City of Guelph

Volume I: GIS Needs Assessment

Geographic Technologies Group
UNDERSTANDING LOCAL GOVERNMENT

1202 Parkway Drive Goldsboro, North Carolina 27534
www.geotg.com | 888.757.4222

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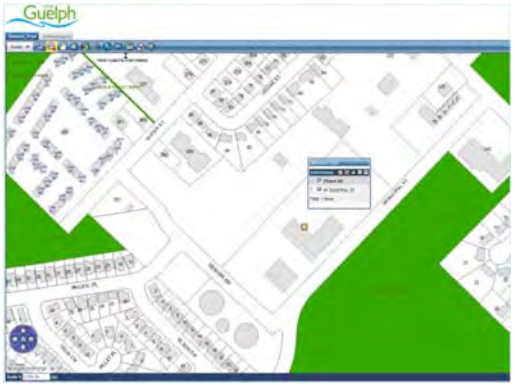
Existing Conditions

Department Overview

The City of Guelph Building Services authorizes all building construction and demolition in Guelph. The department provides services to residential, commercial, industrial, and institutional building sector customers. The department administers and enforces the following City by-laws; zoning, property standards, yard maintenance, standing water, swimming pool, sign, and two-unit house registration. Staff facilitates Guelph's Committee of Adjustment with processing requests for variances to the zoning by-law and consent (severances) applications. This Committee function will be transferred to Clerks in Q1 and Q2 of 2014. The department also manages Guelph's termite control and backflow prevention programs.



Governance of GIS

Building Services has a number of databases to which they contribute data. Each of these databases should be geo-enabled. The department does not have any GIS staff. Planning GIS staff and the GIS team in IT assist Building Services with their GIS needs. A link to the Amanda systems has been created to be used in

conjunction with OnPoint, an intranet GIS data viewer. The OnPoint intranet application is available but lacks key data sets. Overall, the department does not currently use GIS frequently. No end-user tools allow them to use GIS in the field.

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

Current GIS Staffing				
Type		Number of Users	GIS Usage	Primary Tools
	GIS Flagship (Tier 1)	0	NA	NA
	GIS Analytical (Tier 2)	0	NA	NA
	GIS Browser (Tier 3)	5	Low	Has Access to OnPoint

Hardware and Software

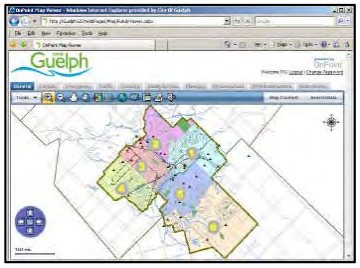
All staff within the Building Services has access to a personal computer. Access is available to the plotter in Planning if large maps are needed. Toughbooks and mobile printers are available for field staff. The department has begun using tablets with Motion Computing for field access to key data in the field. The following table summarizes existing hardware.

Hardware Issues Summary	
Type	**Notes**
Personal Computers	Available to all staff
Laptops	12 for field staff – Toughbooks using Citrix connectivity back to the office
Printers	Ample printers available for use
Plotters	Access to the HP Designjet T1200 Located at City Hall in Planning Print Room
GPS	GPS in conjunction with AVL on vehicles
PDA/MDTs	4 tablets are being used in the field
Scanners	Available as needed

Building Services use a variety of software applications. Microsoft Office is used to conduct office productivity tasks. The following is a list of key software products utilized by the department:

1. Microsoft Office– Used for office productivity

2. Amanda – Core application for permitting, inspections, addresses, property data, zoning, by-law enforcement, termite program. Have GIS adaptor from CSDC.
3. OnPoint - Intranet GIS browser provided by the GIS Team in IT
4. Adobe Suite – For document markup
5. Automated Vehicle Location – Vehicle tracking

AMANDA Back Office Suite CSDC ENABLE. TRANSFORM. LEAD. www.csdcsystems.com **Amanda**	**AMANDA** → AMANDA is a web-based product used for licensing, permitting, planning, and compliance. Building Services uses AMANDA as its primary software application. The software is used for permitting, inspections, addresses, property data, zoning, by-law enforcement, and the termite program. AMANDA data has been linked to GIS but needs to be expanded.
 **OnPoint Intranet GIS**	**OnPoint** → OnPoint from Rolta is utilized as an enterprise-wide GIS intranet solution. The software allows users to access pertinent GIS data via a web browser. Building Services has attempted to utilize OnPoint but has found it to be insufficient to meet their needs. The application is too slow and lacking needed functions.

GIS Needs Assessment

GIS Needs Analysis

Most of Building Services operations have a relationship to a geospatial context. The building, by-laws, and property inspectors continually travel around the City inspecting job sites. Staff has Toughbook laptops and is implementing tablets in the field. They are able to connect back to the office via Citrix and access, review, and update AMANDA records. In order for Building Services personnel to respond quicker to geography-related inquiries, they must have a system that can provide the basis for decision making and information processing that keeps pace with the increasing amount of demand for their services. They currently can access OnPoint via Citrix but the application is not designed as a field tool and speed issues limited is usability.

Building Services will require access to GIS data and the ability to query and perform analysis using elements of GIS data maintained by the City. Additionally, full integration with AMANDA will be required for continued development of the enterprise GIS.

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

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

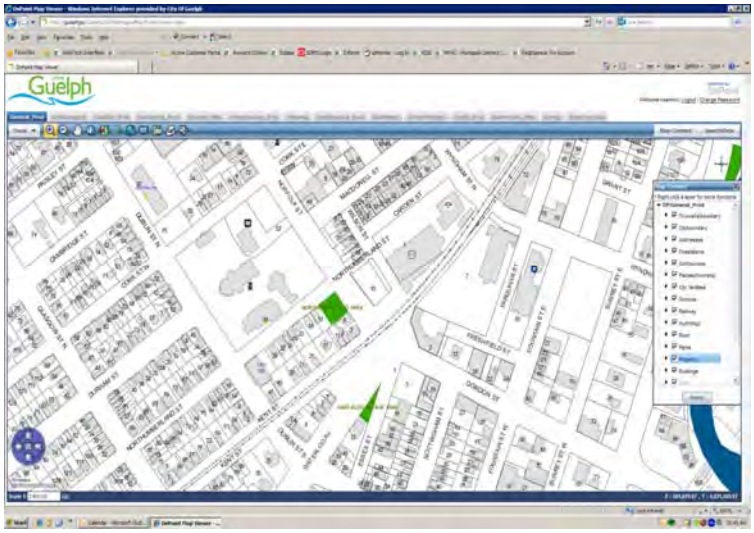
GIS Need	*Method/Application to Meet Need*
Enabling Existing Databases	Data Mining Tools Intranet GIS Data Browser
Mapping and Spatial Analysis of Division Data	Intranet GIS Data Browser
Field Access to Geospatial Data	Mobile GIS Data Browser Tablet Computers
Vehicle Routing Analysis	Intranet GIS Data Browser Mobile GIS Data Browser
Public Access to GIS	Internet GIS Data Browser
Formal GIS Training for Building Services Staff	Third Party Application Training

GIS Need

Enabling Existing Databases

Building Services will be utilizing existing non-spatial data from various applications but especially AMANDA. AMANDA tracks and manages all the permitting, inspections, addresses, property data, zoning, by-law enforcement, and the termite program activities for the department. Most of the existing data relies on parcel identification number (PIN) information and an address as its geographic location base. As such, it is imperative that the City pursue the full integration of AMANDA and GIS based on PIN and/ or address. All pertinent data from AMANDA can then be displayed and queried in a GIS data browser.

Once GIS integration with AMANDA is complete, Building Services should have GIS data layers inside Esri SDE geodatabase(s) depicting their inspection, termite inspections, code enforcement cases, etc. Once the GIS data becomes available as SDE GIS data layers (known as "feature classes"), numerous other Esri-compliant GIS client applications will be able to access it. Web-based products like Intranet and Internet GIS data browsers could then spatially view, browse, and query this database tabular data. The GIS team in IT has done some work in mining data from AMANDA. This data plus other fields will be made available through a series of targeted applications.



It is recommended that an intranet GIS data browser become the centerpiece of GIS use at the city. Either a new more functional version of OnPoint or another application should be extended to have a portal portraying key data for Building Services. This application will not only allow users to view GIS data but also data provided by Building Services and data entered into legacy systems in other departments as well. This application will serve as the primary GIS application for Building Services, and enable staff to accomplish about 90% of their in-office 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.

Additionally, Building Services spend a lot of time researching property ownership information and need access to this data quickly and easily. Having current, accurate, and reliable property ownership information available at the click of a button is very important for the functions of Building Services. It is recommended that this accurate ownership information be included with a live view of the most up-to-date data via an intranet GIS data browser, a new more functional version of OnPoint, or another application that would serve this purpose. The data should be available in the property window of AMANDA as well to ensure ease of access when needed by Building Services staff.

Property Standards Violations Accessible through an Intranet GIS Data Browser

GIS Need

Mapping and Spatial Analysis of Department Data

Building Services staff needs the ability to perform mapping and spatial analysis on interdepartmental data to make connections with seemingly unrelated data. A critical need is to provide Building Services users with enterprise-wide access for mapping and spatial analysis. Building Services' GIS users will benefit from access to the City's base map data as well as GIS data that represent their business functions. Staff has the desire to have the following capabilities:

- Provide GIS mapping out in the field
- Produce optimal routing for visiting sites in the field
- Analyze and report the number of orders, tickets, warnings, and other key data
- Print and post documents from vehicles to post on properties
- Search by Parcel ID, address, or street
- Ownership of nearby properties
- Measurements of property lines
- View properties and their inspection status
- View the location of all inspections and enforcement cases
- View termite zones and inspections
- Mass mail notifications
- View accurate zoning and zoning by-law cases on GIS – ability to select a specific zone, zoning overlays, etc.
- Have building locations mapped (via address point) and linked to applications, building plans, housing enforcement, and zoning data.
- View all demolitions with addresses, type of structure, districts, and other pertinent data
- View pertinent data from other departments
- Attach photos, legal documentation, and approvals to GIS features
- Access to aerials past and present – used to determine non-conforming uses
- View GRCA data such as floodways
- View Ministry of Transport special permissions
- View heritage properties
- View the authoritative City limits

GIS Need

Field Access to Geospatial Data Solutions

Building Services has mobile computers and/or tablets for field staff. Much staff time is comprised of field work. Accordingly, providing personnel with access to maps and GIS data while working in the field is an important part of maintaining an enterprise GIS. Through the use of hardware, software and data that are designed to be interrogated and manipulated away from the office, Building Services 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 the Department tools to perform field data collection, site visits, routing capabilities, and interactive geographic data query and analysis.

A GIS mobile data browser can be loaded on mobile computers, allowing the same capabilities offered by map books, coupled with the ability to conduct query searches on attributes of all information, such as address, PIN, AMANDA record number; link to digital site plan images, optimal routing to cases, and much more.

Inspections staff performing visits to sites 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.

Mobile GIS Browser for Building Services

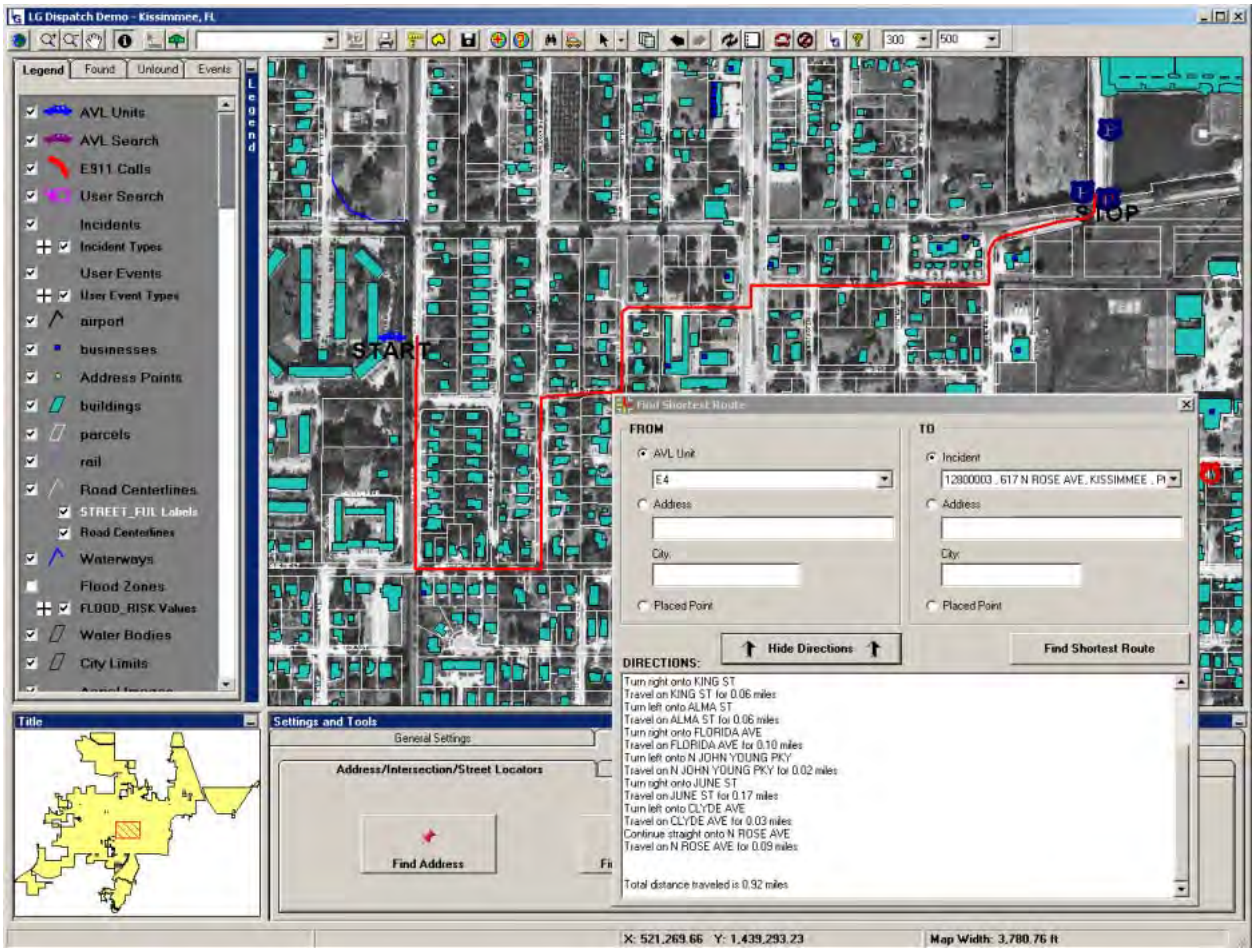
Laptops should be configured with a GIS data browser that includes routing functionality and all relevant GIS layers, including base map layers and aerial photography. A Mobile GIS Data Browser must be easy-to-learn and easy-to-use for the inspectors. This mobile application should be a data browser only, and not allow editing of source data.

GIS Need

Vehicle Routing Analysis

Building Services site inspectors and other staff often have large areas or multiple dislocated personnel to manage. These crew members need the ability to use GIS to map site locations to be visited and automatically determine the best route to take. As a result of not using automatic routing software, the Department is at risk of higher costs due to inefficiencies in fuel usage and overall vehicle maintenance.

Staff spend much of their working time out in the field. Currently, office staff often refers to dated hard paper maps for making decisions on the optimal routes and case balancing for the day. It is recommended that the intranet GIS Data Browser solution have multi-point routing capabilities. This would allow office staff to assign cases to a crew leader and then generate an optimal path and a route manifest for that crew vehicle to follow for that day. As additional calls come in, they can be added to the run list and the route manifest can be updated and provided to staff via laptops connected in the field.



The Intranet Data Browser should support service area analysis, routing, generating travel directions, and finding closest facility.

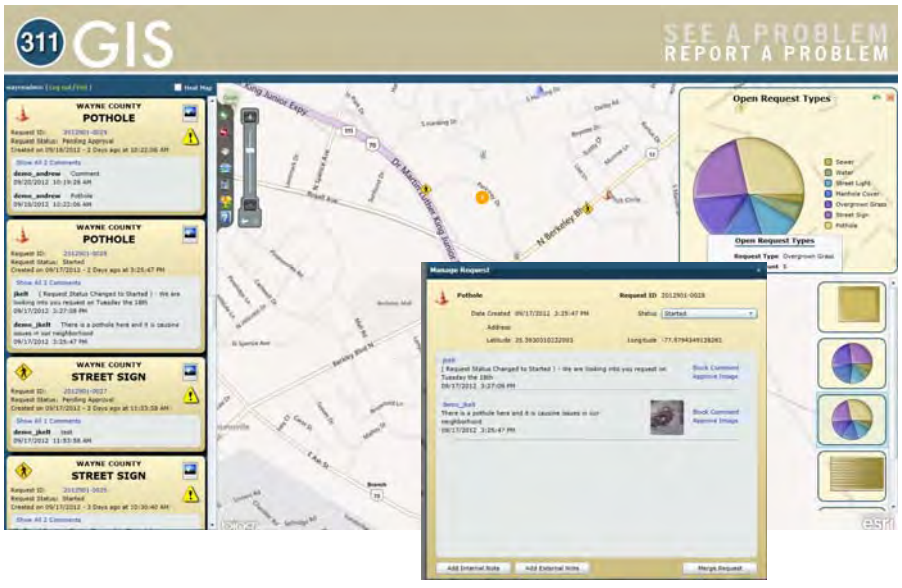
GIS Need

Public Access to Geospatial Information

Providing public access to GIS maps through publicly-accessed Internet applications will help Building Services provide information to citizens. Through an Internet GIS Data Browser permitting, code enforcement and all other Department GIS data can be provided to the public through an intuitive and easy to use interface. Multiple departments would like citizens to be able to make complaints online and view activity/responses. Hundreds of man hours would be saved weekly if this information was made available via the Internet.

Cities define their own categories

Local governments have prioritized citizen engagement. One of the trends is for local government is to implement crowdsourcing tools. Crowdsourcing is a process that involves outsourcing tasks to a distributed group of people. It is distributed problem solving. Esri points out; "developing interactive tools that enable a stronger dialog between government agencies and citizens is proving to be one of the most effective platforms for citizen engagement." In this regard, cities throughout North America are implementing GIS based portals that allow citizens to contribute, as eyes on the street, to collaborative problem solving. These tools allow a city to establish categories that are meaningful to them. As a citizen reports an issue, it is routed directly to a city representative (potentially Service Guelph) who then validates the request as being legitimate. The request then is automatically routed to the appropriate department for action. Each task can be given an urgency rating. For instance, a stop sign down might require a fix within the hour; whereas, an abandoned vehicle might have a twenty-four hour window. These applications are available via computers, tablets, and smart phones. Additionally, these applications provide a dashboard that allows staff to view trends, open issues, and a host of other metrics.



This type of application should be considered a city-wide initiative. It can encompass a number of departmental issues and should be able to push data to a back-end work order systems such as Oracle WAM and AMANDA.

GIS Need

Formal GIS Training for Building Services Staff

Several departments, including Building Services, will benefit from formal training in GIS. It is proposed that Building Services and the GIS team in IT identify key departmental staff to receive formal training. For the immediate future, it is envisioned that all GIS users in Building Services will be Tier 3 – Browser level. As such, only third-party training for the recommended GIS client applications such as; mobile GIS, Intranet and Internet GIS Data Browsers should be considered. Funding for training is paramount to the success of the City's enterprise-wide GIS implementation.

GIS Gap Analysis

GIS Data Layer Inventory

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

Legend

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

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

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Building Services Data			
Amanda Data (Licenses, Permits, and other data)	Automated via Geocoding	Automated	Existing
City Owned Properties	Delineated from Aerial Photography	GIS Team in IT	Existing
Code Violations	Automated via Geocoding	Automated	Desired
Complaints	Automated via Geocoding	Automated	Desired
Easements	Digitized on Screen	Engineering	Partial
Flood Zones	Acquire from GRCA	GIS Team in IT	Existing
Historical Aerial Photography	Aerial Flyovers	GIS Team in IT	Partial
Historic Districts	Digitized on Screen	Building Services	Existing
Heritage Properties	Scan files and scan other documents	Building Services	Partial
Hydrology (Natural Water Features)	Various	GRCA	Existing
Projects	Digitized on Screen	Varies	Recommended
Special Permissions (Ministry of Transportation)	Automated via Geocoding	Ministry of Transport	Recommended
Telecommunica-tion towers from AMANDA	Automated via Geocoding	Automated	Desired
Termite Inspections Zones	Digitized on Screen	Building Services	Existing
Variances, Conditional Uses, Site Design, General Development Plan, and Zoning Map Amendment cases	AMANDA Records and Scan in Paper Records and Link	Building Services	Desired
Water, Sanitary Sewer, and Stormwater Systems	Digitized on-screen and converted from CAD drawings and paper maps	Engineering	Existing but needs spatial improvement
Wetlands	Digitized On-Screen	Ontario Ministry of Natural Resources	Existing

Zoning	Digitized on screen	Planning	Existing
Zoning By-Laws	Scanned and Linked	Various	Desired
Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy, and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using the rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base, as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006, the City acquired rectified digital orthoimagery, which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy, and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.	GIS Team in IT maintains the property data. New property surveys are incorporated as they are received. If staff, in other departments, sees errors they have been asked to report them to the GIS Team in IT.	Existing
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance have occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing

Landmarks	Digitized – have started to develop a commonplace layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhoods	Heads up Digitizing Screen. Subdivisions are available by 61-M plan (Subdivision) layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	GIS Team in IT creates and maintains addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building footprints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by the City to create an updated building layer.	GIS Team in IT	Existing
Contours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; changes are updated with Orhtophoto refresh	Existing

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

Legend	
Existing	
Yes	GIS component currently exists within division.
No	GIS component does not currently exist within division.
Limited/Partial	GIS component exists to a lesser degree.
Desired	
Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.

Limited	Some applicability to divisional needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to divisional need.
Low	Can be met after higher needs are accomplished.

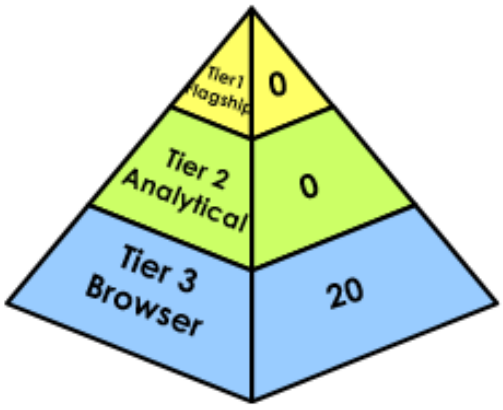
Component	Status		Priority	Notes
	Existing	Desired		
Automated Vehicle Location (AVL)	Yes	Yes	Medium	AVL can be used to track official vehicles; Using AVL conjunction with routing increases efficiency and can reduce fuel consumption, thereby decreasing costs.
Documentation	Yes	Yes	Medium	The GIS Team in IT mandates enterprise GIS documentation processes and procedures.
Enterprise Systems Integration	Yes	Yes	High	Integration with the AMANDA and other key existing databases.
Geocoding	Limited	Yes	High	Comprehensive geocoding will greatly expand the Building Services' mapping functionality.
GIS Data Access	Yes	Yes	High	The Building Services should have access to all city data and data created for the Building Services. An important component for Building Services is access to current and accurate ownership information via the property window in AMANDA and/or the GIS data browser application.
GIS Data Maintenance	No	No	Low	Building Services will be a data consumer. They will not need to create or maintain any GIS data. Data layers will be created from some of their data and will be automated.
GIS Data Sharing	Yes	Yes	High	Building Services needs other department's data and has the desire to

Component	Status		Priority	Notes
	Existing	Desired		
				share some of their data internally and with the public.
GIS Personnel	No	No	Low	Building Services will be a data consumer. As such, they will use easy-to-use GIS data browsers and mobile tools. They will not need any GIS personnel.
Hardware	Yes	Yes	High	Building Services has the hardware they need at this time. They may need to expand the use of tablets in the field in the near future.
Mapping	Limited	Yes	High	Building Services will be a data consumer. As such, they will use easy-to-use GIS data browsers and mobile tools. Most of their mapping needs will be done through these tools
Metadata	Limited	Yes	High	A formal, standardized metadata system needs to be developed and implemented for all GIS data layers authored within Guelph. Standards should be decided upon by the GIS Team in IT.
Mobile Computing Resources	Yes	Yes	High	Having mobile computing for Building Services staff is important. Field observations will need to captured utilizing tablets to update data while in the field.
Network	Yes	Yes	High	High availability of data via the internal network is mission critical.
Routing	No	Yes	Moderate	GIS-based routing is desired by Building Services staff. Field staff are in the field daily and routing tools would be very beneficial. .

Component	Status		Priority	Notes
	Existing	Desired		
Software	Yes	Yes	High	DBS has no GIS software of their own. However, they use the Intranet GIS portals and use should expand as tools improve.
Spatial Analysis and Modeling	No	Limited	Low	Building Services does not do modeling for their tasks. Any modeling needs can be handled by the GIS team in IT.
Training/Education	Limited	Yes	High	This component is considered a high priority for use of GIS within Building Services. Training is needed at the browser and mobile user level for all staff.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Departmental Return on Investment (ROI)

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

Return on Investment Opportunity Building Services	
Opportunity	**Explanation**
Save <u>Time</u> and <u>Respond</u> More Quickly to Service Requests	Staff access to accurate/updated data • Staff should have access to current GIS data to better serve and provide information to the public and decision makers. Additionally, an Internet portal will alleviate many of the calls from citizens.
Save <u>Time</u>	Optimal routing for field staff: • An Intranet GIS Data Browser should be used to generate optimal routes for all site visits. • Ability to view all needed data through one portal would save many hours a week for staff.
<u>Improve</u> Data <u>Accuracy</u>	Better GIS Data and Spatial Analysis: • With the creation of Building Services GIS data layers, the office staff will have much more accurate geographic information pertaining to their business functions. In return, this will allow them to do much of their work more efficiently and with better data providing more accurate mapping and spatial analysis.

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Business Services

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Return on Investment (ROI)

Existing Conditions

Department Overview

The Business Services department leads the City's efforts to provide outstanding customer service and value. There are three divisions within the Business Services department, including Administration, Facility Bookings, Program Registration and Special Events Coordination, and Service Guelph.

Administration

- Administer low-income fee assistance for recreation programs
- Administer the Affordable Bus Pass Program for local residents
- Assess operational effectiveness and efficiencies, provide work planning support, financial oversight and budget coordination

Facility Bookings, Program Registration and Special Events Coordination

- Coordinate permits and reservation bookings for arenas, City hall, civic squares, community rooms and outdoor sports fields and facilities.
- Process applications and coordinate requirements and logistics for all special event permits on City-owned property
- Provide user-level support for 140 CLASS software users in several City departments

Service Guelph

- Provide front-line counter customer service at City Hall
- Provide general email support and distribution
- Administer the main switchboard line
- Provide internal mail service to the City

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.

Business Services staff utilize Google Maps currently for event planning. Business Services will be a Tier 3 GIS user as they will utilize the Internal GIS Data Browser for spatial analysis, but will not maintain 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.

Current GIS Staffing				
Type		**Number of Users**	**GIS Usage**	**Primary Tools**
	GIS Flagship (Tier 1)	0	N/A	None
	GIS Analytical (Tier 2)	0	N/A	None
	GIS Browser (Tier 3)	4	Limited	OnPoint and Google Maps

Hardware and Software

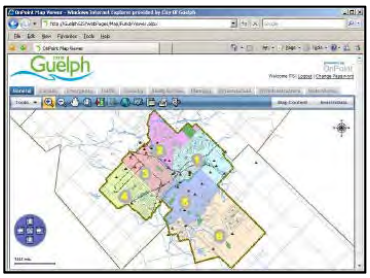
Business Services use personal computers for each of its staff. Printers are available for office use.

Hardware Issues Summary	
Type	**Notes**
Personal Computers	One for each staff person
Laptops	None
Printers	Ample printers available for use

Plotters	None
GPS	None
MDTs	None
Scanners	None

Microsoft Office is used to conduct office productivity tasks. The OnPoint Intranet GIS viewer is used for mailings to citizens near parks that are being upgraded or re-designed. Business Services utilize the following software applications:

1. Microsoft Office– Office Productivity
2. OnPoint – Mailings and site reference and layouts.
3. Google Maps – Site Layouts for Events

 **OnPoint Intranet GIS**	**OnPoint** → OnPoint from Rolta is utilized as an enterprise-wide GIS Intranet solution. The software allows users to access pertinent GIS data via a web browser. Business Services uses the software for mailings to citizens near parks which are undergoing upgrades or re-designs.
 **Google Maps**	**Google Maps** → Google Maps is used for site layouts for events. Staff use Google Maps to plan for upcoming events and the recommended placement for various items such as the stage, vendors, and more.

GIS Needs Assessment

GIS Needs

Business Services 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:

GIS Need	*Method/Application to Meet Need*
Mapping and Spatial Analysis of Business Services Data	Intranet GIS Data Browser
Sharing Data with the Public	Public GIS Data Browser
GIS Based Complaint Tracking	Complaint Tracking Application
Formal GIS Training for Business Services Staff	Business Services Specific Training

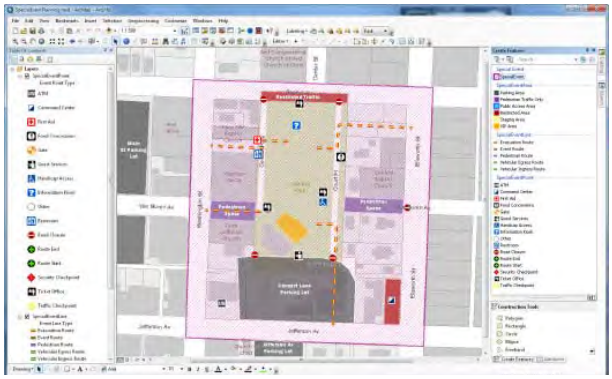
GIS Need

Mapping and Spatial Analysis of Departmental Data

Business Services staff need the ability to perform mapping and spatial analysis on interdepartmental data to make connections with seemingly unrelated data. A critical need for Business Services is to provide users with enterprise-wide access to GIS based mapping and spatial analysis. Business Services GIS users will benefit from access to the City's base map data as well as GIS data that represent their business functions. Upon implementation of an enterprise GIS, Business Services staff will be able to conduct the following types of mapping and analysis:

- Facility Site Selection and Amenity Site Selection – Through the use of GIS, Business Services will be able to analyze where their users are coming from and where the greatest need is for new facilities and amenities. In conjunction with census data, user data, current facility and amenity data Business Services should be able to perform this analysis with an enterprise-wide Intranet GIS Data Browser.
- Registration and Bus Route Comparison – By geo-enabling registration data, Business Services staff will be able to accurately recommend which bus route citizens should take depending on their current location and intended destination.
- Marketing and Announcements – Currently OnPoint is utilized for mailings to citizens. It is anticipated that the enterprise-wide Intranet GIS Data Browser will offer this capability. Users in Business Services will be able to buffer a park that is undergoing upgrades or re-designs by a certain distance (within walking distance) and select all citizens in that area to generate mailing labels for the announcement.
- Dog Park Site Location – By geo-enabling dog licenses, Business Services staff will be able to see where the majority of dog owners are located to accurately plan for future dog park locations.

- Site Layout for Events – Currently Business Services staff utilize Google Maps or OnPoint for site layout planning for events. It is anticipated that an enterprise-wide GIS Intranet Data Browser will serve this function in a more robust manner. This will allow Business Services to create useful maps utilizing GIS data that already exists or is recommended for creation.
- The Mapping of additional data would be of great benefit to Business Services:
    - Parking Areas
    - Bus Routes
    - Voting Locations
    - Vehicle Towing's
    - Pet Licenses
    - Bike Lanes
    - Electric and Water Data
    - Property boundaries
    - Structure or Amenities – ie bunkers, ball diamonds, electrical or water access.

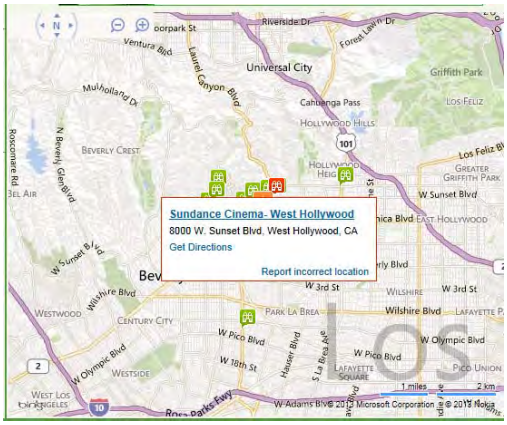


Using GIS for Event Planning

GIS Need

Sharing Data with the Public

Sharing pertinent data with the public via a GIS portal is important to the staff of Business Services. GIS portals will most likely have interfaces for personal computers, tablets, and smart phones. Linking the GIS to the City calendar so that locations of events can be readily mapped via the calendar will prove to be beneficial to not only the citizens of Guelph, but staff within the City as well. Additionally, a map portal showing all events on a map by time selected would be useful. Also, many special events are planned for the City. GIS can be used for pre-planning of these events in regards to logistics.



In addition to the features mentioned above, it will be important for parks and recreation data to be available to the public via this portal. This includes parks and recreation locations as well as park and recreation amenities. Also vital for this portal is the ability for citizens to route to parks and recreation facilities. This will enable citizens to locate areas of interest from their own devices instead of needing to contact the City directly.

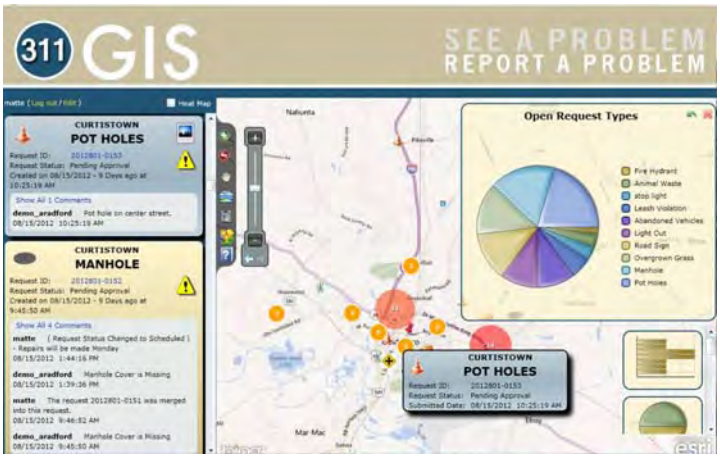
GIS Need

GIS-Based Complaint Tracking

Business Services interacts directly with citizens in regards to concerns/complaints. Many City departments including Business Services would benefit from a web-based GIS application designed for tracking citizen inquiries, complaints, concerns, and other general feedback. Such an application would enhance communication with the public, and allow the City to quickly and effectively respond to requests. From the citizen's perspective, one call to any municipal staff member should result in an inquiry or complaint being logged into the system, routed to the correct department or point of contact, action taken by municipal employees, and follow up to the initial inquiry in an effective and timely manner. Inquiries or complaints should also be logged and tracked via the Internet, mobile device, or in person.

By implementing such an application, the public no longer has to be transferred from one department to another on the phone or in person. Routing of inquiries and complaints would be done internally through email notification, and is therefore transparent to the citizen. City staff can then proactively track, manage, analyze, map and report inquiries and complaints, actions taken, final results, and citizen satisfaction.

A complaint tracking system should include:



Complaint Tracking Application – User Interface

- Web/Phone-in/Walk-In Submittal of Inquiries
- Multiple Search (Query) Capabilities
- Internal Email Server
- Levels of End-User Security
- Assignment of Employees/Departments to Specific Inquiry Types
- Ability to Sub-classify Inquiry Types for Internal Department Use/Reporting
- Automated Email Notification of New Inquiry to Designated Employee and Response to Person Submitting
- Logging of Actions Taken Toward a Solution
- Map and Summary Report Generation

GIS Need

Formal GIS Training for Business Services Staff

All departments, including Business Services, will benefit from formal training in GIS. For the immediate future, it is envisioned that all GIS users in Business Services will be Tier 3 – Browser level. As such, only third-party training for the 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.

GIS Gap Analysis

GIS Data Layer Inventory

Business Services staff do not and will not create any GIS layers. Business Services 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. ***A full Master Data Layer list, with existing and recommend layers can be found in Appendix I of this Needs Assessment.***

Legend

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

The following table lists those data layers that are important to Business Services

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Business Services GIS Data			
Licensed Pets	Extracted from database and geocoded	Automated	Recommended
Complaints	Extracted from database and geocoded	Automated	Recommended
Zoning	Digitized on screen	Planning	Existing
Parking Lots	Digitized on screen	GIS Team in IT	Recommended
Bus Routes	Digitized on Screen	GIS Team in IT	Recommended
Vehicle Towing	Extracted from database and geocoded	Automated	Recommended
Voting Locations	Digitized on Screen	GIS Team in IT	Recommended
Facilities and Amenities	Digitized on Screen	GIS Team in IT	Recommended
Buss Pass Holders	Extracted from database and geocoded	Automated	Recommended
Bike Lanes	Digitized on Screen	GIS Team in IT	Recommended
Electric	Various Collection Methods	Guelph Hydro	Recommended
Water	Various Collection Methods	Guelph Hydro	Recommended
Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006 the City acquired rectified digital orthoimagery which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and	The GIS Team in IT maintain the property data. New property surveys are incorporated as they are received. If staff in other departments see errors they have been asked to report them to the GIS Team in IT.	Existing

	surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.		
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance has occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing
Landmarks	Digitized – have started to develop a common place layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhoods	Heads up Digitizing Screen. Subdivision are available by 61-M plan (Subdivision)layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	GIS Team in IT create and maintain addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building foot prints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by the City to create an updated building layer.	GIS Team in IT	Existing
Contours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; changes are updated with Orhtophoto refresh	Existing

GAP Analysis Chart

Business Services 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.

Legend	
Existing	
Yes	GIS component currently exists within department.
No	GIS component does not currently exist within department.
Limited/Partial	GIS component exists to a lesser degree.
Desired	
Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to departmental needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to departmental need.
Low	Can be met after higher needs are accomplished.

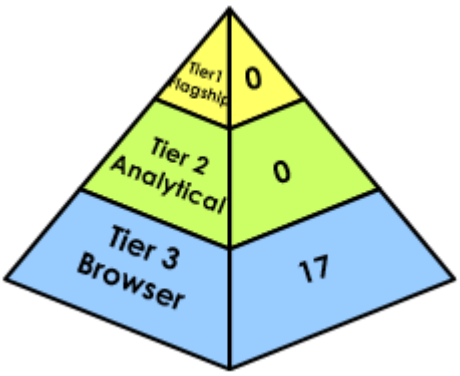
Component	Status		Priority	Notes
	Existing	Desired		
Automated Vehicle Location (AVL)	No	No	Low	AVL can be used to track official vehicles; Using AVL conjunction with routing increases efficiency and can reduce fuel consumption, thereby decreasing costs. Business Services does not currently have a need for AVL
Documentation	No	Yes	Medium	Some documentation on GIS data creation and workflow exists however there is a greater need for creation and standardization for documentation citywide.

Component	Status		Priority	Notes
	Existing	Desired		
Enterprise Systems Integration	Limited	Yes	Medium	Business Services will need access to Class enabled data in conjunction with data from other departmental databases.
Geocoding	Limited	Yes	Medium	Geocoding of (All) Registration holders will be beneficial to Business Services. (including membership pass holders, recreation registrants, etc.
GIS Data Access	Limited	Yes	High	Business Services will need access to GIS layers as outlined throughout this document in an easy-to-use data browser.
GIS Data Maintenance	No	No	Low	Business Services will be a data consumer. They will not create or maintain any GIS data.
GIS Data Sharing	No	Yes	High	Some selected data sets will be shared internally. Additionally, some data will be shared publically such as complaints.
GIS Personnel	No	No	Low	Business Services will be a data consumer. As such, they will use easy-to-use GIS data browsers. They will not need any GIS personnel.
Hardware	Yes	Yes	High	The current personal computers will suffice for running the GIS data browser.
Mapping	Yes	Yes	High	All mapping should be attainable through the Intranet data browser and the mobile data browser.
Metadata	No	Yes	Medium	Business Services needs to know the derivation of the data, its currency, and completeness.

Component	Status		Priority	Notes
	Existing	Desired		
Mobile Computing Resources	No	Yes	Medium	Business Services needs access to GIS data in the field. This includes accessing information about parks and amenities as well as citizen complaints.
Network	Yes	Yes	High	High availability and fast access to GIS data will be important to the success of this initiative.
Routing	No	No	Low	Optimal Route Planning is not a priority for Business Services at this time.
Software	Yes	Yes	High	Business Services will need expanded use of an improved Intranet GIS data browser as well as mobile GIS tools. A citizen complaint portal will need to be evaluated for multiple city departments including Business Services.
Spatial Analysis and Modeling	No	Yes	High	Business Services needs to perform spatial analysis. Such as, select all citizens within walking distance of a park that is being upgraded.
Training/Education	No	Yes	Medium	This component is considered a medium priority for use of GIS within Business Services. Introductory training is needed at the browser user level for all staff.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Return on Investment (ROI)

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

Return on Investment Opportunity Business Services	
Opportunity	**Explanation**
Save <u>Time</u> and <u>Respond</u> 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 save time for citizens and staff.
<u>Encourage Citizen Engagement</u> with Transparent Governance	The various public portals will provide citizens with important data utilizing a method that is intuitive. Mapping interfaces will allow citizens to be more aware and engaged in their community.

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

By-Law Compliance, Security, and Licensing

By-Law Compliance, Security, and Licensing

Section Outline

Existing Conditions

- Department Overview
- Governance of GIS
- Hardware and Software

GIS Needs Assessment

- GIS Needs

GIS Gap Analysis

- GIS Data Layer Inventory
- GAP Analysis Chart

Multi-Tier GIS Application Use

Return on Investment (ROI)

Existing Conditions

Department Overview

By-law Compliance, Security, and Licensing (By-law) are committed to the safety of Guelph citizens and staff, helping to contribute to Guelph being one of Canada's safest cities. By-law is committed to providing 24-hour service to ensure compliance with City by-laws which are designed to protect and enhance the City's quality of life and community well-being. Following are some of the functions performed by the department.

- By-law Compliance and Security
  - Parking
  - Noise
  - Trees
  - Outside Water use and Encroachment
  - Zoning (Parking related offences)
  - Animal Control By-laws
- Licensing
  - Business Licensing
  - Lottery Licensing
  - Liquor Licence Clearances
  - Group Home Registrations

By-law employs 20 full-time staff and currently has vehicles equipped with AVL. One of By-law's vehicle utilizes a License Plate Recognition System for parking enforcement, this system is AVL and GIS based. While By-law is not expected to create GIS data, many databases utilized by the department would benefit from being geo-enabled and viewed in a mapping interface.

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.

By-law staff utilizes the intranet GIS application, OnPoint, for mailings, viewing property lines, and distributing public notices for neighborhood meetings. The table below summarizes the current GIS staff usage within the department. Type represents the current level of GIS experience based on job requirements, and GIS usage can be categorized as Limited, Moderate, or High (i.e. frequency of use), and Primary Tools describes what tools, or how GIS is used to carry out GIS functions.

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

Hardware and Software

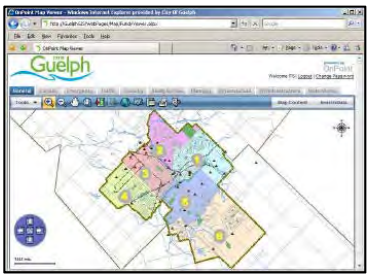
By-law staff share personal computers and laptops. GPS units are utilized to collect information about trees that have been cut down. These GPS units are borrowed when needed from the Forestry staff. Printers are available for office use.

Hardware Issues Summary	
Type	**Notes**
Personal Computers	5 PCs shared amongst Bylaw staff
Laptops	4 laptops for specific staff use, 2 additional shared laptops
Printers	Ample printers available for use
Plotters	None

GPS	Borrowed from Forestry Staff for Tree Collection Purposes
MDTs	None
Scanners	Scanners are built into printers and one scanner for ID entry

Microsoft Office is used to conduct office productivity tasks. The OnPoint Intranet GIS viewer is used for mailings, viewing property lines, and distributing public notices for neighborhood meetings. By-law is looking into software applications, which can be used to track pet information. By-law currently utilizes in-house software at the humane society for tracking this information. Staff have been informed that the Humane Society is considering purchasing DocuPet or similar software in March 2014. If this software is purchased by the Humane Society, By-law staff would have access to this database. By-law utilizes the following software applications:

1. Microsoft Office– Office Productivity
2. OnPoint – GIS Data Viewing
3. Genetec Security Centre – Licence Plate Recognition Software
4. AMANDA – Record Management of Licences
5. CLASS – Payments
6. Nordat – Dispatching and Recording Calls for Complaints, Overnight parking exemption
7. JDE – Financial Processing and specific HR module
8. AutoIssue – Issuance of Parking Infraction Notices
9. AutoProcess – Parking Ticket Database
10. Continuum – Security access and CCTV program
11. Lenel – Security access and CCTV program
12. Easy Lobby – visitor tracking database

 **OnPoint Intranet GIS**	**OnPoint** → OnPoint from Rolta is utilized as an enterprise-wide GIS Intranet solution. The software allows users to access pertinent GIS data via a web browser. By-law uses the software for mailings, viewing property lines, and distributing public notices for neighborhood meetings.

  **AMANDA Licensing**	**AMANDA** → AMANDA is a web-based product used for licensing, permitting, planning, and compliance. By-law uses AMANDA for record management of licences.
 **Nordat**	**Nordat** → By-law utilizes an application from Nordat for the purpose of dispatching and recording calls for complaints from citizens.

GIS Needs Assessment

GIS Needs

By-law 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:

GIS Need	*Method/Application to Meet Need*
☑ Enabling Existing Databases	▭ AMANDA, Nordat, CLASS, AutoIssue, Lenel
☑ GIS Based Complaint Tracking	▭ Complaint Tracking Application
☑ Mapping and Spatial Analysis of By-law Data	▭ Intranet GIS Data Browser

Mobile Computing, Vehicle Routing Analysis and Automated Vehicle Location	Intranet GIS Data Browser Mobile GIS Data Browser / Mobile Apps
Formal GIS Training for By-law Staff	By-law Specific Training

GIS Need

Enabling Existing Databases

By-law utilizes multiple databases to track By-law functions including:

- Complaint tracking
- Dog licensing
- Parking regulations/tickets
- Lottery licensing
- Business licensing
- Zoning Violations
- Liquor Licences

Most of the records within the various databases rely on an address as their geographic location base. As such, it is imperative that the City pursues the integration of the databases with GIS based on address. Data from these databases can then be displayed and queried in a GIS data browser. Once GIS integration with these databases is complete, By-law should have GIS data layers inside Esri SDE geodatabase(s) depicting complaints, licensing, regulations, etc.

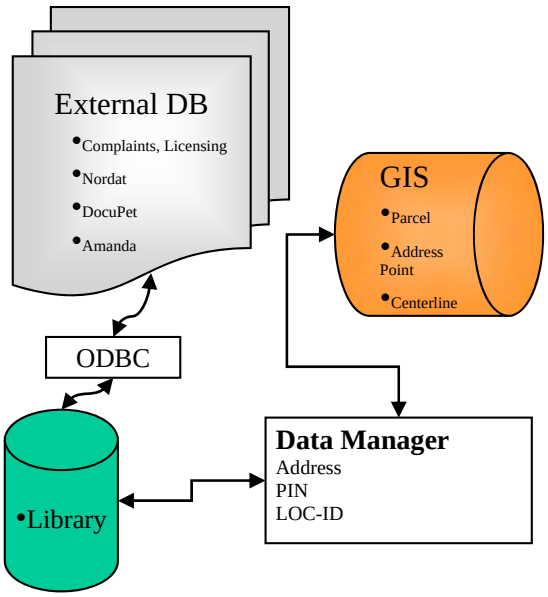
Application to Meet Need

Automated Geo-Enablement Tool

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

An application that acts as an automated geo-coding service that creates GIS data layers from non-spatial relational databases is needed. The results of a successful geo-coding effort will be stored in an industry standard relational database management system (Oracle and 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 (shape files 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 GeoManager 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. Software 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.

Applications to Meet Need

Intranet GIS Data Browser

It is recommended that an enterprise-wide ArcGIS Server (AGS) based Intranet GIS Data Browser tool be implemented to access pertinent spatial data, imaging and spatial analysis functionality. This application will not only allow users to view GIS data but also data

By-law Data Accessible through an Intranet GIS Data Browser

provided by By-law and data entered into legacy systems in other departments, as well. This application will serve as the primary GIS application for By-law, and enable staff to accomplish a majority of their in-office 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.

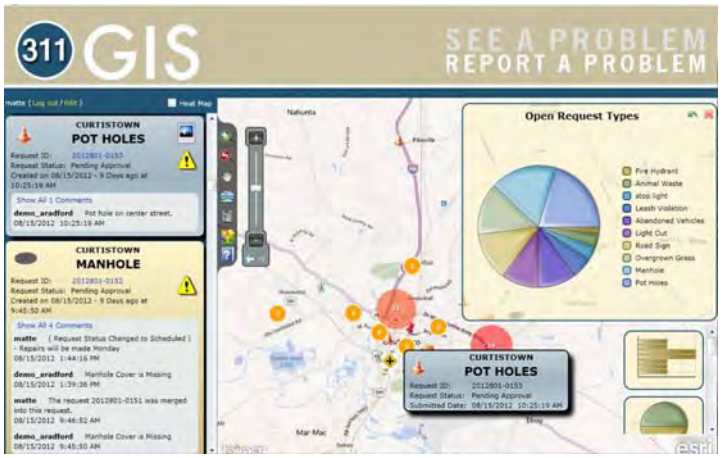
This application will allow for different configurations and different looks depending on workflows of By-law, in comparison to other City departments. With a number of departments interested in providing high-quality geospatial data and maps to their staff, an Intranet GIS Data Browser will be a City-wide initiative. An Intranet GIS Data Browser is a perfect tool to leverage the City's existing IT investments that function on a multi-departmental level.

GIS Need

GIS-Based Complaint Tracking

By-law is tasked with responding to many citizen concerns/complaints. In By-law, each complaint is entered into an application from Nordat. Many City departments including By-law would benefit from a web-based GIS application designed for tracking citizen inquiries, complaints, concerns, and other general feedback. Such an application would enhance communication with the public, and allow the City to quickly and effectively respond to requests. From the citizen's perspective, one call to any municipal staff member should result in an inquiry or complaint being logged into the system, routed to the correct department or point of contact, action taken by municipal employees, and follow up to the initial inquiry in an effective and timely manner. Inquiries or complaints should also be logged and tracked via the Internet, mobile device, or in person.

By implementing such an application, the public no longer has to be transferred from one department to another on the phone or in person. Routing of inquiries and complaints would be done internally through email notification, and is, therefore, transparent to the citizen. City staff can then proactively track, manage, analyze, map and report inquiries and complaints, actions taken, final results, and citizen satisfaction.



Complaint Tracking Application – User Interface

A complaint tracking system should include:

- Web/Phone-in/Walk-In Submittal of Inquiries

- Multiple Search (Query) Capabilities
- Internal Email Server
- Levels of End-User Security
- Assignment of Employees/Departments to Specific Inquiry Types
- Ability to Sub-classify Inquiry Types for Internal Department Use/Reporting
- Automated Email Notification of New Inquiry to a Designated Employee and Response to Person Submitting
- Logging of Actions Taken Toward a Solution
- Map and Summary Report Generation

☑ GIS Need

Mapping and Spatial Analysis of Departmental Data

By-law staff needs the ability to perform mapping and spatial analysis on interdepartmental data to make connections with seemingly unrelated data. A critical need for By-law is to provide users with enterprise-wide access to GIS based mapping and spatial analysis. By-law GIS users will benefit from access to the City's base map data as well as GIS data that represent their business functions. Upon implementation of an enterprise GIS, By-law staff will be able to conduct the following types of mapping and analysis:

- By-law Enforcement staff enforces all of the by-laws of the municipality. They currently use a Nordat application to record all complaints on a per occurrence basis. It would be beneficial if this information were part of a GIS system where all complaint history is stored by property address, which can be retrieved quickly by searching the property.
- Officers currently use paper forms for complaint tracking and follow up. It would be beneficial if they could access complaint data as well as other pertinent GIS data in the field via mobile devices.
- By-law staff enforces the Zoning by-laws with respect to parking, therefore, it may be beneficial to be able find out the current zoning on the property by searching a property address.
- It would be a useful tool for officers to be able to research permits and view permits on a map that have been issued by other divisions to determine if a permit has been issued to allow the activity and the conditions of that permit.
- Dog Licensing Information is stored in an in-house database. It would be beneficial if this information was part of a GIS system and was retrievable by a property search in one system instead of looking at separate systems. Also, there would be benefits if GIS has the capability to plan a route to conduct fieldwork for fail to renew follow up.
- The Department enforces a by-law to prohibit the discharge of firearms in certain areas as set out in maps attached to the by-law. It would be of great benefit for By-law to be able to look at an address or area and determine if it is within the firearm discharge boundary

- Mapping of additional data would be of great benefit to By-law:
    - Business Licences
    - Liquor Licences
    - Tree By-law violations
    - Fire Routes
    - Noise By-law
    - Zoning Violations
    - Parking Tickets
    - Parking Lots patrolled by staff

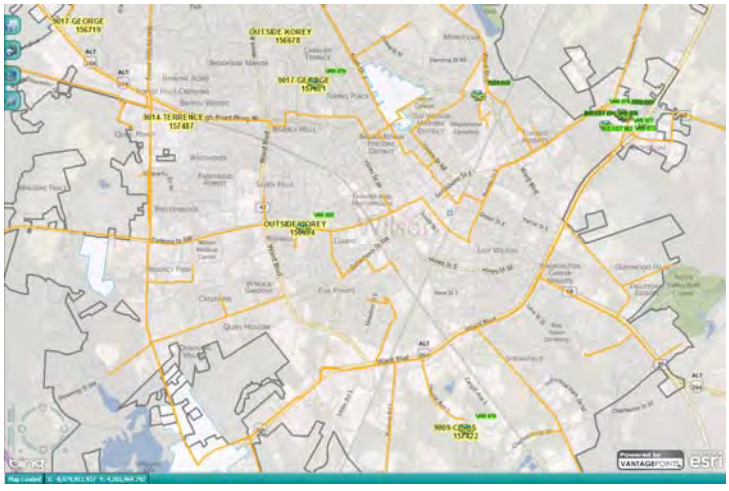
GIS Need

Mobile Computing, Vehicle Routing Analysis and Automated Vehicle Location (AVL)

By-law staff is required in the field for a host of purposes to include researching violations, risk management issues, licensing, and a variety of other tasks. Once a year dog and business licences have to be renewed. A door-to-door canvassing may occur for non-renewed licences. Having this data portable on a laptop, tablet, or smartphone would be a huge benefit and timesaving for staff in the field.

In the case of licensing, office staff would benefit greatly by having optimal routes provided spatially for their door-to-door canvassing. It is recommended that the Intranet GIS Data Browser solution have multi-point routing capabilities. This would allow office staff to generate an optimal path and a route manifest. Each of the vehicles is currently outfitted with AVL devices. The Intranet GIS Data Browser should interface with these AVL devices for seamless operation. Through the use of optimal route planning and AVL, management can make informed decisions in regards to staffing. Managers will have the ability to assign certain officers to certain cases based on their geographic location and availability.

By-law staff needs access to mobile tools for performing licensing enforcement. Currently staff are using paper forms while in the field performing these assessments. By having a digital form based approach, the data can be synced in real-time to the central database and automatically displayed on a mapping interface. This functionality will save staff member's time and increase productivity.



The Intranet Data Browser should support routing, generating travel directions, and AVL

Additionally, the Intranet GIS Data Browser should interface with By-law's Licence Plate Reader System to allow for this data to be viewed geographically.

GIS Need

Formal GIS Training for By-law Staff

All departments, including By-law, will benefit from formal training in GIS. For the immediate future, it is envisioned that all GIS users in By-law will be Tier 3 – Browser level. As such, only third-party training for the 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.

GIS Gap Analysis

GIS Data Layer Inventory

By-law staff does not and will not create any GIS layers. By-law will benefit from access to several GIS data layers. It is expected that once all departmental data is integrated, consolidated, and centrally stored that the staff will have access to all non-classified GIS data layers from other departments. ***A full Master Data Layer list, with existing and recommend layers can be found in Appendix I of this Needs Assessment.***

Legend

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

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

The following table lists those data layers that are important to By-law:

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
By-law GIS Data			
Parking Time Limit Violations	Extracted from database, geocoded and mapped (information is not added to City's GIS database currently. Resides in a separate program – Gentec-Desk	Automated	Existing
Licenced Pets	Extracted from database and geocoded	Automated	Recommended
Complaints	Extracted from database and geocoded	Automated	Recommended
Zoning	Digitized on screen (parking related offences)	Planning	Existing
AMANDA Data	Extracted from database and geocoded	Automated	Recommended
Business Licences	Extracted from database and geocoded	Automated	Existing
Liquor Licences	Extracted from database and geocoded	Automated	Recommended
Tree By-law	Extracted from database and geocoded	Automated	Recommended
Noise By-law	Extracted from database and geocoded	Automated	Recommended
Fire Routes	Digitized on screen	Planning, Fire and GIS Team in IT	Existing
Parking Tickets	Extracted from database and geocoded	Automated	Recommended
Parking Lots	Digitized on screen	GIS Team in IT	Recommended
Fire Arm Discharge Zones	Digitized on screen	GIS Team in IT	Recommended
Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels, are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using the rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base, as well.	The GIS Team in IT maintains the property data. New property surveys are incorporated as they are received. If staff in other departments sees errors they have been asked to report them to the GIS Team in IT.	Existing

	In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006, the City acquired rectified digital orthoimagery, which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.		
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance have occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing
Landmarks	Digitized – have started to develop a commonplace layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhoods	Heads up Digitizing Screen. Subdivisions are available by 61-M plan (Subdivision) layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	GIS Team in IT creates and maintains addresses within GIS. Are notified by Planning when new addresses are required.	Existing

Building Footprints	Original building footprints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by the City to create an updated building layer.	GIS Team in IT	Existing
Contours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; changes are updated with Orhtophoto refresh	Existing

GAP Analysis Chart

By-law 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.

Legend	
Existing	
Yes	GIS component currently exists within department.
No	GIS component does not currently exist within department.
Limited/Partial	GIS component exists to a lesser degree.
Desired	
Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to departmental needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to departmental need.
Low	Can be met after higher needs are accomplished.

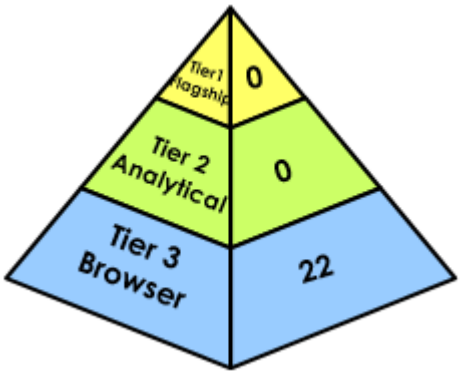
Component	Status		Priority	Notes
	Existing	Desired		
Automated Vehicle Location (AVL)	Yes	Yes	High	AVL can be used to track official vehicles; Using AVL conjunction with routing increases efficiency and can reduce fuel consumption, thereby decreasing costs. By-law currently has AVL enabled vehicles. Using this technology in conjunction with optimal route planning will be very beneficial for the department.
Documentation	Limited	Yes	Medium	Some documentation on GIS data creation and workflow exist, however there is a greater need for creation and standardization for documentation citywide.
Enterprise Systems Integration	Limited	Yes	High	Integration with AMANDA, Nordat, Dog licensing, and other systems will be very important for the success of GIS within By-law.
Geocoding	Limited	Yes	High	Geocoding of Nordat, Dog licensing, Class, AMANDA, and other databases.
GIS Data Access	Limited	Yes	High	By-law will need access to GIS layers as outlined throughout this document in an easy-to-use data browser.
GIS Data Maintenance	No	No	Low	By-law will be a data consumer. They will not create or maintain any GIS data.
GIS Data Sharing	No	Yes	High	Some selected data sets will be shared internally. Additionally, some data will be shared publically such as complaints.
GIS Personnel	No	No	Low	By-law will be a data consumer. As such, they will use easy-to-use GIS data browsers. They will not need any GIS personnel.

Component	Status		Priority	Notes
	Existing	Desired		
Hardware	Yes	Yes	High	The current personal computers will suffice for running the GIS data browser. Laptops, tablets, and/or smartphones will need to be purchased for use with field tools and software.
Mapping	Yes	Yes	High	All mapping should be attainable through the Intranet data browser and the mobile data browser.
Metadata	No	Yes	Medium	By-law needs to know the derivation of the data, its currency, and completeness.
Mobile Computing Resources	No	Yes	High	By-law needs access to GIS data in the field. This includes performing pet licence checks, viewing parcel and ownership information, and AVL/routing.
Network	Yes	Yes	High	High availability and fast access to GIS data will be important to the success of this initiative.
Routing	No	Yes	High	Optimal route planning would be very beneficial to By-law. With the ability to plan officers' days, By-law will see an increase in productivity and efficiency.
Software	Yes	Yes	High	By-law will need expanded use of an improved Intranet GIS data browser as well as mobile GIS tools
Spatial Analysis and Modeling	No	Yes	High	By-law needs to perform spatial analysis. Such as, select all pets within a boundary that have not renewed a pet licence this year and have not yet been visited.

Component	Status		Priority	Notes
	Existing	Desired		
Training/Education	No	Yes	High	This component is considered a medium priority for use of GIS within By-law. Introductory training is needed at the browser user level for all staff.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Return on Investment (ROI)

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

Return on Investment Opportunity **By-law**	
Opportunity	**Explanation**
Save <u>Time</u>	Optimal routing for field staff: • An Intranet GIS Data Browser should be used to generate optimal routes for all fieldwork. One stop shopping for the division would save numerous hours per week.
Improve <u>Information Processing and Save Time</u>	Automation • By-law has to spend much time researching various issues from various data sources. Having all of this information available via one portal will assist greatly and save staff numerous hours.

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

City Clerk

City Clerk

Section Outline

Existing Conditions

- Department Overview
- Governance of GIS
- Hardware and Software

GIS Needs Assessment

- GIS Needs

GIS Gap Analysis

- GIS Data Layer Inventory
- GAP Analysis Chart

Multi-Tier GIS Application Use

Return on Investment (ROI)

Existing Conditions

Department Overview

The City of Guelph City Clerk's Office strives to ensure accountability, transparency, and engagement by administering legislative processes, maintaining, and managing public records and conducting elections. The Office performs the following functions:

- Advise City departments and Council on matters of procedure, policy, and federal, provincial and municipal legislation
- Manage the calendar of Council and Committee meetings
- Manage and publish Council and Committee agendas, minutes, and a formal record of decisions
- Preserve the integrity of the local legislative process by promoting opportunities for the public to participate in Council and Committee meetings
- Process marriage license applications, perform marriage ceremonies, process burial permits, and register deaths under the Vital Statistics Act
- Execute City By-laws and agreements are prepared documents pursuant to the Commissioner for Affidavits Act
- Coordinate and respond to Freedom of Information and Protection of Privacy Act requests
- Acts as the Returning Office to manage local elections for offices on City Council and local school boards

Governance of GIS

There are generally three tiers of GIS users:

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

No GIS software is currently used within the City Clerk's Office. The table below summarizes the current GIS staff usage within the division. Type represents the current level of GIS experience based on job requirements. GIS usage can be categorized as Limited, Moderate, or High (i.e. frequency of use), and Primary Tools describes what tools, or how GIS is used, to carry out GIS functions:

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

Hardware and Software

The City Clerk's Office uses personal computers for each of its staff. No GPS units are utilized. Printers are available for office use.

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

Microsoft Office is used to conduct office productivity tasks. VoterView software is used for elections management. The City Clerk's Office utilizes the following software applications:

1. Microsoft Office– Office productivity
2. VoterView – Election management
3. Amanda – Property related data lookup
4. EDMS – Agendas and minutes
5. MPAC – For names, addresses, birth dates, school support status

DataFix municipal voterview Your Complete Election Solution	**VoterView →** Municipal VoterView offers elector tools to support the municipal election process. With MVV, the user has access to a comprehensive suite of election reports and the ability to update the elector list dynamically from multiple polling locations for advance polls or on election day.

GIS Needs Assessment

GIS Needs

A majority of the City Clerk's Office GIS needs revolve around viewing GIS data, election management, and understanding by-laws and agreements. Staff will require access to GIS data and the ability to query and perform analysis using elements of GIS data maintained by the City.

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

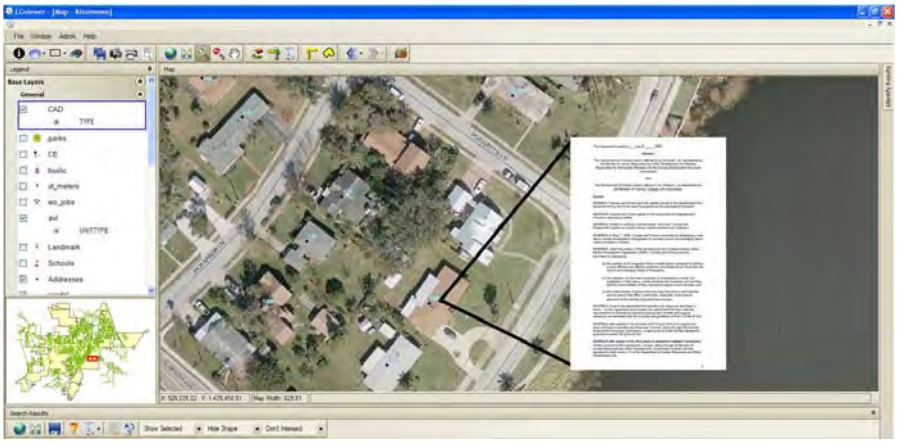
Based on this Needs Assessment, the City Clerk's Office has several identified GIS needs. Where applicable each need will be followed by an application or method to meet that need, some applications/methods will meet several needs. A method or application is only described under one need if it applies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

GIS Need	Method/Application to Meet Need
Division-Wide Access to Geospatial Data	Intranet GIS Data Browser
Ward, Polling Site, and Voter Identification	Intranet GIS Data Browser
Public Access to Geo-Spatial Data – Citizen District Voter Look-Up	Internet GIS Data Browser
Formal GIS Training for Department Staff	Training Classes

GIS Need

Division-Wide Access to Geospatial Data

A key need identified by department personnel is access to shared GIS data within the City. This includes the most recent parcel, address, and street centerline data as well as high-resolution ortho-photography. Using the most recent, accurate GIS layers will provide staff with an invaluable tool for everyday tasks. City Clerk staff can use the intranet browser for the following tasks:



Viewing Development Agreements via a GIS Browser

- Viewing voter information
- Viewing ward and poll locations
- Locating addresses to determine a voter's ward or poll location
- Viewing GIS enabled documents tied to properties detailing land related agreements
- Viewing Amanda data and rezoning data

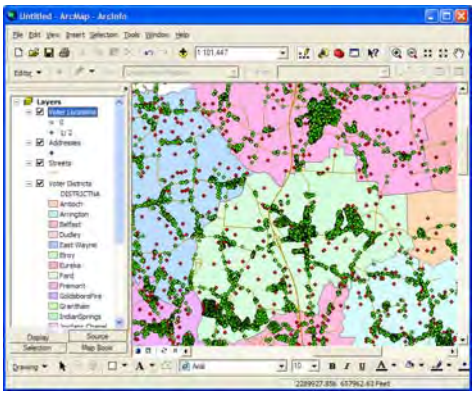
Departmental staff will be able to utilize an intranet GIS data browser to conduct basic spatial analysis and to produce maps and to assist in day-to-day activities.

☑ GIS Need

Ward, Polling Site, and Voter Identification

Employees within the City Clerk's Office will be tier 3 GIS users. They need an easy to use interface that will allow them to quickly view data and print out maps. A voter lookup intranet application should be implemented for departmental staff. This application should allow a user to identify an existing voter, the voter's physical registered location, their ward, and their polling site. The user would zoom into an area visually, by voter, ward, or by address. A button for printing reports and maps would be included.

This application will require the existing voter location GIS point layer, which will be derived from address matching against the street centerlines or address points. This data can be set-up to be utilized within the recommended Intranet GIS data browser.



View Polling Sites and Address for Elections

☑ GIS Need

Public Access to Geo-Spatial Data – Citizen District Voter Look-Up

The City Clerk's Office noted a specific need to provide citizens of Guelph with Election and Voter information on the Internet. It is recommended that departmental staff work with the GIS team in IT to deploy an Internet based application tailored to the needs of voters. One of the functions of this application would be to allow citizens to type in an address and find out which ward they are in and where they should go to vote.

Example of a Voter Application Internet Site

A formal review and assessment process should be established prior to making any information available as some data may be sensitive or confidential. Reviews should be coordinated with the GIS team in IT and approved by the City Clerk's Office to ensure that no sensitive or confidential data is distributed publicly.

GIS Need

Formal GIS Training for Department Staff

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

GIS Gap Analysis

GIS Data Layer Inventory

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

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

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

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
City Clerk GIS Data			
Voters	Automated Address Matching from VoterView	Automated	Recommended
Amanda Data	Automated Extract from Database	Automated	Existing
Polling Sites	Converted from Paper Maps	GIS team in IT	Existing
School Districts	Converted from Paper Maps	GIS team in IT	Existing
By-Laws and Agreements	PDFs linked to their Geography	Various	Recommended
Wards	Converted from Paper Maps	GIS Team in IT	Existing

Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using the rubber sheet method thereby warping the line work. All other data sets were created based upon the parcel base, as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006, the City, acquired rectified digital orthoimagery, which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received, they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.	The GIS Team in IT maintains the property data. New property surveys are incorporated as they are received. If staff, in other departments, sees errors they have been asked to report them to the GIS Team in IT.	Existing
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance have occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing

Landmarks	Digitized – have started to develop a commonplace layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhoods	Heads up Digitizing Screen. Subdivisions are available by 61-M plan (Subdivision) layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	GIS Team in IT creates and maintains addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building footprints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by the City to create an updated building layer.	GIS Team in IT	Existing
Countours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; changes are updated with Orhtophoto refresh	Existing

GAP Analysis Chart

City Clerk Office staff will be data consumers 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.

Legend	
Existing	
Yes	GIS component currently exists within department.
No	GIS component does not currently exist within department.
Limited/Partial	GIS component exists to a lesser degree.
Desired	

Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to departmental needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to departmental need.
Low	Can be met after higher needs are accomplished.

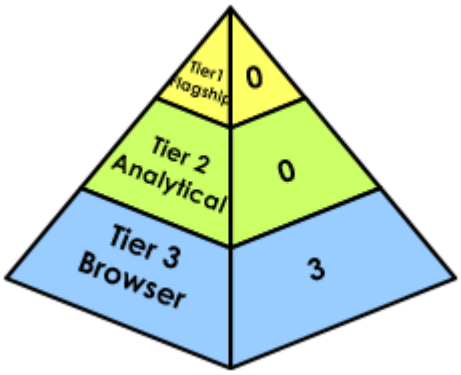
Component	Status		Priority	Notes
	Existing	Desired		
Automated Vehicle Location (AVL)	No	No	Low	City Clerk does not need AVL.
Documentation	Limited	Yes	Medium	Some documentation on GIS data exists. The GIS Team in IT will mandate enterprise GIS documentation processes and procedures.
Enterprise Systems Integration	Limited	Yes	High	Integration with VoterView and AMANDA.
Geocoding	No	Yes	High	Voters will need to be geocoded.
GIS Data Access	Limited	Yes	Medium	The City Clerk's Office will need access to GIS data layers on occasion.

Component	Status		Priority	Notes
	Existing	Desired		
GIS Data Maintenance	No	No	Low	City Clerk will be a data consumer. They will not create or maintain any GIS data.
GIS Data Sharing	No	Yes	Medium	There is a desire to share ward and polling site information via a web portal
GIS Personnel	No	No	Low	City Clerk will be a data consumer. As such, they will use easy-to-use GIS data browsers. They will not need any GIS personnel.
Hardware	Yes	Yes	Low	The current personal computers will suffice for running the GIS data browser.
Mapping	Limited	Yes	Medium	All mapping should be attainable through the Intranet data browser.
Metadata	No	No	Low	City Clerk is not overly concerned with the derivation of the GIS data.
Mobile Computing Resources	No	No	Low	City Clerk has no need for mobile computing.
Network	Yes	Yes	High	High availability and fast access to GIS data will be important to the success of this initiative.

Component	Status		Priority	Notes
	Existing	Desired		
Routing	No	No	Low	City Clerk has no need for GIS based routing.
Software	Limited	Yes	Medium	City Clerk will need the Intranet GIS data browser only.
Spatial Analysis and Modeling	No	No	Low	City Clerk will mainly use GIS for data browsing, information retrieval, and quick map production. Any high-level analysis will be done by the GIS Team in IT on an as-needed basis.
Training/Education	No	Yes	Medium	This component is considered a medium priority for use of GIS within City Clerk. Introductory training is needed at the browser user level for all staff.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Return on Investment (ROI)

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

Return on Investment Opportunity City Clerk	
Opportunity	**Explanation**
Save <u>Time</u>	Data Access for Staff: • An Intranet GIS Data Browser should be used to access data for quick access to pertinent data including by-laws and agreements. This will save staff time in having to research all needed data. • Staff will be able to answer voter related questions via the GIS and Internet, saving staff time.
Improved <u>Customer Service</u>	Internet GIS Data Browser: • Voters will be able to quickly view wards, polling locations, and address information.

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Community Energy

Community Energy

Section Outline

Existing Conditions

- Department Overview
- Governance of GIS
- Hardware and Software

GIS Needs Assessment

- GIS Needs

GIS Gap Analysis

- GIS Data Layer Inventory
- GAP Analysis Chart

Multi-Tier GIS Application Use

Return on Investment (ROI)

Existing Conditions

Department Overview

The City of Guelph is on the forefront of energy conservation, headed up by the Community Energy Department (CED). The City was an early adopter in the development of community energy solutions by being a key player in developing municipal energy distribution in Ontario 100 years ago. The City plans to take the lead for the next 100 years as well and remain consistent with tradition.

To reach this goal, CED has established the following functions and priorities:

- Maximize the energy and water efficiency for buildings, vehicles and industry
- Maximize use of heat generated in electricity generation and existing industrial processes
- Incorporate as many renewable energy sources as feasible
- Team with the existing electricity and gas networks to avoid wasteful duplication of assets

An interview with CED focused on how GIS technology could support the issues and concerns surrounding energy usage, greenhouse gas emissions, the city of Guelph's energy footprint, the City's Community Energy Plan (CEP), and the 2010 "City of Guelph: Integrated Energy Mapping Strategy (G-IEMS).

Increase in costs for energy has put the spotlight on how effective municipalities are using energy. The City of Guelph recognized the growing importance of effective management of energy and water to the economy and the environment. The city has made a commitment to implement an energy plan that will ensure long-term competitiveness and environmental performance of the City. The Overall vision of the CEP includes an assortment of goals and actions that reduce emissions, improve efficiency, and make the city a more competitive and viable place to live. Since the publication of the CEP in 2007 the City of Guelph has seen an increase in population with a corresponding decrease in greenhouse gasses and energy use (Energy Usage and Greenhouse Gas Emissions, Summary Report 2012). This can be attributed to an assortment of activities that drive down greenhouse gas emissions, including solar energy, green transportation, water conservation, and electricity and natural gas conservation.

From a GIS perspective we need to look at these and other activities that are driving down greenhouse gas emissions in the City. It will be these factors that help us identify what type of GIS digital data and database information will be required for future monitoring, management and further success with energy reduction.

The ultimate use of GIS technology is to be able to do exactly what is stated in the G-EIMS: **"visualize energy use of buildings and transportation using maps, and develop a tools to monitor, evaluate and verify progress towards meeting energy and greenhouse gas objectives" (August 2010).** An energy mapping strategy for the City of Guelph must address a very broad range of topics, and as such, a very large and broad array of GIS data layers and databases are required to maintain a reliable monitoring system.

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.

CED staff utilize the intranet GIS application, OnPoint, for real estate analysis and optimal facility location analysis. Staff also use mobile phones to view GIS data while out of the office. The table below summarizes the current GIS staff usage within the department. Type represents the current level of GIS experience based on job requirements, GIS usage can be categorized as Limited, Moderate, or High (i.e. frequency of use), and Primary Tools describes what tools, or how GIS is used to carry out GIS functions.

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

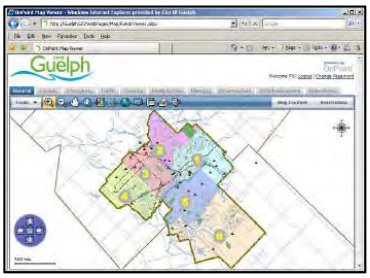
Hardware and Software

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

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

Microsoft Office is used to conduct office productivity tasks. The OnPoint Intranet GIS viewer is used for real estate analysis and optimal facility location analysis. The CED utilize the following software applications:

1. Microsoft Office– Office productivity
2. OnPoint – GIS data viewing



OnPoint Intranet GIS

OnPoint → OnPoint from Rolta is utilized as an enterprise-wide GIS Intranet solution. The software allows users to access pertinent GIS data via a web browser. The CED uses the software to perform real estate analysis and optimal facility location analysis.

GIS Needs Assessment

GIS Needs

The CED 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:

GIS Need	*Method/Application to Meet Need*
Mapping and Spatial Analysis of Community Energy Data	Intranet GIS Data Browser
Geodatabase Design	ArcGIS
Formal GIS Training for Community Energy Staff	Community Energy Specific Training

GIS Need

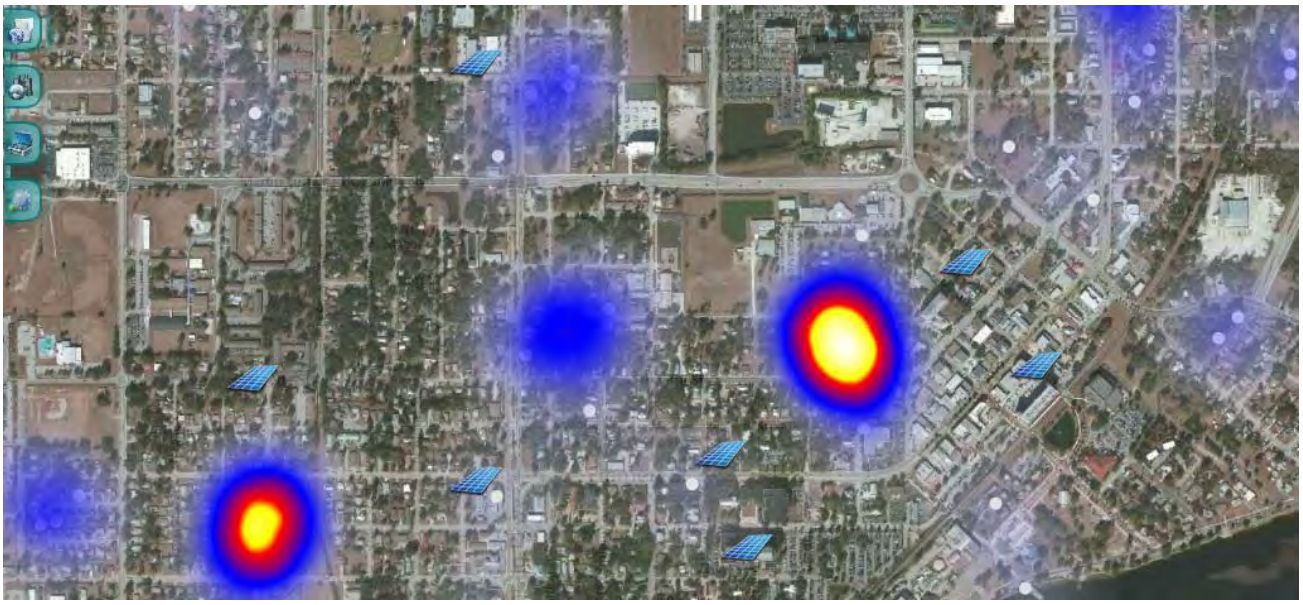
Mapping and Spatial Analysis of Community Energy Data

The City has recognized that there is a compelling case for a "hierarchy for measures: reduce, recycle and replace: Firstly, reduce energy consumption through higher efficiency throughout the energy chain, secondly, recycle energy that otherwise would be wasted, and finally, replace fossil fuels with more benign sources". District heating and cooling responds to this challenge by extending the advantages of renewable heat supply form individual buildings to eco-districts or even cities. During the GIS Needs Assessment interview the issue of "District Heating" came up. District heating is an infrastructure where heat is distributed in pipe networks by circulating heated water. The water delivers heat via substations to connected building s and is returned to the main heating plant where it is heated again. Solar heat can be integrated into the system either by a central or a distribution plant.

If this initiative was developed for the City of Guelph, the GIS would play a significant role in asset management and real-time monitoring of district heating. All "district heating" infrastructure would be mapped modeled, and maintained in the GIS. CED desires to use GIS to monitor the data created from Policy Actions identified in the G-IEMS, including energy certificates, location of loans, incentives, rebates and more.

Additionally, the CED has specific GIS data viewing and analysis needs to include:

- Commercial Real Estate
- Building and Energy Sources
- Building Information
- Greenhouse Emissions
- Renewable Energy Generators
- Solar Energy / Panel Installations



Intranet GIS Data Browser Showing Solar Panel Installations and Energy Consumption Heat Map

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

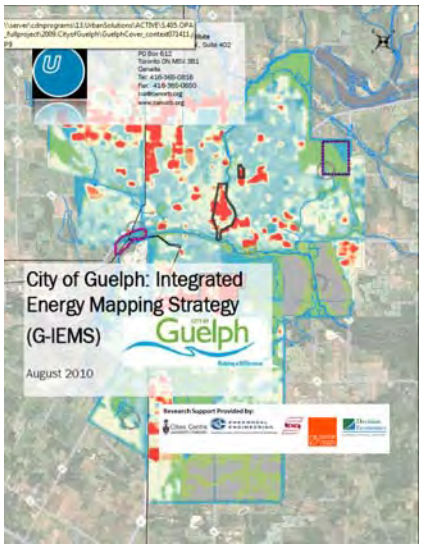
CED should work with the GIS Team in IT and train specific department personnel in the use of GIS to gain quick successes based on mapping and analysis of energy usage, greenhouse emissions, and solar energy installations. Most CED staff should utilize an intranet GIS data browser to conduct basic spatial analysis and to produce maps to assist in day-to-day activities.

GIS Need

Geodatabase Design

An enterprise-wide geodatabase will be utilized for all GIS data layers as part of this GIS implementation. It will be important, though, for this geodatabase to include the feature classes and fields necessary for a successful GIS implementation for Community Energy. The GIS Team in IT will be the manager of the geodatabase, but will need input from the CED staff as to the data and information desired. CED staff will

work with the GIS Team in IT to develop a centralized and corporate style database for use within the G-IEMS. The CED will need to identify the priority and required data layers that will be important for the success of GIS for the CED.



A critical need for the CED will be to constantly update the G-IEMS maps and model with new data, scenarios, or forecasts. This can be accomplished through numerous methods, but the most effective and efficient method will be through automated geocoding of data.

GIS Need

Formal GIS Training for Community Energy Staff

All departments, including Community Energy, will benefit from formal training in GIS. For the immediate future, it is envisioned that all GIS users in the CED will be Tier 3 – Browser level. As such, only third-party training for the 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.

GIS Gap Analysis

GIS Data Layer Inventory

CED staff does not and will not create any GIS layers. Community Energy 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. ***A full Master Data Layer list, with existing and recommend layers can be found in Appendix I of this Needs Assessment.***

Legend

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

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

The following table lists those data layers that are important to Community Energy:

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Community Energy GIS Data			
Zoning	Digitized on screen	Planning	Existing
Land Use	Digitized on Screen	Planning	Existing
Commercial Real Estate	Extracted from database and geocoded	Automated	Recommended
Building Energy Usage	Extracted from database and geocoded	Automated	Recommended
Personal Transportation Energy Usage	Extracted from database and geocoded	Automated	Recommended
Public Transportation Energy Usage	Extracted from database and geocoded	Automated	Recommended
Building and Energy Sources	Extracted from database and geocoded	Automated	Recommended
Buildings	Digitized on Screen	GIS Team in IT	Recommended
Pedestrian Areas	Digitized on Screen	GIS Team in IT	Recommended
Population	Census Data	Federal Census Data	Recommended
Renewable Energy Generators	Extracted from database and geocoded	Automated	Recommended
Solar Energy Installations	Extracted from database and geocoded	Automated	Recommended
Sidewalks	Digitized on Screen	Engineering	Existing
Bike Lanes	Digitized on Screen	Engineering	Existing
Car Share Locations	Extracted from database and geocoded	Automated	Recommended

Water Conservation Areas	Extracted from database and geocoded	Automated	Recommended
Electricity and Natural Gas Conservation Areas	Extracted from database and geocoded	Automated	Recommended
Utility Infrastructure	Digitized on-screen and converted from CAD drawings and paper maps	Engineering	Existing but needs spatial improvement
Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006 the City acquired rectified digital orthoimagery which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.	The GIS Team in IT maintain the property data. New property surveys are incorporated as they are received. If staff in other departments see errors they have been asked to report them to the GIS Team in IT.	Existing

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Limited	Some applicability to departmental needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to departmental need.
Low	Can be met after higher needs are accomplished.

Component	Status		Priority	Notes
	Existing	Desired		
Automated Vehicle Location (AVL)	No	No	Low	AVL can be used to track official vehicles; Using AVL conjunction with routing increases efficiency and can reduce fuel consumption, thereby decreasing costs. Community Energy has no need for AVL.
Documentation	Limited	Yes	Medium	Some documentation on GIS data creation and workflow exists however there is a greater need for creation and standardization for documentation citywide.

Component	Status		Priority	Notes
	Existing	Desired		
Enterprise Systems Integration	Limited	Yes	High	Integration with various databases will be critical to the success of GIS usage within the CED.
Geocoding	Limited	Yes	High	Geocoding of multiple databases will need to take place for GIS usage within the CED.
GIS Data Access	Limited	Yes	High	Community Energy will need access to GIS layers as outlined throughout this document in an easy-to-use data browser.
GIS Data Maintenance	No	No	Low	Community Energy will be a data consumer. They will not create or maintain any GIS data.
GIS Data Sharing	No	Yes	Medium	Some selected data sets will be shared internally.
GIS Personnel	No	No	Low	Community Energy will be a data consumer. As such, they will use easy-to-use GIS data browsers. They will not need any GIS personnel.
Hardware	Yes	Yes	Low	The current personal computers will suffice for running the GIS data browser.
Mapping	Yes	Yes	High	All mapping should be attainable through the Intranet data browser.
Metadata	No	Yes	Medium	Community Energy needs to know the derivation of the data, its currency, and completeness.

Component	Status		Priority	Notes
	Existing	Desired		
Mobile Computing Resources	Limited	Yes	High	Community Energy needs access to GIS data in the field. This includes viewing information about buildings, solar panel installations, energy usage, and other pertinent data.
Network	Yes	Yes	High	High availability and fast access to GIS data will be important to the success of this initiative.
Routing	No	No	Low	Community Energy does not need routing functionality in GIS
Software	Yes	Yes	High	Community Energy will need expanded use of an improved Intranet GIS data browser.
Spatial Analysis and Modeling	No	Yes	High	Community Energy needs to perform spatial analysis as part of their core function of locating high energy/heat areas throughout the City.
Training/Education	No	Yes	Medium	This component is considered a medium priority for use of GIS within Community Energy. Introductory training is needed at the browser user level for all staff.

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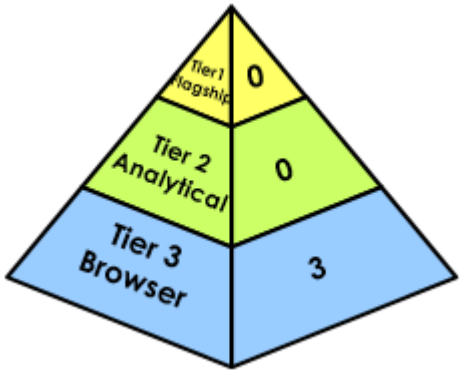
The pyramid and table below outlines the "Tiers of GIS Use" within Community Energy. All are color coded by the level of desired GIS application use. As defined in the Tiers of GIS Users table, a Tier 1 user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 Analytical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



Tiers of GIS Users

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Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Return on Investment (ROI)

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

Return on Investment Opportunity Community Energy	
Opportunity	**Explanation**
Make Better Quality and More Effective Decisions and Comply with Local, Provincial, and Federal Mandates	An Intranet GIS Data Browser should be used to access data for reporting, particularly for energy tracking.
Provide Data to Regulators, Developers, and other Interested Parties and Effective Management of Assets and Resources	Better energy usage/intensity data would help identify opportunities for District Energy/Combined Heat and Power, and may present opportunities to improve the energy efficiency of assets belonging to the City and to the community in general.

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Community Engagement

Community Engagement

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 Department Overview

The City of Guelph Community Engagement Department has oversight on a diverse set of services. The department researches, develops, implements and enhances ways to inform, educate, engage, and collaborate with citizens and develops policies and programs and make decisions that reflect the need of the community. Community Engagement has the following divisions and associated functions:

- **Accessibility Services**
  - Ensure programs, services and facilities are inclusive, accessible and compliant with the Accessibility for Ontarians with Disabilities Act (AODA), and adhere to the Ontario Human Rights Code as it relates to persons with disabilities
  - Facilitate Guelph's Accessibility Advisory Committee and support individual citizens in advocating for increased accessibility.
- **Community Engagement**
  - Develop a Citywide framework to offer more consistent, transparent, inclusive and compelling ways to inform, consult, involve, collaborate and empower community members when making municipal decisions.
  - Show residents and community groups how to provide more accessible and inclusive events and programs through training, mentoring, facilitation, funding and in-kind support.

- **Local Immigration Partnership**
    - Convene and support community partnerships to promote economic and social inclusion of immigrants
    - Develop an online Immigration Portal to support the economic and social inclusion of newcomers both pre- and post-arrival.
- **Seniors Services**
    - Manage a 24,000 square-foot facility and offer events, programs, volunteer management and dining room services in partnership with the Guelph Wellington Seniors Association.
    - Ensure older adults have opportunities to participate in City events, programs, initiatives, and policy decisions impacting the lives of seniors and other community members

- **Policy and Program Development, Research Project Management, and Social Services Liaison**
    - This area of work includes three independent staff – a Project Manager for the Community Wellbeing Initiative, a Policy Analyst, and a Social Service Program and Policy Liaison.
    - Develop, implement and evaluate policies and programs to support vibrant and inclusive communities including the Guelph Community Wellbeing Initiative, Guelph Investment Strategy and the Affordable Bus Pass.
    - Provide oversight, research and program expertise; review social services delivered by the County of Wellington and non-profit health and social service providers including Guelph's emergency youth shelter and long-term care services to ensure they meet community needs and expectations.
- **Youth Services**
    - Coordinate youth services and advocate for City programs and policies designed to engage, consider and reflect the needs of youth in Guelph.

To accomplish this varied set of duties; Community Engagement employs twenty full-time staff.

Governance of GIS

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

3 - Browser GIS user requires only general browsing GIS data functions to create reports, query standard data sets, create tasks like mailing labels, and produce maps.

Community Engagement is primarily a service agency and as such does not have a large need for GIS functionality. No GIS is currently being used by the Department. 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 describe what tools, or how GIS is used to carry out GIS functions.

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

 Hardware and Software

Community Engagement uses personal computers for each of its staff. No GPS units are utilized by Community Engagement. Printers are available for office use.

Hardware Issues Summary	
Type	**Notes**
Personal Computers	One for each staff person
Laptops	Select staff
Printers	Ample printers available for use
Plotters	None
GPS	None
MDTs	None
Scanners	2 Scanners in CSS at City Hall

Community Engagement use the following software applications:

1. Microsoft Office– Office productivity
2. CLASS – customer tracking (Seniors Services, program registration and One2One support)

GIS Needs Assessment

GIS Needs

Community Engagement 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:

GIS Need	*Method/Application to Meet Need*
Mapping and Spatial Analysis of Community Engagement Data	Intranet GIS Data Browser
Customer Interaction Portals	Tier 3 GIS Application
Formal GIS Training for Community Engagement Staff	Community Engagement Specific Training

GIS Need

Mapping and Spatial Analysis of Community Engagement Data

The Community Engagement Department has expressed the desire to have access to various data sets relating to their services. Demographics in conjunction with customer mapping would allow staff to understand where their customers reside and where pockets of potential customers may exist. Customer data could be mined from the CLASS system and geocoded. Any data record with an address or property number can be spatially enabled – or geocoded – by linking the appropriate fields to the appropriate GIS layer – street centerline, tax parcel, or address point. 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 seniors that have visited the Evergreen Seniors Community Centre in the month of December and who live within walking distance or close to a bus stop. The following are mapping and data needs identified by Community Engagement staff:

Mapping of Customer Locations

- CLASS – mapping membership

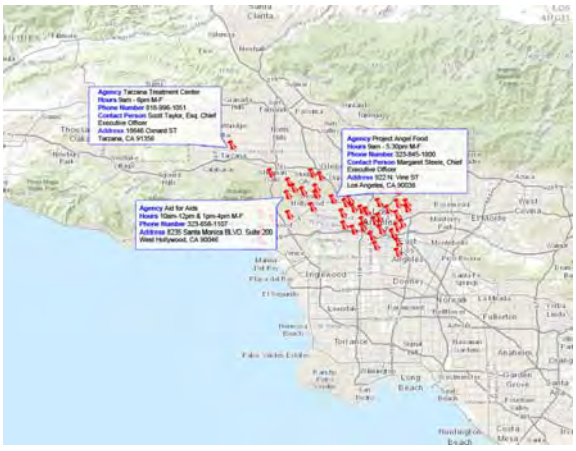
- Targeted geographic based opt-in mail outs
- Demographic analysis – income, age, etc. for targeting services
- Projects layer of all city and community projects
- Map of participants (e.g. all participants in recreation programs over the age of 55)
- Community gardens and food cupboards
- City owned properties for consideration in community gardens
- Urban agriculture locations, local food projects, chicken coops
- Public meetings layer to include topics and who will be speaking
- Map survey results
- Map of facilities listing amenities
- Where are all the social service programs
- Neighborhood groups with contact information
- Map of immigrant and multi-cultural group events and opportunities
- Youth facilities, activities, and optimal location analysis

Community Engagement staff are not GIS professionals. Therefore, the end-user tools to consume and analyze the above information must be intuitive and easy-to-use. An intranet portal should be tailored to the needs of Community Engagement providing their needed data and analytical functions.

GIS Need

Customer Interaction Portals

Staff identified the need to share pertinent data with their clientele. Some of this data can be best presented through on-line mapping portals. These applications should work on personal computers, tablets, and smart phones. Possible mapping portal themes are as follows:



Public Facing GIS Portal of Services Available

- Application showing key services by category to include the following data:
  - Social service agency location to include driving directions, bus route options, agency, hours, phone number, key contact person.
  - Transportation to include the ability to locate the closest or best bus stop. Quick and easy access to route maps and real time updates
  - Public meeting map – show all public meetings to include topics and speakers
  - Collaborative map application that allows citizens to collaborate on key issues

GIS Need

Formal GIS Training for Community Engagement Staff

All departments, including Community Engagement, will benefit from formal training in GIS. For the immediate future, it is envisioned that all GIS users in Community Engagement will be Tier 3 – Browser level. As such, only third-party training for the 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.

GIS Gap Analysis

GIS Data Layer Inventory

Community Engagement staff do not currently create any GIS layers, but have the potential to create GIS data layers moving forward such as data from meetings, surveys, etc.. Many of the data layers needed, though, will be created from existing databases and with help from the GIS team in IT. Community Engagement will benefit from access to several GIS data layers. It is expected that once all departmental data is integrated, consolidated, and centrally stored that the staff will have access to all non-classified GIS data layers from other departments. ***A full Master Data Layer list, with existing and recommend layers can be found in Appendix I of this Needs Assessment.***

Legend

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

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

The following table lists those data layers that are important to Community Engagement:

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Community Engagement GIS Data			
Customers and Participants (From CLASS and other databases)	Geocoded from existing databases	Automated	Desired
City Owned Properties	Geocoded from existing databases and on screen	GIS Team in IT	Existing
Parks	Digitize from parcel data and other sources	GIS Team in IT in Coordination with Parks and Recreation	Existing
Sidewalks	Digitize on Screen	Engineering	Existing
Community Gardens and Food Cupboards	Geocoded from existing databases and on screen	Automated	Desired
City and Community Projects	Digitized on screen and from databases	Automated	Desired
Facilities with Amenities	Digitized on Screen	GIS Team in IT	Partial
Demographics	From biennial census	Statistics Canada	Existing
Immigrant and Multi-Cultural Group Events and Opportunities	Digitized on screen and from databases	Automated	Desired
Neighborhood Groups with Contact Information	Geocoded from existing databases	Automated	Desired
Public Meetings	Geocoded from existing databases	Automated	Desired
Community and Social Service Program Locations	Geocoded from existing databases	Automated	Desired
Urban agriculture locations, local food projects,	Geocoded from existing databases and on screen	Automated	Desired

and chicken coups			
Youth facilities, activities, and optimal location analysis	Geocoded from existing databases and on screen	Automated	Desired
Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels, are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using the rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base, as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006, the City acquired rectified digital orthoimagery, which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels, are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.	GIS Team in IT maintains the property data. New property surveys are incorporated as they are received. If staff in other departments sees errors, they have been asked to report them to the GIS Team in IT.	Existing
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing

Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance have occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing
Landmarks	Digitized – have started to develop a commonplace layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhoods	Heads up Digitizing Screen. Subdivisions are available by 61-M plan (Subdivision) layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	GIS Team in IT creates and maintains addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building footprints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by the City to create an updated building layer.	GIS Team in IT	Existing
Contours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; Changes are updated with Orhtophoto refresh	Existing

GAP Analysis Chart

Community Engagement 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.

Legend	
Existing	
Yes	GIS component currently exists within department.

No	GIS component does not currently exist within department.
Limited/Partial	GIS component exists to a lesser degree.
Desired	
Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to departmental needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to departmental need.
Low	Can be met after higher needs are accomplished.

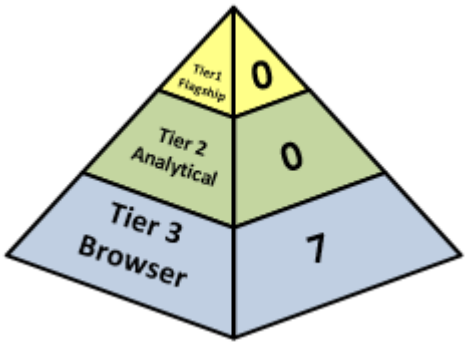
Component	Status		Priority	Notes
	Existing	Desired		
Automated Vehicle Location (AVL)	No	No	Low	Community Engagement has no need for vehicle tracking.
Documentation	Limited	Yes	Medium	Some documentation on GIS data exists. The GIS Team in IT will mandate enterprise GIS documentation processes and procedures.
Enterprise Systems Integration	No	Yes	Medium	Integration with CLASS for customer information is needed.
Geocoding	Yes	Yes	Medium	Geocoding of customer information is needed.
GIS Data Access	Limited	Yes	High	Community Engagement will need access to GIS layers as outlined throughout this document in an easy-to-use data browser.

Component	Status		Priority	Notes
	Existing	Desired		
GIS Data Maintenance	No	No	Low	Community Engagement will be a data consumer. They will not create or maintain any GIS data.
GIS Data Sharing	No	Yes	Medium	Some selected data sets will be shared internally and with the public.
GIS Personnel	No	No	Low	Community Engagement will be a data consumer. As such, they will use easy-to-use GIS data browsers. They will not need any GIS personnel.
Hardware	Yes	Yes	Medium	The current personal computers will suffice for running the GIS data browser.
Mapping	Limited	Yes	High	All mapping should be attainable through the Intranet data browser.
Metadata	No	No	Low	Community Engagement is not overly concerned with the derivation of the GIS data.
Mobile Computing Resources	No	No	Low	Community Engagement does not need to use GIS in the field
Network	Yes	Yes	High	High availability and fast access to GIS data will be important to the success of this initiative.

Component	Status		Priority	Notes
	Existing	Desired		
Routing	No	Yes	Medium	Community Engagement would like to provide routing capabilities on some of the external GIS sites.
Software	Limited	Yes	Medium	Community Engagement will need internal access to data via an easy-to-use intranet application.
Spatial Analysis and Modeling	No	No	Low	Community Engagement will mainly use GIS for data browsing, information retrieval, and quick map production. Any high-level analysis will be done by the GIS Team in IT on an as-needed basis.
Training/Education	No	Yes	Medium	This component is considered a medium priority for use of GIS within Community Engagement. Introductory training is needed at the browser user level for all staff.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Return on Investment (ROI)

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

Return on Investment Opportunity Community Engagement	
Opportunity	**Explanation**
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 save time for citizens and staff.
Incorporate a New Layer of Information that Could Improve the Division's Response to the Social Service and Community Engagement Needs of the Community	• Staff will be able to create maps by census tract or block group that could be helpful in the design and implementation of community engagement programs.

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Corporate Communications

Corporate Communications

Section Outline

Existing Conditions

- Department Overview
- Governance of GIS
- Hardware and Software

GIS Needs Assessment

- GIS Needs

GIS Gap Analysis

- GIS Data Layer Inventory
- GAP Analysis Chart

Multi-Tier GIS Application Use

Return on Investment (ROI)

Existing Conditions

Department Overview

Corporate Communications leads the City's efforts to strengthen citizen and stakeholder engagement and communications. Corporate Communications develop and implement communication and education programs which promote City programs and services. Ensuring accountability, transparency, and engagement by providing strategic communications planning, media relations and issues management leadership to all City departments is an important role for Corporate Communications.

Corporate Communications also manage media relations policies and provide coaching for City spokespeople. Staff are responsible for all City print, broadcasting, web, and social media channels for the purpose of informing and engaging residents, businesses and visitors. Also crucial for the department is researching, developing, proofreading, editing, designing, laying out, producing, and distributing corporate publications, advertisements, and promotional items. The Corporate Communications department strives to ensure that a common theme exists City-wide for all print and digital materials.

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.

Corporate Communications staff do not currently utilize the intranet GIS application, OnPoint. Staff use Google Maps or and Google Earth to view simple maps for their needs. The table below summarizes the current GIS staff usage within the department. Type represents the current level of GIS experience based on job requirements, GIS usage can be categorized as Limited, Moderate, or High (i.e. frequency of use), and Primary Tools describes what tools, or how GIS is used to carry out GIS functions.

Current GIS Staffing				
Type		**Number of Users**	**GIS Usage**	**Primary Tools**
	GIS Flagship (Tier 1)	0	N/A	None
	GIS Analytical (Tier 2)	0	N/A	None
	GIS Browser (Tier 3)	4	Limited	Google Maps and Google Earth

Hardware and Software

Corporate Communications uses personal computers for each of its staff. Staff also have access to two laptops within the department. Printers are available for office use.

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

Microsoft Office is used to conduct office productivity tasks. Staff within Corporate Communications use the Adobe Suite for graphic design and utilize WordPress for website management. Staff will reference online mapping services such as Google Maps and Google Earth on occasion. Staff manages the city's social media presence to include; Facebook, Twitter, Flickr, RSS, LinkedIn, YouTube and other social media outlets. Corporate Communications utilize the following software applications:

1. Microsoft Office– Office Productivity
2. Adobe Suite – Graphic Design
3. WordPress – Website Management
4. Google Maps and Google Earth – Online Mapping Services

Adobe Suite	**Adobe Suite** → The Adobe Suite provides graphic designers with the tools necessary to accomplish creative designs and artwork. Corporate Communications utilize the Adobe Suite for graphic design within the City and to achieve a common look and feel (theme) for all advertisements and media.
WordPress	**WordPress** → WordPress is web software that allows users to create websites or blogs. Corporate Communications utilize WordPress for the City's website. WordPress allows the 20 – 30 web authors within the City to easy make updates to the website through an easy-to-use interface.
 **Google Maps**	**Google Maps and Google Earth** → Google Maps and Google Earth is used by Corporate Communications staff for viewing online maps. This includes streets and aerial photography.

GIS Needs Assessment

GIS Needs

Corporate Communications 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:

GIS Need	*Method/Application to Meet Need*
Mapping and Spatial Analysis of Departmental Data	Intranet GIS Data Browser
Sharing Data with the Public	Internet GIS Application
GIS Based Complaint Tracking	Complaint Tracking Application
Live GIS Maps on Television	Intranet GIS Data Browser
Formal GIS Training for Corporate Communications Staff	Corporate Communications Specific Training

GIS Need

<u>Mapping and Spatial Analysis of Departmental Data</u>

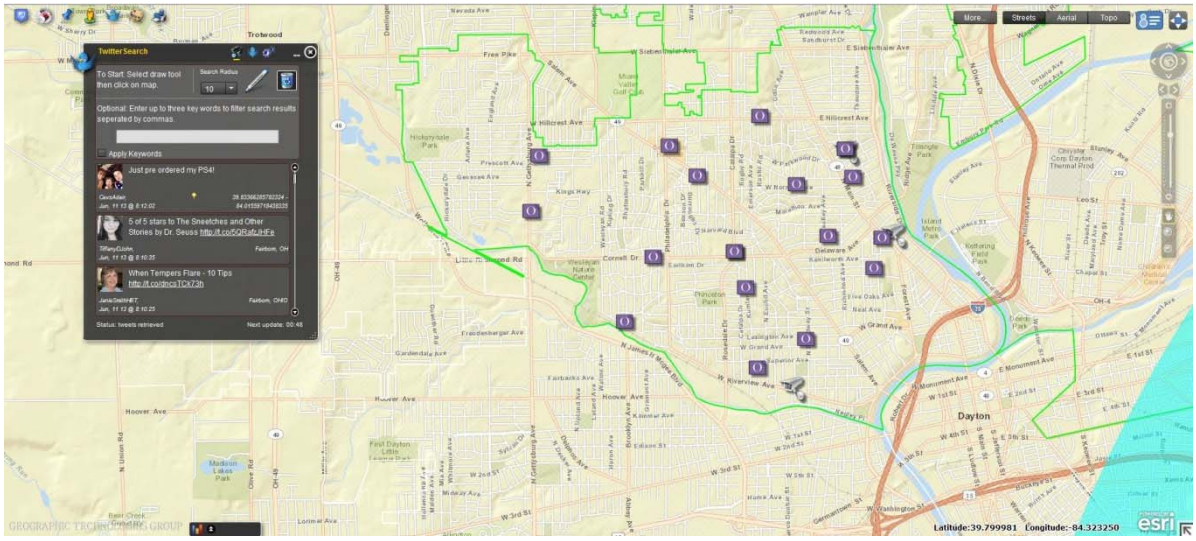
Each department at the City identified a need to have access to pertinent GIS map and tabular data. Corporate Communications should have access to a configuration that includes key data of interest to include trails and trail signs as well as the critical user list from the Water Department. This application will contain a common tool set for all departments, but will have specificity for the needs of Corporate Communications. Staff can leverage the ability to view social media within the Intranet application as well. Tweets from local Twitter users can be viewed to ascertain the perception of the City and/or any issues in the community.

The following data layers and GIS functionality should be incorporated into the portal for Corporate Communications:

- Twitter Feeds on Map (10,000 followers currently)

- Critical User List from Water Department
- Mailing Label Buffer – Ability to buffer a certain area by a defined distance and select all citizens within that area to generate mailing labels for communications.
- Bike Lanes
- Trails and Trail Signs with QR Codes
- School Crossing Guard Locations

Also important for Corporate Communications is the need for map standards. Maps should have a common theme and look and feel. This standard should be agreed upon early in the adoption phase to ensure consistency throughout. Vector images are preferred by the graphic designer to allow for ease of use within the Adobe Suite when creating various media for the City.



Corporate Communications Intranet Portal Viewing Live Tweets

GIS Need

Sharing Data with the Public

Sharing data with the public has been a common theme for many of the departments at the City. Corporate Communications will have an important role in this effort. Corporate Communications will need to assist in ensuring consistency in presentation and that these portals adhere to the overall public information dissemination policies of the City. These GIS portals will most likely have interfaces for personal computers, tablets, and smart phones. Additionally, Corporate Communications staff would benefit by linking GIS to the City calendar

so that locations of events can be readily mapped via the calendar. Additionally, a map portal showing all events on a map by time selected could prove to be beneficial.

GIS Need

GIS-Based Complaint Tracking

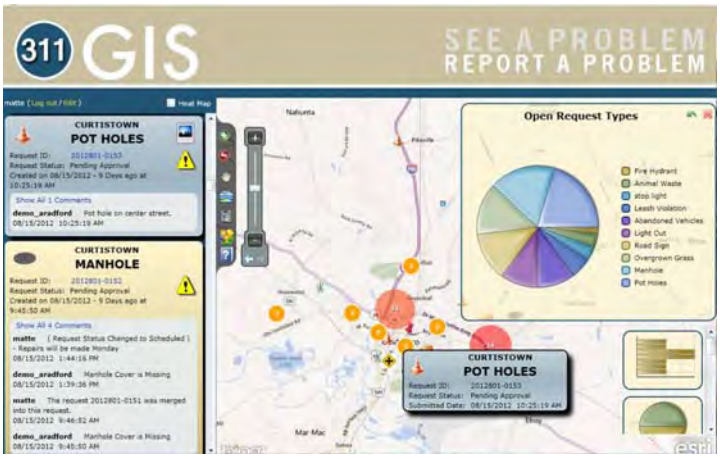
Corporate Communications often receives concerns/complaints from citizens. Many City departments including Corporate Communications would benefit from a web-based GIS application designed for tracking citizen inquiries, complaints, concerns, and other general feedback. Such an application would enhance communication with the public, and allow the City to quickly and effectively respond to requests. From the citizen's perspective, one call to any municipal staff member should result in an inquiry or complaint being logged into the system, routed to the correct department or point of contact, action taken by municipal employees, and follow up to the initial inquiry in an effective and timely manner. Inquiries or complaints should also be logged and tracked via the Internet, mobile device, or in person.

By implementing such an application, the public no longer has to be transferred from one department to another on the phone or in person. Routing of inquiries and complaints would be done internally through email notification, and is therefore transparent to the citizen. City staff can then proactively track, manage, analyze, map and report inquiries and complaints, actions taken, final results, and citizen satisfaction.

Of importance to Corporate Communications is the ability to view road closures, construction areas, snow removal routes, transit routes, waste pickup areas and schedule, water emergencies, floods, spills, and power outages.

A complaint tracking system should include:

- Web/Phone-in/Walk-In Submittal of Inquiries
- Multiple Search (Query) Capabilities
- Internal Email Server
- Levels of End-User Security
- Assignment of Employees/Departments to Specific Inquiry Types
- Ability to Sub-classify Inquiry Types for Internal Department Use/Reporting



Complaint Tracking Application – User Interface

- Automated Email Notification of New Inquiry to Designated Employee and Response to Person Submitting
- Logging of Actions Taken Toward a Solution
- Map and Summary Report Generation

GIS Need

Live GIS Maps on Television

The citizens of Guelph are very tech savvy. Citizens can glean a lot of useful information from high quality map graphics. Technology is available that would allow the City to embed presentation quality maps within the City's television productions. Various products exist to meet this need. One such software is Viz Curious Maps. Viz Curious Maps is the broadcast industry's de facto standard for the creation of branded maps and geographic animations. By extending Viz Curious Maps to a server edition, it can provide real-time branded map imagery embedded within Vizrt's control applications to several clients. Templates created within Viz Curious Maps can be dynamically accessed through the Viz Trio Character Generator and Viz Content Pilot, as well as Viz Weather, Viz Traffic, and Viz Artist. Users can seamlessly create branded and animated maps, add them to graphic templates, or insert them directly into a 3D scene.

Sample Graphic Created with Viz Curious Maps

GIS Need

Formal GIS Training for Corporate Communications Staff

All departments, including Corporate Communications, will benefit from formal training in GIS. For the immediate future, it is envisioned that all GIS users in Corporate Communications will be Tier 3 – Browser level. As such, only third-party training for the 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.

GIS Gap Analysis

GIS Data Layer Inventory

Corporate Communications staff does not and will not create any GIS layers. Corporate Communications 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. ***A full Master Data Layer list, with existing and recommend layers can be found in Appendix I of this Needs Assessment.***

Legend

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

The following table lists those data layers that are important to Corporate Communications:

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended ?*
Corporate Communications GIS Data			
Road Closures	Extracted from database and geocoded	Public Works	Recommended
Projects	Digitized on Screen	Varies	Recommended
Snow Removal Routes	Extracted from database and geocoded	Public Works	Existing
City Tree Removal Activities	Digitized on screen	Public Works	Recommended
Detour Routes	Extracted from database and geocoded	Public Works	Recommended
Guelph Transit Detours	Extracted from database and geocoded	Public Works	Recommended
Parking	Digitized on screen	GIS Team in IT	Existing
Waste Pickup Routes	Digitized on screen	Environmental Services	Existing
Water Emergency Areas	Digitized on screen	Engineering	Recommended
Flood Zones	Province of Ontario	GIS Team in IT	Existing
Spills	Extracted from database and geocoded	Automated	Recommended
Power Outages	Extracted from database and geocoded	Automated	Recommended
Twitter Feed	Extracted from database and geocoded	Automated	Recommended
Critical User List	Extracted from database and geocoded	Water	Recommended
Bike Lanes	Digitized on Screen	Engineering	Existing
Trails	Field data collection	GIS Team in IT in Coordination with Parks and Recreation	Recommended
Trail Signs	Field data collection	GIS Team in IT in Coordination with Parks and Recreation	Recommended
School Guard Crossing Locations	Digitized on screen	GIS Team in IT	Recommended

Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006 the City acquired rectified digital orthoimagery which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.	The GIS Team in IT maintain the property data. New property surveys are incorporated as they are received. If staff in other departments see errors they have been asked to report them to the GIS Team in IT.	Existing
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance has occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing

Landmarks	Digitized – have started to develop a common place layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhoods	Heads up Digitizing Screen. Subdivision are available by 61-M plan (Subdivision)layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	GIS Team in IT create and maintain addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building foot prints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by he City to create an updated building layer.	GIS Team in IT	Existing
Contours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; changes are updated with Orhtophoto refresh	Existing

GAP Analysis Chart

Corporate Communications 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.

Legend	
Existing	
Yes	GIS component currently exists within department.
No	GIS component does not currently exist within department.
Limited/Partial	GIS component exists to a lesser degree.
Desired	

Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to departmental needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to departmental need.
Low	Can be met after higher needs are accomplished.

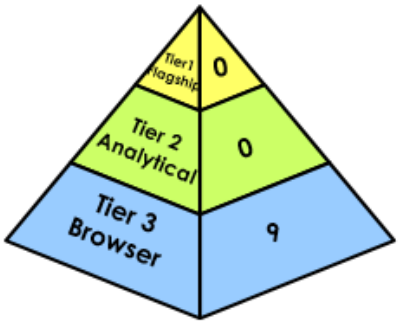
Component	Status		Priority	Notes
	Existing	Desired		
Automated Vehicle Location (AVL)	No	No	Low	AVL can be used to track official vehicles; Using AVL conjunction with routing increases efficiency and can reduce fuel consumption, thereby decreasing costs. Business Services does not currently have a need for AVL
Documentation	No	Yes	Medium	Some documentation on GIS data creation and workflow exists however there is a greater need for creation and standardization for documentation citywide.
Enterprise Systems Integration	Limited	Yes	Low	There is not a great need for data integration within Corporate Communications. Many data layers will come from other departmental databases.
Geocoding	Limited	Yes	Low	There is not a great need for geocoding within Corporate Communications. Many data layers will come from other departmental databases.
GIS Data Access	Limited	Yes	High	Corporate Communications will need access to GIS layers as outlined throughout this document in an easy-to-use data browser.

Component	Status		Priority	Notes
	Existing	Desired		
GIS Data Maintenance	No	No	Low	Corporate Communications will be a data consumer. They will not create or maintain any GIS data.
GIS Data Sharing	No	Yes	High	Some selected data sets will be shared internally. Additionally, some data will be shared publically such as complaints.
GIS Personnel	No	No	Low	Corporate Communications will be a data consumer. As such, they will use easy-to-use GIS data browsers. They will not need any GIS personnel.
Hardware	Yes	Yes	High	The current personal computers will suffice for running the GIS data browser.
Mapping	Yes	Yes	High	All mapping should be attainable through the Intranet data browser and the mobile data browser.
Metadata	No	Yes	Medium	Corporate Communications needs to know the derivation of the data, its currency, and completeness.
Mobile Computing Resources	No	No	Low	Corporate Communications does not need access to GIS while in the field at this time.
Network	Yes	Yes	High	High availability and fast access to GIS data will be important to the success of this initiative.

Component	Status		Priority	Notes
	Existing	Desired		
Routing	No	No	Low	Optimal Route Planning is not a priority for Corporate Communications at this time.
Software	Yes	Yes	High	Corporate Communications will need expanded use of an improved Intranet GIS data browser. Additionally, a public facing application should be deployed along with a citizen complaint system that is GIS based.
Spatial Analysis and Modeling	No	Yes	High	Corporate Communications needs to perform spatial analysis. Such as, select all citizens within an area and generate mailing labels for city communications.
Training/Education	No	Yes	Medium	This component is considered a medium priority for use of GIS within Corporate Communications. Introductory training is needed at the browser user level for all staff.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Return on Investment (ROI)

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

Return on Investment Opportunity Corporate Communications	
Opportunity	**Explanation**
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 save time for citizens and staff.
Encourage Citizen Engagement with Transparent Governance	The various public portals will provide citizens with important data utilizing a method that is intuitive. Mapping interfaces will allow citizens to be more aware and engaged in their community.

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Culture and Tourism

Culture and Tourism

Section Outline

Existing Conditions

- Department Overview
- Governance of GIS
- Hardware and Software

GIS Needs Assessment

- GIS Needs

GIS Gap Analysis

- GIS Data Layer Inventory
- GAP Analysis Chart

Multi-Tier GIS Application Use

Return on Investment (ROI)

Existing Conditions

Department Overview

The City of Guelph Culture and Tourism Department develops and delivers creative, compelling, and innovative programs in an effort to improve the quality of life and community well being. Staff coordinates programming, marketing, fundraising, and other activities to support events, exhibitions, and performances. Culture and Tourism has the following functional areas and associated functions:

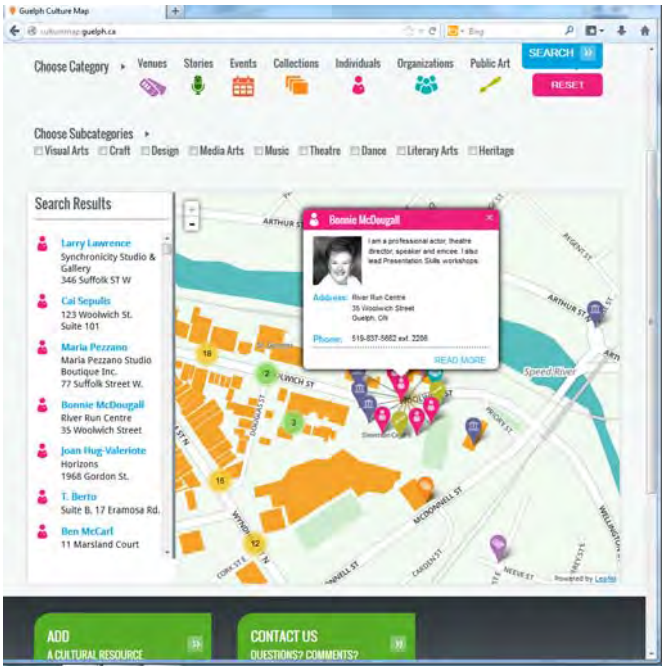
- **Cultural Development**
  - Manage volunteer services at Guelph's culture and heritage facilities
  - Coordinate and promote arts and culture programs, including Public Art
  - Coordinate and maintain the Guelph Culture Map
  - Liaise with and provide support for community art and cultural organizations
- **Guelph Museums, River Run Centre, and Sleeman Centre**
  - Manage operations of the Guelph Civic Museum and John McCrae House
  - Manage and promote events at River Run Centre's 785 seat theatre, 225 seat theatre and multi-purpose reception space
  - Manage all operations of the 4,500 seat Sleeman

Centre Arena

- **Tourism Services** – Manage and operate the Tourism Information Centre in City Hall
- Promote Guelph attractions, facilities, events and businesses

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.



Culture and Tourism is primarily a service agency and as such does not have a large need for GIS functionality. However, staff has deployed a very innovative GIS application, Guelph Culture Map. Guelph Culture Map allows registered users to submit cultural resource information for inclusion on the interactive map. Culture and Tourism staff acts as a gatekeeper of submitted data to ensure its applicability and appropriateness. The table below summarizes the current GIS staff usage within the department. Type represents the current level of GIS experience based on job requirements, GIS usage can be categorized as Limited, Moderate, or High (i.e. frequency of use), and Primary Tools describes what tools, or how GIS is used to carry out GIS functions.

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

Hardware and Software

Culture and Tourism uses personal computers for each of its staff. No GPS units are utilized by Culture and Tourism. Printers and scanners are available for office use.

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

Microsoft Office is used to conduct office productivity tasks. Culture and Tourism utilize the following software applications:

1. Microsoft Office– Office productivity
2. Guelph Culture Map – staff administers this cultural resource crowdsourcing application
3. CLASS – customer and inventory tracking (Museum & Tourism Customers)
4. TixHub – Box Office ticketing system and customer tracking (River Run Customers)
5. Adobe InDesign – graphic design

GIS Needs Assessment

GIS Needs

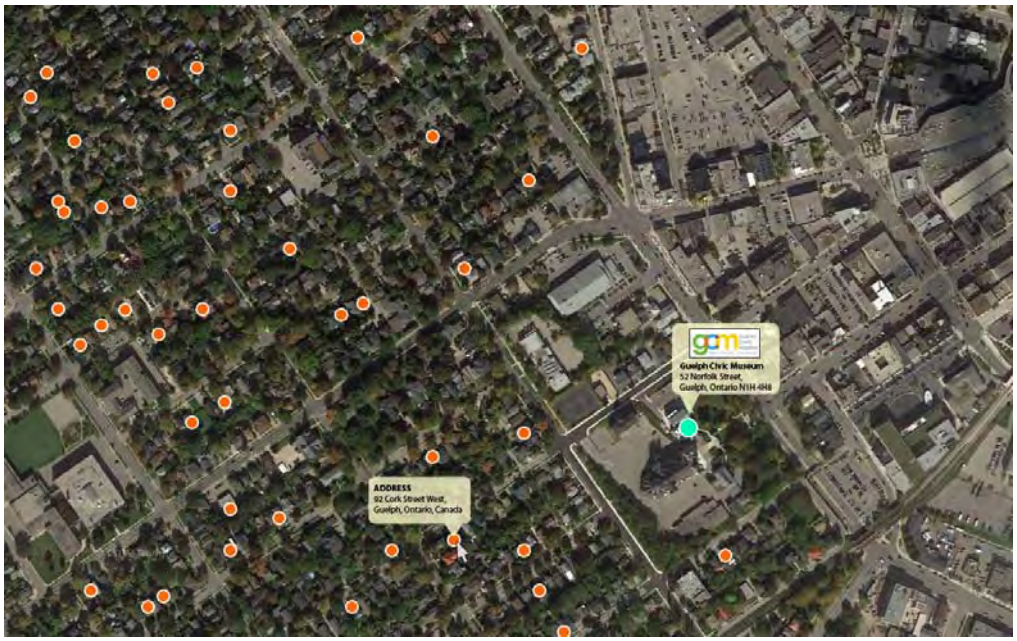
Culture and Tourism can take advantage of GIS in support of various departmental functions. The following are the needs identified during needs assessment interviews. Where applicable, each need listed below will be followed by an application or method to meet that need, some applications/methods will 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:

GIS Need	*Method/Application to Meet Need*
Mapping and Spatial Analysis of Culture and Tourism Data	Intranet GIS Data Browser
Formal GIS Training for Culture and Tourism Staff	Culture and Tourism Specific Training

GIS Need

Mapping and Spatial Analysis of Culture and Tourism Data

The Culture and Tourism Department does not use the city GIS. However, the department has implemented a very user-friendly GIS application, Guelph Culture Map, for identifying cultural resources. This crowdsourcing application allows citizens to input data to contribute to this community map. Culture and Tourism has GIS data sets that they would like to have access to internally. The department would need this data made available through an easy-to-use intranet application.



The Culture and Tourism Department has expressed the desire to have access to demographic data so that they can ascertain target areas for their services. Demographics in conjunction with customer mapping (theater and museum) would allow staff to understand where their customers reside and where pockets of potential customers may exist. Customer data could be mined from the CLASS system and geocoded. Additionally, a layer of all of the cultural/tourism facilities would allow staff to understand the juxtaposition of facilities in relation to customers. Any data record with an address or property number can be spatially enabled – or geocoded – by linking the appropriate fields to the appropriate GIS layer – street centerline, tax parcel, or address point. 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 customers that have visited the museum in the month of December and who live within walking distance.

GIS Need

Formal GIS Training for Culture and Tourism Staff

All departments, including Culture and Tourism, will benefit from formal training in GIS. For the immediate future, it is envisioned that all GIS users in Culture and Tourism will be Tier 3 – Browser level. As such, only third-party training for the 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.

GIS Gap Analysis

GIS Data Layer Inventory

Culture and Tourism staff do not and will not create any GIS layers. Culture and Tourism 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. ***A full Master Data Layer list, with existing and recommend layers can be found in Appendix I of this Needs Assessment.***

Legend

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

The following table lists those data layers that are important to Culture and Tourism:

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Culture and Tourism GIS Data			
Customers (Museum and Theatre)	Geocoded from existing databases	Automated	Recommended
Cultural Resources	Gathered via Guelph Culture Map	Automated	Existing
Facilities	Digitized on Screen	GIS Team in IT	Existing
Demographics	From biennial census	Statistics Canada	Existing
Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006 the City acquired rectified digital orthoimagery, which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.	GIS Team in IT maintains the property data. New property surveys are incorporated as they are received. If staff in other departments sees errors they have been asked to report them to the GIS Team in IT.	Existing

Citywide Base Data			
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance has occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing
Landmarks	Digitized – have started to develop a commonplace layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhoods	Heads up Digitizing Screen. Subdivisions is available by 61-M plan (Subdivision) layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	GIS Team in IT creates and maintains addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building footprints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by the City to create an updated building layer.	GIS Team in IT	Existing
Contours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; Changes are updated with Orhtophoto refresh	Existing

GAP Analysis Chart

Culture and Tourism 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.

Legend	
Existing	
Yes	GIS component currently exists within department.
No	GIS component does not currently exist within department.
Limited/Partial	GIS component exists to a lesser degree.
Desired	
Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to departmental needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to departmental need.
Low	Can be met after higher needs are accomplished.

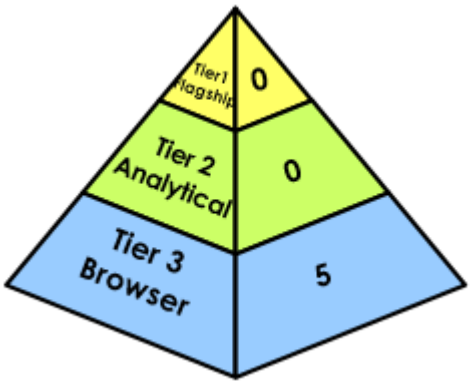
Component	Status		Priority	Notes
	Existing	Desired		
Automated Vehicle Location (AVL)	No	No	Low	Culture and Tourism has no need for vehicle tracking.
Documentation	Limited	Yes	Medium	Some documentation on GIS data exists. The GIS Team in IT will mandate enterprise GIS documentation processes and procedures.

Component	Status		Priority	Notes
	Existing	Desired		
Enterprise Systems Integration	No	Yes	Medium	Integration with CLASS for customer information is needed.
Geocoding	Yes	Yes	Medium	Geocoding of customer information is needed.
GIS Data Access	Limited	Yes	Medium	Culture and Tourism will need access to GIS layers as outlined throughout this document in an easy-to-use data browser. The Department will not be a heavy user of GIS data.
GIS Data Maintenance	No	No	Low	Culture and Tourism will be a data consumer. They will not create or maintain any GIS data.
GIS Data Sharing	No	Yes	Medium	Some selected data sets will be shared internally.
GIS Personnel	No	No	Low	Culture and Tourism will be a data consumer. As such, they will use easy-to-use GIS data browsers. They will not need any GIS personnel.
Hardware	Yes	Yes	Low	The current personal computers will suffice for running the GIS data browser.
Mapping	Limited	Yes	High	All mapping should be attainable through the Intranet data browser.
Metadata	No	No	Low	Culture and Tourism is not overly concerned with the derivation of the GIS data.

Component	Status		Priority	Notes
	Existing	Desired		
Mobile Computing Resources	No	No	Low	Culture and Tourism does not need to use GIS in the field
Network	Yes	Yes	High	High availability and fast access to GIS data will be important to the success of this initiative.
Routing	No	No	Low	Culture and Tourism does not need routing capabilities
Software	Limited	Yes	Medium	Culture and Tourism has deployed a Culture Map application. They will need internal access to more data via an easy-to-use intranet application.
Spatial Analysis and Modeling	No	No	Low	Culture and Tourism will mainly use GIS for data browsing, information retrieval, and quick map production. Any high-level analysis will be done by the GIS Team in IT on an as-needed basis.
Training/Education	No	Yes	Medium	This component is considered a medium priority for use of GIS within Culture and Tourism. Introductory training is needed at the browser user level for all staff.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Return on Investment (ROI)

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

Return on Investment Opportunity Culture and Tourism	
Opportunity	**Explanation**
Improve <u>Customer Service and Customer Relations</u> **<u>Promote</u> the City of Guelph**	• The Guelph Culture Map is a great example of a user-friendly GIS application that enhances the community and the customer experience. The application promotes the City of Guelph and is advantageous in promoting Guelph and improving livability.

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Downtown Renewal

Downtown Renewal

Section Outline

Existing Conditions

- Department Overview
- Governance of GIS
- Hardware and Software

GIS Needs Assessment

- GIS Needs

GIS Gap Analysis

- GIS Data Layer Inventory
- GAP Analysis Chart

Multi-Tier GIS Application Use

Departmental Return on Investment (ROI)

Existing Conditions

Department Overview

As outlined on the City of Guelph's website, Downtown Renewal is part of Finance and Enterprise Services. As such, Downtown Renewal coordinates with other business units (particularly Planning, Engineering, Operations, and Transit) and community partners to develop policies and programs to attract business investment. Downtown Renewal is specifically concerned with implementing key objectives of Prosperity 20/20. Downtown Renewal offers the following services to Guelph's community:

- Attracting new investment to the downtown core.
- Collaborating across City departments and community partners to ensure objective and actions align with the City's economic development strategy.
- Supporting strategic planning activities.
- Developing incentive programs for redevelopment.
- Procuring and distributing grant funds
- Developing key performance measures

Downtown Renewal endeavors to strengthen residential and employment development in downtown Guelph. These services are provided by two staff members within Downtown Renewal.

Governance of GIS

Downtown Renewal is not currently a substantial GIS user. Staff utilizes the OnPoint GIS application to acquire information and perform simple visualization functions. Downtown Renewal relies on the Planning Services Department to provide their mapping needs.

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

Current GIS Staffing				
Type		**Number of Users**	**GIS Usage**	**Primary Tools**
	GIS Flagship (Tier 1)	0	N/A	N/A
	GIS Analytical (Tier 2)	0	N/A	N/A
	GIS Browser (Tier 3)	2	Medium	Used for viewing data stored in OnPoint

Hardware and Software

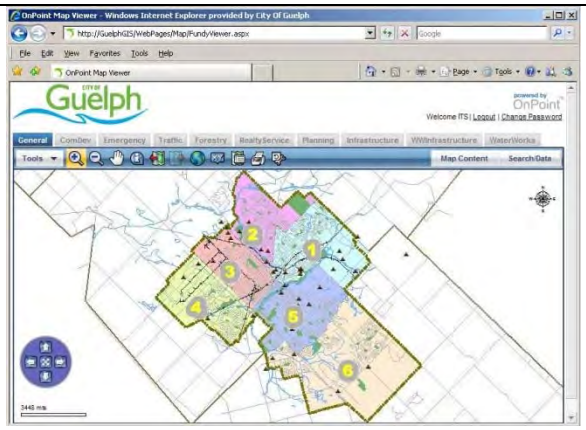
Any hardware issues that were discussed during this Needs Assessment are summarized in the table below. Enterprise wide issues will be discussed in greater detail throughout later chapters of this Needs Assessment and GIS Strategic Implementation Plan.

Hardware Issues Summary	
Type	**Notes**
Personal Computers	Each staff person has a PC
Laptops/Tablets	One laptop shared between staff
Printers	Ample printers available for use
GPS	None
Plotter	None
PDA/MDTs	None
Scanners	Available as needed

Downtown Renewal utilizes the following software applications:

1. MS Office Suite
2. AMANDA – Planning, permitting, licensing
3. Rolta OnPoint – Internal Web-based GIS application

The following describes some of the key software tools utilized by Downtown Renewal.



Rolta OnPoint

Rolta OnPoint → OnPoint is an easy to use intranet GIS data browser that allows users to view data in an intuitive fashion. This is currently the primary GIS tool used by Downtown Renewal.

CSDC AMANDA

CSDC AMANDA → Planning, permitting, licensing
AMANDA provides information related to property, buildings, code enforcement and licensing. A GIS link exist allowing for information to be obtained from a map.

GIS Needs Assessment

GIS Needs

Downtown Renewal should expand their GIS capabilities in order to enhance productivity and functionality of their planning and policy functions. By incorporating advanced GIS methods, the ability to track, analyze and evaluate data will be enhanced and assist staff in strategic planning and policy formation.

Downtown Renewal can quickly enhance their usage of GIS with a few important additions to data layers and applications. Also, GIS will assist in sharing information and data with both internal and external stakeholders (e.g. Business Improvement Areas). The ability to geo-enable databases and spreadsheet of community improvements, retail space, restaurants, taverns, etc. will greatly improve analysis. In addition, acquiring some mobile hardware (tablets), establishing field data collection procedures and performing training is important to the success of Downtown Renewal's GIS efforts. Revitalization and Economic Development agencies throughout the country have implemented GIS in varying capacities, and Downtown Renewal is well positioned to implement GIS more comprehensively and effectively. Access to information should be provided by several user-friendly applications which will be discussed in detail following each need, if appropriate.

Keys to a comprehensive GIS effort will involve implementation of mapping and spatial analysis applications specific for Downtown Renewal. In addition, an increase in educational opportunities, better use of GPS for data acquisition and entry, as well as dynamic, real-time data editing and maintenance will greatly improve their business operations. The use of GIS will contribute to automate procedures such as inspections and reporting within Downtown Renewal.

Key areas of concern for the Downtown Renewal staff members were:

1. Creation of key data layers (e.g. Agreements, Retail, Pedestrian Patterns)
2. Mobile solutions for inspections
3. Ability to visualize data in various forms (maps, charts, etc.)
4. Improve accuracy and implement procedures for GIS/GPS field data collection
5. Data sharing between various departments and external agencies
6. Acquire GIS and data collection training

Based on this Needs Assessment, Downtown Renewal has several 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:

GIS Need	***Method/Application to Meet Need***
☑ Mapping and Spatial Analysis	• ArcGIS for Desktop • Intranet GIS Application • Esri's Community Analyst (Canadian Subscription)
☑ GIS Data Layer Creation	• ArcGIS for Desktop
☑ Field/Mobile Access to Geospatial Data	• Mobile Laptops/Tablets • Mobile GIS Data Browser

☑ GIS Data Access and Sharing	• Desktop GIS • Intranet GIS Application • Internet GIS Data Portal
☑ Public Access Parking Portal	• Internet Application
☑ Pedestrian Traffic Mapping	• Pedestrian Traffic Study • Intranet GIS Application
☑ Formal Training for Staff	• Introduction to ArcGIS I – Tier 2 staff • Introduction to ArcGIS II – Tier 2 staff • Develop GIS/GPS collection Standard Operating Procedures (SOPs)

☑ GIS Need

Mapping and Spatial Analysis

One of the significant benefits that Downtown Renewal will realize from an enhanced implementation of GIS and complementary technologies is increased and improved access to information. Downtown Renewal 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 residential and commercial information in a geographic context; grant applications and materials will include maps and quantitative information from spatial analyses that will give emphasis to areas of concern. Additional training and software tools will be needed to accomplish all of the identified analytical needs of the department.

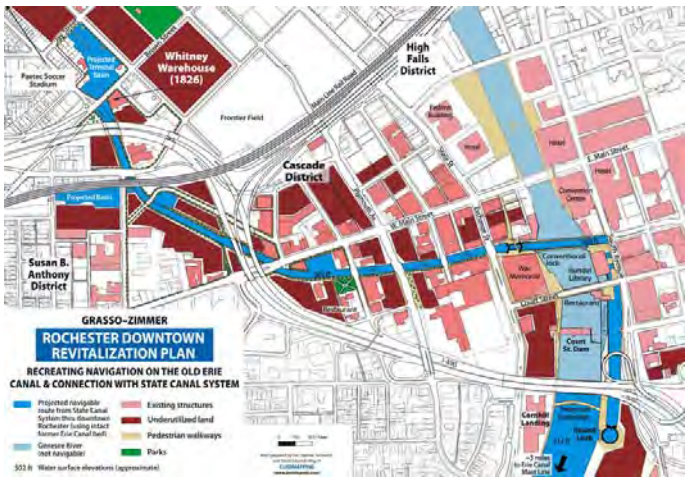
Downtown Renewal will be able to utilize GIS in several tasks, including:

- Viewing and analyzing city demographic information
- Proposed real estate project location analysis
- Identifying vacant and underutilized land/structures
- Environmental Assessment (EA)
- Cost Benefit Analysis (CBA) for projects, programs
- Focus area identification and evaluation (i.e. Assessment Growth Projections
- General land use and infrastructure mapping and analysis
- Citizen education and advocacy
- Statistical analysis for budgetary preparations
- Review land use and permitting
- Reviewing active construction sites
- Evaluating all available properties for economic development purposes

Downtown Renewal will be able to derive valuable spatially-driven information on key issues. To properly perform these analyses, data related to demographics, real estate sales, available land, infrastructure, and

construction needs to be accessible. Some of the information that Downtown Renewal will be able to visualize and analyze via a GIS interface includes:

- Long Range Planning: noise zones, housing analysis, growth scenarios, change detection, biological inventory, land use analysis, growth scenarios analysis, etc.
- Housing Element: Vacant and Underutilized Land Survey.
- Zoning: Determine how zoning impacts housing and property values.
- Environmental Assessment: conduct cost/benefit analysis in review of mitigation monitoring, condition compliance, environmental sensitive areas, national wetlands inventory, air quality, biological concerns, noise issues, and traffic (pedestrian and vehicle).



- Code Enforcement: Find any type of units that qualify for other programs (e.g., house that has numerous infractions, violations, or deemed unsafe). Use information along with census socio-economic data to target areas for rehabilitation programs.
- Parcel by Parcel Analysis: Track owners, age and configuration of parcel. Currently data is limited to MPAC data.
- Citizen complaint system and responses
- Automated welcome package emailed to new residents in downtown.
- Map zoning map amendment, variance and subdivision cases
- More easily develop a “case history” at each address
- Use GIS to link to important documentation such as staff reports, site plans, decision orders and ordinances
- Determine list of affected property owners for public notice mailings
- Develop a publically available portal to distribute zoning information searchable by address or dynamic map selection

The following GIS application should be considered to meet some of the above needs.

A quick and easy method to obtain current demographic, census, health, crime, and business data is through the purchase of a subscription to Esri’s Community Analyst. Using Community Analyst (a cloud based tool), Downtown Renewal can make better informed decisions about projects

and issues affecting their community. Downtown Renewal will be able to discover patterns, relationships, and trends of the Guelph Downtown through maps, reports, and charts.

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

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

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

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

GIS Need

GIS Data Layer Creation

In order to achieve the desired analysis documented above, Downtown Renewal will require data creation and development. The office will rely on external data sources (e.g. demographic analysis) and base map layers to develop maps and conduct analysis. Successful revitalization strategies will depend upon access to a broad range of demographic and geographic information.

GIS will allow staff, developers, residents, and other interested parties to access information about available properties, project areas, parking, demographic data, and business lists within The City of Guelph. The consolidation of disparate datasets requires careful database design and development to ensure that the data layers developed from these data sources are accurate.

For Downtown Renewal to conduct spatial analysis, develop site specific maps, and support economic development initiatives, data and data management will be critical. The type of data that will need to be acquired from internal sources and external vendors includes:

- Business Data—that can be used to identify customers or market size including data by industry, sales volume, and employees
- Household Consumer Data — household attributes including age, gender, income
- Real Estate Data – that is updated daily of available properties that can be easily geocoded (e.g. address point)
- Transportation Data – Bus Routes, Parking, Roads, Rail, Transit
- Infrastructure Data – Age, Size, Material, etc.
- Aerial and other types of spatial photography
- Census Data –tract and block group level
- Property Data
- Crime Data
- Nuisance Abatement Cases
- Graffiti
- Environmental Data
- Cultural Affairs Data

In addition, Downtown Renewal staff desire to have several of their spreadsheets and databases geo-enabled along with layers created defining agreement areas, project areas, Prosperity 20/20 planning areas, retail assessments, greenfields, brownfields, etc. A full list of desired layers can be found in the Gap Analysis section further below. Once these data sets become available, it is important that users have a quick and easy way to access and analyze the data. Downtown Renewal staff should have access to this data both through an intranet GIS portal (OnPoint or similar) and ArcGIS for Desktop.

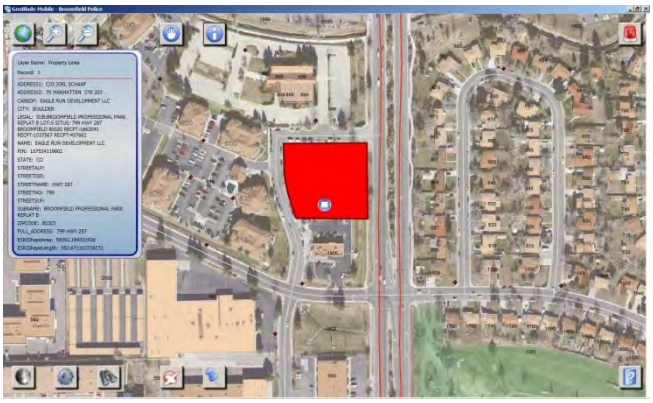
GIS Need

Field/Mobile Access to Geospatial Data

Downtown Renewal stated the desire to utilize GIS in the field and have mobile access for meetings. An annual retail visual inspection could benefit greatly from a mobile application to streamline data updates. Also, staff needs access to geographic data while participating in meetings to better communicate strategies and plans. Accordingly, providing personnel with access to maps and GIS data while working in the field is an important part of maintaining an enterprise GIS. Through the use of hardware, software and data that are designed to be interrogated and manipulated away from the office, Downtown Renewal staff can realize benefits of GIS while in the field and away from the office. Integrating with mobile computers, input devices, software and GIS data into the GIS enterprise will give Downtown Renewal tools to perform field data collection, site visits, and interactive geographic data query and analysis.

A GIS mobile data browser can be loaded on mobile computers, allowing the same capabilities offered by map books, coupled with the ability to conduct query searches on attributes of all information, such as address, ole property, zoning, and much more.

Downtown Renewal staff performing visits to sites needs immediate access to the various database systems to retrieve records and documents, history, or any other pertinent data related to the division's activities. Access to geospatial data from the field will enable 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.



GIS Need

GIS Data Access and Sharing

Much of the GIS data needed by Downtown Renewal is maintained by other City departments or is purchased and a part of the enterprise GIS database (e.g. Census, Utilities, Crime, Parking, Aerials, etc.). Downtown Renewal staff requires access to this data via ArcGIS for Desktop and an intranet GIS web browser. Some analysis can more easily be performed using ArcGIS for Desktop and will provide staff with more flexibility in creating maps and reports. Browser based GIS can then be used as the day to day tool to perform simple queries and visualization tasks.

Financial Incentive Districts

Any data that Downtown Renewal maintains should also be included in the enterprise GIS database. This will allow other departments to benefit from their efforts. In addition, outside agencies like the Business Improvement Area (BIA) need to share data with Downtown Renewal. This can be accomplished in a number of ways. Perhaps the easiest, yet secure method is to create authentication required web services accessible through an internet web server. The Guelph can provide BIA with authentication information that will allow BIA to consume the data. Alternatively, Guelph could simply develop and publish a web application available to the public specific to Downtown Renewal.

Providing public access to GIS maps through publicly-accessed Internet and kiosks mediums will help provide information to the City of Guelph citizens and partners. Through an Internet GIS Data Browser, Downtown Renewal and other departmental data can be provided to the public through an intuitive and easy to use interface. In addition to providing public access to existing data, divisions such as Downtown Renewal 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 properties available. Lastly, citizens, businesses and developers could determine where development and/or major projects will occur for planning and participation.

Sales Tax Regions

GIS Need

Public Access Parking Portal

Visitors and residents alike would benefit from access to data about parking lots, meters, availability, encroachments, and other key parking data. This should be accomplished through the use of intuitive applications that are designed for personal computers, tablets, and phones. The application should suggest possible parking options and provide estimated pricing.

GIS Need

Pedestrian Traffic Mapping

Downtown Renewal staff expressed an interest in performing a Pedestrian Traffic study similar to that of Waterloo University. The development and analysis of pedestrian traffic for downtown Guelph would result in several benefits. Those benefits include:

- Ability to make informed decisions regarding proposed buildings or street redesigns
- Provide information related to determining best location for parks, facilities, bus stops, services, etc.
- Communicate impact of proposals on downtown pedestrians
- Assist in making recommendations related to cross walks and other strategies to keep pedestrians safe

- Provide information for businesses to use for marketing, location options, etc.

Based on the Waterloo study, The City of Guelph could perform a similar study using volunteers who visit downtown often. The study would require the development of a custom mobile application that could run on an iOS or Android device. The application would need to run silently on the volunteer's device and record their GPS location while downtown. This data could then be mapped and analyzed to determine pedestrian traffic flows and routes. Once this data is created, it can be visualized and analyzed using GIS tools.

GIS Need

Formal GIS Training for Staff

Staff that will be performing more advanced GIS analysis and mapping should participate in foundational GIS skills training. Downtown Renewal staff should participate in any enterprise-wide ArcGIS training that is made available. Through the use of ESRI certified instructors, the City can provide GIS instruction and training facilities for its user community by providing onsite training.

As Tier 3 – Browser GIS user intranet, desktop or Internet applications are deployed, Downtown Renewal will require specific training tailored to the GIS interface that may support their workflows. Training is typically arranged by the user level and based on applications that will be deployed throughout the enterprise.

GIS Gap Analysis

GIS Data Layer Inventory

Downtown Renewal 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 Downtown Renewal:

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/ Department	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.

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Downtown Renewal GIS Data			
Parking Lots	Digitized on screen using aerial photography	Outsourced and then maintained by Public Works	Existing
Parking spaces	Digitized on screen using aerial photography	Outsourced and then maintained by Public Works	Existing
Traffic and Parking Signs	GPS collection in the field	Outsourced and then maintained by Public Works	Desired
Street Light and Traffic Signals	Fiber optics CAD layer conversion	Public Works Department	Existing
Real Estate Data	Subscription service or partnership	GIS Team in IT	Recommended
Vacant Land/Structures	Geocoded from source documents	Building Services/Public Works	Desired
Permitting	Extracted from corporate database	Building Services	Desired
Active Construction	Geocoded from source documents	GIS Team in IT	Desired

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Graffiti	Geocoded from corporate databases and sources	Building Services	Desired
Nuisance Abatement	Geocoded from corporate databases	Building Services	Desired
Permits	Geocoded from corporate databases	Various	Desired
Business List/Data	Geocoded from corporate databases	Business Services	Desired
Retail Assessment	Extracted from spreadsheets	Downtown Renewal	Desired
Household Consumer Data	Purchased (Community Analyst)	GIS Team in IT	Recommended
Crime Data	Extract, cleanse, and automatically map from Police database	Automated from Police Department	Desired
Agreement Areas	Digitized on screen from source documents	Downtown Renewal	Desired
Project Areas	Geocoded from corporate databases and sources	Various	Desired
Prosperity 20/20 Planning Areas	Digitized on screen from source documents	Downtown Renewal/Economic Development	Desired
Census Data	Download from Census Bureau	GIS Team in IT	Existing
Bike Routes	Digitized on screen using aerial photography	Public Works	Existing
Buildings	Digitized on screen using aerial photography	GIS Team in IT	Existing
City-owned Property	Extract from Tax Parcels and Aerials	GIS Team in IT	Existing
City-owned utilities	Digitize From As-Builts and other Source Documents	Public Works Department	Existing
Bus Routes	Captured from Source Documents	Transit	Existing
Bus Stops	Captured from Source Documents	Transit	Existing
Central Business District	Digitized on screen	Economic Development/Downtown Renewal	Existing
Landmarks	Extracted from source documents	GIS Team in IT	Existing
Landuse	Extract from Tax Parcels	Planning Services	Existing
Parking Meters	GPS collection in the field	Public Works	Partial
Zoning	Digitized on screen from source documents	Planning Services	Existing
Demographics	Purchased (Community Analyst)	GIS Team in IT	Desired

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006 the City acquired rectified digital orthoimagery which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.	The GIS Team in IT maintain the property data. New property surveys are incorporated as they are received. If staff in other departments see errors they have been asked to report them to the GIS Team in IT.	Existing
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance has occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
City Limits	Digitize from source documents	Planning	Existing
Landmarks	Digitized – have started to develop a common place layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhoods	Heads up Digitizing Screen. Subdivisions is available by 61-M plan (Subdivision)layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	GIS Team in IT create and maintain addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building foot prints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by he City to create an updated building layer.	GIS Team in IT	Existing
Countours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; changes are updated with Orhtophoto refresh	Existing

GAP Analysis Chart

Downtown Renewal has a significant role in GIS for the City of Guelph 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	
Existing	
Yes	GIS component currently exist within Department.

No	GIS component does not currently exist within Department.
Limited/Partial	GIS component exist to a lesser degree.
Desired	
Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to Departmental needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to Departmental need.
Low	Can be met after higher needs are accomplished.

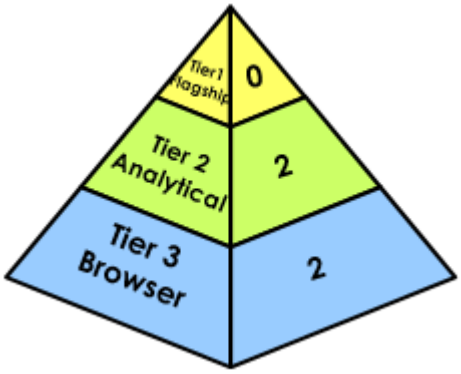
Component	Status		Priority	Notes
	Existing	Desired		
AVL	No	No	Low	AVL can be used to track vehicles; Using AVL conjunction with routing increases efficiency and can reduce fuel consumption, thereby decreasing costs.
Documentation	Limited	Yes	Medium	Little documentation on GIS data creation and workflow exists in the Public Works Department however there is a greater need for creation and standardization for documentation Citywide. The GIS Team in IT will mandate enterprise GIS documentation processes and procedures.
Enterprise Systems Integration	Limited	Yes	Medium	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. Downtown Renewal has limited need for integration with other corporate systems.
Geocoding	Limited	Yes	High	Geocoding will be needed for mapping work orders, permits, inspections and other address based features.
GIS Data Access	Partial	Yes	High	Current databases used within Downtown Renewal have data that could be beneficial Citywide and Downtown Renewal would benefit from access to other departments data layers. GIS Data access is desired and should be addressed throughout the City.

Component	Status		Priority	Notes
	Existing	Desired		
GIS Data Maintenance	Limited	Yes	Medium	Minor GIS data editing will occur within Downtown Renewal. Future creation of departmental layers will need to meet with Citywide data standards set by the GIS Team in IT in order to facilitate confident data sharing and usage between departments.
GIS Data Sharing	Limited	Yes	High	Current databases used within Downtown Renewal have data that could be beneficial Citywide and Downtown Renewal would benefit from access to other departments data layers. GIS Data access is desired and should be addressed throughout the City.
GIS Personnel	Limited	Yes	High	Employees in Downtown Renewal should perform GIS analysis work. These staff will require additional training to better utilize available data and tools.
Hardware	Limited	Yes	Medium	Adequate for GIS usage. Mobile computing resources are limited.
Mapping	Limited	Yes	High	Current GIS-based mapping capabilities in the office are limited. Adherence to Citywide GIS data standards will increase mapping intelligence.
Metadata	Limited	Yes	High	A formal, standardized metadata system needs to be developed and implemented for all GIS data layers authored within the City of Guelph. Standards would be decided upon by the GIS Team in IT.

Component	Status		Priority	Notes
	Existing	Desired		
Mobile Computing Resources	Limited	Yes	High	Mobile computers and mobile GIS viewers would prove valuable for data lookup and analysis, as well as mobile mapping.
Network	Yes	Yes	High	High availability of data via the internal network is mission critical
Routing	No	No	Low	GIS-based routing is currently not implemented and no current need exists for Downtown Renewal.
Software	Limited	Yes	High	Downtown Renewal primarily utilizes OnPoint but will require additional tools and apps for analysis.
Spatial Analysis and Modeling	Limited	Yes	High	Downtown Renewal will benefit greatly in the ability to perform Spatial Analysis.
Training/Education	Yes	Yes	High	This component is considered a high priority for growth of GIS Downtown Renewal. Introductory training is needed at the browser user level. The Tier 2 GIS users will need more advanced training.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Departmental Return on Investment (ROI)

The following table indicates specific Return on Investment opportunities for Downtown Renewal:

Return on Investment Opportunity Downtown Renewal	
Opportunity	**Explanation**
Save <u>Time</u>	• 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 inspections • Enterprise and public map/data access via browser based viewing tools

Return on Investment Opportunity Downtown Renewal	
Opportunity	**Explanation**
	• Target areas to perform work and services. • Quicker location of infrastructure • The review of planning applications with readily available /easily accessible data saving 100s of hours per year
Increase <u>Productivity</u>	Intranet GIS Data Browser and Spatial Analysis: • Use GIS to assist in production of maps and reports • Delivering superior multimedia and analytical presentations. • Finding optimum locations for expanding or relocating companies. • Increase communication with prospective clients by testing location scenarios in real time. • Shortening the time spent on projects due to the early selection of optimum locations • A specific return on investment example for improved productivity would be the rapid turn-around capability on alternative analysis. Several scenarios can be created and analyzed, changes to land use can be made on-the-fly in a staff meeting, and boundary changes modified during a community open house to illustrate how alterations to development patterns will affect an area.
Save <u>Money</u>	Intranet GIS Data Browser and Spatial Analysis: • Data can be queried quickly, reducing time spent looking up records manually • Can find areas of high demand and adjust practices accordingly • Providing electronic copies of maps to customers reduces the printing costs of the department.

Return on Investment Opportunity Downtown Renewal	
Opportunity	**Explanation**
Effective <u>Management</u> of Assets and Resources	*Internet Browser:* • GIS will allow for performance monitoring on such things as planning applications, development and growth management initiatives, inventories such as vacant land, draft approved lots, uptake of units, affordability, staff deployments, fee calculations, and project management
Improved Information <u>Processing</u>	• Downtown Renewal can expect GIS to increase the complexity of analysis opportunities. Increasing demand for impact analysis for new developments should propel methods for faster processing of information frequently requested.
<u>Improve</u> Data <u>Accuracy</u>	*Better GIS Data and Spatial Analysis:* • Working with other departments and City agencies to update data with higher accuracy can improve the results when analyses are performed. By sending errors found in data to the data owners errors can be correct quickly.
<u>Improved Communication, Coordination, and Collaboration</u>	• The users work closely with multiple departments and outside organizations on strategic planning and policy formation. Accurate mapping (including thorough and accurate attribute data) is essential to collaborate on such projects.

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Economic Development

Economic Development

Section Outline

Existing Conditions

- Department Overview
- Governance of GIS
- Hardware and Software

GIS Needs Assessment

- GIS Needs

GIS Gap Analysis

- GIS Data Layer Inventory
- GAP Analysis Chart

Multi-Tier GIS Application Use

Return on Investment (ROI)

Existing Conditions

Department Overview

The primary role of the Economic Development Department (EDD) is to ensure that the City of Guelph is economically viable, resilient, diverse and attractive for business. To reach the goals of Prosperity 2020, the EDD develops and implements programs to retain and expand local businesses and attracts new business investments.

The EDD collaborates with other City departments, local businesses, agencies and organizations to develop programs designed to meet the needs of the City's business community. It is the goal of the EDD to promote the City as an attractive place to set up shop to:

- Diversify the City's Employment Base
- Increase Revenue from the City's Industrial, Commercial, and Institutional Tax Base

To accomplish this goal, the EDD must identify and implement strategic initiatives designed to make Guelph competitive in attracting new investments in the regional and provincial marketplace. The EDD also leads the Guelph Economic Development Advisory Committee in achieving its mandate to stimulate business growth and sustain a strong resilient and diverse local economy.

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

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

Hardware and Software

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

Hardware Issues Summary	
Type	**Notes**
Personal Computers	One for each staff person
Laptops	One for the department. One for G.M.
Printers	Ample printers available for use
Plotters	None
GPS	None
MDTs	None
Scanners	None

Microsoft Office is used to conduct office productivity tasks. The OnPoint Intranet GIS viewer is used for real estate analysis and optimal facility location analysis. The EDD utilize the following software applications:

1. Microsoft Office– Office productivity
2. AMANDA – Permitting – Tracking of Applications
3. SalesForce CRM – Manage Clients and Mail Lists

  **AMANDA Permitting**	**AMANDA** → AMANDA is a web-based product used for licensing, permitting, planning, and compliance. The EDD uses AMANDA for permitting, including the tracking of applications.
 **SalesForce**	The EDD utilize SalesForce as their Customer Relationship Management system. SalesForce is utilized to manage clients and mail lists. This also includes contact information from individuals at shows. SalesForce is also used for reporting activities in regards to contact information.

GIS Needs Assessment

GIS Needs

The enhanced ability to query, analyze, map, and share geographic information will improve operations within the EDD. Currently there is nominal GIS activity within the department. However, much of what is done by the staff has a geographic component and could benefit from GIS.

Based on this Need Assessment, the EDD has several GIS needs. Where applicable each need will be followed by an application to meet that need, some applications will meet several needs:

GIS Need	*Method/Application to Meet Need*
Data Development and Access	Obtain data from internal and external sources as well as create data from existing databases
Economic GIS Web Portal	Intranet GIS Data Browser
Formal GIS Training for EDD Staff	EDD Specific Training

GIS Need

Data Development and Access

The EDD will require data creation and development. The office will rely on external data sources (e.g. demographic analysis) and base map layers to develop maps and conduct analysis. Successful economic development strategies will depend upon access to a broad range of demographic and geographic information.

GIS will allow Economic Development personnel, developers, residents, and other interested parties to access information about available properties, project areas, parking, demographic data, and business lists within the City of Guelph. The consolidation of disparate datasets requires careful database design and development to ensure that the data layers developed from these data sources are accurate.

For Economic Development to conduct spatial analysis, develop site specific maps, and support an economic development research website, data and data management will be critical. The type of data that will need to be acquired from internal sources and external vendors includes:

- Business Data—that can be used to identify customers or market size including data by industry, sales volume, and employees.
- Household Consumer Data — household attributes including age, gender, income
- Real Estate Data – that is updated daily of available properties that can be easily geocoded (e.g. address point)
- Transportation Data – Bus Routes, Parking, Roads, Rail, Transit
- Aerial and other types of spatial photography
- Census Data –tract and block group level
- Property Data
- Available Services – Water, Sewer, Storm Water, Electric, Gas, Telecommunications, Fiber Optics

A full list of desired layers can be found in the Gap Analysis section further below. Once these data sets become available, it is important that users have a quick and easy way to access and analyze the data. Economic Development staff should access all of their needed data through an intranet GIS portal. This portal will have queries, reports, and data that allow Economic Development staff to quickly gather needed data.

GIS Need

Economic GIS Web Portal

Economic Development's processes are inherently geographic. Economic development zones are selected based on their location and proximity to other locations or distributions of people. Maps can provide the EDD, developers, and businesses with an area overview from which economic, demographic, and market patterns can be visualized in a way that written reports and statistical tables cannot. The majority of maps that can be utilized by EDD are simple mapping requests and queries that do not involve spatial analysis or modeling. These are the types of maps that should be fulfilled through a self-service interface. The mapping interface should be simple with prioritized data layers for ease of use and query. More advanced site or market analysis should be completed by properly trained department personnel. An Internet GIS site selection and Economic Web Portal should be developed.

The following sections discuss the proposed functionality and look and feel of a EWP application.

Proposed Functionality:

The EWP integrates many pieces of functionality that will make it a unique and effective tool for the EDD. There will be several tabs on the portal that users can click in order to find out particular information or query specific data layers. These tabs will be outlined in the next paragraphs and a complete description on the functionality included in each tab will be presented:

Land and property is a precious commodity and finding suitable land for development must be well thought out. As developers seek out a location in the City to establish their business, they will need to access maps and analysis of land data in order to make the best decision possible. In the available land tab, users will have the ability to:

- Search by Property Type (Retail, office, industrial, commercial, vacant)
- Search by Property Size (square feet or acres)
- Check boxes – Properties for lease / Properties for sale
- Search by parcel number
- Search by address
- Get up-to-date information on the properties selected
- Picture of the building (except for vacant land)

- Building information
- Parking information
- Amenities
- Infrastructure information
- Parcel information
- View Easements
- Municipal Tax Data
- Municipal Zoning By-Laws
- Land Information – Ministerial orders, restrictive orders, etc.

Demographic Profile

Demographics play a huge role in the economic development of the City. Demographics are data such as population, age, gender, income, education level, race, as well as business information and other data. In the Demographic Profile tab, users will have the ability to:

- Search by demographic type
- View thematic maps
- Choose number of groups and type of distribution
- View demographic reports and charts on screen or export to word or pdf

Education

Education at the regional level will have an impact on future economic development. Users may be interested in finding out which schools and universities are nearby and also obtaining information on size of the school and demographics. This tab will allow users to search schools in the area by name or by address. In the Education tab, users will have the ability to:

- Select from Pre-K-12 schools search drop-down box
- Select from Universities and colleges search drop-down box
- Links to school websites
- Links to SAT Scores
    - Zoom to schools on the map by clicking on the name of the school

Infrastructure

Infrastructure includes transportation and utilities as well as traffic counts. The GIS layers will be available in the layers list and can be turned on and off. Additional functionality available to users when this tab is clicked

will be links to information on the utilities and types of infrastructure available around a pre-defined search area, such as around the parcel that is currently being viewed on the map.

- Water – location and size
- Sewer – location and size
- Storm Water – location, size, and capacity
- Electric – location, size, and capacity
- Gas – location, size, and capacity
- Telecommunications – fiber optics standards
- Roadways
- Rail
- Interstate and Highways
- Traffic Counts
- Transit

Incentives & Programs

Incentives and programs available in the area around the City of Guelph may have an impact on whether businesses choose to relocate to the City. This tab will have the following functionality:

- Local programs search
- Links to local programs and maps of the location
- Links to local chamber of commerce
- Links to regional development agencies
- Links to provincial and federal agencies

Housing Market

The housing market in the area will have an impact on encouraging and promoting economic growth for the City, making the City of Guelph an optimum site for businesses to call home. This tab will allow users to:

- Link to City real estate
- Link to regional realtor association
- View data and reports on pricing range
- Get information on cost of living and relocating

Culture & Recreation

An important factor in economic development is the types of recreation and cultural activities in the area. This tab will allow users to:

- Search parks, museums, or other types of recreation by selecting from a list of information about the following:
    - Culture – Arts and Entertainment
    - Museums
    - Professional Sports
    - Attractions
    - Clubs and Organizations
    - Outdoor Life
    - Places of Worship
    - Recreational Clubs and Associations
    - The ability to zoom on the map to these various locations by clicking on the name

This tab's functionality will include the ability to view demographic information related specifically to the employment labor force. Users can select from a pull down menu all the different types of employees in various business sectors to see on a map where most of the employment and industry is taking place. Also, a button can be added to view various business reports for the surrounding areas. When the report is generated, the businesses at a specific radius will be color coded on the map based on business type.

- Select from drop-down menu type of employee demographics
- View workforce data on the map
    - Workforce availability
- Business reports button for selected site
- Color coded business types for selected radius
- Links to major employers
- Demographics
- Wages / Benefit Rates
- Union / Non-Union Stats
- Unemployment Rate
- Workforce Participation Rate

The types of business parks in the surrounding area will be an important factor in determining optimum site location as businesses try to decide where to go. This tab will have the following functionality:

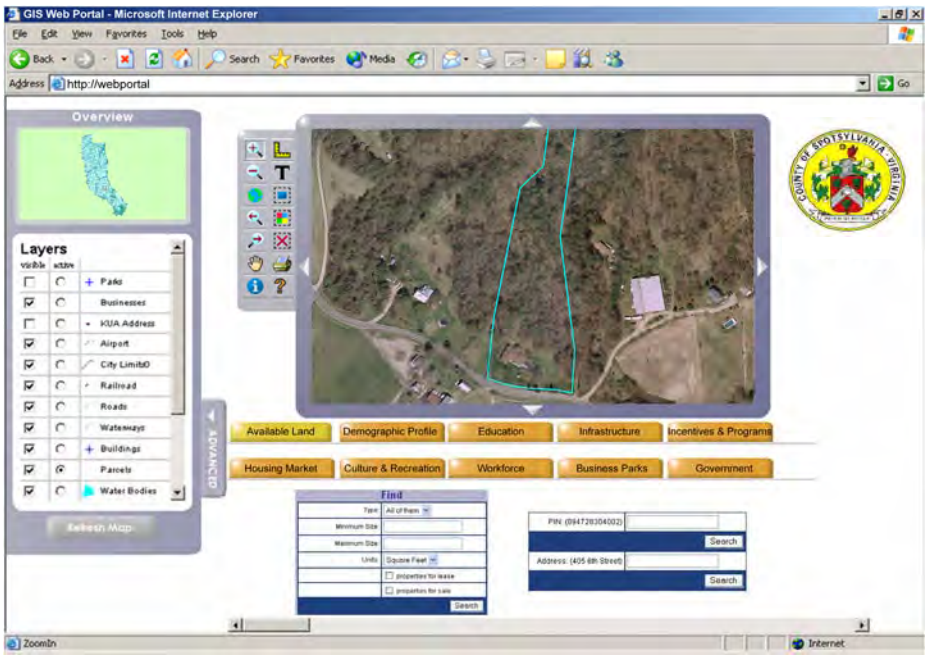
- View top companies
- View tax information for the City

- Information on commercial permits
- Search by business type or name
- Get business counts
- When a specific site or parcel is selected, a button will show allowing the user to click and get a detailed business report of the local area within a specified radius.
- Land Title Information
- Real Estate Data
- Building Permits – Site Plans
- Maps / Surveys
- Transportation Links
- Vacancy Rates
- Greenfield Sites
- Buildings

Government

Knowing where government is located on a map will be important for potential businesses moving to the area. Also, knowing who the key people are at the head of government is important. The government tab will allow users to:

- Locate government offices and programs in the area
- Click on government name and zoom to the location on the map
- Obtain information about city and county manager



GIS Need

Formal GIS Training for Economic Development Staff

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

GIS Gap Analysis

GIS Data Layer Inventory

Economic Development staff does not and will not create any GIS layers. The EDD 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. ***A full Master Data Layer list, with existing and recommend layers can be found in Appendix I of this Needs Assessment.***

Legend

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

The following table lists those data layers that are important to Economic Development:

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Economic Development GIS Data			
Capital Improvement Projects	Digitize from base map data; aggregate layers as needed	Various overseen by GIS Team in IT	Recommended
City Owned Property	Extracted from Parcel Layer	GIS Team in IT	Existing
Easement	Digitized on screen	Engineering	Partial
AMANDA Data	Geo-enabled from existing database	GIS Team in IT	Partial
Airports	Extracted from aerial photography	GIS Team in IT	Existing
Income Tax Locations	Geocoded	Automated from data within Vailtech	Partial
Infrastructure Layers	Digitized and GPS	Water, Public Works, and Engineering	Partial
Business Licenses	Extracted from database and geocoded	Automated	Existing
Assessment Districts	Digitized on screen	GIS Team in IT	Recommended
Redevelopment Projects	Digitized on screen	GIS Team in IT	Recommended
Flood Plains	Province of Ontario	GIS Team in IT	Existing
Land Use	Digitized on screen	Planning	Recommended
Zoning	Digitized on screen	Planning	Existing
Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west.	The GIS Team in IT maintain the property data. New property surveys are incorporated as they are received. If staff in other departments see errors they have been asked to report them to the GIS Team in IT.	Existing

	In 2006 the City acquired rectified digital orthoimagery which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.		
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance has occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing
Landmarks	Digitized – have started to develop a common place layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhoods	Heads up Digitizing Screen. Subdivision are available by 61-M plan (Subdivision)layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	GIS Team in IT create and maintain addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building foot prints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing

	Guelph Hydro utilized the 2000 and then the 2006 imagery provided by the City to create an updated building layer.		
Contours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; changes are updated with Orhtophoto refresh	Existing

GAP Analysis Chart

Economic Development 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.

Legend	
Existing	
Yes	GIS component currently exists within department.
No	GIS component does not currently exist within department.
Limited/Partial	GIS component exists to a lesser degree.
Desired	
Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to departmental needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to departmental need.
Low	Can be met after higher needs are accomplished.

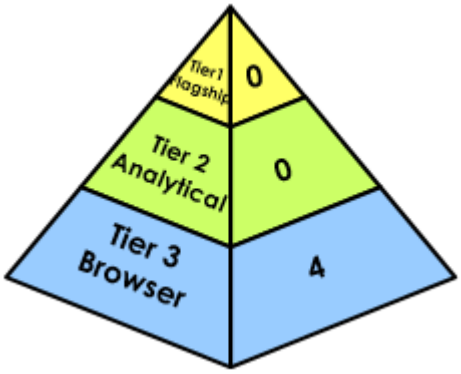
Component	Status		Priority	Notes
	Existing	Desired		
Automated Vehicle Location (AVL)	No	No	Low	AVL can be used to track official vehicles; Using AVL conjunction with routing increases efficiency and can reduce fuel consumption, thereby decreasing costs. Economic Development has no need for AVL.
Documentation	No	Yes	Medium	Some documentation on GIS data creation and workflow exists however there is a greater need for creation and standardization for documentation citywide.
Enterprise Systems Integration	Limited	Yes	High	Integration with existing databases is essential.
Geocoding	No	Yes	High	Comprehensive geocoding will greatly expand Economic Development's mapping functionality. Geocoding is the method that will be used to link many data sets back to address points.
GIS Data Access	Limited	Yes	High	Economic Development would benefit from access to other departments data layers. GIS Data access is desired and should be addressed throughout the city.
GIS Data Maintenance	No	No	Low	Economic Development will be a data consumer. Data layers will be created from some of their data such as that from the available properties database but that will be automated.
GIS Data Sharing	No	Yes	High	Some of Economic Development's data will be pertinent to other departments and as such should be shared.
GIS Personnel	No	No	Low	Economic Development will be a data consumer. As such, they will use easy-to-use GIS data browsers and mobile tools.

Component	Status		Priority	Notes
	Existing	Desired		
Hardware	Yes	Yes	Low	The current personal computers will suffice for running the GIS data browser.
Mapping	Yes	Yes	High	All mapping should be attainable through the Intranet data browser.
Metadata	No	Yes	High	Economic Development needs to know the derivation of the data, its currency, and completeness.
Mobile Computing Resources	No	Yes	Medium	There is not a pressing need to have mobile GIS for the EDD.
Network	Yes	Yes	High	High availability and fast access to GIS data will be important to the success of this initiative.
Routing	No	No	Low	GIS-based routing is not needed by Economic Development staff.
Software	Yes	Yes	High	Economic Development will need expanded use of Intranet GIS data browser and additional functionality as described for an Economic Web Portal.
Spatial Analysis and Modeling	No	Yes	High	Economic Development does spatial analysis as part of their core function of finding optimal business sites.

Component	Status		Priority	Notes
	Existing	Desired		
Training/Education	No	Yes	Medium	This component is considered a medium priority for use of GIS within Economic Development. Introductory training is needed at the browser user level for all staff.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Return on Investment (ROI)

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

Return on Investment Opportunity Economic Development	
Opportunity	**Explanation**
Save Time and Respond More Quickly to Citizen Requests – Will Govern from Certainty in Responding to Inquiries	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: • An Intranet GIS Data Browser should be used to generate high-quality maps for economic development programs, responses to general property inquiries, and brochure production.
Improve Data Accuracy – Will Govern from Certainty in Responding to Inquiries	Better GIS Data and Spatial Analysis: • With the creation of Economic Development GIS data layers, the office staff will have much more accurate geographic information pertaining to their business functions. In return, this will allow them to do much of their work more efficiently and with better data providing more accurate mapping and spatial analysis.
Improve the Economy	Attract and Retain Business: • GIS would be utilized to attract and retain business and industry in the area.

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Emergency Services Department

Emergency Services Department

Section Outline

Existing Conditions

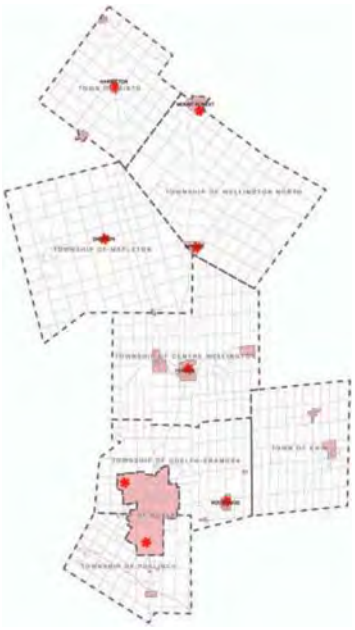
Department Overview

The City of Guelph Emergency Services Department provides fire services, emergency medical services (EMS), and emergency management coordination. The department provides the Guelph community with professional firefighting, citizen rescue services, pre-hospital emergency medical care, and transportation to emergency rooms. Additionally, staff responds to hazardous materials incidents, urban search and rescue incidents, and general public assists. E-911 calls within the city are handled by the City of Guelph Police Department. If the call is for EMS services, it is routed to the Cambridge Central Ambulance Communitcation Centre operated by the Province of Ontario. This dispatch centre in turn relays the call to EMS staff via phone and radio. If the call is for Fire Services, it is routed directly to the Fire Department. County calls for EMS service are routed to OPP dispatch in North Bay and then to dispatch centre in Cambridge to EMS staff. Fire services are provided within the Guelph city limits and part of Guelph/Eramosa Township under a Fire Protection Agreement; whereas, EMS services are provided countywide. Six fire stations are strategically placed throughout the City of Guelph in an effort to arrive within 6.5 minutes to a call. The Fire Prevention Division conducts fire prevention inspections, public education

Guelph Fire Station Locations

demonstrations, stations maintenance, and various training opportunities. Approximately 6,500 fire calls are responded to each year.

As per the 2011-12 City of Guelph Emergency Services Community Report, the City of Guelph is the provider of land ambulance service for the residents of Guelph and Wellington County. The Province sets standards by which ambulance services need to comply, including response times to emergency calls. The service operates from eight stations located in Guelph and Wellington County (see graphic to the right). It serves about 230,000 residents and more than 2,500 square kilometers in urban and rural response landscapes. The location of ambulance stations is determined based on historical call volume, population density, high traffic areas as well as locations that pre-exist the current organization. In 2011, Guelph Wellington EMS deployed eight ambulances and one rapid response unit, 24 hours per day and an additional four vehicles for up to 12 hours per day during peak demand hours. Approximate annual call volume is 18,500 patients.

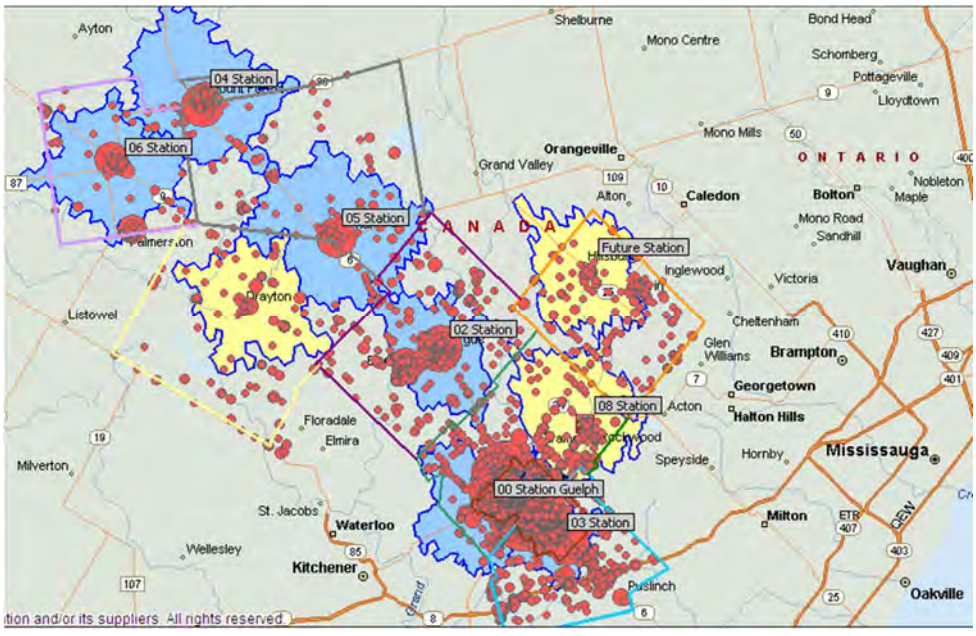


EMS Station Locations

Existing GIS Conditions

Governance of GIS

Very little GIS is being utilized within Emergency Services. It is mission critical that EMS staff is able to find the location of an emergency call. EMS use GPS (Garmin) to route to a call. The Ministry of Health provides a mapping interface for locating calls. However, the application is cumbersome to use and is used by Guelph EMS as a backup system only. EMS plots incidents via Microsoft Streets and Trips in an effort to identify call volume location (graphic to the right). However, this is not automated and is time consuming. Both Fire and EMS use hard copy map books with Fire also having access to mapping to and incident data on mobile



data terminals. No real-time electronic download of the incident data from 911 occurs for EMS. Therefore, each incident is manually entered in the records management systems. No automated mapping of incidents occurs for EMS. Grey Island is utilized city-wide for automated vehicle location (AVL). However, the software is not reliable. All mapping needs are routed to the GIS Team in IT or 3rd party software. The GIS Team in IT provide mapping and GIS related products to Emergency Services staff on an as-needed basis. Also, the GIS Team in IT provide GIS data for the 911 dispatch application at the Police Department. A GIS intranet application, OnPoint, is available for use throughout the city. Emergency Services staff utilizes the software for property information; such as occupancy levels, but find it to be cumbersome, slow, and lacking needed data.

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

Current GIS Staffing				
Type		**Number of Users**	**GIS Usage**	**Primary Tools**
	GIS Flagship (Tier 1)	0	NA	NA
	GIS Analytical (Tier 2)	0	NA	NA
	GIS Browser (Tier 3)	50	Low	Microsoft Streets and Trips and OnPoint

 Hardware and Software

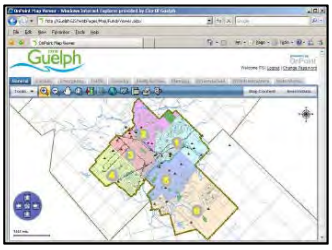
All staff within the Emergency Services Department has access to a personal computer. Mobile data terminals (MDTs) are used on each apparatus and Fire Vehicles use wireless air cards for communications. Each vehicle is outfitted with an automated vehicle location (AVL) device. However, the current AVL software is unreliable. Printers are available for office use.

Hardware Issues Summary	
Type	**Notes**
Personal Computers	Available to all staff
Laptops	Vehicles have laptops used as mobile data terminals (Not EMS)
Printers	Ample printers available for use
Plotters	Have access to GIS Team in IT for large scale maps if needed
GPS	In each vehicle for AVL
PDA/MDTs	MDTs on each vehicle for in field reporting
Scanners	Available as needed

The Emergency Services Department uses Firehouse for fire records management and iMEDIC for EMS records management. Microsoft Office is used to conduct office productivity tasks. The following is a list of key software products utilized by the department:

1. Microsoft Office– Used for office productivity
2. Firehouse - Fire records management
3. iMEDIC – EMS records management
4. Grey Island – automated vehicle location (AVL)
5. OnPoint - Intranet GIS browser provided by the GIS Team in IT
6. Microsoft Streets and Trips – travel directions

	FireHouse → FireHouse software is a fires records management software (RMS) solution. Data about each incident is entered into the RMS. Firehouse has the ability to store a host of key data about the community to include fire pre-plans and hazardous materials information. Currently, some preplans are store in Firehouse. RMS data within Firehouse should be mapped and made available for analysis
	iMEDIC EMS → iMEDIC form Interdev is utilized by EMS as their records management system. The software is utilized for patient care reporting. Data on each incident is tracked within iMEDIC. Location information (address) is stored with each record. This data should be mapped and made available for analysis.
 **Vehicle Tracking**	**Grey Island AVL** → Grey Island provides automated vehicle location (AVL) software and hardware. GPS devices are attached to vehicles and the Grey Island software shows vehicle location via a map; This is not a mobile application in the ambulance, Grey Island is solely used for reporting.. Grey Island has become a subsidiary of WebTech Wireless. The Grey Island system is not working well for Guelph and replacements are being considered.

 **OnPoint Intranet GIS**	**OnPoint** → OnPoint from Rolta is utilized as an enterprise-wide GIS intranet solution. The software allows users to access pertinent GIS data via a web browser. Emergency Service (Fire Department) uses the software for accessing property information; such as, occupancies, square footage, and distance to exposures.

GIS Needs Assessment

GIS Needs

GIS is crucial in the Emergency Services Department's need to integrate technology in support of incident response and public safety. The Emergency Services Department will be able to use GIS in day-to-day tasks, such as incident analysis, emergency management, and public outreach. In addition, the Department will also be able to use GIS for strategic objectives, using sophisticated analyses to improve decision-making, as well as potentially reducing response times.

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

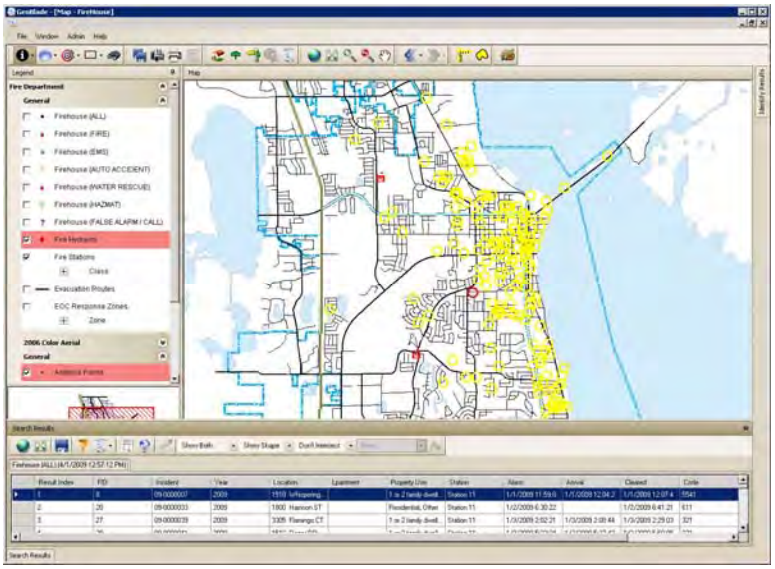
GIS Need	***Method/Application to Meet Need***
☑ Mapping and Spatial Analysis of Fire and EMS Incidents and Inspections	❐ Intranet GIS Data Browser
☑ Geospatial Data Creation and Integration	❐ Data Mining Middleware
☑ Field Access to Geospatial Data	❐ Map Books ❐ Mobile Computers ❐ Mobile GIS Data Browser
☑ Emergency Operations – Disaster Response and Recovery	❐ Disaster Recovery and Damage Assessment Application
☑ Enterprise Access to Digital Pre-plans and Hazardous Material Data	❐ Data Creation and Integration
☑ Utilize Predictive Occurrence Software	❐ Intranet GIS Data Browser ❐ Third Party Software Product

☑ Public Access to Selected GIS Data	☐ Internet GIS Data Browser
☑ Formal Training for Emergency Services Department Staff	☐ Third Party Application Training

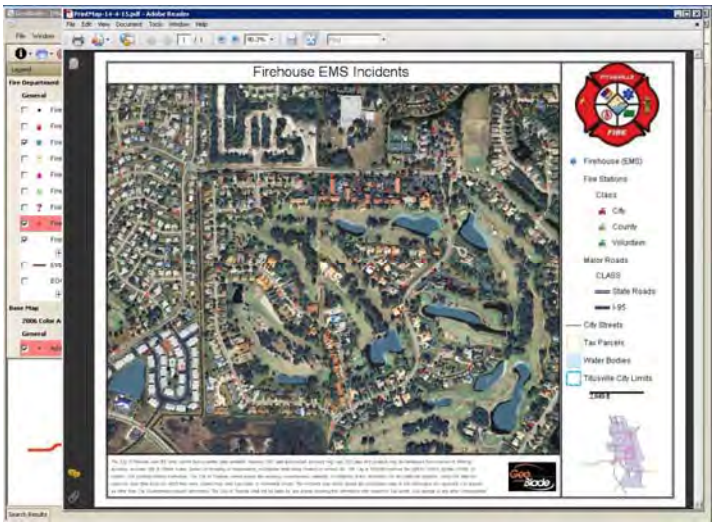
GIS Need

Mapping and Spatial Analysis of Fire and EMS Incidents and Inspections

Currently there is very limited us of GIS within Emergency Services. The OnPoint intranet browser is utilized sporadically for property related inquires. The GIS Team in IT provides as-needed GIS services. The Emergency Services Department should work with the GIS Team in IT to train personnel in the use of GIS to gain quick successes based on mapping and analysis of fire and ambulance stations, response times, hazards, and incidents. Department staff should continue to use an Intranet GIS Data Browser to conduct basic spatial analysis and to produce maps and to assist in day-to-day activities. This Intranet Browser serves the entire City, but should have a specific link for the Emergency Services Department. Emergency Services Department RMS data (Fire and EMS), and inspections data should be address matched to the City's address point layer. Each record will then be given a fixed x, y coordinate and will be available on the map for analysis, query, and reporting. This process should be automated to address match the data in the databases nightly or hourly. Other data tied to these records such as pre-plans and hazardous materials information will be accessible via the Intranet. This application will allow staff to access incident information, as well as do routing and quickly determine areas affected by a spill or fire.



Quick Viewing of Incident Data Residing in FireHouse



Another opportunity to use this Intranet GIS data browser exists with fire inspections conducted through the city. The Emergency Services Department conducts inspections throughout the year. These inspections could be made available to departmental personnel via desktop, tablets, and/or laptop computers, spatially linked to parcel, address, and street centerline data, as well has high-resolution ortho-photography. Using the most recent, accurate GIS layers provides staff members with an invaluable tool for everyday tasks. For more advanced analysis and other tasks such as data creation, determining drive times, or finding the optimal location of a new fire or ambulance station, Emergency Services Department staff should work with the GIS Team in IT using advanced GIS software applications.

Viewing Calls for Service Data will allow staff to Quickly View Patterns of Sickness

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

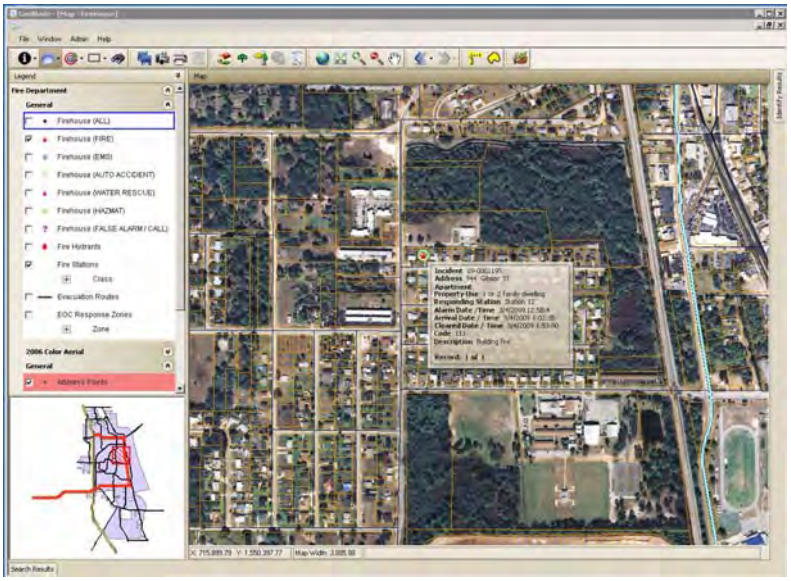
- Track locations of vacant house fires
- Fire hydrant inspections tracking
- Ability to identify correct address of fires even late at night, and then using GIS to find ownership information and notifying the owner
- Identify resource allocation, i.e. what is in each station
- Accessing owner/occupant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

- Evacuation route planning
- Using maps for training personnel
- Communication tower maps
- Automatic aid and mutual aid maps
- Fire hazard severity zone mapping
- Optimal paramedic deployment planning

Application to Meet Need

Intranet GIS Data Browser

It is recommended that an enterprise-wide ArcGIS Server based Intranet GIS Data Browser tool be used for Tier 3 users to access pertinent spatial data, imaging, and spatial analysis functionality. This application will not only allow users to view GIS data, but data entered into other database systems as well.



Geo-Enabled FireHouse data

A large amount of valuable data for the department, and the City, resides in tabular database programs 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, this data needs to be linked to a GIS Data Browser for maximum use of both systems. Critical data layers (such as hazardous materials and building pre-plans), incident information (Fire and EMS) and inspections that reside in various databases can be extracted and the location of each incident mapped via its address.

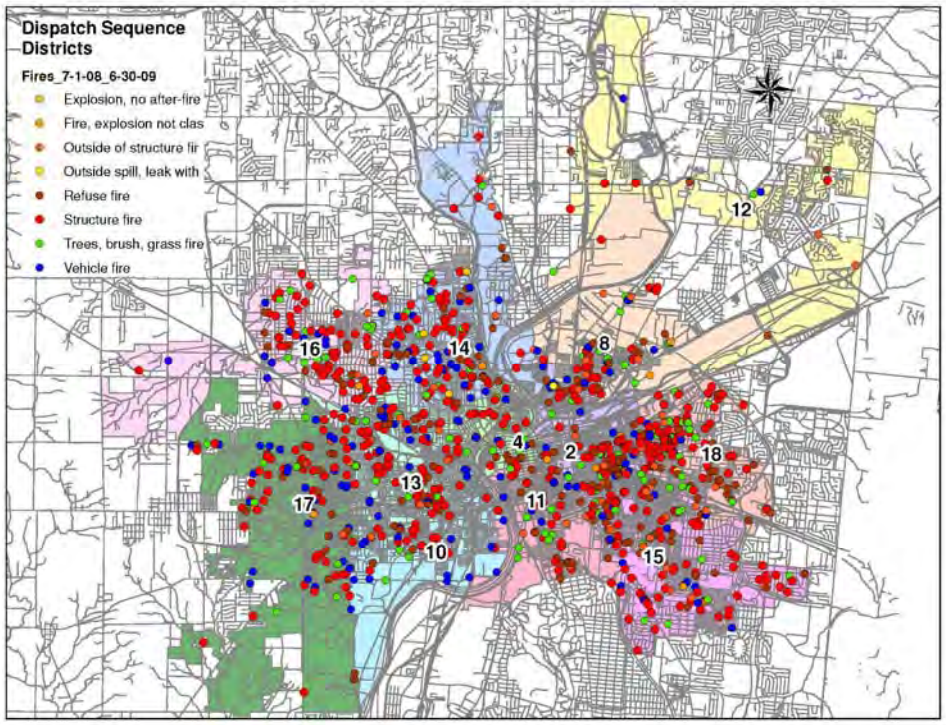
This application will serve as the primary GIS application for the Emergency Services Department and will enable general staff to accomplish about 90% of their GIS tasks. These tasks will include the quick query and search of data, as well as more intricate uses such as citizen notifications and map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

The City has already embraced the concept of allowing departments to have a portal into the GIS data. They are moving the current intranet applications to the newest GIS technology. This system also needs redundancy and be vigorous during power and internet outages that often occur in an emergency. It is recommended that a portal specific to the needs of the Emergency Services Department is created. This portal will contain data specific to the Emergency Services Department as well as data from other departments that is of importance.

GIS Need

Geospatial Data Creation and Integration

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



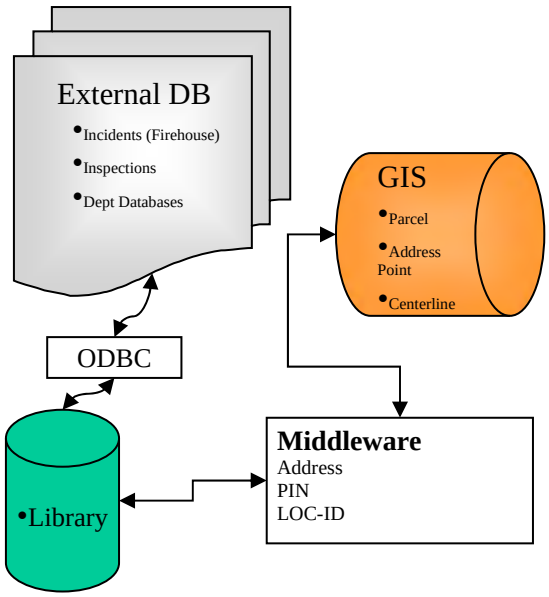
Example – Fire Incidents Geocoded to Address Points

Application to Meet Need

Data Mining Middleware

Emergency Services Department databases with associated addresses can be address-matched to a street centerline layer, tax parcel centroids, or address point layer. Existing databases may

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



Practical Example

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

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

GIS Need

Field Access to Geospatial Data

Providing personnel with access to maps and GIS data while working in the field is an important part of maintaining an enterprise GIS. Through the use of hardware, software, and data that are designed to be interrogated and manipulated away from the office, Emergency Services Department staff can realize benefits of GIS while in the field. Implementing mobile computers, input devices, software and GIS data into the GIS enterprise will give the Emergency Services Department tools to perform address searches; query attributes of all information, such as schools, types of hazardous material stored at a location, link to digital building pre-

plan drawings, and optimal routing. The department currently has mobile data terminals (MDTs) for Fire and EMS. However, mobile mapping is not included on these MDTs.

Additionally Fire personnel stated they wanted mobile GIS for the following:

- Showing public station locations and closest hydrants, flow, capabilities, etc.
- AVL for response and seeing their own vehicles and other vehicles
- Ability to view entire water system in the field
- Viewing of active calls

Additionally EMS staff is seeking mobile GIS for the following:

- AVL for response and seeing their own vehicles and other vehicles
- Ability to see bit maps with trailer parks, floor plans of hospitals,
- Flagging visually hazardous address due to violences, difficult access, public access defibrialltor on scene

Method to Meet Need

Mobile Computers

Historically, Emergency Services Departments have had to rely on map books for viewing data in the field. However, these maps were cumbersome and always out-of-date. A more advanced method for accessing spatial data in the field is through the use of laptops. Currently the Fire department has mobile data terminals in the field. As the MDTs are upgraded, a mobile data browser can be loaded on the mobile computers, allowing the same capabilities offered by map books, but also the ability to conduct address searches; query attributes of all information, such as schools, types of hazardous material stored at a location, link to digital building pre-plan drawings, and optimal routing. EMS have access to tough book laptops that are used for patient care reports but are not docked in the ambulance.

Application to Meet Need

Mobile GIS Data Browser

All relevant layers, including base map layers and aerial photography should be available for display in the GIS data browser. It should be noted that highly accurate geospatial data is required for the successful

implementation of such as solution. It is recommended that this application is an ArcGIS Server based application that can work in a connected or a disconnected environment. The application should be able to use Automated Vehicle Location (AVL) data for display in the application.

GIS Need

Emergency Operations – Disaster Response and Recovery

Emergency Services Department staff are required to manage disaster response and recovery, as well as be in the field after a disaster. They are required to manage damage assessments and report this information back to the City for reporting to the provincial government and for recovery operations. It is recommended that Guelph implement a disaster recovery tool that will enable staff with rugged tablet computers to quickly assess and report the extent of a disaster. This application will allow users to enter the damage done on a site by site basis. Also, the computers should be GPS enabled so that the location of each field representative and the path they have already traveled can be easily ascertained.

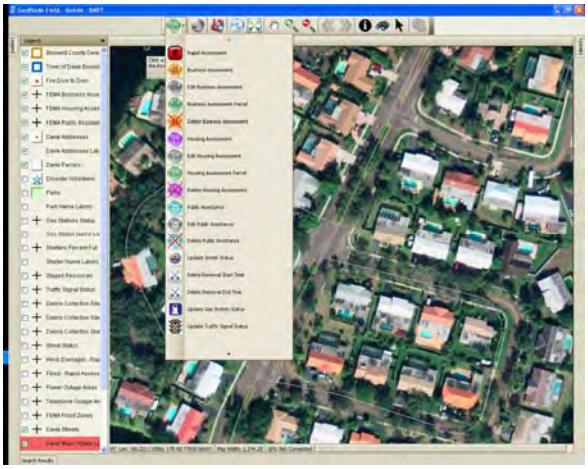
Additionally, staff should have access to a host of information within an EOC or a mobile command unit. These applications should allow for the following functionality:

- Hazardous Material Release Plume Analysis
    - Used output from current plume modeling for viewing within a Guelph based EOC map to determine:
        - How many people are affected
        - What critical infrastructure is affected
        - What target properties (schools, nursing homes, etc.) are affected
    - Ability to integrate reverse dialing software to dial people within the plume
- Evacuation Planning
    - The goal would be to design an effective evacuation plan for a given incident or to change an existing evacuation due to dynamic conditions.
        - Determine street capacities to manage expected evacuation capacity – i.e. if the need to evacuate 15000 people in 2 hours and the streets in area flow x vehicles per hour, how many streets do we need to designate as evacuation routes
        - Identify stop lights and other traffic control devices that will need to be controlled to assist with evacuation
- Damage Assessment and Live EOC
    - Use mapping capabilities to view data from various sources
        - Internal Guelph GIS data
        - Utility outage areas
        - Weather Service data
        - Public Health outbreaks and disease surveillance data
        - Where disaster recovery personnel are in the field

- What damage has occurred where
- Field collection tools to identify damage

Disaster Recovery and Damage Assessment Application

An Intranet application should be available to show all of the data listed above. A mobile application should allow users to rapidly and confidently enter field notes on a mobile form and then transmit the data back to a central location using a wireless connection. GPS enabled computers are essential for the routing and tracking of staff during an event. This application should be tested annually to ensure that each of the components is in an operational state.



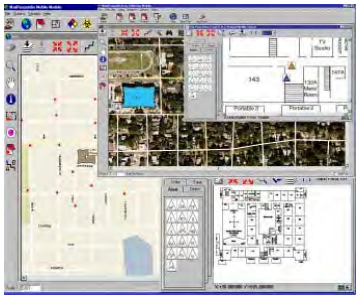
Mobile Application for Damage Assessment

GIS Need

Enterprise Access to Digital Pre-plans and Hazardous Material Data

The Emergency Services Department has created pre-plans manually and digitally. Some of these have been made available through the Firehouse software. Linking plans to GIS can add additional information and analysis capabilities. Pre-plans of critical facilities should be linked to the GIS Intranet application and a mobile data browser application. An icon will show up in the application if a pre-plan is available for a structure. Additionally, hazardous material information is being maintained as paper files. This data should be scanned and linked to the GIS by address - hospitals, trailer parks, retirement facilities for example.

GIS Accessing Pre-Plans and Hazardous Materials Information



GIS Mobile Data Browser with pre-plan data

Case Study: Milford, Connecticut, Emergency Services Department Uses GIS for Optimizing Incident Response. Providing In-Vehicle Access to More than 3500 Prefire Plans.

Emergency Services Departments across the country, no matter the size or location, are dedicated to serving the public and protecting life and property. This dedication drives agencies to constantly improve how they operate—and this is certainly the case with the Milford Emergency Services Department (MFD). Located in Milford, Connecticut, the agency is one of the top-tier fire agencies in the country. MFD is a full-service agency that handles all aspects of emergency services, including fire, emergency medical services, emergency rescue, and hazardous materials response.

The highly touted agency is a class one Emergency Services Department—the highest rating given—and is only one of three in the New England area, with approximately 44 in the United States out of roughly 43,000 Emergency Services Departments.

The Milford GIS applications reduce the amount of time spent doing data entry, data maintenance, and other office work. Fire staff can spend more time training and developing fire response skills.

Wielding Innovation as a Tool of the Trade

The Milford Emergency Services Department has a long history of pre-event planning and data management. As part of its leading fire service delivery efforts, MFD has a comprehensive collection of prefire plans for the thousands of buildings and land parcels located within its service area. The department spent years and hundreds of man-hours working with the community it serves to collect all types of building data. Yet the more information MFD collected, the more it was having trouble maintaining the information and storing it in an optimized way where it could be quickly used in an emergency.

As the department's prefire data grew, MFD began to look at new technologies for better managing its data. While attending a public safety conference, fire chief Louis LaVecchia learned about the ability to manage fire information using GIS. Maps were already crucial to the department's incident plans, but they were paper based and were generated using manual methods. The promise of spatial technology meant a faster, more efficient means of collecting, managing, and using the information in an automated environment. The next step involved getting firsthand knowledge of what computer mapping could mean for his Emergency Services Department.

Employing information he learned at the safety conference, LaVecchia met with staff from ESRI and outlined his specific needs, learning how GIS could help his agency. His department then outlined a plan of action, acquired ArcView software, and trained its staff to begin migrating its paper maps and data into the digital system.

After successfully developing the GIS database, an infrastructure was then put in place to provide instant in-vehicle access to information while deploying to an incident. The resulting GIS platform would dramatically change how the agency could serve the public.

Taking Advantage of Industry Applications

MFD utilizes industry-specific applications from ESRI business partners. First Look Pro software from the CAD Zone (an ESRI Business Partner located in Beaverton, Oregon) is used to organize and access all critical preincident planning information. The CAD Zone uses MapObjects, which provides a very light, fast in-vehicle application for accessing preplans and other facility information important for first responders. The company's integration of prefire incident plans and GIS allowed MFD to leverage its investment in both GIS data and its documentation of critical prefire surveys.

The MFD requires analysis to include incident densities and hot spots and assessment of the city's street network to determine response times and fire apparatus run orders. This analysis is performed using FireView software from the Omega Group (an ESRI Business Partner located in San Diego, Ontario). It allows MFD to better identify incident patterns and carry out improved response strategies. For instance, the software uses the ArcGIS extensions ArcGIS Network Analyst and ArcGIS Spatial Analyst to analyze response times for each MFD station to provide accurate dispatch areas, and the software is also used to identify incident call trends by type of incident, time of day, and day of week to assess staffing requirements.

The MFD dispatch center is equipped with software from CompassCom (an ESRI Business Partner located in Centennial, Colorado) for automatic vehicle location (AVL) and mobile asset tracking. Each piece of fire apparatus is equipped with GIS mapping and AVL equipment, allowing fire commanders, dispatchers, and responders to see the location of other vehicles, emergency incidents, hydrants in relation to those incidents, and all Emergency Services Department trucks at any given time. Incident commanders and chief officers can manage complex incidents more effectively by assigning apparatus to specific locations and tasks that can be viewed and monitored on the GIS map display within the vehicle.

"We used to respond to calls out of the fire station, viewing a paper wall map that measured 40 by 50 inches that had red dots where hydrants were," says Gary R. Guilmette, 30-year MFD veteran and GIS technician. "Now firefighters automatically have wireless access to the prefire plans and GIS data—a full digital map of the city—in their vehicles when they respond to a call. The mobile GIS applications include all the building data, image data, Emergency Services Department connection data, hydrant data, and more."

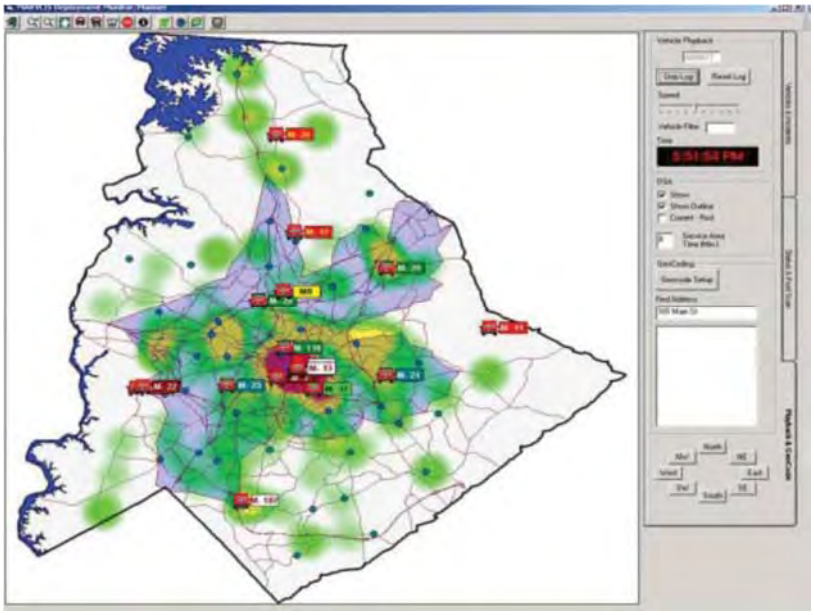
The computer-aided dispatch (CAD) system links to mobile, GIS-enabled computers in the fire trucks. When a call comes into the Milford E911 center, the CAD system automatically notifies the mobile computers; geocodes the emergency incident location on a map display within the vehicle; and displays existing prefire plans in association with the map location, along with integrated tabular information, which is displayed visually while responding to the emergency.

"For our AVL system, mapping is used for everything," says Daniel W. Worroll Jr., MFD Emergency Operations Center coordinator. "In addition to all of our fire resources and apparatus, we have a footprint for every building in Milford. We have city infrastructure data integrated with pictures of houses, commercial buildings, and more. Schools, for instance, have 10–15 pictures showing all types of information, including floor plans. It's been an invaluable tool to give firefighters what they need before they get to a scene."
**Case Study Courtesy of ESRI ArcNews Magazine*

GIS Need

Utilize Predictive Occurrence Software

EMS personnel stated that predictive occurrence software is a high priority. GIS provides the technology for creating a "posting plan" (pre-assigned EMS mobile locations) that efficiently covers EMS call demand for a jurisdiction. GIS displays where to place vehicles on the map for any given period of time based on historical event patterns. Staffing and unit requirements and dispatch needs can be quickly determined and viewed with GIS technology. Various products exist with this functionality. However, it is recommended that the Intranet Data Browser described earlier have a module that allows for predictive posting modeling. This would prevent EMS from having to utilize multiple GIS products and portals.

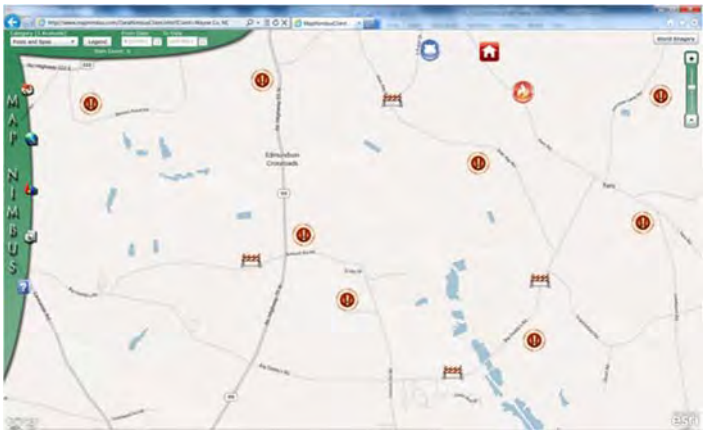


GIS Need

Public Access to Selected GIS Data

It would be beneficial to push emergency related data to the citizens via a web portal. It is recommended that the City use a GIS portal to communicate critical information to citizens. A public safety portal should be considered for sharing pertinent information about fire, EMS, inspections and EOC activities and services. A public portal could include emergency information such as:

- Shelter locations
- Fire, EMS and police stations
- Road closures
- Power outages
- Bridge closures
- Flooded roads



Public Access Application for Disaster Awareness

GIS Need

Formal GIS Training for Emergency Services Department Staff

Several departments/divisions, including the Emergency Services Department, will benefit from formal training in GIS. It is recommended that the Emergency Services Department receive annual GIS training on the various software products as they become available.

Method to Meet Need

Tier 3 Applications (Intranet Browser, Mobile, Routing, etc.) Training – All Staff

As intranet, desktop or Internet applications are deployed, the Emergency Services Department will require specific training tailored to the GIS interface that may support their workflows. 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 and outside vendor or the GIS Team in IT. 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

GIS Gap Analysis

GIS Data Layer Inventory

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

Legend

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

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Emergency Services Department Data			
Abandoned Buildings	Address matched from a database	Automated extraction from a database	Recommended
Amanda Data	Automated via Geocoding	Automated	Existing
Arsons Locations	Extract from Fire and PD RMS Data	Automated extraction from RMS	Recommended
Census Tracts	National Government	Decennial Census	Existing
Day Care Facilities	Generate from Parcel Layer	GIS Team in IT	Existing
Churches/Places of Worship	Generate from Parcel Layer	GIS Team in IT	Existing
Evacuation Routes	Extract from Street Centerline Layer	Emergency Services in conjunction with GIS Team in IT	Recommended
Fire and EMS Incidents (Calls for Service)	Extract from Fire and EMS Data	Automated extraction from RMS	Existing

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Fire Hydrant Buffers	Create from Fire Hydrant Layer	Emergency Services in conjunction with GIS Team in IT. Shows buffer associated with hose lengths	Recommended
Fire Hydrants	GPS field collection	Water Services and Engineering	Existing
Fire Inspections	Extract from Firehouse	Automated extraction from Firehouse	Recommended
Fire and EMS Station Locations	Digitized on screen	Emergency Services in conjunction with GIS Team in IT	Existing
Flood Zones	Province of Ontario	GIS Team in IT	Existing
Hazardous Materials Locations	Geocode and link to existing database	Emergency Services in conjunction with GIS Team in IT	Partial
Knox Boxes	Geocode and link to existing database	Emergency Services in conjunction with GIS Team in IT	Recommended
Pre-Plan Data	Link Visio and Scanned Drawings	Emergency Services in conjunction with GIS Team in IT	Partial
Restaurants	Create from Inspection Records	Emergency Services in conjunction with GIS Team in IT	Recommended
Public Schools	Digitized on screen	GIS Team in IT	Existing
Fire and EMS Districts	Digitized on Screen	Emergency Services in conjunction with GIS Team in IT	Partial – Fire Districts Exist, but not EMS Districts
Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work	GIS Team in IT maintain the property data. New property surveys are incorporated as they are received. If staff in other departments see errors they have been asked to report them to the GIS Team in IT.	Existing

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
	using rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006 the City acquired rectified digital orthoimagery which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.		
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance has occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing
Landmarks	Digitized – have started to develop a common place layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhoods	Heads up Digitizing Screen. Subdivisions is available by 61-M plan (Subdivision)layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	GIS Team in IT create and maintain addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building foot prints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by he City to create an updated building layer.	GIS Team in IT	Existing
Contours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; changes are updated with Orhtophoto refresh	Existing

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

Legend	
Existing	
Yes	GIS component currently exists within division.
No	GIS component does not currently exist within division.
Limited/Partial	GIS component exists to a lesser degree.
Desired	
Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.

Limited	Some applicability to divisional needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to divisional need.
Low	Can be met after higher needs are accomplished.

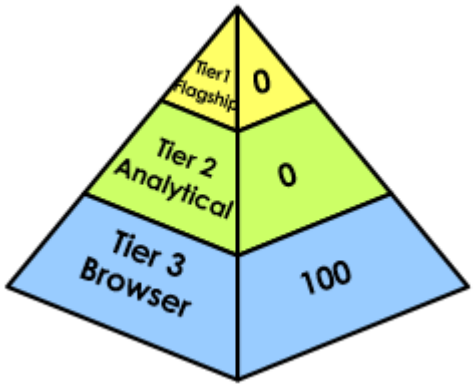
Component	Status		Priority	Notes
	Existing	Desired		
Automated Vehicle Location (AVL)	Yes	Yes	High	Vehicles currently have AVL and this technology is critical for delivery of emergency services. However, current AVL service is unreliable. The City is looking at replacement possibilities.
Documentation	Yes	Yes	Medium	The GIS Team in IT mandates enterprise GIS documentation processes and procedures.
Enterprise Systems Integration	No	Yes	High	Integration with the Fire and EMS RMS data is critical.
Geocoding	Limited	Yes	High	Comprehensive geocoding will greatly expand the Emergency Services Department's mapping functionality. The Emergency Services Department is experiencing limited success with geocoding now.
GIS Data Access	Yes	Yes	High	The Emergency Services Department should have access to all city data and data created for the Emergency Services Department.
GIS Data Maintenance	Yes	Yes	Medium	For the most part, the Emergency Services Department will be a data consumer. They will not need to create or maintain much GIS data. Data layers will be created from some of their data such as that from calls for service database, but that will be automated.

Component	Status		Priority	Notes
	Existing	Desired		
GIS Data Sharing	Yes	Yes	High	The Emergency Services Department needs other department's data and has the desire to share some of their data internally and with the public.
GIS Personnel	No	No	Low	There is not a need for GIS staff within Emergency Services. Their GIS use and access should be primarily through Tier 3 GIS applications. Any high level analysis should be done in conjunction with the GIS Team in IT.
Hardware	Yes	Yes	High	The current personal computers are adequate for running the GIS data browser and mobile applications.
Mapping	Limited	Yes	High	Mapping products are very limited now. However, there is a desire to do much more in this area.
Metadata	Limited	Yes	Medium	A formal, standardized metadata system needs to be developed and implemented for all GIS data layers authored within Guelph. Standards should be decided upon by the GIS Team in IT.
Mobile Computing Resources	Limited	Yes	High	Having mobile computing for Emergency Services Department staff is important for daily EMS, Fire Operations, Inspections, and Emergency Response and Preparedness. Current resources should be augmented to included GIS applications.
Network	Yes	Yes	High	High availability of data via the internal network is mission critical.
Routing	Limited	Yes	High	GIS-based routing is desired by Emergency Services Department staff. EMS has had to deploy GARMIN mobile units in the ambulances for this purpose.

Component	Status		Priority	Notes
	Existing	Desired		
Software	Yes	Yes	High	The Emergency Services Department will need access to a Emergency Services centric GIS data browser and a mobile GIS application.
Spatial Analysis and Modeling	Limited	Yes	High	Optimal EMS/Fire Station location and drive time analysis can be conducted with GIS. Due to the high need, Microsoft Streets and Trips was deployed to demonstrate call location.
Training/Education	No	Yes	High	This component is considered a high priority for use of GIS within Fire and EMS. Introductory training is needed at the browser user level for all staff.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Departmental Return on Investment (ROI)

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

Return on Investment Opportunity Emergency Services Department	
Opportunity	**Explanation**
Increase <u>Productivity</u>	*Intranet GIS Data Browser and Spatial Analysis:* • Locate areas of high fire danger to concentrate fire prevention efforts in those areas of the city • Locate areas of high EMS calls by time of day to optimize response. • Flag facilities with offload delays
Save <u>Money</u>	*Intranet GIS Data Browser and Spatial Analysis:* • Prevention of fires would lead to savings in insurance cost • After identifying areas of high fire dangers, concentrated efforts would make more efficient uses of limited resources • Optimization of response time will compliance to time response standards • Optimization of response time will result in less loss of property Save fuel and vehicle wear Save money for consulting work for station allocation
Improved <u>Efficiency</u>	*Intranet GIS Data Browser and Spatial Analysis:* • Plan for new paramedic ambulance or fire stations • Locate Ambulance Service or Fire Demand Zones *Routing Software:* • Find direct routes to calls for service
<u>Save</u> Lives	*Mobile GIS Data Browser and AVL:* • Provides location of personnel and equipment at all times during a incidents

	Better 911 mapping, Mobile GIS Data Browser and AVL: • Promote scene safety for staff, flagging address, outbreak facilites • Staff will be able to arrive at an incident more quickly thus potentially saving lives. *Digital Availability of Pre-plans:* • In the event of an emergency incident, proper staff will be able to immediately pull up vital data like exit points, fire extinguishers, and digital building schematics, which can prevent life threatening isolation and endangerment of personnel. *Optimal placement of fire and EMS stations:* • Using GIS technology to locate or locate stations decreases response times to incidents by placing stations in a more distributed fashion, as they relate to calls for service *Hazardous materials location layer:* • Having known locations of hazardous materials provides valuable information to personnel during a fire incident

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Engineering Services

Engineering Services

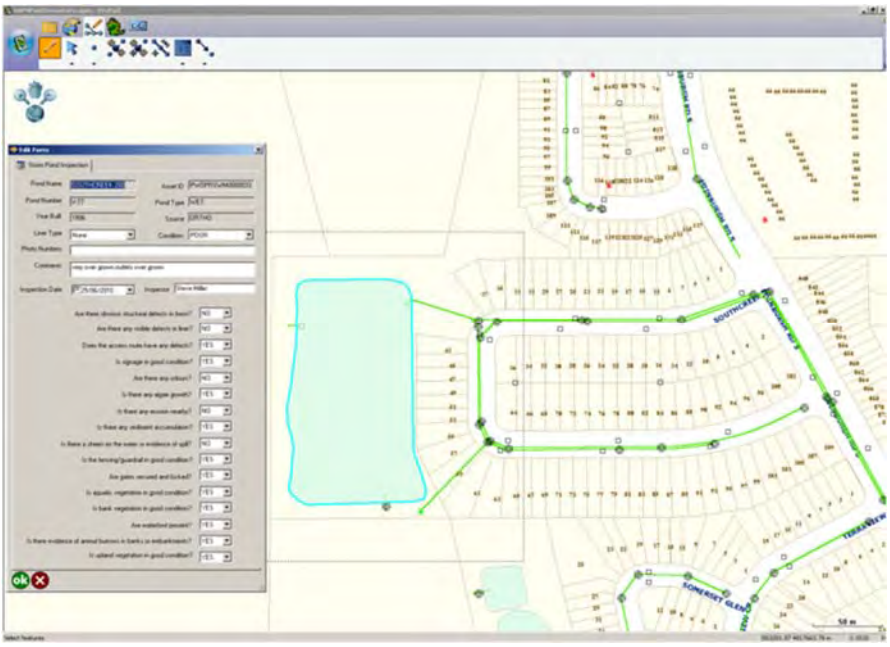
Section Outline

Existing Conditions

Department Overview

The Engineering Services Department works with City departments and the community to ensure that Guelph is a well-designed, safe, appealing, and sustainable city. The department plans, designs, builds and maintains Guelph's roads, storm sewers, water mains, sanitary sewers, and sidewalks. The department also provides engineering expertise when building new City facilities, and reviewing development plans. Additionally, Engineering Services leads Guelph's transportation planning and programs designed to reduce energy consumption and greenhouse gas emissions as part of the Community Energy Initiative.

Governance of GIS



Storm Pond Inventory

The complexity and cost of managing the vast amounts of infrastructure (i.e. public roads, bridges, sidewalks, water, sewer, stormwater), which the City of Guelph manages, has greatly increased demand for geographic information systems (GIS) and global positioning system (GPS) technology. Engineering Services staff understands that it is essential to have an up-to-date and accurate digital representation of infrastructure. Engineering Services is an advanced user of GIS and other geospatial technologies. The department has a full-time GIS Data Technician who is responsible for maintaining key data layers for the organization. Among other layers, the GIS Data Technician maintains the GIS data for the water distribution network, sanitary sewer network, storm sewer network, and sidewalks. This work is critical to the overall success of GIS at the City. Other departments (Water and Public Works) provide information to Engineering as changes are made in the field. This information is then used to update the GIS to reflect field conditions.

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, and complex querying and data modeling. A Tier 3 - Browser GIS user requires only general browsing GIS data functions to create reports, query standard data sets, view data, and produce maps.

ArcGIS Standard (ArcEditor) is utilized extensively by the GIS Data Technician to maintain infrastructure data. Two copies of ArcGIS Basic (ArcView) are available to staff to view and manipulate data and to conduct GIS analysis. An intranet GIS data browser, OnPoint, is available to all Engineering Services staff. However, the application is found to be lacking in regards to functionality, speed, and data. The following table documents the current usage of GIS by Engineering Services.

Current GIS Staffing				
Type		Number of Users	GIS Usage	Primary Tools
	GIS Flagship (Tier 1)	2	High	ArcEditor for maintaining GIS data layers.
	GIS Analytical (Tier 2)	2	High	ArcView for analysis and decision making
	GIS Browser (Tier 3)	20	Low	OnPoint – not used extensively because of lack of usability

Hardware and Software

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

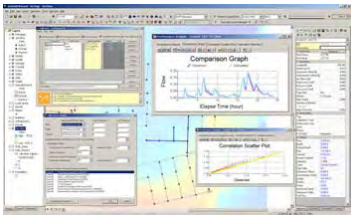
Hardware Issues Summary	
Type	**Notes**
Personal Computers	All Office Staff have PCs.
Laptops	For supervisory staff. Two available
Plotters	Color HP Designjet T2300 and OCE Black and White
GPS	Surveyors will rent them if needed
PDA/MDTs	None
Scanners	Available for use

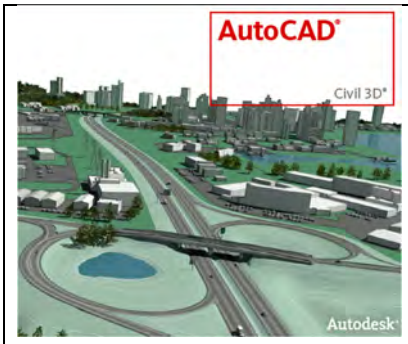
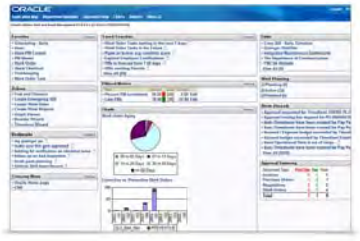
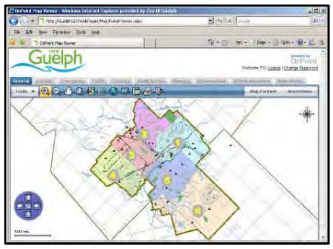
Engineering Services utilizes the following software applications:

1. ArcGIS – Data Creation and Analysis – 2 licenses of Basic and 2 licenses of Standard
2. MS Office Suite – Office productivity (including MS Access and MS Project)
3. PCSWMM – large scale stormwater modeling
4. InfoSWMM - hydrologic and hydraulic, and wastewater modeling
5. Miduss Civil – site specific stormwater modeling
6. Transcad – transportation planning (will be changing to Visum later this year)
7. Synchro Trafficware – traffic modeling and management
8. Engineered Management Systems – bridge inspections
9. TES – traffic management and accident tracking (including bike collision data) – future use for Engineering
10. AutoCAD Civil 3D - design
11. Cartegraph – pavement management

12. AMANDA – site planning and source water protection
13. KISS – document management
14. Oracle WAM – work order management
15. SAWS – database of sewer asset CCTV condition reports
16. CAPS – sewer and water main priority system
17. OnPoint – for quick viewing of property data, not used often

The following includes additional detail on some of these products:

 **ArcGIS**	**ArcGIS** → Two copies of ArcGIS Standard and two copies of ArcGIS Basic are used for mapping and analysis. ArcGIS is used by staff to create and maintain GIS data. ArcGIS Standard (ArcEditor) is used extensively to maintain the infrastructure layers. Also, the tools are used for high-end map creation and analysis. There is a desire for an additional copy of ArcGIS Basic (ArcView).
 **InfoSWMM**	**PCSWMM** → PCSWMM is utilized for stormwater, and watershed modeling. PCSWMM has a GIS engine that works with various GIS data formats including Esri **InfoSWMM** → InfoSWMM from Innovyze is integrated with ArcGIS (requiring a copy of ArcGIS for use). The software is being used for hydrologic, hydraulic, and wasterwater simulation modeling, and can be used for water quality simulation modeling.
 **TransCAD**	**TransCAD, Synchro Trafficware, and TES** → Engineering uses multiple software products for transportation analysis and modeling. TransCAD is a GIS software package designed for managing and modeling transportation data. It uses a non-Esri GIS engine but can import and export to Esri. Trafficware provides a central management system for managing traffic control devices and software for simulating and optimizing traffic. No GIS data is being imported into Trafficware and it is used for small geographic areas. TES is used for tracking and analyzing traffic and turning movements, and accidents.

	**AutoCAD Civil 3D. Miduss Civil, and Engineered Management Systems** → AutoCAD Civil 3D in a civil engineering design and documentation package. AutoCAD data can be exported for use in GIS. Miduss Civil is used by staff for site specific stormwater management requirements. Engineered Management Systems is utilized for bridge management and inspection tracking.
 **Cartegraph**	**Cartegraph** → Engineering uses Cartegraph for pavement management. Cartegraph's pavement module allows for management of inspections, maintenance, and repairs. Staff is experiencing some challenges with linking the pavement data to the GIS streets layer. A pavement assessment is done every four years. A third party contractor conducts the survey.
AMANDA Back Office Suite CSDC **Amanda**	**AMANDA** → AMANDA is a web-based product used for licensing, permitting, planning, and compliance. Engineering mainly utilizes Amanda to discern property related information and for tracking cases. However, they do contribute data to the AMANDA database in regards to site planning and source water protection.
 **Oracle WAM**	**Oracle WAM** → Oracle Utilities Work and Asset Management (WAM) tracks assets, manages lifecycles, tracks work orders and maintenance requests, and manages the financial components of work order management. WAM is a very pervasive system, requiring full commitment from an organization to leverage all of its functions. Data within WAM should be managed via GIS. There is no working link to GIS. Data entered by the Water Department in regards to work orders is being rekeyed into GIS.
 **OnPoint Intranet GIS**	**OnPoint** → OnPoint from Rolta is utilized as an enterprise-wide GIS intranet solution. The software allows users to access pertinent GIS data via a web browser. Engineering Services has access to the software but uses it very sporadically. They feel the software is not meeting their needs, is too slow, and lacks critical data and functions.

GIS Needs Assessment

GIS Needs Analysis

GIS is recognized by the Engineering Department as a tool that can provide critical insight into existing business processes as well as to provide efficiency in operations. Engineering will be able to utilize GIS in day-to-day tasks, such as analysis of wastewater, stormwater, and stormwater operations, review of site information, infrastructure query and analysis, and work order management. In addition, the department will also be able to utilize GIS for strategic objectives and use sophisticated analyses to improve decision-making.

Engineering departments throughout the country have implemented GIS in varying capacities, and Engineering Services is well positioned to implement GIS more fully and effectively. Keys to a comprehensive GIS effort will be the implementation of mapping and spatial analysis applications throughout the various divisions of Engineering, 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 the following needs assessments.

Based on staff interviews, Engineering 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 can fulfill more than one GIS need, like an Intranet GIS Data Browser application. The table below summarizes these needs and how they are to be met:

GIS Need	*Method/Application to Meet Need*
Data Layer Design, Creation and Completion	ArcGIS
Department-wide Access to GIS Data	Intranet GIS Data Browser
Use GIS to Track Projects	ArcGIS Intranet GIS Data Browser
GIS for a Stormwater Utility	ArcGIS
GIS Based Work Order System	ArcGIS WAM or other GIS based work order system
Digital Data Submissions and Standards	Standards Document and Ordinance
Access to Spatially Enabled As- Built, CAD Drawings, and Videos - Linking Digital Documents to GIS	Desktop GIS, Intranet GIS Browser
Field Access to Geospatial Data	ArcGIS Online and Tablets

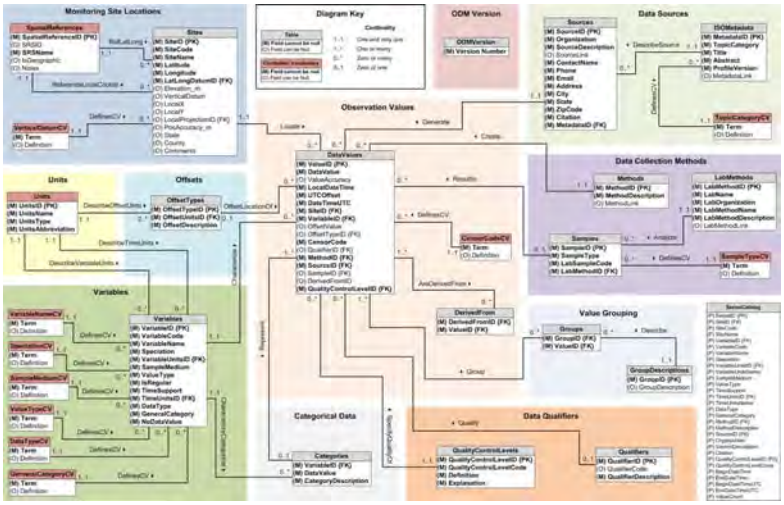
GIS Need	*Method/Application to Meet Need*
☑ Public Access Pertinent Data and Service Requests	▭ Internet GIS Portal
☑ GIS Training for Department Staff	▭ ArcGIS Training ▭ Third Party Application Training

☑ GIS Need

Data Layer Design, Creation, and Completion

Mapping and spatial analysis are key tasks that can enable Engineering Services to improve management, operations, administration, and maintenance of the City's Engineering Services efforts. Staff can realize significant gains in both time and efficiency by using GIS.

The most expensive, yet important aspect of the Engineering Services GIS initiative is the creation of complete and accurate asset inventory data sets. Engineering Services has already created a large volume of GIS data. Some of the existing data layers reside within a framework called a geodatabase model. Esri has established a set of best practices geodatabase design models. These models are designed to house data in a logical fashion and to regulate data fields and values. In ArcGIS, a set of database design specifications for objects in a GIS application. A data model describes the thematic layers used in the application (for example, water system, roads, and bridges); their spatial representation (for example, point, line, or polygon); their attributes; their integrity rules and relationships (for example, pipes must be connected with a transition fitting); their cartographic portrayal; and their metadata requirements. Creating and maintaining these layers is a critical component for success. Geodatabase models should be in place for all systems maintained by Engineering to include: water, stormwater, and sanitary sewer. If not already in place, standard Esri database design models should be utilized and augmented to fit the unique needs of Guelph. This database design process allows all stakeholders to understand the models, comment on the need for specific elements, and/or the alteration of others. A well-designed database will ensure that data integrity is maintained. Other data layers should reside in a geodatabase model. Risk Management expressed the need to have their data reside in a geodatabase



Sample database design flow chart

model. Their model would include elements of concern for them to include vulnerability score anda variety of mapping layers associated with the Source Protection Program..

Additionally, Guelph should consider having their data adhere to Esri's Local Government Information Model and Esri's new ArcGIS for Local Government platform. ArcGIS for Local Government is based on a harmonized information model of GIS datasets, web services, and maps. The harmonized information model is referred to as the Local Government Information Model and connects silos of information in an organization and integrates processes across typical government departments.

The information model includes a series of essential foundation layers and operational information that support a range of key maps and apps within a local government. Its design reflects specific application requirements and the cartographic design elements necessary to produce the following:

- Local Government base maps
- Infrastructure maps and apps
- Land Records maps and apps
- Elections maps and apps
- Public Safety maps and apps
- Planning and Development maps and apps
- Facilities and Campus maps and apps
- Address maps and apps
- Public Works maps and apps

The information model can be configured to support specific business needs, by selecting and implementing specific themes that are part of the integrated information model or by adding fields, and modifying field and layer aliases to reflect terms more widely used by Guelph.

As mentioned, much data has been created by Engineering. Some of those layers are complete, others incomplete, and yet others non-existent. The following is not a comprehensive list of all the GIS data created, refined, needed and/or used by Engineering Services, but the key layers discussed during the needs assessment.

- AMANDA – key information entered into the AMANDA system as it is entered to include site plan information and source water protection information

- KISS – some of the data residing in the KISS document management system has been geo-enabled. Other key images have not.
- Environmental Assessments – need a layer showing where assessments have been completed and provide a link to all pertinent documents
- Flow data – currently in a spreadsheet for storm and sanitary sewer systems. Would like this as a GIS layer.
- Certificates of approvals – data from the Ministry of Environment
- Stormwater Management – need key features created and data currently tracked in Microsoft Access geo-enabled.
- Source Water Protection threats database– Clean Water Act database needs to be linked to GIS
- Collision data – being manually entered into GIS now. Should become a layer linked to a collision database that is automatically geo-enabled
- Bike lanes – existing GIS layer
- Street centerlines – existing GIS layer
- Water distribution system – complete but spatially inaccurate
- Sanitary sewer – complete with some spatial inaccuracies
- Storm water – complete with some spatial inaccuracies
- Sidewalks – complete, digitized from aerial photography
- Easements – old layer not complete and out-of-date
- Risk management features – vulnerability scores, hazard ratings, contaminated sites, inspections
- Impervious surface – needed for future stormwater utility
- Water service backflows
- Water quality storm sections – have a layer now but want a link on maintenance activities
- Contours and digital elevation model – want ½ meter contours and then use ArcHydro for water modeling
- Other utilities
    - Union GAS
    - Guelph Hydro
    - Ontario Hydro
    - Bell
    - Rodgers
    - Trans Canada Pipelines

GIS Need

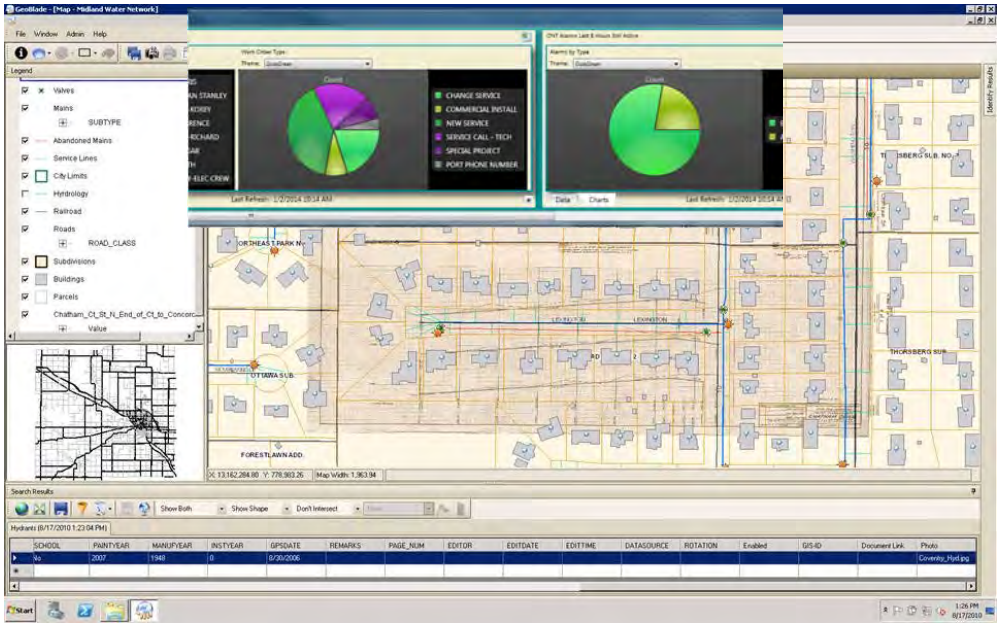
Department-wide Access to GIS Data

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 either for use solely within Engineering Services, 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
- Enhanced Text Placement
- Link to external Databases
- Easy-to-Use interface
- Advanced Graphic Design

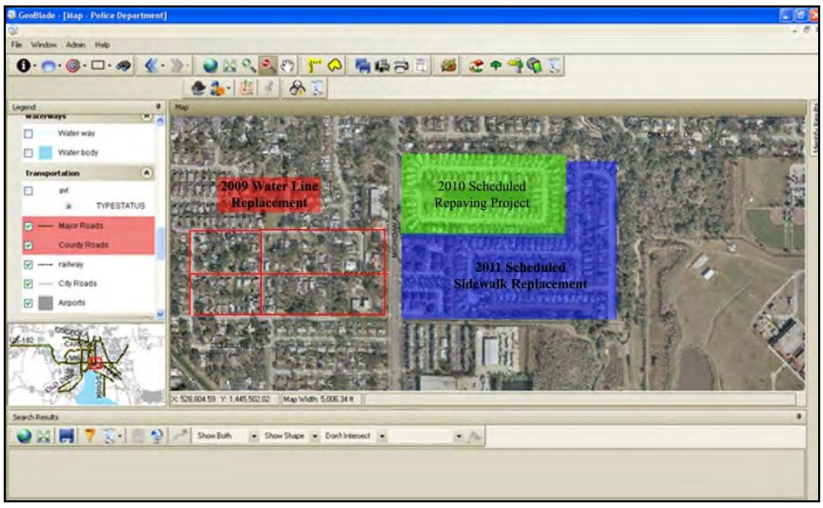
Engineering Services intranet site should be configured to present users with pertinent GIS data and custom defined queries for easy end-user interaction. Currently the city has deployed OnPoint for this purpose. However, the current deployment of OnPoint does not meet the needs of Engineering Services. However, the concept is still valid. The City should seek to deploy a next generation version of OnPoint or an intranet application from another vendor. This application should be deployed systematically throughout city departments. Each department should have a configuration that is tailored to their needs. Only data, reports, queries, map tips, and other features pertinent to Engineering should be made available to Engineering staff. The application must access the key data needed by staff and have fast response times. The new generation of these applications includes executive dashboard, heat maps, and many useful features.



Intranet GIS data Browser Viewing Wastewater Data with an As-Built Back Drop

GIS Need

Use GIS to Track Projects



Engineering Services coordinates, manages, and participates in a variety of capital public infrastructure projects. Staff needs to use GIS to find background information on a given project and produce supporting graphics. Currently, staff has to go to multiple sources to collect the information that they need. Additionally, there is no map layer that tracks historic capital projects, current capital projects (these are being tracked as of 2010 in a shapefile for each year indicating planned extents of project), and future capital projects. This can lead to inefficiencies and duplication of work. A GIS layer should be created to track all capital projects (exists as separate shapefiles for year 2010 to 2013, but is for planned extents of each project – if project scope changes later in year, the layer was not updated). 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, and to notify the public of work in an area. Additionally, this will ensure that capital projects are coordinated to optimize resources and reduce duplication.

GIS Need

GIS for a Stormwater Utility

Impervious Surface GIS Layer

Many local governments are establishing a stormwater utility. A stormwater utility is a utility established to generate a dedicated source of funding for stormwater pollution prevention activities where users pay a fee based on land-use and contribution of runoff to the stormwater system. Fees are typically established based on the impervious surface on a property. Some utilities give residential customers a flat fee called an equivalent resident unit (ERU).

Commercial properties are then given an ERU value based on their total impervious surface. This ERU value is then used to determine the billing rate for that property/customer. The most effective method of determining ERU's is through a GIS layer depicting impervious surfaces. Typically, GIS Technicians or photogrammetric firms use GIS tools to create this impervious surface layer based on what can be derived from aerial photography. If Guelph moves forward with their stormwater utility, GIS will need to be used to create and maintain an impervious surface layer. Also, customers will challenge many of the ERU calculations. Therefore, it is important that GIS can be used and/or maps can be printed to illustrate to the customer how their ERU rate was determined.

GIS Need

GIS Based Work Order System

The City of Guelph manages work orders via the WAM software suite. Work orders are being entered into WAM and distributed to the appropriate crews. However, the WAM system is not linked to GIS. 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.

The City of Guelph has invested in the development of bidirectional integration between Oracle's WAM and the GIS; however, this feature was not user friendly and has not been utilized. Furthermore, the original linkages between WAM and GIS have not been maintained. This makes linking WAM features to GIS features impossible without extensive data cleanup and data entry.

Maintaining accurate spatial data attributes and related data sources are a critical component of a successful GIS implementation. Guelph departments issue and process thousands of work orders throughout the course of a year. This process is now being done manually in most cases. Often infrastructure changes in the field are not reported back to the office resulting in map data that is erroneous. It is recommended that all work orders begin and end with the GIS. 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. 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.

An additional benefit of the GIS-based work order system is continual interpretation, analysis and improvement of mapped (GIS) data. If errors exist on the GIS maps, users can perform redlining or convey needed corrections to the existing data back to the GIS data managers. 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.

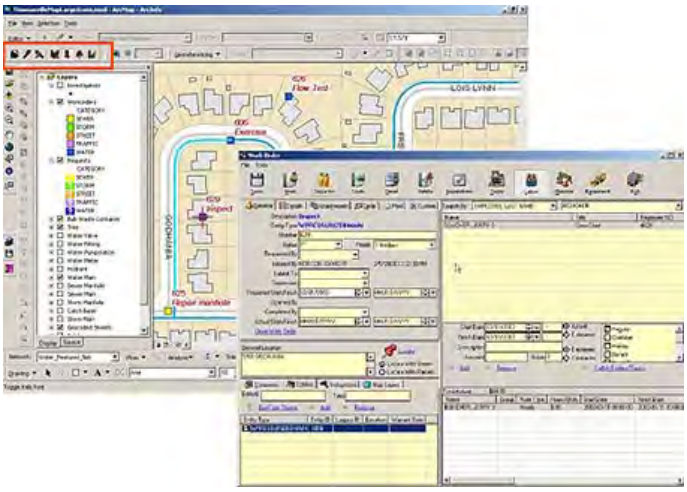
It is imperative that the personnel in charge of updating the GIS be advised of all infrastructure changes and additions through access to the work order system. There are several solution providers that support applications that meet this need. Each solution has various degrees of interaction between work orders, assets and GIS systems. It is important to note that most effective GIS centric work order software is one that stores data in an open database (OLEDB or ODBC compliant). This will allow use of various Tier 3 GIS applications that can access data directly from the work order system. The solution should allow users to quickly print out a map, and a work order form for crews to take into the field. It is critical that this application have the ability to track open work orders. Work orders that are not returned from the field will cause degradation in the GIS data. This must be avoided.

The following solutions should be considered by the City. The first option is to utilize Oracle's GIS link. However, the previous attempt by the city was not successful. The City should carefully consider why the first Oracle mapping link failed and how and if a re-implementation will work. Alternatively, the city should consider other GIS based work order management systems as follows:

1. Azteca Systems - Cityworks

Cityworks® is a GIS-centric Asset and Computerized Maintenance Management System (or CMMS) created specifically for Public Works and Utilities. Utilizing the data contained in the GeoDatabase, Cityworks works to manage the dispersed infrastructure with tools for creating and tracking maintenance activities associated to assets and/or addresses. These include handling requests for service, conflict resolution, work orders, tests and inspections, ad-hoc search and reporting and much more.

With the integration of ESRI's technology, Cityworks is compatible with ArcGIS®. CityworksFM, whose underlying infrastructure data, models are based on industry standards. Off-the-shelf GeoDatabase models are available for Water, Wastewater, Stormwater, Streets, Traffic, Signs, Trees, Parks and Recreation facilities and many others.



Cityworks is built on open standards and with industry standard technology allowing for

access to data in an open architecture that is easy to integrate with your existing business systems. With support for industry leading relational databases like Microsoft SQL Server and Oracle, Cityworks is fully compatible with Microsoft Office.

2 - Lucity

Lucity (formerly GBA Master Series) focuses on the asset and maintenance management needs of an organization. The software synchronizes with GIS to allow for a work order solution based on geography. Lucity highlights the following as main functions of their solution:

- Seamlessly integrate maintenance management, asset inventory and inspection, and GIS compatibility.
- Quickly locate any specific piece of information, from a service request to a current asset inventory.
- Efficiently input the large amount of information your agency generates, through mobile tools or at your desk.
- Generate a work order with one click, and monitor the process from initiation to completion.

- Create standard or custom reports that let you view and communicate big-picture trends, easing the decision-making process.
- Collaborate with our innovative team members to ensure our software works to achieve your distinctive objectives.

3 – Cartegraph

Cartegraph bills itself as a cloud-based Operations Management System capable of communicating with and integrating enterprise systems (e.g. ArcGIS) to provide complete management of all things asset related. Guelph already uses Cartegraph for pavement management. However, staff has stated that the application does not meet their needs. Following are the primary capabilities of the Cartegraph solution:

- Works on any device (desktop, tablet, smart phone)
- Built with latest HTML 5 technology
- Provides very efficient workflows based on best practices
- Based in the cloud – on-premise, hybrid, or hands free
- Base map can be Esri or Google
- Full integration with Esri GIS
- Full integration with any Open 311 system
- User friendly and easy to use

Guelph should aggressively pursue a GIS based work order system. The City has invested much in the Oracle WAM system. Oracle WAM ties to city financials and is not likely to be replaced. However, the City should still pursue a GIS based work management system and attempt to link data to Oracle WAM where practicable. Some duplication data entry may be required, but work orders and assets will be tracked much more effectively. The City should spend time evaluating each solution in an effort to select the best solution for Guelph's needs.

GIS Need

Digital Data Submission and Standards

Based on the Guelph's utilization of outside consultants for various projects, as well as the receipt and review of construction plans from private parties, such as developers, it is recommended that the city establish a set of standards for all CAD data submitted.

An initial recommendation is for Engineering to require that all construction plans be provided in digital format as CAD drawings (this already exists, but has not / is not strongly enforced). In doing so, the department will be able to establish a consistent means for review. In addition, staff will be able to archive this digital data and link it to specific points for visualization in GIS applications.

In the short term, it is recommended that Engineering establish a preliminary set of CAD standards to which all submitted CAD drawings must conform. It is recommended that in the long term the Department work to implement the Federal Geo-Spatial Data Committee (FGDC) Geospatial Positioning Accuracy Standards, Part 4: Architecture, Engineering, Construction, and Facilities Management (FGDC-STD-007.4-2002); this standard is generally known as Part 4 of the FGDC's Geospatial Positioning Accuracy Standards. Alternatively, the city can model their CAD standards after the City of Kitchener. Their standards document can be found at the following URL:
http://www.kitchener.ca/en/businessinkitchener/resources/COK_DTS_EngineeringCADStandards.pdf

Part 4 provides accuracy standards for engineering drawings, maps, and surveys used to support planning, design, construction, operation, maintenance, and management of facilities, installations, structures, transportation systems, and related projects. It is intended to support geospatial mapping data used in various engineering documents, such as architectural, engineering, and construction (A/E/C) drawings, site plans, regional master planning maps, and related GIS), Computer-Aided Drafting and Design (CADD), and Automated Mapping/Facility Management (AM/FM) products. These products are typically created from terrestrial, satellite, acoustic, or aerial mapping techniques that output planimetric, topographic, hydrographic, or feature attribute data.

The Part 4 standard defines accuracy criteria; accuracy testing methodology, and accuracy reporting criteria for object features depicted on A/E/C spatial data products and related control surveys. It references established voluntary standards that may be used for some smaller-scale A/E/C mapping applications. In addition, the standard contains general guidance for specifying accuracy criteria for selected types of A/E/C features or control surveys. Using the standards and guidance contained in this section, end users of A/E/C products can specify surveying and mapping accuracy requirements needed for their projects or specific CADD/GIS layers, levels, or entities. From these specifications, data producers (e.g., surveyors, engineering firms, consultants) can determine the instrumentation, procedures, and quality control processes required to obtain and verify the defined accuracies.

By implementing a common standard, the City will be able to maintain consistent documentation of construction designs/plans provided by external entities. This will facilitate the review and assessment process, and ensure that staff can interpret data consistently. Most developers are already utilizing CAD technology and will be able to adhere to a well-written policy with little extra burden and cost.

GIS Need

Access to Spatially Enabled As-Builts, CAD Drawings, and Videos - 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 Engineering 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 along with computer screens.

The process of establishing GIS to document links has four general phases:

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.)

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.

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.

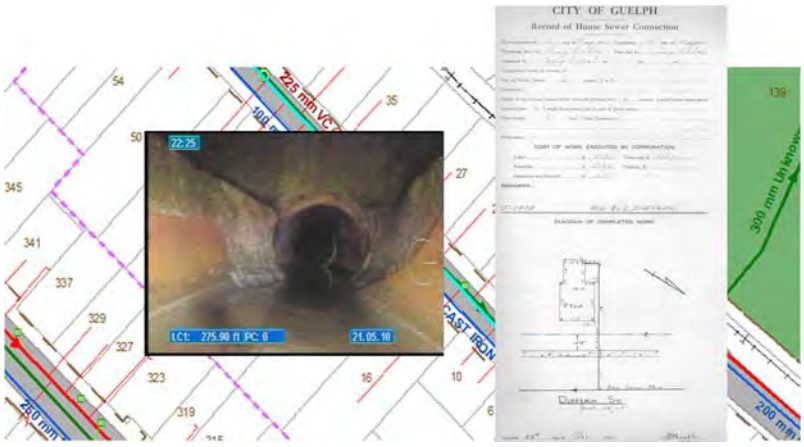
Process Documenting and Metadata

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. Engineering will realize more efficient retrieval of spatially related documents, permanent document storage and easier dissemination of the data held within these linked documents.

There are a host of possible documents that could be linked to GIS to include:

- Detail drawings and inspection reports
- Sewer videos
- As-Builts



1-205 **CCTV and KISS data linked to GIS**

- Subdivision drawings
- Certificates of approval

The City has already experienced success in this area. Some data stored in the KISS system has been geo-enabled and linked. Additionally, sewer videos have been linked to the GIS.

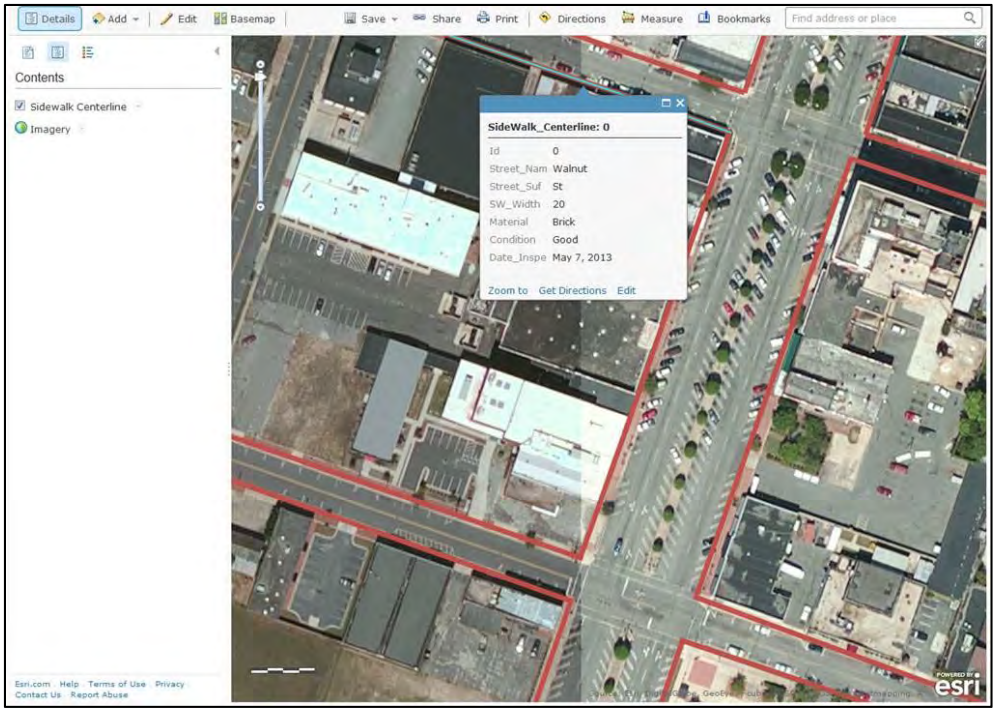
GIS Need

Field Access, Work Order Management, and Data Updates

Providing personnel with access to maps and GIS data while working in the field is an important part of maintaining an enterprise GIS, specifically when maintaining and collecting Engineering related data. Through the use of hardware, software, and data that are designed to be interrogated and manipulated away from the office, engineering staff can realize benefits of GIS while away from their office desk. Implementing mobile computers, input devices, software, and GIS data into the GIS enterprise will give Engineering the tools to perform field data collection, site visits, routing capabilities, and interactive geographic data query and analysis.

The City manages work orders for all of the utility systems. Some work orders are being entered into GIS and the WAM systems and distributed to the appropriate staff. However, not all of the changes that are being done in the field are being noted and returned to GIS staff. Over time, this degrades the accuracy of the GIS data. It must become mandatory that all work orders note work done in the field and that a work order cannot be officially closed until it has been reviewed and the appropriate data entered by the GIS staff.

Additionally, field surveys such as the ones conducted for sidewalk inspections and risk management tasks should have a GIS component. Field crews should use an ArcGIS Online application to view data of interest. The field crew doing the visual inspection should edit attributes. Additionally, photographs can be easily integrated into the field inspections.

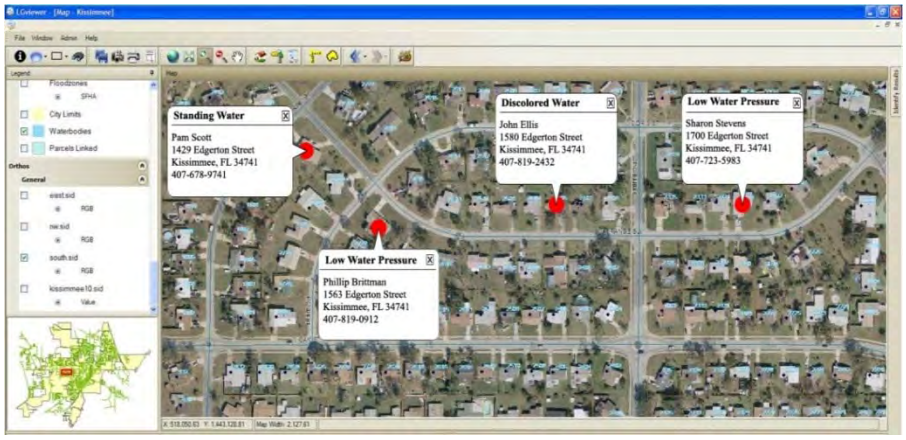


ArcGIS Online for Maintaining Sidewalk Attribution in the Field

GIS Need

Public Access to Pertinent Data and Service Requests

Many City departments including Engineering would benefit from a web-based GIS application designed for tracking citizen inquiries, complaints, concerns, and other general feedback. Such an application would enhance communication with the public, and allow the City to quickly and effectively respond to requests. From the citizen's perspective, one call to any municipal staff member should result in an inquiry or complaint being logged into the system, routed to the correct department or point of contact, action taken by municipal employees, and follow up to the initial inquiry in an effective and timely manner. Inquiries or complaints should also be logged and tracked via the Internet or in person.



By implementing such an application, the public no longer has to be transferred from one department to another on the phone or in

person. Routing of inquiries and complaints would be done internally through email notification and is,therefore, transparent to the citizen. City staff can then proactively track, manage, analyze, map and report inquiries and complaints, actions taken, final results, and citizen satisfaction.

A complaint tracking system should include:

- Web/Phone-in/Walk-In Submittal of Inquiries
- Multiple Search (Query) Capabilities
- Internal Email Server
- Levels of End-User Security
- Assignment of Employees/Departments to Specific Inquiry Types
- Ability to Sub-classify Inquiry Types for Internal Department Use/Reporting
- Automated Email Notification of New Inquiry to a Designated Employee and Response to Person Submitting
- Logging of Actions Taken Toward a Solution
- Map and Summary Report Generation

Additionally, Engineering Services would like to share bike lane information via a GIS application. Also, staff spends many hours every week providing data to consultants and engineering firms. Much time could be saved if plans and profiles were shared on-line.

GIS Need

Formal GIS Training for Engineering Services Staff

Staff that will be performing more advanced GIS analysis and mapping should participate in foundational GIS skills training. Engineering Services staff should participate in any enterprise-wide ArcGIS training that is made available. Through the use of Esri certified instructors, local colleges, internal staff, and web classes, the City can provide GIS instruction and training for its user community by providing onsite training. Various divisions expressed their desire to utilize GIS more extensively. Training should be provided on utilizing GIS for analysis and data maintenance. Tier three training should be provided on tools as they are made available and throughout the year.

GIS Gap Analysis

GIS Data Layer Inventory

Engineering Services will benefit from access to a variety of GIS layers. It is expected that once all departmental data is integrated, consolidated, and centrally stored that the staff will have access to all non-classified GIS data layers from other municipal departments. The following is a list of desired layers for Engineering Services:

Legend

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

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Engineering Services GIS Data			
AMANDA Data	Geo-enabled from existing database	GIS Division in IT	Partial
Bike Lanes	Digitized on Screen	Engineering	Existing
Certificates of Approval	Acquired from the Ministry	Ministry of Environment	Recommended

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Collisions	Being manually entered into GIS now, should be geo-enabled through a database by address	Engineering	Recommended
Easement	Digitized on Screen	Engineering	Partial
Environmental Assessments	Digitized on screen and linked to pertinent database data	Engineering	Recommended
Flow Data – storm and sewer	Spreadsheet data converted to their GIS location	Engineering	Recommended
Impervious Surfaces	Digitized on screen	Engineering	Recommended
KISS Data	Geo-enabled from existing database	GIS Division in IT	Partial
City-owned Property	Extract from Tax Parcels and Aerials	GIS Division in IT	Existing
Projects	Digitized on Screen	Varies	Partial
Risk Management Features	Collected in the field and traced in databases	Engineering	Recommended
Sidewalks	Digitized on Screen	Engineering	Existing
Stormwater Management	Geo-enablement of data stored in Microsoft Access database	Engineering	Recommended
THREATS	Geo-enabled from existing database	GIS Division in IT	Recommended
Water, Sanitary Sewer, and Stormwater Systems	Digitized on-screen and converted from CAD drawings and paper maps	Engineering	Existing but needs spatial improvement
Water Service Backflows	Digitized on-screen of GPS Field collection	Engineering	Recommended
Utilities – External	Other Utilities – Union GAS, Guelph Hydro, Ontario Hydro, Bell, Rodgers, others	Other Utilities	Recommended
Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the	The GIS Team in IT maintains the property data. New property surveys are incorporated as they are received. If staff in other departments sees errors they have been asked to report them to the GIS Team in IT.	Existing

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
	internal line work using the rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base, as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006, the City acquired rectified digital orthoimagery, which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.		
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off, flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance have occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing
Landmarks	Digitized – have started to develop a commonplace layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhood	Heads up Digitizing Screen. Subdivisions are available by 61-M plan (Subdivision) layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layers also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000	GIS Team in IT	Existing

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
	series.		
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	The GIS Team in IT creates and maintains addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building footprints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by the City to create an updated building layer.	GIS Team in IT	Existing
Contours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 (2009 was never delivered) and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; Changes are updated with Orhtophoto refresh	Existing

GAP Analysis Chart

Engineering Services has a significant role in GIS for the City of Guelph 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 division. The matrix below details those relevant components that have been analyzed and assessed as part of the Gap Analysis.

Legend	
Existing	
Yes	GIS component currently exists within division.
No	GIS component does not currently exist within division.
Limited/Partial	GIS component exists to a lesser degree.
Desired	
Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to divisional needs.
Priority	

High	Takes precedent over other needs.
Medium	Secondarily important to divisional need.
Low	Can be met after higher needs are accomplished.

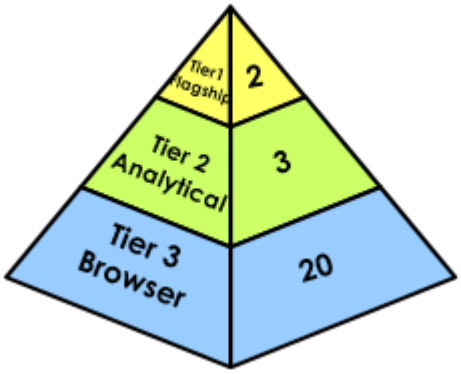
Component	Status		Priority	Notes
	Existing	Desired		
Automated Vehicle Tracking (AVL)	No	No	Low	AVL is not needed for Engineering Services.
Documentation	Yes	Yes	Medium	Some documentation on GIS data creation and workflow exists in Engineering Services; however, there is a greater need for creation and standardization for documentation citywide. The GIS Division in IT will identify enterprise GIS documentation processes and procedures.
Enterprise Systems Integration	Yes	Yes	High	Integration of data within an enterprise system is a must. Engineering Services utilizes many database and IT systems. Integrating GIS data with these systems is critical of Engineering Services' operations.
Geocoding	Limited	Yes	High	Engineering Services has many databases tracking key data. Some of these are address based and should be geo-coded for consumption in GIS.
GIS Data Access	Yes	Yes	High	Current databases used within Engineering Services have data that could be beneficial citywide and Engineering Services would benefit from access to other departments data layers. GIS Data access is desired and should be addressed throughout the City.
GIS Data Maintenance	Yes	Yes	High	Engineering Services maintains a host of GIS layers. They are one of the most prolific GIS users at the city.
GIS Data Sharing	Yes	Yes	High	Some key datasets will need to be shared internally and with the public.

Component	Status		Priority	Notes
	Existing	Desired		
GIS Personnel	Yes	Yes	High	Multiple employees within Engineering Services currently perform GIS work maintaining and analyzing data. This staff is important for the maintenance of the GIS data maintained by Engineering Services.
Hardware	Yes	Yes	High	Current hardware is adequate for GIS use. Tablets may be needed for field access.
Mapping	Yes	Yes	High	Engineering Services is capable of creating their own map products. They will continue to need to create maps for use internally and in the field.
Metadata	Limited	Yes	High	A formal, standardized metadata system needs to be developed and implemented for all GIS data layers authored within the City of Guelph. The GIS Division in IT would decide upon standards.
Mobile Computing Resources	No	Yes	High	Currently staff is not using GIS in the field. However, field inspectors and other risk management staff would benefit from mobile GIS.
Network	Yes	Yes	High	High availability of data via the internal network is mission critical
Routing	No	Yes	Medium	Bicycle routing as they relate to bike lanes is important for the citizens.
Software	Yes	Yes	High	Engineering Services utilizes Esri software for a variety of tasks and will continue to do so.
Spatial Analysis and Modeling	Yes	Yes	High	Engineering Services has the need to do conduct analysis on the water, sewer, stormwater, and transportation systems.

Component	Status		Priority	Notes
	Existing	Desired		
Training/Education	Yes	Yes	High	This component is considered a high priority for growth of GIS within Engineering Services. The Tier 1 and 2 GIS users will need additional advanced training. Tier 3 users will need ongoing training.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Departmental Return on Investment (ROI)

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

Return on Investment Opportunity Engineering Services	
Opportunity	**Explanation**
Increase Productivity and Effective Management of Assets and Resources	Intranet GIS Data Browser and Spatial Analysis: • Optimize work order processing and data capture • Locate underground infrastructure in the field • Target areas to perform work and services. • Become more responsive to citizen requests
Save Time	Intranet and Mobile GIS Data Browsers and Spatial Analysis: • All review of planning applications should have data readily available savings 100s of hours per year • Field access to data will reduce trips to the office for data saving hours per year • Capital Projects using GIS to find background data instead of going to multiple sources – saving hours per year
Comply with Provincial Mandates	Mapping and Spatial Analysis of Department Data: • Ontario Storm Water regulations • Clean Water Act and related Regulations
Improved Efficiency	Intranet and Mobile GIS Data Browsers and Spatial Analysis: • Quicker location of infrastructure • Access to bridge information with detailed drawings for more efficient inspections • Track all road closures

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Finance

Finance

Section Outline

Existing Conditions

 Department Overview

 Governance of GIS

 Hardware and Software

GIS Needs Assessment

 GIS Needs

GIS Gap Analysis

 GIS Data Layer Inventory

 GAP Analysis Chart

 **Multi-Tier GIS Application Use**

 **Return on Investment (ROI)**

Existing Conditions

 Department Overview

The City of Guelph Finance Department strives to ensure financial accountability and transparency in the organization with the goal of making Guelph economically viable and resilient. Main functions of the department include: financial planning, procurement and risk management, reporting and accounting, and taxation. Finance has the following functional areas and associated functions:

- **Financial Planning**
  - Provide long -range financial plans and strategic advice to City Council
  - Support budget preparation and analysis for all City departments
  - Monitor expenses and revenues in compliance with governing policies and legislation
  - Develop user-fee models and perform rate analysis
- **Procurement and Risk Management**
  - Purchase goods and services using open and transparent processes
  - Ensure fair competition and compliance with governing policies and legislation
  - Manage the City's insurance portfolio
- **Financial Reporting and Accounting**
  - Manage accounts payable and receivables
  - Prepare detailed cash flow analysis

- Report on investments and financing opportunities
- Prepare year-end financial statements and Guelph's Financial Information Return (FIR) in accordance with governing policies and legislation

- **Taxation**
  - Bill and collect taxes
  - Review assessment roll and maintain tax collectors roll according to governing policies bylaws and legislation
  - Prepare tax policies, review and establish payment options, process methods and set tax rates
  - Perform tax revenue analysis for City departments
  - Prepare tax certificates and remit education taxes to school boards

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

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

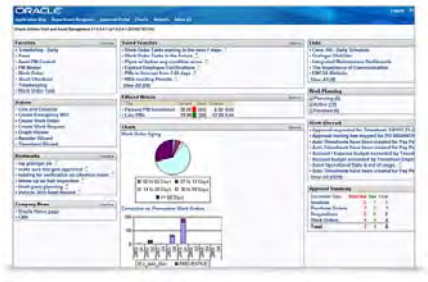
Hardware and Software

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

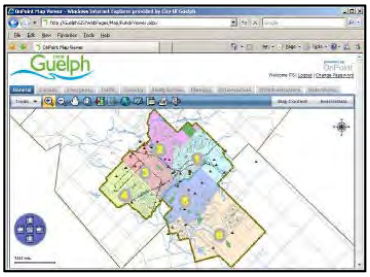
Microsoft Office is used to conduct office productivity tasks. JD Edwards software is used for financial and personnel management. Finance utilizes the following software applications:

1. Microsoft Office– Office productivity
2. JD Edwards – Financial and personnel management
3. Oracle WAM – Purchase orders and tracking of work orders that result in financial charges
4. FleetMatics – Automated Vehicle Location (AVL/GPS) for tracking snow removal vehicles
5. Amanda – case management reporting and accounting
6. OnPoint – GIS data viewing
7. RAC – accounting
8. CLASS – billing
9. Vailtech - taxation



Oracle WAM

Oraclc WAM → Oracle Utilities Work and Asset Management (WAM) tracks assets, manages lifecycles, tracks work orders and maintenance requests, and manages the financial components of work order management. WAM is a very pervasive system, requiring full commitment from an organizaiton to leverage all of its functions. Data within WAM should be managed via GIS.

 **FleetMatics - Vehicle Tracking**	**FleetMatics** → FleetMatics utilizes global positioning systems (GPS) to track vehicles. This automatic vehicle location (AVL) is deployed to track the location of snow removal vehicles.
AMANDA Back Office Suite CSDC **Amanda**	**AMANDA** → AMANDA is a web-based product used for licensing, permitting, planning, and compliance. Finance uses AMANDA for reporting and accounting of cases. AMANDA data is accessible through the OnPoint intranet GIS data browser.
 **OnPoint Intranet GIS**	**OnPoint** → OnPoint from Rolta is utilized as an enterprise-wide GIS intranet solution. The software allows users to access pertinent GIS data via a web browser. Finance uses the software for accessing property information; such as, zoning uses, property analysis, accessing related legal documents about a property.
VAILTECH INC. 	**Vailtech** → Vailtech offers a full suite of integrated financial applications for municipal government. Finance uses Vailtech for taxation. Vailtech data is accessible through the OnPoint Intranet application.

GIS Needs Assessment

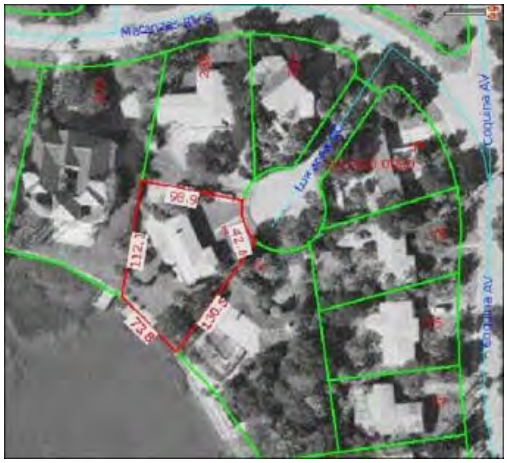
GIS Needs

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:

GIS Need	*Method/Application to Meet Need*
Mapping and Spatial Analysis of Property and Taxation Data	Intranet GIS Data Browser
Mapping of Tangible Capital Assets (TCA)	ArcGIS Intranet GIS Data Browser
Use GIS to Track Projects	Intranet GIS Data Browser
Formal GIS Training for Finance Staff	Finance Specific Training

GIS Need

Mapping and Spatial Analysis of Property and Taxation Data



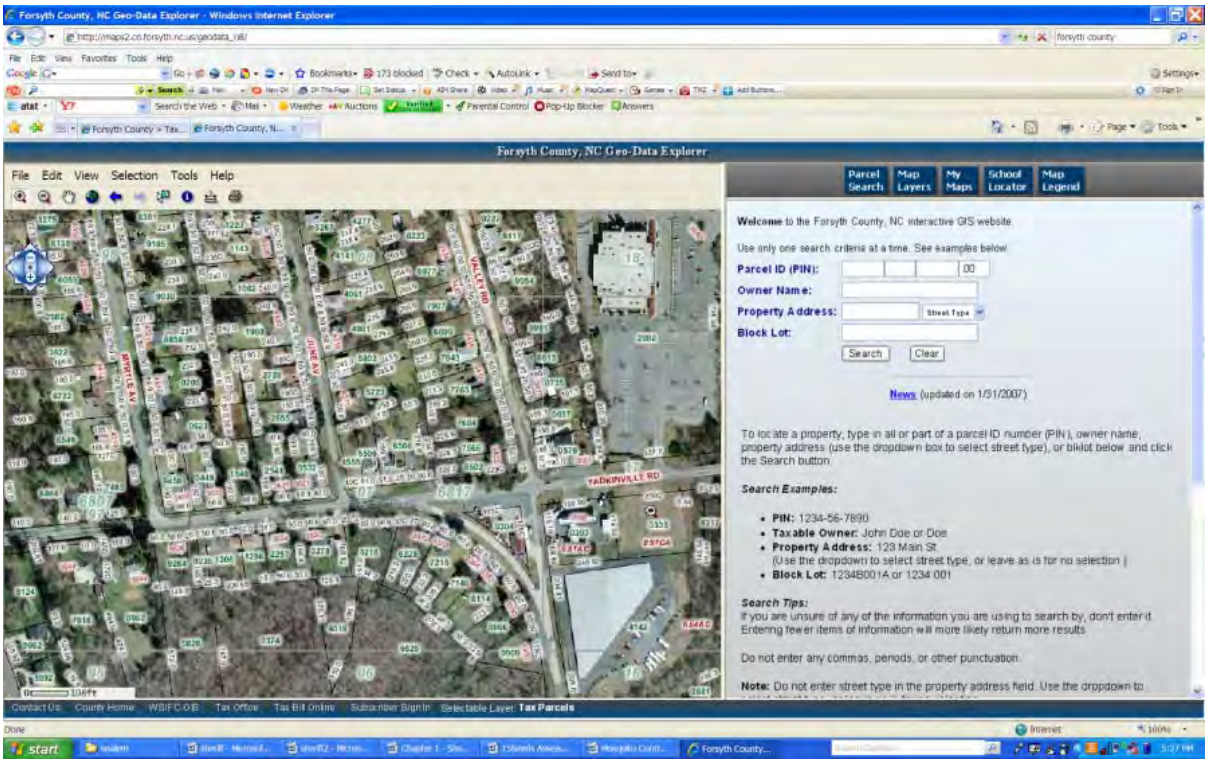
Finance obtains assessment data from the Province (MPAC). In general, the assessment data is received and multiplied by tax levies. This data is imported and managed within the Vailtech assessment software. A host of information exists for each property. The GIS Team in IT maintain an electronic tax parcel map. Each property on this map has a unique property number that corresponds with a unique property number in Vailtech. Vailtech data is tied to the GIS properties and available for querying. Further deployment of Finance specific functionality, within an intranet GIS viewer, should be undertaken. This would allow Finance staff to query and analyze property data, delinquent taxes, sales, and other key metrics. Because of Provincial/Federal law some of this information can only be accessed by authorized staff in Finance.

Also, data as following should be accessible:

- Property inventory such as water meters including size and other city accessories
- Property and accessories to City revenue and expenses such as water, wastewater and other City accessories

Additionally, the Risk Management group has specific GIS data viewing an analysis needs to include:

- Jurisdiction determination
- City tree or not
- Sidewalk inspection report status and reporting
- Citizen claim locations
- Scene investigations
- Viewing of maintenance and compliance records from WAM
- Work orders



User Friendly Access to Property Related Data

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

The Finance Department has expressed the need to access utility billing, business licensing, legal documents, citizen claims, wards, compliance release requests, and the status of payments through a geographic portal. Any data record with an address or property number can be spatially enabled – or geocoded – by linking the appropriate fields to the appropriate GIS layer – street centerline, tax parcel, or address point. 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.

The Finance Department should work with the GIS Team in 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, and Public Sector Accounting Board (PSAB) assets. 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.

GIS Need

Mapping of Tangible Capital Assets (TCA)

For many Finance Departments, auditing is a key issue and GIS can be of assistance. Beginning on January 1, 2009 finance offices were required to move to full accrual accounting (which includes tangible capital assets) as set forth by the Public Sector Accounting Board (PSAB). PSAB is comprised of senior government executives and experts in government financial reporting. Members include: deputy ministers, controllers general, legislative auditors, prominent public accountants with public sector experience, chief financial officers of local governments, analysts, such as bond rating agencies, and accounting professors. PSAB serves the public interest by setting standards and providing guidance for financial and other performance information reported by the public sector. The public sector includes the federal, provincial, territorial and local governments.

Municipalities in Ontario are affected through section 294.1 of the Municipal Act, 2001 & section 231 of the City of Toronto Act, 2006, which require municipalities to:

"… for each fiscal year, prepare annual financial statements for the municipality in accordance with generally accepted accounting principles for local governments as recommended, from time to time, by the Public Sector Accounting Board of the Canadian Institute of Chartered Accountants."

Changes in PSAB guidelines therefore affect municipal financial accounting and reporting requirements. PSAB introduces and approves various proposed amendments to the financial accounting and reporting guidelines, such as the accounting for and reporting of tangible capital assets.

In June 2006, PSAB approved PS 3150, which requires municipalities to report Tangible Capital Assets (TCA) on their Statement of Financial Position (i.e. balance sheet) effective January 1, 2009. It also requires a new format for municipal financial statements and requires that tangible capital assets be amortized on the Statement of Operations (i.e. income statement). All municipalities across Canada must comply – not just Ontario's municipalities.

As the existing capital asset base ages and population grows, increased demands for new capital assets will place further pressures on the ability of a local government to sustain those services. Information about the existing stock, the cost of its use and the needs for its replacement must be at the forefront of decision making. To be useful, that information must be complete, and reliable.

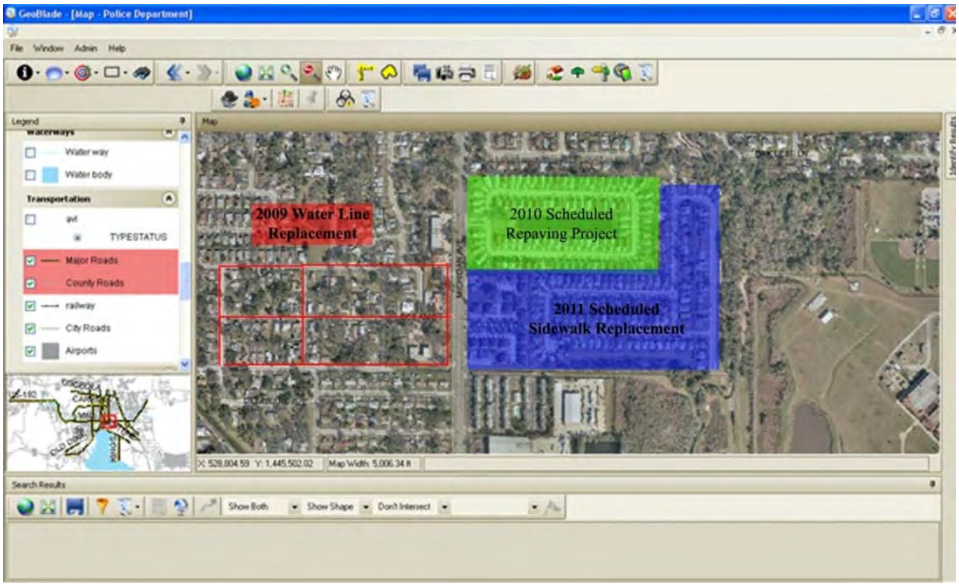
Guelph has complied with this new accounting standard. However, having all infrastructure in the GIS will assist each department with providing more detailed and accurate reports to Finance. Additionally, GIS will afford Finance a viable method of auditing this supplied data by allowing users to quickly query any asset based GIS layer and reviewing summary attributes about the entire system or part of the system.

In order to make these audits viable, several new data layers will need to be created by extracting information from several databases. The GIS Team in IT can assist in data creation and complex spatial analyses. Finance personnel will have access to this data through use of an Intranet GIS application.

GIS Need

Use GIS to Track Projects

The City manages and oversees a host of 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



Using GIS to Track Capital Projects

lead to inefficiencies and duplication of work.

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

GIS Need

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 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.

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. ***A full Master Data Layer list, with existing and recommend layers can be found in Appendix I of this Needs Assessment.***

Legend

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

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

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

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Finance GIS Data			
Capital Improvement Projects	Digitize from base map data; aggregate layers as needed	Various overseen by the GIS Team in IT	Recommended
City Owned Property	Extracted from Parcel Layer	GIS Team in IT	Existing
Citizen Claims	Geocoded from database	Automated	Recommended
City Trees	GPS	Parks	Partial
Delinquent Payments	Extracted from database and geocoded	Automated	Recommended
Income Tax Locations	Geocoded	Automated from data within Vailtech	Partial
Infrastructure Layers	Digitized and GPS	Water, Public Works, and Engineering	Partial
Business Licenses	Extracted from database and geocoded	Automated	Existing
Assessment Districts	Digitized on screen	GIS Team in IT	Recommended
Redevelopment Projects	Digitized on screen	GIS Team in IT	Recommended
Sidewalks	Digitized on screen and with GPS	Public Works	Partial
Sidewalk Inspections	Database that needs geocoded	Finance and Public Works	Recommended
Utility Billing Customers	Extracted from database and geocoded	Automated	Recommended
Work Orders	Extracted from database (WAM) and geocoded	Automated	Recommended
Zoning	Digitized on screen	Planning	Existing

Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006 the City acquired rectified digital orthoimagery which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.	The GIS Team in IT maintain the property data. New property surveys are incorporated as they are received. If staff in other departments see errors they have been asked to report them to the GIS Team in IT.	Existing
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance has occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing
Landmarks	Digitized – have started to develop a common place layer by merging information from various sources.	GIS Team in IT	Partial

Subdivisions/ Neighbourhoods	Heads up Digitizing Screen. Subdivisions is available by 61-M plan (Subdivision)layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	GIS Team in IT create and maintain addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building foot prints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by he City to create an updated building layer.	GIS Team in IT	Existing
Countours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; changes are updated with Orhtophoto refresh	Existing

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.

Legend	
Existing	
Yes	GIS component currently exists within department.
No	GIS component does not currently exist within department.
Limited/Partial	GIS component exists to a lesser degree.
Desired	
Yes	Deemed desirable based on Needs Assessment.

No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to departmental needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to departmental need.
Low	Can be met after higher needs are accomplished.

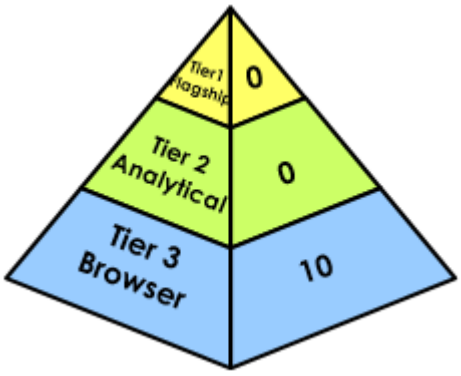
Component	Status		Priority	Notes
	Existing	Desired		
Automated Vehicle Location (AVL)	Yes	Yes	High	Finance uses AVL now for tracking snow removal vehicles.
Documentation	Limited	Yes	Medium	Some documentation on GIS data exists. The GIS Team in IT will mandate enterprise GIS documentation processes and procedures.
Enterprise Systems Integration	Limited	Yes	High	Integration with Vailtech, WAM, JD Edwards, Class, AMANDA, and other databases.
Geocoding	Yes	Yes	High	Geocoding of Vailtech, WAM, JD Edwards, Class, AMANDA, and other databases.
GIS Data Access	Limited	Yes	High	Finance will need access to GIS layers as outlined throughout this document in an easy-to-use data browser. Current OnPoint does not have all needed data.
GIS Data Maintenance	No	No	Low	Finance will be a data consumer. They will not create or maintain any GIS data.

Component	Status		Priority	Notes
	Existing	Desired		
GIS Data Sharing	No	Yes	Medium	Some selected data sets will be shared internally and with the public.
GIS Personnel	No	No	Low	Finance will be a data consumer. As such, they will use easy-to-use GIS data browsers. They will not need any GIS personnel.
Hardware	Yes	Yes	Low	The current personal computers will suffice for running the GIS data browser.
Mapping	Yes	Yes	High	All mapping should be attainable through the Intranet data browser.
Metadata	No	No	Low	Finance is not overly concerned with the derivation of the GIS data.
Mobile Computing Resources	No	Yes	Medium	Risk Management has the need for viewing, collecting, and editing data in the field. An ArcGIS Online application can meet this need.
Network	Yes	Yes	High	High availability and fast access to GIS data will be important to the success of this initiative.
Routing	No	Yes	Medium	Optimal routes for snow collection vehicles.

Component	Status		Priority	Notes
	Existing	Desired		
Software	Yes	Yes	High	Finance will need expanded use of Intranet GIS data browser and tools for Risk Management.
Spatial Analysis and Modeling	No	No	Low	Finance will mainly use GIS for data browsing, information retrieval, and quick map production. Any high-level analysis will be done by the GIS Team in IT on an as-needed basis.
Training/Education	No	Yes	Medium	This component is considered a medium priority for use of GIS within Finance. Introductory training is needed at the browser user level for all staff.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

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.

Return on Investment Opportunity Finance	
Opportunity	**Explanation**
Save <u>Time</u> and <u>Comply with Provincial Mandates</u>	Data Access for Staff: • An Intranet GIS Data Browser should be used to access data for PSAB reporting, property and taxation analysis, preparation of annual budgets, and grant administration

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Information Technology

Information Technology

Section Outline

Existing Conditions

Department Overview

The City of Guelph's Department of Information Technology (IT) is responsible for promoting and facilitating the effective use and integration of technology, development and management of enterprise networks and applications, and the provisioning of fast, secure, and reliable access to all information assets of the city. IT provides customer-driven services citywide in areas utilizing networks, desktops, application support, and related program and project management. The following is the current mission of the IT Department:

> "Information Technology proactively facilitates corporate service excellence through the provision and planned evolution of technology, and related support services."

The goals of IT include:

- Provide reliable, secure, and high performance IT infrastructure to meet the business and service needs of the organization
- Plan, implement, and maintain the corporate desktop, IT Service Desk, and printing/telephony infrastructure
- Support the applications that the corporation uses as a municipal services provider
- Develop and support IT Project and Program Management

The Department is comprised of four divisions with the following functions:

- **Corporate Applications** - provide technical support, maintenance, upgrades and advice to minimize down time and make the best use of Guelph's business-specific information systems including business and permit management (Amanda), parking and recreation programs/facilities management software (Class), purchasing and work order and asset management software (Oracle's WAM), financial software (JDE), and human resources software (Kronos)
- **Client Services** – minimize downtime on all City desktop computers, printers, mobile device and telephone systems by providing technical support, maintenance, upgrades, and service through a centralized IT help desk
- **Technology Services** – maintain, develop, enhance, and protect Guelph's IT network, servers, database, Internet, and communications infrastructure in all City facilities to maximize performance and minimize disruptions
- **Projects and Business Services -** The Projects and Business Services division of Information Technology is goal is to enable City departments to provide better service to the public through technology. It is composed of 3 business units – Geographic Information Systems, Project Management Office and Web Services.
    - **Geographical Information Systems (GIS)**
        - GIS services mandate is to provide leadership and support to City departments enabling them to provide better service to the public through GIS technology services and innovation.
        - A Geographic Information System (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data.
    - **Project Management Office (PMO)**
        - The work of the PMO is inclusive of developing project and program management with a strategic focus, which includes Governance, Financial, Risk, Resource, Quality and Scope management. The team is responsible for project prioritization, process improvement and strategic project planning with IT and city staff.
    - **Web Services**
        - Web Services' mandate is to develop and support guelph.ca and social media properties such as Facebook, Twitter and You Tube. The work of the Web Services Team is to ensure appropriate use of social media and web technologies, and development of e-business strategies for leveraging organizational procedures and processes via the Internet/Intranet. The team is responsible for updating and maintaining all web pages with city staff for guelph.ca, e-newsletters and the internal Corporate Intranet.

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 are using GIS applications to access and use the city's GIS information in a central geodatabase maintained by the GIS Team in IT. Software used to access and edit the data includes Esri's ArcGIS desktop software, Orion's OnPoint software delivered via ArcGIS Server on the intranet, and a number of other specialized products (911 Dispatch and AVL) that use GIS for specific functions. The GIS Team in IT is comprised of GIS professional staff and represents the central location for the citywide geodatabase as well as the focus of GIS expertise. The GIS Team in IT supports all aspects of GIS for the City and serves as a service bureau for most departments for their geoprocessing and cartographic needs. There are a number of other groups in the city that serve as Tier 1 users, to support their department's functions. These Tier 1 departments include; Engineering, Transportation, and Planning. Currently, the GIS Team in IT has two GIS staff, both with the same title (Corporate Applications Analyst – GIS). The GIS staff are tasked mainly with making sure that the current GIS is functional. They have not been tasked with a 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 Director or GIS Coordinator.

The following is a general list of tasks conducted by the GIS Team in IT:

Ongoing Tasks

- SDE/ArcGIS Administration
- Intranet/Internet Maps Configuration and Administration
- Support GIS staff with automating geoprocessing tasks
- Installing, configuring, and/or upgrading all GIS software. (SDE, ArcGIS Server, ArcGIS, Onpoint)
- Providing technical assistance to all GIS users
- Providing GIS products as requested from end-users
- Data layer creation and maintenance (layers not owned by departments)

Coordination/Collaboration/Service Provision

- Coordination with all departments on GIS-related data and analysis needs
- Creation and delivery of geoprocessing services to city staff, consultants and citizen groups
- Creation of cartographic products for city staff, council, consultants, citizen groups and private industry

- Collaborate with other municipal, county and regional agencies, and special districts on GIS-related initiatives for data and cost sharing

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 included 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.

Current GIS Staffing				
Type		**Number of Users**	**GIS Usage**	**Primary Tools**
	GIS Flagship (Tier 1)	2	High	ArcGIS Suite
	GIS Analytical (Tier 2)	0	N/A	N/A
	GIS Browser (Tier 3)	0	N/A	N/A

Hardware and Software

The Information Technology Department has personal computers for each of its employees. The city is on a five-year personal computer replacement policy. Users have access to network printers throughout the city. The City maintains a Storage Area Network (SAN). A majority of servers are virtualized and staff manages servers that house a centralized GIS data warehouse. Computers are connected to a reliable and fast fully switched network. There are multiple city sites that are networked via fiber. The City has deployed a Multiprotocol Label Switching (MPLS) Wide Area Network (WAN). Network speed to a majority of desktops is 100 MBPS with some satellite offices at 10Mbps. Fiber is utilized between floors in city buildings with copper to the desktops. Physical desktops are deployed with Citrix virtual desktops utilized for field access.

The City has access to training rooms for applications training. 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 with cellular air cards utilizing Citrix. A few smartphones and tablets are being used. The city is striving for a more transparent government, wanting to offer more services

on-line. Departments update Internet content via SharePoint and WordPress. The following table is a summary of hardware utilized by IT.

Hardware Issues Summary	
Type	**Notes**
Personal Computers	PCs available for staff. GIS Workstations for GIS Team in IT
Laptops	Available for some staff
Tablets	iPad and Android are deployed to several staff
Printers	City standard
Plotters	Utilize Plotter in Engineering as needed
GPS	Trimble XT (owned by Planning)
PDA/MDTs	None
Scanners	Available

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
- ArcGIS Suite – Used as the core GIS software suite for the City
- Adobe PDF Reader and Acrobat
- OnPoint – Intranet and Internet GIS data browser
- VailTech – municipal taxation
- JD Edwards – financial and human resource management
- Amanda – permitting, planning, and project management
- Oracle WAM – work order management
- Class – billing, parking management, and recreation management
- Synergen - asset and inventory management
- Kronos - payroll (Kronos)

GIS Needs Assessment

GIS Needs

IT has a very advanced GIS staff. These staff members are responsible for maintaining a vast amount of data for all departments, providing GIS products and services to all city staff, citizens and private industry, and tools to enable end users, both internal and external.

Key areas of concern for the GIS Team in IT 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 regulations

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. Establish service level agreements with client departments
11. 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.
12. Improved cooperation with external government entities and private companies

The GIS Team in IT should continue to provide primary support, data development, and maintenance to the enterprise GIS. The GIS Team in IT's contribution to the enterprise GIS is essential to have an up-to-date and accurate digital representation of land management, land use, and infrastructure within the City. Additionally, cross-departmental integration of databases will be required as needed for continued development of the enterprise GIS.

The GIS Team in IT works to provide GIS support to the City's departments. The GIS Team in IT will continue to be the focal point for general technical support as the City expands and increases its utilization of GIS across the enterprise. The GIS Team in IT will need to establish, configure, and support various types of information technology infrastructure, including software, hardware, databases, networks, user accounts, and documentation.

The GIS Team in IT will continue to serve as the in-house GIS experts, putting into action many of the recommendations of this GIS Technology Plan. One of the key issues that the GIS Team in 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 Team in IT will need to identify and devise strategies for ensuring that support is adequate in all aspects of the City's GIS effort; these strategies may entail procurement of new software, outsourcing of projects, additional staffing, and protocols for governance, financing of enterprise and department-specific initiatives, and standards for such issues as data structures, metadata, and software usage.

This needs analysis provides general recommendations for GIS efforts. Comprehensive recommendations for each department/division are provided in other sections of this chapter. Based on this needs assessment, the GIS Team in IT 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 following table summarizes these needs and how they are to be met:

GIS Need	*Method/Application to Meet Need*
Enterprise GIS Coordination	Formalize Hybrid GIS Governance Model Subject Matter Experts within various City Departments
GIS User Support	Organizational GIS Support
Centralized GIS Environment and Shared Esri Licensing Structure for the City	Centralized Governance Model ArcEditor and/or ArcInfo ArcGIS Server
Data Development and Management of Pertinent Data Layers	ArcEditor and/or ArcInfo
Corporate Mobile/Field GIS Access	A shared, scalable solution for all departments Viewing/Editing current data within central GIS database Technology Evaluation
Geospatial Data Creation and Integration	Automated Geocoding Application
Citywide Training	GIS Training Matrix
Department-Wide Access to Geospatial Data	Intranet GIS Data Browser
Public Access to Geospatial Data	Internet GIS Data Browser
Completed Metadata and GIS Data Update Notification	ArcEditor and/or ArcInfo

GIS Need

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. IT has been in charge of the GIS program management for the city's enterprise GIS for the past decade. Data creation, maintenance, and update notifications, desktop and extension licensing, GIS hardware, software, and servers, as well as metadata verification should continue to be managed by the GIS Team in IT.

The GIS Team in IT 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 (See Governance Chapter). 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 Guelph (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 and utilities
- Frequent attendance and participation in local and regional GIS groups
- Distribution and acquisition of geospatial data
- Participation with Provincial and Federal agencies on GIS initiatives

GIS Need

GIS User Support

The GIS Team 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. 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 Team in IT.

Organizational GIS Support

The GIS Team 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.

The current IT help desk process is used by GIS, but not in a consistent manner. A GIS help desk should be formalized. A user should know exactly where to call or email for GIS support, to report a data problem, or for technical assistance. A GIS help 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.

GIS Need

Centralized GIS Environment and Shared Esri Licensing Structure for the City

It is in the best interest of the City to continue to manage a central repository of GIS licenses and resources. All Esri licenses have been consolidated under one central master license for the City and are managed by the GIS Team in IT. All City personnel need access to GIS data maintained by various departments. As part of the City's enterprise wide GIS implementation, all departmental GIS data must be stored in a single repository where all City departments can access up-to-date spatial layers based upon their pre-approved security access. Project specific GIS datasets can continue to be stored by departments where and when it is appropriate to do so. 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 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. The GIS Team in IT has implemented this model. However, there are still some stovepipes that exist throughout the organization. These stovepipes of local data storage management need to be eliminated and everyone should participate in an enterprise-wide approach.

Application to Meet Need

ArcGIS Server

ArcGIS Server is a server-based product that provides a scalable framework for distributing GIS services and data. ArcGIS Server is currently deployed.

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. ArcGIS Server users access these services through their Web browsers using applications that are included with ArcGIS Server, or via third-party applications like Orion's OnPoint product, which the GIS Team in IT is currently using.

In addition, ArcGIS Server services can be accessed using many different clients including ArcGIS Desktop, custom applications created using ArcReader, ArcPad, ArcGIS Server, and a wide variety of mobile and wireless devices.

ArcGIS is recommended as the primary GIS application for continued used at the City; Internet and Intranet applications will require ArcGIS Server, which the GIS Team in IT will be responsible for configuring, updating, and upgrading.

As GIS usage grows, Guelph should consider an enterprise licensing agreement (ELA) from Esri. This means that the City would have unlimited usage of the core ArcGIS software including ArcGIS for Desktop, ArcGIS Server, ArcGIS Extensions (both Desktop and Server), an ArcGIS Online Subscription and access to a predetermined amount of virtual self-led courses. A more detailed look at applications is undertaken in a later chapter.

GIS Need

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 a high priority for the GIS Team in IT to promote GIS implementation enterprise-wide.

Based on interviews, each department identified numerous data layers that would be highly beneficial. Strong coordination must be taken between each department and the GIS Team in IT for data creation and maintenance, to ensure that the right data is provided to the users.

GIS Need

Corporate Mobile/Field GIS Access

Multiple City departments expressed interest in utilizing GIS in the field. In coordination with those interests, the selection and implementation of a shared, scalable solution/s should be a high priority. The application should allow for viewing of data and editing where appropriate. Discussion of options will be discussed in detail in the applications chatper of this strategic plan. The City should undertake a thoruough evaluation of options before acquisition.

GIS Need

Geospatial Data Creation and Integration

Many departments store much of their information in electronic databases that have addresses or property numbers as an attribute; therefore spatially enabling these databases will yield important datasets for the

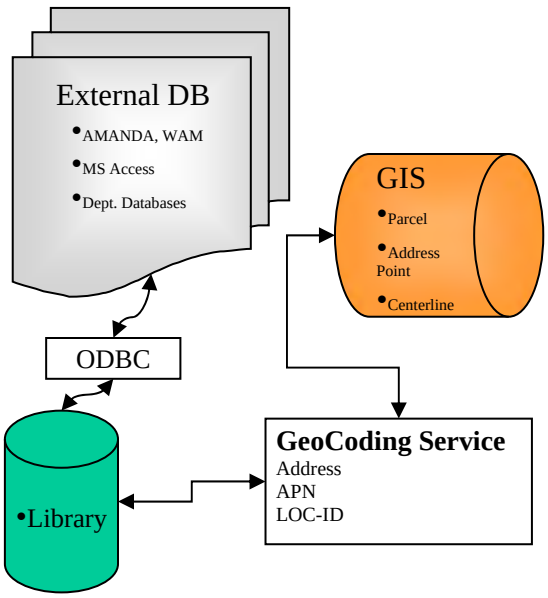
enterprise GIS. Any database with associated addresses can be address-matched to a street centerline layer, tax parcel centroids, or address point layer. Existing databases may need to be formatted for standardized addresses to facilitate address-matching functionality. Address-matched features can be visualized within the GIS and their attributes can be queried. Once the above information is converted and 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

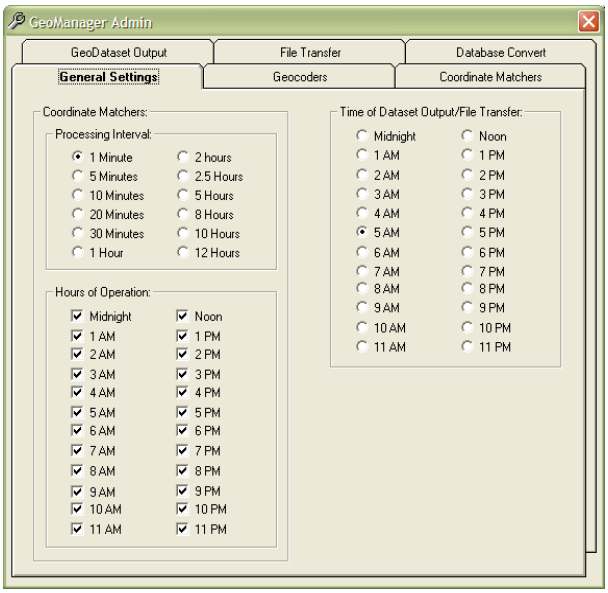
Any database with associated addresses can be address-matched to a street centerline layer, tax parcel centroids, or address point layer. Existing databases may need to be formatted for standardized addresses to facilitate address-matching functionality. Address-matched features can be visualized within the GIS, and their attributes can be queried.

An automated geocoding service application 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 (DB2, Oracle and 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 Number, 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 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 an automated geocoding service 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 geocoding service can generate and export the resulting GIS layer on a regularly scheduled basis.



Geocoding 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.

GIS Need

Citywide Training

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

Class	Site	Trainer	Days	Year of Training - based on this five year plan	Participants	Cost
Creating and Maintaining Metadata Using ArcGIS Desktop	On	Web Course	3 Modules	1	Various	$96
ArcGIS 2: Essential Workflows	On	Esri Authorized Trainer	2	1,2	Various	$5,000
ArcGIS 3: Performing Analysis	On	Esri Authorized Trainer	2	1,2	Various	$5,000

Class	Site	Trainer	Days	Year of Training - based on this five year plan	Participants	Cost
ArcGIS for Server: Site Configuration and Administration	Off	Esri	3	1,2	Various	$1,515
Building Geodatabases	Off	Esri	3	1	Various	$1,515
Configuring and Managing the Multiuser Geodatabase	Off	Esri	3	1	Various	$1,515
Tier 3 Applications	On	Internal	1	1,2,3	Various	Varies

The following is a list of classes the GIS Team in IT should consider in an effort to stay current with the technology:

Desired Training

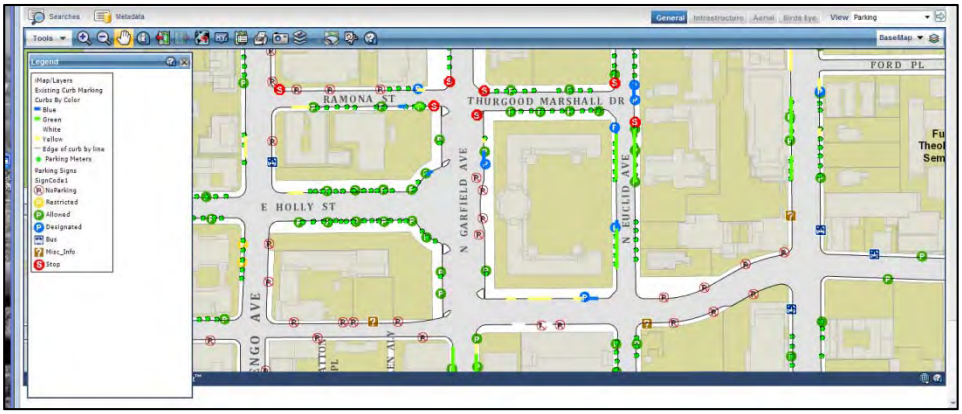
- Intro to Python Scripting
- Introduction to Geoprocessing Scripts Using Python
- Getting to know ArcGIS 10
- Intro to ArcGIS Server
- Data Management in the Multiuser Geodatabase
- Understanding ArcSDE Table Relationships
- ArcGIS Online
- Spatial Analysis
- 3D Development, Animation and Analysis
- Raster Interpretation Analysis
- GIS for emergency management (EOC)
- Project Management
- GISP Accreditation
- Esri Certification

More information on training can be found in the Training Chapter of this Strategic Assessment.

GIS Need

Department-Wide Access to Geospatial Data

Providing users with the ability to view spatial data in a quick and intuitive manner is important for local 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.



The City has been using an ArcGIS Server-based intranet GIS data browser 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. This should be the centerpiece of GIS at the City. The current OnPoint application is underutilized and is being used nominally by city staff. A number of reasons were cited for its lack of use to include; speed, ease-of-use, lack of data, and lack of functionality. It will be imperative that an intranet application is re-launched that overcomes these issues. This could be an upgraded version of OnPoint or another application. The re-launched intranet application should be expanded to include specific portals for each department and some divisions. Instead of having one or two instances of the application with catch all functionality, the application should be configured to have data, reports, queries, map tips, etc. specific to the need of the department. More specific recommendations on the intranet application will be provided in the Software Applications Chapter of this study.

GIS Need

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.

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

- What is the current/future land use of certain property?
- What is the zoning of certain property?

- What is allowed in the zoning?
- What is the maximum density or intensity?
- What plat/subdivision am I in?
- 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 has a few GIS portals now, but they are not widely publicized. 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 (Construction Updates, City-wide Trails, 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.

GIS Need

Completed Metadata and GIS Data Update Notification

During interviews, staff expressed concern that they did not have a full understanding of the spatial and temporal accuracy of the GIS data. To address that concern, focus should be put on completing the development of metadata of the city's existing GIS data, providing notification when data is updated, and publishing the metadata content to users. 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 citywide 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 an automated data update notification process. 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. In this regard, a Metadata Warehouse together with a web-based Metadata Management Tool will allow users to locate, assess and identify methods to access and update GIS metadata.

GIS Gap Analysis

GIS Data Layer Inventory

The GIS data layer inventory identifies key data sets for a department. The GIS Team in IT currently maintains the ArcSDE enterprise geodatabase. The GIS Team in IT creates and maintains various data layers and supports other data layers in the enterprise geodatabase created and maintained by other departments. The GIS Team in IT acts as the custodian of the database and is responsible for establishing and maintaining the corporate GIS database. As new data layers are created, the GIS Team in IT will need to ensure that each layer is at an acceptable accuracy level and that a data update methodology is established. The GIS Team in IT will work closely with each department to ensure that they have the appropriate training and skills to maintain their own GIS layers where appropriate, however the design of the data layer should be conducted in partnership between the respective departments and the IT GIS Team to ensure it is properly modeled. In this recommended environment, the GIS Team in IT provides security and user setup for editing of department-owned data.

As the city moves forward with its enterprise 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.

All geospatial data that City departments currently 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 immediately through the enterprise SDE database. For the most part, City departments are participating in this central GIS concept and are housing their data in the central GIS database. 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 legend describes the data layer table below:

Legend

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

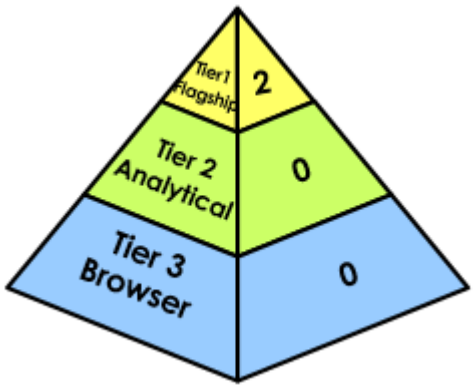
Below are the enterprise-wide data layers. Enterprise-wide data layers are ones that are most commonly used and should be accessible by all users of the GIS.

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using the rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base, as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006 the city acquired rectified digital orthoimagery which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The city receives quarterly digital property updates from Teranet for registered properties and assessment properties.	The GIS Team in IT maintains the property data. New property surveys are incorporated as they are received. If staff in other departments sees errors they have been asked to report them to the GIS Team in IT.	Existing

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance has occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing
Landmarks	Digitized – have started to develop a commonplace layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions / Neighbourhoods	Heads up Digitizing Screen. Subdivisions are available by 61-M plan (Subdivision)layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	The GIS Team in IT creates and maintains addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building footprints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by the city to create an updated building layer.	GIS Team in IT	Existing
Contours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; Changes are updated with Orhtophoto refresh	Existing

Multi-Tier GIS Application Use

Below is a pyramid and table that 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 (Yellow) user is a Flagship GIS user who has access to a fully functioning GIS toolset. A Tier 2 (Green) Analytical user focuses on data analysis, in addition to general browsing capabilities. A Tier 3 (Blue) Browser user requires only general browsing GIS data functions. The Information Technology Department is the most advanced user of GIS in the City.



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Legal and Realty Services

Legal and Realty Services

Section Outline

Existing Conditions

- Department Overview
- Governance of GIS
- Hardware and Software

GIS Needs Assessment

- GIS Needs

GIS Gap Analysis

- GIS Data Layer Inventory
- GAP Analysis Chart

Multi-Tier GIS Application Use

Return on Investment (ROI)

Existing Conditions

Department Overview

The Legal and Realty Services Department offers legal and realty services to City Council and City departments. The primary functions of the department include:

- **Legal Services**
  - Provide legal advice and opinions to Council, Committees and City departments
  - Represent the City before the courts, the Ontario Municipal Board and other administrative tribunals
  - Manage external council
  - Review and prepare contracts, by-laws and other legal documentation
- **Realty Services**
  - Provide site search and selection services for departments seeking additional facilities
  - Negotiate realty agreements
  - Administer the City's Land Encroachment By-law
  - Maintain inventory of all realty interests of the City

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.

Legal and Realty Services have a need for GIS data and GIS functionality. Staff does utilize the intranet GIS application, OnPoint, for property related queries. However, they feel that the application does not meet their needs in regards to data reliability, data completeness, application speed, and application functionality. Additionally, staff often uses other GIS tools such as Google Earth and Google Maps. The table below summarizes the current GIS staff usage within the department. Type represents the current level of GIS experience based on job requirements, GIS usage can be categorized as Limited, Moderate, or High (i.e. frequency of use), and Primary Tools describes what tools, or how GIS is used to carry out GIS functions.

Current GIS Staffing				
Type		**Number of Users**	**GIS Usage**	**Primary Tools**
	GIS Flagship (Tier 1)	0	N/A	None
	GIS Analytical (Tier 2)	0	N/A	None
	GIS Browser (Tier 3)	5	Limited	OnPoint

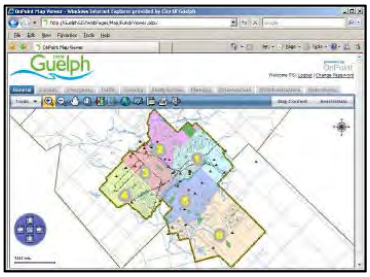
Hardware and Software

Legal and Realty Services use personal computers for each of its staff. No GPS units are utilized by Legal and Realty Services. Printers are available for office use.

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

Legal and Realty Services utilize the following software applications:

1. Microsoft Office– Office productivity
2. JD Edwards – Financial and personnel management
3. Amanda – case management reporting and accounting
4. OnPoint – GIS data viewing
5. Google Maps, Bing Maps, and Google Earth – Map searches, street view, and other data lookup
6. Teranet/Teraview – property lookup
7. Adobe Acrobat – for map and document markup
8. Lexus/Nexus and CANLI – Legal searches
9. Access – database tracking of realty files, city owned properties, and other key data

AMANDA Back Office Suite CSDC **Amanda**	**AMANDA** → AMANDA is a web-based product used for licensing, permitting, planning, and compliance. Legal and Realty Services use AMANDA for data access of cases and property information. AMANDA data is accessible through the OnPoint intranet GIS data browser. However, staff finds this to not be user friendly and that the data is often incomplete and inaccurate.
 **OnPoint Intranet GIS**	**OnPoint** → OnPoint from Rolta is utilized as an enterprise-wide GIS intranet solution. The software allows users to access pertinent GIS data via a web browser. Legal and Realty Services use the software for accessing property information; such as, zoning uses, property analysis, accessing related legal documents about a property. Staff finds the application inadequate for their needs because it is slow, unreliable, and not user-friendly.
 **Teranet and GeoWarehouse**	**Teraview, Teranet, and GeoWarehouse** → Teraview is proprietary software developed by Teranet that provides licensed Electronic Land Registration System clients with remote access to POLARIS, the Government of Ontario's land records database. Legal and Realty staff can perform property searches, submit Land Title documents for registration, as well as view and print instruments, plans and parcel registers. Geowarehouse allows users to view this data via a graphic GIS based application.

GIS Needs Assessment

GIS Needs

Legal and Realty Services can take advantage of GIS in support of various departmental functions. Legal and Realty Services have one primary need with a host of desired functionality. The following is a description of that need.

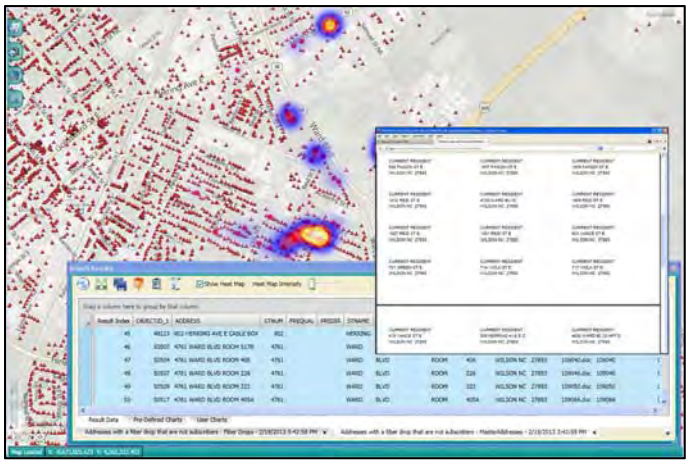
GIS Need	*Method/Application to Meet Need*
Mapping and Spatial Analysis of Property and Other Pertinent Data	Intranet GIS Data Browser
GIS for Court Case Support	Intranet GIS Data Browser
Formal GIS Training for Legal and Realty Services Staff	Legal and Realty Services Specific Training

GIS Need

Mapping and Spatial Analysis of Property and Other Pertinent Data

Legal and Realty Services need to access a host of GIS related data through an easy-to-use application. The OnPoint application is currently available. However, Legal and Reality staff find the application to be clunky, slow, and not user friendly. However, the concept of an easy-to-use yet robust intranet application would allow departmental staff to achieve a majority of their GIS needs. The following is a list of functions and data that are needed in such an application:

- Robust tools for marking up a map with notes and annotation
- Easy tools for determining distance and areas
- Ability to increase/decrease line widths, colour, text boxes, and opacity
- Easy radius searches around any selected features for notifications and mailers
- Additional data that is accurate:
    - Engineering layers
    - Encroachments
    - Easements



- Variances
- Water features
- Geowarehouse property data
- Zoning
- Assessment data such as, sales history, roll numbers, transaction history, sales price, etc.

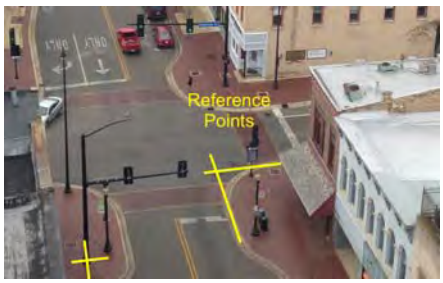
- Geo-enablement of access databases such as, realty and city owned properties
- Ability to track lease management data
- View AMANDA data such as litigation, building permits, and nuisance abatement cases
- Ability to detect change in properties over time
- Click on the map and launch street view functionality

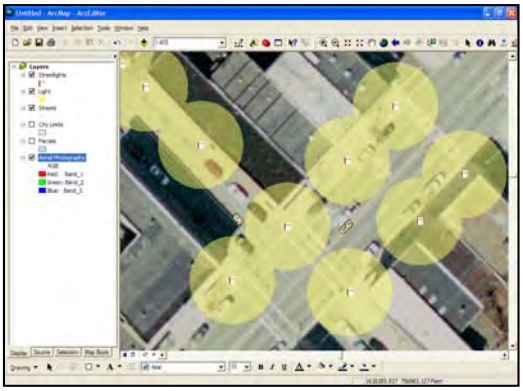
GIS Need

GIS for Court Case Support

Many organizations utilize GIS products in support of court cases. Maps are utilized 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 in excess of the speed limit. However, the city was able to utilize 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 utilizes 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.





GIS Need

Formal GIS Training for Legal and Realty Services Staff

All departments, including Legal and Realty Services, will benefit from formal training in GIS. For the immediate future, it is envisioned that all GIS users will be Tier 3 – browser level. As such, only third-party training for the GIS client applications such as Intranet GIS Data Browsers should be considered. The intranet application should be set-up to include data, queries, reports, and other functions tailored specifically to the needs of Legal and Realty Services. Training is paramount to the success of the City's enterprise-wide GIS implementation.

GIS Gap Analysis

GIS Data Layer Inventory

Legal and Realty Services staff do not and will not create any GIS layers. Legal and Realty Services will benefit from access to several GIS data layers. It is expected that once all departmental data is integrated, consolidated, and centrally stored, that the staff will have access to all non-classified GIS data layers from other departments. ***A full Master Data Layer list with existing and recommend layers can be found in Appendix I of this Needs Assessment.***

Legend

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

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

The following table lists those data layers that are important to Legal and Realty Services:

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Legal and Realty Services GIS Data			
Capital Improvement Projects	Digitize from the base map data; aggregate layers as needed	Various overseen by the GIS Team in IT	Recommended
City Owned Property	Extracted from Parcel Layer and departmental Access databases	GIS Team in IT	Existing
Citizen Claims	Geocoded from database	Automated	Recommended
Amanda Data	Geocoded from database	Various	Partial
Infrastructure Layers	Digitized and GPS	Water, Public Works, and Engineering	Partial
Business Licenses	Extracted from the database and geocoded	Automated	Existing
Assessment Districts	Digitized on screen	GIS Team in IT	Recommended
Assessment Data	Sales history, roll numbers, transaction history, sales price	Province of Ontario	Partial
Zoning	Digitized on screen	Planning	Existing
Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using the rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base, as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation	The GIS Team in IT maintain the property data. New property surveys are incorporated as they are received. If staff in other departments see errors they have been asked to report them to the GIS Team in IT.	Existing

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
	could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006, the city,acquired rectified digital orthoimagery which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The city receives quarterly digital property updates from Teranet for registered properties and assessment properties.		
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance have occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing
Landmarks	Digitized – have started to develop a common place layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhoods	Heads up Digitizing Screen. Subdivisions are available by 61-M plan (Subdivision) layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	The GIS Team in IT creates and maintain addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building footprints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by the City to create an updated building layer.	GIS Team in IT	Existing
Contours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; Changes are updated with Orhtophoto refresh	Existing

GAP Analysis Chart

Legal and Realty Services 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.

Legend	
Existing	
Yes	GIS component currently exists within department.
No	GIS component does not currently exist within department.
Limited/Partial	GIS component exists to a lesser degree.
Desired	

Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to departmental needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to departmental need.
Low	Can be met after higher needs are accomplished.

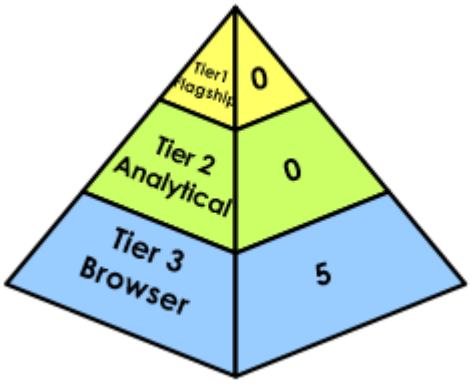
Component	Status		Priority	Notes
	Existing	Desired		
Automated Vehicle Location (AVL)	No	No	Low	Legal and Realty Services does not need this functionality.
Documentation	Limited	Yes	Medium	Some documentation on GIS data exists. The central GIS governance authority will mandate enterprise GIS documentation processes and procedures.
Enterprise Systems Integration	Limited	Yes	High	Integration with AMANDA, and other databases.
Geocoding	No	Yes	Medium	Some Access databases need geocoding.
GIS Data Access	Limited	Yes	High	Legal and Realty Services will need access to GIS layers as outlined throughout this document in an easy-to-use data browser. Current OnPoint does not have all needed data.
GIS Data Maintenance	No	No	Low	Legal and Realty Services will be a data consumer. They will not create or maintain any GIS data.

Component	Status		Priority	Notes
	Existing	Desired		
GIS Data Sharing	No	Yes	Medium	Some selected data sets will be shared internally.
GIS Personnel	No	No	Low	Legal and Realty Services will be a data consumer. As such, they will use easy-to-use GIS data browsers. They will not need any GIS personnel.
Hardware	Yes	Yes	Low	The current personal computers will suffice for running the GIS data browser.
Mapping	Yes	Yes	High	All mapping should be attainable through the Intranet data browser.
Metadata	No	Yes	High	Legal and Realty Services needs to know the derivation of the data, its currency, and completeness.
Mobile Computing Resources	No	No	Low	Legal and Realty Services does not need to use GIS data in the field.
Network	Yes	Yes	High	High availability and fast access to GIS data will be important to the success of this initiative.
Routing	No	No	Low	Legal and Realty Services does not need routing functionality in GIS
Software	Yes	Yes	High	Legal and Realty Services will need expanded use of an improved Intranet GIS data browser.
Spatial Analysis and Modeling	No	No	Low	Legal and Realty Services will mainly use GIS for data browsing, information retrieval, and quick map production. Any high-level analysis will be done by a central GIS resource on an as-needed basis.

Component	Status		Priority	Notes
	Existing	Desired		
Training/Education	No	Yes	Medium	This component is considered a medium priority for use of GIS within Legal and Realty Services. Introductory training is needed at the browser user level for all staff.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Return on Investment (ROI)

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

Return on Investment Opportunity Legal and Realty Services	
Opportunity	**Explanation**
Save <u>Money</u>	• Legal and Realty Services should use GIS in support of lawsuit defense and court case support potentially saving the city money.

Return on Investment Opportunity Legal and Realty Services	
Opportunity	**Explanation**
Improve <u>Information Processing and Save Time</u>	Automation • Legal and Realty Services has to spend a considerable amount of time researching various issues from numerous data sources. Having all of this information available via one portal will greatly assist and save staff an estimated time of 10-20 hours per week.

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Parks and Open Space

Parks and Open Space

Section Outline

Existing Conditions

Department Overview

Parks and Open Space provides and maintains Guelph's parks, trails, recreation, spaces and programs. Parks and Open Space staff ensure Guelph's parks and open spaces are well designed, safe, and appealing. The parks and open space maintained by the city is large which requires large scale planning and maintenance tasks. Staff has two focus areas – 1) Parks and Open Space and 2) Recreation and Facility Programming.

Parks and Open Space Key Functions:

- Design and build new parks and trails
- Review development applications to ensure adequate parkland and cash-in-lieu to acquire new park land, open space landscaping, and trail design
- Renew and redevelop existing parks and infrastructure, i.e., playground retrofits
- Maintain parks and trails to ensure public safety and enjoyment of public spaces, grass cutting and sports fields, playground and trail maintenance, horticulture services and park sanitation
- Operate splash pads, wading pools and amusement rides

- Provide operational support for hundreds of community events including festivals and sports tournaments

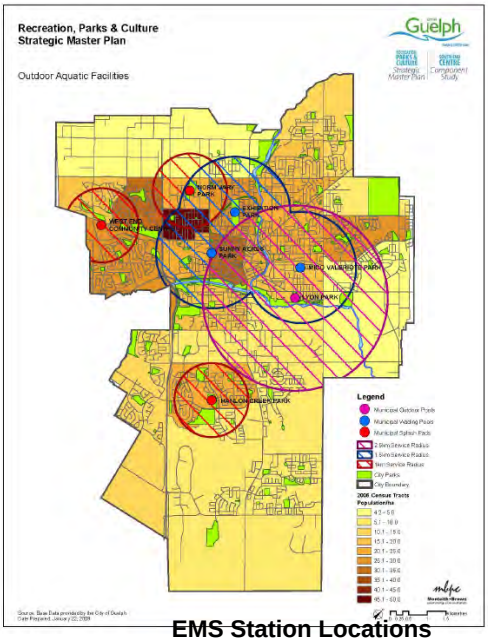
Recreation and Facility Programming Key Functions:

- Operate and maintain safe, clean and affordable recreation facilities including indoor and outdoor pools and arenas
- Develop and provide recreation programming of interest to people of all ages and skill levels including aquatic lessons for all skill levels and summer camp programs
- Liaise with sports groups and associations using City Parks and Open Space
- Develop policies regarding use of City Parks and Open Space to ensure safe, consistent and equitable practices
- Recreation facility development including Victoria Road Community Centre renovation, South End Community Centre business case development

Existing GIS Conditions

Governance of GIS

A Recreation, Parks, and Culture Strategic Master Plan (2009) has been created to guide growth and strategy for the department through the year 2019. This plan utilizes GIS based mapping to illustrate services provided and service areas. Each of the parks and open space sites are depicted, and buffers around these service sites depict geographies/customers served. (Note: While its data analysis section is a useful tool for park planning, it should be noted that the Master Plan recommendations have not been adopted by Council. Also, the data on which it is based is now outdated).



EMS Station Locations

Parks and Open Space are using GIS and GIS products extensively. Almost everything that the department manages has a geographic component to include service locations and customers. GIS can trace its origins to park and open space management. Staff has been provided a link to the enterprise-wide GIS intranet application, OnPoint. The application is meant to be an easy-to-use method of quickly access key spatial and non-spatial information. However, the staff finds the application to be slow and lacking in key data. Therefore, they deem the application unsuitable for their needs.

The department has a critical need to track all of their assets. GIS is a logical method for achieving this need. However, insufficient GIS tools and training have been provided to allow for staff to conduct a maintainable inventory. Therefore, the department undertook a more traditional method of inventorying their infrastructure and assets. Staff conducted a field inventory of each park and asset. Google aerial photography was utilized to depict each park location (see image to the right). Each item in the park was documented to include the asset name, asset type/material, and its condition. This information has been compiled into a report form that is available digitally and has been printed. Information on how to leverage this detailed data will be discussed in the needs assessment section.

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

Current GIS Staffing				
Type		**Number of Users**	**GIS Usage**	**Primary Tools**
	GIS Flagship (Tier 1)	0	NA	NA
	GIS Analytical (Tier 2)	0	NA	NA
	GIS Browser (Tier 3)	5	Low	Has Access to OnPoint

Hardware and Software

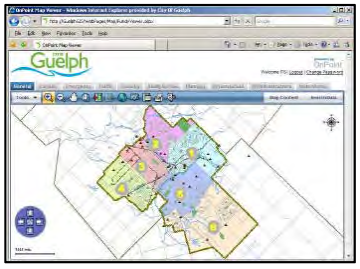
All staff within the Parks and Open Space has access to a personal computer. The following table summarizes existing hardware.

Hardware Issues Summary	
Type	**Notes**
Personal Computers	Available to all staff
Laptops	A few staff have laptops
Printers	Ample printers available for use
Plotters	Available as needed
GPS	None
PDA/MDTs	None
Scanners	Available as needed

The Parks and Open Space use a variety of software applications. Microsoft Office is used to conduct office productivity tasks. The following is a list of key software products utilized by the department:

1. Microsoft Office– Used for office productivity
2. RAC – Accounting and financials
3. JDE - Accounting
4. AutoCAD 2013 – Used for viewing computer aided drafting files/plans from consultants, as well as creating in-house master plans through to tender ready drawing sets.
5. Oracle WAM – Used for managing work orders and assets
6. Amanda – Viewing and inputting of planning records
7. Class – Scheduling and staffing
8. OnPoint - Intranet GIS browser provided by the GIS Team in IT
9. Google Maps – Address identification and mapping
10. IQ2 – Used for remote management and scheduling of irrigation

 **Oracle WAM**	**Oraclc WAM →** Oracle Utilities Work and Asset Management (WAM) tracks assets, manages lifecycles, tracks work orders and maintenance requests, and manages the financial components of work order management. WAM is a very pervasive system, requiring full commitment from an organization to leverage all of its functions. Data within WAM should be managed via GIS. Parks and Open Space use WAM for purchase orders, work requests, and service requests.
AMANDA Back Office Suite CSDC ENABLE. TRANSFORM. LEAD. www.csdcsystems.com **Amanda**	**AMANDA →** AMANDA is a web-based product used for licensing, permitting, planning, and compliance. Parks Planning utilizes Amanda to discern property related information and for tracking cases. The Planning Department uses AMANDA extensively for planning cases and property related issues. Parks and Open Space are included in case management where appropriate.

activecommunities  **CLASS**	**CLASS** → CLASS is a software suite used by Recreation and Parks departments and facilities to manage their facility bookings, program registration, pass sales, point of sale transactions, and provides financial sub-structure that functions as a sub-ledger to the main accounting system.
 **OnPoint Intranet GIS**	**OnPoint** → OnPoint from Rolta is utilized as an enterprise-wide GIS intranet solution. The software allows users to access pertinent GIS data via a web browser. Parks and Open Space has attempted to utilize OnPoint but has found it to be insufficient to meet their needs. The application is too slow, lacks all but very basic open space-related data lacks needed functions. Staff uses OnPoint frequently.
 **Google Maps**	**Google Maps** → Google Maps is used to identify addresses and to for creating maps. Staff used Google Maps as the basis for park asset inventory. Google aerial photography was marked up to show park locations. Map images were created to correspond to a tabular inventory of each park asset.

GIS Needs Assessment

GIS Needs

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

GIS users throughout the Parks Maintenance Division will require access to GIS data and the ability to query, generate basic maps and perform elementary analysis using layers found in the City's GIS data. Additionally,

integration with the department's in-house recreation management system (Class) and asset management system (Hansen) will be required for continued development of the enterprise GIS.

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

Based on this Needs Assessment, Parks and Open Space 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:

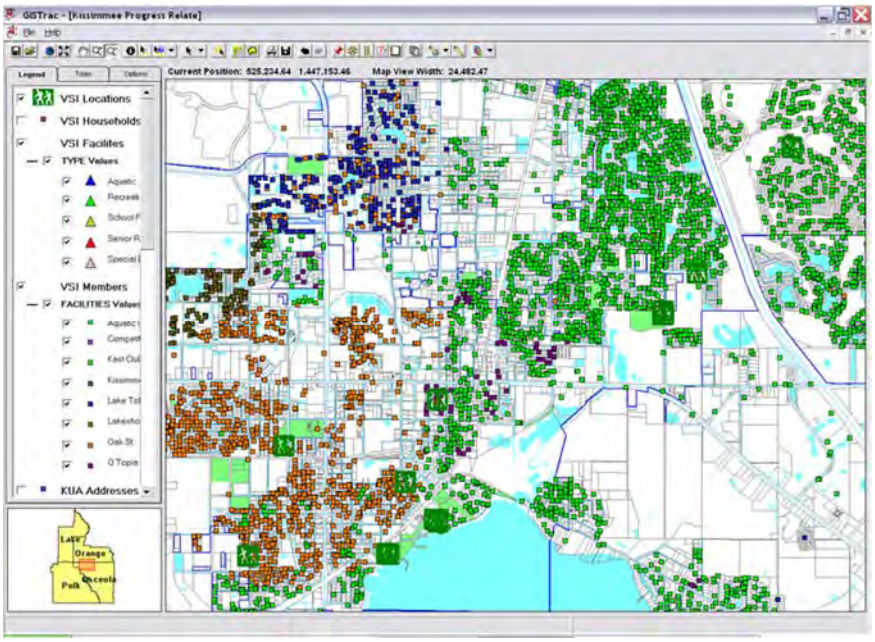
GIS Need	***Method/Application to Meet Need***
☑ Enabling Existing Databases – Geospatial Data Creation and Data Integration	▭ Data Mining Application ▭ Intranet GIS Data Browser
☑ Mapping and Spatial Analysis of Department Data	▭ ArcEditor ▭ Intranet GIS Data Browser
☑ Data Development and Management of Pertinent Data Layers	▭ ArcEditor ▭ GPS Field Collection
☑ Field Access to Geospatial Data Incorporating Field Data Collection	▭ ArcGIS Online ▭ Tablets
☑ Specialized Online Mapping Themes	▭ Internet Applications or ArcGIS Online
☑ Mapping *Ad Hoc* Events	▭ ArcGIS
☑ Use GIS for Park and Trail Planning and Tracking Projects	▭ ArcGIS ▭ Intranet GIS Data Browser
☑ Formal Training for Parks and Open Space Staff	▭ Formal ESRI Application Training ▭ Third Party Application Training

GIS Need

Enabling Existing Databases – Geospatial Data Creation and Data Integration

Parks and Open Space have begun to store information in electronic databases 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. Existing databases (Class and Amanda) may need to be formatted to the Guelph address standard to facilitate address-matching functionality. Address-matched features can be visualized within the GIS, and their attributes can be queried. It is recommended that information stored in paper or other type of hardcopy recording be entered into a database such as MS Access or MS SQL Server. Once the above information is maintained as digital data, it can be spatially enabled for use in the city's GIS and used like any other GIS layer. Additionally, a graphic layer depicting the device managed within the IQ2 software would be beneficial. Information on gallons/liters per minute, times of operation, and other key metrics could be viewed via the GIS.

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 (DB2, Oracle or 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.



GIS Enabling Existing Databases – CLASS recreation users

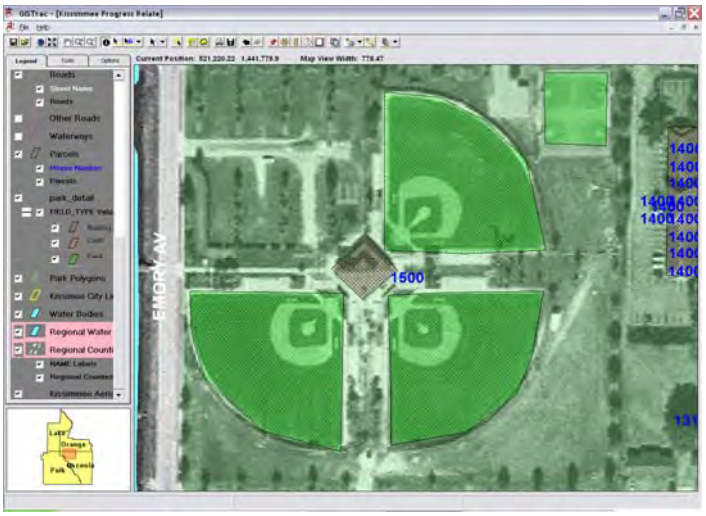
A thorough, up-to-date, searchable database would greatly assist the department in more effectively meeting its legislative requirements e.g. Development Charge Background Studies (every 5 years), Municipal

Performance Measures (annual) and PSAB reporting (annual), which require accurate tracking of City assets. The current data used for these projects (even basic data such as open space areas and trail lengths) is in formats that are difficult to quickly analyze and are inaccurate which results in wasted staff time, a reduced capacity to secure funding for City recreation projects, and other issues.

GIS Need

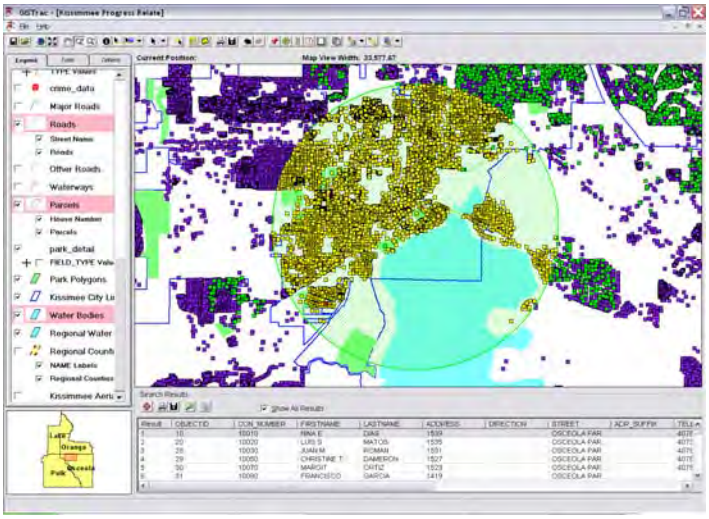
Mapping and Spatial Analysis of Department Data

Parks and Open Space need the ability to perform mapping and spatial analysis on interdepartmental data to make connections with seemingly unrelated data. A need for Parks and Open Space is to provide users with enterprise-wide access to GIS based mapping and spatial analysis. Users in every department 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, Parks and Open Space will be able to more effectively access data from other departments and use buffering to show nearby property owners, other associated data, and also to perform spatial analysis using a simple spatial selection.



Parks and Open Space Specific Intranet Portal

It is recommended that the enterprise-wide ArcGIS Server (AGS) based Intranet GIS Data Browser tool be utilized to access pertinent spatial data, imaging and spatial analysis functionality. Currently, OnPoint was deployed to fill this need. However, the current version does not meet the needs of Parks and Open Space. It is recommended that the City re-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 Parks and Open Space system databases and data entered into legacy systems in other departments, as well. This application will



Select all park users within a kilometer of a facility

serve as the primary GIS application for Parks and Open Space 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.

GIS Need

Data Development and Management of Pertinent Data Layers

Parks and Open Space 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 Parks and Open Space GIS implementation. In conjunction with the GIS team in IT, staff within Parks and Open Space 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.

Park Asset Inventory

Parks and Open Space will benefit from GIS as long as the assets, facilities, and buildings can be represented and displayed within the GIS. The parks (boundaries) have been created 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 Parks and Open Space maintain and manage, must be represented in data layers. A paper inventory has been completed. Each park and discernable amenity was mapped via Google Earth and markup tools. Parks and Open Space Operation staff then conducted an on-site inventory of every asset. This has resulted in a parks and open space asset management book (digital and hard copy). All of the information available in this inventory book needs to be transferred to GIS. Pictures were taken of every park asset and are stored on a computer in Parks and Open Space. Each of these photos should be linked geographically to their GIS asset. During the field inspection process, each asset was given a rating and a color code based on this rating. An asset given a bad rating received a color code of red in the database, those in moderate condition were given a yellow, and those in good condition were given a green color code.

Parks Graphically Depicted on Google Maps and then inventoried

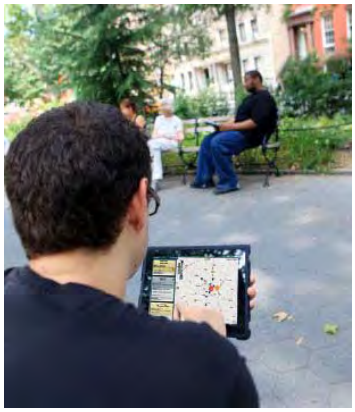
The first step in transferring this information to the GIS should be a database design. The design would allow for each of the existing data elements to be transferred and future data elements to be added. Time is of the essence for this project. The data is still relatively current. However, the longer the data is not made part of a work order system the more inaccurate it will become. The GIS data layer/s should be created, and an update application should be released to staff (this application is discussed as an additional need later in this chapter).

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)
- 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, Parks and Open Space 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

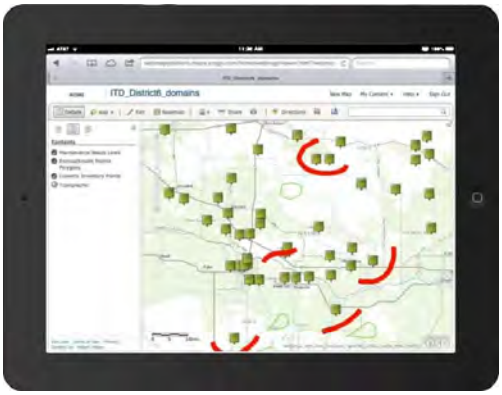


- tree maintenance / blow down
- grass cutting

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 by Parks and Open Space personnel 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. Staff has to inspect equipment weekly. A GPS enabled tablet and mapping information would enable staff to do their weekly 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. Some of this collection has been completed, and an inventory exists (See previous need). 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.

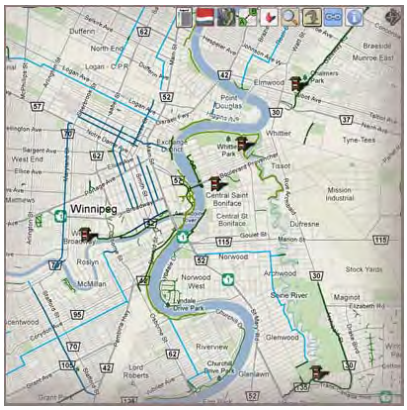
GIS Need

Specialized Online Mapping Themes

Staff expressed a need to develop online web mapping tools for public access with a focus on Parks and Open Space facilities

and amenities. 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 and Parks and Open Space 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 in IT, Parks and Open Space staff must help to define the general city data layers to present, as well as the Parks and Open Space specific layers. Map feature symbology, colors functionality, security settings, and data content must be designed to be consistent with City standards.

Online mapping could be extended to the horticulture aspects of Parks and Open Space. An application could show what is planted and where. The City is invested in curb appeal. Sharing this information with the public would allow access to the online map via crowd sourcing tools. This would elevate the beautification efforts throughout the city.

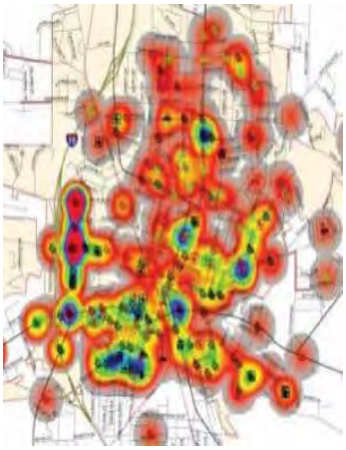
GIS Need

Mapping Ad Hoc Events

Staff expressed a need to map the location of special incidents such as criminal activity reported on or near city properties and injuries reported at city Parks and Open Space sites. “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.

Parks and Open Space 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.



Use GIS for Park Planning and Tracking Projects

Parks and Open Space are responsible for park planning. As such, staff works closely with the Planning Department. They review applications, review plans, and need to see a majority of the information that planners would need to access. Most of the park planning now is focused on smaller parks, and occasionally on larger parks. Staff would like to see all planning proposals as a GIS layer.

Additionally, Parks and Open Space staff coordinates, manages, and oversees a variety of infrastructure projects. Staff need to use GIS to find background information on a given project and produce supporting graphics. Currently, staff have to go to multiple mostly hard copy or on-sitesources to pull together the information that they need. Additionally, there is no map layer that tracks historic, current, and future projects. This can lead to inefficiencies and duplication of work. A GIS layer should be created to track all projects. Some of the benefits of tracking these projects in GIS include the ability to quickly view and analyze where funds have been spent throughout time, plan resources more effectively, and to notify the public of work in an area. Data from the Amanda database, WAM, and preliminary plans should all be accessible. Staff will need access to ArcGIS and training on creating and maintain their own data layers.

GIS Need

Formal Training for Parks and Open Space Staff

Staff that will be performing more advanced GIS analysis and mapping should participate in foundational GIS skills training. Parks and Open Space staff should participate in any enterprise-wide ArcGIS training that is made available via the GIS team in IT. As desktop or internet applications are deployed, Parks and Open Space will require specific training tailored to the GIS interface that may support their workflows. Training is typically arranged at the user level and based on applications that will be deployed throughout the enterprise.

The following case study details GIS usage for Parks and Open Space:

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 out 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 stares 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

GIS Gap Analysis

GIS Data Layer Inventory

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

Legend

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

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Parks and Open Space Data			
Amanda Data	Automated via Geocoding	Automated	Existing
Ball Fields	Delineated from Aerial Photography	GIS Team in IT in Coordination with Parks and Open Space	Existing
Building Schematics	Scanned from Floor Plans	GIS Team in IT in Coordination with Parks and Open Space	Recommended
City Owned Properties	Delineated from Aerial Photography	GIS Team in IT in Coordination	Existing
Grass Cutting/Turf Data, Mowing Areas	Delineated from Aerial Photography	Parks and Open Space	Recommended
Horticulture Features – Beds, Plants, Mulch Areas, etc.	Delineated from Aerial Photography and Field Inventory	Parks and Open Space	Recommended

Members/ Patrons	Geocode from recreation database	Parks and Open Space	Recommended
Park and Open Space Assets	Extract, cleanse, geocode, and map from relational databases; other map sources as required	GIS Team in IT in Coordination with Parks and Open Space	Recommended
Park and Open Space Infrastructure	Field data collection	GIS Team in IT in Coordination with Parks and Open Space	Recommended
Park and Open Space Parking Lots	Digitize from parcel data and other sources	GIS Team in IT in Coordination with Parks and Open Space	Recommended
Park and Open Space Signs Inventory	Field data collection	GIS Team in IT in Coordination with Parks and Open Space	Recommended
Trails	Field data collection	GIS Team in IT in Coordination with Parks and Open Space	Recommended
Park Utility Inventory	Field data collection	GIS Team in IT in Coordination with Parks and Open Space	Recommended
Parks	Digitize from parcel data and other sources	GIS Team in IT in Coordination with Parks and Open Space	Existing
Open Spaces (i.e. natural and stormwater management areas)	Digitized from source maps	GIS Team in IT in Coordination with Parks and Open Space and Engineering	Partial
Population Projections and Population Data and other Census Data	Obtain from external sources	GIS Team in IT	Recommended
Topography	Utilize existing data	GIS Team in IT	Existing
Trees in Parks Inventory	Field data collection	GIS Team in IT in Coordination with Parks and Open Space	Existing
Trees in Open Spaces (i.e. natural and stormwater management areas)	GPS Field Collection	GIS Team in IT in Coordination with Parks and Open Space and Engineering	Partial
Turf Areas	Digitize from parcel data and other sources	GIS Team in IT in Coordination with Parks and Open Space	Recommended
Vandalism	Extract, cleanse, geocode, and map from relational databases; other map sources as required	Automated	Recommended
Water bodies in Parks	Digitize from parcel data and other sources	GIS Team in IT in Coordination with	Existing

		Parks and Open Space	
WAM Records	Extract, cleanse, geocode, and map from relational databases; other map sources as required	Automated	Recommended
Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy, and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using the rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base, as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006, the City acquired rectified digital orthoimagery, which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy, and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.	GIS Team in IT maintains the property data. New property surveys are incorporated as they are received. If staff, in other departments, sees errors they have been asked to report them to the GIS Team in IT.	Existing

Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance have occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing
Landmarks	Digitized – have started to develop a commonplace layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhoods	Heads up Digitizing Screen. Subdivisions are available by 61-M plan (Subdivision) layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	GIS Team in IT creates and maintains addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building footprints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by the City to create an updated building layer.	GIS Team in IT	Existing

Contours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; changes are updated with Orhtophoto refresh	Existing

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

Legend	
Existing	
Yes	GIS component currently exists within division.
No	GIS component does not currently exist within division.
Limited/Partial	GIS component exists to a lesser degree.
Desired	
Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to divisional needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to divisional need.
Low	Can be met after higher needs are accomplished.

Component	Status		Priority	Notes
	Existing	Desired		
Automated Vehicle Location (AVL)	No	No	Low	No pressing need for AVL. However, should be considered for an overall citywide AVL initiative.

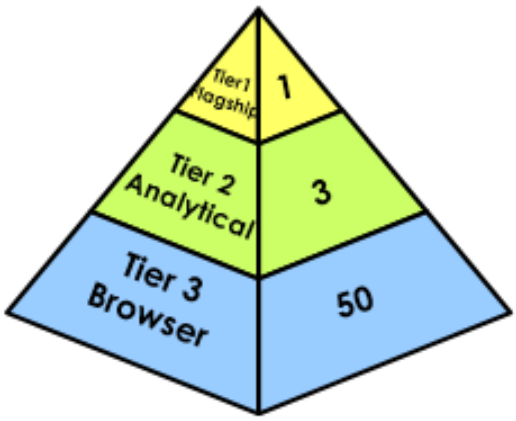
Component	Status		Priority	Notes
	Existing	Desired		
Documentation	Yes	Yes	Medium	The GIS Team in IT mandates enterprise GIS documentation processes and procedures.
Enterprise Systems Integration	No	Yes	High	Integration with the CLASS and other key existing databases.
Geocoding	Limited	Yes	High	Comprehensive geocoding will greatly expand the Parks and Open Space Department's mapping functionality.
GIS Data Access	Limited	Yes	High	The Parks and Open Space Department should have access to all city data and data created for the Parks and Open Space Department.
GIS Data Maintenance	Yes	Yes	High	Parks and Open Space should develop the skills to maintain their own data. This will include the introduction of easy-to-use tablet based applications for the field crews.
GIS Data Sharing	Yes	Yes	High	The Parks and Open Space Department needs other department's data and has the desire to share some of their data internally and with the public.
GIS Personnel	No	Yes	High	Parks and Open Space have a large volume of data that needs to be maintained. A GIS Technician is required to work in Parks and Open Space. The park staff don't have enough time for their existing workload, nor have time to input, maintain, and do complex queries for the large quantity of GIS data for their division. Existing staff needs the tools and training to use GIS effectively.
Hardware	Yes	Yes	High	Parks and Open Space have PCs for utilization of GIS at this time. However, tablets will need to be acquired for field data maintenance.

Component	Status		Priority	Notes
	Existing	Desired		
Mapping	Limited	Yes	High	Mapping products are very limited now. However, there is a desire to do much more in this area.
Metadata	Limited	Yes	Medium	A formal, standardized metadata system needs to be developed and implemented for all GIS data layers authored within Guelph. Standards should be decided upon by the GIS Team in IT.
Mobile Computing Resources	Limited	Yes	High	Having mobile computing for Parks and Open Space Department staff critical. Field staff will need to utilize tablets to update data while in the field.
Network	Limited	Yes	High	High availability of data via the internal network is mission critical.
Routing	Limited	Yes	Medium	Staff expressed the desire for the public to be able to create their own trail maps and routes.
Software	Limited	Yes	High	The Parks and Open Space Department will need access to a Parks and Open Space centric GIS data browser, ArcGIS, and a mobile GIS application.
Spatial Analysis and Modeling	No	Yes	High	Site location studies require spatial analysis. Staff should receive training to do some of this analysis themselves.

Component	Status		Priority	Notes
	Existing	Desired		
Training/Education	No	Yes	High	This component is considered a high priority for use of GIS within Parks and Open Space. Introductory training is needed at the browser user level for all staff and ArcGIS training for a select number of staff.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Departmental Return on Investment (ROI)

The following table indicates specific Return on Investment opportunities for the Parks and Open Space:

Return on Investment Opportunity Parks and Open Space	
Opportunity	**Explanation**
Save <u>Lives</u>	*Intranet GIS Data Browser:* • Park layout and Park Trail data layer (with markers as an attribute) would provide the public with better wayfinding tools for the large expanses of parks and open spaces in the City, and Public Safety personnel locations of emergency events in these parks and open spaces Improved asset and infrastructure planning, inventory and maintenance tracking will improve public safety.
Improved <u>Efficiency</u>	*Intranet GIS Data Browser and Spatial Analysis:* • Improved efficiency in identifying property lines and identifying adjacent property owners that have issues • Estimating projects for budgeting purposes without leaving the office. • Better quality and quicker decision making for park and trail planning • Improved and quicker provision of background data for park and trail construction projects to consultants *Field Access to Geospatial Data Incorporating Field Data Collection* • Allows for doing the weekly inspections electronically as well as accessing plans in the field.
Improve <u>Communications</u>	*Intranet GIS Data Browser and Spatial Analysis:* • Much improved communication and coordination with other departments when it comes to planning for events, traffic control issues, and planning of assets and infrastructure.

Save <u>Time and Improve customer service</u>	*Public Access to Geospatial Information:* • Staff can respond rapidly to customer issues, which are normally associated with property line maintenance or reports of items that require maintenance in parks and open spaces • Improving park user experience • Improving citizen engagement in park and trail planning
Effective <u>Management</u> of Assets and Resources	*Intranet GIS Data Browser and Spatial Analysis:* • Staff can better maintain natural assets such as trees, along with maintenance of Park infrastructure such as Park signage and utilities.
Meeting <u>Council Goals</u>	*GIS will assist in Meeting Council Goals* • Goals regarding: tree canopy percentage, citizen engagement, financial goals, staff collaboration, well designed, safe, appealing city, decision making excellence, optimization of work capacity, and others.

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Planning Services

Planning Services

Section Outline

Existing Conditions

- Department Overview
- Governance of GIS
- Hardware and Software

GIS Needs Assessment

- GIS Needs

GIS Gap Analysis

- GIS Data Layer Inventory
- GAP Analysis Chart

Multi-Tier GIS Application Use

Departmental Return on Investment (ROI)

Existing Conditions

Department Overview

The City of Guelph Planning Services works closely with a number of City departments and community stakeholders to achieve a variety of goals. Planning Services strives to ensure that Guelph continues to be a vibrant, accessible, inclusive and beautiful city that attracts residents, businesses, and visitors. Planning has the following major functions that can be divided into two major categories as follows:

Development Planning:

- Process approvals for Official Plan and Zoning By-law amendments
- Process approvals for site plans, subdivisions, condominiums
- Review and comment on the Committee of Adjustment applications and minor variances to address compliance with relevant planning policies
- Provide advice and information to the development community and public regarding City land use planning policies and procedures
- Environmental review of development applications

Policy Planning and Urban Design:

- Prepare Official Plan updates and Secondary Plans to ensure compliance with provincial and federal legislation and to reflect the community's values and aspirations
- Develop and implement urban design policies and guidelines to ensure new development meets Guelph's goals for a well-designed, safe, inclusive, appealing, and sustainable city
- Data and statistical information analysis to support planning projects
- Review and prepare environmental policies to protect and enhance Guelph's natural assets including rivers, waterways, urban forest, and other naturalized spaces
- Heritage planning to protect and preserve Guelph's cultural assets and places of historic significance

Existing GIS Conditions

Governance of GIS

Planning Departments are some of the most voluminous users of GIS within local government. Everything they do typically ties back to some type of geography. Furthermore, they need a host of disparate data to make decisions and answer questions. Without a fully functional GIS, the data gathering process is difficult and time-consuming. Needed data resides in various systems and databases, in filing cabinets, on paper maps, or has never been gathered. This often leads to decision-making that is based on the best information available. No other department in local government can benefit as much from having a fully developed GIS.

Planning Services is one of the most sophisticated GIS users at the City now. The department has a GIS and Planning Analyst who maintains planning related GIS layers and serves as the department's GIS expert. He works closely with the GIS team in IT to provide analysis and mapping for the department.

Additionally, other departments rely on the GIS/Planning Analyst to assist them with their mapping needs. Two staff utilizes a shared copy of ArcGIS Standard (ArcEditor) and two copies of ArcGIS Basic (ArcView) are used by other staff. Four staff use these Esri tools to include the following positions: GIS and Planning Analyst, Administrator of Planning and Technical Services, Environmental Planner, and Planning Technician II. Staff expressed a need to have access to a copy of ArcGIS Advanced

so that they can utilize some of the advanced tools offered by the software. Additionally, Environmental Planning would benefit from two additional copies of ArcGIS Basic (ArcView). Esri's Spatial Analyst and 3-D Analyst Extensions would give the department needed additional GIS functionality.

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

Current GIS Staffing				
Type		**Number of Users**	**GIS Usage**	**Primary Tools**
	GIS Flagship (Tier 1)	2	High	ArcGIS Standard (ArcEditor) – one shared copy
	GIS Analytical (Tier 2)	2	High	ArcGIS Basic (ArcView)
	GIS Browser (Tier 3)	5	Low	Has Access to OnPoint

Hardware and Software

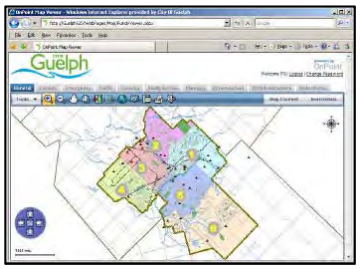
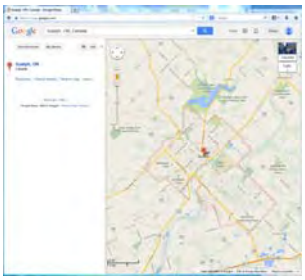
All staff within the Planning Services has access to a personal computer. The following table summarizes existing hardware.

Hardware Issues Summary	
Type	**Notes**
Personal Computers	Available to all staff
Laptops	A few staff have laptops
Printers	Ample printers available for use
Plotters	HP Designjet T1200 Located at City Hall in Planning Print Room
GPS	Trimble GeoTX (with ArcPad) is used for field collection, sign-out required from IT, used primarily by Environmental Planning Staff for field data collection
PDA/MDTs	None
Scanners	Available as needed

Planning Services use a variety of software applications. Microsoft Office is used to conduct office productivity tasks. The following is a list of key software products utilized by the department:

1. Microsoft Office– Used for office productivity
2. ArcGIS – ArcView and ArcEditor
3. AutoCAD – Used for viewing computer aided drafting files/plans from consultants and for creating design concepts
4. Amanda – Viewing of planning records

5. FoxPro – database for complaints
6. OnPoint - Intranet GIS browser provided by the GIS Team in IT
7. Google Maps – Address identification and mapping

 **ArcGIS**	**ArcGIS →** One copy of ArcGIS Standard (ArcEditor) and two copies of ArcGIS Basic are used for data management, mapping and analysis. ArcGIS is used by staff to create and maintain GIS data. ArcGIS Standard (ArcEditor) is used extensively to maintain the planning related layers. Also, the tools are used for high-end map creation and analysis. There is a desire for two additional copies of ArcGIS Basic (ArcView), one of ArcGIS Advanced, one of Spatial Analyst, and one of 3-D Analyst.
AMANDA Back Office Suite CSDC ENABLE. TRANSFORM. LEAD. www.csdcsystems.com **Amanda**	**AMANDA →** AMANDA is a web-based product used for licensing, permitting, planning, and compliance. Planning uses AMANDA as its primary software application. The software is used for development applications, environmental concerns, tracking addressing, zoning cases, heritage inventory, site planning, property information, grant programs, and tracking agreements. AMANDA data has been linked to GIS but needs to be expanded.
 **OnPoint Intranet GIS**	**OnPoint →** OnPoint from Rolta is utilized as an enterprise-wide GIS intranet solution. The software allows users to access pertinent GIS data via a web browser. Planning has attempted to utilize OnPoint but has found it to be insufficient to meet their needs. The application is too slow and lacking needed functions. For the most part, Planning has abandoned the use of the product.
 **Google Maps**	**Google Maps →** Google Maps is used to identify addresses and to for creating maps. Google Maps and Google Earth is used by the Planning Services staff for data visualization and to find field assets.

GIS Needs Assessment

GIS Needs

Planning agencies across the North America have implemented GIS in varying capacities, and Planning Services 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, use of GPS and tablet applications for data acquisition and entry, automated submission and processing of plats and site plans, 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.

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

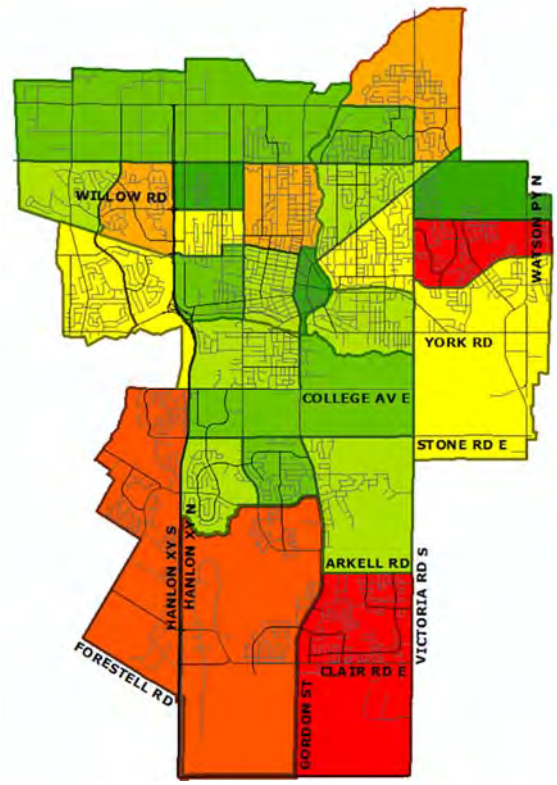
GIS Need	*Method/Application to Meet Need*
☑ Mapping and Spatial Analysis of Department Data	▫ ArcGIS Desktop ▫ Intranet GIS Data Browser
☑ Department-Wide Access to Geospatial Data	▫ Internet and Intranet GIS Data Browser
☑ Automated Neighborhood and Vicinity Mapping	▫ Intranet GIS Data Browser
☑ Integration and Utilization of Imaging Data - Linking Digital Documents to GIS	▫ Document Management System (creating) ▫ Intranet and Internet GIS Data Browsers (viewing)
☑ Public Access to Geospatial Data	▫ Internet GIS Data Browser
☑ GIS Enable the Heritage Inventory and Natural Heritage Inventory	▫ Scanning ▫ Intranet and Internet GIS Data Browser
☑ Public Forum Mapping	▫ Internet and Intranet GIS Data Browser
☑ Field Access to Geospatial Data Incorporating Field Data Collection	▫ ArcGIS Online ▫ Tablets

GIS Need	*Method/Application to Meet Need*
☑ Advanced Analysis Tools	▫ I-Tree ▫ Spatial Analyst ▫ 3-D Analyst
☑ Completed Metadata and GIS Data Update Notification	▫ ArcGIS Desktop
☑ Digital Data Submissions and Standards	▫ Standards Document and Ordinance
☑ Formal GIS Training for Department Staff	▫ Vendor Application Training ▫ Third Party Application Training

☑ GIS Need

Mapping and Spatial Analysis of Department Data

One of the significant benefits that Planning Services will realize from the continued implementation of GIS and complementary technologies is increased and improved access to information. The department will be able to further understand relationships between different types of data in a spatial context, thereby improving decision-making; maps will be used to provide the public with valuable environmental, housing and neighborhood information in a geographic context; grant applications and materials will include maps and quantitative information from spatial analyses that will give emphasis to areas in need of assistance. Planning Services has the ability to achieve continued success due to availability of GIS staff within the department. Additional training and software tools will be needed to accomplish all of the identified analytical needs of the department. Training and staff duties are discussed later in this Needs Assessment.



Guelph Demography

Planning Services will be able to use GIS in several tasks, including:

- Viewing and analyzing city demographic information
- Proposed real estate project location analysis
- Identifying vacant and underutilized land
- Environmental Assessment (EA)

- Cost-Benefit Analysis (CBA) for projects, programs
- Focus area identification and evaluation
- General land use and infrastructure mapping and analysis
- Citizen education and advocacy
- Statistical analysis for budgetary preparations
- Using maps to train personnel
- Review land use and subdivision permitting
- Identify major projects or new developments
- Dovetail with the Integrated Operational Review (IOR) Initiative

Planning Services will be able to derive valuable spatially driven information on key issues. It is recommended that the department work with the GIS team in IT and prioritize GIS-based analyses that can be performed on a project or program basis. Among these analyses, the GIS team in IT could provide support for demographics, real estate sales, inclusionary/affordable housing, parcel-specific environmental assessments, housing/property condition and vacant land.

Some of the information that Planning Services will be able to visualize and analyze via a GIS interface includes:

- Long Range Planning: Historic districts, noise zones, housing analysis, growth scenarios, change detection, biological inventory, land use analysis, growth scenarios analysis, etc.
- Housing Element: Vacant and Underutilized Land Survey.
- Zoning: Determine how zoning impacts housing and property values.
- Affordable Housing: Monitor multi-family units (e.g. crime stats)
- Environmental and LEED Assessments: conduct cost/benefit analysis in review of mitigation monitoring, condition compliance, environmental sensitive areas, national wetlands inventory, storm water regulations, air quality, biological concerns, noise issues, and traffic. Determine which structures are LEED certified.
- Mapping organized neighborhood groups and planning areas.

Guelph Official Plan

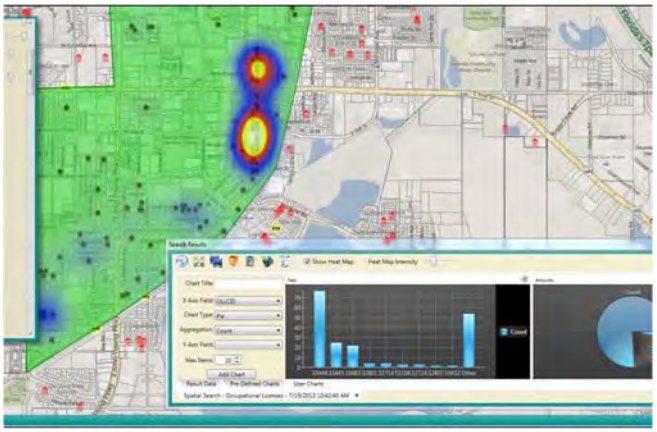
- Parcel-by-Parcel Analysis: Track owners, age and configuration of parcel.
- Tracking data associated with grants expenditures
- Map projects that use federal or provincial funds

- Three dimensional mapping and terrain models with building footprints
- Mapping of nuisance structures and demo lists/progress
- Vacant land management
- Mapping of projects and who is responsible for upkeep (not city projects)
- Map district boundaries to show who needs to be notified/attached to pdf of agreements
- Show data points for citizens who belong to an organized district group
- Map zoning map amendment, variance and subdivision cases
- More easily develop a "case history" at each address
- Use GIS to link to important documentation such as staff reports, site plans, decision letters and ordinances
- Determine list of affected property owners for public notice mailings
- Output addresses to labels automatically
- Automatically included presence of affected organizations, business groups and board members
- GIS Based databases of historic districts and structures, track property history and photographs
- Develop a publically available portal to distribute key information searchable by address or dynamic map selection
- Track environmental concerns and projects
- Need photos associated with a GPS point and field capabilities for remote upload
- Access to key additional data sets to include LIDAR and infrared imaging data

☑ GIS Need

Department-Wide Access to Geospatial Data

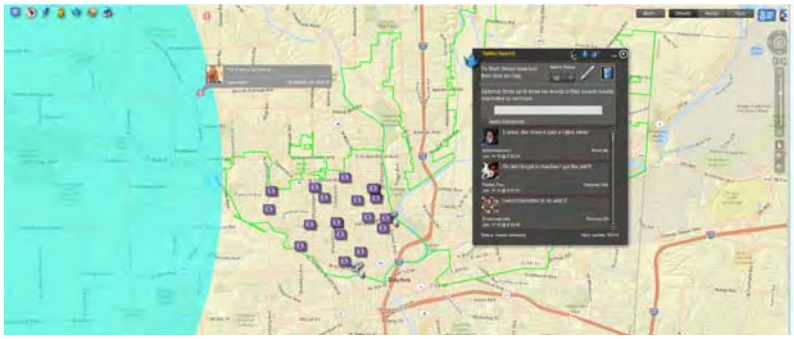
It is recommended that an enterprise-wide ArcGIS Server (AGS) based Intranet GIS Data Browser tool be used to access pertinent spatial data, imaging, and spatial analysis functionality. This application will not only allow users to view GIS data, but data entered into other database systems, as well. Currently OnPoint was implemented to meet this need. However, Planning Services finds OnPoint to be too slow and lack the needed functionality. Therefore, a new functional version of OnPoint or a replacement product will need to be implemented.



Intranet Mapping with Executive Dashboard and Hotspot Functions

A large amount of valuable data for Planning Services 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. The application should provide live access to data from AMANDA and other key systems such as imaging systems that house planning documents and plans.



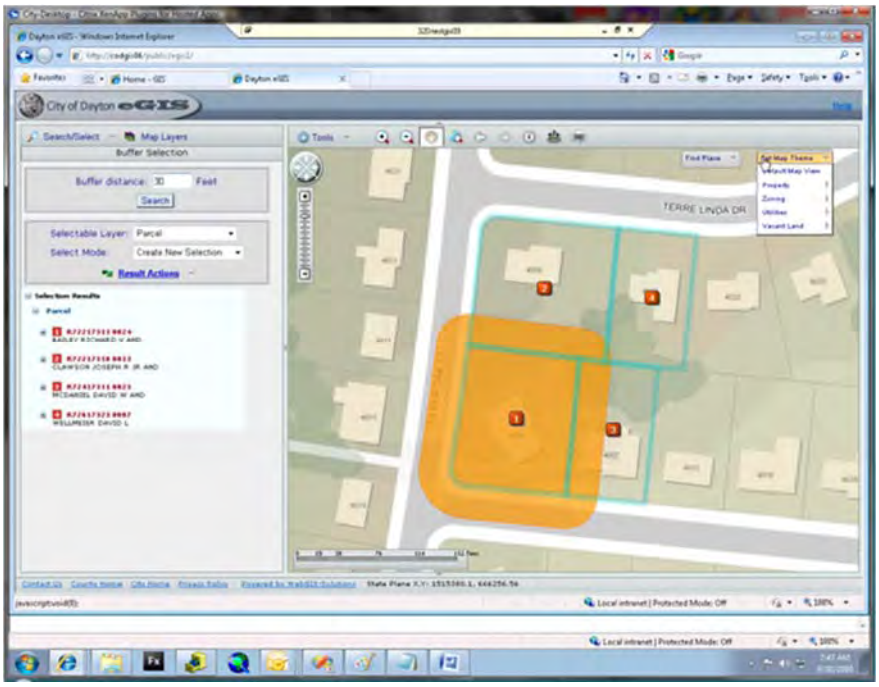
Intranet browser integrated with social media

This application will serve as the primary GIS application for Planning Services, 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. Recent advancements in GIS and intranet products allow for the inclusion of an executive dashboard to view key data, hotspot mapping to view clusters of any desired data, integration with social media, and a wealth of querying capabilities.

GIS Need

Automated Neighborhood and Vicinity Mapping

Planning departments across the country are turning to GIS for automation of several tasks, including the production of neighborhood and vicinity maps for public meetings and public distribution. Planning Services will be able to better serve its public duties by using an automated mapping application that enables staff members to quickly and efficiently create current neighborhood and vicinity maps. It is recommended that an intranet GIS Data Browser application be used to address these mapping



needs. The intranet GIS data browser is a resource that would be the primary tool used by Planning Services staff to view and map GIS data. Additionally, this function can be used for zoning notification and other citizen notification tasks.

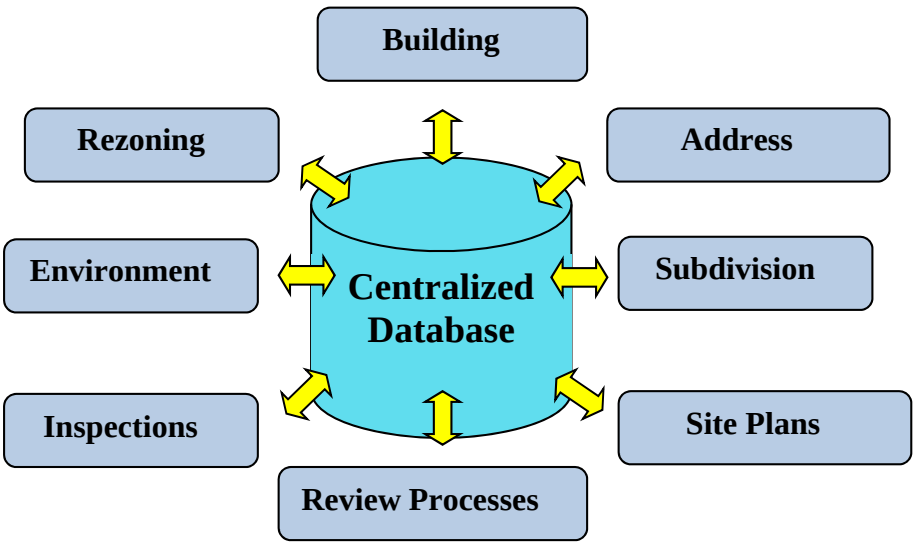
GIS Need

Integration and Utilization of Imaging Data - Linking Digital Documents to GIS

Planning Services handle volumes of paper and digital data that are important for daily decision making. This data can be found in filing cabinets, digitally on computers, or as submitted plans. Using GIS as a portal for all of this information would be a huge advantage for Planning Services staff. These scanned documents can be associated with an address or parcel number and, therefore, be linked into and accessed via the GIS.

Planning Services should implement GIS–digital document linkages to manage digital and paper copy maps and documents that can be linked to actual GIS data features. Many of the documents stored and reviewed by the department 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 along with computer screens.

The concept of a centralized and integrated document management solution is simple: All processes and workflows have access and are integrated with all other processes, sub-processes and workflows. The figure below provides a stylized representation of a centralized model:



Example Graphic of a Central Document Management Storage

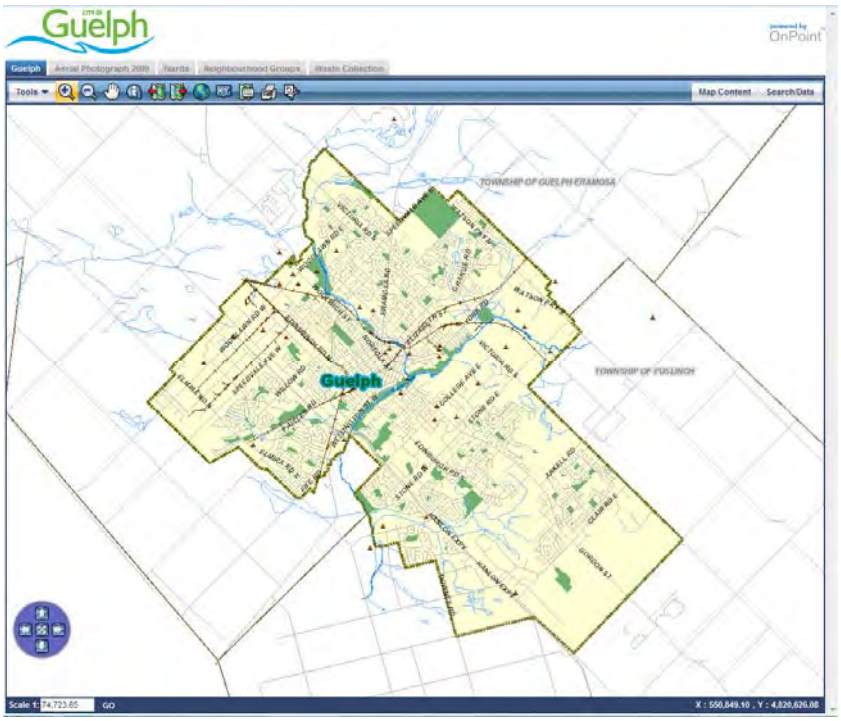
GIS Need

Public Access to Geospatial Information

Providing public access to GIS maps through publicly accessed Internet applications will help provide information to the City of Guelph citizens. Through an Internet GIS Data Browser, Planning and other departmental data can be provided to the public through an intuitive and easy to use interface. In addition to providing public access to existing data, Divisions such as Planning 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.

Typical Permit Center for a Public Community Planning Agency

The City should further implement an ArcGIS Server (AGS) based Internet GIS data browser to provide citizens with access to the Guelph's geospatial data. Currently the City uses a public facing application from OnPoint. OnPoint, ArcGIS Online or other applications should be deployed. These applications should allow for different configurations and different looks. Targeted applications will be deployed specifically for some departments, 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, an internet GIS data Browser will be a City initiative, including Planning Services as a stakeholder in its provisioning. Additionally, Environmental Planning would like to have an application with crowdsourcing functions. They would like the public to be able to submit key information such as bird sightings, frog sightings, and other environmental issues.



Current Public Facing GIS Application

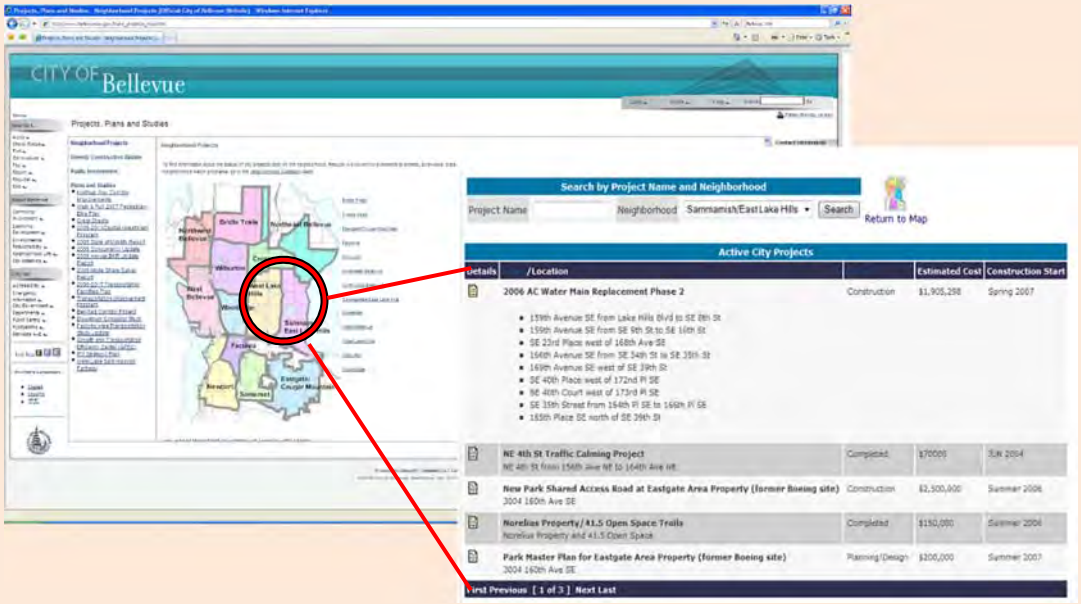
CASE STUDY: Expanding the Use of Internet GIS Applications – Bellevue, Washington

Community Development staff throughout the City needs 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.

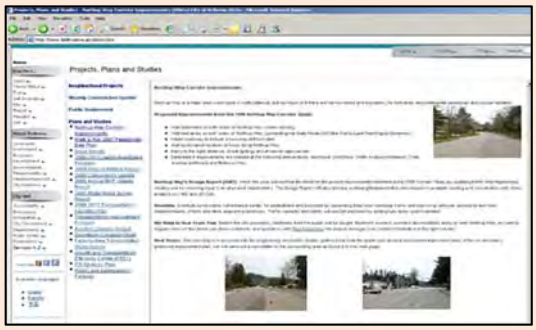
Development Activity – Mapping and reporting of development activity is available to the user.

Neighborhood Projects – status of special projects is 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.

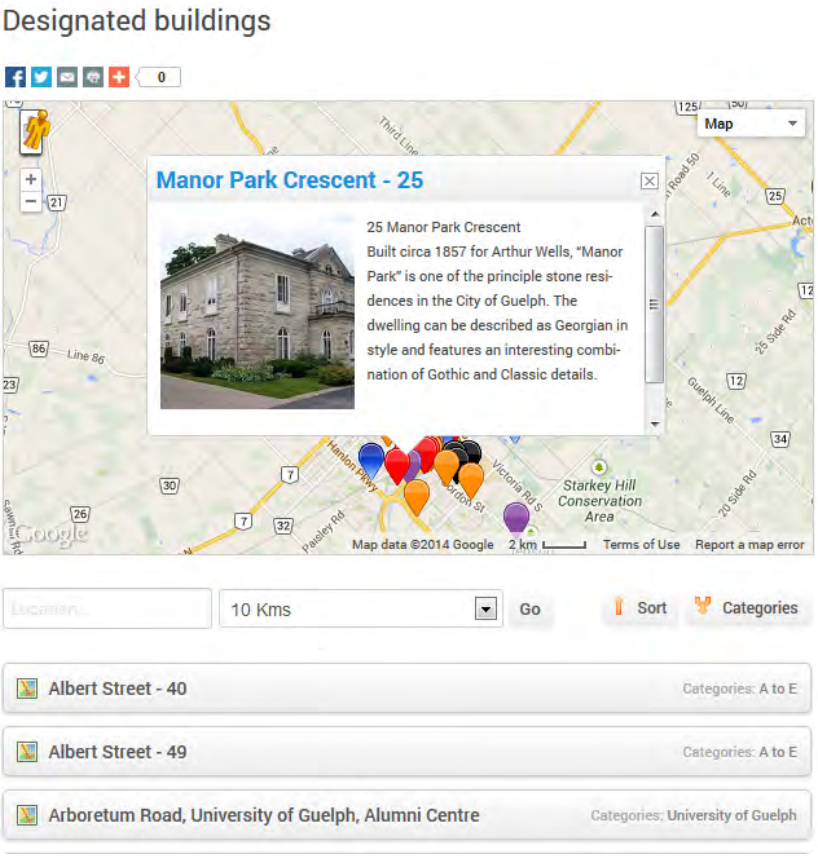


Sample Online Transportation Plan

GIS Need

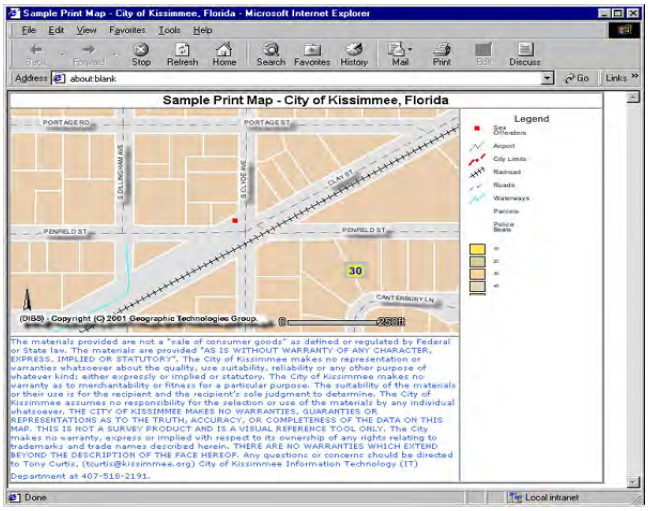
GIS Enable the Heritage Inventory and Natural Heritage Inventory

Guelph has an excellent record of conservation and adaptive re-use of heritage structures. Heritage Guelph is an appointed committee of City Council. In an advisory capacity, Heritage Guelph is responsible for advising Council on matters relating to the architectural, cultural and landscape heritage of the city. Preservation, restoration and re-use of Guelph's significant heritage structures continue to be a priority for the City of Guelph and its citizens. GIS can be used to create a virtual historic district walking tour. Digital photographs and documents describing the historical or neighborhood significance of a property would be linked via an intuitive public access GIS application. A user would be able to query a property through a list of names, by address, or simply by visually locating an area. A Google Maps based application is currently available on the city's website. However, the City might want to consider something with more interactivity, and that consumes data from a live GIS layer. ArcGIS Online should be considered for this function. A similar application should be created for Guelph's Natural Heritage Inventory.



GIS Need

Public Forum District and Vicinity Mapping



Example of a Static Map for Public Meetings

Planning Services conducts public forums and various meetings that would greatly benefit from 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 using 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 a template for the quick production of maps geared towards public forums.

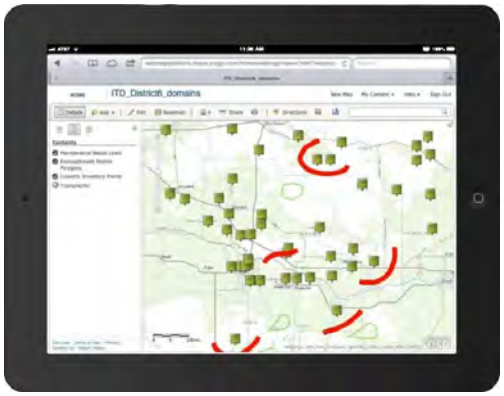
Alternatively, if the issue being discussed requires analyzing specific neighborhood factors in various areas, a live GIS viewing tool should be used. This tool would allow the presenter to zoom into areas of concern and display key data layers, and then accomplish quick analysis, such as selecting all properties within 100 meters 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 Forum Meeting Using GIS Viewing Application

GIS Need

Field Access to Geospatial Data Incorporating Field Data Collection

Another identified need by Planning Services personnel is to have field access to mapping data. ArcGIS Online and tablets can be utilized in the field, allowing access to environmental and other planning data, coupled with the ability to conduct address searches; query attributes of all information, such as environmental areas of concerns, violation locations (especially beneficial for larger sites and landscape inspections), animal sighting locations, link to digital site plan images, and more. A GPS enabled tablet and mapping information would enable staff to do field work and collect needed data with connectivity back to the central database. Additionally, the application should have redlining capabilities. This would allow staff to mark up the digital map for additions and/or corrections. The ability to take photos with automatic GPS coordinates and attach them to collected data is desired.

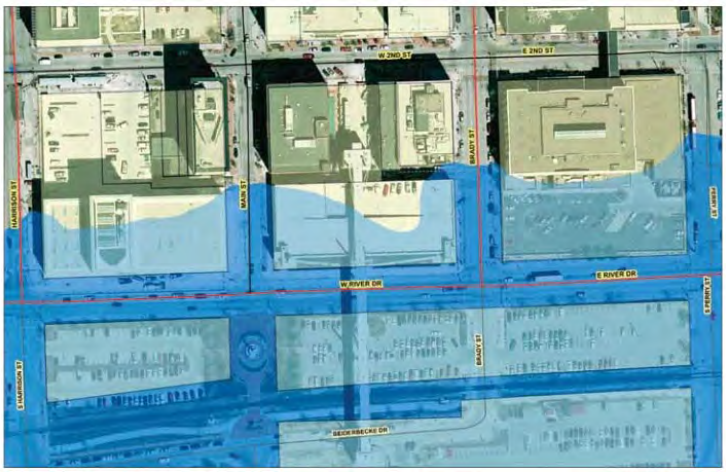


GIS Need

Advanced Analysis Tools

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



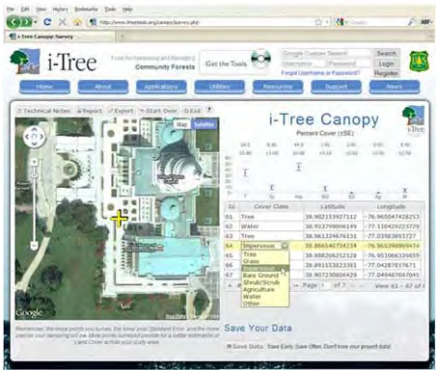
Flooding Analysis with 3D Analysis

- Fully integrate cell-based raster data with traditional vector data sources.

Examples of the types of analysis that you can do with ArcGIS Spatial Analyst include

- Find suitable locations.
- Calculate the accumulated cost of traveling from one point to another.
- Perform land-use analysis.
- Predict fire risk.
- Analyze transportation corridors.
- Determine pollution levels.
- Perform crop yield analysis.
- Determine erosion potential.
- Perform demographic analysis.
- Conduct risk assessments.
- Model and visualize crime patterns.

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



Additionally, staff will be able to consider acquiring other tools that are viable because an advanced GIS is in place. Tools like i-Tree will allow Guelph to strengthen their urban forest management and advocacy efforts by quantifying the environmental services that trees provide and the structure of the urban forest.

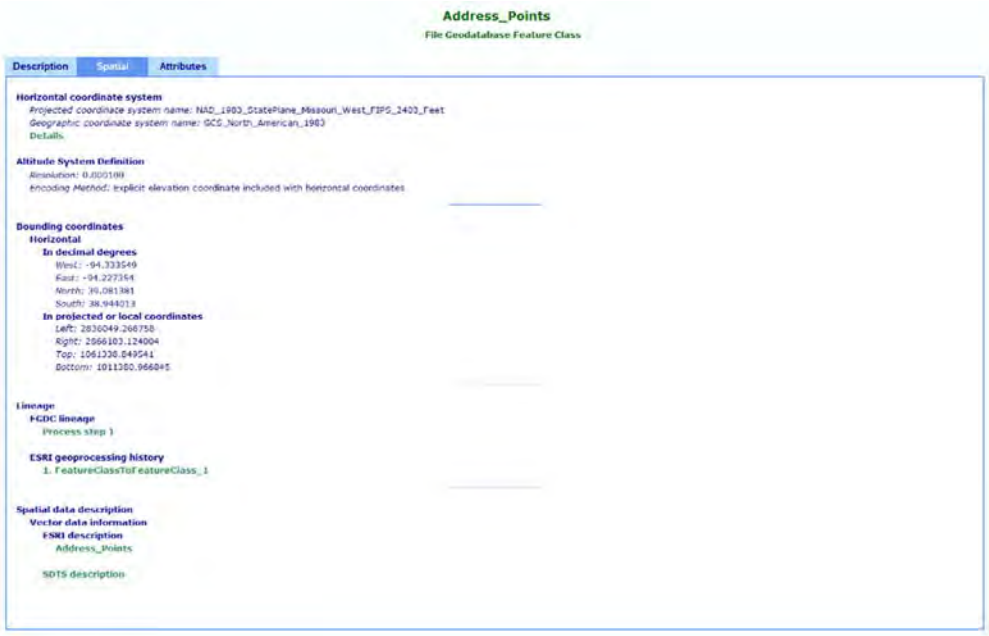
GIS Need

Completed Metadata and GIS Data Update Notification

During interviews, Planning Services expressed the desire to know the derivation, spatial accuracy, and temporal accuracy of GIS data. This should be addressed by maintaining metadata for all GIS layers. 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



Metadata view in ESRI ArcGIS Desktop ArcCatalog software application

As a city standard, metadata should be a requirement for all GIS data layers within the central database repository. For the purposes of this Planning Services GIS need, a focus should be placed on the automated data update notification process. An automated procedure and system of GIS data update notifications should be put in place, enabling every city department and staff member to know exactly what and when updates to important GIS data layers occur. A common communication medium for this task utilizes email notifications to affected city personnel.

GIS Need

Digital Data Submission and Standards

Based on the Guelph's utilization of outside consultants for various projects, as well as the receipt and review of construction plans from private parties, such as developers, it is recommended that the city establish a set of standards for all CAD data submitted.

An initial recommendation is for Planning Services to require that all plans be provided in digital format as CAD drawings. In doing so, the department will be able to establish a consistent means for review. In addition, staff will be able to archive this digital data and link it to specific points for visualization in GIS applications.

In the short term, it is recommended that the City establish a preliminary set of CAD standards to which all submitted CAD drawings must conform. It is recommended that in the long term the Department work to implement the Federal Geo-Spatial Data Committee (FGDC) Geospatial Positioning Accuracy Standards,

Part 4: Architecture, Engineering, Construction, and Facilities Management (FGDC-STD-007.4-2002); this standard is generally known as Part 4 of the FGDC's Geospatial Positioning Accuracy Standards. Alternatively, the city can model their CAD standards after the City of Kitchener. Their standards document can be found at the following URL:
http://www.kitchener.ca/en/businessinkitchener/resources/COK_DTS_EngineeringCADStandards.pdf

Part 4 provides accuracy standards for engineering drawings, maps, and surveys used to support planning, design, construction, operation, maintenance, and management of facilities, installations, structures, transportation systems, and related projects. It is intended to support geospatial mapping data used in various engineering documents, such as architectural, engineering, and construction (A/E/C) drawings, site plans, regional master planning maps, and related GIS), Computer-Aided Drafting and Design (CADD), and Automated Mapping/Facility Management (AM/FM) products. These products are typically created from terrestrial, satellite, acoustic, or aerial mapping techniques that output planimetric, topographic, hydrographic, or feature attribute data.

The Part 4 standard defines accuracy criteria; accuracy testing methodology, and accuracy reporting criteria for object features depicted on A/E/C spatial data products and related control surveys. It references established voluntary standards that may be used for some smaller-scale A/E/C mapping applications. In addition, the standard contains general guidance for specifying accuracy criteria for selected types of A/E/C features or control surveys. Using the standards and guidance contained in this section, end users of A/E/C products can specify surveying and mapping accuracy requirements needed for their projects or specific CADD/GIS layers, levels, or entities. From these specifications, data producers (e.g., surveyors, engineering firms, consultants) can determine the instrumentation, procedures, and quality control processes required to obtain and verify the defined accuracies.

By implementing a common standard, the City will be able to maintain consistent documentation of construction designs/plans provided by external entities. This will facilitate the review and assessment process, and ensure that staff can interpret data consistently. Most developers are already utilizing CAD technology and will be able to adhere to a well-written policy with little extra burden and cost.

GIS 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. Planning Services should participate in any enterprise-wide Esri ArcGIS training that is made available through the GIS team in IT or throughout the City. Through the use of Esri expert instructors, the City can provide GIS instruction for its user community by providing onsite training.

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

GIS Gap Analysis

GIS Data Layer Inventory

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

Legend

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

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Planning Services Data			
Amanda Data (Licenses, Permits, and other data)	Automated via Geocoding	Automated	Existing
Bike Lanes	Digitized on Screen	Engineering	Existing
Certificates of Approval	Acquired from the Ministry	Ministry of Environment	Recommended
Census Data	Download from Census Bureau	GIS Team in IT	Existing
City Owned Properties	Delineated from Aerial Photography	GIS Team in IT	Existing
City Trees	GPS	Parks and Planning	Partial
Code Violations	Automated via Geocoding	Automated	Desired
Complaints	Automated via Geocoding	Automated	Desired
Construction Approvals, Site Alteration, and Tree Removal Permits	New databases that should be automated via geocoding	Automated	Desired
Crime Data	Automated via Geocoding	Automated	Desired
Easements	Digitized on Screen	Engineering	Partial
Engineering Layers (all infrastructure, SWMPs)	Various	Engineering	Partial
Environmental Monitoring (including long term plan for Hanlon Creek Business Park	Digitized on Screen ideally in a format that can be linked to NHS database	Planning Services	Recommended
Fish Habitat	Digitized on Screen	Planning Services	Recommended
Flood Zones	Acquire from GRCA	GIS Team in IT	Existing
Grant Program Locations	Digitized on Screen	Planning Services	Recommended
Historical Aerial Photography	Aerial Flyovers	GIS Team in IT	Partial
Historic Districts	Digitized on Screen	Planning Services	Existing
Heritage Properties	Scan files and scan other documents	Planning Services	Partial
Housing (Social, Rental, Lodging Houses)	Automated via Geocoding	Automated	Desired

Hydrology (Natural Water Features)	Various	GRCA	Existing
Impervious Surfaces	Digitized on screen	Engineering	Recommended
Land Use	Digitized on screen	Planning Services	Partial
LEED Compliance Sites	Automated from a database	Automated	Desired
Natural Heritage System	Digitized and data entry	Planning Services	Desired
Parks	Digitize from parcel data and other sources	GIS Team in IT in Coordination with Planning	Existing
Parking	Digitized from aerials	Transportation	Existing
Parks and Recreation (parklands, trails, others)	Various	Parks	Existing
Population Data – Census Data	Obtain from external sources	GIS Team in IT	Recommended
Population and Employment Projections	Obtain from external sources	Planning Services	Recommended
Projects	Digitized on Screen	Varies	Recommended
Sidewalks	Digitized on Screen	Engineering	Existing
Soils	Digitized	National Government	Desired
Species at Risk (sensitive data)	Digitized	Province	Partial
Species Records	Digitized on Screen	Planning Services	Partial
Topography	Utilize existing data	GIS Team in IT	Existing
Traffic Zones	Digitized on Screen	Transportation and Planning Services	Partial
Utilities – External	Other Utilities – Union GAS, Guelph Hydro, Ontario Hydro, Bell, Rodgers, others	Other Utilities	Recommended
Valley Lands	Digitized on screen	Planning Services	Partial
Variances, Conditional Uses, Site Design, General Development Plan, and Zoning Map Amendment cases	AMANDA Records and Scan in Paper Records and Link	Planning Services	Desired
WAM Records	Extract, cleanse, geocode, and map from relational databases; other map sources as required	Automated	Recommended
Water, Sanitary Sewer, and Stormwater Systems	Digitized on-screen and converted from CAD drawings and paper maps	Engineering	Existing but needs spatial improvement

Wetlands	Digitized On-Screen	Ontario Ministry of Natural Resources	Existing
Wildlife Habitats and Sightings	Digitized on screen and field observations	Planning Services	Partial
Woodlands	Digitized on screen	Planning Services	Partial
Zoning	Digitized on screen	Planning	Existing
Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy, and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using the rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base, as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006, the City acquired rectified digital orthoimagery, which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy, and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital	GIS Team in IT maintains the property data. New property surveys are incorporated as they are received. If staff, in other departments, sees errors they have been asked to report them to the GIS Team in IT.	Existing

	property updates from Teranet for registered properties and assessment properties.		
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance have occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing
Landmarks	Digitized – have started to develop a commonplace layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhoods	Heads up Digitizing Screen. Subdivisions are available by 61-M plan (Subdivision) layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	GIS Team in IT creates and maintains addresses within GIS. Are notified by Planning when new addresses are required.	Existing

Building Footprints	Original building footprints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by the City to create an updated building layer.	GIS Team in IT	Existing
Contours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; changes are updated with Orhtophoto refresh	Existing

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

Legend	
Existing	
Yes	GIS component currently exists within division.
No	GIS component does not currently exist within division.
Limited/Partial	GIS component exists to a lesser degree.
Desired	
Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to divisional needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to divisional need.
Low	Can be met after higher needs are accomplished.

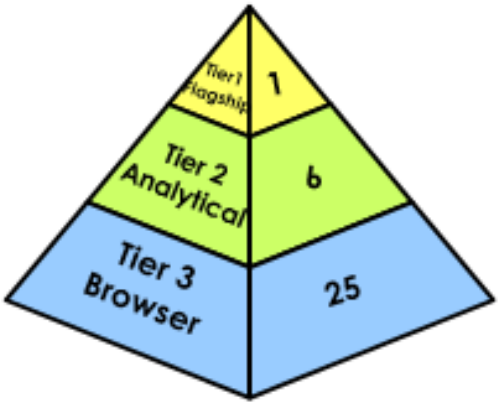
Component	Status		Priority	Notes
	Existing	Desired		
Automated Vehicle Location (AVL)	No	No	Low	No pressing need for AVL. However, should be considered for an overall citywide AVL initiative.
Documentation	Yes	Yes	Medium	The GIS Team in IT mandates enterprise GIS documentation processes and procedures.
Enterprise Systems Integration	Yes	Yes	High	Integration with the AMANDA and other key existing databases.
Geocoding	Limited	Yes	High	Comprehensive geocoding will greatly expand the Planning Services' mapping functionality.
GIS Data Access	Yes	Yes	High	The Planning Services should have access to all city data and data created for the Planning Services.
GIS Data Maintenance	Yes	Yes	High	Planning should continue to develop the skills to maintain their own data. This will include the introduction of easy-to-use tablet based applications for the field crews.
GIS Data Sharing	Yes	Yes	High	Planning Services needs other department's data and has the desire to share some of their data internally and with the public.
GIS Personnel	Yes	Yes	High	Planning Services has a large volume of data that needs to be maintained. Planning Services employs a GIS Technician. Additionally, other staff will need training to advance their GIS skills

Component	Status		Priority	Notes
	Existing	Desired		
Hardware	Yes	Yes	High	Planning has PCs for utilization of GIS at this time. However, tablets will need to be acquired for field data maintenance.
Mapping	Yes	Yes	High	Planning is one of the most prodigious users of GIS at the City. They produce a host of map products.
Metadata	Limited	Yes	High	A formal, standardized metadata system needs to be developed and implemented for all GIS data layers authored within Guelph. Standards should be decided upon by the GIS Team in IT.
Mobile Computing Resources	Limited	Yes	High	Having mobile computing for Planning Services staff is important. Field observations will need to be captured, utilizing tablets to update data while in the field.
Network	Yes	Yes	High	High availability of data via the internal network is mission critical.
Routing	Limited	No	Low	Planning Services does not need to use GIS for routing purposes.
Software	Yes	Yes	High	Planning Services has multiple ArcGIS users and will need to expand with more copies of Basic and a copy of Advanced.
Spatial Analysis and Modeling	Limited	Yes	High	Planning has the need to conduct a number of studies and modelling. However, the lack of data and software hinders those efforts at this time.

Component	Status		Priority	Notes
	Existing	Desired		
Training/Education	Limited	Yes	High	This component is considered a high priority for use of GIS within Planning. Introductory training is needed at the browser user level for all staff and ArcGIS training for a select number of staff.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Departmental Return on Investment (ROI)

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

Return on Investment Opportunity Planning Services	
Opportunity	**Explanation**
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 should save in excess of 40 staff hours a week in Planning Services. *Staff access to accurate/updated data* • Staff should have access to current GIS data to better serve and provide information to the public and decision makers. This should save 10 staff hours a week in Planning Services. • The use of GIS in the field will allow staff to more readily access data and reduce trips. This would save in excess of 5 hours a week.
Improve Data Accuracy	*Better GIS Data and Spatial Analysis:* • Working with other departments and City agencies to update data with higher accuracy can improve the results when analyses are performed. By sending errors found in data to the data owner's errors can be correct quickly. • Will contribute to expediting review of development applications as it will increase effectiveness of inter-departmental collaboration which is one of the most critical challenges in the development review process, as recognized in the Integrated Operational Review project.

Return on Investment Opportunity Planning Services	
Opportunity	**Explanation**
Improve <u>Citizen</u> Access to Government	*Internet Browser:* • Planning Services 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.
Effective <u>Management</u> of Assets and Resources	*Internet Browser:* • GIS will allow for performance monitoring on such things as Planning Services applications, development and growth management initiatives, inventories such as vacant land, draft approved lots, uptake of units, affordability, staff deployments, fee calculations, environmental concerns, and project management.
Compliance with <u>Provincial/Federal Mandates</u>	*Internet Browser:* • GIS can be used by the City to submit accurate monitoring and performance reports to the Province. • Maps needed to satisfy reporting requirements for mandates. • Environmental review requirements – habitats, endangered species, flood zones, underground storage tanks.

Return on Investment Opportunity Planning Services	
Opportunity	**Explanation**
Improved <u>Productivity</u>	*Internet Browser:* • A specific return on investment example for improved productivity would be the rapid turn-around capability on alternative analysis. Several scenarios can be created and analyzed, and changes to land use can be made on the fly in a staff meeting, and boundary changes modified during a community open house to illustrate how alterations to development patterns will affect an area.
Improved Information <u>Processing</u>	• Planning Services would expect GIS to increase the complexity of analysis opportunities. Increasing demand for impact analysis for new developments should propel methods for faster processing of information frequently requested.

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Department of Public Works

Public Works

Section Outline

Existing Conditions

 Department Overview

As outlined on the City of Guelph's website, the Department of Publics Works offers the following services to Guelph's community:

- Roads and Right of Ways: Winter control of roads, sidewalks, city owned steps and parking lots; maintaining storm sewers, manholes, roadside ditches and catch basins; downtown maintenance; road inspection; road repairs; road sweeping; right of way debris pickup; graffiti control; guide rail, hand rail and boulevard maintenance; minor structural and bridge maintenance; shopping cart collection; curb and sidewalk maintenance; Fall loose leaf collection; and 24/7 on-call response.
- Forestry: Maintaining Guelph's tree inventory including tree planting, trimming and removal.
- Traffic and Parking and the Guelph Farmers' Market: Traffic investigations, maintaining traffic and parking signs, traffic control signals, operating downtown municipal parking facilities, administration of parking ticket processes, and the adult school crossing guard program, and the operation of the Guelph Farmers' Market.
- Fleet: Inspection, repair and purchase of City of Guelph fleet and equipment including garbage trucks, ambulances, Guelph Transit buses, police vehicles, and more.

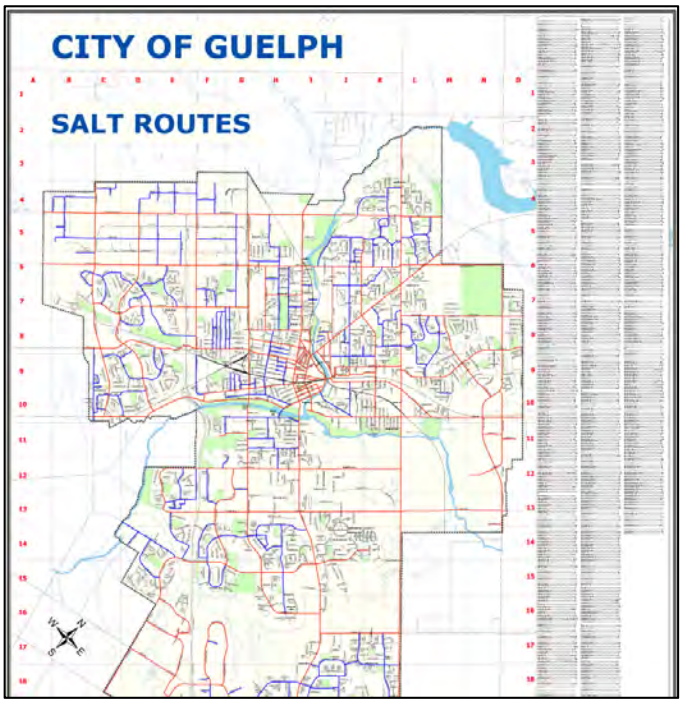
- Administration: Customer service, operating the switchboard, monitoring two way radio calls, traffic and storm locates, and general office duties to support the entire department.

The Department of Public Works strives to preserve, maintain, and enhance the City's infrastructure and natural resources for the benefit of Guelph's community. There are approximately 150 staff members within the Department of Public Works.

Governance of GIS

The complexity and cost of managing the vast amounts of infrastructure (i.e. public roads, sidewalks, stormwater, forestry, parking, 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 understand 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 is not currently a substantial GIS user. Staff in the Forestry Division uses ArcPAD for inventory and inspections in the field. Others divisions use OnPoint for viewing pertinent division specific data but the overall utilization of GIS is low. Public Works relies on the GIS experts in IT for any advanced GIS needs.



The table below 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.

Current GIS Staffing				
Type		Number of Users	GIS Usage	Primary Tools
	GIS Flagship (Tier 1)	0	N/A	N/A
	GIS Analytical (Tier 2)	0	N/A	N/A
	GIS Browser (Tier 3)	~10	Medium	Used for viewing data stored in OnPoint and ArcPAD for tree inventory

Hardware and Software

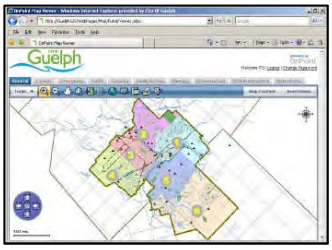
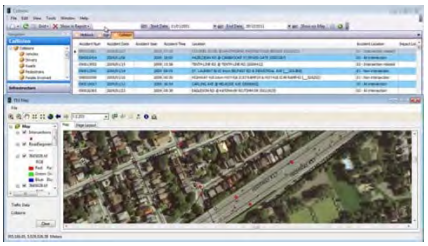
Any hardware issues that were discussed during this Needs Assessment are summarized in the table below. Enterprise wide issues will be discussed in greater detail throughout later chapters of this Needs Assessment and GIS Strategic Implementation Plan.

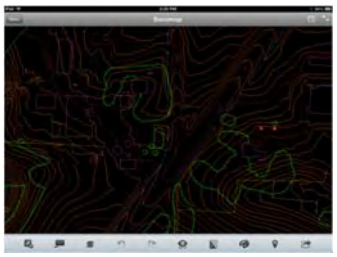
Hardware Issues Summary	
Type	**Notes**
Personal Computers	Available for all staff
Laptops/Tablets	Some Toughbook tablets for GPS of trees
GPS	Trimble GeoExplorer used with ArcPad
Plotter	None

The Public Works Department utilizes the following software applications:

1. MS Office Suite – Office Productivity
2. JDE HR and Kronos – HR Information and Payroll
3. JDE Finance – Financial information and business processes
4. Oracle WAM – Asset inventory, service requests, work and purchase orders
5. Google Maps/Earth – For basic mapping and locations
6. AMANDA – Planning, permitting, licensing
7. ArcPad – Used in Forestry for inventory and inspection
8. Rolta OnPoint – Internal Web-based GIS application
9. Traffic Engineering Software – Used for traffic engineering
10. Webtech (formerly Grey Island) – vehicle tracking web based software
11. Road Inspection Program – Customized internally
12. MapInfo – Stormwater flooding
13. AutoCAD – Design and plan review

The following describes some of the key software tools utilized by the Public Works Department.

 **Oracle WAM**	**Oraclc WAM** → Oracle Utilities Work and Asset Management (WAM) tracks assets, manages lifecycles, tracks work orders and maintenance requests, and manages the financial components of work order management. WAM is a very pervasive system, requiring full commitment from an organizaiton to leverage all of its functions. Data within WAM should be managed via GIS. There is no working link to GIS. Public Works needs to have WAM works orders and their GIS features linked.
Amanda	**AMANDA** → AMANDA is a web-based product used for licensing, permitting, planning, and compliance. Public Works mainly utilizes Amanda to discern property related information and for tracking cases.
 **ArcPad**	**ArcPad** → ArcPad is mobile field mapping and data collection software designed to be easy-to-use. It includes GIS and GPS capabilities for capturing, editing, and displaying geographic information quickly and efficiently. Public Wroks uses ArcPad for their tree inventory efforts.
 **OnPoint Intranet GIS**	**OnPoint** → OnPoint from Rolta is utilized as an enterprise-wide GIS intranet solution. The software allows users to access pertinent GIS data via a web browser. Public Works has access to the software but uses it very sporadically. They feel the software is not meeting their needs, is too slow, and lack critical data and functions.
 **TES**	**TES** → Public Works uses Traffic Engineering Software (TES) for sign and signal inventory. The inventory is not complete. Currently, TES is used for traffic data management and analysis – collisions, volumes, speed, and vehicle classifications. TES has a GIS link designed to allow clients to manage their traffic engineering efforts through a map. Optimally, TES derived data should be consumed within an easy-to-use intranet browser.

 **Vehicle Tracking**	**Grey Island AVL** → Grey Island provides automated vehicle location (AVL) software and hardware. GPS devices are attached to vehicles and the Grey Island software shows vehicle location via a map. Grey Island has become a subsidiary of WebTech Wireless. The Grey Island system is not working well for Guelph and replacements are being considered.
 **AutoCAD**	**AutoCAD** → AutoCAD is used to view, map, maintain, and modify infrastructure data. AutoCAD is limited in its use as a GIS application due to the format of CAD data files. At present the Department relies on AutoCAD for many tasks that should eventually be performed with GIS software; future efforts will need to focus on conversion of this data to a GIS format, such as a geodatabase format.

GIS Needs Assessment

GIS Needs

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 Publics Works Department has many distinct needs related to GIS. The ability to geoenable trees, traffic signals and signs, integrate WAM with GIS, digitize stormwater as-builts and locate spatially, develop a parking layer, establish field data collection procedures 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, 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.

The Public Works Department has a distinct opportunity to incorporate advanced GIS technology. Keys to a comprehensive GIS effort will involve implementation of mapping and spatial analysis applications throughout the Public Works Department, an increase in educational opportunities, better use of GPS for data acquisition

and entry, as well as dynamic, real-time data editing and maintenance. The use of GIS will contribute to automate procedures such as asset inventory and inspections within the Public Works Department.

Key areas of concern for the Public Works Department staff members were:

1. Integration of WAM and GIS
2. Mobile solutions for inventory and inspection of various assets
3. Improve accuracy and implement procedures for GIS/GPS field data collection
4. Create tree layer within GIS based on existing and future GPS locations that store individual tree data (e.g. species, health/condition, hazard rating, diameter, size, etc.)
5. Tie Work Orders spatially throughout the city
6. Show traffic signals and signs as GIS layers
7. Data sharing between various departments
8. Acquire GIS and data collection training at all tiers within the department
9. Support of emergency response

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:

GIS Need	***Method/Application to Meet Need***
☑ Mapping and Spatial Analysis in Support of Forestry, Traffic, Parking and other City infrastructure	• GIS links to tree GPS data (and aerial photography) and various City infrastructure • Desktop GIS • Intranet GIS Application
☑ Data Layer Creation	• ArcGIS • Intranet GIS Application
☑ Field Access, Work Order Management, and Data Updates	• Mobile Laptops/Tablets • ArcGIS Online
☑ Access to Spatially Enabled As-Builts, CAD Drawings, and Documents - Linking Digital Documents to GIS	• Desktop GIS • Intranet GIS Application
☑ Formal Training for Staff	• Introduction to ArcGIS I – Tier 1 and 2 staff • Introduction to ArcGIS II – Tier 1 and 2 staff • Third party application training • Develop GIS/GPS collection Standard Operating Procedures (SOPs)

GIS Need

Mapping and Spatial Analysis in Support of Forestry, Traffic, Parking and other Infrastructure

GIS, aerial photography and address information, when used together, can assist in analyzing and updating various natural resources, permit information, citizen complaints/requests 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:

- Canopy analysis (e.g. species, DBH, health, hazard ratings, etc.)
- Assist in maintaining the landscape and tree cover
- Provide spatial queries of tree types, sizes and conditions
- Data extraction by geographic region analysis (e.g. how much flooding at River Bend Park?)
- Work order mapping and planning
- Track history of citizen concerns/complaints
- Perform analysis for future stormwater system needs
- Track assets and their condition and integrate into work order system
- Mapping of parking lots and parking spaces
- Mapping of all traffic signals, signs and markings
- Mapping of flooding, pipe leaks, and stormwater assets
- Checking traffic complaints
- Checking existing conditions – road width, poles, signs, pavement markings, parking
- Diagrams of notices, advertisements, and instructions
- Mapping of the TES collision database
- Creation of mailing labels via OnPoint
- Linking drawings/documents to spatial data

Urban Canopy layer overlaid on Aerial Photography

Urban Canopy stored as a layer in GIS

Many opportunities exist for the Public Works to use the Intranet GIS data browser (e.g. OnPoint or its replacement) to assist in data mapping and lookup. For example, development data can be linked to parcel

and address points. The intranet 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, storm sewer 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, and proximity analysis. Desktop GIS can be used to assist in reporting storm sewer flooding by extracting coordinates of the structure where the flooding happened and reporting the X and Y coordinates of the site as well as visualization of the site.

Using mobile GIS data browsers, Public Works can provide field crews with maps of the entire stormwater collection system, tree information, work orders, parcels and aerial photographs. This will provide field crews with quick access to information that is needed to do routine maintenance, repairs and other field work.

GIS Need

Data Layer Creation

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 in conjunction with the base map layers that will be made available to all departments. It is recommended that the original data creation is outsourced and then maintained by a GIS resource at the City. The following are key data sets that will need to be created for:

- Parking spaces – metered and unmetered.
- Parking lots – to include lot boundaries, amenities, and parking spaces. Rates and hours of operations should be included as attributes.
- Signs – to include traffic and parking
- Trees – to include color coding for quick referencing of status (e.g. red has work order, green is in good health and yellow has a potential issue)
- Catch Basin and Stormwater assets – flooding, stormwater piping, catch basins, storm ponds, etc.
- Railing and guard rails – geocoded from GPS data collected in the field

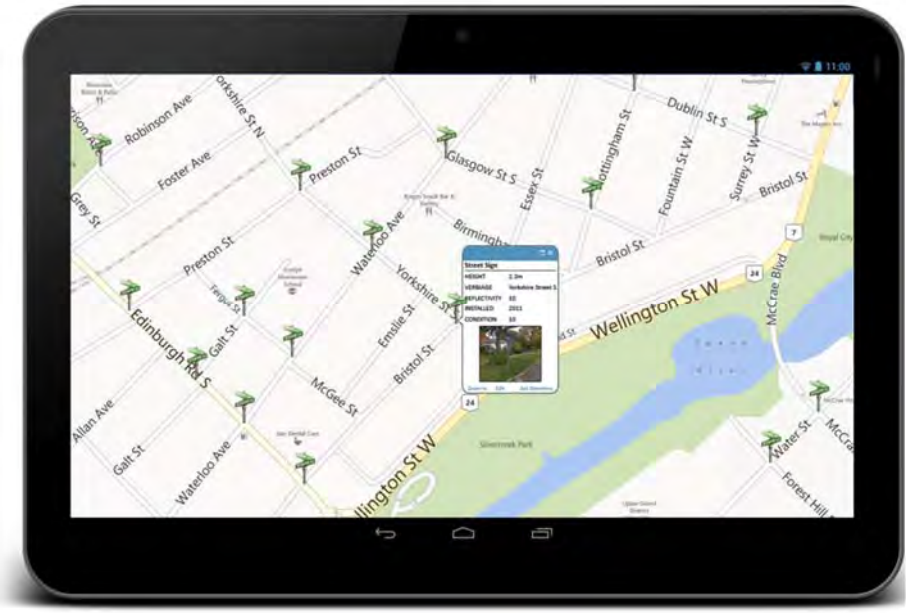
- Potholes and roadway debris – captured during inspections
- Transportation – traffic volumes, bylaw schedules, street order number, signs, cycling network, width of asphalt, medians
- Intersections – traffic volumes, type of traffic control, number of legs, bylaw schedules, street order number (integrated with SLRN), signs, number of approach lanes by type and approach
- Schools and school catchment areas
- Bridges and bridge clearance heights
- Walkways and trails

GIS Need

Field Access, Work Order Management, and Data Updates

Providing personnel with access to maps and GIS data while working in the field is an important part of maintaining an enterprise GIS, specifically when maintaining and collecting Public Works related data. Through the use of hardware, software, and data that are designed to be interrogated and manipulated away from the office, Public Works staff can realize benefits of GIS while away from their office desk. Implementing mobile computers, input devices, software, and GIS data into the GIS enterprise will give Public Works the tools to perform field data collection, site visits, routing capabilities, and interactive geographic data query and analysis.

The Public Works Department manages work orders via the WAM software suite. Much of the needed data has not been created (see data creation section above). These GIS layers need to be created and then managed via GIS with corresponding data in WAM. Staff will need additional training and the entire work flow management process will need to be revamped for management of all data via GIS. Some work orders are being entered into WAM. However, not all of the changes that are being done in the field are being noted and returned to GIS staff. Over time, this degrades the accuracy of the GIS data. It must become



ArcGIS Online for Maintaining Sign Attribution in the Field

mandatory that all work orders note work done in the field, and that a work order cannot be officially closed until it has been reviewed and the appropriate data entered by the GIS staff.

Additionally, field surveys such as the ones conducted for trees, signs, and signals should have a GIS component. Field crews should use an ArcGIS Online application to view each feature in a geographic context. Attributes should be edited by the field crew doing the visual inspection. Additionally, photographs can be easily integrated into the field inspections.

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 along with computer screens.

The process of establishing GIS to document links has four general phases:

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.)

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.

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.

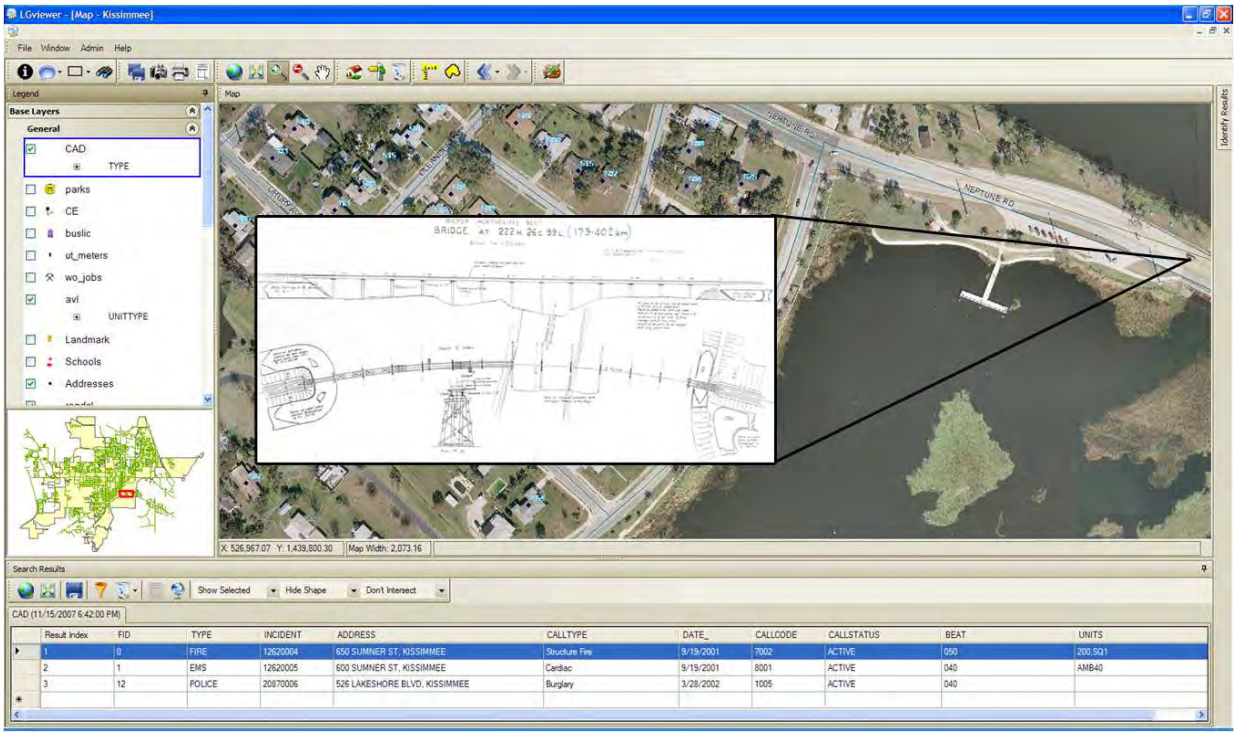
Process Documenting and Metadata

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.

Public Works identified possible documents that could be linked to GIS to include:

- Permits
- As-Builts
- Record Drawings
- Stormwater Improvements
- Canopy Studies
- Sewer monitoring and/or video inspections



Establishing a Geographic Link for Scanned Documents of Project Plans

GIS Need

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. Through the use of Esri expert instructors, the City can provide GIS instruction and training facilities for its user community by providing onsite training.

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.

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

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/ Department	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.

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Public Works Department GIS Data			
Parking Lots	Digitized on screen using aerial photography	Outsourced and then maintained by Public Works	Existing
Parking spaces	Digitized on screen using aerial photography	Outsourced and then maintained by Public Works	Existing
Traffic and Parking Signs	GPS collection in the field	Outsourced and then maintained by Public Works	Desired
Cycling Network	On Screen	Parks	Desired
Traffic Collisions	Entered into Database and GeoCoded	Automated	Desired
Bridges (and clearance heights)	On screen	Engineering	Desired
Medians	Via GPS and On Screen	Public Works Department	Desired
ByLaw Schedules	Tied to centerlines and intersections	Various	Desired
Traffic Control Devices	Via GPS and On Screen	Public Works Department	Desired
Drainage Blocks	Via database linked ot GIS	Public Works Department	Desired
Traffic Volumes	Need to be tied to the centerline	Public Works Department	Desired
Street Light and Traffic Signals	Fiber optics CAD layer conversion	Public Works Department	Existing
Potholes and Roadway Debris	Digitize from existing Excel data	Public Works Department	Desired
Railings and Guard Rails	Via GPS data collection	Public Works Department	Desired
Trees/Canopy	Via existing GPS data	Public Works Department	Partial
Schools and School Catchment Areas	Digitized on Screen	GIS Team in IT	Partial
Walkways and Trails	Digitized on Screen	Parks	Partial
City-owned Property	Extract from Tax Parcels and Aerials	GIS Team in IT	Existing

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Storm Water System	Digitize From As-Builts and other Source Documents	Public Works Department	Desired
Storm Lateral	Digitize from records	Public Works Department	Desired
Catch Basins	Digitize from records	Public Works Department	Desired
Pipe Leaks	Work Order via WAM	Public Works Department	Desired
Flood Zones	Various creation methods	Conservation Authority GIS Team in IT	Desired
Work Orders	Via WAM	Public Works Department	Desired
Service Requests	Via WAM	Public Works Department	Desired
Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using the rubber sheet method thereby warping the line work. All other data sets were created based upon the parcel base, as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006, the City, acquired rectified digital orthoimagery, which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the	The GIS Team in IT maintains the property data. New property surveys are incorporated as they are received. If staff, in other departments, sees errors they have been asked to report them to the GIS Team in IT.	Existing

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
	majority of the problem areas. As new survey plans are received, they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.		
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance have occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing
Landmarks	Digitized – have started to develop a commonplace layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhoods	Heads up Digitizing Screen. Subdivisions are available by 61-M plan (Subdivision) layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as	GIS Team in IT creates and maintains addresses within GIS. Are notified by Planning when new addresses are required.	Existing

Data Layer	Creation Methodology	Recommended Update Division or Individual	Existing or Recommended?
	polygons. These were converted to points when migrated from MapInfo.		
Building Footprints	Original building footprints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by the City to create an updated building layer.	GIS Team in IT	Existing
Countours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; changes are updated with Orhtophoto refresh	Existing

GAP Analysis Chart

The Public Works Department has a significant role in GIS for the City of Guelph 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	
Existing	
Yes	GIS component currently exist within Department.
No	GIS component does not currently exist within Department.
Limited/Partial	GIS component exist to a lesser degree.
Desired	
Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to Departmental needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to Departmental need.
Low	Can be met after higher needs are accomplished.

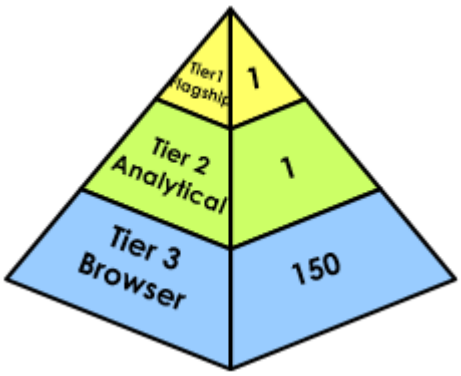
Component	Status		Priority	Notes
	Existing	Desired		
AVL	Yes	Yes	Medium	AVL can be used to track vehicles; Using AVL conjunction with routing increases efficiency and can reduce fuel consumption, thereby decreasing costs.
Documentation	Limited	Yes	Medium	Little documentation on GIS data creation and workflow exists in the Public Works Department however there is a greater need for creation and standardization for documentation Citywide. The GIS Team in IT will mandate enterprise GIS documentation processes and procedures.
Enterprise Systems Integration	Limited	Yes	High	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.
Geocoding	Limited	Yes	High	Geocoding will be needed for mapping work orders, permits, inspections and other address based features.
GIS Data Access	Partial	Yes	High	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.
GIS Data Maintenance	Limited	Yes	High	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 IT Department in order to facilitate confident data sharing and usage between departments.
GIS Data Sharing	Limited	Yes	High	See above.

Component	Status		Priority	Notes
	Existing	Desired		
GIS Personnel	Limited	Yes	High	Employees in the Public Works should perform GIS work maintaining data. These staff are critical for the maintenance of the volumes of GIS data maintained by the Public Works Department in the future.
Hardware	Limited	Yes	Medium	Adequate for GIS usage. Mobile computing resources are limited.
Mapping	Limited	Yes	High	Current GIS-based mapping capabilities in the office are limited. Adherence to Citywide GIS data standards will increase mapping intelligence.
Metadata	Limited	Yes	High	A formal, standardized metadata system needs to be developed and implemented for all GIS data layers authored within the City of Guelph. Standards would be decided upon by the GIS Team in IT.
Mobile Computing Resources	Limited	Yes	High	Mobile computers and mobile GIS viewers would prove valuable for data lookup and analysis, as well as mobile mapping.
Network	Yes	Yes	High	High availability of data via the internal network is mission critical
Routing	No	Yes	Medium	GIS-based routing is currently not implemented. There is a need for field crews to have optimal routing to the open work orders.

Component	Status		Priority	Notes
	Existing	Desired		
Software	Limited	Yes	High	The Public Works Department utilizes Esri software and Rolta for some asset inventory.
Spatial Analysis and Modeling	Limited	Limited	Low	Modeling is done by other departments or consultants
Training/Education	Yes	Yes	High	This component is considered a high priority for growth of GIS within the Public Works Department. The number of staff trained to perform GIS tasks is not enough to address requests throughout the department. Introductory training is needed at the browser user level. The Tier 1 GIS users will need more advanced training.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Return on Investment (ROI)

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

Return on Investment Opportunity Public Works Department	
Opportunity	**Explanation**
Save <u>Time</u>	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 and public map/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
Increase <u>Productivity</u>	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 manhole inverts and

Return on Investment Opportunity Public Works Department	
Opportunity	**Explanation**
	storage capacity, is much faster than completing the tasks manually.
Save <u>Money</u>	Intranet GIS Data Browser and Spatial Analysis: • Data can be queried quickly, reducing time spent looking up records manually • Can find areas of high demand and adjust practices accordingly • Providing electronic copies of maps to customers reduces the printing costs of the department.
Improved <u>Efficiency</u>	Intranet GIS Data Browser and Spatial Analysis: • Mapping demand can help manage tree inventory. • Tracking all road closures will allow for staff to better plan traffic flow Desktop GIS: • Quickly isolate areas in the stormwater system and identify catch basins for cleaning • GIS can assist in tracking inventory of pavement markings and signage making staff more efficient in finding assets and replacing them as needed Mobile GIS: • Providing field personnel with laptops reduces the time spent in the office preparing for assignments. It may reduce their downtime as they wait for record drawings to be located. • Quicker location of infrastructure
<u>Compliance with Regulatory Requirements</u>	• GIS is utilized to comply with required reports and laws. • Mapping of the various data in conjunction with work orders will allow the Public Works Department to better respond to field needs and meet regulated response times.
<u>Ability to Respond More Quickly to Citizen Requests / Improved Access to Government</u>	• Providing electronic maps to outside consultants allows the users to quickly fulfill requests through

Return on Investment Opportunity Public Works Department	
Opportunity	**Explanation**
	e-mail, without having the engineer visit the department. • Maps with accurate spatial locations of lines and manholes 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 us 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 City 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.
Improve Community Safety	• Improved data will improve emergency response

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Service Guelph

Service Guelph

Section Outline

Existing Conditions

- Department Overview
- Governance of GIS
- Hardware and Software

GIS Needs Assessment

- GIS Needs

GIS Gap Analysis

- GIS Data Layer Inventory
- GAP Analysis Chart

Multi-Tier GIS Application Use

Departmental Return on Investment (ROI)

Existing Conditions

Department Overview

ServiceGuelph is the primary customer service contact point at City Hall for the citizens of Guelph. The goal of ServiceGuelph is to provide simple access to City information, services, and resources and to improve the customer service experience for customers. ServiceGuelph team members answer a host of questions about the City and its services. For questions that require other staff involvement, ServiceGuelph team members assist citizens in identifying who can help and direct them to the correct department. The service counter is located at the entrance of City Hall. ServiceGuelph handles approximately eighty different types of transactions and have hundreds of points of contact daily. Four full-time and one part-time team members respond to requests under the guidance of the Supervisor, ServiceGuelph. No database system is in place that records each of the requests. Requests are not logged and are handled as they occur.

Governance of GIS

GIS is not utilized by ServiceGuelph team members. They have access to the intranet GIS viewer but find it to difficult and cumbersome to be of value. The table below summarizes the current GIS staff usage by ServiceGuelph team members. Type represents the current level of GIS experience based on job

requirements, GIS usage can be categorized as Limited, Moderate, or High (i.e. frequency of use), and Primary Tools describes what tools, or how GIS is used, to carry out GIS functions.

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

Hardware and Software

All ServiceGuelph team members have access to a personal computer. Staff works at the front counter and do not work in the field. Therefore, mobile computing is not needed. Printers are available for office use.

Hardware Issues Summary	
Type	**Notes**
Personal Computers	Available to all staff
Laptops	None
Printers	Ample printers available for use
Plotters	None
GPS	None
PDA/MDTs	None
Scanners	Available as needed

Class software is used for taking payments from customers. Class is integrated with other corporate applications (Amanda, JD Edwards, Vailtech, Autoprocess) so that payments can be taken for various services. Microsoft Office is used to conduct office productivity tasks. The following is a list of key software products utilized by the department:

1. Microsoft Office– Used for office productivity
2. Class – used for processing payments

GIS Needs Assessment

GIS Needs

ServiceGuelph is a broker of information. They are the front-line for customer service. Therefore, the more information they have readily available to them the better they will be able to serve their customers. However, it is critical that information is available via intuitive applications that are very easy-to-use. ServiceGuelph team members strive to answer most inquiries within five minutes. Therefore, any tools they use should complement this goal and not be an impediment to customer service. Staff feels that the existing GIS toolset

does not achieve this goal. Based on this needs assessment, ServiceGuelph has GIS needs that directly impact their ability to provide customer service. Where applicable, each need will be followed by an application or method to meet that need, some applications/methods will meet several needs. A method or application is only described under one need, if it applies to multiple needs refer to the previous need for a description. The table below summarizes these needs and how they are to be met:

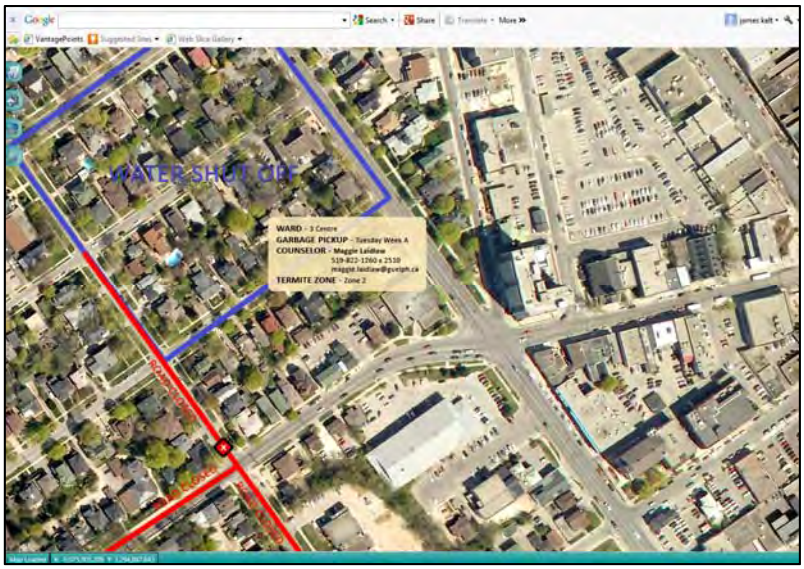
GIS Need	*Method/Application to Meet Need*
☑ Easy-to-use Tools to Facilitate Information Dissemination	• Intranet Customer Service Portal • Internet Customer Service Portal
☑ Customer Request Portal	• 311 GIS Based Application
☑ Formal Training	• Third Party Application Training

☑ GIS Need

Easy-to-use Tools to Facilitate Information Dissemination

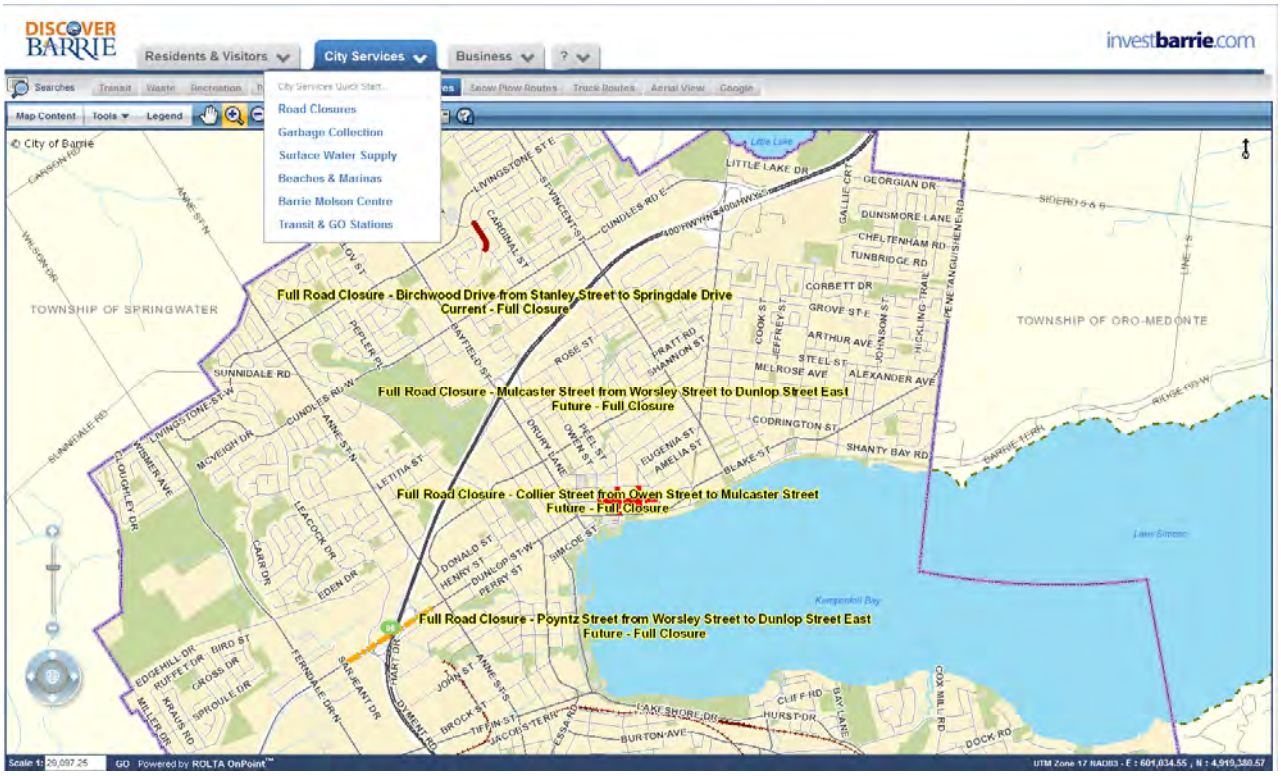
ServiceGuelph staff field a wide variety of questions from customers. Questions must be answered quickly and accurately. Many of these questions are geographic in nature. Therefore, an intuitive and easy-to-use GIS application would significantly beneficial. ServiceGuelph team members needs information about geographic questions such as:

- What ward am I in?
- When is my garbage pickup?
- Who is my Councillor?
- Where are the termite zones?
- Where are the construction projects around the city?
- Where is water being shut off around the city?
- Where is hydrant testing taking place?
- Where are the road closures?



These and hundreds of other geographic questions are posed daily. A well designed GIS intranet application would allow ServiceGuelph team members access to information in order to answer geographic questions quickly and accurately. The application should provide access to pertinent GIS layers and also incorporate data from other databases, such as, Amanda and Oracle WAM.

The intranet applications will allow ServiceGuelph team members to answer questions as they arise. Additionally, providing this information to the citizens via the Internet is an option. Some of the same information that needs to be provided on the intranet application could be provided to citizens directly via an Internet interface. This would improve customer service by allowing them to get answers to important questions at any time. The City will need to commit to Internet portals and ensuring that data is accurate and up-to-date. Below is a similar site implemented by the City of Barrie. This site provides key information to citizens on a host of topics and concerns.

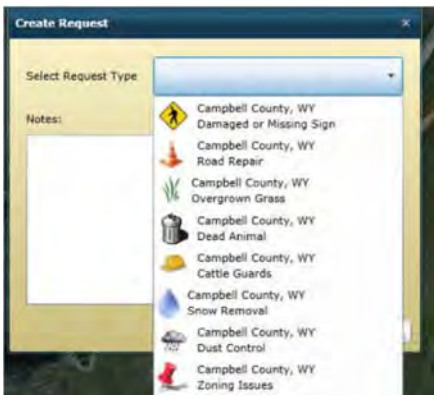


City of Barrie Internet Portal – Road Closures

GIS Need

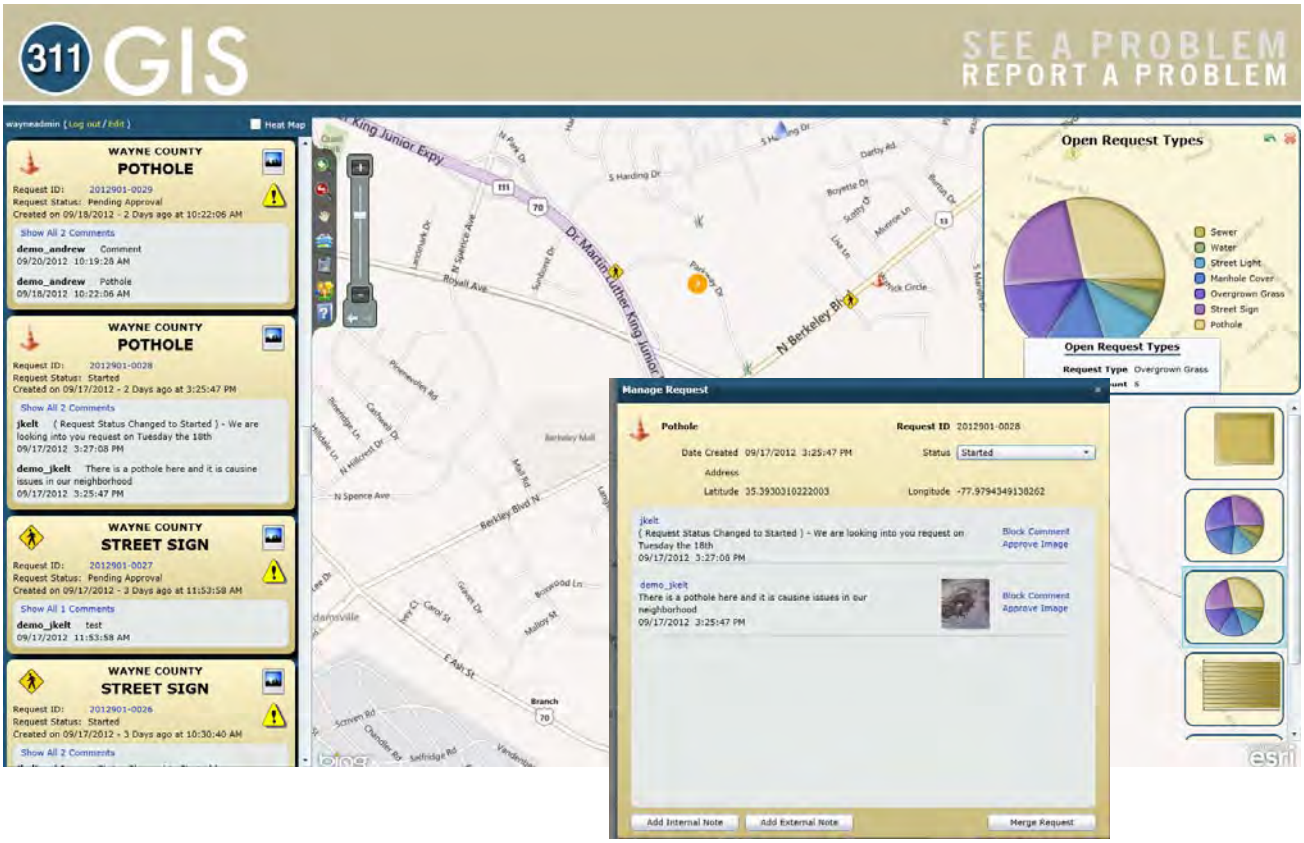
Customer Request Portal

Local governments have prioritized citizen engagement. One of the trends is for local government is to implement crowdsourcing tools. Crowdsourcing is a process that involves outsourcing tasks to a distributed group of people. It is distributed problem solving. Esri points out; "developing interactive tools that enable a stronger dialog between government agencies and citizens is proving to be one of the most effective platforms for citizen engagement." In this regard, cities throughout North America are implementing GIS



Cities define their own categories

based portals that allow citizens to contribute, as eyes on the street, to collaborative problem solving. These tools allow a city to establish categories that are meaningful to them. As a citizen reports an issue, it is routed directly to a city representative (potentially ServiceGuelph) who then validates the request as being legitimate. The request then is automatically routed to the appropriate department for action. Each task can be given an urgency rating. For instance, a stop sign down might require a fix within the hour; whereas, an abandoned vehicle might have a twenty-four hour window. These applications are available via computers, tablets, and smart phones. Additionally, these applications provide a dashboard that allows staff to view trends, open issues, and a host of other metrics.



This type of application should be considered a city-wide initiative. It can encompass a number of departmental issues and should be able to push data to a back-end work order systems such as Oracle WAM.

GIS Need

Formal GIS Training

ServiceGuelph team members stressed the need for intuitive tools that require little training. However, it is important that the city provide training throughout the year on the various tools that are implemented. Initial training should be provided by the software vendor and training should be ongoing throughout the year for new staff and as a refresher for existing staff.

GIS Gap Analysis

GIS Data Layer Inventory

The following are key data layers for ServiceGuelph. However, ServiceGuelph will need access to many more layers than what is in the list below. They will need to have access to a checklist of data layers that exist for the city so they can select those of pertinence. As new data layers are created, they will need to determine whether these new layers are important for customer service. These data elements should be used as the baseline GIS data when developing an enterprise geodatabase. Inclusion of these datasets in the geodatabase will allow for ServiceGuelph to take advantage of the feature dataset capabilities, database topologies, table domains and viewing, and editing security features that are part an enterprise geodatabase. Many of the existing GIS data layers may be combined and organized into feature classes providing easy access to thematic data layers such as points, polygons, annotation, and topology. More information on data layers can be found in the Data Assessment Chapter.

Legend

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

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

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
ServiceGuelph Data			
Parks	Digitized on screen	Parks Planning in Coordination with the GIS Team in IT	Partial
Amanda Data	Automated via Geocoding	Automated	Existing
Citizen Enquiries	Automated via Geocoding	Automated	Recommended
Emergency Shelters	Digitized On Screen	Emergency Services in conjunction with the GIS Team in IT.	Recommended
Public Buildings	Derived from Parcel Layer	GIS Team in IT	Existing
Garbage Pickup Zones	Digitized On Screen	Public Works	Recommended
Wards	Digitized on Screen	GIS Team in IT	Existing
Termite Zones	Digitized on Screen	Building Services in conjunction with the GIS Team in IT	Recommended
Water System	Hard copy maps and GPS	Water	Existing
Road Closures	Digitized on Screen	Public Works and Engineering	Recommended
City-wide Projects	Digitized on Screen	Multiple Departments in Conjunction with the GIS Team in IT	Recommended
Affordable Housing	Address Matched from a Database	Planning	Recommended
Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate	The GIS Team in IT maintain the property data. New property surveys are incorporated as they are received. If staff in other departments see errors they have	Existing

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
	parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006 the City acquired rectified digital orthoimagery which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.	been asked to report them to the GIS Team in IT.	
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance has occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Landmarks	Digitized – have started to develop a common place layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions / Neighbourhoods	Heads up Digitizing Screen. Subdivisions is available by 61-M plan (Subdivision)layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	The GIS Team in IT create and maintain addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building foot prints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by he City to create an updated building layer.	GIS Team in IT	Existing
Contours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; changes are updated with Orhtophoto refresh	Existing

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

Legend	
Existing	
Yes	GIS component currently exists within division.
No	GIS component does not currently exist within division.

Limited/Partial	GIS component exists to a lesser degree.
Desired	
Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to divisional needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to divisional need.
Low	Can be met after higher needs are accomplished.

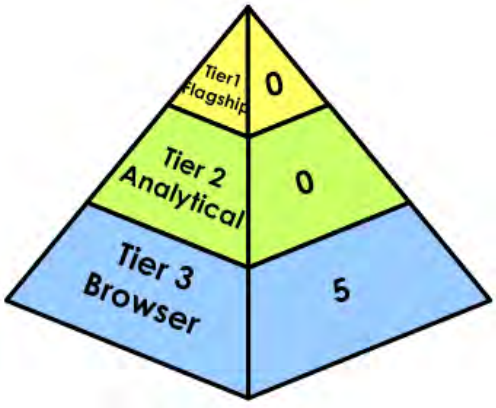
Component	Status		Priority	Notes
	Existing	Desired		
Automated Vehicle Location (AVL)	No	No	Low	ServiceGuelph does not need AVL
Documentation	Yes	Yes	Medium	The GIS Team in IT mandates enterprise GIS documentation processes and procedures.
Enterprise Systems Integration	No	Yes	High	Will need to track and view customer queries via the GIS.
Geocoding	No	Yes	High	Customer concerns and queries should be entered into a database and mapped.
GIS Data Access	Limited	Yes	High	ServiceGuelph has access to OnPoint but find it unsuitable for their needs.

Component	Status		Priority	Notes
	Existing	Desired		
GIS Data Maintenance	No	No	Low	ServiceGuelph will not be maintaining any GIS data
GIS Data Sharing	No	Yes	Medium	If a crowd sourcing portal is implemented, the data will need to be shared organization-wide.
GIS Personnel	No	No	Low	There is not a need for GIS staff within ServiceGuelph. Their GIS use and access should be primarily through Tier 3 GIS applications. Any high level analysis should be done in conjunction with the GIS Team in IT.
Hardware	Yes	Yes	High	The current personal computers are adequate for running the GIS data browser.
Mapping	No	Yes	Medium	ServiceGuelph may elect to print out explanatory maps from the intranet portal for citizens enquiring about a subject.
Metadata	Limited	Yes	Medium	A formal, standardized metadata system needs to be developed and implemented for all GIS data layers authored within Guelph. Standards should be decided upon by the GIS Team in IT.
Mobile Computing Resources	No	No	Low	ServiceGuelph does not need mobile GIS.
Network	Yes	Yes	High	High availability of data via the internal network is mission critical.

Component	Status		Priority	Notes
	Existing	Desired		
Routing	No	No	Low	ServiceGuelph does not need GIS based routing
Software	Limited	Yes	High	ServiceGuelph should have access to a user friendly intranet application. Other software such as Internet and crowd sourcing applications are an option.
Spatial Analysis and Modeling	No	No	Low	ServiceGuelph does not have a need for advanced spatial analysis.
Training/Education	No	Yes	High	This component is considered a high priority for use of GIS within ServiceGuelph. Introductory training is needed at the browser user level for all staff.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Departmental Return on Investment (ROI)

The following table indicates specific Return on Investment opportunities for ServiceGuelph:

Return on Investment Opportunity Service Guelph Department	
Opportunity	**Explanation**
Save Time and Improve Customer Service	*Intranet and Internet GIS Applications:* • Having all pertinent GIS layers accessible at the ServiceGuelph counter will allow staff to more quickly answer questions on a broader range of topics. • Customer service will improve as data will be more readily available to ServiceGuelph team members and made available for citizens to answer their own question through Internet applications.

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Department of Solid Waste Resources

Solid Waste Resources

Section Outline

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- Department Overview
- Governance of GIS
- Hardware and Software

GIS Needs Assessment

- GIS Needs

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- GIS Data Layer Inventory
- GAP Analysis Chart

Multi-Tier GIS Application Use

Departmental Return on Investment (ROI)

Existing Conditions

Department Overview

The Department of Solid Waste Resources (Solid Waste) is divided into three divisions composed of 115 staff members. The three divisions are Waste Collection, Integrated Services, and Waste Resource Innovation Centre (WRIC) Operations. Waste Collection is responsible for By-law enforcement, and residential and non-residential waste collection. Integrated Services is responsible for managing all programs, monitoring key performance indicators, providing clerical support, product sales, management of the closed Eastview Landfill, and operation of the methane system in cooperation with Guelph Hydro. WRIC Operations is responsible for management of the material recovery facility, public drop-off facility, scales and transfer station, maintenance, governance and compliance, and organic waste processing.

Solid Waste completed a Solid Waste Management Master Plan (SWMMP) in August of 2008. The SWMMP provides strategic direction for Guelph's waste management by exploring a wide range of waste minimization, diversion, and disposal options. Per Guelph's website, the SWMMP outlined new waste minimization, diversion and disposal targets, identified both short- and long-term programs designed to achieve the targets, and provided an estimate of the extent to which each component moves the City towards achieving the

overall goals. There were 41 recommendations/goals developed in the SWMMP and 60% have been completed to date. Some key recommendations of the master plan include:

- Introduce more aggressive waste minimization initiatives, such as the adoption of a Zero Waste philosophy, the promotion of waste minimization legislation at the Provincial and Federal level, development of a green purchasing policy for the City, and a plastic film reduction program.
- Assess opportunities for future multi-residential recycling program development in the city
- Investigate opportunities to develop a drop-off reuse facility
- Look at centralized waste and recycling collection in parks and public spaces
- Mandate recycling and composting with special event permits
- Redevelop promotion and education materials to strengthen commitment from the community
- Assess opportunities to recycle construction and demolition waste
- Review and revise list of recyclable materials to achieve high performance recycling
- Explore municipal partnerships for waste disposal options

Solid Waste has made extensive strides in implementing waste management and diversion policies. Further expansion of GIS capabilities can assist Solid Waste with the abilities to track, analyze and evaluate data within the department.

Governance of GIS

Solid Waste is responsible for waste management of over 40,000 households and 500 businesses. In addition, Solid Waste provides servicing to third party public and private sector clients. In 2012, Solid Waste began rolling out a three-stream cart system to all customers with full implementation set for 2014. Residents received an 80 litre green cart for organics, a grey cart for garbage, and a blue cart for recyclables (sizes for the grey and blue cart range from 80 through 360 litres). All carts have radio-frequency identification (RFID) tags attached that the City can use to monitor the carts. All collection vehicles have RFID readers, which have been employed to record the use of the carts since December 2012. In addition to the RFID readers, each truck is equipped with a GPS and cameras to enable drivers to verify collection of carts and routes. Drivers can use the monitoring equipment to report obstruction of carts, contamination issues, and other concerns on the route. Compliance staff, if required can follow up and report.

The amount of data currently being collected and monitored by Solid Waste has increased and will continue to increase as the roll out of the new cart system continues. This vast cart program demands the usage of geographic information systems (GIS) and global positioning system (GPS) technology which Solid Waste has already begun to implement through the use of ArcGIS and AVL systems. In addition, large amounts of data collected by Solid Waste related to cart locations, vehicle route management, individual route volumes and overall program status proves further integration of GIS capabilities will benefit Solid Waste. Solid Waste

staff understands that it is essential to have an up-to-date and accurate digital representation of department specific data. The Solid Waste Department provides innovative waste diversion programs and policies that greatly benefit the City of Guelph.

The Solid Waste Department is currently expanding GIS usage throughout the department to better manage waste collection and diversion. The City's OnPoint web-based GIS in conjunction with AMANDA provide a information backbone for many Solid Waste employees. AMANDA stores property information, compliance issues, property standards, inspections, enforcement actions, and tracks resident education and enforcement visits. ArcGIS is used for collection, producing route maps, storing data to support web applications, and calculating route volumes.

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

Current GIS Staffing				
Type		**Number of Users**	**GIS Usage**	**Primary Tools**
	GIS Flagship (Tier 1)	0	N/A	N/A
	GIS Analytical (Tier 2)	1	High	ArcGIS ArcView
	GIS Browser (Tier 3)	~20	Medium	Used for viewing data stored in OnPoint and AMANDA

 Hardware and Software

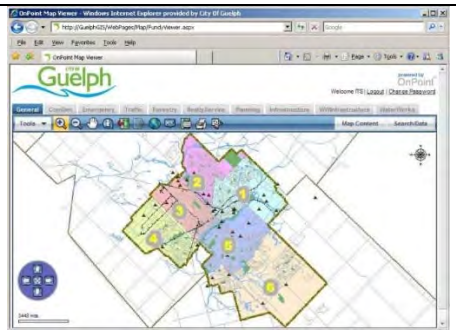
Any hardware issues that were discussed during this Needs Assessment are summarized in the table below. Enterprise wide issues will be discussed in greater detail throughout later chapters of this Needs Assessment and GIS Strategic Implementation Plan.

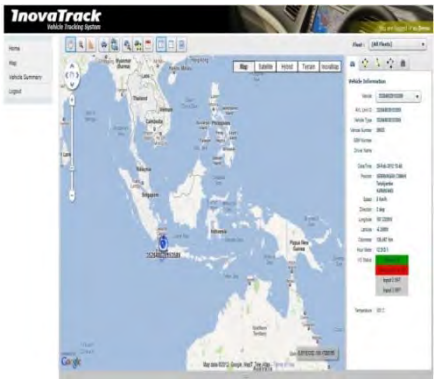
Hardware Issues Summary	
Type	**Notes**
Personal Computers	Available to all staff
Laptops/Tablets	None
Printers	Ample printers available for use
Plotter	None
GPS	GPS in conjunction with AVL on vehicles
PDA/MDTs	None
Scanners	Available as needed

The Solid Waste Resources Department utilizes the following software applications:

1. Microsoft Office – Office Productivity
2. ArcGIS ArcView – For mapping
3. Rolta OnPoint – Internal Web-based GIS application
4. InovaTrack - AVL
5. AMANDA – property info, compliance info and calls

The following describes some of the key software tools utilized by the Solid Waste Department.

<table>
<tr>
<td> 

Rolta OnPoint</td>
<td>Rolta OnPoint → OnPoint is an easy to use intranet GIS data browser that allows users to view data in an intuitive fashion. This tool currently has low usage within the department.</td>
</tr>
<tr>
<td> 

InovaTrack</td>
<td><u>InovaTrack →</u> InovaTrack is a GPS Tracking System or Automatic Vehicle Location (AVL). It is an excellent tool for fleet owners and managers to monitor their trucks, vehicle and equipment.</td>
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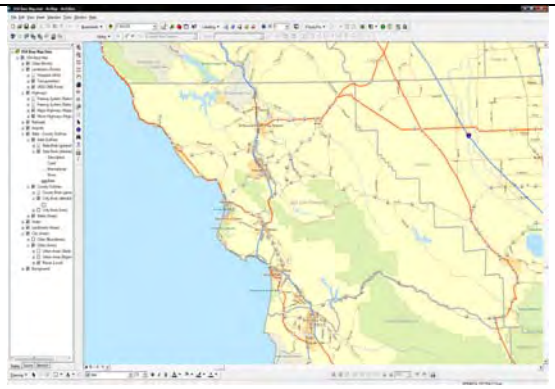
<tr>
<td> 
ESRI ArcGIS</td>
<td>ESRI ArcGIS → ArcGIS is full-featured geographic information system (GIS) software for visualizing, managing, creating, and analyzing geographic data. The industry leader in GIS software, ArcGIS provides users with the capability to perform geographical analysis. 2 workstations have access to ArcGIS.</td>
</tr>
</table>

GIS Needs Assessment

GIS Needs

Solid Waste needs to further implement 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 improved.

Solid Waste has significantly increased GIS usage but some GIS needs still remain. The ability to print maps, rotate existing maps and cart layer creation are still issues that Solid Waste would like to resolve. Waste Collection agencies throughout the country have implemented GIS in varying capacities, and the Department of Solid Waste is well positioned to implement GIS more comprehensively and effectively. Keys to a comprehensive GIS effort will be the development of a cart layer to better track implementation and ensure key performance indicators are met. Access to information should be provided by several user-friendly applications which will be discussed in detail following each need, if appropriate.

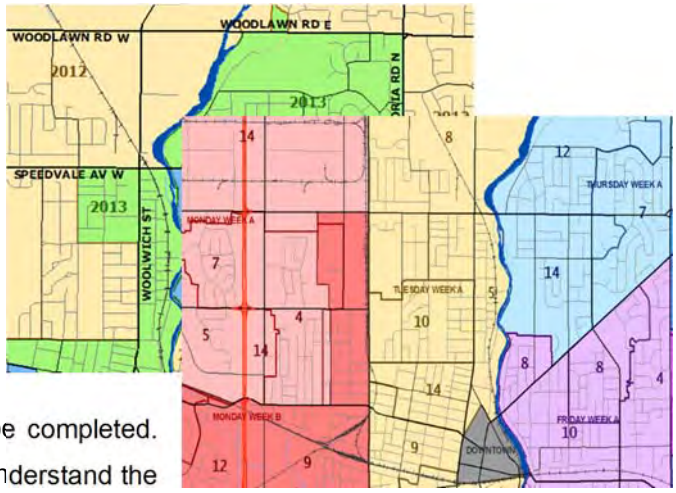
Key areas of concern for the Solid Waste Department staff members were:

1. Create cart layer and sync with AMANDA
2. Improve GIS viewing capabilities (rotation of map)
3. Printing and mapping abilities

Based on this Needs Assessment, the Solid Waste Resource Department has GIS needs. Where applicable, each need will be followed by an application or method recommended to meet that need. The table below summarizes Solid Waste needs and how they are to be met:

GIS Need	*Method/Application to Meet Need*
☑ Data Layer Creation	• Desktop GIS • Internet GIS Application
☑ Formal Training for Staff	• Introduction to ArcGIS I – Tier 1 and 2 staff • Introduction to ArcGIS II – Tier 1 and 2 staff • Third party application training (e.g. OnPoint)

GIS Need



Data Layer Creation

Solid Waste's automated cart rollout has been a major undertaking for the department. Tracking progress, locations, and cart types/sizes delivered to businesses and citizens of Guelph is increasing in importance. Layers and maps for routes and roll out planning have already been developed but a cart specific layer is still an important need yet to be completed. Solid Waste staff needs to be able to visualize and understand the cart rollout progress. To that end, a data layer needs to be created in conjunction with the base map layers that will be made available to the department. It is recommended that the original data creation is outsourced and then maintained by a GIS resource in Solid Waste. The following are key data sets that will need to be created and maintained for successful development of a cart layer.

- Addresses – It was mentioned by several departments, specifically Solid Waste, that the address data set stored in AMANDA is an issue. Addresses do not always align and this issue must be remedied to properly track Solid Waste's cart rollout.
- Cart Sizes – The various sizes need to be developed into a data set and properly selected for each customer/address where carts have been delivered. Approximately 30,000 carts have already been delivered and this information is important to proper development of a cart layer.
- Cart Types – In addition to sizes, a cart type data set (e.g. green, blue and grey) needs to be created and accessed through the cart layer.

By creating a cart layer, Solid Waste will improve tracking capabilities. This will assist with complaints, enforcement and overall cart rollout progress. This information will be made available via the intranet data browser.

GIS Need

Formal GIS Training for Staff

Staff that will be performing more advanced GIS analysis and mapping should participate in foundational GIS skills training. The Solid Waste Department staff should participate in any enterprise-wide ArcGIS training that is made available by the City. Through the use of Esri specialized instructors, the City can provide GIS instruction and training facilities for its user community by providing onsite training. This will assist Solid Waste staff with route mapping along with cart rollout data querying.

As Tier 3 – Browser GIS user intranet, desktop or Internet applications are deployed, the Solid Waste Department will require specific training tailored to the GIS interface that supports their workflows. Currently, Rolta OnPoint is the browser GIS utilized by most of the City. Solid Waste should schedule department specific training through Rolta to aid in printing and viewing issues expressed during the Needs Assessment.

Issues with printing, ease of use, and view manipulation (e.g. rotating maps/views) can all be remedied by investing in user training at all levels of the department. The 20 office staff members responsible for reporting, complaint resolution and By-law enforcement will see immediate benefit from additional training.

GIS Gap Analysis

GIS Data Layer Inventory

The Solid Waste Department will benefit from access to almost all data layers created and obtained for the City. It is expected that once all departmental data is integrated, consolidated, and centrally stored, that staff will have access to all non-classified GIS data layers from other municipal departments. The following is a list of desired layers for the Solid Waste Department:

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/ Department	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.

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Solid Waste Department GIS Data			
Cart Layer	Various creation methods. AMANDA address data will be important to proper creation.	Outsourced and then maintained by Solid Waste	Desired
AMANDA Data	Automated via Geocoding	Automated	Existing
Routing Layer	Generated from AVL system	Solid Waste	Existing
Cart Rollout Polygons	Digitized on screen	Solid Waste	Desired
Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy, and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using the rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base, as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006, the City acquired rectified digital orthoimagery, which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy, and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.	GIS Team in IT maintains the property data. New property surveys are incorporated as they are received. If staff, in other departments, sees errors they have been asked to report them to the GIS Team in IT.	Existing

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance have occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing
Landmarks	Digitized – have started to develop a commonplace layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhoods	Heads up Digitizing Screen. Subdivisions are available by 61-M plan (Subdivision) layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	GIS Team in IT creates and maintains addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building footprints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by the City to create an updated building layer.	GIS Team in IT	Existing
Contours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; changes are updated with Orhtophoto refresh	Existing

GAP Analysis Chart

The Solid Waste Department has a significant role in GIS for the City of Guelph 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	
Existing	
Yes	GIS component currently exist within Department.
No	GIS component does not currently exist within Department.
Limited/Partial	GIS component exist to a lesser degree.
Desired	
Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to Departmental needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to Departmental need.
Low	Can be met after higher needs are accomplished.

Component	Status		Priority	Notes
	Existing	Desired		
Automated Vehicle Location (AVL)	Yes	Yes	High	AVL can be used to track vehicles; Using AVL conjunction with routing increases efficiency and can reduce fuel consumption, thereby decreasing costs.

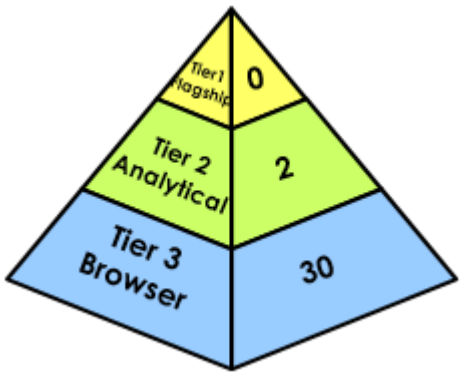
Component	Status		Priority	Notes
	Existing	Desired		
Documentation	Yes	Yes	Medium	The GIS Team in IT mandates enterprise GIS documentation processes and procedures.
Enterprise Systems Integration	Limited	Yes	Medium	Integration of data within an enterprise system is desirable but only if data creation 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.
Geocoding	Limited	Yes	High	Geocoding will be needed for mapping cart rollout and other address based features.
GIS Data Access	Limited	Limited	Medium	Current databases used within the Solid Waste Department have data that could be beneficial Citywide and the Solid Waste Department would benefit from access to other departments data layers. GIS Data access is desired and should be addressed throughout the City.
GIS Data Maintenance	Yes	Yes	Medium	GIS data editing and analysis will occur within the Solid Waste Department. Future creation of departmental layers will need to meet with Citywide data standards set by the GIS team in IT in order to facilitate confident data sharing and usage between departments.
GIS Data Sharing	Limited	Yes	Medium	Building Services needs other department's data and has the desire to share some of their data.
GIS Personnel	Yes	Yes	High	Solid Waste currently has a GIS adept employee. Employees in the Solid Waste should continue to perform GIS work maintaining data.
Hardware	Yes	Yes	High	Adequate for GIS usage. Many mobile capabilities were implemented with the AVL system.

Component	Status		Priority	Notes
	Existing	Desired		
Mapping	Limited	Yes	High	Current GIS-based mapping capabilities in the office are limited. Adherence to Citywide GIS data standards and training will increase mapping intelligence.
Metadata	Limited	Yes	High	A formal, standardized metadata system needs to be developed and implemented for all GIS data layers authored within Guelph. Standards should be decided upon by the GIS Team in IT.
Mobile Computing Resources	Yes	Yes	Medium	Mobile computers and mobile GIS viewers would prove valuable for data lookup and analysis, as well as mobile mapping.
Network	Yes	Yes	High	High availability of data via the internal network is mission critical
Routing	No	Yes	High	GIS-based routing is currently not implemented. There is a need for field crews to have optimal routing to the open work orders.
Software	Yes	Yes	High	The Solid Waste Department uses Rolta and AMANDA for some asset querying. Additionally, a copy of ArcGIS is available for routes.
Spatial Analysis and Modeling	No	Limited	Low	Modeling is done by other departments or consultants

Component	Status		Priority	Notes
	Existing	Desired		
Training/Education	Limited	Yes	High	This component is considered a high priority for growth of GIS within the Solid Waste Department. Few staff is currently trained to perform GIS tasks in the department. Introductory training is needed at the browser user level. The Tier 1 and Tier 2 GIS users will need more advanced training.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Departmental Return on Investment (ROI)

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

Return on Investment Opportunity Solid Waste Department	
Opportunity	**Explanation**
Increase Efficiency and Save Time	Efficiency increases come from better automated map/route production, data updates/maintenance, and

Return on Investment Opportunity Solid Waste Department	
Opportunity	**Explanation**
	data access. Increased efficiency: • 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 cart assets • Automated route planning tools • Enterprise map/data access via browser based viewing tools • Locate assets in the field • Target areas for cart rollout/complaints/enforcement. • Become more responsive to citizen requests • Quicker location of asset • Determine the needs of the field crews (quantities and types) in the office before going out into the field
Increase <u>Productivity</u>	Intranet GIS Data Browser and Spatial Analysis: • Use GIS to assist in production of maps and reports that are required for Master Plan benchmarks. • The use of GIS analysis, for locating cart types, or calculating route volumes and production, is much faster than completing the tasks manually.
Save <u>Money</u>	Intranet GIS Data Browser and Spatial Analysis: • Data can be queried quickly, reducing time spent looking up asset data manually • Can find areas of high demand and adjust routes or personnel accordingly • Providing electronic copies of maps to customers reduces the printing costs of the department.

Return on Investment Opportunity Solid Waste Department	
Opportunity	**Explanation**
Compliance with Master Plan	• GIS is utilized to comply with required reports and progress goals.
Ability to Respond More Quickly to Citizen Requests / Improved Access to Government	• GIS enables users to quickly manipulate data for citizen requests and reporting requirements. Managers can track progress better and have improved access to important data.
Effective Management of Assets and Resources	• GIS will allow us to identify problematic areas based on route volume, the number of complaint calls to an area, or the cart replacement history. • Optimize route assignment by location • Target areas to perform work and services. • Become more responsive to citizen requests • Reduce labor costs by reducing office time for looking up data within the GIS • React more quickly to issues on particular routes or at Solid Waste facilities. • Improved efficiency and production inherently also saves money. Additionally, savings in fuel consumption could be realized if optimal routes are developed.
Improved Communication and Coordination	• Accurate mapping, including thorough and accurate attribute data (e.g. cart layer), is essential for communication and coordination.

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Guelph Transit

Transportation

Section Outline

Existing Conditions

Department Overview

Guelph Transit provides conventional and mobility transit service within the City of Guelph.

In 2012, Guelph Transit launched a new service model that provided enhanced service to the community through direct route design and increased service frequency. After a year-long service review, peak-service frequency was adjusted to current levels in February 2013. Currently, Guelph Transit conventional service provides service every 20 minutes during peak service times Monday to Friday, and every 30 minutes during off peak times and on the weekends and on

civic and statutory holidays. Service is offered on 20 base routes and four university express routes, with stops located throughout the city Guelph Transit express bus service is provided during the University of Guelph fall and winter semesters, with four routes providing 20-minute service frequency Monday to Friday only.

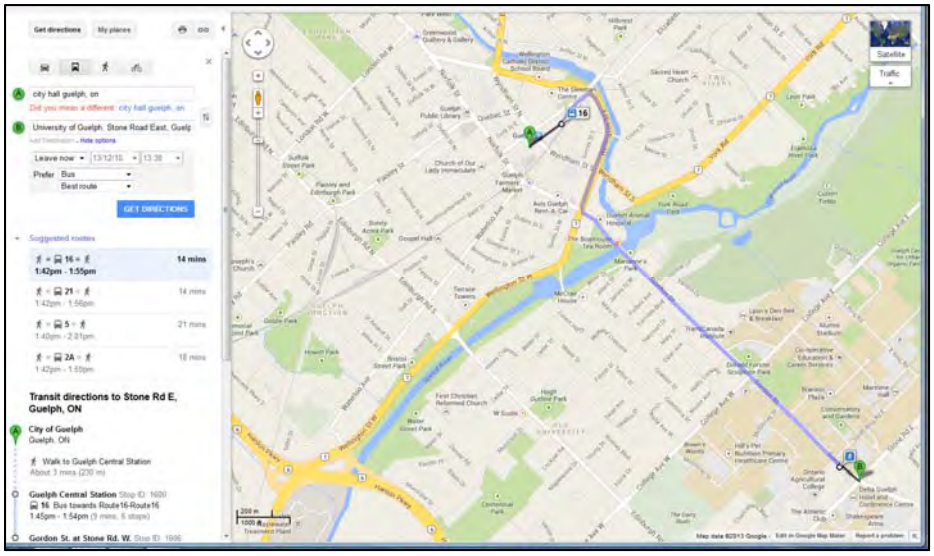
There are currently over 500 bus stops in the city, with some stops providing service to multiple routes, and many stops featuring a variety customer amenities, including shelters, benches and static schedules. Bus stops are currently being upgraded to meet AODA standards, which include a concrete pad that accommodates accessible boarding and alighting. Current bus stop surfaces include concrete, grass, gravel, asphalt and brick.

Mobility Services provides pre-booked, door-to-door accessible service to registered passengers. Mobility Services also provides two partial-service community bus routes that operate from Monday to Friday only.

In 2007, Guelph Transit deployed NextBus, a web based system using global positioning satellites (GPS) technology and modeling to provide riders real-time arrival and departure information. This program was included with the Automated Vehicle Locator (AVL) software that is currently being used at Guelph Transit.

Governance of GIS

Guelph Transit is an advanced user of GIS and other geo-spatial technologies. Automated Vehicle Location (AVL) and GPS are utilized to track bus locations. Staff has two copies of ArcGIS for route analysis, mapping, and modelling. ArcGIS was used to create GIS data such as routes and stops. The GIS Team in IT is relied upon for complex analysis and mapping needs. Staff has access to the OnPoint intranet application but don't find its content and functions to be useful for their purposes. Transit routes are provided to Google for use in the Google Transit route planning feature of Google Maps.



The table below summarizes the current GIS staff usage within Guelph Transit. Type represents the current level of GIS experience based on job requirements, GIS usage can be categorized as Limited, Moderate, or

High (i.e. frequency of use), and Primary Tools describes what tools, or how GIS is used, to carry out GIS functions.

Current GIS Staffing				
Type		**Number of Users**	**GIS Usage**	**Primary Tools**
	GIS Flagship (Tier 1)	2	High	ArcGIS
	GIS Analytical (Tier 2)	0	NA	NA
	GIS Browser (Tier 3)	0	NA	NA

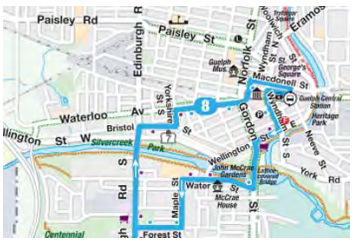
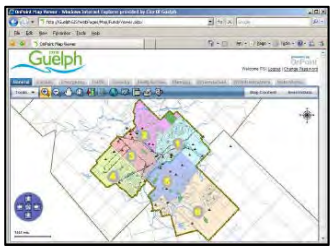
Hardware and Software

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

Hardware Issues Summary	
Type	**Notes**
Personal Computers	All Office Staff have PCs.
Laptops	For supervisory staff
Plotters	None
GPS	On buses for AVL
PDA/MDTs	None
Scanners	none

Guelph Transit utilizes the following software applications:

1. ArcGIS – Data Creation and Analysis – 2 licenses
2. Google Maps – provide route, schedule and fare information through data feed to Google Transit
3. MS Office Suite – Office productivity (including MS Access)
4. Adobe Design Standard, CS6 – for graphics and brochure design
5. Trapeze – scheduling and soon dispatch
6. OnPoint – for quick viewing of property data, not used often
7. WAM/Synergen – for work order management
8. Kronos – time management
9. Adobe PDF – document management
10. Class
11. RAC - budgeting

 **ArcGIS**	**ArcGIS →** Two copies are used for mapping and analysis. ArcGIS is used by staff to create and maintain GIS data. Also, the tools are used for high-end map creation and analysis. There is a desire to use the software to conduct route simulations, run-time checks, and stop simulations. Esri's Network Analyst will be needed for these types of tasks.
 **Google Maps**	**Google Maps →** Google Maps is used to provide citizens route information. Passengers receive step-by-step transit instructions, from origin to destination, including walking distance to and from stops. Guelph Transit contracts a third-party to create the required data feed for acquisition.
 **Trapeze**	**Trapeze →** Trapeze is one of the most prevalent public transportation agency management systems on the market. Guelph Transit utilize Trapeze for operations, scheduling, and soon for dispatch. AVL is readily available within the Trapeze mapping solution. City GIS data can be imported into Trapeze. A variety of layers such as routes, stops, and associated information should be tracked in GIS and imported into Trapeze.
 **OnPoint Intranet GIS**	**OnPoint →** OnPoint from Rolta is utilized as an enterprise-wide GIS intranet solution. The software allows users to access pertinent GIS data via a web browser. Guelph Transit has access to the software but uses it very sporadically.

GIS Needs Assessment

GIS Needs Analysis

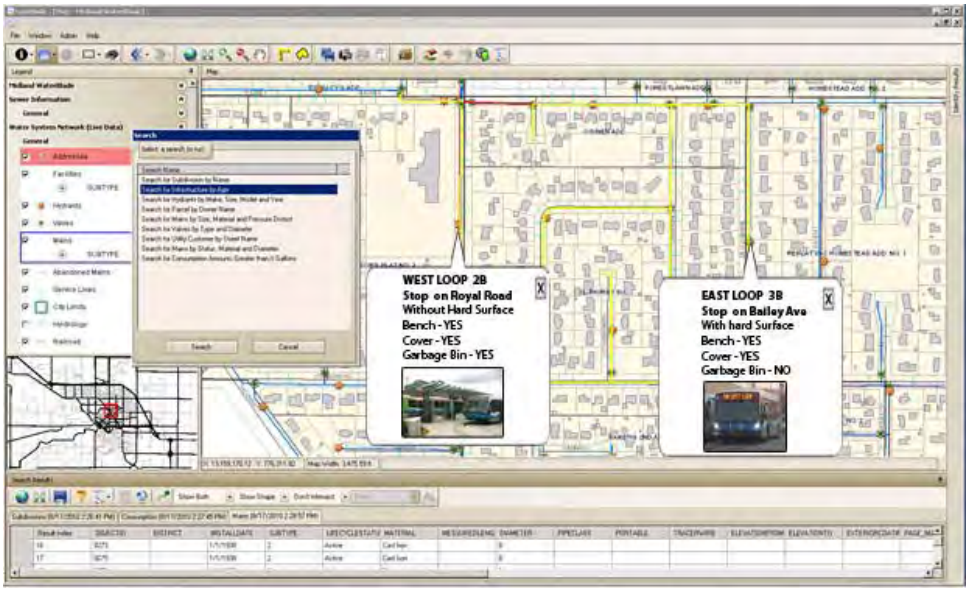
Based on the needs assessment interviews, Guelph Transit has multiple GIS needs. Where applicable, each need will be followed by an application or method recommended to meet that need. Some applications/methods will meet several needs. A method or application is only described under one need. If it applies to multiple needs, refer to the previous need for a description. The following table summarizes these needs and how they are to be met:

GIS Need	*Method/Application to Meet Need*
☑ Data Creation and Access	▫ ArcGIS ▫ Intranet GIS Data Browser
☑ Use GIS to Track Projects	▫ ArcGIS ▫ Intranet GIS Data Browser
☑ Public Access to Guelph Transit data	▫ Internet GIS Portal
☑ GIS Training for Department Staff	▫ ArcGIS Training ▫ Third Party Application Training

GIS Need

Data Creation and Access

Mapping and spatial analysis are key tasks that can enable Guelph Transit to improve management, operations, administration, and maintenance of the City's transportation efforts. Staff can realize significant gains in both time and efficiency by using GIS.



Quick and Easy Access to Key Transportation Data via GIS

The most expensive, yet important aspect of the Guelph Transit GIS initiative is the creation of complete and accurate asset inventory data sets. Guelph Transit and the GIS Team in

IT have already created some transit related data. Creating and maintaining these layers is a critical component for success. Field based data collection efforts should be utilized to create and update GIS layers. The following are data layers that were identified by Guelph Transit staff as being in need of completion, creation, augmentation, or worked into a maintenance regimen.

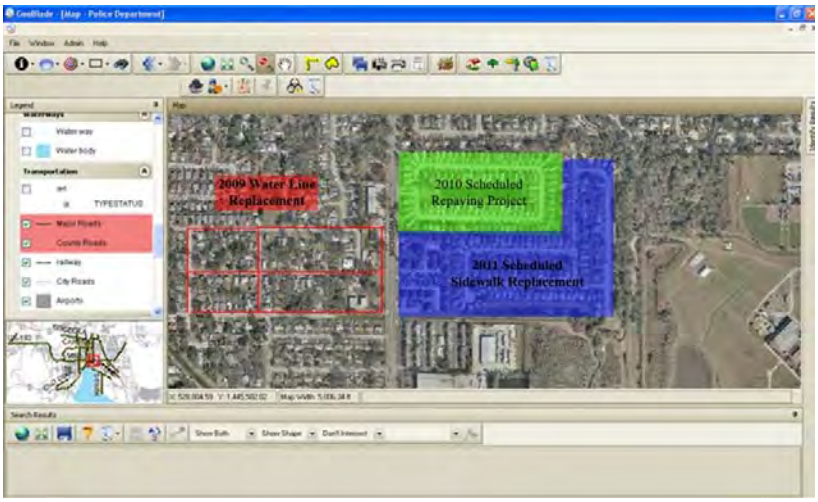
The following is not a comprehensive list of all the GIS data created, refined, and used by Guelph Transit, but the key layers discussed during the needs assessment. Guelph Transit believes that GIS data should be the go-to/ authoritative data portal.

- Bus Route Layer
- Bus Stop Layer
- Traffic by time of day
- Demographics
- Rental unit locations
- Dwelling types – multi-unit, apartment, single family dwelling, etc.
- Bus stop amenities
    - Signage
    - Stop-naming on the flag or shelter
    - Information panel including timetable, network map, contact phone numbers of the operator
    - Garbage bin
    - Benches especially for elderly and persons with a disability
    - Shelters
    - Benches
    - Enhanced information displays / information kiosks
    - Real-time displays
    - Clock
    - Loudspeaker system
    - Heated waiting facilities
    - Toilets at larger bus stops / stations / terminals
    - Left luggage lockers
    - Commercial establishments (e.g. food shops, newspaper kiosks)
    - Customer information center
- Facilities for intermodal trip planning (e.g. bicycle racks, Park & Ride lots)

GIS Need

Use GIS to Track Projects

Guelph Transit needs to know information about changing conditions in the field. Construction projects may affect the ability of a bus to maintain its posted schedule. Staff needs to use GIS to find background information on current and planned projects. Currently, staff has to go to multiple sources to pull together the information that they need. Additionally, there is no map layer that tracks historic, current, and future projects. A GIS layer should be created to track all projects. Some of the benefits of tracking these projects in GIS are the ability to quickly view and analyze road closures and to notify the public of work in an area.



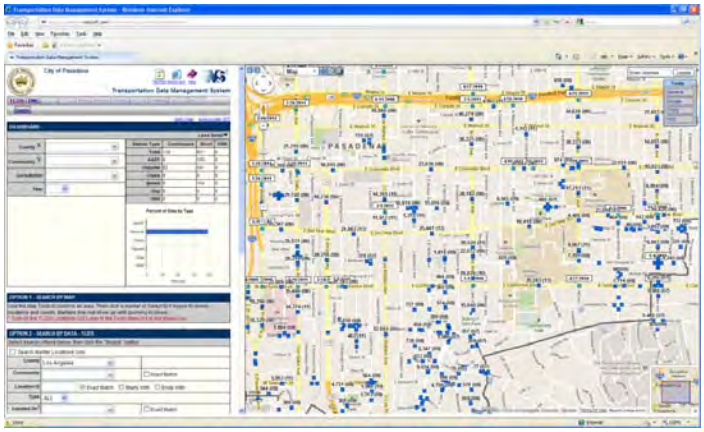
Using GIS to Track City Projects

GIS Need

Public Access to Guelph Transit Data

Guelph Transit provides data via Google Transit about routes. GIS tools for transit will continue to improve. Guelph Transit staff expressed a desire to share the following with the public at a minimum:

- Bus stop locations
- Bus routes
- Bus stop amenities
- Photos of bus stops
- Work zones
- Real time bus tracking



Citizens are becoming more demanding as technology continues to evolve. Many cities are beginning to deploy applications that track bus locations in real time and present them to customers via smart phones and tablets. These “Where’s My Bus” type applications continue to improve and become more readily deployable for local governments. This technology is currently being offered through NextBus. The need

will continue to be relevant, and should continue to be offered to ensure quality customer service. However, this type of application will have to work in concert with the Trapeze application. Therefore, only Trapeze approved applications should be considered.

GIS Need

Formal GIS Training for Guelph Transit Staff

Staff that will be performing more advanced GIS analysis and mapping should participate in foundational GIS skills training. Guelph Transit staff should participate in any enterprise-wide ArcGIS training that is made available. Through the use of Esri certified instructors, local colleges, internal staff, and web classes, the City can provide GIS instruction and training for its user community by providing onsite training. Various divisions expressed their desire to utilize GIS more extensively. Training should be provided on utilizing GIS for analysis and data maintenance. For more occasional advanced analysis such as route optimization and stop simulation, customized training should be provided by the GIS Team in IT.

GIS Gap Analysis

GIS Data Layer Inventory

Guelph Transit will benefit from access to a variety of GIS 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 municipal departments. The following is a list of desired layers for Guelph Transit:

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

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

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended ?*
Guelph Transit GIS Data			
City-owned Property	Extract from Tax Parcels and Aerials	GIS Division in IT	Existing
Sidewalks	Digitized on Screen from Aerial Photography Augmented by Field Survey	Public Works	Existing
AVL/Bus Locations	GPS viewed within Trapeze	Guelph Transit	Existing
Average Annual/Daily Traffic Counts	Field Survey	Public Works	Existing
Zoning	Digitized	Planning	Existing
Traffic Signals	GPS / Field data capture	Public Works	Partial
Projects	Digitized on Screen	Varies	Recommended
Bus Routes	Digitized on Screen – correlate to Street Centerline	Guelph Transit	Existing
Bus Stop Amenities	Entered into bus stop database – See list in the needs assessment above	Guelph Transit	Recommended
Bus Stop Locations	Digitized on screen from aerial photography augmented by field survey	Guelph Transit	Existing
Bus Pads	Digitized on Screen from Aerial Photography	Guelph Transit / GIS Team in IT	Existing
Paratransit Customers	Geocoded from a database	Guelph Transit	Recommended
Census Data	Download from Census Bureau	GIS Team in IT	Existing
Citywide Base Data			

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended ?*
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006 the City acquired rectified digital orthoimagery which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.	The GIS Team in IT maintain the property data. New property surveys are incorporated as they are received. If staff in other departments see errors they have been asked to report them to the GIS Team in IT.	Existing
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance has occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended ?*
Landmarks	Digitized – have started to develop a common place layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhoods	Heads up Digitizing Screen. Subdivisions is available by 61-M plan (Subdivision) layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	The GIS Team in IT creates and maintains addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building foot prints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by the City to create an updated building layer.	GIS Team in IT	Existing
Contours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; changes are updated with Orhtophoto refresh	Existing

GAP Analysis Chart

Guelph Transit has a significant role in GIS for the City of Guelph 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 division. The matrix below details those relevant components that have been analyzed and assessed as part of the Gap Analysis.

Legend	
Existing	
Yes	GIS component currently exists within division.
No	GIS component does not currently exist within division.
Limited/Partial	GIS component exists to a lesser degree.

Desired	
Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to divisional needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to divisional need.
Low	Can be met after higher needs are accomplished.

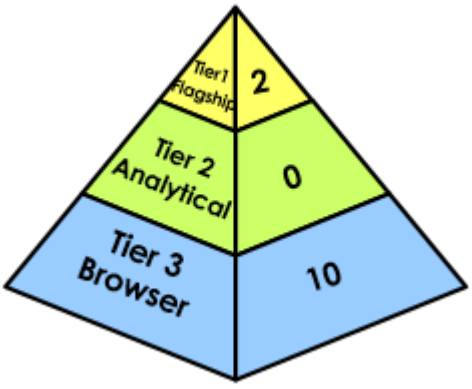
Component	Status		Priority	Notes
	Existing	Desired		
AVL	Yes	Yes	High	AVL is used to track buses. This information will be consumed internally and should be eventually exposed to riders through an easy-to-use portal application.
Documentation	Yes	Yes	Medium	Some documentation on GIS data creation and workflow exists in Guelph Transit; however there is a greater need for creation and standardization for documentation citywide. The GIS Division in IT will identify enterprise GIS documentation processes and procedures.
Enterprise Systems Integration	Yes	Yes	High	Integration of data within an enterprise system is a must. The primary application used by Guelph Transit is Trapeze with data provided to Google Transit. Integrating GIS data with these systems is critical to Guelph Transit's operations.
Geocoding	Limited	Yes	Medium	Most of Guelph Transit's data is not address based. However, the ParaTransit users are tracked by address and are in need of geocoding.
GIS Data Access	Yes	Yes	High	Current databases used within Guelph Transit have data that could be beneficial Citywide and Guelph Transit would benefit from access to other departments data layers. GIS Data access is desired and should be addressed throughout the City.

Component	Status		Priority	Notes
	Existing	Desired		
GIS Data Maintenance	Yes	Yes	High	Guelph Transit uses GIS to edit bus routes and stops. Staff should receive further training on GIS for data maintenance.
GIS Data Sharing	Yes	Yes	High	Route data is shared with Google Transit. Additionally, further data sharing internally and externally is desired
GIS Personnel	Yes	Yes	Medium	Two employees within Guelph Transit currently perform GIS work maintaining and analyzing data. These staff are important for the maintenance of the GIS data maintained by Guelph Transit. These are not full-time GIS staff but use high-end GIS for their job duties.
Hardware	Yes	Yes	High	Current hardware is adequate for GIS use.
Mapping	Yes	Yes	High	Guelph Transit is capable of creating their own map products. They will continue to need to share map data with the public, in both digital and print formats.
Metadata	Limited	Yes	High	A formal, standardized metadata system needs to be developed and implemented for all GIS data layers authored within the City of Guelph. Standards would be decided upon by the GIS Division in IT.
Mobile Computing Resources	No	No	Low	The need to utilize GIS in the field for Guelph Transit staff is limited.
Network	Yes	Yes	High	High availability of data via the internal network is mission critical.
Routing	Yes	Yes	High	Route optimization is critical for Guelph Transit. Stop simulations and route analysis capabilities are needed.

Component	Status		Priority	Notes
	Existing	Desired		
Software	Yes	Yes	High	Guelph Transit utilizes Esri software for a variety of tasks and will continue to do so. Google Transit and Trapeze have mapping functions and will utilize layers of GIS data created within the corporate database.
Spatial Analysis and Modeling	Limited	Yes	High	Guelph Transit has the need to do conduct route analysis, population growth scenarios, and stop simulations.
Training/Education	Yes	Yes	High	This component is considered a high priority for growth of GIS within Guelph Transit. The Tier 1 GIS users will need more advanced training.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Departmental Return on Investment (ROI)

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

Return on Investment Opportunity Guelph Transit	
Opportunity	**Explanation**
Increase Productivity	• Become more responsive to citizen requests • Able to locate all needed information through one portal
Save Time	• Optimization of bus routes • Quick access to all needed data
Improved Customer Service	• Easy to use applications like Where's My Bus will improve the bus usage experience for customers. • Current data provided to Google Transit improves ridership experience.

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Wastewater Services

Wastewater Services

Section Outline

Existing Conditions

- Department Overview
- Governance of GIS
- Hardware and Software

GIS Needs Assessment

- GIS Needs

GIS Gap Analysis

- GIS Data Layer Inventory
- GAP Analysis Chart

Multi-Tier GIS Application Use

Return on Investment (ROI)

Existing Conditions

Department Overview

Wastewater Services is a division of the Planning, Building, Engineering, and Environments. Wastewater Services is tasked with the following services:

- Wastewater Treatment
- Wastewater Collection
- Infrastructure Maintenance
- Lab Services
- Environmental Protection

Wastewater Services provides treatment of domestic, commercial, institutional and industrial wastewater collected from the City of Guelph and the neighbouring Township of Guelph/Eramosa. There are approximately 45 staff members within Wastewater Services.

Governance of GIS

Wastewater Services is responsible for treating sixty-four million liters per day (MLD) of wastewater conveyed through five-hundred-fifteen kilometers of sanitary sewer main. The network of sanitary sewer pipes and four

sewage pump stations deliver all of the sanitary sewage from the City and other sources to the waste water treatment plant (WWTP). The WWTP discharges the effluent into the Speed River, which is part of the Grand River Watershed. Vast amounts of infrastructure (i.e. sewer mains, pump stations, aeration basins, clarifiers, digesters, etc.) are required to safely treat the wastewater for the City, which Wastewater Services manages. This vast network of infrastructure demands the usage of geographic information systems (GIS) and global positioning system (GPS) technology. In addition, large amounts of data collected by Wastewater Services related to process controls, sampling results, could also be stored within GIS allowing better access and analysis by the department. Wastewater Services staff understands that it is essential to have an up-to-date and accurate digital representation of infrastructure. Wastewater Services 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.

Wastewater Services is not currently a significant GIS user. The City's OnPoint web-based GIS is used to find locations and print maps, but no modifications or improvements are relayed to the current GIS system.

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

Current GIS Staffing				
Type		Number of Users	GIS Usage	Primary Tools
	GIS Flagship (Tier 1)	0	N/A	N/A
	GIS Analytical (Tier 2)	0	N/A	N/A
	GIS Browser (Tier 3)	~5	Low	Used for viewing data stored in OnPoint and printing maps

Hardware and Software

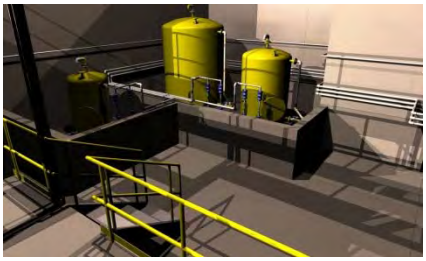
The table below summarizes hardware issues that were discussed during the Needs Assessment. Enterprise wide issues will be discussed in greater detail throughout later chapters of this Needs Assessment and GIS Strategic Implementation Plan.

Hardware Issues Summary	
Type	**Notes**
Personal Computers	Each staff person has access to a personal computer
Laptops/Tablets	Laptops and field computers are not used extensively
GPS	None
Plotter	None

Wastewater Services utilizes the following software applications:

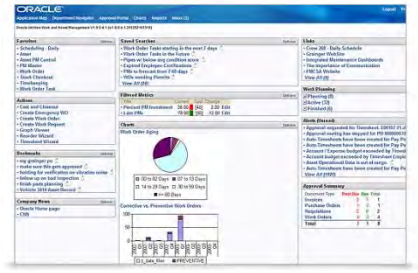
1. MS Office Suite – Office productivity
2. SCADA – Supervisory control and data acquisition
3. Oracle WAM – Asset inventory and work orders
4. MapInfo – Used for analysis, tied to an older program, data used is outdated
5. Rolta OnPoint – Internal Web-based GIS application
6. AutoCAD – Reviewing drawings and plan

The following describes some of the key software tools utilized by Wastewater Services:



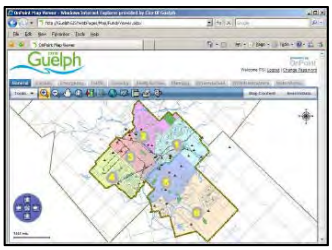
AutoCAD

AutoCAD → AutoCAD is used to view, map, maintain, and modify infrastructure data. AutoCAD is limited in its use as a GIS application due to the format of CAD data files. At present the Department relies on AutoCAD for many tasks that should eventually be performed with GIS software; future efforts will need to focus on conversion of this data to a GIS format, such as a geodatabase format.



Oracle WAM

Oracle WAM → Oracle Utilities Work and Asset Management (WAM) tracks assets, manages lifecycles, tracks work orders and maintenance requests, and manages the financial components of work order management. WAM is a very pervasive system, requiring full commitment from an organization to leverage all of its functions. Data within WAM should be managed via GIS. There is no working link to GIS. Wastewater Services primary use of this application is for work orders with no GIS linkages.

 **OnPoint Intranet GIS**	**OnPoint** → OnPoint from Rolta is utilized as an enterprise-wide GIS intranet solution. The software allows users to access pertinent GIS data via a web browser. Wastewater Services has access to the software but uses it very sporadically. They feel the software is not meeting their needs.

GIS Needs Assessment

GIS Needs

Wastewater Services needs to better implement 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 improved. Based on the low utilization of GIS within the department, Wastewater Services will realize wide-ranging benefits by implementing GIS throughout the department.

Wastewater Services has many needs related to GIS. The ability to geo-enable plant and collection system infrastructure, integrate WAM with GIS, digitize wastewater as-builts and locate spatially, monitor the flushing program, create several infrastructure layers, and perform training at all levels within the department are of immediate importance and concern. Wastewater agencies throughout the country have implemented GIS in varying capacities, and the Department of Wastewater Services 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 Wastewater Services, 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.

Key areas of concern for Wastewater Services staff members were:

1. Create well head layer, topography layer, wastewater laterals and flood plain layer
2. Develop a Wastewater Services specific Intranet GIS
3. Mobile solutions for inventory and inspection of various assets
4. Link work orders spatially throughout the WWTP and collection system
5. Implement Automated Vehicle Location (AVL)
6. Depict WWTP and collection system assets spatially
7. Acquire GIS and data collection training at all tiers within the department

Based on this Needs Assessment, Wastewater Services has various 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:

GIS Need	*Method/Application to Meet Need*
☑ Data Creation, Mapping and Enabling Existing Databases	• Desktop • Intranet GIS Application • Data Mining and Geoenabled data
☑ Access to Spatially Enabled As-Builts, CAD Drawings, and Documents - Linking Digital Documents to GIS	• Desktop GIS • Intranet GIS Application
☑ Department-Wide Access to Spatial Data	• Intranet GIS Application
☑ Data Layer Creation	• Desktop GIS • Internet GIS Application
☑ Field Access to Geospatial Data	• Map Books • Mobile Laptops/Tablets • Mobile GIS Application
☑ GIS Based Work Order System	• Specialized GIS Application, WAM
☑ Automated Vehicle Location	• AVL Vendor • Intranet GIS Application
☑ Formal Training for Staff	• Introduction to ArcGIS I – Tier 1 and 2 staff • Introduction to ArcGIS II – Tier 1 and 2 staff • Third party application training

☑ GIS Need

Data Creation, Mapping and Enabling Existing Databases

Mapping and spatial analysis are key tasks that will enable Wastewater Services to improve management, operations, administration, and maintenance of the department's infrastructure. Wastewater departments throughout the country have realized significant gains in both time and efficiency by using GIS.

An initial recommendation would be that the Wastewater Services discontinue tracking data in spreadsheets that could be better managed in GIS. These spreadsheets should be geo-enabled and converted into GIS layers. At that point, staff should be given the training to update this data via the GIS instead of in spreadsheets. Any needed reports should be generated through canned reports via the GIS database. In addition, key data stored within SCADA for the numerous processes throughout the WWTP could be linked and/or stored in GIS. This can be achieved through both static and dynamic data mining of SCADA. Static

data mining could be achieved by running queries on SCADA routinely (e.g. monthly, quarterly or yearly), and the mined data could be uploaded into GIS for each asset/process. Real-time data, or dynamic data mining, could also be achieved but would require better connectivity between SCADA, WAM and GIS. It is recommended that Wastewater Services proceed with static data mining of SCADA initially due to the simplicity of implementation.

Many opportunities exist for the Wastewater Services to use the Intranet GIS data browser (e.g. OnPoint or replacement) to assist in data mapping, spatial analysis and lookup. For example, process data can be linked to process infrastructure. The intranet browser can reduce the amount of time used to manually look up process information by linking to physical features, which are commonly, used as an identifier for data. For example, secondary treatment results could be linked to the Final Clarifiers, chlorine levels could be linked to the Chlorine Contact Tanks, and lateral/piping work orders could be linked directly to a property. Additionally, scanned documents, wastewater piping as-builts or digital/CAD 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, and proximity analysis. Desktop GIS can be used to assist in reporting wastewater-piping leaks by extracting coordinates of the structure where the leak was found and reporting the X and Y coordinates of the lateral/pipe, as we*ll* as visualization of the surrounding area.

Using mobile GIS applications, Wastewater Services can provide field crews with maps of the entire wastewater collection system, process information, work orders, infrastructure locations and aerial photographs. This will provide field crews with quick access to information that is needed to do routine maintenance, repairs and other fieldwork.

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 created and stored by Wastewater Services can be linked to spatial data features (e.g. plant processes or pipe assets), 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 CAD files, and inefficiencies caused by viewing paper documents along with computer screens.

The process of establishing GIS to document links has four general phases:

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.)

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.

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.

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. Wastewater Services is not the only department requesting document linkage to GIS and the creation of a document management system throughout the City may prove beneficial. Wastewater Services will realize more efficient retrieval of spatially related documents, permanent document storage and easier dissemination of the data held within these linked documents.

CAD Drawings converted to GIS

Wastewater Services identified possible documents that could be linked to GIS to include:

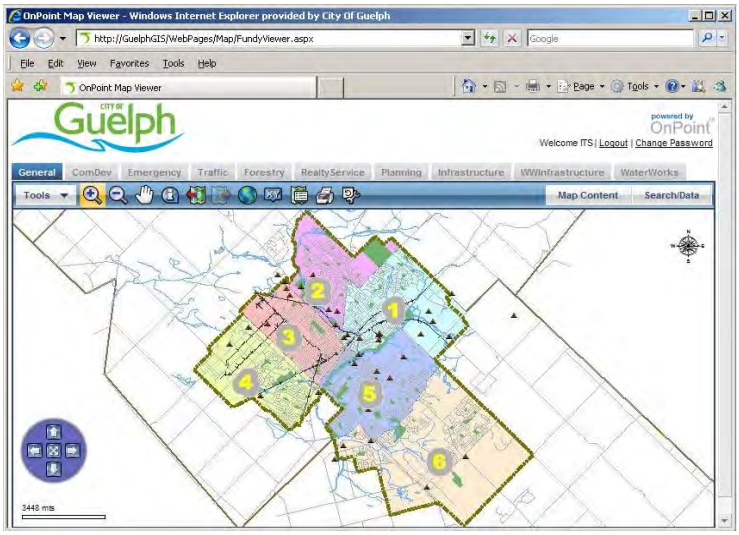
- Work Orders
- As-Builts
- CAD and Record Drawings
- Wastewater Collection System Improvements
- Lateral Sketches
- Fire Pre-Plans

New Plant Drawing Linked to GIS

GIS Need

Department-Wide Access to Geospatial Data

Providing users with the ability to view spatial data in a quick and intuitive manner is important for local governments and is critical within Wastewater Services. The City has implemented web-based data browsers that allow quick viewing and printing of map data, but little configuration has been completed for Wastewater Services. This should be one of the primary methods of enabling end-users access to pertinent department data. This should include custom reports and queries to meet the needs of Wastewater Services.



Wastewater Services intranet site should be configured to present users with pertinent GIS data and custom defined queries for easy end-user interaction. Currently the city has deployed OnPoint for this purpose. The current deployment of OnPoint does not meet the needs of Wastewater Services. However, the concept is still valid. The City should seek to deploy a next generation version of OnPoint or an intranet application from another vendor. This application should be deployed systematically throughout

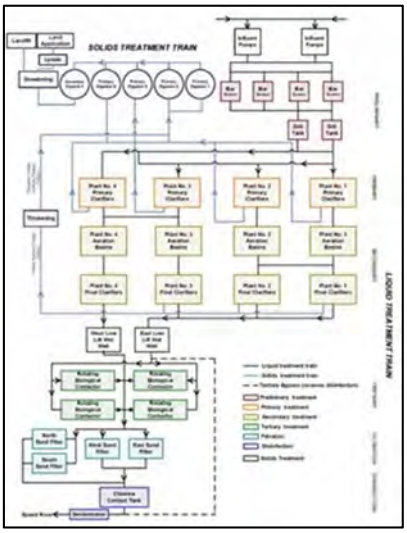
Intranet GIS data Browser Viewing Wastewater Data with an As-Built Back Drop

city departments. Each department should have a configuration that is tailored to their needs. Only data, reports, queries, map tips, and other features pertinent to Wastewater Services should be made available to staff. The application must access the key data needed by staff and have fast response times. The new generation of these applications includes executive dashboard, heat maps, and many useful features.

GIS Need

Data Layer Creation

The majority of Wastewater Services tasks have a spatial component. Wastewater Services staff needs to be able to visualize and understand the connectivity of assets at the WWTP and throughout the collection system. To that end, a number of data layers need to be created in conjunction with the base map layers that will be made available to the department. It is recommended that the original data creation be outsourced and then maintained by a GIS resource in Wastewater Services, in conjunction with Engineering. The following are key data sets that will need to be created for:



- Wastewater Service Assets – laterals, collection system piping, and plant infrastructure need to be created spatially.
- Flushing Program – needs to be visualized spatially to better track 18 month program cycle progress
- Flood Plain and hydrography – understanding the flood plain and river hydrography that affects various assets will aid in maintenance, design and reporting requirements
- Well Heads – will enable staff to quickly see relative location of well heads and their proximity to spills
- Topography – elevation data is extremely important in managing a wastewater collection system
- SCADA – depiction of process connectivity and key results data

GIS Need

Field Access to Geospatial Data

Wastewater Services can benefit from having mobile GIS capabilities, which can be done by providing users with mobile computers and GIS software. Providing personnel with access to maps and GIS data while

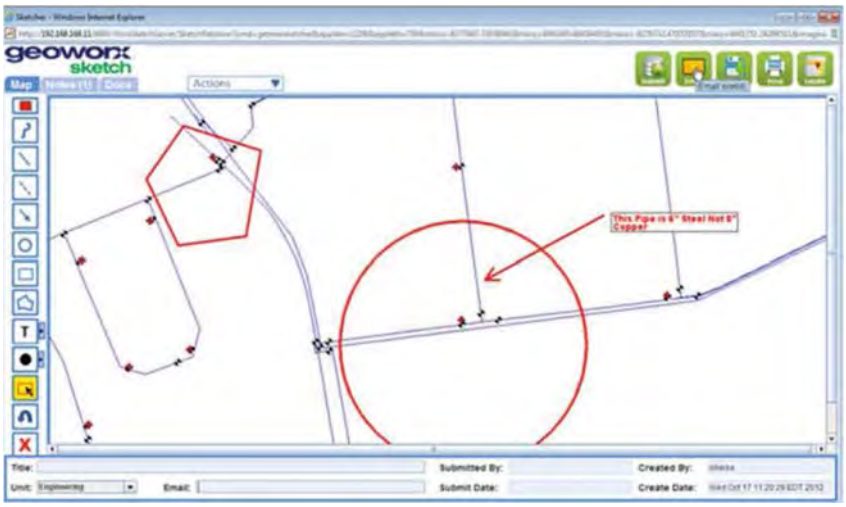
working in the field is an important part of maintaining an enterprise GIS. Through the use of hardware, software and data that are designed to be interrogated and manipulated away from the office, staff can realize benefits of GIS while away from their workstations. Implementing mobile computers, software 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. The following are methods to meet that need:

Map Books

The low cost solution for access to spatial information in the field is via map books. Map books can be generated for all field personnel. Each page can display a different section of the WWTP and/or collection system. The location of all pertinent features, such as piping, pumps, electrical conduit, hot water piping, and digester gas piping can be displayed on top of base map information and aerial photography. Map books represent an effective means of referencing the location of all pertinent features. As features are changed or added, new map books can be generated to reflect these changes.

Mobile Computers

A more advanced method for accessing spatial data in the field is through the use of laptops/tablets. A mobile data browser can be loaded on mobile computers, allowing the same capabilities offered by map books, but also the ability to query attributes of features, provide updates to data, 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 GIS data browser could be deployed to meet this need. All relevant layers, including base map layers and aerial photography should be available for display in the GIS data browser. 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.



Mobile GIS Application

GIS Need

GIS-Based Work Order Management System

Wastewater Services manages work orders via the WAM software suite. Work orders are being entered into WAM and distributed to the appropriate crews. However, changes that are being done in the field are not being noted 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.

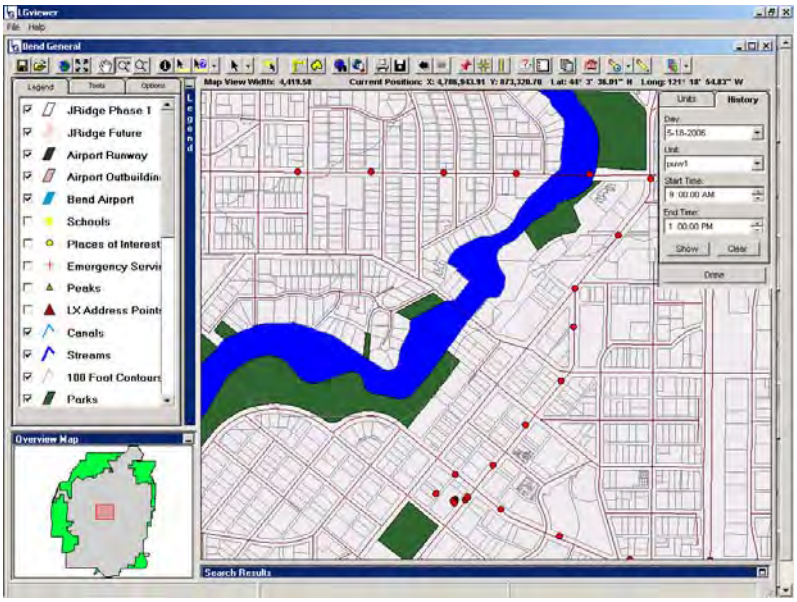
The City Guelph has invested in the development of a bidirectional integration between Oracle's WAM and the City's internal Web-based GIS application OnPoint. Wastewater Services should commit to utilizing this solution or a replacement to allow users to harness the benefits of both GIS and WAM along 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. 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

Automated Vehicle Location (AVL)

Cities throughout Canada realize the benefits of Automated Vehicle Location (AVL) software and services. Other departments within the City have utilized AVL with some success. Wastewater Services should be involved in future AVL discussions to align with the City's direction. 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.



Using GIS to Track Vehicles

Wastewater Services 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, Wastewater Services 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 workday. A complete integration AVL with work orders throughout the City will provide a comprehensive operational picture for management and decision makers as well 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 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. Additionally, this could assist with carbon credits management if regulatory agencies require such analysis.

GIS Need

Formal GIS Training for Staff

Staff that will be performing more advanced GIS analysis and mapping should participate in foundational GIS skills training. Wastewater Services staff should participate in any enterprise-wide ArcGIS training that is made available. Through the use of ESRI certified instructors, the City can provide GIS instruction and training facilities for its user community by providing onsite training.

As Tier 3 – Browser GIS user intranet, desktop or Internet applications are deployed, Wastewater Services will require specific training tailored to the GIS interface that may support their workflows. Training is typically arranged by the user level and based on applications that will be deployed throughout the enterprise.

GIS Gap Analysis

GIS Data Layer Inventory

Wastewater Services 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 the staff will have access to all non-classified GIS data layers from other municipal departments. The following is a list of desired layers for Wastewater Services:

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/ Department	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.

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Wastewater Services GIS Data			
WWTP Assets	Digitized on screen using aerial photography	Outsourced and then maintained by Wastewater Services	Desired
Flushing Program	Digitized on screen based on existing quadrants	Outsourced and then maintained by Wastewater Services	Desired
Sewer Lateral	Digitize from records	Wastewater Services	Desired
Pipe Leaks	Work Order via WAM	Wastewater Services	Desired
Flood Plains and Hydrography	Various creation methods	Conservation Authority IT Department	Desired
Well Head	Digitized on screen using aerial photography or collection of GPS coordinates	Wastewater Services	Desired
Topography	Already created	IT Department	Existing
Work Orders	Via WAM	Wastewater Services	Desired
Service Requests	Via WAM	Wastewater Services	Desired
Fire Pre-Plans	Various creation methods	Fire Department & IT Department	Desired

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Citywide Base Data			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using the rubber sheet method thereby warping the line work. All other data sets were created based upon the parcel base, as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006, the City, acquired rectified digital orthoimagery, which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received, they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.	The GIS Team in IT maintains the property data. New property surveys are incorporated as they are received. If staff, in other departments, sees errors they have been asked to report them to the GIS Team in IT.	Existing
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance have occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing
Landmarks	Digitized – have started to develop a commonplace layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhoods	Heads up Digitizing Screen. Subdivisions are available by 61-M plan (Subdivision) layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layer also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	GIS Team in IT creates and maintains addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building footprints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by the City to create an updated building layer.	GIS Team in IT	Existing
Contours	0.5m Contours are available within Guelph's city limits Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; changes are updated with Orhtophoto refresh	Existing

GAP Analysis Chart

Wastewater Services has a significant role in GIS for the City of Guelph 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	
Existing	
Yes	GIS component currently exist within Department.
No	GIS component does not currently exist within Department.
Limited/Partial	GIS component exist to a lesser degree.
Desired	
Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to Departmental needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to Departmental need.
Low	Can be met after higher needs are accomplished.

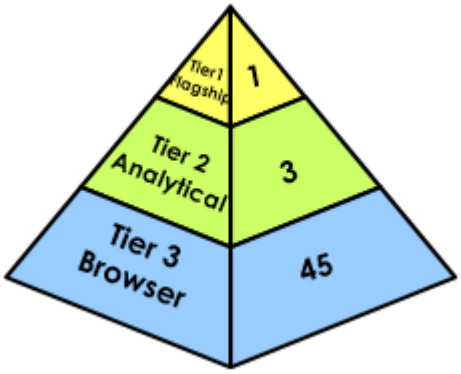
Component	Status		Priority	Notes
	Existing	Desired		
AVL	No	Yes	Medium	AVL can be used to track vehicles; Using AVL conjunction with routing increases efficiency and can reduce fuel consumption, thereby decreasing costs.
Documentation	No	Yes	Medium	Little documentation on GIS data creation and workflow exists in Wastewater Services however there is a greater need for creation and standardization for documentation Citywide. The GIS Team in IT will mandate enterprise GIS documentation processes and procedures.
Enterprise Systems Integration	Limited	Yes	High	Integration of data within an enterprise system is desirable but only if data creation from all departments/division adheres to the same data and metadata standards. Centralized data servers and data sharing are critical to the enterprise-wide success of this project.
Geocoding	No	Yes	High	Geocoding will be needed for mapping work orders, inspections, sewer laterals and other address-based features.

Component	Status		Priority	Notes
	Existing	Desired		
GIS Data Access	Limited	Yes	High	Current databases used within Wastewater Services have data that could be beneficial Citywide and Wastewater Services would benefit from access to other departments data layers. GIS Data access is desired and should be addressed throughout the City.
GIS Data Maintenance	No	Yes	High	Significant GIS data editing and analysis will occur within Wastewater Services. Future creation of departmental layers will need to meet with Citywide data standards set by the GIS Team in IT in order to facilitate confident data sharing and usage between departments.
GIS Data Sharing	Limited	Yes	High	See above.
GIS Personnel	No	Yes	High	Employees in the Wastewater Services should perform GIS work maintaining data. This staff is critical for the maintenance of the volumes of GIS data maintained by Wastewater Services in the future.
Hardware	No	Yes	High	Adequate for GIS usage. Mobile computing resources are limited.
Mapping	No	Yes	High	Current GIS-based mapping capabilities in the office are non-existent. Adherence to Citywide GIS data standards will increase mapping intelligence.
Metadata	No	Yes	High	A formal, standardized metadata system needs to be developed and implemented for all GIS data layers authored within the City of Guelph. The GIS Team in IT would decide upon standards.

Component	Status		Priority	Notes
	Existing	Desired		
Mobile Computing Resources	No	Yes	High	Mobile computers and mobile GIS viewers would prove valuable for data lookup and analysis, as well as mobile mapping.
Network	Limited	Yes	High	High availability of data via the internal network is mission critical
Routing	No	Yes	Medium	GIS-based routing is currently not implemented. There is a need for field crews to have optimal routing to the open work orders.
Software	Limited	Yes	High	Wastewater Services uses Rolta for some asset inventory.
Spatial Analysis and Modeling	No	Limited	Low	Modeling is done by other departments or consultants
Training/Education	No	Yes	High	This component is considered a high priority for growth of GIS within Wastewater Services. No staff is currently trained to perform GIS tasks in the department. Introductory training is needed at the browser user level. The Tier 1 and Tier 2 GIS users will need additional advanced training.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Return on Investment (ROI)

The following table indicates specific Return on Investment opportunities for Wastewater Services:

Return on Investment Opportunity Wastewater Services	
Opportunity	**Explanation**
Increase Efficiency and Save Time	Efficiency increases come from better-automated map/route production, data updates/maintenance, and data access. Increased efficiency: • 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 map/data access via browser based

Return on Investment Opportunity Wastewater Services	
Opportunity	**Explanation**
	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
Increase <u>Productivity</u>	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 manhole inverts and storage capacity, is much faster than completing the tasks manually.
Save <u>Money</u>	Intranet GIS Data Browser and Spatial Analysis: • Data can be queried quickly, reducing time spent looking up records manually • Can find areas of high demand and adjust practices accordingly • Providing electronic copies of maps to customers reduces the printing costs of the department.
<u>Compliance with Regulatory Mandates</u>	• GIS is utilized to comply with required reports and laws.
<u>Ability to Respond More Quickly to Citizen Requests / Improved Access to Government</u>	• Providing electronic maps to outside consultants allow the users to quickly fulfill requests through e-mail, without having the engineer visit the department.
<u>Effective Management of Assets and Resources</u>	• Asset management systems (WAM) tied into GIS will allow us to identify problematic areas based

Return on Investment Opportunity Wastewater Services	
Opportunity	**Explanation**
	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 within the collection system and associated features • Improved efficiency and production inherently also saves money. Additionally, savings in fuel consumption could be realized if unnecessary field verification is avoided.
Improved Communication, Coordination, and Collaboration	• The users work closely with City 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.
Ability to Respond More Quickly to Citizen Requests	• Maps with accurate spatial locations of lines and manholes would enable the users to respond more quickly to emergencies and citizen requests.

CITY OF GUELPH, ONTARIO

GIS Needs Assessment

Water Services

Water Services

Section Outline

Existing Conditions

- Department Overview
- Governance of GIS
- Hardware and Software

GIS Needs Assessment

- GIS Needs

GIS Gap Analysis

- GIS Data Layer Inventory
- GAP Analysis Chart

Multi-Tier GIS Application Use

Departmental Return on Investment (ROI)

Existing Conditions

Department Overview

Guelph relies solely on groundwater for its water supply. The Water Department is committed to reducing water use and protecting water resources. The Department maintains and protects the drinking water supply and distribution which is comprised of the following as per the City of Guelph website:

- 21 operational groundwater wells and a shallow groundwater collector system;
- 31 facilities for water: sources, supply, treatment, storage or transfer;
- Uses chlorine for primary disinfection at 10 locations;
- Uses ultraviolet light and chlorine for multi-barrier disinfection primary disinfection at 3 locations;
- 6.38 kilometres of 900-1050mm diameter water supply aqueduct;
- 5 underground storage reservoirs with a combined approximate capacity of 48,000 cubic metres (48 million litres)
- 3 water towers with a combined approximate capacity of 11,200 cubic metres (11.2 million litres);
- About 545 kilometres of buried water main;
- About 4,015 water main valves;

- About 2,660 fire hydrants;
- About 40,583 water services and water metres.

The Department employs fifty-six employees in the following division: Environmental (6 staff), Conservation (5 staff), Administration (7 staff), Distribution (24 staff), and Supply (14) staff.

Governance of GIS

Water Services has been and will continue to be instrumental in leading the push for an enterprise-wide GIS. The General Manager for Water Services currently serves as the chair of the GIS Steering Committee. As such, he and his department are very aware of the benefits of a fully functioning system. Historically, the City has viewed GIS as a technology and not an enterprise-wide program. Technology is something that can be installed and with some training be successfully utilized. However, GIS does not fit into this category. GIS is a number of technologies that require a well formulated and adopted governance strategy to be useful. If done properly, GIS becomes a pervasive program that integrates all aspects of traditional IT in such a way that staff in all departments is able to perform their jobs more quickly and in a more informed manner. It is important to note that the concept of GIS as the front end to varied data sets like asset management and financials is not the current mindset of the organization. The current view is that GIS is and will continue to be an isolated technology. The first priority for Water Services is to have a reliable, functional, and quick-to-access GIS in the field and office.

Water Services has GIS experienced staff who utilizes ArcGIS Basic (ArcView). Seven copies of ArcView are available. Staff utilizes the software for viewing and analyzing data, and some map generation. Water Services works closely with Engineering. Engineering is responsible for updates to the water system network. As changes are made to the water system, they are relayed to GIS staff in Engineering, who then makes the appropriate changes on the map. Also, Engineering adds new water infrastructure into the GIS. This is all paper driven at this time. There was an attempt to geo-enable field crews with GIS on their laptops. However, the combination of Citrix remote desktop and poor air-card response in tandem with the OnPoint browser yielded a user experience that was not satisfactory. Therefore, field crews no longer attempt to use this solution.

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, and complex querying and data modeling. A Tier 3 - Browser GIS user requires only general browsing GIS data functions to create reports, query standard data sets, view data, and produce maps.

No Tier 1 editing is done by Water Services staff. Seven copies of ArcGIS Basic (ArcView) are available to staff to view and manipulate data and to conduct GIS analysis. An intranet GIS data browser, OnPoint, is available to all Water Services staff. However, the application is found to be lacking in regards to functionality, speed, reporting, printing, query builder capabilities, and data. The following table documents the current usage of GIS by Water Services.

Current GIS Staffing				
Type		**Number of Users**	**GIS Usage**	**Primary Tools**
	GIS Flagship (Tier 1)	0	NA	NA
	GIS Analytical (Tier 2)	7	Moderate	ArcView for analysis and decision making
	GIS Browser (Tier 3)	20	Low	OnPoint – not used extensively because of lack of usability

Hardware and Software

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

Hardware Issues Summary	
Type	**Notes**
Personal Computers	All Office Staff have PCs/laptops.
Laptops	Field crews have laptops but don't use them for GIS
Plotters	Large format plotter in Water Services
GPS	Two Trimble units – 10 years old and do not achieve desired accuracy
PDA/MDTs	None
Scanners	Plotter is able to scan

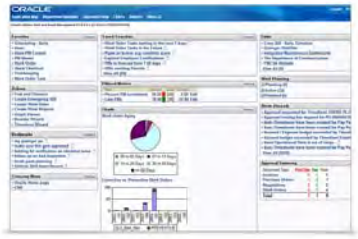
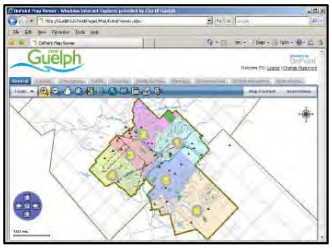
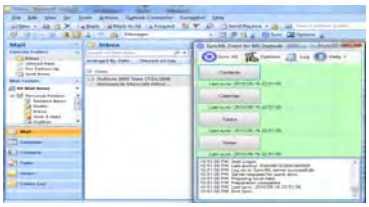
Water Services utilizes the following software applications:

1. ArcGIS – Data Viewing and Analysis, mapping – 7 licenses of Basic
2. MS Office Suite – Office productivity (including MS Access)
3. AutoCAD – for editing CAD data and Truview for viewing
4. Amanda – meter tracking, site planning and source water protection
5. KISS – document management
6. EDMS – document management

7. Oracle WAM – work order management. Outside workers (241) time is entered in WAM, as well as vehicle use and materials on jobs. Also used as database for lead program. Service Requests are created in WAM.
8. OnPoint – for quick viewing of data, used frequently in office.
9. iFIX- SCADA
10. JDE – Financials and HR
11. RAC – Financials
12. Kronos – tracking staff time
13. MocaSoft – Guelph Hydro database
14. InfoWater – Hydraulic modelling
15. WaterTrax – Water quality data sample location database
16. Microsoft Outlook – extensive use for scheduling and contacts

The following includes additional detail on some of these products:

 **ArcGIS**	**ArcGIS** → Seven copies of ArcGIS Basic are used for mapping and analysis. Several staff are competent with ArcGIS. However, refresher training will be needed by some to ensure that new functions and techniques are fully understood by staff.
 **AutoCAD**	**AutoCAD** → AutoCAD is used to view infrastructure data. AutoCAD is limited in its use as a GIS application due to the format of CAD data files. At present, the Department relies on AutoCAD mainly for reviewing and editing CAD files. TruView is used by some staff who just need to view AutoCAD files. They do not use the software for design.
AMANDA Back Office Suite CSDC **Amanda**	**AMANDA** → AMANDA is a web-based product used for licensing, permitting, planning, and compliance. Water meter information is stored in AMANDA. Water Services staff ensures that the water meter information is updated

 **Oracle WAM**	**Oracle WAM** → Oracle Utilities Work and Asset Management (WAM) tracks assets, manages lifecycles, tracks work orders and maintenance requests, and procurement. WAM is a very pervasive system, requiring full commitment from an organization to leverage all of its functions. Data within WAM should be managed via GIS. There is no working link to GIS.
 **OnPoint Intranet GIS**	**OnPoint** → OnPoint from Rolta is utilized as an enterprise-wide GIS intranet solution. The software allows users to access pertinent GIS data via a web browser. Water Services has access to the software. They feel the software is not meeting their needs because of speed and performance.
 **InfoWater GIS Interface**	**InfoWater** → InfoWater is a water distribution modeling and management software application. It runs with ArcGIS Basic allowing for the integration of the water network for modelling purposes. Water Services works closely with consulting engineering firms and Engineering Services for this modelling. The better the GIS data maintained by the city, the more accurate the modelling results within InfoWater.
 **Microsoft Outlook**	**Microsoft Outlook** → Outook is used extensively in Water Services for: 1) Contacts management; 2) Customer Service Documentation; 3) Employee Work Scheduling 4) Customer Relations History; 5) Warehousing Electronic Files and 6) Priority Customer Contacts

GIS Needs Assessment

GIS Needs Analysis

Water Services needs to embed GIS in a majority of their daily activities. Staff in each division expressed GIS needs. Both in-office and field staff need access to the data and GIS query functions. Optimally, as changes are made in the field, they should be noted electronically and automatically sent to Engineering for update. Key utility billing information should be geo-enabled. Each meter, usage, and payment status should be readily accessible for appropriate staff. Based on on-site interviews, Water Services has multiple GIS needs. Where applicable an application or method will be recommended to meet each need. Some

applications/methods will meet several needs. The following table summarizes these needs, and how they are to be met:

GIS Need	*Method/Application to Meet Need*
Data Layer Design, Creation and Completion	ArcGIS
Department-wide Access to GIS Data	Intranet GIS Data Browser
Mapping and Spatial Analysis in Support of Water Operations	ArcGIS Intranet Data Browser
Use GIS to Track Projects	ArcGIS Intranet GIS Data Browser
GIS Based Work Order System	ArcGIS WAM or other GIS based work order system
Access to Spatially Enabled As- Built, CAD Drawings, and Videos - Linking Digital Documents to GIS	Desktop GIS, Intranet GIS Browser
Field Access to Geospatial Data	ArcGIS Online and Tablets
Automated Vehicle Location	AVL Vendor Intranet Data Browser
Public Access Pertinent Data and Service Requests	Internet GIS Portal
GIS Training for Department Staff	ArcGIS Training Third Party Application Training

GIS Need

Data Layer Design, Creation, and Completion

Mapping and spatial analysis are key tasks that will enable Water Services to improve management, operations, administration, and maintenance of the City's infrastructure. Water departments throughout the country have realized significant gains in both time and efficiency by using GIS.

The most expensive yet important aspect of the Water Services GIS initiative is the creation of complete and accurate data sets. Engineering maintains the water system GIS layers and the GIS team in IT maintains other pertinent layers. It will be important to enable other staff to supplement this effort. There are many additional layers desired by Water Services staff. Creating and maintaining these layers will require a re-engineering of Water Services work flows and operations. The utilization of outside resources could augment existing staff to improve the accuracy of data and/or create needed layers. The following are data layers that were identified by Water Services staff as being in need of completion, creation, or augmentation.

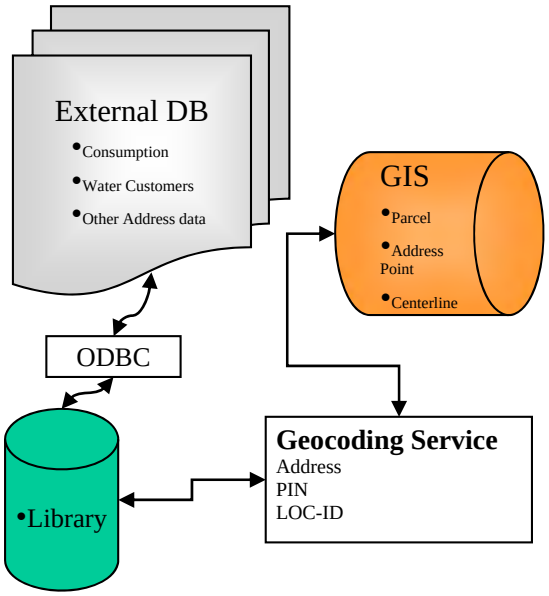
- AMANDA data – all meter data and other pertinent fields should be geo-enabled and tied to their GIS feature
- Compliance data – i.e. AWQI's
- iFix SCADA – each of the eight nodes should be represented on a map. Data collected about each node should be available in real-time via the GIS
- Guelph Hydro data (Mocasoft) – read only now. Can request a full data set. This data should then be geo-coded for use with the GIS
- KISS and EDMS – some data such as valve cards already being linked. Need to link hydrant, service and valve cards
- Conservation information currently in Microsoft Access – all data should be geo-enabled and made into a GIS layer. This data should then be maintained in GIS. Some examples include:
    - Consumption
    - Top users
    - Targeted user response
    - Rebates
- Meters – need a layer representing all meters and associated data (usage, customer, payment status)
- Customer call history and service requests – via various databases to include a recommended 311 GIS based system. Want to see call history and work history.
- Sensitive customers – internal identification and customer signup options should be included. Customers that are deemed sensitive to include:
    - Industries
    - Schools
    - Daycares
    - Elder care facilities
- CCTV – link CCTV files to GIS
- Environmental Layers (some of this data extends outside of the city)
    - Spills and outfalls
    - Surface and groundwater quality
    - Contaminated sites and contaminated site data
    - Source and distribution water quality
    - Raw and untreated water quality
    - Forestry
    - Climate data
    - Hydrogeological and wll related data
    - Source protection data

        - Wellhead protection areas
        - Vulnerable areas
        - Vulnerable scores
        - Locations of significant drinking water threats
        - Conditions sites
    - GRCA data
    - Hydrogeological data – to include geological data – depth, thickness
    - Water levels
    - Aquifers
    - Pumping data
    - Trend data
- Conservation layers
    - Usage by type of business and housing
    - Green space per prospect
    - Census data
    - Flow meter areas
    - Patters of water usage
- Rights-of-way
- City owned property – boundaries and ownership
- Easements
- All other utilities
- Capital Improvement Projects
- Facilities
- Emergency response layers

Where possible it is recommended that Water Services discontinue tracking data in Microsoft Access databases or Microsoft Excel spreadsheets for data that could be better managed in GIS. These files should be geo-enabled and converted into GIS layers. This should not be attempted until the GIS matures. Speed issues must be resolved. At that point, staff should be given the training to update this data via the GIS instead of in Excel or Access. Any needed reports should be generated through canned reports via the GIS.

Some of the aforementioned data is stored in external databases (such as utility customers, customer service history, work orders, and billing information). These databases contain an address field making them a candidate for spatial enablement. Any database with associated addresses can be address-matched to a street centerline layer, tax parcel centroids, or address point layer. This data can be geo-enabled through an automated geocoding service that creates GIS data layers from non-spatial relational databases. The results of a successful geo-coding effort will be stored in an industry standard relational database management

system (SQL Server, Oracle, etc.). The automated process is based completely on standard SQL statements and is customized to utilize a variety of stored location-based data (Parcel PIN, Address, Location-ID, etc.). A second function of the automated service is to generate GIS layers in an industry standard portable format (SDE layers) that could be utilized by a variety of applications. These GIS layers will be created to user specifications. X, Y coordinates will be utilized to display features in a GIS layer. The graphic below shows the process of using a geocoding service to extract data.



Practical Example

Water Services needs to view the location of customers and their consumption from the current billing system. Customer records related to an address can be mapped by linking each record to a spatial feature such as an address point. The geocoding service can generate and export the resulting GIS layer on a regularly scheduled basis.

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. Optimally, data needs to be live linked. Spatial views of live data are recommended.

GIS Need

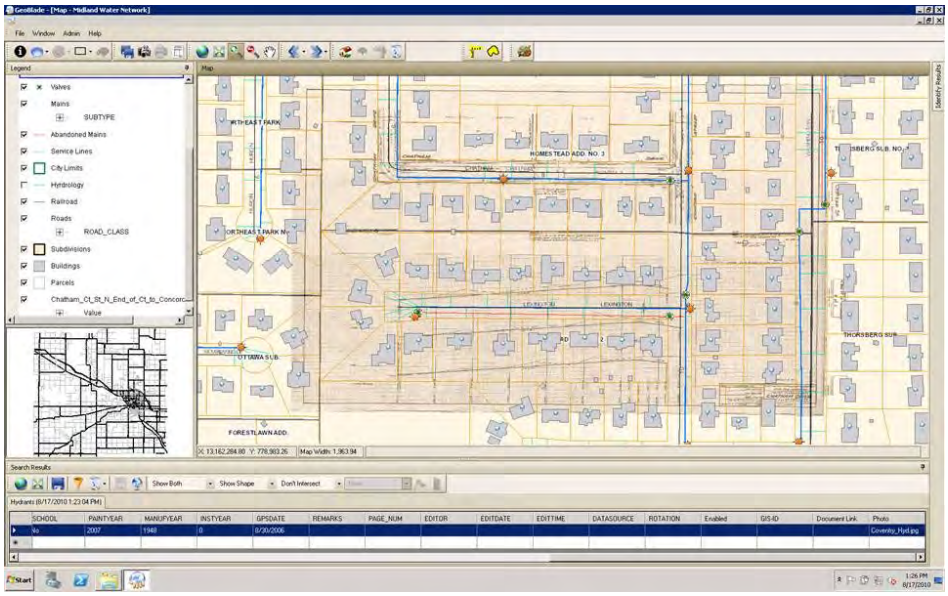
Department-wide Access to GIS Data

Providing users with the ability to view spatial data in a quick and intuitive manner is important for local government utilities 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 Water Services, or as a website available to all internal City departments. Water Services needs to be able to quickly print out quality maps from any browser.

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

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

Water Services intranet site should be configured to present users with pertinent GIS data and custom defined queries for easy end-user interaction. Currently the city has deployed OnPoint for this purpose. The current deployment of OnPoint does not meet the needs of Water Services. However, the concept is still valid. The City should seek to deploy a next generation version of OnPoint or an intranet application from another vendor. This application should be deployed systematically throughout city departments. Each department should have a configuration that is tailored to their needs. Only data, reports, queries, map tips, and other features pertinent to Water Services should be made available to Water Services staff. The application must access the key data needed by staff and have fast response times. The new generation of these applications includes executive dashboard, heat maps, and many useful features.



Intranet GIS data Browser Viewing Water Data with an As-Built Back Drop

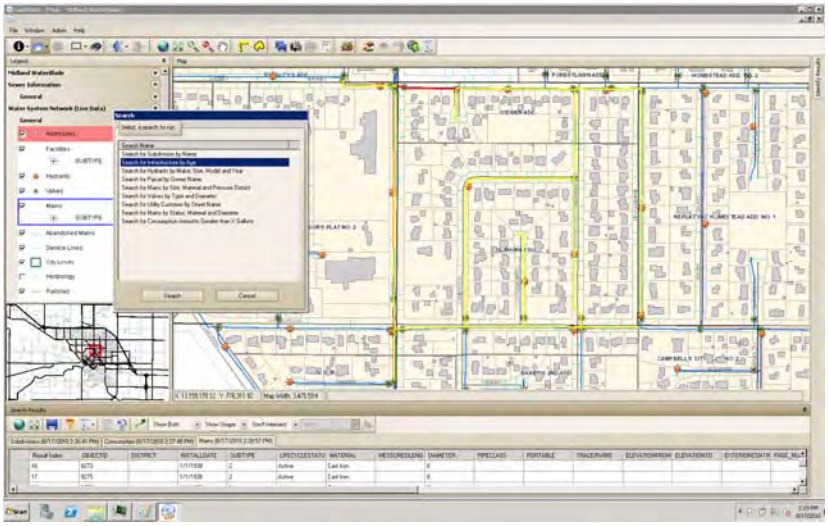
GIS Need

Mapping and Spatial Analysis in Support of Water Operations

The needs assessment interviews identified many ways that Water Services staff want and need to utilize GIS. Water Services staff currently uses an Intranet GIS data browser to quickly view and query information. Staff should be utilizing GIS technology to accomplish analytical tasks as follows:

- Water system analysis and reports – training will be needed
- Work order mapping and planning
- Track history of customer complaints
- Perform analysis for future system needs

- Flow capacity compliance analysis
- Tracking compliance and non-compliance of water
- Water storage-towers and reservoirs, locations of valves, drains info for maintenance procedures and history
- Capital improvement planning - water main breaks vs. water main age vs. water main material and other utilities
- Analyzing billing trends - consumption, late payments, etc.
- Asset management-repair leak and history tracking
- Tying pictures of hydrants to the GIS
- Tying hydrant, service, and valve cards to the GIS
- Assist in identifying pressure zones which would in turn help with hydrant color determination
- View and analyze SCADA data
- View and analyze environmental data
- There is an immedieate need related to completing field locates through ON1CALL



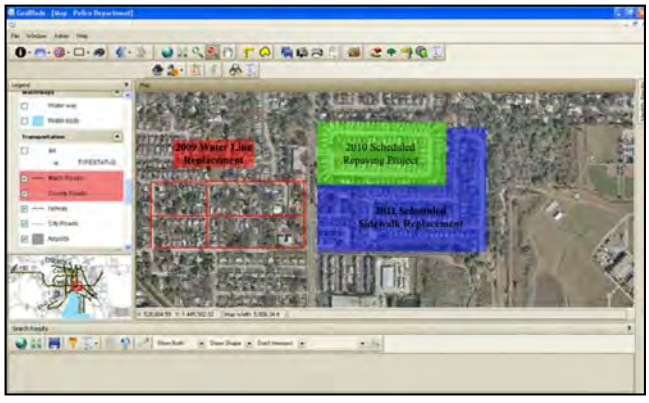
Intranet GIS Data Browser Tracing Service Disruption

The Water Services staff should conduct a majority of this analysis via an intranet GIS data browser. For advanced analysis and other tasks such as data creation and spatial analysis, Water Services staff will be able to utilize more advanced GIS software such as ArcView.

GIS Need

Use GIS to Track Projects

Water Services coordinates, manages, and participates in a variety of capital public infrastructure projects. Staff needs to use GIS to find background information on a given project and produce supporting graphics. Currently, staff has to go to 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 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 throughout time, track road closures, and to notify the public of work in an area. Additionally, this will ensure that capital projects are coordinated to optimize resources and reduce duplication.

GIS Need

GIS Based Work Order System

The City of Guelph manages work orders via the WAM software suite. Work orders are being entered into WAM and distributed to the appropriate crews. However, the WAM system is not linked to GIS. 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.

The City Guelph has invested in the development of bidirectional integration between Oracle's WAM and the GIS. However, this feature was not user friendly and has not been utilized. Furthermore, the original linkages between WAM and GIS have not been maintained. This makes linking WAM features to GIS features impossible without extensive data cleanup and data entry.

Maintaining accurate spatial data attributes and related data sources are a critical component of a successful GIS implementation. Guelph departments issue and process thousands of work orders throughout the course of a year. This process is now being done manually in most cases. Often infrastructure changes in the field are not reported back to the office resulting in map data that is erroneous. It is recommended that all work orders begin and end with the GIS. 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. 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.

An additional benefit of the GIS-based work order system is continual interpretation, analysis and improvement of mapped (GIS) data. If errors exist on the GIS maps, users can perform redlining or convey needed corrections to the existing data back to the GIS data managers. 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.

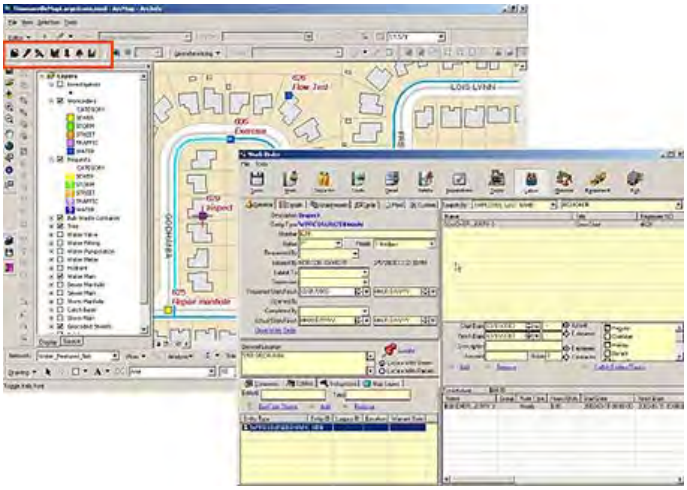
It is imperative that the personnel in charge of updating the GIS be advised of all infrastructure changes and additions through access to the work order system. There are several solution providers that support applications that meet this need. Each solution has various degrees of interaction between work orders, assets and GIS systems. It is important to note, that most effective GIS centric work order software is one that stores data in an open database (OLEDB or ODBC compliant). This will allow use of various Tier 3 GIS applications that can access data directly from the work order system. The solution should allow users to quickly print out a map, and a work order form for crews to take into the field. It is critical that this application has the ability to track open work orders. Work orders that are not returned from the field will cause degradation in the GIS data. This must be avoided.

The following solutions should be considered by the City. The first option is to utilize Oracle's GIS link for WAM. However, the previous attempt by the city was not successful. The City should carefully consider why the first Oracle mapping link failed and how and if a re-implementation will work. Alternatively, the City should consider other GIS based work order management systems as follows:

1. Azteca Systems - Cityworks

Cityworks® is a GIS-centric Asset and Computerized Maintenance Management System (or CMMS) created specifically for Public Works and Utilities. Utilizing the data contained in the GeoDatabase, Cityworks works to manage the dispersed infrastructure with tools for creating and tracking maintenance activities associated to assets and/or addresses. These include handling requests for service, conflict resolution, work orders, tests and inspections, ad-hoc search and reporting and much more.

With the integration of ESRI's technology, Cityworks is compatible with ArcGIS®. CityworksFM, whose underlying infrastructure data, models are based on industry standards. Off-the-shelf GeoDatabase models are available for Water, Wastewater, Stormwater, Streets, Traffic, Signs, Trees, Parks and Recreation facilities and many others.



Cityworks is built on open standards and with industry standard technology allowing for

access to data in an open architecture that is easy to integrate with your existing business systems. With support for industry leading relational databases like Microsoft SQL Server and Oracle, Cityworks is fully compatible with Microsoft Office.

2 - Lucity

Lucity (formerly GBA Master Series) focuses on the asset and maintenance management needs of an organization. The software synchronizes with GIS to allow for a work order solution based on geography.

Lucity highlights the following as main functions of their solution:

- Seamlessly integrate maintenance management, asset inventory and inspection, and GIS compatibility.
- Quickly locate any specific piece of information, from a service request to a current asset inventory.
- Efficiently input the large amount of information your agency generates, through mobile tools or at your desk.
- Generate a work order with one click, and monitor the process from initiation to completion.
- Create standard or custom reports that let you view and communicate big-picture trends, easing the decision-making process.
- Collaborate with our innovative team members to ensure our software works to achieve your distinctive objectives.

3 – Cartegraph

Cartegraph bills itself as a cloud-based Operations Management System capable of communicating with and integrating enterprise systems (e.g. ArcGIS) to provide complete management of all things asset related. Guelph already uses Cartegraph for pavement management. However, staff has stated that the application does not meet their needs. Following are the primary capabilities of the Cartegraph solution:

- Works on any device (desktop, tablet, smart phone)
- Built with latest HTML 5 technology

- Provides very efficient workflows based on best practices
- Based in the cloud – on-premise, hybrid, or hands free
- Base map can be Esri or Google
- Full integration with Esri GIS
- Full integration with any Open 311 system
- User friendly and easy to use

Guelph should aggressively pursue a GIS based work order system. The City has invested much in the Oracle WAM system. Oracle WAM ties to city financials and is not likely to be replaced. However, the City should still pursue a GIS based work management system and attempt to link data to Oracle WAM where practicable. Some duplication data entry may be required, but work orders and assets will be tracked much more effectively. The City should spend time evaluating each solution in an effort to select the best solution for Guelph's needs.

GIS Need

Access to Spatially Enabled As-Builts, CAD Drawings, and Videos - 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 city 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 along with computer screens.

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. Engineering does some of this archiving now and will be able to assist Water Services in scanning additional documents. All hydrant, service, and valve cards should be scanned and linked to the GIS. Additionally, all as builts should be linked and made available as backdrops to the GIS data. It should be noted that scanning old documents would be labour intensive and would need to be prioritized based on staff time availability. Utilization of interns should be considered for such a project.

There are a host of possible documents that could be linked to GIS to include:

- CCTV videos
- As-Builts
- Valve, hydrant, and service cards

The City has already experienced success in this area. Some data stored in the KISS system and some site specific reports for source protection have been geo-enabled and linked.

Water System with As-Built Backdrop

GIS Need

Field Access, Work Order Management, and Data Updates

Providing personnel with access to maps and GIS data while working in the field is an important part of maintaining an enterprise GIS, specifically when maintaining and collecting water infrastructure and environmental data. Through the use of hardware, software, and data that are designed to be interrogated and manipulated away from the office, staff can realize benefits of GIS while away from their office desk. Implementing mobile computers, input devices, software, and GIS data into the GIS enterprise will give Water Services the tools to perform work order notations and changes, data viewing, data input, and interactive geographic data query and analysis.

The City manages work orders for all of the utility systems. Some work orders are being entered into GIS and the WAM systems and distributed to the appropriate staff. However, not all of the changes that are being done in the field are being noted and returned to GIS staff. Over time, this degrades the accuracy of the GIS

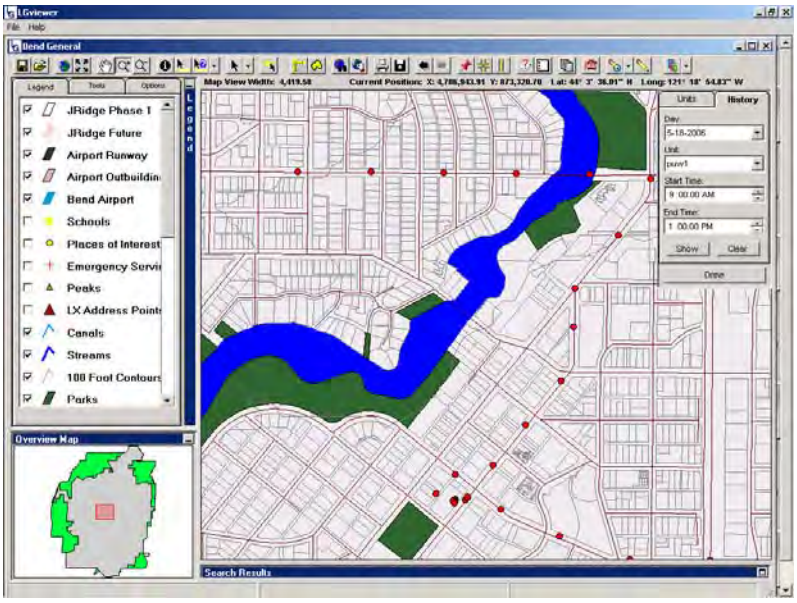
data. It must become mandatory that all work orders note work done in the field and that a work order cannot be officially closed until it has been reviewed and the appropriate data entered by the GIS staff.

Field staff in all divisions would benefit from having GIS in the field. Changes in infrastructure and environmental concerns can be easily viewed and updated from field tablets. Field crews should use an ArcGIS Online application to view and maintain data of interest.

GIS Need

Automated Vehicle Location (AVL)

Cities throughout Canada realize the benefits from Automated Vehicle Location (AVL) software and services. Other departments within the City have utilized AVL with some success. Water Services should be involved in future AVL discussions to align with the City's direction. 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.



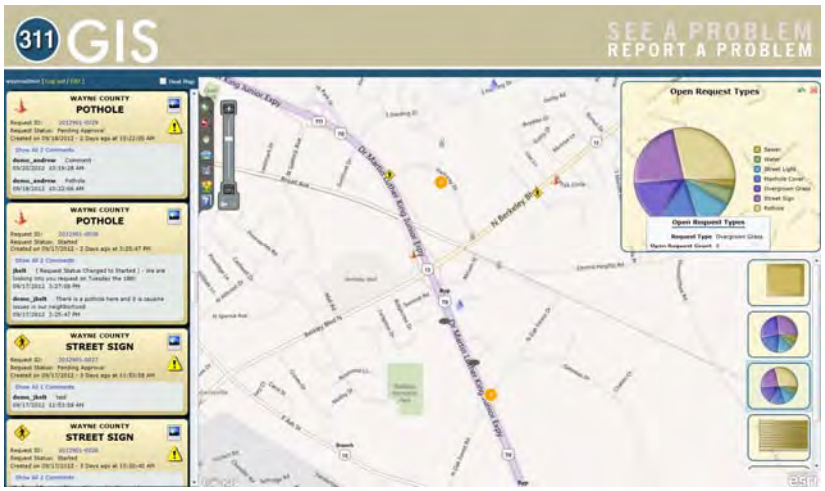
Using GIS to Track Vehicles

Water Services 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, Water Services 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 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.

GIS Need

Public Access Public Service Portal

Many City departments including Water Services would benefit from a web-based GIS application designed for tracking citizen inquiries, complaints, concerns, and other general feedback. Such an application would enhance communication with the public, and allow the City to quickly and effectively respond to requests. From the citizen's perspective, one call to any municipal staff member should result in an inquiry or complaint being logged into the system, routed to the correct department or point of contact, action taken by municipal employees, and follow up to the initial inquiry in an effective and timely manner. Inquiries or complaints should also be logged and tracked via the Internet or in person.



This type of system improves customer confidence and the customer experience greatly. Routing of inquiries and complaints would be done internally through email notification and is, therefore, transparent to the citizen. City staff can then proactively track, manage, analyze, map and report inquiries and complaints, actions taken, final results, and citizen satisfaction.

A complaint tracking system should include:

- Web/Phone-in/Walk-In Submittal of Inquiries
- Multiple Search (Query) Capabilities
- Internal Email Server
- Levels of End-User Security
- Assignment of Employees/Departments to Specific Inquiry Types
- Ability to Sub-classify Inquiry Types for Internal Department Use/Reporting
- Automated Email Notification of New Inquiry to a Designated Employee and Response to Person Submitting
- Logging of Actions Taken Toward a Solution
- Map and Summary Report Generation

GIS Need

Formal GIS Training for Water Services Staff

Staff that will be performing more advanced GIS analysis and mapping should participate in foundational GIS skills training. Water Services staff should participate in any enterprise-wide ArcGIS training that is made available. Through the use of Esri certified instructors, local colleges, internal staff, and web classes, the City can provide GIS instruction and training for its user community by providing onsite training. Various divisions expressed their desire to utilize GIS more extensively. Training should be provided on utilizing GIS for analysis and data maintenance. Tier three training should be provided on tools as they are made available and throughout the year. Training will need to be ongoing and pervasive. Using train the trainer methods is recommended.

GIS Gap Analysis

GIS Data Layer Inventory

Water Services will benefit from access to a variety of GIS layers. It is expected that once all departmental data is integrated, consolidated, and centrally stored that the staff will have access to all non-classified GIS data layers from other municipal departments. The following is a list of desired layers for Water Services:

Legend

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

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

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Water Services GIS Data			
AMANDA Data	Geo-enabled from existing database	GIS Division in IT	Partial
CCTV	Geo-enabled from existing database	GIS Division in IT and Water Services	Recommended
Conservation Features	Geo-enabled from existing database	GIS Division in IT and Water Services	Recommended
Customer Call History and Complaints	Geo-enabled from customer database	Automated	Recommended
Easements	Digitized on Screen	Engineering	Partial
Environmental Assessments	Digitized on screen and linked to pertinent database data	Engineering	Recommended
Environmental Layers	Various	GRCA and Water Services	Partial
KISS and EDMS Data	Geo-enabled from existing database	GIS Division in IT	Partial
City-owned Property	Extract from Tax Parcels and Aerials	GIS Division in IT	Existing
Guelph Hydro (Mocasoft)	Geo-enabled from existing database	GIS Division in IT	Recommended
Meters	Geo-enabled from existing database then corrected on screen	GIS Division in IT, Water Services, and Engineering	Recommended
Projects	Digitized on Screen	Various	Recommended
Rights-of-Way	Digitized on Screen	Engineering	Partial
Risk Management Features	Collected in the field and traced in databases	Engineering	Recommended
Sanitary Sewer, and Stormwater Systems	Digitized on-screen and converted from CAD drawings and paper maps	Engineering	Existing but needs spatial improvement
SCADA	iFix data live within GIS. Geo-enabled from existing database	Automated	Recommended
Water System	Digitized on-screen and converted from CAD drawings and paper maps	Engineering and Water Services	Existing but needs spatial

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
			improvement
Water Service Backflows	Digitized on-screen of GPS Field collection	Engineering	Recommended
Utilities – External	Other Utilities – Union GAS, Guelph Hydro, Ontario Hydro, Bell, Rodgers, others	Other Utilities	Recommended
Citywide Base Data – (It is important to note that Water Services provides services outside of the city, therefore they need base data for their service area)			
Property	Originally the parcel layer was created by digitizing paper assessment maps, which resulted in a highly inaccurate layer. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received, they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. Data is slowly improving over time. The City of Guelph's parcel base was originally created by digitizing paper assessment maps. Efforts were made to relate it to true ground locations and then adjust the internal line work using the rubber-sheet method thereby warping the line work. All other data sets were created based upon the parcel base, as well. In many areas, the differences were more than five (5) meters, in many cases showing the property line cutting into roadways. The inconsistency was NOT uniform so the situation could not be rectified by a global adjustment. Within a few blocks, the shift varied from five (5) meters east to five (5) meters west. In 2006, the City acquired rectified digital orthoimagery, which has become the primary mapping base. Guelph partnered with Teranet in 2010 to spatially align with the 2006 rectified orthophotography. This corrected the majority of the problem areas. As new survey plans are received, they are entered with a high degree of accuracy and surrounding less accurate parcels are best fit with the more accurate data. There still exist areas which require correcting since there have been little to no new development. Data is slowly improving over time. The City receives quarterly digital property updates from Teranet for registered properties and assessment properties.	The GIS Team in IT maintains the property data. New property surveys are incorporated as they are received. If staff in other departments sees errors they have been asked to report them to the GIS Team in IT.	Existing

Data Layer	*Creation Methodology*	*Recommended Update Division or Individual*	*Existing or Recommended?*
Aerial Photography	Guelph is part of a consortium that acquires new aerials every few years. Photography exists for 1983 (BW), 2000 (BW), 2006 (Colour), 2009 (Colour), 2012 (Colour). 2014 will fly again. Beginning in 2006 Guelph became part of a group of local municipalities to acquire updated orthoimagery on an ongoing basis. So far imagery has been gathered for 2006, 2009 and 2012. The captured imagery is 10-12cm resolution being for the most part leaf off flown during spring conditions. Contour generation is also part of these projects. Photography exists for 1983 (BW), 2000 (BW).	Static Map	Existing
Road Centerlines	Data originally purchased from the School Board. Improvements and maintenance have occurred since acquisition. Layer is used corporately by all departments and is also used for Fire Dispatch. Data is not routing ready.	GIS Team in IT	Existing
City Limits	Digitize from source documents	Planning	Existing
Landmarks	Digitized – have started to develop a commonplace layer by merging information from various sources.	GIS Team in IT	Partial
Subdivisions/ Neighbourhood	Heads up Digitizing Screen. Subdivisions are available by 61-M plan (Subdivision) layer, and Neighbourhoods by Neighbourhood group layer	GIS Team in IT	Partial
Water Bodies	Acquired from the Province of Ontario (There is NRVIS and GRCA data on waterbodies and they are slightly different) Hydrology layer acquired as part of 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. River polygon extracted from parcel base. Guelph Lake polygon layers also from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series.	GIS Team in IT	Existing
Address Points	Address points have been created. However, they are stacked for parcels with multi-tenant dwellings. Some address points are on rooftops others on centroids. Original address information captured as polygons. These were converted to points when migrated from MapInfo.	The GIS Team in IT creates and maintains addresses within GIS. Are notified by Planning when new addresses are required.	Existing
Building Footprints	Original building footprints were provided from 1983 Ontario Base Mapping from the Ministry of Natural Resources 1:10000 series. Guelph Hydro utilized the 2000 and then the 2006 imagery provided by the City to create an updated building layer.	GIS Team in IT	Existing
Contours	0.5m Contours are available within Guelph's city limits. Need data for entire service area. Original contours were purchased with 2006 Orthophoto project, with updates in 2009 and 2012. Refresh of dataset is evaluated based on cost/need, as well as coverage area.	Static; Changes are updated with Orhtophoto refresh	Existing

GAP Analysis Chart

Water Services has a significant role in GIS for the City of Guelph 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 division. The matrix below details those relevant components that have been analyzed and assessed as part of the Gap Analysis.

Legend	
Existing	
Yes	GIS component currently exists within division.
No	GIS component does not currently exist within division.
Limited/Partial	GIS component exists to a lesser degree.
Desired	
Yes	Deemed desirable based on Needs Assessment.
No	Deemed to be not desirable based on Needs Assessment.
Limited	Some applicability to divisional needs.
Priority	
High	Takes precedent over other needs.
Medium	Secondarily important to divisional need.
Low	Can be met after higher needs are accomplished.

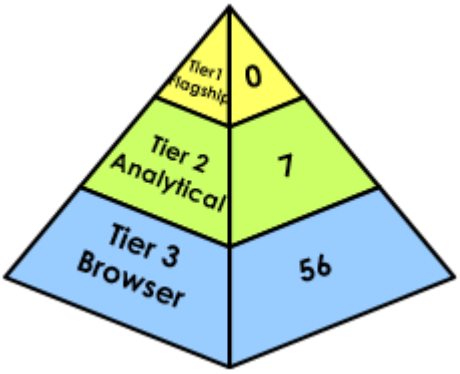
Component	Status		Priority	Notes
	Existing	Desired		
Automated Vehicle Tracking (AVL)	No	Yes	High	AVL can be used to track vehicles; Using AVL conjunction with routing increases efficiency and can reduce fuel consumption, thereby decreasing costs.
Documentation	Yes	Yes	Medium	Some documentation on GIS data creation and workflow exists in Water Services; however, there is a greater need for creation and standardization for documentation citywide. The GIS Division in IT will identify enterprise GIS documentation processes and procedures.

Component	Status		Priority	Notes
	Existing	Desired		
Enterprise Systems Integration	Yes	Yes	High	Integration of data within an enterprise system is a must. Water Services utilizes many database and IT systems. Integrating GIS data with these systems is critical of Water Services' operations.
Geocoding	Limited	Yes	High	Water Services has many databases tracking key data. Some of these are address based and should be geo-coded for consumption in GIS.
GIS Data Access	Yes	Yes	High	Current databases used within Water Services have data that could be beneficial citywide and Water Services would benefit from access to other departments data layers. GIS Data access is desired and should be addressed throughout the City.
GIS Data Maintenance	No	Yes	High	Engineering maintains most of the Water Services layers. However, as field tools are introduced Water Services staff will contribute to this effort.
GIS Data Sharing	Yes	Yes	High	Some key datasets will need to be shared internally and with the public.
GIS Personnel	Yes	Yes	High	Multiple employees within Water Services currently perform GIS work maintaining and analyzing data.
Hardware	Yes	Yes	High	Current hardware is adequate for GIS use. Tablets may be needed for field access.
Mapping	Yes	Yes	High	Water Services creates a number of mapping products. With the addition of a more user-friendly intranet application, staff will be able to create more mapping products
Metadata	Limited	Yes	High	A formal, standardized metadata system needs to be developed and implemented for all GIS data layers authored within the City of Guelph. The GIS Division in IT would decide upon standards.
Mobile Computing Resources	Limited	Yes	High	Currently staff is not using GIS in the field. However, field staff want and need usable field access.

Component	Status		Priority	Notes
	Existing	Desired		
Network	Yes	Yes	High	High availability of data via the internal network is mission critical
Routing	No	No	Low	Vehicle routing with GIS is not a high priority of Water Services.
Software	Yes	Yes	High	Water Services utilizes Esri software for a variety of tasks and will continue to do so.
Spatial Analysis and Modeling	Yes	Yes	Medium	Water Services has the need to do conduct analysis of the water system. They use ArcGIS in conjunction with other software for some modelling.
Training/Education	Yes	Yes	High	This component is considered a high priority for growth of GIS within Water Services. The Tier 1 and 2 GIS users will need additional advanced training. Tier 3 users will need ongoing training.

Multi-Tier GIS Application Use

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



Tiers of GIS Users

Group	Activity
Tier 1 Flagship	☑ GIS Administration ☑ Data maintenance ☑ Data conversion, creation ☑ Spatial Data Management ☑ Technical support ☑ Coordination
Tier 2 Analytical	☑ Data Maintenance ☑ Analytical functions/Geoprocessing ☑ Complex queries ☑ Modeling ☑ Use of desktop extensions ☑ High quality map production
Tier 3 Browser	☑ Browsing/Look-up ☑ Standard reports ☑ Simple query ☑ Map production

Departmental Return on Investment (ROI)

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

Return on Investment Opportunity Water Services	
Opportunity	**Explanation**
<u>Save</u> Lives	• In the event that some of the water quality sampling sites return results that require boil notifications, a GIS based mass notification system can get notices out to residents in a timely manner. • Hydrant information provided to the Fire Department will facilitate their response to emergency calls. • Properly identifying and locating line assets in

	the field may prevent damage to dangerous systems such as buried gas or electric facilities. • Using GIS facilitates the department's response to pump station failures and force main breaks that could endanger public health, particularly following an emergency event. • AVL will help with staff safety as many staff work alone in the field.
Reduced Cost	• Engineering and design project cost can be reduced by approximately 5% per project with reducing time spent in the planning, surveying, and design phases of the project and by minimizing change orders in the field. • Having Guelph utilities mapped and stored in the City's GIS system, the time to mark utilities can be dramatically reduced by an average of 30 minutes per site visit. • Integration of GIS and Asset Management Systems can reduce both CIP and Maintenance cost by more informed selection of assets needing replacement and which assets require different maintenance cycles.
Improved Efficiency	• Quickly isolate areas in the water system and identify hydrants for flushing • Providing field personnel with laptops/tablets reduces the time spent in the office preparing for assignments. It may reduce their downtime as they wait for record drawings to be located. • Streamline workflows and reduce paper and duplicate recording using mobile solutions.
Compliance with Provincial Mandates	• GIS is utilized to comply with required reports and laws.

Ability to Respond More Quickly to Citizen Requests / Improved Access to Government	• Providing electronic maps to outside consultants allow us to quickly fulfill requests through e-mail, without having the engineer visit the department. • 311 based GIS will allow for much better customer service and proactive response.
Effective Management of Assets and Resources	• Asset management systems tied into GIS will allow us to identify problematic areas based on the age of the system, the number of service calls to an area, or the repair history. • Retaining institutional knowledge by storing information like locations, connections, age, condition, and maintenance history of assets can help minimize the impact of employee turnover.

GEOGRAPHIC TECHNOLOGIES GROUP®

1202 Parkway Drive Goldsboro, North Carolina 27534
www.geotg.com | 888-757-4222

January 30, 2015 2:00 PM

City of Guelph