuration details to a level that would allow the City to fully leverage its usability. The City has to depend upon consultants or to Accela Help Desk for configuration issues. To fully leverage Accela GIS will take getting a staff member who is interested and vested in learning Accela GIS from the ground up.
• When GIS staff assist us with specific projects, it is useful. However, we are using an outside vendor Concord Prospector for looking up basic zoning and parcel information on a daily basis because our GIS system is not easy to use and not all staff has access or training on it.
• As mentioned previously the data layers are out of date making mapping more complex.
Question #12 – Do you currently utilize the GIS?

- **Intended purpose** – to gauge the overall usage of the GIS.
- **Analysis of the answers** – The overall usage of the GIS based on the survey results is just above 60%. This leaves all lot of opportunities to expand the use of GIS throughout the City.
Question #13 – 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 #14** – What new capabilities would you like to see in terms of a GIS/automated mapping system?

- **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.
  - Unable to answer because I don't know what kind of possibilities exist. Does GIS offer the ability o map census data like income, household size etc?
  - I would be interested in linking GIS with our business license application so we can see the types of businesses in different parts of the city. However, it is possible our BL software has this already included.
  - All City assets (fiber, streets, buildings, sewer/storm infrastructure, trails, trees, traffic signals and signs, etc.) land use, topography (contours), parks, pretty much anything that has a spatial component.
  - mapping for federal projects
  - All available utility information: PG&E(gas, electric, overhead, Etc), Comcast, Water, Sewer, Etc - Curb Ramp locations at Street intersections, public facilities, Parks, with ADA Compliance information such as Slopes, truncated domes, etc. - Environmentally sensitive areas, Fault line, soil contamination areas, etc. - Signal Locations - Bike route Locations
  - City utilities and assets, property owner info (easier access), City facilities
  - Up to date owner information
  - Record maps and other survey data, sewer and storm drain infrastructure mapped to a reliable accuracy, street plans tied to a monumented centerline, contours, flood zones, easements, right-of-way mapped to a reliable accuracy, street dimensions, drainage areas, watersheds, benchmarks, tools to calculate tributary areas for sewer & storm drain collection systems, property data, permit records tied to properties, utility service areas, inspector zones, street classifications, street moratoriums,...
Demographic information. Business information. Building Information such as size and year constructed

Pictometry. Access to building/house plans. Retained information related to parcels

I would need to learn more about the capabilities of GIS systems to provide an answer to this question.

Income level and ethnicity for whole city by block

Based on my limited knowledge, the potential items are significant. It would be helpful if the GIS team could show examples on how GIS can help us do our jobs better and more efficiently, as well as provide greater public access in a more integrated system, without draining our division's limited resources.

Not sure?

Up to date traffic conditions.

Where do seniors live. 50-64, 65-74, 75-84, 85+, income level, number in household. Where do our customers live, age and income. Board and care homes, assistive living and number of residents.

Property owner Square footage of parcel

Business/Premise information

Radius mailing data.

Larger screen for map and all the items listed in #2 below

Don't know what GIS could do for our programs.

Known building types or other elements that represent hazards in the City, such as soft stories, tilt-ups build before 1972, hazardous materials storage, etc. Water sources, building types, and facilities that can be used during emergencies; Multifamily rental housing complexes that are in the rental inspection program;

Storm Drain and Sewer facilities Street Lights Traffic Signals Street names differentiated between City owned and Private Sidewalk
- parcel information, apns, owner information, zoning, General Plan zoning, utilities, easements, type of land use, size of parcels, etc. Tenants of buildings.
- Demographics including income, ages (youth, adults, seniors)
- Parks, Schools, Hotels, Businesses, Parcel layers, and tax zones.
- Land Use and Zoning, fault zones, flood zones
- utility shutoff locations
Question #15 – 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 examples:
  - Improve Efficiency
  - Increase Productivity
  - Save Time
  - Save Money
  - Make Better Quality and... decisions
  - Improve Data Accuracy
  - Automate Workflow...
  - Save Lives
  - Improve Information...
  - Comply with... standards
  - Protect Your Community
  - Improve Communication...
  - Provide Data to Regulator...
  - Respond More Quickly to...
  - Improve Citizen Access...
  - Effective Management of...
Comments:

- By providing citizens access to information via GIS we could save staff "front counter" or "phone" time, freeing up staff to do other tasks. Reduce redundant tasks.
- Enables us to better execute projects especially to identify potential ROW issues and easement issues.
- With a robust and highly functional GIS, all the above checked items are immediate and tangible benefits. Whatever the upfront investment of time and human capital, the payoff is tremendous. I have personally experienced using a GIS as I have described in Section 1 and the results are well worth the efforts. City staff are able to assist the public more efficiently and more effectively. Inter and intra departmental efficiency, communication, and collaboration are greatly increased. Whether providing information to a homeowner, developer, or City Manager/City Council member, you can do it faster and with more reliable data.
- An improved GIS system would allow us to attract and retain businesses to Concord thereby increase revenue to the City.
- In general, there needs to be more communication between IT and our department as to the functionality available to us.
- Before making contact with citizens GIS helps me to determine if a specific area is within the city's responsibility. Also GIS helps me to pinpoint the correct party when locating the responsible party associated with any conflicts or disputes.
- Clean Water Program annual reporting.
- We use GIS information for interface with Accela such as mapping radiuses around projects for mailings for public hearings. It greatly helps when we have to notify property owners or tenants for specific purposes such as long range planning or current planning hearings.
- Improve target marketing for Parks & Recreation programs.
- Emergency management for shutting down damaged utility.
Question #16 - 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.

  - Network turn capability
  - 3D terrain model
  - Robust GIS web application
  - Integration of GIS with existing City applications
  - Migration to MS SQL standard (currently SQL Express)
  - Standardized data schema
  - Mobile data mapping/management
  - more definitive location of ROW lines and easements
  - Be able to select multiple features using the Control Key
  - Be able to select parcels at a certain distance from specific location
  - Be able to export address and owner/tenant information easily based on the parcel selection for the purposes of official mailers and notification letters
  - Topographic information that can be exported for CAD design purposes and/or exhibit purposes
  - Aerial information that can be exported for exhibit purposes
  - Single platform with customizable layers so that users can choose their own views without having to see or sort through layers that are not useful to them.
  - See my description above in 1. as to everything I want and expect a GIS system to be able to do or provide.
  - Please see www.concordprospector.com as the model we would like to see.
  - See #1
  - there is limited capability in current system. All items above are needed.
  - None at this time.
Question #17 – 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.

![Graph showing various benefits of GIS]

**Respondent’s Comments:**

- Improved customer service, improved communication, cost savings, improved morale.
- Better reporting to state agencies
**Question #18** – 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.
  - IT is an internal service fund so each Department pays a share of the overall GIS program costs (staff, hardware, software, etc.)
  - IT
  - not sure
  - Depends on program (i.e. sewer vs. storm)
  - I am not certain
  - managment
  - IT and Department
  - N/A
  - the new IT 7% charge?
  - funded through cost recovery and interdepartmental charges.
  - Not sure.
  - Don’t know
  - IT
  - Different people/programs depending on the application
  - Development review services revenue; technology fees
  - ?
  - CED administration budget, and some technology fees
  - None
  - Cheryl Owens
  - IT
Question #19 – 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 not received any GIS training. This clearly provides an opportunity in the organization to increase GIS knowledge and usage. However, there are some individuals that have received training and experience in the use of GIS as indicated in the comments.

**Respondent’s Comments:**

- Many
- CAD training 2005?
- I’ve been shown the basic tools I need for my Division need via GIS staff.
- In prior employment, ARCGis
- ArcView training a long time ago
- At Accela Conference
- Crime analysis mapping classes beginning, and intermediate. Spatial analytical training.
- I hold an MA in Geography.
Question #20 – 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 clear lines of responsibility in regards to data management. At this time, most everyone recognizes who to go to for data maintenance tasks, but the GIS Program Analyst within IT will not be the sole data maintenance staff person moving forward based on recommendations in this document and discussions with several departments while on-site.
Question #21 – 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 Victoria Zaldua and 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:

- Victoria Zaldua - IT
- Code Enforcement Officers and Information Technology GIS
- David Boatwright, Public Works Department
- Not sure who it is in the city, but we also use the county for Consortium-wide maps
- IT is the repository for maping data and programming.
- Victoria and our Prospector Rep Pablo
- Currently I go through Victoria Zaldua to create my radius mailings.
- Victoria Z. and Tim Stuart
- Haven’t used GIS for Parks & Recreation
Question #22 – 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 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.

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Question #23 – 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.
  
  - We do not have a well-defined GIS Governance.
  - none
  - Lines of responsibility to be clarified. Processes to update with new/revised data to be established.
  - More communication as to systems available, functionality available, training available and expectations of what we do vs. the GIS division.
  - Providing a functioning system with easy access to data, providing options on system and data improvements and clear training on system use by non-experts.
  - None at this time.
  - Not sure.
- More access and connection and use of tools myself, less reliability on another person. For more sophisticated analysis and tools I would still use the GIS division.
- I have not heard much about GIS Governance
- More staffing and/or individuals trained to assist multiple departments.
- Application knowledge and understanding of Integration of applications has been an area of weakness for the City. I would recommend that the City seek high achiever staff members to manage both GIS and Accela that understand both the business side and the technical side of the products to create the best user experience for the products. I believe you cannot fully develop systems such as this without having a core group of knowledgeable staff to manage them and that are not afraid to develop their fullest potential.
- I believe currently we have 1 GIS staff member serving the City. She could probably use some help
- More training for our staff who do use it, better applications of GIS for the public, and for staff to assist the public
- More flow between the city and the PD. I don’t believe the city understands that the PD now has someone at the PD who can understand all the needs of a true GIS system.
- CED does not have the time or staffing to do GIS work. This task must be done by someone specific to a GIS position such as the GIS manager. It is inappropriate for Planners or Engineers to spend time doing GIS work, as they have other responsibilities that have priority.

**Question #24** – Are there any sources of mapping or database information from other department’s/division’s 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**:
  - Not sure, but as mentioned earlier, a goal of mine would be to map/manage any city asset in GIS.
  - none
  - Don’t know
  - Record drawings for sewer, storm drain, and street infrastructure are either not available or inaccessible. No right-of-way maps appear to exist. Property data is limited and incomplete.
  - Not sure.
  - Sorry but I'm not familiar enough to respond.
  - Don't know enough to answer this question
  - all
  - None at this time.
  - N/A
  - Business license address data
  - I can not think of any
  - ?
  - Currently none.
  - not that I know of
  - crime data maps are helpful to planning
  - I would like access to all GIS layers the city side has access to.
Question #25 – 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 than what they currently have. Perhaps, the issue is that users don’t know where to go to access the data.
- **Respondant’s Comments:**
  - Not sure; same as above.
  - As listed before, more accurate ROW information would be very helpful if it were available.
  - Don't know.
  - Right-of-way, street centerlines, property data.
  - Not that I’m aware of.
  - Don't know enough to answer this question.
  - All.
  - None at this time.
  - Planners have mentioned to me that they'd like to see layers for the Airport Zone and any Fault Zones.
  - Beat, Reporting District, Zip Code, etc.
  - Contours, slopes, photo aerial, measuring tools: distance, area, surrounding land use and districts.
  - I cannot think of any.
  - We have a large map in the EOC that is over twenty years old. When I asked to have it updated, I was told it was current enough.
  - This question should be asked after staff is trained on what a GIS data layer is and how data on a GIS layer can be accessed or consumed in applications. Ideas on data use come from an understanding of the backend setup and examples of how GIS systems can be used. I have listed above some examples of areas I
would like to see, but I believe that Accela GIS can also be utilized in Accela Citizen Access and other areas that are not know currently by staff.

- not that I am aware of
- Address points, Parcel layers, Tax base layers, School zones, County streets, County boundaries, County address points.

**Question #26** – 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).
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</table>
**Comments:**

- I am not sure what the above actually means or can provide the Division. So I answered the questions as best I could.
- No knowledge of system operations.
- I do not have a complete understanding of what each of these line items represents. It would be good to have some narrative around what they are to give some idea of what it might represent or cover. "Software" and "Routing" and "Network" are such generic terms, for example, that I am not sure what they might be in the context of this survey. I feel this section is not really useful to me to fill out since I really don't understand the definition of most of these terms in the context of a GIS system.
- We do not have staff with training to fully utilize GIS. Nor do we have time to include it in our jobs at this moment, nor do we have a funded GIS position in CED.
Question #27 - 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 need identified most frequently for Collaboration and Teamwork followed by a centralized corporate database, goals and objectives, and a vision for GIS. This strategic planning effort will help bridge these gaps by providing a foundation for collaboration through shared vision and documented goals.

Comments:

- No knowledge of my departments GIS needs
**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.

![Bar chart showing the most pressing GIS needs](chart.png)

**Comments:**

- Any extra training and tech support is always useful.
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, streamlining business processes, metadata and an enterprise-wide geodatabase.

![Bar chart showing responses to technical needs](image)

**Comments:**

- No knowledge of department required needs.
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 expansion of digital data layers and better user experiences related to GIS.
Comments:

- We just need to be clear on what is available for us to access, who has access, and training available and then the expectations of what we do ourselves and what the GIS division provides.
- No knowledge of what GIS needs are required.
- I checked "additional staff" with an understanding that existing staff does not have the requisite skill set to technically maintain the City GIS system and its integration components. Whether it is replacing staff or new staff will need to be evaluated.

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:

- Access to and the use of GIS needs to be expanded at the City of Concord. Database schema standards need to be set, data sets evaluated for accuracy and documented, GIS Team staffing levels increased. Governance needs to be defined and put in place. Documentation of processes needs to occur.
- Thanks for strategically reviewing the potential for GIS to increase efficiency and effectiveness in our organization.
- see above
- None at this time.
- None at this time.
- My department uses GIS for only a few, but crucial, things so I am unaware of what a lot of the items specified in this survey are or how it would relate to my department. My emphasis and need is mapping and accurate data/radius accumulation.
- GIS is the responsibility of the GIS staff and any changes should not be put upon other departments.
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 garner 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.