

YELLOWKNIFE FIRE DIVISION MASTER PLAN



City of Yellowknife

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The City of Yellowknife

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PREFACE

The following serves as the City of Yellowknife Fire Division Master Plan. The primary motivation for developing this document is to assist the City of Yellowknife in developing a long-term strategy. The strategy is based on risk, corporate priorities and Council approved budget allocation. The Master Plan will be used to evaluate and forecast immediate and future needs of the community.

All indications suggest Yellowknife will continue to grow and challenge the City's capacity to budget for and deliver emergency services to the community. By establishing formal, risk-based performance measures and monitoring service delivery outputs, Yellowknife will be able to ensure an efficient and effective service to face current and new challenges.

A collaborative process is required to implement the recommendations made in this Master Plan:

1. The Fire Chief and his Leadership team will need to work with members of City Administration and Council in order to establish service delivery benchmarks. These benchmarks will assist in determining priorities for the City's emergency services and are based on:
 - projections for the next five to ten years
 - increase in risk
 - increase in demands for service
 - municipal goals
 - fiscal realities
 - other competing demands
2. Senior administrative staff will need to work with the Yellowknife Fire Division to develop an operational philosophy, expectations for levels of service and performance standards based on community risk factors.

To determine the effectiveness and efficiency of the Yellowknife Fire Division, we analyzed operational and administrative aspects and the department's ability to work cohesively. We interviewed fire service personnel and senior managers to gather additional input.

The implementation of the recommendations contained in this document should be a collaborative process. The Fire Chief, working together with the Senior Management, members of City Administration and Council, will need to establish benchmarks based on increases in risk and demands for service projected for the next 5-10 years. Based on municipal goals, fiscal realities, and other competing demands, these benchmarks will assist in determining priorities for the City's emergency services.



ACKNOWLEDGEMENTS

We would like to acknowledge the City of Yellowknife's foresight in taking steps to guide their long-term planning and inform their decision. This Master Plan was developed collaboratively with the City of Yellowknife's Project Lead Dennis Marchiori and Fire Chief, Darcy Hernblad. Valuable input was also received during the targeted interview process from the following:

- Mark Heyck, Mayor
- Dennis Kefalas, SAO
- Dennis Marchiori, Director, Public Safety
- Darcy Hernblad, Fire Chief
- Kerry Penny, City Solicitor
- Adrian Bell, Councillor
- Shauna Morgan, Councillor
- Craig MacLean, Deputy Chief
- Mike Hoffman, Deputy Chief
- Gerda Groothuizen, Deputy Chief
- Chris Bittrolff, IAFF Union President
- Deanne Buckner, Dispatch Supervisor
- Adam Catcher, Lieutenant
- Dieter Andre, Lieutenant
- Seann May, Senior Firefighter
- Braden Wasiuta, Firefighter



ACRONYMS

AB	Alberta
AHJ	Authority Having Jurisdiction
CAD	Computer-Aided Dispatch
CBA	Collective Bargaining Agreement
CF	Canadian Forces
CFAI	Commission on Fire Accreditation International
CMHS	Canadian Mortgage and Housing Corporation
CPAT	Candidate Physical Ability Test
CPR	Cardio Pulmonary Resuscitation
ECC	Emergency Communications Center
EMD	Emergency Medical Dispatch
EMS	Emergency Medical Services
EMT	Emergency Medical Technician
EOC	Emergency Operations Center
ERF	Effective Response Force
FDM	Flexible Data Management
FF	Firefighter
FTE	Full-time Equivalent
GIS	Geographic Information System
GNWT	Government Northwest Territories
HAZMAT	Hazardous Material
HR	Human Resources
IAFC	International Association of Fire Chiefs
IAFF	International Association of Firefighters
ICMA	International City/County Management Association
IT	Information Technology
JPR	Job Performance Requirement
LEED	Land Environment Economics and Development
LPG	Liquefied Petroleum Gas
MB	Manitoba
MDS	Minimum Duty Strength
MOU	Memorandum Of Understanding
MVC	Motor Vehicle Collision



NBC	National Building Code
NFC	National Fire Codes
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
NWT	Northwest Territories
OHS	Occupational Health and Safety
OK	Oklahoma
OT	Overtime
PCR	Patient Care Reports
POC	Paid On Call
PPE	Personal Protective Equipment
PTSD	Post-Traumatic Stress Disorder
QAP	Quick Access Plans
RCMP	Royal Canadian Mounted Police
RIT	Rapid Intervention Team
SOC	Standards of Cover
TMS	Traumatic Mental Stress
WCB	Workers' Compensation Board
WSCC	Workers' Safety and Compensation Commission
YKFD	Yellowknife Fire Department



TABLE OF CONTENTS

EXECUTIVE SUMMARY I

 INTRODUCTION I

 Emergency Services Master Planning Process.....ii

 DEPARTMENT OVERVIEW III

 COMMUNITY AND RISK OVERVIEW IV

 SUMMARY OF RECOMMENDATIONS IV

 IMPLEMENTATION COSTS AND TIMEFRAME OF RECOMMENDATIONS XV

 SUMMARY XIX

SECTION 1 INTRODUCTION **1**

 1.1 PROJECT BACKGROUND AND SIGNIFICANCE..... 1

 1.2 PROJECT SCOPE..... 1

 1.2.1 Project Purpose..... 1

 1.2.2 Project Objectives 2

 1.3 PROJECT APPROACH 2

 1.3.1 Project Methodology 3

 1.3.2 Emergency Services Master Planning Process..... 5

 1.3.3 Community Comparable Analysis..... 5

 1.4 TARGETED INTERVIEWS AND CONSULTATIVE PROCESS 6

 1.5 STANDARDS AND REFERENCES..... 6

 1.6 STUDY FACTORS 7

SECTION 2 COMMUNITY PROFILE..... **9**

 2.1 COMMUNITY OVERVIEW 9

 2.2 ECONOMY 9

 2.2.1 Yellowknife Economic Indicator..... 9

 2.2.2 Growth Projections 10

 2.3.2 Community Demographics 11

 2.4 COMMUNITY PLANNING AND DEVELOPMENT 12

 2.4.1 Residential Construction..... 12

 2.4.2 Industrial and Commercial..... 13

 2.4.3 Transportation Corridors 13

 2.4.4 Distance and Isolation from neighboring communities 13

 2.4.5 Wildland Urban Interface 13



2.4.6	Water Distribution System and Firefighting	13
SECTION 3	COMMUNITY RISK OVERVIEW.....	15
3.1	COMMUNITY RISK ASSESSMENT	15
3.1.1	Challenges	15
3.1.2	Risk Management	16
3.2	RISK EVALUATION MATRIX	16
3.3	STRUCTURAL RISK ANALYSIS.....	19
3.4	COMMUNITY RISK ANALYSIS OVERVIEW.....	21
SECTION 4	RESPONSE STATISTICS AND PERFORMANCE STANDARDS	23
4.1	RESPONSE STATISTICS.....	23
4.1.1	Historical Response Data	23
4.1.2	Response and Service Categories	27
4.2	INTERVENTION TIME.....	29
4.2.1	NFPA 1710.....	29
4.3	RESPONSE TIME MAPS.....	30
SECTION 5	DEPARTMENT PROFILE.....	33
5.1	DEPARTMENT OVERVIEW	33
5.1.1	Mission and Vision	33
5.2	HUMAN RESOURCES	33
5.2.1	Staffing Complement	34
5.2.2	Department Leadership and Management	37
5.2.3	Administrative Support.....	38
5.2.4	Dispatch Centre Staff	39
5.3	RECRUITMENT, SELECTION, RETENTION AND PROMOTION	40
5.3.1	Recruitment and Selection	40
5.3.2	Paid-On-Call (POC) and Career Standards	41
5.3.3	Workforce Training.....	44
5.3.3.1	Training for the Safety of Firefighters.....	44
5.3.3.2	Training Requirements.....	45
5.3.3.3	Incumbent Training.....	46
5.3.3.4	Specialty Teams Training.....	47
5.3.4	Training Staff.....	47
5.4	CAREER DEVELOPMENT	48
5.5	SUCCESSION PLANNING.....	48



5.6	HEALTH AND WELLNESS	49
5.7	PERFORMANCE STANDARDS	52
5.7.1	Predictive Modeling and Dynamic Deployment	53
5.7.2	Firefighter/Paramedic Staffing Ratio Calculation	55
5.8	STANDARD OPERATING GUIDELINES AND OPERATING POLICIES	56
5.9	EMERGENCY SERVICES DASHBOARD	57
5.10	RECORDS MANAGEMENT	59
5.11	TECHNOLOGY	59
5.11.1	Emergency Service Dispatch Software and Mobile CAD	59
SECTION 6 CORE SERVICES		61
6.1	COMMUNITY SERVICE CONSIDERATIONS.....	61
6.2	EMERGENCY MEDICAL SERVICES.....	61
6.3	FIRE AND RESCUE.....	63
6.3.1	Fire Suppression.....	63
6.3.1.1	Structural Firefighting	63
6.3.1.2	Industrial Firefighting and Response	64
6.3.1.3	Wildland and Wildland Urban Interface Firefighting.....	64
6.3.1.4	Vehicle Firefighting and Extrication	65
6.3.2	Hazmat Response.....	65
6.3.3	Technical Rescue.....	65
6.4	FIRE PREVENTION PROGRAM	66
6.5	FIRE PREVENTION INSPECTIONS	68
6.5.2	Public Education Program.....	70
6.6	MUTUAL AID AND OTHER SERVICE AGREEMENTS	72
6.7	EMERGENCY RESPONSE DEPLOYMENT SYSTEM CAPABILITIES	72
SECTION 7 ASSETS AND FACILITIES		77
7.1	YKFD INFRASTRUCTURE	77
7.1.1	Fire Stations	77
7.1.2	Emergency Communications Centre	80
7.1.3	Fire Training Facility	81
7.2	EQUIPMENT	83
7.2.1	Apparatus and Light Duty Vehicles.....	83
7.3	ANCILLARY EQUIPMENT.....	88
7.4	PERSONAL PROTECTIVE EQUIPMENT	88



7.5	SPECIALIZED OPERATIONS EQUIPMENT	88
7.6	ASSET MANAGEMENT.....	88
7.6.1	Equipment and Apparatus Maintenance.....	89
SECTION 8	MUNICIPAL COMPARATORS.....	91
SECTION 9	SUMMARY	93
APPENDIX 'A'	GLOSSARY OF TERMS	95
APPENDIX 'B'	LIST OF FIGURES, CHARTS, IMAGES, MAPS, AND TABLES	97
APPENDIX 'C'	INTERVIEW GUIDE	99
APPENDIX 'D'	THEORETICAL RESPONSE MAPPING METHODOLOGY	101
	Base Data Layers Requested.....	101
	Data formats	101
	Purpose of Files.....	101
	Theoretical Response Zone.....	102
	Additional Analysis.....	103



EXECUTIVE SUMMARY

Introduction

Fire departments and emergency services across the country are challenged by budget constraints, rising call volumes, and expectations to do more with less while facing increased risk. The demand for emergency response and management services has expanded causing the role to change and the services to diversify. Failing to address these challenges properly leaves a community and its responders vulnerable.

Effective management of an emergency services department requires a clear understanding of risk and an ability to administer an appropriate response. The primary focus of this project was to review the current state of the Yellowknife Fire Division (YKFD) and provide recommendations in a Master Plan document that will assist the City of Yellowknife (Yellowknife) in developing long-term strategies for emergency services.

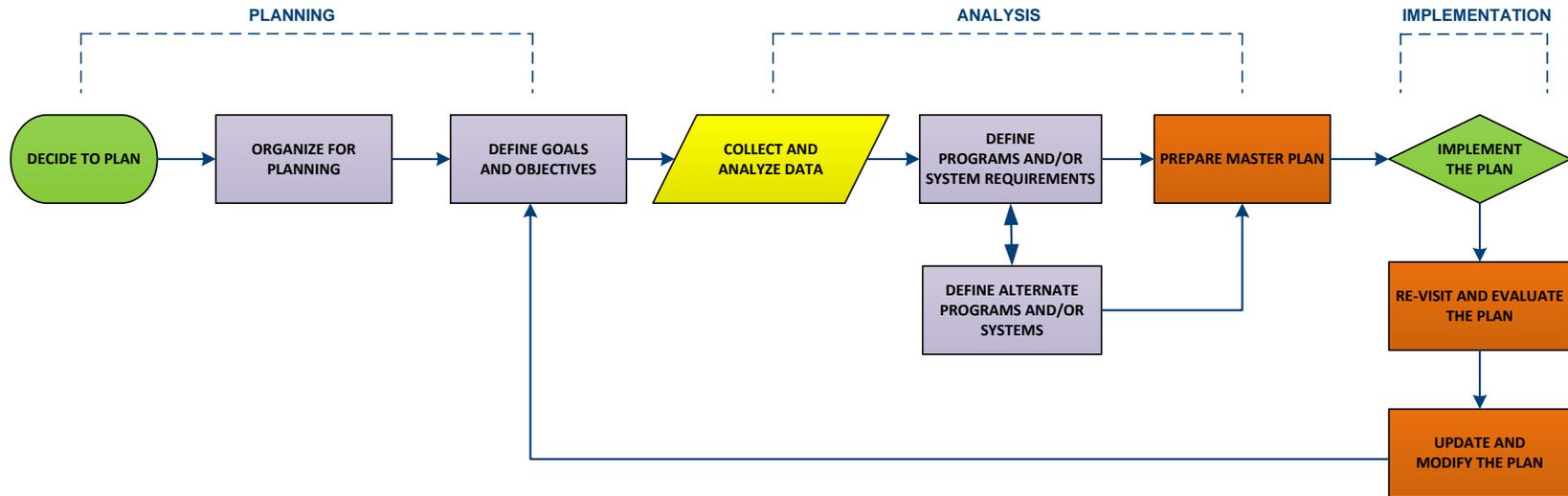
The Master Plan should be considered a dynamic document as it is to be evaluated and updated regularly to reflect rapidly changing information and circumstance of the community.



Emergency Services Master Planning Process

The following diagram illustrates the process we used to complete this Plan.

Figure 1: Master Planning Process





Department Overview

YKFD is a composite service that provides Fire/Rescue and Emergency Medical Services (EMS) to the residents of Yellowknife. YKFD is staffed 24 hours a day by full-time complement of cross-trained personnel in fire/rescue operations and EMS. The department operates out of one (1) fire station strategically and centrally located in the community.

YKFD employs 28 highly skilled full-time operational staff, 20 paid-on-call volunteer positions and 4 volunteer public educators along with a dispatch unit with 4 dispatchers and a dispatch supervisor. YKFD uses the latest in equipment, training and operational methods providing the following services:

- Fire Suppression
- Emergency Medical Services and Ground Ambulance
- Specialty Services
 - Technical Rope Rescue
 - Ice and Water Rescue
 - Vehicle Extrication
 - Trench Rescue
 - Hazardous Material Response
 - Confined Space
- Fire Inspections
- Fire Investigations
- Public Education

YKFD is comprised of four (4) distinct branches, including:

1. Operations
2. Life Safety and Training
3. Employee Safety and Training
4. Administration

Over the years, the Yellowknife Fire Division has faced many challenges. After a period of significant and ongoing changes in leadership and high turnover in staff, the department has now reached a much-needed stable workforce.

The department is focused on continuous improvement with emphasize on safety and collaborative approach to procedures and guidelines for daily operations. Delivery of ongoing training and valuable opportunities to broaden experience has resulted in quality staff; translating into higher degree of customer service and patient care. This includes the recent takeover of emergency dispatch services from Yellowknife Public Works. The excellent condition of their equipment and facilities reflects a high degree of professionalism among a young, energetic and committed team.



Community and Risk Overview

Over the past decade, Yellowknife has experienced a cumulative growth of just fewer than 5%. The environmental scan and community profile analysis projects the population will continually increase by a similar rate for the next decade. From this projection, we extrapolated related risk factors and specific challenges.

Yellowknife, from an overall perspective, has the typical mix of residential, commercial, mercantile and institutional occupancies for a city of its size. The environmental scan and community profile shows there are a number of factors that present increased risks and should be considered as part of Yellowknife's overall emergency response strategy. These factors include:

- Industrial/Economic Development
- Rate of population growth in the community
- Water Distribution System and Firefighting
- Demographics of the community
- Transportation Corridors
- Increased calls for emergency services
- Wildland urban interface
- Distance and Isolation from neighboring communities

After reviewing the incident calls for YKFD, the majority of the calls fall into the following categories:

- Emergency Medical Assistance
- Motor Vehicle Incidents (MVI)
- Investigate Fire Alarms
- Fires (all categories)
- Hazmat (dangerous goods)
- Rescue
- Miscellaneous, i.e. explosions, ruptures, standbys, smoke odors, police assist, etc.

Summary of Recommendations

The following recommendations are drawn from findings presented throughout the report. A timeframe within 0-60 months has been assigned to each recommendation, recognizing that the start and completion of any recommendation is based on annual corporate priorities, and Council approved budget allocations.



Recommendation #1: Develop a building inventory program

(12-24 months)

We recommend that an inventory of all building structures be classified, documented, and maintained using the National Building Code of Canada's Major Occupancy Classification system. It is important that an inspection of all structures be conducted and evaluated in terms of risk assessment/management matrix as described in Image 1, Risk Assessment, Page 16. This will aid in the planning of response resources (personnel and equipment) and standard operating guidelines.

Yellowknife needs to maintain an ongoing assessment of building risk in the community that is not limited solely to construction and permits. This ongoing assessment allows Yellowknife to be well positioned to effectively handle future growth and changing risks to the community.

(Reference: Section 3.3 Structural Risk Analysis, Page 19)

Recommendation #2: Undertake a comprehensive risk analysis of the community and develop a Standard of Cover to effectively manage risks

(0-24 months)

The SOC is used to establish performance benchmarks for existing levels of service providing opportunities for continuous improvement at the same time. This would also provide a well-articulated description of services to be provided to the community with the full understanding and endorsement of elected officials.

The benefits of completing an SOC will ensure that YKFD has a clear understanding of the scope of overall risk for the community while enabling them to identify the resources and response capabilities necessary to adequately address those risks. The SOC will further ensure YKFD has a safe and effective response force for all emergencies including fire suppression, emergency medical services and specialized response situations.

(Reference: Section 3.4 Community Risk Analysis Overview, Page 21)

Recommendation #3: Conduct an in-depth analysis of false alarms

(0-24 months)

We recommend YKFD conduct an in-depth analysis to determine the current trends of false alarms with the view to initiate preventative measures to reduce the occurrence and costs of false alarms.

(Reference: Section 4.1.1 Historical Response Data, Page 23)

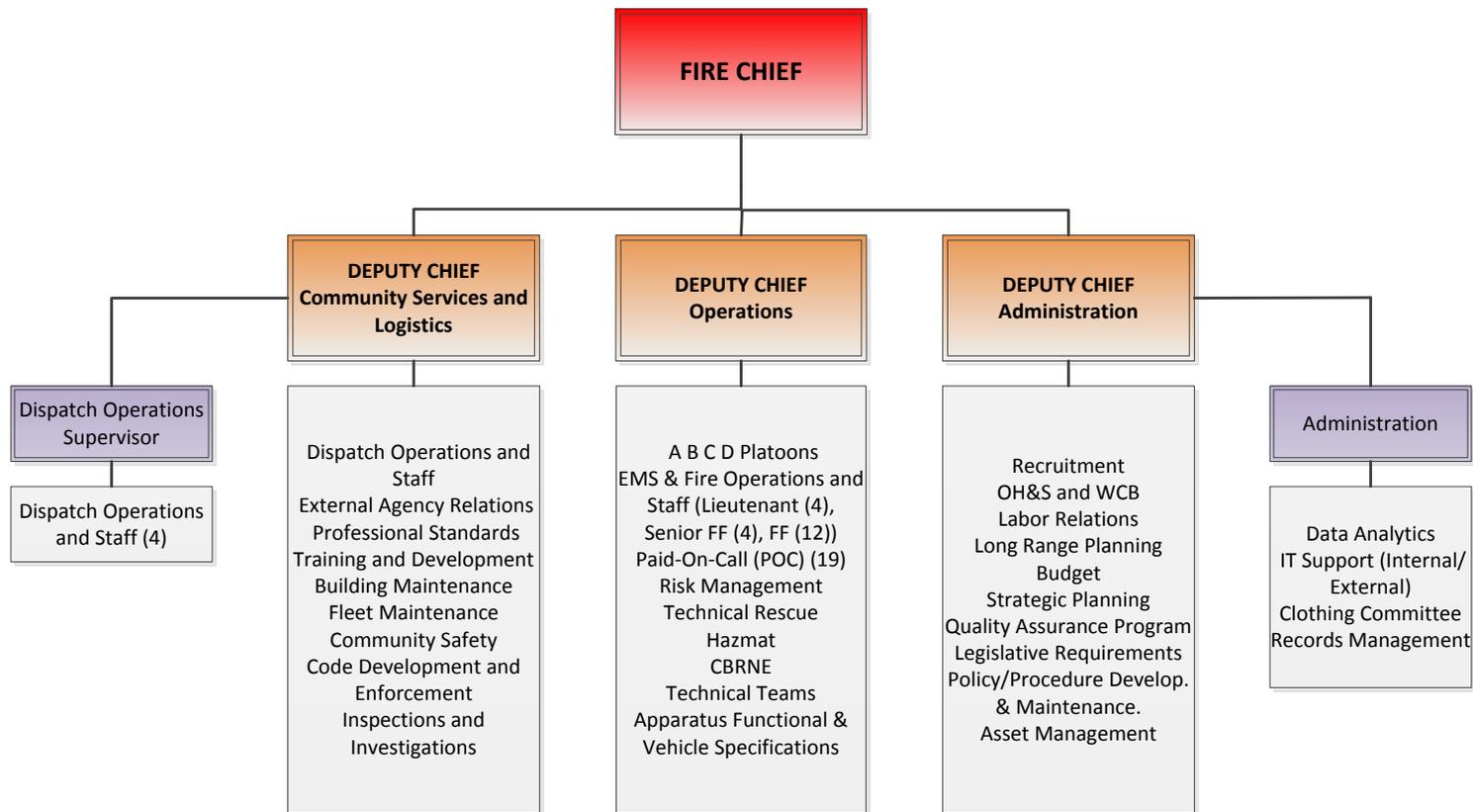


Recommendation #4: Realign the current organizational structure

(12-24 months)

We recommend a structure similar to the example below that has balanced approach to allocating tasks, responsibility and accountability. Additionally, in comparison to the existing 2015 organizational chart, it also shows clear lines of reporting and accountability.

(Reference: Section 5.2.1 Staffing Complement, Page 34)





Recommendation #5: Create a fulltime administrative support position

(0-12 months)

We recommend that YKFD add a fulltime administrative support position responsible for clerical and other office support functions such as:

- Filing and photocopying
- Managing visitors
- Analyzing data
- Administering OH & S and WCB claims
- Tracking inventory of duty clothing
- Managing records

(Reference: Section 5.2.3 Administrative Support, Page 38)

Recommendation #6: Increase staffing levels to meet the requirements outlined in NFPA 1221 (chapter 7) with a minimum of two operators on duty at all times

(0-12 months)

We recommend providing adequate levels of highly trained staff to ensure continuous response to calls by highly trained and alert individuals. This applies to both routine calls for service as well as periods when demands that might exceed the ability for a single operator/dispatcher to manage effectively.

(Reference: Section 5.2.4 Dispatch Centre Staff, Page 39)

Recommendation #7: Continue the Fire Cadet Program

(36-60 months)

As a long-term strategy, we recommend that the primary focus for career recruitment is the continuation of the fire cadet program or other initiatives that seeks out and/or develops candidates that reside in Yellowknife or within the Territory.

(Reference: Section 5.3.1 Recruitment and Selection, Page 40)

Recommendation #8: Formalize the role of the Paid-On-Call members

(36-60 months)

We recommended, given YKFD's challenges with recruitment and retention of POCs and the increasing costs to maintain the current program that YKFD formally establish the POCs as Exterior Operations Level Firefighter with the primary role to support the career operations. Those POCs looking towards career opportunities in YKFD could be offered high-level qualifications as part of the ongoing training program.

(Reference: Section 5.3.2 Paid-On-Call (POC) and Career Standards, Page 41)



Recommendation #9: Enhance the use of on-line delivery of educational material to all staff

(0-12 months)

We recommend YKFD continue to take advantage of the on-line learning environment to enhance the delivery of important educational information and relevant communications to all staff.

(Reference: Section 5.3.3.3 Incumbent Training, Page 46)

Recommendation #10: Review the staff qualifications and standards

(0-12 months)

We recommend YKFD continue to take advantage of their learning environment but should review the current staffing qualifications as the requirements are quite ambitious, specifically referring to the POC members. A review of the service levels will also direct the competency base for career members in accordance with staffing numbers and skills maintenance budgets and training schedules.

- Considerations to recruiting POC members based on JPRs may increase the number of qualified and competent firefighters in a timely fashion.
- Considerations to retaining POC members based on JPRs may increase the sustainability of qualified and competent firefighters.
- Qualifications for career members add to career development (section 5.12), and should be considered as professional development versus job requirements based on a review of the current service levels and staffing models.

Scheduling and records management will assist in tracking certifications and JPR requirements primarily in skills maintenance for all certifications and qualifications.

(Reference: Section 5.3.3.3 Incumbent Training, Page 46)

Recommendation #11: Review and align the training portfolio to include delegating/appointing subordinate training officers to support the Deputy Fire Chief of Employee Safety and Training

(12-24 months)

We recommend YKFD continue to take advantage of the officer core and align the training officer roles and responsibilities to include training related administrative duties such as scheduling and data management. This would result in a broader effort of much needed training focus. This could result in increased training advancement, retention and succession planning.

Due to the high number of call volumes during a shift, it is very difficult to keep training schedules for courses or competency reviews as firefighters and officers are required to respond to calls; thereby interrupting active sessions whether at the fire station or at the remote training grounds. A possible solution for scheduling training is to schedule sessions at the beginning of a shift (prior to shift vehicle inspections or incorporated at the same time) or at shift change (allowing for coverage if a call comes in).

(Reference: Section 5.3.4 Training Staff, Page 47)



Recommendation #12: Create a formalized process for officer development

(0-36 months)

We recommend that YKFD implement an Officer Development Program that follows IAFC guidelines in collaboration with the City of Yellowknife Human Resources. Promotional processes should include job performance requirements and professional qualifications outlined in NFPA 1021. This approach will enhance in-house training and promote understanding of YKFD SOGs and operational directives. The training and mentorship process will also support promotional opportunities for senior staff.

(Reference: Section 5.4 Career Development, Page 48)

Recommendation #13: Establish a formal Succession Plan

(0-36 months)

We recommend that YKFD establish a formal succession plan that will allow for the necessary training and development of existing staff thereby ensuring a smooth transition when changes to key positions and personnel in the leadership team occur. This plan needs to go beyond fire service technical or operational qualifications and include academic, leadership and management development.

(Reference: Section 5.5 Succession Planning, Page 48)

Recommendation #14: Develop a program to address PTSD and TMS for emergency response personnel

(0-12 months)

We recommend that YKFD develop and implement a unique Health and Wellness Program to include components specifically relating to the emergency responders' mental health awareness and readiness. The introduction of such a program will allow YKFD to take a definitive and proactive step to educate, prevent, and support those impacted by occupational stress injury.

One such program is the Mental Health Commission of Canada's (MHCC) 'Road to Mental Readiness (R2MR)' Program for Emergency Personnel (associated but not limited to Firefighter/Paramedics, Dispatch, Emergency Medical Services and Peace Officers). The R2MR program was originally developed by the Canadian National Defence and the Canadian Armed Forces; addresses stigmas, and identifies the signs and symptoms of occupational stress injury, based on a comprehensive mental health continuum model.

(Reference: Section 5.6 Health and Wellness, Page 49)



Recommendation #15: Review the need to invest in Predictive Modeling Software

(24-60 months)

We recommend YKFD invest in evidence-based predictive modeling and dynamic deployment system software that considers historical response data and anticipates the need to recall or increase resources for effective response times. This software provides timely and accurate mission critical information to improve the delivery of services and enhance citizen safety and firefighter safety. The delivery of effective information also means efficient use of resources.

The ultimate cost for an implementation of this software would include set-up fees, annual licensing and support fees, as well as any incremental YKFD staff costs for training or adding new staff with specialized skillsets. Standard pricing from software vendors is not available because the variables depend on YKFD's decisions regarding how they would implement the software. As a point of reference, the City of Kelowna is proceeding with an implementation with a cost of \$225,000 over 5 years. YKFD's application would be considerably less than this.

(Reference: Section 5.7.1 Predictive Modelling and Dynamic Deployment, Page 53)

Recommendation #16: Establish a monthly Emergency Services Dashboard

(12-24 months)

We recommend YKFD establish a monthly fire service dashboard to monitor system outputs. The benefits of a dashboard provide an accountability system within the operational domain that may enhance a culture of continuous improvement amongst fire department staff, and a management tool for the Fire Chief to report on the department's performance from a business perspective.

(Reference: Section 5.9 Emergency Services Dashboard, Page 57)

Recommendation #17: Evaluate and upgrade the current use of FDM software to sufficiently meet the requirements of YKFD

(0-12 months)

It is important to optimize the tools and investment currently in place for YKFD. We recommend that YKFD evaluate and upgrade the current use of FDM software to sufficiently meet the requirements of the department. There are many uses and advantages for the FDM software that would benefit the department's growth and advancement.

FDM also offers on-site training and assistance in customizing their product, which may enhance the overall usage and outcomes of the overall software package. This service is available to information technologists as support and advice as well as training for frontline users.

(Reference: Section 5.10 Records Management, Page 59)



Recommendation #18: In conjunction with recommendation 17, review other opportunities available through the FDM operating platform and the CAD module for more effective and efficient response

(12-24 months)

We recommend YKFD procure the necessary infrastructure, equipment, program and technical support to establish CAD in the primary response apparatus. Mobile CAD enables:

- Shorter turn out times
- Greater Responder safety
- Accurate data
- Lower radio traffic
- Efficient, secure means to transfer sensitive information

Based on 5 emergency vehicles equipped with Mobile CAD, the estimated cost is \$25,000 plus recurring annual license fees of \$1500.00.

(Reference: Section 5.11.1 Emergency Service Dispatch Software and Mobile CAD, Page 59)

Recommendation #19: City of Yellowknife to provide input for a ground ambulance policy and funding framework

(12-24 months)

As indicated in the Terriplan report, there is a need for a GNWT policy and funding framework for pre-hospital care (ambulance service). We recommend the City of Yellowknife's Public Safety Departments enhance the current relationship with the GNWT and provide input into the development of a policy and funding framework for the ground ambulance.

(Reference: Section 6.2 Emergency Medical Services, Page 61)

Recommendation #20: YKFD develop a baseline capacity for industrial firefighting

(12-24 months)

While a large-scale industrial fire or emergency incident is a low probability in Yellowknife, the impacts/consequence depending upon the event would be extreme. In light of the remote and isolated risk factor, we recommended that YKFD enhance the current training program to include a baseline capability to combat industrial fires.

(Reference: Section 6.3.1.2 Industrial Firefighting and Response, Page 64)

Recommendation #21: YKFD complete the wildland and interface firefighting capability and training

(12-24 months)

We recommend YKFD training program place a renewed focus on the wildland and wildland urban interface firefighting capabilities with a view to have all staff trained.

(Reference: Section 6.3.1.3 Wildland Firefighting, Page 64)



**Recommendation #22: YKFD enhance Hazmat qualifications to the technician level
(12-24 months)**

Based upon the response statistics of 28 events in the last 5 years, the community profile in terms of transportation, storage and usage of hazardous materials, and remoteness, we recommend that additional technician level qualified staff should be pursued. With 8 staff members qualified to this level, each platoon would have 2 technicians and the ability to have 24/7 coverage.

(Reference: Section 6.3.2 Hazmat Response, Page 65)

Recommendation #23: The Deputy Chief of Operations investigate the need for a high angle rescue capability and/or alternative tactics

(48-60 months)

Although the response statistics indicate that high angle rescue responses are a low probability, low consequence risk for YKFD, a more detailed study is required. We recommend the Fire Chief conduct an analysis into a training and awareness program delivered to YKFD staff and maintenance workers that utilize platforms and rigging. This analysis may result in alternative tactics to mitigate the need for a high angle rescue capability.

(Reference: Section 6.3.3 Technical Rescue, Page 65)

Recommendation #24: City of Yellowknife expand Bylaw 4502 to include additional fire and life safety requirements

(12-24 months)

We recommend that the City expand bylaw 4502 with a view to provide additional requirements that clarify and/or emphasize the National Fire Code. The additional requirements should be based on local conditions or occurrences where increased awareness of enforcement action may be required.

(Reference: Section 6.4 Fire Prevention Program, Page 66)

Recommendation #25: City of Yellowknife formalize the annual fire inspection program cycle

(12-24 months)

We recommend that as part of the review of bylaw 4502, the City establish a cyclical fire inspection program based on major occupancy classifications where the greatest fire and life-safety risk reduction can be achieved.

(Reference: Section 6.5 Fire Prevention Inspections, Page 68)



Recommendation #26: Modify Emergency Response Deployment System

(12-24 months)

We recommend the City of Yellowknife implements Option 3 and an increase of the MDS to 6 firefighters as the emergency response deployment performance standard. This is based on all the considerations and analysis conducted in this study, which includes:

- community risks
- demographic and community profile
- historical trends
- community expectations
- industry leading practices
- legislated standards
- fiscal tolerance

Within the NFPA standard and the National Institute of Standards and Technology (NIST), YKFD will need to review all non-emergent services with the goal to reduce the total call volume, and complete a review of the PCR to reduce the time required for completion. The City needs to establish alternate programs to manage intoxicated people and the homeless to reduce the dependency upon the ambulance service. The response system identified in Option 3 provides the balance between the number of Firefighters and the public's safety within the fiscal realities of service provision.

(Reference: Section 6.7 Emergency Response Deployment System Capabilities, Page 72)

Recommendation #27: Review and upgrade current dispatch facilities to meet industry requirements as outlined by NFPA 1221

(12-36 months)

We recommend YKFD adopt the Standard for the Installation, Maintenance and use of Emergency Services Communication Systems to satisfy the facility requirements outlined in Chapter 4 of the standard to ensure reliable dispatch functions are carried out in an efficient and professional manner providing timely dispatch of necessary resources to effectively and efficiently deal with emergency calls for service. It further ensures the proper workspace for staff to carry out their duties in a wholesome and healthy workplace.

(Reference: Section 7.1.2 Emergency Communications Centre, Page 80)



Recommendation #28: Establish a committee to review and maintain compliance in design of a the YKFD training facility

(0-24 months)

We recommend that YKFD establish a working committee with select members from YKFD Administration, Training Officers, Firefighters, City Engineers and Planners tasked with making decisions on design and use of the training facility. The goal of the committee is to address budgeting, training requirements environmental considerations, stakeholder input, possible community concerns, expansion, regionalization and potential use of outside parties.

Compliance to NFPA 1402 and 1403 should also be reviewed and considered to allow skills maintenance to support JPRs, based on desired service levels. Basing the facility on these standards will support future expansion for possible changes in service levels, and will also allow for other services/departments to utilize the facility in shared use of the facility and training grounds. Cost savings can also be realized from facility sharing as well as the greater opportunity in joint training and exercises with other agencies and departments.

(Reference: Section 7.1.3 Fire Training Facility, Page 81)

Recommendation #29: Implement a comprehensive Asset Management Program with advanced Equipment Management Software

(0-24 months)

We recommend YKFD investigate and implement an asset management program with industry proven software in order to better track, care for, and extend the life expectancy of equipment and apparatus. This would ensure that preventative maintenance could be diligently tracked to avoid early retirement/replacement. This software will also provide valuable data for possible failure analysis.

This, combined with more rigorous/documented asset management practices, will ensure that the YKFD maintains optimal utilization from it apparatus and equipment. As YKFD currently uses FDM software, this could be a possible tool for equipment and asset management.

(Reference: Section 7.6 Asset Management, Page 88)

Recommendation #30: Consider the advantages of having one or more central fleet mechanics certified as Emergency Vehicle Technicians (EVT)

(12-48 months)

We recommend YKFD consider having at least one trained emergency vehicle technician (EVT) on central staff to address daily critical issues for emergency apparatus. Having an EVT on fleet staff will enable YKFD to be cost-effective and efficient allowing for timely maintenance, service and repairs reducing downtime for essential frontline emergency vehicles.

(Reference: Section 7.6.1 Equipment and Apparatus Maintenance, Page 89)



Implementation Costs and Timeframe of Recommendations

The majority of the recommendations presented in this report are achievable using existing staff time, and will therefore not pose significant additional costs to the City of Yellowknife. Other recommendations regarding staffing, database management, and software will have associated costs. Costs are estimates based on the comparable costs incurred by other departments.

Note: 'Cost Neutral' refers to the use of internal staff through a normal workday schedule. Additional costs may apply if overtime is required.

	Recommendation	2016	2017	2018	2019	2020	2021	Resource	Estimated Cost	Comments
1	Develop a building inventory program		●	●				Internal	Cost neutral	Can be managed by existing resources
2	Undertake a comprehensive risk analysis of the community and develop a Standard of Cover to effectively manage risks	●	●	●				Internal	Cost neutral	Can be managed by existing resources
3	Conduct an in-depth analysis of false alarms			●	●			Internal	Cost Neutral	Can be managed by existing resources
4	Realign the current organizational structure	●	●					Internal	Cost neutral	Can be managed by existing resources
5	Create a fulltime administrative support position	●	●					Competitive Job Posting	See comment	Cost commensurate with current Yellowknife wage format
6	Increase staffing levels to meet the requirements outlined in NFPA 1221 (chapter 7) with a minimum of two operators on duty at all times	●	●					Competitive Job Posting	\$405,000	Recommended to increase the Dispatcher level by 5 with an annual cost of \$405,000 based upon \$81,000 per dispatcher
7	Continue the Fire Cadet Program			●	●	●	●	Internal	Cost neutral	Can be managed by existing resources
8	Formalize the role of the Paid-On-Call members			●	●	●	●	Internal	Cost neutral	Can be managed by existing resources



	Recommendation	2016	2017	2018	2019	2020	2021	Resource	Estimated Cost	Comments
9	Enhance the use of on-line delivery of training and educational material to all staff	●	●					External/Internal	See comments	Online training will have a cost depending on courses. Internal coordination is required to manage the training and learning management system.
10	Review the staff qualifications and standards.	●	●					Internal	Cost neutral	Can be managed by existing resources
11	Review and align the training portfolio to include delegating/appointing subordinate training officers to support the Deputy Fire Chief of Employee Safety and Training		●	●				Internal	Cost neutral	Can be managed by existing resources
12	Create a formalized process for officer development	●	●	●	●			Internal	See comments	Although the process can be handled by existing resources, there will be costs for seminars and additional training.
13	Establish a formal Succession Plan	●	●	●	●			Internal	See comments	Although the process can be handled by existing resources, there will be costs for seminars and additional training.
14	Develop a program to address PTSD and TMS for emergency response personnel	●	●					Internal	See comments	Research, implementation and curriculum design can be handled with internal resources however if you create your own program using available information online. If you adopt an existing program such as R2MR then the minimum spend is \$45k for a mandatory train-the-trainer course and annual registration.



	Recommendation	2016	2017	2018	2019	2020	2021	Resource	Estimated Cost	Comments
15	Invest in Predictive Modeling Software			●	●	●	●	External	Approximately \$225K	Can be done over a 5-year period
16	Establish a monthly Emergency Services Dashboard		●	●				Internal	Cost neutral	Can be managed by existing resources
17	Evaluate and upgrade the current use of FDM software to sufficiently meet the requirements of YKFD	●	●					Internal	See comment	Although the process can be handled by existing resources, there will be costs for additional modules and training.
18	In conjunction with recommendation 17, review other opportunities available through the FDM operating platform and the CAD module for more effective and efficient response.		●	●				Internal	See comment	Although the process can be handled by existing resources, there will be costs for additional modules and training.
19	City of Yellowknife to provide input for a ground ambulance policy and funding framework		●	●				Internal	Cost neutral	Can be managed by existing resources
20	YKFD develop a baseline capacity for industrial firefighting		●	●				Internal	See comment	Can be managed by existing resources
21	YKFD complete the wildland and interface firefighting capability and training		●	●				External	See comment	There will be costs to obtain training and possibly additionally firefighting equipment
22	YKFD enhance Hazmat qualifications to the technician level		●	●				External	See comment	There will be costs to obtain training and possibly additionally firefighting equipment
23	The Deputy Chief of Operations investigates the need for a high angle rescue capability and/or alternative tactics					●	●	Internal	See comment	Can be managed by existing resources. If the need is there, there will be costs to obtain training and possibly additional equipment.
24	City of Yellowknife expand Bylaw 4502 to include additional fire and life safety requirements		●	●				Internal	Cost Neutral	Can be managed by existing resources



	Recommendation	2016	2017	2018	2019	2020	2021	Resource	Estimated Cost	Comments
25	City of Yellowknife formalize the annual fire inspection program cycle		●	●				Internal	Cost Neutral	Can be managed by existing resources
26	Modify Emergency Response Deployment System		●	●				Competitive Job Posting	\$800,000 per year	Recommended to increase from 24 to 32 firefighters at \$100K per year for each firefighter
27	Review and upgrade current dispatch facilities to meet industry requirements as outlined by NFPA 1221		●	●				External	Approximately \$150 000	Based on contractor and trades market rates
28	Establish a committee to review and maintain compliance in design of a the YKFD training facility	●	●					Internal	Cost neutral	Can be managed by existing resources
29	Implement a comprehensive Asset Management Program with advanced Equipment Management Software	●	●					External	See comments	Costs are based on specific requirements and market availability
30	Consider the advantages of having one or more central fleet mechanics certified as Emergency Vehicle Technicians (EVT)	●	●	●	●			Internal or External	See comment	Can train existing mechanics or external job posting. Cost commensurate with current Yellowknife wage format. There will also be costs for the training.



Summary

In creating this document, we analyzed a number of factors to determine the effectiveness and efficiency of Yellowknife Fire Division (YKFD). We evaluated the operational and administrative aspects of YKFD, as well as the ability of the department to work as a cohesive unit. We then reviewed YKFD's response data and its current resources, and assessed their alignment with both existing and projected risks and levels of demand.

There are a number of aspects of the department along with recommendations in this document that need to be considered in order to improve on the effectiveness and efficiencies for YKFD. During a thorough review of YKFD's services, we identified 30 recommendations for improvement. Although each recommendation has a corresponding timeframe, it is important to note this document needs to be re-visited on a regular basis in order to stay pace with the dynamic economy currently experienced by the community.

Our research and consultation with YKFD personnel revealed a number of administrative and operational factors that need to be addressed in order to continue providing quality services effectively and efficiently. Implementation of the recommendations outlined in this document; will better position YKFD to accommodate community growth and activity while maintaining both excellent community relationship and value.



SECTION 1 INTRODUCTION

1.1 Project Background and Significance

Across Canada, all levels of government are facing strong demands for fiscal management. To meet this demand, elected officials are relentlessly looking for ways to reduce and avoid costs while still increasing value in the delivery of services for their citizens. This environment has generated the need for communities to adopt more business-like approaches for delivering public safety services.



Senior fire and emergency service leadership, along with their municipal leadership, need to be proactive and examine all aspects of the service delivery systems to look for innovative efficiencies and effectiveness.

1.2 Project Scope

The goal of the Fire Division Master Plan (Plan) project was to provide the City of Yellowknife (Yellowknife) with a comprehensive plan that outlines key findings and strategic opportunities along with recommendations for improvement. The outcomes are based on in-depth analysis of operations and services provided to the community using applicable legislation, and industry 'best practices' and standards.



The Plan is to include unbiased documented evidence and recommendations that will determine satisfactory service delivery with strategic priorities, action plans, timelines, resources and financial implications, to position Yellowknife as an effective and efficient delivery of emergency services through current and future challenges.

1.2.1 Project Purpose

This Plan will provide a systematic and comprehensive approach to evaluating risk and current capabilities within Yellowknife. Additionally, this Plan will help formulate and communicate strategic direction and highlight opportunities for improved service delivery. Since members of Council, city staff and community members participated during the development of this Plan, it will also provide an objective basis to support decision-making with respect to community emergency service needs.

The study considered:

- 1) Population growth over the next 10–20 years and the potential impact to service delivery
- 2) Key areas such as staffing, station location, vehicles and apparatus (new and replacement cycles), vehicle and apparatus maintenance, other equipment, administration, training, mechanical, fire prevention, emergency planning and public education.



3) Financial implications and timelines

1.2.2 Project Objectives

This document will provide the results of the in-depth analysis done on the Yellowknife Fire Division (YKFD) operations and the services they provide to the community. It is to be used to determine satisfactory service delivery and position the City to be more effective and efficient in the delivery of emergency services through current and future challenges. The Plan identifies current and anticipated risks as well as applicable legislation, industry 'best practices' and relevant standards.

This Master Plan will serve as Yellowknife's blueprint for Fire, Rescue and EMS services. It will:

- address local needs and circumstances based on municipal goals, fiscal realities and other competing demands
- identify and assess the nature and sources of risk in the community
- evaluate the resources available to address these risks
- identify gaps between risks and resources
- provide recommendations for how to address the gaps

1.3 Project Approach

Our assessment of YKFD's services was strategically executed to provide fiscally responsible, long-term and sustainable recommendations. To do this, we had to accurately determine the current state of YKFD and the needs of the stakeholders.

Using available data that included benchmark information, comparable community analyses, and stakeholder interviews with community personnel, we analyzed the services provided by YKFD, both mandated and discretionary.

Our analysis has focused on, but was not limited to, the following areas:

- Service Level Standards
- Operational Staffing Model
- Manpower scheduling and Apparatus Deployment
- Station Location

In addition, we conducted a comprehensive review and gap analysis to address:

- Community Risk
- Current Legislation, Mandate, Empowering By-law and Recognized Industry Standards (i.e. NFPA, etc.)
- Administrative needs (staffing, needs, duties & workload)
- Succession planning
- Fire apparatus and emergency response equipment condition, capability and replacement criteria
- Standard Operating Guidelines, Procedures and Policies
- Office of the Fire Marshal requirements towards the provision of fire services
- Fire station location and condition



- Response times
- Fire prevention and inspection requirements
- Emergency response requirements
- Reporting Structure
- Public Education
- Mutual Aid Agreements
- Health and Wellness
- Training

1.3.1 Project Methodology

We developed the Master Plan for YKFD using the following phased approach:



Table 1: Project Approach

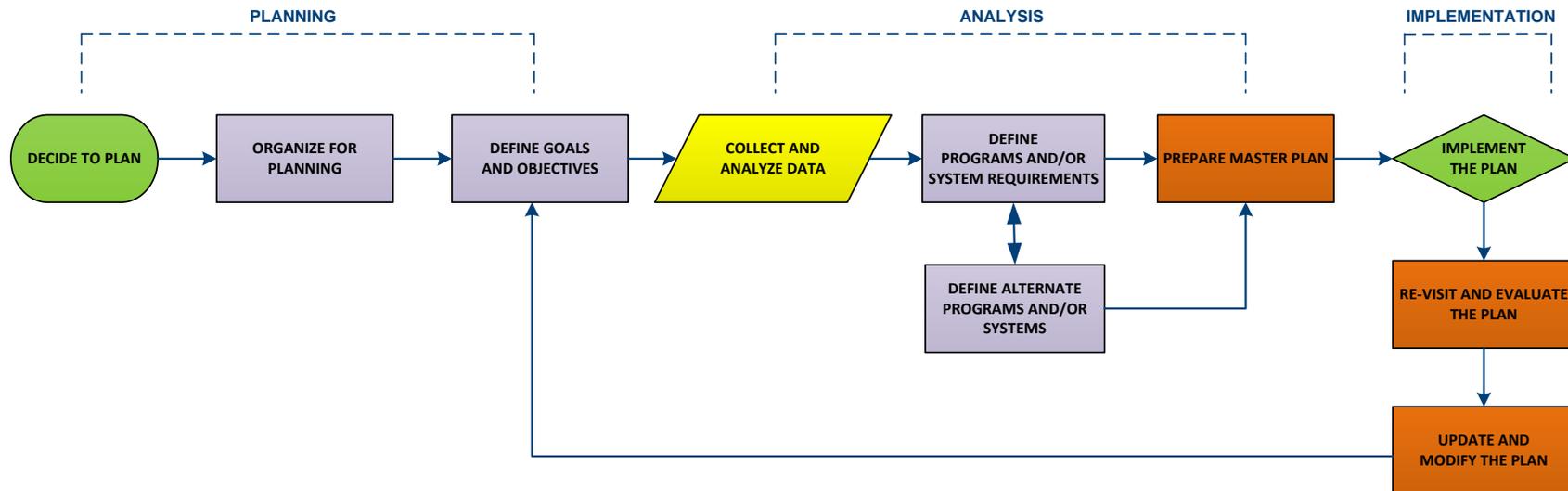
<p>PHASE 1 Start-up Meeting</p>	<ul style="list-style-type: none"> • Meet with Yellowknife’s Director of Public Safety and Fire Chief to review the details of the project • Reviewed the department’s mission, vision, values, strategic priorities, cross-functional processes and systems, along with structure and reporting relationships between the City and YKFD. • Reviewed current legislation, fire services mandate, empowering bylaws, and recognized industry standards
<p>PHASE 2 Data Collection and Targeted Interviews</p>	<ul style="list-style-type: none"> • Conducted targeted interviews to identify risks and resources within the study area and to gauge, risk concerns, operational readiness and effectiveness • Collected and reviewed all available data and information • Identified current level of protection, equipment, public education, inspection, training and available resources
<p>PHASE 3 Gap Analysis</p>	<ul style="list-style-type: none"> • Conducted a risk analysis and needs assessment of current and future emergency response requirements for the community over the next 5 - 10 years • Conducted a comprehensive comparison with similar communities; compared operating models, fire service operations, equipment, staffing, response statistics and budgets for fire departments in those cities
<p>Phase 4 Draft Document Development and Presentation</p>	<ul style="list-style-type: none"> • Presented the preliminary findings and recommendations in a draft Master Plan document, including strategic approaches for: <ul style="list-style-type: none"> ○ setting appropriate strategic goals and objectives to maximize overall efficiencies and effectiveness of operations ○ determining staffing and resource requirements based on historical emergency timelines and response data ○ exploring innovative options such as partnerships and the increased use of technology ○ identifying priorities based on budgets, agreements and safety levels
<p>PHASE 5 Final Document Presentation</p>	<ul style="list-style-type: none"> • The draft document was then updated with further input from the Yellowknife Project Manager, and YKFD in conjunction with the Behr Technical Advisory team to finalize the document.



1.3.2 Emergency Services Master Planning Process

The following diagram further illustrates the process we used to complete this Plan.

Figure 1: Master Planning Process



1.3.3 Community Comparable Analysis

A community comparable analysis is included to analyze industry benchmarks and assess the relative strengths and weaknesses of the recommendations in this report. We used the communities of Camrose (Alberta), Spruce Grove (Alberta), and Thompson (Manitoba) as comparisons for YKFD as to their relative population and type of service.

Each community identified for the following Municipal Comparators assess Budgets and Call Volume data by different means and at different times of the calendar year. We used 2011 – 2015 information, for the purposes of this review in order to get common information from each community.

See Section 8, Page 84



1.4 Targeted Interviews and Consultative Process

Targeted interviews were part of the data collection process. Participants were asked questions related to their areas of expertise. The interviews included an open discussion about YKFD; the strengths, weaknesses, challenges, anticipated changes, observations and other community concerns.

Table 2: Targeted interview list

No.	Name	Job Title
1	Mark Heyck	Mayor
2	Dennis Kefalas	SAO
3	Dennis Marchiori	Director, Public Safety
4	Darcy Hernblad	Fire Chief
5	Kerry Penny	City Solicitor
6	Adrian Bell	Councillor
7	Shauna Morgan	Councillor
8	Craig MacLean	Deputy Chief
9	Mike Hoffman	Deputy Chief
10	Gerda Groothuizen	Deputy Chief
11	Chris Bittrolff	Union President
12	Deanne Buckner	Dispatch Supervisor
13	Adam Catcher	Lieutenant
14	Seann May	Lieutenant
15	Dieter Andre	Lieutenant
16	Braden Wasiuta	Firefighter

Note: Interview Guide is available in Appendix C.

1.5 Standards and References

This Plan considers the following references and standards:

- Northwest Territories Municipal and Community Affairs - Fire Prevention Act
- Northwest Territories Municipal and Community Affairs - Emergency Preparedness
- Northwest Territories Employers' Liability Acts
- IAFC 10 Rules of Structural Engagement
- Managing Fire Services, ICMA Training Institute
- Municipal Government Act
- Managing Fire Service, Institute for Training in Municipal Administration
- National Fire Protection Association's (NFPA) Standards and Guidelines
- National Building and Fire Codes
- Northwest Territories Emergency Plan
- Service provisions from similar communities



- Workers Safety Compensation Commission

1.6 Study Factors

The following factors that could affect both the assessment and effective mitigation of risk were considered and assessed:

- Total area of review
- Population
- Future growth – residential and economic
- Financial resources
- Economics
 - Tourism
 - Agriculture
 - Construction
 - Industrial activity
 - Manufacturing
 - Utilities
 - Retail businesses and other services
- Multi-jurisdictional requirements and cooperation (Mutual Aid)
- Impacts of Government legislation
- Support services – dispatch, maintenance
- Public education and prevention
- Service delivery models
- Current and future development impact on risks and response



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SECTION 2 COMMUNITY PROFILE

2.1 Community Overview

Yellowknife was established in 1934 and serves as the capital city of the Northwest Territories. Located on the northern shore of the Great Slave Lake, the city is approximately 400 km (250 mi) south of the Arctic Circle and covers an area of approximately 136 km² (52.59 sq mi). The surrounding landscape is very rocky and slightly rolling, with many small lakes and park areas.



Although isolated, Yellowknife is accessible by air and road. Travel to Yellowknife is done by driving north from Edmonton or flying on one of five scheduled daily flights from Edmonton or Calgary. The completion of the Deh Cho Bridge across the Mackenzie River means the city is now accessible by road year-round to southern Canada. Highway 3 connects Yellowknife to the rest of Canada and Highway 4 extends further north for commercial traffic.

2.2 Economy

As the largest city in the region, Yellowknife is the hub for mining, industry, transportation, communications, education, health, commerce, and government activity in the territory. Yellowknife has a vibrant tourism industry catering to foreign tourists during winter months. The largest and most recent commercial contributor to Yellowknife's economy is the diamond mining industry.



The major employers in Yellowknife include Diavik Diamond Mines, Dominion Diamonds, DeBeers Canada, First Air, NorthwesTel, RTL Robinson Trucking, the Territorial Government, the Federal Government, and the City of Yellowknife. Government employment accounts for 7,644 jobs, a large percentage of those in Yellowknife

2.2.1 Yellowknife Economic Indicator

Similar to other urban centres, Yellowknife has distinct commercial, industrial, and residential areas. Downtown Yellowknife is home to most of the city's commercial activity, but some retail does exist in Range Lake. Industrial activity is limited to the Kam Lake, Engle Business District and airport subdivisions. Filled with well-educated families earning some of



Canada's highest household incomes, this community spends 40-50 percent more than the Canadian household average.

Yellowknife's residential and commercial building industry is booming. Niven Lake and Grace Lake are currently under active development and expansion. Between 2013 and the present, close to 1000 new residential units have been completed, are under construction or slated for development. Although some of the population lives in high-rises in the downtown core, Frame Lake, Niven Lake, Range Lake, and Old Town are considered the residential sectors.

Yellowknife is an industrial and commercial hub with an experienced mining-support industry serving the NWT and western Nunavut. Government services along with mining and oil and gas industries account for close to 50 percent of the entire Northwest Territories' economy.

The City of Yellowknife offers a variety of development incentives to businesses considering relocating to the city. Tax breaks are available for developments that increase the downtown's residential density. There are also incentives for Brownfield remediation and development, heritage preservation, integrated parking structures and LEED development.

2.2.2 Growth Projections

With the exception of 2006 and 2009, Yellowknife has experienced a modest cumulative increase of just below 5.0 % over the past decade as seen in the table below.

Table 3: Historical Population Growth, 2005 - 2015¹

Year	Actual Population	Increase	Annual % Growth	Cumulative % Growth
2005	19,640	19 (2004)	0.0968	0
2006	19,519	-121	-0.6161	-0.6161
2007	19,672	153	0.7839	0.1678
2008	19,832	160	0.8133	0.9811
2009	19,714	-118	-0.5950	0.3861
2010	19,786	72	0.3652	0.7513
2011	20,037	251	1.2686	2.0199
2012	20,185	148	0.7386	2.7585
2013	20,438	253	1.2534	4.0119
2014	20,497	59	0.2887	4.3006
2015	20,637	140	0.6830	4.9836

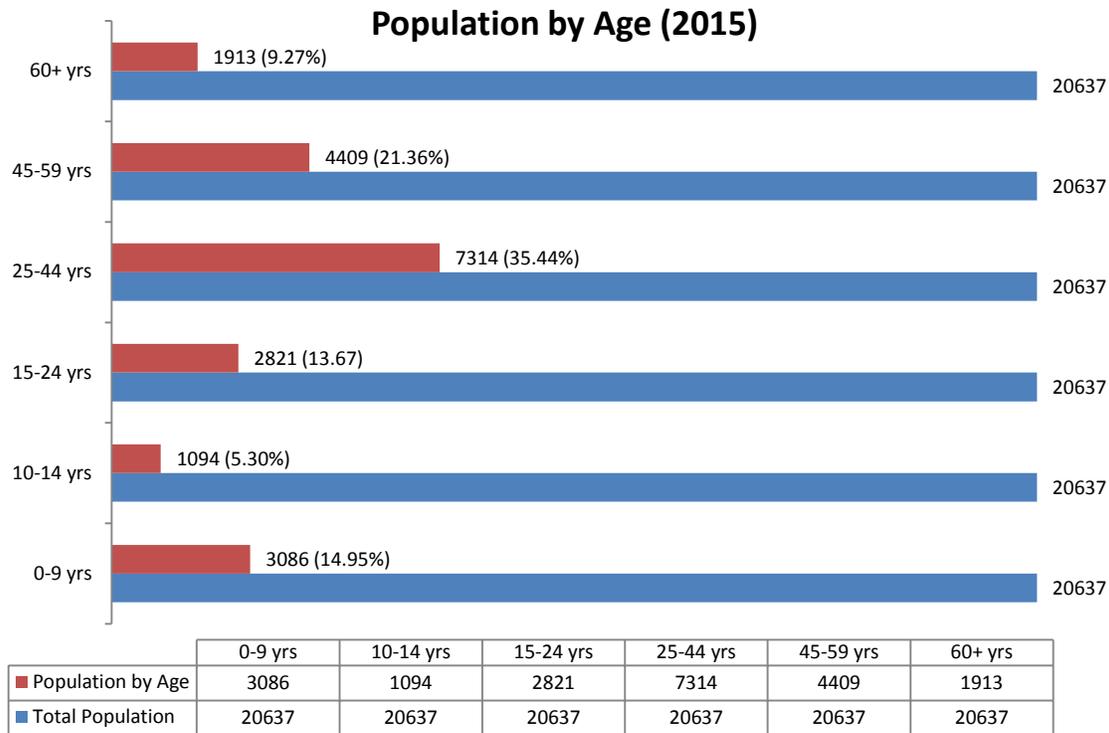
¹ Yellowknife Statistical Profile 2015, www.statsnwt.ca/community-data



2.3.2 Community Demographics

Today, Yellowknife’s population is an ethnically diverse mix; home to a large aboriginal population; immigrants from many parts of the world including, the Philippines, Ghana, Vietnam, China and the United States. For the most part, the community is a family oriented community with approximately 35% of the population ranging between the ages of 25 to 44 and approximately 34% of the population under the age of 24.

Figure 2: Community Demographics



Yellowknife is projected to continue to grow modestly. The anticipated increase in population, dwelling units, and industrial and commercial developments will contribute to increased risk potential and demands on emergency services.



2.4 Community Planning and Development

Yellowknife has a typical mix of residential, commercial/industrial, and institutional land use for a town with a population of just over 20,000 people. While the current types and extent of development are well-served by YKFD, there are factors related to land use interface and community growth that do present higher than normal risks and should be considered as part of Yellowknife's overall emergency response strategy. These factors include:

- Residential construction types
- Rate of growth and demographics
- Industrial and commercial activities
- Transportation and growth in traffic volumes
- Water Distribution system and Firefighting
- Wildland urban interface
- Distance and Isolation from neighboring communities

2.4.1 Residential Construction

Many departments are identifying newer construction as a risk in their Standard Operating Guidelines and Pre-Fire Planning. The increasing average size of single-unit dwellings and decreasing setback distances between buildings impedes firefighting and rescue and increases community risk. 'Lightweight' engineered wood and other code compliant, but potentially hazardous materials, have also affected risk levels. These new construction materials challenge Incident Commanders as they employ firefighting tactics where early floor separation and structural collapse is at an increased risk.

The increasing number of multi-family and apartment units also pose firefighting, rescue and recovery risk on the community. Two key reasons:

- a) Compared to fires in single-unit dwellings, fires in multi-unit dwellings can require substantially more resources to fight, in terms of personnel, apparatus, and water
- b) Even if confined to the unit of origin, incidents in multi-unit dwellings can displace a large number of people.

Over the past decade, Yellowknife has seen a modest increase in annual residential construction starts. Growth is expected to continue, based on the City's estimated population projections and trends in average household size.

Table 4: Yellowknife Residential Construction Starts, 2009 - 2015²

Indicator	2009	2010	2011	2012	2013	2014	2015
Number of new dwelling units (single detached, duplex, multi-unit)	16	57	155	568	147	163	78

² CMHC Starts and Completions Survey (1990 Q1 to 2016 Q2)



2.4.2 Industrial and Commercial

As the largest community in the territory, Yellowknife is the hub for all commercial and industrial activities. Yellowknife has eight (8) key industries that directly contribute to its economy and risk profile - mining, transportation, communications, education, health, tourism, commerce and government.

Industrial and commercial buildings pose challenges to emergency services because of the size of the facilities and the amount of personnel on site. Although both the building and fire codes address fire suppression requirements for each classification, these properties can be taxing for an emergency response, as they require substantially more resources, specifically, more personnel, apparatus, and water.

2.4.3 Transportation Corridors

There are two main roadways that pass through Yellowknife - Highway 3 and Highway 4. Of the two, Highway 3 is the busiest, linking Yellowknife to the rest of Canada. Commercial traffic, particularly those vehicles transporting dangerous goods through the community, is of particular concern, as mitigation requires special training, equipment and a large responder involvement.

The Yellowknife Airport is the busiest in Northern Canada servicing over 500,000 passengers and 30,000 tonnes of cargo each year. The airport is also a Royal Canadian Air Force landing strip for the CF-18 Hornet. The Yellowknife airport authority and not YKFD currently handle emergency services for the airport.

2.4.4 Distance and Isolation from neighboring communities

Yellowknife's isolation from neighboring communities poses added risk to the community. In situations where a large number of resources and equipment are required, such as wildfires, they are unable to rely on the support provided when nearby communities have committed in a reciprocal mutual aid agreement.

2.4.5 Wildland Urban Interface

Wildland Urban Interface has become an emerging issue in communities where large amounts of vegetation (fuel loads) are present. This concern requires considering the need for adequate water distribution, construction setbacks from vegetation and wildland fire training. Although, response statics for wildfires are relatively low in Yellowknife, as indicated in sections 4 and 6.3.1.3, wildland urban interface issues still need to be addressed.

2.4.6 Water Distribution System and Firefighting

Yellowknife has experienced some fluctuating growth in residential development over the past 5 years. As indicated in section 2.4.1, the second quarter housing starts are already at 78. Some areas have chosen to build without having adequate firefighting water resources and residential sprinkler systems. As a result, there is increased risk of,

- fire spread through multiple structures
- endangerment of life safety for residents and the responders



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SECTION 3 COMMUNITY RISK OVERVIEW

3.1 Community Risk Assessment

A community risk assessment identifies inherent risks and associates them with the fire protection and other emergency service needs necessary to effectively, and efficiently manage them. The overall purpose of conducting risk assessments is to establish an immediate, short-term and long-range general strategy for the delivery of emergency services.

Conducting a risk assessment is the first step towards establishing a strategic plan to manage community risks based upon local needs and circumstances. The results are used to make informed municipal decisions regarding prevention and protection resources.

Every municipality has common and unique challenges when it comes to the safety of its citizens. Municipalities have a fundamental and legislative responsibility to conduct community risk assessments in order to provide effective public and private property protection. In general, the needs and circumstances of a community are relative to a municipality's economic situation, geography, population, fixed assets (including structures) and overall service delivery.

Risk Evaluation

- *Identify the existing risk based on calculable criteria or statistics.*
- *Predict future risks and a means of evaluating them to ensure proper mitigation.*

3.1.1 Challenges

Specific challenges that have a correlation with community risks include:

- Industry
- Economy
- Rate of population growth in the community
- Demographics of the community
- Annexation of lands
- Transportation
- Landscape
- Natural Disasters
- Pandemic



3.1.2 Risk Management

Risk management is the anticipated likely occurrence of an unwanted event and the ability to put in place measures to mitigate the negative results of the event. An unpredictable challenge for risk management within a community lies in balancing the probabilities of an emergency with the political climate. Elected officials and policy makers ultimately determine the level of service to be delivered to the jurisdiction area.

YKFD should consider the following Risk Evaluation Matrix to categorize risk, using probability and consequence as a method of assigning risk to individual properties. All properties in Yellowknife can be reviewed and then assigned to one of four risk levels seen on Risk Evaluation Matrix, found page 17.

Image 1: Risk Management



3.2 Risk Evaluation Matrix

The evaluation of risks must account for the frequency and severity of incidents. The risk is determined by analyzing historical, current and projected statistics to develop appropriate levels of service. The staffing model and expected performance matrix is based on the distribution and concentration of resources.

Distribution refers to the number of fixed resources, such as fire stations, that are placed throughout the community. Distribution varies depending on factors related to the number of incidents and types of calls for service in the defined area.

Concentration refers to the assembling of resources, such as work force and equipment, needed to effectively respond to an incident in a given area within the community. It must identify the availability, reliability and time of arrival of a secondary responding unit.

When determining risk, decision-makers must understand the relationship between the probability of an event occurring and the consequence or impact it may have on the community. The adopted service level goals help to determine the necessary concentration and distribution of preparation, prevention and emergency response resources. The challenge for Yellowknife is to find the balance, based on Yellowknife's growth projections, between funding levels and acceptable risk levels for:

- prevention and response services, and
- distribution and concentration of resources

Probability – The likelihood that a particular event will occur within a given time period. An event that occurs daily is highly probable. An event that occurs only once a century is very unlikely. Probability is an estimate of how often an event will occur.



Consequence – There are three types of consequences when considering possible response requirements:

- **Life Safety:** Consequences resulting from incidents that risk the lives of occupants, the lives of responding personnel, and the amount of personnel and equipment required to rescue or protect the lives of occupants from life-threatening situations. Incidents that risk life safety include motor vehicle accidents, extreme weather, flooding, fire, hazmat, medical, and all types of rescue situations.
- **Economic Impact:** Consequences resulting in loss of property, income or irreplaceable assets.
- **Environmental Impact:** Consequences resulting in irreversible or long-term damage to the environment.

Other consequences, such as community impacts like the loss of historic buildings, recreation facilities or community infrastructure, are identified but do not affect how resources are deployed.

The risk assessment can be divided into four quadrants, which pose different requirements for the commitment of resources in each area

Figure 3: Risk Evaluation Matrix

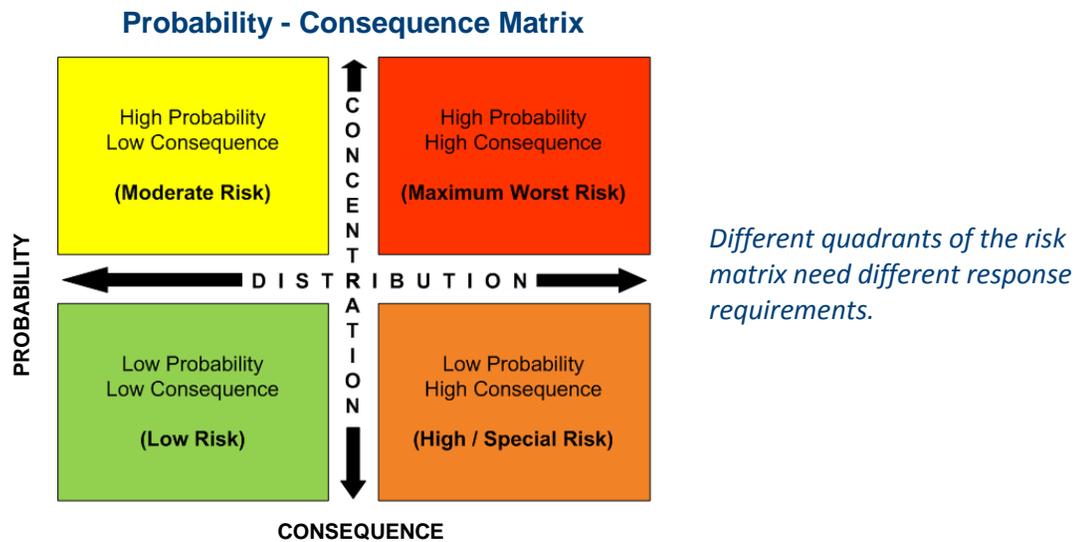




Figure 4: Risk Inventory (SAMPLE)

<p>Low Risk = Low Probability and Low Consequence</p> <p>This category is limited to areas or incidents having a low probability of fire risk and low consequence for the potential for loss of life or economic loss. Some low risks include:</p> <ul style="list-style-type: none"> • outdoor fire pits • non-structure lightning strikes • vacant land • parks without structures • isolated structures such as sheds
<p>Moderate Risk = High Probability and Low Consequence</p> <p>The majority of responses fall under this category. Moderate risks include:</p> <ul style="list-style-type: none"> • motor vehicle collisions • spill clean-up • carbon monoxide detection (emergency medical co-response) • monitoring/local alarms • vehicle fires • dangerous goods incidents with small quantities of a known product (20 litres or less), outdoor odours (natural gas or unknown) • water rescue incidents • miscellaneous explosions • standbys • smoke • odours • fires: <ul style="list-style-type: none"> ○ garbage ○ detached garages ○ single or multi-family residential fires ○ small non-residential buildings less than 600 square meters
<p>High Risk = Low Probability and High Consequence</p> <p>There are very few properties that are considered high probability, high consequence. These properties are categorized as large properties, over 600 square meters, without adequate built-in fire protection systems that have large concentrations of people or have a significant impact on the local economy. High risks include:</p> <ul style="list-style-type: none"> • wildland fires • commercial, industrial warehouse • dangerous goods incidents with large quantities of known products (75 litres or more), unknown products or large exposure • vehicle fires in parkades • Hospitals, care homes, institutions
<p>Maximum Risk = High Probability and High Consequence</p> <p>This category of risk can be generally categorized as properties over 600 square meters that have high economic value in the form of employment or are not easily replaceable, or natural disasters occurring in highly populated areas, creating high life and property loss potential and strains on the department and other agency resources. Damage to properties in this category could result in temporary job loss or permanent closure of the business. Such properties are highly regulated or possess built-in fire protection systems. Some maximum risks include:</p> <ul style="list-style-type: none"> • Elevated or Technical Rescue including trench or high angle • Large vehicle accidents, pile-ups • Quantities of known products (20 to 75 litres), indoor natural gas odour • Explosions or Substation electrical fires • Confirmed natural gas leak • Underground pipeline eruption



3.3 Structural Risk Analysis

Analyzing structural fire risk in a community requires all building stock to be inventoried and evaluated. This inventory identifies the number of single and multi-family residential households, places of assembly including schools, churches, hospitals, personal care homes, etc., as well as all mercantile and industrial occupancies. In so doing, each building is evaluated for risk against the foregoing matrix.

The previous section explains that risk is based on the probability of an emergency occurring in a specific structure and the consequence of such an emergency in terms of impact. The probability – consequence matrix assists in determining the type of risk and the types of prevention needed should an event occur.

Large scale or special demand buildings such as schools, recreation centres, senior's homes and office towers must be constructed and operated in accordance with applicable building and fire codes. The risk for structures like these is assessed against the response capabilities of the fire department. As new residential, commercial and industrial buildings are added to the community inventory, it is important that emergency services be involved early in the planning process. This provides an opportunity to review and evaluate the impact on services allowing for recommendations that would serve to mitigate new risks.

Although, the National Building Code (NBC) and the National Fire Code (NFC) regulate the construction and use of facilities in Yellowknife, there has been no formal collection and identification of structures in the community.

The following tables and graphs are provided as samples to illustrate how the risk profile for Yellowknife can be developed.

Table 5: Structure Inventory (SAMPLE)

Property Type	No. of properties
Assembly	177
Institutional	475
Residential	1,914
Business and Personal Services	2,110
Mercantile	107
Industrial	31
Total	4814

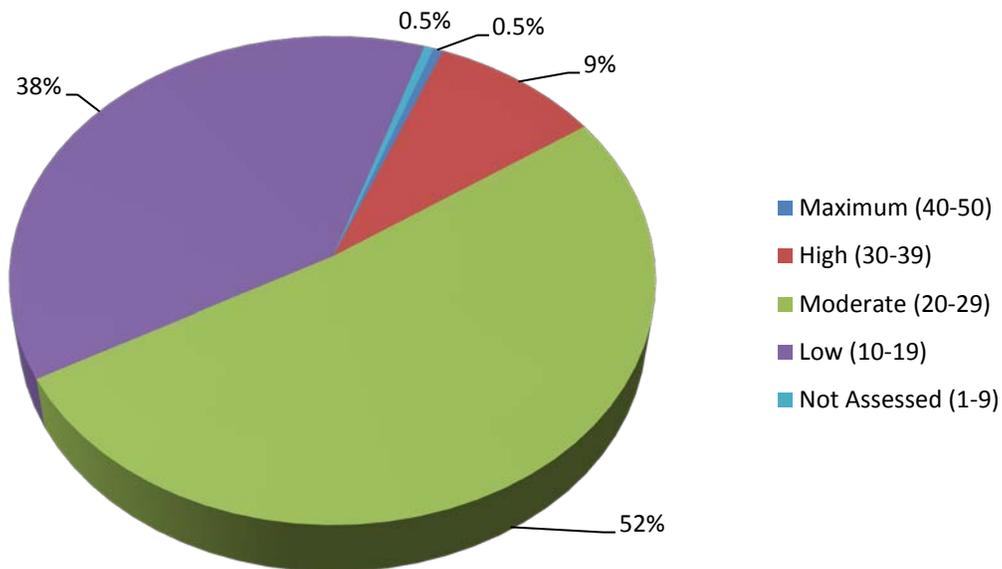
The following sample table and graph display a summary of the risk ratings for properties/buildings that contain commercial and industrial businesses and or occupancy type locations.



Table 6: Structural Risk Summary (SAMPLE)

Risk Designation / Rating	Risk Score Total	Count	Percentage
Maximum	(40 - 50)	3	0.5%
High	(30 - 39)	53	9 %
Moderate	(20 - 29)	293	52 %
Low	(10 - 19)	216	38 %
Not Assessed	(1 - 9)	3	0.5%
Total		568	100%

Figure 5: Estimated Structures Risk Level (SAMPLE)





It is critical to use careful planning and consider alternative solutions when managing risk because the distribution of resources and capacity is limited. Spending large amounts of time and resources to solve a problem or risk with low frequency will have limited impact and make a minimal improvement to community safety. When planning for emergency services, the planning process includes a detailed review of the frequency of events, the potential of loss, and the consequence(s) of loss to ensure efforts maximize safety and minimize consequence.

Recommendation #1: Develop a building inventory program

(12-24 Months)

We recommend that an inventory of all building structures be classified, documented, and maintained using the National Building Code of Canada's Major Occupancy Classification system. It is important that an inspection of all structures be conducted and evaluated in terms of risk assessment/management matrix as described in Image 1, Risk Management, Page 16. This will aid in the planning of response resources (personnel and equipment) and standard operating guidelines.

Yellowknife needs to maintain an ongoing assessment of building risk in the community that is not limited solely to construction and permits. This ongoing assessment allows Yellowknife to be well positioned to effectively handle future growth and changing risks to the community.

3.4 Community Risk Analysis Overview

Historically, the City of Yellowknife has experienced moderate growth and development. This slow change allows YKFD to continuously review and evaluate their services to ensure they are providing a level of service that balances resources with the community's risk. The municipality's fire protection capabilities, emergency response requirements and resource commitments are measured against risks for fire and other emergencies.

It is important for Yellowknife to ensure their performance is aligned with known industry 'best practices', recognized codes and standards outlined by the NFPA, and other crediting bodies such as the Commission on Fire Accreditation International (CFAI). They must also compare themselves with other emergency service departments to establish goals and benchmarks.

The summary of the risks analyzed would need to be in a newly developed document known as a Standards of Cover (SOC). The SOC provides:

- an assessment of the City's service environment including risks
- a description of the service delivery model designed to respond to the unique characteristics of the city and to manage the risks identified with the resources available through prevention, preparedness, and emergency response
- a basis for evaluating performance that addresses both current and future service demands for the City of Yellowknife

YKFD's current response time goals need to reflect a continuous process of examining performance trends, industry standards, and the unique fire and emergency response service needs of the City. This includes ongoing risk assessments measured against available resources in order to determine a level of service that is affordable, acceptable, and appropriate for the citizens of Yellowknife.

Although there is no semblance of an SOC within Yellowknife, work has been started to provide a vision to Council on fire standards and effective deployment of resources (addressing how to



evaluate the city's risks and fire safety needs, the ability to respond to those risks and needs, and identifying the gaps and recommendations for improvements).

Along with the National Fire Protection Association (NFPA) standards 1710 and 1720, YKFD should also consider other industry standards and benchmarks such as those measured by CFAI for developing these goals.

The analysis will provide a comprehensive series of benchmarks, defining an affordable, acceptable, and appropriate level of service for the city. The benchmarks will consider risks and demands for service against available resources. This combination of data will define YKFD's performance expectations, evaluate performance, identify gaps, and guide service improvements.

The SOC will result in a work plan for developing new benchmarks, including conducting community risk assessments and examining the impact on service delivery of current and future planned densification. This further provides the YKFD with Council approved series of principles for establishing the new service level and response time benchmarks.

Recommendation #2: Undertake a comprehensive risk analyses of the community and develop a Standard of Cover to effectively manage risks

(0-24 months)

The SOC is used to establish performance benchmarks for existing levels of service providing opportunities for continuous improvement at the same time. This would also provide a well-articulated description of services to be provided to the community with the full understanding and endorsement of elected officials.

The benefits of completing an SOC will ensure that YKFD has a clear understanding of the scope of overall risk for the community while enabling them to identify the resources and response capabilities necessary to adequately address those risks. The SOC will further ensure YKFD has a safe and effective response force for all emergencies including fire suppression, emergency medical services and specialized response situations.



SECTION 4

RESPONSE STATISTICS AND PERFORMANCE STANDARDS

4.1 Response Statistics

Emergency response statistics are a valuable source of information for identifying current risks and trends for the City of Yellowknife and YKFD. To develop service level standards, the types of calls and the resources employed to deal with emergency responses were analyzed.

Historical call data for the period of 2011– 2015 identified several basic categories of call types for YKFD:

- Emergency Medical Assistance
- Motor Vehicle Incidents (MVI)
- Investigate Fire Alarms
- Fires (all categories)
- Hazmat (dangerous goods)
- Rescue
- Miscellaneous, i.e. explosions, ruptures, standbys, smoke odors, police assist, etc.

These categories become the basis for the levels of service by assessing the current community risks and emergency response resource capability to effectively control and mitigate damage to life and property for each type of event. To obtain an appropriate level of service standard; all stakeholders must understand the risk and be open to recognizing the need for a safe and effective response.

Each type of event requires a minimal amount of staff that are trained and equipped with the appropriate tools to be safe and effective at completing their tasks. For this reason, the levels of service link directly to the staffing model.

To make informed decisions on what level of service YKFD is capable of performing safely and effectively, the stakeholders have to evaluate how well the current response meets the typical daily demands for service.

- Does the response require alternative risk management strategies?
- Is there a need to communicate with the public about what services the municipality offers and what the associated costs are?

4.1.1 Historical Response Data

YKFD's emergency call volume has steadily increased over the last 5 years. Growth in call volume will likely continue as Yellowknife's population and commercial and industrial activities continue to increase. To prepare for this increase, the types of calls that are most common and the highest rates of increase and decrease must be identified. With this information, the Fire Chief, Senior Management and Council can appropriately prioritize the department's budget and resources to address the future demand.



Table 7: Historical Response Data

	2011	2012	2013	2014	2015	2011-2015 (Ave.)	2016 Q1
Total Calls	3106	3261	3297	3345	4295	3461	1,104
Total Fire/Rescue	454	480	470	520	952	575	201
Percent of Call Volume	14.62%	14.72%	14.25%	15.50%	22.15%	16.25%	18.2%
Pre-Hospital Care/Ambulance Calls	2652	2781	2827	2825	3343	2886	903
Percent of Call Volume	85.38%	85.28%	85.75%	84.50%	77.85%	83.75%	81.8%

From 2011-2015, medical response (ambulance) calls accounted for an average 83.75 % of annual call volumes, making it the largest category of call types. Currently, this volume is not manageable with YKFD’s current response capacity. The duty shift is unable to effectively conduct training, perform public education or fire prevention activities, and provide a consistent fire suppression response. The ability to respond is affected by the timing of the calls (coincidental and or sequential) as well as the department’s reliance on recalled off duty staff and group alerts. Further discussion and analysis is presented in Section 6 of this report.

Chart 1: 2011 Call Volumes

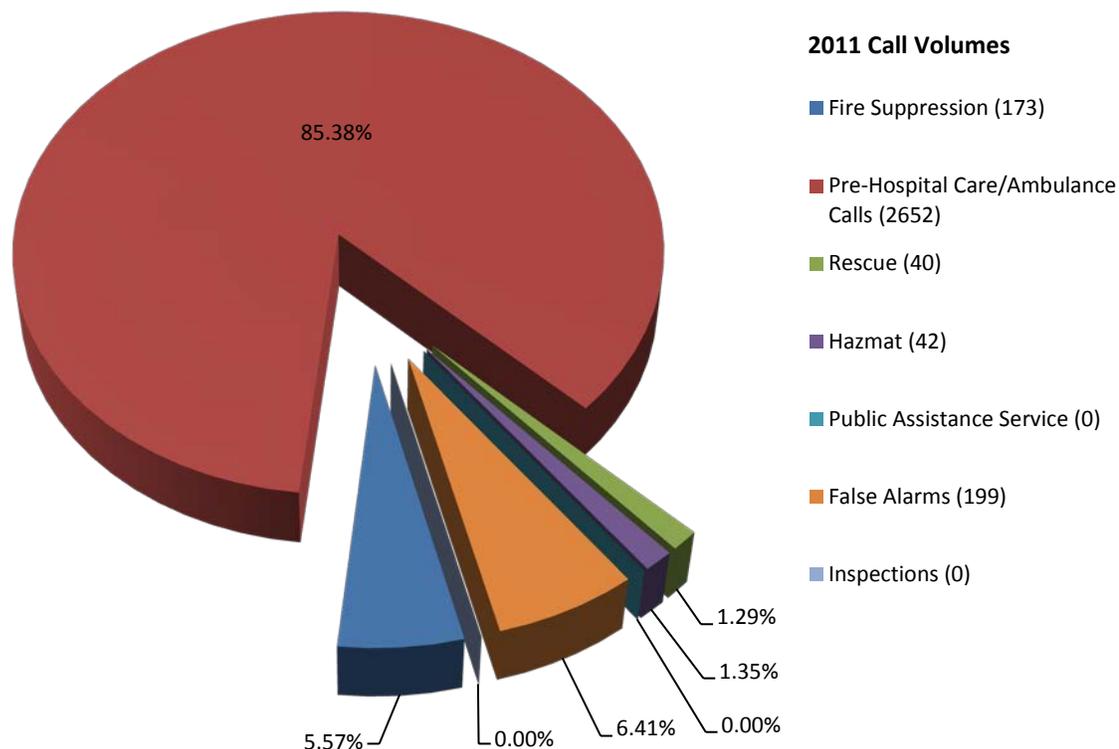




Chart 2: 2012 Call Volumes

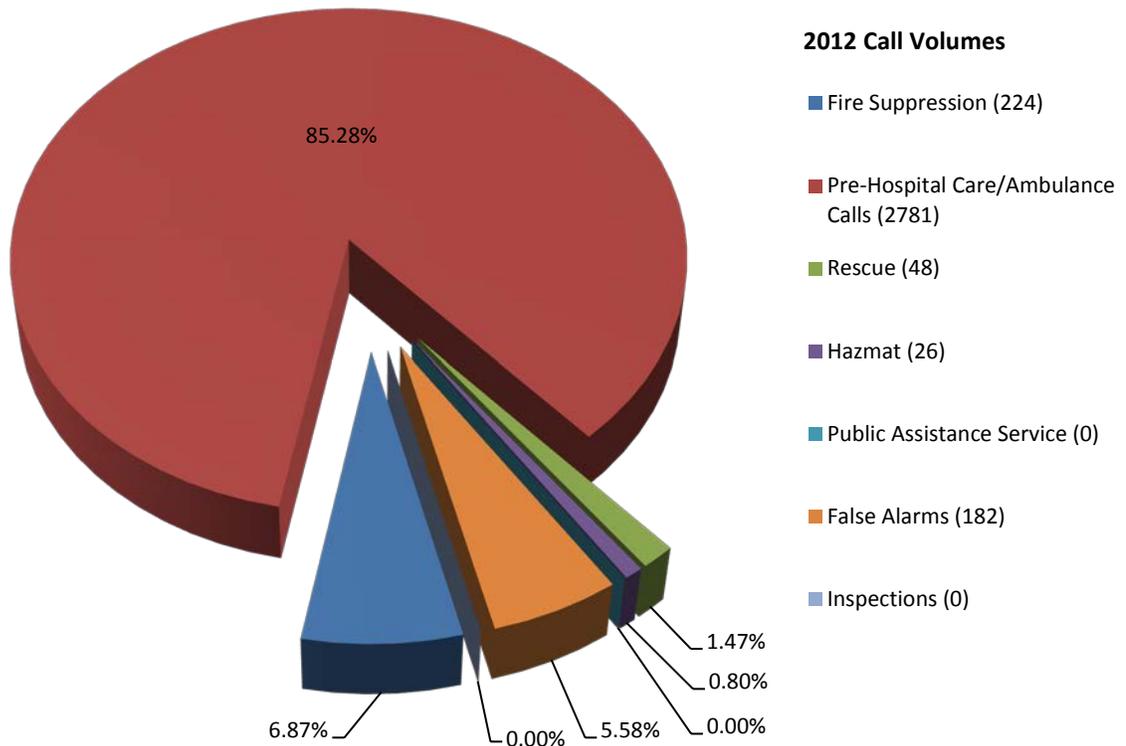


Chart 3: 2013 Call Volumes

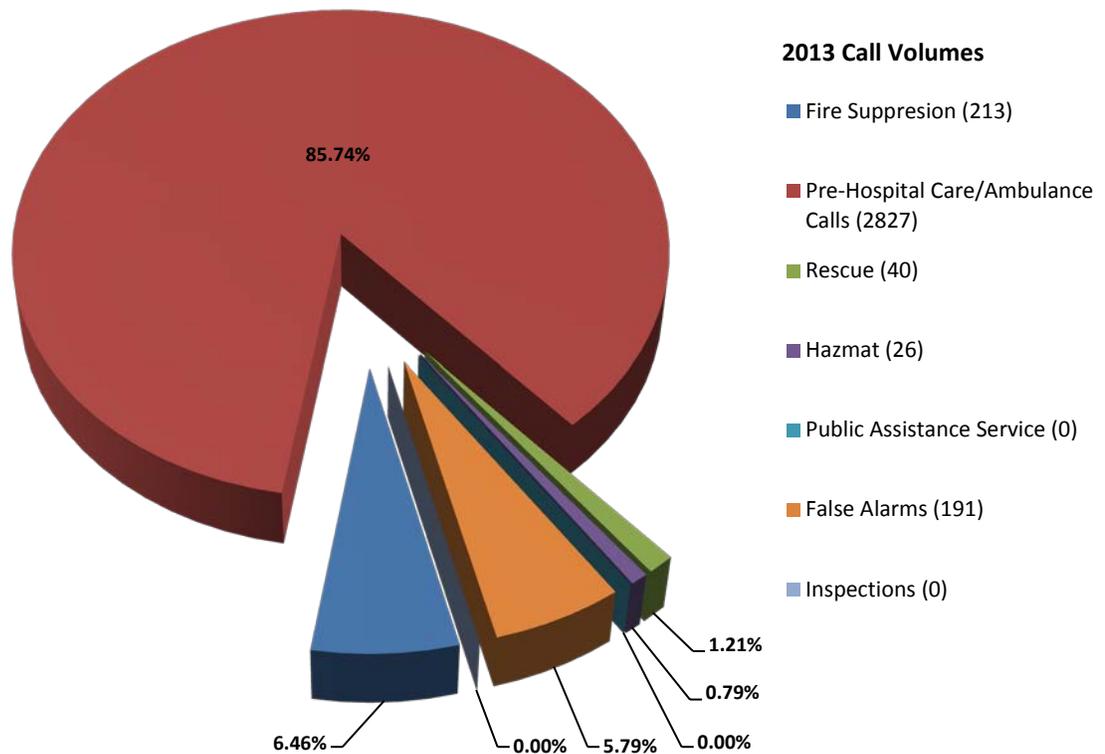




Chart 4: 2014 Call Volumes

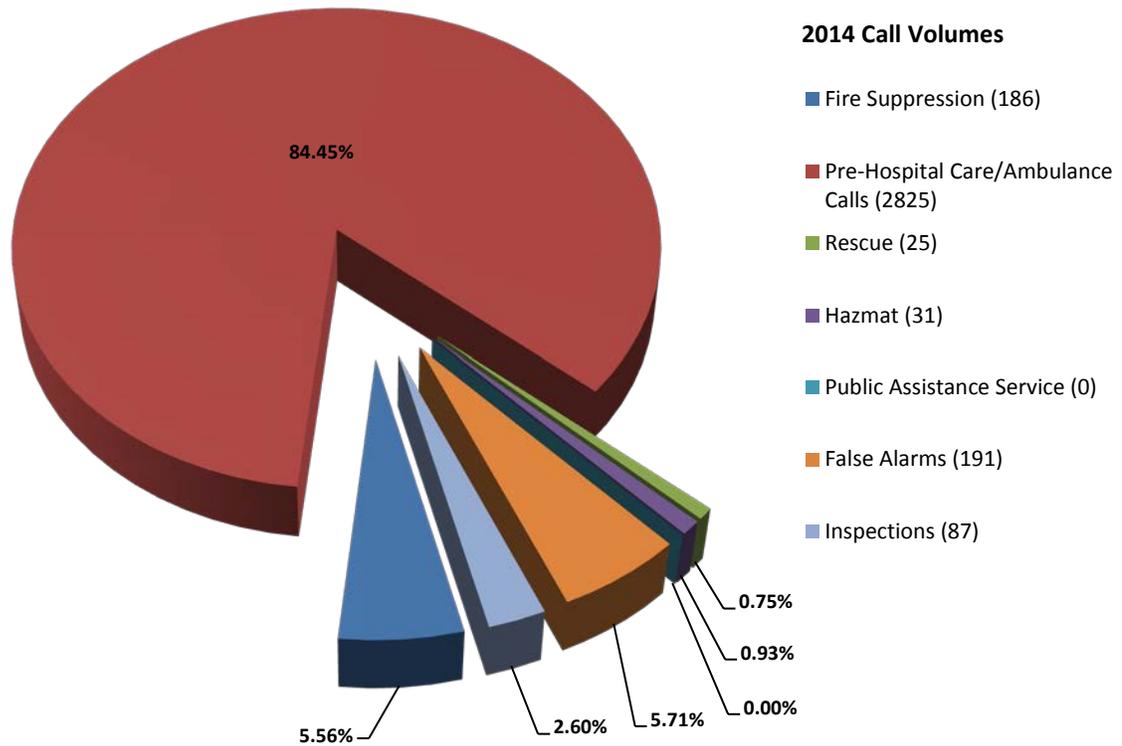


Chart 5: 2015 Call Volumes

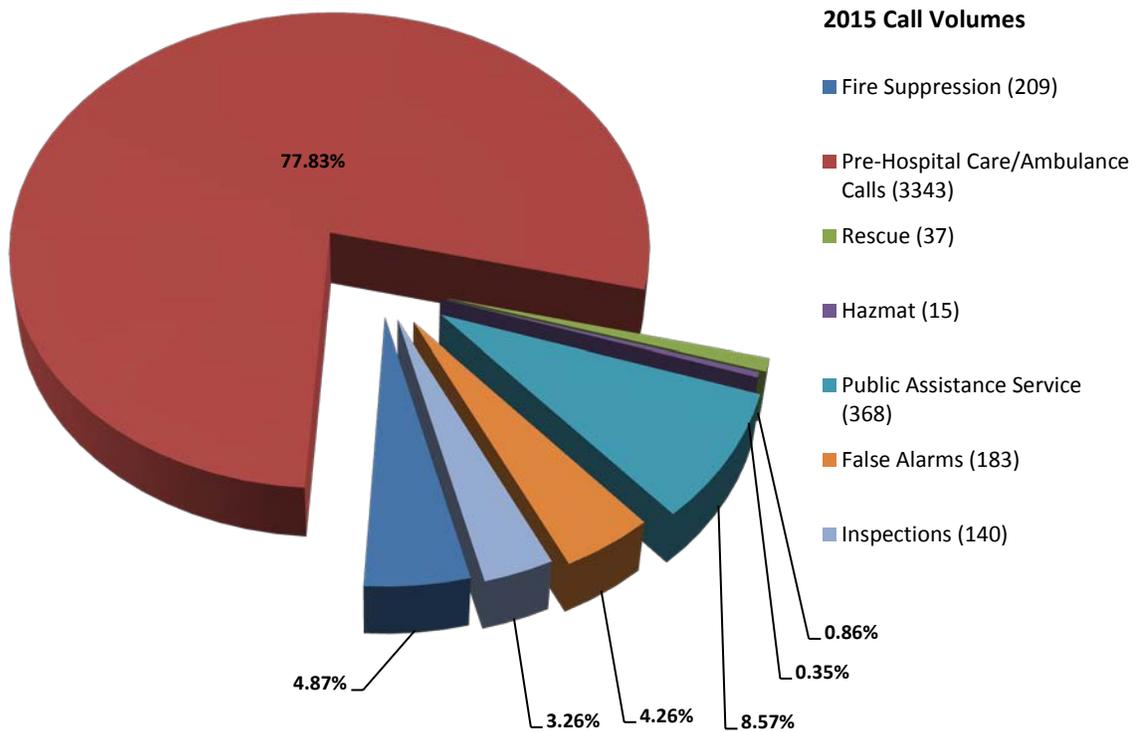




Figure 6: Call Volumes by Type – All Calls, 2011-2015

Call Type	2011	2012	2013	2014	2015
Fire Suppression	173	224	213	186	209
Pre-Hospital/Ambulance Calls	2652	2781	2827	2825	3343
Rescue	40	48	40	25	37
Hazmat	42	26	26	31	15
Public Assistance Service	NA	NA	NA	NA	368
False Alarms	199	182	191	191	183
Inspections	NA	NA	NA	87	140
TOTAL	3106	3261	3297	3345	4295

NA - Not available

The next largest response type compared to ambulance calls is false alarms. It must be noted that YKFD has established penalties (fees) for recurring alarms, which is considered to a leading practice amongst fire services in order to reduce this type of response. While the false alarm trend in Yellowknife remains steady, these service requests consume a considerable amount of the current emergency response capacity. Even though Bylaw 4562 is in place and identifies a \$1000.00 fine for the 3rd and subsequent responses in a calendar year, false alarm responses need to be analyzed to determine if these are malicious, accidental, or due to mechanical or electrical malfunctions.

The analysis will identify if alternate preventative measures would be appropriate. Should the penalties escalate for reoccurring false alarms due to system maintenance deficiencies, or if increased enforcement and education programs be considered for malicious or recurring accidental incidents? Several Alberta and BC municipalities have adopted a false alarm bylaw that invoices building owners for a fire department response after the second false alarm to the same structure or property address.

**Recommendation #3: Conduct an in-depth analysis of false alarms
(0-24 months)**

We recommend YKFD conduct an in-depth analysis to determine the current trends of false alarms with the view to initiate preventative measures to reduce the occurrence and costs of false alarms.

4.1.2 Response and Service Categories

Response/service categories are generally broad and do not make it easy for the Fire Chief to determine trends or evaluate risks. For example, the fire suppression category encompasses all types of fire related responses. If this category was expanded to identify responses such as kitchen or stove-top fires, chimney fires, minor fires (i.e. dumpster fires), the Fire Chief could develop prevention programs that target the recurring types such as cooking safety or promote chimney cleaning and maintenance as part of the public education program.



This same rationale applies for rescue calls. If YKFD was responding to a high number of elevator emergencies, the Fire Chief could meet with elevator maintenance companies or building owners to determine cause and reduction strategies. The table below is an example of the category types that would provide a more complete perspective on the trends and/or risks within the City.

Table 8: Example of Incident Types for Statistical Analysis

INCIDENTS BY TYPE	
EMS	Alfa, Bravo Charlie Delta Echo
Fire Emergency	Alarm Burning Complaint Structure Fire Minor Fire Smoke Car Fire Re-check Wildfire – Grass, Brush, Outdoor Oven/Pot on Stove Explosion
MVI	Extrication No Extrication
Rescue	Stalled Elevator Lake/Marine Rescue High Angle Swift Water Building Collapse Ice
Non-Emergency	Carbon Monoxide Gas/Oil Smell/Spill Power/Telephone/Cable Line Down Natural Gas Leak Aircraft Standby Incident Bomb Threat Hazardous Materials Propane Leak/Smell
Other	Burning Pile Inspection Assist Other Agency Public Service Need Pick-up Confined Space Entry Flood Assessment Rescue-Lock-in Water Problem (in structure)



4.2 Intervention Time

Intervention time is defined as the time between emergency services receiving notification of an emergency and commencing assistance at the scene of the emergency. Increased intervention time can have two important impacts; increased loss and higher property insurance premiums.

- **Discovery:** The time between the start of the emergency and when a person or an engineered system has detected the incident.
- **Emergency Call:** The period of time between discovery of the incident and the actual notification of emergency services.
- **Dispatch Time:** The time required to extract the necessary information from the caller to allow the proper response to be initiated. The dispatcher identifies the correct location and initiates the dispatch by paging the appropriate services.
- **Assembly Time (Chute Time):** The time from when the notification sounds in the fire station or other emergency facility, until the moment the first vehicle leaves the station. In a full-time department, this is expected to be within 60 seconds for medical and 80 seconds for fire related responses (based on NFPA standards).
- **Travel Time:** The time from when the vehicle leaves the station to the when, it arrives on scene of the incident. Once a vehicle leaves the station, it must negotiate the best route between that point and the location of the emergency. Factors to consider for travel time are driver skill, weather, traffic, topography, road conditions and vehicle capabilities.
- **Setup Time:** This is the time it takes, once on site, to evaluate the necessary actions, position the required resources, and starts the intervention. In the case of a fire, sizing-up the scene, assigning the necessary tasks and deploying resources can provide delays on scene. A well-trained crew can minimize these delays while providing a safe, successful response.

The most variable portion of the total intervention time is the response travel time. While the vehicles are travelling the distance from the station to the incident, a number of other factors, including but not limited to, can influence them:

- the layout and footprint of the community (route widths and alternatives)
- impediments such as weather or time of day (traffic jam)
- transportation systems including roadways, bridges, underpasses, overpasses, railway, major highways, construction road surface, and detours

4.2.1 NFPA 1710

The NFPA sets standards for intervention time. *NFPA 1710³: Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments.*

Note: *The NFPA standards are widely accepted as industry best practices or benchmarks for measuring performance and setting targets.*

³ www.NFPA.org/codes and standards



Table 9: NFPA 1710 Intervention Time Defined

Intervention Time					
<i>Time Values</i>					
Notification		Intervention Time			
Discovery	Emergency Call	Call Handling	Assembly or Chute Time	Travel Time	Set-up
Time unknown		60 Seconds	80 Seconds Fire 60 seconds medical	240 Seconds	May vary by event
<i>Time indirectly manageable</i>		<i>Time directly manageable</i>			
<i>Reflex Time</i>					

4.3 Response Time Maps

The more strategically located a station is in a community, and the more direct the travel routes are between the stations and different parts of the community, theoretically, the lower the response times will be from that fire station. Response times typically refer to the combination of call handling, assembly (chute) and travel time.

The following maps depict YKFD's theoretical response zones. They are based upon allowing 60 seconds for call handling, 80 seconds for assembly and 240 seconds in travel time, as specified by NFPA 1710. NFPA standards are widely accepted as industry best practices and are used to establish response goals for the Authority Having Jurisdiction (AHJ). Ultimately, the goals are recommended by the Fire Chief and approved by Council.

Analysis of the common response types, risk factors, actual response times, and concentration of built up areas indicates the City is well served by the current station location according to the criteria for a response outlined in NFPA 1710.

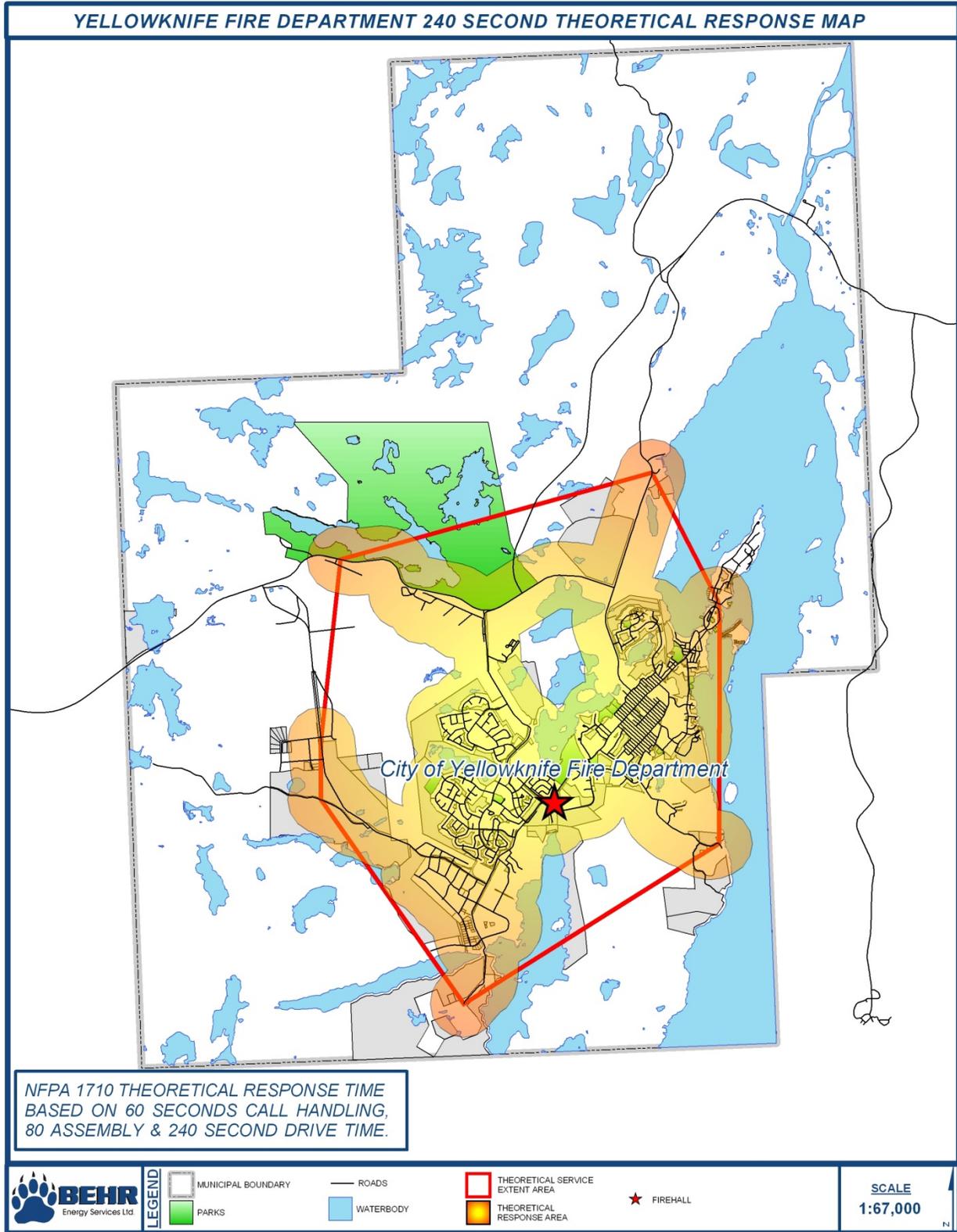
The data retrieved from the Fire Data Management (FDM) system indicates:

- average call handling times for 2015 are approximately 1 minute,
- average turnout times are 1m 20sec during daytime shifts and 1m 45sec during night shifts,
- average travel times vary from month to month, but average approximately 5 minutes

Note: Theoretical response mapping methodology is available in Appendix D.



Map 1: 7-minute Theoretical Response Map (NFPA 1710)





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SECTION 5 DEPARTMENT PROFILE

5.1 Department Overview

Since 1943, the Yellowknife Fire Department has provided critical safety services for the citizens of Yellowknife. Today, YKFD is publicly funded and operates as a full-time integrated department offering multiple services to the citizens, businesses and visitors of Yellowknife. YKFD's services include Fire Suppression & Rescue, Emergency Medical Response (Basic Life Support (BLS)), Emergency Communications and Dispatch, Emergency Management, Public Education, and Fire Inspections. The services provided by YKFD are designed, organized and operated in compliance with Yellowknife's bylaws, goals and objectives for public safety.

5.1.1 Mission and Vision

It is apparent that pride, dedication and honor is a way of life for members of the department. Like any other Fire and Emergency service provider, YKFD faces many challenges in both day-to-day operations and planning. In addition to the challenges, management of operating a city business unit takes careful planning and anticipating unique challenges including administration, finances, communications, resource planning, goal setting and how to achieve objectives. It is important that everyone in the department from the leadership on down are pulling in the same direction. This can be achieved by establishing goals and objectives that identify how the department will manage growth, provide value for the citizens and how they will continually provide for a safe community while in alignment with the City's mission and vision.

YKFD's Mission:

Yellowknife Fire Division is a proactive organization committed to protecting life, property and the environment through education, prevention, training, investigation, rescue, fire suppression and to provide quality emergency medical care through life support services.

YKFD's Motto:

- *Professional in our conduct*
- *Proficient in our actions*
- *Passionate about providing effective customer services*
- *Proud of what we do for the citizens of Yellowknife*

5.2 Human Resources

The heart of any organization is its people. YKFD is classified as an 'Integrated' service capable of providing both Fire/Rescue and Emergency Medical Response. In addition, YKFD has responsibility for Yellowknife's emergency management portfolio and operates its own emergency dispatch centre.



5.2.1 Staffing Complement

Currently, YKFD maintains the following staff to deliver emergency services:

- 1 Fire Chief
- 3 Deputy Chiefs
- 4 Lieutenants
- 20 Firefighter/Paramedics
- 20 Paid-on-Call (POC's)
- 1 Emergency Dispatch Supervisor
- 4 Emergency Dispatchers
- 6 Volunteer Life Safety Public Educators

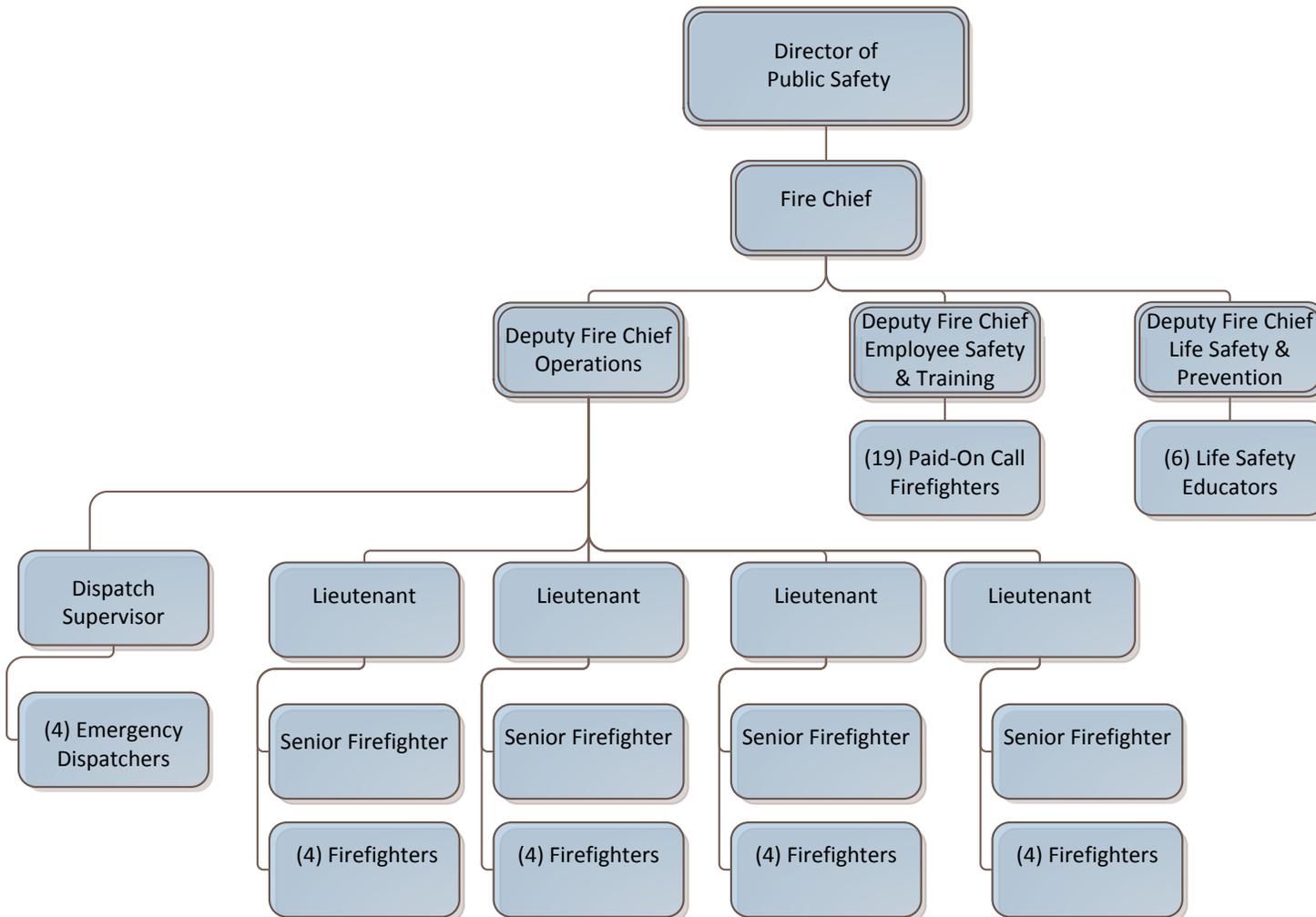
The Fire Chief is responsible for the direct supervision of all staff including the overall operation, planning and fiscal responsibilities for the department. The Chief must ensure appropriate fire and emergency response activities are consistent and meet the standards contained within the municipal, territorial and federal legislation and regulations.

YKFD's current organizational structure poses some challenges, particularly for those at the operational level. The line of reporting seems un-clear to some and confusing to others. In addition, roles and responsibilities come into question during some situations and events. This is of particular concern if this happens during an emergency.

See Figure 7, Page 35



Figure 7: Yellowknife Fire Division Organizational Structure (2016)



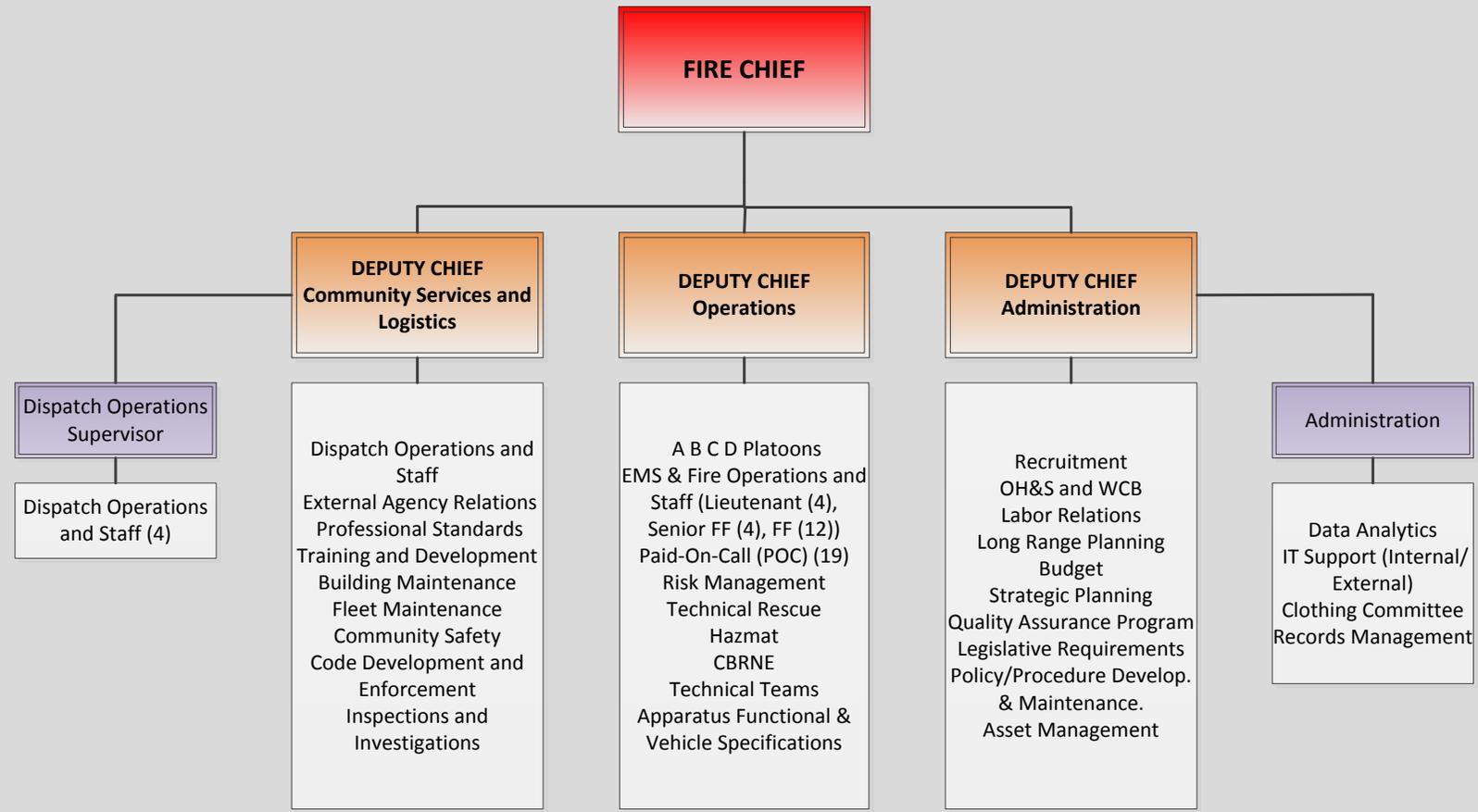


Recommendation #4: Realign the current organizational structure

(12-24 months)

We recommend a structure similar to the example below that has balanced approach to allocating tasks, responsibility and accountability. Additionally, in comparison to the existing 2015 organizational chart, it also shows clear lines of reporting and accountability.

Table 10: Recommended Organizational Chart





5.2.2 Department Leadership and Management

Effective and efficient leadership and management starts at the top to guide an organization towards success. As stated earlier, elected officials are relentlessly looking for ways to effectively manage and avoid costs while still increasing value in the delivery of services for their citizens. This environment has generated the need for communities to adopt more business-like approaches for delivering public safety services.

Running emergency services as a business requires the development of private sector approaches such as:

- conducting regular market analysis
- developing performance measures and quotas for outputs; responses and assembly times
- regularly monitoring and reviewing performance to determine the effectiveness
- developing measurable targets for fire prevention and public education programs

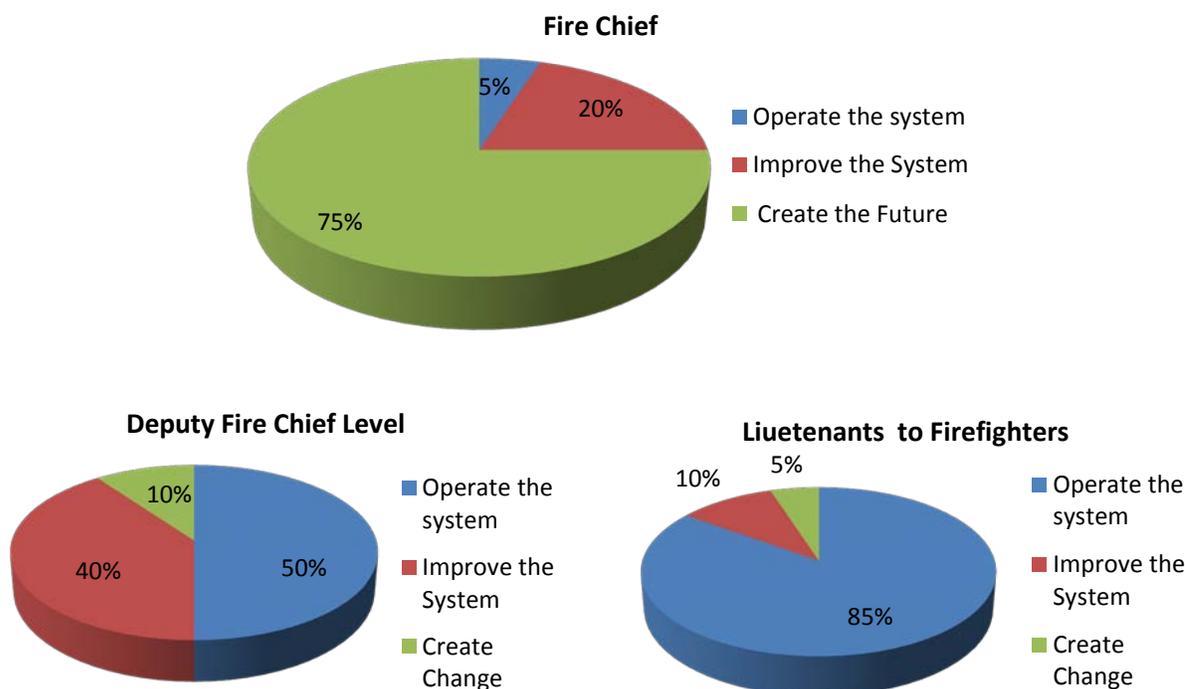
An effective organizational structure must support and promote strong and effective leadership, sound business management and continuity, effective communication and opportunities for staff development. In some cases, this may require a shift from the historical approach of maintaining current systems to a focus on creating a future for the department that is responsive to change, sustainable and efficient.

Emergency service leaders have also had to adopt a more business-like approach to leading and managing their departments. Along with their municipality's senior administration, they need to be proactive and examine all aspects of their service delivery systems to look for innovative efficiencies and effectiveness.

The following images suggest how to allocate leadership time to effectively manage a department.



Figure 8: Fire Service Time Management⁴



When compared to similar sized departments, YKFD is operating with a reasonable number of leadership positions. The leadership and management positions, including the Fire Chief and 3 Deputy Chiefs, are all out-of-scope or ‘non-unionized’. However, the leadership team has endured challenges as they work to foster a collaborative management approach within all aspects of the department.

During the development of this report, the Fire Chief had announced his retirement and the City was recruiting for a new Fire Chief.

5.2.3 Administrative Support

Administrative support staff is an important part of a department’s success. A number of contemporary fire departments have recognized the need for additional bench strength in the business aspects of managing a fire department. Although the demand for YKFD’s services continues to grow and areas of responsibility expand, the level of administrative support has not kept pace.

Currently, YKFD has the use of one (1) administrative support staff for 4 hours per day, 5 days a week. Senior staff members are spending a great deal of time doing administrative work, detracting from their ability to focus on their respective portfolios.

⁴ Sergeant, Chase, (2006) ‘From Buddy to Boss, Effective Fire Service Leadership’, PennWell, Tulsa OK



The feedback received during our interviews indicated the lack of administrative support has made it very challenging YKFD to function as a progressive department. Based on a comparison with other similar sized fire departments, YKFD appears to be under-resourced when it comes to utilizing administrative support. (See *Community Comparators Table #18, Page 94*) Having senior staff, carry out routine administration functions is not cost effective and detracts from opportunities for the leadership to effectively run the more important aspects of the department. Further, in addition to routine functions, the merits of providing administrative support to monitor financial tracking, statistic collection and analyses are invaluable. It should also be noted, that in most jurisdictions, the Fire Department is a stand-alone business unit that's often located remotely from other corporate departments where the opportunity for cross utilization is minimized.

Recommendation #5: Create a fulltime administrative support position

(0-12 months)

We recommend that YKFD add a fulltime administrative support position responsible for clerical and other office support functions such as:

- *Filing and photocopying*
- *Managing visitors*
- *Analyzing data*
- *Administering OH & S and WCB claims*
- *Tracking inventory of duty clothing*
- *Managing records*

5.2.4 Dispatch Centre Staff

The YKFD Dispatch Centre was established in 2014 and consists of one (1) Supervisor and four (4) emergency dispatchers. At this time, the Centre is not being operated in accordance with recommended standards for required staffing levels. For example, a minimum of two operators should be on duty at all times.

The existing shifts and work cycle in the Dispatch Centre do not provide for the best operational performance and individual health and wellness for the staff. Dispatchers often work alone and experience long shifts with limited ability to take sufficient breaks from this stressful environment. This has potential for developing into long-term physical and emotional illnesses for staff and could result in marginalized performance for this very important key function. These conditions may also contribute to a negative response affect.

Recommendation #6: Increase staffing levels to meet the requirements outlined in NFPA 1221 (chapter 7) with a minimum of two operators on duty at all times

(0-12 months)

We recommend providing adequate levels of highly trained staff to ensure continuous response to calls by highly trained and alert individuals. This applies to both routine calls for service as well as periods when demands that might exceed the ability for a single operator/dispatcher to manage effectively.



5.3 Recruitment, Selection, Retention and Promotion

Personnel recruitment is a key function of all emergency service agencies. The community places a tremendous amount of faith in fire and EMS personnel, trusting them to provide the highest level of service when the public is most vulnerable. As such, the process used to select personnel should be very comprehensive.

Experience within the emergency services industry has shown that relaxing the requirements for entry-level positions is not the answer for recruiting any employee. Instead, most departments have had the greatest success when qualified applicants are encouraged to apply. This process often involves targeted advertising and promotional campaigns aimed at demonstrating the salary and benefits, as well as the personal satisfaction of a career in the fire service. Existing employees can be encouraged to participate in any such campaign and professional assistance from a human resource department is advised.

YKFD provides an integrated Firefighting and EMS response for the City and immediate areas. Classified as an integrated department means that individuals are cross-trained in both firefighting and EMS response and all firefighters provide a seamless response to a broad range of emergency types.

5.3.1 Recruitment and Selection

YKFD Administration and City of Yellowknife Human Resources to select the best individual for any available position. YKFD hiring criteria requires career firefighters to have:

- An NFPA 1001 journey person firefighter qualification
- Primary Care Paramedic / Emergency Medical Technician that are based upon the Primary Care Paramedic (PCP) qualifications from the national competency profile
- A pass on the current Candidate Physical Abilities Test (CPAT)

Historically, YKFD conducted active recruitment programs with complete applications available both online and at the municipal offices. In addition, they advertised with posters, web sites and a locally produced video presented in Yellowknife theatres. During these recruiting campaigns, they attracted between 10-20 applicants. Compared to small-sized southern Canadian Cities this response is extremely low. On average, recruitment in these cities should be attracting anywhere between 200-500 applicants. Low applicant numbers like these are indicative of the challenges facing small, isolated northern communities when recruiting qualified professionals.

It is understood, that given the remote northern location and isolation, YKFD like comparable northern communities, will experience higher turnover rates than southern fire services. Since 2010, YKFD has replaced 19 career firefighters. This number is high given there are only 24 staff in the Operations Branch.

- 2012: 4
- 2013: 1
- 2014: 0
- 2015: 2
- 2016: 1 (departure to date)

Two years ago, YKFD acknowledged these challenges and initiated a fire cadet program similar to the program that Calgary Fire Department developed. An innovative aspect of the



YKFD program had them enter into a partnership with the local school district. Prospective students were able to earn 10 High School credits towards their graduation diploma as well as receive the NFPA 1001 accreditation. The program has developed three graduates into active POC members.

Recommendation #7: Continue the Fire Cadet Program

(36-60 months)

As a long-term strategy, we recommend that the primary focus for career recruitment is the continuation of the fire cadet program or other initiatives that seek out and/or develops candidates that reside in Yellowknife or within the Territory.

5.3.2 Paid-On-Call (POC) and Career Standards

The POC contingent of YKFD is a cost efficient support service and considered a valued component of the emergency response system. At the time of this study, YKFD had 12 - 15 POC staff. This capacity is considerably short of what the Deputy Chief of Operations identified as needed. It is felt they need at least 30 POCs to optimize the reliability of their role.

A number of POCs hope to secure a career position, while others simply want to give back to their community. Approximately 40% of POCs are seeking career opportunities either with YKFD or with other fire services. The role of the POC members needs to be evaluated with a view to formally establish that they are there to support the career operations.

The POC system is complicated with defined limitations in remote small-sized cities such as Yellowknife. There must be a balance between training hours and responses so that POC members do not become overwhelmed and leave. YKFD’s challenges with recruitment and retention of POCs are not unique. Volunteer services across Canada are experiencing similar issues.

The continued turnover of POC’s results in budgetary pressures for YKFD and is further exacerbated by the current training standards imposed by YKFD. The recurring costs include time for basic recruit training, the trainer, recruitment, and PPE as well as the costs of certification.

Table 11: YKFD POC Attrition, 2008 - 2016

Year	Transition to Career	Left Program	Total Enrolled	Total Recruitments
2008	1	2	17	1
2009	1	2	18	1
2010	3	3	13	1
2011	1	2	22	1
2012	1	6	20	1
2013	0	7	16	1
2014	0	7	22	1
2015	1	14	20	1
2016	0	4	18	2



YKFD requires the following qualifications for persons to be recruited as a POC:

- NFPA 1001 level II (or train to this level within 12 months)
- First Aid & CPR
- current CPAT certification

The majority of volunteer or POC fire services do not impose the CPAT or completion of the NFPA 1001 in 12 months. The minimum standards include confirmation from their physician that they are medically fit to perform the duties of a volunteer firefighter, they are willing to participate in training, can respond to emergencies day or night on a consistent basis, and live in close proximity to the fire station.

A leading practice is outlined in the BC Fire Commissioner's Minimum Training Standards, Structure Firefighters Competency and Training Playbook (Playbook). This Playbook sets out a competency-based ladder that sets a minimum level of sequential training and operational requirements that must be met by each fire department. The Playbook establishes and describes the minimum competencies required of firefighter roles in the following three categories:

- Exterior Operations Level Firefighter
- Interior Operations Level Firefighter
- Full-Service Operations Level Firefighter

The Playbook standard outlines the minimum competencies drawn from the NFPA standards. The declared service level must be established as formal policy for the department (whether by bylaw, policy or in contract) and needs to be fully reflected in the fire department's operating guidelines and policies. The Authority Having Jurisdiction (AHJ) decides the appropriate service level for its fire service based upon:

- local conditions
- consultation with representatives of the local fire service delivery organization
- the availability and ability of those resources to respond
- the realities of the community in terms of demographics, risks, travel distances, fire hall locations, equipment and staffing models
- the ability of the AHJ to financially support its fire department to enable it to meet all applicable training, safety and operational requirements for the chosen service level

***Recommendation #8: Formalize the role of the Paid-On-Call members
(36-60 months)***

We recommended, given YKFD's challenges with recruitment and retention of POCs and the increasing costs to maintain the current program that YKFD formally establish the POCs as Exterior Operations Level Firefighter with the primary role to support the career operations. Those POCs looking towards career opportunities in YKFD could be offered high-level qualifications as part of the ongoing training program.

The table below describes the current YKFD qualifications and experience for the various career positions. These requirements are consistent with the comparative communities analyzed in this report and other similar fire services.



Table 12: YKFD Operational Qualifications

Position	Qualifications
Fire Chief	<p>NFPA 1001 level II NFPA 1002 (Apparatus operator) NFPA 1021 level IV (Fire Officer) NFPA 1521 (Incident Safety Officer) NFPA 1033, 1031 Investigator/Inspector level I (Level II preferred) NFPA 1041 level II Instructor Primary Care Paramedic / EMT-A Preferred Qualifications: Degree or diploma in fire administration, 10 years of supervisory experience in the fire service</p>
Deputy Chief	<p>Deputy Chief – Life Safety & Prevention: NFPA 1001 level II NFPA 1002 (Apparatus operator) NFPA 1021 level III (Fire Officer) (Level IV elective) NFPA 1521 (Incident Safety Officer) NFPA 1033, 1031 Investigator/Inspector level I (Level II preferred) NFPA 1041 level II Instructor NFPA 1035 Public Fire Educator Deputy Chief – Operations: NFPA 1001 level II NFPA 1002 (Apparatus operator) NFPA 1021 level III (Fire Officer) (Level IV elective) NFPA 1521 (Incident Safety Officer) NFPA 1033, 1031 Investigator/Inspector level I (Level II preferred) NFPA 1041 level II Instructor</p>
Lieutenant	<p>NFPA 1001 level II NFPA 1002 (Apparatus operator) NFPA 1021 level II (Fire Officer) (Level III elective) NFPA 1521 (Incident Safety Officer) NFPA 1033, 1031 Investigator/Inspector level I (Desired) NFPA 1041 level II Instructor Primary Care Paramedic / EMT-A International Trauma Life Support (adult) Health Care Provider – CPR Pediatric Education for Prehospital Professionals (PEPP) Class 3 drivers licence with air brake endorsement Minimum five (5) years of experience with a fire department</p>
Senior Firefighter	<p>NFPA 1001 level II NFPA 1002 (Apparatus operator) NFPA 1021 level 1 (Fire Officer) (Level II elective) NFPA 1521 (Incident Safety Officer) NFPA 1033, 1031 Investigator/Inspector level I (electives) NFPA 1041 level I Instructor (level II elective) Primary Care Paramedic / EMT-A International Trauma Life Support (adult) Health Care Provider – CPR Pediatric Education for Prehospital Professionals (PEPP) Class 3 drivers licence with air brake endorsement</p>
1st Class Firefighter	<p>NFPA 1001 level II NFPA 1002 (Apparatus operator) NFPA 1021 level 1 (Fire Officer) NFPA 1521 (Incident Safety Officer)</p>



Position	Qualifications
	NFPA 1033, 1031 Investigator/Inspector level I (Electives) NFPA 1041 level I Instructor (Elective) Primary Care Paramedic / EMT-A International Trauma Life Support (adult) Health Care Provider – CPR Pediatric Education for Prehospital Professionals (PEPP) Class 3 drivers licence with air brake endorsement
Firefighter	NFPA 1001 level II Primary Care Paramedic / EMT-A International Trauma Life Support (adult) Health Care Provider – CPR Pediatric Education for Prehospital Professionals (PEPP) Class 3 drivers licence with air brake endorsement
Dispatcher	Grade 12 Diploma Emergency Medical Dispatching (EMD) Emergency Fire Dispatching (EFD) Emergency Medical Responder (EMR) Cardio Pulmonary Resuscitation (CPR) Level “C” First Aid (Standard)

5.3.3 Workforce Training

Training and competency refer to the specific programs within a fire department, which exist to support the services YKFD provides. A prepared and competent workforce reduces risk and optimizes service delivery. An effective workforce-training program will align the growth and development of personnel to the organization’s mission and goals.

Training and education program activities are identified by assessing the knowledge and skills needed for the firefighters and medics to perform their duties as outlined in the department’s Standard Operating Guidelines and Procedures. Additionally, Occupational Health and Safety has increased the formal requirements for training and maintaining records of that training and compliance to NFPA standard guidelines. When members are competent in handling tools, scene safety, and driving, they reduce risk and ensure safety; both their own safety and the safety of the public they serve.

As recruiting of qualified personnel becomes more difficult, it will require departments to expand their training programs and scheduling to ensure workers are qualified for all tasks assigned. YKFD has also recognized the need for the development of training that encourages members to plan their future growth within the organization. This training will allow for the much needed succession planning and overall retention of its workforce.

5.3.3.1 Training for the Safety of Firefighters

Source: Northwest Territories (NWT) Occupational Health and Safety (OHS) Regulations, Safety Act:

Training of firefighters is addressed in Part 32, Section 479 of the *Northwest Territories (NWT) Occupational Health and Safety (OHS) Regulations, Safety Act* under ‘Training of Firefighters’.

479:

- (1) An employer shall ensure that
 - (a) a firefighter receives training necessary to ensure that the firefighter is able to safely carry out his or her duties;



- (b) training required by paragraph (a) is provided by competent persons; and
- (c) written records are kept of training delivered to each firefighter.

5.3.3.2 Training Requirements

YKFD offers its members a wide variety of training with the most advanced methodologies necessary to deliver safe and efficient services.

Training for YKFD operational staff can be separated into three (3) general categories:

- Paid-on-call fire fighters
- Full time career fire fighters
- Officers

The fire service follows best practices and procedural guidelines consistent with NFPA 1500 Standard for Firefighting Occupational Health & Safety. All training for fire service members is conducted using instructional methodologies consistent with NFPA 1041 - Standard for Professional Fire Service Instructors, and the operational criteria outlined in:

- NFPA 1001 – Standard for Fire fighter Professional Qualifications
- NFPA 1002 – Standard for Firefighter Driver/Operator Professional Qualifications
- NFPA 472 – Operational Standard for Responders to Dangerous Goods Incidents (Operations Level)

Additional, supplemental training can be obtained through the School of Community Government (SCG):

- NWT Defensive Fire Fighter Course;
- NWT Offensive I, II and III Fire Fighter Course;
- Wild land/ Urban Interface Fire-Fighter Training;
- Fire Fighter Training Modules (Advanced);
- Fire Fighter Officer Training Modules;
- 1041 Level 1 Part I (Instructor Practical Skills Course);
- 1041 Level 1 Part II (Instructor Theoretical Skills Course);
- 1041 Level 1 Part III (Instructor/Evaluator Course);
- Instructor Workshop; and
- Council Orientation to Fire Protection

Historically, there has not been a consistently accepted level of training for firefighters. Many departments tailored their instruction to suit their own needs and internal practices, which led to inconsistent levels of training for an extremely hazardous profession. Since the NFPA 1001 Standard was adopted as the minimum training standard for professional firefighters, a consistent curriculum has been established.



5.3.3.3 Incumbent Training

Incumbent training maintains skills necessary to perform tasks required for duty. The lieutenants or senior officers in each station try to conduct the exercises while members are on shift, but time and call volumes often impede training efforts. Outdoor practical training depends on weather conditions and available water supply. Most practical training is planned outdoors during the summer. The focus is on familiarizing staff with apparatus and equipment as well as modern firefighting techniques and best practices. During winter months, training is primarily indoors.

YKFD incumbent training incorporates an on-line learning environment to deliver updated training material, updated SOP's or SOG's, and other material designed to assist staff perform their duties. The on-line delivery method has proven to be effective for similar departments, which will allow YKFD to develop specific programs for areas that may otherwise be difficult or cumbersome to deliver to all the staff in a timely fashion. The ability to track and report on this type of training also assists with the administration of continuing education.

There are models, such as the BC Playbook (discussed previously), that allow for qualified and competent members, ensuring that JPRs and skills maintenance are conducted annually decreasing hours committed to training (reducing the weekly requirement of three (3) hours to a more manageable number).

Recommendation #9: Enhance the use of on-line delivery of educational material to all staff

(0-12 months)

We recommend YKFD continue to take advantage of the on-line learning environment to enhance the delivery of important educational information and relevant communications to all staff.

Recommendation #10: Review the staff qualifications and standards

(0-12 months)

We recommend YKFD continue to take advantage of their learning environment but should review the current staffing qualifications as the requirements are quite ambitious, specifically referring to the POC members. A review of the service levels will also direct the competency base for career members in accordance with staffing numbers and skills maintenance budgets and training schedules.

- Considerations to recruiting POC members based on JPRs may increase the number of qualified and competent firefighters in a timely fashion.*
- Considerations to retaining POC members based on JPRs may increase the sustainability of qualified and competent firefighters.*
- Qualifications for career members add to career development (section 5.12), and should be considered as professional development versus job requirements based on a review of the current service levels and staffing models.*

Scheduling and records management will assist in tracking certifications and JPR requirements primarily in skills maintenance for all certifications and qualifications.



5.3.3.4 Specialty Teams Training

Specialty teams require knowledge and skills for tasks considered beyond the scope of the normal activities expected of members. YKFD currently provides training and equipment to support and deploy personnel for the following specialty services:

Dangerous Goods/ Hazmat

YKFD does not maintain a Dangerous Goods/Hazmat team, but rather trains the twenty-four (24) career members to the NFPA 472 Operations level.

Technical Rescue

YKFD provides water and ice rescue, confined space rescue and mechanical entrapment rescue based on one or more of the disciplines covered within the NFPA 1006 standard.

5.3.4 Training Staff

Training should encourage and stimulate competency, innovation, and increased effectiveness. Many training courses require an instructor that is extremely knowledgeable in the subject matter and skilled in teaching. The type and number of training courses being offered must balance with the number of skilled and trained instructors available.

Schedules and course content need to be monitored for job performance requirements (JPRs) to meet service levels as well as supporting career development (Section 5.12). Instructors and trainers should report to one individual.

Currently, YKFD offers a sufficient fire and EMS training program. However, it is challenging to maintain incumbent training levels because:

- On-shift training is usually interrupted by response calls
- The training area is in a remote location inside the airport security perimeter
- Paid-on-call (POC) standards are too high

Recommendation #11: Appoint the training portfolio, which includes career and professional development to a deputy fire chief

(12-24 months)

We recommend YKFD continue to take advantage of the officer core and align the training officer roles and responsibilities to include training related administrative duties such as scheduling and data management. This would result in a broader effort of much needed training focus. This could result in increased training advancement, retention and succession planning.

Due to the high number of call volumes during a shift, it is very difficult to keep training schedules for courses or competency reviews as firefighters and officers are required to respond to calls; thereby interrupting active sessions whether at the fire station or at the remote training grounds. A possible solution for scheduling training is to schedule sessions at the beginning of a shift (prior to shift vehicle inspections or incorporated at the same time) or at shift change (allowing for coverage if a call comes in).



5.4 Career Development

Training and education programs are provided to support the organization's developmental needs as well as the employee's career goals. The School of Community Government (SCG) also offers courses (by request) that are customized to meet NWT needs and lead to NFPA certification.

Currently, an on-shift officer or a Senior Officer (Deputy Fire Chief) coordinates the training. This system could be improved if training was coordinated by one individual who would be responsible for scheduling, certifications and, documentation/records management.

Because career and professional development is unique and personal, there is significant benefit from mentorship support. Each individual should use standard criteria to measure their growth against personal and department objectives. Many departments provide these opportunities for growth in their retention and succession planning strategies.

Recommendation #12: Create a formalized process for officer development

(0-36 months)

We recommend that YKFD implement an Officer Development Program that follows IAFC guidelines in collaboration with the City of Yellowknife Human Resources. Promotional processes should include job performance requirements and professional qualifications outlined in NFPA 1021. This approach will enhance in-house training and promote understanding of YKFD SOGs and operational directives. The training and mentorship process will also support promotional opportunities for senior staff.

5.5 Succession Planning

Currently, there is no formal succession plan in place leaving the department vulnerable if any key member of the leadership team decides to leave. At the time this report was being developed, the Fire Chief had announced his intention to retire in late 2016. In addition, over the past 9 years, there has been considerable turnover within the leadership team as numerous Fire Chiefs and Deputy Chiefs having departed the organization.

The number of frontline staff expressing interest in ascending to leadership positions seems encouraging. However, their current qualifications and experience indicate a strong bias towards the technical aspects of the roles and do not reflect leadership expertise in management, labor relations, local government, business and financial acumen required for more senior positions within YKFD.

It is essential to implement a formal succession plan to help the department prepare for future changes resulting from either anticipated or unanticipated departures. The plan will enable the department to fill gaps quickly and effectively. The plan must outline the requirements:

- for each role on the leadership team
- for the adequate training and developmental opportunities to be provided for staff interested in these roles
 - What cross training can be offered
 - What acting opportunities in more senior roles within the Department and the Corporation should be made available



The succession plan should also include annual performance assessments completed by the individual and their immediate supervisor. This is essential in developing career paths and focusing the training and development opportunities that will meet YKFD future staffing requirements.

Recommendation #13: Establish a formal Succession Plan

(0-36 months)

We recommend that YKFD establish a formal succession plan that will allow for the necessary training and development of existing staff thereby ensuring a smooth transition when changes to key positions and personnel in the leadership team occur. This plan needs to go beyond fire service technical or operational qualifications and include academic, leadership and management development.

5.6 Health and Wellness

Northwest Territories (NWT) Occupational Health and Safety (OHS) Regulations and Safety Act, effective August 1, 2016, clarified the employer's responsibilities for providing a safe work environment for emergency operations and fire services. This document explained several areas of the NWT OHS Regulations and the expectations of a municipality or employer for setting a clear understanding of what fire services are provided and to what standard in conjunction with the Workers Compensation Act (14.1 (1)). Some services have gone a step further and adopted the broader spectrum of guidelines in the NFPA 1500: Standard on Fire Department Occupational Safety and Health Program.

Part 3; Sections 12 and 21, and Part 32 of the 'Northwest Territories (NWT) Occupational Health and Safety (OHS) Regulations, Safety Act' prescribe minimum standards for fire service outlines the planning process for ensuring firefighter safety and efficient operations.

Part 3: GENERAL DUTIES General Duties of Employers Obligations (page 14 of the 'Northwest Territories (NWT) Occupational Health and Safety (OHS) Regulations, Safety Act')

Section 12: An employer shall, in respect of a work site,

- (a) provide and maintain systems of work and working environments that ensure, as far as is reasonably possible, the health and safety of workers;*
- (b) arrange for the use, handling, storage and transport of articles and substances in a manner that protects the health and safety of workers;*
- (c) provide information, instruction, training and supervision that is necessary to protect the health and safety of workers; and*
- (d) provide and maintain a safe means of entrance to and exit from the work site.*

Section 21: Occupational Health and Safety Program

- (1) An employer shall provide an occupational health and safety program under this section if*
 - (a) there are 20 or more workers who work at the work site; or*
 - (b) the employer is so directed by the Chief Safety Officer. .*
- (2) An occupational health and safety program for a work site must include*



- (a) a statement of the employer's policy with respect to the protection and maintenance of the health and safety of workers;
- (b) an identification of hazards that could endanger workers at the work site, through a hazard recognition program;
- (c) measures, including procedures to respond to an emergency, that will be taken to reduce, eliminate and control the hazards identified under paragraph (b);
- (d) an identification of internal and external resources, including personnel and equipment, that could be required to respond to an emergency;
- (e) a statement of the responsibilities of the employer, the supervisors and the workers;
- (f) a schedule for the regular inspection of the work site and inspection of work processes and procedures;
- (g) a plan for the control of hazardous substances handled, used, stored, produced or disposed of at the work site and, if appropriate, the monitoring of the work environment;
- (h) a plan for training workers and supervisors in safe work practices and procedures, including procedures, plans, policies or programs that the employer is required to develop;
- (i) a procedure for the investigation of refusals to work under section 13 of the Act;
- (j) a strategy for worker participation in occupational health and safety activities, including audit inspections and investigations of refusals to work under section 13 of the Act; and
- (k) a procedure to review and, if necessary, revise the occupational health and safety program not less than once every three years or whenever there is a change of circumstances that could affect the health or safety of workers.

Part 32: ADDITIONAL PROTECTION FOR FIREFIGHTERS of the 'Northwest Territories (NWT) Occupational Health and Safety (OHS) Regulations, Safety Act' clearly outlines the requirements that firefighters must have appropriate policies and guidelines as to what resources will be deployed to an emergency incident.

Section 478

- (1) In this section, "standard operating procedure" means an operational directive prepared by an employer that establishes a standard course of action for firefighters to follow in respect of emergency incidents to which firefighters could respond.
- (2) An employer, in consultation with the Committee or representative or, if there is no Committee or representative available, the firefighters, shall develop a written plan that establishes procedures to be followed by firefighters in fighting fires.
- (3) A plan required by subsection (2) must include
 - (a) identification of standard firefighting functions, including functions that must be performed simultaneously;
 - (b) the minimum number of firefighters required to perform safely each identified firefighting function, based on written standard operating procedures;



- (c) *the number and types of firefighting vehicles and firefighters required for the initial response to each type of incident;*
 - (d) *the total complement of firefighting vehicles and firefighters to be dispatched in response to each type of incident;*
 - (e) *a description of typical emergency operations, including alarm time, response time, arrival sequence and responsibility for initiating standard operating procedures necessary to protect the health and safety of firefighters;*
 - (f) *a description of the incident management system; and*
 - (g) *a description of the personnel accountability system.*
- (4) *An employer shall (a) ensure that a plan developed under subsection (2) is implemented; and (b) make copies of the plan readily available to firefighters.*

The prevalence of work-inhibiting strains and sprains, cardiovascular illness and deaths among firefighters illustrates the need for a comprehensive health and wellness program in every department. Department leaders often struggle to implement a program for various reasons: resistance, lack of motivation from members, the costs associated with implementing a program and the lack of well-defined requirements. YKFD should provide availability for fitness workouts using fitness equipment located in the fire station or via discounted memberships to other City recreational facilities. Because appropriating time during shifts for physical fitness activity is a challenge due to call volumes, YKFD should conduct a review to ensure their members can benefit from the physical and mental health advantages and meet the demanding job requirements.

Health education programs outline steps for improving fitness and nutrition, getting heart smart and other general health topics like coronary heart disease, diabetes, high cholesterol and high blood pressure. The programs also provide essential information about the risks firefighters face and what can be done to reduce these risks including how to stop smoking.

Wellness is defined as achieving a balance of medical fitness, physical fitness, emotional fitness, behavioral fitness and incorporating rehabilitation when needed. Balance is a key factor in being prepared for the physical demands of firefighting. Physical fitness includes health, strength, suitability and durability. Behavioral fitness is the measure of discipline used to control your thoughts, feelings and behaviors. Achieving a balance of both physical and behavioral fitness maximizes the ability to cope with daily hassles and the extreme stressors that occur while at work, in the home or out in the community.

All aspects of fitness require forms of support. Whether the necessity for access to personal trainers, spiritual leaders, counsellors, nutritionists, or financial planners or tools such as a website focused on workplace wellness^[1]; these types of resources add value to existing programs and increase the likelihood personnel will be able to maintain a work/life balance and their personal health and nutrition. YKFD continues to do good work in promoting workplace safety.

Mental health awareness and readiness has been, and continues to be a trending issue in the emergency response community. The issue of occupational stress injury, including both post-traumatic stress disorder (PTSD) and traumatic mental stress (TMS) are very real issues in emergency services with numerous documented cases.

^[1] <http://workplacewellnessonline.ca>



Recommendation #14: Develop a program to address PTSD and TMS for emergency response personnel

(0-12 months)

We recommend that YKFD develop and implement a unique Health and Wellness Program to include components specifically relating to the emergency responders' mental health awareness and readiness. The introduction of such a program will allow YKFD to take a definitive and proactive step to educate, prevent, and support those impacted by occupational stress injury.

One such program is the Mental Health Commission of Canada's (MHCC) 'Road to Mental Readiness (R2MR)' Program for Emergency Personnel (associated but not limited to Firefighter/Paramedics, Dispatch, Emergency Medical Services and Peace Officers). The R2MR program was originally developed by the Canadian National Defence and the Canadian Armed Forces; addresses stigmas, and identifies the signs and symptoms of occupational stress injury, based on a comprehensive mental health continuum model.

5.7 Performance Standards

The trend within the Canadian Fire Service today is to develop response system performance outputs based upon a number of factors such as assessed community risks, demographic and community profile, historical trends, community expectations and affordability. The overarching goal is to balance public and firefighter safety and create a cost efficient and operational effective performance standard that meets the needs of the respective community. In this context, industry standards such as NFPA are applied as a guideline, but are rarely fully adopted or met as the performance standard.

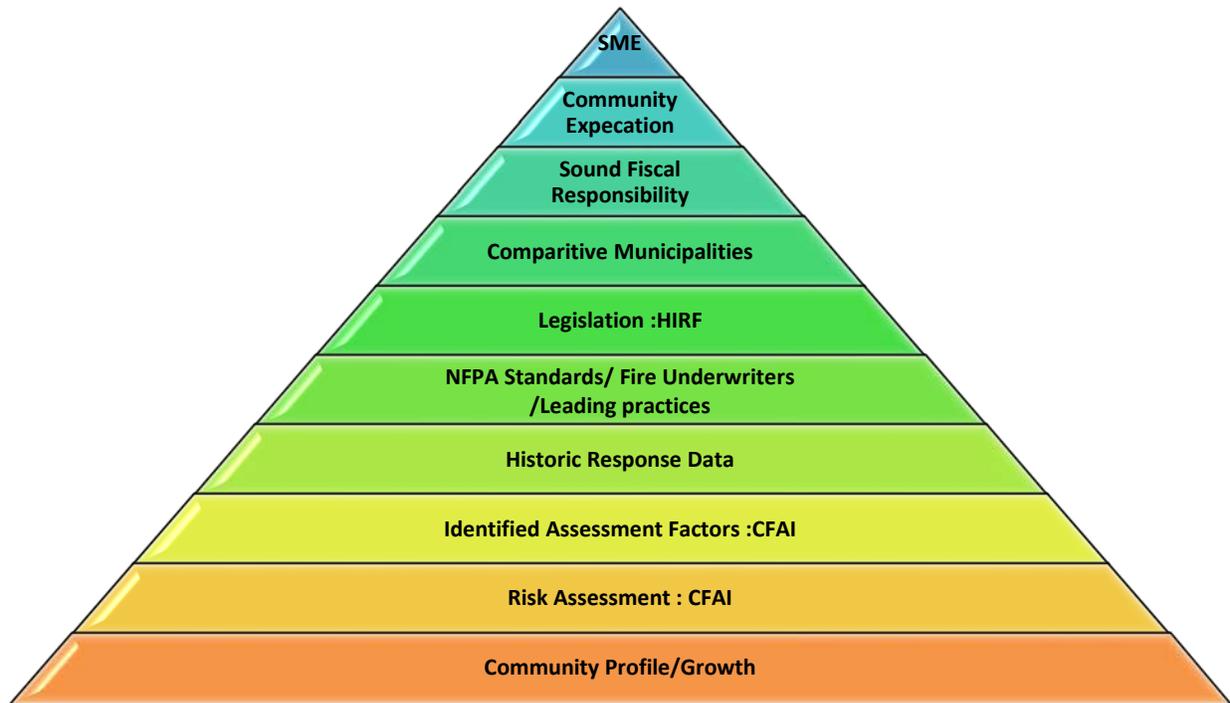
The challenge in community risk management is two-fold:

- having Subject Matter Experts (SMEs) assess the probabilities of an emergency event in a community
- getting the policymakers to support the SMEs' recommendations for the level(s) of service to be delivered to the area.

The Community Risk Assessment, explained in Section 3.4 of this report, provides insights into this process, explains how risks are categorized and how the various layers of information are applied. The goal of this process is to develop a 'Standard of Cover' policy that is supported by the City of Yellowknife Council as the service standard for YKFD.

The following figure shows the various layers of information, data and evidence that lead to recommended performance standards.

Figure 9: Assessment Pyramid



5.7.1 Predictive Modeling and Dynamic Deployment

Fire services have typically used intuition or experience along with stopwatches, road systems or other barriers to define a specific response area. However, spatial information systems such as GIS have come on scene to provide a more accurate, technology-based approach to determining coverage. As a result, innovative departments across North America are no longer relying on a simple geographical response model. These fire services are using Predictive Modeling and Dynamic Deployment to improve the overall efficiency and effectiveness of their emergency responses; computer based systems that reside in the 911/Fire Dispatch Emergency Communications Centre. These systems analyze risk tolerance decisions, historical data, and other related factors to optimize a department's deployment system while accounting for the concentration and distribution of its resources. Calgary is an example of a large multi-station department where predictive modeling is being used to enhance the response system.

When a department has a system for determining deployment that is broadly understood and accepted, it helps policy makers at all levels understand the deployment resources needed. Predictive modeling systems balance future considerations in the development of realistic performance standards using all three of these deployment models to assess the most effective coverage:

Geographical Response Model: Response zones are set based on the community's geography. This is accomplished by identifying key station location or which stations are better suited to respond to an area based on geographical and man-made barriers.



Historically, fire departments have employed a 'geographic response' model. This type of model strategically places fire stations, staff and equipment throughout the community to effectively respond to any type of emergency within an established response area

Dynamic Deployment: Staffing and related resources are strategically positioned and deployed for the most effective and efficient response to an emergency incident. Deployment can be based on peak call volume times, manufacturing and high risk-related functions that may require greater levels of response to certain areas at certain times.

The dynamic response model applies a systematic approach for managing resources based on risks, probability, reliability, and service demands rather than a blanket (geographic) response. This model uses apparatus redeployment guidelines for apparatus redistribution and the day-to-day backfilling or repositioning of resources to improve response performance. When using this system, departments identify optimum station locations, gaps, redundancies or enhancements to allow for more effective utilization of equipment and staffing levels.

Driven by economic factors and increasing call-volumes, many departments are employing peak-time resource redistribution shifting equipment and staff from one station to another to manage changing risk in the community. In some cases, stations might be left vacant or apparatus not staffed during identified quiet times. The City of Toronto is one department currently using this model.

In the context of YKFD and given the strained response capacity from increasing call volumes and coincidental and/or sequential responses, dynamic deployment may provide some relief or an offset within the response system. For example, during events when the station is empty due to multiple calls, this system would assess if a group alert or recall is necessary based upon peak-time responses.

Risk Based Response: Specific response requirements are determined to identify what resources and related training are needed. A number of fire services dispatch a fire fighter engine company for all types of responses when smaller units may be more efficient for lower risk and routine emergencies. The Vancouver Fire Department, for example, deploys a firemedic (crew cab pickup truck) for first medical response calls in the downtown core instead of an engine.

YKFD may want to consider a risk based response. Considering that 98% of the responses to general alarms are false, the department could send a general-purpose vehicle with one firefighter to provide an initial assessment of the alarm cause. Two percent of the time, however, this will result in a delayed response for the engine company to arrive in the event of a fire or another emergency.

The potential cost savings with the implementation of Predictive Modeling and Dynamic Deployment is dependent upon how the system is used. For example, the City of Kelowna is projecting an estimated overtime reduction in the recalling of off duty firefighters to provide geographic coverage when first line units are predisposed for extended periods of approximately \$30,000 per year.

Other programs, such as Vancouver's North Shore, have for the past 2 years, demonstrated improvement to service and response time with existing resources. The system has eliminated guesswork for when and which units are re-positioned in order to ensure coverage.



The City of Toronto employs peak-time resource redistribution. This is where resources (*equipment and staff*) are moved from one station to another in order to manage changing risk in the community throughout the day. In some cases, stations are vacant or apparatus not staffed during identified quiet times. In these examples, the direct cost savings are difficult to estimate. However, operational effectiveness has improved without adding additional resources.

Recommendation #15: Review the need to invest in Predictive Modeling Software (24-60 month)

We recommend YKFD invest in evidence-based predictive modeling and dynamic deployment system software that considers historical response data and anticipates the need to recall or increase resources for effective response times. This software provides timely and accurate mission critical information to improve the delivery of services and enhance citizen safety and firefighter safety. The delivery of effective information also means efficient use of resources.

The ultimate cost for an implementation of this software would include set-up fees, annual licensing and support fees, as well as any incremental YKFD staff costs for training or adding new staff with specialized skillsets. Standard pricing from software vendors is not available because the variables depend on YKFD's decisions regarding how they would implement the software. As a point of reference, the City of Kelowna is proceeding with an implementation with a cost of \$225,000 over 5 years. YKFD's application would be considerably less than this.

5.7.2 Firefighter/Paramedic Staffing Ratio Calculation

While somewhat theoretical, a staffing ratio model can determine the human resource requirement for a response system. This calculation will indicate how many firefighters would normally be required to manage the Minimum Duty Strength (MDS). A typical staffing ratio ranges between 4.8 and 5.4 full time staff members for every 24/7 position.

The following table provides an example of a staffing ratio calculation. If YKFD staffing ratio was 5.3 and the MDS was 6, the total complement would be 32 staff in the Suppression/EMS Branch:



Table 13: Fire Department Staffing Ratio Calculation

Description	Multiplier		Total Hrs./yr.
Total hours coverage per year	365.25 days	24 hrs.	8,766
<i>Divide by the Total Annual Hours</i>			
Annual One Firefighter/Paramedic position	42 hrs./wk.	52 wks.	2,184
Annual sick-time averages			(84)
Annual leave accrued averages/FTE			(210)
Annual average Lieu Time and WCB stats			(42)
Annual Technical Training per FTE			(84)
Annual Corporate Training			(84)
Total Annual Hours			1,728.4
<i>Equals the total number people required to staff one position 24/7</i>			
Staffing Ratio			5.3
<i>Multiply by the MDS</i>			
Minimum Duty Strength (people)			6
<i>Equals the total Firefighter/Paramedic staffing compliment</i>			
Suggested Staffing Complement			32
Increase of Firefighters from current staff compliment			8

5.8 Standard Operating Guidelines and Operating Policies

Standard Operating Guidelines (SOGs) and Standard Operating Policies (SOPs) are operational directives that establish a standard course of action for the firefighter or medic to respond. A department may perform any number of services, and to any level, based on the resources and technical expertise available. Establishing an accepted standard for service delivery offers important benefits to the territorial service, including a solid foundation upon which to develop and deliver an effective community fire service and an opportunity to share and enhance existing practices. Accepted standards also assist communities allocate fire service resources, create training plans, maintain equipment and communications and improve efficiency.

Municipal councils must determine exactly what services the department will provide and to what level or standard. It is then necessary to communicate the expectation to all response staff. The means of communicating and maintaining this information is through a written plan comprised of guidelines, standard operating procedures, and policies.

YKFD's SOGs and SOPs are current and meet the requirements of emergency response operations. YKFD's SOGs and SOPs are well organized, reviewed, and maintained annually using a colour-code system: blue, green, red and yellow.



5.9 Emergency Services Dashboard

Using a dashboard to measure system outputs is not a new concept in private sector businesses. The measuring and reporting of fire service outputs such as call handling, chute or turnout time, travel time, overtime, and budget performance is becoming more common within contemporary fire departments.

The establishment of a dashboard is something needs to be considered. The interviews with staff, Chief Officers, and Councillors, consistently commented on the lack of understanding in what YKFD does and their role within the community. Producing and distributing a monthly dashboard is an accountability process that also informs corporate and political leaders on the service outputs of YKFD.

The challenges to overcome include is building capacity within the system to produce a dashboard report and ensuring there is administrative and technical capacity to maintain the system on an ongoing basis. (See Image 2, Page 58, Sample Dashboard)

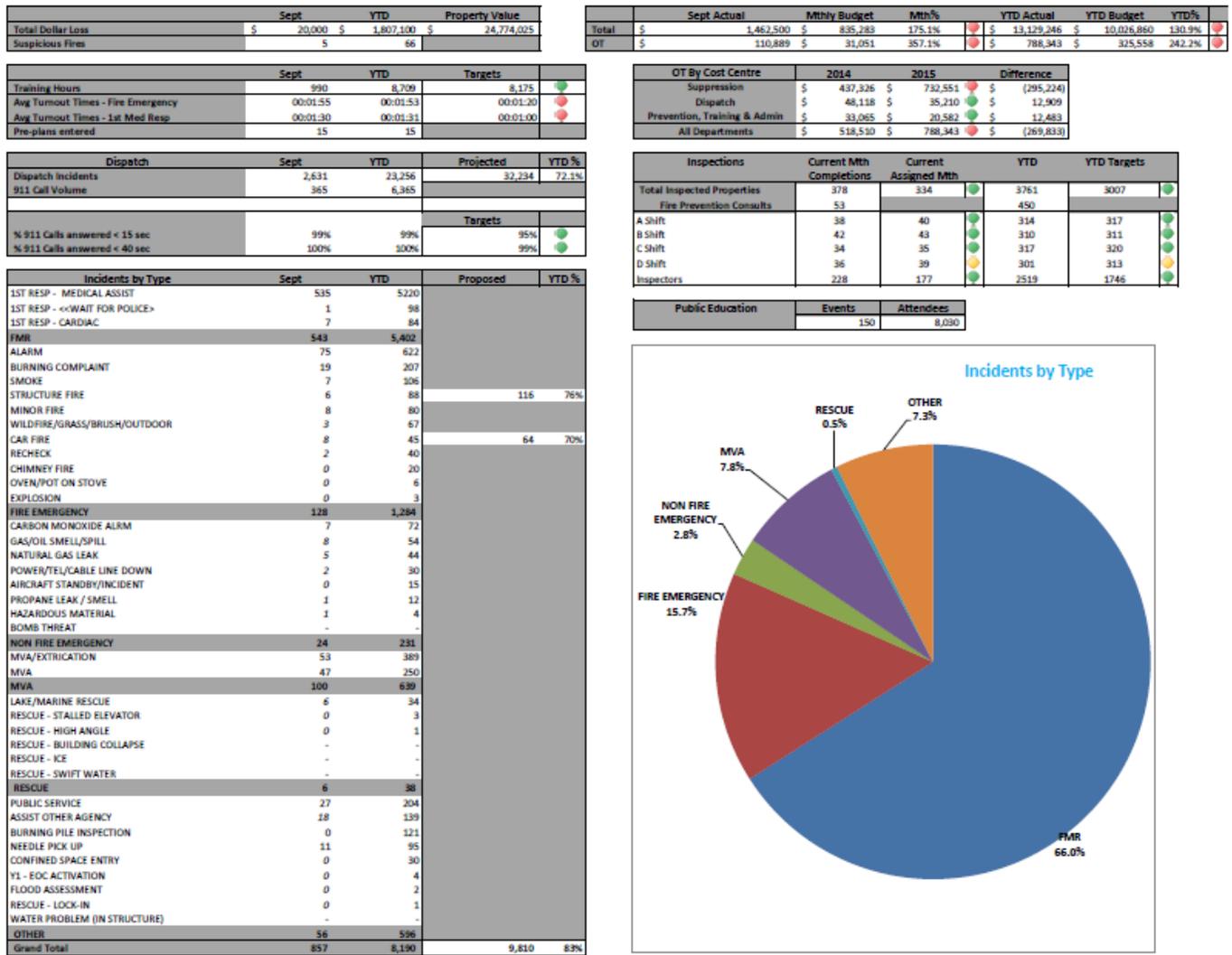
Recommendation #16: Establish a monthly Emergency Services Dashboard

(12-24 months)

We recommend YKFD establish a monthly fire service dashboard to monitor system outputs. The benefits of a dashboard provide an accountability system within the operational domain that may enhance a culture of continuous improvement amongst fire department staff, and a management tool for the Fire Chief to report on the department's performance from a business perspective.



Image 2: Sample Emergency Services Dashboard⁵



⁵ Source: City of Kelowna Fire Services



5.10 Records Management

The current records management system for YKFD is FDM. As purpose-built software for emergency services, FDM provides customizable solutions that include modules for incident data management, property information, pre-fire plans, inspection and investigation records, training records, inventory and asset management and personnel information. The FDM database can also provide the storage of ambulance patient-care information.

Admittedly, as robust as the FDM software is, it is not being used to its potential. Currently, YKFD only uses FDM for Response Statistics. Although, FDM is not the only system or software on the market, considerable money and resources has already been invested.

In recent interviews with department management, resources to properly and fully utilize FDM are an issue.

Recommendation #17: Evaluate and upgrade the current use of FDM software to sufficiently meet the requirements of YKFD

(0-12 months)

It is important to optimize the tools and investment currently in place for YKFD. We recommend that YKFD evaluate and upgrade the current use of FDM software to sufficiently meet the requirements of the department. There are many uses and advantages for the FDM software that would benefit the department's growth and advancement.

FDM also offers on-site training and assistance in customizing their product, which may enhance the overall usage and outcomes of the overall software package. This service is available to information technologists as support and advice as well as training for frontline users.

5.11 Technology

Over the last 20 years, technology has played an increasingly vital role in improving the effectiveness and preparedness of emergency services. The list of technological advancements available for emergency services today is growing exponentially. Being able to navigate your way through the swarms of software and information technology requires extensive research and careful planning to ensure your investment will be effective and sustainable.

Although YKFD has invested in some technological advancement, they have admittedly fallen behind in the realm of Information Technology (IT). Some contributing factors may include:

- a) lack of IT support
- b) lack of resources to keep up with research and maintenance
- c) lack of funding

5.11.1 Emergency Service Dispatch Software and Mobile CAD

Currently YKFD has the foundation for CAD with the FDM system and CAD within the Dispatch Centre. Mobile CAD technology provides a tremendous advantage to the department by taking advantage of GIS mapping and data transmission, while cutting down on radio traffic. Given the increasing call volume and occurrences of sequential and coincidental responses, YKFD administration is confident that this technology could become



a valuable asset to their department if the hardware, software and training were all implemented and the necessary IT support was made available.

Mobile CAD enables emergency service departments to provide higher levels of customer service by enabling:

- **Shorter turn out times:** The location map, incident details, and safety information are all sent immediately to the crews in apparatus. The response process is expedited because crews are no longer pulling out map books and trying to figure out which way to get to the scene while on route.
- **Greater Responder safety:** Responding crews have a much higher degree of situational awareness. Hazardous materials, preplans, and vital safety information attached to the property can be accessed at the push of a button on mobile CAD.
- **Accurate data:** Data feeding analytics is inherently more accurate, allowing managers to see the real picture. With the push of a button on the mobile CAD, the crew updates the apparatus status and providing the correct true response times. There is no more reliance on using voice over radio to announce "on route" or "on scene" hoping the dispatcher clicks the appropriate button right away.
- **Lower radio traffic:** 'Duty cycle' (how much a radio frequency is being used) decreases while lessening the chance of two simultaneous radio transmissions being made. An example of this is during multiple unit responses when everyone is try to announce they are on route.
- **Efficient, secure means to transfer sensitive information:** Dispatch may want to pass on sensitive information such as patient information or door access codes to responding crews. This can all be done with great efficiency using CAD notes. Responders have the ability to read dispatch CAD notes on a mobile CAD device.

Recommendation #18: In conjunction with recommendation 17, review other opportunities available through the FDM operating platform and the CAD module for more effective and efficient response

(12-24 months)

We recommend YKFD procure the necessary infrastructure, equipment, program and technical support to establish CAD in the primary response apparatus. Mobile CAD enables:

- *Shorter turn out times*
- *Greater Responder safety*
- *Accurate data*
- *Lower radio traffic*
- *Efficient, secure means to transfer sensitive information*

Based on 5 emergency vehicles equipped with Mobile CAD, the estimated cost is \$25,000 plus recurring annual license fees of \$1500.00.



SECTION 6 CORE SERVICES

6.1 Community Service Considerations

The development of a fire department must be in response to the needs of the citizens in the community. Unlike many services, the need is not periodic or inevitable. Many citizens will never have to call on the services of their fire department or emergency services, but when the emergency occurs, the expectations are high that the services will provide value for the fees and taxes collected. YKFD is an integrated and composite fire service. Integrated refers to the provision of pre-hospital care (EMS & Ambulance) and fire suppression, rescue, etc., while composite refers to the use of Paid On Call (POC) or volunteer firefighters)

YKFD provides a variety of emergency response functions. The level of these services should be a policy decision approved by Municipal Council. This policy establishes the standard for the department to assess and guide its response capacity. YKFD's principal functions include:

- Emergency Medical Services
- Fire prevention, including public education, fire inspections and investigations
- Fire suppression
- Emergency response, including rescue services
- Emergency Communications Dispatch

It is important to note, YKFD has an extensive system of guidelines, policies and training standards for these functions. They provide direction, ensure safety, and clarity of roles for the department and staff.

As indicated in Section 3.4 Community Risk Assessment, the Fire Chief should develop a Community Risk Assessment and Standards of Cover (SOC) policy that is based upon the risk assessment framework, recommendations and options contained in this report. This SOC identifies benchmarks for each service level output and identifies the achievable performance measures within the allocated resources.

6.2 Emergency Medical Services

In 1971, YKFD assumed responsibility for the ground ambulance services. Prior to this, the Municipal Enforcement Division provided ground ambulance service. A consulting report conducted in 2006 by Terriplan Consultants, while somewhat dated, provided the most recent information regarding the authority and responsibility for ground ambulance services in NWT. The report also included emergency response for areas outside established communities and motor vehicle collisions.

The provision of pre-hospital care (ambulance) throughout the majority of Canada is a Provincial or Territorial responsibility. In the NWT, the Cities, Towns and Villages Act, provides the authority for Municipal Corporations:

- to establish, deliver and operate services public utilities and facilities (which include fire, rescue and ambulance services);
- to set reasonable rates or amounts of deposit, fees or other charges;
- to extend fire and ambulance service ranges outside the community boundaries; and,



- contain provisions stating that volunteers (especially fire and medical volunteers) are not liable for damages, provided they act in good faith and are not negligent in their duties

Under bylaw 4502, Emergency Management and Fire Protection, the City has established an exclusivity provision for ambulance services within the City. The following excerpt applies:

EXCLUSIVE PROVISION OF AMBULANCE SERVICES BY CITY,

5. No person other than the Division shall provide commercial ambulance services within the municipal boundaries of the City except for any person, agency or organization located outside the City, which transports a person to the hospital or other medical care facilities in the City, or transports a person from the City's hospital or other medical care facilities to destinations outside the City without a stop or transfer being made at an airport or other place within the City.

The Terriplan report identified a number of options for GNWT's consideration and concluded the following:

Ground ambulance services are generally being provided at adequate levels to meet the needs of most patients in the NWT. However, for services to be provided effectively over time, a policy and funding framework will need to address: legislated mandates for services; roles and responsibilities for service delivery; an equitable funding approach; increased needs for services for a larger population; recovery of full costs of the services; resources to handle large or multiple accidents at one time; and the purchase, repair or replace vehicles and other medical rescue infrastructure.

The GNWT does have the Ground Ambulance and Highway Rescue Funding Program. This is a territorial government initiative that provides financial assistance to eligible community governments to help support the delivery of ground ambulance and rescue services. It encompasses the provision of ambulance service within communities and on adjacent public highways. In 2014-15, the GNWT allocated \$400,000 to support a number of local government projects and, in particular, provided a portion of this funding to Yellowknife for their rescue vehicle and equipment

Within the current staffing level, YKFD can respond 24/7 with 2 Basic Life Support (BLS) level ambulances providing no other fire or rescue responses are occurring. As indicated in Section 4 of this report, during the period 2011-2015, medical response (ambulance) calls accounted for an average 83.75 % of annual call volumes, making it the largest category of call types.

In the absence of GNWT oversight or governance for the ground ambulance service, YKFD has adapted the qualifications from the national competency profile for Primary Care Paramedics (PCP). Protocols were developed using the Alberta Health care system by the Deputy Chief in charge of Employee Safety & Training. The Patient Care Reports (PCRs) are adaptations from the CHAT standard patient care reporting. CHAT is an acronym for the components of a patient's history - Chief Complaint, History, Assessment and Treatment.



Recommendation #19: City of Yellowknife to provide input for a ground ambulance policy and funding framework

(12-24 Months)

As indicated in the Terriplan report, there is a need for a GNWT policy and funding framework for pre-hospital care (ambulance service). We recommend the City of Yellowknife's Public Safety Departments enhance the current relationship with the GNWT and provide input into the development of a policy and funding framework for the ground ambulance.

6.3 Fire and Rescue

6.3.1 Fire Suppression

6.3.1.1 Structural Firefighting

Fire Suppression Service: YKFD maintains a Minimum Duty Strength (MDS) of 4 firefighters. Based upon scheduled (vacation) and unscheduled absences (sick leave, bereavement etc.) the preferred MDS is 5 firefighters. This MDS provides an Effective Response Force (ERF) of 4/5 firefighters. For clarity, the ERF is the minimum number of personnel that are required initially to manage an event and is necessary to minimize the loss of life and property as well as maintaining firefighter safety. In essence, YKFD's ERF is equivalent to a 4-firefighter engine company.

***Note:** A fire company is defined as the team of firefighters assigned to a fire apparatus. An April 2010 report issued by the National Institute of Standards and Technology (NIST) identifies 5 firefighters as the optimum initial number to effect operations over 22 critical fire ground tasks at a typical single 2000 square foot family residential fire.*

Consistent with National Fire Protection Association (NFPA) Standards, the WSCC Section 32 regulations stipulate that if firefighters enter a structure fire's hazardous atmosphere, the firefighters work in teams, and a suitably equipped rescue team is readily available outside the structure to rescue any endangered firefighter should the breathing apparatus fail or the firefighter become incapacitated for any other reason. This is commonly referred to as, the Rapid Intervention Team (RIT). YKFD has established a minimum structural fire response of 2 firefighters inside and 2 firefighters outside (2-in 2-out) policy to ensure compliance with this regulation. Essentially, this means that the first arriving Engine is not legally able to perform entry into any structure fire to attack the fire or perform a rescue until 4 Firefighters are on the scene. It should be noted that no specific tasks that would interfere or delay RIT deployment can be assigned to the RIT team members. Their sole purpose on scene is for firefighter safety and rescue if required.

Beyond the initial response, NFPA 1710 establishes a full alarm assignment which the number of firefighters require to combat a fire in standard sized single family residence. NFPA recommends 16 firefighters and a safety officer to perform critical tasks at this type of emergency incident.

YKFD's current MDS and ERF has the critical task capability to handle one single family residential fire provided it has not extended beyond the room of origin. This capability assumes that the ERF (partial or full) is not predisposed to other emergencies and that the initial response time does not exceed a total intervention time of 10 minutes. Larger



events such as a fully involved or multiple structure fire, commercial or industrial fires, wildland fires, HAZMAT or technical rescue requirements would significantly overwhelm the on-duty contingent. These events would require a recall or group alert of firefighters in order to staff reserve apparatus with off duty career firefighters (paying overtime) or calling back POCs.

Further discussion including options and recommendations regarding the Emergency Response Deployment System Capacity is presented in Section 6.6 of this report.

6.3.1.2 Industrial Firefighting and Response

In light of Yellowknife's remote and isolated risk factor, YKFD should develop a baseline capability for industrial firefighting in accordance with NFPA 1081. The City has the typical mix of light to heavy industrial facilities for a city of 20,000 people. While a large-scale industrial event is a low probability, the overall consequence for the community would be extreme. The prolonged deployment and limitation of additional resources from outside the City such as mutual aid only serves to exacerbate this risk factor.

Recommendation #20: YKFD develop a baseline capacity for industrial firefighting

(12-24 Months)

While a large-scale industrial fire or emergency incident is a low probability in Yellowknife, the impacts/consequence depending upon the event would be extreme. In light of the remote and isolated risk factor, we recommended that YKFD enhance the current training program to include a baseline capability to combat industrial fires.

6.3.1.3 Wildland and Wildland Urban Interface Firefighting

Wildland fires have occurred within and in close proximity to the City. However, as explained in Section 4 of this report, the response statistics that were provided do not offer the level of detail required to determine the wildland fire trends in and around Yellowknife.

In 2014, NWT experienced a number of large scale wildland fires. Recent events in Alberta (Slave Lake and Fort McMurray) serve to emphasize the need for this type of emergency response service in woodland or Boreal Forest areas such as Yellowknife. YKFD's wildland or interface firefighting is an evolving endeavour with some internal training completed and the procurement of Sprinkler Protection Units (SPUs). As indicated in Section 6.6 there is a MOU with the Environment and Natural Resources Ministry to assist with wildland fires that occur in close proximity to the City.

Recommendation #21: YKFD complete the wildland and wildland urban interface firefighting capability and training

(12-24 Months)

We recommend YKFD training program place a renewed focus on the wildland and wildland urban interface firefighting capabilities with a view to have all staff trained.



6.3.1.4 Vehicle Firefighting and Extrication

YKFD has the training and capability to respond to fires involving vehicles ranging from small passenger cars to transport/commercial vehicles. In addition, they have the training and equipment to perform Motor Vehicle Incident response and extrication.

6.3.2 Hazmat Response

Response capabilities should align with service levels defined in the NFPA 472: Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents service level matrix. It essentially requires that departments without advanced hazmat training take only a limited role in hazmat response.

- The first level involves an operational awareness of hazardous materials that enables emergency response crews to operate and respond safely. This level entails a primarily defensive response where crews may limit the spread of the leaking materials by diking and damming the flows. It does not involve donning protective suits or conducting decontamination.
- The second level requires a more advanced hazardous materials response capability that involves considerably more technical training and equipment. This level is referred to as a 'technician level', with crews trained to don protective suits, enter the hot zone to stop the flow of the product, and establish a decontamination zone for responders and equipment.

Given the training and equipment required to achieve the second level of hazardous materials response, a department must carefully consider whether this level of response is necessary for the protection of the community. Over the last 5 years, the City has experienced an average of 28 hazardous material responses per year. These were considered minor to moderate level events in terms of community impacts. Yellowknife's remote and isolated risk factor places an emphasis for hazardous material response capabilities. Currently all staff are trained to the awareness and/or operations level for hazardous material responses. There are only 3 technician level qualified staff within YKFD.

***Recommendation 22: YKFD enhance Hazmat qualifications to the technician level
(12-24 months)***

Based upon the response statistics of 28 events in the last 5 years, the community profile in terms of transportation, storage and usage of hazardous materials, and remoteness, we recommended that additional technician level qualified staff should be pursued. With 8 staff members qualified to this level each platoon would have 2 technicians and the ability to have 24/7 coverage.

6.3.3 Technical Rescue

Every department must ensure that all members are provided the necessary tools and training to safely and efficiently perform the tasks required when an emergency arises. Specialized operations are an ongoing task that requires constant monitoring to ensure the equipment meets the necessary requirements and that all the members' skills meet the competencies required. Having individuals trained as qualified instructors for these areas is a necessity due to the cost restraints of sending personnel out for training. Currently, the



department has the ability to respond to numerous types of specialized rescue operations such as:

- Vehicle Extrication
- Surface Water Rescue
- Surface Ice Rescue
- Rope and Slope Rescue
- Low angle, and
- Confined space

Note: *These specialized areas each require extensive equipment and training to be maintained to ensure preparedness in the event of an emergency.*

It is of note that there is an absence of high angle rescue capability. Within the response area, there are a number of high rise buildings within the City. If workers were to become trapped or physically unable to remove themselves from a dangerously high position, YKFD could not perform a high angle rescue. An example might be the maintenance staff; window cleaners suspended on platforms or rigging.

The response statistics provided by YKFD do not indicate there is a recurring response required for this category of emergency. As a result, it has been determined that high angle rescue calls are a low probability and therefore a low consequence risk for YKFD. However, the costs to extend the current technical rescue capabilities to include high angle are minimal.

Recommendation #23: The Deputy Chief of Operations investigate the need for a high angle rescue capability and/or alternative tactics

(48-60 months)

Although the response statistics indicate that high angle rescue responses are a low probability, low consequence risk for YKFD, a more detailed study is required. We recommend the Fire Chief conduct an analysis into a training and awareness program delivered to YKFD staff and maintenance workers that utilize platforms and rigging. This analysis may result in alternative tactics to mitigate the need for a high angle rescue capability.

6.4 Fire Prevention Program

As departments increase their emphasis on fire prevention activities, communities are seeing a significant reduction in fire related losses. In Canada alone, deaths caused by fire have been reduced over the last 100 years from 3500 deaths per year to 330 (or 1/100,000 each year). This trend in fire losses has plateaued over the last 20 - 25 years unlike other more frequent response services such as EMS. Fire prevention is a key component of risk management and has gained a higher profile in how departments are allocating their resources. Departments have come to recognize the return on investment in fire prevention is considerably greater than the investment into resources for response and mitigation.

Over time, effective fire prevention programs are reducing particular types of emergency responses in direct proportion to the resources committed to the program. However, the level of resources must be carefully chosen to be cost-effective. Goals must be set and then evaluated regularly to ensure the best value. Currently there are few industry benchmarks or standards



for prevention and public education programming. It is important that departmental benchmarks be established and then reviewed annually against community risk levels and available resources. Data collection and analysis will determine the effectiveness of these programs and their impact on the overall reduction of losses.

Fire prevention activities, public education programs and active involvement in the community are all important efforts that departments are focusing on to reduce the number of emergencies. YKFD has well-established Fire Prevention Programs that deliver comprehensive training in fire prevention and life safety. The Deputy Fire Chief, Life Safety & Prevention along with six volunteer Fire & Life Safety Educators, POCs and the career staff provide:

- a) Fire Inspections & Quick Access Plans (QAPs)
- b) Public Education and Awareness
- c) Building Plan Reviews and Engineering Input
- d) Development Applications review and input
- e) Fire Investigations

The Prevention Branch's main objective is to realize an annual measurable reduction in the number of incidents and severity of losses from fire and injury. Statistics are gathered and analyzed in order to identify trends and irregularities, record, track, and report information related to inspections, occupancies, fire-related damage and loss, complaints and other relevant information.

The NWT Fire Marshal completes the statistical and trend analyses for the entire Territory and initiates specific prevention campaigns based upon leading fire causes. Examples include cooking safety, smoke alarm maintenance, and fire prevention.

The YKFD has an impressive fire prevention and public education program and maintains a strong relationship with the Fire Marshal. As identified in Section 4.1 of this report, the FDM needs to be enhanced to include broader types of response and service categories. With this information, the fire prevention team can identify local trends and which associated prevention initiatives or enforcement activities would help to reduce their occurrence.

It is important to note that the NWT Fire Prevention Act establishes a system of Local Assistants that are empowered to provide fire prevention activities within their respective municipality. The following excerpt applies:

“The chief or acting chief of the fire department of every municipality in which a fire department is established, and the senior administrative officer or other employee appointed by the council of a municipality in which no fire department has been established is, by virtue of his or her office, a local assistant to the Fire Marshal and is subject to the direction of the Fire Marshal in carrying out the provisions of this Act within the limits of the municipality.”

The Act also includes a provision by written agreement authorizing a municipal corporation to exercise any powers or perform any duties of the Fire Marshal under such provisions of this Act and the regulations as may be specified in the agreement. The current arrangement, being deemed a Local Assistant and the authority therein, is meeting the needs of the City.

The GNWT has adopted the National Building Code (NBC) and the National Fire Code (NFC) of Canada as the regulations for the entire territory. The National Model Codes set out the technical provisions regulating activities related to:

- the construction, use or demolition of buildings and facilities



- the condition of specific fire and life safety elements of buildings and facilities
- the design or construction of facilities related to certain hazards
- the protection measures for the current or intended use of buildings

In all cases, it is the owner or owner's agent responsibility to comply with the Codes.

Several Municipalities enact local bylaws such as a 'Fire and Life Safety Bylaw' that clarify and/or emphasize the requirements of the applicable Codes and provide the authority for enforcement. This is particularly important for Bylaw Officers should enforcement be required for those who are in non-compliance with the Regulations. Bylaw 4502, Emergency Management and Fire Protection, contains a number of requirements regarding permitted fires, fire pits, fees, penalties, and charges, and open burning but there is a need to expand this bylaw to include additional local requirements. For example:

- Fireworks and pyrotechnics permits
- Removal of fire hazards
- Vacant, damaged or abandoned buildings that pose a fire public safety risk
- Hazardous material storage and disposal
- Tampering with fire protection equipment
- Storage restrictions in electrical vaults and service rooms
- Refuse and recycling containers clearances
- Combustible dust removal

Recommendation #24: City of Yellowknife expand Bylaw 4502 to include additional fire and life safety requirements

(12-24 Months)

We recommend that the City expand bylaw 4502 with a view to provide additional requirements that clarify and/or emphasize the National Fire Code. The additional requirements should be based on local conditions or occurrences where increased awareness or enforcement action may be required.

6.5 Fire Prevention Inspections

Fire inspections by YKFD are conducted to ensure owners are meeting the Code requirements by keeping structures safe and reducing fire and life safety risks. However, compliance with the NFC and NBC remains a build/facility owner's responsibility. The NFC identifies regular inspections for fire alarm and sprinkler systems, updated fire and emergency evacuations plans, unobstructed means of egress and other fire life safety systems based upon the Major Occupancies Classifications and other criteria contained in the NFC. The NFC does not legislate the frequency or cycle for fire inspections as this is left to the authority having jurisdiction.

The YKFD cyclical fire inspection program is informally determined in conversation with the Director of Public Safety and the Deputy Fire Chief, Life Safety & Prevention. The table below lists the inspections performed by YKFD in 2015 and is deemed a typical representation of the annual inspection program.

The NBC Major Occupancy Classifications for structures are defined below:



- A. Assembly Occupancies: Example: Schools, Restaurants, Community Halls, Churches
- B. Care or Detention Occupancies: Example: Hospitals/Nursing Homes
- C. Multi- Residential Occupancies: Example: Apartments, Hotels, Motels, Dormitories
- D. Business and Personal Services Occupancies: Example: Offices, Beauty Parlors, Banks
- E. Mercantile Occupancies: Example: Department Stores, Shops, Supermarkets
- F. High Hazard Industrial Occupancies: Example: Distilleries, Bulk Plants, Chemical Manufacturing
- G. Medium Hazard Industrial Occupancies: Example: Service Stations, Factories, Storage Facilities
- H. Low Hazard Industrial Occupancies: Example: Warehouses, workshops, Parking Garages

Table 14: Cyclical Fire Inspection Program

Incident Type	January	February	March	April	May	June	July	August	September	October	November	December	Total
Inspections - Group A	2		1	1			1		2	5	2	1	15
Group B	1	1											2
Group C	10	4	3	9	5	6	2	9	2	6	8	9	73
Group D				1									1
Group E						1							1
Group F				1								1	2
Complaint			2	1							1	1	5
Follow-up Inspections	3	2	4	1	3	4	2	4	2	2	5	5	37
Total													136

The YKFD inspection program has focused on Group A and C occupancies. Given that these occupancies usually accommodate large numbers of people it is important the YKFD remains diligent with these fire and life safety inspections. Other municipal fire inspection programs include a significant emphasis on Group B and Group F (1&2) occupancies. Group B Occupancies have a higher risk for fire related death or injuries primarily due to the possibility of diminished capacity or mobility of the occupants. The industrial occupancies of Group F1 and F2 are normally where the highest degree of NFC noncompliance occurs. The City has an industrial park where there is an A-typical mix of residential occupancies mixed with Group F facilities.

For these reasons, YKFD should formalize the cyclical fire inspection program as part of the Bylaw 4502 review previously identified and include a specific focus on Groups B and F occupancies. Moreover, an analysis of the response statistics can provide insights to focus the YKFD Fire Inspection program. It would not be reasonable to establish a fire inspection program goal to inspect every building or facility in the City and as such the cyclical inspection program needs to focus on where the greatest fire and life safety risk reduction can be achieved.



Recommendation #25: City of Yellowknife formalize the annual fire inspection program cycle

(12-24 Months)

We recommend that as part of the review of bylaw 4502, the City establish a cyclical fire inspection program based on major occupancy classifications where the greatest fire and life-safety risk reduction can be achieved.

The YKFD Suppression Branch conducts pre-fire planning to determine access points, exit locations and other components to pre-plan or assist with firefighting operations. In addition, they also conduct “housekeeping” inspections in apartment buildings and apartment style condos. These inspections ensure that exit signs are serviceable, corridors are clear of litter, means of egress are unobstructed and all other fire and life safety systems have been inspected in accordance with NFC.

6.5.2 Public Education Program

Public education programming provides the opportunity for department members to interact with the citizens of their community in a non-emergency setting. YKFD works proactively to reduce the risk of injury and death by delivering programs focused on home safety for families, adults and seniors. This includes ‘home fire’ evacuation drills, smoke alarm campaign, carbon monoxide (CO) testing, fire warden training, fire permits and fire pit inspections, YKFD Open House and a number of programs in local schools.

Overall YKFD has a very good public education program that could serve as an example for other small fire services to emulate. The following tables detail the number of public education events and other fire prevention/safety initiatives conducted in 2015:



Table 15: YKFD Public Education Program

	Presentations	Students (Pre- school - G3)	Presentations	Students (Day Camps)	Presentations	Participants
	14	168 / 35	9	118 / 20		
Firehall						
Grade 4	5	123				
Grade 4/5	5	103				
Grade 5	7	155				
Grade 5/6	4	98				
Grade 6	6	125				
Grade 6/7	1	20				
Grade 7	8	149			5	52 / 5
Grade 7/8	3	53				
Grade 8	6	96			1	2 / 2
Adult	2	16				
Seniors	1	60				
Fire Safety Fair	14	K - 8	(All YK1 & YK2 Schools - Other schools did not respond to invites)			

Table 16: Fire Prevention Suppression Branch Program

Incident Type	January	February	March	April	May	June	July	August	September	October	November	December	Total
CO Testing	3	5	2	2	1	2		2	8	3	7	2	37
Knox Box	1	2	2	4	1	4	1	6	8	3	9	7	48
QAPS	4	5	6	1	7	8	8	4	5	6	4	3	61
Burning Permit /Fire Pit		3		5	24	11	9	10	1	1	1		65
Fire Warden/Evac				3	1		1	1	1	1	1		9
Smoke Alarm Pgm										10			10
Total													230



6.6 Mutual Aid and Other Service Agreements

YKFD's remote and isolated location is a risk factor that needs to be given due consideration. The Mutual Aid and other service agreements are examples of where this factor is prevalent. Communities closely located together can share resources and/or respond to major events for support and response coverage. In Yellowknife, there are no Mutual Aid agreements. There are, however, several 'Memorandum of Understanding (MOU)' documents that have been established to provide additional workforce resource, response vehicles or equipment, and respond to events such as major incidents and wildland fires:

- **Fort Smith and Hay River MOU:**
Provides additional firefighters by flying them in for major events and to relieve YKFD firefighters.
Ground transportation of emergency response apparatus would require 10 hours of travel time.
- **Environment Natural Resources MOU:**
Provides additional wildland firefighting resources for events occurring inside or close proximity to the City.
Provides air support to suppress fires within the City limits.
- **Department of Transport MOU:**
Provides additional firefighting resources by deploying airport firefighters and/or Aircraft Rescue Firefighting (ARFF) vehicles.
Reciprocal agreement is included should the airport require YKFD assistance.
- **Yellowknife Search and Rescue MOU:**
Provides additional workforce for major events.

6.7 Emergency Response Deployment System Capabilities

The current call volume is overwhelming the response deployment system capabilities. Specific indicators include:

- Inability to conduct meaningful training sessions while on duty due to increasing EMS call volume;
- Gaps in geographic fire suppression coverage due to out of town responses, coincidental and sequential responses;
- Inordinate dependence upon the group alerts and call backs of off duty career and POC firefighters;
- Current Minimum Duty Strength of (MDS) 4 firefighters cannot effectively manage call volume, and;
- Routine duties and workload such as basic apparatus and equipment maintenance, station upkeep, fire prevention and public education tasks, and administrative duties cannot be completed during shift hours. In particular, the current Patient Care Report (PCR) requires 1-2 hours to complete.

As indicated in Section 4 of this report, the response statistics provided do not include the level of data necessary to validate the occurrence of coincidental and sequential responses. The response data does show a steady increase in both fire and EMS responses over the last five



years. Based upon industry recommended practices (NIST⁶ and NFPA) and the WSCC⁷ regulations, YKFD's current MDS and Effective Response Force (ERF) has the critical task capability to handle one single family residential fire provided it has not extended beyond the room of origin. This capability assumes the ERF (partial or full) is not predisposed at other emergencies such as an EMS call, and that the initial response time does not exceed a total intervention time of 10 minutes. The following factors contribute to the response system limitations:

- **YKFD is understaffed**

The closest comparator to YKFD in terms of call volumes is Spruce Grove Fire Department, Alberta (See Section 8). Although these two communities have different profiles, risks and operational aspects, Spruce Grove has a contingent of 45 career firefighters to manage a similar call volume to that of Yellowknife which has only 24 firefighters.

- **The volume of recalls is considered to be 'A'-typical for comparative sized fire services**

On average, YKFD requires 75 full group alerts per year to provide additional ERF resources and/or geographic coverage for the City while responding to out of town calls. The out of town responses are primarily for Motor Vehicle Incidents (MVI's), recreational cabin fires, EMS response, etc. This demand represents approximately 1/3 of the annual group alerts.

- **The income accrued from the fee schedule is directed to the City's General Ledger and not apportioned to YKFD for the sustainability of the response system capability**

YKFD does have a fee schedule for all response types and this revenue stream is projected to generate 1 million dollars per year.

- **There is a high turnover rate for firefighters**

The number of group alerts and the recall of off duty career staff has had a direct impact on the feelings of 'burnout' and complacency among the staff. They have also contributed to the 10% average annual turnover rate for career staff over the past 7 years.

In the last 9 years 40 POCs have left the program. The turnover rate of the POC firefighters has been attributed to the high demands required for training and emergency responses amidst their full time jobs, family and personal responsibilities.

- **Overtime cannot be avoided**

In 2015, YKFD paid out more than a quarter million dollars for firefighter overtime (OT). This OT is for shift extensions, shift coverages due to unscheduled absences (sick leave, bereavement, vacancies etc.) and group alerts and/or recalls. This amount translates into a total of 4990.95 hours or, on average 207.95 hours of OT for each firefighter. Based on the average shift duration of 12 hours, each firefighter at YKFD worked an additional 17.30 shifts in 2015. Based on the current 42 hours per week shift

⁶ <https://www.nist.gov/>

⁷ <http://wscn.nt.ca/>



schedule, the additional OT hours averages that each firefighter is working a 45 hours per week work schedule. While this is not considered too excessive, close monitoring will be required as the call volumes increase.

- **PCRs must be completed prior to the end of shift.**

This policy has resulted in a considerable amount of shift extensions and OT according to YKFD staff. The current PCRs require 1-2 hours to complete for every patient that YKFD provides primary care. The form has been developed from Alberta Health by the Deputy Chief Employee Safety & Training. There may be an employee management issue as to why the PCRs are requiring 1-2 hours to complete.

Alberta Health is in the process of establishing a new and automated PCR that requires 5-10 minutes to complete. The manual version of this new PCR requires 20-25 minutes to complete in the absence of the digital automation.

- **There is an escalation in the number of EMS calls.**

In part, this is due to the 2015 RCMP's policy change for dealing with people of diminished capacity through drugs or alcohol and the homeless. Prior to this change, the RCMP would provide transport to those not requiring immediate emergency medical attention to Emergency Room, shelters or the cell block. Since 2015, YKFD has assumed responsibility for this type of response. There is a need for the City to establish alternate programs to manage intoxicated people and the homeless and how these types of responses impact the ambulance service.

Another contributing factor for the ambulance service could be the increase of seniors and retired people that are staying in the City as opposed to moving south.

YKFD ambulance service provides 3-5 patient transfers from the hospital to the airport (vice versa) on a daily basis. The majority of these calls are not deemed as immediate or critical care and could be completed by an alternate service provider.

As indicated Section 3.3 Structural Risk of this report, a complete risk assessment and SOC policy needs to be developed. Determining risk tolerances for the emergency response system is somewhat subjective. However, the statistical analysis, community risk factors, industry leading practices, and regulations combined with the above mentioned response system limitation factors provides the evidence base to develop the SOC and the response system performance targets. The desired outcome is that the response system performance is affordable and balances operational effectiveness with firefighter and public safety.

There are 3 overarching options that the City should consider to achieve this outcome:

- **Option 1:** Maintain the MDS at 4 firefighters. Continue to reduce the call volume by eliminating non-emergent responses or services. One recent example of where this type of reduction was possible is when the ice safety program was contracted to the Yellowknife Snowmobile Club. Other considerations include engaging alternate service providers for transferring patients and managing the homeless and intoxicated people. There is a local company that is capable of delivering these services. Contracting out CO testing, the Knox Box program and burning permits/fire pits inspections to other service providers may also need to be considered.

Fire inspections, the smoke alarm program and pre-fire planning are core services and would have to remain with the suppression branch.



- **Option 2:** Increase the MDS from 4 firefighters to 8. This would mean a total Suppression Branch staff of 42 and an increase of 18 staff from the current level. The ERF could be configured to have 2 ambulances staffed with 2 firefighters and 1 engine company of 4 firefighters. This MDS has the breadth and capacity to effectively manage all the current services, emergency responses, training and workload requirements. Out of town responses and structure fires confined to the room of origin would not normally require the use of OT. This MDS is also consistent with the closest comparative community and respective call volume at Spruce Grove.
- **Option 3:** Increase the MDS from 4 firefighters to 6. This would mean a total Suppression Branch staff of 32 and an increase of 8 staff from the current level. The ERF could be configured to have 1 ambulance staffed with 2 firefighters and 1 engine company of 4 firefighters. Combined with efficiencies gained by predictive modelling (Section 5) and the elimination of non-emergent services identified in Option 1, this MDS has the breadth and capacity to effectively manage all the current services, emergency responses, training and workload requirements as well as reduce OT.

Subject to validation through a complete community risk assessment the preferred option recommended in this study is Option 3.

Recommendation #26: Modify Emergency Response Deployment System

(12-24 months)

We recommend the City of Yellowknife implements Option 3 and an increase of the MDS to 6 firefighters as the emergency response deployment performance standard. This is based on all the considerations and analysis conducted in this study which includes:

- *community risks*
- *demographic and community profile*
- *historical trends*
- *community expectations*
- *industry leading practices*
- *legislated standards*
- *fiscal tolerance*

Within the NFPA standard and the National Institute of Standards and Technology (NIST), YKFD will need to review all non-emergent services with the goal to reduce the total call volume, and complete a review of the PCR to reduce the time required for completion. The City needs to establish alternate programs to manage intoxicated people and the homeless to reduce the dependency upon the ambulance service. The response system identified in Option 3 provides the balance between the number of Firefighters and the public's safety within the fiscal realities of service provision.



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SECTION 7 ASSETS AND FACILITIES

7.1 YKFD Infrastructure

Infrastructure refers to fire stations and other fixed assets or facilities that YKFD occupies and uses. Special attention is required to build and maintain appropriate quality and reliability of these facilities.

7.1.1 Fire Stations

YKFD operates out of one (1) fire station centrally located within Yellowknife. This facility was built in 1989, occupied in 1990 and has had one addition since opening. Our findings indicate the facility serves the department well with no current or foreseeable issues.

Address:	100 Taylor Road		
Use:	Fire and Rescue / Ambulance Response / Dispatch Services		
Bays:	4 (non- drive thru, tandem)	Units:	18
Comments:	This station serves as the hub for all apparatus and light-duty units and response personnel.		



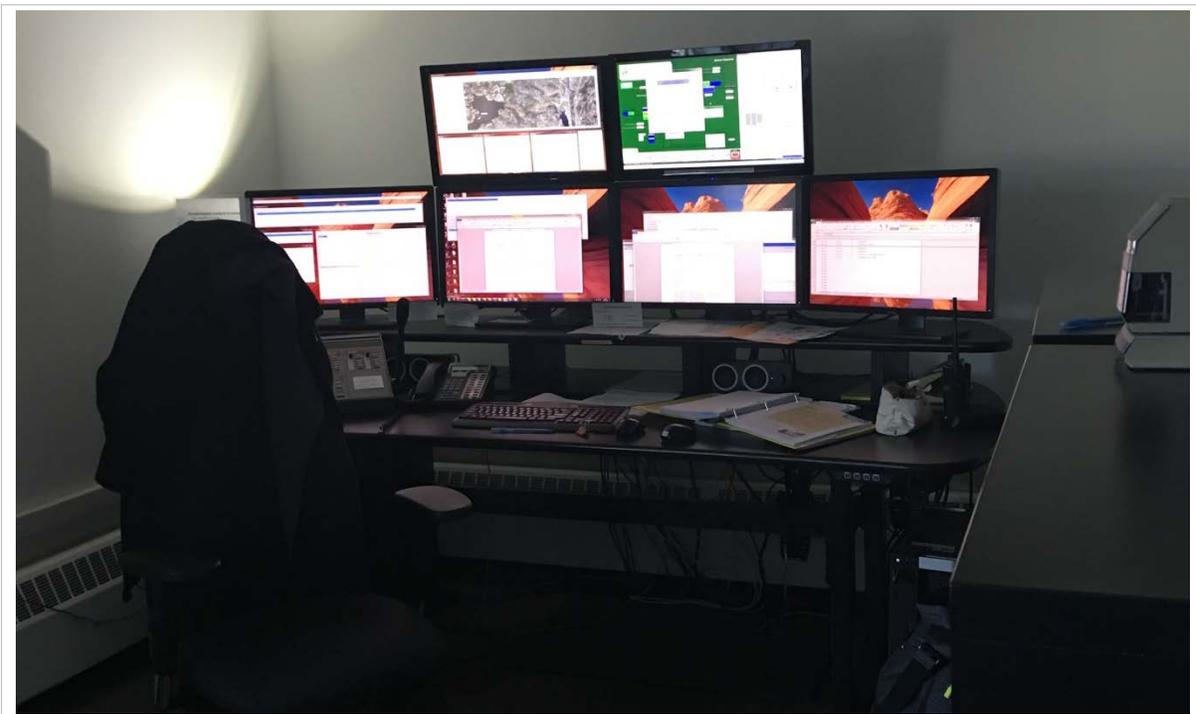






7.1.2 Emergency Communications Centre

Reliable emergency communications are essential to safeguarding public welfare in every community and are critical to enabling an effective emergency response. YKFD operates a dedicated dispatch service on behalf of the City of Yellowknife located at the fire station. This service receives calls, processes them and then dispatches emergency units to the correct location in the appropriate time-period.



NFPA 1221 (*Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*), provides procedural and physical criteria for the installation, performance, operation, and maintenance of public emergency services communications systems and facilities. NFPA also defines the requirements for facilities, equipment, staffing levels and training and certification requirements for operators. YKFD has done a remarkable job of providing the dispatch services for Yellowknife with necessary infrastructure, support and staffing to maintain the service.

While the present centre contains the necessary equipment and technology for current demands, there are a number of areas that require consideration moving forward.

These areas include, but are not limited to:

- Available floor space
- Security
- Proximity of supplemental equipment to dispatch consoles
- Quiet room for dispatchers on break
- Proximity of washrooms and other necessary amenities to the secured dispatch area
- Private office areas for supervisors



Note: YKFD has a functioning back-up ECC located at Pumphouse #1 that contains the necessary equipment to provide an alternate dispatch service.

Recommendation #27: Review and upgrade current dispatch facilities to meet industry requirements as outlined by NFPA 1221

(12-36 months)

We recommend YKFD adopt the Standard for the Installation, Maintenance and use of Emergency Services Communication Systems to satisfy the facility requirements outlined in Chapter 4 of the standard to ensure reliable dispatch functions are carried out in an efficient and professional manner providing timely dispatch of necessary resources to effectively and efficiently deal with emergency calls for service. It further ensures the proper workspace for staff to carry out their duties in a wholesome and healthy workplace.

7.1.3 Fire Training Facility

YKFD operates and maintains a training facility located on the Yellowknife Airport property. This facility has served as the primary training ground where firefighters, from recruits to senior officers, attend courses to maintain their core competencies. The current facility has enabled YKFD personnel to meet the job performance requirements (JPR) associated with their current service levels.

Image 3: Fire Training Facility Location



It is unknown if the facility was originally based on the design and operational guidelines of NFPA 1402: *Guide to Building Fire Service Training Centers* and/or NFPA 1403: *Standard on Live Fire Training Evolutions*; but is a standard that should be reviewed.

A number of structures are located at the facility, including a sea can structure and a mobile trailer unit located near the 3D props.



Other equipment located at the facility includes:

- a fuselage prop for rescue
- a fuselage prop for fire
- a confined space vessel
- 3D fire props which includes a trash dumpster
- a vehicle extrication area
- a pond for drafting and pumping operations
- a large enough area for driver training and staging
- potential area for dangerous goods props (i.e. rail car or domes and larger LPG props)

Image 4: Fire Training Facility Props and Structures





Recommendation #28: Establish a committee to review and maintain compliance in design of a the YKFD training facility

(0-24 months)

We recommend that YKFD establish a working committee with select members from YKFD Administration, Training Officers, Firefighters, City Engineers and Planners tasked with making decisions on design and use of the training facility. The goal of the committee is to address budgeting, training requirements environmental considerations, stakeholder input, possible community concerns, expansion, regionalization and potential use of outside parties.

Compliance to NFPA 1402 and 1403 should also be reviewed and considered to allow skills maintenance to support JPRs, based on desired service levels. Basing the facility on these standards will support future expansion for possible changes in service levels, and will also allow for other services/departments to utilize the facility in shared use of the facility and training grounds. Cost savings can also be realized from facility sharing as well as the greater opportunity in joint training and exercises with other agencies and departments.

7.2 Equipment

7.2.1 Apparatus and Light Duty Vehicles

Apparatus and light-duty vehicles are typically the biggest asset expenditures for most departments. Purchasing and managing these assets requires strong fiscal responsibility to endure public scrutiny. Currently, YKFD has millions of dollars' worth of vehicles and equipment.

The lifespan of apparatus varies depending on its type and use. Current Underwriters Laboratories of Canada (ULC⁸) and NFPA 1901 Standard for Automobile Firefighting Apparatus Standards recommend using apparatus on the front line for up to 15 years, then as a backup for another 4 to 5 years. Of course, this timeline is dependent on the frequency of use and scheduled maintenance.

The array of apparatus and equipment is deemed adequate for the type of service the department provides; there are no foreseeable issues. The following tables summarize YKFD's current apparatus and light-duty equipment.

⁸ Underwriters Laboratories of Canada (ULC) is an independent product safety testing, certification and inspection organization. www.canada.ul.com



Vehicle Description	
Unit Number:	2123-04 (Engine 8)
Year/Make:	2004 Smeal Aerial/ Spartan Chassis
Type:	Quint
Pump Capacity:	7000 LPM. @ 1000 kPa 3500 LPM @ 1700 kPa
Tank Capacity:	1800 L (Water) 135 L (Foam) Foam Pro System-11.5 LPM. Foam capability
Usage:	Primary first-out Engine on all emergencies with-in city boundaries.
	
Unit Number:	2108-94 (Engine 7)
Year/Make:	1994 Ford Cyclone Aerial
Type:	Quint
Pump Capacity:	7000 LPM @ 1000 kPa 4900 LPM @ 1350 kPa 3500 LPM @ 1700 kPa
Tank Capacity:	400 Imp Gallons
Usage:	Primary second-out Engine on all emergencies within city boundaries
	
Unit Number:	2195-12 (Pump 1)
Year/Make:	2012 Rosenbauer Pumper Tanker
Type:	Pumper
Pump Capacity:	4024 LPM @ 1000 kPa 2839 LPM @ 1350 kPa 2017 LPM @ 1700 kPa
Tank Capacity:	1.5?? 136 L (Foam)
Usage:	Non-hydrant areas and out of City fire responses.
	
Unit Number:	2107-16 (Rescue (New))
Year/Make:	2016 SVI Rescue – Spartan Chassis
Type:	Rescue/Mobile Command Unit
Pump Capacity:	N/A
Tank Capacity:	N/A
Usage:	Rescue /Fire/Mobile Command Unit
	



Unit Number:	2110-14 (Tanker 1)	
Year/Make:	2014 Rosenbauer Water Tanker	
Type:	Tanker	
Pump Capacity:	1598 LPM @ 1000 kPa 1122 LPM @ 1350 kPa 797 LPM @ 1700 kPa	
Tank Capacity:	11340 L	
Usage:	Water supply for non-hydrant areas	
Unit Number:	2120-98 (Tanker 2)	
Year/Make:	1998 LT8513 Water Tanker	
Type:	Tanker	
Pump Capacity:		
Tank Capacity:	11365 L	
Usage:	Water Supply for non-hydrant areas.	
Unit Number:	1196-12 (Medic 6)	
Year/Make:	2012 E450 Econoline Ambulance	
Type:	Ambulance	
Pump Capacity:	N/A	
Tank Capacity:	N/A	
Usage:	Medical Response	
Unit Number:	2111-08 (Medic 5)	
Year/Make:	2008 E450 Cutaway Ambulance	
Type:	Ambulance	
Pump Capacity:	N/A	
Tank Capacity:	N/A	
Usage:	Medical Response	
Unit Number:	2109-01 (Medic 4)	
Year/Make:	2001 E450 Econoline Ambulance	
Type:	Ambulance	
Pump Capacity:	N/A	
Tank Capacity:	N/A	
Usage:	Medical Response	



Unit Number:	T022-09 (Rescue Trailer)	
Year/Make:	2009 Enclosed Utility Trailer	
Type:	Enclosed Utility Trailer	
Pump Capacity:	N/A	
Tank Capacity:	N/A	
Usage:	Technical Rescue support for haz mat/ Confined Space Rescue/Wildland Fire	
Unit Number:	Z032-13 (Rescue Boat)	
Year/Make:	2013 14' Zodiac RHIB Model PR0420	
Type:	Zodiac Rescue Boat	
Pump Capacity:	N/A	
Tank Capacity:		
Usage:	Water Rescue and Recovery	
Unit Number:	1173-08 (ATV)	
Year/Make:	2008 Polaris ATV	
Type:	All Terrain Vehicle	
Pump Capacity:	N/A	
Tank Capacity:	N/A	
Usage:	Off road Patient Rescue and Wildland Fire Response	
Unit Number:	1106-07 (Snowmobile 1)	
Year/Make:	2007 Polaris	
Type:	Snowmobile	
Pump Capacity:	N/A	
Tank Capacity:	N/A	
Usage:	Off Road Patient Rescue Response	
Unit Number:	1115-07 (Snowmobile 2)	
Year/Make:	2007 Polaris S07PT6HS	
Type:	Snowmobile	
Pump Capacity:	N/A	
Tank Capacity:	N/A	
Usage:	Off Road Patient Rescue Response	



Unit Number:	Small ATV Forestry Trailer	
Year/Make:	2016	
Type:	Forestry Trailer	
Pump Capacity:		
Tank Capacity:	400 liters	
Usage:	Wildland Fire Response	
Unit Number:	1175-09 (Red 1)	
Year/Make:	2009 F150 XLT	
Type:	Mobile Command Unit	
Pump Capacity:	N/A	
Tank Capacity:	N/A	
Usage:	Mobile Command Unit/ Administration	
Unit Number:	1167-06 (Red 2)	
Year/Make:	2006 F250 4X4	
Type:	Mobile Command Unit/ Administration	
Pump Capacity:	N/A	
Tank Capacity:	N/A	
Usage:		
Unit Number:	1113-08 (Red 3)	
Year/Make:	2008 Toyota Prius Hybrid	
Type:	Electric Vehicle	
Pump Capacity:	N/A	
Tank Capacity:	N/A	
Usage:	Public Service Vehicle (Inspections and Prevention)	



7.3 Ancillary Equipment

Equipment needed for field response operations such as breathing apparatus, vehicle extrication tools and blowers are current, adequate for the needs of YKFD. The ancillary equipment is designed and maintained to meet the department's current core service, goals and objectives. As the response needs change or grow, additional equipment to match the service must be considered.

7.4 Personal Protective Equipment

YKFD personnel are supplied with all required Personal Protective Equipment (PPE) including turnout or bunker gear, gloves, helmets, boots and any specialized gear for specific rescue and EMS operations. The PPE provided is current, adequate and designed to meet the department's goals and objectives.

7.5 Specialized Operations Equipment

Sometimes an effective and efficient response to an incident requires equipment designed for a specific purpose. YKFD responds with specialized equipment to incidents involving motor vehicles, hazardous materials, water, confined spaces and situations requiring rope rescue. The equipment appears to meet the goals and objectives of the department and requires no further action at this time.

7.6 Asset Management

Like many other municipal corporations, Yellowknife Fire Division takes advantage of synergies with other fleet and facilities programs that are managed centrally. However, there is limited connection to the Corporate Asset Management program.

Our findings were:

- The current asset management and procurement program is serving YKFD well as it allows for total control in securing and maintaining the assets
- An in-depth study has never been done for effectiveness and efficiencies of the system
- Up-to-date data management software is lacking. YKFD is using paper hardcopy for most of the day-to-day operations and tracking
- Assets are distributed and managed in different locations

With the exception of apparatus and specialty equipment, which requires a 'Request for Proposal' process, all other purchases are done in-house. In all instances, YKFD staff members are involved in the procurement process.



Recommendation #29: Implement a comprehensive Asset Management Program with advanced Equipment Management Software

(0-24 months)

We recommend YKFD investigate and implement an asset management program with industry proven software in order to better track, care for, and extend the life expectancy of equipment and apparatus. This would ensure that preventative maintenance could be diligently tracked to avoid early retirement/replacement. This software will also provide valuable data for possible failure analysis.

This, combined with more rigorous/documented asset management practices, will ensure that the YKFD maintains optimal utilization from its apparatus and equipment. As YKFD currently uses FDM software, this could be a possible tool for equipment and asset management.

7.6.1 Equipment and Apparatus Maintenance

YKFD does not have a dedicated maintenance department. YKFD staff manage the routine maintenance for all ancillary equipment and personal protective equipment. This includes hand tools, breathing apparatus, thermal imaging cameras, turnout gear and extrication tools. Apparatus maintenance is done by scheduling regular inspections, tests, preventative maintenance, replacement, and emergency repair.

Routine maintenance and service of fire service apparatus and light duty equipment is handled by local dealers or the City's central fleet mechanics. However, specialised service for apparatus requires an Emergency Vehicle Technician (EVT). Currently, there are no EVT's in the territories that can do specialized service or warranty work on fire service apparatus. As a result, YKFD must either fly an EVT into the city or ship the apparatus out to major centres for repair.

Recommendation #30: Consider the advantages of having one or more central fleet mechanics certified as EVT's

(12-48 months)

We recommend YKFD consider having at least one trained emergency vehicle technician (EVT) on staff to address daily critical issues for emergency apparatus. Having an EVT on fleet staff will enable YKFD to be cost-effective and efficient allowing for timely maintenance, service and repairs reducing downtime for essential frontline emergency vehicles.



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SECTION 8 MUNICIPAL COMPARATORS

Comparing YKFD to that of similar communities is a good way to identify benchmarks. Camrose AB, Spruce Grove AB, and Thompson MB were selected as suitable comparators, based on the type of service and population. For the purposes of this municipal comparator review, we used 2011 – 2015 information in order to get common information from each community.

Table #17: Community Comparator Budget Ranking

Community	Population Average	Department Operating Budget	Cost per capita	Percentage of Municipal Budget
Ranking (1 = highest, 4 = lowest)				
City of Yellowknife	2	1	1	2
Camrose AB	3	3	4	4
Spruce Grove AB	1	2	2	1
Thompson MB	4	4	3	3

It is worth noting that there are no ideal comparators for the City of Yellowknife. Unlike its comparators, Yellowknife is the only community situated north of the 60th parallel and is essentially isolated from other major centres. With this location, come certain climate extremes, the lack of mutual aid support and other challenges that are not prevalent with its comparators. This uniqueness must be contemplated when comparing the cost of services and the risks within each community.

Like Thompson, Yellowknife provides frontline ambulance services while Camrose augments provincial EMS services with medical first response. Spruce Grove provides EMS ambulance services through a contract with Alberta Health Services.



Table #18: Community Comparators

Community	City of Yellowknife	Camrose AB	Spruce Grove AB	Thompson City MB	
Population	20,637 (15)	18,069 (15)	32,036 (15)	14,668 (15)	
Growth Percentage (2011-2015)	.84	4.2	4.6	10.53	
Land Area (km²) (Based on corporate municipal boundaries only)	136	42.50	32.37	17.18	
Municipal Budget 2015	\$80,979,000	\$34,850,792	\$80,600,000	\$27,123,106	
Emergency Services Operating Budget	\$4,754,000	\$1,457,277	\$6,774,806	\$1,035,026	
Percentage of Municipal Budget	5.87	4.18%	8.41%	3.82%	
Cost Per Capita	\$230.36	\$80.65	\$201.39	\$70.56	
Service Type: Integrated FIRE/EMS	Yes	No	Yes	Yes	
Department Staffing	49.5 (Composite)	47 (Composite)	51 (Fulltime)	52 (Composite)	
Suppression and Operations	4 Lieutenants 20 FF/Medics 15 POC FF 1 Emergency Dispatch Supervisor 4 Emergency Dispatchers	6 POC Captains 6 POC Lieutenants 26 POC FF	4 Captains 4 Lieutenants 36 FF	24 FF/Medics 4 EMD Dispatchers 19 POC FF	
Support	1 Chief 3 Deputy Chiefs 1 (1/2 time) Admin Support	1 Fire Chief 1 Deputy Chief 1 Inspector/Investigator 1 Fire Prevention Officer 1 (1/2 time) Admin Support	1 Chief 1 Deputy Chief 2 Assistant Deputy Chiefs 3 Administrative assistants	1 Chief 1 Deputy of Operations 1 Deputy of Training/Safety 1 Senior Communications Officer 1 Manager of Public Safety	
# of Stations	1	1	1	1	
Total Call Volume	2011	3106	214	2678	5531
	2012	3261	222	2909	6113
	2013	3297	190	3530	5625
	2014	3345	197	4361	5770
	2015	4295	210	3757	6225
Fire Related Calls	2011	454		501	410
	2012	480	64	496	542
	2013	470	52	492	470
	2014	520	66	519	443
	2015	952	61	534	456
EMS Related Calls	2011	2652	25	2177	5121
	2012	2781	20	2413	5571
	2013	2827	17	3038	5155
	2014	2852	15	3842	5327
	2015	3343	18	3223	5769



SECTION 9 SUMMARY

In creating this document, we analyzed a number of factors to determine the effectiveness and efficiency of the Yellowknife Fire Division (YKFD). We looked at the operational and administrative aspects of YKFD, as well as the ability of the department to work as a cohesive unit. We then reviewed YKFD's response data and its current resources, and assessed their alignment with both existing and projected risks and levels of demand.

There are a number of aspects of the department along with recommendations in this document that need to be considered in order to improve on the effectiveness and efficiencies. During a thorough review of YKFD's services, we identified 30 recommendations for improvement. Although each recommendation has a corresponding timeframe, it is important to note this document needs to be revisited on a regular basis to remain aligned with the dynamic economy experienced by the community.

Our research and consultation with YKFD revealed a number of administrative and operational factors that need to be addressed in order to continue providing quality services effectively and efficiently. Implementation of the recommendations outlined in this document; will better position YKFD to accommodate community growth and activity while maintaining excellent community relationship and value.



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APPENDIX 'A' GLOSSARY OF TERMS

Apparatus	Any vehicle provided with machinery, devices, equipment or materials of the Fire Department for firefighting as well as equipment used to transport firefighters or supplies.
Assembly Time	From the time the notification sounds in the fire station until the first vehicle leaves the station. In a full-time department this is expected to be within 80 seconds but for volunteer departments the time to collect a response crew can vary widely depending on location and time of emergency as well as all the factors that impact travel time.
Chute Time	See Assembly Time
Dangerous Goods	This term is synonymous with the terms <i>hazardous materials</i> and <i>restricted articles</i> . The term is used internationally in the transportation industry and includes explosives and any other article defined as a combustible liquid, corrosive material, infectious substances, flammable compressed gases, oxidizing materials, poisonous articles, radioactive materials, and other restrictive articles.
Discovery	This is the time between the start of the emergency and when someone or an engineered system has detected the incident.
Dispatch Time	This is the time required to extract the necessary information from the caller to allow the proper response to be initiated. The dispatcher identifies the correct fire location and initiates the dispatch by paging the appropriate fire station.
Emergency Call	This is the period between discovery and the actual notification of emergency services.
Emergency Communications Centre (ECC)	A facility dedicated to service receives calls, processes them and then dispatches emergency units to the correct location in the appropriate time-period.
Emergency Operations Centre (EOC)	The protected sites from which civil officials coordinate, monitor, and direct emergency response activities during an emergency or disaster.
Emergency	Any occasion or instance that warrants action to save lives and to protect property, public health and safety. A situation is larger in scope and more severe in terms of actual or potential effects.
Fire Chief	The person responsible for the efficient management of the Fire Department and the condition of all buildings, Apparatus and Equipment under the Fire Chief's control.
Fire Suppression	The application of an extinguishing agent to a fire at a level such that an open flame is arrested; however, a deep-seated fire will require additional steps to assure total extinguishment.



Hazard Analysis	A document, which identifies the local hazards that have caused, or possess the potential to adversely affect public health and safety, public and private property, or the environment.
Impact	The effect that each hazard will have on people such as injury and loss, adverse effects on health, property, the environment and the economy.
Incident	A situation that is limited in scope and potential effects.
Intervention Time	The time from fire reporting to the point where the first arriving pumper, or other apparatus providing comparable functions, arrives at the fire scene and directs an extinguishing agent on the fire.
Mutual Aid Agreement	An agreement between jurisdictions to assist each other during emergencies by responding with available manpower and apparatus.
National Fire Protection Association	The National Fire Protection Association (NFPA) is an internationally recognized trade association established in 1896 that creates and maintains standards and codes for usage and adoption by local governments to reduce the worldwide burden of fire and other hazards. This includes standards and guidelines to which many fire departments utilize to carry on day-to-day operations.
Response	Those measures undertaken immediately after an emergency has occurred, primarily to save human life, treat the injured, and prevent further injury and losses. They include response plan activation, opening and staffing the EOC, mobilization of resources, issuance of warnings and direction, provision of aid, and may include the declaration of a State of Local Emergency.
Risk	The chance or likelihood of an occurrence based on the vulnerability and known circumstances of a community.
Setup Time	This is the time necessary on site to evaluate the necessary actions, position the required resources and commence the intervention. In the case of a fire; completing size-up, assigning the necessary tasks and deploying resources can provide delays on scene. A well-trained crew can minimize these delays while providing a safe, successful response.
Standard Operating Guidelines (SOG)	A written organizational directive that establishes or prescribes specific operational or administrative methods to be followed routinely, which can be varied due to operational need in the performance of designated operations or actions.
Standard Operating Procedures (SOP)	A written organizational directive that establishes or prescribes specific operational or administrative methods to be followed routinely for the performance of designated operations or actions.
Travel Time	Once a vehicle leaves the station, it must negotiate the best route between that point and the location of the emergency. Factors to consider for travel time are driver skill, weather, traffic, topography, road conditions and vehicle capabilities.



APPENDIX 'B'

LIST OF FIGURES, CHARTS, IMAGES, MAPS, AND TABLES

Item	Description	Page
Figures		
Figure 1	Master Planning Process	5
Figure 2	Community Demographics	11
Figure 3	Risk Evaluation Matrix	17
Figure 4	Risk Inventory (Sample)	18
Figure 5	Estimated Structures Risk Level (Sample)	20
Figure 6	Call Volumes By Type – All Calls, 2011-2015	27
Figure 7	Yellowknife Fire Division Organizational Structure (2016)	35
Figure 8	Fire Service Time Management	38
Figure 9	Assessment Pyramid	53
Charts		
Chart 1	2011 Call Volumes	24
Chart 2	2012 Call Volumes	25
Chart 3	2013 Call Volumes	25
Chart 4	2014 Call Volumes	26
Chart 5	2015 Call Volumes	26
Images		
Image 1	Risk Management	16
Image 2	Sample Emergency Services Dashboard	58
Image 3	Fire Training Facility Location	81
Image 4	Fire Training Facility Props and Structures	82
Maps		
Map 1	7-minute Theoretical Response Map (NFPA1710)	31
Tables		
Table 1	Project Approach	4
Table 2	Targeted Interview List	6
Table 3	Historical Population Growth, 2005-2015	10
Table 4	Yellowknife Residential Construction Starts, 2009-2015	12
Table 5	Structure Inventory (Sample)	19
Table 6	Structural Risk Summary (Sample)	20



Item	Description	Page
Table 7	Historical Response Data	24
Table 8	Example of Incident Types for Statistical Analysis	28
Table 9	NFPA 1710 Intervention Time Defined	30
Table 10	Recommended Organizational Chart	36
Table 11	YKFD POC Attrition, 2008-2016	41
Table 12	YKFD Operational Qualifications	43
Table 13	Fire Department Staffing Ratio Calculation	56
Table 14	Cyclical Fire Inspection Program	69
Table 15	YKFD Public Education Program	71
Table 16	Fire Prevention Suppression Branch Program	71
Table 17	Community Comparator Budget Ranking	91
Table 18	Community Comparators	92



APPENDIX 'C' INTERVIEW GUIDE

General

1. Do you think the public feels they are getting value for their tax dollars?
2. What would you perceive the public understanding of the fire department's services and capabilities?

Risks

3. What do you believe to be the greatest risks to your community?
(Fire, Explosion, MVC, Natural Disasters)
4. How do you see levels or types of risk changing?
(Future development, Industry, loss of response resources)
5. Do you believe the community is adequately protected? If not why?
6. Based on the economic growth of the community, do you feel the department can keep up to the current and future demands?
7. What plans has the community adopted for alternate risk reduction strategies for fire and rescues? (fire sprinklers, increased life safety inspection, etc.)

Response

8. Has Senior Management and Council established clear levels of service expectations?
(Performance standards, core service expectations, etc.)
9. Is the department involved in the planning of new communities in the event of an emergency?
10. What performance/service outputs are you tracking (turnout times, response times, call volume, dispatch, fire inspections, public education, etc.)? Do you see areas for improved efficiency or effectiveness?
11. How do you see the department's demands for service growing in the future?
12. Do you believe the department's current response model, in terms of time and manpower, adequate?
13. What do you believe are ideal effective staffing levels for response?
14. In your opinion, are medical responses over tasking the emergency response system capacity?
If so are there any situations or examples that come to mind?
15. In your opinion, is the current response system sustainable? Why or why not?

Staffing, Recruiting and Retention

16. How effective is your current recruiting program? Could it be improved?
17. Do you feel the department is adequately staffed for response?
18. Do you feel the department is adequately staffed for administration or support?
19. Does/has the department experienced a high rate of turnover?
If so, why and what can be done to change this?



Training

-
20. Do you feel the current level of training is adequate for the service expectations?
-
21. How many weeks does a recruit spend at orientation before they go to the floor?
-
22. In your opinion, are there deficiencies in the department's recruit training and incumbent training program?
(scheduling, course delivery (online, classroom))
-
23. What improvements, if any, would you like to see based on your experience with training overall?
-

Equipment

-
24. Do you feel the department is adequately resourced?
(light duty and heavy apparatus, lose equipment and consumables)
-
25. Does the department have an apparatus life-cycle program?
-
26. Is there a reserve fund for apparatus purchases?
-

Asset Management and Maintenance

-
27. What performance measures are in place related to asset maintenance and management
(vehicles, equipment & infrastructure)?
-
28. Are there deficiencies in the current asset management program?
-
29. Does the current vehicle fleet provide the capacity/capability necessary to meet the demands and types of responses and risks?
-
30. What improvements would you suggest?
-

Infrastructure and Facilities

-
31. In your opinion, is the current station functional in meeting the operational requirements of the department?
-
32. Do you feel the current station location provide adequate geographic coverage?
-
33. What other facilities (i.e. training, dispatch) does the department have? Do they meet industry design standards and the department's specific needs?
-
34. Are there future plans for additional facilities?
(Training, Firehall, etc.)
-
35. Has a multi-use facility been considered?
(Fire + Police, Fire + EMS, Fire + EOC, etc.)
-

Technology

-
36. Has the department kept pace with leading technology/practices?
(Records management, Auto & Mobile CAD, Predictive Modeling, training systems, critical task analysis, dynamic and risk based deployments etc.)
-



APPENDIX 'D' THEORETICAL RESPONSE MAPPING METHODOLOGY

Response travel times are directly influenced by station location and can be varied based upon a cost/risk analysis and the development of performance targets.

Base Data Layers Requested

- Hydrology
- Single Line Road/Transportation Network
- Railways
- Municipal Boundaries
- Parks
- Projection File
- Orthophoto (GeoTIFF, Mr.SID), if available
- Emergency Services Locations

Data formats

- Preference of ESRI Shapefiles

Purpose of Files

- A. Hydrology
 - i. Identify needs for response to water locations (if dependant on a water response unit).
 - ii. Can be identified and analysed with the rail network to locate spill contaminations, as well as containment for overland flow & flooding to water spills.
 - iii. Locations of bridge crossings which can convert to varying incidents, as MVC/MVA, spill contaminants, etc.
 - iv. Assists in the definition of the map for locational awareness by others
 - v. Completes the map
- B. Single Line Road/Transportation Network
 - i. Used to determine response times from emergency locations to determine a network based on road speeds.
 - ii. Roads are created into a network for response
- C. Railways
 - i. Identified risk areas for impeding response time when crossing a roadway or proximity to municipal areas will also determine the response and apparatus used for a derailment response or other rail emergency or risks, such as chemical spill evacuations.



D. Municipal Boundaries

- i. Identifies the limits to response for mutual aid and responsibilities when overlaps occur within a response area. Also identifies sub areas for specific mapping and identification of municipal and regional response zones. Provides information for gap analysis for future state locations or refinement of locations.

E. Parks

- i. Identifies the potential risk areas due to accessibility issues for tracts of land, as well as constraints and opportunities for new locational analysis for or against new stations within a municipality. Ability to determine development of new locations due to proximity. Parks are identified as local, regional, provincial, and national.

F. Projection File

- i. To ensure that we have the same data set up as being used by the Municipality or Client, measurements (both distance and time) and spatial location are correct when determining analysis.

G. Orthophoto (GeoTIFF, Mr.SID), if available

- i. We typically do not use the ortho on the output maps, but the analysis sometimes needs clarification of what is on the ground and we use it to quickly ground truth locations and information needed prior to asking clients for clarification, or to substantiate clarification of an area.
- ii. Is a nice to have, yet hard to use, as it takes up a lot of memory/space, and is difficult to ship/transfer.

H. Emergency Services Locations

- i. Identify the actual location rather than a theoretical location based on an address match to ensure that the data location is as correct as possible and no mis-locations are identified on the initial running of the theoretical response times.
- ii. Locations may be moved from within a parcel to the front of the parcel whereby it touches the road network. Ensures the response from the station is captured. There are no corrections made to the movement of station to time, as it is typically within 50 metres.

Theoretical Response Zone

A. Assumptions

- i. Weather is average – no storms, rain, snow etc
- ii. Roadway segments contain a node/junction at intersections
 - If not available, road network needs to be cleaned and fixed
- iii. Roadways need to sometimes extend beyond some municipalities
- iv. Emergency responders are trained on response vehicles
- v. Response vehicles are in good condition
- vi. Roads are dry and in good condition
- vii. Left turns are not reduced by a time %



- viii. Road speeds are provided by client, if not
 - Road class table used to populate speeds based on road classification
 - Road speeds are reduced from the posted sign, typically no more than 5%
 - ix. Traffic volume is average, there is no congestion or there is a free flowing lane to be used
 - x. Rail crossings are free to cross and do not impede response
 - xi. Time of day is based on an average time from 9 am – 9 pm
 - xii. Opticom (or similar product for traffic light manipulation) are present to allow for free moving response
 - xiii. Intersections of roads are not reduced (the roads are reduced from other project limits and averaged over time for generality of best fit)
 - xiv. School zones are not adjusted unless identified, then changes to road net are made
- B. Response Time
- i. Customized response based on Emergency Services Input
 - ii. Response time includes in 80% of all calls for service
 - Total drive time along roads (determined above by road speeds) with:
 - iii. Variances are identified and are tweaked based on known data or other trends
- C. Response Polygons
- i. Identify general area of response from the outer most limits driven
 - ii. Also identify response zones for mutual aid
 - iii. Identify gaps in response
 - iv. Aid in the development of Fire Zones for response
 - v. Assist in the identification of new stations
 - Also identifies needs to move stations to another location, as required

Additional Analysis

- A. Out of Scope Analysis (needs further discussion with client)
- i. Transition from project to operationally based
 - Specific distance and travel
 - Based on time of day
 - Based on time of year
 - Call Volume
 - Call Types
 - Modeling
 - Scripting for batch work



B. Data Availability

- i. When data is available from clients is detailed enough, it is used
- ii. Not all data is detailed enough and assumptions are made

C. Analysis

- i. Additional analysis can be performed (as reduction of road speeds to an intersection)
 - For above example, identification of intersections can be complex, and data not always available:
 - Stop Sign
 - Three Way Stop
 - Yield
 - Lights
 - Flashing Light
- ii. Tends to be time consuming
 - a. Clients not willing to engage cost of this project
 - b. Levels of data may not be accessible
 - c. Missing detail
 - d. Usually is a one off project and new data is typically not leveraged