

City of MARKHAM



Comprehensive
Zoning By-law
Project



**Task 6: Geographic
Information Systems &
Technology Strategy**



February 6, 2015



Markham Zoning By-law Consultant Team

Gladki Planning Associates, R. E. Millward, Woodfield Consulting, Clarion Associates and Antony Usher

Contents

Executive Summary	1
1 Introduction	3
1.1 Guiding Principles	4
1.2 Context	5
2 City of Markham GIS and ITS Capabilities	8
2.1 Current GIS Infrastructure	8
2.2 Current Zoning Data	10
2.3 GIS Linkage	13
2.4 Labeling	17
2.5 Support and Maintenance of Data	18
2.6 Modeling, Query and Search	19
2.7 Geoprecision	20
2.8 Presentation Layer Options	20
2.9 Mobile Applications	23
3 Innovative and Interactive Web-based Zoning By-Laws	25
4 Technology for Zoning	30
4.1 Legal Zoning By-Law Document	31
4.2 Zoning By-Law Map Series	36
4.3 Zoning By-law Interactive GIS	41
4.4 Business Solution Applications	47
5 Stakeholder Analysis	51
5.1 Public	52
5.2 Industry	53
5.3 Staff	53
6 ZBL Geographic Information & Technology Cost Estimates	56
Appendix	63
Appendix 1 - Summary of Consultation	64
Appendix 2 - Open Data	65
Appendix 3 - Sample Project Position Descriptions	66

List of Figures

Figure 1: Project Stakeholders	4
Figure 2: City of Markham Geospatial Database Configuration	9
Figure 3: Ottawa R1 Subzone Provisions (illustrative portion)	16
Figure 4: City of Ottawa R1 Additional Zoning Provisions (illustrative portion)	17
Figure 5: ZBL Consolidation – Project Continuum	26
Figure 6: City of Mississauga Zoning By-Law Document Interface	33
Figure 7: City of Mississauga Zoning By-Law Product Information	34
Figure 8: City of Markham Street Guide - Grid	36
Figure 9: City of Markham Street Map Series, Grid D5	38
Figure 10: City of Markham Street Name Index (part)	39
Figure 11: City of London, ON – Online Zoning By-Law Disclaimer	41
Figure 12: City of Markham Property Details Search	42
Figure 13: City of Markham Property Details Map	43
Figure 14: Town of Oakville Interactive Zoning Map	45
Figure 15: City of Toronto Interactive Zoning Map	46
Figure 16: York Region Story Map Sample	48
Figure 17: City of Brampton Property Report Sample	49

List of Tables

Table 1: ZBL Geographic Information and Technology Capital and Operating Cost Estimates	2
Table 2: City of Markham Zoning Layers	10
Table 3: City of Markham Zoning Attributes	11
Table 4: Representative Zoning Data Dictionary	14
Table 5: Options for Zoning By-Law Presentation Layer	22
Table 6: ZBL Environmental Scan	29
Table 7: Legal Zoning By-Law Document Options	35
Table 8: ZBL Map Series Considerations	40
Table 9: ZBL Interactive GIS Considerations	44
Table 10: Future Zoning By-Law Technology Access Considerations	53
Table 11: ZBL Human and Technology Requirements (and Options)	57
Table 12: ZBL Geographic Information and Technology Capital and Operating Cost Estimates	60
Table 13: ZBL Technology Capital Project Cost Estimates	61
Table 14: ZBL Technology Operating Budget Increment Estimates	62

Draft

Executive Summary

There is a significant diversity of need among the many stakeholders who share a common desire to see zoning information and systems that would be accessible. Their common goals include the

- Ability to regulate appropriate and desirable development in the City over time
- Ability to promote as simple and intuitive a by-law as possible
- Ability to ensure that zoning variances/amendments/consolidations are automatically related in the zoning by-law text and on the resulting interactive mapping

This document speaks to the strategic directions suggested for the City, the detailed specifications for which will be finalised by City staff at the time of implementation of the web mapping aspects of the new zoning bylaw as it completes over the next two years. Meeting the strategic goals requires adherence to certain key principles.

City of Markham's Geospatial Information and Technology Capabilities: Quality information is the foundation for supporting the business requirements for Development Services at the City of Markham. The City is already engaged in many activities that support the current infrastructure and geospatial information environments, and are well placed to extend those activities as development services datasets (including a consolidated zoning by-law) mature.

Legal Zoning By-Law Document: Text document should be presented online, as fully indexed and searchable files. Stakeholders require the ability to copy and/or download parts of, or entire documents. The complexity of the content requires that advanced help functionality such as pop-up hyperlinks to key definitions and illustrations are accessible to the Stakeholder.

Zoning By-Law Map Series: Portable, digital map series can be a valuable adjunct to interactive text and mapping environments. These printable map sheets can also be offered as a complete set in a Map Book application and/or hard copy printed format as a schedule to the consolidated Zoning by-law. A declining minority of potential Stakeholders prefer access via paper map.

Zoning By-Law Interactive Geographic Information Systems (GIS): Communication through visualization is an important consideration for making zoning information available to stakeholders. The map provides a visual tool to access information required by knowledgeable staff to interpret a consolidated zoning by-law. An increasing majority of potential stakeholders prefer access via an interactive mapping environment.

Zoning By-Law Business Solutions Applications: Zoning can/should be the gateway dataset into a solution where all questions can be answered with simple, reusable computer functions deployed as business-specific applications to automate repetitive tasks. Creating, integrating and extending products and processes derived from the consolidated zoning by-law data should be thought of as the long term objective for the City's use of zoning and property-related information.

In order for the City of Markham to be an innovative leader amongst its peers in the GTA, Ontario, Canada and abroad, the organization needs to play in each of the spaces described above. It will not be enough to master one, while ignoring the others.

Members of the Public, Staff and Industry will be looking for the City to deliver in all these areas to service a particular future requirement. The estimated investment for the City over the next five years is \$873,300; mostly manpower. See the assumptions and details on the estimated costs in Section 6 of this report.

Table 1: ZBL Geographic Information and Technology Capital and Operating Cost Estimates

Project Component		2016	2017	2018	2019	2020	Total
Total Capital Project	\$000	147	302.1	287.1	0	0	736.2
Total Operating Budget Increment	\$000	0	0	0	137.1	0	137.1
Total Project Cost	\$000	147	302.1	287.1	137.1	0	873.3

Draft

1 Introduction

This document outlines strategic considerations, options and associated requirements for the implementation of an innovative and interactive GIS, web-based comprehensive zoning by-law by the City of Markham.

The project requirements included

1. Review and assessment of the City's existing GIS and ITS framework, resources and capabilities
2. Review and assessment of best practices examples of innovative and interactive web-based zoning by-laws within the Greater Toronto Area, Ontario and/or Canada/USA
3. Identification of potential issues and challenges associated with the implementation of an innovative and interactive GIS, web-based zoning by-law,
 - a. Including potential options for addressing identified issues and challenges
 - b. Estimated initial start-up costs as well as estimated ongoing maintenance and operating costs
4. Consultation with City Staff and stakeholders where necessary to obtain input
5. Summary of consultation undertaken as part of review and assessment process
6. Present findings of review and assessment at a non-statutory Public Open House to obtain input and feedback.

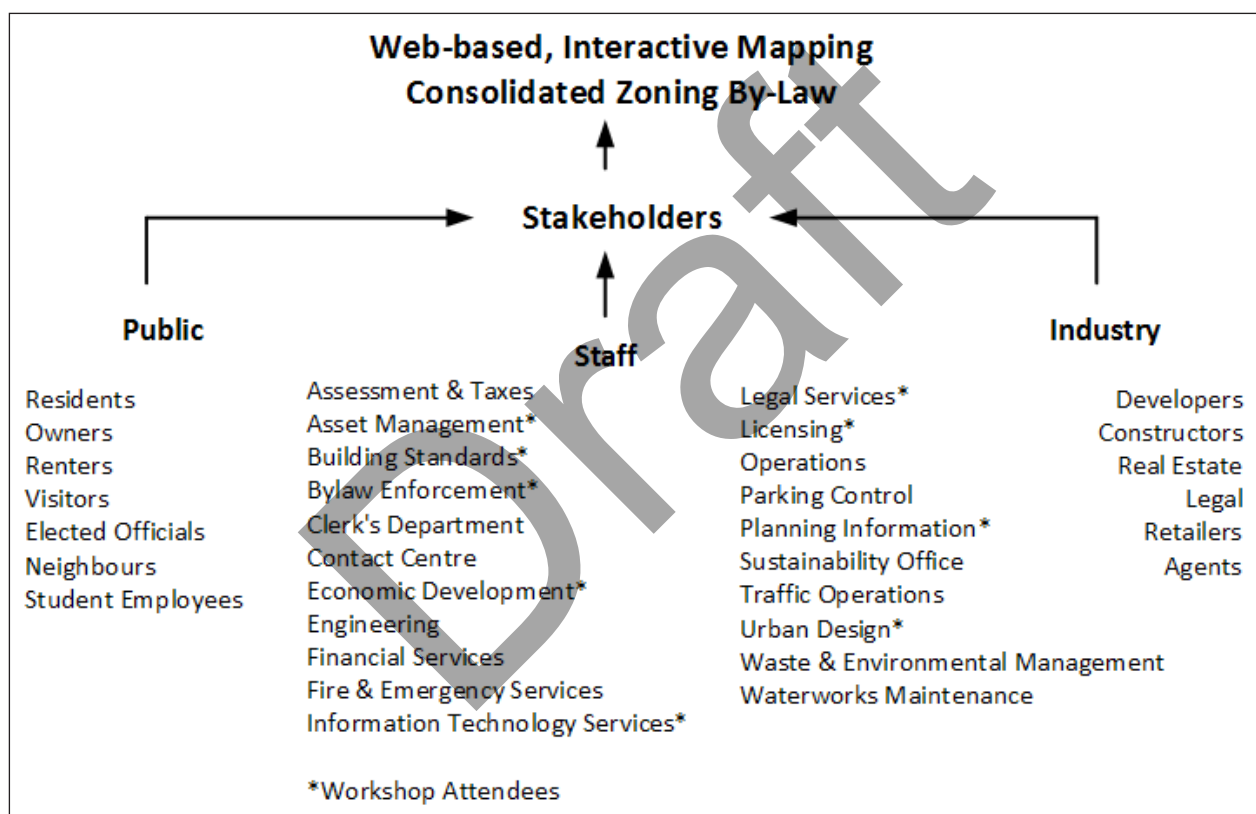
Comments were gathered through a series of meetings with multiple stakeholders who participate in the creation, maintenance, and use of the zoning data at the City. Current practices were discussed along with future requirements for the zoning business process. The presentation of zoning by-law

data in other similar jurisdictions was also investigated, and suggestions about how other municipal governments are making zoning information easily understandable and accessible will be illustrated.

The report identifies issues, and outlines potential options and implications, for moving forward with a new web-based zoning by-law. This includes the business processes that establish and maintain the zoning by-law website. In turn, the website informs the awareness and enforcement of the by-law. This is a critical information loop between data creators and data consumers, both contributing to the overall health and currency of the data and the usefulness of the information in the City's business process..

Note to Reader: There are many words that can be used to describe individuals and organizations having an interest in the consolidated zoning by-law, and technology solutions to access the zoning information. Throughout this report we will refer to these stakeholders as belonging to one of three groups: Public, Staff and Industry.

Figure 1: Project Stakeholders



1.1 Guiding Principles

While the City did not dictate any guiding principles or over-arching themes for this ZBL/GIS step of the project the consulting team found it very useful to develop the following as directions for research and meetings with staff.

These were presented to a number of staff and were generally accepted in that over-arching or umbrella theme sense. We list them below and suggest the City will review them with an eye to approving them in substance, in principle, so that the web based mapping delivery of the new zoning bylaw can be executed with service goals in mind.

GIS data driven sites based on address, parcel, roll and zone should/could:

- Enable a very broad enquirer base to access core ZBL information at address level
- Enable a beneficial percentage of current letter, fax, email, phone and in-person counter enquiries to be answered through self-help web pages
 - Textually through access to printable official copies of Bylaw documents
 - Visually through printable maps and drawings of appropriate zones and exception flags
- Contribute to staff efficiencies by transferring 'basic' and 'informational' and 'educational' enquiries to the ZBL map site
- Contribute to staff efficiencies and effectiveness (saving time and ensuring consistency) by empowering City contact staff to assist in directing ad hoc or general public enquiries to the web site instead of engaging in potentially time intensive research and delayed answer efforts (and repeats)
- Increase the effectiveness of Planners, Inspectors & Managers by enabling field access to the entire ZBL documentation (textual & visual) by staff and residents.
- Align to City initiatives for efficiency, paperless, self-serve, transparency, compliance

1.2 Context

In a not-so-really-distant future it should be anticipated that Markham, and most municipalities, will have a service paradigm delivered on an address or parcel basis. Online services currently exist, and will grow to track and display (subject to privacy and legal considerations) every attribute about any parcel as well as every activity at that address over time and including service or event subscriptions acquired by residents of that address.

There are after all 'only' about 85,000 unique parcels in Markham today and perhaps doubling over the next 30 years. That is a big number yet it also is an administratively imaginable number for which to have a broad data base of attributes and histories tied to each parcel or address. Powerstream has over 360,000 customers/meters that it manages a wide array of data attributes about. We believe keeping such a longer range view is appropriate when considering how to manage zoning bylaw administration in the shorter term of 1 to 5 years.

A succinct branding might be seen as 'every property every attribute'. Such council approved approaches may then be subject to a single sign-in for owners and designated staff while general viewers may over time be able to see general aggregations of publically suitable information. That is where the web based Zoning Bylaw aspects become desirable.

There are ample and significant precedents at the City for the move to providing information and access to information via digital documents and online mapping. Several ongoing projects will make significant contribution to the City's technological and organizational capacity for providing property information, when they are fully implemented in the future, including:

ePlan Review - Electronic plan submission online, including automated tools for circulation and comment about building applications in the Planning and Building departments. The themes and goals for this project revolve around

- paperless flows of information

- on-line applications for permits, queries and approvals
- electronic submission of drawings
- mapping of nearby related land features or underground infrastructure
- website gateway to anything related to identifiable properties

It is envisaged perhaps that all information and all relevant rules can be determined via a web access that is both map driven by location or text driven by legal matters in question.

Digital Markham – This IT program now commencing to review and forecast enhanced online service provisioning including the Portal sub-project which provides responsive content/form factor to a variety of browser types (desktop, tablet, hand held devices). Additionally it should provide increased public online maps in HTML5 using Latitude Geographics' Geocortex product as a flexible and configurable design and delivery tool.

Asset Management Photo and Image Management – a recent project has been identified to assess storing and making available a variety of 'picture' files for a number of purposes related to assets. This project will hopefully entertain needs and opportunities in other departments where multimedia can be stored and retrieved according to their location and matter of interest. The zoning bylaw GIS and other search services may benefit from the core technologies that may be chosen to fill the identified asset management need. Examples of compliant structures and/or non-compliant structures or uses come to mind, as do site specific bylaw exceptions where the searchable address based picture may best demonstrate the approved exception etc.

It should be understood that a property/zoning portal (e.g. a single focus site or a multi-focus address/parcel based one) is among several related channels open to provide information to requestors and decision makers inside and outside of the City's administration. GIS or geographic information and technologies are tools to enable self-serve and advisory services to be provided by the City, whether parcel specific, local area inclusive or city wide thematic in nature.

Existing, well documented planning application processes (including Plan of Subdivision, Plan of Condominium, Zoning By-Law Amendment, Official Plan Amendment, Heritage Permit, Site Plan Approval) could incorporate improved access to zoning and other property information. Completion of application, circulation of application, internal/external review, report to committee, public notice, recommendation, acceptance or refusal, and appeal could all benefit from a common, authoritative view of zoning and property information through a web-based portal.

Integration of planning information with case management, customer relationship management and other business systems could help improve business processes City-wide. During meetings, there was discussion of instances where an applicant stated that "someone at the City said I could do that" when referring to an improvement in land or building that they undertook. Full documentation about customer interaction, information request, customer disposition – along with the substantive information provided – would put the city on a better footing to answer enforcement requests and to defend itself in legal proceedings. We wonder how much this 'someone said' issue is minimized when the enquirer does the majority of up-front research themselves on the web and only leaves the truly complex or unanswerable details to 'someone' in person who then uses the same web based tools to walk the person to the official conclusion.

As the front-line to clients, Development Services is currently dealing with information that is difficult to find, collate and explain. These efforts are attempted piecemeal now, but could be done with much

more confidence if commonly requested information was easier to access and available to a wider group of customer service and professional staff.

Any system that presents the zoning (and other property information) for general use, needs to have a legal disclaimer attached to ensure that requestors understand that electronic and interactive mapping versions of the information are presented for convenience purposes. This is common practice for all jurisdictions that were investigated for this review, and the City should be no different. The systems provide enough information to satisfy those requestors who are “fishing” for information or have high-level and/or general questions. These systems DO NOT make decisions. They provide context and they inform. They do not provide legal counsel, they provide background and they inform.

Staff also presented a converse, and equally compelling argument for “flagging” those areas/parcels where a system might automatically direct the requestor to seek further clarification and or advisory services. These might include areas currently under review or appeal, or areas of future development where Official Plan definitions exist prior to detailed zoning designations. This would ensure that clients understand that expert, official interpretation of zoning by qualified City staff is a key part of meeting their particular information request.

Regardless of the detail required to answer the individual request, customers want access to information and want answers fast. It is important to have question and answer “scripts” to take information providers through commonly requested scenarios. Such frequently asked question documents (FAQs) would assist in building knowledge around which questions are answered most frequently, and how facts can be conveyed to requestors in a consistent manner. Typically, reports are designed using a combination of business information and map visualization – and these reports are easily generated (and printed, if required) at the service counter, from the requestor’s desktop or in the field on mobile devices.

City staff have been living with the current process of providing by-law information to requestors for the past number of years. They have firsthand knowledge of complication involved in pulling the information together. This has created a reluctance in the past to give free access to zoning information to outside requestors. Even highly knowledgeable, and experienced City staff had a hard time making definitive statements to zoning questions. The zoning by-law consolidation project is meant to create an information and technology delivery system that is easier to understand, access, and use for actionable results.

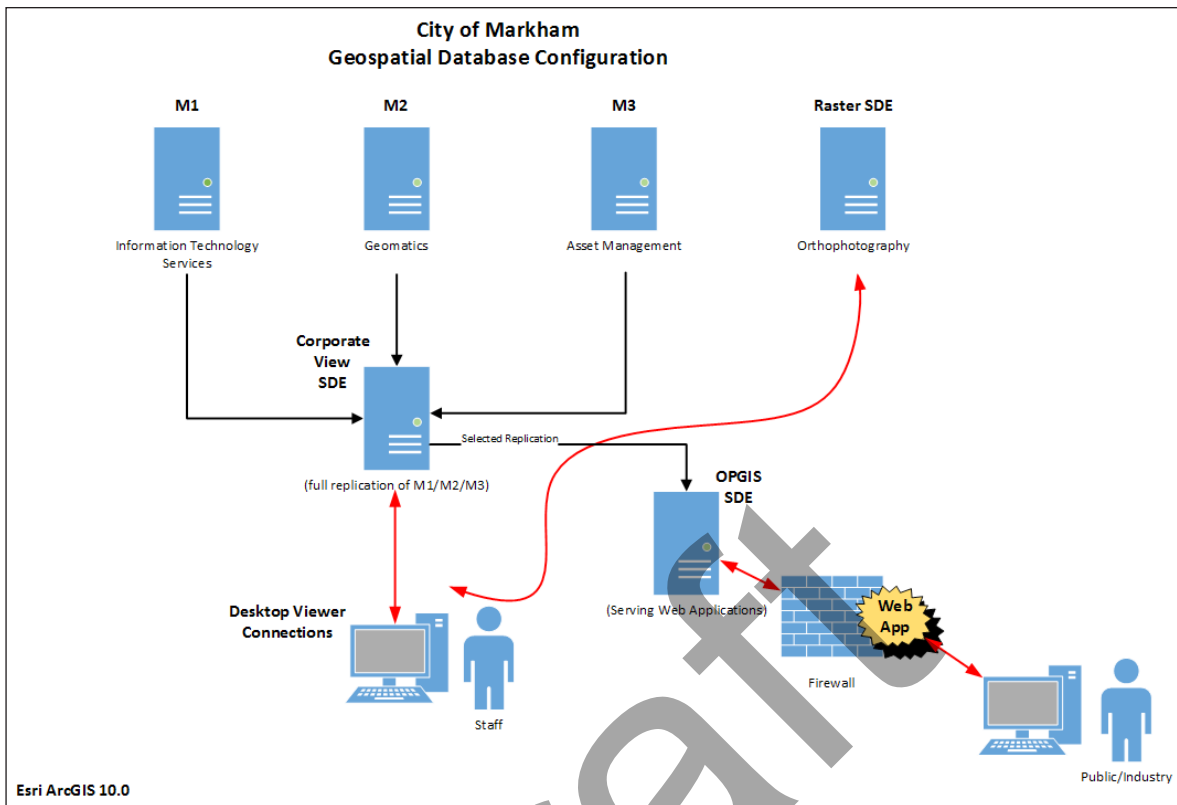
2 City of Markham GIS and ITS Capabilities

The creation and maintenance of a zoning by-law **IS** a mandated function of the municipal government. There are no specific legislative or regulatory dictates on **HOW** the information should be shared. Indeed, peer organizations provide zoning by-law access through hard copies at the customer service counter, posted online documents, map series sheets, interactive GIS and in business applications. There is no standard or common maturity level among the peers surveyed.

Principle: Quality information is the foundation for supporting the business requirements for Development Services at the City of Markham. The City is already engaged in many activities that support the current infrastructure and information environments, and are well placed to extend those activities as development services datasets (including a consolidated zoning by-law) mature.

2.1 Current GIS Infrastructure

Consultation with the GIS staff in the Information Technology Services and the Geomatics group in Development Services (Planning Dept) indicates that the City is in an excellent position to move forward with the consolidated zoning by-law project in both the information and technology spheres. Both the GIS/ITS and the Planning/Geomatics teams consistently portrayed their geospatial processes to be co-operative for the development and maintenance of the required data and technologies. This is and will remain a required foundation to any successful application of geographic zoning information delivery to the three stakeholder communities. The back-office set-up has been recently upgraded to Esri ArcGIS version 10.0. A schematic of the environment is included below.

Figure 2: City of Markham Geospatial Database Configuration

Observations about this database configuration:

- Production databases are dedicated to the major data maintenance groups. This creates flexibility around administration of the production data without impacting other Stakeholders.
- Distributed data maintenance is a broad industry trend that the City of Markham has been following for many years.
- Full replication of the M-production databases to the Corporate View SDE allows desktop viewers to access the current data without the need to worry about downtime on production databases.
- Raster data is stored separately, due to its large footprint and different administrative requirements.
- Selected replication of data takes place to OPGIS, which serves data to web applications. This ensures that public access is outside the corporate firewall, for enhanced security

There are only a couple of areas where the City's set-up might move up in step with other peer organizations:

- Many organizations do not utilize the full capability of database versioning, history, and relationship classes to manage transactional data.
 - Versioning can allow Stakeholders to build scenarios in the same geographic area as different proposals are being examined. The final approved scenario is written back to the current state, and other versions can be maintained or discarded.

- Full history would provide lineage between parent-child geographic features. Inheritance of attribute data would need to be determined by setting up pre-determined rules. For example, if a polygon is split, do the two children polygons automatically inherit the attributes of the original parent? Using history means that no information is ever discarded, old features are retired, but still available for audit and reporting purposes.
- Relationship classes are used to control the topological relationships among geographic feature classes. These are used to define how polygons, lines and points should exist in the database relative to other geographies. They are a good quality assurance/quality control tool to ensure data maintenance is rigorous and correct.
- The diagram (Fig 2) does not indicate how staff utilize web applications from inside the firewall, unless the desktop viewer is also an alias for internal web application(s).
- There is no indication of any disaster recovery capability in the system. While production boxes (M1-M3) may be down for an indefinite period of time without impacting service levels, the Corporate View and OPGIS SDE could benefit from active or passive failover to separate hardware, potentially off-site from the main datacentre. Without it, mission critical business solutions may be vulnerable to an outage.

2.2 Current Zoning Data

The City provided screen captures of the *D7 Zoning Mask* as representative of the typical data that Stakeholders would “mash-up” to access zoning data through an ArcMap map data file (.mdx). The following layers were identified residing in the default instance of SDE in the production database:

Table 2: City of Markham Zoning Layers

SDE Dataset	Feature Class
GEOMATOWN. ZONING	GEOMATOWN.MINISTERS_PARKWAY_BELT
	GEOMATOWN.MINISTERS_ZONING_ORDER_AIRPORT
GEOMATOWN. UTILITIES	GEOMATOWN.STREET_NAMES
	GEOMATOWN.YRCP_ROADS
GEOMATOWN. ZONING	GEOMATOWN.AMEND_TXT
	GEOMATOWN.ASTERIX
	GEOMATOWN.PARENT_BYLAW_Anno
	GEOMATOWN.PARENT_BYLAW
	GEOMATOWN.ZONING_DESIG_Anno
	GEOMATOWN.ZONING_DESIGNATION
	GEOMATOWN.AMEND_LINE_WORK
GEOMATOWN. OFFICIAL_PLAN	GEOMATOWN.SPA_2008
CGISOWN. CADASTRAL	CGISOWN.CADASTRAL_ANNO
	CGISOWN.PARCEL
	CGISOWN.BOUNDARY

As the zoning data is sourced from parcel boundaries, the cadastral dataset is the foundation of this map data file.

The parent by-law is indicated, as well as the more familiar zoning designations.

An amendment line file is present, but would not have attribute data associated with a particular site specific amendment. It would be a visual cue that an amendment exists for that area, and the AMEND_TXT would point staff to the amendment number.

Provincial minister's orders are present, representing large swaths of the City where zoning does not tell the entire story of what can and cannot be done with land.

Road casements and street name text round out the layers accessed here.

Several ideas come to mind that would aid in the usefulness of accessing these zoning data layers:

- The feature class names reflect a database administrator's view of the world, and would be unintelligible to most casual Stakeholders. If desktop GIS software is being deployed more widely at the City in the future, friendly aliases for these layer names would be appropriate for discovering data.
- There was no metadata repository identified where the Stakeholder could browse information about content of the data, or how and when the data is collected and updated.
- As the .mdx is organized to depict a zoning map series view of the data, annotation layers are included to provide labeling. In an interactive view of the data, the administrators and users would need to plan the level of labeling required at various map zoom levels.
- Modern web mapping applications access a "cache" or image of the data as a "map service" to limit network resources used in refresh of the map in the browser window.

Table 3: City of Markham Zoning Attributes

Table Name	Attribute Name	Sample Values
GEOMATOWN. PARENT_BYLAW	BY_LAW	BY-LAW 304-87 BY-LAW BY-LAW 90-81 BY-LAW 108-81 BY-LAW 127-76, etc . . .
GEOMATOWN. ZONING_DESIGNATION	ZONE_CODE	R4 01 R1 RST1 (H)RM3 C.C.A. M.C.(90%) MJC*336*340(H), etc . . .

Table Name	Attribute Name	Sample Values
	LANDUSE	Residential Open Space Hazard Industrial Institutional Commercial, etc . . .
	ZONE_DESC	Single Detached Dwelling Open Space Street Townhouse Industrial Single and Multiple Detached Dwelling Residential Commercial Selected Industrial with Limited Commercial Institutional Highway Commercial Rural Residential Semi Detached, etc . . .
	BY_LAW	BY-LAW 151-75 BY-LAW 2237 BY-LAW 2571 BY-LAW 250-77, etc . . .

Screen shots of the *Parent By-Law* and *Zoning Designation* tables were provided as listings of the primary zoning attributes maintained in the current environment. Each contains system generated fields for OBJECTID, SHAPE (e.g. polygon), as well as SHAPE_AREA and SHAPE_LEN to describe the area and perimeter of the individual polygons. Sample business attributes are reproduced in Table 3 above.

The City's Zoning By-Law Consolidation project will be addressing the domains of these key zoning layers. The planning consultant is currently strategizing on a simplification of the zoning by-law. The outcome of that process will dictate what the target information environment will look like. The source data environment is not in pristine condition. A few general comments can be made about the contents of Table 2 above.

In the PARENT_BYLAW table, there is no need to store the characters "BY-LAW" as part of the attribute. The field might better be named BY_LAW_NUM and the relevant text (e.g. "304-87") stored against the polygon.

In the ZONING_DESIGNATION table, several observations can be made. It seems that the ZONE_CODE attribute is a proxy label for much more than the codes that represent the zoning designations. The

inclusion of “(H)” as a prefix would indicate some holding status on that particular polygon. “(90%)” would probably indicate some kind of density measure that should not be part of the ZONE_CODE domain. “MJC*336*340(H)” is mixing a number of data elements in a single value. The important message from examination of this sample data is that data standards, quality control and data audit will be important components of the go-forward strategy for the City’s zoning data.

The LANDUSE and ZONE_DESC attributes will follow the changing designations that emerge in the consolidation project. Some of these values are quite lengthy character strings. It might be useful to include both short and long descriptions as text for these attributes, to assist flexibility in query, labeling and reporting.

Current zoning was examined in two different products for this study. First, as hard copy maps. The map series are quite attractive, utilizing conventional thematic colour, shading and symbology to illustrate the zoning and base data on the maps. Second, the zoning boundaries and labeling were superimposed on property boundaries and building footprints from the Property Details Search tool (see Figure 12).

Both are appropriately designed for their respective uses. The usefulness and understandability of the hardcopy and online maps should be discussed with a wide array of stakeholders as possible. Does the design and standards suit all uses and all s? Everyone will have an opinion about how the maps can be made better from an aesthetic perspective. Incorporating as many suggestions as is practical would demonstrate the transparency of the zoning by-law consolidation process, and would provide a vehicle for discussing how the maps will be used and how output products address new regulations such as Accessibility for Ontarians with Disabilities Act (AODA).

2.3 GIS Linkage

The primary key used to link zoning attributes to geographic features is ADDRESS¹. Address is something that the Public, Staff and Industry will have when they want to query a GIS view of the Zoning By-Law. Address is already used as the identifier in the Zoning Search web-form currently used for intake of zoning enquiries.

We make a distinction here between a PRIMARY ADDRESS of a property parcel, and the many SECONDARY ADDRESS (convenience, entrance, driveways) that can be related to a PRIMARY ADDRESS. There is a one-to-one relationship between a primary address and a parent zoning designation. This would correspond to the boundaries of the property parcel that is identified with the primary address.

In some cases, a Secondary Address demonstrates a parent zoning designation that is different from the Primary Address. For instance, when a primary address identifies a tower structure, and related secondary addresses identify commercial uses in a podium structure under the tower. A footprint of the podium structure could be used to map the Commercial designation wholly contained in the parcel identified by the tower’s Primary Address.

Note that whatever hierarchy that is developed for the City’s Consolidated Zoning By-Law, it can be accommodated by an address-to-zoning relationship. The example described below uses a generic hierarchy and the terminology that is commonly used in the formatting of zoning by-law documents in Ontario municipalities.

1 More precisely, the unique system generated numeric identifier that describes a specific primary address point, which is in turn associated with a particular property parcel polygon.

The `parent zoning designation` can also be referred to as the CHAPTER (or PART) attribute, referring to the main Chapter portions of the zoning by-law. Chapters can refer to Residential, Commercial, Industrial, Open Space, etc . . . This layer makes up the City-wide view of zoning.

The SECTION of the zoning by-law refers to one level down from the parent designations, where the domains often include a numeric value to indicated differing conditions within a parent designation. The Residential CHAPTER, may be subdivided into several second level SECTIONS: R1, R2, R3, etc . . . Each SECTION has slightly different form and performance standards that make the distinctions relevant. These may include for example, single detached, semi-detached, apartment, etc . . .

The CHAPTER.SECTION attribute provides a continuous geographic coverage of the jurisdiction suitable for mapping in a GIS. There are additional attributes that may be found discretely scattered across the jurisdiction, and are often handled as *overlays*, or maps which can be displayed on top of the main map. These include (but are not limited to): EXCEPTION; HEIGHT; DENSITY.

Whatever the attributes that the business wishes to create and maintain in the new mapping environment, the various coded domains used for each attribute become parameters to be passed to the database query of the Zoning By-Law Text document to be presented in a graphic window alongside or in addition to the mapping window. For instance, a database record may store the information CHAPTER=10, SECTION=10.20, EXCEPTION=211. If the stakeholder clicked on the parcel, any of three documents could be linked depending on what was required: Display of the Chapter 10 text, Section 10.20 text or Exception 211 text.

Presentation of text and map at this level of detail fulfills the current state-of-the-art in municipal interactive zoning and mapping. The data dictionary for a representative implementation is reproduced below.

Table 4: Representative Zoning Data Dictionary

Variable Name	Description	Illustrative Value	Notes
OBJECTID	Unique system identifier	270	
GEN_ZONE	Type of Zone	0	Blank
ZN_ZONE	Specific Zone Code	RD	
ZN_HOLDING	Holding By-law Flag	N	(YorN)
HOLDING_ID	Holding By-law Identifier	0	Blank
FRONTAGE	Minimum Lot Frontage	10.5	(m)
ZN_AREA	Number of Permitted Units	371	
DENSITY	Ratio of building floor area to lot area	0	Not calculated
COVERAGE	Percent of lot covered by buildings	0	Not calculated
FSI_TOTAL	Floor Space Index	0	Not populated
PRCNT_COMM	Percent Commercial floor area	-1	Not populated
PRCNT_RES	Percent Residential floor area	-1	Not populated
PRCNT_EMMP	Percent employment floor area	-1	Not populated
PRCNT_OFFC	Percent office floor area	-1	Not populated

Variable Name	Description	Illustrative Value	Notes
ZN_EXCPTN	Zoning Exception	Y	(YorN)
EXCEPTN_NO	Exception Identifier	211	
STAND_SET	Development Standard Identifier for Commercial	-1	Not populated
ZN_STATUS	Zoning Status Flag	3	Internal status flag
ZN_STRING	Zoning Label ¹	RD (f10.5; a371) (x211)	
AREA_UNITS	Area Units	0	Not populated
ZBL_CHAPTR	Reference to Chapter	10	
ZBL_SECTN	Reference to Section	10.20	
ZBL_EXCPTN	Reference to Exception	900.3.10(211)	

Several fields are coded with 0 or -1, showing that not all fields are populated in the database. Their inclusion indicates a willingness to populate these fields as some future date for business purposes.

Inclusion of any or all of these variables as part of the City's consolidated zoning by-law interactive mapping environment should be based upon the City's documented Stakeholder need as the project is underway and the target by-law text and associated information is being compiled.

Under the various sections of a zoning by-law, there is reference to PERMITTED USE. In the case of the City of Ottawa Zoning By-Law, accessible via image PDF and interactive map, Part 6 (Residential). Section 155 (R1) has the permitted uses

bed and breakfast	home-based business
community garden	home-based daycare
detached dwelling	park
diplomatic mission	retirement home, converted
group home	secondary dwelling unit

It would be very interesting for stakeholders to be able to be presented with a browseable list, or query window to choose a permitted use, and see which parcels on the map permitted that use. These database views would have to be pre-defined, as stakeholders would not wish to endure a performance penalty to generate these sub-sets of data in real time.

To our knowledge none of the twenty largest municipalities in Ontario have this level of granularity in their data. As will be discussed in section 5 of this document, this type of data would be welcome by public, staff and industry alike.

A still lower level of granularity in zoning data is information regarding PROVISIONS or performance standards for properties in each Chapter and Section. Most zoning by-laws contain tables for each Chapter and Section which detail various additional regulations. A piece of the Ottawa R1 Subzone Provisions are reproduced below.

Figure 3: Ottawa R1 Subzone Provisions (illustrative portion)

I Sub-Zone	II Minimum Lot Width (m)	III Minimum Lot Area (m ²)	IV Maximum Building Height (m)	V Minimum Front Yard Setback (m)	VI Minimum Corner Side Yard Setback (m)	VII Minimum Rear Yard Setback (m)	VIII Minimum Interior Side Yard Setback (m)	IX Maximum Lot Coverage (And Other Provisions)	X End Notes (see Table 156B)
A	30	1 490	11	7.5 ¹⁶	7.5 ¹⁶	12 ¹⁶	6	20%	
AA	30	1 390	11	5	5	7	3	na	
B	27	925	11	4.5 ¹⁶	4.5 ¹⁶	12 ¹⁶	4.5	30%	
BB	30	1 110	11	4.5 ¹⁶	4.5 ¹⁶	12 ¹⁶	4.5	25%	
C	24.5	740	11	4.5	4.5	11	3.5	33%	
CC	20	900	9.5	5	5	8	2	40%	
D	20	600	11	6	4.5	9	1	40%	
E	19.8	1 390 ¹	11	7.5 ¹⁵	4.5	12	0.9 & 1.2	15% ²	1,2,15

Note that many of the provisions refer to length, area, setback, lot coverage – all dimensions that are inherent in keeping property boundaries and building footprints together in a corporate GIS. Investigation of adherence to these provisions could also be assisted in an interactive zoning map.

Finally, there are very particular additional standards that could be verified using zoning and additional mapping layers. Several examples are included in Figure 4 below.

Figure 4: City of Ottawa R1 Additional Zoning Provisions (illustrative portion)

I Endnote Number	II Additional Zoning Provisions
2	Maximum lot coverage is 25% for a lot connected to a piped municipal water supply
3	Minimum total interior side yard setback is 2.4 m, with one minimum yard, no less than 0.9 m. Where there is a corner lot on which is located only one interior side yard, the minimum required interior side yard setback equals the minimum required for at least one yard. (By-law 2008-462)
4	Minimum rear yard setback is 25% of the lot depth which must comprise at least 25% of the area of the lot, however it may not be less than 6.0 m and need not exceed 7.5 m. Despite the foregoing, on lots with depths of 15 metres or less, the minimum rear yard setback is 4 m.
5	Minimum total interior side yard setback is 2.1 m, with one minimum yard, no less than 0.9 m. Where there is a corner lot on which is located only one interior side yard, the minimum required interior side yard setback equals the minimum required for at least one yard. (By-law 2008-462)
6	Minimum total interior side yard setback is 3.6 m, with one minimum yard, no less than 1.2 m. Where there is a corner lot on which is located only one interior side yard, the minimum required interior side yard setback equals the minimum required for at least one yard. (By-law 2008-462)
7	Minimum total interior side yard setback is 2.5 m, with one minimum yard, no less than 1 m. Where there is a corner lot on which is located only one interior side yard, the minimum required interior side yard setback equals the minimum required for at least one yard. (By-law 2008-462)

Operationalizing these provisions in actionable GIS analytical scripts would be exceedingly difficult, but not impossible. Complex topological rules (regarding relationship of points, lines and polygons in the GIS) are supported by the software. Complex business rules are also supported. If the consolidated zoning by-law simplified Chapter, Section, Exception, Provisions and Additional Provisions, there would be substantial area to model common business queries and practices using the GIS interface, constrained by time and effort required to do the work.

2.4 Labeling

Presentation of annotation on hard copy and interactive maps are an important aspect to conveying zoning information to Stakeholders. Annotation has traditionally been placed and manipulated manually, and stored as an Annotation feature class in ArcGIS. This still exists to support legacy data and applications. More prevalent recently is the storage of text in the database with all other geographic features, and accessing the data as one would points, lines and polygons.

Functionality to manage text that was once part of a third-party product (Maplex) was first integrated in the ArcGIS desktop via the Maplex Extension, and now has been deployed as part of the core functionality in ArcGIS for Desktop Standard.

Careful use of settings in the labeling functions of ArcGIS can utilize database elements as labeling text for hardcopy and interactive maps. In the representative zoning data dictionary (Table 4 above), the text string “RD (f10.5; a371) (x211)” is stored as a concatenation of the ZONE DESIGNATION, FRONTAGE, PERMITTED UNITS and EXCEPTION. By using this string as the default label on the interactive canvas,

the stakeholder will quickly parse any of these values before needing to click on the parcel to get additional details.

As long as the structure of the concatenated string is well known, a key is available to explain obscure code values, and the exception documents are accessible via a fileshare on the network – much of the information requirements will have been met at first glance of the screen.

One needs to take care about auto-labeling with long, concatenated strings of this type. If all polygons are auto-labeled indiscriminately, the legibility and understandability (and hence, usefulness) of the mapping window will be negatively impacted.

Determining which labeling densities work at various map zoom levels is an activity that is part of the data compilation and interactive map testing, prior to final compilation and deployment of the web map to a server or online repository.

2.5 Support and Maintenance of Data

Any information product created and disseminated by the City needs to have a sustainable maintenance process behind it, updated at Stakeholder defined intervals. Those data sets required for a zoning/property environment should be chosen by the Stakeholder community, in consultation with information and technology providers who will configure interface and functionality to meet the Stakeholders' business requirements.

The City is well positioned for sustainability of information and technology for zoning and property-based applications. Information Technology Services (ITS) is responsible for administration and security of the enterprise GIS environment. Data maintenance is divided amongst groups – the GIS group in ITS, the Geomatics group in Planning Services and Asset Management. Each is responsible for data closest to their business responsibilities. Together they control the full picture.

Enterprise and departmental data is created and maintained through well-defined and established processes and replicated to map servers that support all mapping applications in the City. The core geography is available from one location, as the authoritative information used across the organization.

For instance, zoning data is wholly maintained by the Planning Department to the benefit of the entire organization. Street centreline and address information is the basis for dispatch data used for Fire Services. Also, the master address table propagates to integrated business applications such as Amanda, and address points are identified as proposed or active according to where they sit in the plan of subdivision process.

The back-end GIS technology environment supporting enterprise and departmental data is solid. A recent software upgrade has made the back-end better able to support current front-end and mobile application requirements. ITS deployment of the current Geocortex product will allow applications to be configured and deployed with greater ease and in tighter timeframes. This is beginning to happen already.

The various mapping tools currently deployed on the corporate web site have been developed using previous best-of-breed tools. Each of them was developed to provide maximum value to the organization, *at the time of their creation*. Whether the sites have been done using the Web Application Development Framework (Geologic, eRoads), Microsoft Silverlight (Ward Map, Electronic Recycling), or Adobe Flex (Vacant Lands, Parks & Pathways) all viewers are serviceable for the time being. ITS is now standardizing on HTML5 to serve all web browsers and mobile form factors, so the City will

gain efficiencies from re-usability of code when current sites/tools are retired and new applications are deployed.

2.6 Modeling, Query and Search

The Stakeholders of zoning and other property data sets spoke in a unified voice, that the means to answer their business questions should be easy to use. This is the level of complexity that can be managed by those non-professional staff that require access to the zoning/property data, and for those members of the public who might use a future zoning site.

A few pick lists could define the geographies and/or attributes that would be searched by the requestor, and returned on the map canvas or report document that is created. This is somewhat smarter than the standard reports that some municipalities (City of Brampton mentioned in section 4.4) currently provide.

Application widgets that provide domain values for desired attributes could also be provided. Think of a query builder with spatial and attribute filters and operators being used to provide specific information that the Stakeholder is looking for. The storage and maintenance of attributes equals overhead for the City, but if these elements are currently captured at the application/review stages in planning and building business systems, there is no technical reason why they could not be linked and presented via GIS.

Note: It is a business decision to make the Planning and Building data completely transparent through an interactive mapping database, and this should be pursued where business requirements warrant.

The data should not be duplicated in systems, but accessed via normalized tables, tabular queries, table joins or persistent tabular views. Testing of performance for these operations is critically important. There needs to be a balance between the data that can be presented, and the time it takes to make the necessary calls to produce the selected data set. Instead of doing this on the fly, commonly used fields can be replicated to a publishing server that is physically separate from production servers (for security purposes) and is optimized for performance of display and access to map and attribute information. The replication can be done at whatever frequency is deemed necessary for the query at hand. Some are done immediately after data update, some nightly or at a less frequent basis.

There is benefit in creating a complete property information data model based on Stakeholder requirements documented in common questions asked via the current web-form submission and those recorded at the counter. Basic versus specialized questions can be differentiated in those requests, and this might point the City in direction of software configuration and deployment.

A conceptual (business) model for zoning and related property information should be created to evaluate the feasibility of integration of the GIS-based data and those attributes held in related business systems. This should include Official Plan as well as the newly consolidated Zoning information, and other planning and building layers of high value to the Stakeholder community.

The zoning detail going down to the granularity of permitted uses and site specific amendments *on a parcel or address basis* would meet the current and future requirements expressed in the workshops undertaken in this review.

This broad view of property information, with detail to the parcel or address would provide the greatest benefit to the Stakeholders of the system, the stakeholders, making common questions like “can I put a daycare at 123 Main St” or “does my deck conform to the bylaw” much easier to self-answer or to clarify a staff decision.

2.7 Geoprecision

Today, most municipal web sites have PDF or HTML access to the zoning document, and mapping is often there but can have the aura of an afterthought. Markham should turn this situation on its head, making interactive mapping access to the data just as easy and intuitive as the digital version of the by-law document. In fact, there should be bi-directional query and browse capability between these formats. With appropriate legal disclaimer, and with sufficient confidence in data maintenance processes, the map and the document should stand together as two equal products to assist the business of the City.

We found that there are a variety of levels of enquiry that requestors are interested in (city, ward, neighbourhood, subdivision, parcel) and there are varying levels of information detail that could or should be made available to those requestors (zones, permitted uses, use standards, general provisions).

Meeting the need of multiple resolution is handled well by an interactive mapping tool. There are generally 12-14 zoom levels available in a typical web-map from continent-level to parcel-level resolution. The top level can begin at whatever scale is required for the request being served.

The amount of attribute information presented at any map resolution will be dictated by what Stakeholders are required to “know” for their particular request. Trusted staff might have access to “all” the data in the GIS and from integrated business systems. The casual requestor may be limited to the zoning category for a particular address point. There are many other positions on the continuum between these two extremes. Site-specific flags can vary from none to simple asterisk alerts to detailed text along this continuum.

The important takeaway is to design applications that understand the Stakeholder requirement, and create the right mix of scale and data to allow people to get their tasks done quickly and correctly. Identifying “communities” of Stakeholders with common requirements, will allow the City to prioritize the design and deployment of applications to access zoning (and broader Planning Services) data. Much of the demand for service can probably be addressed with a few simple apps that smartly integrate mapping and information in customer service and decision support processes.

2.8 Presentation Layer Options

It is our understanding that as the update of the City’s Geocortex environment has been completed, and this option is already being used for new development of interactive mapping capabilities. Geocortex is a robust and forward-looking approach. With its extension to CSDC’s Amanda product, it serves map-based integration of planning/building/licensing information well.

The other options presented below are for information purposes, as a diversity of options can be offered to address the business requirements being expressed by the organization.

Latitude Geographics – Geocortex Essentials

Latitude Geographics is a worldwide Platinum Partner of Esri Inc, and is based in Victoria, BC. They provide Visual Studio tools to create business workflows and web mapping applications in a range of local government business areas.

Latitude leverages the .Net development framework, and the entire suite of Esri ArcObjects (via ArcGIS for Server) to provide comprehensive functionality for the desired workflow through their Geocortex Essentials product.

Under Task 6 of this ZBL and GIS project we note that Latitude Geographics could be engaged as an additional sub-consulting partner, to provide their software solution and professional services to stand-up a Zoning Web Application for the City.

The tight integration of development between Esri Inc and Latitude Geographics means that configured applications are “future-proofed”, that is GCX stays in lock-step with ArcGIS platform technology. The GCX technology lifecycle can be thought of as a series of updates, versus software upgrades (with their oft-seen migration headaches).

Latitude has a large footprint of application implementations throughout Ontario, the rest of Canada, the United States and Worldwide.

Esri - ArcGIS Online

Esri’s cloud-based web mapping solution, ArcGIS Online, can take a map service feed from the City’s GIS environment, and present it to all members of the Zoning project team, to a wider City environment, and even to the public.

This solution is browser based, and provides functionality to present zoning polygon and attributes, conduct simple spatial analysis and ability to save views and/or print maps. The Story Maps describe above are based on an ArcGIS Online template.

ArcGIS Online can be a low cost subscription for up to five map contributors. Stakeholders of the data can access the map interface with additional (minimal) incremental cost based on Esri’s “service credit” regime.

Esri Canada – Canadian Municipal Data Model and Application Templates

Esri Inc has been working with the Planning & Development community in the United States to provide template data models and “commercial-off-the-shelf” (COTS) applications for what they call “Land Use Public Comment” via the Esri Marketplace. This free application is built to consume map services that follow publishing data standard of the Esri Local Government template.

The City’s zoning data can be published as a map service in this format, and easily consumed by the Land Use Public Comment application located here:

This particular example is configured to provide comment on development proposals, but could easily be adapted for display, enquiry and comment on the City’s zoning information.

Skill set required to implement this solution is ability to understand and extend the existing, fully-functioning application using the Javascript Application Programming Interface (API).

There is no incremental cost for the data model or application templates associated with this option. Note that Esri Canada has released the Canadian Municipal Data Model (CMDM), a derivative of the US local government data model. *ZoningDistrict* is a polygon feature type included in the CMDM, with domains for zoning code and description included among other attributes.

Note that Geocortex Essentials can take a feed from ArcGIS Online, as the map source for the Zoning data layer. This presents an additional option to by-pass ArcGIS for Server map services in favour of Cloud-hosted map services, wrapped by Geocortex web application functionality.

Esri - ArcGIS for Server Templates and Development

The final option for the implementation of a Zoning Web Application would be using out-of-the-box (OOTB) implementation of ArcGIS for Server web mapping templates, augmented by Silverlight and/or Javascript development.

This model would require the most dedicated and in-depth development resources of the four options presented here. It is the most time consuming, and poses the most risk as interface and functionality needs to be invoked and tested with rigorous application development practices.

If this is the preferred option for the web application, Esri Canada could be approached for a professional services engagement. This option may be cost prohibitive, as the price of a web mapping application developed by Esri Canada could potentially exceed the value of this choice over others.

Table 5: Options for Zoning By-Law Presentation Layer

Options for ZBL Presentation Layer	Opportunities	Issues
Geocortex Essentials (GCX)	<ul style="list-style-type: none"> • Configurable tools to extend Esri investment • Native extensions to CSDC's Amanda product • City currently has good success with GCX 	<ul style="list-style-type: none"> • Preferred HTML5 viewer does not have full functionality (as of Q1 2015) • Additional skill sets required, but simplifies leveraging ArcGIS for Server • Additional budget required
ArcGIS Online	<ul style="list-style-type: none"> • Leverage low-cost viewing environment for all stakeholders • Cloud-based portal and collaborative environment • Cached web map ensures good performance • Google "Philadelphia zoning ArcGIS online" 	<ul style="list-style-type: none"> • Named-user/operating budget funded model is unfamiliar to some cities • Least functionality of four options • Perception of privacy issues around cloud storage

Options for ZBL Presentation Layer	Opportunities	Issues
Canadian Municipal Data Model & Application Templates	<ul style="list-style-type: none"> • Out-of-the-box data model for publishing server • Viewing application templates offers plug-and-play option • Zero cost solution • Esri Canada developing in-demand applications • Google “Napierville zoning ArcGIS online” 	<ul style="list-style-type: none"> • Evolves with/by incremental community involvement in the Esri Marketplace/ArcGIS Online • Zoning model is very basic
ArcGIS for Server Templates and Development	<ul style="list-style-type: none"> • Configurable viewership with ArcGIS for Server • Server is already owned by the City • Javascript API available for platform independence 	<ul style="list-style-type: none"> • Development effort required • Might require Esri Canada professional services

2.9 Mobile Applications

Mobile use of geographic information is exploding. Anyone with a smartphone or a tablet, who is also network capable, should be able to reach the text and mapping resources that they need to do their job.

While vendors provide Software Developer Kits (SDKs) and Application Programming Interfaces (APIs) to enable direct use of device and client-server functionality, these frameworks require specialized skills and investment of development time that the City may not have. Generally, these tools are not the answer.

Neither is ArcPad, Esri’s workhorse mobile application that is soon to be at the end of the software lifecycle.

Instead, development for Android, iOS and Windows Mobile has taken off in the Apps-space. *ArcGIS App for Smartphones and Tablets* is available on each of these platforms via their respective app stores.

This is a viewing and editing app to leverage ArcGIS Online, the Esri cloud solution where zoning data might find a home, depending on the deployment model for the presentation layer.

Other more specialized apps (including zoning data viewers) exist in the cloud, and are available for download and testing. These apps are generally lightweight, purpose-built to perform some particular set of viewing and editing tasks. They may not be appropriate as a sustainable production solution, as they are owned and maintained by third parties who may or may not perpetuate the solution over a long period of time.

Latitude Geographics’ Geocortex Essentials (GCX) product is a web site configuration tool that allows the developer to create functionality and workflow for field and desktop activities – while deploying in whichever operating system and form factor is required. By this definition, it is a powerful mobile application platform.

GCX is being supported for Silverlight and HTML5 platforms – with the latter being the newest and most promising for the long run. It will take time for full functionality to be ported from Silverlight to HTML5. The library of GCX configuration objects, plus ArcObjects from ArcGIS for Server and .Net object need to be moved over to HTML5. Until that time, there is a trade-off to be considered between platform independence of HTML5 and the more robust functionality of the current Silverlight offering.

For the purposes of this strategy, with a 3-5 year time horizon for a production solution, the GCX HTML5 deployment should be available and useful for viewing and updating database attributes. Specialized functionality (including the GCX-Amanda Extension) currently only available for Silverlight may not come online as quickly.

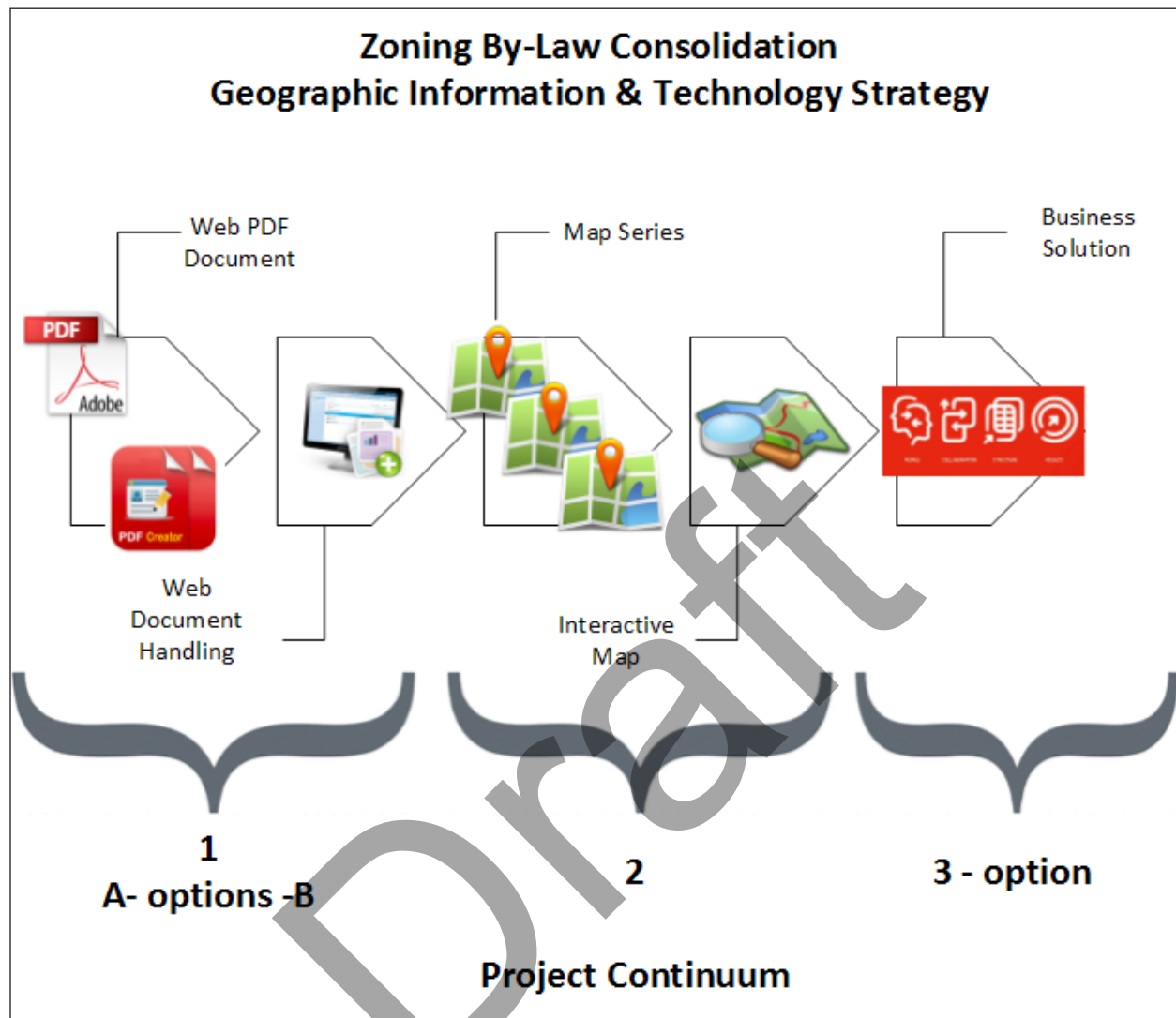
A hybrid approach might be in order – deploy a richer Silverlight solution to staff, while providing the public, industry and staff remote from the City's network, a simpler viewing experience in HTML5.

Draft

3 Innovative and Interactive Web-based Zoning By-Laws

This section is a summary of the research on the disposition of by-law text and interactive mapping sites of peer organizations in Ontario. The information is derived from online search of the organizations' corporate website for evidence of access to zoning text, zoning maps, interactive mapping and supporting information.

Figure 5: ZBL Consolidation – Project Continuum



An examination of the 'state-of-the-art' in the Zoning By-Law geographic information and technology space reveals three key findings:

1. The interactive text portion of the ZBL project continuum can be served by professional level PDF files. Use of internal or external document management system might introduce risk and additional costs, but may yield superior results for the stakeholders.

Note that preparation of the text can continue without impact to the project whether option 1a or option 1b is pursued. Contemplating how far the text will be automated is an important early decision to be made.

2. Both the Map Series and Interactive Map products can be pursued for modest outlay, will benefit current and future stakeholders, and may lead to "geographic multipliers" around new uses of geography that may not be envisioned yet.

3. Desire for a more fulsome Business Solution was a common theme at the workshop table, however it is quite possibly outside the scope of getting the zoning by-law up and viewable. It may be that the various incarnations of the Interactive Map can feed existing and/or new business solutions as they go through their own refresh lifecycles.

Zoning By-Law Legal Document

Recent and ongoing office consolidations of zoning by laws across the sample organizations, with two (**Hamilton, Kitchener**) undergoing a comprehensive review like Markham's . Toronto and Oakville have recently come through similar processes.

Current standard practice is to make the text of the zoning by-law accessible by chapter in PDF format via HTML links. This provides access to the text information, but there is no searchability or interactivity with the text document. Text is generally current within six months of recent approved amendments, which are used as trigger for the update process, usually added to an index of amendments and as schedules the by law. Universally, there is no indication of the location of the amendment found in the index text, even though an address is often included in the body of the amendment.

Mississauga has made a significant contribution in eliminating these functional barriers (see Figure 6 below). Richmond Hill does not publish the zoning by law text online for external access, and has its Municipal Code 'Book' maintained by a third party publisher.

Zoning By-Law Map Series

Most sample municipalities provide static PDF maps of zoning designations to Stakeholders. These large scale (small area), black and white maps are easily downloadable and printable by the enquiring public. They are organized on an index map basis, covering the entirety of the municipality's jurisdiction. Unfortunately, they do not allow Stakeholders to search by address, intersection and/or street block face to find the correct key-map to reference for the required zoning designation. Mississauga provided a PDF street name index to map grid reference, which is serviceable for small residential streets. For long thoroughfares, cross-reference to multiple map sheets is made and the Stakeholder is still required to have detailed knowledge about the jurisdiction's geography that they may not possess.

These sheets can also be collated into a book and printed on a fee-for-service basis for those Stakeholders who wish to have all the zoning maps available for reference. For Markham, the placement of the index grid and key map polygon boundaries into accessible corporate GIS layers and integration with enterprise geocoding services will make the Stakeholder experience of "finding" their desired location much easier. Links between the GIS and the PDF key maps can be maintained efficiently by Geomatics staff.

Zoning By-Law Interactive GIS

All of the organizations investigated have some type of enterprise GIS environment which serves as the mapping platform for a number of organizational datasets. Most have leveraged that environment to display zoning information applying the same methodology. The most robust and attractive solutions are based upon newer technologies and therefore can generally present zoning as a single business layer (with ancillary references to site specific, or related attribute information). These mapping solutions also have the capability of accepting URL references to the by law text held on the organization's network infrastructure.

The solutions found wanting in the sample are older, less flexible solutions which tend to have a “one-interface-fits-all-data” design model. These solutions also are limited in browser support, require plug-ins and/or utilize pop-up windows which degrade the Stakeholder experience of connecting and using the interface and zoning data. The same comparison can be made between Markham’s older Geologic product and the newer applications coming out of the upgrade to Esri’s ArcGIS 10x and Latitude’s Geocortex products. Markham is on good footing to take advantage of lighter, purpose-built applications when the consolidated zoning by law data is available to be mapped online.

Disclaimers exist either with the interactive mapping or in the by-law text. Usually not both, and never in neither. Oakville has a very good user guide embedded on every result of the interactive mapping.

Business Solution Applications

The location of the zoning by law information is split between Resident and Business portals. Hamilton had the information under the Administrative umbrella, while Kitchener had their zoning by-law review process identified as a strategic administrative initiative, while the existing zoning by law can be found under the business portal.

Generally, the zoning web page is three or four levels down from the home page, which is an impediment to Stakeholders who desire “single-click” access to information. Hamilton and Kitchener use table of contents menus on the left of the screen to make navigation to the lower levels of the website somewhat easier. In Markham, the consolidated by-law will make the news feed on the front page of the corporate web site at important milestones, but it will be important to provide easy navigation and increase the relevance of search terms to ensure access to the future web text and mapping tools.

Only a couple of municipalities use their corporate GIS to launch property data reports (**Brampton, Kitchener**). Although each is using older mapping technologies, they have done a good job of integrating the map interface with attribute information stored in GIS and related property and building systems for access for staff and the public.

Open data has been adopted by some of the municipalities, but zoning is not a data set that is generally part of the releasable information (the notable exception is Toronto which releases only generalized designations). Markham could use Open Data as an umbrella to allow Stakeholders to reach into the City’s rich information environment, but issues such as advisory requirements and liability would need to be considered.

Table 6: ZBL Environmental Scan

ZBL Environmental Scan	Description	Toronto	Ottawa	Mississauga	Brampton	Hamilton	London	Vaughan	Kitchener	Windsor	Richmond Hill	Oakville	Burlington	Greater Sudbury
1.0 Legal Document														
Document Consolidated	Year (ns – not specified)	2013	2008	2007	2004	2005	2011	2012	2010	ns	2014		ns	2010
Document Access	PDF/HTML/Both	B	HTML	B	B	HTML	B	PDF	HTML	PDF	Not available online		HTML	PDF
Searchable	Yes/No	N	N	Y	N	N	N	N	N	N	N		N	N
Update Lag	Months (ns – not specified)	6	2	6	ns	ns	current	ns	current	current	current		ns	ns
2.0 Static Cartography														
Index Map	Yes/No	Y	N	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Key Map(s)	Yes/No	Y	N	Y	N	N	Y	Y	Y	broken link	Y	Y	N	Y
Map Presentation	Colour/Black&White	B&W	na	B&W	na	na	B&W	BW	BW	unknown	C	BW	na	C
3.0 Interactive Mapping														
Disclaimer	Map/Text	M	M	T	M	T	M	T	M	M	T	M	T	N
Zoning	Yes/No	Y	Y	N	Y	Y	Y	N	Y	N	N	Y	Y	N
Technology		Esri	Esri	na	Visual Fusion	Map legacy Guide	na	na	Esri/ Rolta	na	na	Esri/ Latitude	Esri/ Latitude	na
Multi-Search	Yes/No/ Not Applicable	Y	Y	na	Y	Y	Y	na	Y	na	na	Y	Y	na
Enterprise GIS	Yes/No	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Technology		Esri	Esri	Bentley	Visual Fusion	Map Guide	Esri/ Latitude	Bing/ Esri	Esri/ Rolta	Esri/ Latitude	Google/ Esri/ Rolta	Esri/ Latitude	Esri	Esri
Multi-Search	Yes/No	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Plugin	Yes/No	N	N	Y	N	Y/N	N	N	Y/N	N	N	N	N	N
Browser Support	Limited			L		L		L	L	L				
Pop-up	Yes/No	N	N	N	N	Y	Y	N	Y	N	Y	N	N	N
4.0 Web Portal														
Link Position (level)	number	3	4	4	3	4/2	3	3	4	4	na	2	4	2
Zoning Web Location	Resident/Business/ Administration	R	R	R	B	A	B	B	B/A	R	na	A	A	B
Property Report	Yes/No/Limited	N	L	N	Y	N	N	N	Y	N	na	N	N	N
Open Data	Yes/No	Y	Y	Y	N	N	Y	N	Y	Y	N	N	Y	N

4 Technology for Zoning

As has been stated above, the existing zoning document was created and managed primarily for traditional hard copy use. By-law 177-96 consolidated Nov 1, 2014, is available as a Portable Document Format (PDF) from the City's web site. This is a good thing. The digital version allows navigation from the table of contents to various locations in the document via hyperlinked page numbers. At this time, however, the content is not searchable in any meaningful way.

In Markham, current public access to zoning information is via the "Zoning Search Form" and "Property Details Search" tool described above. The current tool for accessing zoning information via an interactive mapping interface is an internal application called *Geologic*. The tool provides access to a comprehensive list of enterprise mapping layers, but that is both a strength and a weakness. A strength in that it provides "one-stop" for access to geography and related attribute information. A weakness in *Geologic* is that in the tab and check-box format of the process design, zoning is only one of many layers available for display, and the large number of layers accessed increases re-draw time significantly. This is not a good thing.

The technology underpinning *Geologic* is at the end of its lifecycle, and Stakeholders suggest that upgrades to the mapping environment will provide a number of potential improvements to the solution. When paired with the consolidated zoning by-law, there is an optimism that much more will be possible in the near future when the tool is upgraded.

The following sections describe various aspects of on-line access to zoning information – the issues and options that could be used to meet the Stakeholder needs identified above. Examples from other jurisdictions are used to illustrate current approaches to delivering in each of these technology areas. Markham can learn from the activities of peer organizations in presenting the textual and map views of zoning and property information in an attractive, easy-to-use interface with rich, detailed data and available for self-service and to support advisory services.

4.1 Legal Zoning By-Law Document

Principle: Text documentation should be presented online, as fully indexed and searchable files. Stakeholders require the ability to copy and/or download parts of, or entire documents. The complexity of the content requires that advanced help functionality such as pop-up hyperlinks to key definitions and illustrations are accessible to the Stakeholder.

The overriding issue related to the legal zoning by-law document is whether an electronic version of the document can also be considered as the official and legal version of the document. This matter will likely be settled or managed by a variety of warnings, agreement check boxes and/or seeking provincially acceptable legal interpretations. As with other and similar web based applications, an explanatory clause directing that in the case of any disagreement (e.g. typos or delayed updates) between the web version and the hard text version (in the City Clerk's office) that the Clerk's printed copy will be primary. Such legal clarifications will be required at the time of web development and launch and would of necessity rely on the then latest statutes, laws and legal rulings.

Several jurisdictions deposit the official version of the document with the City Clerk, as a static file in *Portable Document Format* or PDF. This format is familiar to internet users, as many websites use PDF as the storage medium for document sharing, as it can be downloaded to many platforms while maintaining a document's look and feel. It is estimated that 90% of personal computers have Adobe Acrobat Reader installed for reading PDF files.

The ubiquity of PDF Reader is also a weakness, because it offers the least software functionality when viewing PDF files. More sophisticated software is required to both create and consume PDF files with the functionality noted in the principle above. A full license of Adobe Acrobat Professional which is capable of reading and writing the latest ISO 32000-1:2008 (PDF 1.7) standard is beyond the means of most casual Stakeholders, both inside the municipality and in the public. It is with this and other enterprise desktop or cloud-based content management software that much of the value in tagging, searching and collaborating on documents is found.

For example, in the past Stakeholders have often kept a `well-used` copy of the hard-copy zoning by-law at the side of their desk – complete with Post-It notes and `dog-eared` page corners to mark important sections of the document. Notes and bookmarks are part of standard functionality in professional-level document management solutions. These features can be maintained by an individual, or shared across a workgroup.


Investigating some of the latest PDF files posted on the City of Markham website showed that the files were created in the PDF 1.6 standard, and were image-based files vs vector-based text files. As posted, there was no search possible in the documents. The consultant was able to pull the documents into a professional-level software tool, and use a `recognize text` function to create index and searchability. If desired, there will need to be a step in the by-law document creation process to ensure full indexing and search is enabled for any by-law document posted in the future.

The best example of this type of fully accessible and searchable online zoning document is the *City of Mississauga Interactive Zoning By-law*. This website includes additional functionality enabled by Hypertext Mark-up Language, version 5 (HTML5) and eXtensible Mark-up Language (XML) for style formatting and presentation.

The electronic text document interface is the best tool for accessing relevant zoning information that was investigated for this report. Getting into the details of the zoning document is easily accomplished using this interface. Note in Figure 6 (below) the fully discoverable Table of Contents frame on the left of the screen, as well as the highlighted and underlined words that denote hyperlinks to pop-up definitions of terminology (such as `building structure` in the screen capture).

Draft

Figure 6: City of Mississauga Zoning By-Law Document Interface



MISSISSAUGA
Leading today for tomorrow

MISSISSAUGA ZONING BY-LAW

CONTENTS

SEARCH

WHAT'S NEW

INFO

HELP

CONTACT US

4.2 R1 to R5 ZONES (DETACHED DWELLINGS - TYPICAL LOTS)

4.2.1 R1 to R5 Permitted Uses and Zone Regulations

All buildings and structures shall comply with the provisions contained in Parts 1 to 3 and Section 4.1 of this contained in Table 4.2.1 - R1 to R5 Permitted Uses and Zone Regulations

Table 4.2.1 - R1 to R5 Permitted Uses and Zone Regulations

Column Line I,0	A ZONES	B R1	C R2	D R3	E R4	F R5
PERMITTED USES						
2.0	RESIDENTIAL					
2.1	Detached Dwelling	✓(1)	✓(1)	✓(1)	✓(1)	✓(1)
ZONE REGULATIONS						
3.0	MINIMUM LOT AREA					
3.1	Interior lot	750 m ²	695 m ²	550 m ²	365 m ²	295 m ²
3.2	Corner lot	835 m ²	810 m ²	720 m ²	500 m ²	415 m ²
4.0	MINIMUM LOT FRONTAGE					
4.1	Interior lot	22.5 m	18.0 m	15.0 m	12.0 m	9.75 m
4.2	Corner lot	22.5 m	21.0 m	19.5 m	16.5 m	13.5 m
5.0	MAXIMUM LOT COVERAGE	25%	30%	35%	40%	40%
6.0	MINIMUM FRONT YARD					
6.1	Interior lot	9.0 m (2)(7)	9.0 m (2)	7.5 m (2)	6.0 m (2)	4.5 m (2)
6.2	Corner lot	7.5 m (2)	7.5 m (2)	6.0 m (2)	6.0 m (2)	4.5 m (2)
6.3	Front garage face - interior lot	(8)	(8)	(8)	(8)	6.0 m
6.4	Front garage face - corner lot	(8)	(8)	(8)	(8)	6.0 m

Building - Google

mississauga.paperless.com/

Building - means a structure occupying an area greater than 10 m² consisting of a wall, roof and floor.

HOME

Map Index for Mississauga

Mississauga Zoning By-law

Amendments to By-law 0225-2007

Appeals to By-law 0225-2007

Table of Contents

HOW THIS BY-LAW WORKS

Part 1: Administration, Interpretation, Enforcement and Definitions

Part 2: General Provisions

Part 3: Parking, Loading and Stacking Lane Regulations

Part 4: Residential Zones

PURPOSE

4.1 General Provisions for Residential Zones

4.2 R1 to R5 Zones (Detached Dwellings - Typical Lots)

4.2.1 R1 to R5 Permitted Uses and Zone Regulations

4.2.2 R1 Exception Zones

4.2.3 R2 Exception Zones

4.2.4 R3 Exception Zones

4.2.5 R4 Exception Zones

4.2.6 R5 Exception Zones

4.3 R6 and R7 Zones (Detached Dwellings - Shallow Lots)

4.4 R8 to R11 Zones (Detached Dwellings - Garage Control Lots)

4.5 R12 to R14 Zones (Detached Dwellings - Modular Lots)

4.6 R15 Zone (Detached Dwellings - Port Credit)

4.7 R16 Zone (Detached Dwellings on a CEC - Private Road)

4.8 RM1 and RM2 Zones (Semi-Detached Dwellings)

4.9 RM3 Zone (Semi-Detached Dwellings on a CEC - Private Road)

4.10 RM4 Zone (Townhouse Dwellings)

4.11 RM5 Zone (Street Townhouse Dwellings)

4.12 RM6 Zone (Townhouse Dwellings on a CEC - Private Road)

4.13 RM7 and RM8 Zones (Detached, Semi-Detached, Duplex, Triplex and Horizontal Multiple Dwellings with More Than 6 Dwelling Units)

4.14 RM9 Zone (Horizontal Multiple Dwellings With More Than 6 Dwelling Units)

4.15 RA1 to RA5 Zones (Apartment Dwellings)

Part 5: Office Zone

Part 6: Commercial Zones

Part 7: City Centre Zones

Part 8: Employment Zones

Part 9: Open Space Zones

Part 10: Greenbelt Zones

Part 11: Parkway Belt Zones

Part 12: Other - Utility, Institutional, Development, Buffer and Airport Zones

Part 13: Zoning Maps

The document is available online via Internet Explorer revision 8 or later from the City of Mississauga web site, or in hard copy format for purchase from a third party document provider called *Orderline*. Mississauga has outsourced the printing and distribution of the full zoning document, and subscription to zoning by-law amendments delivered in hard copy format. The product metadata is presented as Figure 7 below.

Figure 7: City of Mississauga Zoning By-Law Product Information

City of Mississauga Zoning By-law 0225-2007 by Orderline

Orderline is the official distributor of Zoning and Planning documents for the City of Mississauga.

Mississauga City Council passed the Mississauga Zoning By-law 00225-2007 on June 20, 2007. The By-law was approved by the Ontario Municipal Board with exception of site specific appeals on September 10, 2007.

Orderline offers the complete Mississauga Zoning By-law and Zoning Maps in a Binder Pak and Quarterly Binder Amendment packages.

Mississauga Zoning By-law and Zoning Maps

The Mississauga Zoning By-law 0225-2007 by Paperless is over 1200 pages of by-law information economically priced to ensure that compliance stays within your budget. The By-law (current version: **June 30, 2014**) is available for purchase as a **Binder Pak** containing a By-law 3-ring binder (8.5» x 11») and a Zoning Maps 3-ring binder (11» x 17»).

To update your current binder, **Quarterly Binder Amendment Packages** can be purchased individually.

Product Features

- printed in black and white
- fully tabbed
- Zoning Maps indexed by street
- Definitions and “How to” Sections
- Dictionary Style Headers

As with any business process, there is a time lag associated with making updates available in the online version of the document. Some municipalities seek to make frequent updates to the text document and the online document immediately after council has given approval. This could include changes to the body of the text and/or addition of amendments or exceptions to the document. The online version is considered “up-to-date” at all times.

Other organizations hold changes for a quarterly or annual office consolidation of all changes accumulated during the previous period. The online version of those documents have a prominent effective date indicated, and require disclaimer about additional amendments and exceptions which would need to be accessed through expert advisory contact.

A conundrum. Readers will no doubt understand that the longer the interval from Council or Committee approval of zoning matters to live web based map or text availability ... the more the very nature of open web-based zoning bylaw transparency and access is potentially compromised. Net cost savings, if any, based on office consolidation routines versus overnight updates may therefore be illusory in the future.

As far as making the updates themselves, it seems that the only time savings might come from editing smaller portions of the overall document in a more structured environment. Re-posting an image based PDF would require editing the source word processing document, then exporting to whole document to PDF. If the same changes were done in a structure Electronic Document Management System, the changes would be smaller, and propagated automatically.

Table 7: Legal Zoning By-Law Document Options

OPTIONS for ZBL Text Document	Opportunities	Issues
1) Image-based PDF Stored as a scanned images	<ul style="list-style-type: none"> • Web-based access fulfilled • Ubiquitous readability 	<ul style="list-style-type: none"> • No indexing or search capability • Slower update cycle (full document change required)
2) Font-based PDF Stored as binary data, expressed via fonts	<ul style="list-style-type: none"> • Index and search-ready • Supports PDF-Universal Accessibility² (PDF-UA) format 	<ul style="list-style-type: none"> • Enhanced functionality through professional-level software tools only, increasing costs for the project team. An enterprise implementation might be cost prohibitive.
3) Document Management System Stored as database elements, expressed via HTML style sheets	<ul style="list-style-type: none"> • Documents stored as database elements • Presentation functionality extended via HTML5 and/or XML programming 	<ul style="list-style-type: none"> • Work within enterprise document management software/governance framework • Easier and quicker update of smaller portions of the zoning by-law text

4.2 Zoning By-Law Map Series

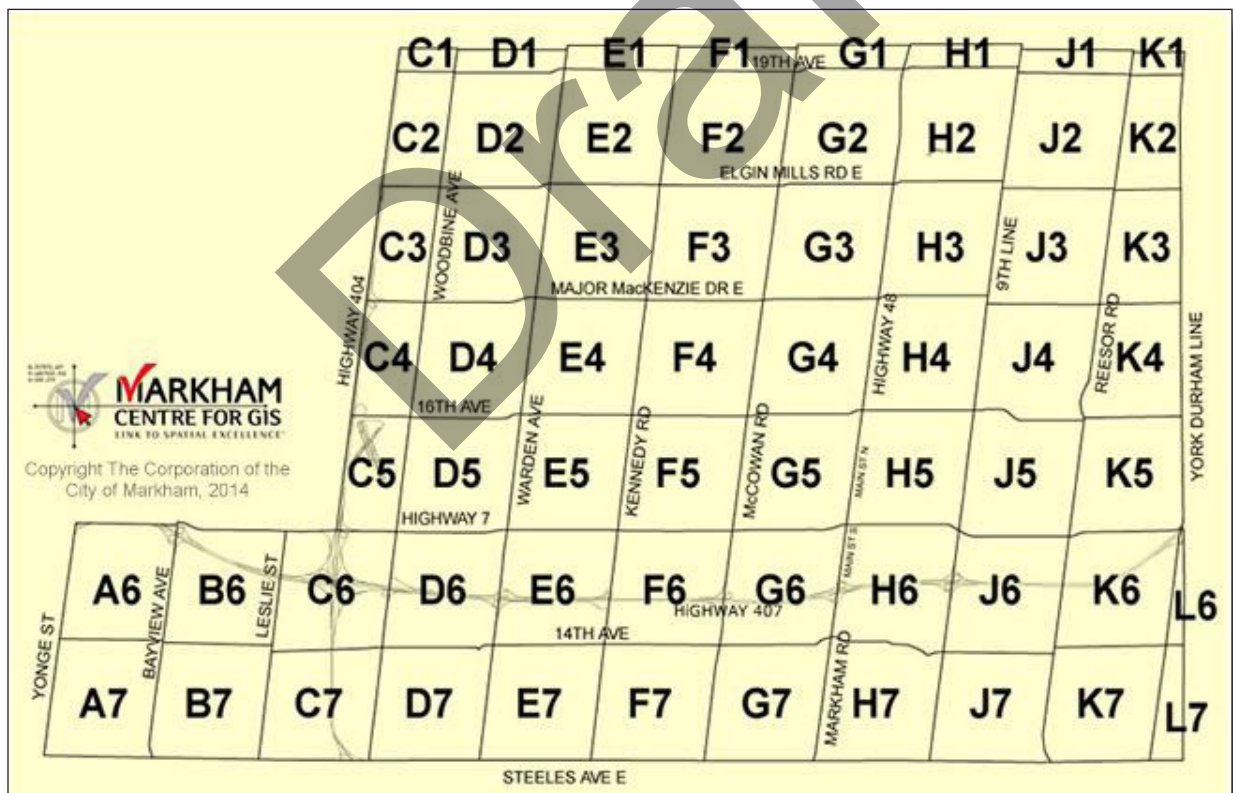
Principle: A portable, digital map series can be a valuable adjunct to interactive text and mapping environments. These printable map sheets can also be offered as a complete set in a Map Book application and/or hard copy printed format as a schedule to the consolidated Zoning by-law. A declining minority of potential Stakeholders prefer access via paper map.

Planning Act, RSO 1990 – Part V - Land Use Controls and Related Administration, states *Use of maps*

(7) Land within any area or areas or abutting on any highway or part of a highway may be defined by the use of maps to be attached to the by-law and the information shown on such maps shall form part of the by-law to the same extent as if included therein. R.S.O. 1990, c. P.13, s. 34 (7).

Jurisdictions often provide a series of large-scale map sheets of small geographic areas that convey detailed zoning information to internal stakeholders and/or information requestors. They may be collated in a hard copy Map Book of all zoning maps for the jurisdiction, or downloaded/printed from a web site on a per-sheet basis. Markham has a portion of the corporate networked storage infrastructure dedicated to PDF zoning maps for internal use. This would likely continue for some time as a ‘bonus’ back-up.

Figure 8: City of Markham Street Guide - Grid



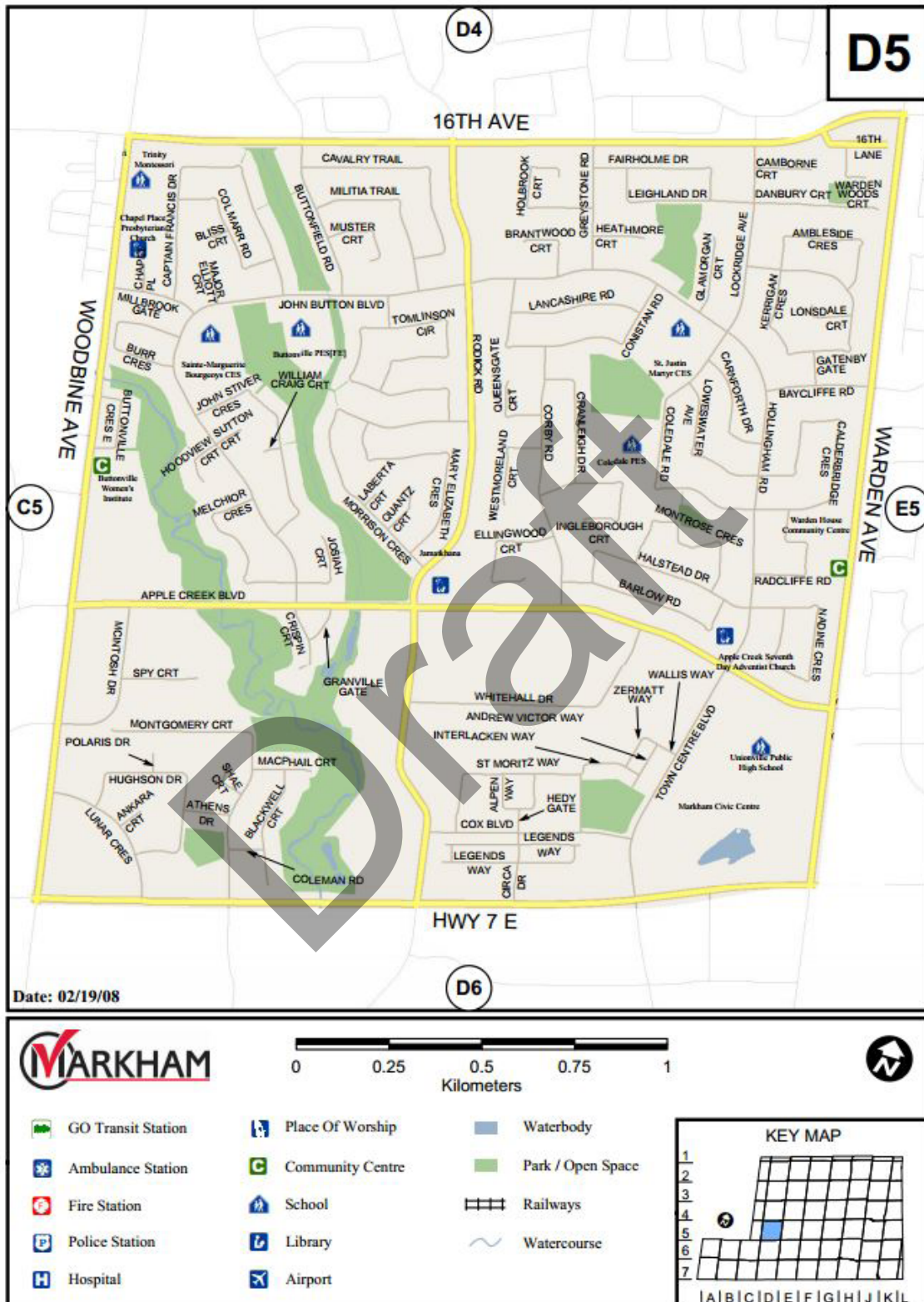
Typically municipalities use regular blocks as the boundaries for map sheets. These might include Wards, Lot/Concession Fabric and Planning Districts, or any other polygonal grid that covers the entirety of the jurisdiction.

Map Scale refers to the relationship between distance in the real-world, and the same distance on the map. A map scale of 1:25,000,000 is used to depict a large area the size of a North America, where one centimetre on the map is the equivalent of 250 kilometers on the ground.

The City of Markham street guide grid (above) would be a logical grid to produce generalized maps of zoning for the entire jurisdiction. Figure 8 does not have a scale indicated, but as reproduced on this printed page, the scale is approximately 1:225,000 or one cm equals 2.25 km on the ground.

Draft

Figure 9: City of Markham Street Map Series, Grid D5



The content in each grid cell is mapped at a scale of 1:13,000 or each centimetre representing 130 m on the ground at the full 8 1/2" x 11" printed size. Many jurisdictions provide downloadable, image-based pdf zoning maps of this quality and resolution, a sample of Markham's street map data is presented as Figure 9 above.

Visualization of zoning boundaries at the parcel-level would require mapping at a larger scale, representing a smaller area than discussed above. Zooming in to a 1:2,000 scale on an interactive zoning website would provide a view of the data where one centimeter is the equivalent of 20 meters on the ground, perhaps representative of one average residential lot frontage width. This scale would provide good view of contextual information such as building footprints, sidewalks, and other commonly identifiable features.

Obtaining the correct hardcopy zoning information is wholly dependent on being able to identify in which grid zone the requestor's parcel of interest is located. Large-scale map sheets/books are quite useless without a street-to-map index or an address geocoding tool to direct a requestor to the particular sheet that they need. The beginning of the current City Street Name Index document is reproduced below.

Figure 10: City of Markham Street Name Index (part)

Street Name Index		1
Street Name	Map Concession	
11th Conc	K7, L7	
14th Ave	C6 ,C7, D6, D7, E6, E7, F7, G6, G7, H6, H7, J6, J7, K6, K7, L6, L7	
14th Lane	C6	
16th Ave	C4, D4, D5, E4, E5, F4, F5, G4, G5, H4, H5, J4, J5, K4, K5	
16th Lane	D4, D5	
19th Ave	C1, C2, D1, D2, E1, E2, F1, F2, G1, G2, H1, H2, J1, J2, K1	
9th Line	H1, H2, H3, H4, H5, H6, H7, J1, J2, J3, J4, J5, J6, J7	
A		
Aaron Way	C5	
Abberley St	J6	
Abbotsbury Lane	F4	
Abelson Crt	F7	
Abercorn Rd	G5	

For long streets that cross many map sheet grids, a street address geocoding tool would be more useful than the Street Name Index in finding the parcel location for the zoning query. Entering an address into an interactive mapping environment (see Figure 12) would place the map window at the desired location - without having to have particular knowledge of the area, or without the need to pan the map to other grids if the location was not precisely resolved.

Naturally there is effort associated with creating and maintaining an updated series of zoning maps. When amendments are made to the by-law text/boundaries on a city-wide or site specific basis, the mapping needs to be updated. This work is part of the documented geomatics business process already well-established at the City of Markham. No significant increased staff time is required to maintain the grid-to-parcel relationship in the future (after the zoning by-law consolidation).

Generating and maintaining a zoning map series in Standard Letter Format, for “quick and dirty” printouts of neighbourhood zoning designations and site specific amendment labels, is a product that would be useful for both casual and professional Stakeholders of zoning data in the City. Once the grid extents are established, and the “look and feel” of the zoning map product is decided, an automated process can be launched at whatever desired frequency to refresh the map sheets on the shared drive (e.g. monthly, after council-approved amendments are posted, upon office consolidation.)

It would be preferable to create a Map Book as a digital product, for browsing on the desktop or tablet. If a requestor required a hardcopy print of individual sheets or the entire series, they would do that for themselves. The City might also contract a third-party printing house to produce hard copies of the Map Book on demand (for a fee) if Stakeholders requested it.

A digital map series covering the entire City geography would be a valuable and complementary addition to the variety of text/map data access channels for users, including an interactive GIS tool discussed below.

Table 8: ZBL Map Series Considerations

ZBL Map Series Considerations	Opportunities	Issues
1) ZBL Map Series	<ul style="list-style-type: none"> • Easily viewable, text-based PDF files (black & white or colour) • Viewable on desktop and mobile devices • Printable by Stakeholder 	<ul style="list-style-type: none"> • Map series/map book creation and update effort • Added cost of map series/map book creation software (for example, Esri Production Mapping)
2) Map Index	<ul style="list-style-type: none"> • Map Index live link to selected PDF file on accessible file system • Map-to-Street Name index file already created and maintained 	<ul style="list-style-type: none"> • Geocoding tool to take address as input and return correct map grid reference is more useful
3) Map Sheets	<ul style="list-style-type: none"> • Utilize existing Street Grid sheets to depict generalized zoning by-law information 	<ul style="list-style-type: none"> • Design cartographically attractive and functional ZBL mapping standard

4.3 Zoning By-law Interactive GIS

Principle: Communication through visualization is an important consideration for making zoning information available to users of the data. The map provides a very familiar visual tool to access information required by knowledgeable staff to interpret a consolidated zoning by-law. An increasing majority of potential Stakeholders prefer access via an interactive mapping environment.

Location is an “indexing tool” to relate seemingly disparate elements into a whole. Interactivity allows each Stakeholders’ experience to be personalized, to provide answers to individual’s questions. Presenting the consolidated zoning by-law through an accessible, interactive mapping interface is an importation option for the ZBL consolidation project.

There is no express or implied statement that an interactive ZBL environment provides the sufficient legal explanation of the rights and duties associated with property in the City. In fact, all municipal jurisdictions surveyed have some type of standard disclaimer to 1) note the possible errors of omission or commission in the zoning data, and 2) direct users of online text or mapping ZBL resources to the expert interpretation of Development Services staff. It is this advisory service that the mapping environment may enable, to streamline searching for definitive information in the legal text. The disclaimer from the City of London, ON is reproduced below.

Figure 11: City of London, ON – Online Zoning By-Law Disclaimer

Disclaimer

The City of London zoning maps and related by-law information are provided as a public service. In any situation where the printed official map or by-law document of the City of London differ from electronic versions contained in this website, the official printed publications take precedence. Users of this electronic information should verify it with the printed official information before acting on it.

Content you access here is not necessarily an exact and/or current reproduction of official documents. For example, by-law revisions may be in progress or Internet browser display capability may affect map presentation formats. The City of London does not warrant the accuracy of these electronic versions and accepts no responsibility for any damages suffered by any person as a result of decisions made - or actions based - on informational content accessed via its Internet site.

Official versions of all zoning maps and related information can be obtained from the City of London Zoning Division by calling (519) 661-4660.

Copyright City of London 2003

Note: Zoning maps of the City of London are not to be distributed or used for commercial purposes but may be used for other purposes provided that the above disclaimer and copyright notice is presented. If you have any questions about the use, reproduction or distribution of zoning maps and/or related by-law information please e-mail Legal Services or call 661-2500 Ext. 4940.

Do you accept these terms?

[I accept](#)

[I do not accept](#)

The City of Markham is well equipped to deliver an interactive GIS tool to its internal and external clients. They are already doing this on a number of fronts.











- *Geologic*, as discussed briefly above.
- *Online Permits Applications and Licenses (OPAL)* with address-based access to zoning information and flags for current applications in the City's Amanda system
- *Vacant Land Database*, to market land to potential business investors
- *Property Details Search*, to provide access to common property description screening criteria

Figure 12: City of Markham Property Details Search

PROPERTY DETAILS SEARCH

[Bookmark this page](#)

For a thorough interpretation of any proposed use or development standard, please perform a zoning search. There is no charge for a zoning search and search results will be provided within 3 or 5 business days.

50 ANDERSON AVE - (Locate property on zoning map)		
Zoning Bylaw	BY-LAW 88-76 as amended	
Zoning Designation	MIC - SELECTED INDUSTRIAL WITH LIMITED COMMERCIAL	
Official Plan Designation	Commercial	
Federal Airport	Subject property is NOT located within the Federal Airport Zoning Order	
Oak Ridges Moraine	Subject property is NOT located within the Oak Ridges Moraine	
Provincial Greenbelt	Subject property is NOT located within the Provincial Greenbelt	
Conservation Authority	Subject property is NOT located within the TRCA Screening Zone	
Markham Register of Property of Cultural Heritage Value or Interest	No	
Ministry of Transportation	Subject property is located within the MTO Screening Zone	
Development District	East	
Ward	5	
Assumption Status of Subdivision	Assumed	

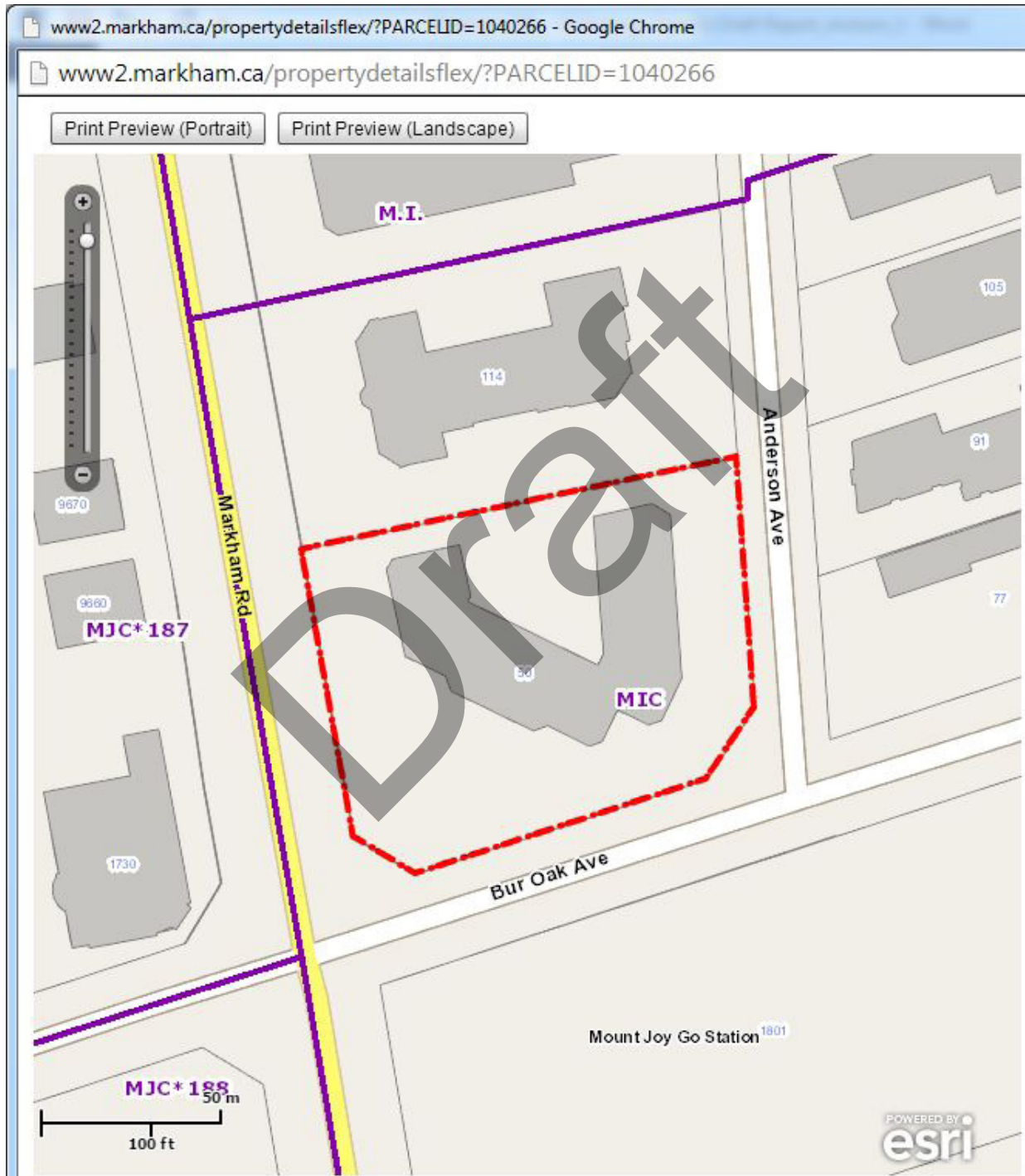
[New Search](#)

Of these tools, the *Property Details Search* site is of most relevance. It is a good start at presenting text/database information in an easy to use interface, with some interactive map capability. Access to the tool is via a street address entry form. When a valid address is input, a table appears with description of screening attributes and links to other relevant text and map documents and/or websites.

The property details for 50 Anderson Ave are reproduced above. The link beside the address at the top of the table invokes a new browser window that presents the City's enterprise mapping environment

with the zoning information overlaid. The centre section of the table displays several key property attributes at the requested address. Each of the links at the right side of the table lead the user to further web- or map-based information about the address.

Figure 13: City of Markham Property Details Map



Future iterations of this site could address some of the common functionality that was seen in the thirteen peer organizations whose interactive GIS tools for zoning and property information were researched. (See Appendix 1)

Table 9: ZBL Interactive GIS Considerations

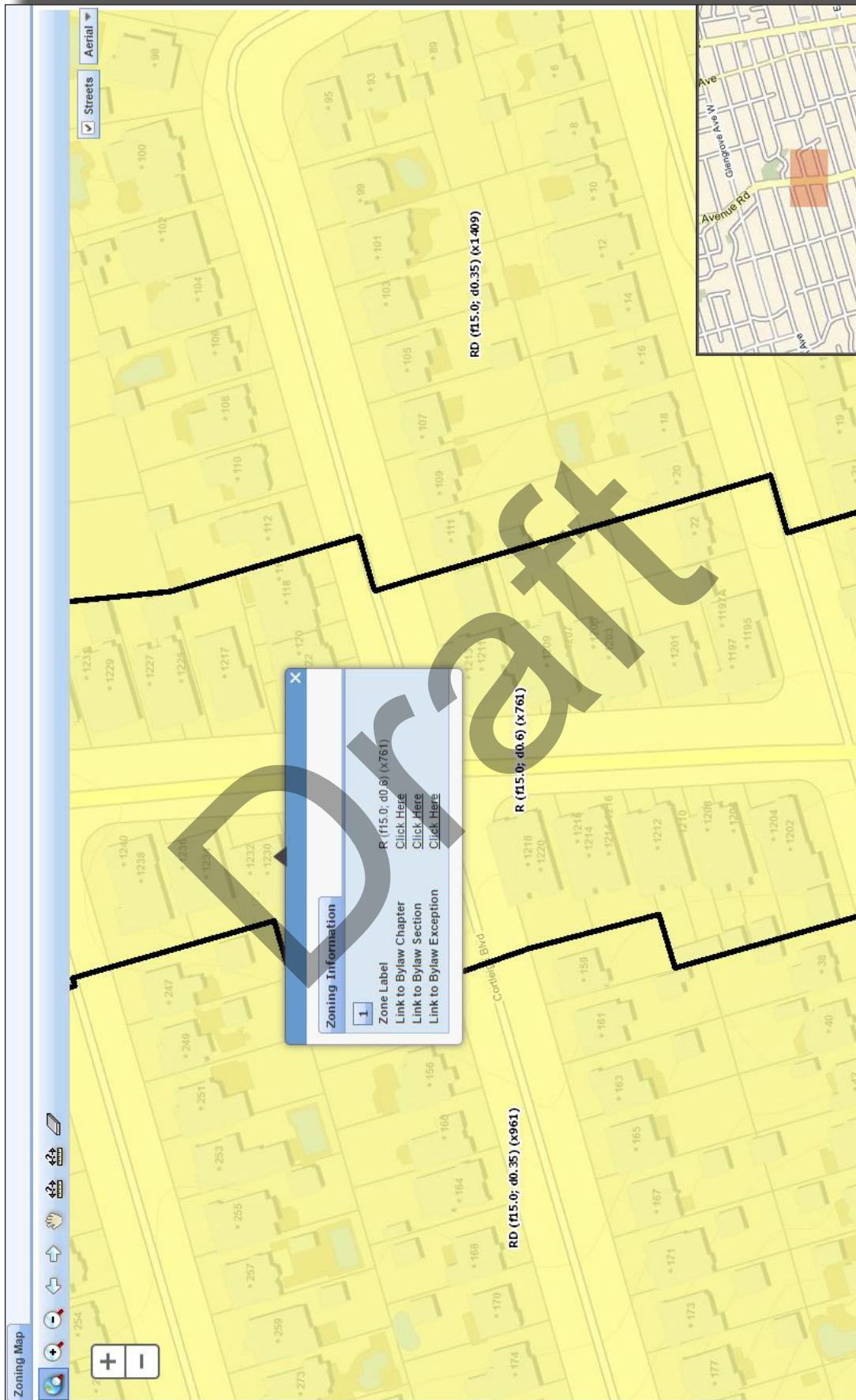
ZBL Interactive GIS	Opportunities
ZBL Interactive GIS	Fully interactive address input form either <u>from a map</u> or <u>from a web form</u> , with number and street name completion to assist in finding valid addresses
	As demonstrated by Property Details Map window, existing zoning polygons exist for the City. Existing code could be used to expose the consolidated by-law in a similar use case
	Existing and Future Zoning polygons and attributes could be used for data conversion, analysis and reporting purposes
	Link between the screening results table and the live, interactive map canvas of various screening layers in the GIS (Airport, Moraine, Greenbelt, Conservation Authority, Cultural Heritage, Ministry of Transportation, Assumption Status) versus websites and PDF maps currently referenced
	Other user defined geographic screens could be user selectable and evaluated through point-in-polygon analysis of virtually any of the geographic layers maintained in the City's GIS
	Issues
	Stakeholder consultation to determine specific functional requirements of the ZBL interactive GIS when the capital project begins. New functionality requires new effort by human resources during the implementation project.
	Taking the screening concept even further, the common and most important screening layers could be part of a standard property report generated for review and/or hard copy printing
	Link to the Zoning and/or Official Plan web site might be able to open the relevant documents to the correct section, subsection and page number that relates to the parcel being queried

The Town of Oakville (Figure 14, below) has done a good job of creating hypertext links in their GIS zoning data that presents the relevant portions of their zoning by-law when requested from the map. This involves keeping page numbers in the zoning text document in synch with page number references in the zoning GIS data. It is an extra step in the data maintenance process, but ensures that the hypertext links are always relevant for the parcel that is selected. Those links that do not have text behind them are noted as `Not Applicable` in the link list. Note: While this may seem an extra step it is also an extra quality verification action and as such should be considered as a sound investment, not a mere cost.

Figure 14: Town of Oakville Interactive Zoning Map



Figure 15: City of Toronto Interactive Zoning Map



The City of Toronto goes about the issue of correlating text and map in a slightly different way. The text information that is to be presented in a browser window visualized using XML, while the presentation of the text is assembled on-the-fly based on queries of the category, section and exception attributes stored in the GIS. This method means that the text presented in the map is always linked to the latest zoning information, and the XML only needs to be updated when the substantive zoning text is modified.

In Figure 15, the zoning information for “1230 Avenue Rd” is presented in a pop-up window when the user clicks on the property. Some identifying text labels are presented on the map canvas as well in the pop-up window. These are the commonly requested zoning attributes: Parent Designation, Height Standard, Density Standard and Exception Number.

Both of these solutions bring zoning text and mapping closer together, but neither Oakville nor Toronto present the full by-law text in a format better than simple HTML links to major document sections. An ideal solution might integrate the digital text capabilities of the Mississauga solution with the interactive mapping capabilities of Oakville or Toronto – with bi-directional search and presentation capabilities. This may be accomplished if text information is stored in a database, and displayed text information can pass a mapping argument to the GIS for simultaneous display.

Particular issues around integration of text and mapping, and of making the zoning information the basis for solution-oriented business applications are discussed in the next section.

4.4 Business Solution Applications

Making zoning information more accessible to both the casual and professional user is the primary objective of this technical strategy. Incorporating the best aspects of the web sites described above will ensure that this objective is met by the City of Markham.

Through discussion with a diverse set of information users and providers it is apparent that **EVENTUALLY**, the business needs will go beyond this first step of increasing understandability and accessibility of the consolidated zoning information. The scope of making knowledge-based decisions incorporating zoning data with expanded spatial/tabular information should be the long-term target for derivative products of Markham’s zoning by-law consolidation.

Principle: Zoning can/should be the gateway dataset into a solution where all questions can be answered with simple, reusable computer functions deployed as business-specific applications to automate repetitive tasks. Creating, integrating and extending products and processes derived from the consolidated zoning by-law data should be thought of as the long term objective for the City’s use of zoning and property-related information.

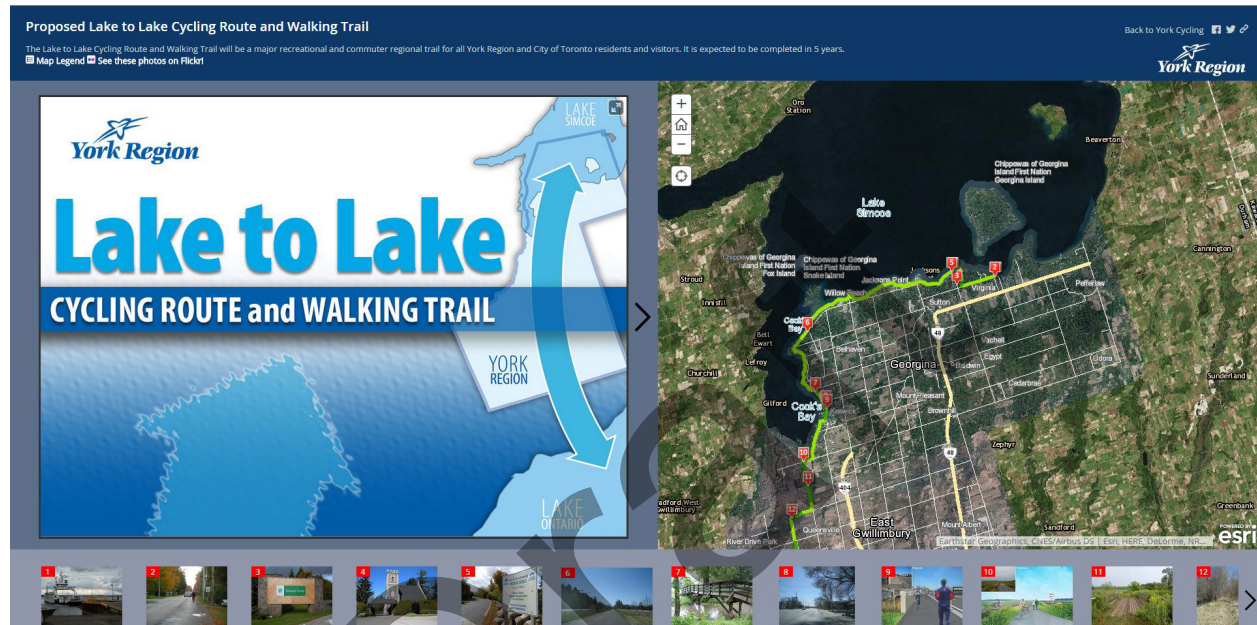
There is a trend in business and GIS application development moving away from monolithic, all-data/all-functionality websites and towards process-specific functionality to take users from Step 1 to Step *n*. These small applications exist as a shortcut on a user’s desktop, and are invoked to provide consistent answers to common questions. A current example of this type of application the Story Map tool.

Story Map is a simple, yet valuable use of the mapping interface as a window into municipal data. Geocoded locations are presented on the map, with a display block on the left side of the webpage and a carousel of pictures at the bottom of the website. The user needs zero GIS knowledge to navigate the map interface, while interacting with the multimedia elements that are displayed.

The important take-away is that the ability to disseminate knowledge on a particular topic in a simple and easily deployable template makes the use of geographically referenced information more compelling for both the provider and the consumer.

An example is the proposed *Lake to Lake Cycling Route and Walking Trail* in York Region. Although the content is of different subject matter, the reader can imagine a ZBL story map configured to step users through various illustrative examples of proposed parent zoning designations with sample pictures in the carousel.

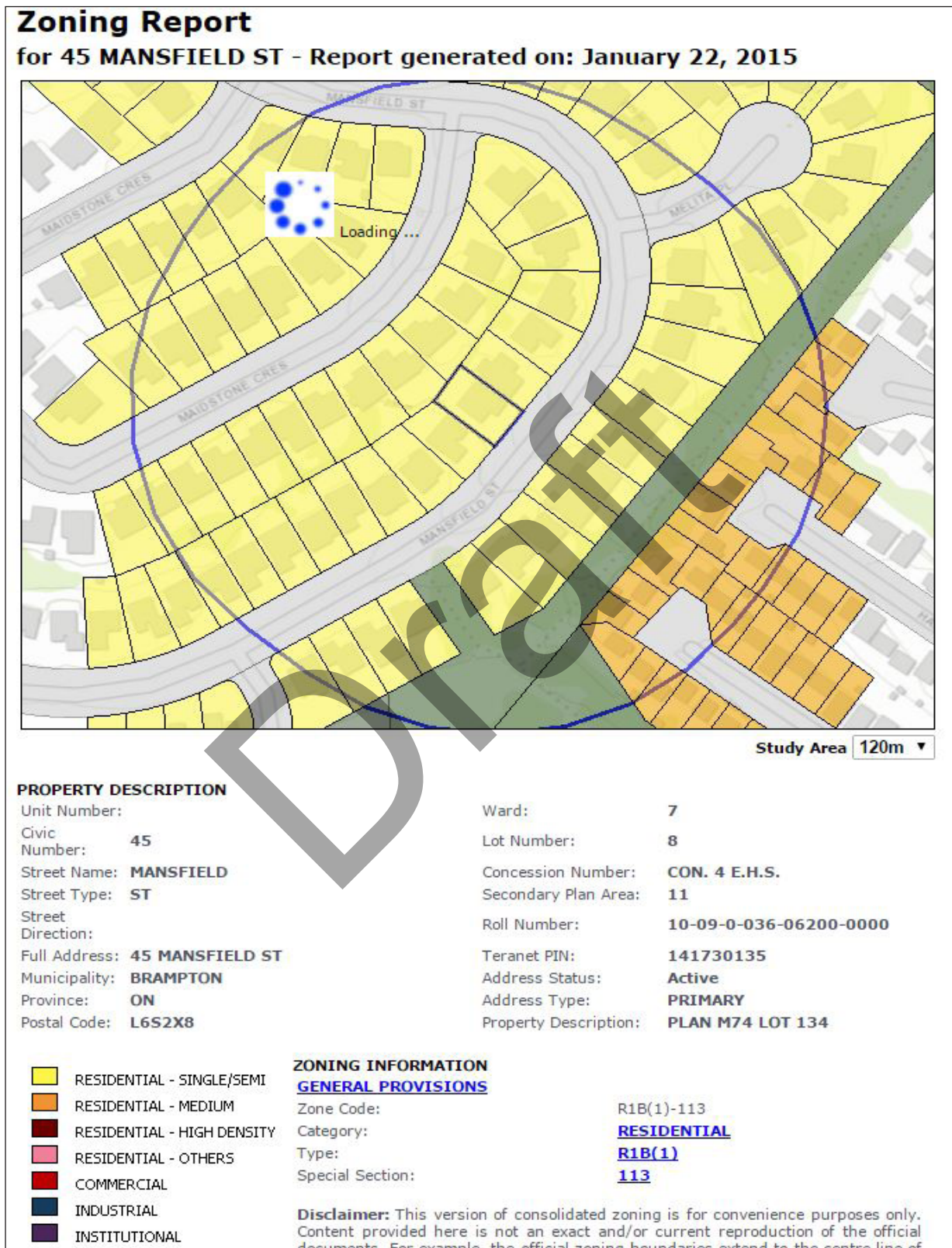
Figure 16: York Region Story Map Sample



Mapped, graphic and tabular information is all displayed in an easy to navigate and understandable package. Other map functionality such as slider bars could toggle between existing zoning and proposed consolidated zoning to show how the designations might change for a given area.

Input from users of Markham's zoning data indicates that understanding the zoning category or site specific amendment is of greatest interest to many users, but there are some who wish to ask further questions of a future system. An example might be searching for permitted uses in a particular area, linkage to property/building and/or infrastructure services information.

Figure 17: City of Brampton Property Report Sample



The knowledge requirement is for a user to determine a future location (address or area) for a permitted use on a particular property, with serviceability of that use, and the availability of properties that match that criteria to provide multiple options for the business to consider. The “where” of the question is helpful, but the “what” and “how” of the question will drive investor’s decision-making about bringing their business to launch in Markham.

No organization we investigated is doing the additional step described above. But it is something that users described as being the ultimate goal of a system that leverages enterprise geographic information and technology with zoning and building information. The first tentative steps in this direction are seen in standard property reports generated via interactive mapping by the City of Brampton.

In this case selecting a property and requesting the property report generates a document where much of the common information a user may wish to see about a property is automatically provided. Zoning details are most prevalent, but Brampton also includes assessment, demographic and other information that could be leveraged by users inside and outside the organization.

Draft

5 Stakeholder Analysis

Various persons and organizations have an interest in zoning information created and maintained by the City. These include, but are not limited to,

- Citizens whose land-based activities are regulated by the municipal government
- Private investors, developers and contractors, who seek to develop tracts of land or improve property for profit
- Private agents (in real estate and law) acting on behalf of citizens and developers to transact and improve property
- City planners whose accountability for adherence to the provincial Planning Act and Markham's zoning by-laws
- City staff who use zoning information in their business process to deliver services to the public
- City staff who create and maintain the information and provide the technology infrastructure to allow the zoning to be used by all stakeholders
- By law enforcement
- Tax base integrity, based on agreement between MPAC reported property attributes and the City's zoning and land use reality

There is a common desire to see information and systems that would be accessible

- to regulate appropriate and desirable development in the City over time
- to promote simple and intuitive by-law information as possible

- to ensure that zoning variances/amendments/consolidations are automatically related in the zoning by-law text and on the resulting interactive mapping

Currently, there is staff time and effort expended to correctly interpret zoning on a single- request basis. Multiple volumes of textual information need to be consulted, with additional details found in manually cross-referencing site specific amendments to ensure a correct legal interpretation is provided to the information requestor.

In the future, it is expected that the consolidated zoning by-law and its interactive mapping environment, may provide an information platform, a catalyst perhaps, to increase the quality and completeness of development applications.

5.1 Public

The public are key stakeholders in the provision of zoning data via interactive mapping. Rate payers wish to know what they are permitted-to or restricted-from doing on their property. Lawyers and Real Estate people engaged as agents, or representatives of the public wish to have access to zoning information as it impacts the transaction of land or the marketability of property for specific uses.

The public could be well served by simple, web-based, interactive mapping tools that provide intuitive interface to high-level zoning information. Every municipal jurisdiction investigated for this report had zoning information available via mapping on the web.

In Markham's case, the "Zoning Search Form" allows users to input the subject address, which is submitted to the planning department for disposition within five business days. Recent annual web form queries have numbered in excess of 3000. If these queries take an average of two hours each to close or 'settle' this simple effort consumes about one full time employee. Residents can also obtain parent by-law number and zone for a specific property online via the "Property Details Search" tool.

The Zoning By-law Consolidation project is setting the stage for up-to-date, interactive access to zoning information via the City's web portal and geographic information repository. We expect that with the acceptance of the new consolidated by-law [c. 2016], the tools and information required for zoning data access will leap-frog many other jurisdictions' current offerings such as plan PDF map books and basic address based maps.

For those without web-access, or those who prefer to request information via the front-counter or via the municipal call centre, we have seen how the same web-based tools created for citizen (or internal staff use) can be employed by front-line staff to answer questions more fully and in a more timely manner than is currently possible. The result is increased customer service satisfaction, the use of front-line staff for common/simple/repetitive requests, and freeing costly departmental professional staff to use their time for more complex enquiries or other higher value activities.

Step Six of the ZBL Consolidation project was not requested to quantify cost avoidance and/or cost savings associated with automated access to zoning information, but consultation with staff conveyed that current zoning search takes a significant amount of time, while intake and resolution lies with building/zoning staff. Lowering the time expended to answer common questions ("can my client put a daycare at . . .?" or "can I build a deck on my house?" etc . . .) and having the questions answered by lower cost staff or the web itself, is an intuitive case for both efficiency and effectiveness in City operations.

5.2 Industry

No development industry stakeholders or private sector agents were presented to the consultants for discussion of their particular user requirements. There was an indication by staff about how these industry professionals interact with the City, on the various development files that they pursue. It was believed that secure, role-based login to a deeper level of zoning mapping and attributes might be appropriate.

There are also engineering or planning consulting firms contracted by the City for specific initiatives that would benefit from zoning and other geographic information via secure access to the City’s spatial repository. These groups would likely require network access agreements, and data licensing agreements to be put in place in order to incorporate the City’s geography into their deliverables. Consumption of open data as secure map services will ensure that contractors have the latest geographies available to them at all times, and that downloads do not become outdated as soon as the data is received by the client.

All stakeholders will have an opportunity to provide input at the Open House and Stakeholder meeting(s) targeted for May 2015.

5.3 Staff

Virtually every operating department at the City has some interest in land – where an asset is located, where current clients reside, or where operations will change in the future. Display of common geographies allow managers and executives to see patterns and details that would not be apparent in a document, spreadsheet or non-spatial database. Cross-references such as municipal address, street name and address range, intersection, postal code are all ways that multiple departments track the location of their municipal business interests. Giving map-based, geographic information access to citizens and partners keep them apprised of the progress of projects/programs, alerts them of future initiatives and allows them to see the “bigger picture”.

Of course, it is the City’s staff and business processes which benefit most from easy access to accurate, current and timely geographic data. Each department has established processes that use geo-referenced information to great effect. Some more than others. With or without an accompanying map. Several consumers of zoning data provided in-depth commentary on current issues around accessing information in the following areas of inquiry about access to by-law information:

Table 10: Future Zoning By-Law Technology Access Considerations

Future Zoning By-Law Technology Access Considerations	
Text Printed Environment	Text Online Environment
<ul style="list-style-type: none"> • The printed document will always be useful, and will represent the correct and legal document for the foreseeable future • Decision to be made about whether Clerk has a role in storage and handling of text document 	<ul style="list-style-type: none"> • Provides a convenient format for using the text document to the greatest benefit (search, mark-up) • Not interpreted as the legal and correct version of the zoning by-law

Future Zoning By-Law Technology Access Considerations	
Text Document	Map Visualization
<ul style="list-style-type: none"> Any text document suffers from the sheer size and complexity of the structure and content of such a large information source 	<ul style="list-style-type: none"> Most stakeholders will relate well to the map as the repository of zoning information. It is an extension of increased use of location-based services on personal smart devices
Intuitive Interface	Complex Interface
<ul style="list-style-type: none"> Lighter, more purpose-built applications have a cleaner interface and takes the public or staff member through a series of simple steps to provide input for correct processing and resolution 	<ul style="list-style-type: none"> Previous paradigm of GUI design had a multitude of tabs, pick-lists, and buttons to provide full functional access to data and mapping elements Only savvy professionals would benefit from content, it inhibits use by untrained staff
Zoning Designations	Building Standards
<ul style="list-style-type: none"> The top-level “parent” designations, which provide a thumbnail view of zoning across the jurisdiction. Most stakeholders would appreciate the parent designation on a map, with explanation in the text document 	<ul style="list-style-type: none"> Public confuse zoning designations with building standards Stakeholders described usefulness of showing a map of subject property to the public to ensure they are aware of property lines, ravine boundary, etc . . .
Public and Industry Access	Staff Access
<ul style="list-style-type: none"> Consensus that these stakeholders can live with less functionality and information in their application, but enough to make a new tool useful 	<ul style="list-style-type: none"> Staff asking for as much as the information and technology tools can give them Especially when it comes to productivity boosters like saved queries and text/map mark-up
Field Access	Office Access
<ul style="list-style-type: none"> Access described for Public and Industry should be available via networked resources for anyone who requires the information Includes City Staff in the course of their daily activities, wherever and whenever needed 	<ul style="list-style-type: none"> More options for desktop and other devices in the office environment. Application may be useful to professionals, counter staff, call centre staff who don't have means to currently field simple calls

Future Zoning By-Law Technology Access Considerations	
<p style="text-align: center;">Volume of Requests</p> <ul style="list-style-type: none"> • Increasing volumes of work require a change to the zoning by-law information, technology and process • Online environment may be able to provide metrics on use of Zoning information inside and outside the organization 	<p style="text-align: center;">Source of Requests</p> <ul style="list-style-type: none"> • Online solution will meet needs of stakeholders who do not currently have good access to the information • Expect requests to be sourced from areas of the organization who would like to have access, but currently do not.
<p style="text-align: center;">Low Impact Business Requests</p> <ul style="list-style-type: none"> • Simple and/or nuisance requests can be handled in a more expeditious manner by staff trained to use information and technology tools. 	<p style="text-align: center;">High Impact Business Requests</p> <ul style="list-style-type: none"> • Requests with high impact, and high visibility will continue to be dealt with by senior development services staff, who will also benefit from a streamlined information access process.

Draft

6 ZBL Geographic Information & Technology Cost Estimates

There are four components to the geographic information and technology cost estimates presented below.

1. Capital budget component for a fixed, 3 year project to prepare, quality assure and migrate textual and geographic information from the current ZBL environment to the new environment.
2. Operating budget component (here noted for 2 additional years) for additional incremental monies required to sustain the new ZBL text and geographic information environments.

With each of the capital and operating components, there are 3. Human Resources and 4. Technology Resources that should be budgeted.

Table 11: ZBL Human and Technology Requirements (and Options)

	Capital (2016-2018)	Operating (2019-ongoing)
Human Resources	<p>Information Analyst required for three years (2016-2018), salary and benefits grossed-up to \$120k per annum.</p> <p>Role: Project point person for compilation, preparation, conversion between old and new environments – text and mapping information.</p> <p>Business Analyst required for one year (2017), salary and benefits grossed-up to \$100k per annum.</p> <p>Role: Document specific user functional requirements for consolidated zoning by-law environment, and derivative solutions.</p> <p>GIS Programmer Analyst required for one year (2018), salary and benefits grossed-up to \$150k per annum.</p> <p>Role: Configuration and/or development of software tools specified in BA work above.</p>	<p>Information Analyst required for ongoing maintenance of new text/mapping information environment.</p> <p>Role: Continued maintenance of text/mapping environments.</p>
Technology Resources	<p>Requirement: Data Preparation, Quality Assurance, Quality Control</p> <p>Purchase: 2016</p> <p>Maintenance: 2017-2018</p> <p>Tool: Feature Manipulation Engine (FME)</p> <p>Supplier: Safe Software, Victoria BC</p> <p>Cost: C\$9,000 concurrent use license</p> <p>Add'l concurrent use license C\$3,000; maintenance C\$1,800 per concurrent use license</p>	<p>Requirement: Data Preparation, Quality Assurance, Quality Control</p> <p>Maintenance: 2019</p> <p>Tool: Feature Manipulation Engine (FME)</p> <p>Cost: approximately C\$1,800 per concurrent use license</p>

	Capital (2016-2018)	Operating (2019-ongoing)
Technology Resources	<p>Requirement: Legal Document Preparation</p> <p>Purchase: 2016</p> <p>Maintenance: 2017-2018</p> <p>Tool: Adobe Acrobat Professional</p> <p>Supplier: Adobe Systems, Inc. San Jose, CA</p> <p>Cost: C\$495 single use license purchase, maintenance C\$150 per single use license (x6 project members)</p>	<p>Requirement: Legal Document Preparation</p> <p>Maintenance: 2019-2020</p> <p>Tool: Adobe Acrobat Professional</p> <p>Cost: C\$150 single use maintenance</p>
	<p>Option: ZBL Legal Document Presentation</p> <p>Purchase: 2017</p> <p>Maintenance: 2018</p> <p>Tool: Orderline/Paperless</p> <p>Supplier: Orderline.com Toronto, ON</p> <p>Cost: \$50,000 for Proof-of-Concept of automated handling of online legal text document</p>	<p>Option: ZBL Legal Document Presentation</p> <p>Maintenance: 2019-2020</p> <p>Tool: Orderline/Paperless</p> <p>Cost: Annual fee for automated handling of online legal text document <i>To Be Determined</i></p>
	<p>Requirement: Map Series Preparation</p> <p>Purchase: 2017</p> <p>Maintenance: 2018</p> <p>Tool: Production Mapping</p> <p>Supplier: Esri Canada, Toronto, ON</p> <p>Cost: C\$15,000 concurrent use license purchase, maintenance C\$4,500 per concurrent use license</p>	<p>Requirement: Map Series Preparation</p> <p>Maintenance: 2019-2020</p> <p>Tool: Production Mapping</p> <p>Cost: C\$4,500 concurrent use maintenance</p>
	<p>Requirement: Interactive GIS</p> <p>Purchase: 2017</p> <p>Maintenance: 2018</p> <p>Tool: Geocortex Essentials (GCX)</p> <p>Supplier: Latitude Geographics , Victoria, BC</p> <p>Cost: C\$20,000 4-core Server license, maintenance C\$5,000 4-core Server license</p>	<p>Requirement: Interactive GIS</p> <p>Maintenance: 2019-2020</p> <p>Tool: Geocortex Essentials</p> <p>Cost: C\$5,000 4-core Server maintenance</p>

	Capital (2016-2018)	Operating (2019-ongoing)
Technology Resources	Option: Business Solution(s) Purchase: 2017 Maintenance: 2018 Tool: Geocortex Essentials-Amanda Extension Supplier: Latitude Geographics , Victoria, BC Cost: C\$5,000 purchase and maintenance	Option: Business Solution(s) Maintenance: 2019-2020 Tool: Geocortex Essentials-Amanda Extension Cost: C\$5,000 Maintenance

Notes to Human and Technology Requirements (and Options) Table

Timetable for capital project and operating budget increments are wholly dependent upon the end of the strategy phase of the Zoning By-Law Consolidation project.

The numbers presented in these tables are representative of cost associated with human and technology resources. Confirmation of amounts will occur through standard budgetary procedures. The amounts here are the best estimate with current knowledge of potential geographic information and technology activities.

Human resources make up 84 percent of the total project cost estimated here. There are resources currently employed at the City who could work successfully in the areas described above. Those existing resources could be substituted for project resources identified above, if existing workload could be transferred to free up existing, skilled resources.

Naming specific software products is for illustrative purposes only. All human and technology resources utilized in the project will be subject to the City’s procurement procedures, including sole-source where appropriate.

No allowances have been made for additional hardware to support the new ZBL text or mapping environments. Hardware is generally budgeted and procured by the Information Technology department, so requests should be made in conjunction with IT planning cycles. Also, Zoning is not envisioned as a mission critical application, without the need for 24x7x365 failover infrastructure. The zoning data and processes should be addressed appropriately in corporate disaster recovery plans and procedures.

The **Information Analyst** position is added to the capital project in the first year and retained as a new position in the operating budget in 2019. Note that the operating budget increment in 2019 is not repeated in 2020, as that amount will have been added to the department base budget as a new position in 2019. The **Business Analyst** and **GIS Programmer Analyst** positions are retained each for a year to gather and implement requirements for the Interactive GIS and potentially for the Business Solutions portion of the project. Sample job descriptions have been included in Appendix 3 of this report.

Feature Manipulation Engine (FME) is a data conversion and quality assurance tool with deep integration to the Esri product stack. It is envisioned that additional QA/QC activities can be undertaken from both the corporate database and mapping tools, especially when walking data between existing zoning classifications and proposed new classifications.

The **Orderline/Paperless** option is dependent on the desire of the City to pursue out-sourced management of the ZBL legal document. A proof-of-concept project is added as a sub-project in the capital activities to explore possibilities. The cost of the maintenance of an Orderline solution was not readily available to the consultants (marked as *TBD*), except for the fact that it is less than \$100,000 per year according to City of Mississauga budget documents.

It is envisioned that if a third-party was used to manage the text portion of the consolidated ZBL, there could be a reduction in the Information Analyst's role to 0.5 FTE in the 2019 operating budget. The \$60,000 savings in this position could offset some or all of the production costs of an Orderline solution. See superscript 1 in Table 13 below.

Esri's **Production Mapping** product contains functionality for map book production that is directly applicable to the ZBL project. There is also functionality for managing maintenance of geospatial data in an enterprise environment, which might be useful for other groups maintaining data at the City. Additional purchase and maintenance commitments to Esri Canada may make discussion of an Esri Enterprise Licensing Agreement of greater interest to the City.

Addition of a 4-core server license of **Geocortex Essentials** assumes that load on the existing GCX server may exceed capacity as more applications come online. The **GCX-Amanda Extension** has the capability to integrate more development and building information into the business application solutions that may be envisioned for zoning and property description

Table 12: ZBL Geographic Information and Technology Capital and Operating Cost Estimates

Component		2016	2017	2018	2019	2020	Total
Total Capital Project	\$000	147	302.1	287.1	0	0	736.2
Total Operating Increment	\$000	0	0	0	137.1	0	137.1
Total Project Cost	\$000	147	302.1	287.1	137.1	0	873.3

Table 13: ZBL Technology Capital Project Cost Estimates

Component		2016	2017	2018	2019	2020	Total
Capital Project							
Human Resources (increment)	FTE	+1	+1	-1/+1	-2		0
Information Analyst	\$000	120	120	120			360
Business Analyst	"	0	100	0			100
GIS Programmer Analyst	"	0	0	150			150
Human Resources Total	\$000	120	220	270			610
Technology Resources							
Data Preparation {							
Quality Assurance { FME	\$000	9	2	2			13
Quality Control {							
ZBL Legal Document Preparation and Presentation							
Adobe Acrobat Pro	"	3	0.6	0.6			4.2
Option – Orderline Proof-of- Concept	"	0	50	<i>TBD</i>			50
Map Series Production							
Production Mapping	"	15	4.5	4.5			24
Interactive GIS							
Geocortex (GCX) Essentials	"	0	20	5			25
Business Solutions							
Option: Geocortex-Amanda Extension	"	0	5	5			10
Technology Resources Total	\$000	27	82.1	17.1			126.2
Capital Project Total	\$000	147	302.1	287.1			736.2

Table 14: ZBL Technology Operating Budget Increment Estimates

Component		2016	2017	2018	2019	2020	Increment
Operating Budget Increment							
Human Resources	FTE				1	0	1
Information Analyst – add to operating budget	\$000				120 ¹	0	120
Human Resources Increment	\$000				120	0	120
Technology Resources							
Data Preparation { Quality Assurance { FME Quality Control {	\$000				2	0	2
ZBL Legal Document Preparation and Presentation Adobe Acrobat Pro	“				0.6	0	0.6
Option – Orderline Production	“				<i>TBD</i> ¹		<i>TBD</i>
Map Series Production Production Mapping	“				4.5	0	4.5
Interactive GIS Geocortex (GCX) Essentials	“				5	0	5
Business Solutions Geocortex-Amanda Extension	“				5	0	5
Technology Resources Increment	\$000				17.1	0	17.1
Operating Budget Increment	\$000				137.1	0	137.1

Appendix

1 – Summary of Consultation

2 - Open Data

3 - Sample Project Position Descriptions

Draft

Appendix 1 - Summary of Consultation

	Name	Business Unit
1	Avila, Maira	
2	Bird, Chris	
3	Blake, Ronald	
4	Bordone, Sabrina	
5	Burke, Ewan	
6	Campbell, Sally	
7	Davies, Dave	
8	DiPerna, Stephanie	
9	Geyer, Stephen	
10	Hare, Huyen	
11	Heaslip, Scott	
12	Henriques, Anna	
13	Hutcheson, Regan	
14	Jay, Catherine	
15	Karumanchery, Biju	
16	Kendall, Richard	
17	Miller, David	
18	Miller, Matthew	
19	Nelson, Greg	
20	Orsi, Nathalie	
21	Pearce, David	
22	Poos, Michael	
23	Tadmire, Robert	
24	Tecsa, Teodor	
25	Villella, Tom	
26	Whynot, Scott	
27	Wilson-Peebles, Andrea	
28	Wiles, Bill	
29	Wokral, Peter	
30	Vandezande, Richard	
31	Zhang, Arno	
32	Roberts, Bradley	
33	Wouters, Margaret	

Appendix 2 - Open Data

Zoning data is part of the range of geographic information sometimes placed under the umbrella of municipal Open Data initiatives. Some organizations have embraced open data and released dozens of data sets for public consumption. Others have data release policies that meet the volume and content of their current requests, so no open data policy is in place. The City of Markham is closer to the latter case.

The ITS department has a strategic pilot project in its 2014 work plan “. . . that supports community engagement and also provides citizens and businesses access to selected data.” Those layers include roads, civic addresses and ward boundaries. The data is being packaged in Shapefile, Personal Geodatabase and KML formats. Approval by the City’s legal department is required before any data is available via the open data pilot.

Thus far, the City has used the licensing approach also taken by York Region. They are following the movement toward transparency of data, and due diligence around copyright and intellectual property related to open data. In the past, cursory data was given away, and deeper levels of information have always been available to trusted parties and partners.

The ‘Open data paradigm’ is not culturally embedded in the fabric of the City of Markham organization at this time. There is a willingness to encourage self-service, as demonstrated by the number of online services now provided by the City. There is, however, a reluctance to release information that is “semi-judicial” in nature, or data which may impact property valuation and/or marketability based on the permitted uses represented in the data file. This is neither ‘good’ nor ‘not good’, it just is. No doubt the growing Canadian experience with such more open processes will provide actionable guidance to Markham and all municipalities in the years ahead.

It is a policy question that is beyond the scope of this review. Zoning data can be freely available to internal and external users as a digital document and as an interactive map as described above without placing it under the umbrella of an open data program. If there is a future decision to provide open data to the public, it should be noted that the community would be well served if key datasets are released as “map services” vs static files. This way, developers could point their applications to the map service published by the City and have access to the most up-to-date information available at any time.

Appendix 3 – Sample Project Position Descriptions²

Position Title: **Information Analyst**

Position Summary:

Conducts advanced analyses of spatial and non-spatial data for users throughout organization. Creates information products expressing the results of analytical processes using corporate information management tools. Prepares project plans, directs vendors, and coordinates internal team members in the completion of spatial and non-spatial data collection, management, analysis and reporting projects. Designs and implements databases in corporate relational database management system and helps programming staff understand data processes while creating and maintaining end user applications.

Essential Job Functions:

Performs advance analysis of spatial and non-spatial data using information technology tools (25%)
Coordinates the procurement and distribution of data (20%)
Manages highly complex information and technology projects (15%)
Creates and manages online tools using spatial and non-spatial data (15%)
Serves as database administrator for project-related data (15%)
Reviews work products of other technical staff (10%)

Minimum Education and Experience:

Bachelor's degree in computer science, information science, geography, engineering, planning, or GIS; or equivalent academic credentials related to the field of employment; four years of experience in the use of enterprise-class technology systems; or any equivalent combination of education and experience. GIS or Information Management certification can be used to establish equivalency. A master's degree in a related field with extensive coursework in spatial and non-spatial information management can substitute for two years of relevant work experience.

Critical Knowledge, Skills, and Abilities:

Knowledge of the principles of geographic information science and GIS technology. Extensive skill in the use of electronic document management software, case management, asset management software, particularly with integration to ArcGIS in its desktop and online forms. Ability to develop and maintain online information management tools for non-GIS users. Considerable skill in applying information technology to solve more difficult analytical problems. Expert knowledge of relational database management systems and the ability to use the SQL language. Moderate ability to utilize data transformation and quality control/quality assurance tools as a means of importing and exporting data for use by the engineering Department. Skill in spoken and written communications, including the ability to express meaning through oral, written, statistical, cartographic and infographic communications.

² Adapted from J.A. Butler (2013) Model Job Descriptions for GIS Professionals (2ed.). Des Plaines, IL: Urban and Regional Information Systems Association

Position Title: Business Analyst

Position Summary:

Applies knowledge of business and public administration skills with assisting large organizations in analyzing and implementing, business process modelling, business systems planning, process re-engineering, business analysis and requirements management. Prepare business cases, project charters, concept documentation, project plans and related materials that contribute to City initiatives and the effective use of IT assets and services that will lead to service efficiencies and optimization of resources.

Essential Job Functions:

Documents and analyzes business processes and requirements, input costs and output levels and conducts workflow analysis and business process modelling (25%)

Provide documentation, including but not limited to requirements definitions, cost estimations, environmental scans, process models and technology roadmaps in support of all stages (Concept, Definition, Planning, Execution) of a project or initiative (20%)

Identify, analyze, rationalize and optimize business processes, input and output at a detailed level by interviewing, documenting and facilitating business process review/re-engineering sessions (15%)

Conduct research into assigned area ensuring that such research takes into account developments within the field, corporate policies and practices, legislation and initiatives by other levels of government (15%)

Conduct analyses to measure the effectiveness of technology solutions and service delivery methods and processes. (15%)

Document or contribute to product visions, user cases, user case models and supplementary specifications including screen mock-ups, report mock-ups and business rules (10%)

Minimum Education and Experience:

Post-secondary education in business or public administration or in a discipline pertinent to the job function or an equivalent combination of education and experience. CBAP certification would be an asset. Experience in using a variety of software packages including MS Office (e.g., Word, Excel, Power Point), process design software (e.g. Rational Modeller, Visio), business requirements management and quality assurance tools (e.g., Blueprint, HP QC) and project management software (e.g., MS Project).

Experience in business process modelling, business requirements elicitation and management, business systems plans

Critical Knowledge, Skills and Abilities

Experience in the Information & Technology Industry. Superior analytical, interpersonal and problem-solving skills. Excellent oral and written communication skills. Demonstrated ability to work with minimum supervision. Good organization skills with the ability to handle multiple tasks and projects concurrently and meet deadlines. Familiarity with municipal government legislation

Position Title: GIS Programmer Analyst**Position Summary:**

Creates and maintains IT products for the GIS workgroup and the clients it supports. Designs and implements spatial databases using enterprise-level technology tools. Designs and builds webpages offering spatial data functions to internal and external users. Troubleshoots and maintains custom software and webpages. Creates new desktop and online GIS software tools for use by public, staff and industry. Interfaces GIS and other software to construct complex applications. Works with other staff to define requirements for spatial and non-spatial software and create a flowchart of applications and databases to meet those requirements.

Essential Job Functions:

Constructs and maintains GIS applications (35%)
Creates web apps for intranet and internet users (25%)
Administers information and technology serving the project group (15%)
Participates with other staff to complete complex IT-based projects (15%)
Serves as database administrator for project spatial and non-spatial data (10%)
Performs as webmaster for GIS-related pages on the county's website (10%)

Minimum Education and Experience:

Bachelor's degree in information technology, computer science, or GIS; or equivalent academic credentials related to the field of employment; four years of experience in using information technology, with at least two of those years of experience in the use of GIS technology; or any equivalent combination of education and experience.

Critical Knowledge, Skills, and Abilities:

Extensive knowledge of the principles of information technology. Working knowledge of GIS software functionality and construction. Extensive skill in the use of online and desktop application programming languages and methods. Ability to develop and maintain online spatial data tools for GIS and non-GIS users. Considerable knowledge of relational database management systems and the ability to use the SQL language. Skill in industry standard development and configuration tools to create new spatial and non-spatial applications. Knowledge of general IT functions, such as network construction and database management. Ability to use agile programming methods to develop new applications. Knowledge of the principles and practices of website development. Considerable ability to diagnose and repair problems with the currently deployed versions of the Windows operating system. Skill in building and operating web and map server software installations.

End of draft report.

(Footnotes)

1 See Section 2.4 of this report for details about labeling

2 Universal Accessibility supports functionality such as scalable fonts and machine readable text-to-speech that would assist in meeting Accessibility for Ontarians with Disabilities Act (AODA).

Draft