City of Fort Saskatchewan

Fire Underwriters Survey

2020

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Opta Information Intelligence, an SCM Company
8333 Eastlake Drive
Burnaby, BC V5A 4W2
1-800-665-5661

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1. SCOPE OF OUR ENGAGEMENT

The Fort Saskatchewan Fire Department (FSFD) contracted the services of SCM Opta Information Intelligence Inc. (formerly IAO) to evaluate the community's fire protection programs in order to update the Fire Insurance Grades for the community. The purpose of the assessment is to determine whether the community's current Fire Insurance Grading classifications are representative of the fire protection programs and fire protection resources that are currently in place within the community. A Fire Insurance Grading review is a key part of the assessment process.

The significant findings of the Fire Underwriters Survey (FUS) fire protection review were requested to be outlined within a short narrative report format. The report will provide an update on the City of Fort Saskatchewan (COFS) Fire Insurance Grading assignments and make recommendations aimed at improving the levels of public fire protection and improving Fire Insurance Grading classifications for the City.

1.1. Acknowledgement

Opta Information Intelligence Inc. wishes to thank Fort Saskatchewan Fire Department and City of Fort Saskatchewan Public Works for their valuable assistance in conducting this survey and preparation of this report.

1.2. Distribution of Use

This report, along with the findings and conclusions, contained herein, is intended for the sole use of the Fort Saskatchewan Fire Department to assist in the public fire protection planning needs of the community.

Judgements about the conclusions drawn, and opinions presented in this report should be made only after considering the report in its entirety. This report is Private and Confidential and is intended for the exclusive use of the COFS.

1.3. Reliance and Limitation

We have relied on the general accuracy of information provided by stakeholders without independent verification. However, we have reviewed this information for consistency and reasonableness. The accuracy of our conclusions is dependent upon the accuracy and completeness of this underlying data. Therefore, any discrepancies discovered in this data by the reader should be reported to us and this report amended accordingly, as warranted.

2. EXECUTIVE SUMMARY

This report covers a Fire Insurance Grading review update for the City of Fort Saskatchewan. The review covers the 4 areas of the Fire Insurance Grading assessment, i.e. Fire Department, Water Supplies, Fire Safety Control, and Emergency Communications. Recommendations concerning the items reviewed have been provided in order to improve or maintain credit. Each of the 4 areas have been assigned a Relative Classification which is based on a 1 to 10 scale (1 being the best). The final Public Fire Protection Classification (PFPC) is based on the relative classifications and is also on a 1 to 10 scale (1 being the best).

The final points calculated for the City of Fort Saskatchewan have improved from 62.67 in 2013 to 69.16 in 2020. As a result, the overall PFPC calculated for the City of Fort Saskatchewan is PFPC 4. The Dwelling Protection Grade (DPG) has improved for the City from DPG 3A to DPG 1 (1-5 with 1 being the best).

The following table provides a summary of improvements:

Grading Area	Grades/Relative Class 2013	Grades/Relative Class 2020
Fire Department	4	3
Water Supply	3	2
Fire Safety Control	6	5
Emergency Communications	2	1
Final PFPC (Points)	4 (62.67)	4 (69.16)
Dwelling Protection Grade (DPG	3A	1

Items related to Fire Department operations and Prevention (Fire Safety Control) are discussed throughout the report with recommendations provided considering improving or maintaining credit within the grading. Overall, the level of public fire protection provided within the City of Fort Saskatchewan has improved. The Fire Department is well administered and has put many programs in place that provide a good level of public fire protection within the community.

There are two more notable areas that would result in further improvements to the PFPC. One concerns addressing the gap in response on the southwest portion of the City. This area has seen recent expansion as well as the addition of annexed land. The new development is being placed further from the current Fort Saskatchewan Fire Hall. The report shows that the current fire hall covers 28% of properties under initial response benchmarks. Adding a secondary all would increase the coverage by approximately 50-60% depending on final placement. Optimal placements are shown in the report.

The second notable area is the development of a dedicated fire prevention program and strategic plan. Prevention programs account for over 20% of the final PFPC applied to a community.

Recommendations Summary
Recommendation 1 Consider Additional Fire Hall in the Southwest of the City.
Recommendation 2 Update Training Facility.
Recommendation 3 Implement pre-plans in accordance with NFPA 1620 and make them available digitally
Recommendation 4 Complete Community Risk Assessment and Risk Reduction Plan

Recommendation 5 Acquire Additional Staff as Needed to Meet Frequency of Inspections
Recommendation 6 Inspection Records should be stored in a Records Management System
Recommendation 7 Develop and Implement Public Education Programs

Summary tables of credit scores have been provided in section 11. Recommendations have been provided for any areas of the Grading where notable credit is still available. A summary of recommendations is provided below.

3. TERMS OF REFERENCE

Term	Definition
Aerial Fire Apparatus.	A vehicle equipped with an Aerial ladder, elevating platform, Aerial ladder platform, or water Tower that is designed and equipped to support firefighting and rescue operations by positioning personnel, handling materials, providing continuous egress, or discharging water at positions elevated from the ground.
Aid - Automatic Aid	A plan developed between two or more fire departments for immediate joint response on first alarms. This process is accomplished through simultaneous dispatch, documented in writing, and included as part of a communication center's dispatch protocols.
Aid - Mutual Aid	Reciprocal assistance by emergency services under a prearranged plan. This is part of the written deployment criteria for response to alarms, as dispatched by the communications center.
Basic Fire Flow	The value which represents the fire potential of most large properties in the municipality, but may exclude several of the largest properties not considered as usual to the municipality. Normally, the value used as the Basic Fire Flow will not be the peak required fire flow in the municipality. The Basic Fire Flow is the benchmark against which all protective facilities are measured.
Building	Any structure used or intended for supporting or sheltering any use or occupancy.
Building area	The greatest horizontal area of a building above grade within the outside surface of exterior walls or within the outside surface of exterior walls and the centre line of firewalls.
Building height	The number of storeys contained between the roof and the floor of the first storey.
Built Environment	Buildings and structures: human-made buildings and structures, as opposed to natural features.
Classification Standard for Public Fire Protection (CSPFP)	Fire risk rating schedule applied by the FUS to public fire protection in Canada. The Schedule applies various processes of modelling and scoring to produce a value representing public fire protection services relative to fire risk.
Combustible	A material fails to meet the acceptance criteria of CAN4-S114, “Determination of Non-Combustibility in Building Materials.”
Commercial Lines Insurance	A distinction marking property and liability coverage written for business or entrepreneurial interests (includes institutional, industrial, multi-family residential and all buildings other than detached dwellings that are designated single family residential or duplex) as opposed to Personal Lines.
Community - Major or Large	An incorporated or unincorporated community that has: • a populated area (or multiple areas) with a density of at least 400 people per square kilometer; AND • a total population of 100,000 or greater.
Community - Medium	An incorporated or unincorporated community that has: • a populated area (or multiple areas) with a density of at least 200 people per square kilometer; AND/OR • a total population of 1,000 or greater.
Community - Small	An incorporated or unincorporated community that has: • no populated areas with densities that exceed 200 people per square kilometer; AND • does not have a total population in excess of 1,000.
Company	A group of members that is (1) under the direct supervision of an officer or leader; (2) trained and equipped to perform assigned tasks; (3) usually organized and identified as engine companies, ladder companies, rescue companies, or squad companies; (4) usually operates with one piece of fire apparatus (Pumper, ladder truck, elevating platform, rescue, squad, ambulance); and (5) arrives at the incident scene on fire apparatus or assembles at the scene prior to assignment. The term company is synonymous with company unit, response team, and response group.
Demand Zone Levels	An area used to define or limit the management of a risk situation. A demand zone can be a single building or a group of buildings. It is usually defined in terms of geographical boundaries, called fire management areas or fire management zones.
Detached Dwelling	Buildings containing not more than two dwelling units in which each dwelling unit is occupied by members of a single family with not more than three outsiders, if any, accommodated in rented rooms. Aka. One- and Two-Family Dwelling

Dwelling Protection Grade (DPG)	The fire insurance grade or grades utilized by Personal Lines Insurers in Canada. The DPG is a number between 1 and 5 that is calculated by comparing the fire risk in terms of require fire flows to available resources. Unlike the PFPC system, within the DPG system, the benchmark required fire flow is a constant, and is typical for a Detached Dwelling. The DPG for communities across Canada is determined from a basic survey of the available resources related to fire risk reduction and fire protection capacity.
Dwelling, Typical	Refers to One- and Two-Family Detached Dwellings: - with no structural exposures (buildings with an area exceeding 9.3 sq.m) within 3 m; - with no unusual fire risks (such as wood shake roofs); AND - with an effective area (all storeys excluding basements) not exceeding 334 sq.m (3,600 sq.ft).
Emergency Dispatch Protocol	A standard sequence of questions used by telecommunicators that provides post-dispatch or pre-arrival instructions to callers.
Emergency Incident	Any situation to which the emergency services organization responds to deliver emergency services, including rescue, fire suppression, emergency medical care, special operations, law enforcement, and other forms of hazard control and mitigation.
Emergency Response Facility (ERF)	A structure or a portion of a structure that houses emergency response agency equipment or personnel for response to alarms. Examples of ERFs include a fire Hall, a police Hall, an ambulance Hall, a rescue Hall, a ranger Hall, and similar facilities.
Emergency	A condition that is endangering or is believed to be endangering life or property; an event that requires the urgent response of an emergency response agency.
Engine	A fire department Pumper having a rated capacity of 2840 L/min (625 Igpm) or more.
Exposing building face	That part of the exterior wall of a building which faces one direction and is located between ground level and the ceiling of its top storey or, where a building is divided into fire compartments, the exterior wall of a fire compartment which faces one direction.
Exposure	The heat effect from an external fire that might cause ignition of, or damage to, an exposed building or its contents.
Fire Apparatus	A fire department emergency vehicle used for rescue, fire suppression, or other specialized functions.
Fire Department Vehicle	Any vehicle, including fire apparatus, operated by a fire department.
Fire Department	A fire department is a group of persons formally organized as an authorized service of a municipal or other local government having a sustainable source of funding, which could include taxation, fees for services provided, contracts, permit fees or other reliable sources of revenue which will support the cost of services provided. A minimum number of trained persons able and equipped to respond with motorized firefighting apparatus to extinguish fires or to respond to other classes of circumstances which may occur within a designated geographical area.
Fire Department. - Public Fire Department	A legally formed organization providing rescue, fire suppression, emergency medical services, and related activities to the public.
Fire Force, Available	A measure of the human resources that are available to participate in firefighting operations on the fire ground or an equivalent measure.
Fire Force, Required	A measure of the human resources that are needed to participate in firefighting operations on the fire ground (or an equivalent measure) for an ideal response based on the required fire flow, number of companies and average response time as specified in the Table of Effective Response.
Fire Flow	The flow rate of a water supply measured at 20 psi (137.9 kPa) residual pressure that is available for firefighting.
Fire Growth Potential	The potential size or intensity of a fire over a period of time based on the available fuel and the fire's configuration.
Fire Hall	An "emergency response facility" where fire department apparatus and equipment are housed, protected against harm, and made readily accessible for use in emergencies. The Fire Hall is normally the location where Firefighters respond from. Other primary purposes include training and administration of the fire department.
Fire Hydrant	A reliable connection to a water main for the purpose of supplying water efficiently and reliably to fire hose or other fire protection apparatus. To be recognized for Fire Insurance Grading purposes, the device shall be designed and installed in accordance with CAN/ULC S520, UL 246 and/or AWWA C502/C503 and listed for use as a fire hydrant by UL and/or ULC.

Fire Hydrant – Public	A fire hydrant situated and maintained for public use on a public right-of-way (or easement) to provide water for use by the fire department in controlling and extinguishing fires. The location of a public fire hydrant is such that it is accessible for immediate and unrestricted use by the fire department at all times. Public fire hydrants are owned and maintained by the government entity (ex. city, village, etc.) which is responsible for maintaining the hydrants and water supply distribution system in operating condition at all times and is authorised to levy taxes to fund the operation and maintenance programs.
Fire Hydrant – Private	A fire hydrant located on privately owned property, or on streets not dedicated to public use. Although a private fire hydrant may be connected to a public water supply system, maintenance of the hydrant and access to the hydrant are the responsibility of the property owner. Private hydrants are normally required where buildings are so located on the property or are of such size and configuration that a normal hose lay from a public hydrant would not reach all points on the outside of the building.
Fire load	(as applying to an occupancy) The combustible contents of a room or floor area expressed in terms of the average weight of combustible materials per unit area, from which the potential heat liberation may be calculated based on the calorific value of the materials, and includes the furnishings, finished floor, wall and ceiling finishes, trim and temporary and movable partitions.
Fire Protection	Methods of providing fire detection, control, and extinguishment.
Fire Suppression	The activities involved in controlling and extinguishing fires. Fire suppression includes all activities performed at the scene of a fire or training exercise that expose fire department members to the dangers of heat, flame, smoke, and other products of combustion, explosion, or structural collapse.
First Responder (EMS)	Functional provision of initial assessment (airway, breathing, and circulatory systems) and basic first aid intervention, including CPR and automatic external defibrillator (AED) capability. A first responder assists higher level EMS providers.
First Storey	The uppermost storey having its floor level not more than 2 m above grade
Grade	(as applying to the determination of building height) The lowest of the average levels of finished ground adjoining each exterior wall of a building, except that localized depressions such as for vehicle or pedestrian entrances need not be considered in the determination of average levels of finished ground.
Hazard	The potential for harm or damage to people, property, or the environment. Hazards include the characteristics of facilities, equipment systems, property, hardware, or other objects, and the actions and inactions of people that create such hazards.
Hazardous Material	A substance (solid, liquid, or gas) that when released is capable of creating harm to people, the environment, and property.
Incident Commander.	The person who is responsible for all decisions relating to the management of the incident and is in charge of the incident site.
Incident Management System (IMS)	An organized system of roles, responsibilities, and standard operating procedures used to manage emergency operations. Such systems are also referred to as incident command systems (ICS).
Initial Attack	An aggressive suppression action consistent with fire fighter and public safety and values to be protected.
Initial Attack Apparatus	Fire apparatus with a permanently mounted fire pump of at least 250 USgpm (950 L/min) capacity, water tank, and hose body whose primary purpose is to initiate a fire suppression attack on structural, vehicular, or vegetation fires, and to support associated fire department operations.
Ladder Company	A fire department company that is provided with an Aerial fire apparatus and is trained and equipped to support firefighting and rescue operations by positioning personnel, handling materials, providing continuous egress, or discharging water at positions elevated from the ground.
Ladder Truck	An alternate name for Aerial Fire Apparatus.
Master Stream	A portable or fixed firefighting appliance supplied by either hose lines or fixed piping and that has the capability of flowing in excess of 300 USgpm (1140 L/min) of water or water based extinguishing agent.
Member	A person involved in performing the duties and responsibilities of a fire department, under the auspices of the organization. A fire department member can be a full-time or part-time employee or a paid or unpaid volunteer, can occupy any position or rank within the fire department, and can engage in emergency operations.
Mobile Water Supply (Tanker)	A vehicle designed primarily for transporting (pickup, transporting, and delivery) water to fire emergency scenes to be applied by other vehicles or pumping equipment.
Non-combustible	A material that meets the acceptance criteria of CAN4-S114, “Determination of Non-Combustibility in Building Materials.”

Non-combustible construction	The type of construction in which a degree of fire safety is attained by the use of non-combustible materials for structural members and other building assemblies.
Non-combustible Material	A material, as defined in NFPA 220, Standard on Types of Building Construction, that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapours when subjected to fire or heat. Materials reported as non-combustible, when tested in accordance with ASTM E 136, Standard Test Method for Behaviour of Materials in a Vertical Tube Furnace at 750°C, are considered non-combustible materials.
Officer	
Officer - Company Officer	A supervisor of a crew/company of personnel. This person could be someone appointed in an acting capacity. The rank structure could be either sergeant, lieutenant, or captain.
Officer - Incident Safety Officer	An individual appointed to respond or assigned at an incident scene by the incident commander to perform the duties and responsibilities of that position as part of the command staff.
Officer - Supervisory Chief Officer	A member whose responsibility is above that of a company officer, who responds automatically and/or is dispatched to an alarm beyond the initial alarm capabilities, or other special calls. In some jurisdictions, this is the rank of battalion chief, district chief, deputy chief, assistant chief, or senior divisional officer (UK fire service). The purpose of their response is to assume command, through a formalized transfer-of-command process, and to allow company officers to directly supervise personnel assigned to them.
One- and Two-Family Dwelling	Buildings containing not more than two dwelling units in which each dwelling unit is occupied by members of a single family with not more than three outsiders, if any, accommodated in rented rooms.
Optimum Level of Fire Protection	The combination of firefighting staff and apparatus that delivers a suppression effort commensurate with the fire demand faced, yet representing the most efficient use of resources in a safe and effective manner.
Peak Fire Flow	All buildings and building groups within a District or Municipality, the highest calculated required fire flow.
Personal Lines Insurance	Insurance covering the liability and property damage exposures of private individuals and their households as opposed to Commercial Lines. Typically includes all detached dwellings that are designated single family residential or duplex.
Personal Protective Clothing	The full complement of garments Firefighters are normally required to wear while on emergency scene, including turnout coat, protective trousers, fire-fighting boots, fire-fighting gloves, a protective hood, and a helmet with eye protection.
Personal Protective Equipment	Consists of full personal protective clothing, plus a self-contained breathing apparatus (SCBA) and a personal alert safety system (PASS) device.
Public Fire Department	An organization providing rescue, fire suppression, emergency medical services, and related activities to the public.
Public Fire Protection Classification	The fire insurance grade or grades utilized by Commercial Lines Insurers in Canada. The PFPC is a number between 1 and 10 that is calculated by comparing the fire risk in terms of require fire flows to available resources. The PFPC for communities across Canada is determined from an extensive survey and analysis of the fire risk in the built environment and the available resources related to fire risk reduction and fire protection capacity.
Public Fire Service Communications Center	The building or portion of the building used to house the central operating part of the fire alarm system; usually the place where the necessary testing, switching, receiving, transmitting, and power supply devices are located.
Public Safety Answering Point	A facility in which 9-1-1 calls are answered.
Pumper	Fire apparatus with a permanently mounted fire pump of at least 750 USgpm (2850 L/min or 625 Igpm) capacity, water tank, and hose body whose primary purpose is to combat structural and associated fires.
Quint	Fire apparatus with a permanently mounted fire pump, a water tank, a hose storage area, an Aerial ladder or elevating platform with a permanently mounted waterway, and a complement of ground ladders. The primary purpose of this type of apparatus is to combat structural and associated fires and to support fire-fighting and rescue operations by positioning personnel-handling materials, providing continuous egress, or discharging water at positions elevated from the ground.
Required Fire Flow	The rate of water flow, at a residual pressure of 20 psi (138 kPa) and for a specified duration, that is necessary to confine and control a major fire in a specific building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure. This may include as much as a city block.
Storey	That portion of a building which is situated between the top of any floor and the top of the floor next above it, and if there is no floor above it, that portion between the top of such floor and the ceiling above it.

Wildland/Urban Interface	The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

4. FIRE UNDERWRITERS SURVEY

FUS is a national organization that represents more than 85 percent of the private sector property and casualty insurers in Canada. FUS provides data to program subscribers regarding public fire protection for fire insurance statistical and underwriting evaluation. It also advises municipalities if they desire to review the current levels of fire protection in the community and provide direction with recommendations where improvements will enable them to better deal with fire protection problems.

FUS offices maintain data from surveys on fire protection programs for all incorporated and unincorporated areas across Canada. The results of these surveys are used to establish the Public Fire Protection Classification (PFPC) and Dwelling Protection Grade (DPG) for each community. The PFPC and DPG is also used by underwriters to determine the amount of risk they are willing to assume in a given community or section of a community.

The overall intent of the grading systems is to provide a measure of the ability of the protective facilities within a community to prevent and control major fires that may be expected to occur by evaluating in detail the adequacy, reliability, strength and efficiency of these protective facilities.

4.1. Fire Insurance Grading Classifications

Public Fire Protection Classification (PFPC):

The PFPC is a numerical grading system scaled from 1 to 10. Class 1 is the highest grading possible and Class 10 indicates that little or no fire protection is in place. The PFPC grading system evaluates the ability of a community's fire protection programs to prevent and control major fires that may occur in multi-family residential, commercial, industrial, and institutional buildings and course of construction developments.

FUS also assigns a second grade for community fire protection, referred to as the Dwelling Protection Grade, which assesses the protection available for buildings such as single-family dwellings.

Dwelling Protection Grade (DPG):

The DPG is a numerical grading system scaled from 1 to 5. One (1) is the highest grading possible and five (5) indicates little or no fire protection is provided. This grading reflects the ability of a community to handle fires in buildings such as single family residences.

The method used to calculate the PFPC and DPG is called the Classification Standard for Public Fire Protection.

4.2. Public Fire Protection Classification System

The Public Fire Protection Classification grading system is a measure of a community's overall programs of fire protection. The ability of a community's fire defences are measured against recognized standards of fire protection relative to fire hazard and the fire/life safety risk present within the community. The following areas of fire protection are reviewed in the survey and have the following weights within the PFPC grading system:

- Fire Department 40%

- Water Supply 30%
- Fire Safety Control 20%
- Fire Service Communications 10%

The above classifications are conveyed to subscribing companies of FUS. FUS subscribers represent approximately 85-90% of the fire insurance underwriters in Canada. Subscribers use this information as a basis in their fire insurance underwriting programs to set limits in the amount of risk they are willing to assume within a given portion of a community, and to set fire insurance rates for commercial properties. Improved fire protection grades may result in increased competition for insurance underwriting companies to place their business within a community. Our analysis indicates that an improved fire protection grade has a positive effect on fire insurance rates.

In addition, PFPC classifications are a measure of the level of fire protection within a community. Many progressive communities use the classification system to assess the performance of their fire protection programs, and to plan the direction of fire protective services for the future of the community.

PFPC Grades do not apply beyond 5km road response distance from a recognized Fire Hall.

4.3. Dwelling Protection Grading System

Dwelling Protection Grades are based on a 1 to 5 grading system; DPG 5 indicates little or no fire protection being available. Most small and midsize communities that have a gradable emergency water supply are assigned a DPG 3A rating, which the insurance industry has termed fully protected. DPG 3B refers to communities, or portions of communities, that have a recognized fire department but are not protected with a recognized water supply. The insurance industry has termed this 'semi-protected'. Within the FUS grading, a grade of 3B indicates that the fire department is equipped, trained, prepared and adequately staffed to provide "Standard Shuttle Service" to a fire event within a reasonable response time (i.e. utilize a Pumper, tender and various related equipment to deliver water to a fire site and provide structural firefighting at the fire event).

The protected assignment refers to DPG 1 to DPG 3A. An unprotected designation refers to DPG 5. DPG 3B and 4 are given the semi-protected designation. The lower the DPG assignment is, the larger the discount given in fire insurance rates. The discounts given for an identical property considered fully-protected over those considered unprotected can be approximately 60%. Where there is sufficient population and sufficient taxation base, the savings generated can more than offset the operating and capital costs of an effective fire service.

A summary of the requirements for the Dwelling Protection Grade system is provided in APPENDIX E Dwelling Protection Grade Summary of Basic Requirements.

Many insurers have simplified the Dwelling Protection Grading system to a simple three tier system. This is typical for setting insurance premium rates for detached single family residences only. Some insurers also inquire as to whether a department is career, composite, or volunteer.

Different insurers utilize the Dwelling Protection Grades differently to set their own rates based on the marketplace and their own loss experiences. The three tier system that is typically used by many insurers is shown in Table 1.

Table 1 FUS Grades Correlation to Commonly used Insurance Terminology and Simplified Grades

FUS Dwelling Protection Grades	System Used by Many Insurance Companies "3 tier" system	Insurance Companies typically refer to this grade as
1	Table I	Fully Protected, Career
2	Table I	Fully Protected, Composite
3A	Table I	Fully Protected, Volunteer
3B[1]	Table II	Semi–Protected, Volunteer (Shuttle)
4	Table II or III	Limited–Protection, Volunteer
5	Table III	Unprotected

The fire insurance industry has minimum requirements that communities must meet in order for their fire protection program to receive recognition.

It should be noted that DPG Grades do not apply beyond 8km road response distance from a recognized Fire Hall.

4.4. Measuring Fire Risk in This Review

The strength of fire defence within a community depends largely on the will and financial ability of the community to support this emergency service. FUS and the National Fire Protection Association statistics indicate that the larger the population of a community, the higher the level of fire protection, when measured against the risk of fires within the community. The best scenario for the level of fire protection occurs when expectations of fire suppression and prevention match the community's willingness to pay for this expectation.

Community growth resulting from capital developments increases the level of fire risk; however, the development of fire protective services often falls behind the developments, particularly in communities where growth happens quickly. If the community expectation levels are constant and the fire protective service level is also constant, then as the fire risk level increases the fire protection level relative to the fire risk level decreases and community expectation may no longer be met.

Optimum Level of Fire Protection

The combination of firefighting staff and apparatus that delivers a suppression effort commensurate with the fire demand faced, yet representing the most efficient use of resources in a safe and effective manner.

4.5. Overview of the Assessment Process

There is no one universal model of fire defence that can be applied to all situations or to a community requiring this emergency service. Ideally, the strength of a fire protection program is balanced between the risk of serious fire and the community's fire loss experience. Fire defences should be tailored with these issues in mind. To gauge the needs of the fire service based on experience alone would be to ignore perils that have not yet occurred. Ignoring experience and focusing on risk alone may tend to build-up a fire department force beyond the financial acceptability of the community paying for the service.

FUS measures the ability of a fire department against the risk of fire likely to occur within a community. This measurement is usually not determined by the most significant risk, nor is it based on the average fire risk. Our

1 Note that communities qualifying for Dwelling Protection Grade of 3B may also be able to achieve an equivalency to 3A through Superior Tanker Shuttle Service Accreditation.

measurement tends to focus on those structures where there is a considerable risk to fire and life safety, and where total or temporary loss of a particular structure would have a significant impact on a community's tax base and economy. A fire department should be structured and supported to effectively deal with everyday emergencies while at the same time capable of controlling and extinguishing most fires that may occur.

FUS examines the entire program of the community's fire defence in order to assess and grade the overall program. There are some areas within a FUS grading that carry substantial weight, such as:

- Type and number of apparatus
- The condition and age of fire apparatus and fire suppression equipment
- The type of apparatus and ancillary equipment for the hazards present
- Pumping capacity
- The type of staffing (i.e. career Firefighters vs. volunteers)
- The distribution of companies relative to fire risk
- Response to alarm protocols
- Response times to critical risks
- Management of emergency services
- The quality of training programs for the fire fighter including specialized training
- The availability, adequacy and reliability of emergency water supplies.
- Fire prevention inspections
- Public education programs
- Building controls (application of Building Codes and related standards; plan review process; effective construction inspection and permit process; local building bylaws)
- Automatic fire protection systems
- Emergency communication systems

5. REVIEW SCOPE AND METHODOLOGY

5.1. Review Objectives

The scope of this review was to conduct an assessment of the City of Fort Saskatchewan fire protection programs for Fire Insurance Grading and to update the Fire Insurance Grades for the City. The review involved the following:

- Citywide risk assessment
- Fire Department operations
- Programs of Fire Safety Control including those of fire prevention and public education
- Dispatch and communications
- Water Supply
- Complete a Fire Insurance Grading Review

The following key contacts were made and provided information throughout the survey and development of the report:

- Shawn McKerry, Fire Chief
- Douglas Stein, Assistant Fire Chief
- Bradley McDonald, Public Works
- Carl Stewart, GIS technician

6. COMMUNITY RISK AND HAZARD ASSESSMENT

6.1. Background

A risk assessment was conducted throughout the City of Fort Saskatchewan to aid in determining the community's fire protection needs and to assist in assessing the adequacy of the current Fire Hall location and distribution of apparatus. A risk and hazard assessment, along with a response distance review, lays the groundwork for determining fire protection needs within a community. This assessment is important in ascertaining organizational structure, personnel, training, fire apparatus and fire equipment needs, response time benchmarks and adequacy of fire hall location.

The "Risk and Hazard Assessment" is an evaluation of the fire loading and risk present in a given area.

6.2. Measuring Fire Risk

Adequate response to a fire emergency is generally measured by the speed with which a responding firefighting crew(s) can arrive at the fire emergency with sufficient resources, to have a reasonable degree of opportunity to control or extinguish a fire. Simply put, the response provided by a firefighting crew should equal the potential severity of the fire or fire emergency.

Generally, the potential severity of a fire event is associated with the fuel load present and exposures to the fire. Factors such as building construction materials; quality of construction; building renovation history; building size, height and age; occupancy and hazards associated with the occupancy, will all contribute to the potential severity of a fire. In addition, other buildings sufficiently exposed to a burning building can contribute to the magnitude of a fire and the resources necessary to be in place to control or extinguish a given fire. Alternatively, building controls and automatic fire protection systems (both active and passive) that limit fire spread will reduce the potential severity of a fire. For building controls to be considered effective, their design, installation and maintenance must also be reviewed as any weak link may result in the system being ineffectual.

Much of the research into fire protection requirements for individual buildings and communities and the corresponding number of Pumper companies and response times has been conducted by FUS and the National Fire Protection Association (NFPA). FUS evaluates adequacy of response by comparing the potential severity of fires that may occur with a rating of the ability of fire crews and their resources responding within a specified time period relative to the fire magnitude potential.

The base point, within the Classification Standard for Public Fire Protection for measuring fire risk and the resultant available and adequate response is the determination of Required Fire Flows (RFF).

6.3. Required Fire Flows

Required Fire Flows (RFF) may be described as a measurement of the amount and rate of water application, and fire company response (resources and response times), required in firefighting to confine and control the fire magnitude possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposures.

RFFs were derived for buildings throughout the COFS using the methodology described in the FUS 1999 Guideline "Water Supply for Public Fire Protection" (refer to Appendix B). The calculation takes into account the construction type, occupancy, exposures, total effective area, and the fire protection systems in place for each risk. The RFF calculation is based on the following formula:

$F = 220C\sqrt{A}$ .....*see additional notes in appendix A*

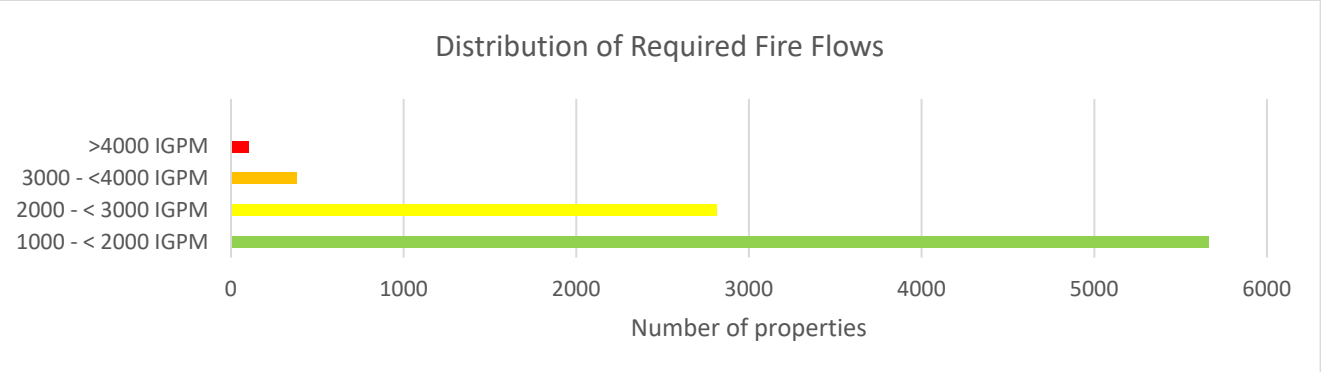
Where:

- C=coefficient related to the type of construction
- A=total effective building area

GIS building and zoning-based data related to Required Fire Flow variables as well as manual calculations were used to derive Required Fire Flows for buildings throughout the community. Manual calculations are shown in figure 2 with a table of values used for the calculations shown in Appendix A. In order to, create a risk layer for the complete District Required Fire Flow values were then assigned based on the allowable construction from the COFS Zoning Bylaw. These values are shown in figure 3. These values were typically found to fall within the RISK RATING limits of Table 4 FUS - Table of Effective Response.

Overall, 9,014 Required Fire Flows were derived for the COFS. The distribution of RFFs is shown in Figure 1.

Figure 1 RFF Distribution COFS



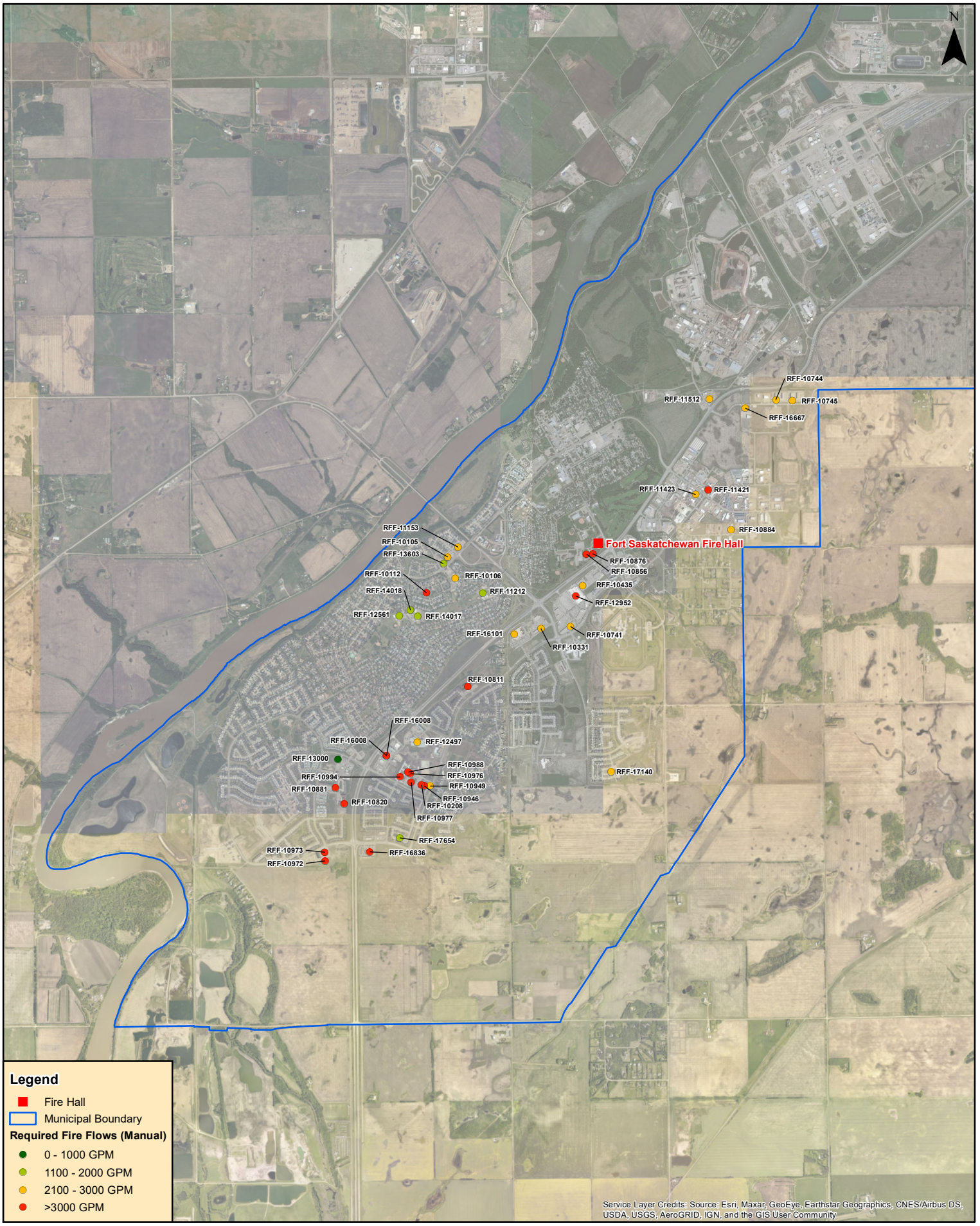
The Guide for Determination of Required Fire Flow (see Appendix B), Note A indicates that the guide is not expected to necessarily provide an adequate value for lumber yards, petroleum storage, refineries, grain elevators, and large chemical plants but may indicate a minimum value for these hazards.

6.4. Basic Fire Flow for the COFS

The Basic Fire Flow is determined from the analysis of the RFFs. The value which represents the fire potential of most large properties in the municipality but may exclude several of the largest properties not considered as usual to the municipality. Normally, the value used as the Basic Fire Flow will not be the peak RFF in the municipality.

The 90th percentile (approx.) RFF value for the COFS was then used to select the final Basic Fire Flow for the City which is 4,200 IGPM (19 000 L/min).

RFFs calculated that were higher than the Basic Fire Flow are not excluded from the Classification Standard for Public Fire Protection. They are still utilized under specific items of the Rating. Additional resources and planning may be required to adequately provide protection to peak RFF risks.



Fort Saskatchewan, AB

Figure 2 - Required Fire Flow Locations (Manual)

Scale = 1:50,000 0 0.5 1 Km

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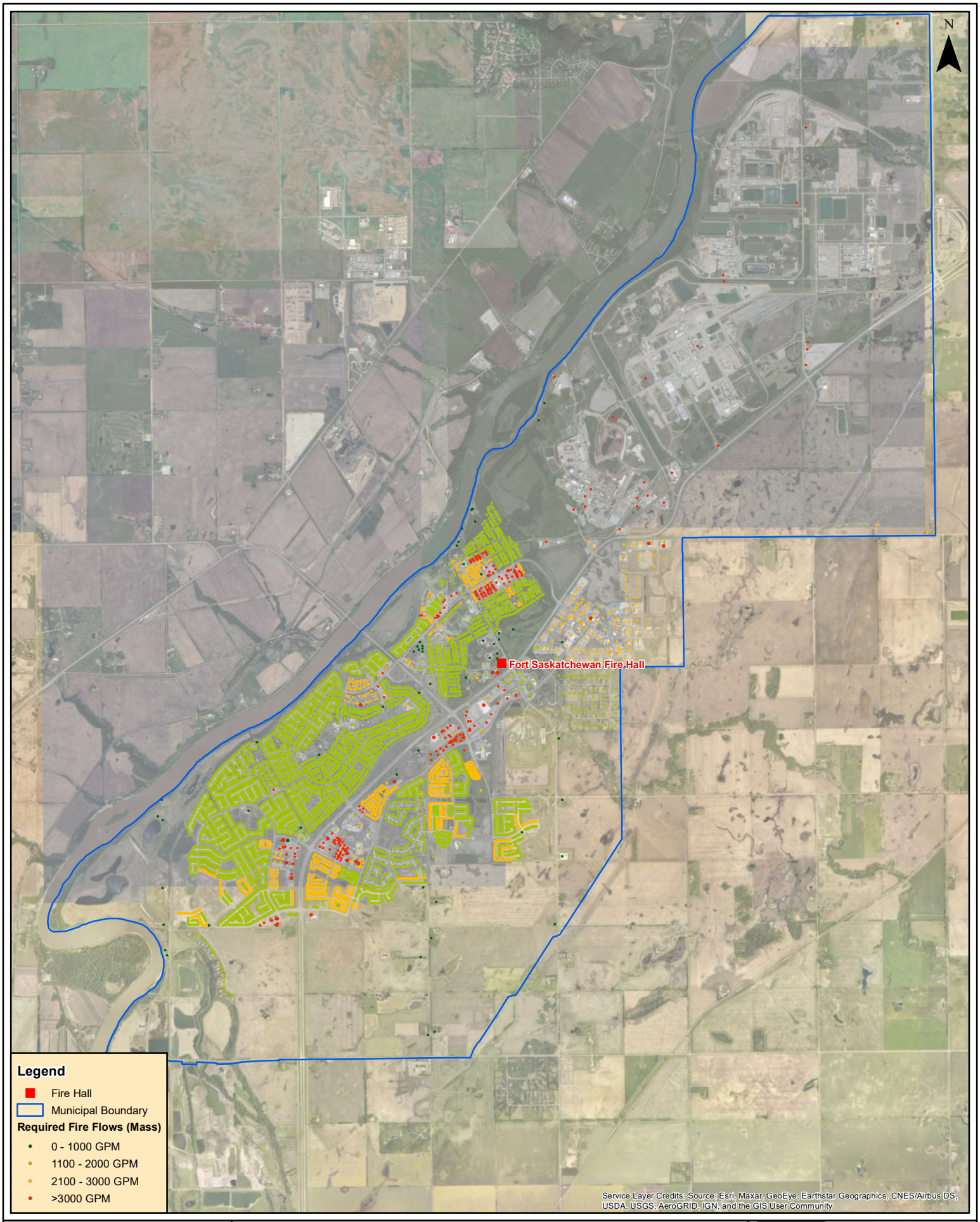

Fort Saskatchewan, AB

Figure 3 - Required Fire Flow Locations (Mass)

Scale = 1:60,000 0 0.5 1 Km

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7. PFPC - FIRE DEPARTMENT ASSESSMENT

7.1. Fire Department Grading Items

The following items are assessed as part of this study and as part of the Fire Insurance Grading process.

Areas analyzed in the assessment of the Fire Department are as follows:

- FD – 1: Engine Service
- FD – 2: Ladder Service
- FD – 3: Distribution of Companies
- FD – 4: Engine and Ladder Pump Capacity
- FD – 5: Design, Maintenance and Condition of Apparatus
- FD – 6: Number of Line Officer – Fire Suppression
- FD – 7: Total Fire Force Available
- FD – 8: Engine and Ladder Company Unit Manning
- FD – 9: Master and Special Stream Devices
- FD – 10: Equipment for Engines and Ladder Apparatus
- FD – 11: Fire Hose
- FD – 12: Condition of Fire Hose
- FD – 13: Training and Qualifications
- FD – 14: Response to Alarms
- FD – 15: Fire Ground Operations
- FD – 16: Special Protection Required
- FD – 17: Miscellaneous Factors and Conditions
- FD – 18: Pre-Incident Planning
- FD – 19: Administration

7.2. Engine Service

Fire departments are evaluated for the number of engine companies in service relative to the overall fire potential and the area being protected. Engine apparatus are required to be adequately housed and staffed in order to receive full credit.

The engine service grading item refers to the amount of credit received for each of the department's engines. Recognition and credit for engines may be reduced or withheld based upon the measured reliability of the pumps and the apparatus upon which they are installed (ex. factors such as age, listing, testing, etc.).

Fire apparatus that serve dual purposes are evaluated based on the primary duty it serves on the fire ground. For example, a ladder apparatus with a fire pump may be credited in one of two ways.

- 100 percent credit as a ladder apparatus and 50 percent credit as an engine, or
- 100 percent credit as an engine apparatus and 50 percent credit as a ladder apparatus.

This depends upon the number of apparatus a department has available and where credit should be distributed properly in the grading depending on the primary use of the fire apparatus.

Apparatus needs based on Basic Fire Flow:
The benchmark number of Engine Companies that the COFS can receive credit for is based on the Basic Fire Flow of 4,200 IGPM (19 000 L/min). Initial apparatus needs are cross referenced with Table 4 FUS - Table of Effective Response. For a Basic Fire Flow of 4,200 IGPM (19 000 L/min) 5 Pumper apparatus are needed.

The City of Fort Saskatchewan has limited resources at the Fort Saskatchewan firehall to respond to a larger structure fire. As such the City has aid agreements in place for response. There is an "Automatic Fire Mutual Aid agreement" in place with Strathcona County. The agreement provides for automatic response to a limited portion of the District. There is also a "Fire Mutual Aid Agreement" in place with the Municipal District of Sturgeon County. These agreements provide for varying levels of service based on the request.

The Fort Saskatchewan Fire Chief indicated that, in practice, any structure fire call, to any property in the northeast area of Fort Saskatchewan, would dispatch Strathcona Fire Department automatically (same dispatch provider as the City of Fort Saskatchewan). Based on the proximity of Strathcona County and the City of Fort Saskatchewan, closer fire halls in these communities are credited in this Grading. Depending on the levels of cooperative service between the individual fire departments the levels of credit in the Fire Insurance Grade vary. A complete unified level of service and dispatch, where the individual Departments align fire/rescue related programs and practices and adopt common operating and performance standards (where applicable), would mean that apparatus from responding fire halls would be given full credit.

Apparatus needs based on response facility locations:
Further apparatus needs are determined based on distribution of resources to provide reasonable coverage within the City. Ideally between 90%-100% of properties should have a Pumper apparatus response within first due response times which are taken from Table 4. A GIS optimization analysis determines the number of facilities in the City needed to provide more than 90% coverage.

It can be seen in Figure 4 that 2 facilities would be needed to provide 98% coverage of properties under first due response distances provided in Table 5. The number of properties that would be covered by each facility are shown as labels. The current fire hall is located close to one of the optimized facility locations which would cover 2,825 properties. The second optimized facility would cover 5,994 properties. This shows that there are a large number of properties that are not covered under ideal first due response distances in the west of the City. The actual current distribution of resources is assessed in section 7.4 of this report (Distribution of Companies).

Apparatus needs based on call volume:
Final apparatus needs are then based on the frequency of alarms for a fire company and total number of "Fire" calls annually. Where a Pumper company receives in excess of 2,500 calls per year, additional companies are needed. For a municipality having more than 250 fires per year, one additional Pumper company is needed. Call data was provided by Fort Saskatchewan Fire Dispatch and is summarized in Table 2.

Table 2 2019 Call Summary

Total Incidents for 2019	664
"Fire" Incidents for 2019	28

Based on the preceding 3 underlined considerations, the total needed Pumper companies for benchmarking within the Classification Standard for Public Fire Protection is 5. For Fire Insurance Grading, a fire department

should have one reserve engine for each eight engines in service. A fire department even with a single engine company should have a reserve engine.

A summary of Pumper apparatus credit is provided in Table 3. Quint apparatus can receive 100% credit as a Pumper company and 50% as a ladder company, or vice versa, depending on its primary use. Apparatus credited as AD (Active Duty) under Duty Status receive 100% credit as first responding. AA (Automatic Aid) under Duty Status receive 33% (approx.) credit as first responding. OA (Outside Aid) under Duty Status receive 16% (approx.) credit as first responding.

Table 3 Credited In-Service Engine Summary

Identifier	Apparatus Credit	Year	Engine Credit	Reserve Engine Credit	Duty Status	Pump Capacity (IGPM)
160-P9	Engine	2002	1	0	AD	1,250
160-51	Engine	2019	1	0	AD	1,750
160-L1	Quint	2009	0.5	0	AD	1,500
160-22	Engine	2019	1	0	AD	1,750
160-05	Tender	1991	0	0	R	110
Strathcona - Squad 4	Engine	2009	1	0	AA	1500
Strathcona - Tanker 4	Tender	2011	1	0	AA	1500
Total Engine/Reserve Credit			3.5(AD), 2 (AA), 0(OA)	0		
Credit Receivable			5	0		

The City of Fort Saskatchewan received **78%** credit for this grading item.

Fort Saskatchewan, AB

Figure 4 - Pumper Optimized Locations (98% Coverage)

Scale = 1:60,000 0 0.5 1 Km

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7.3. Ladder Service

Fire departments are evaluated for the number of ladder companies in service relative to the overall fire potential and the area being protected. Ladder apparatus are required to be adequately housed and staffed in order to receive full credit. Recognition and credit for ladders may be reduced or withheld based upon the measured reliability of the apparatus upon which they are installed (ex. factors such as age, listing, testing, etc.).

Fire apparatus that may serve dual purposes are evaluated based on the primary duty it serves on the fire scene. As previously stated, a ladder apparatus with a fire pump may be credited in one of two ways.

- 100 percent ladder credit as a ladder apparatus and 50 percent credit as an engine, or
- 100 percent credit as an engine apparatus and 50 percent credit as a ladder apparatus.

This all depends upon the number of apparatus a department has available and where credit should be distributed properly in the grading depending on the primary use of the fire apparatus.

Response to buildings that are 3 storeys or 10 m (35 ft) or more in height, or buildings that have a Required Fire Flow greater than 3,000 IGPM (227 L/s), or any combination of these criteria, should have a ladder company (Refer to APPENDIX D Requirements for Aerial Apparatus). The height of all buildings in the community, including those protected by automatic sprinklers, is considered when determining the number of needed ladder companies for Fire Insurance Grading.

Apparatus needs based on Basic Fire Flow:
The benchmark number of ladder companies that the COFS can receive credit for based on the Basic Fire Flow of 4,200 IGPM (19 000 L/min) is 1. Values are cross referenced with the Table of Effective Response. Again, further apparatus needs are determined based on distribution of resources to provide reasonable coverage within the District. Ideally between 90%-100% of properties (where ladder response is needed) should have a ladder apparatus response within first due response time which is derived from the RFF calculated for the property and referenced from Table 5.

Apparatus needs based on response facility locations:
Further apparatus needs are determined based on distribution of resources to provide reasonable coverage within the City. Ideally between 90%-100% of large properties (3 storeys or 10 m (35 ft) or more in height, or buildings that have a Required Fire Flow greater than 3,000 IGPM) should have a Ladder apparatus response within first due response times which are taken from Table 5. A GIS optimization analysis determines the number of facilities in the District needed to provide more than 90% coverage.

It can be seen in Figure 5 that 1 facility in Fort Saskatchewan could theoretically provide 85% coverage if placed as shown (properties considered for ladder coverage are also shown on the map). As such additional apparatus are not needed for distribution. The number of properties that would be covered by each facility are shown as labels. The actual current distribution of resources is assessed in section 7.4 of this report (Distribution of Companies).

Apparatus needs based on call volume:
Final apparatus needs are then based on the frequency of alarms for a fire company and total number of “Fire” calls annually. Where a Pumper company receives in excess of 2,500 calls per year, additional companies are needed. Call data was provided and is summarized in Table 2. No additional apparatus are needed based on the call volume.

Table 4 Credited In-Service Ladder Summary

Identifier	Apparatus Credit	Year	Ladder Credit	Reserve Ladder Credit	Duty Status	Pump Capacity (IGPM)
160-L1	Aerial	2009	1%	0%	AD	1500
Total Ladder/Reserve Credit			1(AD), 0(AA)	0		
Credit Receivable			1	0		

The City of Fort Saskatchewan received **88%** credit for this grading item.

Fort Saskatchewan, AB

Figure 5 - Ladder Optimized Location (85% Coverage)

Scale = 1:60,000 0 0.5 1 Km

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7.4. Distribution of Companies

7.4.1. Background

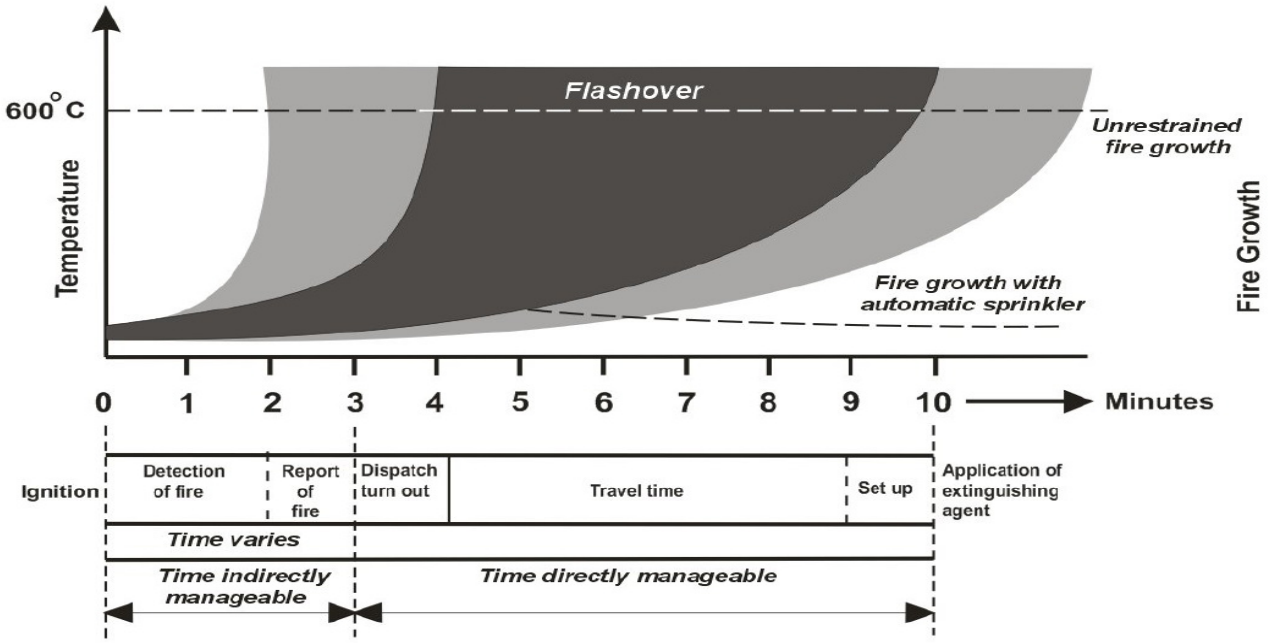
This item concerns the placement of companies, throughout the Fire Protection Area, when considering the ideal response times listed in Table 5 FUS - Table of Effective Response.

Within the Table of Effective Response the following are identified for each Required Fire Flow (RFF) (building):

- First due response – Initial number of companies within a specified time/distance depending on RFF value
- Second due response – Secondary number of companies within a specified time/distance depending on RFF value
- Total concentration response – Total number of companies within a specified time/distance depending on RFF value

The intent of fire department response is to arrive at a fire scene with the necessary resources before the point of flashover, see Figure 6. Beyond the point of flashover, it can become very difficult to combat a fire as fire growth increases exponentially as can be seen.

Figure 6 Fire Propagation Curve (source NFPA)



It can be seen from Figure 6 that in order for a fire department to arrive with the necessary resources at a specific point of fire growth would require knowledge/control of all aspects of two systems: the fire and the response. In both cases neither system is completely controllable and as such most response distances/times are based on empirical data and research from mutual agencies. Ideal response distances/times form the basis of fire hall location/apparatus distribution.

For response assessment within the Classification Standard for Public Fire Protection, the Table of Effective Response is used as the benchmark, see Table 4 FUS - Table of Effective Response. A single family dwelling structure can have an RFF value of 1100 IGPM. The benchmark response for 1100 IGPM is read from the Table of Effective Response (see Table 4) as follows:

- Initial response to alarms for Pumper companies is 2, i.e. 1 Pumper company in a first due response time of 4 minutes (same as NFPA 1710) and 1 Pumper company in a second due response time of 6 minutes.
- The total number of Pumper companies required is 2 in 6 minutes.
- In the case of 1100 IGPM (84 L/s) a Ladder company is required only if the building is 3 stories or greater.

Within the Classification Standard for Public Fire Protection individual property response is measured against these benchmarks with 100% credit being applied where the ideal distances/times are met.

7.4.2. Response Assessment Model

As road speed network data was not available for the District, response times were converted to response distance based on the following relationship (source The New York City - RAND Institute):

$$1.065d = \mathrm{t} - 0.65$$

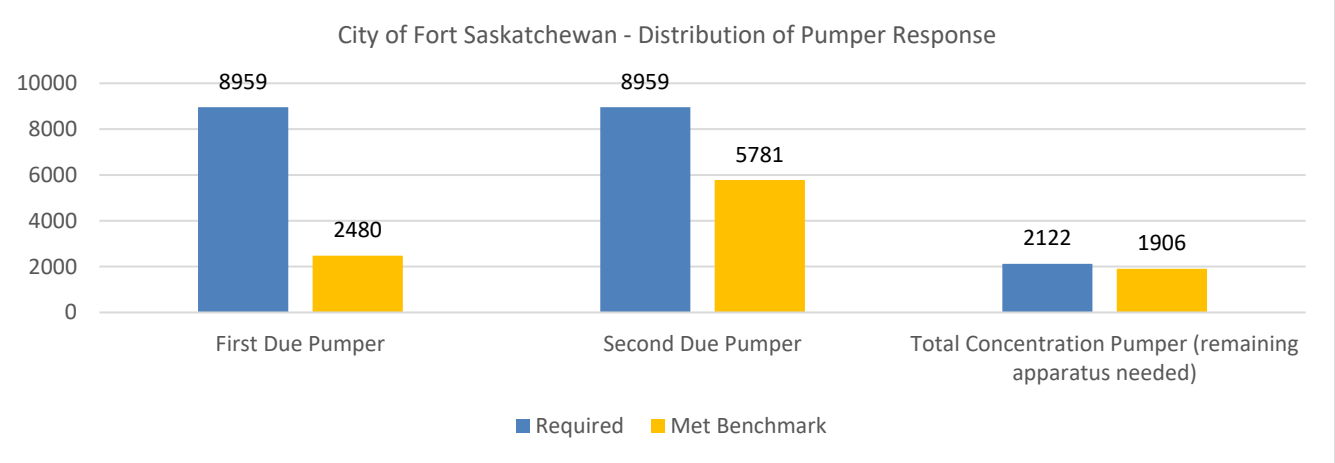
Where:

- d = distance (km)
- t = time (min)

GIS was used with municipal road network data to determine the response distances from each facility/apparatus to each RFF point.

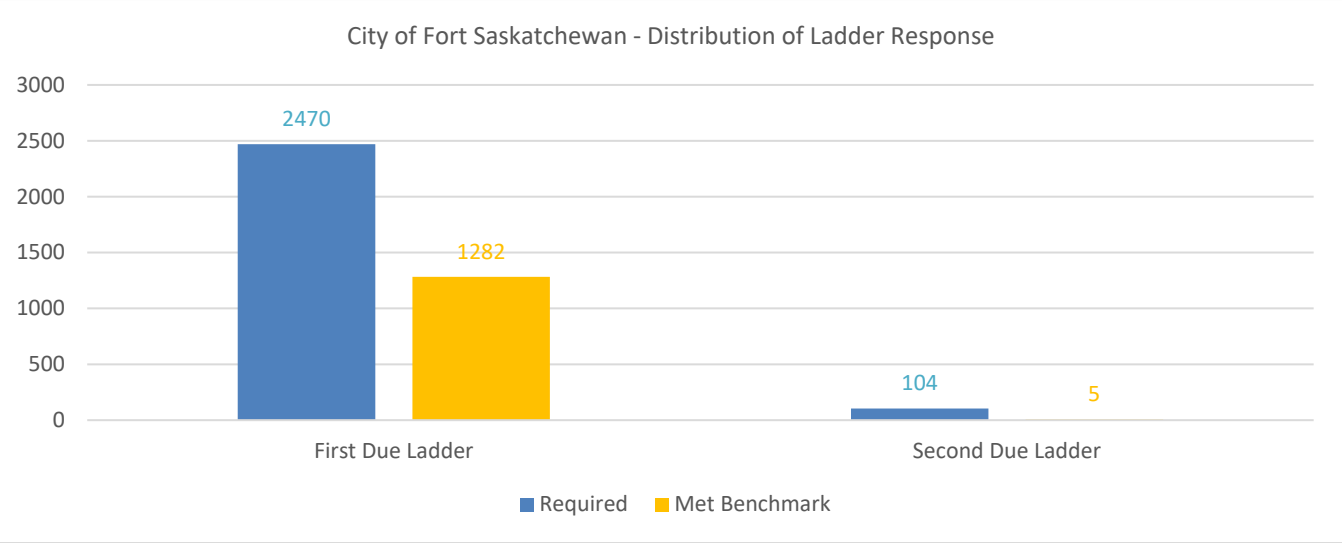
The results are summarized in Figure 7. In summary, 28% of RFF points lie within first due response distances. Percentage credit received for each RFF point is shown in Figure 12 (map). Figure 9 shows how well each RFF point met the benchmark Pumper response for all apparatus needed.

Figure 7 Pumper Response Credit



Ladder response results are summarized in Figure 8 and Figure 10. In summary, 66% of properties lie within first due ladder response distances.

Figure 8 Ladder Response Credit



The City of Fort Saskatchewan received **55%** credit for this grading item.

There is a notable gap in response to the southwest area of the City. Figure 9 shows a section of the Pumper Credit map (Figure 12). There is a cluster of properties that receive 0% pumper response credit: both in the west and the south. This is the area where the City is expanding and has recently annexed land for future growth.

Figure 9 Response to Southwest Area of the City

Figure 10 shows the limit of the PFPC Fire Insurance Grades for the City. Areas highlighted red indicate where PFPC 10 applies (complete Fire Insurance Grade maps provided in section 12 of this report). In some cases, the PFPC applied to a specific property beyond 5km may be adjusted if the property is sprinklered; however, this decision is outside of the Fire Underwriters Survey and would be made at the property level by an underwriter. Considering the current level of response to the area, and the future anticipated development, an additional Fire Hall should be considered to address the lack of response.

Figure 10 Limit of Application of PFPC Grades

Recommendation 1 Consider Additional Fire Hall in the Southwest of the City

The City should consider an additional fire hall in the in order to address the gap in response in the southwest portion of the community.

Table 5 FUS - Table of Effective Response

The following Table aids in the determination of Pumper and Ladder Company distribution and total members needed. It is based on availability within specified response travel times in accordance with the fire potential as determined by calculation of required fire flows, but requiring increases in availability for severe life hazard.

1 (a)	Very small buildings, widely detached buildings.	2	400	1	0	7.5	-	*9	1	7.5	*1	9
(b)	Scattered development (except where wood roof coverings).	3	600	1	0	6	-	*7.5	1	6	*1	7.5
2	Typical modern, 1 - 2 storey residential subdivision 3 - 6 m 10 - 20 ft. detached).	4-5	800-1,000	2	0	4	6	*6	2	6	*1	6
3 (a)	Close 3 - 4 storey residential and row housing, small mercantile and industrial.	6-9 10-13	1,200-2,000 2,200-2,800	2 2	1(if required by Hazards)	3.5 3.5	5 5	*4 *4	2 3	5 6	*1 *1	4 4
3 (b)	Seriously exposed tenements. Institutional. Shopping Centres Fairly large areas, fire loads, and exposures.	14-16 17-19	3,000-3,600 3,800-4,200	2 2	1 1	3.5 3.5	5 5	4 4	4 5	7 7	1 **1	4 4
4 (a)	Large combustible institutions, commercial buildings, multi-storey and with exposures.	20-23 24-27	4,400-5,000 5,200-60,00	2	1	2.5 2.5	4 4	3.5 3.5	6 7	7.5 7.5	2 2	5 5
4 (b)	High fire load warehouses and buildings like 4(a).	28-31 32-35	6200-6800 7000-7600	3	1	2.5 2.5	3.5 3.5	3.5 3.5	8 9	8 8	3 3	7 7
5	Severe hazards in large area buildings usually with major exposures. Large congested frame districts.	36-38 39-42 43-46	7,800-8,400 86,00-9,200 9,400-10,000	3	3	2 2 2	3.5 3.5 3.5	2.5 2.5 2.5	10 12 14	8 9 9	4 5 6	7.5 8 9

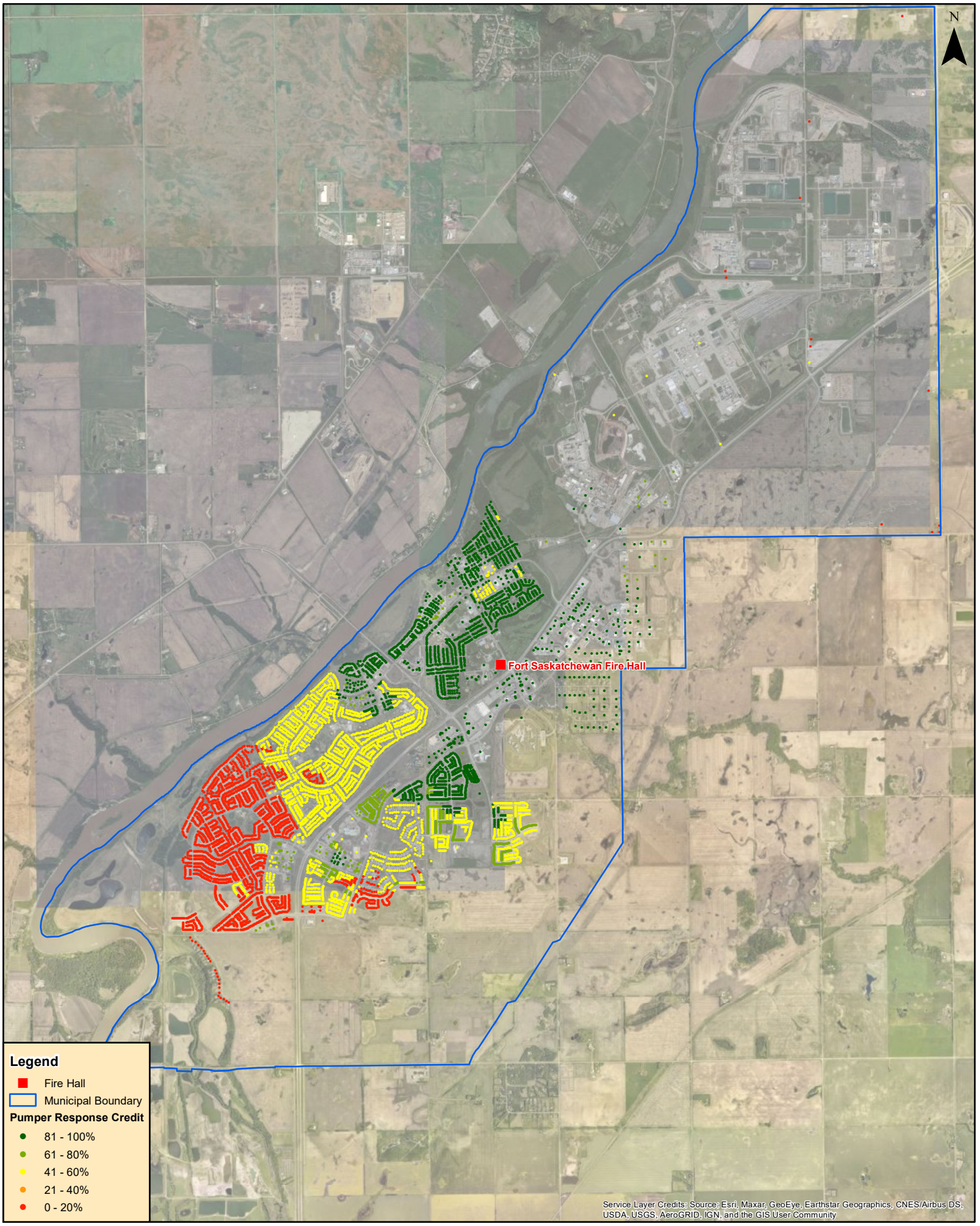
Notes to Table of Effective Response

* A ladder company is required here only when exceptional conditions apply, such as 3 storey heights, significant life hazards.

** For numerous or large single buildings over three stories use two ladder companies in 5 minutes.

When unsprinklered buildings over six stories have fire flow requirements less than Group 4, the number of Pumper and Ladder Companies under “Total Availability Needed” should be increased at least to the next group to provide the additional manpower required except where this additional manpower regularly responds in the time allotted, as occurs in some volunteer or composite fire departments.

The table gives travel times for apparatus AFTER dispatch and turn-out. Under very exceptional conditions affecting total response time, these nominal figures should be modified.



Fort Saskatchewan, AB

Figure 11 - Pumper Response Credit

Scale = 1:60,000 0 0.5 1 Km

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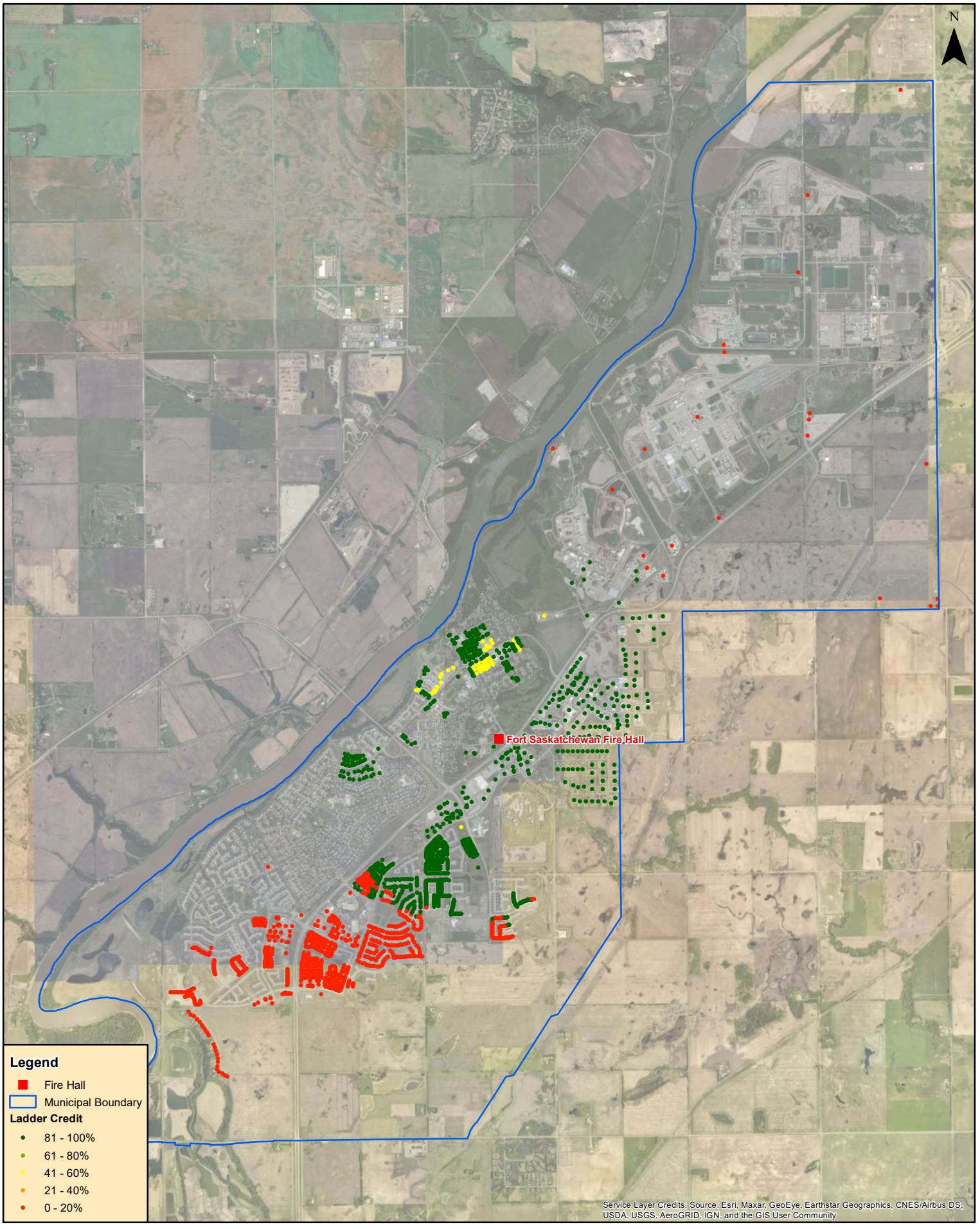

Fort Saskatchewan, AB

Figure 12 - Ladder Response Credit

Scale = 1:60,000 0 0.5 1 Km

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7.5. Engine and Ladder Pump Capacity

The Engine and Ladder Pump Capacity grading item refers to the capacity of credited, recognized pumps located on fire apparatus. Recognition and credit for pumps on fire apparatus may be reduced or withheld based upon the measured reliability of the pumps and the apparatus upon which they are installed (ex. factors such as age, listing, testing, etc.).

Fire apparatus that may serve dual purposes are evaluated based on the primary duty the apparatus serves on the fire scene (ladder or pump). As previously stated, a ladder apparatus with a fire pump may be credited in one of two ways.

- 100 percent credit as a ladder apparatus and 50 percent credit of the pump on the apparatus, or
- 100 percent for the pump on the ladder and 50 percent credit as a ladder apparatus.

This depends upon the number of apparatus a department has available and where credit should be distributed properly in the grading depending on the primary use of the fire apparatus.

Total credited Pumper capacity is summarized in Table 2.

The City of Fort Saskatchewan received **99%** credit for this grading item.

7.6. Design, Maintenance and Condition of Fire Apparatus

Maintaining a reliable fire apparatus fleet could well be the most important capital asset for any municipal fire department. Firefighters are heavily dependent on the performance of their fire apparatus to deliver emergency services to protect lives, property and the environment. The apparatus must be maintained in superior operating condition and perform at the highest levels of safety, availability, functionality and reliability to ensure that emergency services are provided in a timely and efficient manner. When adequate performance levels can no longer be assured, apparatus should be replaced without delay, where possible.

The public fire service is rather unique when compared to other emergency services due to the fact that fire department apparatus are not continuously in use. However, when in use, fire apparatus are subject to considerable mechanical stress due to the nature of their function. The types of mechanical stresses that present immeasurable wear and tear on apparatus include, but are not limited to the following:

- The nature of emergency responses,
- Repeated acceleration and braking,
- Frequent defensive driving manoeuvres,
- High engine speeds prior to sufficient engine warm-up,
- Excessive loads adding additional stresses (water weight and equipment), and
- Long term cumulative effects of emergency responses and extreme operating conditions resulting in reduced performance levels and fatigued mechanical components and assemblies.

Visual indications of the effects of mechanical stress do not always manifest themselves on the exterior of the apparatus; they are often effectively masked in most fire departments by a higher standard of aesthetic care and maintenance.

Fire Department apparatus should be of suitable design and well maintained for the emergency service that is to be performed. A breakdown en-route to, or on the fire ground could result in loss of life and greater damage to property. Maintenance facilities, quality of maintenance programs, qualifications of maintenance personnel, apparatus suitability and apparatus age are considered in this item.

Maintenance Facilities and Personnel

Regular maintenance on fire apparatus is conducted at the Fort Saskatchewan Fire Hall. Extensive repairs are completed at the Fort Saskatchewan Public Works facility. The Fire Hall mechanic is currently completing Emergency Vehicle Technician certification.

Engine and Ladder Testing

Engine and ladder service tests including but not limited to pump testing are valuable in assessing the effectiveness of the preventive maintenance program. Service tests of pumps and ladders on apparatus are generally conducted to show whether the equipment is working correctly. Annual pump performance testing is completed annually. Aerial testing is completed annually by a third party.

The City of Fort Saskatchewan preventive maintenance program includes a minor monthly inspection as well as an annual major inspection. The annual major inspection includes the Commercial Vehicle Inspection.

Pre-trip inspections are completed at the beginning of every shift. Any mechanical issues are reviewed daily by senior officers and by the fire hall mechanic, and subsequently prioritized. Records are kept in paper format. An annual report is completed and submitted to the Fire Chief.

Age, Obsolescence and Condition of Apparatus

As fire department apparatus age, numerous studies have confirmed that they tend to require maintenance and/or repair on a more frequent basis, thus increasing costs and decreasing their level of reliability. Increased frequencies of maintenance/repair result in more “out of service” time often leading to an increased reliance on reserve apparatus, which typically have been demoted to reserve status as a result of exceeding its front line response expectancy. Increased probability of apparatus and equipment breakdowns or failures can also negatively impact the fire department’s level of personnel safety and operational efficiency.

A lack of readily available replacement parts can also make long term use of the apparatus less economically feasible. Vehicle, pump and equipment manufacturers typically maintain a parts inventory for each model year for a finite period of time. After that period has passed the necessary replacement parts may be difficult to locate and/or obtain which can lead to increased “out of service” time or result in the apparatus being operated with deficiencies. Availability of replacement parts can be particularly problematic with fire department apparatus, largely due to the limited market and specialized nature of the individual components which in many cases must be re-built or custom fabricated. As previously mentioned, increased “out of service” time often results in an increased dependency on reserve apparatus which can further drive up maintenance/operating costs.

Obsolescence is another key factor related to aged fire department apparatus. Modern fire apparatus continually increase levels of safety, performance, functionality and reliability through the use of new technology, improved engineering practices and compliance with updated, recognized industry standards. Fire department apparatus

equipped with the latest operating capabilities and safety features will ensure that fire fighter operational efficiency is maximized and their risk to possible injuries is kept to a minimum.

Service life is considered to be the period of time in which a fire department apparatus can be maintained in superior operating condition and is capable of adequately, reliably and efficiently performing all of its originally designed functions and duties. There are a number of indicators that will enable fire service management and fleet managers to understand that a piece of apparatus may in fact be reaching the end of its serviceable life span. The majority of these indicators will likely be identified during regular maintenance or annual testing of apparatus such as:

- Decline in pump capacity,
- Degradation of braking systems (longer braking distances experienced),
- Decreased engine performance, reliability and acceleration,
- Structurally weakened chassis due to constant load bearing,
- Slower engine warm up times, and
- Engines operating at higher revolutions per minute (RPM).

The National Fire Protection Association (NFPA) standards do not specify a mandatory retirement age for fire apparatus mainly due to the number of individual factors that can affect the lifespan of any fire department apparatus. The NFPA does however recommend that fire apparatus older than fifteen (15) years, that have been properly maintained and that are still in serviceable condition, be shifted from first-line service and placed in reserve status (see *NFPA 1901 Annex D Guidelines for First-Line and Reserve Fire Apparatus*). The NFPA further recommends that any apparatus over twenty-five (25) years of age or those not conforming to applicable NFPA fire apparatus standards should be replaced.

FUS considers the age of fire department apparatus to be one of many important factors when conducting a Fire Insurance Grading evaluation. Within the Classification Standard for Public Fire Protection apparatus are credited based on age. The COFS has a population of 24,149 (2016) and as such follows a 20-year replacement cycle, see Appendix C.

The City of Fort Saskatchewan received **99%** credit for this grading item.

7.7. Number of Line Officers – Fire Suppression

The number of Chief Officers and Company Officer positions is reviewed and graded under this item. The number of Chief Officers and Company Officers required to receive maximum credit for this grading item is determined from the Basic Fire Flow and the resulting number of engine and ladder companies associated with the benchmark.

Chief Officers

For Fire Insurance Grading the maximum credit FSFD can receive for Chief Officers is 2. Full credit is received for each career Chief or career Deputy Chief on the department. An Auxiliary Chief or Auxiliary Deputy Chief is credited at 50 percent.

FSFD has a career Fire Chief and 4 Assistant Chief Officers. As such the total credit for Chief Officers is 5.

Company Officers

The number of Company Officers that FSFD can receive maximum credit for Fire Insurance Grading is determined by the total number of engine and ladder companies based on the Basic Fire Flow benchmark and an on duty shift factor. Credit can be received through a combination of career and auxiliary officers on the fire department. Full credit is received for each career officer on the department. Auxiliary officers are credited at 50 percent.

FSFD has 4 career officers and 4 Paid on Call officers.

The City of Fort Saskatchewan received **62%** credit for this grading item.

7.8. Total Fire Force Available

Under this grading item, a fire department is measured in its ability to meet the staffing requirements as determined by the Basic Fire Flow benchmark from the Table of Effective Response. For the grading of this item there should be at least six competent career Firefighters available and assigned to respond to fire for duty with each required engine and ladder company. The number of these Firefighters that should be on-duty with the apparatus of these companies at all times should be appropriate to the fire risk and fire incidence load.

For the purposes of Fire Insurance Grading, the maximum creditable number of career Firefighters per company is six (including officers). Therefore, the maximum credit that the FSFD can receive for this grading item is 36 career Firefighters based on 5 engine companies and 1 ladder companies.

The total maximum creditable number of Firefighters is based on the number of companies (total concentration) and the maximum creditable number of career Firefighters per company (four) per shift (including officers), available continuously year round (day and night) for Fire Insurance Grading.

Credit for available fire force may be received according to the:

- minimum career Firefighters on duty,
- minimum regular vol. and off shift response of career Firefighters on 1st alarms,
- police officer/fire fighter and ambulance attendant/fire fighter,
- minimum automatic aid response,
- minimum mutual aid response, and
- minimum response of off-shift career Firefighters on multiple alarms.

Note that probationary Firefighters (incomplete training) and junior Firefighters (under age) are not credited due to lack of active fire ground duties.

Minimum Career Firefighters on Duty

The minimum number of career Firefighters on duty is determined by reviewing the fire departments records. Records are reviewed to determine the number of Firefighters on duty as during normal vacation periods less average details and sick leaves, but not the absolute minimum that may occur only one or two days a year. This includes career company officers and Firefighters. For Fire Insurance Grading, career Firefighters on duty are equal to one Fire Fighter Equivalent Unit (FFEU).

FSFD are credited with 4 Firefighters (including Officer) which is equivalent to 4 FFEU.

Minimum regular vol. and off shift response of career Firefighters on first alarms

Fire departments having off duty career members or auxiliary members responding on first alarms may receive credit. Typically three off duty or auxiliary members responding on first alarm are considered as one FFEU for grading purposes. Consideration for credit is based on records being available indicating response statistics. If no records are kept of response, credit for FFEU is limited to one FFEU for each six off duty or auxiliary members claimed to respond.

FSFD are credited with 43 Firefighters (including Officers) which is equivalent to 7.17 FFEU.

Police and Ambulance Personnel

Fire Departments may receive credit within the grading of this item for police and ambulance personnel responding and performing fire ground duties. The amount of credit depends upon the extent to which they are available and are used for response to fire alarms. Records of response and training are reviewed to determine that amount of credit that can be received. Each ambulance attendant/fire fighter or police officer/fire fighter on duty in a radio equipped vehicle and responding on first alarm equals 0 FFEU.

Automatic Aid

Fire departments that have formal contracts for automatic aid response may receive credit for the personnel responding for this grading item. For personnel to be credited for automatic aid the responding fire department should be within 8 km in road travel distance to built-up areas of the community or municipality. Each career fire fighter from the responding fire department may be credited as one FFEU and each volunteer fire fighter from the responding fire department may be credited as 0.33 FFEU.

Strathcona are credited with 4 Firefighters which is equivalent to 4 FFEU. It should be noted that Aid credit is not considered in the same manner as FSFD staffing.

Mutual Aid

Fire departments that have formal contracts for mutual aid response may receive some credit for the personnel responding for this grading item. For personnel to be credited for mutual aid the responding fire department should be within 25 km of travel distance to built-up areas of the community or municipality. Each career fire fighter from the responding fire department may be credited as one FFEU and each volunteer fire fighter from the responding fire department may be credited as 0 FFEU.

Off shift Response on Multiple Alarms

Fire departments that have formal agreements for career members to respond off shift on multiple alarms may receive credit for members responding within this grading item. Career members responding on multiple alarms are credited on the basis of four off duty career members being equal to one FFEU. Auxiliary members are credited the same as on first alarm as 1/3 if statistical records of response are available or 1/6 if no records of response are available.

The City of Fort Saskatchewan received **70%** credit for this grading item.

7.9. Engine and Ladder Company Unit Manning

This grading item measures the company unit strength of on-duty paid personnel responding on in-service apparatus. A maximum manning of six can be credited for each in service engine and ladder company.

The number of members credited on-duty and on first alarm response determined from section 7.8 is used in the analysis of this grading item. The number of in-service engines and ladder apparatus is determined from sections 7.2 and 7.3.

The amount of credit received in this grading item is as follow:

Average Company Staffing	Credit
6 members	240
5 members	230
4 members	225
3 members	210
2 members	180
1 member	120
0 members	0

The FSFD received credit for 11.17 FFEU credited on-duty. The Fire Department has 3.5 apparatus credited in-service. Fort Saskatchewan Fire Department has an Average Company Staffing of 2.481. Amount of credit received is interpolated between the values indicated in the table above.

The City of Fort Saskatchewan received **94%** credit for this grading item.

7.10. Master and Special Stream Devices

This grading item considers the equipment Firefighters would use to be effective in combating large fires and fires in upper storeys or hard to reach locations. Equipment considered under this grading item are fixed and portable turrets, large spray nozzles, distributing nozzles, foam equipment, and elevated master stream devices.

Detailed inventories have been developed by FSFD to keep track of equipment stored on its fire apparatus; no further review was completed.

The City of Fort Saskatchewan received **100%** credit for this grading item.

7.11. Equipment for Engines and Ladder Apparatus, General

This grading item considers the general equipment for engine and ladder apparatus. Equipment includes, but is not limited to, rope, cutters, fire extinguishers, nozzles, first aid equipment, wrenches, generators, salvage tarps, etc.

Detailed inventories have been developed by FSFD to keep track of equipment stored on its fire apparatus; no further review was completed.

The City of Fort Saskatchewan received **100%** credit for this grading item.

7.12. Fire Hose

Fire hose used by the fire department should be distributed so that each engine company carries a minimum of at least 360 m (1,200 ft) of 65 mm (2 ½ in) (or larger), 180 m (600 ft) of 38 mm (1 ½ in), and 60 m (200 ft) of 25 mm (1 in) booster hose (or equivalent hose). A fire department should maintain a complete reload or spare hose at the Fire Hall. Maximum credit for this grading item is given if the fire department meets or exceeds the minimum hose totals. Larger hose may be credited in the place of smaller hose.

Detailed inventories have been developed by FSFD to keep track of equipment stored on its fire apparatus; no further review was completed.

The City of Fort Saskatchewan received **100%** credit for this grading item.

7.13. Condition of Fire Hose

This grading item reviews the condition and maintenance of the fire department's fire hose. Fire hose should be properly cared for. Fire hose failure on the fire ground can lead to injury or death of building occupants or to Firefighters, and result in unnecessary property damage. Suitable facilities should be provided for washing, drying, and storing of fire hose. Fire hose should be maintained in good condition and tested annually to at least 1,700 kPa (250 psi) pressure.

Testing Program and Age of Fire Hose

A portion of this grading item reviews the testing procedures and frequency of testing of the fire department fire hose. Fire hose should be maintained in accordance with NFPA 1962, *Standard for the Inspection, Care, and Use of Fire Hose, Couplings, and Nozzles and the Service Testing of Fire Hose,* recent edition.

FSFD has a hose maintenance program in place and adequate portable hose dry racking units are in place.

The City of Fort Saskatchewan received **100%** credit for this grading item.

7.14. Training and Qualifications

Fire Department training is commensurate with fire potential in the community or municipality which facilitates the effective handling of fires through provision of a competent force of personnel. The objective of this grading item is to measure qualifications of the members of the department through the results of the training programs, not simply the programs and facilities themselves. The training and qualifications grading item is separated into five areas for review.

Generally, facilities should be provided, sufficient in size and number and suitably equipped, for the proper instruction of all members. There should be a complete, uniform training program under the close supervision of a competent officer; the program should include the study and development of modern practices, including standard operational procedures. There should be a comprehensive schedule of regular classes and drills at the training facility and at fire Hall. Special classes for new members, officers, operators, and drivers should be held.

Quality of Basic Recruit Training

This portion of the grading item reviews the basic recruit training program used by the fire department including the probation period. Ideally a fire fighter should serve a probation period of up to one year in training status in which thorough training is provided in safe and efficient firefighting and the probationer is assessed in actual fire service performance.

Generally, training should produce, for most of the force, an all-round fire fighter/fire prevention inspector. This allows the firefighting force to complement the fire prevention staff in the total fire department objective. Recruit training should be separate from the routine drill program.

The Fort Saskatchewan Fire Department (FSFD) completes a cooperative hiring program. Currently there are no minimum qualifications needed for new recruit applications outside of a Class 5 driver's license.

New recruits go through a 6-month initial probation training program. The recruit training standards are NFPA 1001 level 1 & level 2 and NFPA 472(1072) Awareness & Operations status. After 6-mounths recruits may be moved to permanent part time status based on their leadership assessments.

Quality of On-going Drills and Training

This portion of the grading reviews a fire departments on-going drill and training program. Generally, a fire department training program should include practice evolutions, classroom work, firefighting, prevention and other areas, all to be contained in a department manual; as well as inter-company and building familiarization exercises. This program should be under the supervision of an officer in charge with developing, coordinating and evaluating the results.

The Fort Saskatchewan program administrators developed an annual training program that includes daily, monthly, semi-annual, and annual training schedules to enhance skills and ensure that Job Performance Requirements are regularly reviewed. This contributes to skills equivalency amongst all crew members.

Live fire training must be completed off-site and out of the community. As such Live fire training is not completed annually.

Qualifications of Officers

A portion of the grading item reviews the fire departments qualifications of line officers and promotion of its members. Within the Fire Insurance Grading, promotions should be carried out under a documented system

providing job related criteria for each rank for internal and lateral entry. Written and oral examinations, in-service training, programs directed toward particular job positions, and evaluation by superiors as well as training ground tests should be used for the selection of candidates for fire suppression officer positions. Career, on-call and auxiliary members of the same fire department should be trained to identical qualification levels. (NFPA Standards for Professional Qualifications, 1001, 1002, 1021, 1031 and 1041 are indicative of good practice.)

All Fort Saskatchewan Fire officers are trained up to NFPA 1021 certification levels. An ongoing online training program that includes in-house officer level Job Performance Requirement completion and tracking are in place.

Qualification of Specialists

A portion of the grading item reviews the specialized training and qualifications of members of the fire department. Training and education of members of the department on the job or by outside resources should provide personnel with the abilities to perform their manual rescue firefighting, firefighting or specialist functions effectively in a manner commensurate with the size of the fire department and the fire potential of the community or municipality, including pump and ladder operators, mechanics, communications and any other fire suppression specialized personnel.

Members of Fort Saskatchewan conducts specialist training that includes Driver Operator NFPA 1002, NFPA 1001 level 1&2and NFPA 472 certified Hazardous Material Operations level. Fire Prevention skills that includes NFPA 1031, 1035,1041 and NFPA 1033 certification.

Facilities for Training

Generally, facilities for drill and training should be readily available and include; necessary buildings or structures for ladder work; smoke and breathing apparatus training space; use of Pumpers and hose lines space; lecture space; and should be in keeping with the size of the fire department. Larger fire departments should have full training facilities capable of duplicating or simulating a variety of fire types and situations using real fires. Smaller departments may use provincial, regional or cooperative training facilities according to need. These should provide for a broad range of realistic training exercises. Training facilities should always work towards meeting the needs of the potential fires.

Fort Saskatchewan training takes place at the parking lot of the Fire Hall. Currently Fort Saskatchewan members need to leave the City to complete Live Fire training. The Fort Saskatchewan training facility includes open space to perform fire drill training, lecture room and smoke training room.

The City of Fort Saskatchewan received **81%** for this grading item.

Recommendation 2 Update Training Facility

Fort Saskatchewan Fire Department should work towards an updated training facility with adequately sized training grounds and equipped with various training needs to accommodate the demand for the levels of service provided.

7.15. Response to Alarms

An adequate initial response of apparatus and personnel upon receipt of an alarm of fire is essential to provide for prompt control of what is generally an escalating emergency. This is required to be pre-arranged in nature as far as possible to ensure reliability. Efficient advance plans should be made for developing a maximum concentration of forces including reserve apparatus and outside assistance for the largest fires. Response should be commensurate with the hazard of the location responded to, with due consideration for the likelihood of other simultaneous fires. Minimum responses to fires in buildings considered reasonable are set out in Table 5, which is based off the Table of Effective Response.

First Alarm Response to Commercial Districts

The Basic Fire Flow Benchmark of 4,200 IGPM (16 000 L/min) is used to determine the response on first alarm to commercial districts. From Table 5 the initial response is 2 Pumpers and 1 ladder. FSFD sends this initial response to structure fire calls using Automatic Aid.

First Alarms Response to Residential Districts

An average required fire flow for residential districts was determined and used for the first alarm response for residential districts. An average required fire flow of 1,600 IGPM (121 L/s) was determined. Again, from Table 5, the initial response is 2 Pumpers and 1 ladder. FSFD sends this initial response to structure fire calls using Automatic Aid.

Suitable Pre-arranged responses (Running Cards)

When a fire department requires the response of more than three engine companies determined by the Basic Fire Flow Benchmark, pre-arranged responses (running cards) are reviewed.

Generally, running cards should set fourth assignments of specific companies to respond to locations throughout the community or municipality on first and succeeding alarms, even though specific assistance is frequently specified by the officer requesting it. Running cards should call for relocation of companies on second alarms and succeeding alarms may be necessary for the purpose of equalizing depleted coverage of the community or municipality during large fires.

FSFD has detailed response guidelines in place as shown in Chapter 4 of the Standard Operational Guidelines. The guidelines were created through critical tasking which was used in developing the Fort Saskatchewan Fire Department Service Level Policy.

Table 6 Initial Response to Alarms of Fire

Group	General Description Examples	Fire Flow		Response to First Alarm		Add for Severe Life Hazard: Engine, Ladder or Rescue Company, at Least
		L/min x 1000	Approx. Igpm range	Engine Companies	Ladder Companies	
1 (a)	Minor fires not in buildings, very small buildings, widely detached	1	200	1		
		2	400			
1 (b)	Scattered development (except wood covered roofs)	3	600	1		

2	Typical modern, 1-2 storey residential subdivision, 3-6 m (10-20 ft.) detached.	4-5	800 - 1,000	2		
3 (a)	Close 3-4 storey residential & row housing, small mercantile and industrial	6-13	1,200 - 2,800	2	1 (if required by hazards)	
3 (b)	Seriously exposed tenements. Institutional. Shopping Centres. Fairly large areas & fire loads, exposures.	14-19	3,000 - 4,200	2	1	1
4 (a)	Large combustible institutions, commercial buildings, multi-storey and with exposures.	20-27	4,400 - 6,000	2	1	1
4 (b)	High fire load warehouses and buildings like 4 (a).	28-35	6,200 - 7,600	3	1	1
5	Severe hazards in large area buildings usually with major exposures. Large congested frame districts.	36-46	7,800 - 10,000	3	2	1

Suitable Covering-in and 2nd Alarm Responses

When a fire department requires the response of more than three engine companies determined by the Basic Fire Flow Benchmark, the means of which a fire department has capacity to provide cover-in and 2nd alarm response is reviewed. If 4 apparatus are committed to a structure call the mutual aid agreement in place with surrounding municipalities would need to be used.

The City of Fort Saskatchewan received **96%** credit for this grading item.

7.16. Fire Ground Operations

Good results at the fire scene depend on the use of effective and efficient fire suppression methods and standard operating procedures, involving the laying of 65 mm (2 ½ inch) or larger hose lines, connecting Pumpers to hydrants, connecting to and supplying sprinkler and standpipe systems in buildings so equipped, and the efficient use of breathing equipment and tools and other devices as may be called for by the conditions encountered.

FSFD has a detailed list of Standard Operating Guidelines. These are regularly updated as needed.

Initial Available Fire Force Response to Commercial Districts

This portion of the grading item reviews staffing availability to provide initial response. The initial available fire force relies on aid response for structure fire calls.

The City of Fort Saskatchewan received **87%** credit for this grading item.

7.17. Special Protection Required

Some municipalities have particular fire hazards within areas they protect requiring specialized apparatus or equipment which should be provided either by the fire department, individual property owners, or both together. These hazards, including waterfront port and marina facilities, large petrochemical installations or brush and grass fire potentials should be provided for.

The previous Fire Underwriters Survey study noted the following:

"Fort Saskatchewan Fire Department provides primary/secondary response to various industrial facilities in the community. Site specific emergency response plans are in place for some of the facilities; however, due to the size of the plans it is difficult for the fire department to have good knowledge of scenarios. The City of Fort Saskatchewan will rely on industrial facility contacts to maintain incident command and direct the fire department during a fire scenario. It is unclear if the Fort Saskatchewan Fire Department has a clear understanding of industry expectations during an event and if these expectations are reasonable or whether further gap analysis is needed. It does not appear that the Fort Saskatchewan Fire Department has reviewed a building risk assessment/credible scenarios for the facilities requiring response whether it is primary or secondary. There does not appear to be a memorandum of understanding in place between the facility owners and the fire department. As already discussed various members of the fire department are trained to NFPA 1081 and various members work at the industrial facilities."

During this survey the Fire Department clarified that they will rely on the industrial facility for incident command and direction at a fire call to the industrial area. As the industrial facilities have not identified any specific apparatus/equipment needs for FSFD response, there is no special protection required under this item.

The City of Fort Saskatchewan received **100%** credit for this grading item.

7.18. Miscellaneous Factors and Conditions

Records (For Effective Operations, Planning)
Suitable records of fires, fire operations, personnel, training, fire hose and other essential matters should be kept. Records should be maintained as they are essential to effective and responsible management of a fire department. Daily, monthly, and annual reports are useful management tools for the Fire Chief.

Generally, records of fires, training, tests, attendance and activities in the department should be developed to aid in planning future activity and policy as well as the assessment of performance. Good records of performance evaluations, work record and training should be maintained for each member.

Records related to training and personnel are maintained in a record management system/database. Apparatus maintenance and testing records are largely paper based. Pumper test records were provided. Ladder test records were also provided for review. Equipment inventories were provided. An annual report is also completed.

Fire Hall (Suitability)

All Halls should be of substantial construction, suitable for the service, and located and arranged for ease and quickness of response. Proper safeguards against internal hazards should be provided. Construction of fire Halls should be substantial, non-combustible, preferably fire resistive and protected from exposures, with internal and external hazards minimized. Halls should be equipped with adequate heating and lighting with consideration of the need to dry or thaw wet or frozen equipment and perform maintenance on apparatus.

Apparatus Refueling

Generally, fuel should be available in sufficient quantities at convenient points within the community or municipality. Suitable arrangements should be made for delivery of fuel to apparatus at fires of long duration. Fuel is available 24/7 for the FSFD.

Response Delays (Exceptional)

Every fire department may have delays in response for personnel or when on route to an emergency. The possibility of delays due to poor condition of roads, including inadequate snow removal and sanding, steep grades, vehicle parking, traffic, railroad crossing, and other similar features should be considered.

The City of Fort Saskatchewan received **95%** credit for this grading item.

7.19. Pre-Incident Planning

Pre-incident planning is one of the most effective tools a fire department has in controlling or reducing the damage caused by fire, and identifying potential hazards or unsafe conditions at an emergency. Planning for fires in industrial and commercial occupancies increases the confidence and ability of the fire department in handling the fires and reduces the risk to the life safety of the Firefighters involved.

This grading item reviews the fire departments pre-incident planning program. Review of this grading item looks at the pre-incident plan inspection program, preparation of plans, quality of data, and the use of pre-incident plans in training.

Preplans are not maintained and or created by the department members on an annual basis due to the number of prevention staff. There are a limited number of pre-plans accessible through the active 911 application.

The City of Fort Saskatchewan received **54%** credit in this grading item.

Recommendation 3 Implement pre-plans in accordance with NFPA 1620 and make them available digitally

Comprehensive pre-incident plans should be developed for all commercial, institutional, industrial and multi-family residential occupancies. These pre-incident plans should be part of training evolutions, desk top exercises and partnership training with large industrial sites which may have some resources (ex. private fire brigades).

Pre-incident plans should ideally be created according to NFPA 1620, Standard for Pre-Incident Planning and updated as needed. Pre-incident response plans should be regularly updated through site visits, communication with facilities and drill operations. Regular site visits and updating are important during course of construction. All pre-plans should be made available digitally and updated from a centrally hosted server.

7.20. Administration

Fire departments should be administrated and managed by qualified and progressive leadership with adequate authority to carry out its mandate. Adequate procedures should be established to govern the administration and operation of the organization. The fire department should be organized with appropriate staff for routine management and operational firefighting and emergency command. The FSFD is organized with career administration and staffing to manage the operations of fire suppression, training, and fire prevention. The Department is well managed.

The City of Fort Saskatchewan received **100%** credit in this grading item.

8. PFPC - FIRE SAFETY CONTROL ASSESSMENT

8.1. Fire Safety Control Grading Items

The sections below cover the four grading items that pertain to Fire Safety Control. Twenty percent of the Public Fire Protection Classification for the FSFD comes from the grading of Fire Safety Control. Fire Safety Control has become an increasingly heavily weighted portion of the Fire Insurance Grading system.

A substantial degree of safety to life and protection of property from fire should be provided by provincial and municipal control of hazards. Control can be best accomplished by the adoption and enforcement of appropriate codes and standards for manufacture, storage, and use of hazardous materials and for building construction, as well as through training, advisory and education programs for the public.

This grading item reviews the general fire prevention, inspection and investigation activities of the fire department. Generally, the official in charge of fire prevention activities, in cooperation with the chief of the fire department, should establish an inspection procedure for correction of: obstructions to exits which interfere with emergency egress or with fire department operations; inadequate or defective automatic or other fire alarm/fire extinguishing equipment; or conditions in buildings or other structures which create a severe life hazard potential. Provisions should be made for the investigation of fires.

The fire prevention program should include visiting and inspection of dwellings on an occupant voluntary basis and the continuous education of the public. The fire department should maintain a highly visible profile in enforcement, education, training, and advisory services.

The recent publication of NFPA 1730 – Standard on Organization and Deployment of Fire Prevention Inspection and Code Enforcement, Plan Review, Investigation, and Public Education Operations to the Public shows clear recognition of the importance and effectiveness of fire prevention programs. The document references the “Tri-Data” reports and largely follows the methods developed in other prevention proactive countries. From the Tri-Data report Global Concepts in Residential Fire Safety:

“Of all the best practices identified in this study, one stands out. To reduce fire causalities in the home, the British fire service is visiting large numbers of high-risk households to do fire safety inspections and risk reductions, especially to ensure they have a working smoke detector. This approach has required a major change in the culture and mission of the British fire service. It should be adapted for use in the United States. The approach is thought by the British to be a major factor in the 40 percent drop in fire deaths in the United Kingdom over the last 15 years, and it probably could have a large impact in the United States and other nations as well.”

While each community will have their own risks and reduction programs, prevention will be more and more viewed as a frontline service and not a support service.

8.2. Fire Prevention – General Program

Overview and Mandate

The Fort Saskatchewan Fire Prevention Division does not have a dedicated Fire Prevention Officer. The division responsibilities are handled by the crew on shift. The delegates are responsible for:

- AB Fire & Building code prevention inspections.
- Plan review, fire safety planning oversight, business license applications.
- Fire investigation & fire investigation reporting.
- Public education; school programs, seniors, businesses, residents.

The minimum qualifications for the SCO's are Group B Level 1 Inspector & Investigator.

Members performing Prevention duties also have a duty to respond to fire calls. As such regular inspections can get lesser priority. The Department has identified a frequency of inspections based on the Building Code Occupancy Classifications; however, the Department appears to lack the resources to meet this frequency.

Target Hazard Priority Program

An official community risk assessment, specific to prevention, has not been completed. The community is described as affluent with many retired seniors and professional/academic families. The municipality is comprised of mostly high-end retail shops, restaurants and cafes. The Division notes the greatest risk is senior safety in apartment/condominium buildings.

The Department has outlined a frequency of inspections in their Quality Management Plan, see table 7. A total of 694 buildings have been identified for inspection.

Table 7 Inspection Frequency

Building Code Occupancy Classification	Inspection Frequency
A1 – Assembly occupancies	Annually
A2 – Assembly occupancies	Annually
A3 – Assembly occupancies	Every two years
A4 – Assembly occupancies	Every two years
B1 – Detention occupancies	Annually
B2 – Treatment occupancies	Annually
B3 – Care occupancies	Annually
C – Residential occupancies	Every two years
D – Business and personal services occupancies	Every two years
E – Mercantile occupancies	Every two years
F1 – High-hazard Industrial occupancies	Annually
F2 – Medium-hazard Industrial occupancies	Annually
F3 – Low-hazard Industrial occupancies	Annually

100 inspections were completed in 2019. The FSFD currently does not have the capacity to meet the frequency of inspections. Although the FSFD has access to a records management system the inspection records are not entered into the system.

Recommendation 4 Complete Community Risk Assessment and Risk Reduction Plan

A Community Risk Assessment (CRA) should be complete for the City of Fort Saskatchewan as per NFPA 1730 – Standard on Organization and Deployment of Fire Prevention Inspection and Code Enforcement, Plan Review, Investigation, and Public Education Operations. The CRA should be a formally documented process and include the following profiles:

- Demographics
- Geographic overview
- Building Stock
- Fire Experience
- Responses
- Hazards

- Economic Profile

The CRA should be reviewed at periodically to ensure that it continues to meet the needs of the community. Stakeholders outside of the Fire Department should be consulted especially considering the economic profile of the community. The CRA should lead to a formal Community Risk Reduction (CRR) plan that will then inform on development of inspection prioritization as well public education programming and targeting.

It is recommended that NFPA 1730 be used as a reference document for developing a prevention division that meets the needs of the City of Fort Saskatchewan.

Recommendation 5 Acquire Additional Staff as Needed to Meet Frequency of Inspections

Dedicated staff should be acquired to meet lead prevention division and meet the frequency of inspections. This should be a dedicated prevention role without a duty to respond to calls. For maximum credit these positions should be trained to NFPA 1031, Standard for Professional Qualifications for Fire Inspector and Plan Examiner (as well as other required safety codes certifications) and ideally have an industrial background.

Recommendation 6 Inspection Records should be stored in a Records Management System

FSFD currently has access to a records management system; however, inspections are scheduled using spreadsheet software. Ideally, inspection records should be stored in a records management system for inspections scheduling and re-inspection.

Cooperation with Building Department

The Division is well integrated into the building process from initial review through to final inspection. Through municipal business licensing all businesses are inspected, and business owners are entered into the records management system properties profile. All occupancies are continually updated regarding renovations, life safety upgrades, change of occupancy use. There is good cooperation between the Building Department and the Fire Department.

Public Education

Public Education is currently a shared responsibility of 4 response crews. Public Education activities are not tracked in hours or number of attendees. The current Public Educational program consist of:

- School visits
- Preschool presentations
- Station tours
- And Fire prevention week activities

Recommendation 7 Develop and Implement Public Education Programs

The Public Education Program should be developed to meet the needs of the community. The Community Risk Reduction (CRR) plan should be used to guide and develop education activities. Personnel should be qualified to both provide as well as evaluate the program and report on how the programs meet the needs of the CRR.

The Division should partner with other private, public, or nonprofit organizations as appropriate to develop new programs or revise exiting programs based on the CRA.

Again, NFPA 1730 should be used as a reference document for developing public education programs as part of the overall City CRR program.

Qualifications
Fire Crews complete an in-house crew inspection program in addition to NFPA 1001, 1035 and 1041.

Dwelling Visits
Home safety inspections would be provided on request. The program is not promoted.

The COFS received **53%** for this grading item.

8.3. Fire Safety Laws and Enforcement

This grading item reviews the fire safety laws in use and the enforcement of those laws within a community or municipality. Adequate laws or ordinances should be enacted to properly regulate the manufacture, storage, transportation and use of hazardous liquids, gases, and other combustible materials, including the handling of combustible waste, and to properly control building construction and electrical, heating, and ventilating installations. The National Fire and Building Codes of Canada and the Canadian Electrical Codes are accepted as the minimum standard regulation.

Generally, for enforcement purposes, inspections shall be made by personnel having specialized knowledge of special hazards by fire company members. Inspections should be made as frequently as may be necessary for the proper enforcement of fire prevention regulations.

Proper records of permits (licenses if required by local regulation), inspections, violations and their correction, and of all other important matters should be kept and analyzed.

The AB Fire Code is used in the FSFD and enforced through City of Fort Saskatchewan Fire Prevention Division. 100 inspections were completed in 2019 based on the frequency for inspections.

The COFS received **38%** for this grading item.

8.4. Building Construction Laws and Enforcement

This grading item reviews the building construction laws in use and the enforcement of those laws within a community or municipality. An adequate building construction code and enforcement program should be provided in the municipality, using a code equal to or better than the National Building Code of Canada.

Automatic fire protection sprinklers are installed in some buildings throughout the City of Fort Saskatchewan; however, automatic sprinkler protection systems are typically only installed where required by the AB Building Code. The AB Building Code is a minimum standard and does not require sprinkler systems to be installed in many

occupancies that contain high occupant densities and increased life safety risks. Additionally, the AB Building Code does not require pre-existing buildings to be brought up to meet current code requirements.

Sprinkler protection (when designed and installed in accordance with NFPA 13 and maintained in accordance with NFPA 25) is widely accepted as one of the most effective methods of reducing fire risk in buildings and communities. Statistically properly designed, installed and maintained sprinkler systems have been shown to reduce fire losses significantly and reduce the number of lives lost to fire.

The COFS received **76%** for this grading item.

8.5. Electrical Code and Inspections

This grading item reviews the extent of electrical code inspections and enforcement. An electrical code should be applicable and equivalent to the Canadian Electrical Code and be enforced by an inspection and permits program.

The COFS received **86%** for this grading item.

9. PFPC - FIRE SERVICE COMMUNICATIONS ASSESSMENT

9.1. Fire Service Communications Grading

Ten percent of the Public Fire Protection Classification of the COFS comes from the grading of Fire Service Communications.

This grading item reviews the facility used for emergency communications. Equipment for the receipt and transmission of alarms should be housed securely and be protected against fire or damage from other sources, including flooding, vandalism, and earthquakes. Emergency communication centres should be of non-combustible construction with one- to three- hour protection from exposures depending on complexity of the installation. Most importantly, there should be protection from ignition sources and rapid initial fire spread through control of such sources as flammable furnishings and building finish materials.

The facilities could not be visited during this review; however, details were provided through a questionnaire. Previously the facilities were last visited in 2012.

The initial 911 call is received at the Strathcona County Emergency Communications Centre. The building is sprinklered and has a secondary power source which is tested monthly. There is a secondary PSAP (Public Safety Answering Point) available. Call processing time targets mean that calls must be answered within 15 seconds 95% of the time. Telus provides provincial 911 service calls answer statistics monthly and reported that 97.5% of calls met these times. 96.3% of calls are transfers to dispatch within 60 seconds.

Dispatch is also handled at the Strathcona County Emergency Communications Centre. 88.9% of calls are dispatched within 60 seconds.

Item score breakdowns are not provided in this section (see section 11).

The COFS received **a Relative Class 1** (1-10 scale with 1 being the best) in this grading area.

10. WATER SUPPLY ASSESSMENT

10.1. Water Supply Grading Items

Thirty percent of the Public Fire Protection Classification of the City of Fort Saskatchewan comes from the grading of the Water Supply.

An adequate and reliable water supply is an essential part of the firefighting facilities of a community or municipality. A water supply is considered to be adequate if it can deliver the Basic Fire Flow for the appropriate duration while simultaneously providing domestic water supply at the max day demand; if this delivery is possible under certain emergency or unusual conditions, the water supply is also considered to be reliable.

In most municipalities, due to structural conditions in some areas, the possibility exists that a combination of unfavourable factors, such as the delayed receipt of an alarm of fire, high winds, or an explosion, will result in a fire becoming large enough to tax the ability of the fire service to confine the fire using the normally available water supply.

If, at the same time, the water supply is lacking or is considerably curtailed due to the failure of essential equipment (reliability); any fire, even if relatively small upon the arrival of the fire department, could rapidly expand and extend to adjoining buildings, becoming a conflagration.

In order to provide reliability, duplication of some or all parts of a water supply system is important, the need for duplication being dependent upon the extent to which the various parts may reasonably be expected to be out of service as a result of maintenance and repair work, emergencies, or some unusual condition. The introduction of storage, either as part of the supply works or on the distribution system, may partially or completely offset the need for duplicating various parts of the system; the value of the storage depends upon its amount, location and availability.

Gravity Systems and Pumping Systems

Gravity systems delivering supply from the source directly to the community or municipality without the use of pumps is advantageous from a fire protection standpoint because of its reliability, but the reliability of a pumping system can be developed to such a high degree through redundancies and back-up power supplies that no distinction is made between the two types.

Storage

In general, storage reduces the requirements of those parts of the system through which supply has already passed. Since storage usually fluctuates, the total normal daily minimum maintained or 80 percent of capacity is the amount that is considered as available.

Pump Capacities

As part of the grading analysis of pumps for Fire Insurance Grading the capacities of pumps are de-rated by 25 percent to factor in age and reliability.

10.2. System Description

The City of Fort Saskatchewan Water Distribution System Master Plan, completed by Associated Engineering April 2009, was used as a reference for system details and description as well as further details provided by City of Fort Saskatchewan Engineering.

Water is supplied to the City of Fort Saskatchewan by the Capital Region Northeast Water Services Commission (CRNWSC) from 2 sources: one source is from the City of Edmonton and the second is from Strathcona County. These 2 supply lines combine into one prior to entering the main reservoir. Water is then pumped into the distribution system and fills the elevated water tank and the Westpark reservoir. In 2014 an additional supply line as added from the (CRNWSC).

Water systems at the industrial sites were not considered as part of this grade update.

10.2.1. Main Pumphouse and Reservoir (M-PR)

The main reservoir has a capacity of 13,640 m^3 (3,000,377 Imp gal.). The pumphouse has 2 distribution pumps (P-2 and P-3) and one standby pump (P-1):

- Electric motor driven service pump P-2 is rated at 94.7 L/s (1250IGPM)
- Electric motor driven service pump P-3 is rated at 94.7 L/s (1250IGPM)
- Diesel engine driven standby pump P-1 is rated at 189.4 L/s (2500IGPM)

10.2.2. Westpark Pumphouse and Reservoir (WP-PR)

The Westpark reservoir has a capacity of 5,000 m^3 (1,099,845 Imp gal.). The pumphouse has 2 distribution pumps (P-10 and P-11) and one fire pump (P-12).

- Electric motor driven service pump P-10 is rated at 50.5 L/s (667IGPM)
- Electric motor driven service pump P-11 is rated at 50.5 L/s (667IGPM)
- Diesel engine driven fire pump P-12 is rated at 303 L/s (4000IGPM)

10.2.3. Elevated Storage Tank

The Tower storage tank has a capacity of 946 m^3 (208090 Imp gal.). The tank has a 250mm inlet and outlet pipe.

10.2.4. Domestic Demand

The Master Plan provided an average day domestic demand of 360 L/c/d (Litres per capita per day). The population of the City of Fort Saskatchewan in 2016 is 24,149. The maximum day demand factor used in this update is 1.68

Item score breakdowns are not provided in this section (see section 11).

The COFS received **a Relative Class 2** (1-10 scale with 1 being the best) in this grading area.

The Fire Department asked for comment on private hydrant maintenance related to the application of Fire Insurance Grades. Insurers search for the applicable Grade for an address using the Fire Insurance Grading Index (https://www1.optaintel.ca/FUSPortal/Account/Login.aspx). When there is a noted private hydrant protecting the property the following displays:

> *"This property is protected by **private hydrants**, however these hydrants are connected to a **recognized public water system**. Insurers should take steps to ensure that the hydrants are maintained in accordance with NFPA 25: Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems (current edition). If the hydrants are maintained in accordance with the Standard then they should be considered as recognized private hydrants. Note: the property owner is responsible for maintaining the hydrants and should be able to provide maintenance records. Hydrants that are not maintained should not be considered as recognized."*

In this case we are explaining to the user that the water system operator (the City of Fort Saskatchewan in this case) is not responsible for maintenance. The decision to accept/not accept the hydrant is left to the insurer. The City asked whether taking ownership of these hydrants and maintenance would affect this. Naturally, if the City was to assume ownership of hydrants and maintenance then this would be noted in the Grading Index and the above search message would not appear.

11. FIRE INSURANCE GRADING

Fire insurance grades are calculated as a single point in time measurement of fire risk and fire protection. The measurement is intended to be representative of the normal level of fire risk and fire protection resources in a community or a municipality at some given point in time and is considered from the perspective of property protection.

The fire insurance grades have been calculated for the COFS in 2020 based on information acquired throughout the field survey and described in this report.

11.1. PFPC - Fire Insurance Grading Areas

To determine the final fire insurance grades, four separate relative classifications (with differing weights) have been determined:

- Fire Department (40%)
- Water Supplies (30%)
- Fire Prevention and Safety Control (20%)
- Emergency Communications (10%)

Each of these areas is further broken down and scored in a number of separate items with differing weights based on the importance of the item with respect to control of losses.

11.2. Fire Department Assessment within the Fire Insurance Grading

Fire Department contributes 40 percent of the overall grade in the calculation of Public Fire Protection Classification. Relative classifications are based on a 1 to 10 scale with 1 being the highest level.

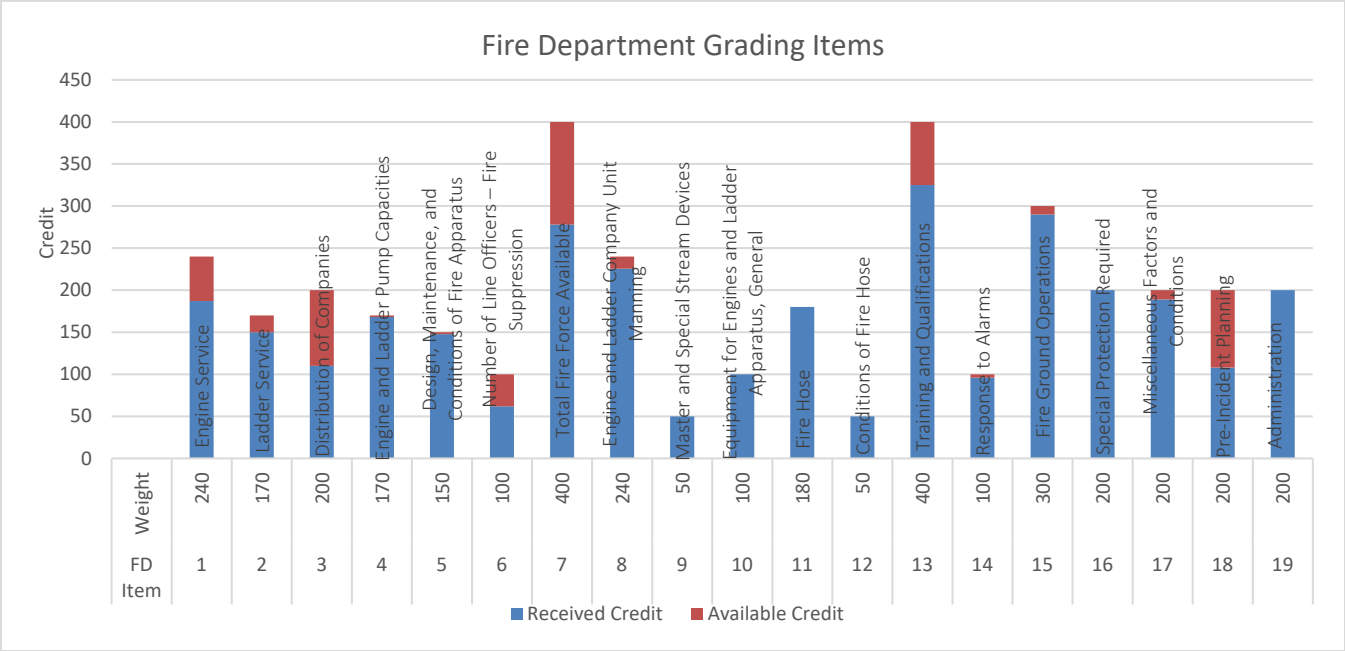
Results are shown in Table 8 and Figure 11.

Table 8 COFS Fire Department Grading Items Overall Summary

Grading Item	Category	Credit Received	Maximum Credit	% of FD	% of All
FD-1	Engine Service	187	240	2.05%	2.63%
FD-2	Ladder Truck Service	150	170	1.64%	1.86%
FD-3	Distribution of Companies and Type of Apparatus	110	200	1.26%	2.19%
FD-4	Pumper Capacity	168	170	1.84%	1.86%
FD-5	Design, Maintenance and Condition of Apparatus	148	150	1.62%	1.64%
FD-6	Number of Line Officers – Fire Suppression	62	100	0.67%	1.10%
FD-7	Total Fire Force Available	278	400	2.45%	4.38%
FD-8	Pumper and Ladder Company Unit Manning	226	240	2.14%	2.63%
FD-9	Master and Special Stream Devices	50	50	0.55%	0.55%
FD-10	Equipment for Pumpers and Ladder Trucks, General	100	100	1.10%	1.10%
FD-11	Hose	180	180	1.97%	1.97%
FD-12	Condition of Hose	50	50	0.55%	0.55%
FD-13	Training and Qualifications	325	400	3.56%	4.38%

FD-14	Response to Alarms	96	100	1.05%	1.10%
FD-15	Fire Ground Operations	290	300	2.84%	3.29%
FD-16	Special Protection Required	200	200	2.19%	2.19%
FD-17	Miscellaneous Factors and Conditions	189	200	2.07%	2.19%
FD-18	Pre-Fire Planning	108	200	1.18%	2.19%
FD-19	Administration	200	200	2.19%	2.19%
Weight in Grading	40			Credit Received	28.14
Relative Classification 3					

Figure 13 Fire Department Grading Items Overall Summary



The relative classification of the COFS Fire Department portion is 3.

11.3. Water Supplies within the Fire Insurance Grading

Water Supply contributes 30 percent of the overall grade in the calculation of the Public Fire Protection Classification. Relative classifications are based on a 1 to 10 scale with 1 being the highest level.

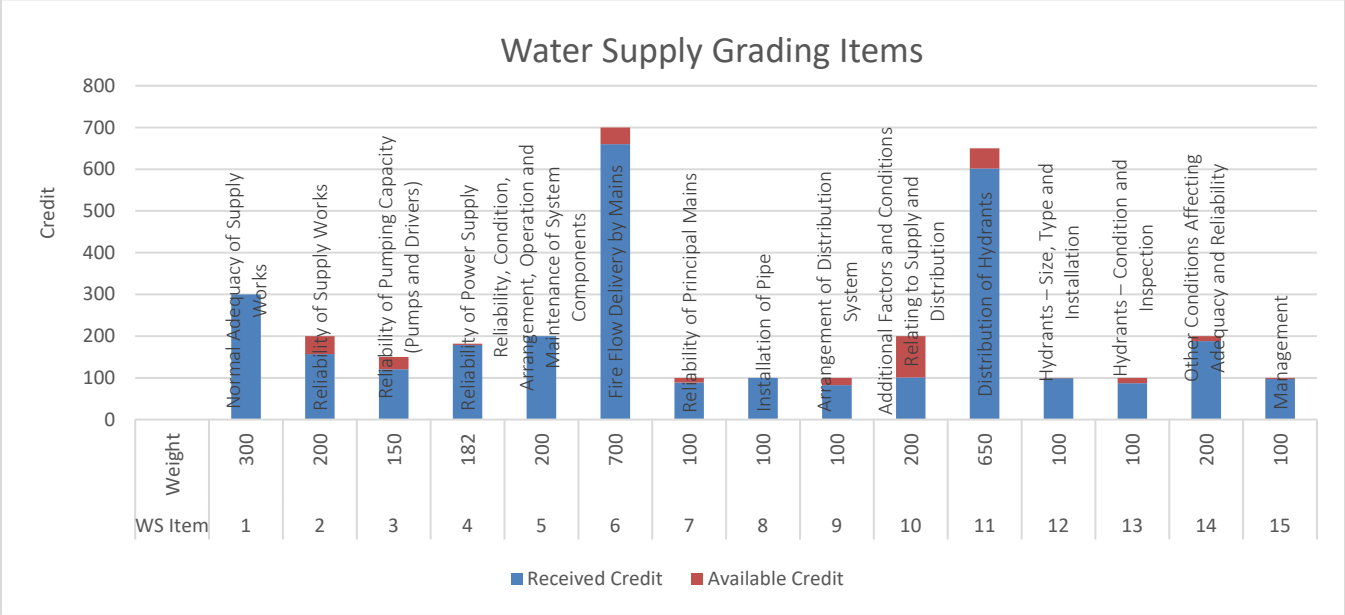
Results are shown in Table 9 and Figure 12.

Table 9 COFS Water Supply Grading Items Overall Summary

Grading Item	Category	Credit Received	Maximum Credit	% of WS	% of All
WS-1	Normal Adequacy of Supply Works	300	300	2.66%	2.66%
WS-2	Reliability of Sources of Supply	157	157	1.39%	1.77%
WS-3	Reliability of Pumping Capacity (Pumps and Drivers)	134	121	1.18%	1.33%

WS-4	Reliability of Power Supply	182	179	1.61%	1.61%
WS-5	Reliability, Condition, Arrangement, Operation, and Maintenance of System Components	200	200	1.77%	1.77%
WS-6	Fireflow Delivery by Mains	660	660	5.85%	6.21%
WS-7	Reliability of Principal Mains	94	89	0.83%	0.89%
WS-8	Installation of Pipes	100	100	0.89%	0.89%
WS-9	Arrangement of Distribution System	83	83	0.73%	0.89%
WS-10	Additional Factors and Conditions Relating to Supply and Distribution	114	101	1.01%	1.77%
WS-11	Distribution of Hydrants	602	602	5.34%	5.77%
WS-12	Hydrants – Size, Type, and Installation	99.0	99.0	0.88%	0.89%
WS-13	Hydrants – Condition and Inspection	87	87	0.77%	0.89%
WS-14	Other Conditions affecting Adequacy and Reliability	188	188	1.67%	1.77%
WS-15	Management	97	97	0.86%	0.89%
Weight in Grading	30			Credit Received	24.35
Relative Classification 2					

Figure 14 Water Supply Grading Items Overall Summary



The relative classification of the COFS Water Supply portion is 2.

11.4. Fire Safety Control within the Fire Insurance Grading

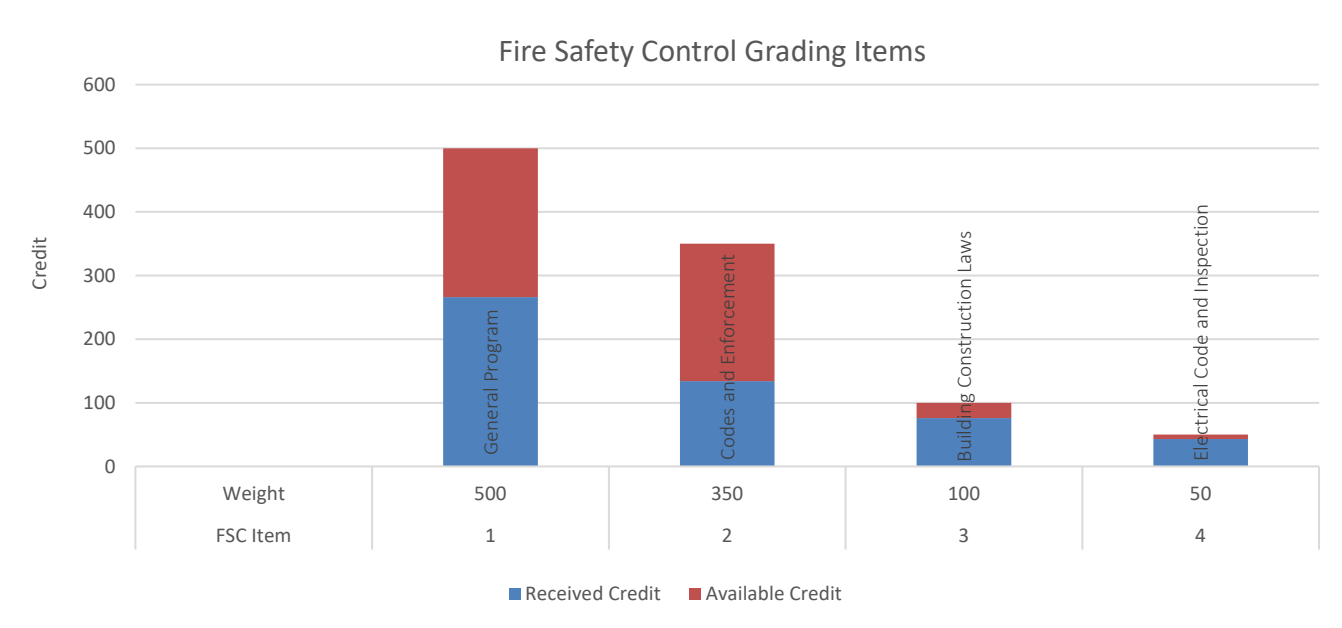
Fire safety control contributes 20 percent of the overall grade in the calculation of the Public Fire Protection Classification. Relative classifications are based on a 1 to 10 scale with 1 being the highest level.

Results are shown in Table 10 and Figure 13.

Table 10 FSFD Fire Safety Control - Grading Item Results

Grading Item	Category	Credit Received	Maximum Credit	% of FSC	% of All
FSC-1	General Program	266	500	5.32%	10.00%
FSC-2	Codes and Enforcement	134	350	2.68%	7.00%
FSC-3	Building Construction Laws and Enforcement	76	100	1.52%	2.00%
FSC-4	Electrical Code and Inspections	43	50	0.86%	1.00%
Weight in Grading	20			Credit Received	10.38
Relative Classification 5					

Figure 15 Fire Safety Control Grading Items Overall Summary



The relative classification of the COFS Fire Safety Control portion is 5.

11.5. Fire Service Communications within the Fire Insurance Grading

The relative classification of the COFS Communications portion is 1.

11.6. Summary of PFPC Fire Insurance Grading

The overall Public Fire Protection Classification grade is determined by totaling the credit received per grading item. A summary of the relative classifications and results of each grading area is provided in Table 10.

Table 11 Summary of Public Fire Protection Classification Grading Areas

Area of Grading	Weight within Grading	Credit Received 2020	Relative Classifications 2020
Fire Department	40	28.14	3
Water Supply	30	24.35	2
Fire Safety Control	20	10.38	5
Fire Service Communications	10	10	1
Divergence Penalty		1.62	
Special Hazard Analysis		2.08	
Total Credit Score		69.16	

Table 12 indicates the credit range of each PFPC grade. The final PFPC for the **City of Fort Saskatchewan is PFPC 4**.

Table 12 PFPC Credit Range

Overall PFPC	Credit Range Per PFPC Grade
1	90.00 – 100.00
2	80.00 – 89.99
3	70.00 – 79.99
4	60.00 – 69.99
5	50.00 – 59.99
6	40.00 – 49.99
7	30.00 – 39.99
8	20.00 – 29.99
9	10.00 – 19.99
10	0.00 – 9.99

11.7. DPG – Fire Insurance Grading

To determine Dwelling Protection Grade many of the details were used to calculate the Public Fire Protection Classification. Dwelling Protection Grade 1 applies to the COFS.

12. Fire Insurance Grading Classification Reassignment

12.1. Fire Insurance Grading Reassignment

A Public Fire Protection Classification of 3 and a Dwelling Protection Grade 1 were determined based on this Fire Insurance Grading review.

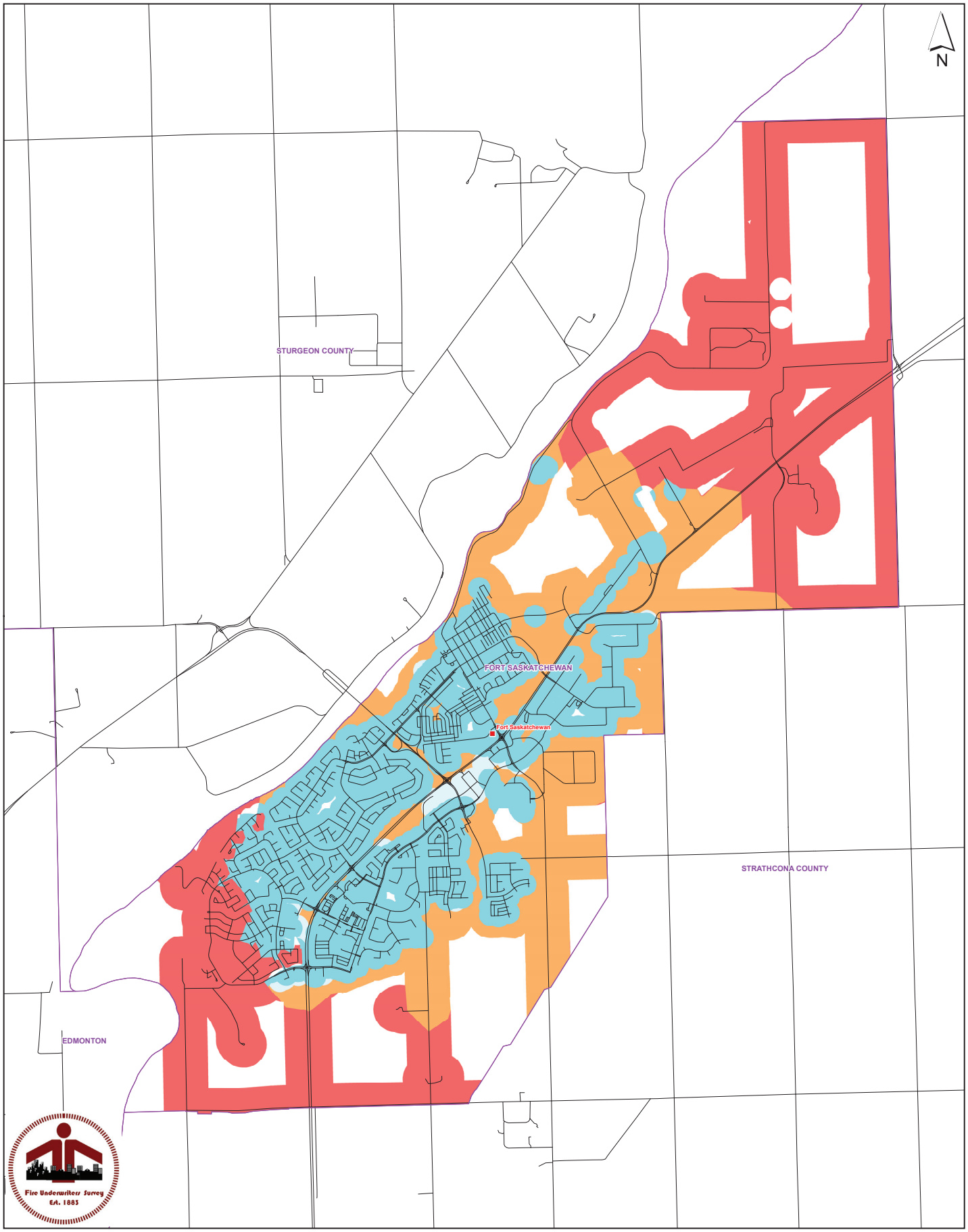
Table 12 shows the Fire Insurance Grades that were applied to the COFS prior to this survey and report and the updated grades in 2020.

Table 13 COFS Fire Insurance Grading Classifications

SUB DISTRICT(S)	PPFC 2013	PFPC 2020	COMMENTS
COFS - HPA	4	4	Hydrant Protected – Commercial Lines insured properties within specified distances of a hydrant on the COFS water system and within specific distances of the FSFD Fire Hall.

SUB DISTRICT(S)	DPG 2013	DPG 2020	COMMENTS
COFS - HPA	3A	1	Hydrant Protected – Personal Lines insured properties within 300 m of a fire hydrant on the COFS water system and within 8 road km of the FSFD Fire Hall.

These Grades are illustrated in Figure 16 and Figure 17 below.



Fort Saskatchewan, AB

Scale = 1:16,000 0 280 560 1,120 m

Figure 16 COFS – PFPC Grades 2020

Fire Underwriters Survey
A Service to Insurers and Municipalities

Legend

- Fire Hall
- Road
- Fire Protection Boundary
- 1
- 1 (Private Hydrant Protected)
- 2
- 2 (Private Hydrant Protected)
- 3
- 3 (Private Hydrant Protected)
- 4
- 4 (Private Hydrant Protected)
- 5
- 5 (Private Hydrant Protected)
- 6
- 6 (Private Hydrant Protected)
- 7
- 7 (Private Hydrant Protected)
- 8
- 8 (Private Hydrant Protected)
- 9
- 9P
- 10

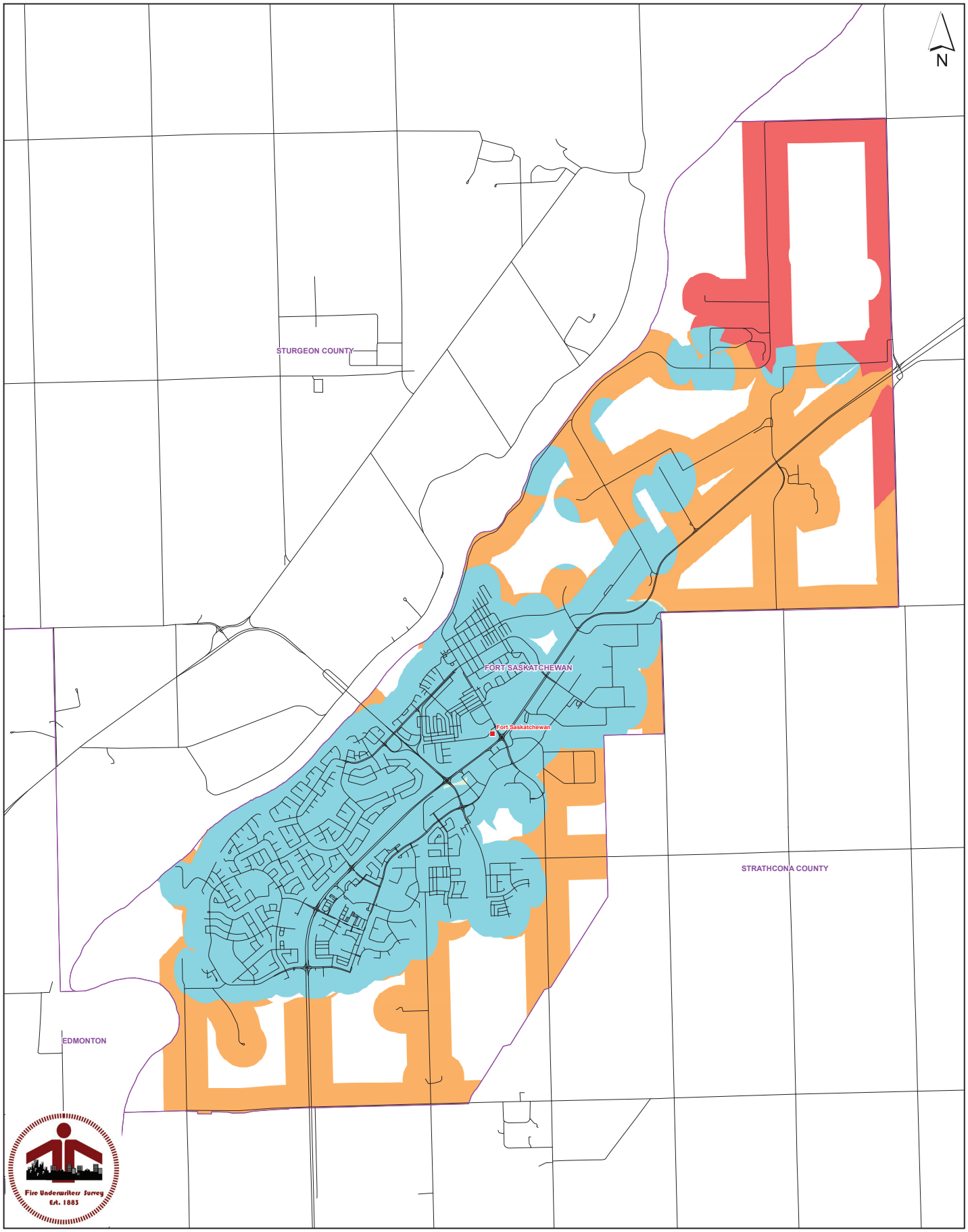
These maps and figures are not intended to illustrate the exact response distance or fire insurance grade coverage areas but can be used to aid in determining the fire insurance grade that should be applied to the property in question. Fire Underwriters Survey does not warrant or make any representations with respect to the quality, completeness, currency or accuracy of anything contained in this map, the fitness of this map for any purpose or results obtained using information contained in this map and is not responsible for any action taken in reliance on information contained in this map. In all cases, field data should be used to confirm the data and accuracy of these maps; if differences are noted please contact Fire Underwriters Survey at 1-800-665-5661.

Date Drawn: 2020-12-29

Drawn By: CY

☐ Preliminary ■ Final

Type: Commercial



Fort Saskatchewan, AB

Scale = 1:16,000 0 280 560 1,120 m

Figure 17 COFS – DPG Grades 2020

Fire Underwriters Survey
A Service to Insurers and Municipalities

Legend

- Fire Hall
- Road
- Fire Protection Boundary
- 1
- 1 (Private Hydrant Protected)
- 2
- 2 (Private Hydrant Protected)
- 3A
- 3A (Private Hydrant Protected)
- 3B(F)
- 3B(L)
- 3B(S)
- 3B
- 4
- 5

These maps and figures are not intended to illustrate the exact response distance or fire insurance grade coverage areas but can be used to aid in determining the fire insurance grade that should be applied to the property in question.
Fire Underwriters Survey does not warrant or make any representations with respect to the quality, completeness, currency or accuracy of anything contained in this map, the fitness of this map for any purpose or results obtained using information contained in this map and is not responsible for any action taken in reliance on information contained in this map. In all cases, field data should be used to confirm the data and accuracy of these maps; if differences are noted please contact Fire Underwriters Survey at 1-800-665-5661.

Date Drawn: 2021-01-04

Drawn By: CY

☐ Preliminary ■ Final

Type: Personal

APPENDIX A Manual Required Fire Flow Calculations

RFF Number	Effective Total Area	Building Construction	Coeff	Occupancy Charge	Sprinkler Protection Reduction	Exposure Charge	RFF
	m^2						IGPM
10745	9,340	Ordinary Construction	1	0%	-40%	0%	2,900
10744	9,184	Ordinary Construction	1	0%	-40%	0%	2,900
11512	2,838	Non-Combustible	0.8	15%	0%	0%	2,200
16667	2,892	Ordinary Construction	1	-10%	0%	0%	2,400
16836	5,152	Ordinary Construction	1	0%	0%	0%	3,500
10973	3,642	Wood Frame	1.5	-15%	0%	0%	3,700
10972	3,696	Wood Frame	1.5	-15%	0%	0%	3,700
10949	1,040	Wood Frame	1.5	-15%	0%	40%	2,900
10946	866	Wood Frame	1.5	-15%	0%	65%	3,100
10208	7,952	Wood Frame	1.5	-15%	-45%	10%	3,500
10977	7,908	Wood Frame	1.5	-15%	-45%	20%	4,000
10976	7,736	Wood Frame	1.5	-15%	-45%	12%	3,700
10988	1,950	Wood Frame	1.5	-15%	0%	55%	4,400
10994	940	Wood Frame	1.5	-15%	0%	65%	3,100
10820	16,012	Wood Frame	1.5	-15%	-45%	5%	4,600
10881	9,204	Wood Frame	1.5	-15%	-45%	25%	4,800
16008	6,453	Wood Frame	1.5	-15%	-45%	15%	3,500
13000	1,508	Non-Combustible	0.8	0%	-45%	0%	900
16008	8,116	Wood Frame	1.5	-15%	-45%	0%	3,100
12497	18,436	Non-Combustible	0.8	-10%	-45%	0%	2,600
12561	4,265	Ordinary Construction	1	-15%	-45%	5%	1,500
14018	3,920	Ordinary Construction	1	-15%	-45%	10%	1,800
14017	3,148	Ordinary Construction	1	-15%	-45%	0%	1,300
11212	5,640	Ordinary Construction	1	-15%	-45%	10%	2,000
10106	2,181	Ordinary Construction	1	0%	0%	15%	2,600
13603	838	Ordinary Construction	1	0%	0%	5%	1,300
10105	992	Wood Frame	1.5	0%	0%	10%	2,400
11153	2,560	Ordinary Construction	1	-15%	0%	5%	2,200
10811	12,712	Wood Frame	1.5	-15%	-45%	5%	4,200
16101	8,187	Ordinary Construction	1	15%	-45%	0%	2,900

10331	1,172	Wood Frame	1.5	0%	0%	20%	2,900
10741	7,379	Non-Combustible	0.8	15%	-45%	5%	2,200
12952	14,887	Non-Combustible	0.8	15%	-45%	20%	4,000
10435	5,326	Non-Combustible	0.8	15%	-45%	10%	2,200
10856	5,232	Wood Frame	1.5	-15%	0%	15%	5,100
10876	9,472	Wood Frame	1.5	-15%	-45%	10%	4,000
10884	4,016	Non-Combustible	0.8	0%	0%	0%	2,400
11421	1,918	Combustible	1.5	0%	0%	35%	4,200
11423	2,622	Non-Combustible	0.8	0%	0%	10%	2,200
10112	1736	Wood Frame	1.5	-15%	0%	25%	3300
17654	360	Wood Frame	1.5	-15%	0%	75%	2,000
17140	974	Wood Frame	1.5	-15%	0%	25%	2,400

WATER SUPPLY
FOR
PUBLIC FIRE PROTECTION

1999

FIRE UNDERWRITERS SURVEY

A SERVICE TO INSURERS AND MUNICIPALITIES

For further information on this document or any matters relating to the Fire Underwriters Survey please contact the appropriate offices of CGI Risk Management Services (formerly the Insurers' Advisory Organization) as follows:

Western Canada	CGI Risk Management Services Fire Underwriters Survey 3999 Henning Drive Burnaby BC V5C 6P9	Local: 604-6841581 Toll Free: 1-800-665-5661 Fax: 604-688-6986
Central Canada	CGI Risk Management Services Fire Underwriters Survey Suite 800, 7015 Macleod Tr. SW Calgary Alberta T2H 2K6	Local: 403-296-1300 Toll Free: 1-800-465-4264 Fax: 403-296-1316
Quebec	CGI Risk Management Services Fire Underwriters Survey 1611 Crémazie Blvd. East Montreal, Quebec H2M 2P2	Local: 514-735-3561 Toll Free: 1-800-263-5361 Fax: 514-844-0777
Ontario	CGI Risk Management Services Fire Underwriters Survey Lock Box 200 150 Commerce Valley Drive, West Markham, Ontario L3T 7Z3	Local: 905-882-6300 Toll Free: 1-800-387-4356 Fax: 905-695-6543
Atlantic Canada	CGI Insurance Business Services Fire Underwriters Survey 238 Brownlow Avenue, Suite 300 Park Place Center Dartmouth, Nova Scotia B3B 1Y2	Telephone: 902-423-9287 Toll-Free: 1-800-639-4528 Fax: 902-423-7376

FIRE UNDERWRITERS SURVEY is financed by the Canadian Insurance industry and utilizes technical staff of CGI Risk Management Services (formerly the Insurers' Advisory Organization Inc.) Its purpose is to survey fire protection conditions in Canadian communities and municipalities, providing data and advisory services to fire insurance underwriters and public officials concerned.

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WATER SUPPLY FOR PUBLIC FIRE PROTECTION

PREFACE

This guide summarizes the more significant recommendations of Fire Underwriters Survey with respect to fire protection requirements in municipal water works system design. It reflects the manner in which FUS assesses the water supply aspect of a municipality's fire risk potential during surveys on behalf of the Canadian property insurance industry and represents the accumulated experience of many years of study of actual fires. Water supply is one of a number of components evaluated by FUS in the municipal fire protection system. Recommendations applying to the fire departments and code enforcement are covered in other publications of Fire Underwriters Survey. FUS local offices are prepared to assist municipal officials or their consultants with advice on special problems, as time limits permit, in accordance with the intent of this guide. The minimum size water supply credited by FUS must be capable of delivering not less than 1000 L/min for two hours or 2000 L/min for one hour in addition to any domestic consumption at the maximum daily rate. Static suction supplies to fire department pumpers are recognized as a supplement to the piped system.

In the FUS assessment of a water supply system, the major emphasis is placed upon its ability to deliver **adequate** water to control major fires throughout the municipality on a **reliable** basis via sufficient and suitable **hydrants**. What is ultimately available to the fire department is the critical test in this fire protection evaluation.

Rates of flow for firefighting purposes are expressed in litres per minute as this is the adopted unit for the firefighting field.

In this edition all quantities are specified in S.I. units.

PART I

GENERAL

ADEQUACY AND RELIABILITY. An adequate and reliable water supply for firefighting is an essential part of the fire protection system of a municipality. This is normally a piped system in common with domestic potable water service for the community.

A water supply system is considered to be fully adequate if it can deliver the necessary fire flow at any point in the distribution gridiron for the applicable time period specified in the table “Required Duration of Fire Flow” with the consumption at the maximum daily rate (average rate on maximum say of a normal year). When this delivery is also possible under certain emergency or unusual conditions as herein specified, the system is considered to be reliable. In cities of population in excess of 250,000 (or smaller places with high fire incident and severe hazard conditions) it is usually necessary to consider the possibility of two simultaneous major fires in the area served by the system.

Fire flows are amounts of water necessary to control fires. These are determined as shown in Part II. System design should contemplate meeting the required fire flows existing or probable with the possible exception of gross anomalies where there is no fire threat to the remainder of the community. In these cases, the properties should preferably be modified in hazard to reduce the required flow as part of a coordinated community fire protection system.

The protection of buildings by automatic sprinkler systems is a significant contribution to the fire protection of the community and should be encouraged, not penalized by onerous service charges or metering requirements.

In order to provide reliability, duplication of some or all parts of the system will be necessary, the need for duplication being dependent upon the extent to which the various parts may reasonably be expected to be out of service as a result of maintenance and repair work, an emergency or some unusual condition. The introduction of storage, either as part if the supply works or on the distribution system, may partially or completely offset the need for duplicating various parts of the system, the value of the storage depending upon its amount, location and availability.

STORAGE. In general, storage reduces the requirements of those parts of the system through which supply has already passed. Since storage usually fluctuates, the normal daily minimum maintained is the amount that should be considered as available for fires. Because of the decrease in pressure when water is drawn down in standpipes, only the portion of this normal daily minimum storage that can be delivered at a residual pressure of 150kPa at the point of use is considered as available. As well as the quantity available, the rate of delivery of water to the system from storage for the fire flow period is critical to this consideration.

PRESSURE. The principal requirement to be considered is the ability to deliver water in sufficient quantity to permit fire department pumpers to obtain an adequate supply from hydrants. To overcome friction loss in the hydrant branch, hydrant and suction hose, a minimum residual water pressure of 150 kPa in the street main is required during flow. Under conditions of exceptionally low suction losses, a lower residual may be possible. This includes the use of 100 mm and larger outlets for fire department pumper use and hydrants with large waterways.

Higher sustained pressure is of importance in permitting direct continuous supply to automatic sprinkler systems, to building standpipe and hose systems, and in maintaining a water plan so that no portion of the protection area is without water, such as during a fire at another location. Residual pressures that exceed 500 kPa during large flows are of value as they permit short hose-lines to be operated directly from hydrants without supplementary pumping.

SUPPLY WORKS

NORMAL ADEQUACY OF SUPPLY WORKS. The source of supply, including impounding reservoirs, and each part of the supply works should normally be able to maintain the maximum daily consumption rate plus the maximum required fire flow. Each distribution service within the system should similarly support its own requirements. In large cities where fire frequency may result in simultaneous fires, additional flow must be considered in accordance with the potential. Filters may be considered as capable of operating at a reasonable overload capacity based upon records and experience. In general, overload capacity will not exceed 25 percent, but may be higher in well designed plans operating under favourable conditions.

The absolute minimum supply available under extreme dry weather conditions should not be taken as the measure of the normal ability of the source of supply such as supply from wells. The normal or average capacity of wells during the most favourable nine month period should be considered, or the normal sustained flow of surface supplies to the source.

RELIABILITY OF SOURCE OF SUPPLY. The effect on adequacy must be considered for such factors as frequency, severity and duration of droughts, physical condition of dams and intakes; danger from earthquakes, floods, forest fires, and ice dams or other ice formations; silting-up or shifting of channels; possibility of accidental contamination of watershed or source; absence of watchmen or electronic supervision where needed; and injury by physical means. Where there is a risk of disruption, special precautions or alternate supplies should be arranged.

Where the supply is from wells, some consideration should be given to the absolute minimum capacity of the wells under the most unfavourable conditions; also to the length of time that the supply from the wells would be below the maximum daily consumption rate, and the likelihood of this condition recurring every year or only at infrequent intervals. It should be recognized that some water is generally available from wells and that the most extreme conditions are not as serious as a total interruption of the supply, as would be the case in the breaking of a dam or shifting of a channel. The possibility of clogging, salinity, and the need for periodic cleaning and overhauling must be considered. Dependence upon a single well, even where records are favourable, may be considered a feature of unreliability.

Frequent cleaning of reservoirs and storage tanks may be considered as affecting reliability.

Continuity of, and delay in implementing water supplies obtained from systems or sources not under the control of the municipality or utility should be considered also from these aspects.

GRAVITY SYSTEMS. A gravity system delivering supply from the source to distribution directly without the use of pumps is advantageous from a fire protection point of view because of its inherent reliability, but a pumping system can also be developed to a high degree of reliability.

PUMPING

RELIABILITY OF PUMPING CAPACITY. Pumping capacity, where the system or service is supplied by pumps, should be sufficient, in conjunction with storage when the two most important pumps are out of service, to maintain the maximum daily consumption rate plus the maximum required fire flow at required pressure for the required duration. For smaller municipalities (usually up to about 25,000 population) the relative infrequency of fires is assumed as largely offsetting the probability of a serious fire occurring at times when two pumps are out of service. (The most important pump is normally, but not always, the one of largest capacity, depending upon how vital is its contribution to maintaining flow to the distribution system.)

To be adequate, remaining pumps in conjunction with storage, should be able to provide required fire flows for the specified durations at any time during a period of five days with consumption at the maximum daily rate. Effect of normal minimum capacity of elevated storage located on the distribution system and storage of treated water above low lift pumps should be considered. The rate of flow from such storage must be considered in terms of any limitation of water main capacity. The availability of spare pumps or prime movers that can quickly be installed may be credited, as may pumps of compatible characteristics which may be valved from another service.

POWER SUPPLY FOR PUMPS. Electric power supply to pumps should be so arranged that a failure in any power line or the repair or replacement of a transformer, switch, control unit or other device will not prevent the delivery, in conjunction with elevated storage, of required fire flows for the required durations at any time during a period of two days with consumption at the maximum daily rate.

Power lines should be underground from the station or substation of the power utility to water plants and pumping stations and have no other consumers enroute. The use of the same transmission lines by other consumers introduces unreliability because of the possibility of interruption of power or deterioration of power characteristics.

Overhead power lines are more susceptible to damage and interruption than underground lines and introduce a degree of un-reliability that depends upon their location and construction. In connections with overhead lines, consideration should be given to the number and duration of lightning, wind, sleet, and snow storms in the area; the type of poles or towers and wires; the nature of the country traversed; the effect of earthquakes, forest fires, and floods; the lightning and surge protection provided; the extent to which the system is dependent upon overhead lines; and the ease of, and facilities for, repairs.

The possibility of power systems or network failures affecting large areas should be considered. In-plant auxiliary power or internal combustion driver standby pumping are appropriate solutions to these problems in many cases, particularly in small plants where high pumping capacity is required for fire protection service. When using automatic starting, prime 'movers' for auxiliary power supply and pumping should have controllers listed by Underwriters' Laboratories of Canada to establish their reliability.

FUEL SUPPLY. At least a five day supply of fuel for internal combustion engines or boilers used for regular domestic supply should be provided. Where long hauls, condition of roads, climatic conditions, or other circumstances could cause interruptions of delivery longer than five days, a greater storage should be provided. Gas supply should be from two independent sources or from duplicate gas-producer plants with gas storage sufficient for 24 hours. Unreliability of regular fuel supply may be offset in whole or in part by suitable provisions for the use of an alternate fuel or power supply.

BUILDINGS AND PLANT

BUILDINGS AND STRUCTURES. Pumping stations, treatment plants, control centres and other important structures should be located, constructed, arranged, and protected so that damage by fire, flooding, or other causes will be held to a minimum. They should contain no combustible material in their construction, and, if hazards are created by equipment or materials located within the same structure, the hazardous section should be suitably separated by fire-resistive partitions or fire walls.

Buildings and structures should have no fire exposures. If exposures exist, suitable protection should be provided, Electrical wiring and equipment should be installed in accordance with the Canadian Electrical Code. All internal hazards should be properly safeguarded in accordance with good practice. Private in-plant fire protection should be provided as needed.

MISCELLANEOUS SYSTEM COMPONENTS, PIPING AND EQUIPMENT. Steam piping, boiler-feed lines, fuel-piping (gas or oil lines to boilers as well as gas, oil or gasoline lines to internal-combustion engines), and air lines to wells or control systems should be so arranged that a failure in any line or the repair or replacement of a valve, fuel pump, boiler-feed pump, injector, or other necessary device, will not prevent the delivery, in conjunction with storage, of the required fire flows for the specified duration at any time during a period of two days with consumption at the maximum daily rate.

Plants should be well arranged to provide for effective operation. Among the features to be considered are: ease of making repairs and facilities for this work, danger of flooding because of broken piping; susceptibility to damage by spray; reliability of priming and chlorination equipment; lack of semi-annual inspection of boilers or other pressure vessels; dependence upon common non-sectionalized electric bus bars; poor arrangement of piping; poor condition or lack of regular inspections of important valves; and factors affecting the operation of valves or other devices necessary for fire service such as design, operation, and maintenance of pressure regulating valves, altitude valves, air valves, and other special valves or control devices, provision of power drives, location of controls, and susceptibility to damage.

Reliability of treatment works is likely to be influenced by the removal from service of at least one filter or other treatment unit; the reduction of filter capacity by turbidity, freezing or other conditions of the water; the need for cleaning basins; and the dependability of power for operating valves, wash-water pumps, mixers and other appurtenances.

OPERATIONS. Reliability in operation of the supply system and adequate response to emergency or fire demands are essential. Instrumentation, controls and automatic features should be arranged with this in mind. Failure of an automatic system to maintain normal conditions or to meet unusual demands should result in the sounding of an alarm where remedial action will be taken.

The operating force should be competent, adequate, and continuously available as may be required to maintain both the domestic and fire services.

EMERGENCY SERVICES. Emergency crews, provided with suitable transportation, tools and equipment, should be continuously on duty in the larger systems and be readily available upon call in small systems. Spare pipe and fittings, and construction equipment should be readily available. Alarms for fires in buildings should be received by the utility at a suitable location where someone is always on duty who can take appropriate action as required, such as placing additional equipment in operation, operating emergency or special valves, or adjusting pressures. Receipt of alarms may be by fire alarm circuit, radio, outside alerting device, or telephone, but where special operations are required, the alarm service should be equivalent to that needed for a fire station.

Response of an emergency crew should be made to major fires to assist the fire department in making the most efficient use of the water system and to ensure the best possible service in the event of a water main break or other emergency. The increase of pressures by more than 25 percent for fires is considered to increase the possibility of breaks.

PIPING

RELIABILITY OF SUPPLY MAINS. Supply mains cut off for repair should not drastically reduce the flow available to any district. This includes all pipe lines or conduits on which supply to the distribution system is dependent, including intakes, suction or gravity lines to pumping stations, flow lines from reservoirs, treatment plant piping, force mains, supply and arterial mains, etc. Consideration should be given to the greatest effect that a break, joint separation or other failure could have on the delivery of the maximum daily consumption rate plus required fire flow at required pressure over a three day period. Aqueducts, tunnels or conduits of substantial construction may be considered as less susceptible to failure and equivalent to good mains with a long history of reliability.

INSTALLATION OF PIPE. Mains should be in good condition and properly installed. Pipe should be suitable for the service intended. Asbestos-cement, poly-vinyl chloride (PVC), cast and ductile iron, reinforced concrete and steel pipe manufactured in accordance with appropriate Canadian Standards Association or ANSI/AWWA standards, or any pipes listed by Underwriters' Laboratories of Canada for fire service are considered satisfactory. Normally, pipe rated for a maximum working pressure of 1000 kPa is required, Service records, including the frequency and nature of leaks, breaks, joint separations, other failures and repairs, and general conditions should be considered as indicators of reliability. When mains are cleaned they should be lined.

Mains should be so laid as not to endanger one another, and special construction should be provided to prevent their failure at stream crossings, railroad crossings, bridges, and other points where required by physical conditions; supply mains should be valved at one and one half kilometre intervals and should be equipped with air valves at high points and blow offs at low points. Mains should not be buried extremely deep or be unusually difficult to repair, though depths to ten feet may be required because of frost conditions.

The general arrangement of important valves, of standard or special fittings, and of connections at cross-overs, intersections, and reservoirs, as well as at discharge and suction headers, should be considered with respect to the time required to isolate breaks. The need for check valves on supply or force mains and for other arrangements to prevent flooding of stations or emptying of reservoirs at the time of a break in a main should also be considered, as well as the need for relief valves or surge chambers. Accessibility of suitable material and equipment and ease of making repairs should be considered.

Arterial feeder mains should provide looping throughout the system for mutual support and reliability, preferably not more than 1000 metres between mains. Dependence of a large area on a single main is a weakness. In general the gridiron of minor distributors supplying residential districts should consist of mains at least 150mm in size and arranged so that the lengths on the long sides of blocks between intersecting mains do not exceed 200 metres. Where longer lengths of 150mm pipe are necessary 200mm or larger intersecting mains should be used. Where initial pressures are unusually high, a satisfactory gridiron may be obtained with longer lengths of 150mm pipe between intersecting mains.

Where deadends and a poor gridiron are likely to exist for a considerable period or where the layout of the streets and the topography are not well adapted to the above arrangement, 200mm pipe should be used. Both the ability to meet the required fire flows and reliability of a reasonable supply by alternate routing must be taken into account in this consideration.

VALVES. A sufficient number of valves should be installed so that a break or other failure will not affect more than 400 metres of arterial mains, 150 metres of mains in commercial districts, or 250 metres of mains in residential districts. Valves should be maintained in good operating condition. The recommended inspection frequency is once a year, and more frequently for larger valves and valves for critical applications.

A valve repair that would result in reduction of supply is a liability, but because of the probable infrequency of occurrence, it might be considered as introducing only a moderate degree of unreliability even if it resulted in total interruption. The repair of a valve normally should be accomplished in two days. Valves opening opposite to the majority are undesirable and when they do occur they should be clearly identified.

HYDRANTS

SIZE, TYPE AND INSTALLATION. Hydrants should conform to American Water Works Standard for Dry Barrel Fire Hydrants or Underwriters' Laboratories of Canada listing. Hydrants should have at least two 65mm outlets. Where required fire flows exceed 5000 l/min or pressures are low there should also be a large pumper outlet. The lateral street connection should not be less than 150mm in diameter. Hose threads, operating and cap nuts on outlets should conform to Provincial Standard dimensions. A valve should be provided on lateral connections between hydrants and street mains.

Hydrants that open in a direction opposite to that of the majority are considered unsatisfactory. Flush hydrants are considered undesirable because of delay in getting into operation; this delay is more serious in areas subject to heavy snow storms. Cisterns are considered unsatisfactory as an alternative to pressure hydrants. The number and spacing of hydrants should be as indicated in the table titled "Standard Hydrant Distribution".

INSPECTION AND CONDITION. Hydrants should be inspected at least semi-annually and after use. The inspection should include operation at least once a year. Where freezing temperatures occur, the semi-annual inspections should be made in the spring and fall of each year. Because of the possibility of freezing they should be checked frequently during extended periods of severe cold. Hydrants should be kept in good condition and suitable records of inspections and repairs be maintained. Hydrants should be painted in highly visible colours so that they are conspicuous and be situated with outlets at least twelve inches above the grade. There should be no obstruction that could interfere with their operation. Snow should be cleared promptly after storms and ice and snow accumulations removed as necessary.

HYDRANT DISTRIBUTION. Hydrant locations and spacing should be convenient for fire department use. Hydrants should be located at intersections, in the middle of long blocks and at the end of long dead-end streets. To allow for convenient utilization of water supplies, distribution density of hydrants should be in accordance with the required fire flows indicated in the table titled "Standard Hydrant Distribution" (page 16). The maximum recommended spacing of hydrants in commercial, industrial, institutional and multi-family residential areas is 90 metres; in single family residential areas 180 metres is recommended. In areas where fire apparatus have access (e.g. large properties, private developments, etc.), hydrants should be required by bylaw. The planning of hydrant locations should be a cooperative effort between the water utility and fire department.

RECORDS

PLANS AND RECORDS. Complete, up-to-date plans and records essential for the proper operation and maintenance of the system should be available in a convenient form, suitably indexed and safely filed. These should include plans of the source as well as records of its yield and a reliable estimate of the safe yield; plans of the supply works including dams, intakes, wells, pipelines, treatment plants, pumping stations, storage reservoirs and tanks; and a map of the distribution system showing mains, valves, and hydrants. Plans and maps should be in duplicate and stored at different locations.

Detailed distribution system plans, in a form suitable for field use, should be available for maintenance crews. Records of consumption, pressures, storage levels, pipes, valves, hydrants, and of the operations of the supply works and distribution system, including valve and hydrant inspections and repairs should be maintained.

TABLES

STANDARD HYDRANT DISTRIBUTION	
Fire Flow Required (litres per minute)	Average Area per Hydrant (m^2)
2,000	16,000
4,000	15,000
6,000	14,000
8,000	13,000
10,000	12,000
12,000	11,000
14,000	10,000
16,000	9,500
18,000	9,000
20,000	8,500
22,000	8,000
24,000	7,500
26,000	7,000
28,000	6,500
30,000	6,000
32,000	5,500
34,000	5,250
36,000	5,000
38,000	4,750
40,000	4,500
42,000	4,250
44,000	4,000
46,000	3,750
48,000	3,500

REQUIRED DURATION OF FIRE FLOW	
Fire Flow Required (litres per minute)	Duration (hours)
2,000 or less	1.0
3,000	1.25
4, 000	1.5
5,000	1.75
6,000	2.0
8000	2.0
10,000	2.0
12,000	2.5
14,000	3.0
16,000	3.5
18,000	4.0
20000	4.5
22,000	5.0
24,000	5.5
26,000	6.0
28,000	6.5
30,000	7.0
32000	7.5
34,000	8.0
36,000	8.5
38,000	9.0
40,000 and over	9.5

Interpolate for intermediate figures

Area refers to surface area of blocks and bounding streets. For a street without adjacent streets, a depth of one-half block is used.

A water supply system is considered to be adequate for fire protection when it can supply water as indicated above with consumption at the maximum daily rate. Certain types of emergency supplies may be included where reasonable conditions for their immediate use exist. Storage on the system is credited on the basis of the normal daily minimum maintained insofar as pressure permits its delivery at the rate considered.

PART II

GUIDE FOR DETERMINATION OF REQUIRED FIRE FLOW
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N.B. It should be recognized that this is a "guide" in the true sense of the word, and requires a certain amount of knowledge and experience in fire protection engineering for its effective application. Its primary purpose is for the use of surveyors experienced in this field, but it is made available to municipal officials, consulting engineers and others interested as an aid in estimating fire flow requirements for municipal fire protection.

Required Fire Flow may be described as the amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure. This may include as much as a city block.

1. An estimate of the fire flow required for a given area may be determined by the formula:

$$F = 220C\sqrt{A}$$

where

F = the required fire flow in litres per minute.

C = coefficient related to the type of construction.

= 1.5 for wood frame construction (structure essentially all combustible).

= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).

= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).

= 0.6 for fire-resistive construction (fully protected frame, floors, roof).

Note: For types of construction that do not fall within the categories given, coefficients shall not be greater than 1.5 nor less than 0.6 and may be determined by interpolation between consecutive construction types as listed above. Construction types are defined in the Appendix.

A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

For fire-resistive buildings, consider the two largest adjoining floors plus 50 percent of each of any floors immediately above them up to eight, when the vertical openings are inadequately protected. If the vertical openings and exterior vertical communications are properly protected (one hour rating), consider only the area of the largest floor plus 25 percent of each of the two immediately adjoining floors.

For one family and two family dwellings not exceeding two storeys in height, see **Note J.**

2. The value obtained in No. 1 may be reduced by as much as 25% for occupancies having a low contents fire hazard or may be increased by up to 25% surcharge for occupancies having a high fire hazard. Those may be classified as to contents as follows:

Non-Combustible	-25%	Free Burning	+15%
Limited Combustible	-15%	Rapid Burning	+25%
Combustible	No Charge		

As guide for determining low or high fire hazard occupancies, see the list in the Appendix. The fire flow determined shall not be less than 2,000 L/min,

3. The value obtained in No.2 above may be reduced by up to 50% for complete automatic sprinkler protection depending upon adequacy of the system. The credit for the system will be a maximum of 30% for an adequately designed system conforming to NFPA 13 and other NFPA sprinkler standards. Additional credit of up to 10% may be granted if the water supply is standard for both the system and fire department hose lines required. The percentage reduction made for an automatic sprinkler system will depend upon the extent to which the system is judged to reduce the possibility of fires spreading within and beyond the fire area. Normally this reduction will not be the maximum allowed without proper system supervision including water flow and control valve alarm service. Additional credit may be given of up to 10% for a fully supervised system.

4. To the value obtained in No. 2 above a percentage should be added for structures exposed within 45 metres by the fire area under consideration. This percentage shall depend upon the height, area, and construction of the building(s) being exposed, the separation, openings in the exposed building(s), the length and height of exposure, the provision of automatic sprinklers and/or outside sprinklers in the building(s) exposed, the occupancy of the exposed building(s), and the effect of hillside locations on the possible spread of fire.

   The charge for any one side generally should not exceed the following limits for the separation:

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

   The total percentage shall be the sum of the percentage for all sides, but shall not exceed 75%.

   The fire flow shall not exceed 45,000 L/min nor be less than 2,000 L/min.

Notes to Calculation

Note A: The guide is not expected to necessarily provide an adequate value for lumber yards, petroleum storage, refineries, grain elevators, and large chemical plants, but may indicate a minimum value for these hazards.

Note B: Judgment must be used for business, industrial, and other occupancies not specifically mentioned.

Note C: Consideration should be given to the configuration of the building(s) being considered and accessibility by the fire department.

Note D: Wood frame structures separated by less than 3 metres shall be considered as one fire area.

Note E: Fire Walls: - In determining floor areas, a fire wall that meets or exceeds the requirements of the current edition of the National Building Code of Canada (provided this necessitates a fire resistance rating of 2 or more hours) may be deemed to subdivide the building into more than one area or may, as a party wall, separate the building from an adjoining building.

Normally any unpierced party wall considered to form a boundary when determining floor areas may warrant up to a 10% exposure charge.

Note F: High one storey buildings: When a building is stated as 1=2, or more storeys, the number of storeys to be used in the formula depends upon the use being made of the building. For example, consider a 1=3 storey building. If the building is being used for high piled stock, or for rack storage, the building would probably be considered as 3 storeys and, in addition, an occupancy percentage increase may be warranted.

However, if the building is being used for steel fabrication and the extra height is provided only to facilitate movement of objects by a crane, the building would probably be considered as a one storey building and an occupancy credit percentage may be warranted.

Note G: If a building is exposed within 45 metres, normally some surcharge for exposure will be made.

Note H: Where wood shingle or shake roofs could contribute to spreading fires, add 2,000 L/min to 4,000 L/min in accordance with extent and condition.

Note I: Any non-combustible building is considered to warrant a 0.8 coefficient.

Note J: Dwellings: For groupings of detached one family and small two family dwellings not exceeding 2 stories in height, the following short method may be used. (For other residential buildings, the regular method should be used.)

Exposure distances	Suggested required fire flow	
	Wood Frame	Masonry or Brick
Less than 3m	See Note "D"	6,000 L/min
3 to 10m	4,000 L/min	4,000 L/min
10.1 to 30m	3,000 L/min	3,000 L/min
Over 30m	2,000 L/min	2,000 L/min

If the buildings are contiguous, use a minimum of 8,000 L/min. Also consider Note H.

OUTLINE OF PROCEDURE

A. Determine the type of construction.

B. Determine the ground floor area.

C. Determine the height in storeys.

D. Using the fire flow formula, determine the required fire flow to the nearest 1,000 L/min.

E. Determine the increase or decrease for occupancy and apply to the value obtained in D above. Do not round off the answer.

F. Determine the decrease, if any, for automatic sprinkler protection. Do not round off the value.

G. Determine the total increase for exposures, Do not round off the value.

H. To the answer obtained in E, subtract the value obtained in F and add the value obtained in G.

The final figure is customarily rounded off to the nearest 1,000 L/min.

APPENDIX

TYPES OF CONSTRUCTION

For the specific purpose of using the Guide, the following definitions may be used:

Fire-Resistive Construction - Any structure that is considered fully protected, having at least 3-hour rated structural members and floors. For example, reinforced concrete or protected steel.

Non-combustible Construction - Any structures having all structural members including walls, columns, piers, beams, girders, trusses, floors, and roofs of non-combustible material and not qualifying as fire-resistive construction. For example, unprotected metal buildings.

Ordinary Construction - Any structure having exterior walls of masonry or such non-combustible material, in which the other structural members, including but not limited to columns, floors, roofs, beams, girders, and joists, are wholly or partly of wood or other combustible material.

Wood Frame Construction - Any structure in which the structural members are wholly or partly of wood or other combustible material and the construction does not qualify as ordinary construction.

OCCUPANCIES

Examples of Low Hazard Occupancies:

Apartments
Asylums
Churches
Clubs
Colleges & Universities
Dormitories
Dwellings
Hospitals
Hotels
Institutions
Libraries, except Large Stack Room Areas
Museums
Nursing, Convalescent and Care Homes
Office Buildings
Prisons
Public Buildings
Rooming Houses
Schools
Tenements

Generally, occupancies falling in National Building Code Groups A, B, C and D are of this class.

Examples of High Hazard Occupancies:

- Aircraft Hangars
- Cereal, Feed, Flour and Grist Mills
- Chemical Works - High Hazard
- Cotton Picker and Opening Operations
- Explosives & Pyrotechnics Manufacturing
- Shade Cloth Manufacturing
- Foamed Plastics, Storage or use in Manufacturing
- High Piled Combustibles Storage in excess of 6.5 metres high
- Linseed Oil Mills
- Match Manufacturing
- Oil Refineries
- Paint Shops
- Pyroxylin Plastic Manufacturing & Processing
- Solvent Extracting
- Varnish and Paint Works
- Woodworking with Flammable Finishing
- Linoleum and Oilcloth Manufacturing

Other occupancies involving processing, mixing storage and dispensing flammable and/or combustible liquids. Generally, occupancies falling in National Building Code Group F, Divisions 1 and 2 would be in this class.

For other occupancies, good judgment should be used, and the percentage increase will not necessarily be the same for all buildings that are in the same general category - for example "Colleges and Universities": this could range from a 25% decrease for buildings used only as dormitories to an increase for a chemical laboratory. Even when considering high schools, the decrease should be less if they have extensive shops.

It is expected that in commercial buildings no percentage increase or decrease for occupancy will be applied in most of the fire flow determinations. In general, percentage increase or decrease will not be at the limits of plus or minus 25%.

EXPOSURES

When determining exposures it is necessary to understand that the exposure percentage increase for a fire in a building (x) exposing another building (y) does not necessarily equal the percentage increase when the fire is in building (y) exposing building (x). The Guide gives the maximum possible percentage for exposure at specified distances. However, these maximum possible percentages should not be used for all exposures at those distances. In each case the percentage applied should reflect the actual conditions but should not exceed the percentage listed.

The maximum percentage for the separations listed generally should be used if the exposed building meets all of the following conditions:

a. Same type or a poorer type of construction than the fire building.
b. Same or greater height than the fire building.
c. Contains unprotected exposed openings.
d. Unsprinklered.

CONVERSION FACTORS

Multiply	By	To Obtain
Centimetre	0.3937	Inches
Cubic Foot	0.0283	Cubic Metres
Cubic Metre	35.3145	Cubic Feet
Cubic Metre	219.97	Imperial Gallons
Cubic Metre	1.000	Litres
Foot	0.3048	Metres
Horsepower	0.7457	Kilowatt
Imperial Gallon	4.546	Litres
Inch	2.54	Centimetres
Kilogram	2.2046	Pounds
Kilogram of Water	1	Litres
Kilopascal	0.1450	Pounds per sq. inch
Kilowatt	1.341	Horsepower
Litre	0.21997	Imperial Gallons
Litre of Water	1	Kilograms
Metre	3.281	Feet
Metre of Water	10	Kilopascals
Pound	0.4536	Kilograms
Pound per sq. inch	6.89476	Kilopascals
U.S. Gallons	0.8327	Imperial Gallons
Imperial Gallons	1.201	U.S.Gallons

TECHNICAL BULLETIN

FIRE UNDERWRITERS SURVEY™

A Service to Insurers and Municipalities

INSURANCE GRADING RECOGNITION OF USED OR REBUILT FIRE APPARATUS

The performance ability and overall acceptability of older apparatus has been debated between municipal administrations, the public fire service and many others for years. Fire Underwriters Survey (FUS) has reviewed experiences across Canada and in other countries and has developed a standard for acceptance of apparatus as the apparatus becomes less reliable with age and use.

The public fire service is unique compared to other emergency services in that fire apparatus vehicles are not continuously in use. However, when in use, the apparatus is subject to considerable mechanical stress due to the nature of its function. This stress does not normally manifest itself on the exterior of the equipment. It is effectively masked in most departments by a higher standard of aesthetic care and maintenance. Lack of replacement parts further complicates long term use of apparatus. Truck and pump manufacturers maintain a parts inventory for each model year for a finite time. After that period, obtaining necessary parts may be difficult. This parts shortage is particularly acute with fire apparatus due to the narrow market for these devices.

Fire Underwriters Survey lengthy experience in evaluating fire apparatus indicates that apparatus should be designed to an acceptable standard. The standard that is accepted throughout Canada by Fire Underwriters Survey is the Underwriters' Laboratories of Canada (ULC) Standard S515 (most updated version) titled, "Automobile Fire Fighting Apparatus," which was adopted as a National Standard of Canada in September 2004. Alternatively, NFPA 1901, the Standard for Automotive Fire Apparatus (most updated version) is also accepted by Fire Underwriters Survey with respect to apparatus design. Fire apparatus should be built by recognized manufacturers and tested by a suitably accredited third party.

Fire apparatus should respond to first alarms for the first fifteen years of service. During this period it has reasonably been shown that apparatus effectively responds and performs as designed without failure at least 95% of the time. For the next five years, it should be held in reserve status for use at major fires or used as a temporary replacement for out-of-service first line apparatus. Apparatus should be retired from service at twenty years of age. Present practice indicates the recommended service periods and protocols are usually followed by the first purchaser. However, at the end of that period, the apparatus is either traded in on new apparatus or sold to another fire department. At this juncture, the unit may have one or more faults which preclude effective use for emergency service. These deficiencies include:

a. Inadequate braking system
b. Slow pick-up and acceleration

c. Structurally weakened chassis due to constant load bearing and/or overloading
d. Pump wear

FUS has modified its application of the age requirement for used or rebuilt apparatus. Due to municipal budget constraints within small communities we have continued to recognize apparatus over twenty years of age, provided the truck successfully meets the recommended annual tests and has been deemed to be in excellent mechanical condition. The specified service tests are outlined below under the heading "Recommended Service Tests for Used or Modified Fire Apparatus". Testing and apparatus maintenance should only be completed by a technician who is certified to an appropriate level in accordance with NFPA 1071, *Standard for Emergency Vehicle Technician Professional Qualifications*.

Insurance grading recognition may be extended for a limited period of time if we receive documentation verifying that the apparatus has successfully passed the specified tests. If the apparatus does not pass the required tests or experiences long periods of "downtime" we may request the municipal authority to replace the equipment with new or newer apparatus. If replacement does not occur, fire insurance grading recognition may be revoked for the specific apparatus which may adversely affect the fire insurance grades of the community. This can also affect the rates of insurance for property owners throughout the community.

Table 1 Service Schedule for Fire Apparatus For Fire Insurance Grading Purposes

Apparatus Age	Major Cities [3]	Medium Sized Cities [4]	Small Communities [5] and Rural Centres
0 – 15 Years	First Line Duty	First Line Duty	First Line Duty
16 – 20 Years	Reserve	2nd Line Duty	First Line Duty
20 – 25 Years [1]	No Credit in Grading	No Credit in Grading *or* *Reserve* [2]	No Credit in Grading *or* *2nd Line Duty* [2]
26 – 29 Years [1]	No Credit in Grading	No Credit in Grading *or* *Reserve* [2]	No Credit in Grading *or* *Reserve* [2]
30 Years +	No Credit in Grading	No Credit in Grading	No Credit in Grading

[1] All listed fire apparatus 20 years of age and older are required to be service tested by recognized testing agency on an annual basis to be eligible for grading recognition. (NFPA 1071)

[2] Exceptions to age status may be considered in a small to medium sized communities and rural centres conditionally, when apparatus condition is acceptable and apparatus successfully passes required testing.

[3] Major Cities are defined as an incorporated or unincorporated community that has:
- *a populated area (or multiple areas) with a density of at least 400 people per square kilometre; AND*
- *a total population of 100,000 or greater.*

[4] Medium Communities are defined as an incorporated or unincorporated community that has:
- *a populated area (or multiple areas) with a density of at least 200 people per square kilometre; AND/OR*
- *a total population of 1,000 or greater.*

[5] Small Communities are defined as an incorporated or unincorporated community that has:
- *no populated areas with densities that exceed 200 people per square kilometre; AND*
- *does not have a total population in excess of 1,000.*

Table 2 Frequency of Listed Fire Apparatus Acceptance and Service Tests

	Frequency of Test					
	@ Time of Purchase New or Used	**Annual Basis**	**@ 15 Years**	**@ 20 Years** *See Note 4*	**20 to 25 Years (annually)**	**After Extensive Repairs** *See Note 5*
Recommended For Fire Insurance Purposes	Acceptance Test if new; Service Test if used & < 20 Years	Service Test	Acceptance Test	Acceptance Test	Acceptance Test	Acceptance or Service Test depending on extent of repair
Required For Fire Insurance Purposes	Acceptance Test if new; Service Test if used & < 20 Years	No Test Required	No Test Required	Acceptance Test	Acceptance Test	Acceptance or Service Test depending on extent of repair
Factor in FUS Grading	Yes	Yes	Yes	Yes	Yes	Yes
Required By Listing Agency	Acceptance Test	No	No	No	N/A	Acceptance Test
Required By NFPA *See Note 6*	Acceptance Test	Annual Service Test	Annual Service Test	Annual Service Test	Annual Service Test	Service Test

Note 1: See: 'Service Tests for Used or Rebuilt Fire Apparatus' for description of applicable tests
Note 2: Acceptance Tests consist of 60 minute capacity and 30 minute pressure tests
Note 3: Service Tests consist of 20 minute capacity test and 10 minute pressure test in addition to other listed tests
Note 4: Apparatus exceeding 20 years of age may not be considered to be eligible for insurance grading purposes regardless of testing. Application must be made in writing to Fire Underwriters Survey for an extension of the grade-able life of the apparatus.
Note 5: Testing after extensive repairs should occur regardless of apparatus age within reason.
Note 6: Acceptance Tests: See NFPA 1901, Standard for Automotive Fire Apparatus
Service Tests: See NFPA 1911, Standard for Service Tests of Fire Pump Systems on Fire Apparatus, Article 5.1

SERVICE TESTS FOR USED OR MODIFIED FIRE APPARATUS

The intent of this document is to ensure that all used or modified fire apparatus, equipped with a pump or used for tanker service, essentially meet the requirements of Underwriters' Laboratories of Canada (ULC) "Standard for Automobile Fire Fighting Apparatus" S515-04 or subsequent (current) editions of the Standard. Full adherence with the following specified tests is recommended when purchasing used apparatus.

Weight Tests

Load Balance Test:

When fully laden (including a 460kg (1000 lbs) personnel weight, full fuel and water tanks, specified load of hose and miscellaneous equipment), the vehicle shall have a load balance of 22% to 50% of total vehicle mass on the front axle and 50% to 78% of this mass on the rear axle.

Distribution of mass of 33% and 67% respectively on the front and rear axles is preferable for a vehicle having dual rear tires or tandem rear axles.

For a vehicle having tandem rear axles and dual tires on each axle, a loading of between 18% and 25% on the front axle with the balance of mass on the rear axles is permissible.

Road Tests

Acceleration Tests:

2.1.1) From a standing start, the apparatus shall attain a true speed of 55 km/h (35 mph) within 25 seconds for Pumpers carrying up to 3,150 litres (700 gallons) of water.

For apparatus carrying in excess of 3,150 litres (700 gallons) or apparatus equipped with aerial ladders or elevating platforms, a true speed of 55 km/h (35 mph) in 30 seconds should be attained.

2.1.2) The vehicle should attain a top speed of at least 80 km/h (50mph).

Braking Test:

The service brakes shall be capable of bringing the fully laden apparatus to a complete stop from an initial speed of 30 km/h (20 mph) in a distance not exceeding 9 metres (30 feet) by actual measurement. The test should be conducted on a dry, hard surfaced road that is free of loose material, oil and grease.

Pump Performance Tests

Hydrostatic Test

Recent evidence of hydrostatic testing of the pump for 10 minutes at a minimum pressure of 3,400 kPa (500 psi). APPLICABLE TO NEW OR REBUILT PUMPS ONLY (see 3.3).

Priming and Suction Capability Tests

Vacuum Test:

The pump priming device, with a capped suction at least 6 metres (20 feet) long, shall develop –75 kPa (22 inches of mercury) at altitudes up to 300 metres (1000 feet) and hold the vacuum with a drop of not in excess of 34 kPa (10 inches of mercury) in 10 minutes.

For every 300 metres (1000 feet) of elevation, the required vacuum shall be reduced 3.4 kPa (1 inch mercury).

The primer shall not be used after the 10-minute test period has been started. The test shall be made with discharge outlets uncapped.

Suction Capability Test:

The pump (in parallel or series) when dry, shall be capable of taking suction and discharging water with a lift of not more than 3 metres (10 feet) through 6 metres (20 feet) of suction hose of appropriate size, in not more than 30 seconds and not over 45 seconds for 6000 L/min (1320 Igpm) or larger capacity pumps. Where front or rear suction is provided on midship pumps, an additional 10 seconds priming time will be allowed. The test shall be conducted with all discharge caps removed.

Pump Performance

Capacity Test:

Consists of drafting water (preferably with a 10 feet lift) and pumping the rated capacity at 1000 kPa (150 psi) net pump pressure for a continuous period of at least 1 hour.

Pressure Test:

Under the same conditions as in 3.3.1 above pumping 50% of the rated capacity at 1700 kPa (250 psi) net pump pressure for at least ½ hour

For additional information on the above noted tests and test procedures, the following documents provide useful data:

- Underwriters Laboratories of Canada (ULC) publication titled S515 Standard for Automobile Fire Fighting Apparatus, latest edition.
- Fire Underwriters Survey (FUS) publication titled Fire Stream Tables and Testing Data latest edition.
- International Fire Service Training Association (IFSTA) publication titled Fire Department Pumping Apparatus, latest edition.
- National Fire Protection Association (NFPA) 1901 Standard for Automotive Fire Apparatus, latest edition.
- National Fire Protection Association (NFPA) 1911 Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus, latest edition.
- National Fire Protection Association (NFPA) 1912 Standard for Fire Apparatus Refurbishing, latest edition.

For further information regarding the acceptability of emergency apparatus for fire insurance grading purposes, please contact:

Western Canada	Quebec	Ontario	Atlantic Canada
Risk Management Services Fire Underwriters Survey 3999 Henning Drive Burnaby, BC V5C 6P9 1-800-665-5661	Risk Management Services Fire Underwriters Survey 1611 Crémazie Blvd. East Montreal, Quebec H2M 2P2 1-800-263-5361	Risk Management Services Fire Underwriters Survey 150 Commerce Valley Drive, West Markham, Ontario L3T 7Z3 1-800- 268-8080	Risk Management Services Fire Underwriters Survey 238 Brownlow Avenue, Suite 300 Dartmouth, Nova Scotia B3B 1Y2 1-800-639-4528

TECHNICAL BULLETIN

FIRE UNDERWRITERS SURVEY™

A Service to Insurers and Municipalities

LADDERS AND AERIALS: WHEN ARE THEY REQUIRED OR NEEDED?

Numerous standards are used to determine the need for aerial apparatus and ladder equipment within communities. This type of apparatus is typically needed to provide a reasonable level of response within a community when buildings of an increased risk profile (fire) are permitted to be constructed within the community.

Please find the following information regarding the requirements for aerial apparatus/ladder companies from the Fire Underwriters Survey Classification Standard for Public Fire Protection.

Fire Underwriters Survey

Ladder/Service company operations are normally intended to provide primary property protection operations of

1.) Forcible entry;
2.) Utility shut-off;
3.) Ladder placement;
4.) Ventilation;
5.) Salvage and Overhaul;
6.) Lighting.

Response areas with 5 buildings that are 3 stories or 10.7 metres (35 feet) or more in height, or districts that have a Basic Fire Flow greater than 15,000 LPM (3,300 IGPM), or any combination of these criteria, should have a ladder company. The height of all buildings in the community, including those protected by automatic sprinklers, is considered when determining the number of needed ladder companies.
When no individual response area/district alone needs a ladder company, at least one ladder company is needed if the sum of buildings in the fire protection area meets the above criteria."

The needed length of an aerial ladder, an elevating platform and an elevating stream device shall be determined by the height of the tallest building in the ladder/service district (fire protection area) used to determine the need for a ladder company. One storey normally equals at least 3 metres (10 feet). Building setback is not to be considered in the height determination. An allowance is built into the ladder design for normal access. The maximum height needed for grading purposes shall be 30.5 metres (100 feet).

3999 Henning Drive
Suite 101
Burnaby, British Columbia
V5C 6P9

T: 604.609.4146
Toll Free: 1.800.665.5661
F: 604.688.6986

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Opta Information Intelligence
www.fireunderwriters.ca
www.optaintel.ca

Exception: When the height of the tallest building is 15.2 metres (50 feet) or less no credit shall be given for an aerial ladder, elevating platform or elevating stream device that has a length less than 15.2 metres (50 feet). This provision is necessary to ensure that the water stream from an elevating stream device has additional "reach" for large area, low height buildings, and the aerial ladder or elevating platform may be extended to compensate for possible topographical conditions that may exist. See Fire Underwriters Survey - Table of Effective Response (attached).

Furthermore, please find the following information regarding communities' need for aerial apparatus/ladder companies within the National Fire Protection Association.

NFPA

Response Capabilities: The fire department should be prepared to provide the necessary response of apparatus, equipment and staffing to control the anticipated routine fire load for its community.

NFPA *Fire Protection Handbook, 20th Edition* cites the following apparatus response for each designated condition:

HIGH-HAZARD OCCUPANCIES (schools, hospitals, nursing homes, explosive plants, refineries, high-rise buildings, and other high-risk or large fire potential occupancies):

*At least four pumpers, **two ladder trucks** (or combination apparatus with equivalent capabilities), two chief officers, and other specialized apparatus as may be needed to cope with the combustible involved; not fewer than 24 firefighters and two chief officers.*

MEDIUM-HAZARD OCCUPANCIES (apartments, offices, mercantile and industrial occupancies not normally requiring extensive rescue or firefighting forces):

*At least three pumpers, **one ladder truck** (or combination apparatus with equivalent capabilities), one chief officer, and other specialized apparatus as may be needed or available; not fewer than 16 firefighters and one chief officer.*

LOW-HAZARD OCCUPANCIES (one-, two-, or three-family dwellings and scattered small businesses and industrial occupancies):

*At least two pumpers, **one ladder truck** (or combination apparatus with equivalent capabilities), one chief officer, and other specialized apparatus as may be needed or available; not fewer than 12 firefighters and one chief officer.*

In addition to the previous references, the following excerpt from the 2006 BC Building Code is also important to consider when selecting the appropriate level of fire department response capacity and building design requirements with regard to built-in protection levels (passive and active fire protection systems).

Excerpt: National Building Code 2006

A-3 Application of Part 3.

In applying the requirements of this Part, it is intended that they be applied with discretion to buildings of unusual configuration that do not clearly conform to the specific requirements, or to buildings in which processes are carried out which make compliance with particular requirements in this Part impracticable. The definition of "building" as it applies to this Code is general and encompasses most structures, including those which would not normally be considered as buildings in the layman's sense. This occurs more often in industrial uses, particularly those involving manufacturing facilities and equipment that require specialized design that may make it impracticable to follow the specific requirements of this Part. Steel mills, aluminum plants, refining, power generation and liquid storage facilities are examples. A water tank or an oil refinery, for example, has no floor area, so it is obvious that requirements for exits from floor areas would not apply. Requirements for structural fire protection in large steel mills and pulp and paper mills, particularly in certain portions, may not be practicable to achieve in terms of the construction normally used and the operations for which the space is to be used. In other portions of the same building, however, it may be quite reasonable to require that the provisions of this Part be applied (e.g., the office portions). Similarly, areas of industrial occupancy which may be occupied only periodically by service staff, such as equipment penthouses, normally would not need to have the same type of exit facility as floor areas occupied on a continuing basis. It is expected that judgment will be exercised in evaluating the application of a requirement in those cases when extenuating circumstances require special consideration, provided the occupants' safety is not endangered.

The provisions in this Part for fire protection features installed in buildings are intended to provide a minimum acceptable level of public safety. It is intended that all fire protection features of a building, whether required or not, will be designed in conformance with good fire protection engineering practice and will meet the appropriate installation requirements in relevant standards. Good design is necessary to ensure that the level of public safety established by the Code requirements will not be reduced by a voluntary installation.

Firefighting Assumptions

The requirements of this Part are based on the assumption that firefighting capabilities are available in the event of a fire emergency. These firefighting capabilities may take the form of a

paid or volunteer public fire department or in some cases a private fire brigade. If these firefighting capabilities are not available, additional fire safety measures may be required.

Firefighting capability can vary from municipality to municipality. Generally, larger municipalities have greater firefighting capability than smaller ones. Similarly, older, well established municipalities may have better firefighting facilities than newly formed or rapidly growing ones. The level of municipal fire protection considered to be adequate will normally depend on both the size of the municipality (i.e., the number of buildings to be protected) and the size of buildings within that municipality. Since larger buildings tend to be located in larger municipalities, they are generally, but not always, favoured with a higher level of municipal protection.

Although it is reasonable to consider that some level of municipal firefighting capability was assumed in developing the fire safety provisions in Part 3, this was not done on a consistent or defined basis. The requirements in the Code, while developed in the light of commonly prevailing municipal fire protection levels, do not attempt to relate the size of building to the level of municipal protection. **The responsibility for controlling the maximum size of building to be permitted in a municipality in relation to local firefighting capability rests with the municipality. If a proposed building is too large, either in terms of floor area or building height, to receive reasonable protection from the municipal fire department, fire protection requirements in addition to those prescribed in this Code, may be necessary to compensate for this deficiency.** Automatic sprinkler protection may be one option to be considered.

Alternatively, the municipality may, in light of its firefighting capability, elect to introduce zoning restrictions to ensure that the maximum building size is related to available municipal fire protection facilities. This is, by necessity, a somewhat arbitrary decision and should be made in consultation with the local firefighting service, who should have an appreciation of their capability to fight fires.

The requirements of Subsection 3.2.3. are intended to prevent fire spread from thermal radiation assuming there is adequate firefighting available. It has been found that periods of from 10 to 30 minutes usually elapse between the outbreak of fire in a building that is not protected with an automatic sprinkler system and the attainment of high radiation levels. During this period, the specified spatial separations should prove adequate to inhibit ignition of an exposed building face or the interior of an adjacent building by radiation. Subsequently, however, reduction of the fire intensity by firefighting and the protective wetting of the exposed building face will often be necessary as supplementary measures to inhibit fire spread.

In the case of a building that is sprinklered throughout, the automatic sprinkler system should control the fire to an extent that radiation to neighbouring buildings should be minimal. Although there will be some radiation effect on a sprinklered building from a fire in a neighbouring building, the internal sprinkler system should control any fires that might be ignited in the building and thereby minimize the possibility of the fire spreading into the exposed building. NFPA 80A, “Protection of Buildings from Exterior Fire Exposures,” provides additional information on the possibility of fire spread at building exteriors.

The water supply requirements for fire protection installations depend on the requirements of any automatic sprinkler installations and also on the number of fire streams that may be needed at any fire, having regard to the length of time the streams will have to be used. Both these factors are largely influenced by the conditions at the building to be equipped, and the quantity and pressure of water needed for the protection of both the interior and exterior of the building must be ascertained before the water supply is decided upon. Acceptable water supplies may be a public waterworks system that has adequate pressure and discharge capacity, automatic fire pumps, pressure tanks, manually controlled fire pumps in combination with pressure tanks, gravity tanks, and manually controlled fire pumps operated by remote control devices at each hose station.

For further information regarding the acceptability of emergency apparatus for fire insurance grading purposes, please contact:

Western Canada	Quebec	Ontario	Atlantic Canada
Fire Underwriters Survey	Fire Underwriters Survey	Fire Underwriters Survey	Fire Underwriters Survey
3999 Henning Drive	1611 Crémazie Blvd. East	150 Commerce Valley Drive, West	238 Brownlow Avenue, Suite 300
Burnaby, BC V5C 6P9	Montreal, Quebec H2M 2P2	Markham, Ontario L3T 7Z3	Dartmouth, Nova Scotia B3B 1Y2
1-800-665-5661	1-800-263-5361	1-800- 268-8080	1-800-639-4528

Dwelling Protection Grade Summary of Basic Requirements per Fire Station[i]

DWELLING PROTECTION GRADE	WATER WORKS SYSTEM	FIRE DEPARTMENT		CORRELATION WITH PFPC[ii] Public Fire Protection Classification
		EQUIPMENT	FIREFIGHTERS[iii]	
1	Water supply system designed in accordance with Fire Underwriters Survey standard "Water Supply for Public Fire Protection" with a relative classification of 5 or better	Response from within 8 km by road of a triple combination pumper	Minimum Response: - On-duty: 3 career fire fighters, plus - Off-duty: fire chief or other officer	Water Supply and Fire Department must grade PFPC Relative Class 5 or better
2	Water supply system designed in accordance with Fire Underwriters Survey standard "Water Supply for Public Fire Protection" with a relative classification of 6 or better	Response from within 8 km by road of a triple combination pumper	Minimum Response: - On-duty: 1 career fire fighters, plus - On-call: 15 auxiliary fire fighters	Water Supply and Fire Department must grade PFPC Relative Class 6 or better
3A	Water supply system designed in accordance with, and meeting the minimum requirements of, Fire Underwriters Survey standard "Water Supply for Public Fire Protection"	Response from within 8 km by road of a triple combination pumper	15 auxiliary fire fighters	No Public Fire Protection Classification required
3B	Not required – however fire department must have adequate equipment, training and access to approved water supplies to deliver standard shuttle service in accordance with NFPA 1142, Standard on Water Supplies for Suburban and Rural Fire Fighting	2 units required. Triple combination pumper plus a mobile water supply with a combined water carrying capacity of not less than 6,820 L (1,500 IG)	15 auxiliary fire fighters	No Public Fire Protection Classification required
4[3]	Not required – however fire department must have adequate equipment, training and access to approved water supplies to deliver shuttle service in accordance with NFPA 1142, Standard on Water Supplies for Suburban and Rural Fire Fighting	2 units required. Triple combination pumper plus a mobile water supply with a combined water carrying capacity of not less than 6,820 L (1,500 IG)	15 auxiliary fire fighters	No Public Fire Protection Classification required
5	Unprotected communities or communities not qualifying for Grades 1, 2, 3A, 3B, or 4 above	Unprotected communities or communities not qualifying for Grades 1, 2, 3A, 3B, or 4 above	Unprotected communities or communities not qualifying for Grades 1, 2, 3A, 3B, or 4 above	No Public Fire Protection Classification required

[i] Refer to additional notes and requirements for interpretation

[ii] The P.F.P.C. is a sophisticated municipal fire protection grading system utilized for Commercial Lines insurance. PFPC fire insurance grades are scaled from 1 to 10. One (1) represents a high level of fire protection and 10 indicates little or no recognized fire protection. This system evaluates the ability of a community's fire defences to prevent and control major fires that may occur in commercial, industrial and institutional buildings and/or districts.

[iii] Requirements for Dwelling Protection Grade 4 are the same as for Dwelling Protection Grade 3B, however in some cases, an allowance may be considered for Dwelling Protection Grade 4 where all of the criteria for Dwelling Protection Grade 3B have been met with one exception. If more than one criteria has not been met (ex. less than 15 auxiliary fire fighters and a single pumper apparatus) Dwelling Protection Grade 5 is applied.

Where Dwelling Protection Grade 4 is applied, a signed letter of intent from the community is to be sent to Fire Underwriters Survey indicating that improvements will be made, within an agreed timeframe, to meet the criteria of Dwelling Protection Grade 3B.

It is important to note that the absolute minimum number of auxiliary fire fighters considered within the fire insurance grading is 10 and that maximum age of apparatus that can be considered is 30.