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FOR PUBLIC RELEASE

November 5, 2010

Charlie Lake Fire Department
13065 Firehall Road
Box 250 Charlie Lake, BC
V0C 1H0

Attention: Mr. Allan Pinkerton, Fire Chief – Charlie Lake Fire Rescue (CLFR)

RE: Fire Underwriters Survey – Charlie Lake Fire Protection Area

A survey of the Charlie Lake Fire Protection Area was conducted on September 29th and 30th, 2010. The results of this survey are now complete and offered for your information. Fire Underwriters Survey (FUS) conducted the assessment primarily for fire insurance grading purposes and classification purposes. The following report provides a brief description of the grading process and outlines significant findings of the assessment. In addition and at the request of CLFR, this report also includes comments and general recommendations that are aimed at improving the level of fire protection within the Charlie Lake Fire Protection Area for fire insurance grading and life safety purposes.

Note that comments made within this report are general statements giving indication where fire protection improvements can be considered in addition to potential implications if certain decisions are made.

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1. Fire Underwriters Survey

Fire Underwriters Survey is a national organization that represents more than 85 percent of the private sector property and casualty insurers in Canada. Fire Underwriters Survey provides data to program subscribers regarding public fire protection for fire insurance statistical and underwriting evaluation.

Fire Underwriters Survey offices maintain data from surveys on fire protection programs throughout 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 the major fires that may be expected to occur by evaluating in detail the adequacy, reliability, strength and efficiency of these protective facilities.

Public Fire Protection Classification

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 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 Fire Underwriters Survey. 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 on 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 placing 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 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.

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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 Fire Underwriters Survey 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 fire fighting 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.

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.

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 1-1.

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

Insurance Bureau of Canada Dwelling Protection Grades. Statistical "5 tier" System:	System Used by Many Insurance Companies Underwriting "3 tier" System:	Insurance Companies refer to this Grade as:
1 2 3A	Table 1	Protected
3B 4	Table 2	Semi - Protected
5	Table 3	Unprotected

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Improvements that would have a cumulative positive effect on fire insurance grading classifications and fire protection ability are discussed within this report. The intent of identifying areas where improvements can be made is to provide the Charlie Lake Fire Department direction in their community fire protection planning – if so desired and supported by the community.

FIRE INSURANCE GRADING RESULT

The fire insurance grades that were previously applied to Charlie Lake were as follows:

1. **Charlie Lake Public Fire Protection Classification (PFPC)**

   Class 10 Applies to all properties insured under Commercial Lines.

2. **Charlie Lake Dwelling Protection Grade (DPG)**

   Grade 3B Applies to all properties insured under Personal Lines within 8 road km of the Charlie Lake fire station but not within 300 m of a recognized hydrant.

Although improvements have been made in certain areas of the fire protective services in Charlie Lake since the last Fire Underwriters Survey, there are a few key areas where the level of service has not been maintained. As a result, the following fire insurance grading classification will now be assigned to Charlie Lake.

1. **Charlie Lake Public Fire Protection Classification (PFPC)**

   Class 9 Applies to all properties insured under Commercial Lines within 5 road km of the Charlie Lake fire hall but not within 150 m of a recognized hydrant.

2. **Charlie Lake Dwelling Protection Grade (DPG)**

   Grade 3B Applies to all properties insured under Personal Lines within 8 road km of the Charlie Lake fire station but not within 300 m of a recognized hydrant.

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2. 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 the experience and focusing on risk alone may tend to build up a fire department force beyond the financial acceptability of the community paying for this 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 measurement tends to focus on those structures where there is considerable risk fire and life safety and where total or temporary loss of a particular structure would have 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 being capable of controlling and extinguishing most fires that may occur.

To achieve this objective, the structure of a fire department must be tailored to the needs of a community, and will vary for each community. Each component of fire defences must be evaluated and developed to achieve the desired and correct level of benefit. For this reason no two fire departments will be the same. Some of the factors that must be balanced and tailored against the fire risk, degree of criticality, community expectation, fire experience, and the ability to financially support this emergency service, are as follows:

- Type, number and condition of fire apparatus
- Pumping capacity
- Response to alarm protocols
- Response times to critical risks
- Adequacy of the fire fighter and emergency responder training program including specialized training
- Emergency communication systems
- Ancillary equipment
- Fire department roster type and response levels
- Fire safety education
- Building controls
- Fire prevention inspections
- Adequacy & reliability of emergency water supplies
- Automatic fire protection systems
- Management of emergency services

FUS examines the entire program of a community's fire defences in order to assess and grade the overall program. For instance, strengths in community fire safety can offset some deficiencies in emergency water supplies, and vice versa. Alternatively, there are some areas within a FUS grading that carry substantial weight, such as:

- The type of manning (i.e. career fire fighters vs. volunteers),
- The quality of training programs,
- The type of apparatus and ancillary equipment for the hazards present,
- The condition, age and maintenance of fire apparatus and fire suppression equipment,
- The distribution of companies relative to fire risk,
- The availability, adequacy and reliability of emergency water supplies
- Response to alarms procedures, and
- Fire safety inspections.

The Survey found that improvements would be beneficial in the following protection programs:

- Reliability of response to alarms
- Suitability and functionality of fire stations
- Fire fighting strength
- Officer stregth
- Lack of adequate training facilities
- Emergency water supply coverage across the District

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3. Community Risk and Hazard Assessment

Background

A fire hazard and risk assessment was conducted throughout Charlie Lake to aid in determining the community's fire protection needs and to assist in assessing the adequacy of the fire department. A risk and hazard assessment, along with a response distance review, community growth assessment and assessment of trends of emergency responses, lays the groundwork for determining fire protection needs within a community. This assessment is important in determining organizational structure, personnel requirements, training requirements, fire apparatus and fire equipment needs, response time requirements and adequacy of fire station location.

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

Fire Risk Assessment in Charlie Lake

Charlie Lake building stock consists of:

- Single residential homes
- Multi-family residences and town homes
- Commercial and Mercantile space, such as
  - Restaurants
- Service buildings
- Light industrial

Required Fire Flows (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 exposures) were calculated for what was considered, in conjunction with the fire department and specific site inspections, to be the major risks within the community and at the same time being representative of the community. Required Fire Flows (RFF) were calculated for the community using the methodology described in the Fire Underwriters Survey 1999 Guideline "Water Supply for Public Fire Protection", see Appendix B.

It is important to stress that the Basic Fire Flow assigned is not the peak required fire flow and is intended to be adequate for 90% of the typical structure fires that are expected to occur based on the Required Fire Flows calculated during the risk assessment. Notably, Required Fire Flows were not calculated for all buildings throughout the community and specialized risks with high fire flows should be reviewed on an ongoing basis.

Basic Fire Flows are then used in conjunction with Table 3-1 Fire Underwriters Survey – Table of Effective Response to determine and grade against the requirements for fire insurance grading purposes.

Charlie Lake has been assigned a Basic Fire Flow of 1500 Igpm. It is important to note that this benchmark is assigned for the buildings that are insured under Commercial Lines. Buildings insured under Personal Lines typically have Required Fire Flows of 800 – 1000 Igpm. Recommendations made

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throughout this report are intended to help improve the level of fire protection for both the PFPC and DPG.

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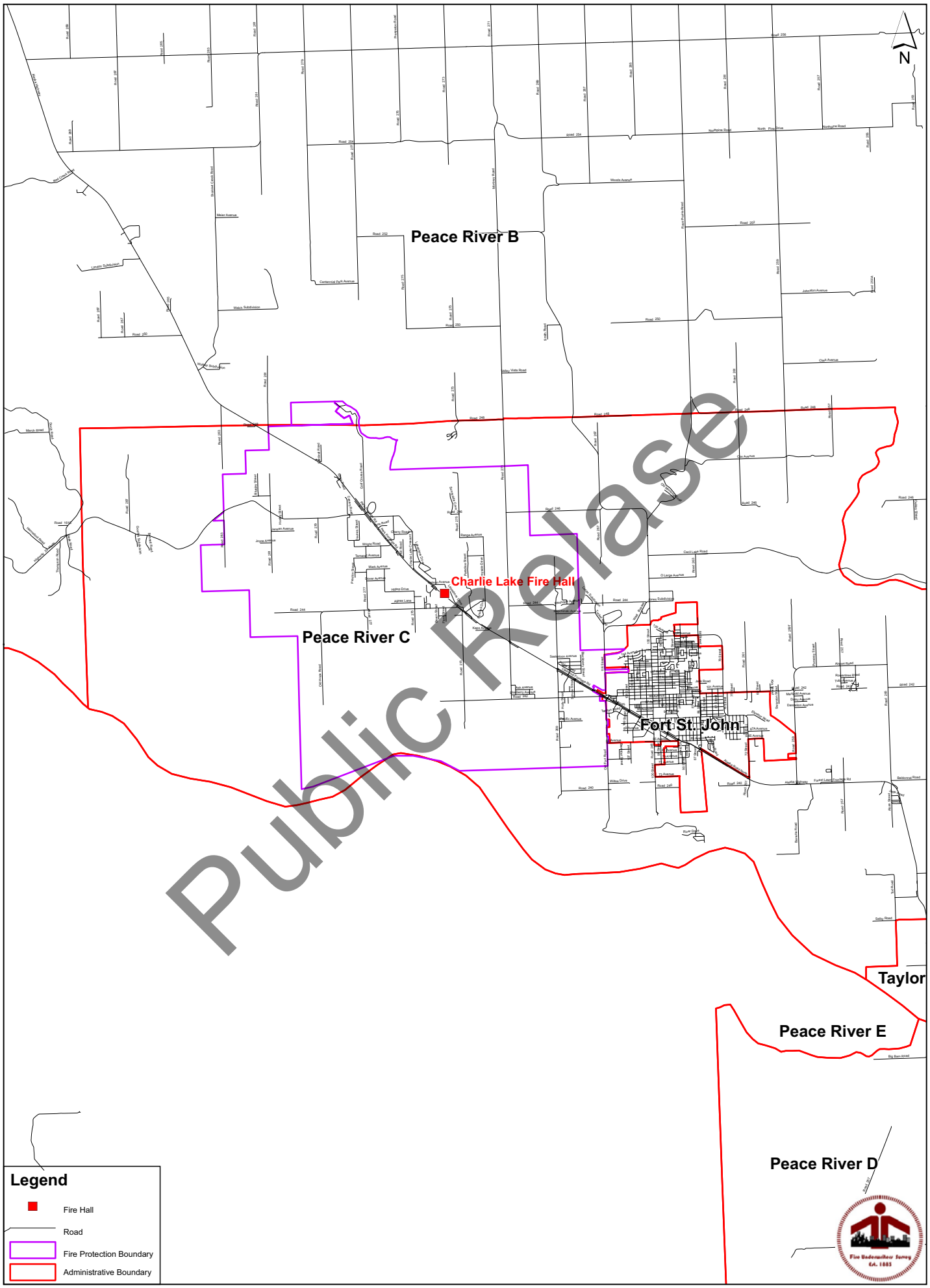
Figure 3-1 Charlie Lake Fire Protection Area



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Charlie Lake	Charlie Lake and the Surrounding Area Scale = 1:40,000 0 500 1,000 2,000 Meters	Fire Underwriters Survey

Table 3-1 Fire Underwriters Survey – Table of Effective Response

The following Table aids in the determination of Engine 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.

RISK RATING	BUILDING DISTRICT EXAMPLES	FIRE FLOW L/min X1000	FIRE FLOW Approx. Igpm Range	INITIAL RESPONSE TO ALARMS Engine Companies	INITIAL RESPONSE TO ALARMS Ladder Companies	1st DUE Engine Company, Minutes	2nd DUE Engine Company, Minutes	1st DUE Ladder Company, Minutes	TOTAL AVAILABILITY NEEDED Engine Companies. No.	Engine Companies. Min.	Ladder Companies No.	Ladder Companies Min.
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

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4. Fire Department Assessment

Apparatus in Service

The FUS grading schedule evaluates the needed number of fire apparatus that are in service relative to the community's fire risk and fire hazard. The greater that risk and hazard rating, the more resources are needed to control or suppress a given fire, and consequently the greater the number of fire apparatus that are required. In assessing the number of pumper trucks that can be credited available for service, a number of factors are considered including:

- Apparatus type,
- Apparatus condition,
- Apparatus age,
- Apparatus maintenance programs,
- Community emergency response profile requirements,
- The number and location of emergency response points

The Charlie Lake Fire Department (CLFD) apparatus that is of interest for fire insurance grading is as follows:

Table 4-1 Apparatus Summary

Identifier	Year	Manufacturer	Type	Credited Pump Capacity (Igpm)	Credited Tank Capacity (Igal)	ULC Listing	Age in 2010
Engine 1	2005	Sterling HUB	Pumper/Tender Combo	1050	2000	206C	5
Engine 5	2000	Fort Gary International	Pumper	1050	1000	173C	10
Tender 6	2002	International	Mobile Water Supply	0	3500	-	8
Engine 3	1983	GMC Anderson	Brush apparatus	0	0	NIL	27

Within the fire insurance grading, apparatus can be credited up to a maximum of 20 years of age; however, pump tests and service tests should be provided so that the apparatus can receive recognition.

Recommendation 1 Maintain Apparatus Replacement Schedule

In order to continue to provide a reasonable level of fire protective services throughout the Charlie Lake Fire Protection Area, it is recommended that funds continually be set aside for the replacement of front line fire fighting apparatus. Once apparatus have exceeded 20 years of age, they can no longer be recognized for fire insurance grading purposes. This is due to factors such as unreliability, spare parts become obsolete, increased safety risk for fire fighters using apparatus and increased probability of mechanical breakdowns.

Recommendation 2 Have Mobile Water Supply Apparatus Meet ULC or NFPA Requirements

In order to receive a Dwelling Protection Grade 3B, the Fire Department should have a pumper apparatus that meets the requirements of a 'pumper' apparatus and have a mobile water supply that

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meets the requirements of a 'mobile water supply' as defined by ULC S515 or NFPA 1901. Further to these requirements, the combined water carrying capacity of both of these apparatus shall be not less than 1500 Igal. Other requirements must be met in order to receive DPG 3B. See Recommendation 6.

Recommendation 3 Develop Formal Automatic Agreements and Practice for STSS Accreditation

CLFD should continue to practice for Superior Tanker Shuttle Service accreditation with the Fort St. John Fire Department (FSJFD). When reviewing the assets available to CLFD, it may be possible that STSS accreditation be awarded. Some insurers have opted to grant a reduction toward a hydrant protected rate in home owners' fire insurance premiums.

It is recommended that CLFD, FSJFD and other fire departments involved in shuttle operations in Charlie Lake develop formal aid agreements in areas where shuttle operations will be used. Additionally, each fire department involved should develop Standard Operating Guidelines that address first alarm responses where shuttle operations are to be used in or outside of their fire protection area. The aid agreement should indicate that all departments respond to the incident on first alarm.

The automatic aid agreement should also include a response from the FSJFD for structure fire calls throughout Charlie Lake when response from the Charlie Lake fire fighters is known to be limited (i.e. work week, long weekends, etc).

Developing an automatic aid agreement requires careful consideration. There are many factors to consider, such as the cost of receiving automatic aid from career fire fighters, and the fire insurance grading is only one such factor.

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Distribution of Resources, Response Distances and Times

Within the fire insurance grading, adequate distribution of resources are measured against the benchmarks from Table 3-1 Fire Underwriters Survey – Table of Effective Response. A significant portion of the PFPC is determined by the area effectively covered by the fire department. The more area effectively covered the more credit that can be awarded.

The Basic Fire Flow associated with the Charlie Lake Fire Protection Area has been set at 1500 Igpm. The benchmark requirements of this Basic Fire Flow are shown in Table 4-2.

Table 4-2 Summary of Response Benchmarks for Basic Fire Flow

Basic Fire Flow	1st Due Pumper	2nd Due Pumper	Total Pumper Companies Available	Minutes for all to arrive
1500	3	5	2	5
1500	2.7 km	4.1 km	2	4.1 km

There are several important factors that are used in determining insurance rates for all types of properties. Although the specific methodologies used by each insurer may differ slightly, there are several key factors that due to their importance are weighted heavily in most systems. The most significant factors influencing fire insurance rates are:

- PFPC (fire insurance grade),

- Type of responding fire department (auxiliary, career, or combination),
- The apparatus fleet and capacities,
- The response distance, and
- Distance to hydrants.

Response distance from fire station to property has a large influence on the insurers' calculation rates. Most insurance rating systems utilize response distance categories. It is important to note that response distance (in conjunction with fire department type, auxiliary or career) is used as a general way of determining approximate response times.

Table 4-3 illustrates the insurance industry standard for writing insurance based off distance from the nearest responding fire station.

Table 4-3 Insurance Industry Response Distance Standard

	Personal Lines - DPG Response Distance By Road (km)	Commercial Lines - PFPC Response Distance by Road (km)	Downgrade FUS Classification
Ideal	5	2.5	0
Maximum	8	5	1 class
Rare/Rural	13	8	Unprotected or 2 classes[1]

Resources for firefighting are centrally located within Charlie Lake. There are a number of Commercial Lines insured risks that are located in Clairmont which are beyond the insurance industry maximum recognized response distance (5 road km) for pumper response.

Approximately 95% of the risks insured under Personal Lines (detached dwellings) are within 8 road km of the CLFD. However, there are a few developments that are in the proposal and development stage that may be beyond 8 road km of the fire station. It can be expected that these risks would be treated as unprotected; however some insurers may choose to accept risks beyond 8 road km.

The figures shown on the following pages are intended to visually illustrate the coverage area for the fire station within the Fire Protection Area. These figures are not intended to illustrate the exact response distance for each of the areas shown; however, they are intended to be used as a visual tool to assist the readers in showing areas where a delayed response is possible and understanding the methodology of the fire insurance grading process.

Currently, the location of the existing station is adequate when considering that the majority of the building stock within Charlie Lake is insured under Personal Lines.

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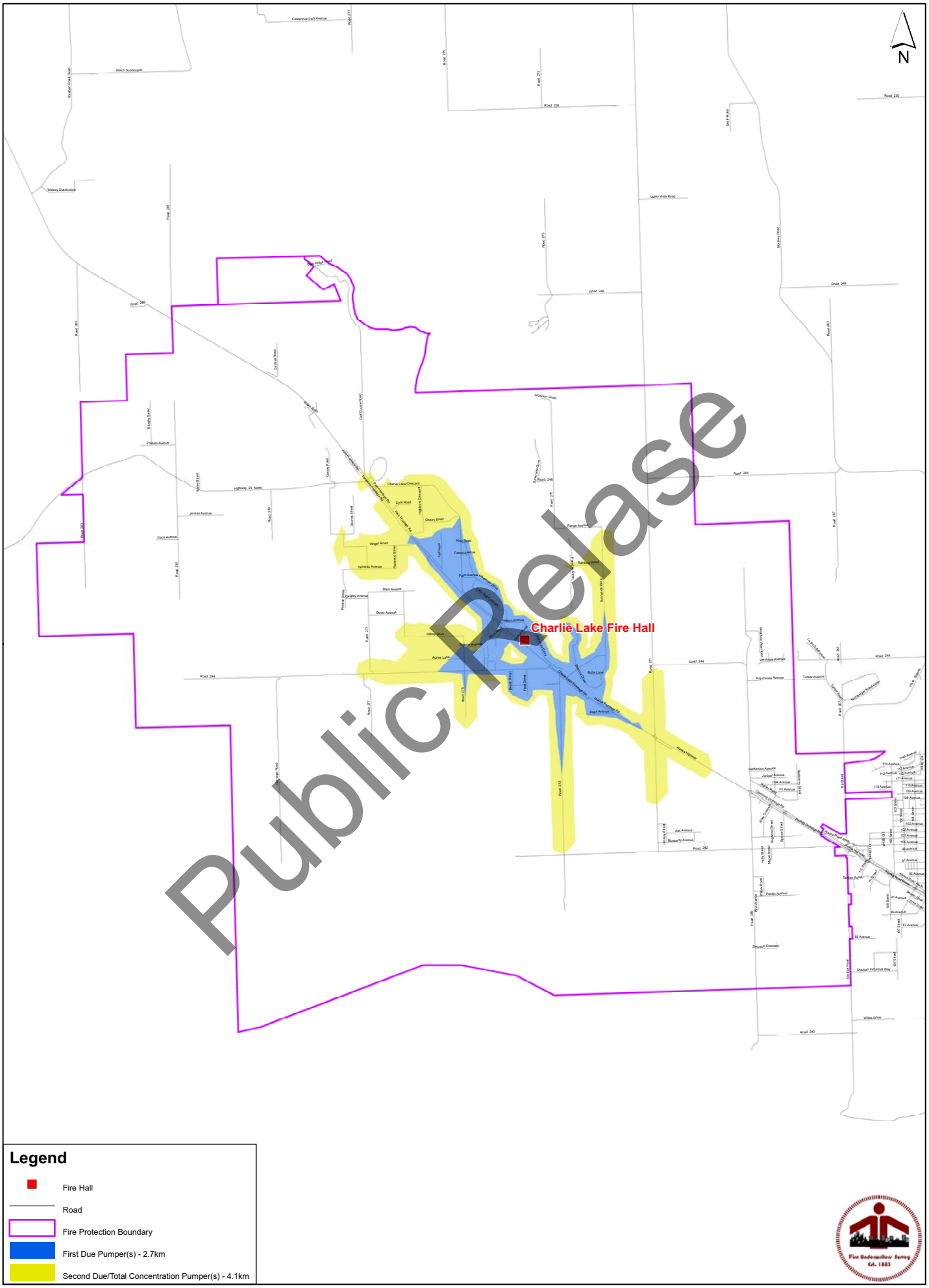
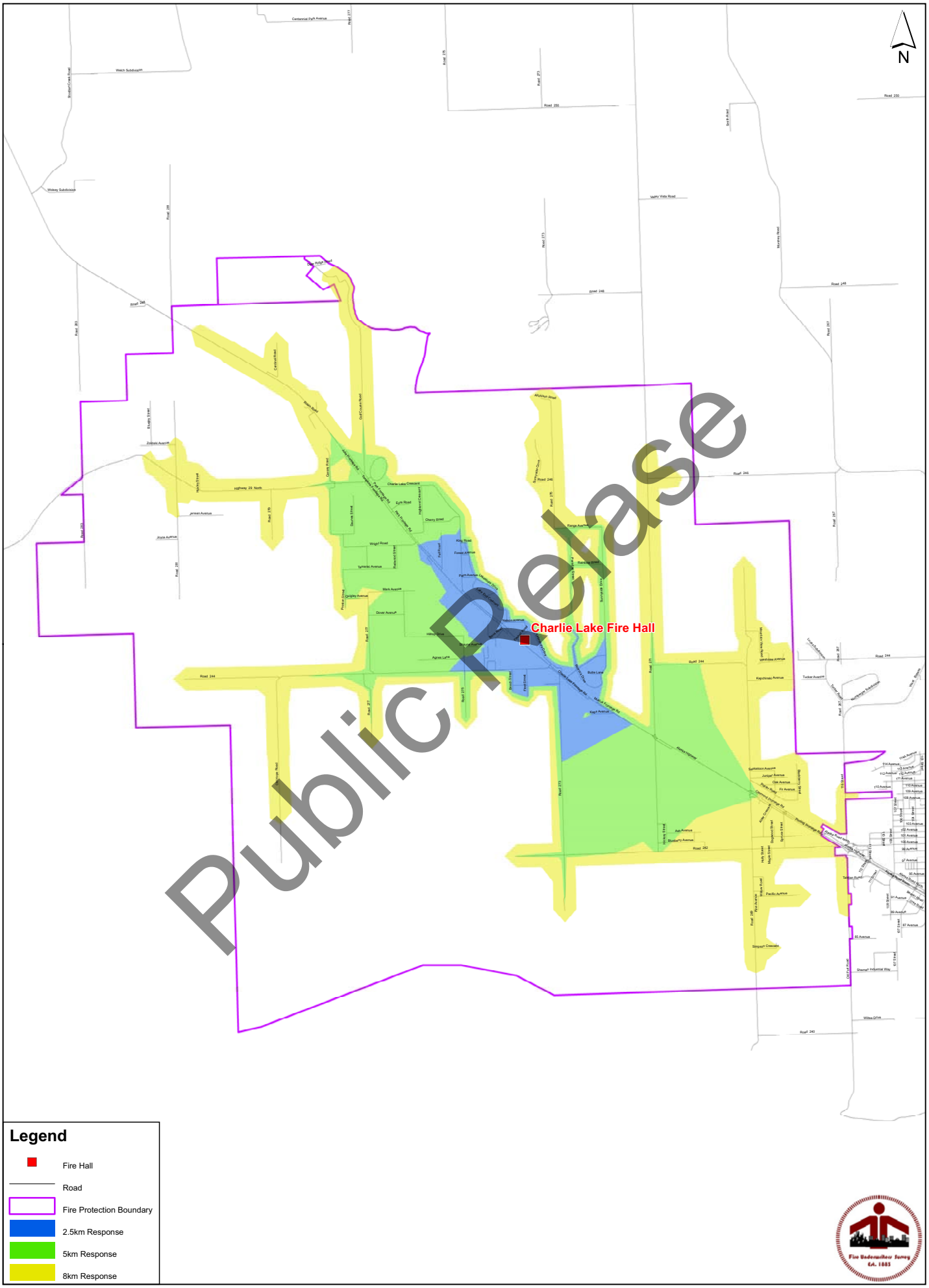
1 Properties beyond the maximum response distance of the responding fire station will typically be treated as unprotected by insurers; however, some insurers who specialize in rural risks may downgrade 2 classes.

Figure 4-1 Effective Pumper Response Coverage



Charlie Lake	Pumper Response from Fire Hall Scale = 1:20,000 (0, 250, 500, 1,000 Meters)	Fire Underwriters Survey

Figure 4-2 2.5/5/8 Road km Response



Charlie Lake	2.5/5/8km Response from Fire Hall Scale = 1:20,000 (0, 250, 500, 1,000 Meters)	Fire Underwriters Survey

Design, Maintenance and Condition of Apparatus

The fire insurance grading evaluates the overall maintenance and service program for fire apparatus and equipment. Well documented, preventative maintenance service performed by a mechanical service department is the benchmark used for comparison. Mechanical service should be available on demand when needed.

CLFD utilize a local licensed mechanic for major engine and chassis repairs and contracts Profire Emergency Equipment. Each pumper apparatus receives pump tests and service tests on an annual basis. Each apparatus receives a pre and post check as well as weekly and monthly checks where each item is removed from the apparatus and operated as needed.

Currently, the Fire Chief is typically the only member who conducts regular inspections maintenance for each apparatus, hose, SCBA and other equipment in the hall and attached to the apparatus. When considering the amount of equipment that each apparatus has and the amount of tools needed to adequately equip an apparatus, conducting regular inspections for apparatus and associated equipment requires a significant amount of time. The amount of time needed to be spent performing this duty can significantly take away from other duties of the Fire Chief in a community of similar size.

Recommendation 4 Develop Career Fire Fighter Positions

To assist the Fire Chief in administrating and operating the fire department, it is recommended that a career fire fighter positions be developed. These members can take on certain tasks and responsibilities needed to keep the fire department operating so that the Fire Chief can focus on the critical services that the fire department provides including, but not limited to:

- developing fire department budgets
- developing a strategic master plan,
- promoting fire safety and prevention in the community including the implementation of relevant education programs,
- assisting the public in obtaining solutions to fire safety and prevention issues,
- oversee the provision of services for the protection of lives and property from fire hazards within the community,
- establishing and maintain a complement of well trained and qualified auxiliary fire fighters for suppression and rescue activities

These career fire fighters can be expected to be primarily responsible for the training and maintenance programs. They should have or work towards completing the necessary certifications and qualifications to be an officer (i.e. NFPA 1001 Level 2, NFPA 1021 Level 1 and 2, NFPA 1041). Other roles and duties this member can be responsible for, or assist in directing are, the Prevention and Public Education programs. See Recommendation 11.

Recommendation 5 Expand or Renovate Fire Hall to Accommodate Additional Paid Members

Should the community move forward with developing additional career positions, it is recommended that the fire hall be expanded or renovated to accommodate office space for this additional member.

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Additionally, consideration should be given to expanding or renovating the fire hall to provide for more training space.

Total Available Fire Force

The previous Fire Underwriters Survey had included a total of 25 fire fighters. Table 4-4 illustrates the current fire fighting roster.

Table 4-4 Fire Fighting Roster Strength

Rank	Number	Credited Fire Fighters
Fire Chief	1	1
Assistant Fire Chief	1	1
Officer	3	3
Captain	2	2
Fire Fighter	8	8
Reserve	2	0
Probationary	2	0
Total	19	15

Recommendation 6 Implement NFPA Fitness Program and Approval of a Qualified Doctor

For fire fighter health and safety, it is recommended that all members of the fire department, whom actively participate in performing fire ground operation, undergo a physical from a qualified doctor. The doctor should be able to confirm whether or not the fire fighter is physically capable of performing strenuous activity that is involved in structural fire fighting.

Additionally, the fire department should consider implementing NFPA 1583, *Standard on Health-Related Fitness Programs for Fire Fighter,* recent edition. This will help provide a greater level of safety for fire fighters and community members by making sure that fire fighters are physically fit and able to perform various fire ground operations.

Recommendation 7 Improve Fire Fighting Roster and Implement a Duty Crew System

The Fire Department should continue to make improvements to the fire fighting roster. When the number of fire fighters on the roster improves to the point where the Fire Department can sustain a duty crew it is recommended that the Fire Department implement a formal Duty Crew system. The Duty Crew should consist of at least 1 Officer and 2 Fire Fighters (3 total). Additionally, a Duty Crew should be developed for the management team so that the Fire Chief or Assistant Fire Chief will respond as well. A signed agreement between the Fire Department and fire fighters should be put in place. The agreement should require a response from duty crew fire fighters during scheduled times when fire fighter response is known to be limited. To help provide incentive for fire fighters to be on a duty crew, consideration should be given to providing financially compensating the fire fighters that are on the duty crew.

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Implementing a Duty Crew system will help ensure that there will be some level of response continually available throughout the year (day or night) increasing the level of safety throughout the community. If the Fire Department can not improve its fire fighting roster to a level that will support a duty crew system, consideration should be given to hiring additional career fire fighters. See Recommendation 4.

Training Program

The Fire Department training program is reasonable for a community of this size and the program facilitates the effective handling of fires through the training of a capable fire force.

Currently, the Fire Department has different members who are in varying stages of completing the NFPA 1001 Level 1 certification. The Fire Department has various tools and props (confined space, self rescue, etc) available and utilizes various text books and videos during training for theoretical work. Live Fire is used as part of the training program. All but 4 members have received this training; however, they are scheduled to complete this training within the next 6 months.

During training nights, attendance has been noted to be a concern. It can be expected that if the training program can be further developed, attendance may improve and recruitment of new fire fighters may be possible. Improving the training program can be completed by hiring additional staff. It is extremely difficult for a single member responsible for completing most tasks needed to operate a fire department that provides a number of community services. See Recommendation 4.

The Fire Department has only a single member that is NFPA 1021, *Standard for Fire Officer Professional Qualifications*, Level 2. The captains on the fire force are captains by name only, not by certifications. These members have been named Captain for reasons such as dedication, attendance, or fire ground knowledge.

Recommendation 8 Continue to Improve Training Program and Continue to Work towards NFPA 1001 Level 1

As mentioned, the fire department has different members in varying stages of attaining their NFPA 1001 Level 1 certification through the Justice Institute of British Columbia (JIBC) in Fort St. James. To help provide a reasonable level of fire protection throughout the community and provide a greater level of efficiency during fire ground operations it is recommended that the Fire Department continue to train its fire fighters to NFPA 1001 Level 1.

Recommendation 9 Provide Additional Training for Captains/Officers to Meet NFPA 1021

To help improve efficiency during fire ground operations and other fire department operations, it is recommended that officers work towards attaining NFPA 1021 Level 1 certifications. Having multiple personnel on the fire ground trained to effectively set up, organize and command resources (Incident Command) is a vital asset for fire departments. This can be expected to increase the overall level of safety for each fire fighter during emergency events and create a greater level of efficiency helping to reduce the amount of dollar or life loss.

Fire Department Records

CLFD recently adopted data management software and are now tracking emergency calls, fire fighter training, maintenance records, etc. Though much of the records are kept on paper and stored in the fire

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hall, the fire department is moving forward with storing everything in the data management software. This information is backed up every month on a local external hard drive.

Recommendation 10 Connect Fire Department Computer Database to Regional District Servers

Currently, Fire Department records (paper or digital) are kept locally in the fire hall. In the event of vandalism, theft, or loss of building due to seismic event or fire, the Fire Department records and information may be completely lost. It is recommended that the computers used in the Fire Department have a connection to remote server where the information contained can be remotely stored and be more secured from vandalism, theft or fire. Much of the information is important as it helps protect the Fire Department and Regional District from liability.

Fire Prevention and Public Education

Currently, there are no formal programs in place for fire inspections or public education. The Fire Department does visit the school within the community and provides discussion about fire awareness and safety; however, age groups are not targeted nor are specific programs implemented to help improve the level of safety throughout the community.

Fire prevention inspections are only completed on request and are primarily based on the most basic components of the British Columbia Fire Code or basic home safety.

Recommendation 11 Develop Fire Prevention and Public Education Programs

To help improve the overall level of safety and help reduce the level of fire risk within the community it is recommended that the Fire Department and Regional District implement a formal Fire Prevention and Public Education program. These programs can help improve the amount of exposure the Fire Department has within the community as well as reduce the life safety risk.

Programs that should be developed are:

1. *Home Smoke Alarms*: The Fire Department should target portions of the community and inspect homes for working smoke alarms. While this inspection is being completed, the Fire Department can also inform the resident about general home safety as it relates to fire and what to do in the event of a fire in their home.
2. *Learn Not to Burn®*
3. Fire Extinguisher Training

It can be expected that the additional career members can assist or direct these programs. See Recommendation 4.

In order for a prevention program to be successful and have an impact, enforcement of Building and Fire Codes is necessary. Steps should be taken towards making the necessary changes so that bylaws can be put in place and enforced by the Fire Department and the Regional District.

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Planning and Development

Currently, the Fire Department does not formally take part in the planning and development process for any new developments within the community. Over time, a barrier has been created that has hindered communication between the Fire Department and the Planning and Development department. The Fire Department is not notified by the Regional District when new developments have been accepted. The Fire Department is made aware of new developments regularly touring the community and seeing when land is being excavated or construction has begun. This is a significant concern when considering that water supplies for fire fighting are limited.

Recommendation 12 Allow Fire Department to Take Part in Community Planning and Development

It is recommended that the Fire Chief take part in community planning and development. As the community grows and new developments are accepted, the Fire Department should provide commentary and feedback to the Regional District. The Fire Chief should comment on what capabilities the Fire Department has in providing protection to any new and existing developments and how the capabilities may be improved through additional resources such as dedicated water storage tanks, fire fighting access, limiting building sizes based on resources available.

Fire Society and the Regional District

A fire protection society was established by the Regional District in 1994. The 'Fire Society' was established by the Regional District to address the concerns of the public (acquire funds for the fire department so that a reasonable service is provided). Members of the Society consist of fire department members only. The Regional District felt that funds were unnecessarily being provided and established a Fire Committee. The Committee consists of 8 members and provides insight and advice for the Fire Society; however, they have no voting power. Since then, conflicting ideas between the Fire Society and the Regional District have resulted in some issues not being resolved or being resolved with minor impact.

Recommendation 13 Reorganize Fire Society

It is recommended that the Fire Society be reorganized so that the Fire Committee has voting powers. This will help bring a balance back between all parties involved and help resolve any conflicts or that may arise.

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5. Cost Benefit of the Fire Insurance Grades

There is a common misconception that fire service in Canada is a Federal or Provincial service. This is not true. In Canada, fire suppression is optional for local governments, but most communities provide protection for their residents. Local governments opt to provide this service to help ensure a certain level of safety is available. The level of safety that is provided is dependent on the choices of the community and the level of investment in fire protection. Residents can compare the savings in fire insurance costs with the taxes they pay for the protection, and this gives them some indication of the net benefit they receive from fire protection. However the benefits of fire protection go beyond reductions in insurance premiums. The most obvious benefit of fire protection is the improved level of life safety. Furthermore, communities with strong fire protection facilities and programs have greater economic stability that results from businesses having better access to insurance and being more protected against the peril of fire.

Throughout this report, recommendations have been put forward from the perspective of improving fire protection levels to an appropriate level to maintain the current fire insurance grading classification and to help improve the level of life safety throughout the community. It is normal for communities to improve the level of protection compared to the level of risk as time goes on, and the insurance industry encourages this process by giving reduced insurance rates to communities that provide higher standards of fire protection. The Charlie Lake Fire Department has also requested information regarding the impact of changing the level of fire protection to a lesser standard of care.

The following table shows average premiums as they relate to detached dwellings in Charlie Lake. The values shown here are based on actual quotes as well as calculated values for Fire and Extended Coverage insurance in Charlie Lake. Discounts and cost additions for an average policy include, but are not limited to:

- Loyalty Discount (5 years required) – minus 15%
- Claims free (3 years required) – minus 15%
- Age credit (45 – 54) – minus 10%
- $1000 Deductible – plus 15%
- Wood heater or wood stove – plus 20%
- Liability limits ($2 million) – plus $10
- Water coverage – plus $30

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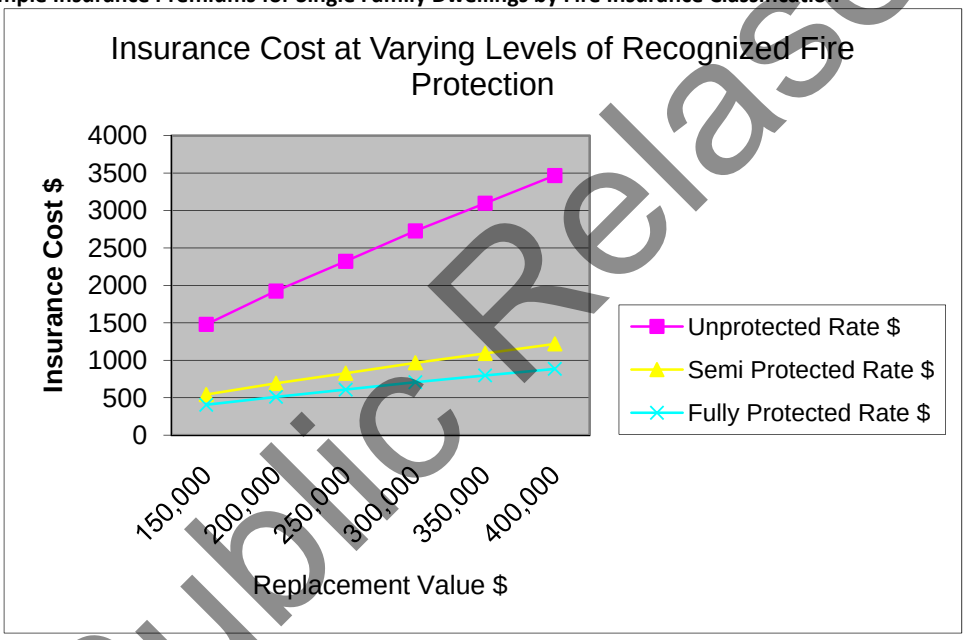
Table 5-1 Example Insurance Premiums for Single Family Dwellings by Fire Insurance Classification

Replacement Value ($)	Unprotected Rate ($)	60± % Reduction	Semi Protected Rate ($)	75± % Reduction	Fully Protected Rate ($)
150000	1479		542		405
200000	1924		692		511
250000	2321		827		608
300000	2727		966		707
350000	3096		1091		797
400000	3466		1218		885

Figure 5-1 Example Insurance Premiums for Single Family Dwellings by Fire Insurance Classification



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The cost of insurance per dollar insured is shown to have an average difference of 60%± between Semi Protected rates and Unprotected rates. The difference between Fully Protected rates and Unprotected rates is in the order of 75%±. Note that individual cases may vary by as much as 10% from figures shown here; however, these figures are average.

Currently, the amount paid for fire protection within Charlie Lake is 0.67 cents for every $1000 of insured value. If the average home is $300 000 then the average home owner would pay $200 for fire protection. If the levels of fire protective services deteriorate resulting in Dwelling Protection Grade 5, it could be anticipated that each home owners' rate would increase from $966 to $2727.

Within Charlie Lake, there are approximately 2300 buildings that would be insured under Personal Lines insurance. We can then roughly determine that the amount of savings in insurance would be in the order of $5 200 000 community wide. Since the community does have a fire department that can

provide some level of service that is recognizable for fire insurance grading purposes, constituents pay approximately $200 annually for the service. This recognizable level of service helps the constituents avoid paying potentially higher fire insurance premiums for their buildings which could be in the order of $1500-$3000 more per property on an annual basis.

It is important to remember that the values used are only approximations and intended to give an idea of how influential the fire insurance grading can be.

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6. Service Options

Charlie Lake is a small community with limited resources located adjacent to a larger community with significantly greater fire protection resources. As such, Fire Underwriters Survey has reviewed the possibility of several options for providing fire protection services to the Charlie Lake area.

The Charlie Lake Fire Department has done an exemplary job of protecting the community with limited resources, however as fire protection is being reviewed, consideration should be given to the possibility of providing fire protection services to the Charlie Lake community through the Fort St. John Fire Department or some variant of a combination service.

Dissolving a community's fire department and contracting emergency response services may present more obstacles than solutions. One of these obstacles is providing a service that the constituents of Charlie Lake are willing to pay for. Charlie Lake has an established fire department that is recognized for fire insurance grading purposes. At the current point in time, the Fire Department is capable of providing fire protective and emergency response services for its community and is receiving an insurance cost benefit. However, with certain investments and strategic decisions, higher standards of service can be provided, potentially improving the cost benefit of having a recognized fire department.

In the event that Charlie Lake can not make improvements or continue to maintain the levels of service they provide, one solution that may be explored combines both Charlie Lake and Fort St. John. An agreement can be put in place so that Fort St. John will respond on first alarm to all calls throughout Charlie Lake to supplement the Charlie Lake Fire Department response. Charlie Lake will still be the primary service provider for fire and other emergency response services; however, the response will be supported by the Fort St. John Fire Department which will help to improve the overall level of response.

A second option that may be explored, in the event that Charlie Lake can not continue to maintain the levels of service they provide, includes amalgamation or contracting emergency response services from Fort St. John. However, this should only be considered after it has been confirmed that Charlie Lake can not maintain its current level of emergency response services. If Fort St. John were to be the primary fire and emergency response service provider, the fire hall in Charlie Lake would still have to be active in order for the constituents of Charlie Lake to receive any cost benefit of paying for the service because of the response distance from the existing Fort St. John fire station.

Both options involving a response from Fort St. John must also consider the constituents of Fort St. John and what level of service they will be provided with in the event that the Fort St. John Fire Department is responding outside the legal boundary of the City. Furthermore, a detailed review of the costs involved may indicate that the cost of having a fire response from Fort St. John is substantially higher than the cost of operating an autonomous service. This is due to the use of career fire fighters in Fort St. John. The career fire fighter response has the significant advantage of reduced turn out time and improved reliability, however there is significant cost associated with these benefits.

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7. Conclusion

This Fire Underwriters Survey found that CLFD has made significant improvements in its fire department; however, increases in the level of risk (and risk distribution) in addition to deterioration of the fire department roster strength have been noted resulting in a reduced level of fire protective services.

The previous assessment included more than 20 auxiliary fire fighters and sufficient apparatus to qualify a DPG 3B. The fire fighting roster has been reduced since then and 15 fire fighters have been considered, maintaining DPG 3B. See Recommendation 6. This was determined to be one of the most significant findings of this assessment. Both the Fire Department and Regional District should develop a plan that will help strengthen the fire fighting force so Charlie Lake can continue to have DPG 3B in the event of the roster strength being further reduced. Consideration should be given to developing a formal aid agreement with Fort St. John and other neighbours that addresses automatic response and mobile water supplies in areas where water supplies for fire fighting may be limited. If an agreement can be put in place, the community may qualify for STSS accreditation which may further reduce insurance rates.

The discussion of amalgamating the fire protective services into Fort St. John's is a topic that requires careful consideration. Though Fort St. John can be expected to provide a higher standard of fire and emergency response services, the associated cost may be higher than what is currently being provided by the Charlie Lake Fire Department. This higher cost may not be sustainable by the constituents of Charlie Lake. Additionally, Fort St. John will need to consider response for the constituents of its own community in the event that the fire department has responded outside the legal boundaries of the City. Charlie Lake may wish to develop an agreement with Fort St. John that includes an automatic response to all calls that will supplement the Charlie Lake fire department.

Other areas of interest and concern have been commented on via recommendations. Though some of the recommendations are not vital for the community's DPG, they are considered to be good engineering practices and can help improve the overall level of life safety for the residents of Charlie Lake.

Previously, the Public Fire Protection Classification (PFPC) that was applied for the buildings insured under Commercial Lines was 10. Since then, it was determined that there is some level of recognized service that is available for these buildings, as such, the PFPC has been improved from 10 to 9. To improve this further to an 8 or a 7, a recognized hydranted water supply system would have to be installed and then assessed.

The community may elect to provide a different level of fire protection than what is currently being provided. Depending on the changes, this may positively or negatively impact the fire insurance grades of the community. Should the community make improvements as suggested within this report, they would continue to maintain their DPG 3B but also improve the overall level of safety throughout the entire community. Fire Underwriters Survey should be notified of any changes or improvements in any of the fire protection services provided throughout the fire protection area. This will ensure that

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insurance policies in the community are written at the appropriate rates to the level of fire protection that the community can provide and may reduce liability exposures in lawsuits related to fire loss claims.

Figure 7-1 and Figure 7-2 illustrate the fire insurance grades that will be applied to Charlie Lake. DPG 3B will apply to properties insured under Personal Lines that are within 8 road km of the Charlie Lake fire station. DPG 5 will apply to properties insured under Personal Lines that are beyond 8 road km of the Charlie Lake fire station.

Public Fire Protection Classification (PFPC) 9 will apply to properties insured under Commercial Lines that are within 5 road km of the Charlie Lake fire station. PFPC 10 will apply to properties insured under Commercial Lines that are beyond 5 road km of the Charlie Lake fire station.

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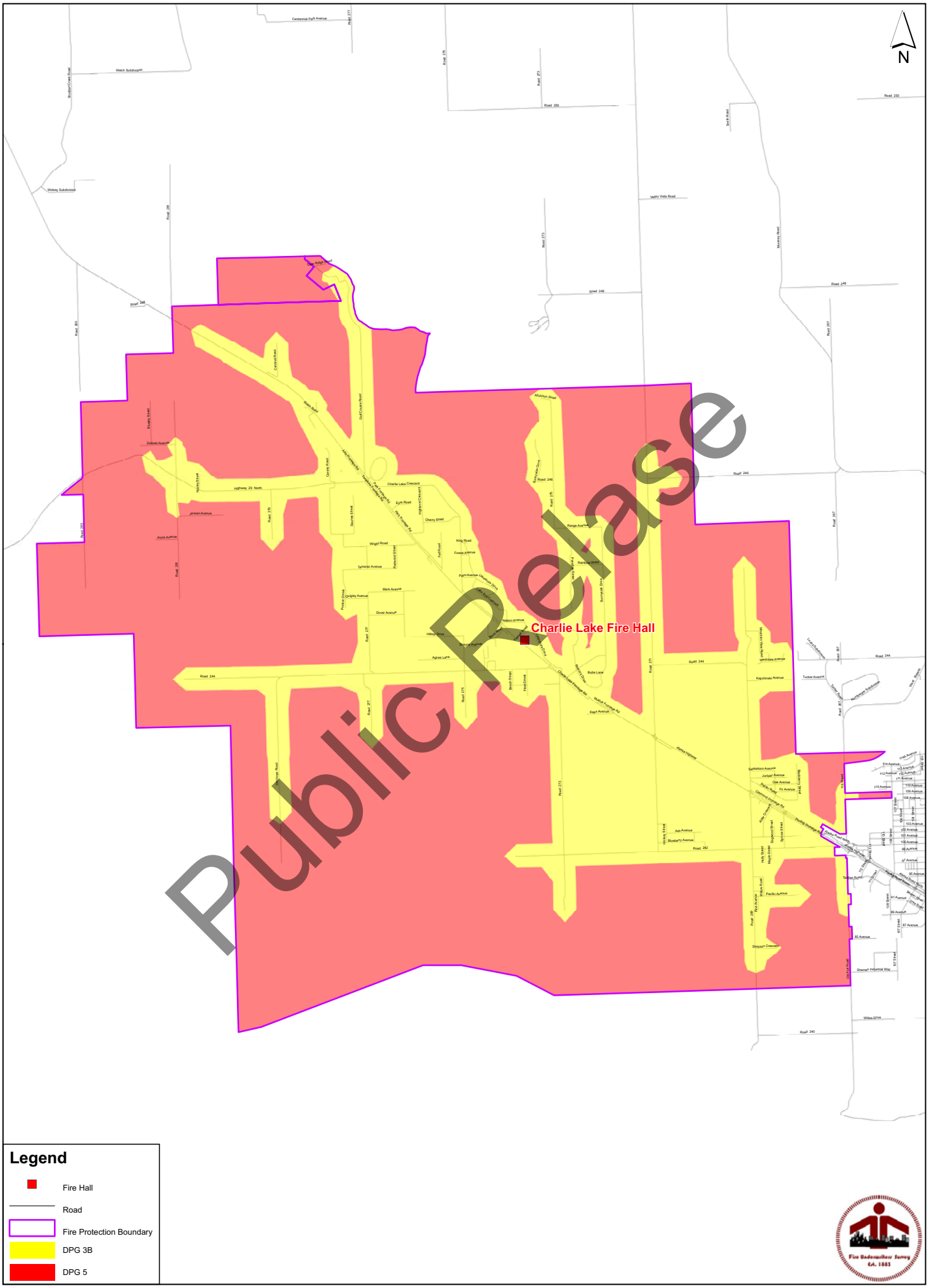
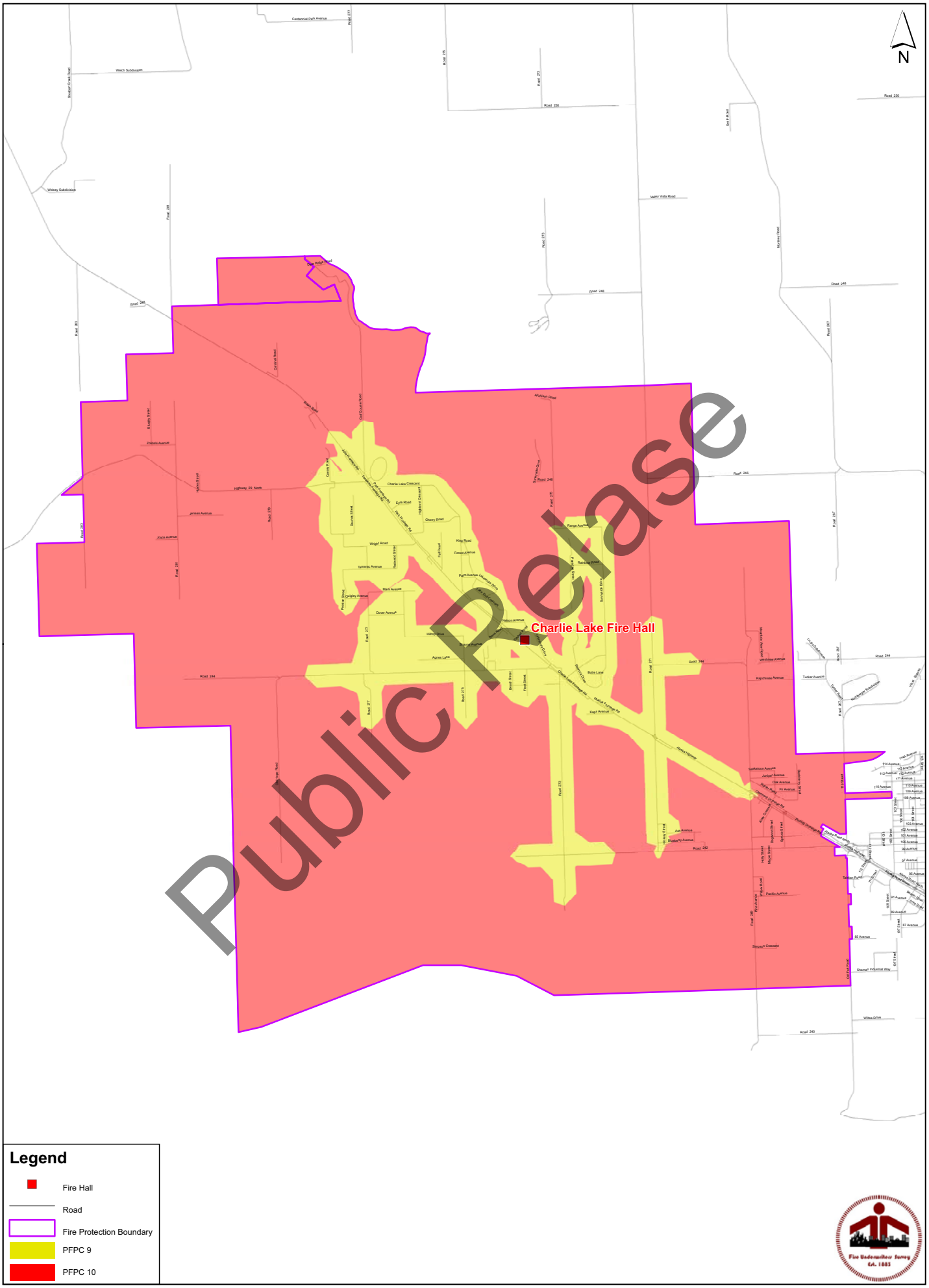
Figure 7-1 Dwelling Protection Grades (DPG)



Charlie Lake	Personal Lines Insurance - Dwelling Protection Grades	Fire Underwriters Survey
	Scale = 1:20,000 0 500 1,000 Meters	

Figure 7-2 Public Fire Protection Classification (PFPC)



Charlie Lake	Commercial Lines Insurance - Public Fire Protection Classification	
	Scale = 1:20,000 0 500 1,000 Meters	Fire Underwriters Survey

APPENDIX A

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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

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[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.

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APPENDIX B

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WATER SUPPLY
FOR
PUBLIC FIRE PROTECTION

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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:

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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.

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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.

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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.

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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.

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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.

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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.

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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.

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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.

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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.

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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.

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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.

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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.

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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.**

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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.

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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.)

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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.

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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.

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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%.

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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.

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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

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APPENDIX C

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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 S515-04 titled, "Automobile Fire Fighting Apparatus," which was adopted as a National Standard of Canada in September 2004. Fire apparatus should be built by recognized manufacturers.

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

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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 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 Underwriters Survey grades of the community. This can also affect the rates of insurance for property owners throughout the community.

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

Apparatus Age	Major Cities [3]	Medium Sized Cities [4] or Communities Where Risk is Significant	Small Communities [5] and Rural Centres
0 – 15 Years	First Line	First Line	First Line
16 – 20 Years	Reserve	2nd Line	First Line
20 – 25 Years [1]	No Credit in Grading	No Credit in Grading *or* *Reserve* [2]	No Credit in Grading *or* *2nd Line* [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
For
Fire Insurance Grading Purposes

	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

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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.

1.) Weight Tests

1.1) 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 axels.

For a vehicle having tandem rear axels 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.

2.) Road Tests

2.1) 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).

2.2) 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.

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3.) **Pump Performance Tests**

3.1) 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).

3.2) Priming and Suction Capability Tests

3.2.1.) 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.

3.2.2.) 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.

3.3) Pump Performance

3.3.1.) 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.

3.3.2.) 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/

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

- Underwriters Laboratories of Canada (ULC) Standard S515-04 "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 title "Fire Department Pumping Apparatus", latest edition.
- National Fire Protection Association (NFPA) 1901 Standard title "Pumper Fire Apparatus", latest edition.
- National Fire Protection Association (NFPA) 1911 Standard titled "Service Tests of Pumps on Fire Department Apparatus" 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 1-800-387-4356	Risk Management Services Fire Underwriters Survey 238 Brownlow Avenue, Suite 300 Dartmouth, Nova Scotia B3B 1Y2 1-800-639-4528

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APPENDIX D

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A-3 Application of Part 3.

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

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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.

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