



# From Department Silos to Enterprise GIS

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Miguel Garriga, GIS Manager  
[MGarriga@Altamonte.org](mailto:MGarriga@Altamonte.org)  
407-571-8067

Richard Littlefield, GIS Analyst  
[RLittlefield@Altamonte.org](mailto:RLittlefield@Altamonte.org)  
407-571-8251



## Abstract

The City of Altamonte Springs is restructuring the City's GIS to improve data quality and access. What started as Department silos of information have been transformed into a Citywide resource, accessible by web maps and mobile devices. The City is leveraging ArcGIS Desktop, ArcGIS Server, SDE, and ArcGIS Online to make content available to City employees and the public. From field workers to managers, our goal is to give everyone access to the information they need from any device, anywhere.



Paper #: 712

Paper Title: From Department Silos to Enterprise GIS

Session Title: Implementing a GIS Enterprise System

Date: Thursday, July 17, 2014

Time: 1:30 PM - 2:45 PM

Room: Room 25 C



# City of Altamonte Springs

- Central Florida (N of Orlando)
- I-4 Corridor
- City Employees: 400
- Residents: 42,000
- Daytime Population: 100,000
- Office / Retail / Education
  - Altamonte Mall
  - Florida Hospital Altamonte
  - Adventist Health Systems HQ
  - Seminole State College



# GIS at the City of Altamonte Springs

## Software

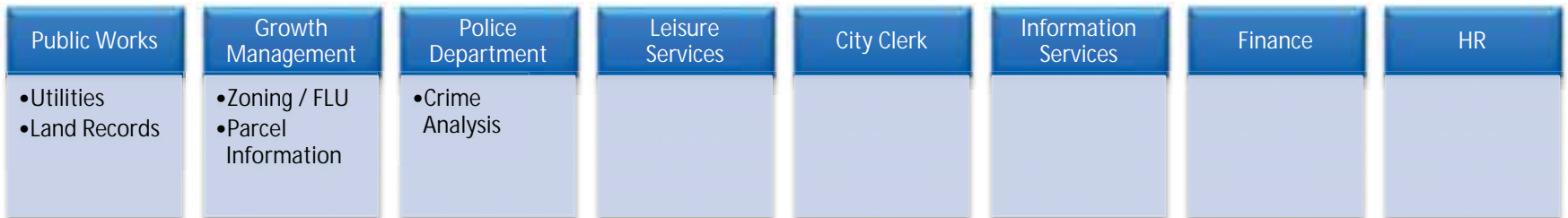
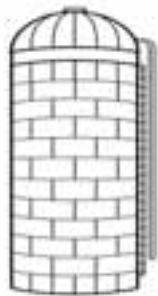
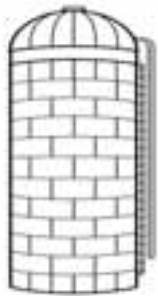
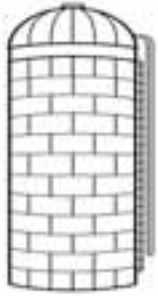
- MapInfo was City's first GIS
- Esri starting in 1983
- Standardized on Esri in 2009

## Milestones

- 1983      Hand-drawn Basemap
- 1991      CAD Basemap
- 2001      Utility Layers Converted to GIS



# Silos

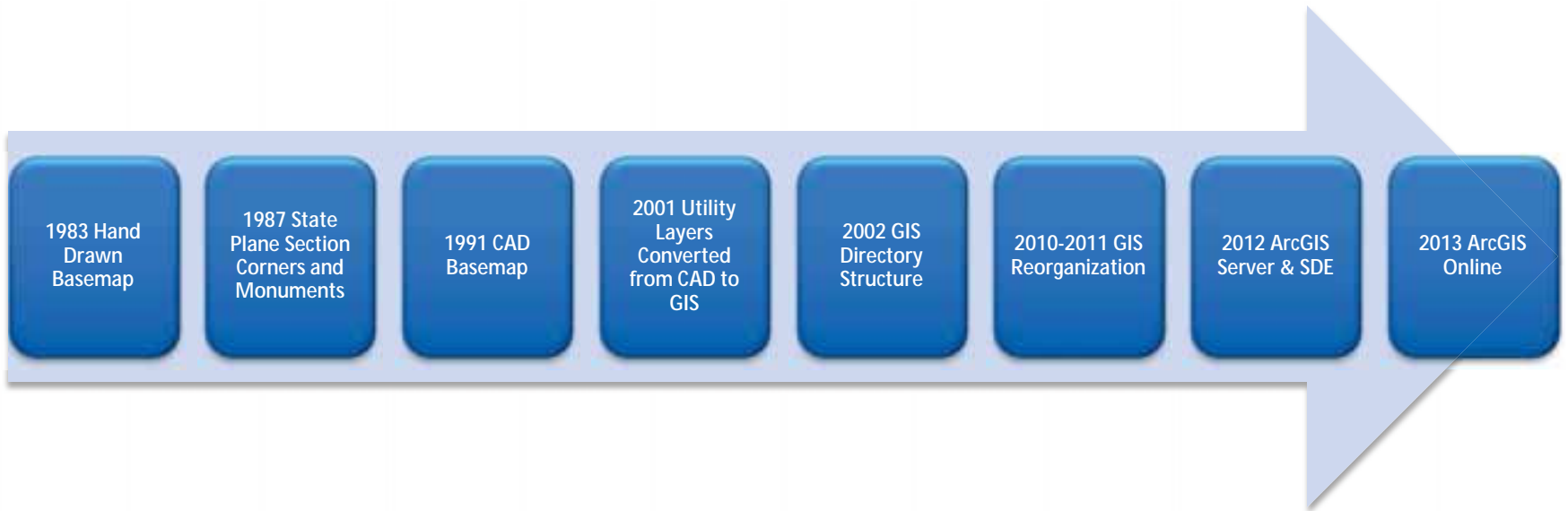


# Enterprise



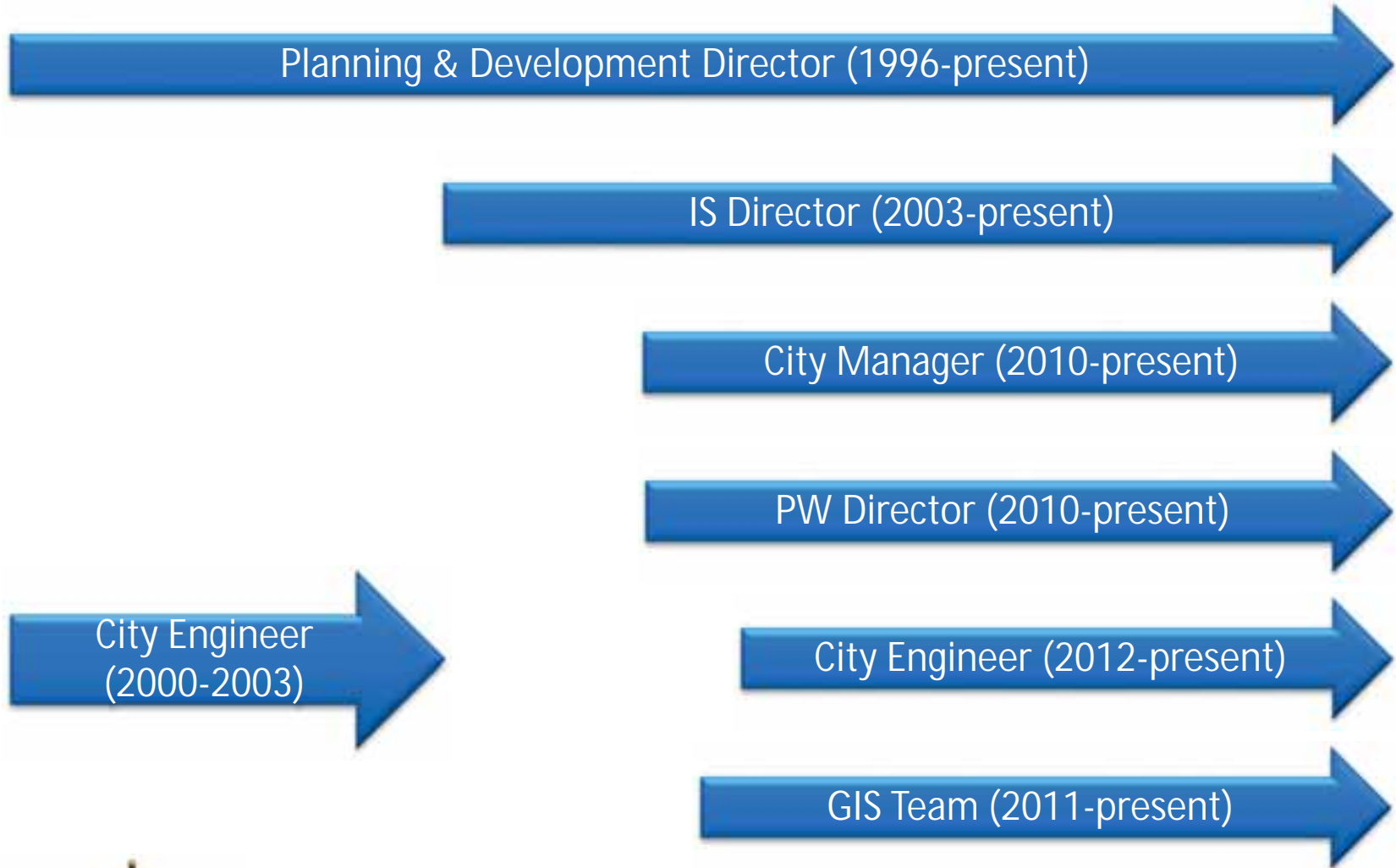
Public Works	Growth Management	Police Department	Leisure Services	City Clerk	Information Services	Finance	HR
<ul style="list-style-type: none"><li>•Utilities</li></ul>	<ul style="list-style-type: none"><li>•Zoning / FLU</li><li>•Parcel Information</li><li>•Land Records</li></ul>	<ul style="list-style-type: none"><li>•Crime Analysis</li></ul>	<ul style="list-style-type: none"><li>•Park Mgmt</li></ul>	<ul style="list-style-type: none"><li>•Commission Districts</li></ul>	<ul style="list-style-type: none"><li>•Fiber Maps</li></ul>		

# Milestones





# GIS Advocates



# Information Silos

- An information silo is an insular management system incapable of reciprocal operation with other, related information systems

Symptoms:

- Lack of Cooperation
- Internal Competition
- Breakdown in Communications

*Sources: Wikipedia, Marcel Cote*

# Silos

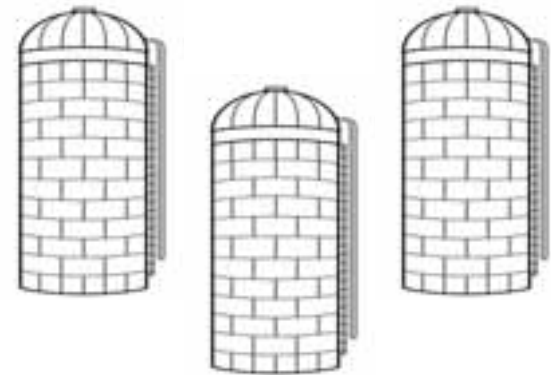
Good for storing  
Bad for sharing

Walls that keep things in also keep things out  
Bunker Mentality

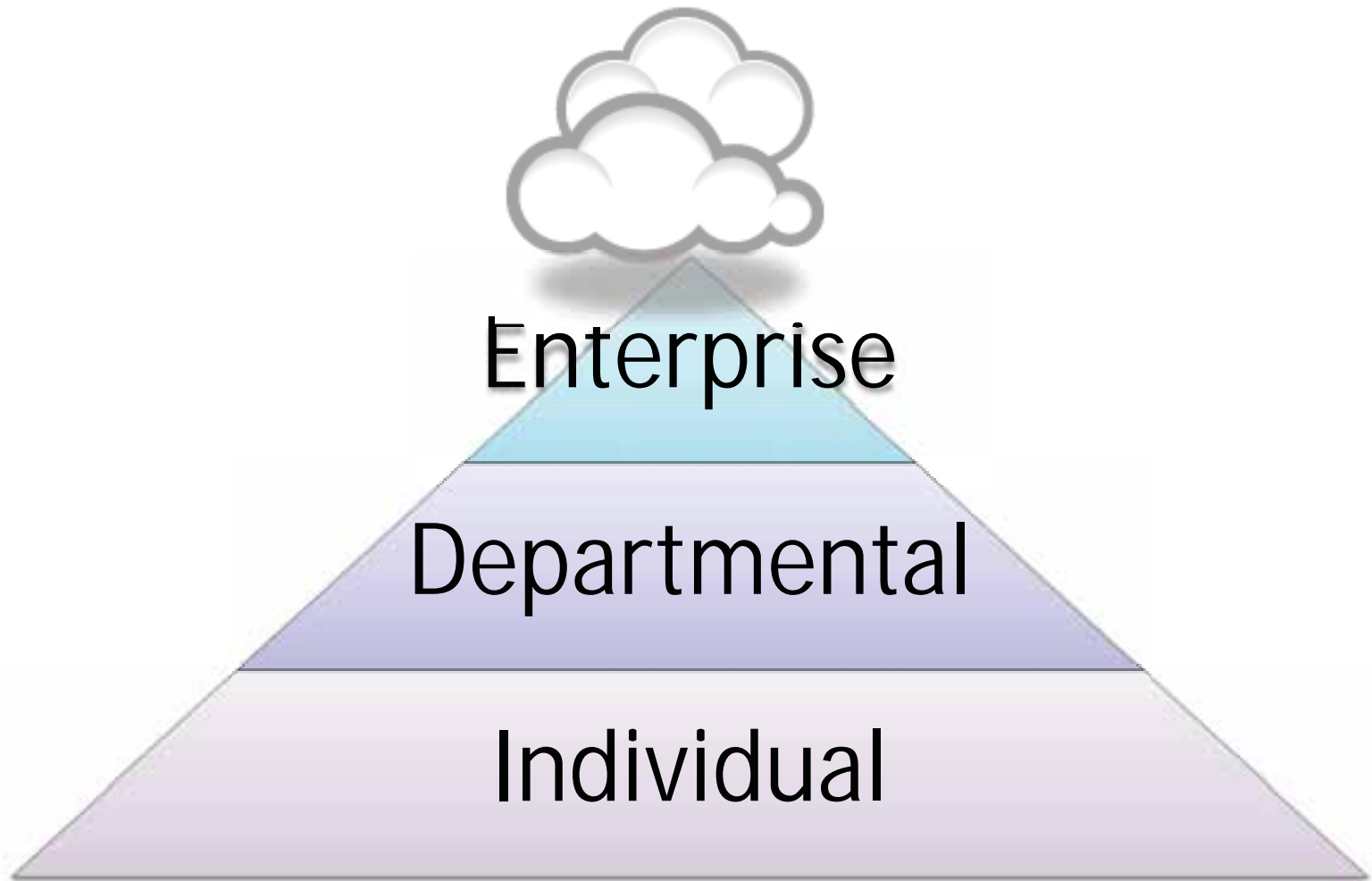
- “My Data”
- Protect the Data
- Resist Sharing Data
- Resist Changing Data
- Errors may never see the light of day

Not ideal for Citywide GIS

- Redundant datasets
- No Data Sharing
- Data Quality Issues
- Inefficient Workflows



# GIS Continuum



# Enterprise GIS

- Enterprise GIS
  - GIS that is integrated through an entire organization so that a large number of users can manage, share and use spatial data and related information to address a variety of needs
  - Enterprise GIS is also made available to other software systems
- Should be capable of:
  - Supporting huge number of simultaneous transactions
  - Integrating with other Enterprise Systems (SAP, Billing)
  - Integrating with Open Geospatial Consortium (OGC) Standards
  - Displaying data in the same way (styles/symbols) for Desktop, Web, and Mobile users
  - Reusable functionality across Desktop, Web, and Mobile

Source: Wikipedia



# GIS Status 2010

## GIS Staff:

- Public Works – Utility Maintenance
  - (1) CADD/GIS Technician
  - (1) CAD Technician
- Growth Management - Planning & Zoning
  - (1) Planning and Development Review Specialist
- GIS User Experience: ArcReader for 29 users in 4 Depts
- Data: Shapefiles, Personal Geodatabases
- Issues: SLOW performance, data locking, poor quality

# ArcReader Issues

- Free viewer, introduced in 1990s (v 8?)
  - Need ArcPublisher Extension to create
  - Unlimited ArcReader users
- Pros:
  - Inexpensive way to deploy GIS to lots of users
  - Looks like ArcGIS Desktop: Easy for GIS professionals
- Cons:
  - Dated Technology
  - Had to install/maintain on each user's PC
  - Looks like ArcGIS Desktop: Hard for casual users
  - Actual use was far below reported use

# GIS Status 2010

## Summary

- GIS maintained by non-GIS professionals
- ArcReader for non-GIS users
- Data in Shapefiles and Personal Geodatabases
- Slow performance, data locking
- No data sharing between users (Silos)
- Incredibly bad data design and workflows



# GIS Restructuring 2010

- City's 2 remaining GIS Staff Retiring
- Opportunity to re-invent the City's GIS
- City IS Governance Board met with GIS leaders from surrounding local governments
  - Goal: Citywide GIS
  - Skills needed
  - Job Titles, Salaries
- New GIS position under IS, funded by PW

# GIS Restructuring 2011

New Position: Senior GIS Analyst

- Under Information Services Department
- Redesign, Restructure GIS Program

First Task: What do we have ?

- Data: Good ? Bad ?
- Software: Do we have what we need ?

# GIS Restructuring

## What do we have ?

1. Data and Map Inventory
  - What data and data products (paper and interactive maps) do we have ?
2. User Survey
  - Which users use which maps ?
  - Who are the real users ?
3. GIS Assessment
  - Overall shape of our GIS
  - Data quality in particular

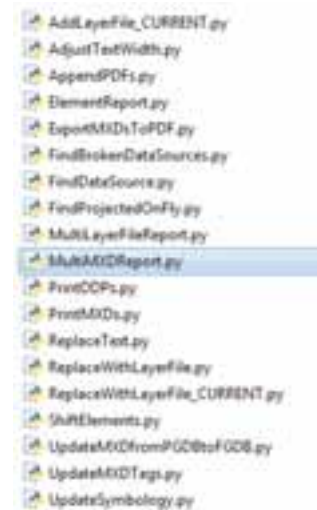
# 1. Data & Map Inventory

## Data Exploration / Discovery Tools

### Tools for analyzing your data

Layers, Domains, Subtypes, Fields, Feature Counts...

- Python
  - Arcpy.mapping sample script tools
    - MultiMXDReport.py
- XRay
- ArcGIS Diagrammer



# Data and Map Inventory

## Python: MultiMXDReport

- Arcpy.mapping Sample Script: MultiMXDReport
  - Recursively Search Folders for MXDs
  - Identify Data Sources used
  - Output to text files
  - Turn into Excel Tables
- Map-Layer Lookup Table (Excel)
  - Map: What Layers are used in a particular map
  - Layer: What Maps does Layer appear in ?
- Result: Identified Key Layers and Maps



# 2. User Survey

## Who Uses What ?

### Grumblings about ArcReader

- Users: Performance slow; data locking
- IS: Has to be installed / maintained on each user's PC
  - Everyone claimed to use it (but few actually did)

### Dozens of ArcReader maps

- All Equally Important (!?)

### Survey:

- List of ArcReader Maps
- Do you use this map ? (Check box)
  - How often ? Let users specify time units – daily, monthly, etc
  - Notes (*Open-ended* questions proved *very* useful !)

# ArcReader Survey Public Works

ArcReader Survey: Please fill out all fields and indicate which ArcReader files you use. Return to Miguel Gattiga by Wed, Feb 2.

Your Name: \_\_\_\_\_ Department: \_\_\_\_\_ Division: \_\_\_\_\_

What do you use ArcReader for? \_\_\_\_\_

Folder	PMF File		Notes: How Often do you use?
G:\GDB\ArcReader Users\	SubdivisionData.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\	Wetiva_BMAP_Project_Locations_Map.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\City Owned Properties	COAS_Properties.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS_Potable Water Maps	COAS_Potable_Water_System_Map.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS_Reclaimed Water Maps	COAS_Reclaimed_Water_Map.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS_Reclaimed Water Maps	COAS_Reclaimed_Water_Pocket_Projects.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS_Refuse Routes Map (PDF)	refuse_routes.pdf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS_Sanitary Sewer System Maps	COAS_Sanitary_Sewer_System_Map.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS_Sanitary Sewer System Maps	CoAS_Sewer_Customers.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS_Storm System Maps	CoAS_Flood_Hazard_Areas.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS_Storm System Maps	COAS_Flood_Zone_Map.pmf	<input type="checkbox"/>	
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G:\GDB\ArcReader Users\CoAS_Storm System Maps	COAS_Wetlands.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS_Storm System Maps	Drainage_Basins_and_Subbasins.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS_Storm System Maps	Watershed_and_Hydrology.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS All Utilities Map	Altamonte_Springs_Utilities_Map.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS All Utilities Map	COAS_Utilities_and_Easement_Map.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS All Utilities Map	Seminole_County_Water_Service_Areas.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS City-Wide Aerial	CoAS_Aerial.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS Fire Hydrant Map	COAS_Fire_Hydrant_Map.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS NGS Map	COAS_NGS_Map.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS NGS Map	COAS_NGS_Map_v_Annotation.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS Street Maintenance Map	CoAS_Street_Maintenance_Map.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS Zoning Map	COAS_Zoning_Map.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS Easement Map	Altamonte_Springs_Easement_Map.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\CoAS Sem City Soil Map	SEMCTY_Soils_Map.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\Consumptive Use and RCW Pockets	Consumptive_Use_and_RCW_Distribution_Map.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\Emergency_Event Management	Emergency_Event_Map.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\Future Land Use Map	FLU_MAP.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\PD_Records City Properties	PD_Records_City_Properties.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\PD_Records City Properties.pmf	PD_Records_City_Properties.pmf	<input type="checkbox"/>	
G:\GDB\ArcReader Users\Sem City GIS Data	Seminole_County_GIS.pmf	<input type="checkbox"/>	

Do you use any ArcReader files not listed above?  No

If Yes, which ones: \_\_\_\_\_

Other Notes or Comments: \_\_\_\_\_



# Survey Results

## Users – Identified:

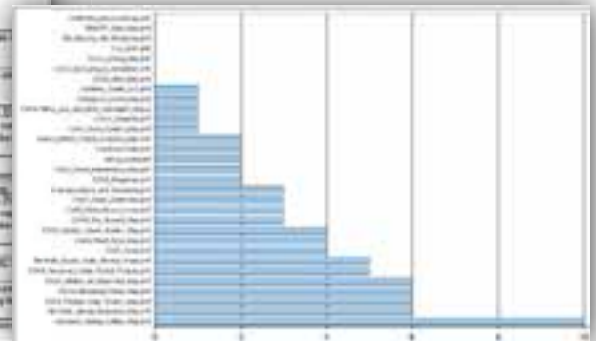
- Power Users
- Potential Data Stewards
- Non-Users

## Data & Maps - Identified:

- Core layers and map products
  - A few maps used regularly
  - Other maps rarely or never used
- Dead layers and map products
  - Discontinue maintenance on them

# User Survey Results

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	Survey Title	Proj. Eng. / Research	Proj. Eng. / Utility	Finance	IT/Systems	Planning	Utility	Reg.	Env.	Public	Gov.	Other	Notes		
1	Departmental Budget														
2	Water & Sewer Authority														
3	Water & Sewer Authority														
4	Water & Sewer Authority														
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50	Water & Sewer Authority														



# 3. GIS Assessment

- What do we have:
  - Data
  - Software
  - Hardware
  - Staff
- How good is what we have ?
- What does each Dept want to do with GIS
  - Are we able to support that ?

# GIS Assessment

## Findings – Data Quality

- Duplicate Datasets
  - Between PW and GM
  - Within PW: Between CAD and GIS
  - Examples: City Boundary, Lakes, Parcels, Lots, Addresses
- Duplicate Data Maintenance
- Many Empty Layers
- Some layers had no attributes (at all) !
- Many attributes not fully populated
  - Pipe Diameter, Material
  - Path to Record Drawing (hyperlink)

# GIS Assessment Duplicate Data



Public Works (CAD)



Growth Management (GIS)

# GIS Assessment

## Findings - CAD Issues

### General CAD Issues

- Data Sharing One-Way, from CAD to GIS
- City would load Entire CAD Basemap into ArcGIS, draw GIS layers on top
- CAD Layers Poorly Organized – features in wrong layers
- CAD Polygons would not close in GIS

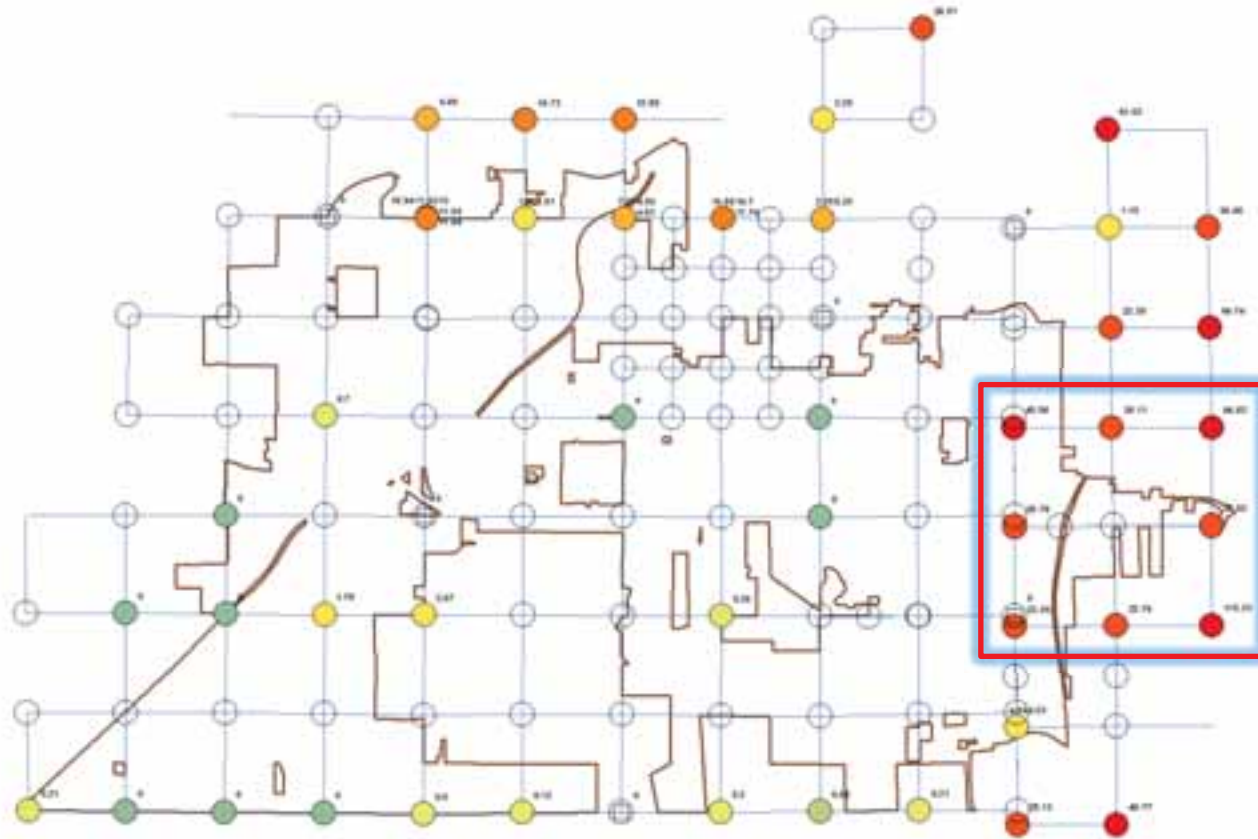
### CAD Alignment Issues

- CAD and GIS data did not line up in some areas
- Public Works believed all CAD linework was survey accurate
  - Overlays with accurate aerial imagery and GIS Layers proved otherwise
  - Major effort to convince spatial accuracy varied a great deal throughout City
- *Shapes of individual features may be survey accurate, but their position in space may not be*

# CAD Alignment Issues

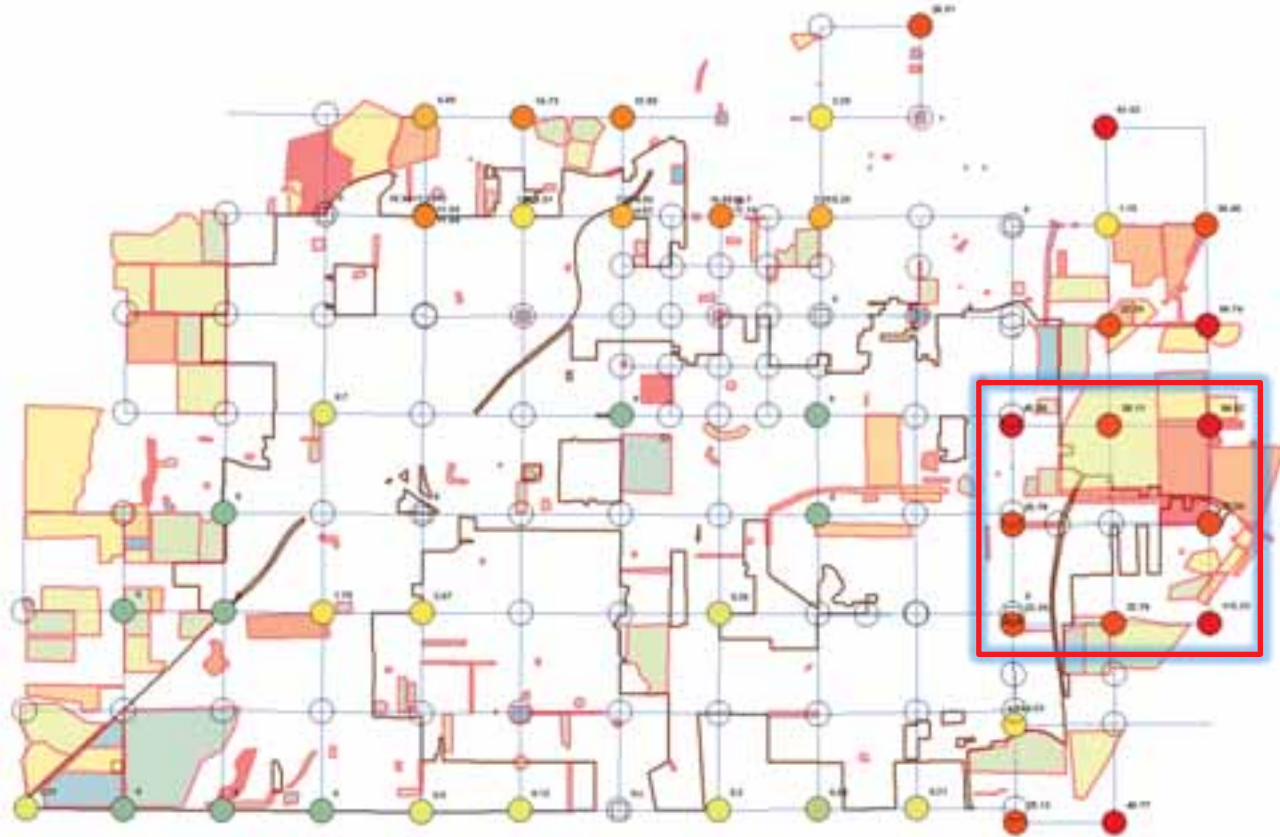


# CAD Alignment - Distance from CAD Corners to Certified Corners





# CAD Alignment – Corner Displacement and Visible Alignment Problems



# Recommendations

## Data

- Avoid duplication of data between & within Departments
- Share data between Departments, Users
  - Should only be one definitive dataset for a given layer
- CAD
  - Identify what layers only exist in CAD and are not in GIS
    - Easements and Annexations
  - Fix alignment issues and move to GIS
- Edit and maintain data at the source
  - by the people who know the data best
  - in the office, or in the field
- Redesign layers as needed to improve data quality, efficiency
- Improve data maintenance workflows
- Use File Geodatabase instead of Personal GDB (avoid Shapefiles)
- Store Enterprise Geodatabase Layers in SDE
- Establish Direct Connection to County SDE
- Improve data sharing between City and County

# Recommendations

## Data and Map Products

- Each data and map product should have a Steward
  - Stewards to maintain Map and Data Inventories
- Discontinue maps and layers no one uses
  - If a product has no Steward to vouch for it
- Resolve Data Conflicts
  - Reorganize layers to avoid duplication
  - One City Boundary

# Recommendations Software

- Replace ArcReader with web maps for all users
- Implement ArcGIS Server Standard Workgroup
  - Enterprise Geodatabase (SDE) SQL Server Express
  - Deploy web mapping applications:
    - Viewing, Analysis, and Data Maintenance
- ArcGIS Desktop for GIS professionals, for analysis and data maintenance that cannot be done with web maps

# Recommendations

## Hardware

- Existing ArcGIS Desktop PCs underpowered
- Specs for new GIS Server
- Acquire a 4" GPS
- Check Esri Hardware Bundles:
  - <http://www.esri.com/hardware>
  - Decent performance
  - More than just minimum requirements

# Recommendations

## Hardware - GIS Server

### Dedicated GIS Server

- ArcGIS Server Standard Workgroup
- SDE
  - SQL Server Express
- All GIS data and project files
- Imagery

# Recommendations

## Training

- GIS Staff training needs:
  - ArcGIS Desktop
  - ArcGIS Server & SDE Administration
  - Web Mapping
- Non-GIS Professionals - User training needs:
  - ArcGIS I – Too much for non-GIS folks ?
  - Provide ArcGIS Online training as needed

# Recommendations

## GIS Goals

- Improve Data Quality
  - Eliminate data latency, redundancy
- Facilitate Maintenance
- Ease of Use and Accessibility
- Improve Access to Information
  - Give City Employees access to the information they need anytime, anywhere, from any device
  - From Desktop, in the field, or in a meeting
- GIS as a Citywide resource, accessible by web maps and mobile devices
- Expand reach of GIS into new departments and users



# Goal

Allow City Employees To Access  
The Information They Need  
Anywhere,  
Anytime,  
From Any Device.

# Moving Forward

## The Plan - Phased Approach

- Phase 1
  - Enterprise Geodatabase in SDE
  - Web Maps for PW and GM
- Phase 2
  - Web Maps with Edit capability
  - High-accuracy GPS capability (decimeter / 4")
  - Mobile GIS – view and edit data in field
- Phase 3
  - Roll out GIS for additional Departments
  - Create Public-facing web maps on [Altamonte.org](http://Altamonte.org)

# Phased Approach

## Actual Order

- Year 1
  - Install ArcGIS Server (Standard Workgroup)
  - Enterprise Geodatabase in SDE (SQL Server Express)
  - ArcGIS Server Manager 10.0 Web Maps for PW and GM
  - High-accuracy GPS (decimeter / 4") with ArcPad
- Year 2
  - Upgraded to ArcGIS 10.1 Desktop & Server
  - ArcGIS Viewer for Flex 3.3 for Web Maps
    - Additional Departments
    - Edit capability
  - Mobile GIS with ArcGIS Mobile
  - **ArcGIS Online for Organizations**
- Year 3
  - Mobile GIS with ArcGIS Online
  - Public-facing web maps on Altamonte.org with ArcGIS Online

# Enterprise GIS Architecture

- Data Architecture
- Data Governance
- Integration with other Systems
- High Availability, Seamless Failover
- Redundancy / Disaster Recovery
- Privacy of data
- Compliance to laws and regulations
- Realtime monitoring with rich trace information for troubleshooting
- Reporting (typically allowing for intelligent management)

*Source: Wikipedia*



# City IS Infrastructure Today

- Virtualized Servers with High Availability, Fault Tolerance
- SAN Mirroring - Can run the City from either of these 2 server locations:
  - Main Site: IS Building (The Dome)
  - Failover Site: Public Works Admin Building
- Network
  - Gigabit connection from Servers to Desktop
  - 100Meg from City to Internet Provider and County
- GIS Server
  - Virtual server, 2TB Disk Space, 64-bit OS
  - Intel Xeon CPU E5-2665 @2.40GHz (2 processors)
  - 8GB RAM
  - ArcGIS Server (Standard Workgroup)
  - SDE (SQL Server Express)
  - All GIS data and project files, Imagery, Record Drawings

# What Can We Do Now That We Couldn't Do Before ?

- ArcGIS Online solution for:
  - Mobile Maps
  - Public Web Maps on Altamonte.org
- Improved Data Quality
  - Better Data --> Better Decisions
- Fast Turnaround Time for Maps and Analysis
  - Internal Studies
  - Local, State and Federal Government Meetings
- New Uses
  - “What if” Scenarios

# What's Next

- Esri Enterprise License Agreement (ELA)
  - Access to more Desktop licenses and Extensions
  - ArcGIS for Server Enterprise Advanced
  - ArcGIS Online 100 Named Users
- New Enterprise Resource Planning (ERP) Software
  - Citywide – All Departments
  - Load GIS data into new ERP
  - Tight integration between GIS and ERP

# Thinking About Enterprise GIS

- What Does Enterprise GIS Mean for Your City ?
  - What do you need GIS for ?
  - What do you want it to do ?
  - What systems must it support, interface with ?
- How robust is your software, hardware, data, staff ?
  - Know what you have
  - Can it support what you want ?



# Enterprise GIS

- Options depend on the size of your organization (and \$)
  - We were able to accomplish a lot with ArcGIS for Server Standard Workgroup and SQL Server Express
  - We look forward to moving to Enterprise Advanced
- Centralized GIS data accessible to and shared by multiple systems in multiple departments
  - ERP system
  - Permitting Application
  - Work Orders
  - Facilities Maintenance
- GIS as single, authoritative source for information
- Integrated with other business systems
- Streamline separate systems into one
- Easy to use

# Factors for Success

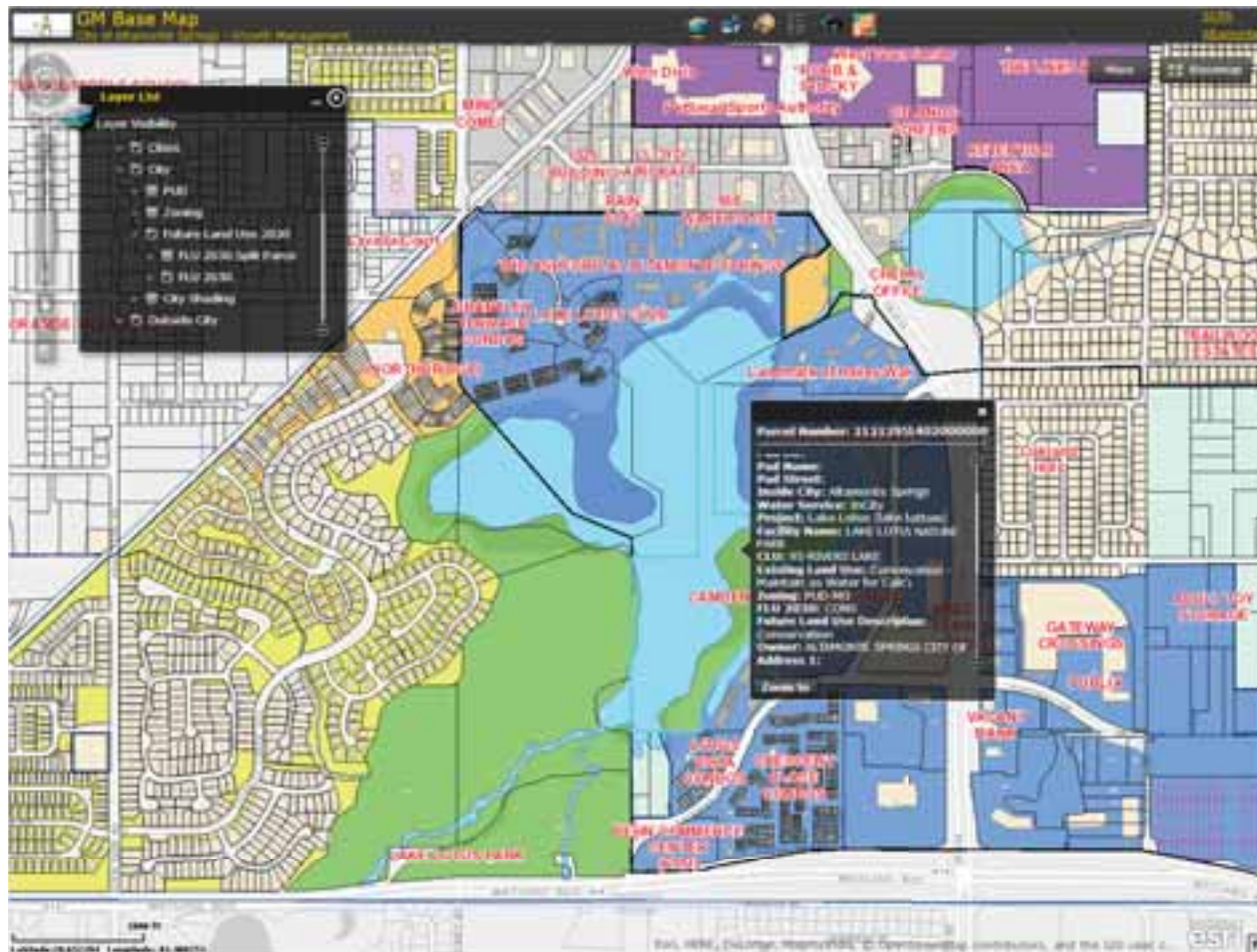
- GIS Advocates
  - Key people in positions of leadership
  - Motivated individuals to test and use
- GIS Governance Committee
  - Organization and Department Buy-In
- Assessment
  - What do you have ?
  - What do you want ?
- Staff Expertise – Skills, Training
- Esri Support

# City Web Maps GM, PW, LS



# Web Maps

## Growth Management



# Web Maps

## Leisure Services



# Neighborhood Enhancement Projects

## Improving GIS Citywide One Neighborhood at a Time

- Goal: High-accuracy surface utility points Citywide
- Citywide effort prohibitive
- Neighborhood Enhancement Projects makes the scope more manageable
  - GPS surface features while in the neighborhood for enhancement projects
  - Realign Utility Network to high-accuracy points

# Neighborhood Enhancement Project Spring Oaks



# Neighborhood Enhancement Projects Design / Bid Package

Formerly CAD Maps  
Now GIS Maps





# Event Planning

## City Hosts Several Large Festivals

- Regional Fireworks Display
- Family Fest
- Jazz Jams
- 5K Runs/Walks
- Art Expo
- Winestock
- Taste of Altamonte
- Beer and Bacon Fest
- Latin Food & Wine Festival
- Private Events



# Event Planning Old Way



# Event Planning Editable Web Map



# ArcGIS Online

## Mobile Apps & Public Web Maps

### ArcGIS Online

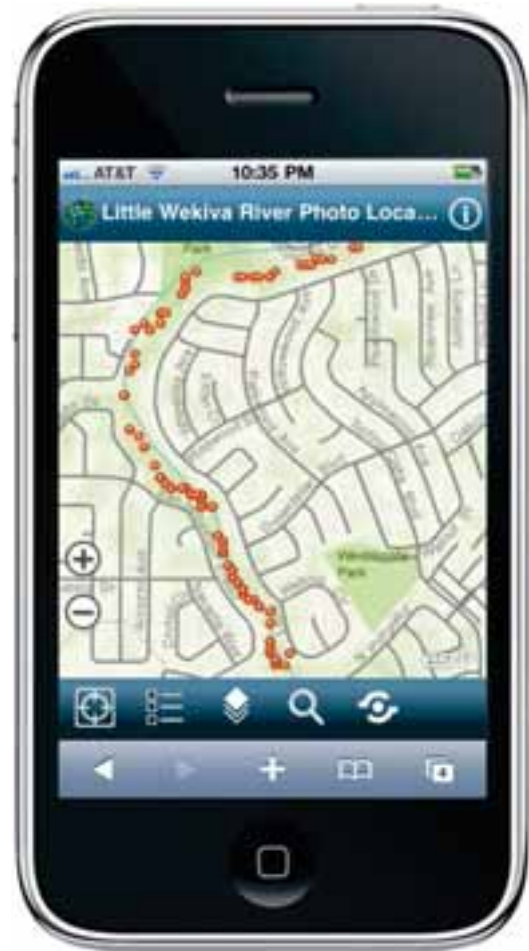
- create and share maps.
- We saw value in:
  - **Mobile** mapping through the free ArcGIS App
  - **Public-facing web maps** and downloadable layers
    - Reduce load on our own City servers



# ArcGIS Online for Mobile GIS

## Early Prototype (2011)

- Stormwater Infrastructure Inspection
- Pictures taken on iPhone from Canoe going down Little Wekiva River
- iPhone Pics converted to points
- Shapefile uploaded to ArcGIS Online
- ArcGIS App



# ArcGIS Online & ArcGIS Server

## Managers and Field Workers

- Sensitive layers (Utilities) on City's ArcGIS Server
- Non-sensitive layers (Zoning) hosted on ArcGIS Online Cloud
- Services combined as needed



# Mobile Platforms

## iPad

- Advantages
  - Easy to use
  - Cheaper than ruggedized tablet
  - Free ArcGIS App
- Disadvantages
  - Not Ruggedized
    - Lifeproof impact proof (MIL STD 810F-516) and water proof
  - Not Sunlight Readable
    - Porta-Brace Hoodies
  - Cannot browse Record Drawings (TIFs and PDFs)
    - GoodReader App

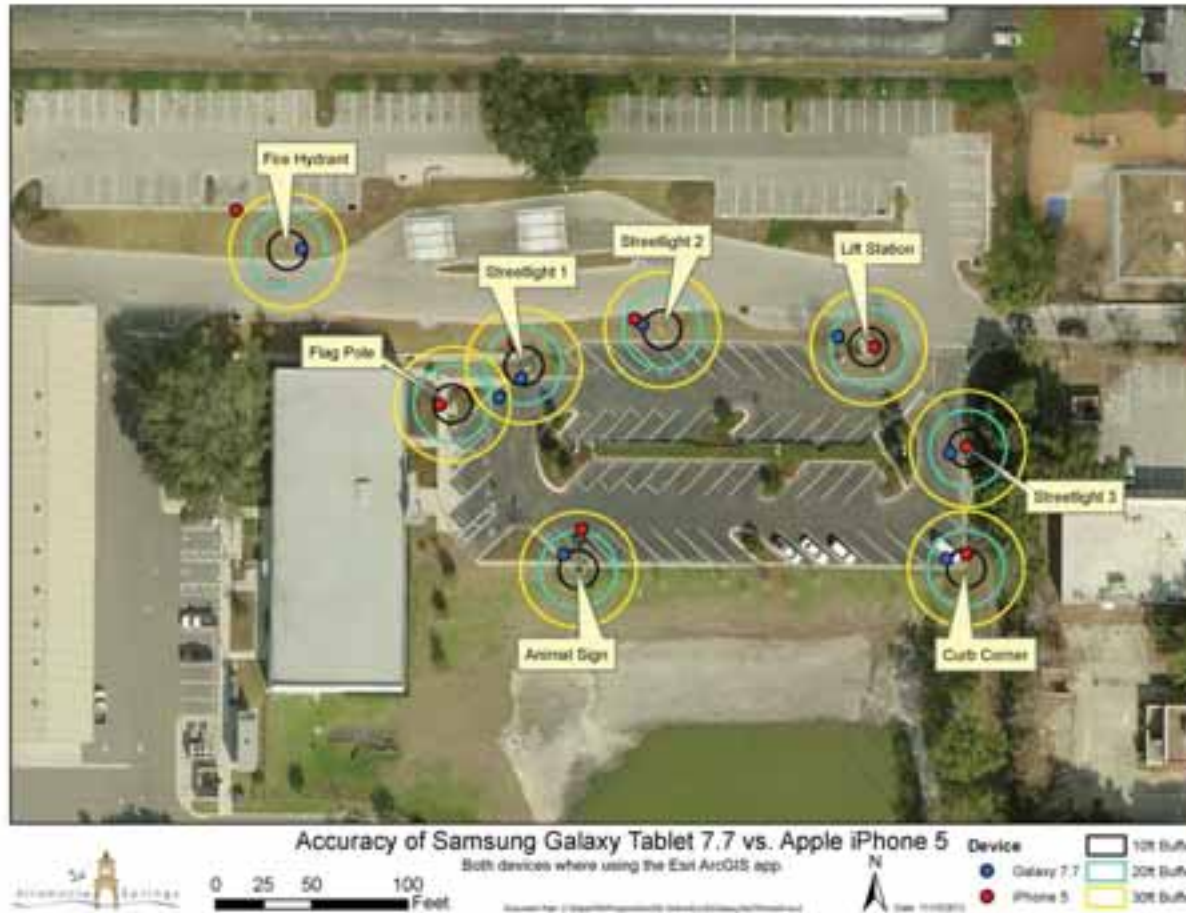


## Ruggedized Windows Tablet

- Windows 7 (City not on 8 yet)
- Advantages:
  - Ruggedized
  - Easy to load and view Record Drawing (TIFs and PDFs)
- Disadvantages:
  - No ArcGIS App for Windows
    - Use ArcGIS Online web page instead



# Mobile Device GPS Accuracy

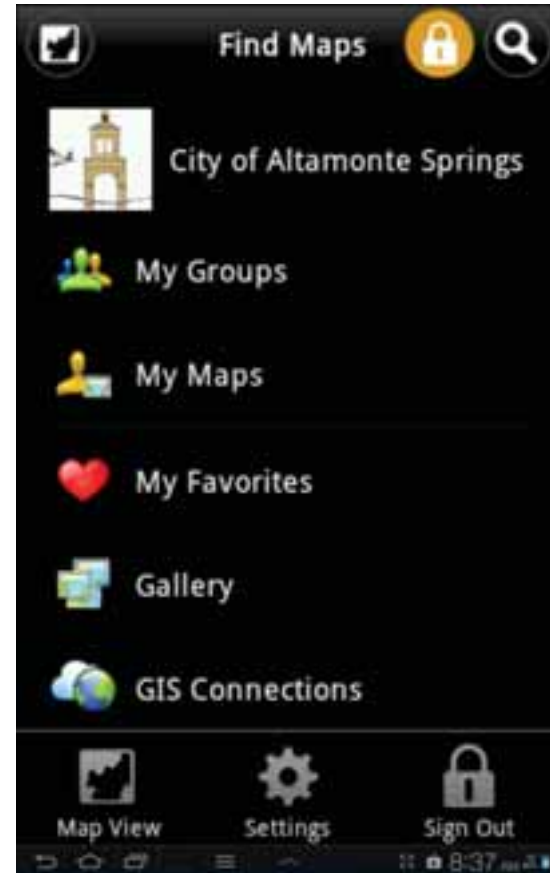




# ArcGIS App iOS / Android



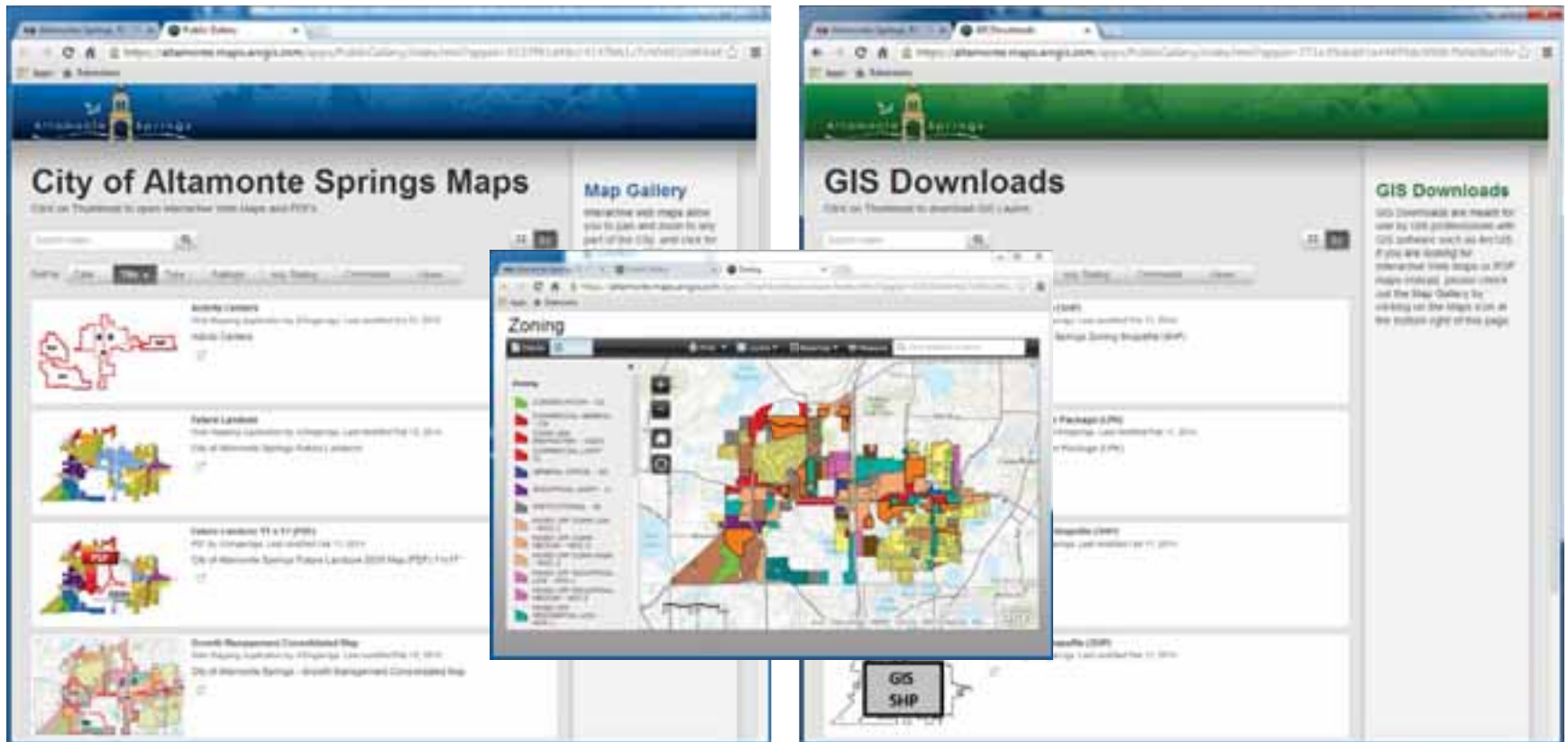
Device  
Neutral



# ArcGIS Online

## Public Web Maps on [Altamonte.org](http://Altamonte.org)

- Interactive, easy to use web maps
- Downloadable PDF maps
- Downloadable GIS layers
- For GIS Professionals



# City Street Name and Address Verification

## New ERP

- Need to load a GIS Address Point layer

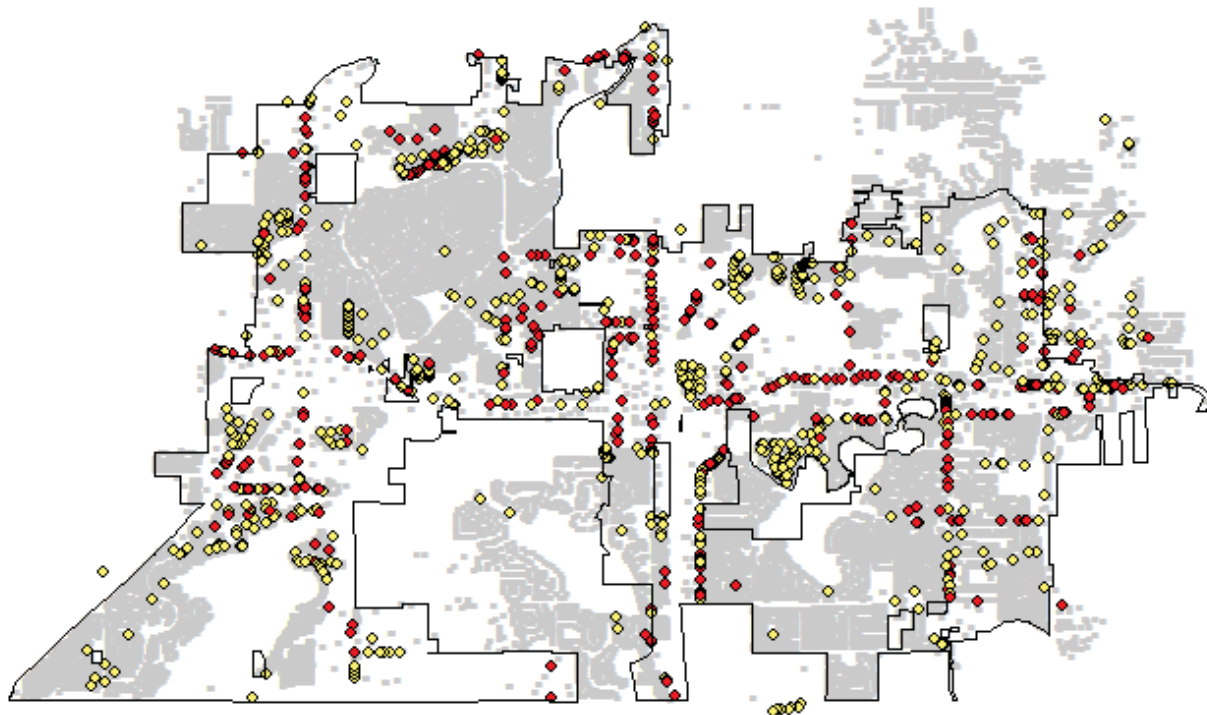
Evaluated 3 separate sources:

1. GIS Address Layer
  - polygon-based, poorly maintained
2. Accela Permitting Application
3. Sungard HTE Database
  - Highest level of confidence in quality of addresses (Customers get their bills)



# Addresses at a Glance

- **Grey:** City – County Address Matches (24,485 exact matches)
- **Red:** Apartment/Suite Number Issues (3,556)
- **Yellow:** Address Number Issues (985)





# Questions ?

# Thank you !

Miguel Garriga, GIS Manager

[MGarriga@Altamonte.org](mailto:MGarriga@Altamonte.org)

407-571-8067

Richard Littlefield, GIS Analyst

[RLittlefield@Altamonte.org](mailto:RLittlefield@Altamonte.org)

407-571-8251

