Strathcona County

Emergency Services

Alberta

Standards of Cover

2013

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Introduction

The following report serves as the Strathcona County "Integrated Risk Management Plan: Standards of Cover" document. The Center for Fire Accreditation International (CFAI) defines the process, known as "deployment analysis," as written procedures which determine the distribution and concentration of fixed and mobile resources of an organization. The purpose for completing such a document is to assist the agency in ensuring a safe and effective response force for fire suppression, emergency medical services, and specialty response situation in addition to homeland security issues.

The creating an Integrated Risk Management Plan: Standards of Cover requires that a number of areas be researched, studied and evaluated. The following report will begin with an overview of both the community and the agency. Following this overview, the agency will discuss areas such as risk assessment, critical task analysis, agency service level objectives, and distribution and concentration measures. The agency will provide documentation of reliability studies and historical performance through charts and graphs. The report will conclude with policy recommendations.

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Executive Summary

Should include:

- ✓ Risk definitions
- ✓ Level of service definitions
- ✓ Performance goals, objectives, and measures
- ✓ Compliance methodology
- ✓ Conclusions and recommendations

Component A – Description of Community Served

Organization Overview

SCES is a standing department within the general government of Strathcona County. The primary mission of the department has been and will continue to be fire protection for the citizens and properties located within Strathcona County; but as the field has evolved, so have the ancillary missions of SCES. Today, the department is the sole provider of specialized rescue services within Strathcona County and is currently serving as a regional dispatch center responsible for over 86,000 dispatches throughout the capital region last calendar year. In 2009, the responsibility and oversight of emergency medical services (EMS) was assumed by the Province of Alberta and SCES serves as a contract provider to the Province.

SCES provides fire, rescue, and EMS services from six permanent stations, only four of which are staffed on a continuous basis. Stations located within the more densely populated areas are staffed while those stations in the more remote areas are utilized by on-call personnel on an as-needed basis. SCES uses a total of 30 primary response apparatus (including reserves).

Governance and Lines of Authority

SCES is a standing department within the organizational government of Strathcona County. As such, the fire chief and department director report to the Associate Commissioner of Community Services. The department's primary functions and authority to operate are outlined within county by-law. The fire chief is as an appointed official serving at the pleasure of the chief commissioner and county council.

The department is segregated into clear divisions that are tasked with specific duties and responsibilities including:

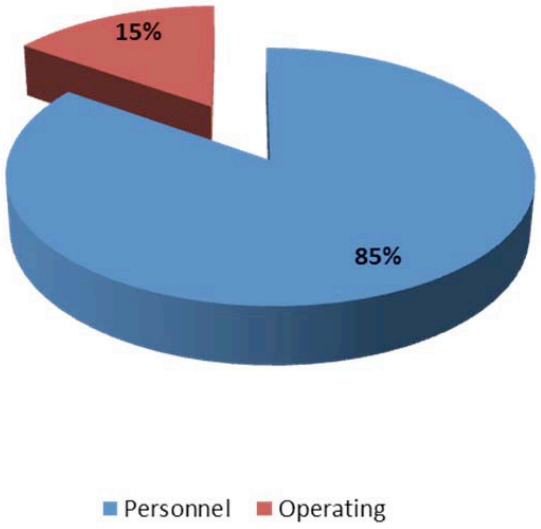
- Community Safety and Emergency Communications – Managed by a deputy chief
- Operations – Managed by a deputy chief
- Human Resources and Logistics – Managed by a deputy chief
- Business Operations – Managed by an assistant chief
- Emergency Management – Managed by an assistant chief

Each division head reports to the fire chief as the direct supervisor. In regard to field operations, the department staffs four platoon chiefs that oversee the day-to-day operations and supervise each of the department's four shifts. These personnel report to the deputy chief of operations as their direct supervisor.

Organizational Finance

As a standing department within the Strathcona County government SCES's funding is received through the county's general fund. The SCES budget operates on a one-year cycle from January 1 to December 31. The current fiscal year department budget totals $24,860,710 and is not segregated into operating divisions as is the department. Beginning with the 2012 fiscal year, each operating division will have its own budget from which to operate. As is true with most career fire departments across North America, a majority of the SCES budget is dedicated to personnel as illustrated in the following figure.

Figure 1: Total Fire Protection Budget Distribution
Based on 2012 numbers



Although the department's total budget totals $24,860,710, not all of the budget is derived from property taxes. In fact, a significant portion of the overall budget ($8,463,369 for 2011) comes from user service fees and contracts with the Province or private industry as illustrated in the figure below.

Figure 2: Service Fee and Contract Distribution

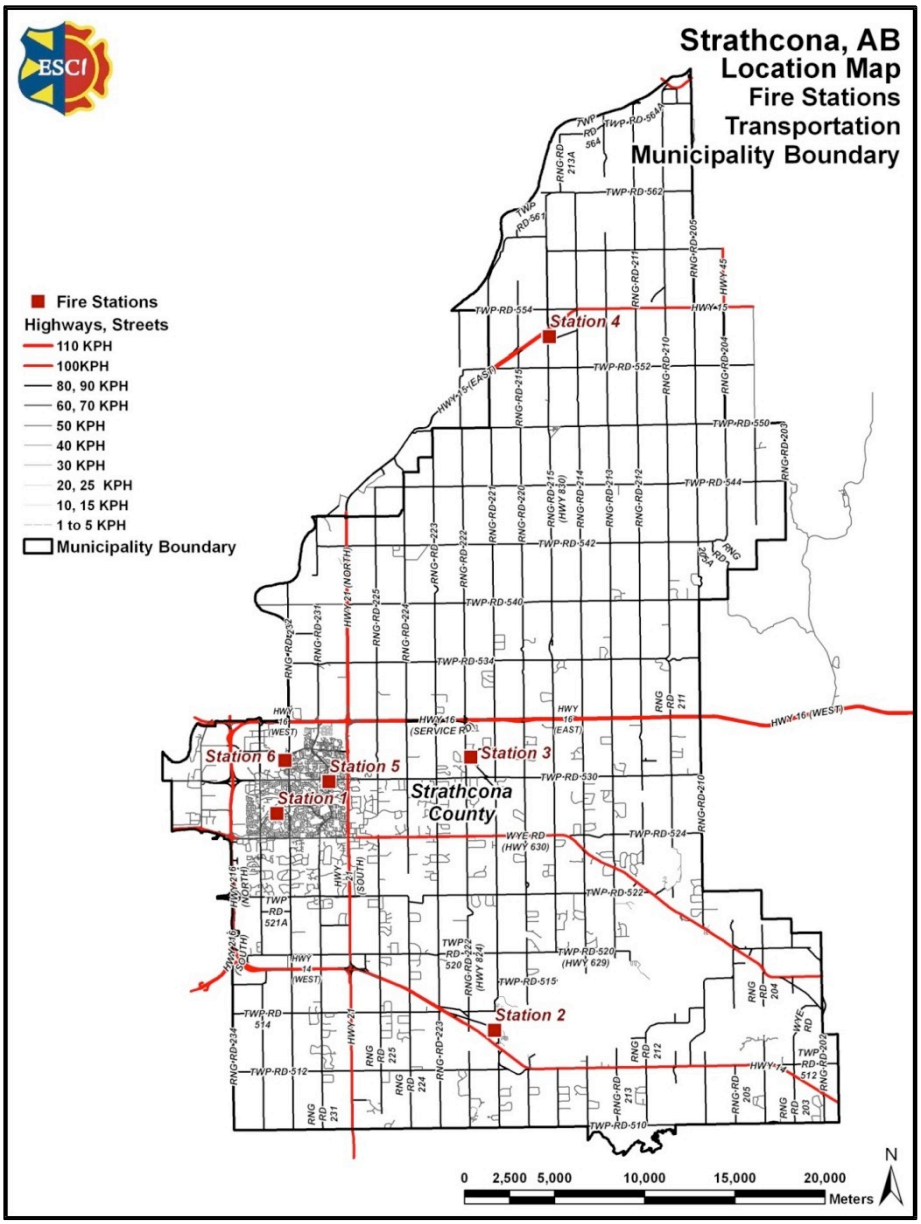
Revenue Source	Total	Percent of Total
User Fees	$2,865,309	11.5
Contracts	$5,597,830	22.5
Property Taxes	$16,381,588	65.9

As of the current fiscal year, SCES does not hold any debt.

Service Area Overview

Strathcona County, Alberta, is a specialized municipality located in central Alberta to the east of the City of Edmonton. Strathcona County Emergency Services provides fire protection, rescue, hazardous materials, and emergency medical response services to the entirety of Strathcona County and is part of the provincial EMS system that can be utilized anywhere throughout the province but is primarily used within Strathcona County and the City of Edmonton. The following figure illustrates the primary service area of SCES, which is comprised of approximately 1,265 $km^{2.}$

Figure 3: Service Area Overview (note: Station 6 opened 2013)



As of the 2011 federal census, the population of the county was 92,490, making it the third largest municipality in Alberta behind Calgary and Edmonton and the 55th largest municipality in Canada.[1] The 2006 federal census estimated total population at 82,511. For the purposes of this report, the municipal census numbers will be utilized for all comparisons and projections.

1 Statistics Canada. 2012. Strathcona County, Alberta (Code 4811052) and Division No. 11, Alberta (Code 4811) (table). Census Profile. 2011 Census. Statistics Canada Catalogue no. 98-316-XWE. Ottawa. Released February 8, 2012. http://www12.statcan.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E (accessed March 8, 2012).

Component B – Review of Services Provided

Services Provided

The department provides a variety of services, including fire suppression, emergency medical services (EMS, including transport), vehicle extrication, medium (operations) levels technical rescue and dangerous goods incident response, fire code enforcement, fire investigation, dispatch services, and public education. For technician-level response to incidents involving dangerous goods, the department calls upon either Edmonton Fire Department's response team or a private contractor.

The following chart provides basic information on each of the department's core services, its general resource capability for that service, and information regarding staff resources for that service. Additional detail on service capabilities will also be provided throughout this document.

Figure 4: Summary of Services Provided

Service	General Resource/Asset Capability	Basic Staffing Capability
Fire Suppression	6 engines 2 aerial apparatus 2 heavy rescue 6 tankers/tenders 5 brush units 1 specialty vehicles Additional mutual aid engines, aerials, and support units available	154 suppression-trained operations personnel 50 paid-on-call personnel Additional mutual aid firefighters available
Emergency Medical Services	8 ambulances – ALS equipped 4 engines – ALS plus equipped 2 rescue – BLS plus equipped 1 specialty vehicle – ALS equipped	56 certified paramedics 98 certified emergency medical technicians
Vehicle Extrication	4 engines equipped with hydraulic rescue tools, hand tools, stabilization cribbing 2 rescue equipped with air bags, cutting torch, combination cutter-spreader hydraulic rescue tool, hand tools, stabilization cribbing	
RIT		All staff trained at RIT and self-rescue

Assets and Resources

Facility Information

SCES has six fire stations. The newest was built in 2012 and opened in 2013 and is a modern and well-designed fire facility. Station 1 was built in 1974 and, until the opening of the new Station 6, served as the department's main fire station and administrative headquarters. Stations 2 and 3, built in 1980 and 1976 respectively, are smaller station and serve as paid-on-call stations, which are not routinely staffed. Stations 4 and 5, built in 2001 and 1991 respectively, are career fire stations that are adequate for their current uses. A seventh station (Station 7) is currently contained within the department's long-range plan and is schedule for budget approval in 2015 and construction possibly in 2017. Whether or not this station is actually constructed remains to be seen.

While different fire departments may have different facility requirements, there are basic needs each fire station has to address—quick response time and housing of apparatus and equipment. Everything else depends on a particular department's budget and needs. Fire station designs are unlike any other type of project; many subtle elements and specialized systems go into a fire station.

Inadequate facilities for housing firefighters and apparatus detract from a department's mission. Limited space can significantly impact the available options for resource assignment, hinder the ability to maintain a well-trained and fit workforce, and may affect member and employee morale.

The primary functions that take place within the fire station environment should be closely examined and adequate, efficient space for all functions should be provided. Some examples include:

- Housing and cleaning of apparatus and equipment
- Administrative office duties where necessary
- Firefighter training
- Firefighter fitness
- Residential living that is gender compatible for on-duty career and/or PIP members
- Operations that include enough room for community groups and parking

While this list may seem elementary, the lack of dedicated space compromises the ability of the facility to support these functions, and can detract from its primary purpose. The following evaluation and

general condition assessment was conducted at the department's facilities. However, it should be noted that this review was not a full facilities assessment as would be conducted by an engineer or architect. Such a study would be far more detailed than an evaluation conducted for this document. This focus is on operational conditions, efficiency, safety, and staff and apparatus space needs.

The following inventory and general condition assessment was conducted on the department's apparatus.

	Station 1
Facility used for	Active response station
Address of Facility	1933 Sherwood Drive
Year Facility Initially Constructed	1974
Number of Major Additions or Renovations	Renovation underway in 2015
Building Square Feet	18,729
Drive-through capable used with stacked parking	4

	Station 2
Facility used for	Active response station
Address of Facility	22142 South Cooking Lake Road
Year Facility Initially Constructed	1980
Building Square Feet	3,993
Back-in single unit	4

	Station 3
Facility used for:	Active response station
Address of Facility	6 Main Street, Ardrossan
Year Facility Initially Constructed	1976
Number of Major Additions or Renovations	0
Building Square Feet	2,982
Apparatus Bays:	
Back-in single unit	3

	Station 4
Facility used for	Active response station Training or drill facility
Address of Facility	55305 Range Road 214
Year Facility Initially Constructed	2001
Number of Major Additions or Renovations	0
Building Square Feet	23,000
Drive-through capable used with stacked parking	4

	Station 5
Facility used for	Active response station
Address of Facility	2099 Clover Bar Road
Year Facility Initially Constructed	1991
Number of Major Additions or Renovations	1
Year of Major Addition/Renovation	2010
Building Square Feet	6,469 – Additional 3,303 added in 2010
Back-in single unit	1
Drive-through capable used with stacked parking	2

	Station 6
Facility used for	Active response station Administrative offices (HQ station) Training or drill facility
Address of Facility	915 Bison Way
Year Facility Initially Constructed	2012
Building Square Feet	63,625
Drive-through capable used with stacked parking	4

Apparatus Information

In totality, SCES maintains a fleet of six engines, six tanker/tenders, two aerial trucks, eight ambulances, five brush units and two other specialty vehicles. [2] Most of the current emergency vehicles fall within what is considered to be an acceptable life span, with an average age calculated at 10.3 years. The following figures summarize fire and emergency response apparatus that was in service at the time of data collection. A summary of apparatus is provided in the following figure.

[2] Accurate as of time of data collection. Since that time, SCES has put new vehicles into service and retired others. The SCES fleet is dynamic and changes frequently.

Figure 5: Apparatus Summary

Unit	Location
Squad 1	Station 1
Engine 2	Station 2
Engine 3	Station 3
Squad 4	Station 4
Squad 5	Station 5
Squad 6	Station 6
Tower 1	Station 1
Tower 6	Station 6
Rescue 1	Station 1
Rescue 6	Station 6
Tanker 1	Station 1
Tanker 2	Station 2
Tanker 3	Station 3
Tanker 4	Station 4
Tanker 5	Station 5
Tanker 6	Station 6
Special Ops	Station 6
Ambulance 2125	
Ambulance 2163	
Ambulance 2164	
Ambulance 2165	
Ambulance 2209	
Ambulance 2210	
Ambulance 2282	
Ambulance 2283	
Brush 1	Station 1
Brush 2	Station 2
Brush 3	Station 3
Brush 4	Station 4
Brush 6	Station 6
Ranger side-by-side (ATV)	Station 4
Airboat	Station 6

Staffing Information

Fire and EMS (emergency medical services) organizations must provide adequate staffing in three key areas: Emergency services, Administration, and Support. ESCI surveyed SCES to assure that a reasonable balance between the three areas is maintained, given the realities of available local resources.

Although Canada does not have Occupational and Safety rules and regulations that specifically address firefighter workplace safety and an equivalent to the two-in, two-out rule considered to be the an international standard, the Province of Alberta Occupational Health and Safety (OH&S) Code does contain information related to workplace safety that can be applied to firefighting, specifically Parts 7, 10, 18, and 28. There are several North American standards that address staffing issues, particularly in regards to safety. Specifically, the U.S. *OSHA Respiratory Protection Standard 29 CFR 1910.134*; *NFPA 1710 Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations to the Public by Career Fire Departments; and NFPA 1720 Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, Special Operations to the Public by Volunteer Fire Departments, and NFPA 1500 Standard on Fire Department Occupational Safety and Health Programs* are frequently cited as authoritative documents.

Organizational Structure

Span of control, also known as span of management, is a human resources management term that refers to the number of subordinates a supervisor can effectively manage. Developed in the United Kingdom in 1922, the concept of span of control evolved from the assumption that managers have finite amounts of time, energy, and attention to devote to their jobs. In research of British military leaders, it was found that leaders could not effectively control more than three to six people directly.

This generally accepted *rule of thumb* for span of control is still considered relevant today and applies not only to the military, but correspondingly to the fire service. It is important to note that all managers experience a decrease in effectiveness as their span of control exceeds the optimal level. In other words, the limitations implied by span of control are not short-comings of certain individual managers, but rather of managers in general. In addition, it is important to understand that span of control refers only to direct reports, rather than to an entire corporate hierarchy (all personnel in the fire department).

> "Extending span of control beyond the recommended limits engenders poor morale, hinders effective decision making, and may cause loss of the agility and flexibility that give many entrepreneurial firms their edge."[3]

SCES is organized in the typical top-down hierarchy. The chain of command is identified with common roles for a department of this size. The department's organizational chart appears to be functional and primary roles are well identified. The department is clearly segregated into operating divisions with specific roles and responsibilities for each.

Administration and Support Staff

One of the primary responsibilities of a fire department's administrative and support staff is to ensure that the operational entities have the ability and means to accomplish their duties on the emergency incident. Efficient and effective administration and support are critical to the department's success. Without sufficient oversight, planning, documentation, training, and maintenance, the operational entities of a fire department will fail any operational test. Additionally, like any other part of a fire department, administration and support require appropriate resources to function properly.

Analyzing the administrative and support positions of a fire department facilitates an understanding of the relative number of resources committed to this important function. The appropriate balance of the administrative and support components to the operational component is critical to the success of a department's mission and responsibilities.

The following figures outline the corporate, administrative, and/or support organizational structure and complement of the fire department.

[3] Hendricks, Mark. *Span Control* Entrepreneur, January 2001.

Figure 6: Administrative and Support Positions

Position	Number
Department Director and Fire Chief	1.0
Deputy Chief	3.0
Assistant Chief	2.0
Division Chief	1.0
Fire Marshal	1.0
Captain	2.0
Lieutenant	5.0
Material Management Controller	1.0
Material Management Assistant	0.6
Accounting Assistant I	1.0
Support Assistant	1.0
Technical Analyst	2.0
Administrative Assistant	6.6
Community Safety Education Coordinator	1.0
Fire Prevention Engineer	1.0
Quality Management Coordinator	1.0
Communications and Marketing	1.0
Total Fire and Emergency Management	31.2
Communication Division Chief	1.0
Communications Captain	1.0
Communications Lieutenant	3.0
Communications Qualified Officer	4.0
Communications Operator	4.0
Total Communications	**13.0**
Total Departmental	**44.2**

Emergency Services Staff

It takes an adequate and well-trained staff of emergency responders to put the appropriate emergency apparatus and equipment to its best use in mitigating incidents. Insufficient staffing at an operational scene decreases the effectiveness of the response and increases the risk of injury to all individuals involved. The following figures summarize the personnel assigned to street-level service delivery as provided by the department.

Figure 7: Operations Complement (Full time)

Position	Number
Platoon Chief	4.0
Assistant Platoon Chief	4.0
Captain	12.0
Lieutenant	21.0
Qualified Officer	4.0
Firefighter	109.0
Total	**154.0**

The department has 154 career emergency response personnel plus approximately 50 part-time paid-on-call personnel that supplement the career staff. The population of SCES's area is approximately 92,490.[4] The ratio of firefighters per 1,000 population is 1.60 including all career personnel. The firefighters per 1,000 population is above the regional median but is only slightly below the national high based on NFPA statistics.

In communities across North America, the number of fire calls has declined over the past decade. Yet as the frequency of fires diminishes, in part due to stricter fire codes and safety education, the workload of fire departments has risen sharply; medical calls, hazardous materials calls, and every sort of household emergency is now addressed by fire departments. Therefore, as the frequency of fires diminishes, the need for a ready group of personnel has increased.

Although modern codes tend to make fires in newer structures more infrequent, today's energy-efficient construction (designed to hold heat during the winter) also tends to confine the heat of a hostile fire. In addition, research has shown that modern furnishings generally burn hotter (due to synthetics), and roofs collapse sooner because prefabricated roof trusses separate easily after a very short exposure to flame. In the 1970s, scientists at the National Institute of Standards and Technology found that after a fire breaks out, building occupants had about 17 minutes to escape before being overcome by heat and smoke. Today, that estimate is three minutes.[5] The necessity of firefighters arriving on the scene of a fire in the shortest span of time is more critical now than ever.

Along with a quick response, a robust, well-trained, and appropriately equipped complement of emergency workers is needed to successfully mitigate structural fires. Too few firefighters at an emergency scene decreases effectiveness and increases the risk of injury to firefighters and civilians alike.

While many requests for emergency assistance are comparatively low risk requiring few personnel, the emergency workers needed to mitigate a structure fire are greater. A house fire involving just one room and its contents is considered a moderate risk incident in the industry.

SCES operates six fire stations throughout the primary response area but only staffs Stations 1, 4, 5 and 6. Stations 2 and 3 are unstaffed and have volunteer firefighters assigned for response duties. At maximum staffing, SCES maintains 38 personnel on duty (26 suppression and 12 EMS dedicated personnel) and has a policy minimum staffing of 29 personnel, including those on EMS transport units required by contract. Staffing for specific apparatus is dependent upon the incident.

[4] Based on 2011 Census Canada.

[5] National Institute of Standards and Technology, *Performance of Home Smoke Alarms, Analysis of the Response of Several Available Technologies in Residential Fire Settings,* Bukowski, Richard, et al.

Component C – Review of the Community Expectations and Performance Goals

The ultimate goal of any emergency service delivery system is to provide sufficient resources (personnel, apparatus, and equipment) to the scene of an emergency in time to take effective action to minimize the impacts of the emergency. This need applies to fires, medical emergencies, and any other emergency situation to which the fire department responds. Obtaining and understanding the desires and expectations of community stakeholders is an important first step. SCES is committed to incorporating the needs and expectations of residents and policy makers in the service delivery planning process. Although no formal community input was sought during the process of developing this document, it will become increasingly important to emphasize public process and inter-agency communication as the demand for service increases throughout the community. The input received will help guide the department's vision, planning efforts, policy decisions, and service delivery.

Stakeholder Expectations

In preparation of this SOC document, various community officials, along with SCES staff members, were interviewed. In addition, a public engagement session was held in June 2012 to gather input from external stakeholders. The various stakeholders hold SCES in high regard. The vast majority of stakeholders interviewed during the development of this SOC document indicated service levels were "excellent" when asked to describe the overall level of service provided by SCES. Several other comments documented during the stakeholder interviews were constructive and consistent with this general assessment.

Community Service Level Area Considerations

In many communities, it is appropriate to consider variations in the service levels and expectations of the community based on population densities. This is because rural areas often present lower risks than urban areas based on land use and structure types. In additions, rural area dwellers often have a different expectation of service delivery based on their geographic distance from service centers and the availability of lower revenue-producing assessed values found in rural areas.

In the typical SOC process, the service area classifications are broken down into five categories:

- **Metropolitan**-geography with populations of over 200,000 people in total and/or a population density of over 7,800 people per square kilometre. These areas are distinguished by mid-rise and high- rise buildings, often interspersed with smaller structures.

- **Urban**-geography with a population of over 30,000 people and/or a population density of over 5,200 people per square kilometre.
- **Suburban**-geography with a population of 10,000 to 29,999 and/or a population density of between 2,600 and 5,200 people per square kilometre.
- **Rural**-geography with a total population of less than 10,000 people or with a population density of less than 2,600 people per square mile.
- **Wilderness/Frontier/Undeveloped**-geography that is both rural and not readily accessible by a publicly or privately maintained road.

An analysis of population density in Strathcona reveals that no geographic analysis areas fall into the metropolitan or wilderness areas. The county's population ranges between urban, suburban and rural throughout, and the geography contains many mid-rise structures.

As a result of this analysis and through the concurrence of the stakeholders and community input, tiered service delivery zones were established in this Standards of Cover document that mirror the recommendations set forth above for the urban, suburban and rural areas of Strathcona County.

Community Expectations

In general, the public engagement process, in combination with stakeholder and citizen input, has identified four key expectations:

- Quick response
- Trained and capable personnel
- State of the art equipment and tools
- Good community relations and public education

Resulting Outcome Goals

Using the information gained through the process of public engagement, stakeholder interviews, and strategic planning workshops, SCES has developed overall goals for each of the services it provides. These performance goals further define the quality and quantity of service expected by the community and consistently pursued by SCES.

Figure 8: Community Expectations

Service	Community Outcome Goal
Fire Suppression	*For all fire incidents, SCES shall arrive in a timely manner with sufficient resources to stop the escalation of the fire and keep the fire to the area of involvement. An effective concentration of resources shall arrive within time to be capable of containing the fire, rescuing at-risk victims and performing salvage operations, while providing for the safety of the responders and general public.*
Emergency Medical Services	*For all emergency medical incidents, SCES shall arrive in a timely manner with sufficient trained and equipped personnel to provide medical services that will stabilize the situation, provide care and support to the victim and reduce, reverse or eliminate the conditions that have caused the emergency while providing for the safety of the responders. When warranted, timely transportation of victim(s) to appropriate medical facilities shall be accomplished in an effective and efficient manner.*
Vehicle Extrication	*For all vehicle accidents where rescue of victims is required, SCES shall arrive in a timely manner with sufficient resources to stabilize the situation and extricate the victim(s) from the emergency situation or location without causing further harm to the victim, responders, public and the environment.*
Technical Rescue	*For all technical rescue incidents, SCES shall arrive in a timely manner with sufficient resources to stabilize the situation and establish an action plan for the successful conclusion of the incident. Working in conjunction with additional specially trained and organized regional resources, SCES will perform the necessary rescue functions while providing for the safety and security of the responders, public and the environment.*

Component D – Overview of Community Risk Assessment

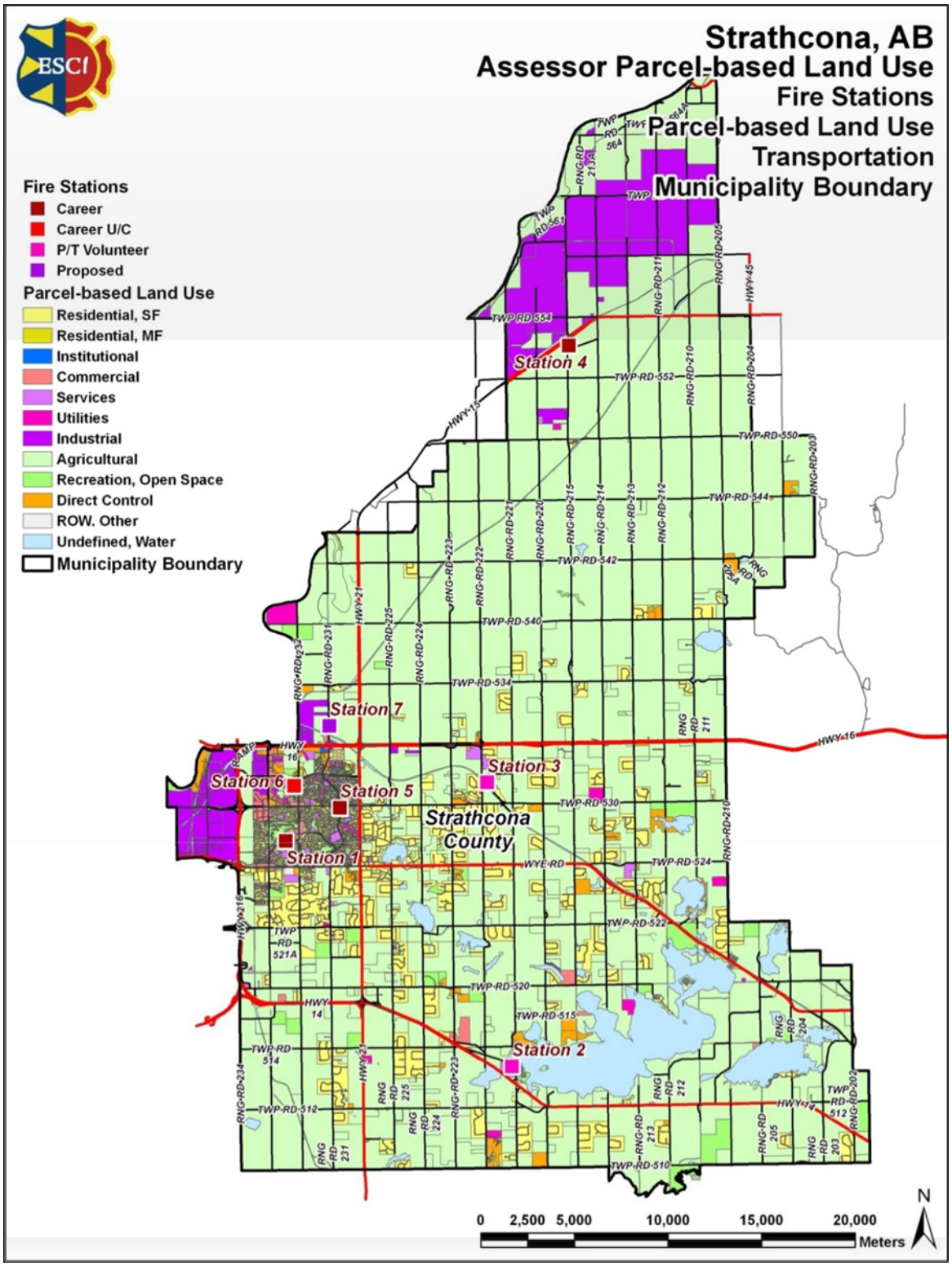
This section analyzes certain categorical risks that are present within Strathcona County that potentially threaten the persons and businesses within the community. These risks are identified to assist SCES in developing and evaluating mitigation plans should an emergency occur.

Overall Geospatial Characteristics

The fire service assesses the relative risk of properties based on a number of factors. Properties with high fire and life risk often require greater numbers of personnel and apparatus to effectively mitigate a fire emergency. Staffing and deployment decisions should be made with consideration of the level of risk within geographic sub-areas of a community.

The community's risk assessment has been developed based on potential land use within its boundaries. These potential uses are found in the county's zoning designations and land use plans. The following maps illustrate how land use (potential scale and type of development within geographic sub-areas) is distributed throughout Strathcona County.

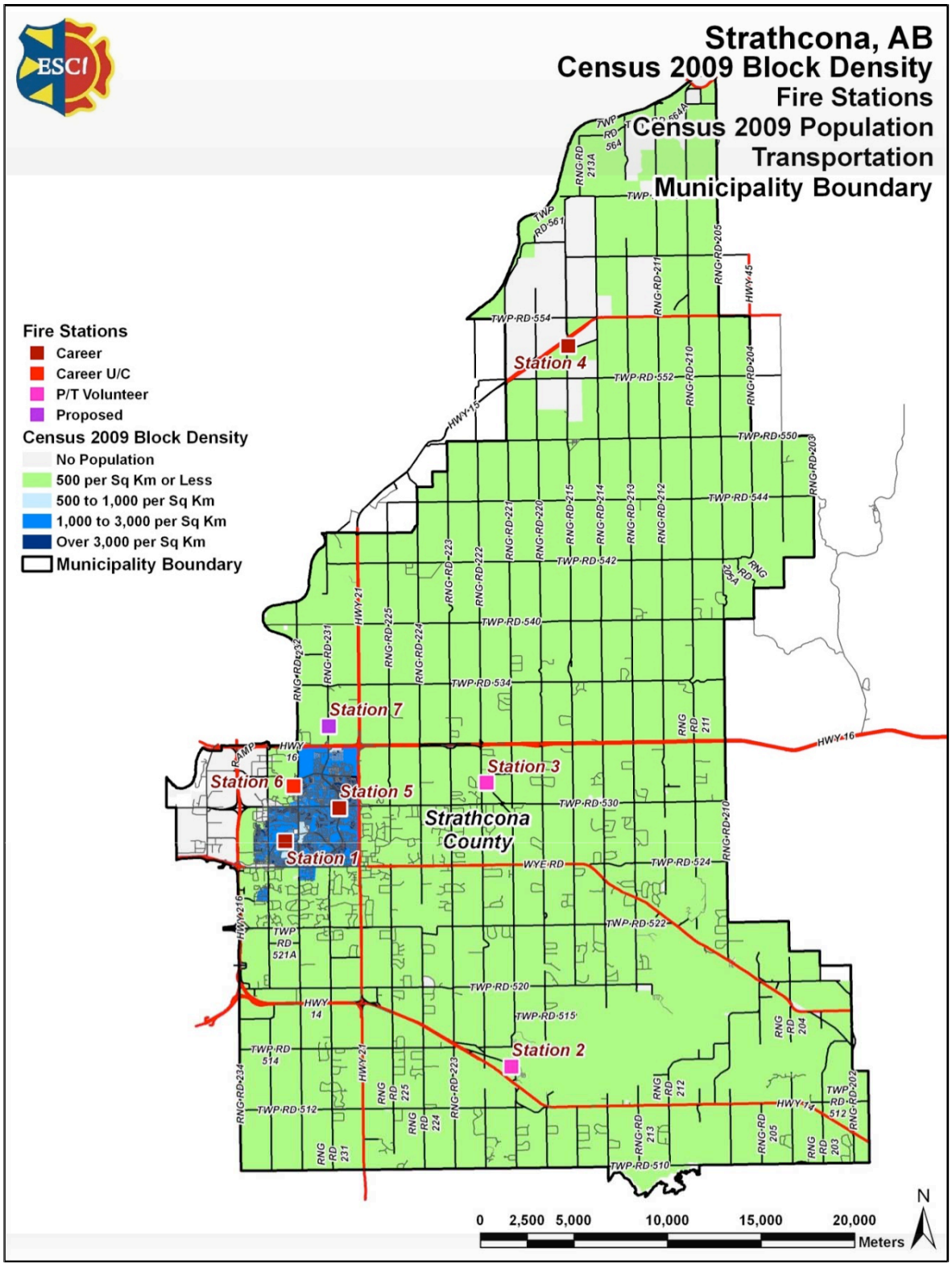
Figure 9:Community Land Use Assessment



The areas outside Sherwood Park contain mostly low to moderate risk properties with a scattering of high risk commercial and/or industrial areas, particularly in the northern portions of the county.

Unlike medical responses that focus on human life, fire incidents are intended to protect property in addition to life. Typically, the most frequent occurrences of fires are in the more populated areas where structures are also denser. The following map illustrates how the varying levels of population density are distributed throughout Strathcona County.

Figure 10: Population Density

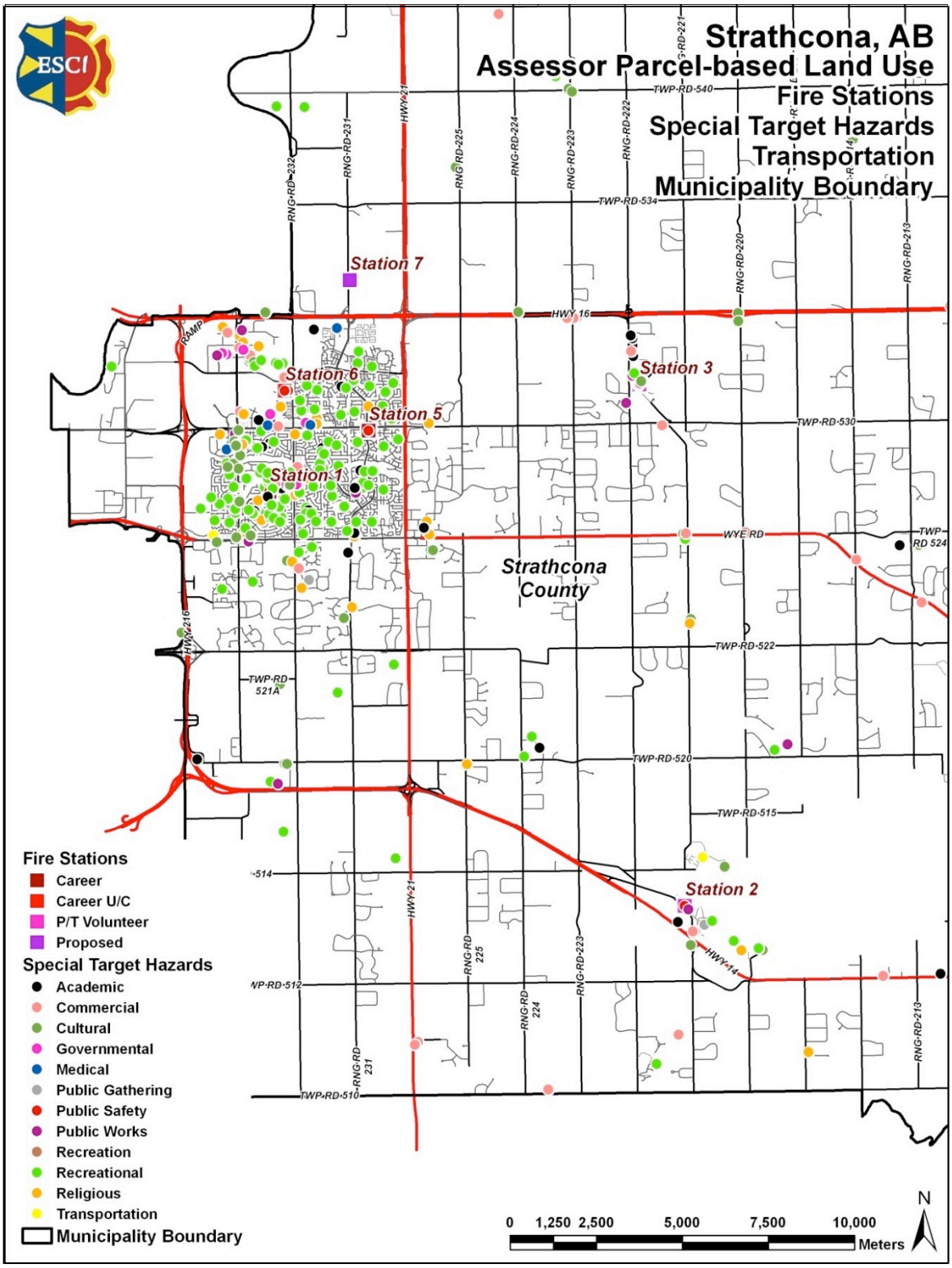


A vast majority of the area outside Sherwood Park has a much lower population density than the urban area. In regards to community risk, the areas of higher population density will typically generate a higher service demand than the rural areas. This has also been illustrated in the service demand analysis section of this report. Future planning of fire stations has already begun and is focused on the urban areas while those areas outside Sherwood Park have received an appropriate level of attention in regard to the deployment of physical resources based on perceived risk.

Additional areas of special risk are created by the presence of facilities in which larger numbers of people congregate or where life risks are higher due to occupant's age, disability, or other conditions. Additionally, buildings that are of cultural importance or contain hazardous materials are also identified as target hazards by fire departments because they will require additional resources in the event of a fire. The following map locates various facilities of importance[6] to the fire department that are identified as special or target risks within the community. Each location type is discussed separately in the section that follows.

[6] Based on available geographic data.

Figure 11: Target Risks



Most of the target risk facilities are located within Sherwood Park.

Physical Assets Protected

Government Buildings

Essential to the response, mitigation, and preservation of a community during and after an emergent event are government buildings. These are buildings which contain the equipment, staff, and archival records essential to the primary functions of government. These include most municipal, state or federal offices, emergency services facilities, libraries, postal facilities, communication centers, and the Emergency Operations Center (EOC).

The only governmental buildings within Strathcona County are those belonging to the County and the Hamlet of Sherwood Park. These facilities are co-located within Sherwood Park within one mile of SCES Station 1.

Congregational

There are certain identifiable places where larger congregations of people converge for one reason or another. Some of these types of facilities have been or will be discussed in other sections as appropriate. What follows are congregational facilities that do not necessarily fit into those other sections and are higher risk due to larger populations within the facility and the economic or community impact of a loss due to fire or some other event. A vast majority of all general congregational places are located within the area of Sherwood Park, which is covered by career fire stations.

Schools/Universities/Daycares

There are a number of educational institutions within Strathcona County. These are facilities which contain children and college-aged population representing the future of the community and the region. Though primarily operational during the daytime hours, evening classes or athletic events creates an environment in which many persons can occupy the property at varying hours of the day and early evening. Schools, universities and daycares are scattered throughout Strathcona County with a heavier concentration within Sherwood Park and others within the rural areas. The two rural stations would be the primary response unit for several of these locations supplemented by career personnel from Sherwood Park.

Houses of Worship

Churches, mosques, and temples are all a part of the local mosaic. There are houses of worship of many varieties located within Strathcona County and most host activities throughout the weekdays and

evenings aside from scheduled worship services on weekends. Religious facilities, like academic institutions, are scattered throughout Strathcona County with a higher concentration within Sherwood Park. Other facilities are located throughout the rural areas but, as described earlier, are typically only occupied during limited periods of time.

Retail Centers

Aside from thriving downtown commercial centers, the auto-dependent retail centers have proliferated throughout the landscape. From department store anchored strip malls to the enclosed pedestrian variety; these retail centers attract a large amount of shopping visitors to their properties, especially during winter holidays.

Not all congregational facilities can be mapped either because of the lack of data or due to the number of the facilities themselves. Nonetheless, buildings which are employment centers, social halls, and nightclubs have a higher population density than in residential areas and contribute significantly to the economic well-being of the community. As in most communities, the majority of Strathcona County's retail centers are located within the more densely populated Sherwood Park and are served by career stations. In addition, the aerial apparatus are located within close proximity for a rapid response.

High Density Housing

Although most housing within Strathcona County is in the form of single family residences, higher density housing such as condominiums, townhouses, apartments and subsidized senior housing units do exist within the response area. Additionally, there is a certain amount of public housing for low income persons that also have higher population densities. Included with these are shelters that serve the homeless, women's protective services, student dormitories, and other group quarters. These types of housing have a higher risk for the loss of life and correlate with higher rates of multiple emergency responses compared to single family residential areas.

High density housing within Strathcona County is limited to Sherwood Park currently and consists of several apartment complexes and recently constructed senior housing. This multi-story senior housing poses a unique risk to the community in regards to fire protection but is located such that it can be served by appropriate resources.

Medical Facilities

Caring for the sick and infirmed is every community's moral responsibility. However, when an emergency threatens the facilities that care for them or the community at large, this population must be assisted to reach a safe place that can continue to care for them. Identifiable facilities include hospitals, clinics (such as dialysis centers), nursing homes, and assisted living facilities. Additionally, the community should be aware of those who are infirmed or disabled that live in residences throughout the city.

A new community hospital is under construction north of Sherwood Park. This facility will serve areas primarily to the west of Edmonton and will function as a receiving point for both critical and non-critical patients from throughout the region.

Other Critical Infrastructure

In this section, other types of critical infrastructure to a community are discussed for the fire department to plan a response and mitigation plan in the event of an emergency.

Water Distribution

The most obvious element of this system that affects the fire department is the hydrants. Additionally the water supply pipes, pumps, and facilities are essential to not only supplying water to suppress fires but the drinking supply and cooling processes in manufacturing. As this water is utilized, the waste or run-off into the sewer pipes, pumped along, and processed in a wastewater facility are also essential to the ecological and human health needs of a community.

The water system within Strathcona County is primarily limited to Sherwood Park. In certain portions of the county, SCES depends on tanker shuttles for its fire protection water supply. During a tanker shuttle, the fire department typically establishes at least one "water point", a location from which water can be pumped into the tankers by means of either a drafting pumper or gravity flow. The flow of water requires tanker trucks to move back and forth between a fire scene and the water point.

Time is consumed at the point where the tankers are loaded with water, known as "load time". Time is also consumed at the point where they discharge their water at the fire scene, typically into portable dump tanks, known as the "offload time". The final element of time in a tanker shuttle is consumed by travel back and forth, which is dependent on the distance between the fire and the water point.

During interviews, it became obvious that the community has a limited number of water points available for fire protection supply. This is a critical factor in the ability of the fire department to maintain adequate flow of water at a fire scene, quantified by the measurement of litres per minute (LPM). An inadequate flow can result in continued fire spread and the inability to control a fire.

It is important that the fire department completes true and accurate calculations of its normal tanker shuttle capability, using tested load and offload times and true capacity (based on weight testing). Maps can then be generated using established water points in the town that would demonstrate LPM flow capability on all town street segments. The map street segments could be color-coded to show LPM capability.

More importantly, once this calculation effort was completed it would become relatively obvious where additional water points would most benefit the town. To that end, additional effort could be made to obtain rights to any existing static supplies or new water points, such as cisterns or gravity tanks, which could be installed.

It is also important that SCES recognize the criticality of LPM flow and the proximity of water points as it considers new development or redevelopment of areas. The county is in the best position to require installation of adequate and plentiful water points through land use regulations and permit processes.

The establishment of additional water points spread strategically throughout the county would have perhaps the greatest positive impact on the firefighting abilities of SCES.

To the department's credit, it was recently accredited through the fire underwriters survey for water shuttle. SCES is the first department in Alberta, Manitoba, or Saskatchewan to receive this accreditation. The construction of water lines to outlying areas will assist the department in addressing water supply issues within the rural zones.

Communications

While it may be obvious that emergency communication centers and the transmitting and receiving equipment are essential, there are other communication facilities and equipment that are equally essential to the community and government operations. These are the central Communication Offices and lines of local telephone providers. Internet service providers, along with wireless cellular communication carriers provide essential communication capabilities for the community as well as

emergency personnel through their facilities, and equipment. Currently, there is no formal mapping of critical communications resources within Strathcona County.

Energy

Previously discussed community services, from communications, to traffic signals, to normal operations require the use of energy. Whether it is fuel distribution and storage tanks to natural gas pipelines and regulator stations, the community is dependent upon energy sources. One of the most important energy elements is the electrical distribution infrastructure. This includes the generation facilities, the transmission lines, and the substations that are located across every community in the nation.

Strathcona has a unique risk with the proximity of oil refining and processing facilities and the energy requirements of those properties in addition to the normal energy transmission needs of the general community. The department, through County by-law, limits development within certain distances of these processing facilities but has not formally mapped other energy infrastructure.

Bridges

These structures provide essential crossings and unimpeded travel across physical and man-made barriers. In the event of an emergency, these are crucial along evacuation routes as well as for aid supplies to be brought into the area.

Bridges throughout Strathcona County are primarily limited to major highway overpass/underpass structures. These bridges are located along Highway 216, Highway 16 and Highway 21.

Structural

The protection of property in most cases refers to a building and its contents. This has been the basic mission of the fire department since its inception. Certain buildings, their contents, functions, and size are more difficult to fight a fire and require special equipment, operations, and training.

Dangerous Goods Preplanning

Buildings that have been identified as containing hazardous materials can create a dangerous environment during a spill, rupture, or fire to the community as well as the firefighters. Special equipment such as clothing and detectors, along with specialized training are necessary to successfully mitigate a dangerous goods incident. The following map pinpoints locations where dangerous goods are known to be present.

Multi-Storied Buildings

Buildings that are above two floors pose a special risk in an emergency. Fire on higher floors requires an aerial fire truck to be able to deliver water into the building that does not have standpipe infrastructure. Additionally, victims trapped on higher floors may be in need of rescue by its tall ladder.

Currently, SCES protects a number of high-rise structures including hotels, governmental structures, and senior living facilities. In addition, three pockets within Sherwood Park exist where high-rise development is expected to occur. With this in mind, SCES should continue to plan and prepare for high-rise firefighting and rescue operations.

Topographic and Weather Related Risks

Weather Risk

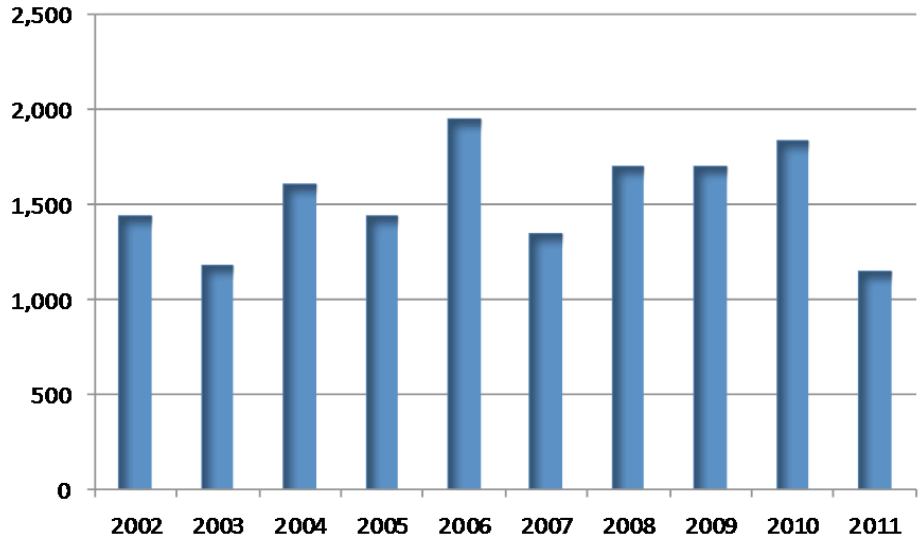
Central Alberta is known for its mild summer climate and extremely cold winters and firefighters face weather emergencies almost every year. Weather in Alberta is produced by the interaction of air masses with different temperature and moisture characteristics. The properties of these air masses vary with the season, with whether the air mass was formed over land or sea, and with the latitude of the air mass's area of formation. In the winter, Alberta's weather is dominated by the maritime polar and the continental polar air masses. The maritime polar air mass from the north Pacific is moist, providing moisture for snow in the mountains and to a lesser extent over the prairies. The continental polar mass, formed over Canada's interior, is dry and cold. Occasionally the continental arctic air mass advances into Alberta from the far north, creating intense cold weather. In the summer, Alberta's weather continues to be dominated by the maritime and continental polar air masses, but maritime tropical air masses from the Gulf of Mexico and from the Pacific sometimes enter Alberta, often bringing significant moisture.

Wildfire Risk

The urban setting of Sherwood Park and surrounding developed areas limit the most frequent threat to smaller brush fires. The remainder of the County, however, is rural in nature and, with a mix of residential and heavy industrial and geological industry, wildfire is a real threat. In February 2010, Strathcona County conducted a Wildfire Perception Survey with rural residents using a questionnaire designed by SCES. Respondents were asked to rate the level of risk a variety of natural hazards posed to their property over the next five years. Nearly half of respondents indicated drought was a high risk followed by approximately one quarter of respondents that reported wildfire was a high risk.

Throughout Alberta, wildfire frequency has been varied as illustrated in the following figure.

Figure 12: Historical Alberta Wildfire Activity[7]



Over the last five years, SCES has experienced 12 wildfire incidents with 10 of those occurring during 2010.

Geographic/Geological Risk

Certain geographic and geologic risks create situations that threaten the community or are physical barriers to street connectivity for emergency service response. One of these is the hydrological features such as lakes, rivers, bays, inlets, and inter-coastal waterways. Although in some cases, a bridge can be constructed to traverse these barriers, most times it is a limited number. Fortunately, these are not of major concern in Strathcona County. The flat terrain of the area also precludes any mountainous barriers.

Man-made barriers

There are man-made barriers that also affect the response capability of emergency services and they are present in almost every community, and especially with urban areas such as Sherwood Park. Unless elevated, limited access freeways and rail lines can interrupt street connectivity forcing apparatus to negotiate a circuitous route to reach an emergency scene. While freeways and other arterials can have

[7] http://www.srd.alberta.ca/Wildfire/WildfireStatus/HistoricalWildfireInformation/documents/WildfiresByYear-2011.pdf. Accessed 22 June 2012.

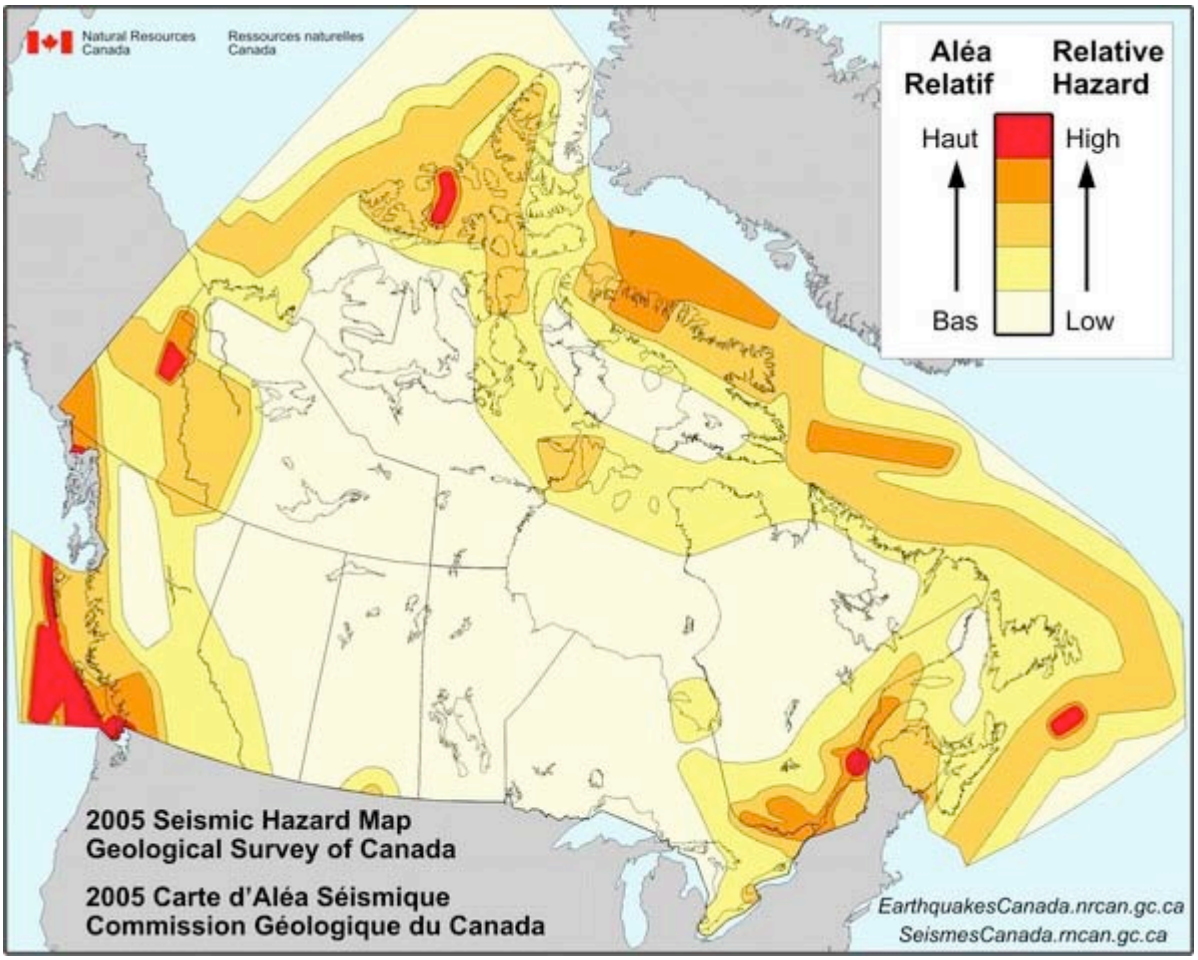
safety barriers or medians to separate opposing traffic lanes, cross-over or breaks are limited. Street-level rail lines can impede traffic even at crossings when the trains traverse through the city.

Other man-made barriers to street connectivity are the proliferation of cul-de-sac developments and gated communities which provide limited access points for emergency responders. Fortunately for SCES, these types of issues are limited. Still, there are some areas throughout the primary response area that limit accessibility or are only accessible by gravel or other unimproved roadways.

Fault lines

Earthquakes are possible throughout Canada but certain areas have a higher probability of experiencing damaging ground motions caused by these quakes. The map below provides an idea of the likelihood of experiencing strong earthquake activity at various locations across the country.

Figure 13: Earthquake Risk



As illustrated in the map above, a majority of the Province of Alberta, including Strathcona County, lies within zones of low earthquake risk.

Transportation Network

Transportation corridors provide necessary access and egress for the County. These take the forms of roads, airports, and railway.

Roads

The following figure illustrates the annual average daily traffic counts for the both the urban and rural areas of Strathcona County.

Figure 14: Travel Volume - Urban

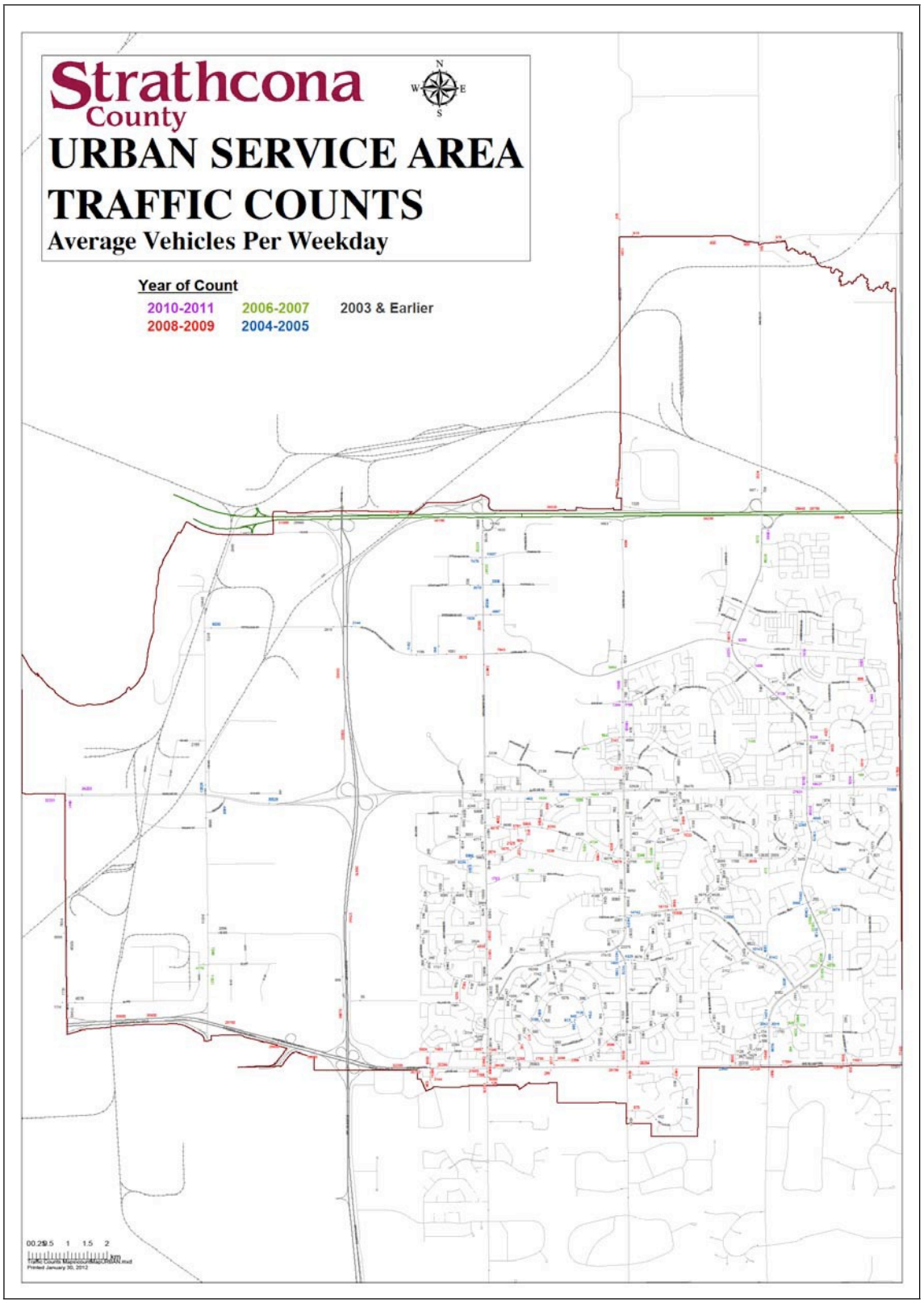
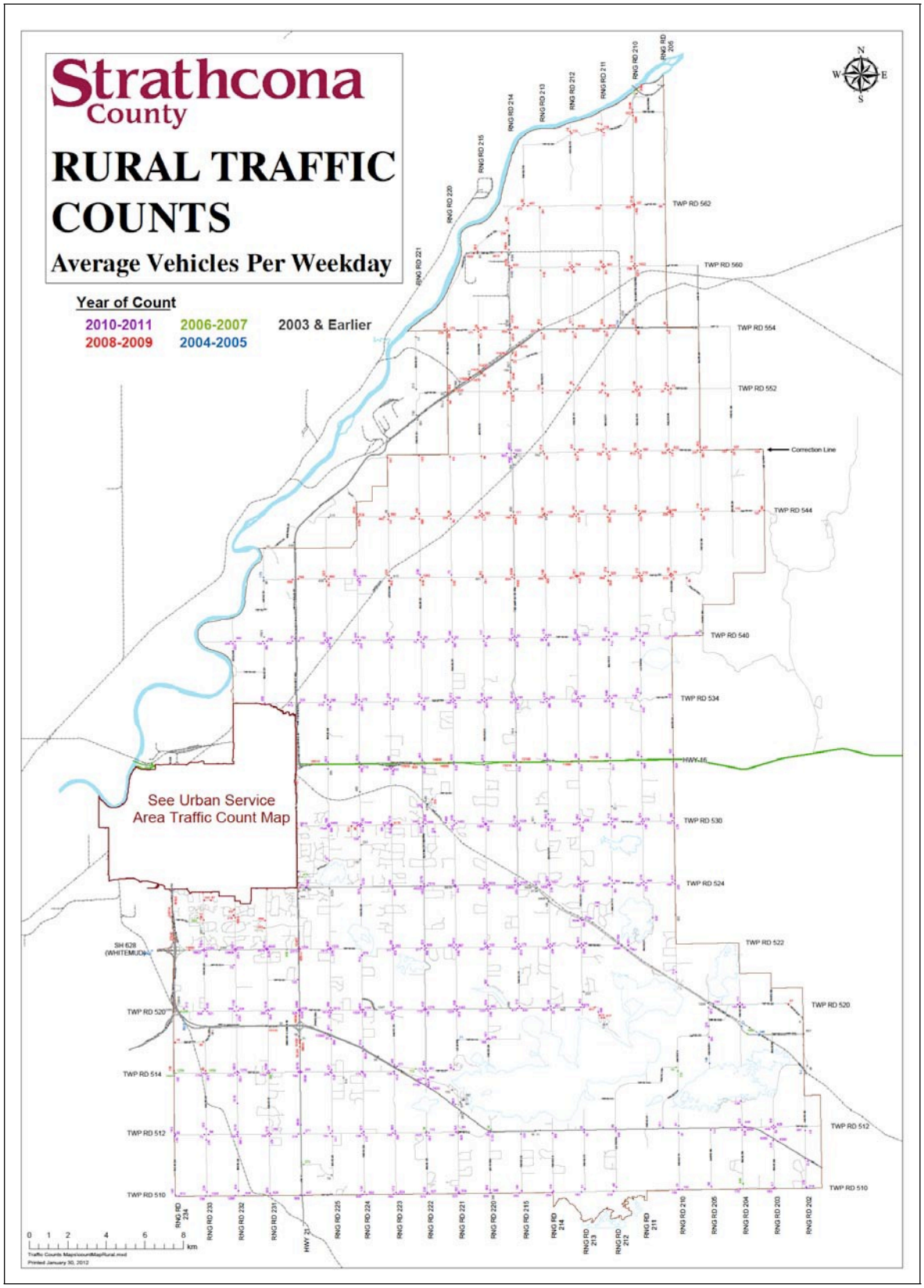


Figure 15: Travel Volume - Rural



While this only counts vehicles it does not account for the number of passengers onboard. Additionally, some of these travelers may just be passing through at a given time or their final or interim destination may be within Strathcona County itself. Another element often overlooked that is essential to the safety of motorist and pedestrians are the traffic signals. Without these devices operational, such as during a power outage, significant increases in collisions are likely to occur. Intersections are the leading location for motor vehicle collisions. Other dangerous intersections are near freeway interchanges as entering or exiting vehicles merge into other lanes for the maneuver.

Rail

In 2006 there were 48,068 kilometres of railways, stretching from the Atlantic to the Pacific oceans. The two largest Class 1 carriers, Canadian National Railway Company (CN) which owns or leases 22,686 kilometres of railways and Canadian Pacific Rail Company (CPR) which owns or leases 12,812 kilometres. The regional and short line railways combined own or lease a total of 11,734 kilometres. Regional railways are mid-sized railroads that do not have a national presence. Short line railways provide localized rail services and are usually partnered with larger railways. Mainlines are the principal artery of the railway system from which the collectors and primary feeders (branches), yards, and spurs are connected. Mainline tracks generally allow travel at higher speeds than branch lines and are usually maintained and built to a higher standard than yards and branch lines. Stations refer to either train stations (a terminal where trains load or unload passengers or goods) or railway junctions (where two or more railway lines cross). Rail lines within Strathcona County are currently limited to Canadian National freight that shares track with VIA Rail passenger service. All rail lines and crossings within Strathcona County are at grade level rather than elevated or subterranean. The risk of collision between automobiles that ignore the signal barriers or pedestrians walking on the tracks is higher than an elevated or subterranean rail lines.

Airports

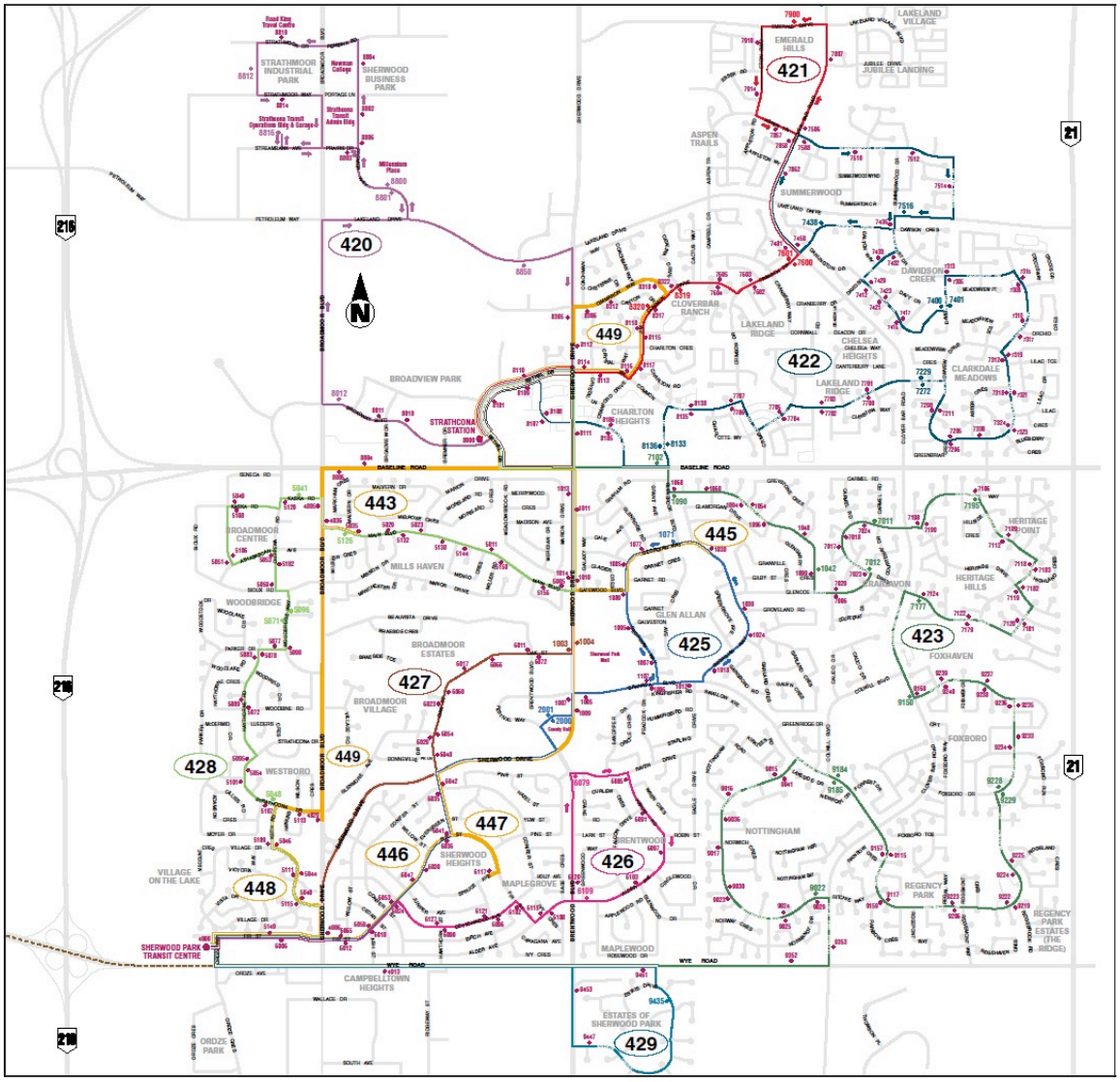
Edmonton International Airport (EIA-YEG) lies approximately 30 km from downtown Sherwood Park and provides the only commercial air service to the greater Edmonton area. EIA is the fifth busiest airport in Canada in terms of passenger traffic and is Canada's largest airport as measured by land mass measuring just less than 7,000 acres. Runway 02-20 is directly in line with Sherwood Park and there is significant potential for incident within the primary response area of SCES. Warren Thomas (Josephburg) Aerodrome is located 1.6 kilometres north of Josephburg on Secondary Highway 830 and is approximately 5 kilometres south of Alberta's Industrial Heartland.

Although primarily used for general aviation, oil companies use the facility approximately twice daily with jet service. The airport has one paved runway, 4,560 feet in length. SCES has provided service to this facility in the way of ARFF resources from Station 4. Several other general aviation airports also exist within the primary response area such as South Cooking Lake Airport.

Bus

Strathcona County Transit operates bus service throughout Sherwood Park as well as the industrial area to the east of Sherwood Park. Use of these services reduces the total number of vehicles on the roadways but also poses a significant risk if a bus is involved in a collision. In 2011, Strathcona County Transit provided a total of over 2.3 million rides. Strathcona County Accessible Transit (SCAT) transported over 14,000 special needs passengers during the same period. The following map illustrates how prevalent bus routes and potential incidents are throughout Strathcona County, primarily within Sherwood Park.

Figure 16: Bus Routes



Terrorism

The proximity of Strathcona County to a major international city, an international airport and the proximity of oil processing refineries raises the level of concern of possible terrorist activity compared to most other areas of the country. Most of the previous categorized risks in the community are potential targets for such activity. The department needs to be vigilant in its training and preparedness in the event one or more coordinated acts of terror occur in the Edmonton region.

Hazard Vulnerability Analysis

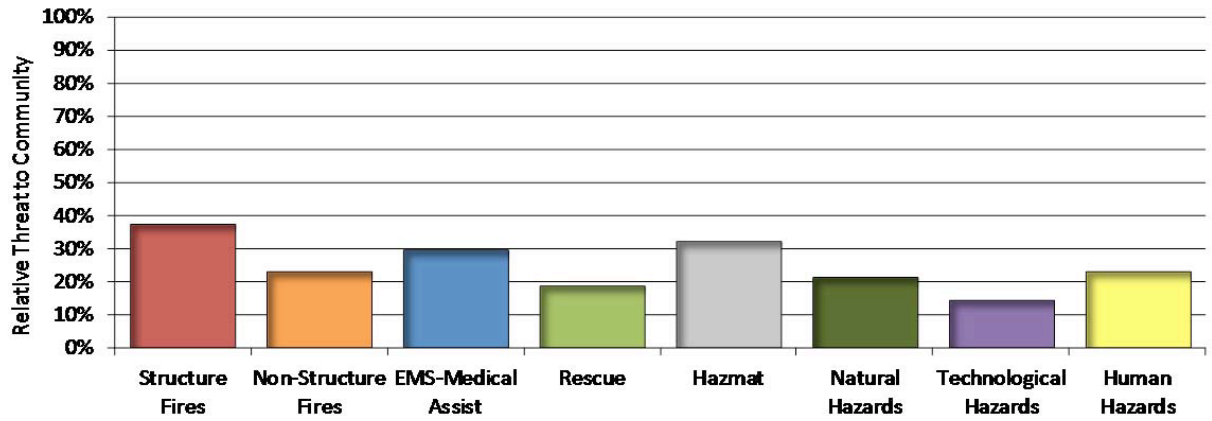
Based on the narrative descriptions of the various hazards commonly found throughout the SCES primary response area, a numerical ranking of community hazards has been developed. Historical

incident data as well an assessment of the community and its vulnerabilities was used to numerically rate each potential hazard. Community hazards were segregated into broad categories as follows:

- Structure Fires
- Non-structure Fires
- EMS-Medical Assist
- Rescue
- Hazardous Materials
- Natural Hazards
- Technological Hazards
- Human Hazards

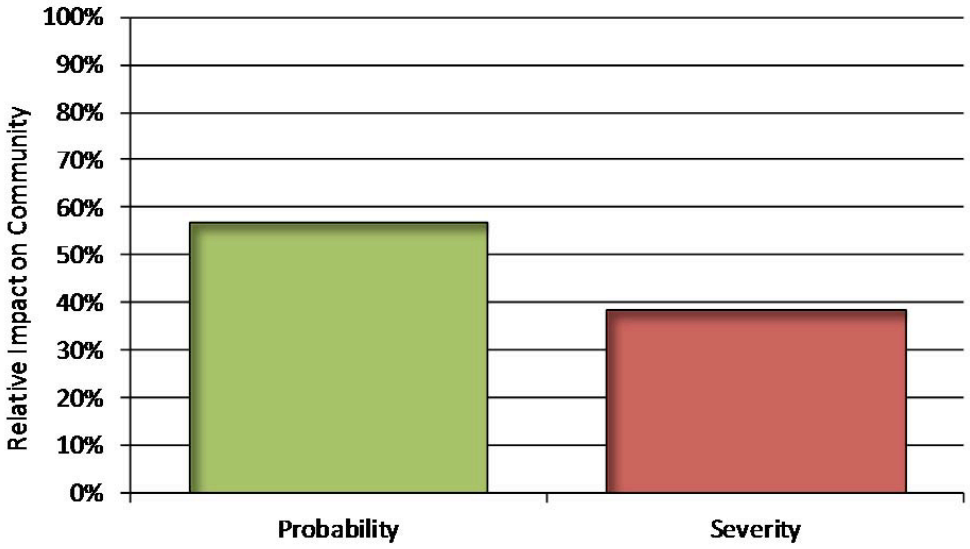
Within each of the aforementioned categories, more specific hazards were identified and a probability score between zero (representing "Not Applicable") and three (representing "High") was assigned to each. A severity score was then developed for each of the sub-categories using the same scale for impact and a reverse scale for preparedness and response. The overall scores were then used to generate a relative risk score based on what percentage of each risk applied to Strathcona County. Complete documentation of categorical scoring can be found in the appendix of this document. Based on the completed hazard vulnerability analysis, the following representation of relative community risk was developed.

Figure 17: Hazard Specific Relative Risk



Structure fire incidents represent the highest level of relative risk within Strathcona County, followed by hazardous materials/dangerous goods and medical incidents. Although the probability of each type of incident is relatively low, the potential severity of each incident is somewhat higher as illustrated in the following figure.

Figure 18: Relative Community Impact



As can be seen from the figure above, the relative community impact is somewhat lower than the potential probability. In other words, although incident probability is relatively high, when an incident occurs, the potential community impact is relatively low in comparison.

Critical Tasking

SCES's service area has a densely populated urban environment and, as such, contains an elevated number, density, and distribution of risk. SCES should have the resources needed to effectively mitigate the incidents that have the highest potential to negatively impact the community. As the actual or potential risk increases the need for higher numbers of personnel and apparatus also increases. With each type of incident and corresponding risk, specific critical tasks need to be accomplished and certain numbers and types of apparatus should be dispatched. This section considers the community's identified risks and illustrates the number of personnel that are necessary to accomplish the critical tasks at an emergency.

Tasks that must be performed at a fire can be broken down into two key components: life safety and fire flow. Life safety tasks are based on the number of building occupants, and their location, status, and ability to take self-preservation action. Life safety related tasks involve the search, rescue, and evacuation of victims. The fire flow component involves delivering sufficient water to extinguish the fire and create an environment within the building that allows entry by firefighters.

The number and types of tasks needing simultaneous action will dictate the minimum number of firefighters required to combat different types of fires. In the absence of adequate personnel to perform concurrent action, the command officer must prioritize the tasks and complete some in chronological order, rather than concurrently. These tasks include:

- Command
- Scene safety
- Search and rescue
- Fire attack
- Water supply
- Pump operation
- Ventilation
- Backup/rapid intervention

Critical task analysis also applies to non-fire type emergencies including medical, technical rescue, and hazardous materials emergencies. Numerous simultaneous tasks must be completed to effectively control an emergency. The department's ability to muster needed numbers of trained personnel quickly enough to make a difference is critical to successful incident outcomes.

SCES has developed the following Critical Task analyses for various incident types. Further it has defined, based on current unit staffing levels, the number and type of apparatus needed to deliver sufficient numbers of personnel to meet the critical tasking identified. Review of the Critical Task analysis indicates that all are in keeping with industry standards and provide the minimum number of personnel needed for effective incident operations.

Critical tasks are those activities that must be conducted in a timely manner by firefighters at emergency incidents in order to control the situation. The fire department is responsible for assuring that responding companies are capable of performing all of the described tasks in a prompt, efficient, and safe manner.

Fires – Critical tasking for fire operations is the minimum number of personnel to perform the tasks required to effectively control a fire in the listed risk category. Major fires (beyond first alarm) will require additional personnel and apparatus.

Emergency Medical – Critical tasking for emergency medical incidents is the minimum number of personnel to perform the tasks required to support the identified strategy based on the department's adopted medical protocol.

The figure below summarizes SCES's personnel needs for specific incident types.

Figure 19: Summary of Critical Tasking Analysis

Task	Number of Personnel	
	Urban	Rural
Low Rise Residential Structure Fire	16	20
Moderate Risk Commercial Structure Fire	16	20
High Risk Commercial Structure Fire	16	20
Grass/Brush Fire	6	13
Car Fire	6	8-10
Emergency Medical Incident	2-6	2-6
Motor Vehicle Crash	8	10-12
Hazardous Materials Incident	16	20

The figure above illustrates how SCES would staff particular example incidents within its primary response area. The figures do not include mutual aid companies responding from the City of Edmonton or elsewhere. Additionally, personnel assigned to Alberta Health Services are not counted in this critical tasking exercise due to the fact that these personnel must be able to be released from fire activities

within 90 seconds of dispatch to a medical emergency. As is common in most areas of North America, fire departments staff their resources so that an initial emergency response force can minimize spread or exacerbation of an incident while awaiting additional resources from other areas for high risk or unusual incidents.

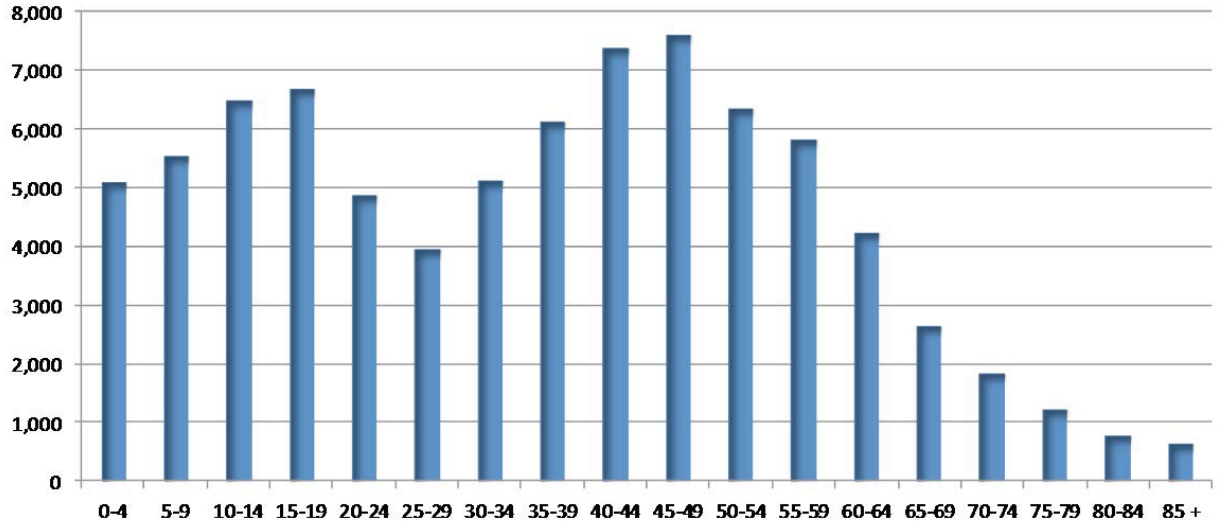
Development and Population Growth

Current Population Information

According to the 2011 federal census estimates, the estimated population of Strathcona County was 92,490 persons. This represents an overall increase of 12.1 percent since the 2006 census when a population of 82,511 was recorded. The average annual growth rate this decade has been 4.2 percent.

How this population is composed by age group can have a significant effect upon the fire service. The following figure distributes the population into age groups based on available census information.

Figure 20: Population by Age, 2006[8]

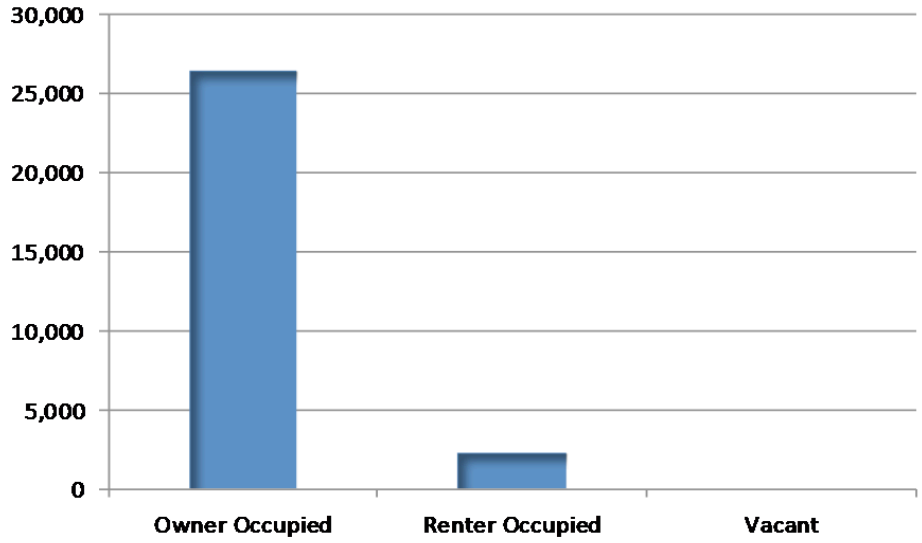


Approximately 8.6 percent of the population is 65 years of age or older and 6.2 percent of the population is under 5 years of age, placing a total of 14.8 percent of the area's population within the significant target age groups that pose the highest risk for fatalities in residential fire incidents and typically generate higher levels of medical incident service demand.

Numerous rentals and vacancies can signal economic conditions that correlate with higher rates of emergency incidents. The following figure illustrates the distribution of housing units by tenure throughout Strathcona County.

[8] Although total population from the 2011 federal census has been released, data pertaining to age distribution and housing characteristics is only available from the previous census.

Figure 21: Select Housing Characteristics

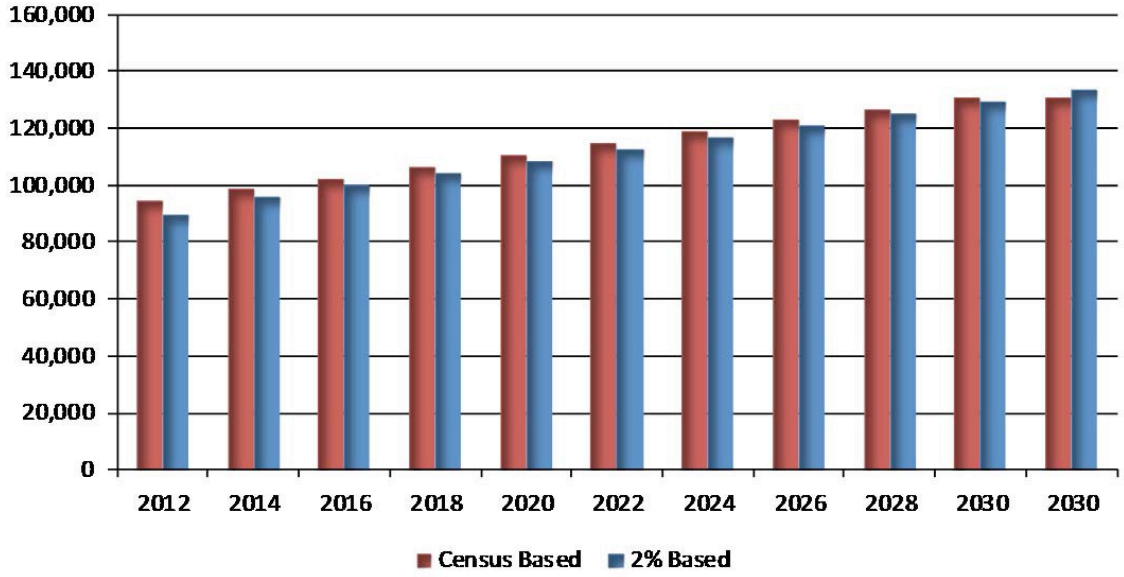


The high level of owner-occupied housing indicates a stable economic environment that would tend to decrease overall demand for emergency services. Available census information does not indicate the number of vacant properties but, based on the high rate of owner occupation, one could assume that the vacancy rate for Strathcona County would be extremely low.

Population Growth Projections

The population within Strathcona County has grown steadily throughout the last decade. Local planning officials anticipate that additional growth may continue throughout the region at a similar rate as previously experienced. In developing forecasts for population growth, ESCI typically develops a forecast based on several years of census experience. For Strathcona County, ESCI used figures from 1990 through 2006 as reported by Statistics Canada to create a mathematical forecast of total population. In addition, information was taken from Strathcona County's future land use plan, which indicates that a 2 percent population growth rate is used as the base for future land use planning. These two population forecasts are illustrated in the following figure.

Figure 22: Population Forecast

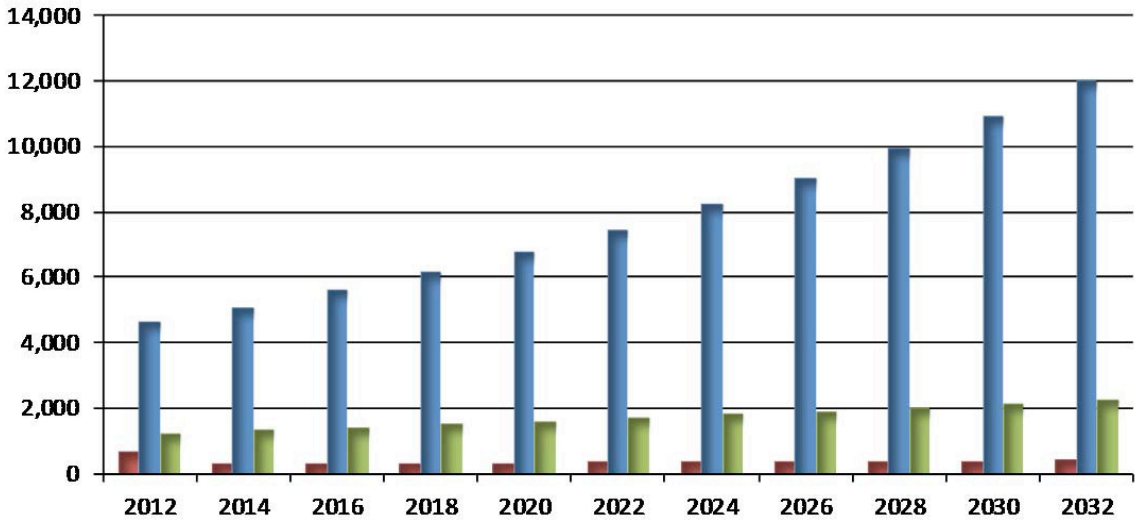


It is not the intent of this study to be a definitive authority for the projection of future population in the service area, but rather to base recommendations for future fire protection and emergency services needs on a reasonable association with projected service demand. Since it is known that the service demand for emergency agencies is based almost entirely on human activity, it is important to have a population-based projection of the future size of the community. Planning should begin now to maintain the resources needed to meet the continuing demand for services throughout Strathcona County.

Calls for Service

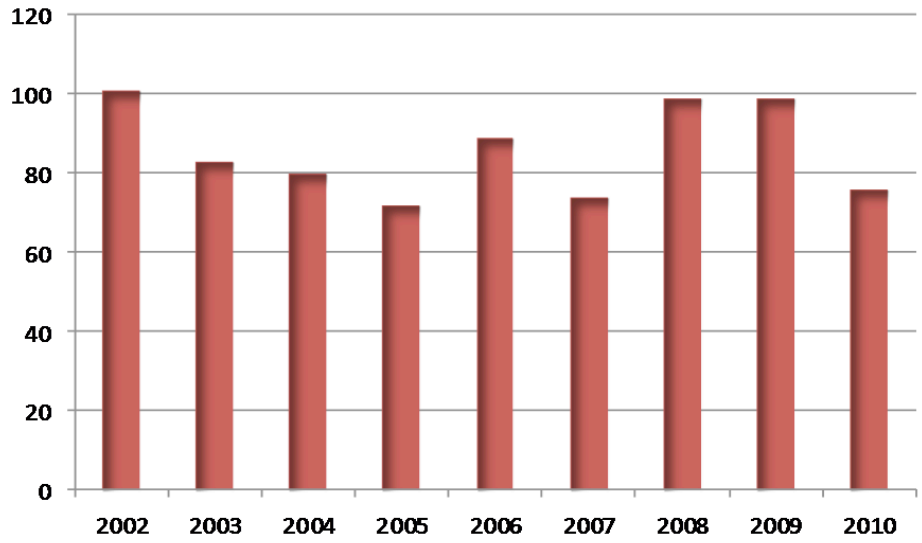
Demand is defined as the workload experienced by an emergency services organization. This workload can be emergency and/or non-emergency depending on the mission of the organization. For SCES, most of the demand is related to EMS responses, as identified in the figure below.

Figure 23: Service Demand by Major Category, 2002 - 2010



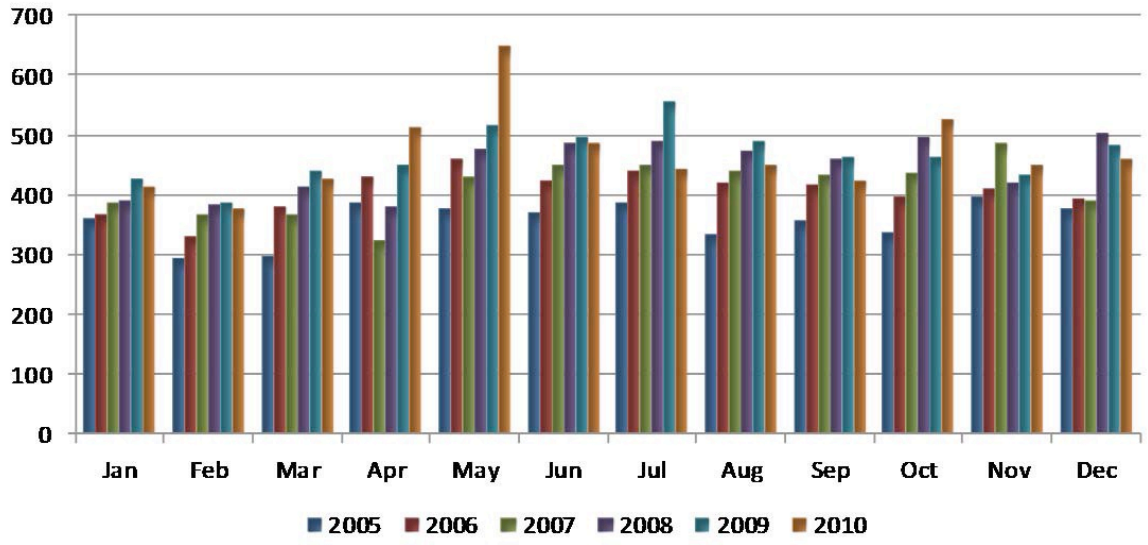
As evidenced by the figure above, a majority of SCES's service demand is EMS in nature. Over the nine-year period evaluated, EMS incidents have increased a total of 62.4 percent while actual fire incidents have increased 72.9 percent but with much higher variability. Although total fire incidents have increased, structure fires have generally been on the decline over the data period as illustrated in the following figure.

Figure 24: Structure Fires, 2002 - 2010



Service demand is not static, and SCES's workload varies by temporal variation. The following figures illustrate how SCES's service demand varies by month, day of week, and hour of day in order to identify any periods of time that pose significantly different risks and hazards. ESCI begins this analysis by evaluating service demand by month.

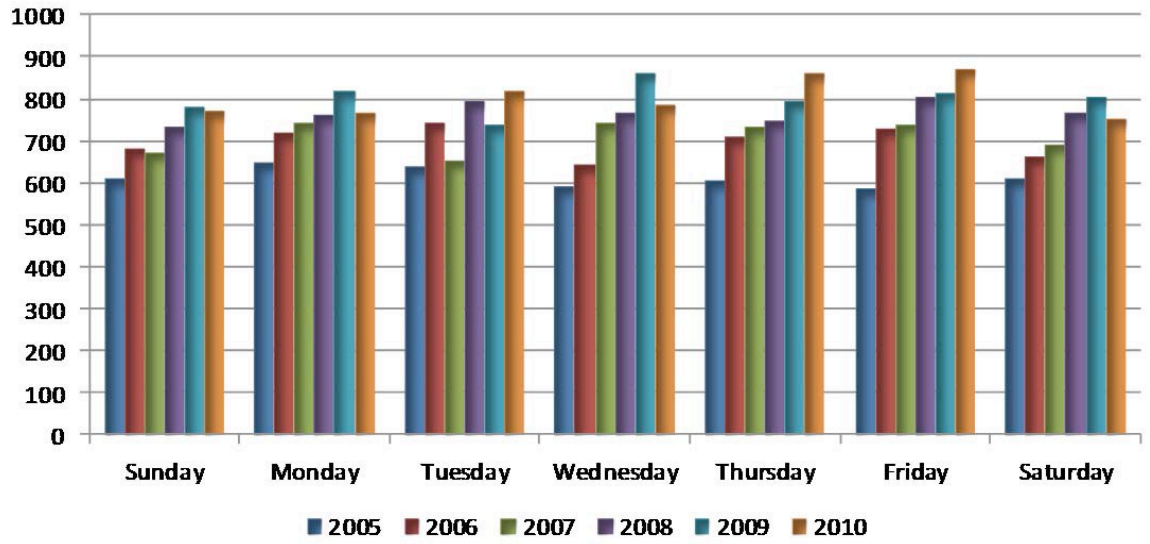
Figure 25: Service Demand by Month, 2005 - 2010



Although there are several spikes in service demand in different months within each year, overall analysis indicates that workload is somewhat higher in the spring and summer months as the general

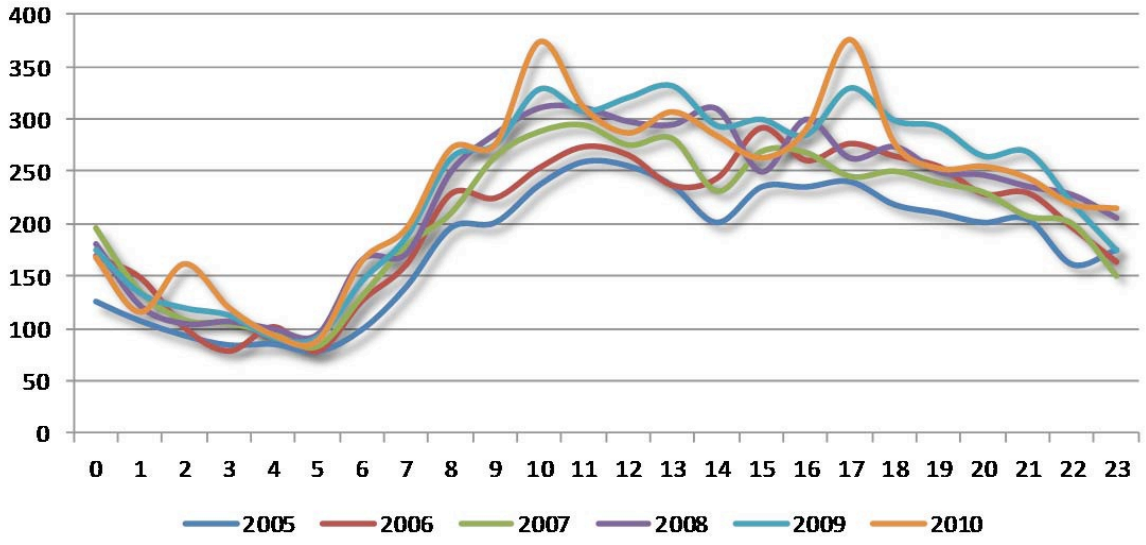
population begins to be more active at the conclusion of winter. Analysis continues with a look at service demand by day of week.

Figure 26: Service Demand by Day of Week, 2005 - 2010



Over the data period provided, there seems to have been a shift of daily workload. Early in the data period, the busiest days were Sunday and Monday; during 2010, Thursday and Friday were generally the busiest days. The temporal analysis concludes with an evaluation of service demand by hour of day.

Figure 27: Service Demand by Hour of Day, 2005 - 2010

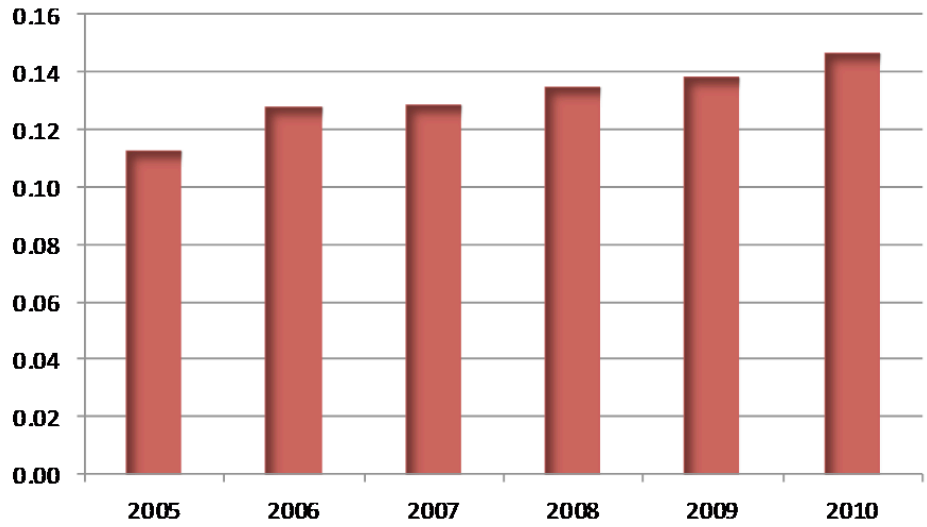


As expected, workload by hour of day is lowest during the overnight and early morning hours with a general increase beginning around 6:00 a.m. and peaking during the midday hours before tailing off into the evening. This typical bell curve pattern of demand closely follows general human activity patterns.

Since a majority of the department's workload is medical in nature, it is useful to determine how well medical resources are being utilized. One method to evaluate utilization is to use what is commonly known as unit hour utilization (UHU). UHU is an indicator of how busy a given unit or unit types are within a certain system. UHU is calculated by dividing the total number of incidents by the total number of available hours of the units being measured. In this case, SCES uses four transport ambulances to fulfill the contractual obligations of Alberta Health Services and these ambulances are on duty 24 hours per day.

The levels of efficiency, or UHU, vary from organization to organization but, in general, experience has shown that fire-based EMS systems strive for a UHU of around .25. In third service systems, that UHU goal is routinely .30, and in private for-profit providers, UHU levels can reach as high as .35 or.40 in an effort to maximize profits. The differences in the threshold levels are typically addressed through the modification of shift length to attain a higher utilization ratio. Research has shown that UHU's above these thresholds lead to increased employee burnout and an increased likelihood of clinical errors. Since SCES is technically a fire-based EMS model, a UHU of .25 would be an acceptable upper limit. Given the workload over the past six years, SCES's ambulance UHU has been calculated and is illustrated below.

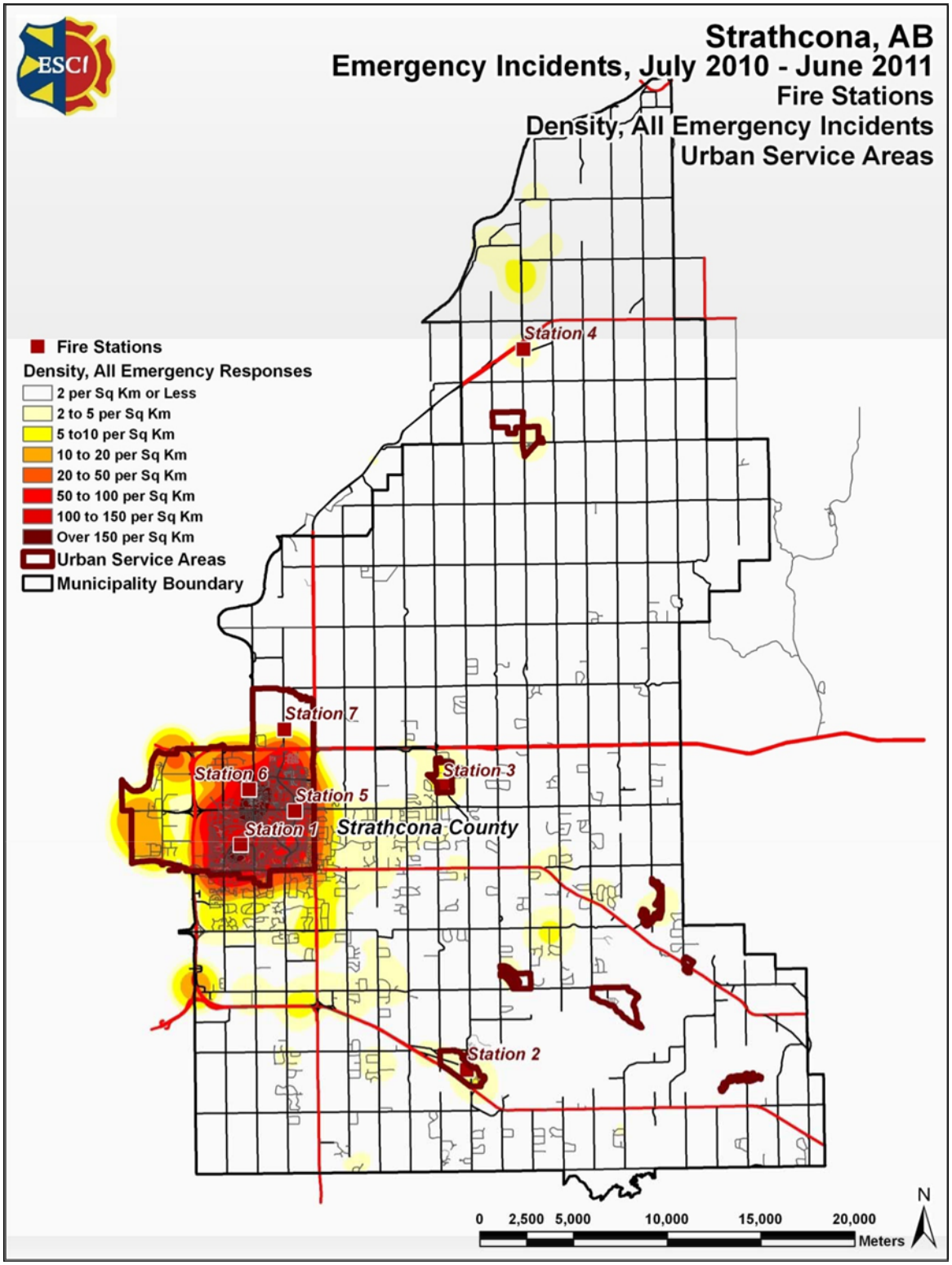
Figure 28: Historic Unit Hour Utilization (based on 8 ambulances)



As can be seen in the figure above, the UHU for SCES's ambulances has been increasing steadily over the past six years. Based on linear projections in service demand, SCES will reach the .25 threshold in 2028. This does not take into account, however, other modifiers to service demand projections.

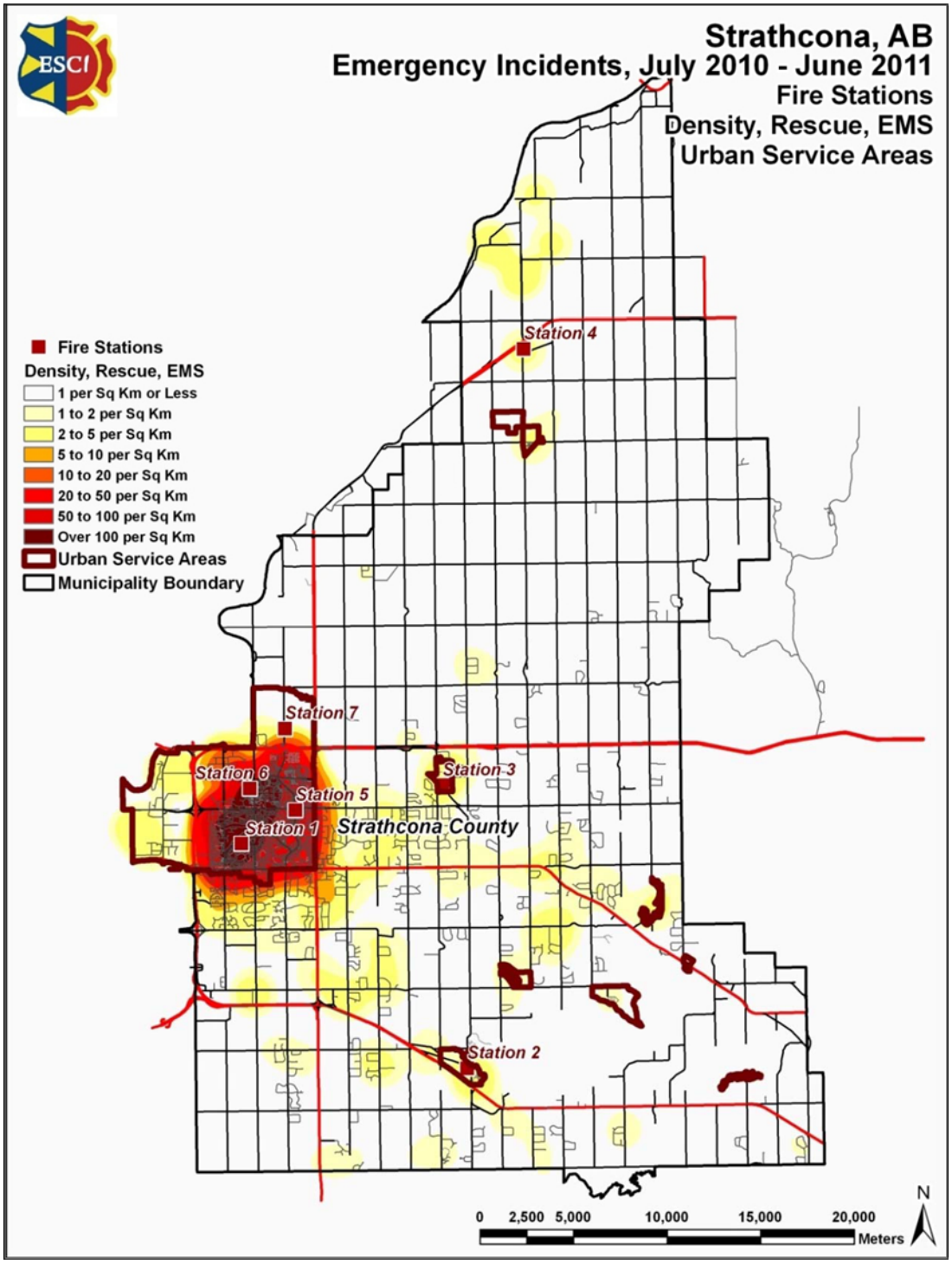
The final evaluation of service demand is geographical. The following map illustrates total service demand for SCES for the 12-month period of July 1, 2010 to June 30, 2011.

Figure 29:Geographic Service Demand



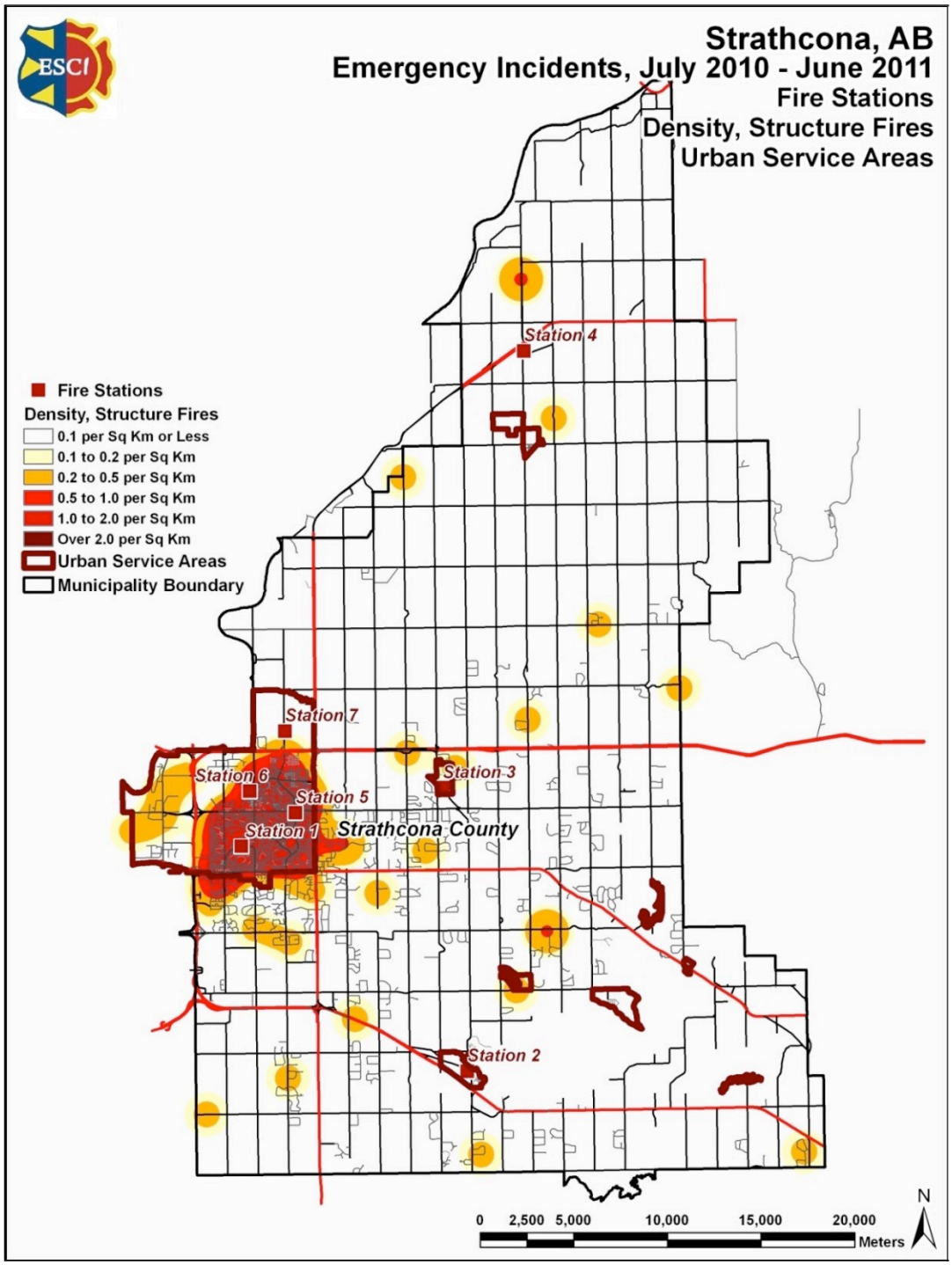
A vast majority of service demand is concentrated in close proximity to the current station locations. Another way to view this service demand is by incident type. Medical and rescue incidents comprise a majority of the SCES service demand as illustrated geographically in the following map.

Figure 30:Geographic Service Demand- Medical/Rescue Incidents



Although SCES provides EMS to areas outside Strathcona County as part of the Provincial EMS system, those incidents occurring within Strathcona County are again concentrated within Sherwood Park. The following figure illustrates the department's lowest frequency but most high risk incidents, structure fires.

Figure 31: Geographic Service Demand - Structure Fires



Not unsurprisingly, structure fire service demand follows the areas with higher population densities and higher structure densities. A scattering of structure fires is also noted throughout the entirety of the County, but at a much lower density than within Sherwood Park.

Component E – Review of Historical System Performance

When evaluating the effectiveness of any resource deployment scheme, it is not only necessary to evaluate the geographic distribution of resources to determine their physical capability to travel to, and gather at, emergency incidents within target time frames; it is also necessary to evaluate the workload of the individual companies to determine to what extent their availability for dispatch is affecting the response time performance. In simplest terms, an engine company cannot make it to an incident across the street from its own station in four minutes if it is unavailable to be dispatched to that incident because it is committed to another call.

Since the fractal performance goals are typically set at something less than 100 percent (in the case of SCES, at 90 percent), there is a built-in accommodation for at least some such instances in any deployment scheme where physical location and travel time are not a detracting factor, as in the case of SCES.[9] However, where workload is high, availability rates for a busy company can begin to drop below the 90th percentile. A unit that is unavailable for more than 10 percent of its primary assigned calls will certainly have difficulty achieving a 90th percentile response time target. In such cases, additional companies may need to be assigned in that same station to cover the high service demand, at least during peak workload periods. Another option is to build additional facilities with companies located closer together in high workload areas in order to permit lower travel times of the secondary units that would be dispatched to replace the unavailable primary company when it is committed to a call.

The measurement of the performance of a first-due unit to actually arrive first in its assigned primary response area is known as unit *reliability*. The reliability analysis will begin by measuring the reliability of each fire station in Strathcona County to get one of its assigned apparatus to incidents within its primary response area as the first arriving apparatus, regardless of type. This will measure overall fire station reliability. This will account for the common practice of sending an alternate unit to a call it would not normally be dispatched to when the most appropriate unit in that station is unavailable.

The total incident response time continuum consists of several steps, beginning with initiation of the incident and concluding with the appropriate mitigation of the incident. The time required for each of

[9] See section on Distribution Analysis.

the components varies. The policies and practices of the fire department directly influence some of the steps, but two are only indirectly manageable. The parts of the continuum are:

1. **Detection:** The detection of a fire (or medical incident) may occur immediately if someone happens to be present or if an automatic system is functioning. Otherwise, detection may be delayed, sometimes for a considerable period.
2. **Report:** Today most emergency incidents are reported by telephone to the 9-1-1 center. Call takers must quickly elicit accurate information about the nature and location of the incident from persons who are apt to be excited. A citizen well trained in how to report emergencies can reduce the time required for this phase.
3. **Call Processing:** The dispatcher must identify the correct units, subsequently dispatch them to the emergency, and continue to update information about the emergency while the units respond. This step offers a number of technological opportunities to speed the process, including computer aided dispatch and global positioning systems.
4. **Turnout:** Personnel must don appropriate equipment, assemble on the response vehicle, and begin travel to the incident. Good training and proper fire station design can minimize the time required for this step.
5. **Travel:** This is potentially the longest phase of the continuum. The distance between the fire station and the location of the emergency influences total response time the most. The quality and connectivity of streets, traffic, driver training, geography, and environmental conditions are also a factor.

As is apparent by this description of the sequence of events, application of water in time to prevent flashover, or the timely initiation of potentially life-saving medical care, is a serious challenge for any fire department. It is critical, though, as studies of historical fire loss data can demonstrate. Portions of the total response time sequence that are within at least some control of SCES are evaluated in the following paragraphs.

Call Processing

Call processing is the sole responsibility of the individuals within the Emergency Communications Center. Telecommunicators, or dispatchers, receive training in Priority Dispatch and are expected to adhere to the call processing standards set forth by that credentialing agency. Until recently, SCES Communications was responsible for the receiving and dispatching of all fire and medical calls for a number of agencies throughout the region. EMS dispatch, however, was transferred to the Provincial EMS Regional Communications center in 2011. The following figures illustrate the department's historic call processing performance.

Figure 32: Call Processing History

Average

	2005	2006	2007	2008	2009	2010	2011
EMS	01:13	01:09	02:09	02:08	01:49	01:43	01:39
Fire	03:15	02:50	03:12	03:37	03:21	04:06	03:45
Other	01:58	02:03	02:23	02:31	02:17	02:59	02:39
Rescue	03:35	03:36	03:05	03:21	04:19	06:20	02:21

90th Percentile

	2005	2006	2007	2008	2009	2010	2011
EMS	03:25	02:24	03:30	03:43	03:34	04:01	03:43
Fire	02:29	02:27	03:30	03:46	03:36	04:15	03:43
Other	02:29	02:27	03:29	03:42	03:31	04:02	03:39
Rescue	04:05	02:24	03:43	03:17	04:54	04:59	03:12

Turnout Time

As discussed earlier in this document, turnout time is one area of the overall response time that field personnel have at least some ability to control, given proper facilities that allow for rapid and efficient movement of personnel. The following figures illustrate the department's historic turnout time performance.

Figure 33: Turnout Time History

Average

	2005	2006	2007	2008	2009	2010	2011
EMS	01:17	01:05	01:27	01:36	01:19	01:17	01:19
Fire	02:54	02:56	02:51	03:00	02:36	02:22	02:35
Other	02:09	02:00	02:24	02:42	02:06	02:17	02:28
Rescue	01:58	02:18	02:32	02:01	01:44	01:34	02:13

90th Percentile

	2005	2006	2007	2008	2009	2010	2011
EMS	02:47	02:25	02:38	03:05	02:42	02:46	03:02
Fire	02:36	02:26	02:49	03:04	02:42	02:46	03:03
Other	02:36	02:25	02:49	03:05	02:42	02:46	03:03
Rescue	02:35	02:27	02:43	02:38	02:36	02:20	03:11

Travel Time

Travel time is one component of total response time that is rarely controllable by fire department personnel. Traffic congestion, intersections, construction, and distance all play crucial roles in travel time. The following figures illustrate the department's historic travel time performance.

Figure 34: Travel Time History – First Arriving Unit

Average

	2005	2006	2007	2008	2009	2010	2011
EMS	05:27	05:42	06:15	06:29	06:39	06:26	07:28
Fire	07:36	07:36	08:11	11:04	10:46	10:17	10:15
Other	06:16	06:55	06:49	07:31	07:52	07:16	06:57
Rescue	07:00	13:18	05:08	09:59	11:09	06:39	08:17

90th Percentile

	2005	2006	2007	2008	2009	2010	2011
EMS	11:23	12:02	12:41	14:19	13:57	13:36	13:42
Fire	11:22	12:03	12:41	14:19	13:57	13:36	13:40
Other	11:21	12:03	12:39	14:19	13:57	13:36	13:42
Rescue	11:05	11:18	12:57	14:08	14:02	13:20	13:42

First Arriving Unit Time

Upon evaluation of the data retrieved from both the CAD and incident reporting datasets, non-emergency responses and miscellaneous calls were removed in order to gain a full understanding of how well the system was performing for emergency incident first unit arrival times. Over the last three years of CAD data, response time performance has increased by a total of six percent when measured at the 90th percentile and seven percent on average. The following figures illustrate the department's historic total response performance.

Figure 35: Response Time History - First Arriving Unit

Average

	2005	2006	2007	2008	2009	2010	2011
EMS	06:43	06:47	07:42	08:07	07:58	07:42	08:47
Fire	10:42	10:32	11:02	15:07	13:38	12:52	13:04
Other	08:22	08:55	09:17	10:10	10:00	09:37	09:24
Rescue	08:58	15:46	07:40	12:00	12:55	08:13	09:53

90th Percentile

	2005	2006	2007	2008	2009	2010	2011
EMS	0:13:30	0:13:53	0:14:30	0:16:34	0:15:46	0:15:20	0:15:17
Fire	0:13:27	0:13:55	0:14:30	0:16:34	0:15:46	0:15:21	0:15:16
Other	0:13:26	0:13:53	0:14:29	0:16:34	0:15:46	0:15:20	0:15:17
Rescue	0:13:19	0:12:59	0:15:00	0:16:32	0:15:47	0:14:59	0:15:16

SCES serves a large geographical area containing varying levels of population density and service demand. Thus, varying levels of performance are achieved based on the location of the incident. The following figure illustrates the department's performance based on a segregation of urban and rural response zones.

Figure 36: Density Based Response Performance

Fire Responses

	Urban Average	Urban 90th Percentile	Rural Average	Rural 90th Percentile
2005	06:38	10:14	10:13	16:55
2006	06:43	11:09	11:03	18:12
2007	06:44	10:06	11:32	18:28
2008	07:16	10:36	11:57	20:16
2009	06:53	10:22	11:49	20:29
2010	07:12	11:17	12:24	21:23
2011	07:05	11:03	12:11	19:39

Medical Responses

	Urban Average	Urban 90th Percentile	Rural Average	Rural 90th Percentile
2005	05:52	08:28	11:30	18:20
2006	05:58	08:48	11:07	18:40
2007	06:53	09:53	13:20	20:26
2008	06:58	10:10	13:05	21:10
2009	06:23	10:16	12:20	20:55
2010	06:11	09:51	12:46	20:24
2011	06:36	10:42	12:24	21:09

Effective Response Force

Effective Response Force (ERF) is the number of personnel required to be present on the scene of an emergency incident to perform the critical tasks in such a manner to effectively mitigate the incident without unnecessary loss of life and/or property. The ERF is specific to each individual type of incident, as are the critical tasks that must be performed. For the purposes of this example, high and maximum

risk incidents have been utilized, and it is assumed that lower risk incidents will have better performance than those that require a higher concentration of resources. The following figures illustrate the department's historic ERF performance.

Figure 37: Effective Response Force Assembly Performance – Three or More Apparatus

	Average	90th Percentile
2005	0:18:26	0:32:31
2006	0:26:05	0:47:51
2007	0:17:59	0:30:43
2008	0:16:33	0:26:17
2009	0:14:01	0:21:23
2010	0:15:08	0:26:24
2011	0:16:16	0:28:44

Call Concurrency and Resource Drawdown

Another way to look at resource workload is to examine the amount of time multiple calls occur simultaneously. Calls for each year were examined to find the frequency that apparatus are handling multiple simultaneous calls. This is important because as calls occur simultaneously, resources become stretched and cause response times to extend due to apparatus responding from more distant locations. The figure below illustrates how often multiple calls are occurring.

Figure 38: Call Concurrency

EMS Concurrency

	1	2	3	4	5	6	7	8	9	10
2005	1560	971	316	72	5	1	0	0	0	0
2006	1575	1158	420	111	24	3	0	0	0	0
2007	1700	1275	554	170	37	3	0	0	0	0
2008	1732	1360	581	175	46	6	0	0	0	0
2009	1744	1516	643	209	41	4	0	0	1	2
2010	1701	1553	701	206	31	5	1	1	0	0
2011	910	815	363	58	6	0	0	0	0	0

Fire Concurrency

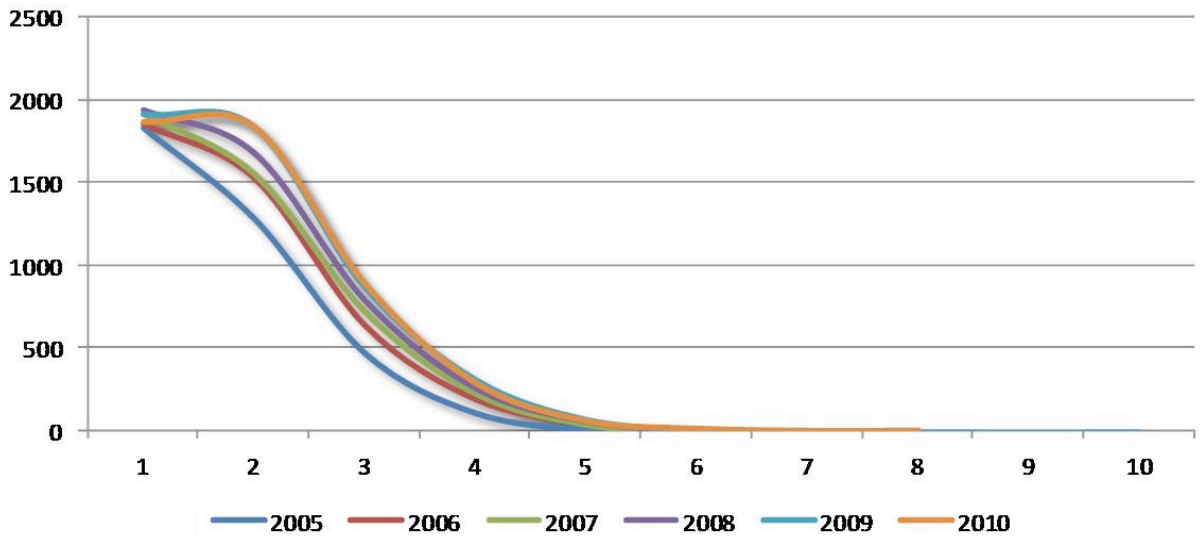
	1	2	3
2005	128	1	0
2006	152	5	0
2007	218	15	0
2008	300	12	2
2009	319	18	1
2010	243	19	4
2011	136	9	0

Overall Concurrency

Single	2	3	4	5	6	7	8	9	10
52.7%	26.7%	12.2%	5.1%	2.0%	0.8%	0.3%	0.1%	0.1%	0.0%

As in most communities, the majority of calls occur singularly. However, as communities grow the propensity for concurrent calls increases. When the concurrency reaches a level at which it stretches resources to near capacity, response times begin to extend. This is represented in the following figure.

Figure 39: Historic Call Concurrency



Although multiple medical calls will cause drawdown, especially as concurrency increases, they usually occupy one unit at a time. Concurrent fire calls, however, are of more concern as they may require multiple unit responses for each call depending upon the dispatch criteria. 'Other' calls that are neither actual fires nor medical calls have similar rates of concurrency and, depending on the dispatch criteria, may create periods of extensive resource drawdown.

It is also important to note that the station area with the highest workload typically has the highest rate of concurrent calls. This requires response units from other stations, to respond into this area. Other stations will therefore, also have higher concurrencies proportional to their workload. The impact on district area reliability can be affected by several factors such as:

- Out of service for mechanical reasons
- Out of service for Training exercises
- Out of area on move-up deployment
- Lack of staffing
- Concurrent calls

When these factors impact the reliability of a station to respond within its prescribed territory, response time performance measures for the back-up station/apparatus can be negatively affected.

Data Collection and Reporting

In order to adequately evaluate the performance of any system, accurate data must be available. Without accurate data, conclusions drawn from any analysis conducted are suspect. Given the call volume and complexity of SCES, the validity of data is crucially important.

The term, "garbage in, garbage out" is more important than ever when attempting to evaluate an emergency response system in an effort to validate the need for resources. Without accurate and reliable data, very little can be accomplished in terms of performance evaluation and improvement. As is true with any data analysis, however, there should be an understanding of how the analysis compares to real world experience. The data presented in this document indicate that SCES is performing at a level consistent with industry best practices as well as project team expectations.

The following section of this document will address each of the potential areas of improvement discussed previously and provide policy recommendations that will allow the department to address, rectify, improve, and re-evaluate the desired outcomes

Component F – Performance Objectives and Performance Measures

Dynamics of Fire in Buildings

Most fires within buildings develop in a predictable fashion, unless influenced by highly flammable material. Ignition, or the beginning of a fire, starts the sequence of events. It may take several minutes or even hours from the time of ignition until a flame is visible. This smoldering stage is very dangerous, especially during times when people are sleeping, since large amounts of highly toxic smoke may be generated during this phase.

Once flames do appear, the sequence continues rapidly. Combustible material adjacent to the flame heat and ignite which in turn heats and ignites other adjacent materials if sufficient oxygen is present. As the objects burn, heated gases accumulate at the ceiling of the room. Some of the gases are flammable and highly toxic.

The spread of the fire from this point continues quickly. Soon the flammable gases at the ceiling as well as other combustible material in the room of origin reach ignition temperature. At that point, an event termed “flashover” occurs; the gases and other material ignite, which in turn ignites everything in the room. Once flashover occurs, damage caused by the fire is significant and the environment within the room can no longer support human life.

Flashover usually occurs about five to eight minutes from the appearance of flame in typically furnished and ventilated buildings. Since flashover has such a dramatic influence on the outcome of a fire event, the goal of any fire agency is to apply water to a fire before flashover occurs.

Although modern codes tend to make fires in newer structures more infrequent, today’s energy-efficient construction (designed to hold heat during the winter) also tends to confine the heat of a hostile fire. In addition, research has shown that modern furnishings generally burn hotter (due to synthetics).

In the 1970s, scientists at the National Institute of Standards and Technology found that after a fire broke out, building occupants had about 17 minutes to escape before being overcome by heat and

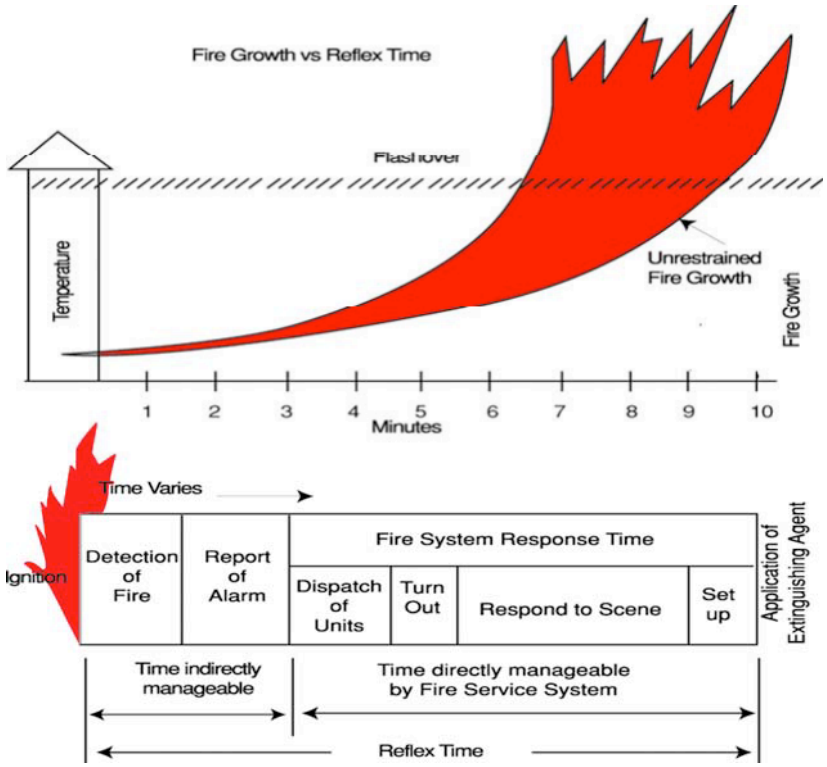
smoke. Today, that estimate is as short as three minutes.[10] The necessity of effective early warning (smoke alarms), early suppression (fire sprinklers) and firefighters arriving on the scene of a fire in the shortest span of time is more critical now than ever.

Perhaps as important as preventing flashover is the need to control a fire before it does damage to the structural framing of a building. Materials used to construct buildings today are often less fire resistive than the heavy structural skeletons of older frame buildings. Roof trusses and floor joists are commonly made with lighter materials that are more easily weakened by the effects of fire. "Light weight" roof trusses fail after five to seven minutes of direct flame impingement. Plywood I-beam joists can fail after as little as three minutes of flame contact. This creates a dangerous environment for firefighters.

In addition, the contents of buildings today have a much greater potential for heat production than in the past. The widespread use of plastics in furnishings and other building contents rapidly accelerate fire spread and increase the amount of water needed to effectively control a fire. All of these factors make the need for early application of water essential to a successful fire outcome. A number of events must take place quickly to make it possible to achieve fire suppression prior to flashover. The figure below illustrates the sequence of events.

[10] National Institute of Standards and Technology, *Performance of Home Smoke Alarms, Analysis of the Response of Several Available Technologies in Residential Fire Settings,* Bukowski, Richard, et al.

Figure 40: Fire Growth vs. Reflex Time



As is apparent by this description of the sequence of events, application of water in time to prevent flashover is a serious challenge for any fire department. It is critical, though, as studies of historical fire losses can demonstrate.

The National Fire Protection Association found that fires contained to the room of origin (typically extinguished prior to or immediately following flashover) had significantly lower rates of death, injury, and property loss when compared to fires that had an opportunity to spread beyond the room of origin (typically extinguished post-flashover). As evidenced in the following table, fire losses, casualties, and deaths rise significantly as the extent of fire damage increases.

Figure 41: Fire Extension in Residential Structures

Consequence of Fire Extension In Residential Structures 2003 - 2007

	Rates per 1,000 Fires		
Extension	**Civilian Deaths**	**Civilian Injuries**	**Average Dollar Loss Per Fire**
Confined to room of origin or smaller	2.44	25.67	$5,317
Confined to floor of origin	16.18	72.79	$34,852
Confined to building of origin or larger	27.54	54.26	$60,064

Source: National Fire Protection Association “Home Structure Fires”, March 2010

Emergency Medical Event Sequence

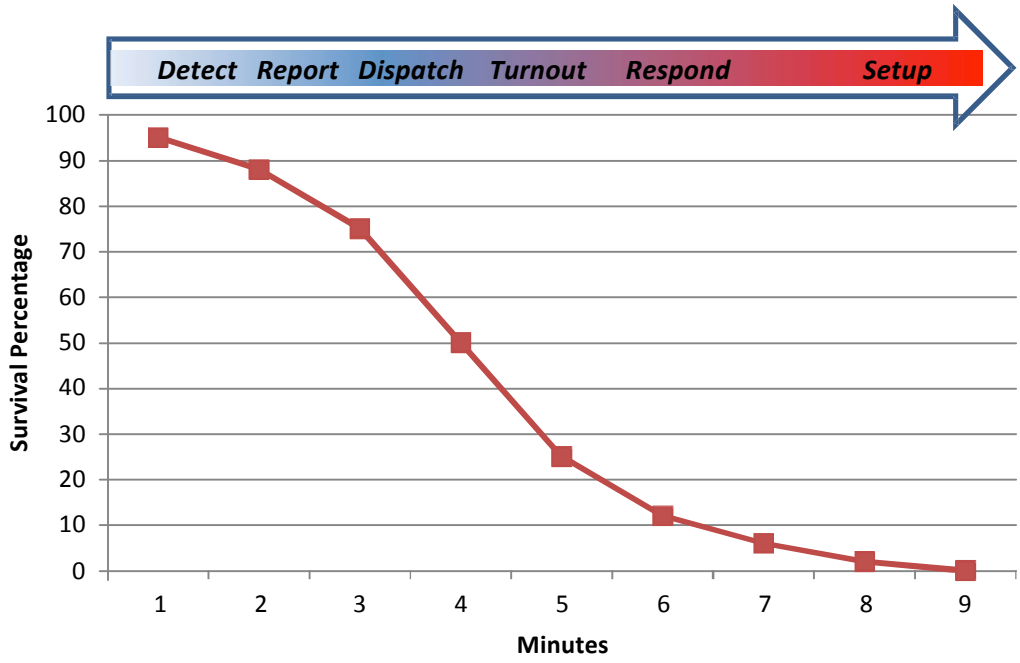
Cardiac arrest is the most significant life-threatening medical event in emergency medicine today. A victim of cardiac arrest has mere minutes in which to receive lifesaving care if there is to be any hope for resuscitation.

The American Heart Association (AHA) issued a set of cardiopulmonary resuscitation guidelines designed to streamline emergency procedures for heart attack victims, and to increase the likelihood of survival. The AHA guidelines include goals for the application of cardiac defibrillation to cardiac arrest victims.

Cardiac arrest survival chances fall by 7 to 10 percent for every minute between collapse and defibrillation. Consequently, the AHA recommends cardiac defibrillation within five minutes of cardiac arrest.

The following table illustrating cardiac arrest survivability was published in a 1998 study by the Emergency medical Directors Association of California. It illustrates the value of early CPR and cardiac defibrillation as shown below.

Figure 42: Cardiac Arrest Event Sequence



The percentage of opportunity for recovery from cardiac arrest drops quickly as time progresses. The stages of medical response are very similar to the components described for a fire response. Recent

research stresses the importance of rapid cardiac defibrillation and administration of certain medications as a means of improving the opportunity for successful resuscitation and survival.

Current Service Delivery Goals

SCES has established the following service delivery targets for emergency response times.

Call-Handling Performance Criterion

In many emergency services organizations, call-handling or call-processing are not functions under direct control of the fire department. This is not however the case in Strathcona County. SCES maintains in-house dispatch personnel that handle all radio communications from time of dispatch until incident completion for a number of fire agencies while EMS dispatch is handled by the regional provincial communications center. For fire dispatch, this allows department management to have an unusually high level of control over how dispatch procedures are developed and/or modified to improve overall service delivery.

No formal call answering or call processing time standards have been adopted, though the concept has been discussed. Currently, performance measurement focuses primarily on workload, which is not necessarily an indicator of quality, efficiency or effectiveness. Formal performance objectives should be established and measured.

Based on NFPA 1221 standards, call processing time—the time between when the call is answered and when the call is dispatched to responding units—should be less than 60 seconds 95 percent of the time. It is recommended that SCES establish the following performance objective in regards to call processing time.

For 90 percent of all calls for service received, SCES will notify and dispatch the appropriate units in less than 60 seconds. Call intake and dispatch personnel will continue to receive and relay vital information until all instructions have been issued or the initial unit arrives on scene.

Turnout Time Performance Criterion

Turnout time is one area that the fire department has total control over and is not affected by outside influences. Turnout time, or the time between when the call is received by the response units (dispatched) and when the unit is actually en route to the scene (responding), can have dramatic effects on overall response times. Reducing this single response time component reduces total response time.

The current version of NFPA 1710 recommends a turnout time performance objective of 80 seconds or less for suppression incidents and 60 seconds or less for medical/rescue incidents. Without

consideration of actual historical turnout time performance, the establishment of a turnout time objective is difficult. Given that turnout time is one area in which field personnel can dramatically improve overall response time, an aggressive objective is recommended. With this in mind, SCES has established the following Turnout Time Performance Objective.

For 90 percent of all suppression dispatches received, SCES will be en route to the incident in 80 seconds or less, regardless of incident risk type. Additionally, for 90 percent of all medical/rescue dispatches received, SCES will be en route to the incident in 60 seconds or less, regardless of the incident risk type.

Distribution Performance Criterion

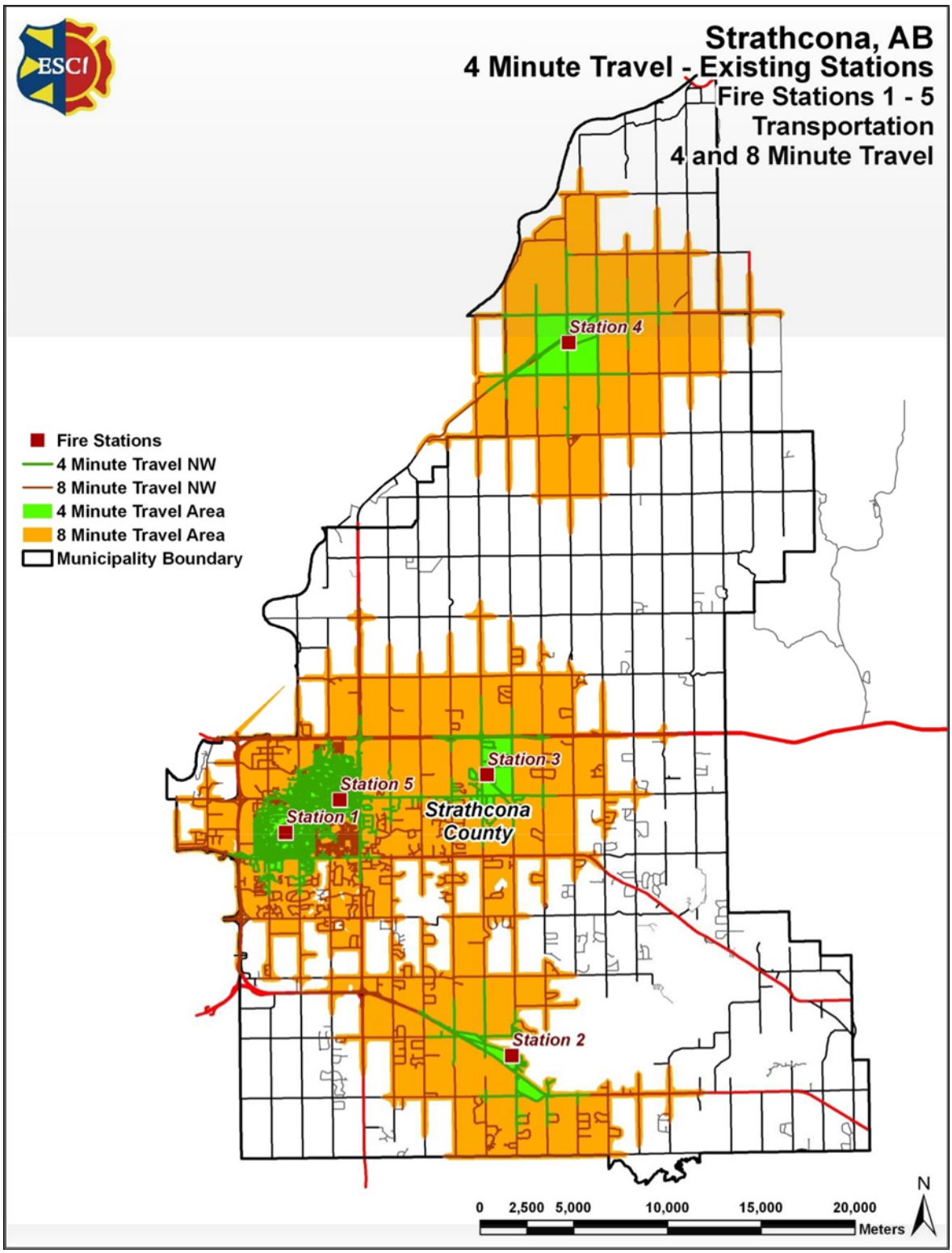
A fire department's *distribution* is essentially the location of resources to assure an initial intervention within the specific time frame identified in the community's performance goals. In Strathcona County, the goal for the first-arriving unit in the emergency risk categories is nine minutes less, at least 90 percent of the time, including call processing and firefighter turnout time. Historical performance notwithstanding, SCES has established the following First Due Response Performance Objective.

For 90 percent of all emergency incidents regardless of risk, the first due unit shall arrive within six minutes total response time in the urban area and 14 minutes total response time in the suburban and rural areas. The first due unit shall be capable of advancing the first line for fire control or starting rescue or providing basic or advanced life support for medical incidents.

Current Distribution Capability Analysis

Fire protection and ALS/BLS first response emergency medical services within Strathcona County are provided by the fire department from five strategically located facilities. Several major arterial roadways as well as geographical barriers exist throughout the response area. In order to visualize the potential response time capabilities from the current fire stations, the following map demonstrates those areas within a **four-minute travel time** of the stations on the actual roadway network. Reduction of speed has been calculated to account for turning apparatus and negotiating intersections. The amount of time between the initial dispatch and the responding unit to actually become en route (turnout time interval) to the scene has not been included. The four-minute travel time is used here after the modeling of several times. The four-minute model allows the department to cover most of the populated areas with little in the way of excess redundancy.

Figure 43: Initial Unit Travel Time Capability



As illustrated, SCES can reach a majority of the populated areas within Strathcona County within eight minutes (93.9 percent of service demand). There are areas of the County outside the eight minute travel time but these areas are largely undeveloped. It should be noted here that this analysis is based on travel time only and does not consider staffing at individual stations. Stations 2 and 3 are volunteer stations, which will see extended response times.

Concentration Performance Criterion

A fire department's *concentration* is the spacing of multiple resources close enough together so that an initial "Effective Response Force" (ERF) for a given risk can be assembled on the scene of an emergency within the specific time frame identified in the community's performance goals for that risk type. An initial effective response force is defined as that which will be most likely to stop the escalation of the emergency. The ERF for structural fire risks in Strathcona County is identified as a collective response of three engines, one truck, one command vehicle, and one ambulance to meet minimum staffing requirements for a typical residential structure fire. This initial ERF does not necessarily represent the entire alarm assignment, as additional units may be assigned based on long-term incident needs and risks. SCES has established the following Concentration Performance Objective.

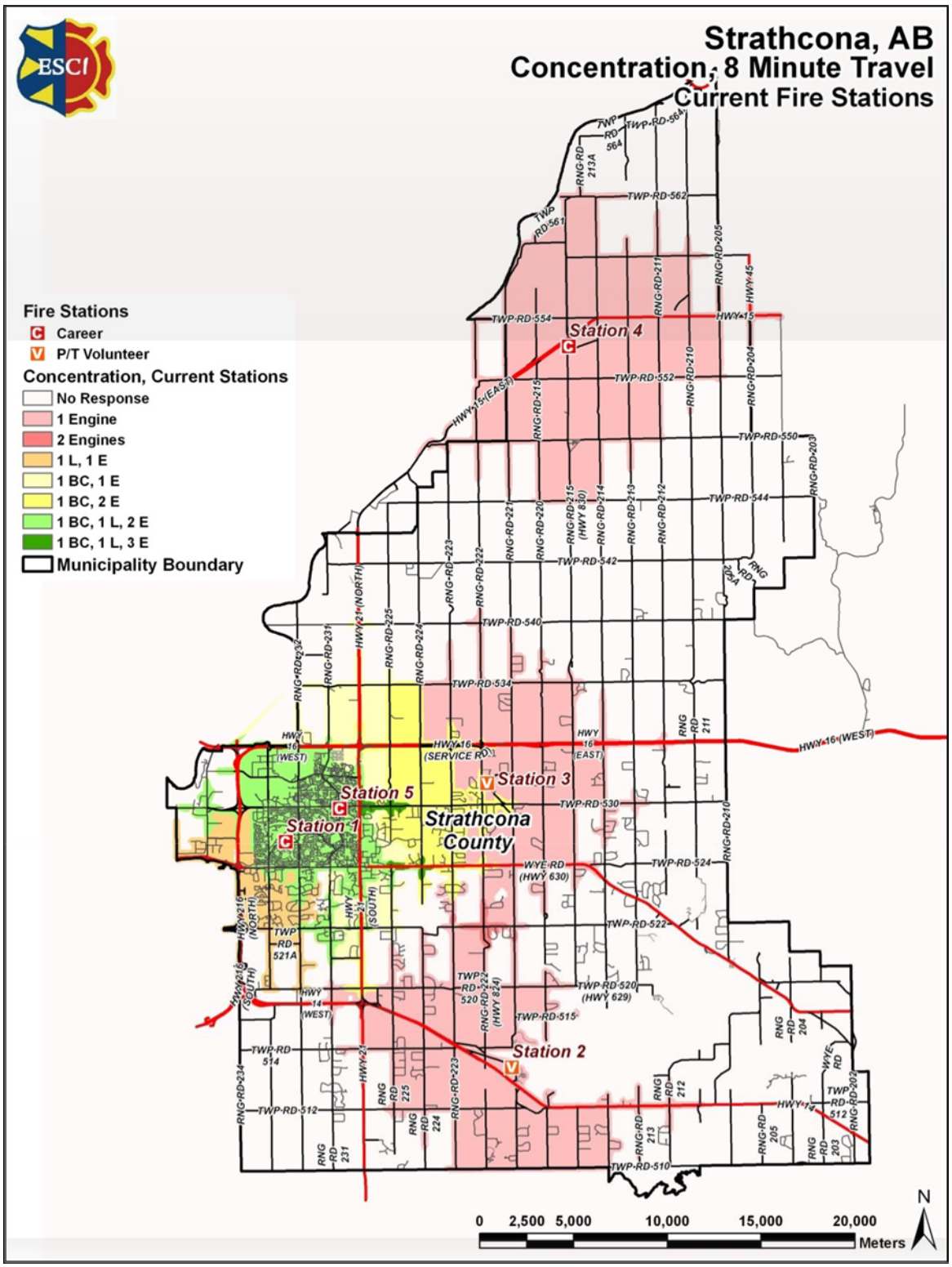
For 90 percent of all moderate risk incidents and above, SCES shall assemble an Effective Response Force (ERF) within eight minutes total response time in the urban area and within 18 minutes in the rural areas. This ERF shall be able to flow up to 3,500 gpm for firefighting or be able to handle a multiple-casualty emergency medical incident.

Current Concentration Capability Analysis

Standard firefighting procedures call for the arrival of the entire initial assignment (sufficient apparatus and personnel to effectively combat a fire based on its level of risk) within a certain amount of time. This is to ensure that enough people and equipment arrive soon enough to be effective in controlling a fire before substantial damage occurs.[11] The following figures illustrate the capability of SCES in potentially achieving its goal for concentration of apparatus resources within eight of travel time.

[11] See supplemental discussion about time/temperature curve and the effects of flashover.

Figure 44:Effective Response Force



The previous figure illustrates that the distribution of available apparatus is sufficient to provide an effective response force to a majority of the developed areas within the County.

Component G – Overview of Compliance Methodology

The preceding sections of this report provide a detailed analysis of the historical performance of SCES resources. In order for this analysis to prove beneficial to department and city decision-makers, continued analysis should be performed on a routine basis. The data provided to the study team for analysis proved to be difficult to analyze from the standpoint of being consistent and complete. Future efforts to measure performance will also be hindered by these issues without significant improvement in the data collection process.

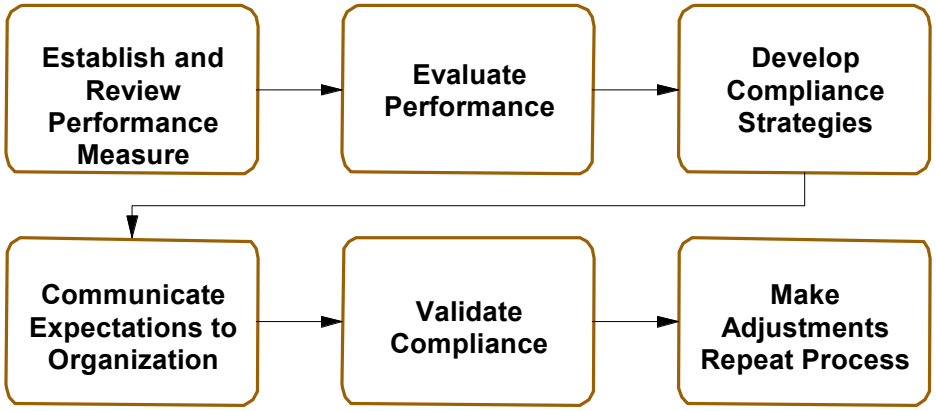
SCES is committed to a continual process of analyzing and evaluating actual performance against the adopted standards of cover and has adopted policies to enhance the data collection procedures of field operations personnel. Periodic review of the department's records management system reports will be necessary to ensure compliance and reliability of data.

Maintenance of Effort requires that performance objectives and performance measures are evaluated and efforts are made to reach or maintain the established levels.

Compliance Model

Compliance is best achieved through a systematic approach. SCES has identified the following six-step compliance model.

Figure 45: Maintenance of Effort Compliance Model



Step 1: Establish/Review Performance Measures

1. Complete the initial Standard of Cover process. Conduct a full review of the performance measures every five years. This process is risk-based and evaluates:

    - Services provided are identified
    - Levels of service are defined
    - Levels of risk are categorized
    - Performance Objective and Measures developed:
        - Distribution Measures
        - Concentration Measures

Step 2: Evaluate Performance

1. Performance measures are applied to actual services provided:

    - System level
    - First Due Area level
    - Unit level

Step 3: Develop Compliance Strategies

1. Determine issues and opportunities:

    - Determine what needs to be done to close identified gaps
    - Determine if resources can or should be reallocated
    - Seek alternative methods to provide service at desired levels
    - Develop budget estimates as necessary
    - Seek additional funding commitment as necessary

Step 4: Communicate Expectations to Organization and Stakeholders

1. Communicate expectations:

    - Explain method of measuring compliance to personnel who are expected to perform the services

- Provide feedback mechanisms
- Define consequences of noncompliance

2. Train Personnel:
   - Provide appropriate levels of training/direction for all affected personnel
   - Communicate consequences of noncompliance
   - Modify (remediate) internal processes, application systems, and technical infrastructure as necessary to comply

Step 5: Validate Compliance

1. Develop and deploy verification tools and/or techniques that can be used by divisions of the organization on an ongoing basis to verify that they are meeting the requirements:
   - Monthly evaluation:
     - Performance by Unit
     - Overall Performance
     - Review of performance by Division
   - Quarterly evaluation:
     - Performance by Unit
     - Performance by First Due
     - Overall Performance
     - Review of performance by Executive Management
2. Determine whether independent validation and verification techniques will be used to measure the performance, and solicit external assistance as necessary.

Step 6: Make Adjustments/Repeat Process

1. Review changes to ensure that service levels have been maintained or improved. Develop and implement a review program to ensure ongoing compliance:
   - Annual Review and Evaluation

- Performance by Unit
- Performance by First Due
- Overall Performance
- Review of performance by Governing Body
- Adjustment of performance standards by Governing Body as necessary

- Five Year Update of Standards
  - Performance by Unit
  - Performance by First Due
  - Overall Performance
  - Adoption of performance measures by Governing Body

2. Establish management processes to deal with future changes in the SCES service area.

Component H – Overall Evaluation, Conclusions and Recommendations to Policy Makers

Overall Evaluation

The standards of cover process based on the *CFAI Standards of Cover 5th Edition* required the completion of an intensive analysis on all aspects of the SCES deployment policies. The analysis used various tools to review historical performance, evaluate risk, validate response coverage, and define critical tasking. The analysis relied on the experience of staff officers and their historical perspective based on their collective experience combined with historical incident data captured by both the dispatch center and the department's in-house records management system.

Presentation of the information follows the format recommended in the *CFAI Standards of Cover 5th Edition*, including: Description of Community Served; Review of Services Provided; Review of Community Expectations and Performance Goals; Overview of Community Risk; Review of Historical System Performance; and Overview of Compliance Methodology. This section summarizes the results of all the analyses completed in the SOC process including conclusions and recommendations.

The Description of Community Served provided a general overview of the organization, including governance, lines of authority, finance, and capital and human resources, as well as an overview of the service area including population and geography served. The Review of Services Provided detailed a brief overview of the core services the organization provides based on general resource/asset capability and basic staffing complements. During the Review of Community Expectations and Performance Goals, it was determined that the community had high expectations of the department, felt generally positive about its services, and shared certain areas of concern particularly in regards to delivery of service to special populations.

An overview of community risk was provided to form the basis for the department's development of mitigation plans. Geospatial characteristics, topographic and weather risks, transportation network risks, physical assets, and critical infrastructure were reviewed and developed into a hazard vulnerability assessment that identified structure fires, hazardous materials and medical incidents as the primary risks within the community. As a factor of risk, community populations and demographics are evaluated against historic and projected service demand.

Evaluating risk using advanced geographic information systems (GIS) provided an increased understanding of community risk factors, which can lead to an improved deployment policy. Computer modeling of the department's response capability, both for distribution and concentration, indicated that the fire stations are adequately sited based on historical service demand. The present fire station locations complement the geography of the county and provide a total reflex time for first arriving units within the department's objectives.

The premise of the distribution policy is to consider the potential for life loss, economic value, and fire flow requirements. Travel time modeling was conducted, using computer modeling, to evaluate travel time using four and eight minutes as the maximum travel time for the first arriving unit. The modeling indicated that the present station locations provide coverage to approximately 65.6 percent of requests for service within a four minute travel time and 93.9 percent within eight minutes of travel time. With the addition of Stations 6 and potentially Station 7, this coverage increases to 72 percent within four minutes of travel and 94.4 percent within eight minutes of travel.

The Review of Historical System Performance evaluated each component of the emergency incident sequence. Total response time included a number of components such as call processing, turnout, and travel. Beyond the response time of the initial arriving units, the additional components of concentration and effective response force, reliability and call concurrency were evaluated.

Call processing time is above industry standards and its reduction would provide an opportunity to reduce overall incident time. Turnout time is also above industry standards. This is also an area of opportunity to reduce overall incident time that is within direct control of department personnel.

Travel times to actual incidents were longer than desired but the distance from existing fire stations should not be the issue impeding performance. Other factors are in play keeping response units from providing timely response such as unit availability, traffic, and route impedance. First unit arrival response time is currently above the current performance objective in both the urban and rural areas of the County.

Concentration is measured by the ability of the department to assemble a certain number of apparatus and personnel within a pre-determined amount of time. Historical data indicate that the department has had difficulty assembling an effective response force of at least three apparatus within established objectives.

Historical reliability is defined as the probability that the required amount of staffing and apparatus will be available when an emergency call is received. Analysis indicates that as calls for service increase overlapping calls become increasingly frequent. SCES is not currently experiencing numerous concurrent responses.

Overall system performance when measured by the draft Standards of Cover performance measures shows a lack of compliance in all areas. A summary of performance objectives as they compare to current performance is provided in the following figure.

Figure 46: 2010 Performance Objective – Actual Performance Comparison

Performance Indicator	Performance Objective	Fractal	Current Performance (2009)	Difference
Call Processing Time (Fire)	0:01:00	90th	0:03:43	0:02:43
Call Processing Time (EMS)	0:01:00	90th	0:03:43	0:02:43
Call Processing Time (Rescue)	0:01:00	90th	0:03:12	0:02:12
Call Processing Time (Other)	0:01:00	90th	0:03:39	0:02:39
Turnout Time (Fire)	0:01:20	90th	0:03:03	0:01:43
Turnout Time (EMS)	0:01:00	90th	0:03:02	0:02:02
Turnout Time (Rescue)	0:01:00	90th	0:03:11	0:02:11
Turnout Time (Other)	0:01:20	90th	0:03:03	0:01:43
Response Time - First Arriving Unit (Fire): Urban	0:09:00	90th	0:11:03	0:02:03
Response Time - First Arriving Unit (EMS): Urban	0:09:00	90th	0:10:42	0:01:42
Response Time - First Arriving Unit (Fire): Rural	0:14:00	90th	0:19:39	0:05:39
Response Time - First Arriving Unit (EMS): Rural	0:14:00	90th	0:21:09	0:07:09
Response Time - Full Response Force*	0:12:00	90th	0:28:44	0:16:44

*Represents combined ERF and does not differentiate between urban and rural responses.

As can be seen from the figure above, opportunities for system improvement exist in all of the performance indicators.

Recommendations

During the course of this analysis a number of issues, concerns, and opportunities were identified. The following recommendations are intended to accomplish three primary objectives:

1. Improve SCES's ability to evaluate its performance on a regular and ongoing basis and respond more effectively to changing circumstances.

2. Improve service delivery with minimal expenditure of funds.

3. Identify service level improvement opportunities that can be implemented as funding becomes available.

The recommendations are described as performance improvement goals, and should be implemented as funding allows. Each will improve SCES's ability to provide effective service to the community.

Performance Goal A: Improve call processing times so that resources are dispatched within 60 seconds when measured at the 90th percentile.

Industry guidelines set call processing targets at 60 seconds when measured at the 95th percentile regardless of incident type. This is the time between when a dispatcher receives the call for assistance and when resources are dispatched. SCES's current call processing performance is over three minutes when measured at the 90th percentile.

With the transition of EMS dispatch to the Provincial dispatch center, the focus of SCES personnel should be on fire and rescue emergencies. The overall workload should be reduced such that more time can be spent on fine-tuning the call processing methodologies and system that are currently in place.

Performance Goal B: Improve turnout times so that initiation of response occurs within one minute 20 seconds for suppression incidents and one minute for EMS incidents from time of dispatch 90 percent of the time

Industry guidance sets a target of 80 seconds or less for suppression incidents and 60 seconds or less for EMS incidents, 90 percent of the time to initiate response (turnout time). This is the time period between when dispatchers notify response personnel of the incident and when response crews begin travel towards the location. SCES's current turnout time performance currently ranges between 3:03 and 3:11 with EMS incidents achieving the quickest turnout.

SCES should explore whether dispatch broadcast times can be reduced, fire station layouts can be modified, and technology opportunities such as enhanced mobile data computing capability can be implemented to shorten turnout times.

Response personnel performance must also be addressed. Department management should regularly prepare information indicating current performance by response crews. Performance expectations should be reinforced and periodic monitoring conducted to determine if improvements are being made and sustained. Response personnel must make serious efforts to improve their turnout time performance for the benefit of the community.

Performance Goal C: Improve travel time to emergencies so that the time from initiation of response to arrival at incident is within the established response performance objective based on incident type.

There are several opportunities to improve travel times, the longest phase of the overall response continuum. SCES should explore areas of potential improvement in travel times based on enhanced routing of emergency apparatus through advanced mobile mapping and directional equipment or other methods to reduce vehicle impedance throughout the primary response area.

Performance Goal D: Follow a plan for future fire station locations and resource distribution to accommodate the area's growth and development.

The current deployment of SCES stations is sufficient to handle existing workload within the adopted response performance objectives. Previous recommendations in regards to resource distribution to more adequately provide for an effective response force concentration are already being evaluated. As the community continues to grow, a firm plan should be followed to develop additional response facilities to serve those new areas that could potentially impact service delivery by the department and re-align apparatus and personnel resources as necessary.

Component I – Appendices, Exhibits, and Attachments