

The background of the cover is an aerial photograph of a city, likely Edmonton, showing a mix of residential and commercial areas. A large, semi-transparent green rectangle covers the left two-thirds of the image. On the right side, there is a vertical strip of the original, unfiltered aerial photograph, showing more detail of the city's layout, including streets, buildings, and trees with autumn foliage.

# PROGRAM AND SERVICE REVIEW

Geographic Information Systems  
& Spatial Analytics Service Review

February 2019

The logo for the City of Edmonton, featuring the word "Edmonton" in white lowercase letters on a blue square background.

## **TABLE OF CONTENTS**

|   |           |
|---|-----------|
| <b>INTRODUCTION</b>   | <b>3</b>  |
| <b>GEOGRAPHIC INFORMATION SYSTEMS AND SPATIAL ANALYTICS SERVICE BACKGROUND</b>  | <b>3</b>  |
| Current State of Service Delivery   | 4         |
| Figure 1.0 - Organizational Teams Across Geospatial Related Services            | 5         |
| Figure 2.0  | 12        |
| Table 1.0 - Level of Support by Business Area for each Geospatial Service Layer | 15        |
| <b>SERVICE REVIEW METHODOLOGY AND FOCUS AREAS</b>                               | <b>16</b> |
| <b>ANALYSIS AND RECOMMENDATIONS</b>   | <b>16</b> |
| Availability of Corporate Based Services  | 16        |
| RECOMMENDATION 1  | 19        |
| RECOMMENDATION 2  | 21        |
| RECOMMENDATION 3  | 23        |
| Table 2.0   | 23        |
| <b>APPENDIX</b>   | <b>25</b> |
| APPENDIX A - PROCESS MAPPING OF CORE PARCEL LAYERS                              | 25        |
| Detailed process map connecting work required for building core parcel layers   | 25        |
| APPENDIX B - UPDATE SERVICE LIST DEFINITION                                     | 26        |
| APPENDIX C - OVERVIEW OF THE PROGRAM AND SERVICE REVIEW                         | 27        |
| Figure 3.0: Service Review - Review Process                                     | 27        |
| REVIEW PROCESS  | 28        |
| <b>DISCOVERY AND FINDINGS</b>   | <b>28</b> |

## INTRODUCTION

The purpose of the Program and Service Review is to evaluate if City provided services are advancing Council's strategic goals and whether those services are still a priority for citizens. This is done by examining the relevance, effectiveness and efficiency of a service through the Service Review Process.

This report is the result of the Service Review Process for the Geographic Information Systems and Spatial Analytics Service, which is identified in the City of Edmonton Service list as part of the Internal Information Management Category, formerly the Cartographic Mapping Service.

## GEOGRAPHIC INFORMATION SYSTEMS AND SPATIAL ANALYTICS SERVICE BACKGROUND

This is a broad reaching service that is rapidly evolving due to the advancement of technology and tools available in generating mapping, geospatial information and analytics. The service stretches across all aspects of the City from legal documentation, to urban planning, capital projects, city operations, citizen services, emergency management, economic development, taxation, elections, public engagement and open data. The growth of data-driven decision-making and advanced analytics continues to expand into all facets of City business. This digital transformation is gaining speed and a strong enterprise GIS will be part of the foundation. The various groups of specialists across the city are providing services but everyone in the city (internal and external) can be considered a consumer or user of mapping and geospatial information.

### Three main functions of the service may be considered:

1. **Cartographic Mapping** - traditional mapping services providing the necessary information required for all functions across the city (data creation in parcel layers, mapping for visualization, and print material for communications).
2. **Geospatial Data Analytics** - acting as a system of insight, GIS data is used to generate analytics to support operational decision making and provide understanding on complex issues to drive strategic decisions and policies.
3. **Geospatial Information System (GIS) Strategic Planning and Platform Management** - management of the enterprise environment and its growth, including custodianship of spatial assets and the integration of GIS with operational systems (e.g. Computer Aided Dispatch systems).

Digital transformation continues to raise the benchmark for the deployment of technology to deal head-on with the demands of the modern organization. Capturing and using location as part of today's data assets is commonplace. The work to build, maintain, and grow the system that supports a modern enterprise environment is unending as technologies continue to push ahead. For example, in the past decade, major advancements to manage spatio-temporal large data has evolved from concept to a scalable environment adept at meeting the needs of analytics. 3D modeling has also evolved and together, these are poised to support Smart City initiatives to improve service delivery for health or emerging technologies like autonomous vehicles. For the City of Edmonton to be successful in its digital transformation, both keen and creative users of GIS in business and skilled industry experts will be required to bring location based decision making and place-relevant strategies to life.

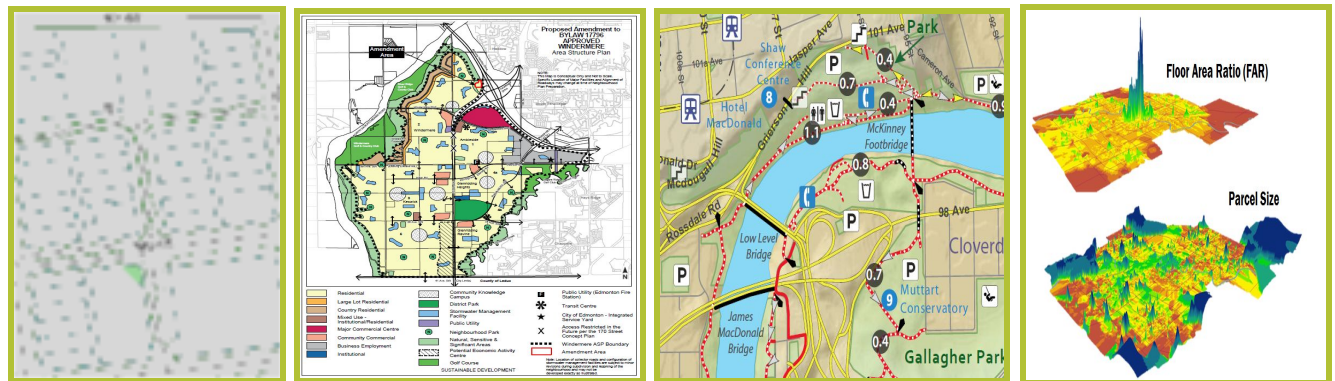
Governance and an end-to-end GIS platform can improve the effectiveness, efficiencies, and synergies of these users and service providers. Because the City has lacked data governance and has not invested in a GIS strategy, data varies greatly in quality, is siloed, or is difficult to find and retrieve - in short, there is little confidence in the data. Additionally as part of geospatial information



and analytics, leadership is required in setting best practice and enterprise standards to support the growing utilization and collection of data.

**Geospatial information is considered any data set to a location creating connections between assets, people, services and activities.**

### Sample of GIS Services:



## Current State of Service Delivery

The recipient of the service is potentially every person working in the corporation and all public citizens. Like the burgeoning analytics sector, this service generates no recovery revenue for the City; rather it provides a key internal and external information back-bone for operational systems and data driven decision making.

From an organizational perspective, the service delivery is provided by multiple departments and branches at the City. Currently a hybrid model of a hub and spoke system for the service delivery, with Open City and Technology as the main hub. The overall effectiveness and strength in using geospatial information is closely tied to the inherent business acumen required in understanding each area's core business and its service. As such the geospatial service is mostly an internal service supporting multiple business areas.

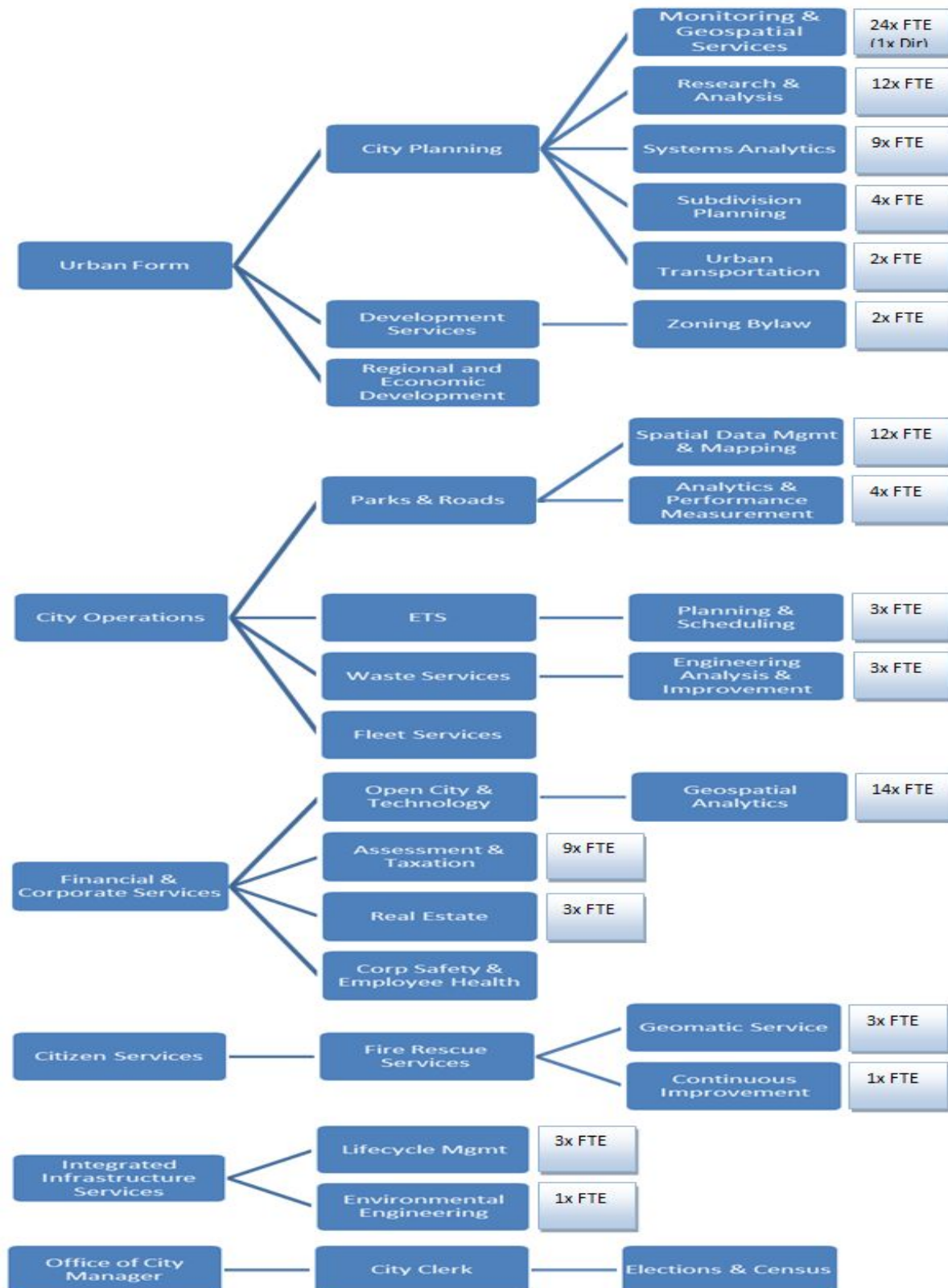
## Public Service Digest Geospatial Maturity Index (GMI) Results

The Public Sector Digest (PSD) recently launched the first ever Geospatial Maturity Index (GMI) ranking to benchmark Canadian municipalities. Benchmarking is based on responses to survey questions on three categories: Readiness, Implementation and Impact. Similar to the Open Cities Index (OCI), the benchmarking for municipalities drives discussion on best practices, strategies and challenges organizations face.

Edmonton ranked 75 out of the 146 organizations participating in the Geospatial Maturity Index (GMI). This is not a reflection of the positive work and services provided by the City on GIS services. Rather, the ranking is an indication that the overall service is evolving as technology advances and that traditional map making services (cartography) is not the primary service anymore. GIS data and technology now drive sophisticated analytics to enhance decision making, communications, transparency and increased efficiency in operations.

The city's ranking is a reflection of the ongoing transformation of the organization. It highlights the need for corporate level strategy, enterprise level best practices, data governance, and accessibility to the right tools to guide the evolution of the GIS services. The City of Calgary's #1 ranking is strongly based on the implementation of such corporate based strategies: a GIS Communications Plan aligned to its corporate strategy and dedicated PMs to guide GIS projects.

**Figure 1.0 - Organizational Teams Across Geospatial Related Services**



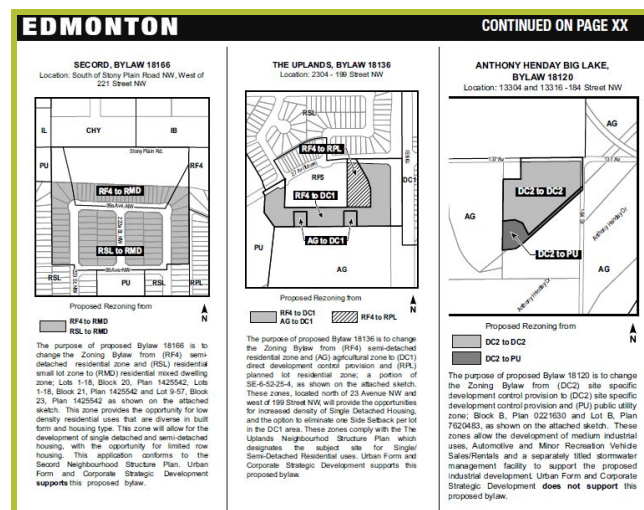
The current hybrid service delivery model - Hub and Spoke concept with major business partners as spokes to the core technology infrastructure from Open City and Technology.



### These geospatial service areas include:

**Urban Form** - As one of the largest contributors to geospatial information, the unique nature of land use and urban planning naturally embeds almost all activities to a spatial context. Within this group, understanding the connectivity of spatial data that contributes to each scenario of design is key. In June 2017, under the City Planning reorganization, GIS services were consolidated to bring specialists and technicians together to advance the delivery of the service to the department under the Urban Analysis section.

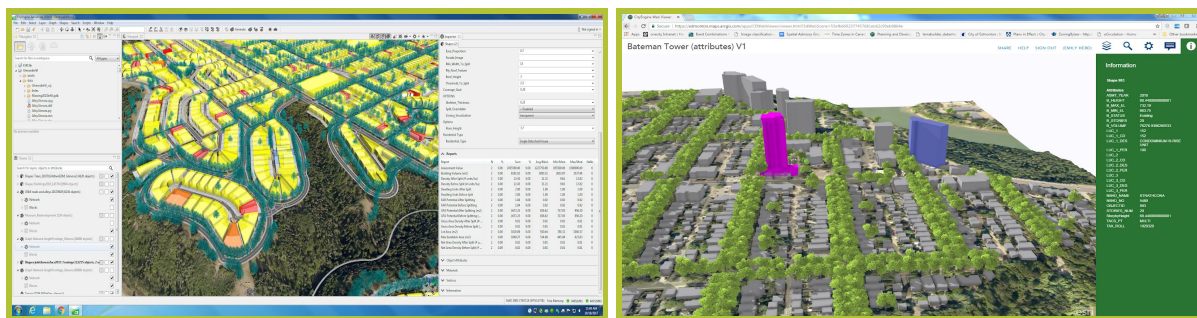
- Monitoring & Geospatial Services** - (24 FTE (1xDir) - critical services in data contribution on land development application (LDA) and GIS data support for all planning work. Work supports Land Development Application (LDA) process, subdivision, zoning, Area Structure Plans (ASP), Neighbourhood Structure Plans (NSP) maps, public consultation map products, plans in effect database, neighbourhood boundary, land use, zoning, elections and assessment parcels. This teams operates to support legal mapping work continuously as well as supporting all proposed land application work that makes the service unique in stretching real life and proposed development.
- Research & Analysis** - (12 FTE) - provides geospatial analytics for land use, planning, projections, modeling, 3D visualization, demographic spatial visualizations and strategic projects support. This group is expanding the smart analysis the city is doing on scenario



planning and understanding how changes in use, policy and development impacts the city eco-system for urban planning.

- **Systems Analytics** (9 FTE) - although not directly GIS services, the work on a large scale Regional Transit Model (RTM) utilizes geospatial information to produce a model to support transit development in both understanding current operations and future planning. The large scale modeling has potential to support other analytics in land use and transportation based planning and operations. These large scale transit model are built to support municipalities and regions for decades of future planning.
- **Subdivision Planning** (4 FTE) - title and addressing work to support subdivision development is a main contributor to the four major legal parcel geospatial data the City needs to maintain and update. Addressing supports all areas of the City as the city grows and addressing is created.

### Sample by Research & Analysis of modelling and visualization:



- **Urban Transportation** (2 FTE) - the walk edmonton project develops wayfinding signage and consistency in presenting the city walkability to citizens. This work focuses on access to information and ease of use for the public to support local citizens and tourists.
- **Zoning Bylaw (under Development Services)** (2 FTE) - specific evaluation on request for zoning changes work with geospatial services to determine impact and feasibility on request for zoning changes to existing developments. These requests are driven by the public and the city provides due diligence on determining the impact of each change.
- **Regional and Economic Development** - leverages geospatial services to analyze and develop visualization of economic development information for development work to stimulate economic activity in the city. An online Facilitation Tool for development and business attraction is also supported through a third party provider under EdmontonIndustrialLand.ca.

**City Operations** - integrated geospatial information is embedded in all aspects of City Operations and the support of the network of infrastructure across the city from roads, transportation, transit, parks and open spaces, trails and bike network, to waste services. The increased use of smart technology throughout city operations enhances the need and connectivity of operational data to geospatial information for more effective data driven decision making.

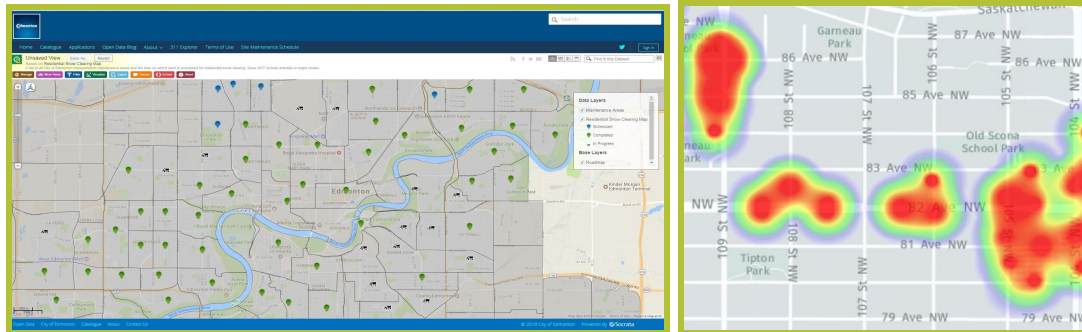
- **Parks and Roads (as part of Business Integration Section)**: in late 2017, the reorganization and merger of Parks and Transportation branch consolidated the major GIS specialists under the same branch to integrate the road network with open spaces operations.
  - **Spatial Data Management & Mapping** (12 FTE) - this combined group manages the critical data input and management on geospatial data for all roads, trails, bike network, parks and open spaces. Providing the legal geospatial information for the road network and parcel of land as the foundational layer of mapping. Also integrating geospatial data to support operations (such as open space maintenance operations). This core group also provides key support to cadastral mapping and



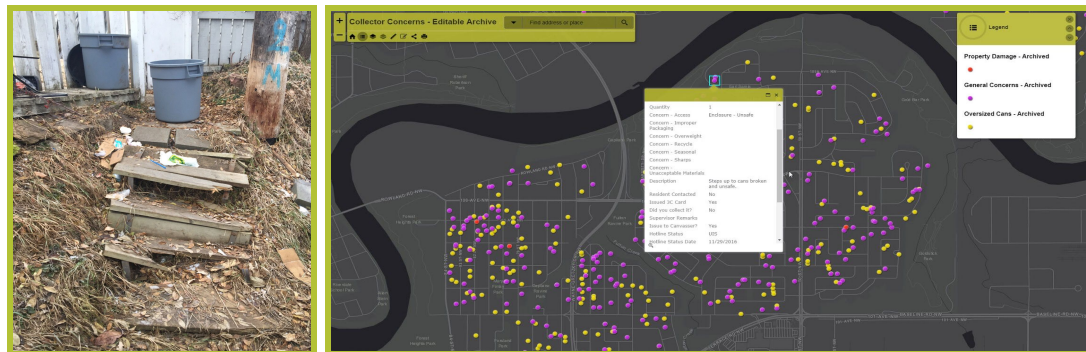
Program and Service Review: **GIS and Spatial Analytics Service Review**

road networks that support core parcel layers in the real world to proposed land development applications process.

- **Analytics & Performance Measurement (4 FTE)** - provides operational analytics support to support ongoing operations, traffic safety data (hotspot mapping) and special projects (such as snow removal de-icing solutions). This analytics support continues to increase in driving smart decision making, with more technology being imbedded in city operations, such as smart traffic lighting, understanding and interpreting data collected with increase the efficiency of operations.

**Sample by Parks and Roads Snow Clearing and Traffic Safety Heat Map:**

- **Planning & Scheduling (under Edmonton Transit Service (3 FTE))** - providing current route maps, integrating to online/mobile transit apps to share service information to the public and operational data analytics to improve operations.
- **Engineering Analysis & Improvement (under Waste Management Services (3 FTE))** - supporting dispatching, route optimization, operational data analysis and development of mobile web-based tools to advance real-time support to field staff in operations. Mobile services provide immediate sharing of information in the field, plan work schedules, provide live updates and reduces re-work at fixed terminals.
- **Fleet Services** - moving towards GPS technology in all fleet vehicles to enhance fleet performance and track operational/maintenance data to improve operations.

**Sample by Waste Services mobile mapping app to enhance field staff:**

**Citizen Services** - has limited capabilities in geospatial services currently, informally relying on support from Fire Rescue Services for general mapping and GIS services, but has potential to grow opportunities in the future.

- **Fire Rescue Services** - requires key integration of geospatial services to its operational effectiveness through its Computer Aided Dispatch system and service continuity support during technology disruptions.
  - **Geomatics Service** (under Emergency Systems (3 FTE)) - primary service in supporting geospatial data to update, ensure integration and successful operation of



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the Computer Aided Dispatch system. Providing up to date back-up systems in mapping during periods of technology disruption. Updating complex card products for critical building information required for fire emergencies. Secondary services to support requests for mapping products from rest of the Citizen Services department.

- **Continuous Improvement** (1 FTE) - conducting operational analytics on fire and emergency services related data such as incident reporting, response time and areas of coverage by stations.

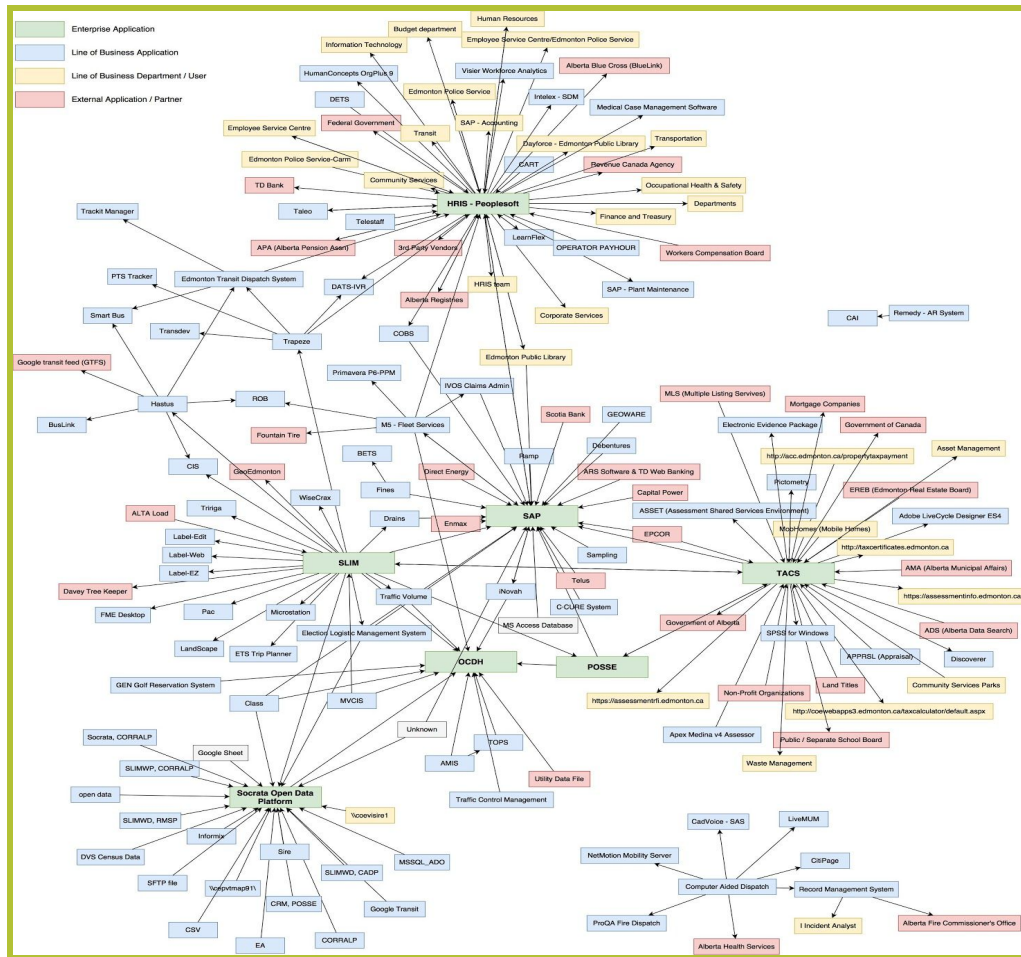
**Sample by Fire Rescue Services on fire prevention and dispatch:**

**Integrated Infrastructure Services** - has limited capabilities in geospatial services currently but has potential to grow opportunities in the future.

- **Lifecycle Management** (under Infrastructure Planning and Design (3 FTE)) - starting to potentially integrate lifecycle data to geospatial information for increased access to data, potential mobile products for support field staff work, link to visualization of data and set up potential for analysis of data for improved decision making.
- **Environmental Engineering** (under Business Planning & Support (1 FTE)) - uses geospatial data integration to connect environmental reports to mapping and database to increase accessibility of reports and provide potential analytics.

**Financial and Corporate Services**

- **Assessment and Taxation (9 FTE)** - provides legal parcel layer data for taxation, updates data, supports the operations and provide analysis of the branch services. Integrates with the city planning on parcel layer information.
- **Real Estate (3 FTE)** - provides the legal parcel layers for the City Corporate Holdings as a record of land holdings for the entire City. The potential for additional integration of geospatial information for all holdings to include building information from systems such as Tririga.
- **GeoSpatial Analytics** (under Open City and Technology (14 FTE)) - provides infrastructure support for applications, integration of GIS systems to other enterprise systems, database support services and infrastructure maintenance services. Below is a network map of existing enterprise systems that rely on geospatial data support:



- **Corporate Safety & Employee Health** - potential future use for aligning incident reporting to geospatial information for additional data analysis or info sharing.

#### Office of City Manager -

- **Elections and Census** (under City Clerk) - receives support on geospatial products and tools to support elections and census activity as required.

## Systems Thinking Approach

**Systems Thinking focuses on recognizing the complexity of interconnections between the parts of a system and synthesizing them into a unified view of the whole to reveal interdependencies.**

Since the service is so widespread and broadly reaching in stakeholders and users, considering the service in a systems thinking approach would provide an appropriate holistic

context. An appreciation for the relationship of each of the specialist teams providing their services and how they perform as cohesive interdependent teams should be considered. This also provides further understanding of how geospatial information and capabilities underpins subject matter experts that integrate operating data and their core business acumen to geospatial data.

Geospatial data without the sense of the corporate business objectives would yield analysis of only half the picture in each situation. An example would be land use planner's analysis and modeling focuses on optimal use of urban form and design, but we work collaboratively to apply knowledge on transit, transportation road network, tax implications and social programming through the same base geospatial data. Each unique lens through subject matter experts provides more in-depth and comprehensive analysis and information for data driven decision making.

One potential systems thinking view on the service is a cohesive service comprised of four interdependent layers of geospatial data, functions, use, and human capital.

### **The four layers can be considered by the following:**

1. **Core Parcel Layers of the City** - this is the four foundational mapping parcel layers that are legally maintained by the city and forms the base mapping for the city.
  - Cadastral Map (Parks and Roads)
  - Land Title and Addressing (Subdivisions)
  - Property Assessment (Assessment and Taxation)
  - City Corporate Land Holdings (Real Estate)

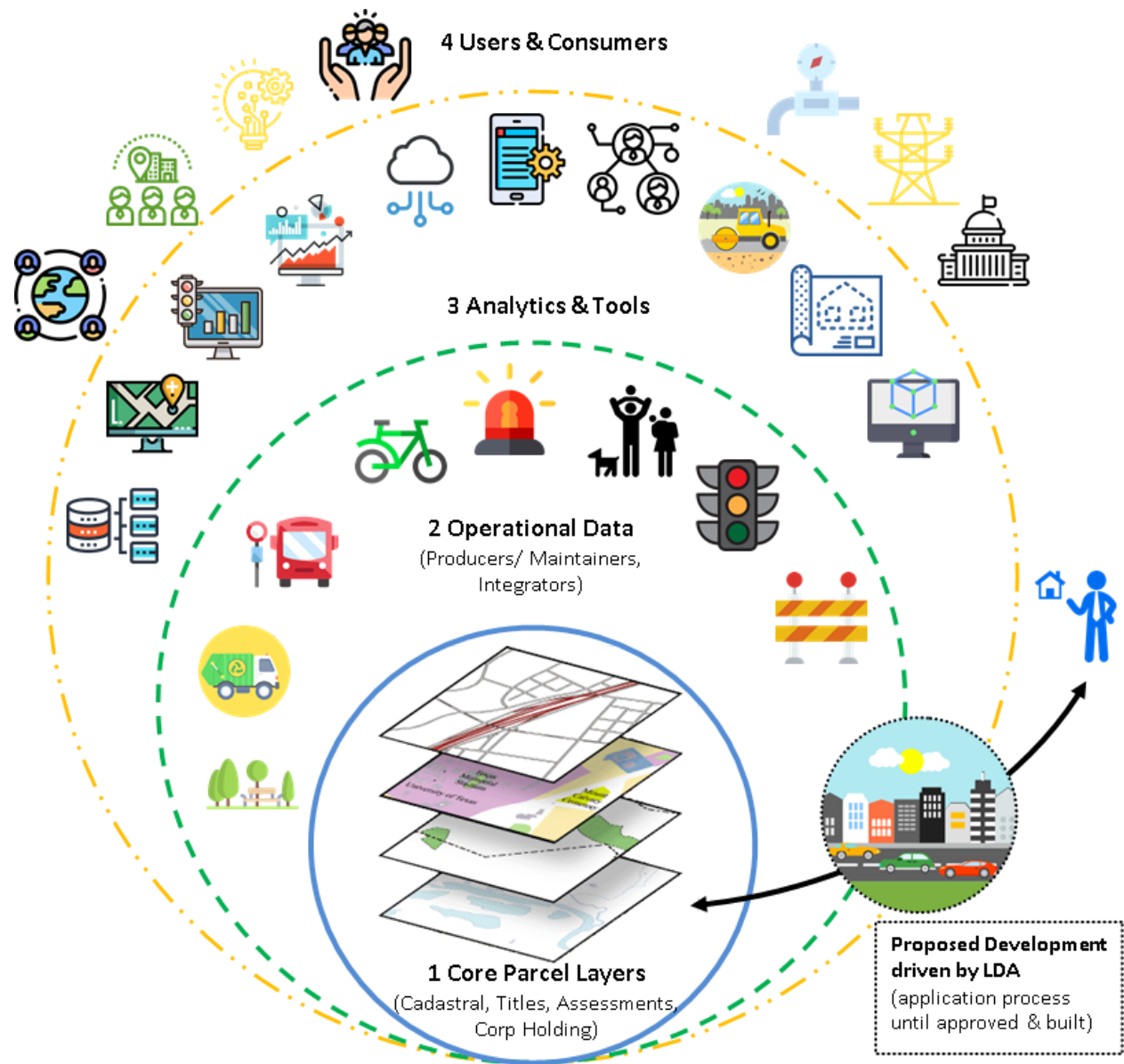
**\*Land Development Applications Process** - This is a unique process that intertwines with the core parcel layers and also drives updates to these layers. The LDA process is unique since it is driven by developers and businesses. It requires the same specialists to work in the proposed development world collaboratively generating data to support the city in assessing and approving each application. Once proposals become reality, the legal updates process commences.

*(Refer to Appendix A - Process mapping of Core Parcel Layers.)*

2. **Operational Data Producers/Maintainers/Integrators** - the teams that contribute to geospatial data, input operating data with geospatial data, integrate geospatial systems with other operating systems, and technical support teams.
3. **Analytics and Tools** - all teams that provide analysis with geospatial data and apply geospatial information to operational data analysis.
4. **Users/Consumers** - All internal and external users of geospatial information and data.



Figure 2.0



## Layer #1 - Core Parcel Layers of the City

The Core Parcel layer and Operational Data layer create the backbone and foundational data for the city's geospatial information. The Core Parcel layer requires the technical skills of a geospatial technician in creating parcel geometry and having the understanding of their specific areas of expertise.

## Layer #2 - Operational Data Producers/Maintainers/Integrators

While the Operational Data layer comprises of both technical geospatial experts and operational data experts, depending on the business area. The Operational Data layer is a growing area of service as technology is making the link to geospatial information for operational data has become more accessible and easier to integrate to other systems. This change in technology has increased the opportunity for operational specialists to learn how to integrate geospatial data. SLIM data warehouse update and maintenance is currently the hub for information connecting to other enterprise platforms.



## Layer #3 - Analytics and Tools

Similarly, the growth and advancement of the Analytics and Tools layer is increasing exponentially on the heels of increased technology, big data, 3D modeling, augmented reality, mobile and online platforms. This expansion provides this layer as the premier growth segment of the service; and with access to advancing software and enterprise platforms, more operational areas and businesses will be able to integrate geospatial data to its future analytics and decision making framework. Further advancement and benefits will be gained through the creation of mobile and online based tools and apps that can support live updates and instant communication of information for field staff. The city has already started developing these tools in Waste Management Services through the use of ArcGIS Online to enable Customer Support Centre and Social Marketing Canvassers to respond to citizen inquiries and to resolve safety issues for residential collections staff.

Based on Recommendation #6 from the Business Solution Service Review (August 2017), Open City and Technology has finalized an Enterprise Licensing Agreement (ELA) with the Government of Alberta to leverage purchasing power and gain access to ESRI ArcGIS products to support all of the City's geospatial needs. This will move the geospatial services into a software licensing rich environment where more users can gain access to tools required for geospatial data analysis.

#### Layer #4 - Users/Consumers

As the layers expand in service and capability, more users and consumers of geospatial-related data will gain exposure to new ideas and concepts through knowledge sharing internally and publicly via crowdsourcing of ideas that leverage open data. This trend will bring in current non-users in the city to become geospatial contributors as they are able to connect data and benefit from accessibility to the technology through an enterprise platform environment.






























Non-contributors are currently in Integrated Infrastructure Services and Citizen Services. Opportunity for leveraging geospatial data in lifecycle management (such as integration of building conditions to geospatial data or more accurate open space asset management for verification and maintenance) and social services (like connecting bylaw enforcement to social initiatives and neighbourhood capacity building) will provide benefit in analytics to enhancing those services.

As the system is organically building off each layer, reinforcing more data, creating new tools to support staff efficiency and effectiveness, it will also enhance visualization of data to communicate more effectively with the public to aid in explaining complex issues promoting transparency and accountability. But the growth of such a system can only thrive if the foundation and governance are strong. There is a need for a framework on structuring the spatial data, with common practices and protocols and governance of the data. If there is a lack of structure, then there will be no cohesion to the data collected and silos of data will form. With a lack of integration, these silos will reduce overall effectiveness of potential analytics leading to a lack of awareness of data and duplication of effort. A strong foundation will ensure data integrity, create ease of access, stimulate collaboration and spur innovation.

Given these four service layers, the following table shows the level of support to the corporation provided by each business area. This helps us understand where the current capability in each service layer area is organized within the city.



**Table 1.0 - Level of Support by Business Area for each Geospatial Service Layer**

|  |                                      |                                       | Core Parcel Layer  | Operational Data Producers/ Maintainers/ Integrators                                  | Analytics and Tools   | Users/ Consumers  |
|--|--------------------------------------|---------------------------------------|--|---|---|---|
|  Current Geospatial Specialists |                                      |                                       |  |   |   |   |
|  Partial & Early Stage          |                                      |                                       |  |   |   |   |
|  Potential Future               |                                      |                                       |  |   |   |   |
| Urban Form & Corporate Strategy  | City Planning                        | Monitoring & Geospatial Services      |    |   |   |   |
|  |                                      | Research & Analysis                   |  |    |   |   |
|  |                                      | *Systems Analytics                    |  |    |   |   |
|  |                                      | Subdivision Planning                  |     |   |   |   |
|  |                                      | *Urban Transportation                 |  |   |   |  |
|  | Development Services                 | *Zoning Bylaw                         |  |   |    |   |
|  | RED                                  | *Regional & Economic Development      |  |   |   |  |
| City Operations  | Parks & Roads                        | Spatial Data Management & Mapping     |    |   |   |   |
|  |                                      | Analytics & Performance Measurement   |  |    |   |   |
|  | Edmonton Transit Service             | Planning & Scheduling                 |  |    |   |   |
|  | Waste Management Services            | Engineering Analysis & Improvement    |  |    |   |   |
|  | Fleet & Facilities                   | *Fleet Services                       |  |   |    |   |
| Citizen Services   | Fire Rescue Service                  | Geomatic Service                      |  |  |   |   |
|  |                                      | Continuous Improvement                |  |  |   |   |
|  | Community Standards & Neighbourhoods | *Community Standards & Neighbourhoods |  |   |  |   |
|  | Social Development                   | *Social Development                   |  |   |  |   |
|  | Community Recreation & Facilities    | *Community Recreation and Facilities  |  |   |  |   |
| Integrated Infrastructure Services   | Infrastructure Planning & Design     | Lifecycle Management                  |  |   |  |   |
|  | Business Planning & Support          | Environmental Engineering             |  |   |  |   |
| Financial & Corporate Services   | Assessment & Taxation                | Assessment & Taxation                 |  |   |   |   |
|  | Real Estate                          | Real Estate (Corporate Holdings)      |   |   |   |   |
|  | Corporate Safety                     | *Corporate Safety                     |  |   |  |   |
|  | Open Data & Technology               | GeoSpatial Analytics                  |  |   |   |   |
| Office of City Manager   | City Clerk                           | *Elections & Census                   |  |  |   |   |
| Other levels of Government, Agencies & Partners  |                                      |                                       |  |  |   |   |
| Citizens & General Public  |                                      |                                       |  |   |  |   |

(\*) Indicates that there are some geospatial related work starting or with some support connections.

## SERVICE REVIEW METHODOLOGY AND FOCUS AREAS

The review process begins with scope definition (Appendix C) and preliminary analysis, followed by the creation of focus areas. The focus areas refine analysis within a service area to inform recommendations. Focus Areas were approved by service DCM Sponsor (April 2018) and received support and validation from the service owner.

### Focus areas for this review:

- Resource Allocations and Organizational Structure
- Levels of Capability Provided
- Data Governance

Results of the service review provided updates to the Service List description of the 1004 Cartographic Mapping Service to 1004 Geographic Information Systems & Spatial Analytics Service (Appendix B has the fully updated service description).

Recommendations are framed around the focus areas through the lenses of relevance, effectiveness and efficiency.

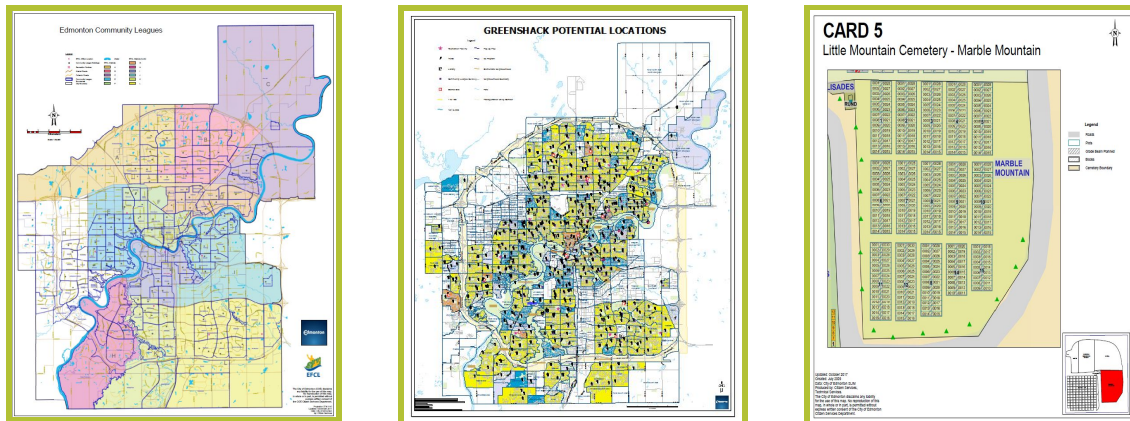
## ANALYSIS AND RECOMMENDATIONS

### Availability of Corporate Based Services

As the city evolves and improves as modern organization, realignment and re-organization across the city fosters an environment for collaboration, increased sharing of knowledge and alignment of work to create efficiency and enhance effectiveness. Strengthening the hybrid service delivery model will improve services while leveraging business partner expertise and expand services to current non-users.

Throughout each interview conducted with business areas, it was evident that each area dealt with a certain amount of ad hoc GIS support requests that were beyond the scope of their core business functions. The positive culture of collaboration at the city has resulted in work being completed through inter-departmental peer relationships, but such informal work has increased to the point where service and quality have suffered. Most of Citizen Services lacks any GIS resources and Fire Rescue Service takes on mapping requests from the entire department where they are able. Similarly, City Planning gets hundreds of requests from departments outside of UFCSD for support. Requests are handled as availability of capacity allows.

Significant changes occurring at the City, including Cultural Transformation, Data Governance, and Digital Transformation suggests that the Open City and Technology's GIS team expand its capacity to address the needs of staff in departments without any dedicated resources; principally Citizen Services and Integrated Infrastructure Services. In addition to the work the corporate GIS team undertakes to manage the data and GIS platform at the city, the group should act as advisors who fulfill requests for business and also engage business areas to raise competencies in working with GIS. A central point of contact for the enterprise and a mechanism for requesting geospatial services would reduce the redundancy of efforts and data silos that currently exist in the City.

**Sample by products provided to Citizen Services from Fire Rescue Services:**

A current gap in leadership for setting best practices and enterprise standards across the organization continues to limit the growth of the service. The ability to enable smarter data-driven decision making results in pockets of expertise or anachronistic practices that contribute to inconsistent levels of service across the organization.

In preparation for the implementation of ArcGIS, this expansion of business services would also provide a platform for the service to be marketed to the entire city by educating users of the potential benefits and possibilities in leveraging geospatial data within their operations. This would also create an equitable landscape for accessing and using geospatial technology across all departments without the resourcing of service teams for each department. Further benefits of engaging Open City and Technology with more users and clients will strengthen the technical experts' understanding of user requirements and business challenges that will bring all the stakeholder groups closer. This shared partnership will ensure that the governance and framework for managing the data will be more collaborative and cohesive. Additionally, this will enable Open City and Technology to be leaders in setting best practices and an enterprise standard for GIS information and data. Overall role clarity and strengthening of the service delivery model will strengthen the governance model for the service.

The following case studies provide some examples of the potential opportunities for such a consulting and analytics service from Open City and Technology GIS team.

**Case Study #1 - Field Deployment Common Operating Picture For Public Service Delivery**

A potential benefit is a common operating picture mapping system for personnel deployed in the field for various services. The development of this deployment data for all community service staff would better integrate and connect the city. One example would be the spatial overlay of deployed Bylaw Officers, Peace Officers, Neighbourhood Resource Coordinators, Social Workers, Development Officers, and Economic Development Officers along with special social projects and initiatives in the community so clear communications could be accessed and readily used to respond more effectively to citizens. An easy to reference digital mapping product that is easily kept up to date would facilitate greater integration of field staff and communications internally, improving response to public needs or de-escalating challenging situations. The ease of access to such deployment information would also enable departments such as Integrated Infrastructure Services to communicate and engage the public about when construction is happening within communities.

**Case Study #2 - Recreation and Programming Service Accessibility**

A potential benefit is increased data and analytics used in planning for recreation facilities and programming to communities. Coverage of basic-commitment services to residents could be mapped/integrated with accessibility and attendance data. This would help identify gaps in services provided to certain communities and demographics. Combined with socioeconomic data, this could



help inform Administration on the development of new programs, optimization of existing ones, or the need for refocusing on different communities. This type of visualization of services would also improve transparency by depicting the net benefits communities are receiving through recreation facilities and programming.

### **Case Study #3 - Integration of Lifecycle Management, Leasing and Property Data**

A potential benefit to city asset management could be achieved by connecting leased-building location, corporate-holdings location, and lifecycle management data for city assets. This would increase the sharing of knowledge for those managing the assets as well as users of each asset. Currently information is siloed and some systems do not provide visualization and mapping capability (such as Tririga for facility management). ESRI ArcGIS provides compatibility with Tririga to connect the database to mapping. An integrated system of accessing facility and property data would enhance the integration of Integrated Infrastructure Services Lifecycle Management with Financial and Corporate Services Real Estate and Citizen Services Housing and end users of each asset.

### **Case Study #4 - Visualizing Change in Housing and Zoning Impacting Affordability**

Potential example based on the work of Seattle Mandatory Housing Affordability proposals that leveraged the use of GIS and mapping to demonstrate a visualization of how changes in development zoning would impact Seattle across the entire city by ensuring new commercial and multifamily residential development contributes to affordable housing. The information and analysis were used to convey and evaluate where areas of mandatory housing affordability would be applied potentially and where the policy would not apply. This includes the impact on types of development and benefits to community, changes in each community impacted, alignment of info on specific requirements by parcel for sharing information and public access. Setting a holistic broad-based approach to analysis, policy development and transparency in public engagement on conveying changes to impact social issues.

## **RECOMMENDATION 1**

As part of strengthening the hybrid service-delivery model, formalize the responsibilities of the central role of Open City and Technology and the major partner satellite roles of the business areas. The role clarity on service delivery and support will provide a strengthened governance model for the service.

### **Role clarity for service delivery:**

- The central function of Open City and Technology to include:
  - Geospatial solution consulting and strategic leadership;
  - Enterprise GIS implementation, administration, and system integration;
  - Management of public and external-partner facing digital mapping solutions
  - Geospatial data acquisition, custodianship, and provisioning; and
  - Location-intelligence and geospatial-analytics as a service for business units without dedicated GIS analysts.

- The satellite function of those major business partners with dedicated GIS Analysts to include:
  - Usage of GIS data, software, and tools to perform business tasks, collect data, develop insights, and support business processes;
  - Business-specific location-intelligence and geospatial-analytics; and
  - Stewardship and maintenance of business-specific geospatial data.

Additionally, conduct a third-party in-depth review of GIS functions across the City, to identify further synergies and refinements to strengthen the hybrid service delivery model.

### Impact

A re-alignment of skills required to provide client-based business services in the Open City and Technology Spatial team.

- Provide services to all non-users especially those departments that do not have GIS staff and reduce non-sustainable growth of distributed staff.
- Reduce informal requests to specialized teams (Urban Form and City Operations).
- OCT to be lead on a collaborative governance model for services.
- Enhance partnerships and collaborations between Open City and Technology and business units.
- Create more opportunity for learning and development among non-technical users.
- Create opportunities for more Open Data to the public.
- Enhanced uptake of the new ESRI product.
- Drive modernized data and information sharing capabilities.

Relevance

Effectiveness

Efficiency

## Levels of Capability Provided

The trend of the Analytics and Tools layer continuing to grow is already occurring across the city as every department is striving to work smarter and leverage data and technology. Within the geospatial services a clear disparity exists in analytics due to the primary reason of lack of access to the right enterprise software solutions. Open City and Technology has signed the Enterprise Licensing Agreement (ELA) with the Government of Alberta for ESRI ArcGIS. This discrepancy was evident throughout this review based on work product, demos and tools shown to the project team. Soon, the city will move into a licensing rich environment and access to the appropriate tools will be provided to all potential users.

Obtaining the ArcGIS platform does not guarantee a successful implementation of ArcGIS. Critical supporting services must be in place for all users as this enterprise solution is implemented. The most important factors to consider are training and access to supporting technology tools. A comprehensive training plan for all levels of the platform must be available and in place to support each user on implementation. Since ArcGIS offers multiple levels of sophistication for its users, Open City and Technology must be prepared to lead and support training at all levels of the platform to engage existing specialists in their transition to the new platform while educating the possibilities to new users across the city. The training must be formal and practical to support the transition to the new platform. Consolidation of teams performing core mapping and core data maintenance within Open City and Technology will support this transition as they can support their peers in learning the new platform. The expansion of consulting services within Open City and Technology will also reinforce the training and expansion of the service to non-users.

In addition to training and development, Open City and Technology must also ensure access to appropriate supporting software tools (such as FME) are provided to complement the utilization of ArcGIS. FME is a critical software integrator that is currently in use by many analytics teams when they require the collection and integration among multiple database platforms across the city (such as linking POSSE data to SAP data then to geospatial data). During the duration of this review, lack of FME license availability (shortage) for analytics users averaged four times a month; where users are requesting access amongst each other.

During implementation of the new product prior to a fully formed system, tools such as FME are necessary to ensure that the full capability can be achieved with ArcGIS. If these supporting tools are scarce then the transition to a new platform for technical specialists will stall due to perceived lack of capability, complexity and perception of additional work required for transition.



| RECOMMENDATION 2  |               |            |
|---|---------------|------------|
| Open City and Technology to provide leadership on GIS technical training, process improvement, GIS data literacy, and competency development for GIS users of various levels of sophistication.   |               |            |
| Impact  |               |            |
| <ul style="list-style-type: none"> <li>• To support the successful access to the new ESRI products to the city.</li> <li>• Support access to new ESRI product for users.</li> <li>• Support developing appropriate user levels for ESRI product.</li> <li>• To leverage existing users of ESRI to support peer development.</li> <li>• Maximize full potential of ESRI with access to supporting software for analytics.</li> <li>• Support marketing and education of non-users to the platform capabilities.</li> </ul> |               |            |
| Relevance   | Effectiveness | Efficiency |

## Data Governance

Throughout the service review it was clear that stronger data governance is essential to the future growth of the service. As discussed previously, the system reliance in each layer of the service will only be as effective as the governance and framework for the geospatial data. Clarity on data standards, stewardship of data, custodians of data, source of data, coordinated efforts on feature classes, standardization of metadata and leveraging the new Business Analytics Catalogue for spatial data are foundational to the effective growth of the service.

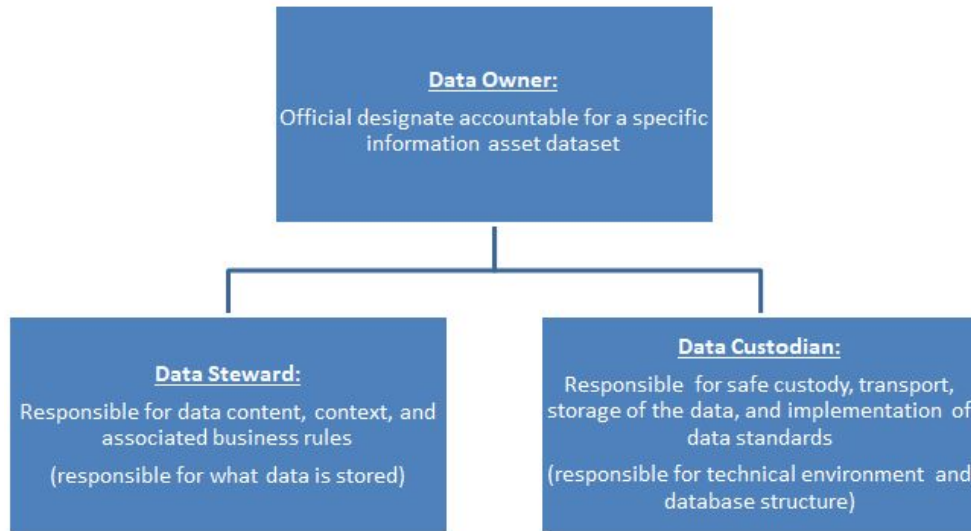
The city has already evolved greatly over the past decade with expansion into advanced analytics and open data. The elevation of every service is based on ensuring we are working smarter through data driven decision making processes. For this service in particular, that means having accurate, consistent, current, and comprehensive data. A complete and robust data governance model should seek to fulfill those four categories so that all users can be confident in the overall integrity of the city's geospatial data.

As Open City and Technology prepares for the implementation of ArcGIS, there is an opportunity and obligation to ensure that a plan is in place to address the following:

- data warehouses are reviewed and rationalized,
- connectivity to existing systems,
- maintenance of historic data,
- new standards are created for data management,
- rationalization of existing data is reviewed,

Program and Service Review: **GIS and Spatial Analytics Service Review**

- processes for input of new data are clear,
- establishment of metadata standards, and
- integration of data into the Business Analytics Catalogue are achieved.



Open City and Technology is already busy working on all these issues to ensure that risk in disruption of services is mitigated while transitioning users to the new platform expediently.

The Open City and Technology GIS team should be the recognized Data Custodian for all GIS related data, managed at the enterprise level to support the forward development of the service and data for the city. Managing as the data custodian at the enterprise level will ensure that data is consistent, accessible and maintain a source of truth for all users across the city for both internal operating data and purchased data. Maintaining an enterprise-level data custodian role will be more effective at managing acquired, internally-generated, and crowd-sourced data to benefit all user groups.

The success of a strong data governance model can only be built on a foundation of mutual respect for the expertise each business unit brings to the collective table and a shared responsibility in building this service for the future. As a system that is intimately dependent on each layer, the data governance foundation needs to be accepted and followed by all users as stakeholders.

| <b>RECOMMENDATION 3</b>   |                      |                   |
|---|----------------------|-------------------|
| Open City and Technology to act as the Corporate Data Custodian to lead best practices and set enterprise standards in the development of a data governance model, while implementing a framework for a steward-custodian model of spatial data management.   |                      |                   |
| <b>Impact</b>   |                      |                   |
| <p>Provide clarity on a consistent framework for geospatial data to support the successful transition of a new enterprise platform.</p> <ul style="list-style-type: none"> <li>• Provide accurate data as source of truth.</li> <li>• Provide integration of data for ease of use across multiple platforms and users.</li> <li>• Provide data that is shareable with external partners and collaborators.</li> </ul> |                      |                   |
| <b>Relevance</b>  | <b>Effectiveness</b> | <b>Efficiency</b> |

### What Works Cities

Notable findings and next steps emerged from the City's recent engagement with Bloomberg Philanthropies' What Works Cities program that corroborate the points made in section 4.3 Data Governance. Those findings are referenced and placed into context here for GIS.

Below, the table is an excerpt taken from the Transition Plan report.

**Table 2.0**



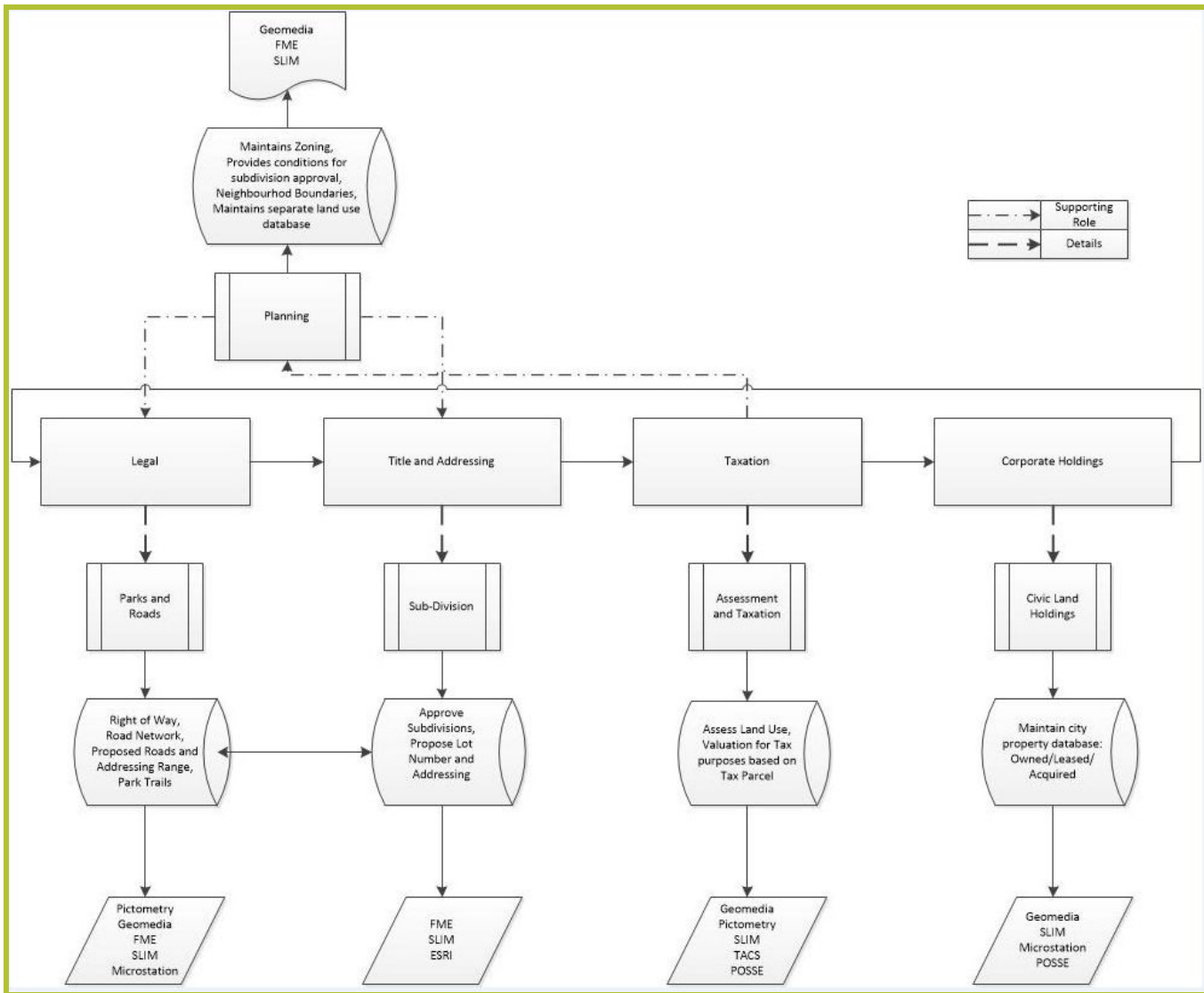
The most significant factors that hold our organization back from using data and analytics to drive more day-to-day decisions resonate well with the state of GIS data in the City. The practices, processes, and disparate groups working on data maintenance have definitely contributed to these factors. Each business group has worked to achieve their own mandate with loose and informal overall purpose. Data is shared ineffectively between groups working on related processes. As a result, when related data is brought together, there are often serious inconsistencies. As examples of this, consider that land use bylaw zones are not aligned to parcel boundaries, or alternatively, that street addresses are conceptually complete but impractical for first responders.

A best practice cited in the What Works Cities report is that there be a “data leadership team and resources”. A governance framework is under creation and that framework will address some of the data quality and accountability issues. However, to address some data issues, there are cases where realignment of groups maintaining foundational GIS data assets would improve enterprise data in an integrated way (e.g. parcels, addresses, streets).



## APPENDIX

### APPENDIX A - PROCESS MAPPING OF CORE PARCEL LAYERS



**Detailed process map connecting work required for building core parcel layers:**

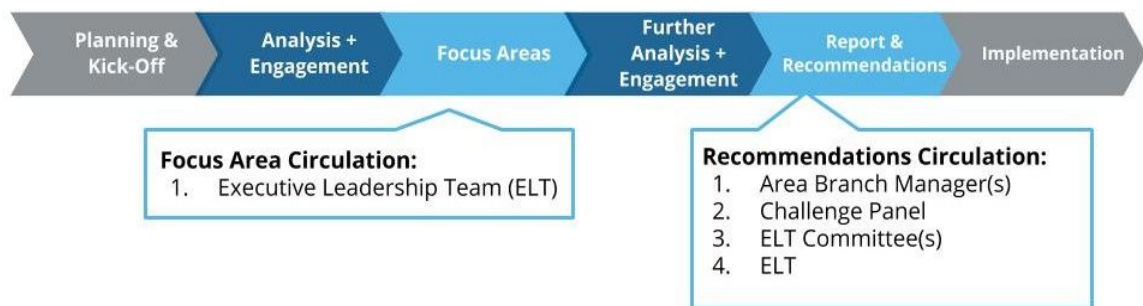
**APPENDIX B - UPDATE SERVICE LIST DEFINITION****Table 3.0 - 1004 Geographic Information Systems & Spatial Analytics Service**

|                                   |  |
|-----------------------------------|--|
| <b>Service Name</b>               | Geographic Information Systems & Spatial Analytics Service   |
| <b>Service ID</b>                 | 1004   |
| <b>Public/ Internal</b>           | Internal   |
| <b>Service Description</b>        | An internal (provider) service providing mapping and geographic information services to the Corporation  |
| <b>Program Category</b>           | Information Management   |
| <b>Service output</b>             | Maps, GIS Data Management, Analytics and Derivative Products and Services  |
| <b>Service Output Type</b>        | Provide Rules  |
| <b>Target Group</b>               | Corporation (department)   |
| <b>Target Group Service Value</b> | Quality geographical information about CoE   |
| <b>Sub Services</b>               | <ol style="list-style-type: none"> <li>(1) Addressing and Street Naming - A public service provided to property owners, residents and occupants offering clear identification of a property by a property address fronting on a public highway.</li> <li>(2) Emergency Response Mapping - An internal (provider) service provided to Fire Rescue offering emergency response mapping</li> <li>(3) Spatial Analysis - A public and/or provider (internal) service provided to people interested in cartographic maps and / or spatial analysis / data visualization by offering technical support and experience (including 3D modeling, photo imagery and LIDAR technology).</li> <li>(4) Application of spatial information - advice/ recommendations/ professional expertise on how to apply</li> <li>(5) Transportation and Drainage analysis</li> <li>(6) Spatial asset management</li> <li>(7) Spatial asset governance</li> <li>(8) Spatial resource acquisition</li> <li>(9) Staff enablement with GIS tools</li> </ol> |
| <b>Supporting area(s)</b>         | <ul style="list-style-type: none"> <li>• Open City and Technology</li> <li>• City Planning</li> <li>• City Operations</li> <li>• Fire Rescue Services</li> <li>• Integrated Infrastructure Services</li> </ul>   |
| <b>Alias Service Name(s)</b>      | Geographic Information Systems, GIS, Mapping   |

## APPENDIX C - OVERVIEW OF THE PROGRAM AND SERVICE REVIEW

The purpose of the Program and Service Review is to evaluate if the services the City provides are helping Council reach its strategic goals and whether those services are still a priority for citizens. The recommended three-year review, approved by Council, will evaluate the relevance, effectiveness and efficiency of our programs and services as well as determine how we can improve services that matter to Edmontonians and provide the best value for their tax dollars. The review process, as shown in Figure 1, begins with a High Level Review. A Challenge Panel, consisting of community, industry and peer subject matter experts, provide focus to the analysis then challenge the recommendations and provide guidance on whether an In-depth Analysis is necessary.

**Figure 3.0: Service Review - Review Process**



## REVIEW PROCESS

The review included the following engagement and analysis to determine the current state of the service, and evaluate the relevance, effectiveness and efficiency of the service:

### Engagement

- Interviewed all stakeholders of the services from management, supervisors and front-line staff employees.
- Attendance at Spatial User Group and FME User Group monthly meetings to answer questions and listen to users discuss projects, solutions to issues, collaboration and challenges.

### Analysis

- Conducted Strategic and Business Plan review for applicable operations.
  - Over a dozen planning documents from OCT Spatial Review and Spatial Improvement Project documentation.
  - Review of draft Business Technology Strategy.
  - Review of work, reports, products and demos produced by stakeholder groups
  - Breathe Strategy
- Interviewing management staff and front-line staff.
- Conducted benchmarking against other municipalities.

## DISCOVERY AND FINDINGS

The review identified the following service trends, key process improvements and cost drivers for consideration in the development of recommendations.

### Service Trends

- Geospatial analytics with integration to operational analytics is a growing slice of the service demanded throughout all city departments. The more data we are able to integrate to geospatial information, the more the city can analyze and leverage for data driven decision making.
- Increased use of geospatial visualization tools and products to support public engagement, share information more broadly and convey decisions through more accessible visualization of scenarios and impact.
- Increased open data and accessibility to operational data to geospatial information for the general public.



Program and Service Review: **GIS and Spatial Analytics Service Review**

- Increased ability for analytics of operational data combined with geospatial information; more big data analytics.
- More integration of online and mobile web based tools and products to provide real-time sharing of information.
- Increased optimization of people, equipment and assets to improve operations through geospatial tools and data.

**Key Processes**

- Process for updating four core legal parcel data and geometry for base city map.
- Multiple processes for integrating various geospatial work with operational units throughout the city departments (required for each area of specialization, example land use planning is different than city operations).
- Inconsistent framework for governing data creation, metadata information, and accessibility of existing data.

**Cost Drivers**

- Personnel (regular FTEs staff).
- Information Technology asset management.