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SCM Risk Management Services Inc.
Municipal Consulting Services

A Service to Insurers and Municipalities ™

2009

FINAL

Fire Department Operational Study

Fire Underwriters Survey

City of Campbell River

rms

NFPA® MEMBER 08-09

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1. SCOPE OF OUR ENGAGEMENT

The scope of this assignment was to conduct an assessment of the City of Campbell River Fire Protection Program, for three purposes being:

- To evaluate the Fire Department's organization of operations and to help the Fire Department to operate in the most efficient and effective manner possible, and
- To evaluate the community's fire protection needs, and
- To evaluate whether the community's fire insurance grading classifications need updating based on the current level of fire protection available to the community.

A supplementary objective was to provide direction to the Campbell River Fire Department as to where improvements to the community's fire protection programs could be made should fire insurance grading classifications remain status quo or be subject to downgrading.

1.1. Acknowledgement

RMS wishes to thank the Campbell River Fire Department, the Water Department and all those within the fire protection area and local districts for their valuable assistance in conducting this survey and preparation of this report.

1.2. Distribution of Use

This report, along with the findings and conclusions, contained herein, is intended for the sole use of the City of Campbell River to assist in the fire protection planning needs of the community.

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

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1.3. Reliance and Limitation

We have relied on the general accuracy of information provided by stakeholders including the City of Campbell River; however we have reviewed this information for consistency and reasonableness. The accuracy of our conclusions is dependent upon the accuracy and completeness of this underlying data. Therefore any discrepancies discovered in this data by the reader should be reported to us and this report amended accordingly, as warranted.

2. EXECUTIVE SUMMARY

This report outlines the significant findings of a Fire Department Operational Study and Fire Underwriters Survey of the City of Campbell River and Fire Department. The City of Campbell River requested Risk Management Services (RMS) Municipal Consulting Services to conduct an assessment to evaluate the operations of the fire department and the fire defences in the City for the purpose of operational decision making and updating insurance grading classifications. A second objective of the study is to evaluate the fire protection needs of the City and make recommendations in the areas that would maintain the overall level of fire protection as well as fire insurance grading classifications.

In order to determine the fire protection needs in the City of Campbell River, a fire hazard and life safety assessment was undertaken. The purpose of this review was to identify and quantify fire risk and hazard and life safety issues related to fire protection. The level of fire risk and fire load in Campbell River was found to have increased substantially since the last survey in 1982.

Within the fire insurance grading the level of risk with respect to structural fires and conflagrations is quantified in terms of required fire flows. The overall level of risk determined for each community or sub-district thereof is referred to as the basic Fire Flow. The Basic Fire Flow of the City of Campbell River as determined in this study is 19,000 LPM (4,200 Igpm). This is then the benchmark that the community is measured against.

This report focuses upon areas of fire department operations and water supply for fire protection that require upgrades to improve the level of fire protection to correspond with the community's current fire risk levels. A number of conclusions have been made as a result of our assessment. Those conclusions, and recommendations to address any concerns raised, are described throughout this report.

This assessment of the City of Campbell River finds that the City has made, and continues to make, considerable improvements to the level of fire protection it provides to the community.

The final Public Fire Protection Classification of the City is based on a measurement of the protective facilities against a benchmark of risk within the built environment in the community.

The four areas of protective/preventive facilities that are measured each have assigned relative classifications on a scale of 1 to 10 with 1 representing the highest standard of protection and 10 representing no protection.

Area of Grading	Weight within Grading	Relative Classification
Fire Department	40%	6
Water Supplies	30%	2
Fire Safety Control and Prevention	20%	4
Emergency Communications	10%	3

The area where the most significant improvement is needed is in Fire Department. The area protected by the Fire Department has been reviewed and to provide an ideal level of protection, one additional fire station would be required to serve the northern area of the community. Currently, the Campbell River Fire Department provides a career response from one fire station and an auxiliary response from the second fire station. The maximum credit that could be received in this area of the grading would include career response from three fire stations including one in the northern area.

A cost benefit analysis was also completed as part of this study which indicates that the greatest cost benefit for fire protection comes from Personal Lines insurance and occurs when a community fire insurance grade improves to Dwelling Protection Grade 3A.
The City of Campbell River substantially exceeds the requirements for this grade, however continues to receive significant cost benefits through reduced insurance premiums on Commercial Lines albeit to a smaller extent.

Reduction in fire protection service levels as well as reduction in other service levels throughout the City may be required due to the economic downturn, however are not recommended. Should the City of Campbell River wish to further decrease the level of fire protection service being provided, it would increase the risk of life and property losses to fire and adversely impact the insurance rates of property owners. This may

also reduce potential business development due to reduced access to the insurance market.

In the course of this evaluation, Campbell River has been compared to a number of similar communities in the province and has been found to have spending levels within normal range of other municipalities with respect to fire protection. Significant reductions in fire protection spending may result in a short term improved budget outlook, however the increased risk to life and property of the constituents may result in greater economic hardship should a significant loss occur.

Summary of Recommendations

Recommendation 8.2-1 Assign Specific Duties and Responsibilities for Captains to Manage Administrative Work Load

In order to help maximize efficiency within the fire department operations, it is recommended that each Captain be assigned specific departmental and shift duties, including but not limited to:

- Preparing of Fire Department employee payroll including documenting employee's holiday, bank and sick time balances.
- Coordinating training opportunities as required including scheduling, venues, travel arrangements, accommodations, meals and reimbursements.
- Assisting with building and apparatus maintenance and repairs including gathering quotes, preparing specification comparisons and making recommendations as required.

- Issuing and processing purchase orders as required for all Fire Department purchasing including coding and processing invoices.

The Captain rate was bargained in 2009. In exchange for enhanced salary, the Union and Employer negotiated additional administrative/supervisory duties for the Captain Positions.

The primary responsibility for the Captains is for response to emergency calls throughout the community and to ensure that fire fighting tools, equipment and apparatus are properly maintained, in addition to monthly fire prevention inspections and fire fighter training. Typically, these responsibilities can occupy an entire shift for a Captain and their crew. Additionally, consideration should be given to the time needed to train these members as administrators (ex. office software, protocols, coding, etc.).

If the Captains are to be responsible for administrative duties, it is important that the amount of time spent on tasks is tracked and documented. Regular performance reviews should be conducted between the Fire Department management and the Captains. During the reviews, the documentation of time spent on tasks and the completion status of the tasks should be the primary focus. The documentation should indicate if other responsibilities are being overlooked as a result of additional work load.

If it is determined that the Captains cannot adequately fulfill their additional duties and responsibilities, consideration should be given to

1. providing additional training and/or administrative tools to facilitate efficient completion of administrative tasks; and/or
2. re-evaluating job descriptions; and/or
3. reinstating the Administrative Assistant position

Recommendation 8.3-1 Improve Fire fighting Roster Depth and Provide a Minimum Available Fire Force of 4 or Greater

In order to reduce the use of fire fighter over time, it is recommended that additional fire fighting personnel be acquired. This will allow the fire department to rely less on overtime to maintain a 4 fire fighter crew, in addition to maintaining a day shift Fire Prevention Officer with the previous level of fire prevention services throughout the community. This will help the Fire Prevention program by having a dedicated FPO.

Reassigning a day shift Fire Prevention Officer to fire fighting duties reduces the level of Fire Prevention services provided throughout the community and has an adverse effect within the fire insurance grading for the City of Campbell River. It can be expected that the frequency of inspections, for any given building, will reduce and there is the potential for buildings to go an excessive amount of time before receiving a fire

prevention inspection ultimately increasing the life safety risk of the occupants and the fire fighters.

Recommendation 8.5-1 - Decommission and Replace Apparatus in Excess of 20 Years of Age.

To reduce the risk to the life safety of fire fighters utilizing the apparatus, an apparatus replacement program should be developed. The replacement program should take into consideration the benefits with respect to fire insurance grades as well as the costs associated with owning and maintaining apparatus.

To ensure that apparatus is recognized for fire insurance grading purposes, the replacement program for apparatus within the City of Campbell River should not exceed a 20 year life cycle for apparatus. See Appendix D.

Recommendation 8.7-1 – Expand Fire Department to Provide Improved Fire Protection Coverage throughout the Community

In order to provide the optimum level of fire protection throughout the entire community, additional resources should be acquired. An additional fire station should be constructed and be located so that the industrial mill buildings and surrounding area are within a reasonable response distance from the station.

Option 1

To provide the ideal level of fire protection to the industrial mill area, within the fire insurance grading, it is recommended that a new fire station be built. The new fire station should have all the tools and equipment needed by the fire fighters in addition to 2 pumper companies and 1 ladder company. The location of the fire station should be situated so that the response requirements of the first and second due pumper and ladder companies can be met. Additionally, the number of fire fighters (career or auxiliary) should be sufficient to operate each apparatus safely and effectively.

Providing a fire station that is located within the response requirements of the first and second due pumper and ladder companies, is housed with 2 pumpers and 1 ladder and is staffed with an adequate number of fire fighters will result in attaining the maximum amount of credit within this portion of the fire insurance grading. Additionally, from the perspective of the insurer, these buildings will be considered to be “protected” because they are within 5 road km of a fire station.

Option 2

To provide a recognized level of coverage, from the perspective of an insurer, it is recommended that a satellite fire station be situated so that no building in the Catalyst area is beyond 5 road km of the satellite fire station. The station should be staffed with

a minimum of 15 auxiliary members from Fire Station 1 and be housed with at least one recognized pumper apparatus.

From the perspective of most insurers, the Catalyst buildings are considered to be "unprotected" because they are beyond 5 road km from a fire station. Providing a fire station that has a pumper apparatus with the necessary tools, equipment, staffing and is within 5 road km will change the Catalyst protection status from "unprotected" to "fire hall protected" or "protected" should the hydrant system be recognized.

Recommendation 8.9-1 Take steps to ensure that apparatus are professionally maintained by appropriately qualified personnel

Apparatus used by the fire department is critically important to the life safety of fire fighters as well as to those persons involved in accidents or fires that are responded to. Failure of apparatus (or sub-system) to operate according to specification during an emergency may result in significant increase in risk to life safety and property losses. For this reason, it is important that a high standard of care be utilized in maintaining emergency apparatus and equipment.

The recommended standards for maintaining fire apparatus are:

1. All Manufacturer Specifications
2. NFPA 1911: Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus, 2007 Edition

Maintenance to fire apparatus should be completed by a certified Emergency Vehicle Technician (NFPA 1071: Standard for Emergency Vehicle Technician Professional Qualifications). The Campbell River Fire Department maintenance program manager should be highly familiarized with the Manufacturers' specifications for maintenance and with NFPA 1911.

Recommendation 8.13-1 - Increase Available Fire Force

To maintain or improve the Public Fire Protection Classification, the available fire force should be improved for the Campbell River Fire Department. Additional credit could be received up to a maximum of 60 fire fighters per shift. Note that the available fire forces can be improved through additional auxiliaries up to 50% of the required fire force. (In the case of Campbell River, the required fire force is 60, so the maximum available fire force that can be provided through auxiliaries and other FFEU sources is 30.)

Should the City of Campbell River opt to provide additional fire fighter positions, the amount of credit in the Available Fire force section will not only improve but, if the day shift Fire Prevention Officer can return to their previous duties, additional credit can be

awarded within the Fire Safety Control portion of the fire insurance grading. It can be assumed that the frequency of inspections will improve to previous levels and the overall level of Fire Prevention Services will improve.

Providing career staffing is a serious matter that requires careful consideration. There are many factors to consider and the fire insurance grading is only one such factor.

Recommendation 8.14-1 - Implement Duty Crew System to Help Improve Response Times

In order to help reduce the response times for apparatus that is staffed by auxiliary members, consideration should be given to implementing a duty crew system for both fire stations as they both operate using auxiliary members. The number of auxiliary members that are part of the duty crew should be sufficient enough to adequately and safely operate the emergency apparatus.

Implementing a duty crew system has the potential to help reduce response times for additional apparatus needed on emergency scenes. Within the fire insurance grading, any member responding as part of the duty crew is graded the same as an auxiliary member.

Recommendation 8.15-1 Improve Pre-Incident Planning Program

In order to improve the pre-incident plan program utilized by the CRFD, it is recommended that all pre-incident plans be updated as required upon completion of any building inspection conducted within the City of Campbell River. Additionally, continuous efforts should be given to increasing the percent of buildings that have pre-incident plans. All of the pre-incident plans should be stored digitally and in hard copy and be made available to the fire fighters and the dispatchers. Upon receipt of an emergency call and dispatch of fire fighters, the dispatcher should have the ability to provide the fire fighters with the pre-incident plan details (i.e. pre-plan number, etc.) or relevant information (hazmat storage, etc.).

Recommendation 9.1-1 Reassign Shift Fire Prevention Officer

It is recommended that a crew Fire Prevention Officer be reassigned from fire fighting duties to regular day shift Fire Prevention Officer. By reassigning this member, Campbell River buildings will be inspected and re-inspected in a timely manner. Additionally, reassigning a shift Fire Prevention Officer to regular day shift Fire Prevention duties will help improve the level of Fire Prevention services provided throughout the community and have a positive effect within the fire insurance grading for the City of Campbell River. It can be expected that the frequency of inspections, for any given building, will improve as well as the record keeping and overall administration of the program. Additionally, this allows the Fire Chief to manage the Prevention Program as a whole and focus their attention on more managerial duties.

Recommendation 9.1-2 – Maintain the Sprinkler Bylaw

To reduce fire risk and improve life safety throughout the community, it is strongly recommended that the Sprinkler Bylaw be maintained. An effective Sprinkler Bylaw reduces the required fire flow for any given building and has the potential to create a "cap" on the Basic Fire Flow, and the associated benchmarks that the community is graded against.

Furthermore, consideration should be given to expanding the scope of the sprinkler bylaw to include retrofitting existing building stock in stages.

Recommendation 9.2-1 Improve Fire Prevention Inspection Program

To improve the level of fire prevention and reduce the overall fire risk in the community, the Fire Prevention Inspection Program should be improved to include a minimum of one inspection per year for all hotels, public buildings and industrial occupancies in the City. Increased inspection frequency should be provided to occupancies with increased fire risk and/or life safety issues.

The City of Campbell River should consider providing an additional full time Fire Prevention Officer (Local Assistant to the Fire Commissioner) to conduct inspections on a reasonable frequency schedule. If the community cannot regularly conduct fire prevention inspections, due to a lack of resources, consideration should be given to outsourcing fire prevention inspection related services.

Reference: FIRE SERVICES ACT [RSBC 1996] CHAPTER 144

> *Municipal duty to inspect hotels and public buildings*
> *Section 26*
> *(1) A municipal council must provide for a regular system of inspection of hotels and public buildings in the municipality.*
> *(2) A municipal council may authorize persons, in addition to the local assistant, to exercise within the municipality some or all of the powers under sections 21 to 23. The information gathered in the inspection process should be utilized in developing the pre-incident plans for the community as well.*

Note: Failure to comply with the Fire Services Act may result in a significant liability exposure for the City if a fire related loss should occur.

3. TERMS OF REFERENCE

Term	Definition
Aerial Fire Apparatus.	A vehicle equipped with an aerial ladder, elevating platform, aerial ladder platform, or water tower that is designed and equipped to support fire fighting and rescue operations by positioning personnel, handling materials, providing continuous egress, or discharging water at positions elevated from the ground.
Aid	
Aid - Automatic Aid.	A plan developed between two or more fire departments for immediate joint response on first alarms. This process is accomplished through simultaneous dispatch, documented in writing, and included as part of a communication center's dispatch protocols.
Aid - Mutual Aid.	Reciprocal assistance by emergency services under a prearranged plan. This is part of the written deployment criteria for response to alarms, as dispatched by the communications center.
Basic Fire Flow.	The benchmark required fire flow for a community, typically the fifth highest calculated required fire flow of all areas within the community. The Basic Fire Flow is the benchmark against which all protective facilities are measured.
Building	Any structure used or intended for supporting or sheltering any use or occupancy.
Building area	The greatest horizontal area of a building above grade within the outside surface of exterior walls or within the outside surface of exterior walls and the centre line of firewalls.
Building height	The number of storeys contained between the roof and the floor of the first storey.
Built Environment	Buildings and structures: human-made buildings and structures, as opposed to natural features
Combustible	A material fails to meet the acceptance criteria of CAN4-S114, “Determination of Non-Combustibility in Building Materials.”
Commercial Lines Insurance	A distinction marking property and liability coverage written for business or entrepreneurial interests (includes institutional, industrial, multi-family residential and all buildings other than detached dwellings that are designated single family residential or duplex) as opposed to Personal Lines.
Community - Major or Large	An incorporated or unincorporated community that has: • a populated area (or multiple areas) with a density of at least 400 people per square kilometre; AND • a total population of 100,000 or greater.
Community - Medium	An incorporated or unincorporated community that has: • a populated area (or multiple areas) with a density of at least 200 people per square kilometre; AND/OR • a total population of 1,000 or greater.
Community - Small	An incorporated or unincorporated community that has: • no populated areas with densities that exceed 200 people per square kilometre; AND • does not have a total population in excess of 1,000.

Company.	A group of members that is (1) under the direct supervision of an officer or leader; (2) trained and equipped to perform assigned tasks; (3) usually organized and identified as engine companies, ladder companies, rescue companies, or squad companies; (4) usually operates with one piece of fire apparatus (pumper, ladder truck, elevating platform, rescue, squad, ambulance); and (5) arrives at the incident scene on fire apparatus or assembles at the scene prior to assignment. The term company, is synonymous with company unit, response team, and response group.
Demand Zone Levels.	An area used to define or limit the management of a risk situation. A demand zone can be a single building or a group of buildings. It is usually defined in terms of geographical boundaries, called fire management areas or fire management zones.
Detached Dwelling	Buildings containing not more than two dwelling units in which each dwelling unit is occupied by members of a single family with not more than three outsiders, if any, accommodated in rented rooms. aka. One- and Two-Family Dwelling
Dwelling Protection Grade (DPG)	The fire insurance grade or grades utilized by Personal Lines Insurers in Canada. The DPG is a number between 1 and 5 that is calculated by comparing the fire risk in terms of require fire flows to available resources. Unlike the PFPC system, within the DPG system, the benchmark required fire flow is a constant, and is typical for a Detached Dwelling. The DPG for communities across Canada is determined from a basic survey of the available resources related to fire risk reduction and fire protection capacity.
Dwelling, Typical	Refers to One- and Two-Family Detached Dwellings: - with no structural exposures (buildings with an area exceeding 9.3 sq.m) within 3 m; - with no unusual fire risks (such as wood shake roofs); AND - with an effective area (all storeys excluding basements) not exceeding 334 sq.m (3600 sq.ft).
Emergency Dispatch Protocol.	A standard sequence of questions used by telecommunicators that provides post-dispatch or pre-arrival instructions to callers.
Emergency Incident.	Any situation to which the emergency services organization responds to deliver emergency services, including rescue, fire suppression, emergency medical care, special operations, law enforcement, and other forms of hazard control and mitigation.
Emergency Response Facility (ERF).	A structure or a portion of a structure that houses emergency response agency equipment or personnel for response to alarms. Examples of ERFs include a fire station, a police station, an ambulance station, a rescue station, a ranger station, and similar facilities.
Emergency.	A condition that is endangering or is believed to be endangering life or property; an event that requires the urgent response of an emergency response agency.
Engine	A fire department pumper having a rated capacity of 2840 L/min (625 Igpm) or more.

Exposing building face	That part of the exterior wall of a building which faces one direction and is located between ground level and the ceiling of its top storey or, where a building is divided into fire compartments, the exterior wall of a fire compartment which faces one direction.
Exposure	The heat effect from an external fire that might cause ignition of, or damage to, an exposed building or its contents.
Fire Apparatus.	A fire department emergency vehicle used for rescue, fire suppression, or other specialized functions.
Fire Department Vehicle.	Any vehicle, including fire apparatus, operated by a fire department.
Fire Department.	A fire department is a group of persons formally organized as an authorized service of a municipal or other local government having a sustainable source of funding, which could include taxation, fees for services provided, contracts, permit fees or other reliable sources of revenue which will support the cost of services provided. A minimum number of trained persons able and equipped to respond with motorized fire fighting apparatus to extinguish fires or to respond to other classes of circumstances which may occur within a designated geographical area.
Fire Department. - Public Fire Department.	A legally formed organization providing rescue, fire suppression, emergency medical services, and related activities to the public.
Fire Force, Available	A measure of the human resources that are available to participate in fire fighting operations on the fire ground or an equivalent measure.
Fire Force, Required	A measure of the human resources that are needed to participate in fire fighting operations on the fire ground (or an equivalent measure) for an ideal response based on the required fire flow, number of companies and average response time as specified in the Table of Effective Response.
Fire Flow	The flow rate of a water supply, measured at 20 psi (137.9 kPa) residual pressure, that is available for fire fighting.
Fire Growth Potential	The potential size or intensity of a fire over a period of time based on the available fuel and the fire's configuration.
Fire Hall	An "emergency response facility" where fire department apparatus and equipment are housed, protected against harm, and made readily accessible for use in emergencies. The fire hall is normally the location where fire fighters respond from. Other primary purposes include training and administration of the fire department.
Fire load	(as applying to an occupancy) The combustible contents of a room or floor area expressed in terms of the average weight of combustible materials per unit area, from which the potential heat liberation may be calculated based on the calorific value of the materials, and includes the furnishings, finished floor, wall and ceiling finishes, trim and temporary and movable partitions.
Fire Protection.	Methods of providing fire detection, control, and extinguishment.
Fire Suppression.	The activities involved in controlling and extinguishing fires. Fire suppression includes all activities performed at the scene of a fire or training exercise that expose fire department members to the dangers of heat, flame, smoke, and other products of combustion, explosion, or structural collapse.
First Responder (EMS).	Functional provision of initial assessment (airway, breathing, and circulatory systems) and basic first aid intervention, including CPR and automatic external defibrillator (AED) capability. A first responder assists higher level EMS providers.

First Storey	The uppermost storey having its floor level not more than 2 m above grade
Grade	(as applying to the determination of building height) The lowest of the average levels of finished ground adjoining each exterior wall of a building, except that localized depressions such as for vehicle or pedestrian entrances need not be considered in the determination of average levels of finished ground.
Hazard.	The potential for harm or damage to people, property, or the environment. Hazards include the characteristics of facilities, equipment systems, property, hardware, or other objects, and the actions and inactions of people that create such hazards.
Hazardous Material.	A substance (solid, liquid, or gas) that when released is capable of creating harm to people, the environment, and property.
Incident Commander.	The person who is responsible for all decisions relating to the management of the incident and is in charge of the incident site.
Incident Management System (IMS).	An organized system of roles, responsibilities, and standard operating procedures used to manage emergency operations. Such systems are also referred to as incident command systems (ICS).
Incipient Stage	Refers to the severity of a fire where the progression is in the early stage and has not developed beyond that which can be extinguished using portable fire extinguishers or handlines flowing up to 473 L/min (125 gpm). A fire is considered to be beyond the incipient stage when the use of thermal protective clothing or self-contained breathing apparatus is required or an industrial fire brigade member is required to crawl on the ground or floor to stay below smoke and heat.
Initial Attack.	An aggressive suppression action consistent with fire fighter and public safety and values to be protected.
Initial Attack Apparatus	Fire apparatus with a permanently mounted fire pump of at least 250 gpm (950 L/min) capacity, water tank, and hose body whose primary purpose is to initiate a fire suppression attack on structural, vehicular, or vegetation fires, and to support associated fire department operations.
Insurance Risk	A building insured under *Personal Lines* or *Commercial Lines* that can result in a loss from a structure fire.
Ladder Company.	A fire department company that is provided with an aerial fire apparatus and is trained and equipped to support fire fighting and rescue operations by positioning personnel, handling materials, providing continuous egress, or discharging water at positions elevated from the ground.
Ladder Truck.	An alternate name for Aerial Fire Apparatus.
Master Stream.	A portable or fixed fire fighting appliance supplied by either hose lines or fixed piping and that has the capability of flowing in excess of 300 gpm (1140 L/min) of water or water based extinguishing agent.
Member.	A person involved in performing the duties and responsibilities of a fire department, under the auspices of the organization. A fire department member can be a full-time or part-time employee or a paid or unpaid volunteer, can occupy any position or rank within the fire department, and can engage in emergency operations.
Mobile Water Supply (Tanker, Tender)	A vehicle designed primarily for transporting (pickup, transporting, and delivery) water to fire emergency scenes to be applied by other vehicles

or pumping equipment.

Non-combustible	A material that meets the acceptance criteria of CAN4-S114, "Determination of Non-Combustibility in Building Materials."
Non-combustible construction	The type of construction in which a degree of fire safety is attained by the use of non-combustible materials for structural members and other building assemblies.
Non-combustible Material	A material, as defined in NFPA 220, Standard on Types of Building Construction, that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat. Materials reported as non-combustible, when tested in accordance with ASTM E 136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C, are considered non-combustible materials.
Officer	
Officer - Company Officer.	A supervisor of a crew/company of personnel. This person could be someone appointed in an acting capacity. The rank structure could be either lieutenant, or captain.
Officer - Incident Safety Officer.	An individual appointed to respond or assigned at an incident scene by the incident commander to perform the duties and responsibilities of that position as part of the command staff.
Officer - Supervisory Chief Officer.	A member whose responsibility is above that of a company officer, who responds automatically and/or is dispatched to an alarm beyond the initial alarm capabilities, or other special calls. In some jurisdictions, this is the rank of battalion chief, district chief, deputy chief, assistant chief, or senior divisional officer (UK fire service). The purpose of their response is to assume command, through a formalized transfer-of-command process, and to allow company officers to directly supervise personnel assigned to them.
One- and Two-Family Dwelling	Buildings containing not more than two dwelling units in which each dwelling unit is occupied by members of a single family with not more than three outsiders, if any, accommodated in rented rooms.
Optimum Level of Fire Protection.	The combination of fire fighting staff and apparatus that delivers a suppression effort commensurate with the fire demand faced, yet representing the most efficient use of resources in a safe and effective manner.
Peak Fire Flow.	All buildings and building groups within a District or Municipality, the highest calculated required fire flow.
Personal Lines Insurance	Insurance covering the liability and property damage exposures of private individuals and their households as opposed to Commercial Lines. Typically includes all detached dwellings that are designated single family residential or duplex.
Personal Protective Clothing	The full complement of garments fire fighters are normally required to wear while on emergency scene, including turnout coat, protective trousers, fire-fighting boots, fire-fighting gloves, a protective hood, and a helmet with eye protection.
Personal Protective Equipment	Consists of full personal protective clothing, plus a self-contained breathing apparatus (SCBA) and a personal alert safety system (PASS) device.

Public Fire Department	An organization providing rescue, fire suppression, emergency medical services, and related activities to the public.
Public Fire Protection Classification	The fire insurance grade or grades utilized by Commercial Lines Insurers in Canada. The PFPC is a number between 1 and 10 that is calculated by comparing the fire risk in terms of require fire flows to available resources. The PFPC for communities across Canada is determined from an extensive survey and analysis of the fire risk in the built environment and the available resources related to fire risk reduction and fire protection capacity.
Public Fire Service Communications Center	The building or portion of the building used to house the central operating part of the fire alarm system; usually the place where the necessary testing, switching, receiving, transmitting, and power supply devices are located.
Pumper	Fire apparatus with a permanently mounted fire pump of at least 750 gpm (2850 L/min or 625 Igpm) capacity, water tank, and hose body whose primary purpose is to combat structural and associated fires.
Quint	Fire apparatus with a permanently mounted fire pump, a water tank, a hose storage area, an aerial ladder or elevating platform with a permanently mounted waterway, and a complement of ground ladders. The primary purpose of this type of apparatus is to combat structural and associated fires and to support fire-fighting and rescue operations by positioning personnel-handling materials, providing continuous egress, or discharging water at positions elevated from the ground.
Required Fire Flow.	The rate of water flow, at a residual pressure of 20 psi (138 kPa) and for a specified duration, that is necessary to confine and control a major fire in a specific building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure. This may include as much as a city block.
Storey	That portion of a building which is situated between the top of any floor and the top of the floor next above it, and if there is no floor above it, that portion between the top of such floor and the ceiling above it.
Wildland/Urban Interface	The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

4. FIRE UNDERWRITERS SURVEY

4.1. 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. The Survey provides data to program subscribers regarding public fire protection for fire insurance statistical and underwriting evaluation. It also advises municipalities of deficiencies in their fire defences and recommends improvements to enable them to better deal with fire protection problems.

Fire Underwriters Survey offices maintain data from surveys on fire protection programs throughout all municipalities across Canada. The results of these surveys are used to establish the Public Fire Protection Classification (PFPC) for each community. The PFPC 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.

4.2. Fire Insurance Grading Classifications

Public Fire Protection Classification

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

Fire Underwriters Survey also assigns a second grading system for community fire protection. The second grading system, entitled Dwelling Protection Grades (D.P.G.) assesses the protection available for small buildings such as single-family dwellings.

Dwelling Protection Grade

The DPG is a numerical grading system scaled from 1 to 5. One (1) is the highest grading possible and 5 indicates little or no fire protection is present. This grading reflects the ability of a community to handle fires in small buildings under Personal Lines insurance. This is insurance covering the liability and property damage and exposures of private individuals and their households as opposed to Commercial Lines. Typically includes all detached dwellings that are designated single family residential or duplex.

4.3. The Public Fire Protection Classification System

The PFPC grading system is a measure of a community's overall programs of fire protection. The DPG grading system only evaluates a fire department's ability to control or extinguish fires in small buildings.

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 broad areas of fire protection are reviewed in the survey and have the following weights within the FUS grading system:

Fire department operations	40%
Fire safety control within the community	20%
Fire service communications	10%
Water supplies and distribution system	30%

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 in the amount of risk they are willing to assume within a given community or portion of a community, and to set fire insurance rates for commercial properties. Improved fire protection grades may result in increased competition for insurance underwriting companies to place their business within a community. Our analysis indicates that an improved fire protection grade has a positive effect on fire insurance rates.

In addition, FUS 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.

PFPC classifications should not only be viewed in terms of improved fire insurance rates but also as a measure of fire protection that is present. Based on the FUS review, it is our opinion, that there are areas within City of Campbell River's fire protection programs where improvement is warranted. Improvements are recommended due to the ongoing growth and development in the community.

4.4. The Dwelling Protection Grading System

Dwelling Protection Grades are based on a 1 to 5 grading system; DPG 5 indicates little or no fire protection is available. Most small and midsized 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[1]. 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 provided "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. The lower the DPG assignment is, the larger the discount given in fire insurance rates. The discounts given for an identical property considered fully-protected over those considered unprotected can be approximately 60%. Where there is sufficient population and sufficient taxation base, the savings generated can more than offset the operating and capital costs of an effective fire services.

A summary of the requirements for fire departments to receive the various protection grades is indicated in Table 4.4-1 - FUS Dwelling Protection Grades - Minimum Requirements Per Fire Station.

Table 4.4-1 - FUS Dwelling Protection Grades - Minimum Requirements Per Fire Station

DWELLING PROTECTION GRADE	WATER WORKS SYSTEM	FIRE DEPARTMENT		CORRELATION WITH PUBLIC FIRE PROTECTION CLASSIFICATION (P.F.P.C.) See "Note" below
		EQUIPMENT	FIRE FIGHTERS	
1	Hydrant system capable of delivering 200 Igpm for 2 hours or 400 Igpm for 1 hour in conjunction with consumption at maximum daily rate.	Response from within 8 km by road of a standard pumper.	Response of 3 on-duty career members plus fire chief or other officer not required on-duty.	Water supply and fire department must grade Class 5 or better.
2	Same as 1	Same as 1	Response of 1 on-duty career member and 15 auxiliary, fully equipped.	Water Supply and Fire Department must grade Class 6 or better.
3A	Same as 1	Same as 1	15 auxiliary, fully equipped[1]	Not correlated to Public Fire Protection Classification.
3B	Not required	2 units required. Standard pumper plus a tanker.	15 auxiliary, fully equipped	Not correlated to Public Fire Protection Classification.
4	Not required	Standard pumper or 800 I.gal. tanker with booster pump of 200 Igpm capacity.	10 auxiliary, fully equipped	Not correlated to Public Fire Protection Classification.
5	Unprotected communities or communities not qualifying for Grades 1, 2, 3A, 3B, or 4 above.			

[1] A fully equipped fire fighter consists of a fire fighter having personal protective equipment as defined in NFPA 1001.
"Personal Protective Clothing" is the full complement of garments fire fighters are normally required to wear while on emergency scene including turnout coat, protective trousers, fire fighting boots, fire fighting gloves, a protective hood, a protective helmet with eye protection.
"Personal Protective Equipment" consists of full personal protective clothing, plus a self-contained breathing apparatus (SCBA) and a personal alert safety system (PASS) device.
A minimum of 4 SCBA units are required, each with a spare air cylinder, for a standard pumper.

Many insurers have simplified this grading system to a simple three tier system. This is typical for a 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 4.4-2 - FUS Grades correlation to commonly used Insurance terminology and simplified grades.

Table 4.4-2 - FUS Grades 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

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

- Fire Department Organization
- Membership/Roster
- Training
- Apparatus Requirements
- Fire Suppression Capability, and
- Alarm Notification

4.5. Measuring Fire Risk in This Review

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

Community growth resulting from capital developments increases the level of fire risk in such communities; however, the development of fire protective services often falls behind the expectations of the community and in some cases fire departments are simply incapable of providing a reasonable level of fire protection to the community.

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

The City of Campbell River has several characteristics that present fire fighting and life safety challenges, such as:

- Significant public safety risk due to the size of population
- Large number of multiple storey buildings insured under Commercial Lines
- Industrial area + mill with excessive response distances

4.6. 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 a community's fire loss experience. Fire defences should be tailored to meet both of these needs. To gauge the needs of the fire service based on experience alone would be to ignore perils that have not yet occurred. Ignoring experience and focusing on risk alone may tend to build-up a

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

In the case of the City of Campbell River, the fire protective service was measured in its ability to provide fire protection to the various zones and typical risks found in the community. These zones and risks included, but were not limited to:

- single family residential
- small, medium and large scale commercially insured buildings
- public/institutional zones

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

- The type of manning (i.e. career fire fighters vs. auxiliaries),
- The quality of training programs,
- The type of apparatus and ancillary equipment for the hazards present,
- The condition and age of fire apparatus and fire suppression equipment,
- The distribution of companies relative to fire risk,
- The fire prevention and public education programs, and
- The availability, adequacy and reliability of emergency water supplies.
- Type of, and number of apparatus
- Pumping capacity

- Response to alarm protocols
- Response times to critical risks
- Adequacy of the fire fighter training program including specialized training
- Emergency communication systems
- Ancillary equipment
- Fire department roster type and response levels
- Fire safety education
- Building controls (application of Building Codes and related standards; plan review process; effective construction inspection and permit process)
- Fire prevention inspections
- Adequacy & reliability of emergency water supplies
- Automatic fire protection systems
- Management of emergency services

5. PROJECT SCOPE AND METHODOLOGY

5.1. Project Objectives

The scope of this assignment was to conduct an assessment of the City of Campbell River Fire Protection Program, for three purposes being:

- To evaluate the Fire Department's organization of operations and to help the Fire Department to operate in the most efficient and effective manner possible, and
- To evaluate the community's fire protection needs, and
- To evaluate whether the community's fire insurance grading classifications need updating based on the current level of fire protection available to the community.

A supplementary objective was to provide direction to the Campbell River Fire Department as to where improvements to the community's fire protection programs could be made should fire insurance grading classifications remain status quo or be subject to downgrading.

The evaluation is intended to consider both current and future fire protection needs. The tasks and methodology used to conduct the assessment are listed below:

1. Community Risk and Hazard Assessment including
    - Assessment of community profile
    - Profile and quantify hazard and risk
    - Assess planning methods for future growth

2. Fire Department Assessment including assessments of
    - Fire Department Profile
    - Operations and Administration
    - Apparatus and equipment
    - Distribution of resources
    - Pumping capacity
    - Maintenance programs

3. Staffing and personnel
    - Training programs
    - Pre-Incident Planning Program

4. Fire Safety Control Assessment

5. Emergency Communications Assessment

6. Water Supplies for Fire Protection Assessment
    - Evaluate emergency water supplies capacity and storage
    - Test water supplies at various representative points throughout system
    - Analyze water system for weaknesses and lack of redundancy
    - Compare available water supplies to combined domestic demand and calculated fire flow needs

7. Complete a fire insurance grading review of the community

8. Develop a report that includes findings and recommendations

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

- Bill Halstead, General Manager of Protective Services
- Dean Spry, Chief Fire Official
- Ian Baikie, Deputy Fire Chief – Operations
- Chris Vrabel, Deputy Fire Chief – Communications
- Derek Bowen – Water Department – Water Foreman
- Various Staff and others.

6. CITY OF CAMPBELL RIVER

6.1. General Description

The City of Campbell River had a population of approximately 28,200 in 2001 which has not significantly changed and is approximately 29,500 as of 2006 (StatsCan). Campbell River covers an area approximately 150 km^2. The majority of buildings in the main downtown core are 2-3 storeys in height which consists primarily of large and small mercantile and restaurants. An industrial area is located on the north side of the Campbell River. Buildings in this area are typically 1-2 storeys having occupancies such as, general storage, auto body shops, net lofts, etc. Travelling further north of this industrial area, there is a milling operation that is owned and operated by Catalyst. Along the Island Highway (19A), a number of 4-5 storey hotels and multi-family residential buildings are found. It is important to note that there are various 3-5 storey multi-family residential buildings that are located throughout the community.

6.2. Local Governance

The responsibility for local government, in the City of Campbell River, is entrusted in a Mayor and 6 Councillors. A general election is held every three years, most recently in November 2008.

The function of Council is to establish corporate policy and to set direction for the community. This is achieved through their annual Strategic Plan, Financial Plan, Council Policies and Bylaws. Implementation of Council Policy is delegated to the Chief Administrative Officer who is responsible for the actions of all staff.

Within City Hall, there are a number of different City Departments, some of which follow:

Operations

Working in consultation with Facilities and Supply Management, this department is responsible for the maintenance and operation of the City's transportation, water distribution and waste water.

Planning and Land Use

Primarily application and regulation driven, the Department is responsible for review and processing of development applications including Official Community Plan and Zoning Bylaw amendments, development permits, building inspections, variance applications and subdivision. They are also responsible for the City's long rang planning, such as the Official Community Plan and the Zoning Bylaw.

Corporate and Protective Services

The offices of the City Clerk provides administrative services to Council and its committees, to all City departments and to the citizens of Campbell River.

Facilities and Supply Management

Facilities and Supply Management is responsible for purchasing on behalf of all City departments, facility repair and maintenance, inventory management, fleet management and capital work.

Human Resources

The Human Resources Department is responsible for a variety of services including employment, recruiting and staffing, compensation, labour relations, training, occupational health and safety, and the development of human resources policies.

Finance Department

The Financial Services Department manages the City's Financial Information system. The Information Services Department is part of the Finance Department and is responsible for the electronic assets of the City. This includes the network infrastructure, servers, workstations and laptops, GIS and Business Systems

Capital Works Department

This department is responsible for all Long-Term Planning, Design, Capital Construction, and Record Information related to any and all infrastructure within the City boundaries.

7. COMMUNITY RISK AND HAZARD ASSESSMENT

7.1. Background

A fire hazard and risk assessment was conducted throughout the City of Campbell River 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 in determining the 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. Historical call volumes are also utilized in the evaluation process.

7.2. Measuring Fire Risk

Adequate response to a fire emergency is generally measured by the speed with which a responding fire fighting crew(s) can arrive at the fire emergency with the correct type and amount of resources to have a reasonable degree of opportunity to control or extinguish a fire. Simply put, the response provided by a fire fighting crew should equal the potential severity of the fire or fire emergency. The required response from a fire fighting crew is greater if life safety is a factor in a fire event and the expected response time is shorter.

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

maintenance must also be reviewed as any weak link may result in the system being ineffectual.

Much of the research into fire protection requirements for individual buildings and communities and the corresponding number of "*pumper companies*" and response times has been conducted by Fire Underwriters Survey and the National Fire Protection Association. Fire Underwriters Survey evaluates adequacy of response by comparing the potential severity of fires that may occur with a rating of the ability of fire crews and their resources responding within a specified time period relative to the fire and life safety risk potential that may be needed.

In a fire and life safety risk analysis, the fire protection area is broken up into zones of fire emergency risk and hazard profiles. For this review, the fire protection needs of each community zone were evaluated. A fire and life safety risk analysis provides much of the data that is necessary to comment on the community's fire protection needs including fire apparatus requirements, fire equipment and other areas of a community's fire protection programs.

Table 7.2-1 The Table of Effective Response illustrates various sectors commonly found in most communities, and indicates a range of risk ratings that are commonly applied to these sectors. The Table also indicates a range of fire flows that are normally associated with each community sector profile. Additionally, Table 7.2-1 indicates the number of Pumper trucks, ladder trucks, and associated companies that are expected to be needed to control and suppress fires occurring within representative building zones throughout the community.

The number of fire companies that will be needed is correlated to fire loading within the community's building stock and to life safety risks present. Fire flow requirements are determined by construction characteristics, occupancy, size, and exposures to representative buildings throughout the community.

Table 7.2-1 The Table of Effective Response

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

RISK RATING	BUILDING DISTRICT EXAMPLES	FIRE FLOW Approx. L/min X1000	FIRE FLOW Approx. Igpm Range	INITIAL RESPONSE TO ALARMS Pumper Companies	INITIAL RESPONSE TO ALARMS Ladder Companies	1ST DUE Pumper Company, Minutes	2ND DUE Pumper Company, Minutes	1ST DUE Ladder Company, Minutes	TOTAL AVAILABILITY NEEDED Pumper Co's. No.	TOTAL AVAILABILITY NEEDED Pumper Co's. Min.	TOTAL AVAILABILITY NEEDED Ladder Co's. No.	TOTAL AVAILABILITY NEEDED Ladder Co's. Min.
1 (a)	Very small buildings, widely detached. Scattered	2	400	1	0	7.5	-	*9	1	7.5	*1	9
(b)	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	800-1000	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	1200-2000 2200-2800	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 and fire loads, exposures.	14-16 17-19	3000-3600 3800-4200	2	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	4400-5000 5200-6000	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	7800-8400 8600-9200 9400-10000	3	3	2 2 2	3.5 3.5 3.5	2.5 2.5 2.5	10 12 14	8 9 9	4 5 6	7.5 8 9

Notes to Table of Effective Response

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

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

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

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

7.3. Fire Risk in the City of Campbell River

The community has been reviewed from the perspective of life safety, fire loading, fire risk, and response characteristics.

Each area of the community has been reviewed with building risk assessments. Building Risk Assessment was performed at three levels of measure:

1. *Occupancy Risk:* Is defined as an assessment of the relative risk to life and property resulting in a fire inherent in a specific occupancy or in a generic occupancy class. (Occupancy "Required Fire Flow")

2. *Fire Flow Demand Zone*: Is an area used to define or limit the management of a risk situation. A fire flow demand zone can be a single building or a group of buildings. It is usually defined with geographical boundaries and also can be

called fire management areas or fire management zones. (FFDZ "Required Fire Flow")

3. *Community:* Is defined as the overall profile of the community based on the unique mixture of individual occupancy risks, fire flow demand zone risk levels, and the level of service provided to mitigate those risk levels. ("Basic Fire Flow")

The community was divided up into geographically similar areas (from the perspective of fire fighting response characteristics) identified as "fire flow demand zones" organized as shown in Figure 7.3-1 – Campbell River Fire Flow Demand Zones and Table 7.3-1 – Campbell River Fire Flow Demand Zones.

To develop the required fire flows in the various fire flow demand zones in the City of Campbell River, the methodology described in Fire Underwriters Survey 1999 standard "Water Supply for Public Fire Protection" was used.

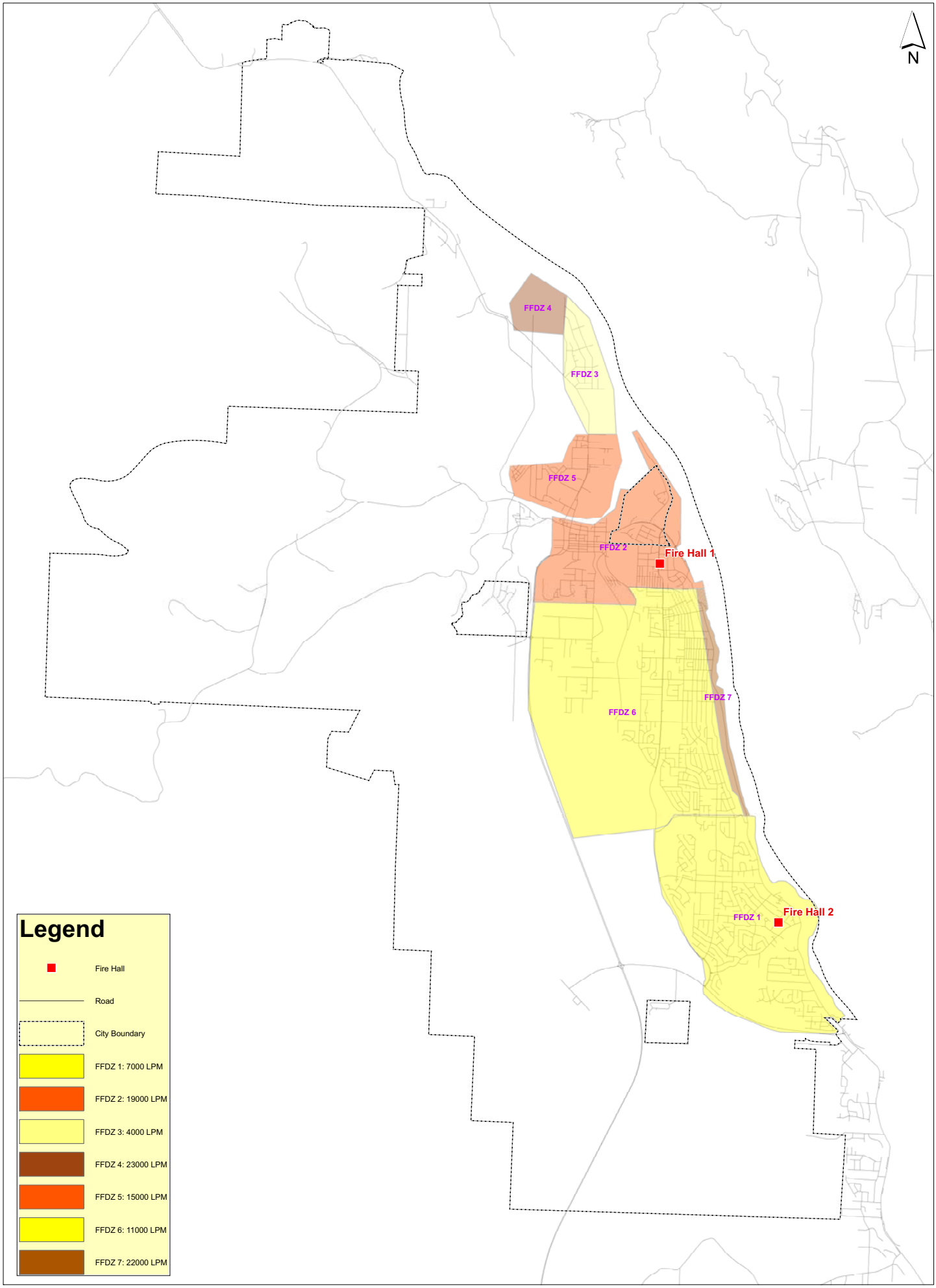


Figure 7.3 1 – Campbell River Fire Flow Demand Zones

Table 7.3-1 – Campbell River Fire Flow Demand Zones

Zone #	Fire Flow Demand Zones (FFDZ)	Fire Zone Risk Rating	Final (Igpm)
1	Commercial	3a	1500
2	Commercial	3b	4200
3	Single Family Residential	2	800
4	Industrial	4a	5000
5	Industrial	3b	3300
6	Commercial	3a	2500

Final fire flows (with associated risk categories from the FUS Table of Effective Response) for each fire zone are shown in Figure 7.3-1 – Campbell River Fire Flow Demand Zones.

The required fire flows were calculated for a representative sampling of buildings as well as for a representative sampling of "construction parameter zones" based on Zoning Bylaws and local construction practices. Each "fire flow demand zone" was assessed for primary zoning (industrial, commercial, residential, etc.) and for typical building construction.

The intent of setting the final required fire flows in this manner is not to provide adequate water supplies for the worst case scenario, but rather to provide adequate water supplies for fire fighting in the majority (90%) of structure fires (not including WUI). The final required fire flows are intended to be adequate for existing construction as well as new construction occurring in already built-up areas of the community.

It should also be noted that the required fire flows set by the Fire Underwriters Survey are intended as a benchmark that the community will be measured against. These fire flows are intended to be adequate to fight fires offensively, and to provide property protection (including exposure protection) in addition to life protection.

Final fire flows (with associated risk categories from FUS Table of Effective Response) for each fire zone are shown in Table 7.3-1 – Campbell River Fire Flow Demand Zones. The final fire flows are utilized with associated risk categories from Table 7.2-1 The Table of Effective Response to determine the appropriate level of response from fire departments, including items such as response times and apparatus requirements. These are also used to determine staffing requirements and optimal apparatus and fire

station locations based on achieving the level of response indicated in the Table of Effective Response 90% of the time.

It is important to note that one of the most significant areas, in terms of risk, is a mill site owned and operated by Catalyst. The primary focus of this mill is for the production of paper and newsprint. The operations needed to complete this production can be considered severely hazardous in terms of providing a reasonable level of fire protection. There are multiple structures that are greater than 10 m in height and have large footprint areas.

Catalyst has expressed interest opting not to pay for the fire protection services provided by the Campbell River Fire Department, excluding them from the Campbell River Fire Protection Area. At the request of the Fire Department, two analyses have been conducted. The first analysis includes the Catalyst buildings and the associated benchmarks that the community is graded against. The second analysis excludes the Catalyst buildings and the associated benchmarks that the community is graded against. Comments throughout the report indicate the different impacts and implications of including or excluding the Catalyst buildings in the fire protection area.

The Basic Fire Flow associated with the Campbell River Fire Protection Area has been set at 19,000 LPM (4,200 Igpm). The Basic Fire Flow remains unchanged with or without the Catalyst buildings. The benchmark requirements of this Basic Fire Flow from Table 7.2-1 The Table of Effective Response are as shown in Table 7.3-2 Summary of Response Benchmarks for Basic Fire Flow. The community is measured against these benchmarks to establish the fire insurance grading classification.

Table 7.3-2 Summary of Response Benchmarks for Basic Fire Flow

Basic Fire Flow	1st Due Pumper	2nd Due Pumper	1st Due Ladder	Total Pumper Companies available	Minutes for all to arrive	Total Ladder Companies available	Minutes for all to arrive
19,000 LPM	3.5 minutes	5 minutes	4 minutes	5	7 minutes	2	5 minutes
19,000 LPM	2.7 km	4.1 km	3.1 km	5	6.0 km	2	4.1 km

7.4. Future Fire Risk in City of Campbell River

The Basic Fire Flow of the community has been set at 19,000 LPM (4,200 Igpm). The Basic Fire Flow of the community is not expected to change significantly in the next 10 years. This is primarily due to an effective sprinkler bylaw that has been used in the community for over 10 years. An effective sprinkler bylaw will help reduce the overall risk throughout the community and has the potential to set a "cap" on the benchmarks that the community is measured against for fire insurance grading purposes.

From the perspective of insurers, the level of fire risk is a function of several key factors (each of which are influenced by a number of sub-factors) that include:

i. **Likelihood** of fire events occurring
    a. Influenced by many risk factors
    b. Occupancy type (industrial, commercial, multi-family residential)
    c. WUI - wildland urban interface exposures and Climatic conditions
    d. Presence of combustibles, presence of ignition sources
    e. Quantity of area protected, number of buildings/risks
    f. Population demographic
ii. **Consequence** of fire events occurring
    a. Loss of life
    b. Density of population
    c. Number of persons expected to be affected
    d. LOSS OF PROPERTY and PROPERTY VALUES[2]
    e. Loss of business, employment, tax revenue, economic impacts
iii. **Controls in place to prevent** fire event from occurring
    a. Codes, Bylaws and enforcement measures
    b. Fire Prevention Program
    c. Community and building design
iv. **Controls in place to reduce impact** of fire event that occurs
    a. Quality and availability of fire department
    b. Number of staff and quality of training program
    c. Number of apparatus and quality/reliability of equipment

[2] This is the most heavily weighted factor.

d. Availability and reliability of adequate water supplies for fire fighting

When there is an increase in the quantity of values that are being protected by a fire protective service organization, the level of fire protective service typically must increase to meet the increased risk levels. If the level of fire protective service remains a constant during the rise of protected property values, then the rated overall level of risk increases and the fire insurance grade typically reflects this.

8. FIRE DEPARTMENT ASSESSMENT

8.1. Fire Department Profile

The Campbell River Fire Department (CRFD) is a composite fire department with 47 auxiliary members and the following career roster:

	Pre-cutbacks	Post-cutbacks
Chief Officers	4	3
Fire fighters and line officers	19.6	18.6
Fire Prevention Officers	2	1
Administrative Personnel	1	0
Total Positions	26.6	22.6

The department has in the past used overtime shifts to ensure that 4 career firefighters are on duty at all times. Normally, this would result in increased cost to the department as overtime rates are higher than standard pay rates, however the union and management came to agreement to allow the management to use fire fighters to in-fill short-staffed shifts at the standard pay rate.

The majority of auxiliary fire fighters live in the City of Campbell River and are mainly available to respond.

The Campbell River Fire Department is operated and funded by the City of Campbell River and provides fire protection, prevention and rescue services to the City and Electoral Area D which covers an area of approximately 150 km^2.

In addition to those primary services noted above, the department is also responsible for the following services:

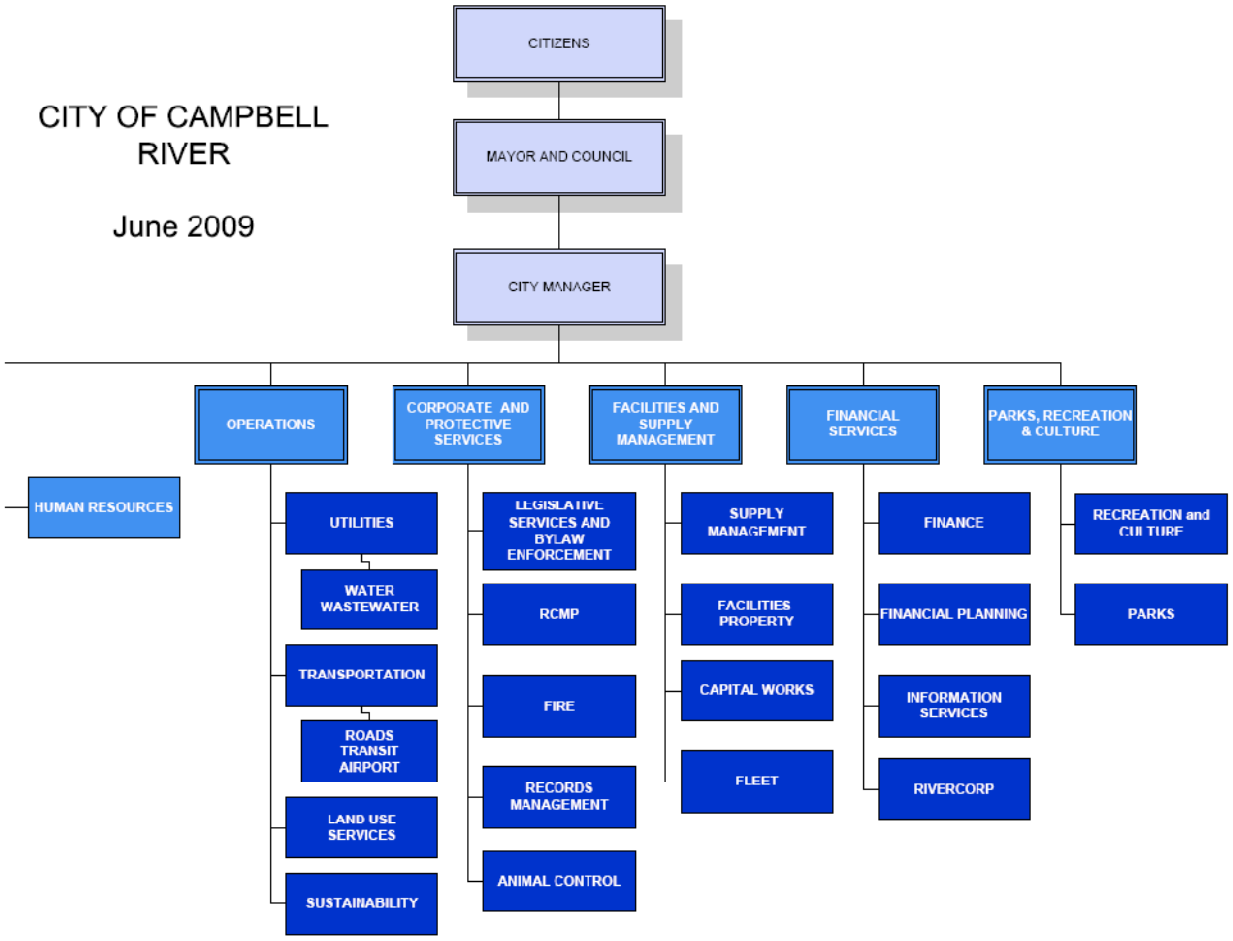
- fire prevention public education,
- fire prevention inspections,
- fire investigations,
- bylaw enforcement as it relates to fire protection,
- industrial fire protection and training,
- aircraft crash rescue and fire fighting,
- emergency medical services,

- high angle and slope rescue,
- confined space rescue,
- hazardous materials response, and
- motor vehicle accident response.

8.2. Fire Department Operations and Administration

The City of Campbell River is organized as follows:

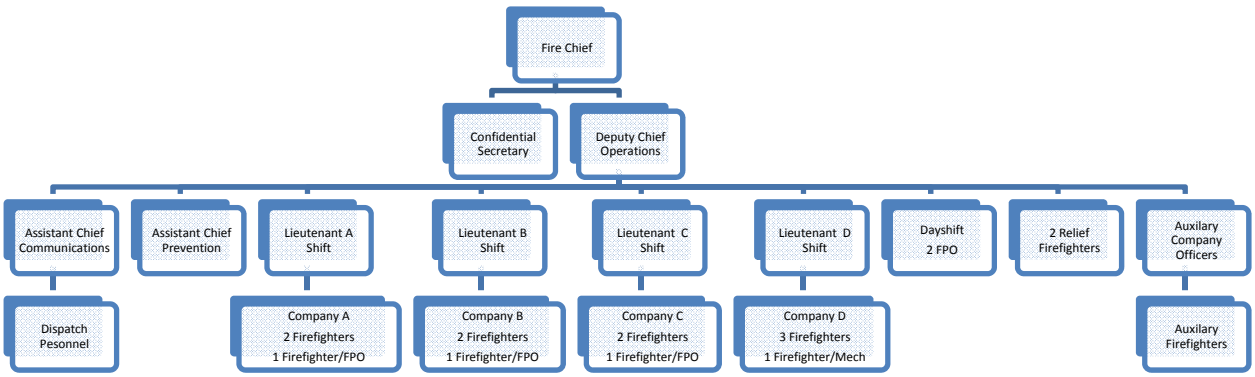
Figure 8.2-1 City of Campbell River Organization Chart[3]



[3] http://www.campbellriver.ca

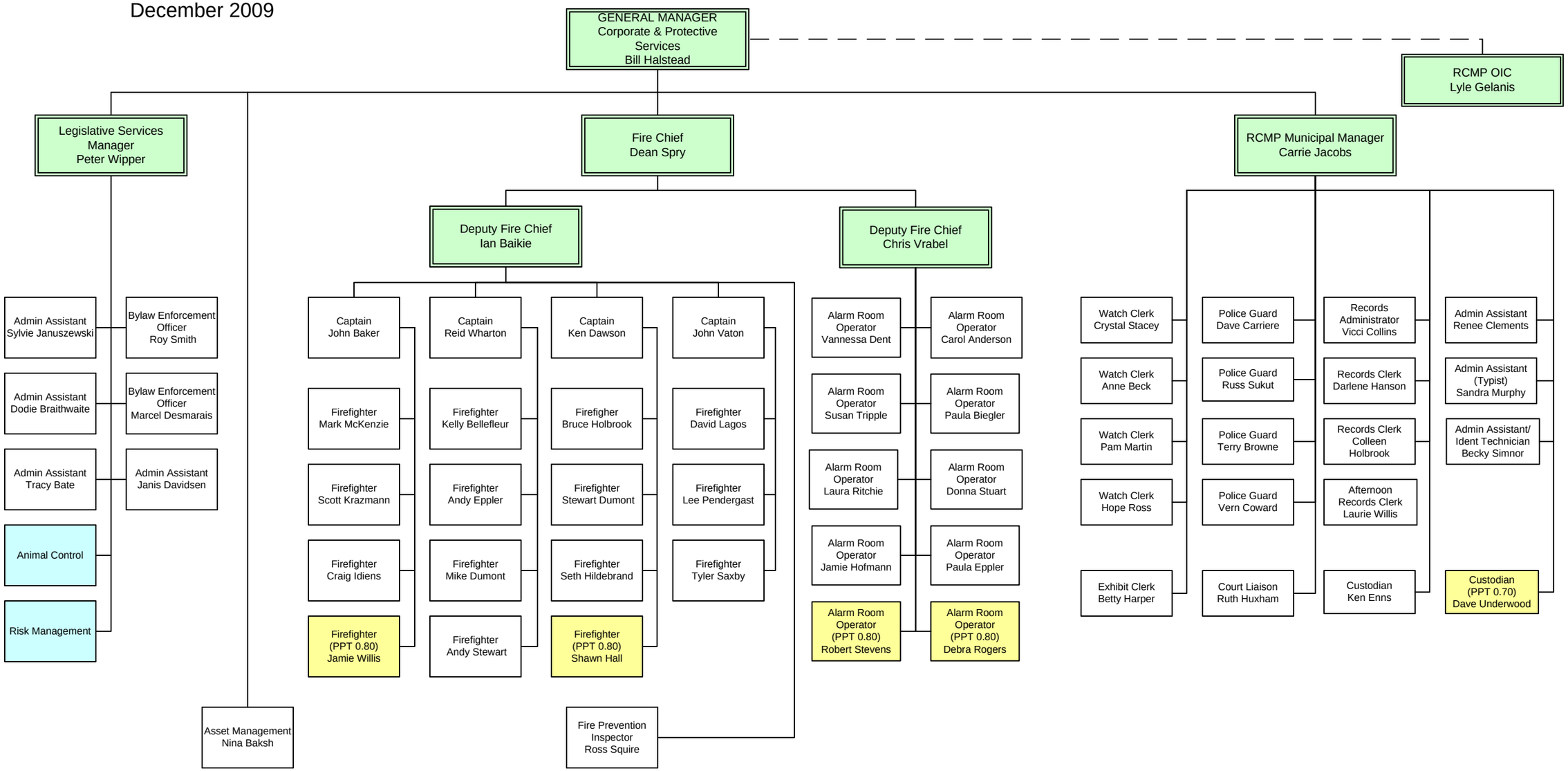
The fire department is included under the Corporate and Protective Services department Management and is organized as follows:

Figure 8.2-2 Fire Department Organization Chart (former)



CITY OF CAMPBELL RIVER
Corporate and Protective Services Division
December 2009

Figure 8.2-3 Fire Department Organization Chart (current)



8.2.1. Job Duties and Descriptions

General Manager of Corporate and Protective Services

The General Manager of Corporate and Protective Services has the Fire Department report directly to them and in turn reports to the CAO. The General Manager of Corporate and Protective Services is also responsible for the police department, legislative services, bylaw enforcement, animal control and records management.

Fire Chief

Under the direction of the General Manager of Corporate and Protective Services, the Fire Chief is primarily responsible for the management and overall operation of the Fire Department according to Council Policy, Provincial Statutes and the Fire Services Bylaw. The Fire Chief facilitates and manages Fire Prevention, Fire Suppression and Rescue services/programs for the City of Campbell River.

Other duties of the Fire Chief include, but are not limited to:

- development of the Fire Department budget;
- provision of leadership to all areas of the Fire Department;
- promotion of fire safety awareness and fire prevention practice in the community;
- management of personnel in accordance with the terms of the collective agreement between City of Campbell River and the International Association of Fire fighters Local 1668; and
- response to all major alarms as required (24/7).

The Fire Chief position has been occupied by three different persons between 2006 and 2009.

Currently, the Fire Chief is Dean Spry (since September 2009) and he is also appointed to act as a Local Assistant to the Fire Commissioner under the Fire Services Act.

Deputy Fire Chief (DFC) – Communications

Under the direction of the Fire Chief, the Deputy Fire Chief of Communications is responsible for the overall direction and training of the Communications and Dispatch

Division. This DFC establishes protocols to promote the efficiency of the division and is responsible for all fire dispatch training. The DFC is responsible for planning, organization, administration and operation of the Enhanced 911 system of the North Island 911 Corporation which provides dispatch services for 49 other fire departments. 80% of the funding for 911 services in Campbell River is paid for by the North Island 911 Corp.

Other duties include, but are not limited to:

- development of operations budget of the communications and dispatch division;
- development of operating procedures and standing orders for the regulation of functions and staff in the division;
- communication/explanation of Municipal and Departmental policy to staff;
- provision of statistical and narrative reports to the Fire Chief on all operations, together with recommendations for improving, modifying or replacing procedures currently in effect;
- participation in collective bargaining process and in hearing grievances;
- management of personnel in accordance with the terms of the collective agreement between the City of Campbell River and the International Association of Fire fighters Local 1668;
- training of dispatch staff, officers and members of other fire departments in communication and dispatch procedures according to established policy and guidelines;
- research of current trends in technology for emergency communications equipment and methods; and
- response to all major alarms as required (24/7);

Other duties and responsibilities include the administration of Fire Department payroll including maintenance of tracking system to monitor Fire Department employee's holiday, bank and sick time balances to ensure congruence with the Finance Department.

Chris Vrabel is the current Deputy Fire Chief (DFC) of Communications. DFC Vrabel has held this position since January 2009 and is appointed to act as a Local Assistant to the Fire Commissioner under the Fire Services Act.

Deputy Fire Chief - Operations

Under the direction of the Fire Chief, the Deputy Fire Chief of Operations is responsible for the department operations and administration. This includes ensuring that fleet vehicles, fire apparatus and fire stations are maintained; developing the operations and capital budget.

Other duties and responsibilities include, but are not limited to:

- response to major fires and related emergencies in the absence of the Fire Chief or the other Deputy Fire Chief;
- incident command of fires and related emergencies;
- supervision of fire investigations;
- development of statistical and narrative reports with recommendations for improving, modifying or replacing procedures/methods;
- quality control of the efficiency of fire fighting operations and the proficiency of fire fighting staff;
- management of personnel in accordance with the terms of the collective agreement between the City and the International Association of Fire fighters Local 1668;
- recruiting and selection of fire fighter candidates;
- collective bargaining process;
- hearing of grievances;
- development of training program for Fire Department;
- administration of Fire Department payroll including maintenance of a tracking system to monitor Fire Department employee's holiday, bank and sick time balances to ensure congruence with the Finance Department.
- coordination of training opportunities

This current Deputy Fire Chief position has been filled by Ian Baikie since January 2009 who is appointed to act as a Local Assistant to the Fire Commissioner under the Fire Services Act. Ian Baikie has been operating as a chief officer for CRFD since 1997.

Alarm Room Operator/Clerk - Dispatcher

There are a minimum of two Alarm Room Operators (ARO) on duty at all times who provide dispatch services to 49 other fire departments. Reporting to the Communications Deputy Fire Chief, the ARO answer all incoming calls (telephone, radio, fixed alarm, 911 communications equipment, etc.) and dispatch appropriate emergency resources as outlined in Policies and Operational Guidelines.

Other duties and responsibilities include, but are not limited to:

- monitoring of all radio traffic, during incident responses and maintenance of communication between units, personnel and Incident Command;
- contacting outside agencies as required by various incident types;
- recording of communications digitally and manually;
- assisting in preparation of reports;
- entering and collating of operation and administrative statistics;
- general filing and typing of correspondence, records and reports.

Fire fighter – Captain (Career)

There are a total of 4 Captain positions currently within the Campbell River Fire Department. Each Captain reports directly to a Deputy Fire Chief. Captains are selected from a "pool" of fire fighters who have received the necessary training required in order to be a Captain. At any given time there are a total of 6 fire fighters who can be promoted if an existing Captain opts to leave the fire department or retire.

Until 2009, the Campbell River Fire Department did not promote officers above the rank of Lieutenant. One of the shifts that the Fire Department made in 2009 was the shift of Lieutenants to Captain positions. As part of the shift, the newly appointed Captains have been assigned additional administrative responsibilities and accordingly have received more lucrative compensation packages.

The Captains' primary roles and duties are to supervise platoons. They are responsible for the completion of the day to day shift duties including response to rescue and medical emergencies, fire suppression duties, fire company inspections of buildings, training their platoon in all fire fighting, rescue and medical skills to NFPA 1001 Level 2. They ensure that the performance of routine equipment maintenance and housekeeping duties are completed as outlined in the Guidelines and as directed by a

Chief Officer. Additionally, they are approved for purchasing of equipment and supplies and the completion and processing of the required financial documentation per City Policy.

With the loss of the Administrative Assistant, it is expected that the Captains are to take a more supervisory role within the fire department. Other duties include, but are not limited to:

- response to emergencies as required by Departmental procedure and taking appropriate actions as specified by Department Standard Operation Guidelines or good fire service practice to mitigate or resolve such emergencies;
- command of incidents as required, dependent upon the availability of Chief Officers;
- ensuring the safety of all fire fighting staff and the public.
- exercising considerable independence of judgement and action on the fire ground;
- participating in determining the cause of the incident/fire;
- participating in critiques and sharing of information with other agencies and being well prepared to give evidence in all matters arising from their duties;
- completing of reports that are required under provincial or municipal jurisdiction such as Fire Commissioner or Incident Reports;
- completing proper documentation as per City Policy of all equipment or supplies that they or their staff have purchased.

Fire fighter (Career)

There is a total of 19.6 Fire fighter positions within the Fire Department. Under the direct supervision of their shift Captain or Incident Commander, the Fire fighters are responsible for response to emergency calls and providing appropriate services as required including emergency rescue and fire suppression in addition to response to natural disasters, major accidents, incidents involving hazardous materials, and other emergency situations as required. Additionally, they are to perform a wide variety of technical tasks in support of fire suppression, specialized operations, hazardous materials, prevention functions, emergency rescue operations and administrative tasks in support of the Fire Department.

Other duties and responsibilities include, but are not limited to:

- operating, inspecting, repairing and performing other technical tasks related to the apparatus and equipment in the Fire Department to ensure all equipment and apparatus is maintained;
- participating in cleaning and maintaining station facilities, training grounds, equipment and apparatus;
- participating in a variety of fire prevention operations, activities and programs including training, fire investigations, code enforcement and equipment operation and maintenance;
- giving tours of assigned fire station, demonstrate fire equipment and apparatus and participate in other educational programs for various groups and general public.

Recommendation 8.2-1 Assign Specific Duties and Responsibilities for Captains to Manage Administrative Work Load

In order to help maximize efficiency within the fire department operations, it is recommended that each Captain be assigned specific departmental and shift duties, including but not limited to:

- Preparing of Fire Department employee payroll including documenting employee's holiday, bank and sick time balances.
- Coordinating training opportunities as required including scheduling, venues, travel arrangements, accommodations, meals and reimbursements.
- Assisting with building and apparatus maintenance and repairs including gathering quotes, preparing specification comparisons and making recommendations as required.
- Issuing and processing purchase orders as required for all Fire Department purchasing including coding and processing invoices.

The Captain rate was bargained in 2009. In exchange for enhanced salary, the Union and Employer negotiated additional administrative/supervisory duties for the Captain Positions.

The primary responsibility for the Captains is for response to emergency calls throughout the community and to ensure that fire fighting tools, equipment and apparatus are properly maintained, in addition to monthly fire prevention inspections and fire fighter training. Typically, these responsibilities can occupy an entire shift for a Captain and their crew. Additionally, consideration should be given to the time needed to train these members as administrators (ex. office software, protocols, coding, etc.).

If the Captains are to be responsible for administrative duties, it is important that the amount of time spent on tasks is tracked and documented. Regular performance reviews should be conducted between the Fire Department management and the Captains. During the reviews, the documentation of time spent on tasks and the completion status of the tasks should be the primary focus. The documentation should indicate if other responsibilities are being overlooked as a result of additional work load.

If it is determined that the Captains cannot adequately fulfill their additional duties and responsibilities, consideration should be given to

1. providing additional training and/or administrative tools to facilitate efficient completion of administrative tasks; and/or
2. re-evaluating job descriptions; and/or
3. reinstating the Administrative Assistant position

Alternately, if the administration of the fire department suffers as a result of the loss of the dedicated administrative assistant position, it may be advisable to return to the use of an administrative assistant / confidential secretary. If the hourly rate of the position is lower than the hourly rate of a Captain or Deputy Chief, it may be more cost effective to have the Confidential Secretary completing the administrative work, particularly if Captains and Chiefs are completing this work at overtime rates, or if the work being completed, is sub-standard.

8.3. Fire fighting Roster

What is the significance of a 4 man crew with respect to fire fighting?

The following three references provide a background of standards that reference the importance of responding with 4 fire fighters per company:

- WorkSafe BC, Occupational Health and Safety Regulations
    a. Chapter 31 Fire fighting, Sentence 31.23 Entry into buildings:
        i. When self-contained breathing apparatus must be used to enter a building, or similar enclosed location, the entry must be made by a team of at least 2 fire fighters**.**
        ii. Effective voice communication must be maintained between fire fighters inside and outside the enclosed location.
        iii. During the initial attack stages of an incident at least one fire fighter must remain outside.

iv. A suitably equipped rescue team of at least 2 fire fighters must be established on the scene before sending in a second entry **team** and not more than 10 minutes after the initial attack.

v. The rescue team required by subsection (4) must not engage in any duties that limit their ability to make a prompt response to rescue an endangered fire fighter while interior structural fire fighting is being conducted.

- NFPA 1710, Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments:
    a. Sentence 5.2.3.1 Fire companies whose primary functions are to pump and deliver water and perform basic fire fighting at fires, including search and rescue, shall be known as engine companies.
    b. Sentence 5.2.3.1.1 These companies shall be staffed with a minimum of four on-duty personnel.

Although not enforceable, NFPA 1710 is a recognized judicial standard.

- Fire Insurance Grading (Canadian Public Fire Protection Classification Standard):
    a. the number of available fire fighters has a significant impact on the fire insurance grades of a community.
    b. Notably, the available fire force is one of the most heavily weighted aspects of the grading
    c. The available fire force is frequently the most limiting factor with respect to improved fire insurance grades for most communities in Canada
    d. Note that within the fire insurance grading system, there is no reference specifically to 4 fire fighters per company. The fire insurance grading system utilizes the Table of Effective Response to determine the maximum credit that is appropriate for the level of risk within the built environment, and measures the community against that benchmark.

Currently, the CRFD has the following career roster:

Table 8.3-1 CRFD Shift Staffing

	Shift	Position	FTE
1	**A Shift**	**Capt**	**100%**
2	A Shift	FF	100%
3	A Shift	FF	100%
4	A Shift	FF	100%
5	**B Shift**	**Capt**	**100%**
6	B Shift	FF	100%
7	B Shift	FF	100%
8	B Shift	FF	100%
9	B Shift	FF/Shift FPO	100%
10	**C Shift**	**Capt**	**100%**
11	C Shift	FF	100%
12	C Shift	FF	100%
13	C Shift	FF/Shift FPO	100%
14	**D Shift**	**Capt**	**100%**
15	D Shift	FF	100%
16	D Shift	FF	100%
17	D Shift	FF/Shift FPO	100%
18	Dayshift	FF/FPO	100%
19	Part time	FF	80%
20	Part Time	FF	80%
1	Dayshift	Chief (Management)	100%
2	Dayshift	D/Chief (Management)	100%
3	Dayshift	D/Chief (Management)	100%

Excluding management, there are a total of 18 fire fighters at 100% FTE (full time equivalent) and 2 fire fighters at 80% FTE; for a total of 19.6 FTE positions. One of the full time positions is a dedicated dayshift Fire Prevention Officer. This leaves 18.6 FTE fire fighters on the roster for fire fighting duties and response. The CRFD currently provides a fire fighting response of 4 on-duty fire fighters in keeping with the above noted references. This can be difficult to achieve.

Consider that there are 365.25 days per year which can be divided into 91.25 4-day periods each of which is covered by 2 shifts. Therefore it can be said that there are 182.5 company-shifts per year (where each company shift consists of 4 12-hour shifts within a 4 day period).

Each of the 4 companies then works one quarter of the 182.5 company-shifts per year; or 45.625 4-day shifts per fire fighter (or company). On average each fire fighter is absent approximately:

Table 8.3-2 Average Annual Absences per Shift

	vacation	supp.vac.	stat	sick	TOTAL
hours	300	19.2	132	62.3	513.5
12hr days	25	1.6	11	5.19	42.8
Company shifts (4day)	6.25	0.4	2.75	1.30	10.7

16 FTE fire fighters working
45.626 company-shifts per year
Each of the 16 fire fighters misses 10.7 company-shifts per year
16 fire fighters x 10.7 absent company-shifts per year
=171.2 company shifts of required coverage

Consider that a FTE can be defined as a fire fighter that works (45.626-10.7) company-shifts per year = 34.926 company shifts per year = 1 FTE fire fighter

Therefore to provide coverage of 4 fire fighters for all company-shifts
(171.2 company shifts of required coverage) / (34.926 company shifts per FTE fire fighter) = 4.9 FTE fire fighters

To provide continuous coverage of 4 fire fighters without use of overtime, a total of 16FTE fire fighters + 4.9 FTE fire fighters = 20.9 would be needed.

Currently, the City has required that the Fire Department operate within the limitation of 19.6 FTE including the dedicated FPO. As noted this leaves 18.6 FTE fire fighters which is 2.3 FTE fire fighters too few to provide continuous coverage with 4 fire fighters.

Between 2006 and 2009, several fire department positions have been eliminated. Each of the position eliminations occurred when there were changes due to fire fighters or management leaving the department. During this time period, the fire department has been re-structured to adjust to having less staff positions.

The Union and City have an agreement that stipulates when fire fighters cover shifts to ensure 4-fire fighter response, they do so at straight time pay as opposed to overtime pay which is a higher rate. To date this has worked to maintain coverage with 4 fire fighters, however when the total cost of fire fighter staffing is considered the total cost remains over-budget. As mentioned previously, the City has required the CRFD limit expenditures to 19.6 FTE, including the dedicated FPO, which leaves 18.6 fire fighters for coverage.

Recommendation 8.3-1 Improve Fire fighting Roster Depth and Provide a Minimum Available Fire Force of 4 or Greater

In order to reduce the use of fire fighter over time, it is recommended that additional fire fighting personnel be acquired. This will allow the fire department to rely less on overtime to maintain a 4 fire fighter crew, in addition to maintaining a day shift Fire Prevention Officer with the previous level of fire prevention services throughout the community. This will help the Fire Prevention program by having a dedicated FPO.

Reassigning a day shift Fire Prevention Officer to fire fighting duties reduces the level of Fire Prevention services provided throughout the community and has an adverse effect within the fire insurance grading for the City of Campbell River. It can be expected that the frequency of inspections, for any given building, will reduce and there is the potential for buildings to go an excessive amount of time before receiving a fire prevention inspection ultimately increasing the life safety risk of the occupants and the fire fighters.

8.4. Fire Station Suitability

The CRFD operates out of two fire stations. Fire Station 1 is located in the northern half of the City and Fire Station 2 is located in the southern half of the City. Both of these fire stations are centrally located within their respective portions of the City boundary.

Fire Station 1 is located at 675 – 13th Avenue, in the downtown core of Campbell River. It has a footprint area of approximately 840 m^2 and is of 2 storey non-combustible construction, non-sprinklered and has a monitored fire alarm system. There is a total of 8 bay doors, 6 of which are used for fire apparatus. Backup power is supplied by a diesel generator that is tested on a monthly basis. This generator has the capacity to run building and operation essentials only.

Service rooms (electrical and mechanical) were noted to have unsealed penetrations through fire separations.

There are individual offices for the Fire Chief, Deputy Fire Chiefs and, on-duty Captain. Additionally, there is a communications/dispatch room. A training/meeting room is provided on the second floor in addition to a full kitchen. Sleeping dorms/quarters are provided for both men and women fire fighters.

Fire Station 2 is located at 261 Larwood Rd, which is primarily a single family residential area. This hall is operated by auxiliary members only. It has a footprint area of approximately 650 m^2 and is 1 storey and of ordinary construction (non-combustible construction with combustible members), non-sprinklered and has a monitored fire alarm system. There is a total of 4 bay doors, 3 of which are used for fire apparatus. Back up power is supplied by a diesel generator that is tested on a monthly basis. This generator has the capacity to run building and operations under full load.

There is a general lounge/meeting area for auxiliary members. A training room is provided with the necessary equipment to conduct classroom training sessions.

Service rooms (electrical and mechanical) were noted to have unsealed penetrations through fire separations.

Figure 8.4-1 - Campbell River Fire Station Location indicates the location of the Fire Stations within the fire protection boundary. The colour shaded areas indicate the primary service area boundaries for each Fire Station based on equal response distance.

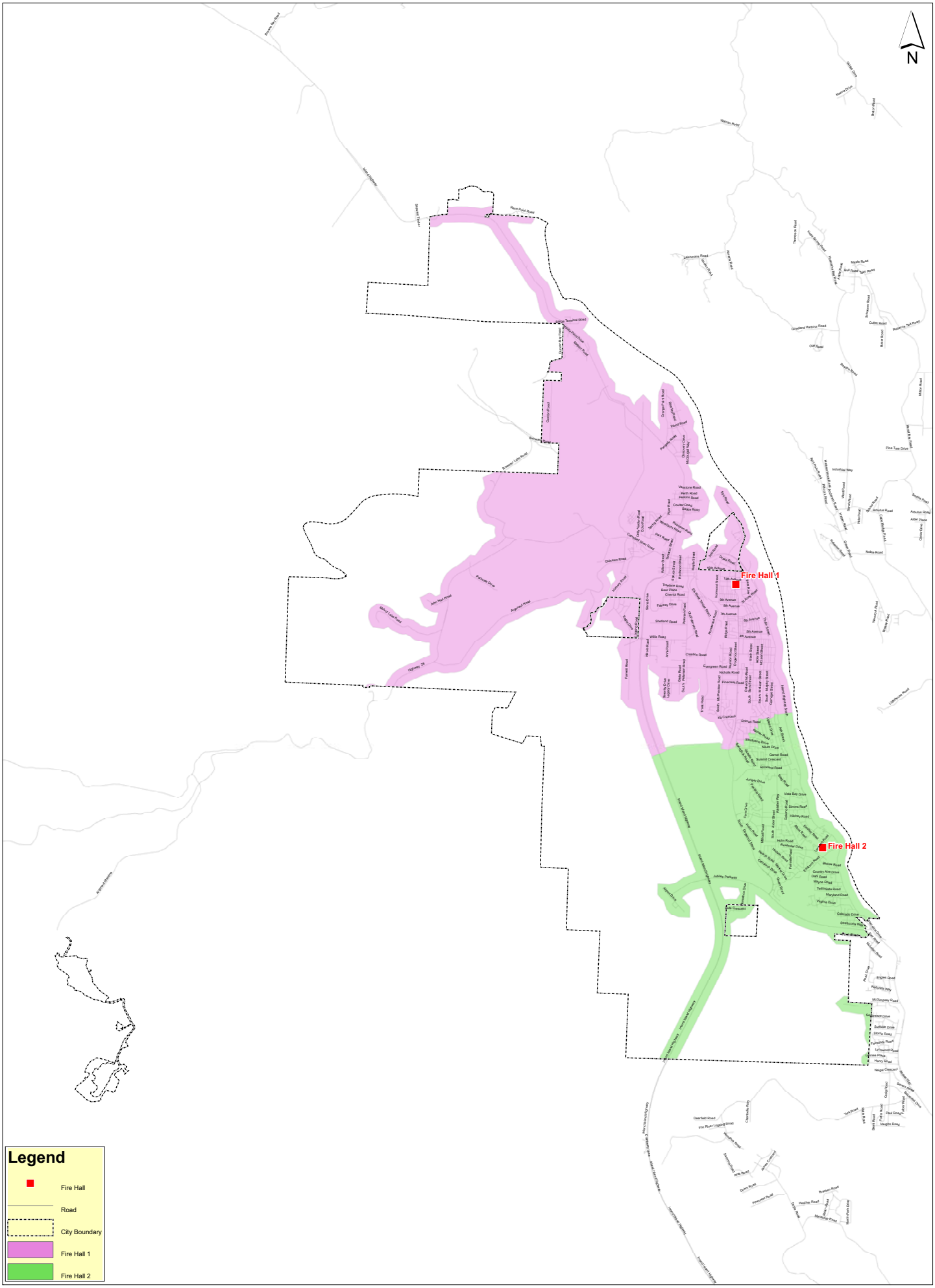


Figure 8.4 1 - Campbell River Fire Station Location

Fire Underwriters Survey

8.5. Apparatus and Equipment

The in service apparatus, at the time of the survey, for Campbell River Fire Department is as follows:

Table 8.5-1 Apparatus Summary

Year	Identifier	Manufacturer Spec	Type	**Age** in 2009	**Pump Capacity** (LPM)	ULC #	Pumping Credit Capacity %	**Credited Pump Capacity** (LPM)	Credited Tank Capacity (Liters)
2009	E11	Spartan Gladiator	Pumper	1	8,000	59024	100	8,000	2,250
1993	L1	Spartan Anderson	Ladder	16	5,700	-	50[4]	2,850	2,250
1980	E12	Superior International	Pumper (Reserve)	29	4,700	2665	0	0	0
2003	T1	Sterling	Tender	6	2,250	-	0	0	13,500
2005	R1	Freightliner Central State	Rescue	4	N/A	N/A	N/A	N/A	N/A
1999	E21	Spartan Smeal	Pumper	10	8,000	13C	100	8,000	2,250
1993	E22	Superior	Pumper	16	7,000	7603	100	7,000	2,250
1987	E23	Mack	Pumper (Reserve)	22	5,700	4202	0	0	0
							Total Capacity:	25,850	22,500
							Total Credited Capacity:	19,000	22,500

The Campbell River Fire Department fleet includes apparatus for:

- 3 Pumper Companies
- 1 Ladder Companies[5]
- 2 Reserve Pumper Companies

Within the fire insurance grading, the Campbell River Fire Department is credited with 3.5 pumper companies and credited 1 ladder company.

[4] Ladder companies are credited at either 50% Pumper Company + 100% Ladder Company or vice versa; in this case the former is used.

[5] See Section 8.6 Ladder Service

Based on the benchmarks noted in Table 7.3-2 Summary of Response Benchmarks for Basic Fire Flow, a maximum of 5 pumper companies and 2 ladder companies can be credited within the fire insurance grading. It is important to note that this number of companies does not include the total needed number of companies for distribution which is discussed in detail in Section 8.7 Distribution of Resources, Response Distances and Times.

Within the fire insurance grading schedule, apparatus is only recognized for first line service in medium sized communities such as Campbell River, for 20 years. After 20 years, it is expected that the apparatus will be retired or moved to reserve status. In some cases, credit for fire insurance grading can be extended for apparatus beyond 20 years in service contingent upon an assessment of indicators of reliability of the apparatus such as usage history, testing and maintenance records. Apparatus beyond 30 years in age cannot credited within the fire insurance grading.
See Appendix D.

The CRFD has budgeted funds to purchase a new ladder apparatus in 2013. A new ladder apparatus can cost between $500,000 and $1,000,000, depending on the configuration and options such as elevating platforms, etc. It is expected that this apparatus will be housed in Fire Station 1. The 1993 ladder apparatus could then be sent back to the manufacturer for a complete tear down and rebuild. This apparatus could then be housed in Fire Station 2. Having a second ladder apparatus in the City would provide significant benefits in several areas of the fire insurance grading including:

- Improved credit for distribution of response for ladders
- Improved credit for pump capacities (ladders receive 50% pump credit over and above the credit they receive as ladders)
- Improved credit for reserve capacity of ladders
- Improved credit for total concentration of ladders for large risks that can receive credit for more than one ladder response

With ladder apparatus housed in both fire stations, ladder coverage for initial response throughout the southern portion of the community would be significantly improved.

Additionally, during large industrial fires and conflagrations involving multiple structures or concurrent events, a second ladder apparatus would be available for response.

Recommendation 8.5-1 - Decommission and Replace Apparatus in Excess of 20 Years of Age.

To reduce the risk to the life safety of fire fighters utilizing the apparatus, an apparatus replacement program should be developed. The replacement program should take into consideration the benefits with respect to fire insurance grades as well as the costs associated with owning and maintaining apparatus.

To ensure that apparatus is recognized for fire insurance grading purposes, the replacement program for apparatus within the City of Campbell River should not exceed a 20 year life cycle for apparatus. See Appendix D.

8.6. Ladder Service

Response areas with 5 buildings that are 3 stories or 10.7 metres (35 feet) or more in height; or districts that have a Basic Fire Flow greater than 15,000 LPM (3,300 IGPM); or any combination of these criteria; should have a ladder company included in the response profile. The height of all buildings in the community, including those protected by automatic sprinklers, is considered when determining the number of needed ladder companies within the fire insurance grading. Additional ladder companies may be required based on the level of risk (see Table 7.2-1) and the distribution needs (see Section 8.7).

The fire protection service area has a significant number of buildings that are 3 storeys (10 m) or greater and have a high fire flow (required fire flow of 15,000 LPM or greater). Additionally, there are a number of industrial sites where an elevated master stream would be needed to effectively fight fires.

Based on the risk profile of the community, the City of Campbell River is deemed to require ladder company service for fire insurance grading purposes.

The Basic Fire Flow for the City of Campbell River has been set at 19,000 LPM (4,200 Igpm) in 2009.

Note: within the fire insurance grading system, aerial apparatus may be credited in one of three ways:

i. Credited as 1 full ladder (100% ladder function credit)
ii. Credited as 1 full ladder (100% ladder function credit) plus ½ pumper (50% of its pump capacity) credited in addition to full credit given to ladder function
iii. Credited as 1 full pumper (100% of pump capacity) plus ½ ladder (50% of ladder function) credited in addition to full credit given to ladder function

The Campbell River Fire Department has received credit for 1 ladder company. Ladder 1 is credited 100% as a ladder apparatus and credited 50% as a pumper apparatus (including 50% of pump capacity).

8.7. Distribution of Resources, Response Distances and Times

There are several important factors that are used in determining insurance rates for all types of properties. Although the specific methodologies 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)
- the type of responding fire department (volunteer, combination or career);
- 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 of rates. Most insurance rating systems utilize response distance categories. It is important to note that response distance (in conjunction with fire department type, volunteer or career) is used as a general way of determining approximate response times.

Table 8.7-1 Response distance standards

	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[6]

Resources for fire fighting are located in two different areas within the City of Campbell River. There are a significant number of Commercial Lines[7] insured risks located in the north of the Campbell River which are beyond the insurance industry maximum

[6] 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.

[7] Commercial Lines insurance is a distinction marking property and liability coverage written for business or entrepreneurial interests (includes institutional, industrial, multi-family residential and all buildings other than detached dwellings that are designated single family residential or duplex) as opposed to Personal Lines.

recognized response distance (5 road kilometre maximum) for pumper or ladder companies.

Approximately 95% of the risks insured under Personal Lines (detached dwellings) are within 8 road km of a Fire Station. The Campbell River Fire Department is currently credited as being able to provide a reasonable level of response for single family residential structure fires within the fire protection boundary.

Factors that influence response time include the distance of responding auxiliary fire fighters from the fire hall as well as physical impedances such as;

- steep hills,
- sharp curves,
- single road access (i.e. waterfront properties),
- bridges closures,
- road closures due to river flooding, etc.

When considering buildings insured under Commercial Lines, the benchmarks as shown in Table 7.3-2 Summary of Response Benchmarks for Basic Fire Flow indicate that the first due pumper company benchmark response travel time is 3.5 minutes, the second due pumper company benchmark response travel time is 5 minutes and the first due ladder company benchmark response travel time is 4 minutes. These response travel times correlate to response distances of 2.7 km for the first due pumper company, 4.1 km for the second due pumper company and, 3.1 km for the first due ladder company. Note that the response travel times used for fire insurance grading purposes do not include dispatch or turn-out times (i.e. wheel-start to wheel-stop only).

The figures shown on the following pages are intended to visually illustrate the coverage areas for each Fire Station within the City of Campbell River. 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.

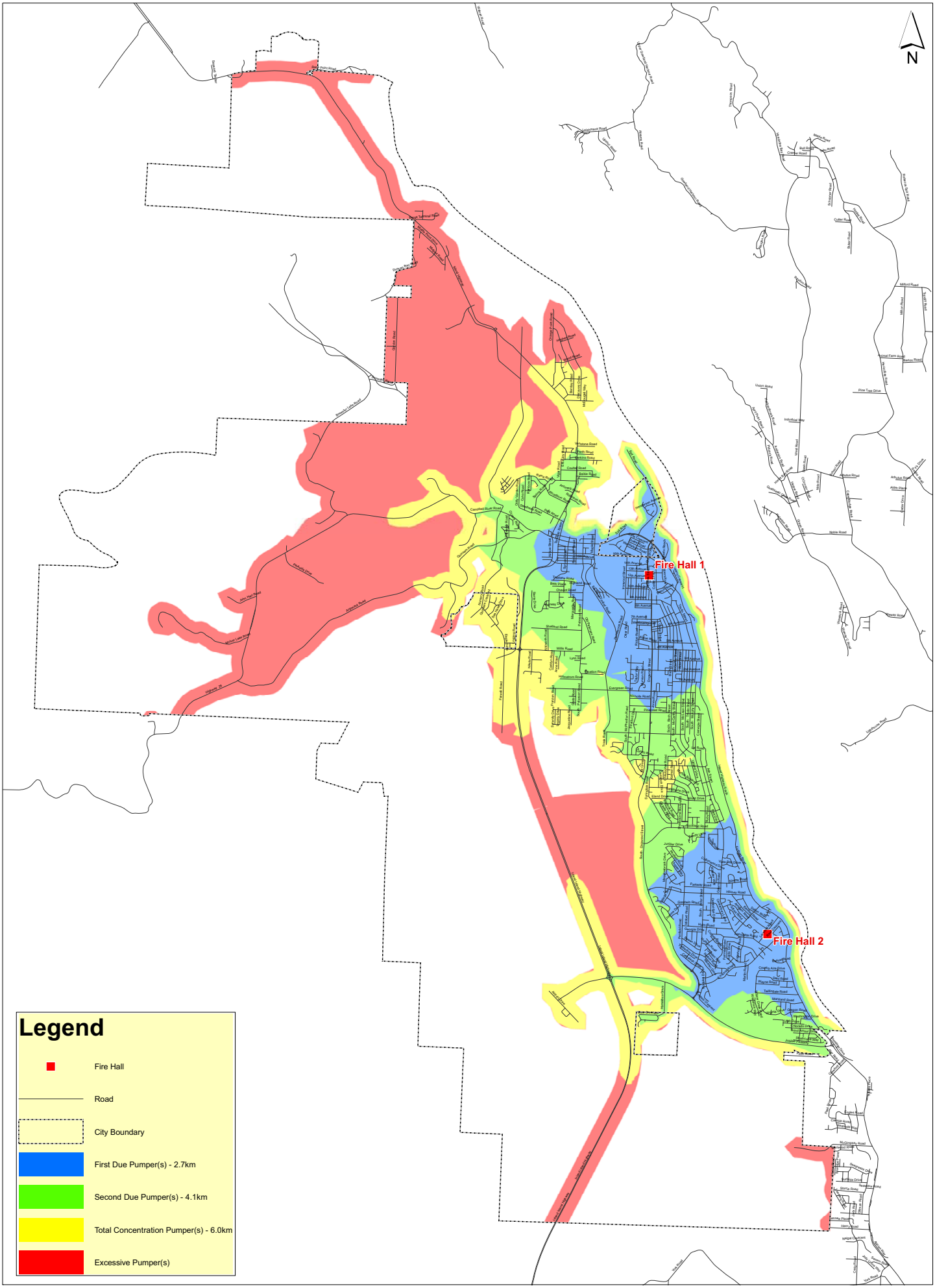


Figure 8.7 1 Pumper Response Coverage Map

Fire Underwriters Survey
A Service to Insurers and Municipalities

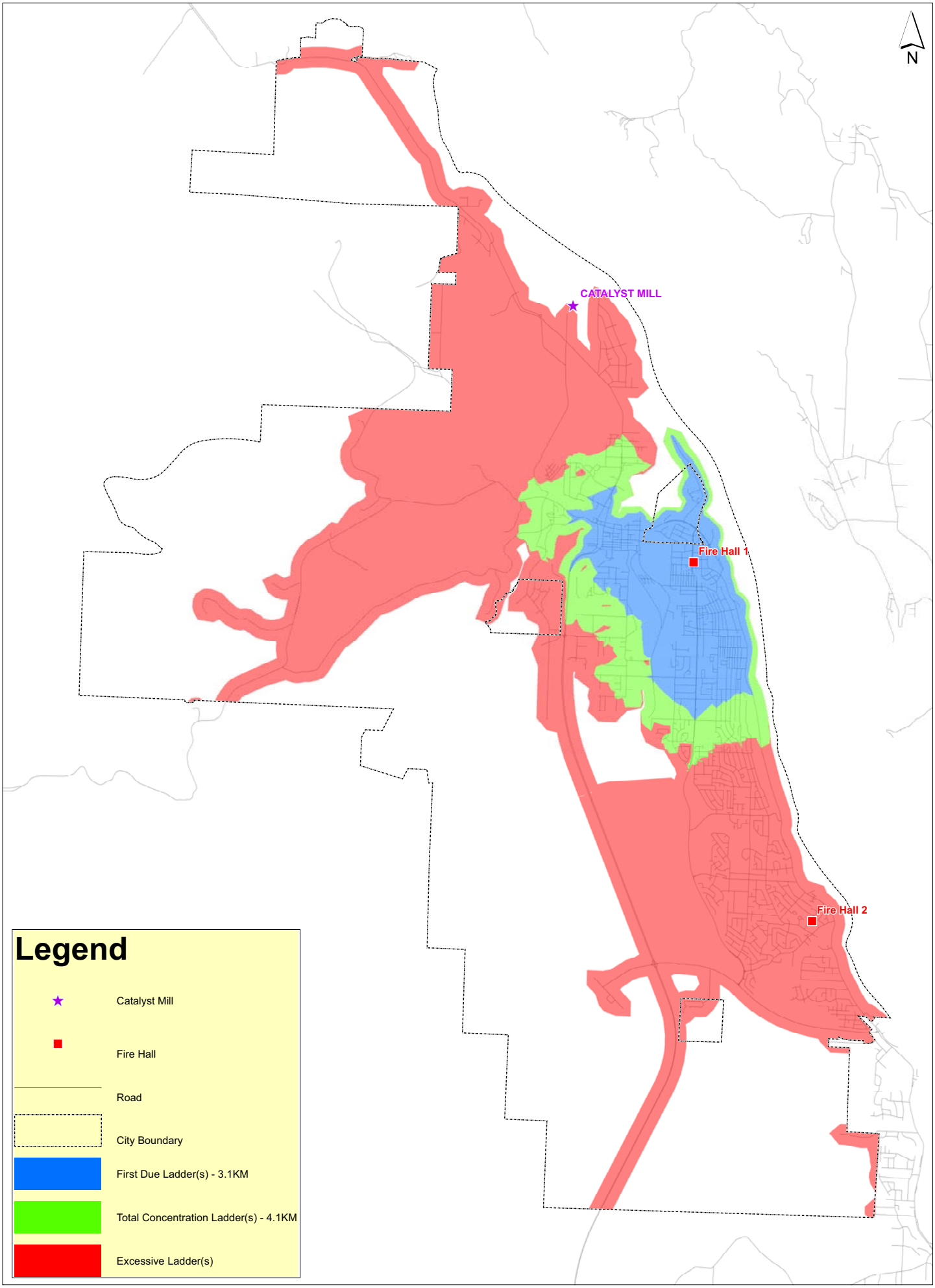


Figure 8.7 2 Ladder Response Coverage Map

City of Campbell River

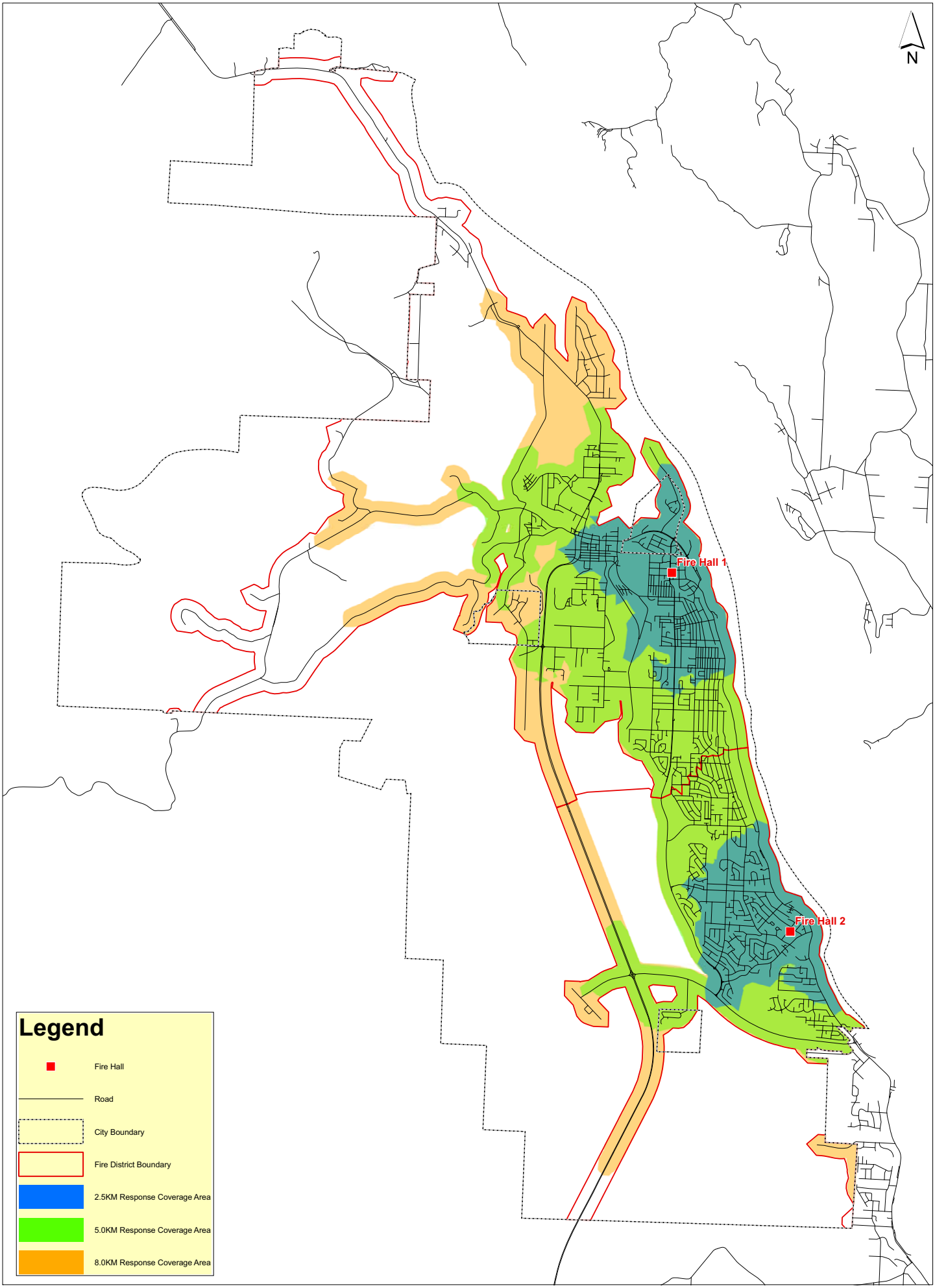


Figure 8.7-3 Insurance Industry Standard Response Distance Coverage Map

Figure 8.7-1 Pumper Response Coverage Map indicates the areas that are covered by the first and second due pumper companies, the areas covered by the total concentration benchmarks, and the areas considered to be beyond the benchmark response distances associated with the Basic Fire Flow.

Figure 8.7-2 Ladder Response Coverage Map indicates the areas that are covered by the ladder company.

Figure 8.7-3 Insurance Industry Standard Response Distance Coverage Map shows the coverage areas based on the insurance industry's standards for determining insurance rates.

Response to the Catalyst Mill site
Currently, the nearest responding apparatus is approximately 7 road km distant from the Catalyst buildings. For this reason the Catalyst area would be considered to be "unprotected" by most insurers.

With the current locations of the existing Fire Stations a reasonable level of response (with respect to response time) for the potential fire risk is not provided to the Catalyst industrial site.

As previously noted, the Benchmarks for response come from the Basic Fire Flow (see Section 7.3) and Table 7.2-1 The Table of Effective Response. These Benchmarks for response are adjusted for distribution needs. In the case of Campbell River, additional companies for distribution are added to the Basic Fire Flow benchmarks as follows:

Table 8.7-2 Summary of Response Benchmarks for Basic Fire Flow plus Distribution

Basic Fire Flow	1st Due Pumper	2nd Due Pumper	1st Due Ladder	Total Pumper Companies available	Minutes for all to arrive	Total Ladder Companies available	Minutes for all to arrive
19,000 LPM	3.5 minutes	5 minutes	4 minutes	5	7 minutes	2	5 minutes
19,000 LPM	2.7 km	4.1 km	3.1 km	5	6.0 km	2	4.1 km
For Distribution				+2		+1	

To satisfy the total distribution needs for response within this portion of the fire insurance grading, the Campbell River Fire Department is deemed to need 2 additional pumper companies and 1 ladder company that is able to respond within the benchmarks set by the Basic Fire Flow. This increases the amount of available credit for pumper companies to 7 and increases the amount of available credit for ladder companies to 3.

If the Catalyst mill area is excluded from the City, additional resources for distribution are deemed unnecessary, within the fire insurance grading. The available credit for the number of total needed number of pumper companies remains 5 and the total available credit for the number of needed number of ladder companies remains 2 as indicated in Table 7.3-2 Summary of Response Benchmarks for Basic Fire Flow.

Additionally, Recommendation 8.7-1 – Expand Fire Department to Provide Improved Fire Protection Coverage throughout the Community would not to be need made.

It is important to note that the term "number of companies needed" refers to the maximum creditable within the fire insurance grading. This is the benchmark that the community is measured against and is derived from the risk assessment. When a community receives the maximum credit in all areas of the fire insurance grading then a PFPC of 1 is applied. This is very uncommon due to the high cost associated with this level of fire protection. See Figure 8.7-4 Campbell River Fire Protection Service Area Showing Maximum Available Credit.

Recommendation 8.7-1 – Expand Fire Department to Provide Improved Fire Protection Coverage throughout the Community

In order to provide the optimum level of fire protection throughout the entire community, additional resources should be acquired. An additional fire station should be constructed and be located so that the industrial mill buildings and surrounding area are within a reasonable response distance from the station.

Option 1

To provide the ideal level of fire protection to the industrial mill area, within the fire insurance grading, it is recommended that a new fire station be built. The new fire station should have all the tools and equipment needed by the fire fighters in addition to 2 pumper companies and 1 ladder company. The location of the fire station should

be situated so that the response requirements of the first and second due pumper and ladder companies can be met. Additionally, the number of fire fighters (career or auxiliary) should be sufficient to operate each apparatus safely and effectively.

Providing a fire station that is located within the response requirements of the first and second due pumper and ladder companies, is housed with 2 pumpers and 1 ladder and is staffed with an adequate number of fire fighters will result in attaining the maximum amount of credit within this portion of the fire insurance grading. Additionally, from the perspective of the insurer, these buildings will be considered to be "protected" because they are within 5 road km of a fire station.

Option 2

To provide a recognized level of coverage, from the perspective of an insurer, it is recommended that a satellite fire station be situated so that no building in the Catalyst area is beyond 5 road km of the satellite fire station. The station should be staffed with a minimum of 15 auxiliary members from Fire Station 1 and be housed with at least one recognized pumper apparatus.

From the perspective of most insurers, the Catalyst buildings are considered to be "unprotected" because they are beyond 5 road km from a fire station. Providing a fire station that has a pumper apparatus with the necessary tools, equipment, staffing and is within 5 road km will change the Catalyst protection status from "unprotected" to "fire hall protected" or "protected" should the hydrant system be recognized.

See Figure 8.7-4 Campbell River Fire Protection Service Area Showing Maximum Available Credit

Note: further information on Distribution of Resources can be found in Section: 13.4 Standard of Response Cover.

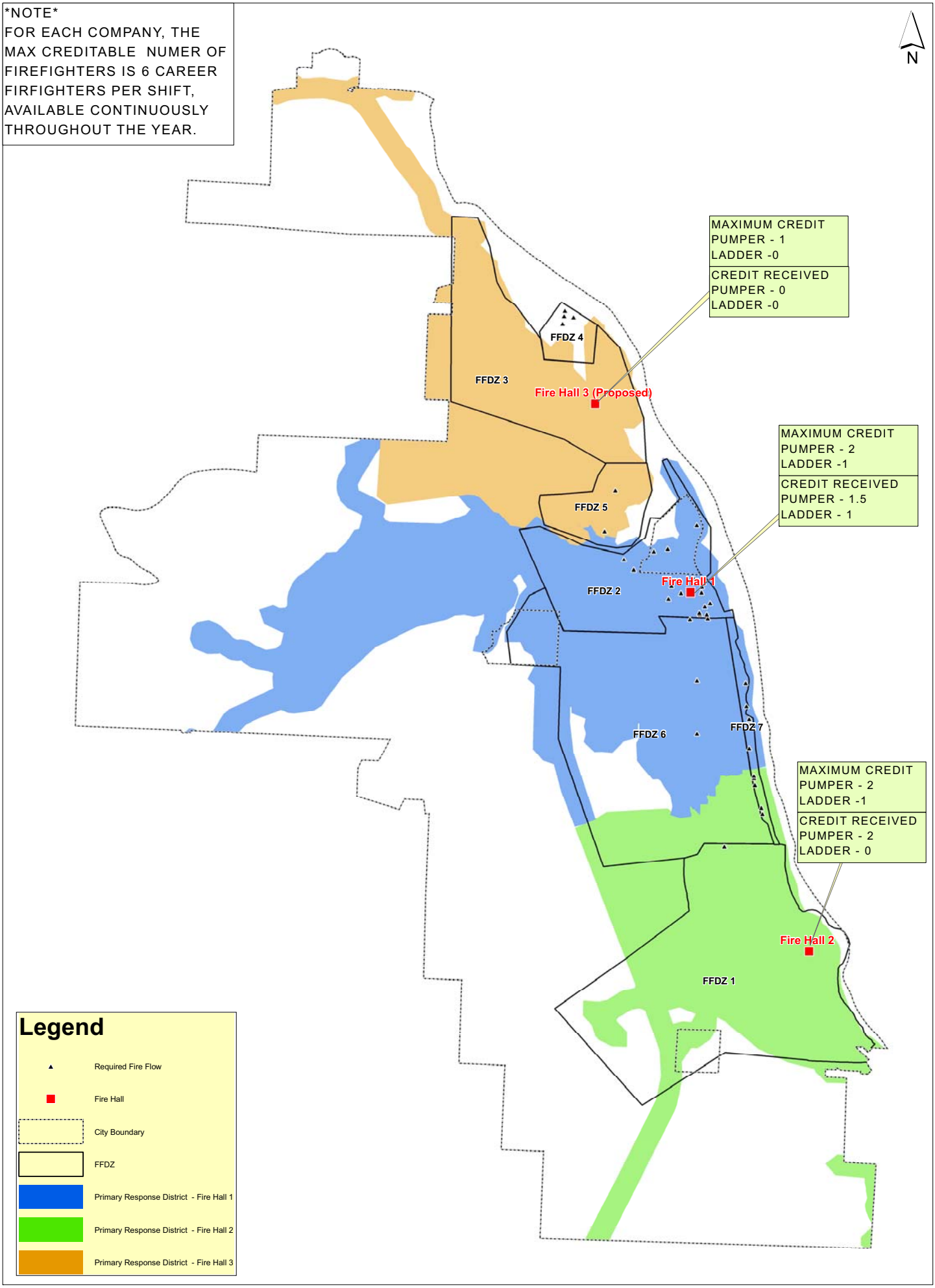


Figure 8.7-4 Campbell River Fire Protection Service Area Showing Maximum Available Credit

8.8. Pumping Capacity

The total credited Pump Capacity is calculated for comparison to the Basic Fire Flow for the community. The calculation is conducted as follows:

$$PC_{Total} = PC_{Primary} + PC_{Support}$$

PC_{Total} = Total Credited Pump Capacity
$PC_{Primary}$ = Primary Pump Capacity (local to the specific station)
$PC_{Support}$ = Support Pump Capacity (coming from other areas/stations)

Primary Pump Capacity (Primary PC) is set by taking the sum of the rated capacities of the pumpers in the station and downgrading from 100% of the rated capacities based on reliability factors (including but not limited to age, quality, listing and pump test results).

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

The fire department has a credited pump capacity of 19,000 LPM

The Basic Fire Flow assigned to the community is 19,000 LPM. It should be noted that many areas of the community are residential and have required fire flows of 3,000-4,000 LPM however, it must also be noted that there are a significant number of industrial and commercial risks where fire flows are in the order of 16,000 – 22,000 LPM.

8.9. Apparatus Maintenance Programs

The fleet mechanical/maintenance program is the responsibility of the Deputy Fire Chief of Operations. This DFC is responsible for all duties that were performed by the former

Mechanic/Fire fighter. All scheduling and delivery of tools, equipment and parts for the apparatus is the responsibility of the DFC. Additionally, the DFC is responsible for scheduling regular maintenance and repairs for the apparatus and pumps as well as developing and processing all invoices as they relate to the maintenance of the apparatus. All records are maintained by the DFC.

Major repairs (engine, brakes, chassis, etc) to the apparatus are completed by local contractors; however these contractors do not use certified Emergency Vehicle Technicians (EVT). The pumps on the apparatus are serviced by Pro Fire Ltd. from Nanaimo who utilize certified EVT's. Records for each in-service apparatus are maintained in a digital database and are available upon request.

Recommendation 8.9-1 Take steps to ensure that apparatus are professionally maintained by appropriately qualified personnel

Apparatus used by the fire department is critically important to the life safety of fire fighters as well as to those persons involved in accidents or fires that are responded to. Failure of apparatus (or sub-system) to operate according to specification during an emergency may result in significant increase in risk to life safety and property losses. For this reason, it is important that a high standard of care be utilized in maintaining emergency apparatus and equipment.

The recommended standards for maintaining fire apparatus are:

3. All Manufacturer Specifications
4. NFPA 1911: Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus, 2007 Edition

Maintenance to fire apparatus should be completed by a certified Emergency Vehicle Technician (NFPA 1071: Standard for Emergency Vehicle Technician Professional Qualifications). The Campbell River Fire Department maintenance program manager should be highly familiarized with the Manufacturers' specifications for maintenance and with NFPA 1911.

8.10. Fire Fighting Ancillary Equipment and Hose

Hoses are visually checked after each use and are hung in the hose tower in Fire Station 1. Table 8.10-1 - Summary of Hose and Nozzles on Apparatus illustrates how much hose

is available to the Fire Department and where it is located. It is important to note that 1¾" nozzles and hoses are considered to be an equivalency to 1½" nozzles and hoses. For the purpose of fire insurance grading, the totals of both have been combined and considered 1½".

Table 8.10-1 - Summary of Hose and Nozzles on Apparatus

		Hose		Nozzles	
Apparatus	Hi Vol.	2 ½"	1 ½"	2 ½"	1 ½"
Engine 11	1,300'	1,100'	1,100'	3	6
Engine 12	1,000	1,000'	1,000'	3	2
Rescue 1	-	-	-	-	-
Tender 1	100'	200'	200'	-	-
Ladder 1	650'	600'	400'	6	3
Engine 21	1,300'	1,000'	600'	2	4
Engine 22	900'	200'	750'	-	-
Engine 23	1050'	850'	400'	-	-
Fire Hall	500'	1,650'	1,700'	-	-
Total Available	6,800'	5,700'	5,520'	14	15
Max Permissible Credit	8,400'		2,100'	30	
Credit Received	8,400'		2,100'	29	

The fire department has an adequate amount of hose and nozzles and has received full credit in this portion of the fire insurance grading.

Ground ladders are tested regularly in house by the maintenance officer. Details of the service test have been submitted and indicate that all ladders in service have successfully passed their service test. Currently, the fire department has an adequate number and assortment of ladders for the in-service apparatus.

8.11. Fire Protective Clothing & Breathing Apparatus

The fire department is well equipped with personal protective clothing (PPC) and personal protective equipment (PPE). Most of the gear is new and is generally replaced every 7 years. The gear and equipment is washed in-house and is inspected after each

use including practices. Any deficiency is shown to an officer and if deemed unsafe or questionable, a replacement set is provided.

The Fire Department has a total of 32 Self Contained Breathing Apparatus (SCBA) and a total of 37 spare bottles.

The fire department has technicians that are trained to conduct minor regular maintenance on the SCBA units. All SCBA have PASS alarms attached that are checked each week and after each use. Maintenance of the SCBA is planned, recorded, and conducted in house. There is a fill station at each fire station that is serviced by Aquatech on a regular basis. Records are available upon request.

8.12. Automatic Aid & Mutual Aid Agreements

CRFD has a Mutual Aid agreement in place is with the Courtenay Fire Department. As Campbell River does not have a reserve ladder apparatus, when Campbell River ladder apparatus is out of service, the Courtenay Fire Department is notified and a request for ladder service may be sent by the Campbell River Fire Department on first alarms. If additional resources are required, CRFD can request the mobile water supply or pumper apparatus from the Oyster River Volunteer Fire Department or the Comox Valley Fire Department for a pumper apparatus.

8.13. Available Fire Force

Campbell River's Basic Fire Flow benchmark has been set at 19,000 LPM (4,200 Igpm) in 2009.

Based on the Basic Fire Flow alone, the maximum available credit includes 5 pumper companies and 2 ladder companies being available to respond continuously, year round. When considering adequate distribution and providing adequate response coverage for the Catalyst buildings, the maximum available credit increases to 7 pumper companies and 3 ladders. For the purpose of fire insurance grading, the benchmark (maximum available credit) of career fire fighters per company is 6 (including officers). Therefore, the maximum available credit for the number of career fire fighters that the Campbell

River Fire Department can receive is 60 career fire fighters per shift (including officers) available continuously year round (day and night).

When excluding the Catalyst buildings from the fire protection area and effectively from the fire insurance grading for Campbell River, additional companies to satisfy adequate distribution of apparatus are not needed. The maximum available credit that the CRFD could receive would then be 5 pumper companies and 2 ladder companies. Accordingly, the maximum number of career fire fighter that the Campbell River Fire Department can be credited would be 42.

When considering that the Catalyst buildings are currently within the fire protection area, the CRFD has been graded with a maximum creditable number of career fire fighters per shift of 60.

Where Fire Departments are operating with a roster, such as Campbell River, the Available Fire Forces for fire insurance grading purposes are calculated as follows;

- Each full time, on duty, career fire fighter is credited as 1 fire fighter.

Fire fighter Equivalent Units (FFEU) [8]

- 1 FFEU is credited for every 3 off-shift career fire fighters who are scheduled to respond.
- 1 FFEU is credited for every 4 off-shift career fire fighters who are not scheduled to respond, but are available to respond.
- 1 FFEU is credited for every 3 auxiliary or off duty career fire fighter (based on the average turn-out to fires).

Note the term FFEU is not interchangeable with FTE and they have distinctly different meanings.

- *One Fire fighter Equivalent Unit (FFEU) refers to the capacity of the Fire Department to respond with one fire fighter continuously year round.*

[8] The sum of all such equivalent fire fighter units (including those from automatic and outside aid) shall not exceed 50% of the lesser of

a) the required strength of existing companies (@ 6 fire fighters per company), or
b) required companies (based on the Table of Effective Response @ 6 fire fighters per company).

- *One Full Time Equivalent (FTE) refers to one fire fighter working full time hours, which as noted previously accounts for less than 25% of continuous coverage.*

Statistical data indicates that the 3 year average turnout of auxiliary fire fighters to structure fires in Campbell River is 8.8 fire fighters. The number of auxiliary fire fighters that is used for fire insurance grading purposes is 2.93. Note that this number includes auxiliary members responding from both fire stations and also includes off-shift career members responding.

Credit has also been awarded for off duty managers responding to fire calls.

- 1920 hours on duty/ 8760 hrs/yr = 22% on duty coverage per manager
  (0.22 x 3) = 0.66
- 6840 hours off duty / 8760 hrs/yr = 78% off duty coverage per manager
  (0.78 x 3) = 2.34

The total credited available fire force for the Campbell River Fire Department is:

Credit from on duty fire fighters + credit from auxiliary members + credit for on duty managers + credit for off duty managers
4 + 2.93 + 0.66 + 0.78 = 8.37 FFEU

The number of credited auxiliary fire fighters and off shift is less than 50% of the required fire force (based on the Table of Effective Response and the Basic Fire Flow of 19,000 LPM) and is therefore acceptable. (Not more than 50% of the credited available fire force can come from FFEU through auxiliaries and aid, etc.).

The Campbell River Fire Department is credited with 8.37 FFEU in the Available Fire Force section of the fire insurance grading. Additional credit could be awarded up to a maximum of 60 FFEU through:

- improving turn-out number of fire fighters to structure fires,
- providing additional career staff whose primary responsibility is fire fighting,
- developing shifts that have a greater number of fire fighters on duty and stationed at the Fire Stations 24/7/365.

Note: as stated previously, not more than 50% of the credited available fire force can come from FFEU through auxiliaries and aid, etc. for fire insurance grading purposes.

Recommendation 8.13-1 - Increase Available Fire Force

To maintain or improve the Public Fire Protection Classification, the available fire force should be improved for the Campbell River Fire Department. Additional credit could be received up to a maximum of 60 fire fighters per shift. Note that the available fire forces can be improved through additional auxiliaries up to 50% of the required fire force. (In the case of Campbell River, the required fire force is 60, so the maximum available fire force that can be provided through auxiliaries and other FFEU sources is 30.)

Should the City of Campbell River opt to provide additional fire fighter positions, the amount of credit in the Available Fire force section will not only improve but, if the day shift Fire Prevention Officer can return to their previous duties, additional credit can be awarded within the Fire Safety Control portion of the fire insurance grading. It can be assumed that the frequency of inspections will improve to previous levels and the overall level of Fire Prevention Services will improve.

Providing career staffing is a serious matter that requires careful consideration. There are many factors to consider and the fire insurance grading is only one such factor.

8.14. Planned Responses

The CRFD response plan is to respond with the 4 on duty career fire fighters on Engine 11 to all emergency calls to any area of the City. However, for structure fires in Fire Station 2's area, the 4 on duty career members are to respond with Ladder 1. During major structure fires, a general "call out" is sent out to all auxiliary members. When 4 auxiliary members have responded to Fire Station 1, Ladder 1 is typically the next apparatus to respond. Rescue 1 typically leave the station when 2 fire fighters have arrived. These apparatus may have a prioritized response depending on the nature of the emergency call.

The response plan in Fire Station 2's boundary is to respond to all emergency calls as resources permits. Engine 21 is normally the first apparatus to leave the station. The on duty career members from Fire Station 1 will respond with either Engine 11 or Ladder 21, as determined by the Captain or a Deputy Fire Chief.

When considering that Fire Station 2 is staffed by auxiliary members only and Fire Station 1 relies on auxiliary members for additional apparatus, response from these fire stations to emergency scenes can be expected to be delayed significantly due to variability in turn-out time. During a fire event, this delay can significantly change a fire fighting crew's capacity to effectively fight a fire and may result in increased levels of property damage and risk to life.

Recommendation 8.14-1 - Implement Duty Crew System to Help Improve Response Times

In order to help reduce the response times for apparatus that is staffed by auxiliary members, consideration should be given to implementing a duty crew system for both fire stations as they both operate using auxiliary members. The number of auxiliary members that are part of the duty crew should be sufficient enough to adequately and safely operate the emergency apparatus.

Implementing a duty crew system has the potential to help reduce response times for additional apparatus needed on emergency scenes. Within the fire insurance grading, any member responding as part of the duty crew is graded the same as an auxiliary member.

8.15. Pre-Incident Planning

The fire department has developed pre-incident plans for approximately 60% of the buildings other than detached dwellings. The pre-incident plans are kept in binders in both fire stations and in digital format on Engine 11 and 21. Building familiarization tours are completed by the fire department during regular building inspections.

Recommendation 8.15-1 Improve Pre-Incident Planning Program

In order to improve the pre-incident plan program utilized by the CRFD, it is recommended that all pre-incident plans be updated as required upon completion of any building inspection conducted within the City of Campbell River. Additionally, continuous efforts should be given to increasing the percent of buildings that have pre-incident plans. All of the pre-incident plans should be stored digitally and in hard copy and be made available to the fire fighters and the dispatchers. Upon receipt of an emergency call and dispatch of fire fighters, the dispatcher should have the ability to provide the fire fighters with the pre-incident plan details (i.e. pre-plan number, etc.) or relevant information (hazmat storage, etc.).

8.16. Training & Qualifications

8.16.1. Training Provided

All career fire fighter certification is conducted through the Justice Institute of British Columbia (JIBC). Career fire fighters are certified to NFPA 1001, Standard for Fire Fighter Professional Qualifications, Level 2 Fire Fighter.

All Captains (career) are certified to NFPA 1021, Standard for Fire Officer Professional Qualifications and an additional 6 First Class Fire fighters (career) are certified to this standard also. In this way, the training program forms the basis of the fire department succession plan. In the event an Officer opts to leave the fire department, there is a pool of 6 qualified fire fighters to choose from that can be promoted to Captain.

All auxiliary members within the CRFD must be NFPA Fire Fighter Level 1 certified and attend a Live Fire exercise (through the JIBC) before they take part in fire ground operations. Once complete, they have limited duties during actual incidents (ex. fire ground, rescue, hazmat, etc.). After a 6 month period, the auxiliary members are then trained and certified to NFPA Fire Fighter Level 2. The fire department has 73% of its fire fighting roster certified at Fire Fighter Level 1 or 2. The remaining members have been with the fire department for less than one year and are currently enrolled in the JIBC Basic Fire Fighter program.

Specialized training (hazmat, hi-angle technical rescue, etc) is available for any member of the Fire Department. The fire department sends its members to receive Live Fire Training through the Comox Fire Training Centre. Auxiliary members typically receive a 2 hour training session in the spring and fall seasons. Career members receive a full day of Live Fire training on an annual basis.

The Deputy Fire Chief of Operations is responsible for the overall training program for both the career and auxiliary members, this includes maintaining training records. Additionally, the DFC is responsible for providing specialized training opportunities for all auxiliary fire fighters.

Training for the on duty career members is every shift for 1.5 – 2 hours. Various areas are covered during the training hours which include necessary knowledge and skills needed to attain NFPA 1001 Level 2, rope rescue, ladder operations, first responder, auto extrication, etc. The auxiliary members train every Wednesday night for approximately 2 hours. These members train for the skills needed to participate in fire ground operations.

There are a total of 4 career members and 11 auxiliary members who are certified to NFPA 1041, Standard for Fire Service Instructor Professional Qualifications.

The benchmarks for training within the fire insurance grading for auxiliary and career fire fighters respectively are:

- Auxiliary: Certified Fire Fighter Level I per NFPA 1001 (as relates to providing structural fire protection) or equivalent AND trains a minimum of 48 hrs per year (documented),
- Career: Certified Fire Fighter Level II per NFPA 1001 or equivalent AND trains a minimum of 2 hours per shift

8.16.2. Record Keeping

The Campbell River Fire Department maintains records through a computer database that is well organized. These records are updated on a regular basis and can be used in planning training programs to ensure that all members have achieved reasonable levels of training in appropriate areas. The records are backed up in the local servers in the fire station and remotely at City Hall. Records were available for review.

8.16.3. Training Facilities

The Campbell River Fire Department own and operate the training facility located adjacent to the airport in Campbell River. The facility includes a 2 storey non-combustible building, and other various tools and props necessary for fire fighting training.

8.17. Fire Department Assessment within the Fire Insurance Grading

The Fire Department Assessment contributes 40% to the total fire insurance grade of the community. This is the most heavily weighted portion of the grading and as such is considered to be the most significant indicator of a community's overall preparedness for dealing with fire emergencies.

The Campbell River Fire Department has been graded as having a relative classification of 6 in the current fire department assessment. There are a number of areas within the Campbell River Fire Department grading that have significant deficiencies which can be addressed by implementing the recommendations identified throughout this section of the report, with the most significant being the provision of additional staffing in the Fire Department.

Implementing the recommendations throughout this section of the report can significantly help create a greater level of efficiency in fire department operations and can result in an improved fire insurance grade for the City of Campbell River, depending on the degree to which the recommendations are implemented.

Table 12.2-2 – Key Recommendation Summary provides a list of recommendations that have the most significant impact with respect to fire department operational effectiveness. The table provides the details of the associated benefit within the fire insurance grading. The cost benefits associated with various fire insurance grades are described in Section 13.2 Cost Benefits of Fire Protection.

9. FIRE SAFETY CONTROL

Fire Prevention and Fire Safety Control including Building and Fire Code effectiveness have become an increasingly heavily weighted portion of the fire insurance grading system. This is a result of statistical data showing that communities employing effective programs in these areas have significantly reduced fire related losses.

The City of Campbell River has been reviewed in the effectiveness of its practices with regard to Fire Prevention and Fire Safety Control.

9.1. Codes and Bylaws: Construction Control, Plan Review, Building Inspection and Permit Process

The building inspectors are employees of the City of Campbell River. The City provides building permits and reviews plans for new construction. The city does not have a local engineer to sign off on plans submitted to the city.

Key Codes and Standards:

National: National Building Code
National Fire Code

Provincial: British Columbia Building Code
British Columbia Fire Code

Municipal: Zoning Bylaw No. 1530, 2002
Building Regulations Bylaw No. 3060

The Campbell River Fire Department has a strong emphasis on public education and prevention. The day shift fire fighting crew is responsible for building inspections and compliance with the BC Fire Code. The City is divided up into equal portions and each portion is assigned a crew that conducts the inspections for the buildings in the area. While conducting inspections, these members enforce what is needed by the Building and Fire Codes or local bylaws and do not require or request that the building or property owner go beyond what is provided in the codes or bylaw. Each month the crews are assigned specific buildings within their designated area and are expected to complete the inspection of all the buildings on that list for that month. A report

indicating the deficient areas is provided to the building owner and a copy is kept for the Fire Department.

Previously, when the Fire Department had a regular day shift Fire Prevention Officer, significantly deficient buildings were re-inspected by this member in order to ensure that compliance with complex issues were resolved within a reasonable amount of time.

Recently, the day shift FPO was reassigned to fire fighting duties on a regular company. Each company has a member who is trained to conduct fire prevention inspections; however, due to time constraints, these crew FPO's are not able to conduct all inspections and re-inspections in their assigned area of the City during regular working hours. This increases the life safety risk to responding fire fighters and occupants.

Since the day shift FPO has been reassigned to fire fighting duties, the Deputy Fire Chief of Communications and Prevention has taken over the responsibilities of scheduling all inspections and re-inspections, data entry, record keeping, completing incomplete crew inspections and other administrative duties as they relate to fire prevention and public education. This is temporary as these duties will be transferred to the Fire Chief once a reasonable time frame has passed.

Recommendation 9.1-1 Reassign Shift Fire Prevention Officer

It is recommended that a crew Fire Prevention Officer be reassigned from fire fighting duties to regular day shift Fire Prevention Officer. By reassigning this member, Campbell River buildings will be inspected and re-inspected in a timely manner. Additionally, reassigning a shift Fire Prevention Officer to regular day shift Fire Prevention duties will help improve the level of Fire Prevention services provided throughout the community and have a positive effect within the fire insurance grading for the City of Campbell River. It can be expected that the frequency of inspections, for any given building, will improve as well as the record keeping and overall administration of the program. Additionally, this allows the Fire Chief to manage the Prevention Program as a whole and focus their attention on more managerial duties.

9.1.1. Automatic Sprinkler Protection

The City of Campbell River has a sprinkler bylaw that has been in place for since 1994. The bylaw is part of Campbell River Building Bylaw No. 3060, 2003, and states the following:

Section 28.2

"Except as provided otherwise in this Bylaw, where an owner of land within a Fire Limit Area constructs a building or an addition to a building or alters a building for change of use; the owner must install a fire sprinkler system throughout the entire building…The sprinkler system must be installed and maintained to standards as set out in the British Columbia Building Code or to the required standards of the National Fire Protection Association (NFPA) current as of the date of the Permit."

Section 28.3

"Unless required otherwise by the Building Code, the requirements of section 28.2 shall not apply:

(a) where the construction falls within the scope of Part 9 of the BC Building Code and the building contains no more than two residential units;

(b) where there is new construction of a complex building not exceeding 200 m^2 total floor area;

(c) where there is construction of an addition to an existing complex building where the floor area addition does not exceed 100 m^2;

(d) where there is construction of an addition to an existing building where the floor area addition does not exceed 25% of the existing building floor area, to a maximum of 200 m^2;

(e) where there is a renovation or alteration of an existing building provided the occupancy is not Public Assembly or Residential;

(f) to building of non-combustible construction in industrial zones, in which processes are carried out making compliance with the requirements of section 28.2 impracticable, and where other equivalent or better fire protection equipment is installed as designed in conformance with good fire

protection engineering practice by a registered professional. Such special and unusual structures include, but not be limited to the following:

- *steel mills;*
- *aluminum plants;*
- *refining*
- *power generation*
- *liquid storage facilities; and*
- *pulp and paper mills"*

The sprinkler bylaw is an important element within the fire insurance grading.

Installation and maintenance of fire protection sprinklers helps reduce the required fire flow for any given building. Sprinkler Bylaws also reduce the overall Basic Fire Flow of the community and thereby decrease all associated benchmarks that the community is measured against throughout the fire insurance grading.

Notably the Campbell River Sprinkler Bylaw has been implemented for more than 10 years. As the ratio of sprinklered buildings to non-sprinklered buildings improves, the Basic Fire Flow of the community decreases which results in lower benchmarks for fire protection. The implementation of the sprinkler bylaw in Campbell River has resulted in a reduction on the Basic Fire Flow from 4800 IGPM to 4200 IGPM.

Should the community decide to rescind the sprinkler regulation, the Basic Fire Flow will increase on an ongoing basis as buildings are constructed with higher required fire flows. As the Basic Fire Flow increases, so too do all of the associated benchmarks that the community is graded against for fire insurance grading. The end result of this is the fire insurance grade is adversely affected.

Looking ahead, as the community grows, a higher percentage of the building stock will be sprinkler protected and the Basic Fire Flow will continue to decrease. To quantify the degree of impact the decreasing benchmark has, refer to Table 7.2-1 The Table of Effective Response and note that the benchmark number of companies (Total Availability Needed) that the community is measured against, has decreased from 6 to 5 for pumpers and 2 to 1 for ladders. This has a significant positive impact on the fire

insurance grade as if there were no sprinkler requirements, the Basic Fire Flow would be 4800 and the community would be measured against the associated benchmarks:

Table 9.1-1 Comparison of Response Benchmarks for Basic Fire Flow

Basic Fire Flow	Benchmark Total Pumper Companies	Total Ladder Companies available	Benchmark Pumper Fire Force
Basic Fire Flow in 2009 (with Sprinkler Bylaw in place for 10+ years)			
19,000 LPM	5	2	42 fire fighters
Basic Fire Flow if Campbell River had no Sprinkler Bylaw			
22,000 LPM	6	3	54 fire fighters

Note that the total benchmark number of companies (pumper and ladder) currently is 7 after the sprinkler regulation has been in place for 10 years and the Basic Fire Flow is 19,000 LPM (4,200 Igpm).

Without the sprinkler regulation, the Basic Fire Flow would be 22,000 LPM (4,800 Igpm) and the associated benchmarks that Campbell River would be measured against would include the need for two additional companies (one pumper and one ladder) as well as 12 additional fire fighters.

The implementation of the sprinkler regulation is onerous, but an extremely important step toward managing the fire risk in the community. In the absence of a sprinkler bylaw, the Basic Fire Flow continues to rise as a community grows. Once a sprinkler bylaw is established, the Basic Fire Flow tends to decrease and the only time additional resources are required is when the community boundaries expand resulting in additional needs for distribution coverage.

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

Furthermore, the implementation of the sprinkler regulation allows municipal designers to significantly reduce the required capacities of water mains, pump stations and

storage requirements. This has an immediate impact that reduces the cost of development as well as the cost of maintenance of the water system.

Recommendation 9.1-2 – Maintain the Sprinkler Bylaw

To reduce fire risk and improve life safety throughout the community, it is strongly recommended that the Sprinkler Bylaw be maintained. An effective Sprinkler Bylaw reduces the required fire flow for any given building and has the potential to create a "cap" on the Basic Fire Flow, and the associated benchmarks that the community is graded against.

Furthermore, consideration should be given to expanding the scope of the sprinkler bylaw to include retrofitting existing building stock in stages.

9.2. Code Enforcement, Inspections, and Local Assistance to the Fire Commissioner

The Fire Chief, Deputy Fire Chiefs and Fire Prevention Officers are all Local Assistants to the Fire Commissioner. This grants them the ability to conduct a building inspection without notice and provide a fine for any compliance issues. The fire fighting crews inspect buildings for Fire Code compliance (fire extinguishers, maintenance of fire protection/detection systems, means of egress, etc.). Areas of concern are documented and a report indicating a time frame for compliance with any areas of non-compliance is provided to the building owner with a copy kept for the fire department records. More complex issues or re-inspections are the responsibility of the crew FPO or Deputy Fire Chief.

Table 9.2-1 – Previous Inspection Frequency by Occupancy Type or Building Use

Type	Frequency
Sprinklered buildings	Annual
Buildings with Monitored Fire Alarm	Annual
Rooms with Sleeping Areas	6 months
Cooking	6 months
Welding, Spray Booth, Hot Works	6 months
Non Sprinklered Offices, small mercantile, etc	2 years

In the past, there were two dedicated Fire Prevention Officers and the inspection schedule was being maintained at the frequencies noted above. However with the recent cutbacks and re-assignment of a dedicated FPO to fire fighting duties, this schedule is not being maintained, and inspections are becoming increasingly out of date. The overall program of inspections was 20% behind schedule at the time of survey and noted to be getting worse.

Recommendation 9.2-1 Improve Fire Prevention Inspection Program

To improve the level of fire prevention and reduce the overall fire risk in the community, the Fire Prevention Inspection Program should be improved to include a minimum of one inspection per year for all hotels, public buildings and industrial occupancies in the City. Increased inspection frequency should be provided to occupancies with increased fire risk and/or life safety issues.

The City of Campbell River should consider providing an additional full time Fire Prevention Officer (Local Assistant to the Fire Commissioner) to conduct inspections on a reasonable frequency schedule. If the community cannot regularly conduct fire prevention inspections, due to a lack of resources, consideration should be given to outsourcing fire prevention inspection related services.

Reference: FIRE SERVICES ACT [RSBC 1996] CHAPTER 144

Municipal duty to inspect hotels and public buildings
Section 26
(1) A municipal council must provide for a regular system of inspection of hotels and public buildings in the municipality.
(2) A municipal council may authorize persons, in addition to the local assistant, to exercise within the municipality some or all of the powers under sections 21 to 23. The information gathered in the inspection process should be utilized in developing the pre-incident plans for the community as well.

Note: Failure to comply with the Fire Services Act may result in a significant liability exposure for the City if a fire related loss should occur.

9.3. Public Education Program

Public education is an effective method for fire departments to reduce frequency and severity of fire losses through educating the public about what they can do to reduce their own risk and improve their chances of surviving should a fire occur. Public education is also a valuable public relations tool. Fire department representatives

participating in public education are ambassadors for the department and can have a very strong impact on the public opinion of the department.

The Campbell River Fire Department currently uses the following programs for public education:

- Fire Prevention Week – pamphlets, newspaper, radio, etc
- Fire Safety House - grade 3 students in the entire regional district
- School Tours – Learn Not to Burn
- Fire Extinguisher Training
- Smoke Alarm Program – Wal-Mart, Canadian Tire
- Fire Station Tours
- Semi-annual school fire drills
- Halloween Safety

9.4. Fire Prevention within the Fire Insurance Grading

Fire Prevention and Fire Safety Control Programs contribute 20% to the total fire insurance grade of the community.

The City of Campbell River is rated as having a relative Public Fire Protection Classification of 4 in the area of Fire Safety Control. The reduction of commitment to dedicated Fire Prevention Officers is one of the most critical components for this portion of the fire insurance grading. Reassigning a crew FPO to regular day shift Fire Prevention duties will help maintain the frequency of inspections and re-inspection.

The use and implementation of the sprinkler bylaw is one of the most critical components within the Fire Prevention Program and the CRFD as a whole. It dramatically reduces the required fire flow for any new construction and reduces the life safety risk to the fire fighters and the occupants of the building. The implementation of the Sprinkler Bylaw (part of the Building Bylaw) provides significant benefit in this area of the grading.

10.EMERGENCY COMMUNICATIONS

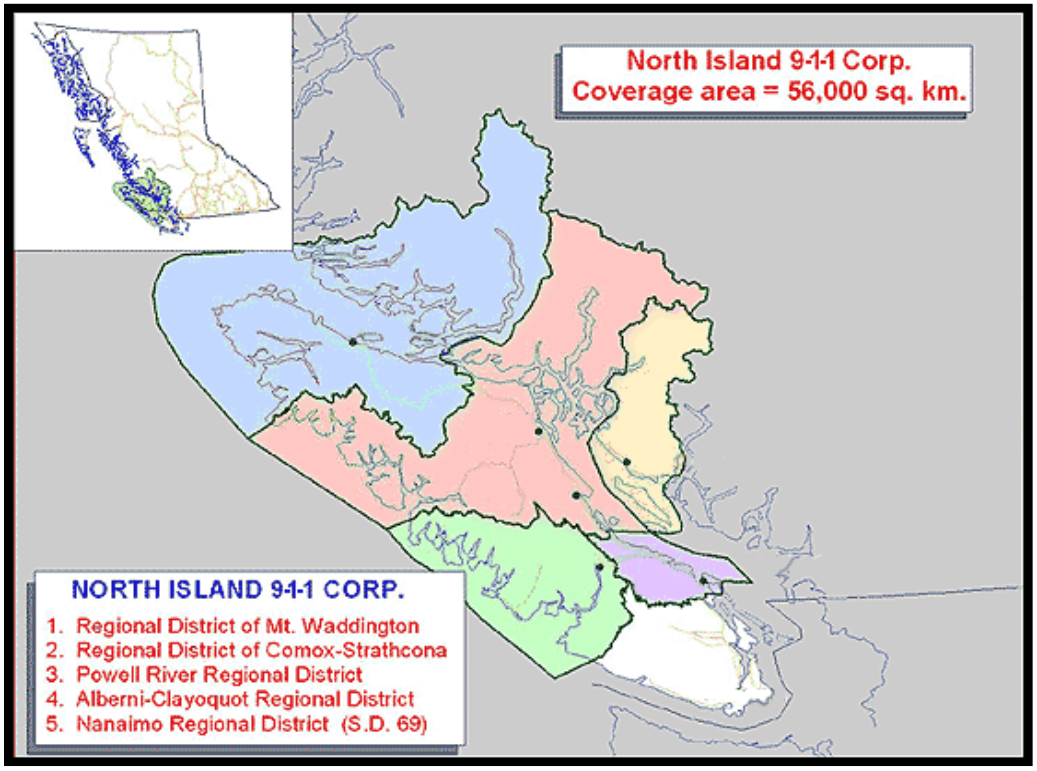
10.1. System Description

Emergency Communications is provided by North Island 9-1-1 Corporation. North Island 9-1-1 provides and manages emergency 911 services to:

- Comox Valley Regional District,
- Strathcona Regional District,
- Regional District of Mt. Waddington,
- Regional District of Alberni-Clayoquot,
- Powell River Regional District (excluding Lasqueti Island), and
- a portion (School District No. 69) of the Nanaimo Regional District.

The North Island 9-1-1 Corporation coverage is shown in Figure 10.1-1 North Island 9-1-1 Corporation Coverage Area. In 2008 the Province of British Columbia restructured the Comox-Strathcona Regional District into two separate regional districts: the Comox Valley Regional District and the Strathcona Regional District.

Figure 10.1-1 North Island 9-1-1 Corporation Coverage Area



The initial answering point for public safety calls is the RCMP Operational Communications Centre (OCC) in Courtenay. The North Island 9-1-1 Corporation contracts the RCMP OCC to perform this function. Fire calls are relayed to the fire dispatch centre in Campbell River. All ambulance calls are relayed to the B.C. Ambulance Service in Victoria.

Figure 10.1-2 Emergency Communication Organizational Chart

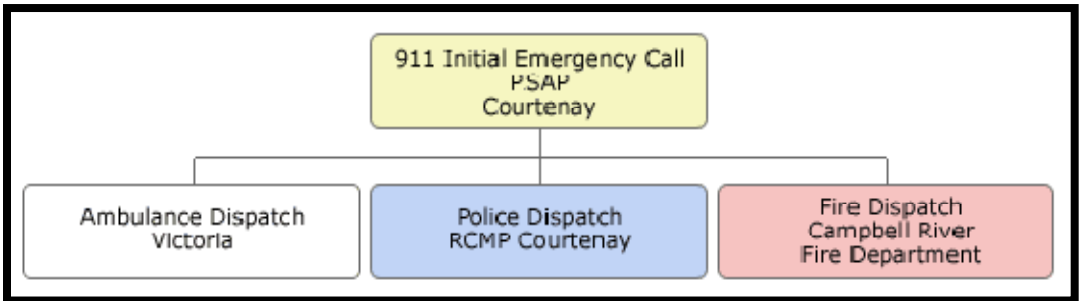
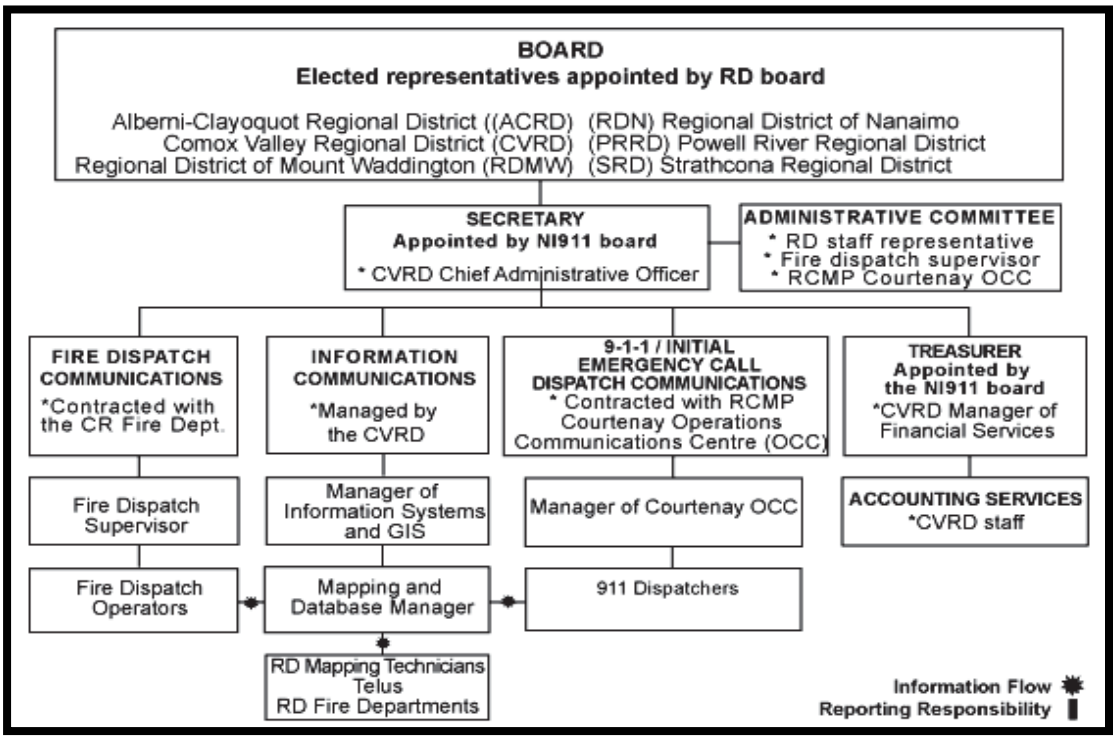


Figure 10.1-3 Organizational Chart (North Island 9-1-1)



10.2. Courtenay PSAP/Police Dispatch Centre

The Courtenay Operations Communications Centre (OCC) is responsible for supporting the largest geographical 9-1-1 area in Canada. All employees in this centre are both 9-1-1 and police dispatch trained. Approximately 30 full-time and nine casual employees comprise the Courtenay OCC Staff.

10.3. Receiving and Handling of Emergency Calls

When a 911 call is received it is distinguishable by a unique emergency call sound and is answered by the first available operator. The dispatch operator will ask the caller whether they would like police, fire or ambulance. A computer screen appears displaying the callers address, name, and telephone number, as well as a business name in the event that they are calling from a business, and effectively pinpoints the caller's location.

It is the Courtenay OCC's policy that the 9-1-1 telecommunicator will stay on the line when done streaming/transferring calls. This ensures effective communication has been established between the caller and the agency desired.

Emergency calls are recorded utilizing a digital recording system made by Eventide. A main recorder keeps all incoming phone lines and radio transmissions made from within the OCC.

A radio dispatching system is provided at the OCC. The radio dispatching system utilized by the OCC is called the Windows InterTalk Console and has been modified to meet the needs of the RCMP.

A computer aided dispatch system is also utilized by the OCC. It is an overall system used by all police agencies in British Columbia called Police Records Information and Management Environment (PRIME).

The dispatch operator will then relay the call to the appropriate unit. Calls regarding fire emergency are instantly directed to North Island 9-1-1's fire dispatch centre in Campbell

River. Ambulance emergency calls are relayed immediately to Victoria, while calls for police are dispatched by the Courtenay OCC Dispatch Operators. Radio support is also provided for the 17 detachments and two highway patrols within the jurisdiction.
All 9-1-1 emergency call histories are automatically recorded.

10.4. Personnel and Training

The Courtenay OCC has between six and eight telecommunicators on duty depending on the time of day and day of the week. The centre has one supervisor assigned per shift. This supervisor is available to the team 20 to 24 hours per day. If the shift supervisor is off-shift or taking time off, there is always an acting shift supervisor in their place. Shift supervisors report to the OCC manager. The OCC does not have facilities for telecommunicators to sleep on shift.

The OCC currently has seven telecommunicator/dispatcher work stations and two additional work stations are available if required.

The Courtenay OCC has its own training centre. It has two telecommunicator work stations that are used as training stations. The two stations are convertible to fully functioning operational work stations if needed.

The British Columbia RCMP OCC staff members are trained under the "Telecom Operator Apprenticeship Program." It is an eight week program that is administered at the RCMP's Pacific Region Training Centre, followed by on the job training with a field coach until the program is complete. Completion of this program requires participants to complete a Demonstrated Proficiency Test and a final exam that must be signed off by a senior staff member.

10.5. Campbell River Fire Dispatch

The Campbell River Fire Dispatch Centre is partnered with approximately 49 fire departments. The dispatch area covered by the communications centre and member fire departments extends approximately 56,000 square kilometres over the northern portion of Vancouver Island and the mainland around Powell River.

10.6. Communication Centre

The Campbell River Fire Dispatch Centre has three dedicated fires lines and five business lines. Fire lines are not progressive to business lines. Primary and secondary dispatch circuits are provided for transmitting alarms. If failure were to occur of the primary circuit, it would not affect the operation of the secondary circuit.

Radio dispatching is provided by Orbacom TDM 150. Communication with fire departments is achieved with a software application called "The Resource," which is visible at the dispatch console.

10.7. Receiving and Handling of Emergency Calls

The communications system utilizes many different systems and mediums for establishing and maintaining contact with the Fire Departments, including regular telephone lines, mountaintop towers with VHF radio repeaters as well as satellite phone systems. The system is designed to be fault tolerant, with backup for paging and emergency power into remote areas particularly in the event of the most severe weather situations.

Emergency calls are recorded utilizing Comlog Digital Voice Recorder. An instant recorder is provided for each telecommunicator.

Incoming 9-1-1 calls are routed through Avel-CAD, a computer aided dispatch and mapping system. The Avel-CAD mapping software utilizes GIS mapping and automatically centre a map over the civic address locating the 9-1-1 caller when using a standard home phone within any of the six regional districts. The Avel-CAD system provides resource information and sector data for all 49 locations that the dispatch centre services. It provides tracking services to capture critical times or benchmarks throughout the duration of incidents.

The use of a cell phone however, requires the caller to provide an address, landmark, or other location descriptor to the dispatcher, who will enter the information manually,

enabling the mapping software to then pinpoint the location and indicate the proper fire department to be dispatched.

Radio and telephone communications are recorded on an CVDS recorder for archiving and instant playback recording for dispatchers to verify address at any time during an incident.

10.8. Personnel and Training

The Campbell River Fire Dispatch Centre has two telecommunicators on duty twenty-four hours a day. The centre has three workstations for telecommunicators. Sleeping accommodations are not provided for staff at the dispatch centre.

The dispatch centre does not have its own training centre. Training is conducted in-house with the goal to be as close to *NFPA 1061: Standard for Professional Qualifications for Public Safety Telecommunicator*, as possible. Records of training are kept.

10.9. Emergency Communications within the Fire Insurance Grading

Emergency Communications contribute 10% to the total fire insurance grade of the community.

The Campbell River Fire Department is rated as having a Public Fire Protection Classification of 3 with respect to emergency communications.

11.WATER SUPPLIES FOR FIRE PROTECTION

Water supplies for fire protection are a critical component of the community's fire defence systems. Water supplies for fire protection were evaluated for adequacy in several areas including but not limited to:

- Fire Flow Delivery – the ability of the water system to deliver the *Required Fire Flows* (from Section 7.3 - Fire Risk in the City of Campbell River) to each identified *Fire Flow Demand Zone*
- Storage Adequacy – quantity of stored water reasonable for expected demands and duration of appropriate flows during expected fire events
- Distribution System Adequacy – layout and arrangement of piping and pump capabilities, looping/grid design of pipe networks for maximum versatility and minimum losses
- Hydrant Distribution – appropriate spacing and distribution to minimize hose lays and other delays in setting up an initial attack during structure fires
- System Design and Installation – the overall design of the system with regard to redundancy, and capability to continuously provide full service to all areas during all foreseeable events (including catastrophic events and/or perils)
- Maintenance of System and Components – system and component maintenance meets recognized standards and improved reliability of system

This section highlights some of the significant findings of the fire insurance grading emergency water supply review. Areas where improvements can be made have been noted.

11.1. Water Systems / Districts Overview

Water supplies for public fire protection are provided by the City of Campbell River. Water is supplied from the reservoir behind the BC Hydro owned John Hart Dam. The dam has 3 penstocks, with arterial mains running off them that supply water to the City of Campbell River and other communities. The City of Campbell River has 3 arterial mains (760 mm, 500 mm and 300 mm) that tap into the penstocks and feed the Campbell River Water Distribution System.

11.2. Water System Evaluation Results

11.2.1. City of Campbell River

The entire water system is monitored using a SCADA system. The 3 mains running from the penstocks are 760 mm, 500 mm and, 300 mm (30", 20", 12"). Each of these mains feeds into a single 1050 mm (41") "Raw Water" main and is UV treated. Once the water is UV treated, a 1050 mm "UV Treated Water" main feeds the three mains that supply the Campbell River distribution system. Once UV treated, water is then chlorinated and supplied to 2 reservoirs via gravity (Holm Road and Evergreen). Holm Road and Evergreen reservoirs each have a capacity of 4.5 ML (1.0 IMG). Evergreen Reservoir supplies water for the downtown core and the rest of the northern portion of the City while Holm Road Reservoir supplies water to the southern portion of the City.

A smaller, separate water system, located in the northern most portion of the City, provides water supplies to a small industrial and residential area. The system is supplied by John Hart Pump station which has a capacity of 40 LPS which then supplies Snowden Reservoir has a capacity of 0.9 ML (0.2 IMG). The water is chlorinated and then distributed into the water system. At 0.59 ML (0.13 IMG) the first pump begins to refill the reservoir. At 0.54 ML (0.12 IMG) a second pump activates and supports the first pump. The low level alarm engages at 0.45 ML (0.1 IMG).

Evergreen Reservoir is supported by Evergreen Booster Station. This booster station has 3 separate pumps. One pump has a capacity of 60 LPS and two pumps each with a capacity of 276 LPS. The low level alarm engages at 65% capacity of the reservoir. This booster is used only during peak demand periods.

Holm Road Reservoir is supported by Holm Road Booster Station. This booster station has a total of 4 pumps (2 minor and 2 fire pumps). The two minor pumps have a capacity of 15 LPS and the two fire pumps have a capacity of 75 LPS each. The minor pumps activate when the demand from the reservoir is 14 LPS. The first fire pump activates when demand is 25 LPS and the second fire pump activates when demand is 85 LPS. This booster station is used only during peak demand periods.

11.3. Volume of Stored Water for Fire Fighting and Domestic Use

The determination method of Required Fire Flows (RFF), Basic Fire Flows (BFF), fire event duration, and minimum hydrant distribution is detailed in the Fire Underwriters Survey document “Water Supplies for Public Fire Protection”.

The absolute minimum water storage for fire fighting for any water system to be recognized for fire insurance purposes is 24,000 Imperial Gallons.

The maximum capacity of the reservoirs and the refill rate of the reservoirs (for the typical fire event duration) are de-rated with a safety factor for the calculation of the total available water resources for fire fighting.

Table 11.3-1 Available Water Resources for Fire Fighting summarizes the minimum required storage volume (BFF for the typical fire event duration) for each water system (column referred to as “Req’d Fire Storage”).

Table 11.3-2 - Summary of Recommended and Required Water Volumes for Fire Fighting also shows the recommended emergency storage (.25 of sum of “Req’d Fire Storage” and Domestic Storage).

Water supply systems designed to provide fire protection should meet the following to be considered a “Good Supply” with regard to adequacy of storage.

The required total effective storage should be based on the following formula:

Equation I $\quad$ *Total Storage Required* $= A + B + C + D$

Where:

A = fire protection storage capacity as calculated (based on Basic and Required Fire Flows determined utilizing the accepted Standard “Water Supply for Public Fire Protection” and Fire Underwriters Survey methodologies

B = equalization storage capacity equal to 25% of projected maximum day demand (MDD)

C = emergency storage capacity (25% of (A + B))

D = Concurrent demand capacity; (Calculated volume equal to the Peak Hour Demand (PHD) flow rate for the typical fire event duration)

Water supply systems designed to provide fire protection should meet the following to be considered an "**Adequate Supply**" with regard to adequacy of storage.

The required minimum storage of the water system to be considered adequate for fire insurance grading is based on the following formula:

Equation II *Minimum Storage Required = A + E*

Where:

A = fire protection storage capacity as calculated (based on Basic and Required Fire Flows determined utilizing the accepted Standard "Water Supply for Public Fire Protection" and Fire Underwriters Survey methodologies

E = Calculated volume equal to MDD flow rate for the typical fire event duration

Alternatively, to meet the minimum requirements for fire insurance grading, water systems **without storage** may be able to qualify as an **"Adequate Supply"** if they are consistently available[9].

The required minimum firm flow availability of the water system (to be considered adequate for fire insurance grading) is based on the following formula:

Equation III Minimum flow availability = BFF + PHD

Where:

BFF = Basic Fire Flow

PHD = Peak Hourly Demand = (MDD/24) x 2

[9] *For water supplies to be considered to be consistently available, documentation must be provided of water levels of source(s) for a minimum of 25 years (50 years preferred). Additionally, detailed documentation of system reliability (including all main breaks and other service interruptions) must be provided for a minimum of 25 years (50 years preferred)*

The formulas noted above may be modified if the level of risk within the community is unusual or if the situation warrants. In some cases alternatives to the above noted formulas are developed and considered based on specific situations.

Ideally, the water supply should be capable of providing fire flows to all built-up areas of the protected community. The water supply system should be designed and constructed such that water supplies are uninterrupted even during system maintenance, main breaks, reservoir cleaning, extended periods of drought, and catastrophic events (such as seismic events, wind storm, power failures, etc.). This can be achieved through the use of redundant design with multiple sources and storage locations, looped distribution system, back up power, and other safety factors included within the scope of good engineering practices.

For each of the zones in the water systems, Figure 11.3-1 - Recognized Water Supply for Fire Fighting shows a comparison of the minimum water required (for fire fighting) to the recommended storage capacity (to qualify as a “Good Water Supply”). The figures also show the amount of water that is actually available for fire fighting (including reservoir refill during fire event) and the quantity of water storage in the system. (if this information was available) As noted in Table 11.3-2 - Summary of Recommended and Required Water Volumes for Fire Fighting and Figure 11.3-1 - Recognized Water Supply for Fire Fighting, the City of Campbell River has storage capacities that are considered to be adequate (for the minimum storage capacity with regard to fire fighting).

Improvements made to the water supply systems for fire fighting should be reported to Fire Underwriters Survey.

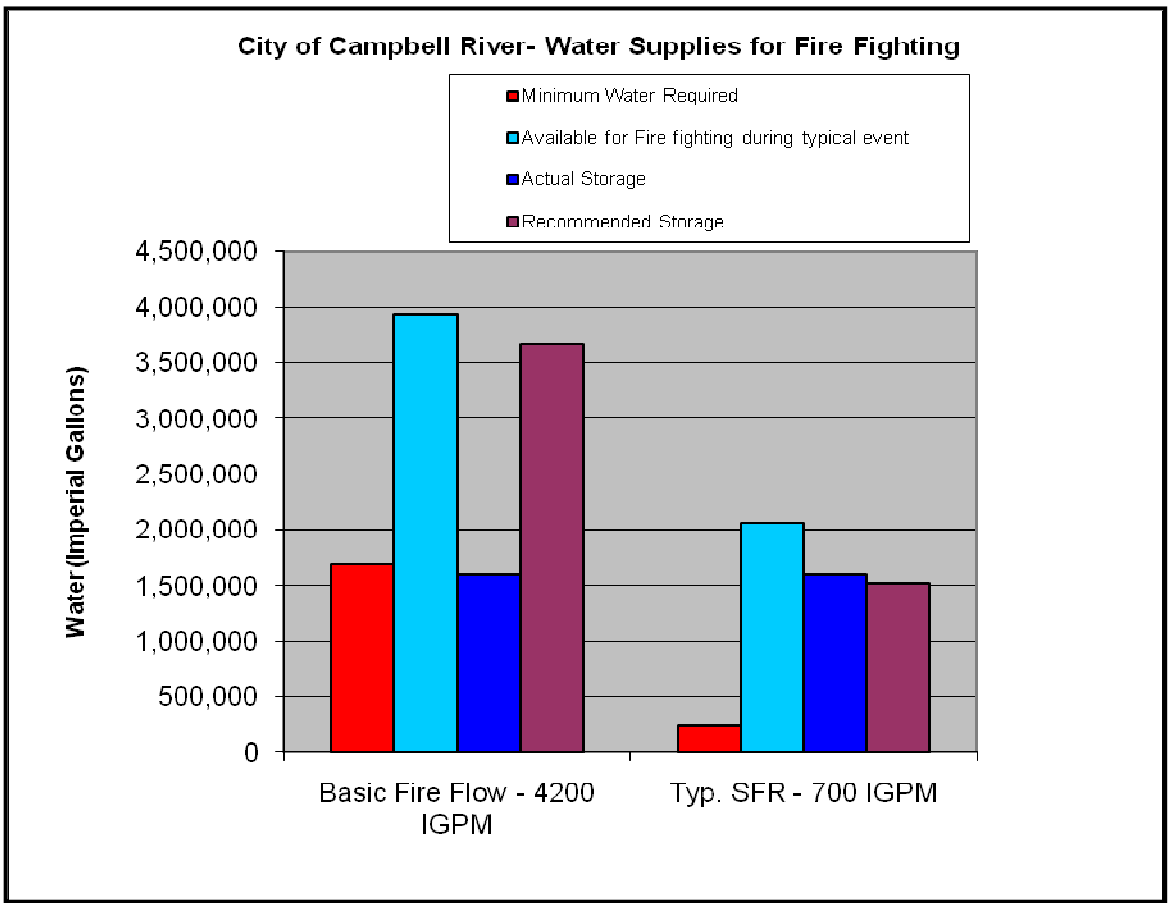
Table 11.3-1 Available Water Resources for Fire Fighting

	MDD	PHD	Total Storage	Total Refill Rate	Refill during Event Duration	Total Available Water Resources
Notes --->				derated 25-50%		Derated 25-50%
Units --->	*MGD*	*IGPM*	*I. gal*	*IGPM*	*I. gal*	*I. gal*
Campbell River						
Basic Fire Flow	3.5	4860	1,600,000	10,400	2,652,000	3,932,000
Typ. SFR	3.5	4860	1,600,000	10,400	780,000	2,060,000

Table 11.3-2 - Summary of Recommended and Required Water Volumes for Fire Fighting

					Variables --->	A	B	C	D	Eq.I	E	Eq.II
	BFF	**Fire Duration**	**MDD**	**PHD**	**Total Available Water Resources**	**Required Fire Storage**	**Domestic Storage**	**Emergency storage**	**Concurrent Domestic Demand$_{max}$**	**Recommend storage**	**Concurrent Domestic Demand $_{peak}$**	**Minimum Water Req'd**
Notes --->					Derated by 20%	BFFxDuration	.25 MDD	.25 (MDD+Fire)	PHDxDuration		MDDxDuration	
Units --->	*Igpm*	*hrs*	*MGD*	*IGPM*	*I. gal*	*I. gal*	*I. gal*	*I. gal*	*I. gal*	*I. gal*	*I. gal*	*I. gal*
Campbell River												
Basic Fire Flow	4200	4.3	3.5	4860	3.932,000	1,071,000	875,000	486,500	1,240,000	3,672,000	620,000	1,691,000
Typ. SFR – 3000 LPM	700	1.3	3.5	4860	780,000	52,500	875,000	232,000	365,000	1,524,000	183,000	235,000

Figure 11.3-1 - Recognized Water Supply for Fire Fighting



11.4. Available Fire Flow

The water supply system's capacity to deliver the fire flows was reviewed. The ability of the system to provide the calculated required fire flows for individual location is indicated in Table 11.4-1 - Campbell River Flow Test Results. Any deficiency that is shown is determined when comparing an Available Fire Flow (i.e. flow test result) to the Required Fire Flow of the nearest significant risk. If the Available Fire Flow is less than the Required Fire Flow, then that specific Available Fire Flow is considered to be deficient with respect to the ability to provide a reasonable amount of water to control a fully involved structure fire.

Table 11.4-1 - Campbell River Flow Test Results

Flow Test #	Test Hydrant Number	Required Fire Flow (LPM)	Available Flow @ 20 psi (LPM)	Deficiency (LPM)
1	185	10000	19000	no deficiency
2	285	3000	7600	no deficiency
3	398	15000	8200	6800
4	697	9000	11800	no deficiency

The City of Campbell River should continue to make improvements throughout the water supply system in order to provide greater flow capacity for fire fighting purposes, in particular at locations where the fire risk is high.

11.5. Water Supplies within the Fire Insurance Grading

Water supplies contribute 30% to the total fire insurance grade of the community.

The water supplies available for fire fighting by the Campbell River Fire Department have been graded and assigned a relative classification of 2. The water supplies are considered to provide a high standard of redundancy and capacity as compared the level of risk within the community, however, a few minor deficiencies have been noted and recommendations for improvements should be considered.

12.FIRE INSURANCE GRADING CLASSIFICATIONS

12.1. Changes to Fire Insurance Grades

The City of Campbell River has been reviewed and has not maintained a Public Fire Protection Classification (PFPC) of 4. As a result of the 2009 assessment, the PFPC for the City of Campbell River is 5. The following information will be published in the fire insurance grading index for the insurance community to set rates on. The information will apply to the City of Campbell River.

Table 12.1-1 and Table 12.1-2 indicate the fire insurance grades that were applied to the City of Campbell River and the Campbell River Fire Department prior to this survey, and the updated grades based on the findings of the survey in 2009.

Note that should the City of Campbell River wish to avoid downgrades to the PFPC, then a plan should be presented to Fire Underwriters Survey to address the deficiencies either utilizing the recommended approach specified in this report, or utilizing other improvements in fire protection/prevention or risk reduction measures.

Unless specifically requested to delay the publication of the updated fire insurance grade information to allow the City of Campbell River to act on the recommendations within this report, Fire Underwriters Survey will publish the modified fire insurance grades to the Fire Insurance Grading Index. The change from PFPC 4 to PFPC 5 will have an adverse impact on the access to the insurance market and the property insurance rates for properties insured under Commercial Lines.

Table 12.1-1 Fire Insurance Grading Classifications - Dwelling Protection Grades

SUB DISTRICT(S) and contract protection areas	DPG 1982	DPG 2009	COMMENTS
City of Campbell River	1	**1**	Hydrant Protected - detached dwellings within 300 m of a recognized fire hydrant and within 8 road km of Fire Station 1.
City of Campbell River	3A	**3A**	Hydrant Protected - detached dwellings within 300 m of a recognized fire hydrant and within 8 road km of Fire Station 2
City of Campbell River	3B	**3B**	Fire Station Protected - detached dwellings within 8 km by road of Campbell River Fire Station 1 but not within 300 m of a recognized fire hydrant.
City of Campbell River	-	**4**	Fire Station Protected – detached dwellings within 8 km by road of Campbell River Fire Station 2 but not within 300 m of a recognized fire hydrant.
Rest	5	**5**	Unprotected - detached dwellings further than 8 km by road of the Campbell River Fire Station.

Table 12.1-2 Fire Insurance Grading Classifications - Public Fire Protection Classifications

SUB DISTRICT(S) and contract protection areas	PFPC 1982	PFPC 2009	COMMENTS
City of Campbell River	4	**5**	Hydrant Protected - commercial properties within 5 road km of Campbell River Fire Station and 150 m of a recognized fire hydrant.
City of Campbell River	8	**8**	Fire Station Protected - commercial properties within 5 km by road of a Campbell River Fire Station but not within 150m of a recognized fire hydrant.
Rest	10	**10**	Unprotected - commercial properties further than 5 km by road of a Campbell River Fire Station.

12.2. Maintaining Current Fire Insurance Grades

Within the fire insurance grading, the final PFPC is determined based using a 100 point scoring system. The amount of credit received from all areas within the fire insurance grading (Water Supplies, Fire Department, Fire Safety Control and, Emergency Communications) is used in determining the amount of final credit points the community receives. Table 12.2-1 Public Fire Protection Classification Number Scale indicates the number of final credit points associated with each PFPC.

From this assessment, the City of Campbell River has been credited a total of 59.76 credit points (PFPC 5). The previous assessment had determined that the City of Campbell River was a PFPC 4.

Table 12.2-1 Public Fire Protection Classification Number Scale

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

To maintain a PFPC 4, various options are available. Within the fire insurance grading, each component is weighted differently. The amount any item is weighted is dependent on the importance of the item with respect to providing structural fire protection. For example, the number of available fire fighters is weighted more heavily when compared to the minor and miscellaneous equipment that is available for fire fighting.

The recommendations made throughout the report are the recommendations that would have the greatest impact on the fire insurance grading. The amount of impact any recommendation has is dependent upon the degree to which it is implemented.

Table 12.2-2 – Key Recommendation Summary indicates key recommendations made throughout the report and the individual impact they can have depending on the degree to which they are implemented. Typically, implementing a single recommendation does not result in improving or maintaining a fire insurance grade, rather, it is implementing a combination of recommendations. Additionally, some recommendations have an effect on multiple areas throughout the grading and would have varying effects on the final credit points. For example, implementing Recommendation 8.2-1 affects the amount of credit awarded in the record keeping of the fire department, the apparatus maintenance program and part of the fire prevention program for a potential combined total of 1.77 additional credit points. Implementing Recommendation 8.9-1 affects the same areas of the prevention program as Recommendation 8.2-1 and would have a potential of 1.38 credit points being awarded. Therefore, if both of these recommendations were implemented the total additional credit points would be non-cumulative.

While including the Catalyst buildings within the fire protection boundary, implementing Recommendation 8.2-1, Recommendation 8.3-1, Recommendation 8.9-1 or, Recommendation 9.1-1 would likely result in the City of Campbell River receiving in excess of 60.00 final credit points which would be sufficient to retain a PFPC 4. The actual amount of credit awarded is dependent on the degree to which the recommendations are implemented.

Note that the system is complex due to many areas having an overlapping effect. Fire Underwriters Survey will be available to explain the varying effects of recommended actions at the request of the Fire Department or City.

When excluding the Catalyst buildings from the City and grading, the theoretical final credit points for the City of Campbell River would be 61.22, maintaining a PFPC 4.

Implementing, Recommendation 8.2-1, Recommendation 8.3-1, Recommendation 8.9-1 and Recommendation 9.1-1 would not be necessary to maintain a PFPC 4; however, these recommendations would help the CRFD operate with a greater level of efficiency and an additional 4.23 credit points for a theoretical total of 65.45 final credit points (PFPC 4).

It is not required that the City or Fire Department implement any of the recommendations made throughout this report; however, the recommendations that are indicated in Table 12.2-2 – Key Recommendation Summary would most likely result in maintaining a PFPC 4 for the City of Campbell River and help create a greater level of operating efficiency within the Fire Department.

Table 12.2-2 Key Recommendation Summary

Recommendation	Necessary Action	Area(s) Effected Within Grading	Degree of implication	Potential Credit Received	Final Potential Credit Points w/ Catalyst	Potential PFPC	Final Potential Credit Points w/o Catalyst	Potential PFPC
Recommendation 8.2‑1 Assign Specific Duties and Responsibilities for Captains to Manage Administrative Work Load	Ensure all Captain duties are completed. If it is determined they are not being completed adequatley, develop Administrative Assistant position	FD - 17	FULL					
		FD - 5	FULL					
		FP-1	FULL					
		FP-2	FULL					
		Total Combined Points		**1.77**	61.53	4	62.99	4
Recommendation 8.3‑1 Improve Firefighting Available Fire Force	Hire Additional Firefighters	FD-7	Minimum needed to Maintain 4					
		FD-8	Minimum needed to Maintain 4					
		FD-14	Minimum needed to Maintain 4					
		FP-1	Minimum needed to Maintain 4					
		FP-2	Minimum needed to Maintain 4					
		Total Combined Points		**1.38**	61.14	4	62.6	4
		FD-7	Additional 2 FF on duty					
		FD-8	Additional 2 FF on duty					
		FD-14	Additional 2 FF on duty					
		FP-1	Additional 2 FF on duty					
		FP-2	Additional 2 FF on duty					
		Total Combined Points		**2.85**	62.61	4	64.07	4
Recommendation 8.7‑1 – Expand Fire Department to Provide Improved Fire Protection Coverage throughout the Community	Provide additional pumper and ladder companies	FD - 1	Additional 2 pumpers and 1 ladder					
		FD - 2	Additional 2 pumpers and 1 ladder					
		FD - 3	Additional 2 pumpers and 1 ladder					
		FD - 8	Additional 2 pumpers and 1 ladder					
		Total Combined Points		**3.26**	63.02	4	64.48	4
		FD - 1	1 Additional Pumper					
		FD - 3	1 Additional Pumper					
		FD - 8	1 Additional Pumper					
		Total Combined Points		**0.67**	60.43	4	61.89	4
Recommendation 8.9‑1 Provide Mechanic Position within the Fire Department	Appoint a Mechanic	FD - 5	FULL	**0.45**	60.21	4	61.67	4
Recommendation 9.1-1 - Reassign Shift Fire Prevention Officer	Reassign a crew FPO to regular day shift FPO	FP-1	FULL					
		FP-2	FULL					
		Total Combined Points		**1.38**	61.14	4	62.60	4

13.FIRE DEPARTMENT MANAGEMENT AND OPERATIONAL ANALYSIS

13.1. Disclaimer

The following information is provided by specific request of the City of Campbell River. Reducing levels of fire protection will increase risk to life safety of constituents of the City and responding fire fighters. Reducing the level of fire protection will also result in increased property losses when fires occur and this may have a detrimental impact on the economy of the City through loss of tax revenue, loss of population and numerous subsidiary effects. Liability exposure may be increased as a result of reducing protection levels.

13.2. Cost Benefits of Fire Protection

Fire Underwriters Survey was originally developed after a number of communities across North America had massive conflagration losses. The fire insurance grading system was developed to provide insurers with information related to the levels of fire risk and fire protection within each community in Canada. The system is designed to provide a cost benefit to communities for providing fire protection. Communities that have effective and appropriate levels of fire protection for the level of fire risk within their protection areas, receive lower fire insurance grades, which in turn will result in lower insurance premiums for property owners.

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 classifications. 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. However the City of Campbell River has also requested information regarding the impact of changing the level of fire protection to a lesser standard.

Here is a quick summary of the cost benefits associated with various fire insurance grades for the City of Campbell River.

The following assessed values for Campbell River (improvements only) were used for this analysis:

Class One Residential - Personal Lines	$ 1,259,963,704.00	*Personal Lines Insured*

Class One Residential - Commercial Lines	$ 592,924,096.00	
Class Four Major Industry	$ 133,965,000.00	
Class Five Light Industry	$ 10,973,500.00	
Class Six Business And Other	$ 490,261,300.00	
	$ 1,228,123,896.00	*Commercial Lines Insured*

The following assessed values were not used:

Class Two Utilities	*$*	*200,628,000.00*
Class Seven Managed Forest Land	*$*	*-*
Class Eight Recreation and Non Profit	*$*	*14,895,400.00*
Class Nine Farm	*$*	*-*

Note that typically, detached dwellings are insured with packaged insurance referred to as Basic or Extended Coverage (EC). Packaged insurance includes insurance for more than one type of loss. For example depending on where a property is located, such packages may be available for perils such as windstorm, hail, explosion, civil commotion, riot, aircraft damage, vehicle damage, smoke damage, vandalism, malicious mischief, sprinkler leakage damage, sinkhole collapse, and volcanic action.

As fire is only one part of typical insurance packages, changes to fire insurance grades do not affect all types of insurance. However, changes to fire insurance grades and associated fire insurance portions of insurance packages still have a significant impact on the overall cost of insurance.

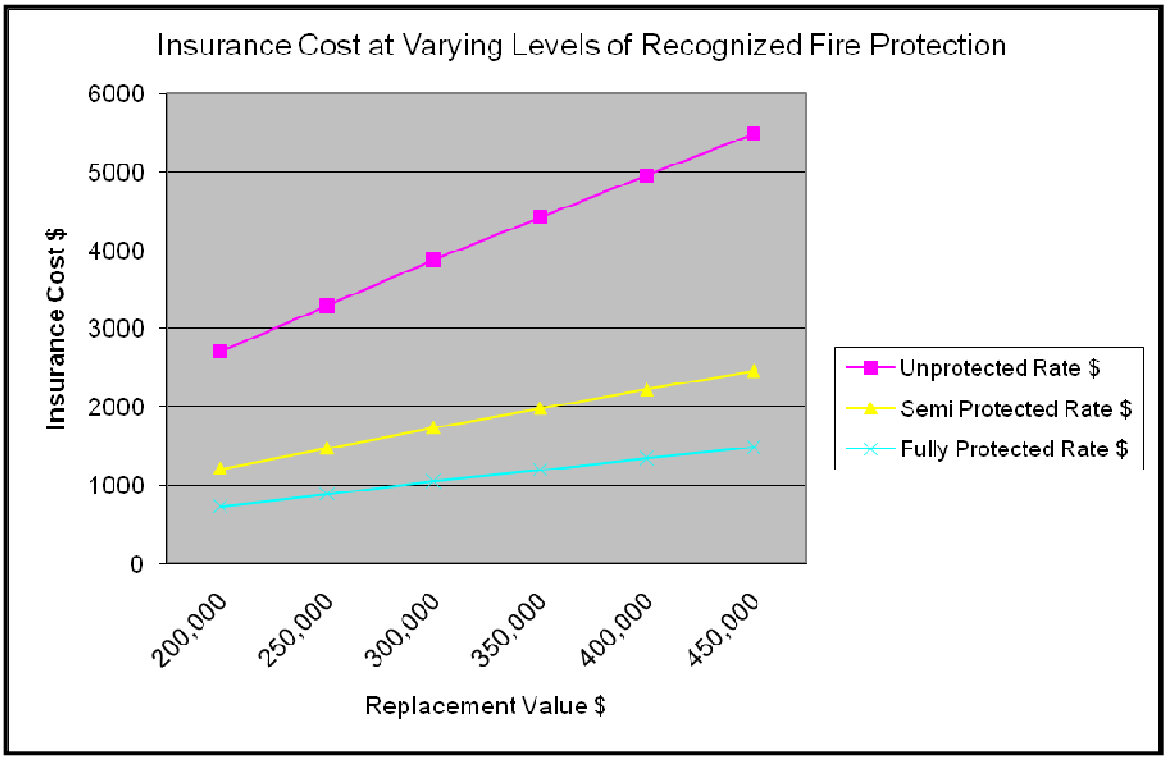
The following table shows average insurance premiums as they relate to detached dwellings in Campbell River. The values shown here are based on actual quotes as well as calculated values for Fire and Extended Coverage insurance in Campbell River.

Table 13.2-1 Example Insurance Premiums for Single Family Dwellings by Fire Insurance Classification

Replacement Value $	Unprotected Rate $	60± % reduction	Semi Protected Rate $	32± % reduction	Fully Protected Rate $
200,000	2710		1215		739
250,000	3290		1475		893
300,000	3880		1741		1053
350,000	4422		1987		1201
400,000	4953		2226		1349
450,000	5489		2465		1491

The cost of insurance per dollar insured is shown to have an average difference of 32%± between Semi-Protected rates and Unprotected rates. The difference between Fully Protected rates and Unprotected rates is in the order of 60%±. Note that individual cases may vary by as much as 10% from the figures shown here, however these figures are average values. The following figure shows the trend line for each of the tiers of insurance

Figure 13.2-1 Example Insurance Premiums for Single Family Dwellings by Fire Insurance Classification



Insurance companies have different ways of interpreting fire insurance grades and using the information they acquire through the fire insurance grading index. Most insurers in Canada currently use a three tier system that groups communities into three "tiers" of fire protection; protected, semi-protected and unprotected. These three tiers are normally correlated to Dwelling Protection Grades as follows.

Table 13.2-2 Dwelling Protection Grades and Insurance 3 Tier System

Fire Underwriters Survey Dwelling Protection Grades.	System Used by Many Insurance Companies "3 tier" system.	Insurance Companies typically refer to this grade as :
1 2 3A	Table I	Protected
3B[10] 4	Table II	Semi - Protected
5	Table III	Unprotected

Considering that Campbell River is Dwelling Protection Grade 1 which translates to Protected, the cost benefit to property owners of single family residences and duplexes (total of $ 1,259,963,704 insured under Personal Lines) is estimated as follows:

Table 13.2-3 Total Estimated Cost of Personal Lines Insurance

Fire Insurance Grade	Average Rates per $100 insured		Cost of insurance
Un-protected	1.12		$ 14,101,413.78
Semi-protected	0.45		$ 5,621,533.06
Fully-protected	0.30		$ 3,823,959.84

Having a Dwelling Protection Grade of 3A or better allows Personal Lines insurers to write insurance at protected rates. The estimated cost benefit to property owners insured under Personal Lines is $10.277 million per year.

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

It is unlikely that the City of Campbell River would drop below DPG 3A even if it does not maintain career fire fighter staffing. The Dwelling Protection Grade system for Personal Lines insurance is a measure of the capacity to control a single family residential fire and as such, the requirements are not as difficult to meet as those of the PFPC system used for Commercial Lines. It is not uncommon for auxiliary departments with properly designed municipal water supply systems to achieve a Dwelling Protection Grade 3A and the associated protected rates for Personal lines insurance.

The following table shows the varying insurance rates (per $100 insured values) for risks insured under Commercial Lines.

Table 13.2-4 Insurance Rates (per $100 insured) for PFPC Classes 4-8

Assessed Values	Example Occupancy	Insurance Premium Rates/ $100 insured			
		PFPC 8	PFPC 6	PFPC 5	PFPC 4
$163,420,433	**Office**	$ 0.0013059	$ 0.0011068	$ 0.0010232	$ 0.0009618
$163,420,433	**Hotel**	$ 0.0014001	$ 0.0011436	$ 0.0010361	$ 0.0009567
$163,420,433	**Condo**	$ 0.0014089	$ 0.0011510	$ 0.0010430	$ 0.0009633
$592,924,096	**MFR - Apartment Complex**	$ 0.0018106	$ 0.0014188	$ 0.0012546	$ 0.0011336
$144,938,500	**Industry**	$ 0.0024736	$ 0.0019400	$ 0.0017159	$ 0.0015509

Table 13.2-5 Insurance Cost for Campbell River Simplified Assessed Values for PFPC Classes 4-8

Assessed Values	Example Occupancy	Insurance Premium Rates/ $100 insured			
		PFPC 8	PFPC 6	PFPC 5	PFPC 4
$80,185,766	**Office**	$213,412	$180,877	$167,209	$157,181
$80,185,766	**Hotel**	$228,805	$186,888	$169,320	$156,344
$80,185,766	**Condo**	$230,243	$188,097	$170,448	$157,423
$496,215,696	**Apartment Complex**	$1,073,548	$841,241	$743,883	$672,139
$20,600,100	**Light Industry**	$358,525	$281,181	$248,701	$224,786
TOTALS					
$1,228,123,896		**$2,104,534**	**$1,678,283**	**$1,499,560**	**$1,367,873**

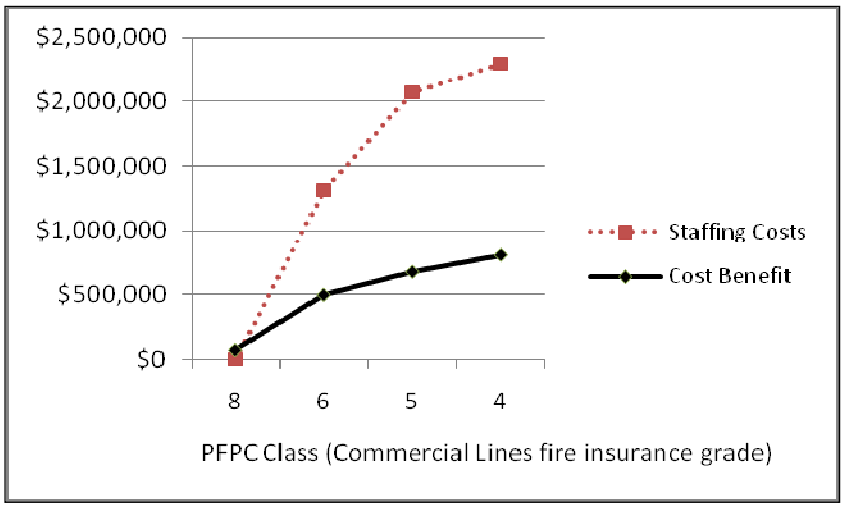
The cost difference to property owners between the commercial fire insurance grades (PFPC) class 8 and class 4 is $736,661 per year.

If we consider that the current calculated PFPC class of Campbell River is 5 (2009) and that a 4 could be achieved with the addition of 3 career firefighters (and the implementation of other recommendations listed in this report), we can graphically show the estimated costs of PFPC classes comparatively with the associated cost benefits. Note that this presentation is a simplification as there are numerous variables considered in PFPC calculations and in this case we are considering making changes only to the most significantly weighted (and costly) portion, the available fire force.

We have added in data points for:

- PFPC 4 (with 21.6 FTE)
- PFPC 5 (with current 18.6 FTE)
- PFPC 6 which represents the Fire Department with 10 less career fire fighters (8.6 FTE); and
- PFPC 8 with zero FTE career firefighters (but still with career management).

Figure 13.2-2 Costs of fire Protection and associated insurance cost benefit for commercial lines



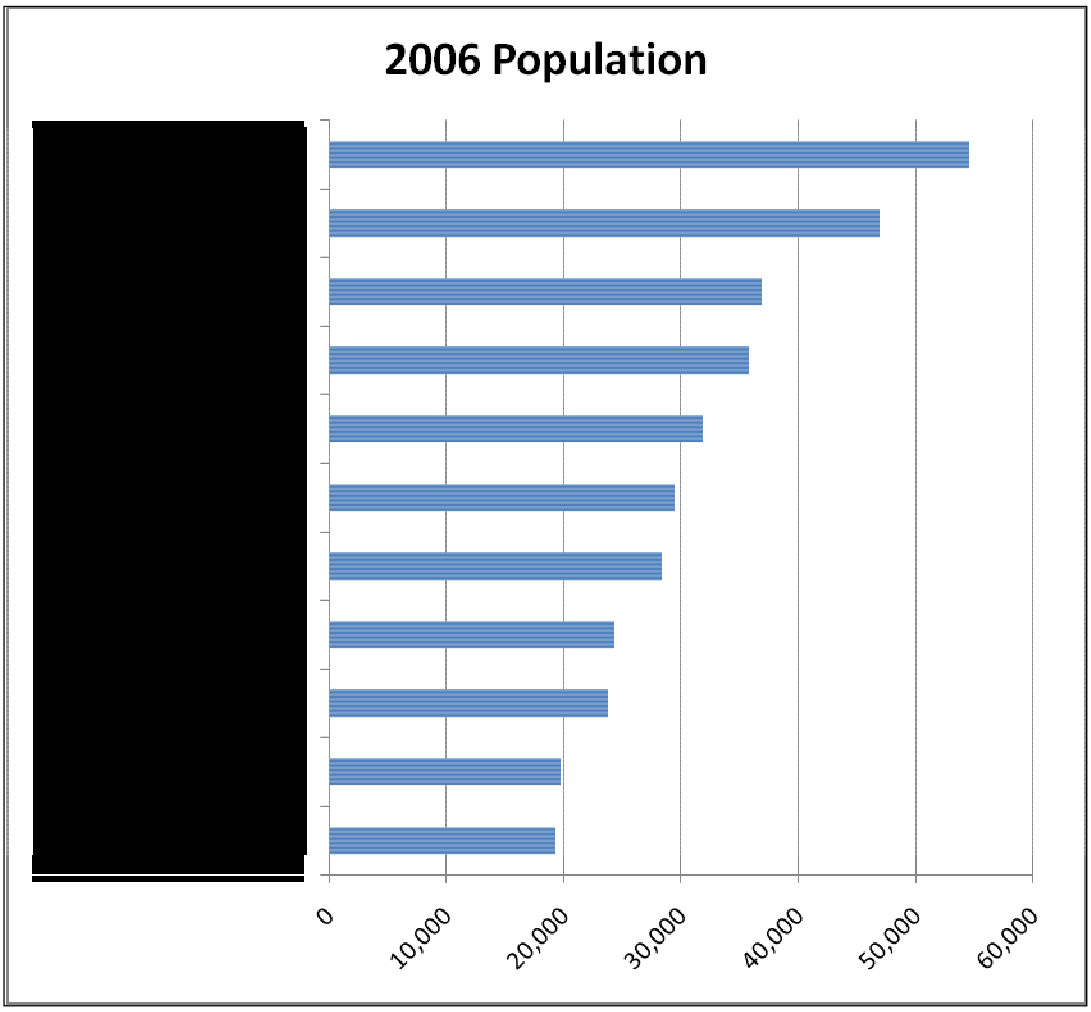
13.3. Comparison to similar communities

When making decisions with respect to the level of investment in protective services that a community wishes to make, it may be helpful to compare the level of investment to similar communities. The following figures are intended to provide a visual comparison of Campbell River with respect to similar communities.

The data upon which these figures are based is from various years between 2003 and 2009. Unfortunately, complete data for all communities was not available for a single year. For this reason, the data should be considered for informational purposes only as the differences between years may skew the true results. However, the information may still prove useful for purposes of comparison.

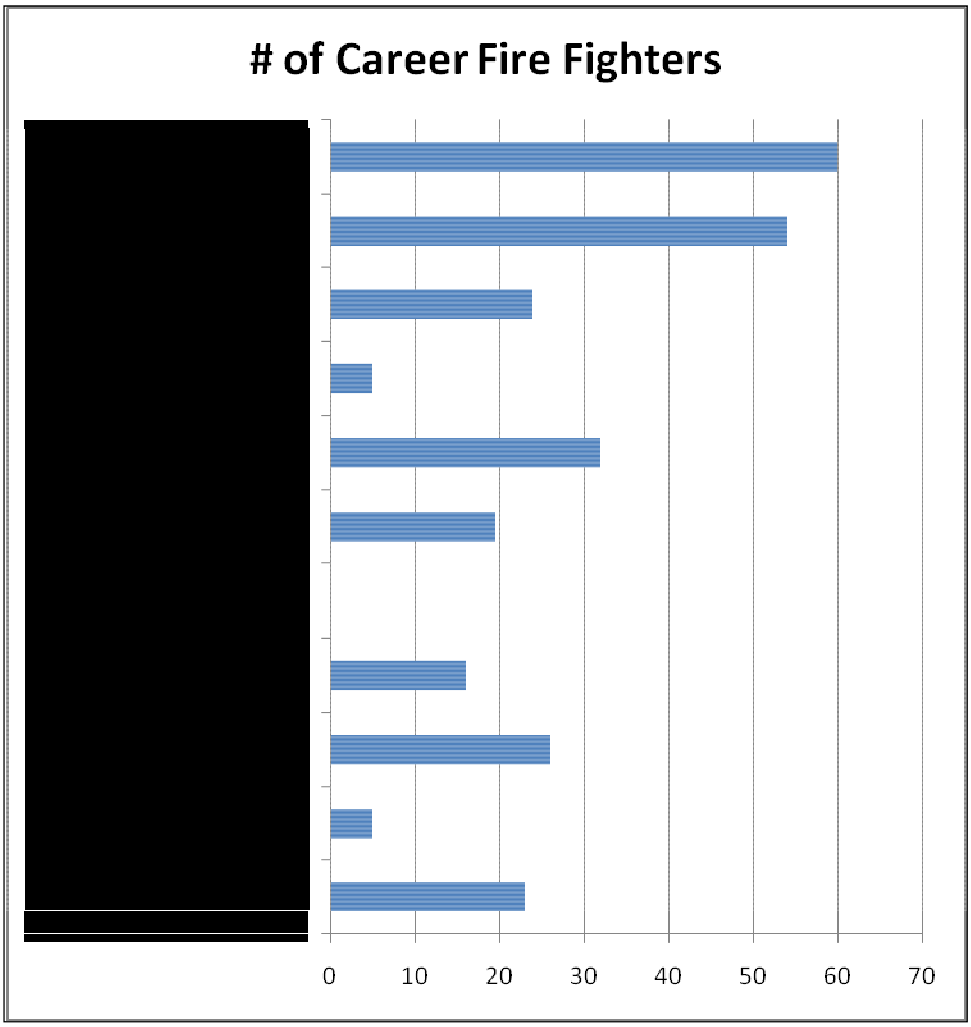
The number beside the community name refers to the PFPC classification of the community.

Figure 13.3-1 Populations of Communities for Comparison



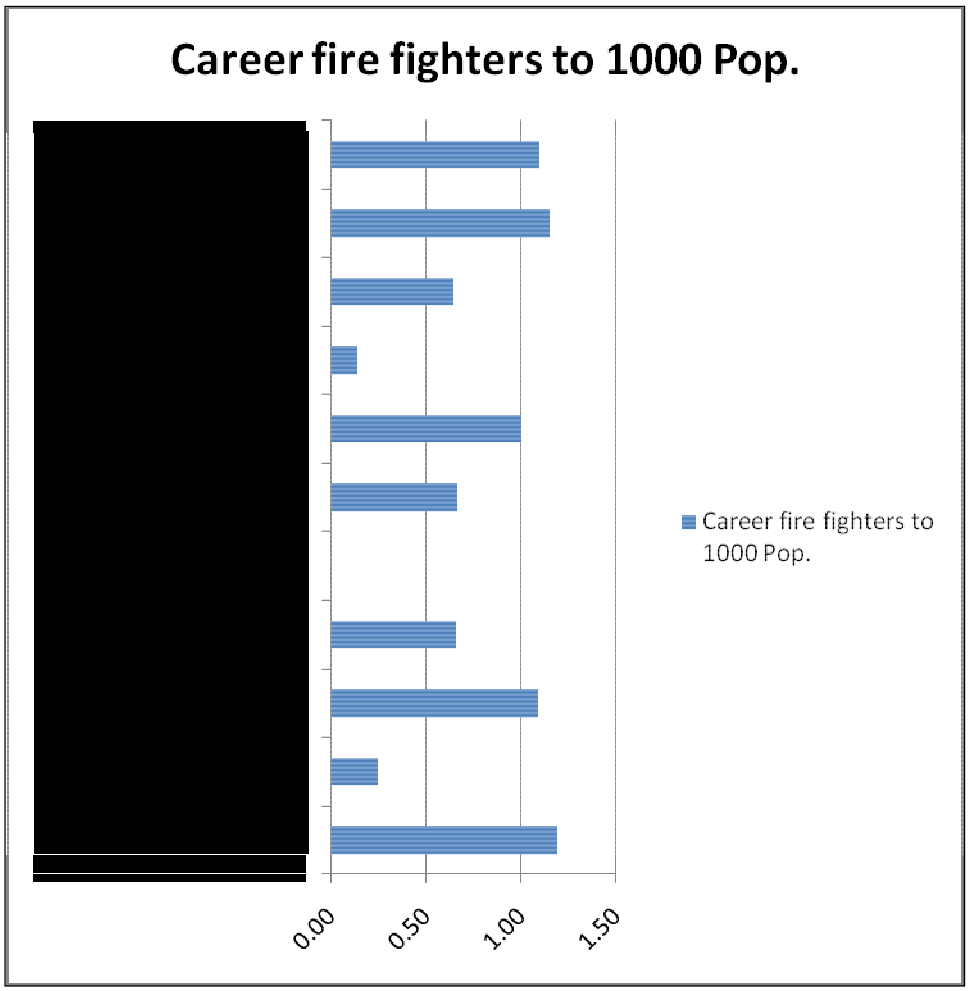
Note that population figures shown here do not inlcude external service areas whether served by contract or under Aid agreement.

Figure 13.3-2 Number of Career Fire Fighters in Communities for Comparison



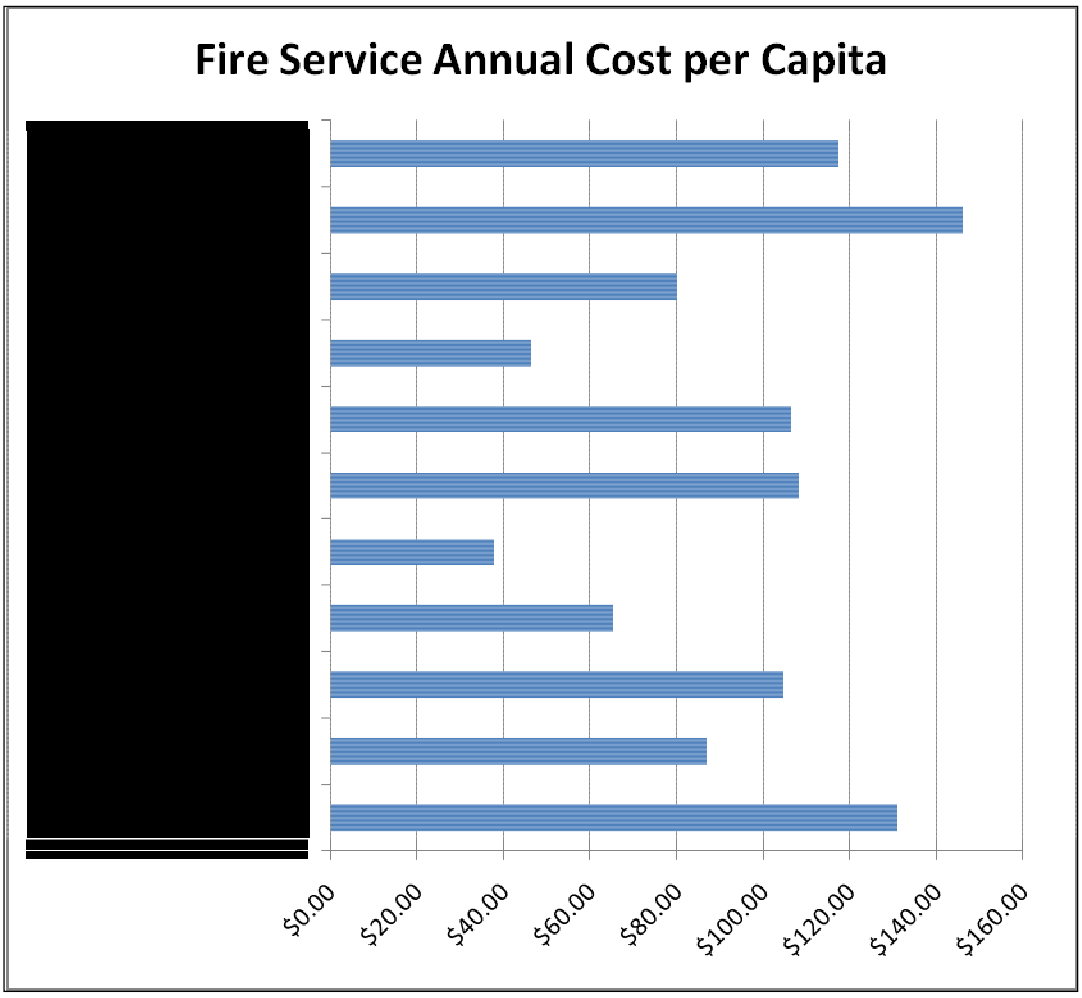
This figure shows that Campbell River has a moderate number of career firefighters in comparison with the other communities in the same population range. Note that only The District of Mission operates with less fire fighters and a greater population, however the Public fire protection Classification, shown in brackets after the name, is a 6 in Mission.

Figure 13.3-3 Career fire Fighters per Thousand Population in Communities for Comparison



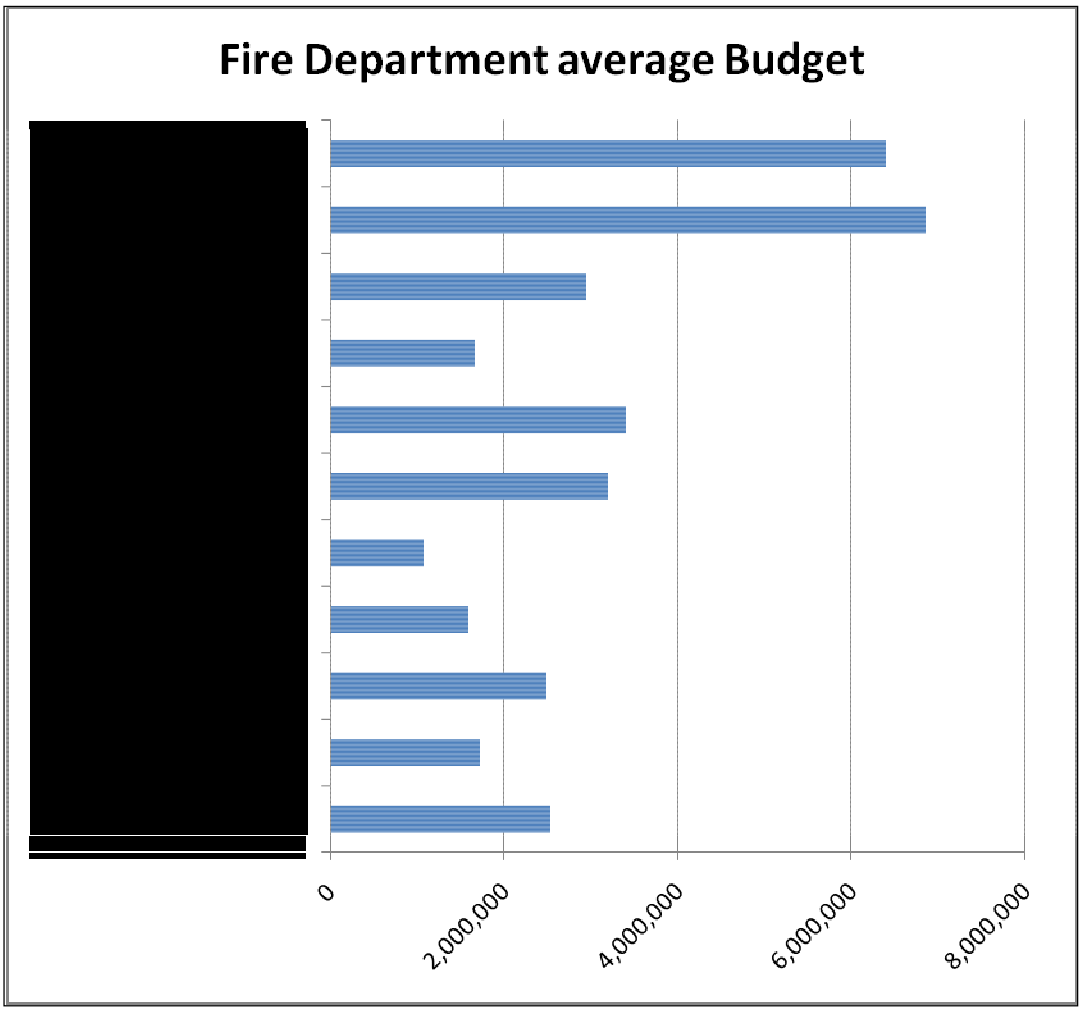
This figure shows that Campbell River has a moderate number of career firefighters per capita in comparison with the other communities.

Figure 13.3-4 Annual Fire Protection Costs per Capita in Communities for Comparison



The cost of fire protection per capita in Campbell River is well within the normal range of other municipalities within the same population range. Note that there is a correlation between investment in fire protection and improved PFPC classifications, shown in brackets after community name.

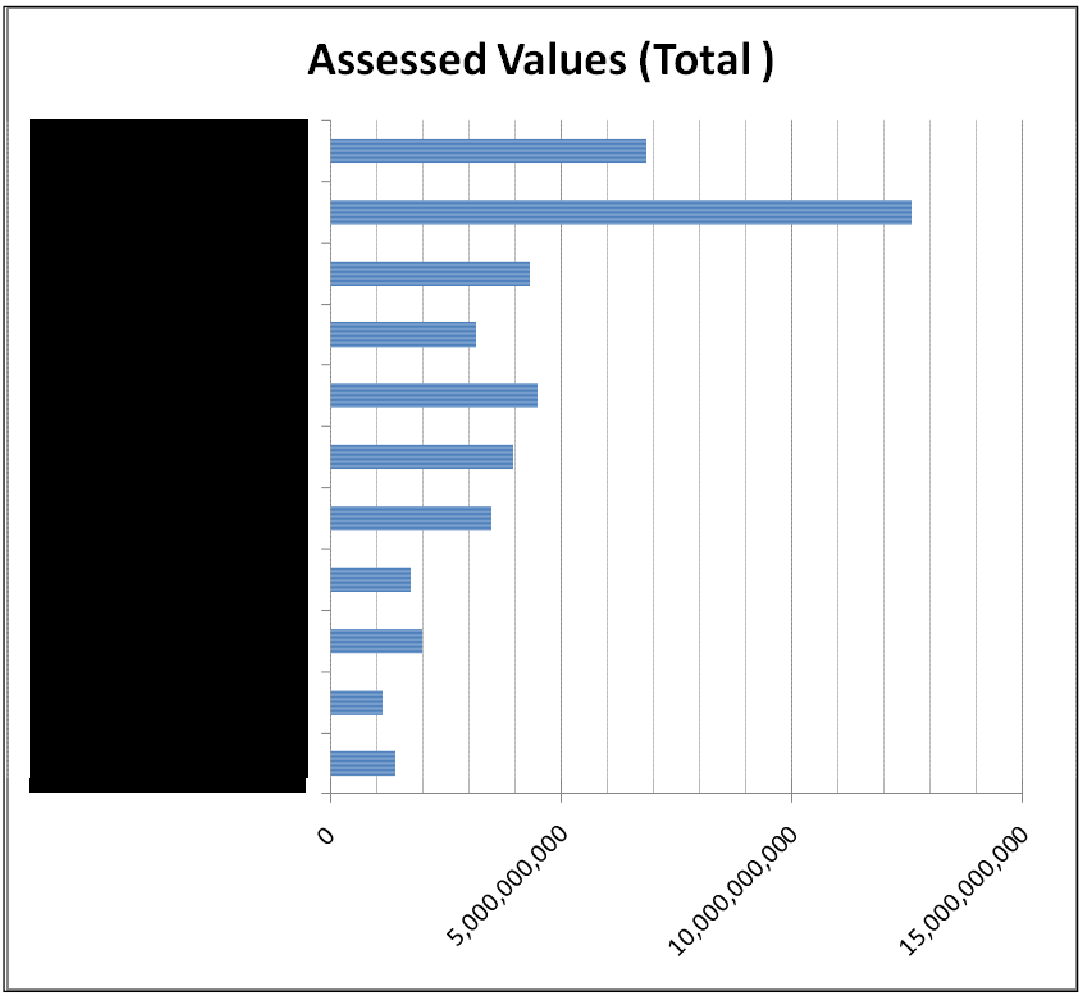
Figure 13.3-5 Annual Fire Department Budget in Communities for Comparison



Campbell River's Fire Protection budget is shown here again to be in the mid range for communities in a similar population range within British Columbia.

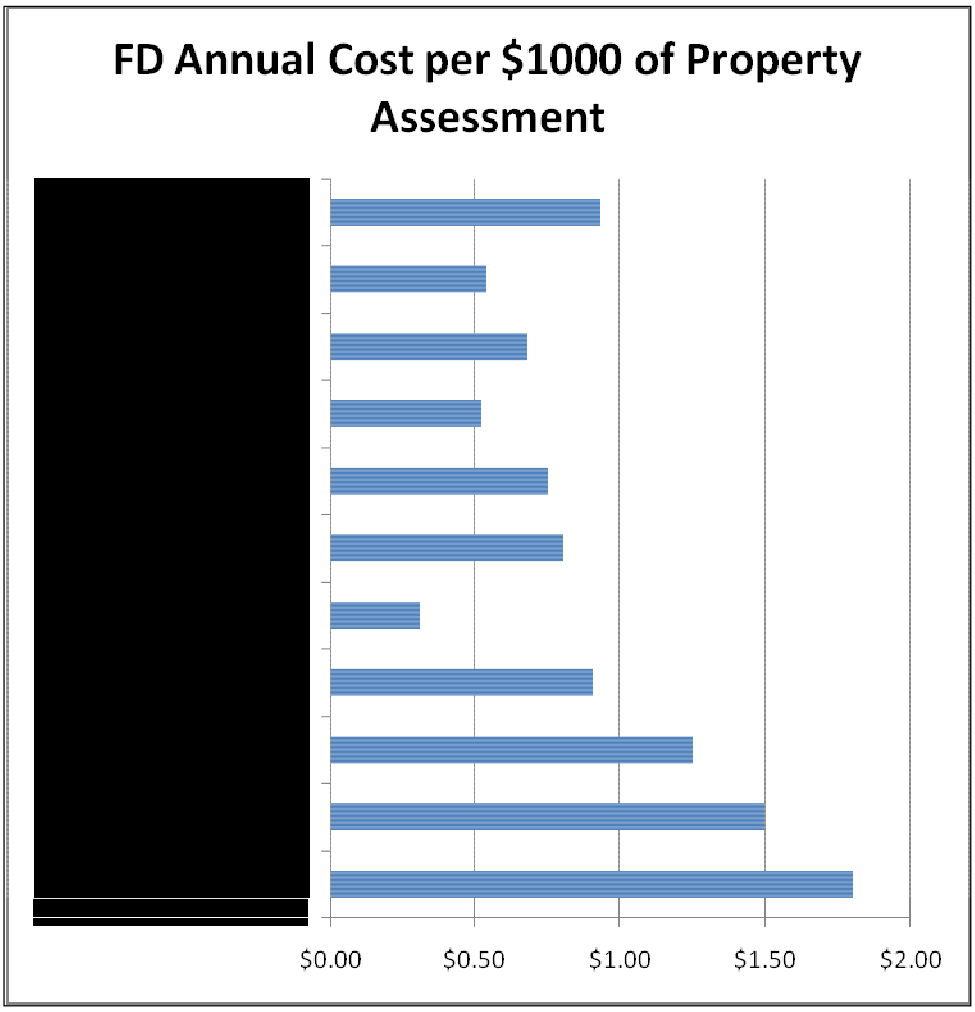
The communities with the highest populations and assessed values tend to have the highest budgets for fire protection. Provision of quality fire protection programs attracts business to the community as businesses have greater access to a more competitive insurance market. Additionally, the local economy is stabilized as fire losses become less significant.

Figure 13.3-6 Assessed Values in Communities for Comparison



Campbell River is in the mid range with respect to the assessment roll. The assessment roll is an indicator of the amount of properties that are being protected by the fire department.

Figure 13.3-7 Fire Protection Cost per $1000 of Property Assessment in Communities for Comparison



The cost of fire protection per $1,000 of assessed value is comparatively low in Campbell River. The derived annual cost of fire protection per $1,000 of assessed value in Campbell River is $0.81.

13.4. Standard of Response Cover

To make choices that are appropriate for the constituents of the community, it is important that decision makers understand the consequences of the choices that are made. With respect to fire protection, as noted in the previous section, the choices that are made affect the property insurance rates and access to the insurance market. However more important considerations are life safety and property protection.

One of the primary reasons to adopt a response time standard is to ensure that the government and fire department are adequately performing due diligence in planning and executing emergency response. The response time standard also serves to protect the fire department and local government from liability associated with negligence[11].

To develop the response time standard, the fire department should break down total response time into specific time intervals for each of the components that make up *Response Time,* ie. *Dispatch Time, Turn Out Time, Travel Time, Access Time and Set-up Time.* These can then be statistically analysed to determine the level of service that actually is being provided in the community.

Response time standards should be set out realistically based on what the fire department can reasonably achieve. Standards of response times should take into account the variables that may factor into actual response times (including weather, time of call, etc.). The standards of response are typically set out with a goal response time that is achievable a specified percentage of the time.

[11] *See Appendix C: Article Fire Department Liability Source: Singleton Urquhart Fire Loss Group*

13.4.1. Timely Delivery of Service

The primary function of all fire departments is the timely delivery of quality emergency services. The critical performance measures of service delivery are commonly known as response time. In using response time as a performance measure, it is important that the elements of response time be defined and understood.

- *Response Time (R_T):* For the purpose of this study, response time is defined as the total amount of time between the receipt of the initial call in the dispatch center (phone ring) and the arrival of fire apparatus (wheel stop) at the incident scene. Response time consists of several time elements that are listed and defined below.

  $$R_T = \sum D_T + TO_T + Tr_T$$

  - *Dispatch Time (D_T):* The amount of time that it takes to receive and process an emergency call. This includes receiving the call, determining the nature of the emergency, verifying the location of the emergency, determining what resources are required to handle the call and notifying the units that are to respond.

  - *Turn Out Time (TO_T):* The amount of time that it takes a fire crew to react after receiving dispatch information and prepare to leave the station (wheel start).

  - *Travel Time (Tr_T):* The amount of time that it takes for a piece of fire apparatus to travel from the fire station to the incident scene (wheel start to wheel stop).

  - *Access Time:* The amount of time required for the fire crew to move from where the apparatus stops to where the emergency exists. Ex. moving through building to fire location.

- *Set-up Time:* The amount of time required by fire departments to set up, connect hose lines, position ladders, etc. and prepare to extinguish fire.

- *Reflex Time (RX_T):* The sum of dispatch time and turn out time.
  $$RX_T = \sum D_T + TO_T$$

Many fire departments establish service delivery standards or response time goals for their departments so that they have an indicator or benchmark by which to measure their service delivery. Some of the elements that determine these are:

- Staffing
- Risk
- Density of:
  - Population
  - Buildings
  - Development
- Geography
- Layout of streets and roads

13.4.2. Fire Department Response Management

Various standards and guidelines have been developed to assist fire protection agencies and governments to manage response times and set reasonable goals for response times that can be achieved the majority of the time. It is important that communities record response times and review historical data to determine to what level the fire department is meeting the standard set out by the community.

13.4.2.1. Managing Dispatch Time

The receipt of the alarm and the dispatch of units are manageable by the way that alarms are received and the way that dispatch activities are handled. Properly designed and used *"Enhanced 911"* and *"computer aided dispatch*

systems" can effectively minimize the time required to receive and handle alarms.

Note: NFPA 1221 (Emergency Communications) states:

- *Ninety-five percent of alarms shall be answered within 15 seconds, and 99 percent of alarms shall be answered within 40 seconds.*
- *Ninety-five percent of emergency dispatching shall be completed within 60 seconds.*

13.4.2.2. Managing Turn Out Time

In career and composite fire departments, *Turn Out Time* may be managed to some degree by decreasing the time required for crews to receive alarm information (through improved communications). Optimizing layout of fire stations with respect to auxiliary response is another method used to manage turn-out time.

Note: NFPA 1710 (for Career Fire Departments) states:

- *The fire department shall establish the following time objective 90% of the time: One minute (60 seconds) for turnout time.*

13.4.2.3. Managing Travel Time

Travel Time is one of the most manageable segments of time in the entire sequence. This is the amount of time required for a piece of fire apparatus to travel from a fire station to an incident scene (wheel start to wheel stop).

As with *Turn Out Time*, *Travel Time* may be managed by placing resources including fire station and apparatus strategically in the community to minimize the amount of time for fire fighters to travel from the fire station to the fire scene.

Note: NFPA 1710 (for Career Fire Departments) states:

- *The fire department shall establish the following time objective 90% of the time:*
    - *4 minutes (240 seconds) or less for the arrival of the first arriving engine company at a fire suppression incident,*

- *8 minutes (480 seconds) or less for the deployment of a full first alarm assignment at a fire suppression incident*

13.4.2.4. Managing Access Time

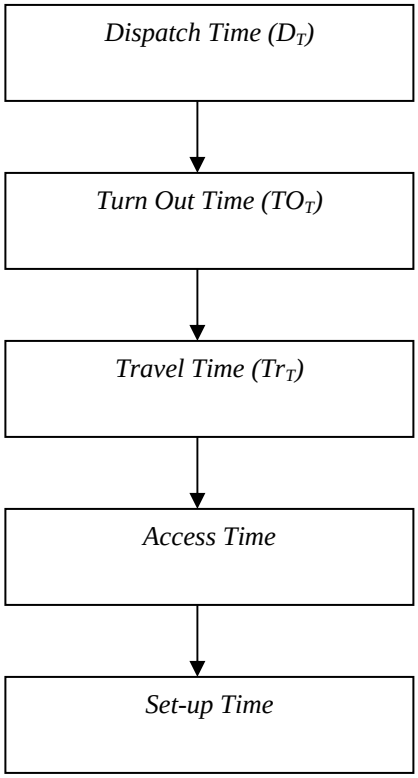
Access Time can be managed with an effective pre-fire planning program that familiarizes fire fighters with access points and travel routes through buildings. The use of key boxes can facilitate access in buildings that may be locked and coordinating efforts with security forces can also reduce access time.

Note: NFPA 1620 provides a detailed methodology for developing pre-fire plans.
Note: not included in Response Time

13.4.2.5. Managing Set Up Time

Set-up Time can be effectively reduced with regular fire department training and practice. Providing the fire department with proper equipment can also improve set-up time.

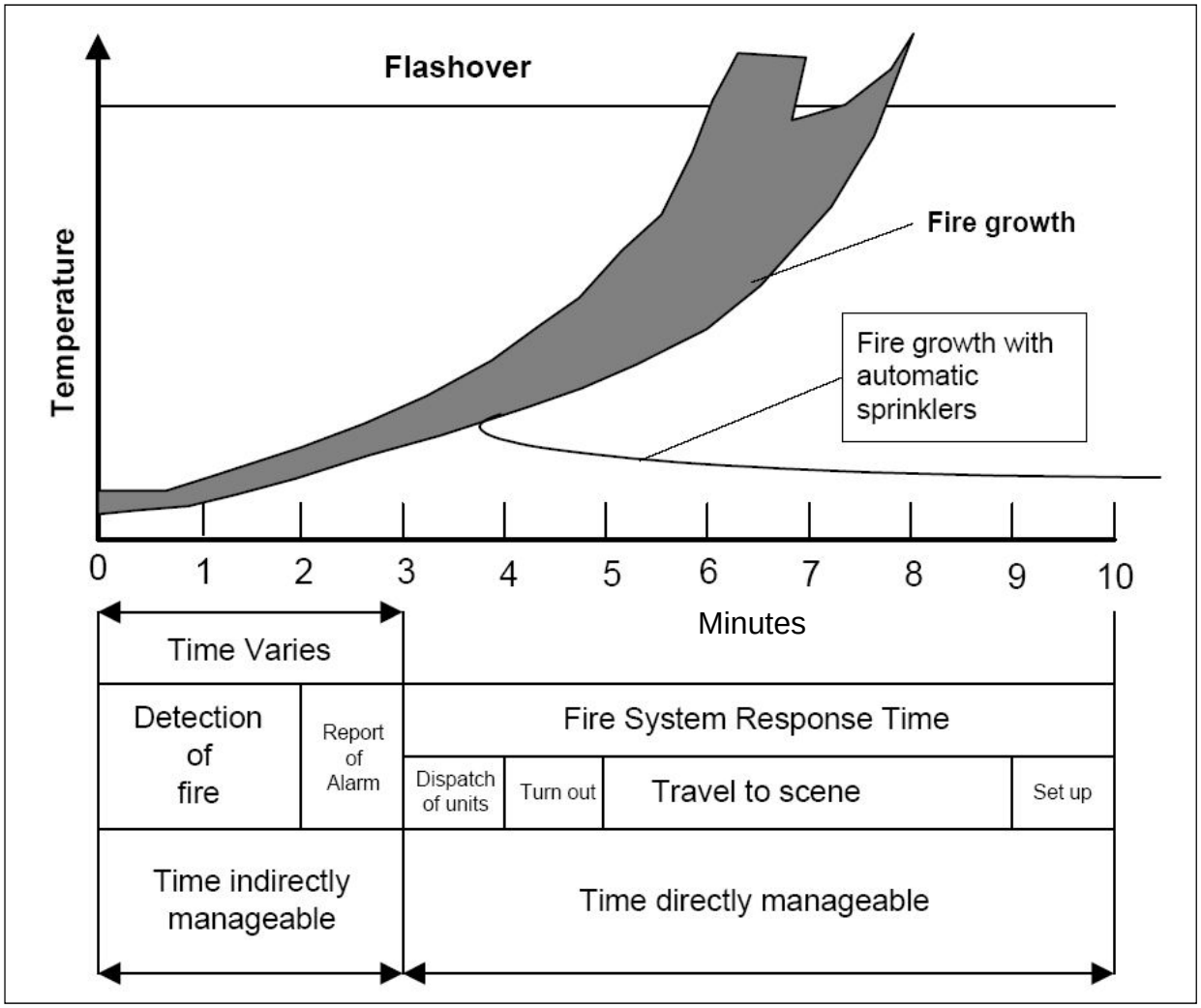
Figure 13.4-1 Fire Department Response Time Sequence



13.4.2.6. Fire Growth and Flashover

Fire growth can expand extremely quickly (50 times its volume per minute). The time segment between fire ignition and the start of fire suppression activities is critical and has a direct relationship to fire deaths and injuries and fire losses, as well as the safety of fire fighters initiating search, rescue and fire fighting operations. Figure 7-2 provides an illustration of fire growth over time (for a typical single family dwelling), and the sequence of events that represent fire detection and response times.

Figure 13.4-2 Standard Time Temperature Curve



13.4.2.7. Managing Detection/Reporting Time

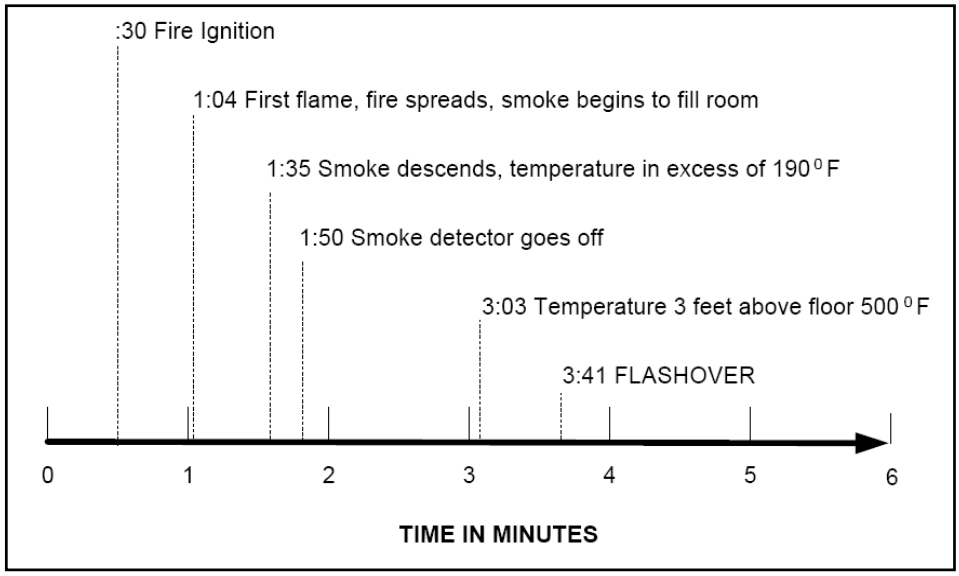
The time segment between the ignition of a fire and the reporting of a fire will vary and is indirectly manageable. The fire department and local government may improve the times for fire detection and reporting through various programs including but not limited to

- Fire Prevention Programs
  - Smoke detector/alarm installation programs
  - Smoke detector/alarm testing programs
  - Smoke detector/alarm free battery programs
  - Bylaws requiring sprinklers and/or fire detectors
  - Alarm monitoring programs
  - Fire prevention inspections (determine adequacy of controls in place)

The amount of time between ignition and detection of a fire will vary depending upon the means of detection. Some types of heat detection and smoke detection along with automatic extinguishing systems provide the fastest means and most reliable means of detecting fires. The use of sight and/or smell (manual systems) will typically take longer depending upon circumstances.

Figure 13.4-3 Sequence Of Events In A Typical Residential Fire shows the ignition and fire growth sequence that was recorded for a fire in a single-family dwelling that was intentionally set and documented for educational purposes.

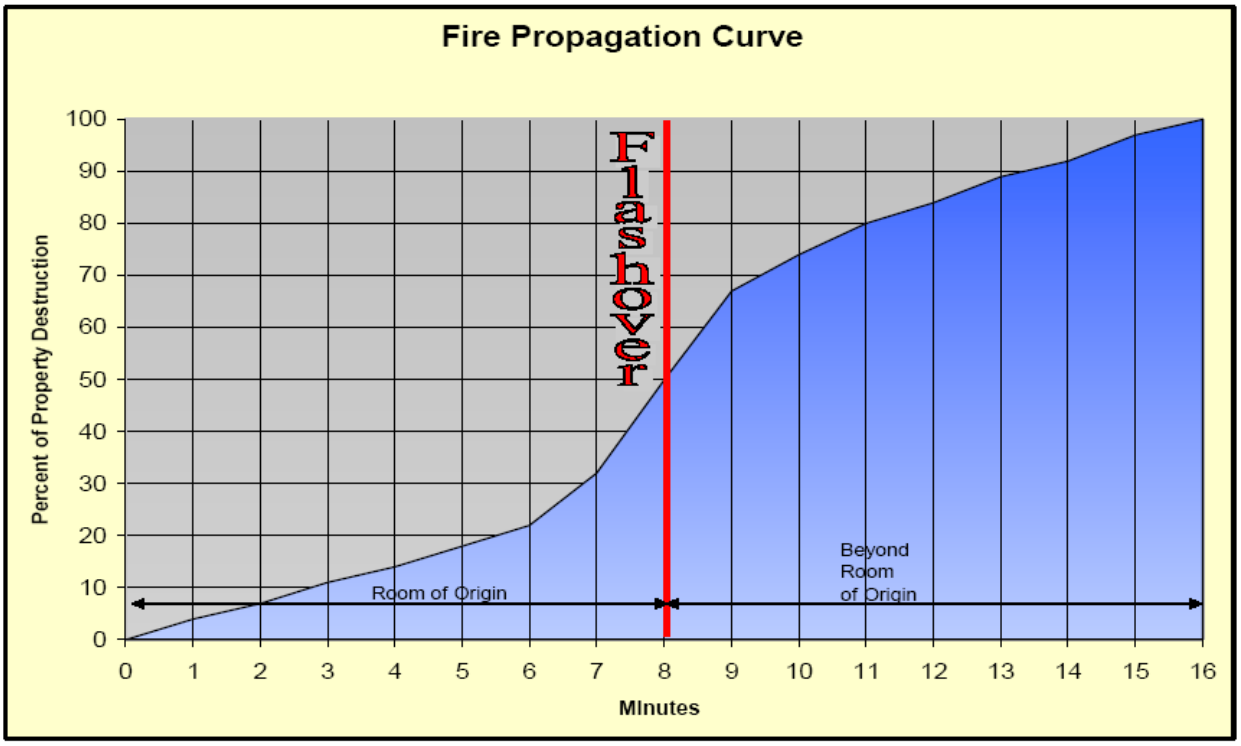
Figure 13.4-3 Sequence Of Events In A Typical Residential Fire



Flashover is defined by the International Fire Service Training Association as the "stage of a fire at which all surfaces and objects within a space have been heated to their ignition temperature, and flame breaks out almost at once over the surface of all objects in the space."

Data generated by the National Fire Protection Association provides evidence that rapid and aggressive interior attack can substantially reduce the human and property loss associated with structural fires. At each stage of a fire's extension beyond the room of origin, the rate of civilian deaths, injuries, and property damage grows exponentially. Clearly, an early and aggressive offensive initial interior attack on a working structural fire results in greatly reduced loss of life and property damage. Consequently, given that the progression of a structural fire to the point of "flashover" generally occurs in less than 10 minutes, one of the most important elements in limiting fire spread will be reducing the response time of the fire department. Figure 13.4-4 Fire Propagation Curve shows an alternative fire propagation curve for a modelled fire in a typical single-family dwelling.

Figure 13.4-4 Fire Propagation Curve



Regardless of whether flashover occurs in 4 minutes or 8 minutes as depicted in the examples (previous Figures). All of the examples illustrate the need for a timely and efficient response once a fire has been reported. Reduction of response time will improve the chance that the fire department has to save lives and reduce property losses.

13.4.2.8. Managing Fire Growth

One of the most effective ways to reduce losses and improve the effectiveness of the fire suppression program is to manage fire growth through built-in fire protection systems. Fire protection systems include active and passive fire protection. Active fire protection systems such as sprinkler have been proven very effective[12] in minimizing fire losses in single family dwellings and have improved the effectiveness of the overall fire suppression programs and reduced total loss values.

[12] See Appendix E.

Sprinkler systems are typically activated within the first minutes after a fire reaches the incipient/developing stage and before flash-over occurs. In the vast majority of cases, in buildings with properly installed and maintained sprinkler systems, fires are confined to the room of origin and flash over does not occur. This greatly reduces property losses.

Additionally, water damage resulting from sprinklers is considerably less than water damage resulting from fire department hose streams. In some cases, water damage from hose streams exceeds the fire damage in a loss.

Sprinklers are designed to respond very early when a fire occurs and keep the fire from growing beyond the incipient stage. This early response has been proven to be a very effective method for reducing losses and controlling fires. Statistically, requiring sprinkler systems to be installed in buildings has proven to be the most effective and reliable method for reducing the number of deaths caused by fire as well as reducing the cost associated with losses from fire.

Table 13.4-1 Sprinkler Fire Protection Statistics from Residential Structure Fires - Personal Lines[13]

Category	Homes (Apartments and One- & Two-Family)	Rooming, Boarding and Lodging Houses	Hotel and Motel
Percent of fires in buildings with automatic suppression system	2.10%	17.20%	34.50%
Deaths per 1,000 fires with no automatic suppression system present	9.5	13.4	8.5
Deaths per 1,000 fires with automatic suppression system present	2.2	0	0
Reduction in deaths per 1,000 fires when automatic suppression systems were present	76.60%	100%	100%
Average loss per fire when automatic suppression system was present	$5,383	$1,819	$6,530
Average loss per fire with no automatic suppression system present	$10,877	$12,346	$15,690
Reduction in loss per fire when automatic suppression systems were present	50.5%	85.3%	58.4%

[13] Source: The U.S. Fire Problem Overview Report, Marty Ahrens, NFPA, June 2001

Table 13.4-2 Sprinkler Fire Protection Statistics from non-Residential Structure Fires - Commercial Lines[13]

Category	Eating and Drinking Places	Educational Property	Industrial and Manufacturing	Stores and Other Mercantile	Facilities that Care For the Aged
Percent of fires in buildings with automatic suppression system	29.20%	23.90%	41.30%	25.90%	73.60%
Deaths per 1,000 fires with no automatic suppression system present	0.8	0	0.9	1	10.8
Deaths per 1,000 fires with automatic suppression system present	0	0	1.2	0.3	1.9
Reduction in deaths per 1,000 fires when automatic suppression systems were present	100%	N/A	30.40%	66.60%	82.00%
Average loss per fire when automatic suppression system was present	$6,533	$2,802	$19,238	$8,609	$1,789
Average loss per fire with no automatic suppression system present	$18,845	$12,912	$55,749	$27,725	$3,973
Reduction in loss per fire when automatic suppression systems were present	65.30%	78.30%	65.50%	68.90%	55.20%

Numerous areas around the world including in the U.S. and Canada have implemented sprinkler regulations that require all types of buildings to be sprinkler protected. The most progressive of these, have implemented retroactive installation requirements that give a certain time frame for all buildings to upgrade sprinkler protection.

The effectiveness of sprinkler systems has been proven through research and experience. As with any significant change in the way business is done, there are always skeptics who question the logic of changing and with good reason, change for the sake of change is not always advisable. However in cases where it is proven unquestionably that the improvement has a measurable positive impact on the community, then the improvement must be made. The

implementation of regulations for seat belts in automobiles followed a similar historical path with skeptics refuting the safety improvements associated with seat belts. As data regarding improvements in safety piled up, eventually communities and industry shifted to providing regulations requiring seat belts to be a standard feature provided in all automobiles as well as regulations requiring that seat belts be used.

Sprinkler protection is following the same path as seat belts. Proactive communities and developers have already embraced sprinkler system regulations and are safer communities for it. Reactive communities that resist this change typically make the change after there is a loss of life or loss of property that significantly impacts the local economy.

In the case of Campbell River, the Building Bylaw already includes requirements for sprinkler systems for new buildings which is an extremely effective step toward improving fire protection levels in the community, however there is a large building stock of unsprinklered occupancies through the City that pre-date the Bylaw.

Each time the fire insurance grading system is revised, additional credit is given to sprinkler systems and sprinkler regulations. Currently a proposed change to the fire insurance grading system is to include a level of recognition to sprinkler regulation implementation as an equivalency to traditional fire protection methods. Once implemented, this will give communities additional credit for sprinkler system regulations and be of particular benefit to properties in areas where traditional fire protection is not available or comes at a distance that is too far to be recognized for fire insurance grading purposes.

13.4.3. Insurance perspective

The different service levels/capacities of fire protection are referred to as Standards of Response Cover. The Table of Effective Response provides examples of various Standards of Response Cover that are specifically associated with risk level (basic fire flow). The Table of Effective Response includes benchmark levels of response that all

Canadian communities are measured against for the purposes of insurance grading, however these benchmarks are only fully achieved in the most well-developed areas of the country. Typically, communities improve their fire insurance grades as they grow and through investment in fire protection, receive higher percentages of credit of the benchmark standards of response cover set out in The Table of Effective Response.

13.4.4. NFPA 1710 perspective

NFPA 1710 recommends that the first company arrive at the scene of a structure fire within five minutes or less from the dispatch, 90% of the time. The standard establishes that a response "company" consists of four personnel. The standard does not require that all four be on the same vehicle, but does expect that the four will operate as a single functioning unit once on scene.

There is another reason the arrival of four personnel is critical for structure fires. As mentioned earlier, current WCB regulations require that before personnel can enter a building to extinguish a fire at least two personnel must be on scene and assigned to conduct search and rescue in case the fire attack crew becomes trapped. This is referred to as the "two-in, two out" rule. There is no exception to this rule, even if it is known that persons are trapped inside the building.

Finally, the NFPA standard calls for the arrival of the entire initial assignment (all engine companies, ladder company(s), rescue, and a chief officer) within nine minutes or less from dispatch, 90% of the time. This is to ensure that enough people and equipment arrive soon enough to be effective in controlling a fire before substantial damage or a conflagration occurs.

NFPA 1710 describes the following performance as meeting the structure fire response criteria of the standard:

- Turnout time within one minute, 90% of the time
- Arrival of the first "company" (travel time) within five minutes of dispatch, 90% of the time, or

• Arrival of the entire initial response assignment (all units assigned to the call) within eight minutes of dispatch, 90% of the time.

Note: NFPA 1710 represents a high standard[14] of fire protection and smaller communities may not be able to realistically achieve this standard. Accordingly NFPA also produces the standard NFPA 1720, the Standard for Rural Fire Departments. In the case of Campbell River, it is recommended that NFPA 1710 be adopted, with policy statements regarding areas where compliance with the standard is not achieved. Such policy statements should be made public so that the community is aware of the standard of protection that is being provided.

13.4.5. Campbell River Response Statistics

Looking at the responses to structure fires and the statistical times for response, indicates that the level of service is considerably higher in the geographic area around the career hall than it is in the geographic area around the auxiliary hall with respect to response times.

Based on the statistical response data from 2004 – 2009 (inclusive) the following Standards of Response Cover is achievable in the City of Campbell River:

1. Response of 4 firefighters with fire apparatus from Station 1 within 12 minutes throughout the entire community 90% of the time.

The Standard of Response Cover statement should be revised to include achievable targets for:

- dispatch time (60 sec)
- turnout time for career firefighters (60-120 sec)
- travel time
- total

[14] See Item 2 under Section 8.3

Additional data should be gathered, stored and analysed through the communications centre to further develop the Standards of Response Cover for the City. Each year, the Standards of response Cover should be reviewed and compared against statistics to ensure that the level of service that is stated in the Standard is being provided.

The Standards of response Cover should be adjusted accordingly to the status of the community each year. For example if the community annexes a large amount of land, the Standards of response may have to be reduced to remain achievable, and vice versa, if a higher Standard of response Cover is desired, then additional resources may need to be acquired, or the service area /risk may need to be reduced.

The following Figures and maps form the basis of the Standards of Response Cover analysis and can be provided for the community's further use in GIS formats upon request.

Figure 13.4-5 Campbell River First Due Response Times for Hall 1 (Career)

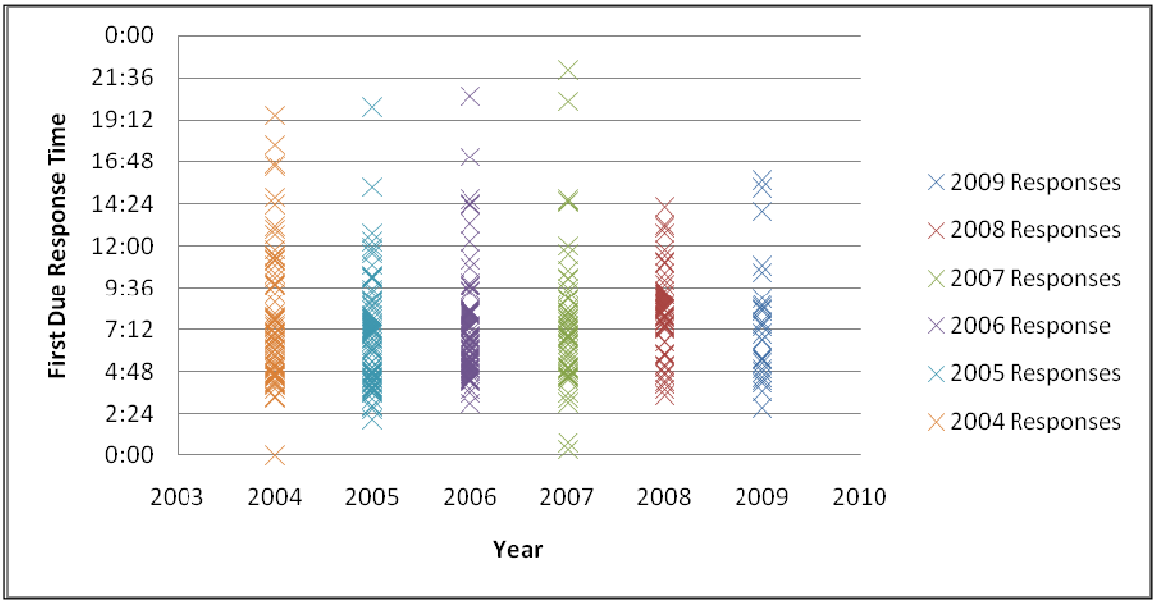


Figure 13.4-6 Campbell River First Due Response Times for Hall 2 (Auxiliary)

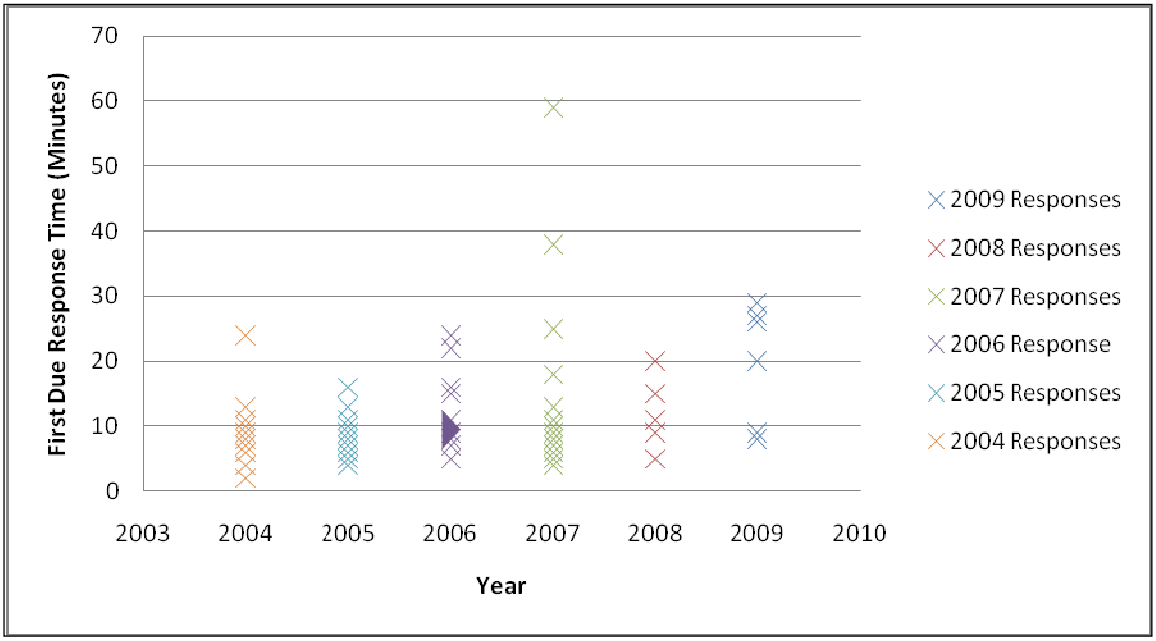


Figure 13.4-7 Number of Structure Fires per Year with First response by Career Company 2004-2009[15]

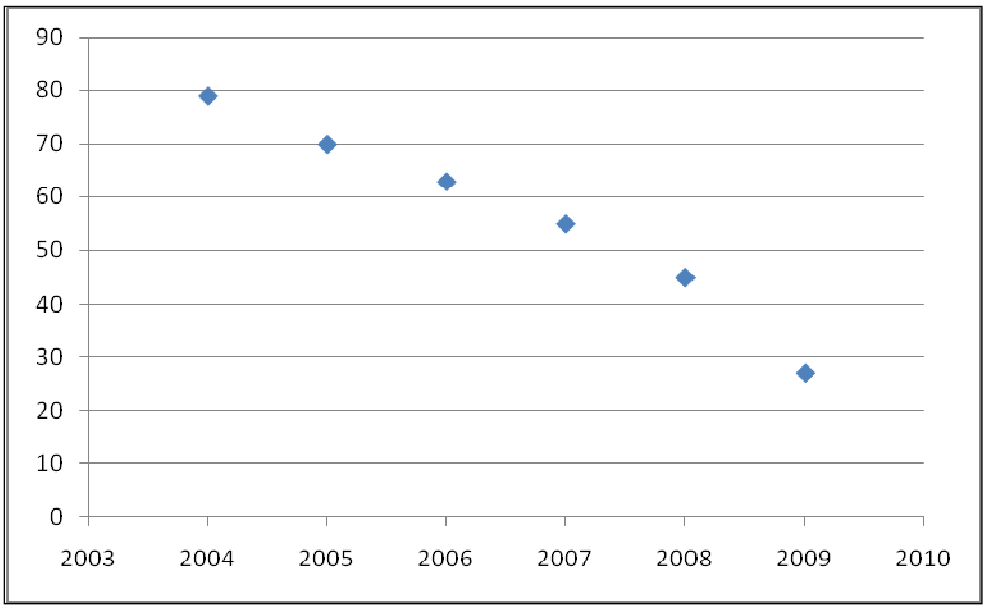
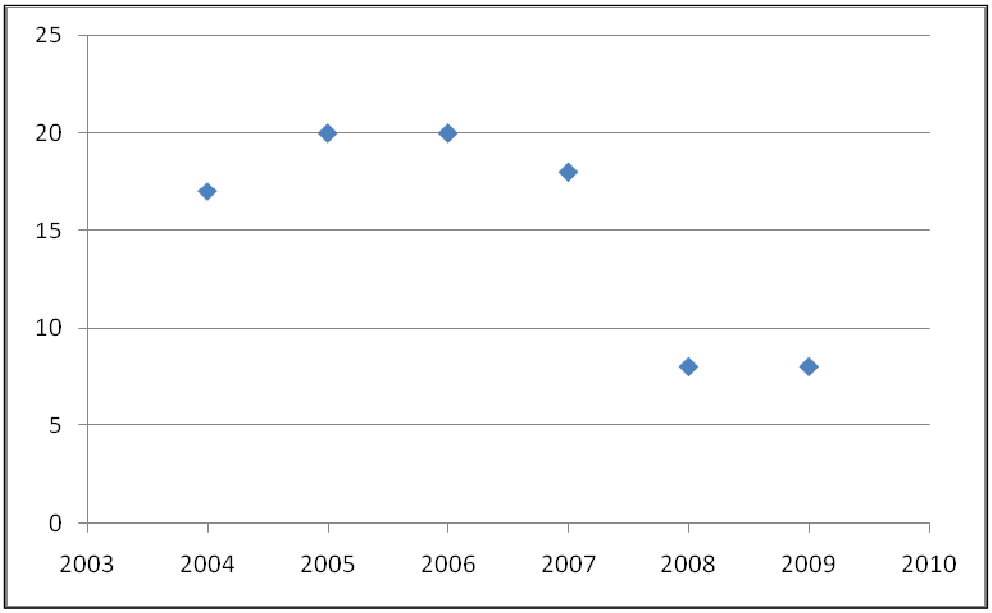


Figure 13.4-8 Number of Structure Fires per Year with First response by Auxiliary Company 2004-2009



[15] 2009 statistics are incomplete (year to date)

Figure 13.4-9 Average First Due Response Time from Hall 1 (Career)

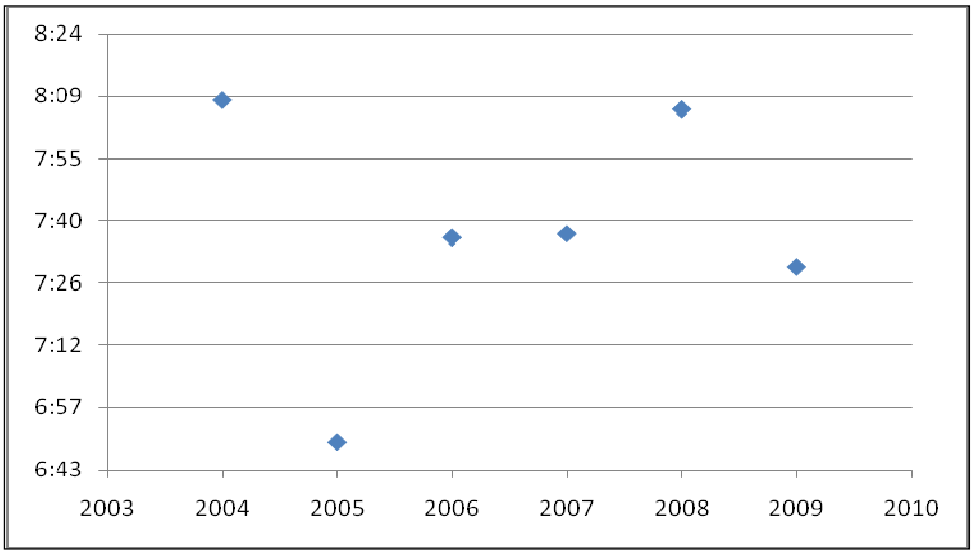
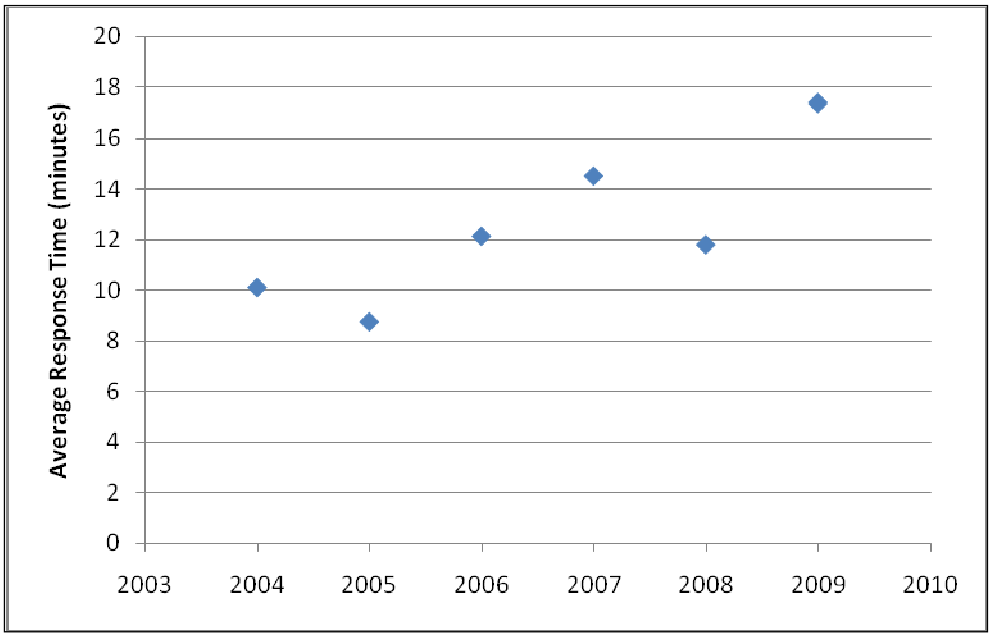


Figure 13.4-10 Average First Due Response Time from Hall 2 (Auxiliary)



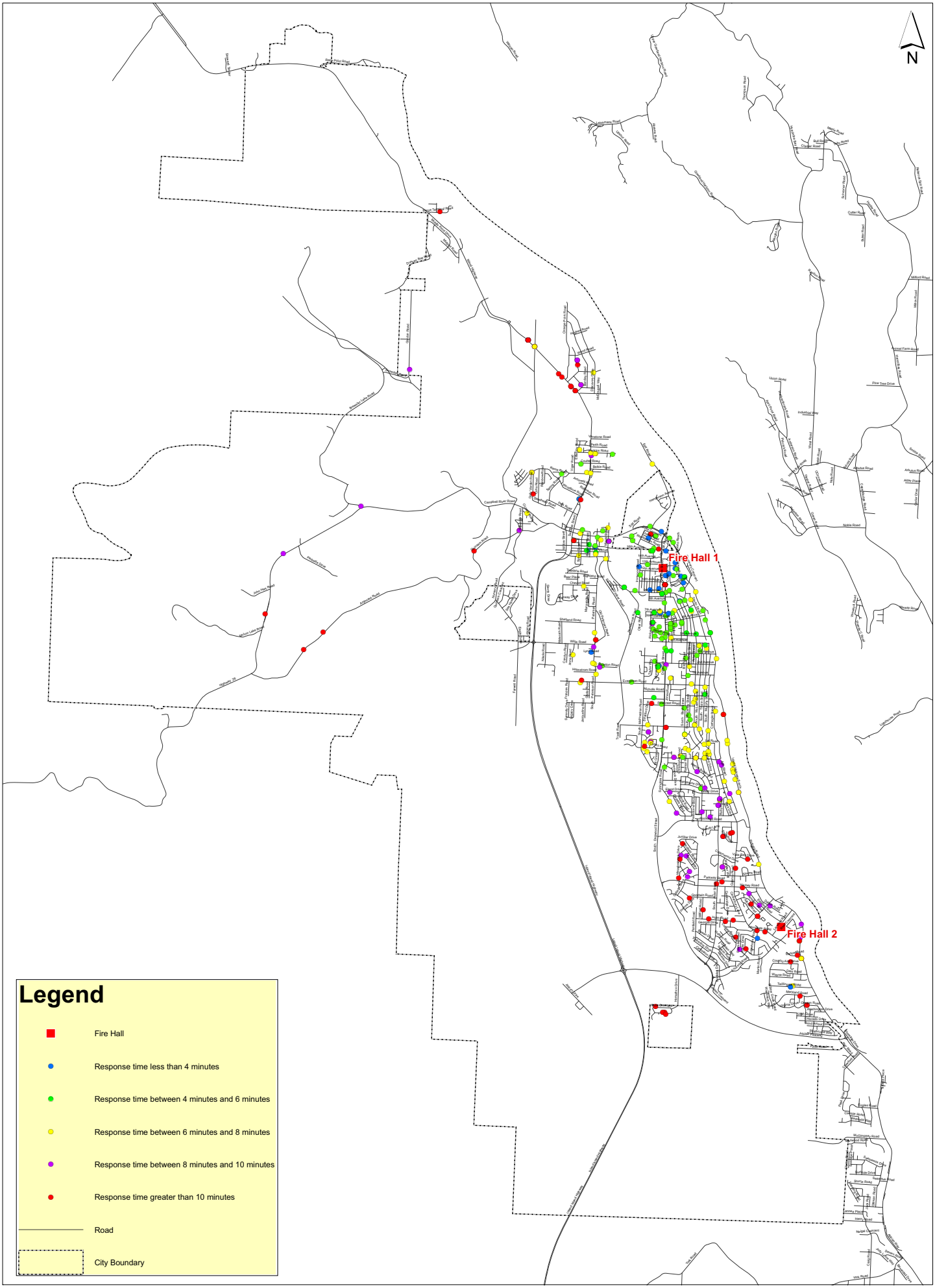


Figure 13.4 11 Career Response Times To Fire Incident (2004 - 2009)

City of Campbell River

Fire Underwriters Survey

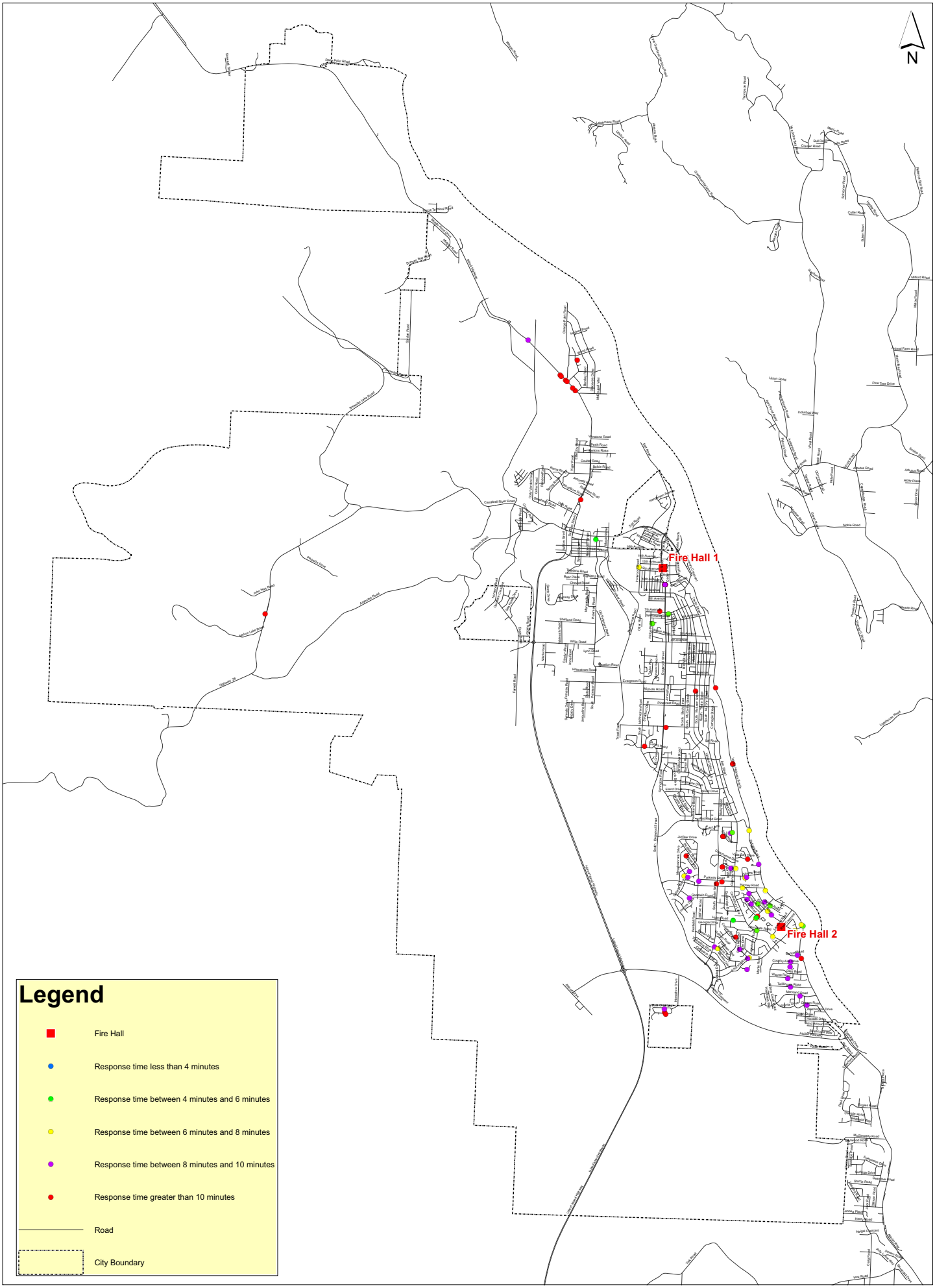


Figure 13.4 12 Auxiliary Response Times To Fire Incident (2004 - 2009)

City of Campbell River

Fire Underwriters Survey

13.5. Downsizing Fire Protection?

When communities consider downsizing protective facilities, it is important that due consideration be given to the potential effects. When speaking in terms of fire protection, reducing service levels directly impacts the life safety of constituents and the fire insurance grades of the community. Property and Casualty (P&C) insurers across Canada use fire insurance grades to determine insurance capacities. The better the fire insurance grade, the higher the capacity and the more competitive the insurance market becomes. Lower insurance rates result from this process. Likewise, when fire insurance grades get worse, the insurers lower their capacities, the insurance market becomes less competitive, and there is a corresponding increase in insurance rates. In some cases, insurers will entirely avoid writing insurance in an area because of the risk it presents. This can be very problematic for businesses and in such cases, a single business may have to insure through multiple insurers. Larger businesses may avoid such areas altogether due to problems in acquiring stable access to the insurance market.

However the cost benefits of reduced property insurance do not entirely offset the cost of fire protection. That being said, fire protection is one of the few areas a municipality can invest in that provides a cost benefit to its constituents and improves the commercial viability of property for potential business. Investment in street lighting, policing and other areas does not result in cost benefits or reduced insurance premiums. This must be considered by the decision makers prior to making cuts to fire protection services.

Should the decision be made to reduce the level of service in the area of fire protection? The decision should be made as carefully as possible. Key items to consider include:

- the level of fire risk throughout the community,
- the level of expectation of the residents of the community and
- the importance of insurability within the community.

Furthermore, a reasonable set of Standards of Response Cover must be developed and the fire department must statistically track the level of service being provided to ensure

that the level of service being provided (as stated in the Standards of Response Cover) is commensurate with the level of service being expected by the City.

Consideration should also be given to polling the local population to determine the willingness to pay for fire protection services.

13.6. The Heart of the Matter

The primary problem is the amount of funding that is allocated to the fire department is not adequate to provide a standardized level of service in accordance with NFPA 1710. This can be addressed by providing additional funding or by reducing the costs of operating the fire department. The issue here is that the municipality cannot afford to increase the funding and the Fire Department cannot continue to provide the standardized level of service with less funding.

The question for this issue is then how can the Fire Department continue to provide the same level of service with less funding? There is no simple answer to this question, however some options will be discussed in the next section.

13.7. Thinking Outside the Box

Fire Departments across the country face similar problems with respect to providing a reasonable level of service within budgetary limitations. As communities grow, the tolerance for fire risk tends to decrease and public outrage at fire losses tends to increase as the community beliefs shift toward thinking of fire losses as being avoidable.

In Campbell River one of the primary issues identified is maintaining a standardized level of service to the community core within budgetary limitations that prevent adding additional career fire fighters.

13.7.1. Develop a Work Experience Program (WEP)

Develop a Work Experience Program that attracts young fire fighters who have acquired certification through outside agencies such as the JIBC. Primary elements of such a program would include:

1. WEP Fire Fighters would live at the fire hall and work in the community
2. Responsibilities would include duty crew response during non-working hours
3. Free room and board for fire fighters
4. Job with the City of Campbell River or participating company (incentives for participation could include tax credits, advertising, etc.)
5. Training allowance for WEP Fire Fighters

The success of such a program would be linked to WEP candidates being attracted to the position by being offered on the job training while being employed and receiving a regular income.

This type of program has been successful in other areas of Canada. One of the key elements of the program is that the host fire department must have an exemplary training program that attracts you fire fighters. The training they receive in the Work Experience Program must be an effective spring board for young fire fighters to start their career from. As such, the host fire department must develop a program that

effectively develops young fire fighters through training and experience in a short time frame. Typically this is possible with a Fire Training Centre.

13.7.2. Develop a Fire Fighter Training Centre

Invest in a Training Program and Training Centre that allows fire fighters to achieve desirable certifications Level 1 and Level 2 as well as specialized skills such as high angle rescue, incident command, etc. The Training Centre can start out by using the assets the Fire Department currently has for training and on an ongoing basis improving these assets through investment and seeking the assistance and charitable contributions of the community.

The standard NFPA 1402: Guide to Building Fire Service Training Centers, 2007 Edition should be used as a reference tool for designing training grounds.

13.7.3. Continuously Invest in Fire Fighters

The ability to attract and retain fire fighters to supplement Campbell River's career fire force is directly affected by the how the Campbell River Fire Department and the City of Campbell River are seen to treat their fire fighters.

Particularly with respect to recruiting and retaining auxiliary fire fighters, it is important to ensure that the fire department and its representatives have high standards of integrity. Just as it is important for individuals to seek to improve the community through their actions it is equally important for the community, through its agents, to make such improvements as will benefit its members in matters that are important to them.

13.7.4. Develop a Public Relations Campaign

The Campbell River Fire Department has some negative public relations issues. To address these issues, the Fire Chief could initiate a public relations program that can be incorporated with Fire Prevention and Public Education programs. The objective of this program should be to improve the relationship between the fire department members, the community, industry and the elected officials.

This program can include various components such as social events, volunteerism coordinated charitable functions, etc. but the underlying intent should be to improve how the Fire Department is perceived publicly, and how the Fire Department perceives the public. Harboured negative feelings can become a vicious cycle that leads to lower morale and takes away from the great relationship a fire department should have with the community it serves. One of the most important steps that the Fire Chief can take in this area is to work internally with department members to improve their outlook on the community they serve and its elected officials. Members of the Campbell River Fire Department are ambassadors of the department to the community and they can have a great impact on the public perception of the department.

See Appendix F

14.PROJECT CONCLUSIONS

The City of Campbell River is currently experiencing an economic downturn. However the fire risk and fire load in the community has grown since the previous survey in 1982.

The level of fire protection and fire prevention in the City has improved since the last survey, however the level of risk has increased at a greater pace. Therefore the previous Public Fire Protection Classification of 4 is no longer being maintained. Based on the survey in 2009, the Public Fire Protection Classification currently maintained is a 5. This affects properties insured under Commercial Lines. The previous Dwelling Protection Grade of 1 remains the same after this survey as the level of protection capacity as compared to the fire risk inherent in a single family residence remains effective.

Within the fire insurance grading the level of risk with respect to structural fires and conflagrations is quantified in terms of required fire flows. The overall level of risk determined for each community or sub-district thereof is referred to as the basic Fire Flow. The Basic Fire Flow of the City of Campbell River as determined in this study is 19,000 LPM (4,200 Igpm). This is then the benchmark that the community is measured against.

Each of the four primary areas related to fire protection have been measured against the benchmark Basic Fire Flow and assigned a relative classification on a 1-10 scale, with 1 representing the ideal and 10 representing no recognized level.

The Fire Department in Campbell River has been determined to have a relative classification of 6. The area protected has been reviewed and to provide an ideal level of protection, 1 additional fire station would be required to serve the northern area of the community. Currently, the Campbell River Fire Department provides a career response from one fire station and an auxiliary response from the second fire station. The maximum credit that could be received in this area of the grading would include career response from three fire stations including one in the northern area.

The most significant areas where improvements would positively impact the PFPC observed throughout this study are:

- the distribution of companies;
- available fire force; and
- administration and operations of the fire department.

For a summary of the most significant recommendations relating to fire insurance grading see Table 12.2-2 – Key Recommendation Summary.

These areas are deficient when measured against the benchmark of the required number of fire personnel and companies for the Basic Fire Flow associated with the City of Campbell River. Other areas where improvement is encouraged are discussed within this report. The available fire force issue could alternatively be partially addressed with a Work Experience Program as described in Section 13.7.1.

The community provides a high level of service and redundancy with regard to water supplies for fire protection. As a result, further improvements to the water supply system would have little impact on the Public Fire Protection Classification.

The Fire Safety Control and Fire prevention area of the grading is well served by the Sprinkler Bylaw and this area has a relative classification of 4. However, when considering the operational aspects of the Fire Prevention Inspection program, improvement can be made. One of the key areas within the Fire Safety Control portion of the grading for Campbell River is the promotion and requirement for automatic sprinkler systems in new construction.

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 likely maintain previous PFPC classification. Fire Underwriters Survey should be notified of any changes or improvements in any of the fire protection services provided throughout the fire protection area.

Fire Underwriters Survey does not recommend reducing fire protection service levels in the City of Campbell River. However the City will need to decide based on the economic impacts and risk tolerances what level of service the constituents of the community wish to pay for. The community may wish to provide a higher or lower standard of protection than it currently does. Providing a lower standard of fire protection will result in cost savings in terms of fire protection cost but will result in increased insurance premiums and risk levels. The increased risk is with respect to life and property. There are numerous costs associated with fire losses that affect a community's economic viability in the long term. If the community elects to provide reduced levels of fire protection it should be conscious of the increased risks associated with such a decision.

It is important that the community report significant changes to the level of fire protection or fire risk within the community to Fire Underwriters Survey. This will ensure that 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 exposure in lawsuits related to fire loss claims.

Appendix A

WATER SUPPLY
FOR
PUBLIC FIRE PROTECTION

1999

FIRE UNDERWRITERS SURVEY

A SERVICE TO INSURERS AND MUNICIPALITIES

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

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

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

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WATER SUPPLY FOR PUBLIC FIRE PROTECTION

PREFACE

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

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

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

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

PART I

GENERAL

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

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

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

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

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

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

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

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

SUPPLY WORKS

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

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

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

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

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

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

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

PUMPING

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

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

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

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

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

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

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

BUILDINGS AND PLANT

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

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

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

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

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

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

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

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

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

PIPING

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

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

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

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

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

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

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

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

HYDRANTS

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

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

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

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

RECORDS

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

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

TABLES

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

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

Interpolate for intermediate figures

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

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

PART II

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

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

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

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

where

F = the required fire flow in litres per minute.

C = coefficient related to the type of construction.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Notes to Calculation

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

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

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

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

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

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

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

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

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

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

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

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

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

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

OUTLINE OF PROCEDURE

A. Determine the type of construction.

B. Determine the ground floor area.

C. Determine the height in storeys.

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

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

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

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

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

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

APPENDIX

TYPES OF CONSTRUCTION

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

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

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

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

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

OCCUPANCIES

Examples of Low Hazard Occupancies:

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

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

Examples of High Hazard Occupancies:

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

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

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

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

EXPOSURES

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

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

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

CONVERSION FACTORS

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

Appendix B

Campbell River Flow Tests

Year	Flow Test #	Available Flow at 20 psi (Igpm)	Required Fire Flow Number	Required Fire Flow (Igpm)
2009	1	4200	22	2200
2009	2	1700	SFR	800
2009	3	1800	SFR	800
2009	4	2600	School (SPR)	2000
1981	1	2416		2416
1981	2	1719	SFR	800
1981	3	1400	29	2900
1981	4	1137	SFR	800
1981	5	1542	SFR	800
1981	6	9096		9096
1981	7	5692	22	5692

WATER FLOW TEST REPORT

FIRE UNDERWRITERS SURVEY
A SERVICE TO INSURERS AND MUNICIPALITIES

Available Fire Flow Calculator

Name of Risk:	Home Hardware	Test No.	1
Municipality:	City of Campbell River	Test By:	Sunjeev Sodi
Purpose of Test:	Fire Insurance Grading	Date:	22-Sep-09
Type of Construction	Noncombustible		
Ground Floor Area	5000 sq m	# of storeys	1
Occupancy	Group E	Sprinklered?	y
Exposures	Front: n/a Rear: 10-20 m	Left: n/a	Right: 10-20 m

Size of Main: Dead End: Two Ways: Loop: x

Source Reliable: Y If not explain:

Comments:

TEST DATA:

Location of test hydrants; Residual: Hydrant # 185 (11th Ave + Dogwood St)

Flow: Hydrant # 184 (12th Ave + Dogwood St)

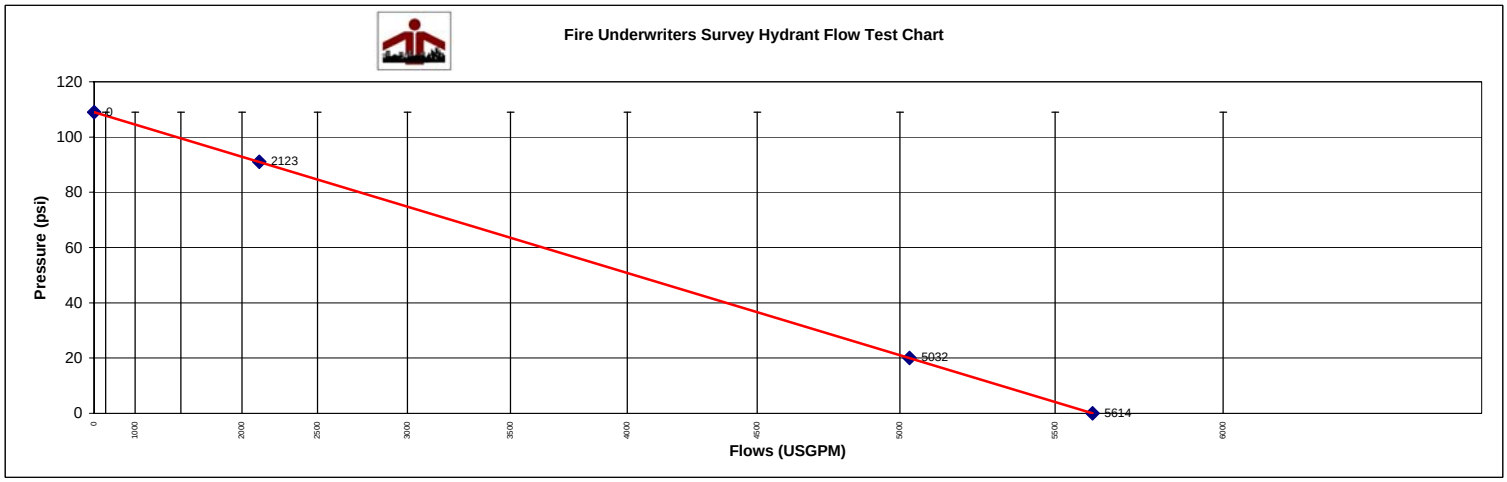
FLOW HYDRANT(S)		Orifice #2	Orifice #3	Orfice #4
SIZE OPENING:	4			
COEFFICIENT:	0.712			
PITOT READING:	39			
GPM:	2123	0	0	

TOTAL FLOW DURING TEST: 2123 USGPM; 8035 L/MIN; 1768 IGPM

STATIC READING: 109 PSI RESIDUAL: 91 PSI

RATED CAPACITY:			AT 0 PSI		
	5032	USGPM		5614	USPGM
	4192	IGPM		4677	IGPM
	19047	L/MIN		21250	L/MIN

REMARKS:



Locations Maps:

WATER FLOW TEST REPORT

FIRE UNDERWRITERS SURVEY
A SERVICE TO INSURERS AND MUNICIPALITIES

Available Fire Flow Calculator

Name of Risk:	SFR	Test No.	2
Municipality:	City of Campbell River	Test By:	Sunjeev Sodi
Purpose of Test:	Fire Inurance Grading	Date:	22-Sep-09
Type of Construction	Wood Frame		
Ground Floor Area	150 sq m	# of storeys	2
Occupancy		Sprinklered?	no
Exposures	Front: n/a Rear: n/a Left: n/a	Right:	n/a

Size of Main: | Dead End: | Two Ways: | Loop: x

Source Reliable: | If not explain:

Comments:

TEST DATA:

Location of test hydrants; Residual: Hydrant #285 (Maria Grove + Cedar Street)

Flow: Hydrant #284 (571 Cedar St)

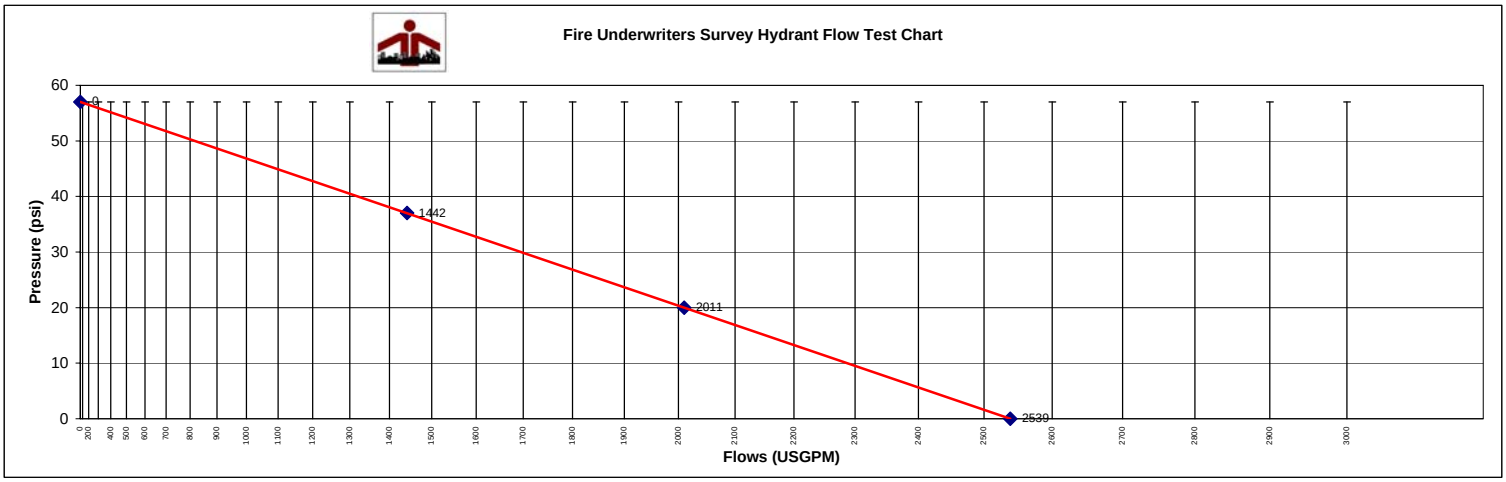
FLOW HYDRANT(S)		Orifice #2	Orifice #3	Orfice #4
SIZE OPENING:	4			
COEFFICIENT:	0.712			
PITOT READING:	18			
GPM:	1442	0	0	

TOTAL FLOW DURING TEST: 1442 USGPM; 5459 L/MIN; 1201 IGPM

STATIC READING: 57 PSI RESIDUAL: 37 PSI

RATED CAPACITY:		AT 0 PSI		
	2011 USGPM		2539	USPGM
	1675 IGPM		2115	IGPM
	7610 L/MIN		9610	L/MIN

REMARKS:



Locations Maps:

Provided by:
Fire Underwriters Survey
Municipal Engineering Division

3999 Henning Drive
Burnaby, BC V5C 6P9
1-800-665-5661

WATER FLOW TEST REPORT

FIRE UNDERWRITERS SURVEY
A SERVICE TO INSURERS AND MUNICIPALITIES

Available Fire Flow Calculator

Name of Risk:	SFR	Test No.	3
Municipality:	City of Campbell River	Test By:	Sunjeev Sodi
Purpose of Test:	Fire Inurance Grading	Date:	22-Sep-09
Type of Construction	Wood Frame		
Ground Floor Area	150 sq m	# of storeys	2
Occupancy		Sprinklered?	no
Exposures	Front: n/a Rear: n/a Left: n/a	Right:	n/a

Size of Main: | Dead End: | Two Ways: | Loop: x

Source Reliable: | If not explain:

Comments:

TEST DATA:

Location of test hydrants; Residual: Hydrant # 798 (Elizebeth Rd + Delvecchio Rd)

Flow: Hydrant # 396 (Delvecchio Rd + Jesmar Pl)

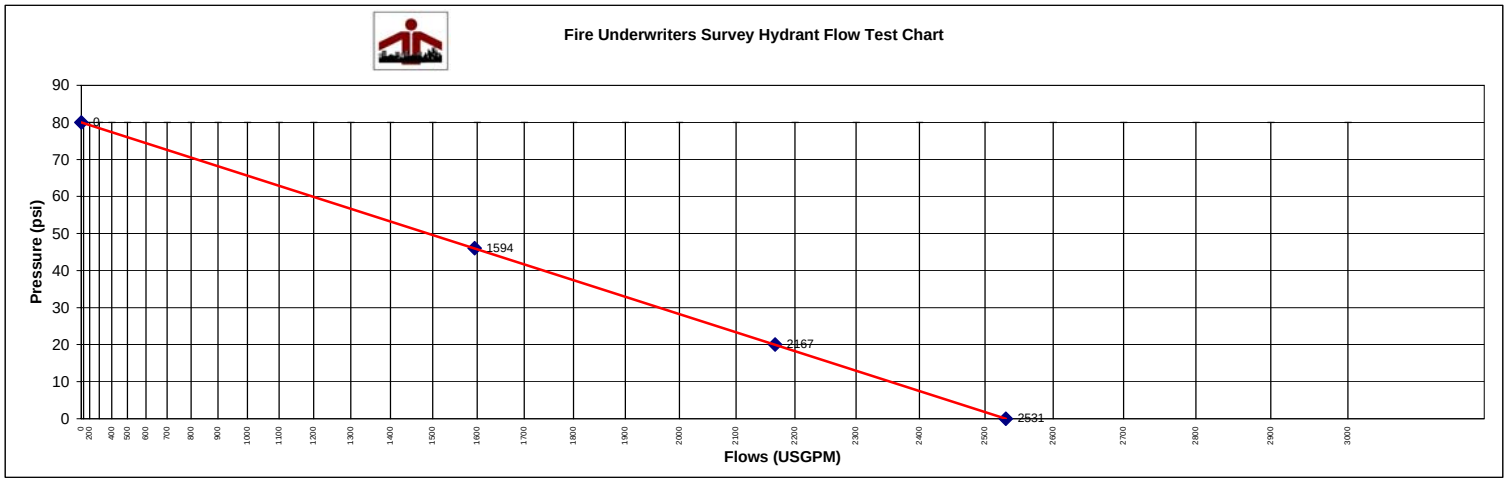
FLOW HYDRANT(S)		Orifice #2	Orifice #3	Orfice #4
SIZE OPENING:	4			
COEFFICIENT:	0.712			
PITOT READING:	22			
GPM:	1594	0	0	

TOTAL FLOW DURING TEST: 1594 USGPM; 6035 L/MIN; 1328 IGPM

STATIC READING: 80 PSI RESIDUAL: 46 PSI

RATED CAPACITY:			AT 0 PSI		
	2167	USGPM		2531	USPGM
	1805	IGPM		2108	IGPM
	8201	L/MIN		9580	L/MIN

REMARKS:



Locations Maps:

Provided by:
Fire Underwriters Survey
Municipal Engineering Division

3999 Henning Drive
Burnaby, BC V5C 6P9
1-800-665-5661

WATER FLOW TEST REPORT

FIRE UNDERWRITERS SURVEY
A SERVICE TO INSURERS AND MUNICIPALITIES

Available Fire Flow Calculator

Name of Risk:	Willow Point Elementary	Test No.	4
Municipality:	City of Campbell River	Test By:	Sunjeev Sodi
Purpose of Test:	Fire Inurance Grading	Date:	22-Sep-09
Type of Construction	Wood Frame		
Ground Floor Area		# of storeys	2
Occupancy		Sprinklered?	y
Exposures	Front: n/a Rear: n/a	Left: n/a	Right: n/a

Size of Main: Dead End: Two Ways: Loop: x

Source Reliable: If not explain:

Comments:

TEST DATA:

Location of test hydrants; Residual: Hydrant # 697

Flow: Hydrant # 696

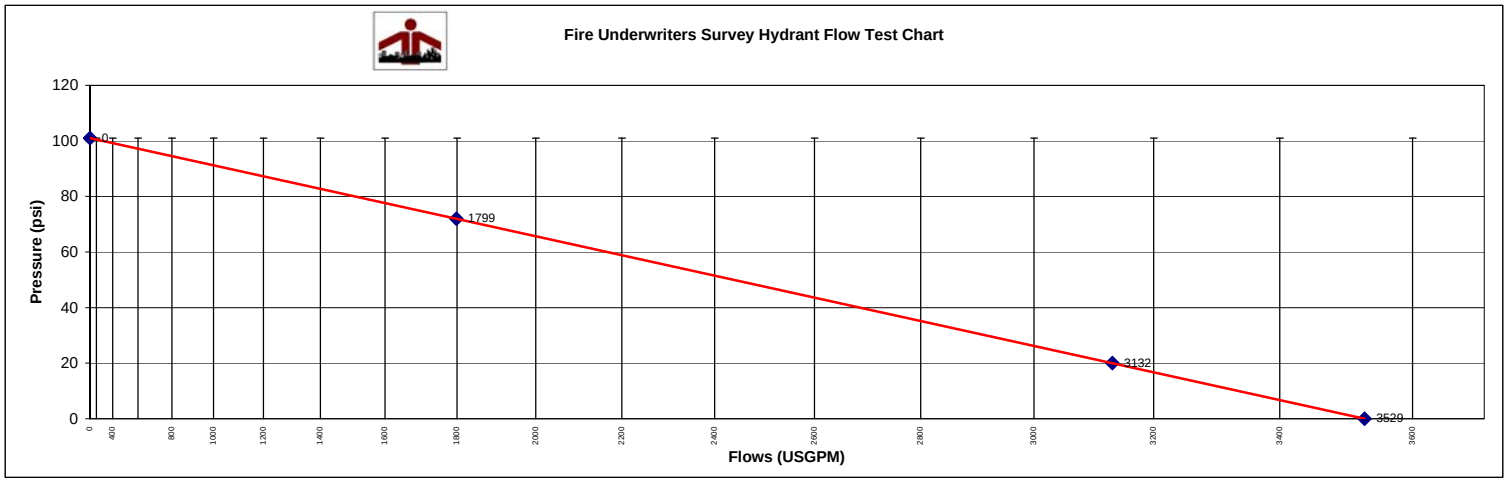
FLOW HYDRANT(S)		Orifice #2	Orifice #3	Orfice #4
SIZE OPENING:	4			
COEFFICIENT:	0.712			
PITOT READING:	28			
GPM:	1799	0	0	

TOTAL FLOW DURING TEST: 1799 USGPM / 6808 L/MIN / 1498 IGPM

STATIC READING: 101 PSI RESIDUAL: 72 PSI

RATED CAPACITY:		AT 0 PSI		
	3132 USGPM		3529	USPGM
	2609 IGPM		2939	IGPM
	11856 L/MIN		13356	L/MIN

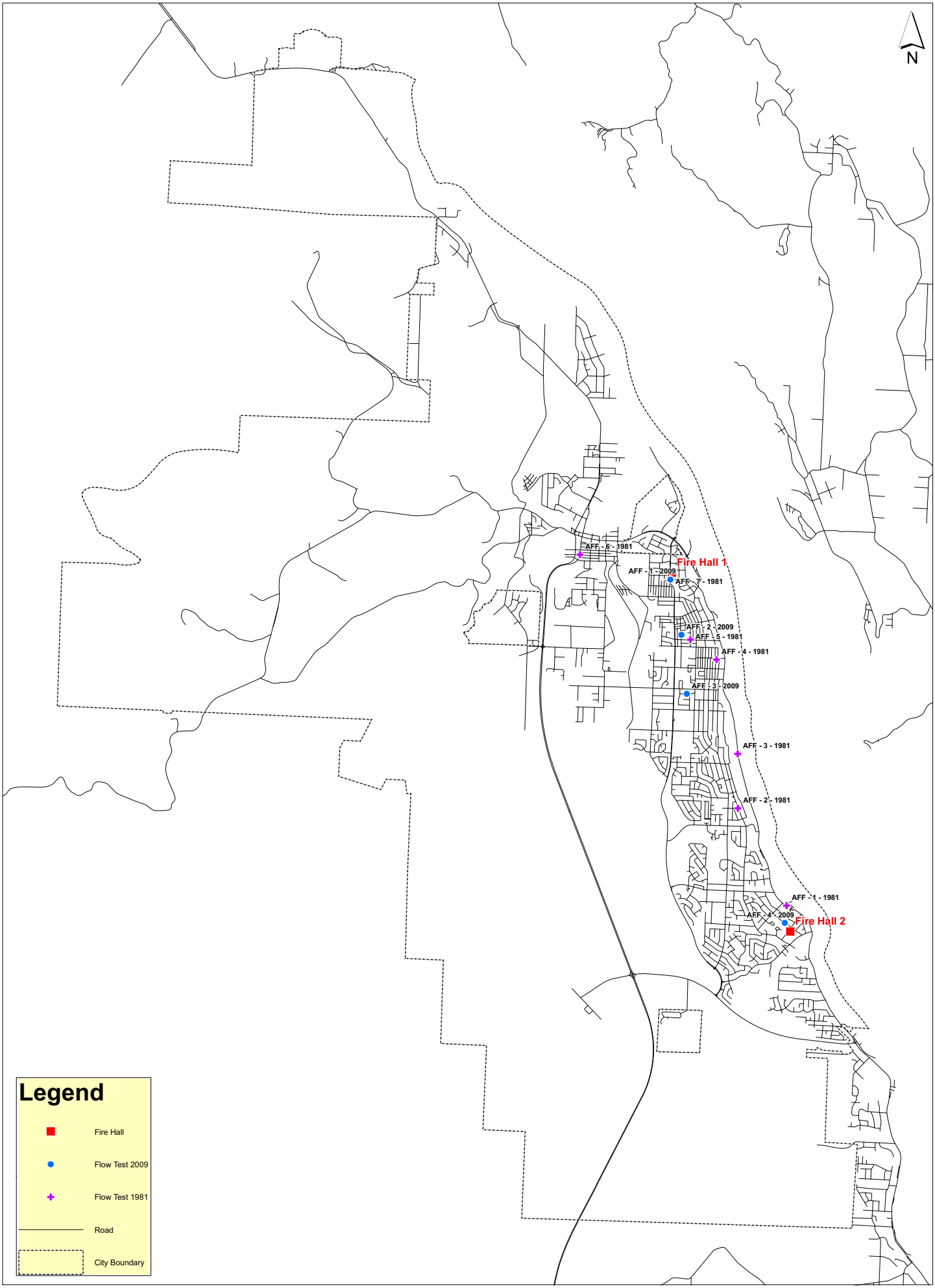
REMARKS:



Locations Maps:

Provided by:
Fire Underwriters Survey
Municipal Engineering Division

3999 Henning Drive
Burnaby, BC V5C 6P9
1-800-665-5661



AVAILABLE FIRE FLOW TEST LOCATIONS

City of Campbell River

Fire Underwriters Survey

Appendix C

FIRE DEPARTMENT LIABILITY

Paul McDonnell and Stacy Robertson

I. Introduction

Many firefighters and municipal insurers believe that actions against fire departments are a relatively new phenomena. In reality there are hundreds of reported decisions involving lawsuits against fire departments. Currently there are more successful actions against fire departments than in the past.

Possibly the first reported British case which commented on fire department liability is the 1537 Decision in Maleverer v. Spinke , 1 DYER, 35b Trinity Term, 29 H.E.N. 879, wherein Chief Justice Coke of the Kings Bench Division II cited the example of a fire department pulling down a house on fire for the safety of the neighbouring houses as an example of a justifiable commission of a tort.

The Maleverer v. Spinke, supra, decision also exemplified the overriding reluctance of the Courts to impose liability on fire departments for their acts and omissions in responding to fires. In the past 20 years, however, there have been a number of decisions which have imposed liability on fire departments to a greater degree than ever before. The reasons for these successful suits have been a relaxation of the doctrine of government immunity, an expanding area of law pertaining to municipal liability, a proliferation of litigation awareness, economic realities which have motivated insurers to seek recovery of their subrogated interests, closer scrutiny of activities of all professions generally and an increasing role by the Courts in loss distribution and public accountability.

The test to determine whether a fire department was negligent is no different than other cases of negligence in that the Plaintiff must show:

1. That the fire department owed a duty of care to the Plaintiff;
2. That the fire department should have observed a particular standard of care in order to perform or fulfil that duty;
3. That the fire department broke its duty of care by failing to fulfil or observe its required standard of care;
4. That such breach of duty caused damage or loss to the Plaintiff; and
5. That such damage was not too remote a consequence of the breach so as to render the fire department not liable for its occurrence.

In this paper, we present a summary of the Court decisions which have defined the parameters of fire department liability in negligence. In particular, we will summarize the

recent Court decisions which have dramatically affected the liability exposure now faced by fire departments in both their preparation for and response to fires.

II Duty of Care

Generally speaking, fire departments owe a duty of care to property owners to be careful to ensure that their fire suppression efforts protect the interests of the property owner and adjacent property owners. As noted by Lord Wilburforce of the House of Lords in Anns v. Merton London Borough Council (1978), A.C. 728.

> "Through the trilogy of cases in this House - Donahue v. Stevenson (1983), A.C. 562, Hedley Byrne and Co. Ltd. v. Heller and Partners Ltd. (1964), A.C. 465, and Dorset Yacht Co. Ltd. v. Home Office (1970), A.C. 1004, the position has now been reached that in order to establish that a duty of care arises in a particular situation, it is not necessary to bring the facts of that situation within those previous situations in which a duty of care has been held to exist. Rather the question has to be approached in two stages. First, one has to ask whether, as between the alleged wrongdoer and the person who has suffered damage, there is a sufficient relationship of proximity or a neighborhood such that, in the reasonable contemplation of the former, carelessness on his part may be likely to cause damage to the latter - in which case a prima facie duty of care arises. Secondly, if the first question is answered affirmatively, it is necessary to consider whether there are any considerations which ought to negative, or reduce or limit the scope of the duty or the class of person to whom it is owed or the damages to which a breach of it may give rise."

The Anns v. Merton, supra, decision established that municipalities may have private law duties to avoid causing damage to others in close proximity which co-exist with the municipalities' public law duties.

In such early decisions as Arial v. Edmonton (City) (1935), 2 W.W.R. 536 (Alta T.D.) and Wing v. Moncton (City) (1940), 14 M.P.R. 415, (1940) 2 D.L.R. 740 (M.B.C.A.) the Courts drew a distinction between acts of misfeasance, a positive, overt act of wrongdoing and non-feasance, a mere omission or failure to do something. These decisions held that municipalities could not be held liable for misfeasance. Other decisions such as Stevens and Wilson v. Chatham City (1934), S.C.R. 353, (1934) 3 D.L.R. 1, affirming (1933) O.R. 305 (1933) 2 D.L.R. 407 (C.A.) and Seguin v. Hawkesbury(Town) (1955), O.R. 956, (1955) 5 D.L.R. 809 (C.A.), held that failures that amounted to acts of non-feasance would not result in liability for the responsible municipalities.

In recent Court decisions however the traditional distinctions between acts of misfeasance and non-feasance have been given little consideration by the Courts. In Kamloops (City) v.

Neilson (1984), 10 D.L.R. (4th) 641 (S.C.C.), the Supreme Court of Canada held that categorizing an act as either misfeasance or non-feasance was irrelevant. The municipality was under a duty to do the thing it failed to do. While that particular case involved the construction of a home with defective foundations, it could be applied to a fire fighting situation. The approach that a municipality could not be held responsible for damages unless it acted negligently in the performance of a duty expressly imposed by statute was altered by the Kamloops v. Neilson, supra, decision.

Since that decision, the Courts have been analyzing whether a particular decision made by a municipality was a policy decision or a decision made within its “operational sphere". Some insight into the distinction between these two areas was provided by Mr. Justice Mason of the Australian High Court in the 1985 decision in Sutherland Shire Council v. Heyman.

> "True policy decisions involve social, political and economic factors. in such decisions, the authority attempts to strike a balance between efficiency and thrift, in the context of planning and predetermining the boundaries of its undertakings and of their actual performance. True policy decisions will usually be dictated by financial, economic, social and political factors or constraints.
>
> The operational area is concerned with the practical implementation of the formulated policy; it mainly covers the performance or carrying out of a policy. Operational decisions will usually be made on the basis of administrative direction, expert or professional opinion, technical standards or general standards of reasonableness."

In Just v. British Columbia (1989), 64 D.L.R. (4th) 689 (S.C.C.), Mr. Justice Corey stated as follows:

> "Over the passage of time the increased government activities gave rise to incidents that would have led to tortuous liability if they had occurred between private citizens. The early government immunity from tortuous liability became intolerable. This led to the enactment of legislation which in general imposed liability on the Crown for its acts as though it were a person. However, the Crown is not a person and must be free to govern and make true policy decisions without becoming subject to tort liability as a result of those decisions. On the other hand, complete Crown immunity

should not be restored by having every government decision designated as one of policy. Thus, the dilemma giving rise to the continuing judicial struggle to differentiate between policy and operation. Particularly difficult decisions will arise in situations where government inspection may be expected.

The dividing line between "policy" and "operation" is difficult to fix, yet it is essential that it be done."

Accordingly, the Courts now consider whether or not the act or omission which might expose the municipality to liability was as a result of a policy decision or a decision made within its operational sphere. The municipality would not be found responsible for any policy decision it might make but if the decision was within the operational sphere of the municipality's power, insofar as it was the practical execution of its policy decision, private law duties and obligations would be applicable.

In Riverscourt Farms v. Niagara-On The Lake (1992) 8 M.P.L.R. (2d) 13 (Ont. Gen. Div.), it was held that by-laws, resolutions, internal directives, administrative decisions and discretion in the execution of activities within the operational sphere all fall within the realm of policy decisions. That case involved a situation where fire fighters were unable to extinguish a fire at the Plaintiff's premises due to an inadequate water supply in the area where the Plaintiff's premises was located. While it was foreseeable that a lack of water supply could result in fire damage, the Court held that the town was exercising a policy decision in not upgrading its water system and was therefore not liable in negligence. The fire fighting strategy implemented by the responding fire department was also not faulted by the Court.

Whether or not a duty of care exists in any individual situation must be determined from the particular facts of each case. The Anns v. Merton, supra, decision established a two step test to determine whether a private law duty of care is owed by a municipality over and above any public law duties it may owe. The test in the Anns v. Merton, supra, case is as follows:

1. Is there a sufficiently close relationship between the parties so that, in the reasonable contemplation of the municipality, carelessness on its part might cause damage to that person? If so,

2. Are there any considerations which ought to negate or limit the

   (a) scope of duty,
   (b) class of person to whom the duty is owed, or

(c) the damages to which a breach may give rise.

The main factor in determining whether a sufficiently close relationship exists is foreseeability. As per Donahue v. Stevenson, supra, the fire department must take reasonable care to avoid acts or omissions which it can reasonably foresee would be likely to injure anyone closely or directly affected by its actions that the fire department ought reasonably to have contemplated as being so affected
when directing its mind to the acts or omissions called into question. Legislation and bylaws can assist in whether or not a sufficiently close relationship exists.

In Nelson v. Victoria County (Municipality) (1987), 81 N.S.R. (2d) 334, 203 A.P.R. 334 (T.D.), the Court held that the Municipal Act could be used to establish whether or not the relationship necessary for the imposition of civil liability arises. In that case a volunteer fire department from a neighbouring county was called to respond to a fire at the Plaintiff's premises as the volunteer department was closer than the fire department in the county in which the home was located. The home was destroyed by fire and the Plaintiff alleged that the response time was too slow. The action was dismissed against the municipality on the grounds that the responding fire department had no duty to provide fire protection services to the neighbouring county where the home was located, that there was no agency relationship in existence between the two departments and that the fire suppression efforts of the volunteer department were in no way negligent.

In Densmore v. Whitehorse (City) (1986), 5 B.C.L.R. (2d) 284 (Y.T.S.C.), however the municipality was held liable to a Plaintiff residing outside the municipality's area despite the fact that the municipality was not under contract to service that area. In that particular case the fire department dispatcher had advised the Plaintiff that the department would attend despite the fact that the residence was outside the municipal borders. The fire chief vetoed the dispatcher's decision, which was subsequently reversed by the City's Mayor. Ultimately the fire department attended at the fire scene but the Plaintiff's possessions within the home were completely destroyed by the fire. The Court held that once the City took on the responsibility of putting out the fire, it took on the duty of doing it without negligence. The Court held that there was a duty upon the dispatcher not to mislead the Plaintiff that there would be a fire department response to the fire. Accordingly, the City was held liable as the Plaintiff had relied upon the dispatcher and taken no steps to remove her possessions from the home.

In 1998, the Court of Appeal of Newfoundland held in Hammond v. Wabana (Town), [1998] N.J. No. 336 that members of a fire department, volunteer or otherwise, owe a duty of care to the owners and occupants of property when the department is called upon to respond to a fire within its geographic jurisdiction. The imposition of this duty of care by Canadian courts is well established by the caselaw. However, as noted above, while the

policy decision of a municipality to prohibit its fire department from engaging in certain activities may not be subject to civil liability, if it is decided that such actions are to be undertaken by the fire department and those actions are performed negligently, the municipality would be exposed to civil liability. The duties and powers imposed upon a municipality under its enabling legislation can impact on its liability exposure within the "policy" versus "operational" consideration sphere.

For example, legislation requiring inspections of a building and authorizing fire department personnel to enter and inspect the building and make orders against the owner of the building for any safety or fire violations would require such inspectors to perform their duties without negligence. In contrast, a Municipal Act may enable a municipality to establish a fire department and provide fire fighting and fire protection services but such legislation would not necessarily require or make mandatory the formation of such a department.

In Stevens and Wilson v. Chatham, supra, the Ontario Court of Appeal held that there was no obligation upon a municipality in that province to maintain a fire brigade, and no obligation to take charge and extinguish fires that occur within that municipality. Accordingly, the formation of a fire department would be a policy decision.

Once that policy decision is made however, and a department established, the municipality can be held liable for any negligent acts or omissions by the department members in the performance of their duties where such acts are performed within the municipality's operational sphere. The cases of Hammond v. Wabana (Town) , supra, Kamloops v. Neilson, supra, Bayus v. Coquitlam (City) (1993), 16 M.P.L.R. (2d) 205 (B.C.S.C.) and Dunsmore v. Whitehorse (1985), 5 W.W.R. 708 (Y.T.S.C.), all helped in establishing the principle that once policy decisions are made to establish a fire department, the municipality must ensure that the operation of that department is without negligence.

III Standard of Care

As is evident from the above-noted cases, the Courts have established that municipalities owe a duty of care to members of their community to ensure that fire departments conduct their response to a fire in a reasonable manner and without negligence. Whether or not such response is performed in a negligent manner is determined by the standard of care which the municipality or its fire department is required to meet. In Just v. British Columbia, supra, it was stated:

> "The requisite standard of care to be applied to the particular operation must be assessed in light of all the surrounding circumstances, including, for

example, budgetary restraints in the availability of qualified personnel and equipment."

In Bayus v. Coquitlam (City), supra, the Court held that the standard of care that a community should accept from its fire department is a "high standard of service, consistent with the resources the community has made available for fire protection..." and the community is entitled to expect that the members of its fire department will do the best job they can with the resources available. The standard of care is based upon the particular circumstances of that department and the community is not entitled to expect either perfection or a standard applicable to the best trained, best equipped and most competent fire department.

The Courts have recognized the difference between professional and volunteer fire departments. In Hammond v. Wabana (Town), supra, the Court considered the standard of care applicable to volunteer fire departments. In the majority decision of the Newfoundland Court of Appeal it was held that the volunteer fire department met the appropriate standard of care in the circumstances because, although the fire fighters could have handled the situation better, they did not do anything to worsen the situation. The standard expected of a volunteer fire department and its members is that, with the resources available to them, they will do their best to suppress the fire. A bona fide decision or action will not be open to question unless it causes the worsening of the fire and is a substantial departure from the basic principles of fire fighting.

In considering the particular nature of a volunteer fire department, the Court made the following comments:

"A community which establishes a volunteer fire fighting service does so because it recognizes the need to be able to respond quickly to situations which may threaten life and, secondarily, property. It is expected that volunteer firefighters will undertake activity that poses a risk. A volunteer firefighter is unpaid and is acting outside the normal area of work, training or experience; firefighting is not a sport and it does not bring with it the exhilaration of mountain climbing or parachute jumping. Firefighting is a dirty, dangerous activity, undertaken not when you feel like it or when weather permits, but when the alarm bell rings. The Judge concluded that in his view the motivation to put oneself at risk derives primarily from the desire to provide a measure of protection for the individuals in the community and that the expectation of the community is that those who volunteer for firefighting duty are willing to put themselves at risk to provide a degree of life and safety protection for the residents of the community. In sum, the

undertaking of a volunteer firefighter is purely a public service rendered without expectation of remuneration or reward."

With respect to the standard of care the Court stated:

"The standard of care must be expressed in terms that make it appropriate to volunteer fire fighters who have very little training, experience, and obliged to rely on imperfect equipment and a dubious water supply."

"The standard of care may be influenced, at least to some extent, by such factors as training, equipment and resources available. Presumably a community would expect a higher level of skill and a more consistent record of success from a very experienced, efficient and well-trained fire department, using the latest equipment, than it would of a fire department with little experience, negligible training and minimal antiquated equipment. The standard of care must be one that recognizes the local situation and the particular fire fighters in question."

Other factors the Court considered were:

1. Was the size of the fire unusual for the area?
2. How much experience did the fire fighters have on a fire that size?
3. If the fire department is accused of negligence by omission, what was the reason / motivation for the omission? If the omission was done for the safety of the inexperience volunteers, than an omission that may be negligent for a professional fire fighter may not be a negligent omission for a volunteer.

The minority of the Newfoundland Court of Appeal strongly expressed its contrary view and found that the volunteer fire department did not meet the appropriate standard of care in the circumstances. The minority found that the volunteer fire department was negligent, despite equipment and logistical difficulties due to the nature of a volunteer department, for the following reasons:

1. Failing to gain access to the fire;
2. Failing to provide ventilation;
3. Failing to protect the exposures; and
4. Failing to call for assistance from a professional fire department earlier.

The Plaintiff in Hammond applied to the Supreme Court of Canada for leave to appeal. On December 2, 1999, the application for leave to appeal was dismissed without Reasons.

In Killip's Television Service Ltd. v. Stony Plain (Town) [2000] A.J. No. 145 2000 ABQB 79 the Alberta Court of Queens Bench considered the issue of the applicable standard of care for a volunteer fire department. After considering the Hammond, supra, decision, the Alberta Court held that the Hammond standard, while appropriate for the Wabana circumstances, did not lend itself to the wide application needed for the many and various types of volunteer fire department serving the majority of Canadian communities.

Combining the concept of reasonableness with the particular circumstances of the fire department in question, allows for the flexibility which is required to enable the standards to serve the broad variety of circumstances which exist in Canada, including circumstances such as those in the Wabana case. The Alberta Court stated that "like circumstances" and "like resources" allow for consideration of the subjective matters which were deemed so important in Hammond, such as community expectations, degree of concern for firefighter safety, the nature of the training, and the equipment available.

The Alberta Court considered the following appropriate articulation of the standard of care:

> The volunteer fire department must perform in a manner which is reasonable for a volunteer fire department in like circumstances and with like resources.
>
> There may be circumstances in which a volunteer fire department will have met the standard of care despite the substantial breach of basic firefighting principles. Whether a substantial breach will be unreasonable will depend on the circumstances relevant to the standard of care as well as the nature of the fire and its surrounding conditions.

In the Killip's case, the Fire Departments had provided basic training to their firefighters. Some firefighters benefitted from training in addition to basic training. The resources available to each department were adequate to fight the types of fires most common in the two communities. Water supply was adequate. It was reasonable for the taxpayers to expect this fire to be fought giving high priority to firefighter safety, and generally in compliance with basic firefighting principles. Therefore, for this fire, substantial departure from those principles generally would not be reasonable, even though most structural fires make up only about 10% of the Stony Plain's Fire Department's work, and this fire was the most difficult one faced by some of the firefighters who testified.

Another recent unreported decision, from Ontario, is Gallagher v. Burlington (City) (7 February, 1994), (Ont. Gen. Div.), which identifies that the fire department of Burlington is made up of both professional and volunteer units, with back-up volunteers for the

professional units. The fire department is co-ordinated through a central system. The qualifications of the fire fighters, either at the regular or supervisory level, were not discussed. Nonetheless, the Court held that the community was entitled to expect a high standard of service from the fire department, consistent with the resources the community made available for fire protection. The fact that some of the fire fighters attending the fire in question may have been volunteers was not identified, nor were its implications discussed.

In *British Columbia v. Canadian Forest Products Ltd.* (2002), 100 B.C.L.R. (3d) 144 (C.A.) the Province was seeking to recover lost revenue from the destruction of a forest by fire. The fire was caused by an unextinguished holdover fire from burning procedures undertaken by Canadian Forest Products during the previous winter. The fire appeared to originate from the burning process to consume logging waste in the landing area. The Court found that the monitoring process adopted by Canadian Forest Products in the areas where there had been burnings over the winter was seriously deficient. The Court found that, even after learning about reports of smoke in the area where the fire occurred, and despite requests by employees familiar with the area to have infrared scanning performed, Canadian Forest Products neglected to do so. The Court found this to be a serious omission. Regarding the standard of care, the Court stated:

> "The standard of care is exacting. All reasonable precautions must be taken.
>
> In *Tahsis*, the Court cited, with approval, and emphasized, the following principle:
>
> "I would go so far as to say that in a case of the present class, no precaution which was commercially practical ought to have been omitted, and any omission of a practicable precaution would constitute a failure of duty.
>
> The defendants' omissions depriving it of the opportunity to locate, and extinguish, the hold over fire, constituted a failure to meet the standard of care imposed upon it."

This exacting standard of care referred to by the Court applies to a commercial operation that is setting fires in the course of its business. This standard of care would not apply to a fire department responding to a call.

The Court did, however, state that the Ministry of Forests had a responsibility to safeguard the forests of the Province and to be in a position to take swift and effective action when a forest fire breaks out. The Court concluded that the fire fighting operation of the Ministry contributed to the Province's damages. The Court stated:

> "There may have been some lack of effective coordination by Mr. Saunders (perhaps it was just too large a fire for someone of his experience), and the back burn error that occurred on the evening of the 29th of June was a serious error and one that increased the risk and increased the area of burned forest. I have no doubt that this specific operation fell below acceptable fire fighting standards and increased the harm by expanding the area of the fire."

The Court did note that Ministry employees were faced with an emergent situation, and had to respond to it without the luxuries of time and reflection. However, this fact did not exonerate the problems from liability, but was simply taken into account in reducing the Province's contributory negligence from 50% as apportioned by the trial judge, to 30% as varied by the Court of Appeal. The Court found that Canadian Forest Products had a higher degree of blameworthiness for what ultimately occurred and apportioned 70% of the liability for the Province's losses against it.

In Haag v. Marshall (1989), 39 B.C.L.R. (2d) 205 (C.A.), the Court held:

> "In cases of professional negligence above all, with many difficult and varied situations met, if a Plaintiff hopes to succeed on the grounds of lack of competency, it must be fairly demonstrated that it has fallen below an established standard or practice in the profession."

In Laurentide Motels Ltd. et al. v. Ville de Beauport et al., (1984) 45 M.P.L.R. 1 (S.C.C.), the trial judge's decision, as supported by the Supreme Court of Canada, resulted in a significant liability finding against the municipality on the following basis:

1. Once a municipality makes a policy decision to establish a fire department it has then moved into the operational sphere and must ensure that there is a practical execution of its policy decision. Through the adoption of bylaws the municipality can define its own limits of liability;
2. The municipality had intended to operate the water and firefighting services which it created and held liable for its negligence in failing to check and maintain fire hydrants;
3. There was negligence on the part of the fire department and the fire chief for choosing fire fighting methods contrary to the rules of caution in the circumstances, unwarranted delay in calling for mutual aid and lack of foresight and negligence in the use of the aforementioned fire hydrants.

The Beaufort Fire Department had responded to a reported fire at the Plaintiff hotel and had discharged the 500 gallons of water available from its pumper truck without having fully extinguished the fire. The fire crew was unable to locate a fire hydrant initially and

ultimately found hydrants buried in snow and frozen. Approximately 40 minutes after the initial call a workable hydrant was located and they were able to recharge their lines and continue their suppression efforts. Unfortunately by that time the fire had re-established itself and destroyed the premises.

In St. James v. Squamish District Fire Department (18 December, 1986), Vancouver Registry, No. C851 767 (B.C.S.C.), the Court established liability on the basis of the rekindling of a fire. The Plaintiff had reported a fire to the Squamish Fire Department which in turn attended and extinguished the fire. There was some overhaul at the scene but approximately three hours after the fire department left the Plaintiff's residence a second fire was reported. Expert evidence was led that the fire fighters did not follow standard fire prevention and overhaul practices but the presiding judge confirmed that absolute perfection was not demanded of these fire fighters although they must meet an accepted standard which; in the opinion of the trial judge, would be virtually universal and if not universal, at least the same throughout North America.

It was determined that the fire department's actions at the Plaintiff's premises were operational and not policy and the duty of the fire department in responding to the call was to extinguish the fire and make sure that it would not rekindle. Since this was not done liability was found against the fire department.

As noted above, the Riverscourt Farms v. Niagara On The Lake, supra, decision, dealt with a situation where an inadequate supply of water prevented the responding fire department from extinguishing a fire at the Plaintiffs premises. The municipality was aware of the water supply shortfall prior to the fire 'and the fire chief had warned the town counsel about the situation. It was clearly foreseeable that in the event of a fire excessive damage could occur due to the shortage of water. At issue was whether or not this was a policy or operational sphere decision. The Plaintiff had argued that once the municipality made the decision to have a water system and a fire department, it followed that it was required to make such plans operational. In the absence of such operational abilities the municipality should have drafted a bylaw which would have limited its liability due to a lack of resources. While no such bylaw was issued the presiding judge held that this was not necessary and that the decision of the town counsel was a policy decision. Accordingly, he declined the Plaintiff's argument that liability rested with the municipality for damages flowing from the inadequate water supply.

In Bell v. Winnipeg (City) and Moist (1993), 86 Man., R. (2d), 89 (File No. Cl 86-01-0922 (Man. Ct. Q.B.), the Plaintiff sued the City and the fire chief for damages after his home was destroyed by fire. The Plaintiff's daughter had contacted the fire department but unfortunately had given the wrong directions resulting in a response time of over 15 minutes. By the time of the fire department's arrival the Plaintiff's home was totally involved

in fire and muddy road conditions and no fire hydrant access complicated the situation. A water lagoon in close proximity to the premises was accessed via a pump.

While it was argued that the dispatcher was negligent in failing to establish accurate directions to the fire scene the judge concluded that responsibility ultimately rested with the Plaintiff in that regard. The judge further held that the responding fire departments were adequately trained and equipped and despite the implementation of effective firefighting methods the degree of involvement of the fire was too great to allow suppression upon the fire department's arrival on the scene.

The Just v. British Columbia, supra, decision expressly stated that the manner and quality of an inspection system is operational in nature and therefore creates a duty of care. In Barrat v. District of North Vancouver (1980), 114 D.L.R. (3d) 577 (S.C.C.), the Supreme Court of Canada held that the determination of the frequency of such inspections was a matter of policy and solely within the municipality's discretion. While each of those cases pertained to transportation services as opposed to fire fighting departments, the principals established are applicable to inspections made by fire department members. An example of this would be the potential exposure on fire departments arising out of routine by-law inspections wherein the inspector fails to note and enforce infractions which subsequently cause or contribute to the occurrence of a fire or the resulting damage. In addition to this there is potential exposure pertaining to such issues as the failure to enforce by-laws pertaining to the restriction of propane tanks within buildings. Commonly large apartment buildings have propane barbecues on every balcony which could potentially cause or contribute to the occurrence of or damage resulting from a fire.

As previously noted, the Kamloops v. Neilson, supra, decision, established the distinction between policy and operational duties. In Jung v. District of Burnaby (1978), 91 D.L.R. (3d) 592 (B.C.S.C.), an employee at the Municipal Fire Department had advised the Plaintiff that its building complied with fire code regulations when in fact no such compliance existed. The Plaintiff purchased the building but argued that it would not have done so if the Defendant had communicated the true compliance status. The Court held that the municipality was liable for the damages incurred by the Plaintiff in having to comply with fire regulations following the purchase of the property.

In Bayus v. Coquitlam, supra, it was held that the Defendant municipality owed a duty of care to the Plaintiff to ensure that the fire department carried out its response in a reasonable manner. The City had failed to maintain current maps and accordingly the fire department took approximately twice as much time as the Court felt was reasonable in responding to the fire. The Court held that the delay had occurred because the City had breached its duty of care to the Plaintiff in failing to ensure that all of its fire fighters had adequate knowledge of the outlying areas of the City, in failing to ensure that its fire

fighters maintained the technical standards of fire fighting required of them and in failing to provide and maintain accurate maps of the City and its outlying areas for the members of the fire department.

Dispatching of fire department personnel can also lead to findings of negligence against a municipality or its fire department. Hachey v. Bathurst (City) (1990), 3 M.P.L.R. (2d) 195 (N.B.Q.B.), held that acts or omissions by emergency dispatchers fall within a municipality's operational sphere and are therefore subject to a duty of care. While each case must be examined in light of its particular fact situation some general guidelines have been established vis-a-vis dispatcher liability.

In Hachey v. Bathurst, supra, a dispatcher was erroneously advised that the Plaintiff's home was located outside the City boundaries when in fact it was within those boundaries. The trial judge held the dispatcher negligent in relying on the caller's confused directions without making further enquiries before dispatching another fire department to the home when the area was within the City boundaries. On appeal this decision was reversed however as the Court found the dispatcher had acted prudently by making two enquiries of the caller regarding the location of the home vis-a-vis the City boundaries. The Court of Appeal did approve the principle that dispatchers must exercise considerable judgment when dealing with emergency situations and the conduct in question must be examined in light of the prevailing circumstances.

IV Proximate Cause of Loss

In a negligence action the Plaintiff must prove that the breach of duty of care by the defendant fire department or municipality caused damages to the Plaintiff. The damage must be as a direct and immediate consequence of the negligent action. The department must be shown to have been responsible for the direct and immediate consequences of its negligence.

In Kamloops v. Neilson, supra, the Court held that only loss due to the breach of the duty of care of the municipality will be compensable in damages.

The Courts may apportion liability between Defendants as well as between the Plaintiff and the Defendants. The imposition of liability against a fire department may result in a finding of liability for those damages arising out of that negligence. Bayus v. Coquitlam (City), supra, was one such case. The Court found that the fire department's actions had resulted in a delay in commencing fire suppression efforts at a critical point in the progression of the fire. The Court concluded that had the suppression efforts been commenced earlier there would have been less damage to the Plaintiffs property and accordingly apportioned 15% of the liability on the fire department.

In Hudson v. Riverdale Colony of Hutterian Brethren (1980), 114 D.L.R. (3d) 352 (Man. C.A.), the Court found a fire department negligent in setting a secondary fire designed to eliminate fuel for the primary fire. The secondary fire went out of control resulting in damage to the Plaintiff's premises. The Court held that the fire department was equally to blame for the fire and apportioned 50% liability as the department's negligence caused or contributed to the Plaintiff's ultimate damages.

In *British Columbia v. Canadian Forest Products Ltd., supra*, the Court of Appeal overturned the trial Court's finding of equal responsibility as between Canadian Forest Products which negligently started and failed to detect a fire and the Province which was negligent in fighting the fire. The Court of Appeal acknowledged that the Province's operation fell below acceptable fire fighting standards, but also noted that they were faced with an emergent situation and had to respond to it without the luxuries of time and reflection. This was taken into account in varying the Province's responsibility to 30% from the 50% found by the trial judge. The Court did not however find that the emergent situation absolved the Province from its negligence for lack of effective coordination and a back burn error which increased the scope of the fire.

V Exclusions of Liability

As noted at the outset of this paper, there has been an increase in successful negligence actions against municipalities and their fire departments. In an effort to limit such liability exposure municipalities should review their empowering statutes and bylaws to determine whether there is any legislation providing that fire fighting services be considered a decision within the policy sphere of the municipality and therefore be exempt from civil liability. If a decision falls within the operational sphere, liability will attach if the fire department is negligent in the performance of its duties. Bylaws can be drafted however to restrict the scope of the operational sphere.

Fire departments and municipalities should also be aware of what statutory duties the department may have. Fire departments should be aware not to undertake or perform services that they are not under a duty to perform. It must be kept in mind that once a municipality makes a policy decision to have a fire department there is a legal obligation that it become properly operational. Command decisions made at the fire scene during the course of fire suppression efforts will be subject to considerable sympathy from the Court. Fire departments' training and education programs however will be scrutinized. Particular attention should be devoted to overhauling fire scenes to ensure that no rekindling occurs. As previously noted, while absolute perfection is not required, if a fire department's efforts fall below an acceptable standard liability exposure may result.

VII Conclusion

Recent decisions such as Laurentide Motels v. Ville de Beauport, supra, and Bayus v. Coquitlam (City), supra, have established that the Courts will impose liability on fire departments if their response time is not within acceptable standards. Similarly, cases such as St. James v. Squamish, supra and Densmore v. Whitehorse , supra, have established that where departments are not diligent in their overhauling of fire scenes and a re-ignition of the fire occurs, again an apportionment of liability will be made against the fire departments to reflect their negligence. In the past the Courts were inclined to overlook such transgressions as the overall concern of the Courts was to ensure that fire departments continued their fire fighting efforts without being preoccupied with liability exposure for improper procedures or questionable decisions.

The evolution of fire department liability goes hand-in-hand with the overall decrease in government immunity and the expanding area of municipal and professional liability. More and more the Courts have implemented the apportionment of liability to parties which in the past may have been forgiven for their mistakes on the basis that the overall good which they offered to the community outweighed the detrimental results of those individual errors.

Society as a whole has moved toward a less forgiving approach to negligence and the Courts have reflected society's desire to apportion responsibility to those individuals or entities which have caused damage to others as a result of their negligence.

It is hoped that this paper has provided some insight into the recent developments in fire department liability and the direction in which the Courts appear to be headed on such issues in the future.

Appendix D

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

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.

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

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.

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/

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

Appendix E

Residential Fire Sprinklers For Life Safety

An Economic and Insurance Perspective

Prepared for the Orange County Fire Authority, California

February 25, 2001

By: ***Buddy Dewar***
National Fire Sprinkler Association

Executive Summary

- A review of current economic literature, specifically *elasticity of demand* research conducted by third parties not associated with the stakeholders of this issue, clearly indicates that a 1% increase in the cost of the construction of a new home caused by installing a fire sprinkler system will not cause the potential homebuyer to no longer afford the new home.
- The two decisive factors that dictate what value home at the high limit a potential homebuyer can purchase are the amount of available income for housing and the current mortgage interest rate.
- Fire sprinkler systems can be installed in any value house. Therefore, the potential homebuyer, regardless of the amount of income available for housing, or the mortgage rate, can purchase a new home containing a life safety residential fire sprinkler system.
- There is a propensity for homebuilders to oppose any government mandate that drives up the cost of construction. Homebuilders are speculating what the future sales market will be when they commence construction. The finished product is available for sale many months after construction begins. This forms the foundation for the want to minimize cost drivers when the substantive concern should be changes in the mortgage rates.
- The cost to repair fire structural damage will always be more expensive than water damage caused by fire sprinklers. The potential liability losses from fire will always be greater than the potential water damage losses from fire sprinklers. Recognizing the property and liability savings resulting from the installation of fire sprinklers, all major insurance companies provide for reduced insurance rates for all occupancies including single-family homes.
- To look singularly at and focusing on water damage without analyzing the potential fire losses had the fire sprinkler system not been present is a misrepresentation.
- The many myths shadowing fire sprinkler systems need to be understood. Each fire sprinkler operates independently, not the total flooding of buildings as frequently portrayed in movies. The odds of an inadvertent or accidental discharge of a fire sprinkler have been reported by one national testing laboratory to be in the millions to one.
- Insurance companies consider water damage in the amount of the insurance reduction it provides for various occupancies. Some commercial properties can receive as much as a 75% reduction in its insurance rates. This author receives a 10% reduction for the fire sprinkler system installed in my single-family home. Both these figures were derived after considering water damage repair costs; again fire damage is always greater than sprinkler water damage.
- The National Institute of Science and Technology reports a potential 82% reduction in fire deaths should fire sprinklers be installed in all residential occupancies. Accordingly, the potential owner must be afforded fire sprinkler protection for their family. Those homebuilders who do not install affordable fire sprinklers are at the peril of the legal system as they know or should have known the life safety benefits of residential fire sprinkler systems.

Residential Fire Sprinklers for Life Safety: An Economic and Insurance Perspective

I. INTRODUCTION

The United States has one of the highest fire loss rates of the industrialized world - in both terms of fire deaths and fire losses. This unenviable status has mystified world fire service experts because the solution to significantly reduce the fire death rate is available and affordable. The simple solution to minimize our nation's fire death rate is residential fire sprinklers. But there exists opposition to installing these new technologically advanced residential fire sprinklers because of economic reasons. This paper will focus on the economic concerns of installing residential fire sprinklers with specific focus on ***affordable housing*** and ***insurance rate reductions.*** We will discuss the U.S. fire problem as well as the cost of installing residential fire sprinklers. We will analyze the impact of an increase in the asset price for new housing by discussing the many underlying forces that affect supply and demand of housing. We will also discuss actions that may be taken by local government to make the installation of residential fire sprinklers economically palatable for the homebuilder and the public.

II. LITERATURE REVIEW - THE FIRE PROBLEM

The United States has led the industrialized world in fire deaths and fire losses for decades. Is the U.S. fire problem getting any better? The United States Fire Administration studied the fire death rates of 14 industrialized nations for the period of 1979 to 1992. The United States fire death rate fell 46.3 percent, from 36.3 fire deaths per million population in 1979 to 19.5 fire deaths per million population in 1992 and averaged 26.5 fire deaths per million population during this 13-year period.

(Figure 1). This study also shows that while the United States has shown remarkable improvement in its fire death rate during this period, so have the rest of the industrialized nations. The U.S. fire death rate is over *five* times that of Switzerland, the nation with the lowest rate of all the countries considered in the study (Trends, 1997)

Average Fire Death Rate by Country

(1979-1992)

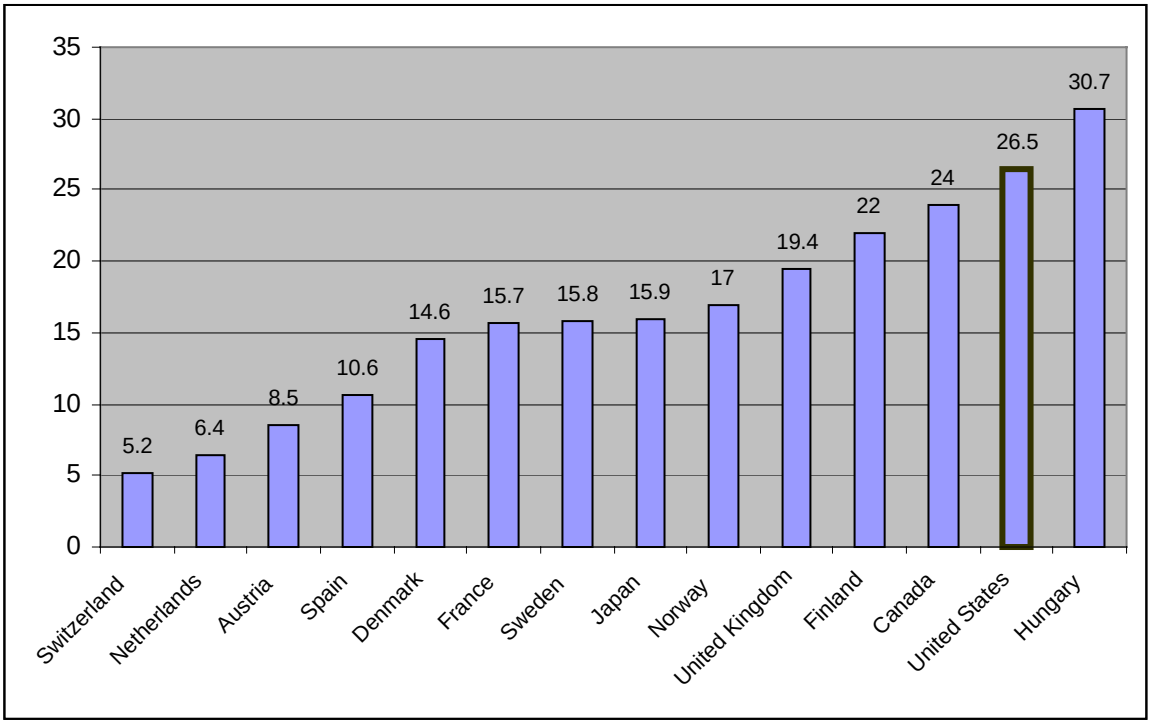


Figure 1. Source: *Fire Death Rate Trends: An International Perspective*

The U.S. fire death rate reduction has largely been attributed to the use of smoke detection devices in residential occupancies. However, smoke detection technological advances also contributed to the international fire death rate reduction still keeping the U.S. with its high fire death rate country status. The Consumer Products Safety Commission estimates that 88 percent of U.S. households have at

least one smoke detector (Smoke Detector, 1994). Technology has made smoke detection devices affordable and reliable when properly maintained. Disturbing is the report that in 14.8 percent of residential fires resulting in death the smoke detector failed to operate largely because of poor battery maintenance (Fire, 1997). But even more disturbing, smoke detectors did, in fact, operate in 19 percent of fires in which a death occurred. This is most disturbing since there is widespread belief that an operating smoke detector is a near failsafe fire safety device. In some of these cases, the detector may have gone off too late to allow the victim ample time to safety exit or the victim may have been too inebriated or feeble to react. (Fire, 1997)

What has the fire services so mystified is the reality that these fire deaths can be ***reduced by an estimated 82%*** if new technology residential fire sprinklers were installed along with the smoke detectors (Ruegg, 1984). Using the 10-year average of U.S. fire deaths from 1985-1994 of 5,770 fire deaths per year, an 82% reduction means that over 4,700 people a year during this period would have survived the fire (Fire, 1997).

While the installation of fire sprinklers have become more widespread in commercial structures, not so for residential occupancies where 71% of all our fire deaths occur (Fire, 1997). One reason the installation of fire sprinklers in residential occupancies is not so wide spread is concerns about the cost. *Homebuilders frequently argue that increased costs chase away or limit the pool of potential buyers, a myth dispelled by and is the main focus of this paper.*

The national model building codes allow for construction tradeoffs when fire sprinkler systems are installed. Tradeoffs such as reduced fire resistant ratings,

travel distance extension thereby allowing less stairways, increases in the size of the area requiring fire stopping, and a multitude of other tradeoffs provide cost savings to the developer when buildings are designed with fire sprinklers and these tradeoffs used (SBC, 1997). The Florida Legislature in 1993 passed a law requiring all new buildings three stories and above to be built with fire sprinklers installed. While it took some developers time to adjust their construction plans and specifications to include fire sprinklers and take advantage of these building code allowed tradeoffs, today this progressive law meets with little opposition because the construction cost savings far out weigh the added expense of installing the fire sprinkler. In most cases, the building can be built at a much lower cost per square foot with the fire sprinkler system and taking advantage of the code allowed tradeoffs, and often the dollar cost savings per square foot of construction is substantial (Advantage, 1997). Recent statistics from the National Fire Protection Association shows impressive results of installing fire sprinkler systems in residential occupancies. The fire death rate per thousand fires in hotel and motel occupancies is 1.6 in fire sprinkler equipped properties and 9.1 in hotels and motels with no fire sprinklers (U.S. Experience, 1998). With fire safety problems controlled in new high-rise or three-story and above structures thus minimizing the potential for large loss of life from a single fire, the focus now turns to one- and two-family dwellings.

While our nation's fire service is most interested in *retrofitting* residential fire sprinklers in existing homes, the political reality of making this happen, coupled with the increased cost of retrofit verses new construction makes the enactment of retrofit fire sprinklers ordinances for existing single-family homes not a viable option. But the

installation of fire sprinklers in new constructed homes must be considered. The National Association of Home Builders reports that from 1985 to 1997, 13,704,000 new homes were built in the U.S. This averages to 1,054,000 homes per year during this 13-year period (Characteristics, 1997). This means that if affordable fire sprinkler systems could be installed in these new single-family homes, over one million families each year will receive the superior life safety protection features provided by residential fire sprinklers.

The construction tradeoffs allowed by the building code in three-story and above new construction property make fire sprinkler systems affordable, actually a cost savings in almost all cases. Cost savings from these construction tradeoffs do not hold true for the one- and two-family dwelling. There simply are not enough construction tradeoffs available in the national building codes to offset the cost of installing fire sprinklers in the one- and two-family dwelling. However, insurance savings help recover the cost of the system in the long-run.

The manufacturers of fire sprinkler products have spent many dollars on new innovative technology in an effort to make the installation of residential fire sprinkler systems in these small dwellings affordable. The invent of residential quick response fire sprinklers has resulted in a significant reduction in the water volume and pressure needed to successfully control a fire meaning less water, smaller pipes, thus, lower costs (FYI, 1996). In Germantown, Tennessee, one fire sprinkler contractor is installing residential fire sprinklers in these single-family homes at a cost of $0.84 per square foot (Security, 1998). This amounts to an average slightly over a 1% increase in construction costs. In Altamonte Springs, Florida, Steve Randall, Chief Building

and Fire Official, reports that a new technology fire sprinkler system was installed at a cost of $0.38 per square foot or well under 1% of the construction costs (Altamonte, 1998). ***Assuming that there are no impact fees or other governmentally imposed taxes, fees, or other cost drivers that will escalate the cost of the fire sprinkler system, a 1% increase in the cost of construction appears to be an appropriate measure of the impact of installing residential fire sprinklers in new homes.*** Still, with this minor cost adjustment, homebuilders typically object to the added cost of the residential fire sprinkler system because they erroneously suggest that the added cost means a decline in the pool of potential buyers.

While this paper focuses on economic issues, it is appropriate to discuss externalities that also act as a barrier to the installation of fire sprinkler systems. Some developers, whose reliance on subcontractors to complete a new home in a timely basis, are reluctant to add another subcontractor to the list of people they must coordinate. They argue that conflicting work schedules of subcontractors and the need for one to complete work before another trade can begin its work is a substantive issue and adding another subcontractor exacerbates an already bad situation. Security Fire Protection, a progressive Memphis sprinkler contractor, has developed a solution to this subcontracting dilemma. Once the electrical contractor has placed its last wire in the attic space, the fire sprinkler installer shows up at the job site at 5:00 PM and by the next morning, the bulk of the fire sprinkler system is installed. The dry wall contractor simply cuts out a hole for the fire sprinkler drop in the same manner as they would prepare the walls for an electrical outlet. Later the

fire sprinkler installer will return to adjust the fire sprinkler drops and finalize the installation, activities that typically take a couple of hours (Security, 1998).

III. LITERATURE REVIEW - THE ECONOMIC ISSUES

The substantive issue facing the Orange County Fire Authority is the challenge from builders who argue that the cost of adding fire sprinklers in residential occupancies is causing a decline in affordable housing. It is my understanding that the Orange County Fire Authority has adopted an ordinance requiring residential occupancies 6,000 square feet and larger to be protected by a residential fire sprinkler system and that this square foot threshold was established after evaluation of its first responding unit's fire suppression capability. Surely the builders are not arguing that the added cost of the fire sprinkler system is chasing away potential buyers of a 6,000 square foot single-family home? Not many people can afford a single-family home of this size. Thus, the builders must be arguing that a 1% increase in construction costs is chasing away potential condominium or townhouse buyers. And the bigger the building, the greater the savings from construction trade-offs allowed by the code. How significant is a 1% increase in construction costs on the demand for new housing? To answer this question, we will investigate the basic forces underlying the supply and demand for housing – ***prices, demographic changes and population shifts, income, cost and availability of credit, the cost of rental housing, and consumer preferences*** (Smith, 1969). We will be reviewing current literature in the field of elasticity of supply and demand for many of these underlying factors. First, it is important to understand the complexity of the housing market in an economic perspective. At the time the homeowner buys a home,

condominium or a townhouse, the transaction is best labeled as an investment in a particular asset, *housing stock.* During the time after occupancy, it is possible to define the consumption of housing services including many variables like the annual cost of debt, the opportunity cost of equity in the house, depreciation and maintenance, and the effect of homeownership upon tax liabilities. Thus, recognition of this dual nature of housing - *housing is both an investment good and a consumption good* - is essential to understanding the market for owner-occupied housing (Follain, 1992). The cause and effects of the price of housing is a more complex issue than for an ordinary consumption good because one must consider that housing is both a consumption and an investment good.

A. Price. Price impacts both the supply and demand for housing and both are time sensitive. The focus of this paper is to determine if a minor increase (1%) in the price of a new home, condominium, or townhouse has a *substantive* impact on the ability of the homebuilder to sell new housing stock, ***the demand for housing.*** Price-elasticity of demand is defined *as the percentage change in new home sales divided by the percentage change in price.* Elasticity is a ***measurement*** of ***responsiveness.*** The word "measure" means that elasticity results are reported as numbers, or *elasticity coefficients.* The word "responsiveness" means that there is a stimulus-reaction involved. Some change or stimulus (1% increase in price) causes people to react by changing their behavior (forgo buying a new house), and elasticity measures the extent to which people react. If the price-elasticity of demand coefficient is greater than 1, the demand is then elastic. When the demand is elastic,

a small change in price has a relative big change in quantity consumed. Figure 2 shows an elastic demand curve.

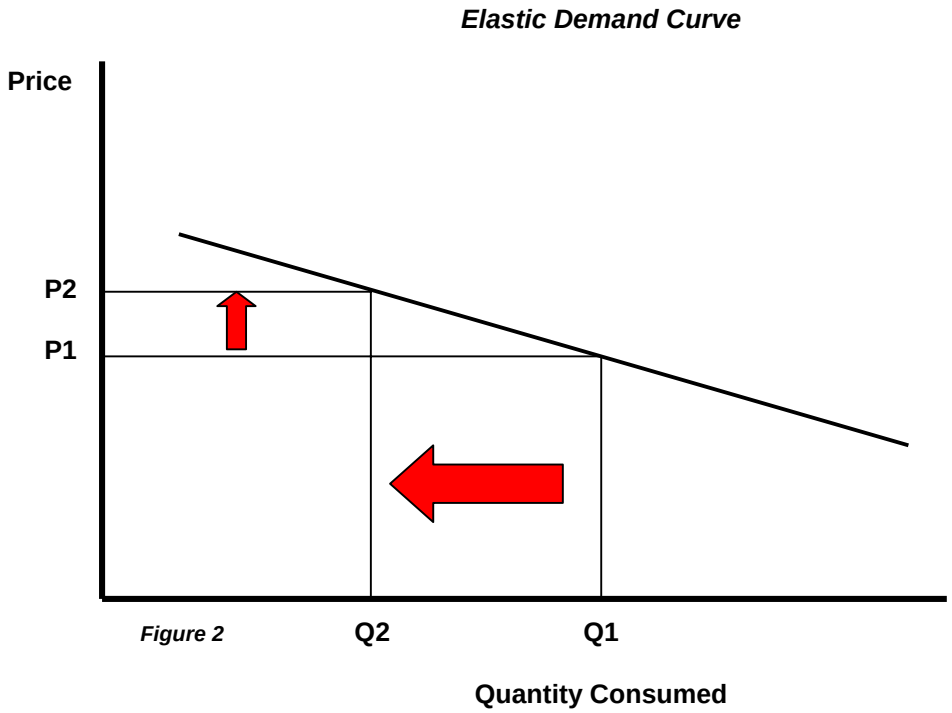


Figure 2

The price at P1 was increased to P2. The corresponding shift of quantity consumed from Q1 to Q2 represents a significant reduction in quantity consumed when compared to the price increase. When price-elasticity of demand is considered in the context of volume of new homes sold, an elastic demand, *or an elasticity coefficient greater than 1,* means that an increase in the sales price will significantly impact the developer's ability to sell the home, condominium, or townhouse. The greater the elasticity coefficient is above 1, the greater the impact. When the price-elasticity of demand coefficient is greater than 1, as the price increases, the associated decrease in quantity consumed ends in a decrease in revenue (Brickley, 1997).

When the elasticity coefficient is *less than 1,* demand is considered to be *inelastic.* When the demand is inelastic, a change in price will have a small impact on the quantity sold. (Figure 3)

Inelastic Demand Curve

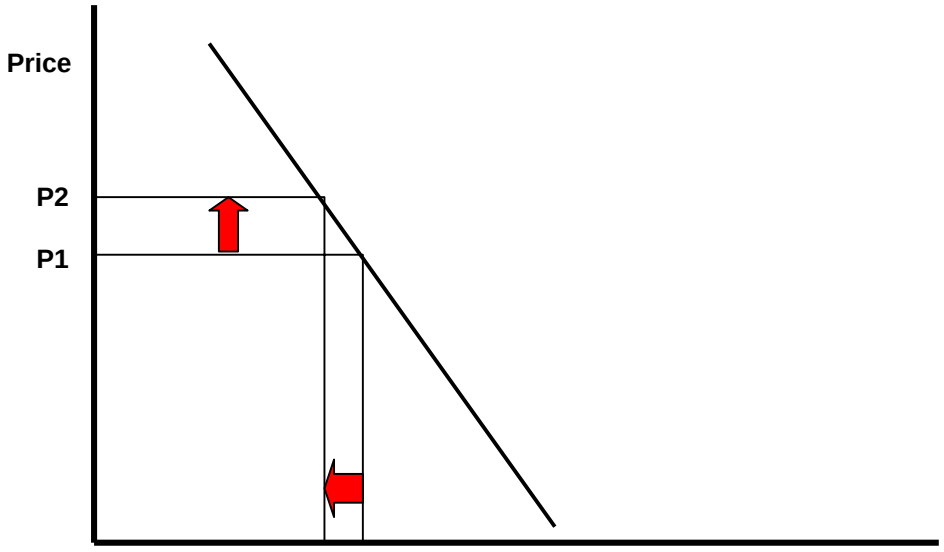


Figure 3

The price at P1 was increased to P2. The corresponding shift of quantity consumed from Q1 to Q2 represents an insignificant reduction in quantity consumed when compared to the price increase. While there is a reduction in the quantity of products consumed when the elasticity of demand coefficient is less than 1, *or inelastic,* the responsiveness of the consumer's preference is insignificantly affected by the increase in price. If the elasticity of demand coefficient is less than one, or inelastic, the increase in price brings in more revenue then that lost by the insignificant reduction in quantity consumed (Brickley, 1997).

Now comes the question what is the price-elasticity of demand for new housing or the percentage change in new home, condominium, and townhouse sales divided by the percentage change in new home prices? Computing price-elasticity is far beyond the scope of this paper. We have, however, researched current writings on elasticity and the housing market in an effort to determine if this demand is *elastic or inelastic.*

In a recent paper, DiPasquale and Weaton (Housing Market, 1992), the price-elasticity of demand was computed numerous times using a series of different adjustment models. The adjustments factored into the equation included the cost of the land, which often is not computed in other studies, and the expected age of ownership. The price-elasticity of demand coefficient for all equations with and without adjustment factors fell between -0.09 to -0.19 or a very *inelastic coefficient* (Housing Market, 1992). While the law of supply and demand dictates that an increase in price will result in a reduction in quantity consumed, an inelastic demand coefficient suggests that the revenues generated by the increase in price offset the lost volume of sales. An elasticity of -0.09 means that for every 1% increase in price, the quantity demanded will decrease by 0.09%. Given the small (5.6%) movement in the homeownership rate over the past three decades, in contrast to the 110% swing in real prices, a very inelastic demand coefficient is reasonable to expect (Housing Market, 1992).

The DiPasquale study produced a lower price-elasticity of demand coefficient than other studies. Quigley's study also produced inelastic coefficients ranging between -0.5 to -0.7 (Quigley, 1979). The difference is that the DiPasquale study

included variables that addressed housing as both a consumption and an investment good while the Quigley study only used consumption good variables.

The price-elasticity of demand being less than 1, as reported in these studies clearly demonstrate that the installation cost of the fire sprinkler system, which relate to a 1% cost increase, will have a negligible impact, if even measurable, on sale of the new home, condominium, or townhouse.

What this all means is that the consumer comes to the table with a set amount of money available to purchase a new home, condominium, or townhouse. The consumer is restricted by the amount of money they bring to the table, not the value of the housing. Again, very few people, and certainly I am not one of them, can afford a 6,000 square foot single-family home, condominium, or townhouse. There are fire sprinklers in $12,500 homes, $25,000 homes, and $250,000 homes. The fire sprinkler system, as the major life safety system from the ravages of fire, should be viewed as essential to the safety and welfare of the occupant just as much as Ground Fault Circuit Interpreters, fire resistant material, earthquake bracing and the many other construction code requirements that are in place to protect the occupant. Surely, the builders are not arguing that those who live in affordable housing should not be given proven fire safety protection?

As indicated earlier, price changes also influence the supply of housing. The elasticity of supply is the percentage change in quantity supplied divided by the percentage change in price. The supply side of the housing equation is a more complex issue with developers particularly with respect to short and long run implications. In the short run, an increase in demand is countered by an increase in

price while supply remains pretty much constant as the time to build a new single-family home could take longer than the period of the increased demand. Thus the developer is speculating what the demand will be months later when the house is completed. With increasing material and labor costs, the homebuilder is always looking for innovative ways to construct the new home at the least cost because of the *uncertainty* of the market once the home is available for sale.

In most studies on housing construction, the production or supply side of new housing units is determined by the price of the house (Follain, 1992). The average price of the new stock increases as this stock grows, because useable land becomes scarcer. High price levels will generate an increased flow of units only until the current stock catches up with the long run supply schedule (Housing Market, 1992). This can be illustrated in a supply and demand graph as in Figure 4.

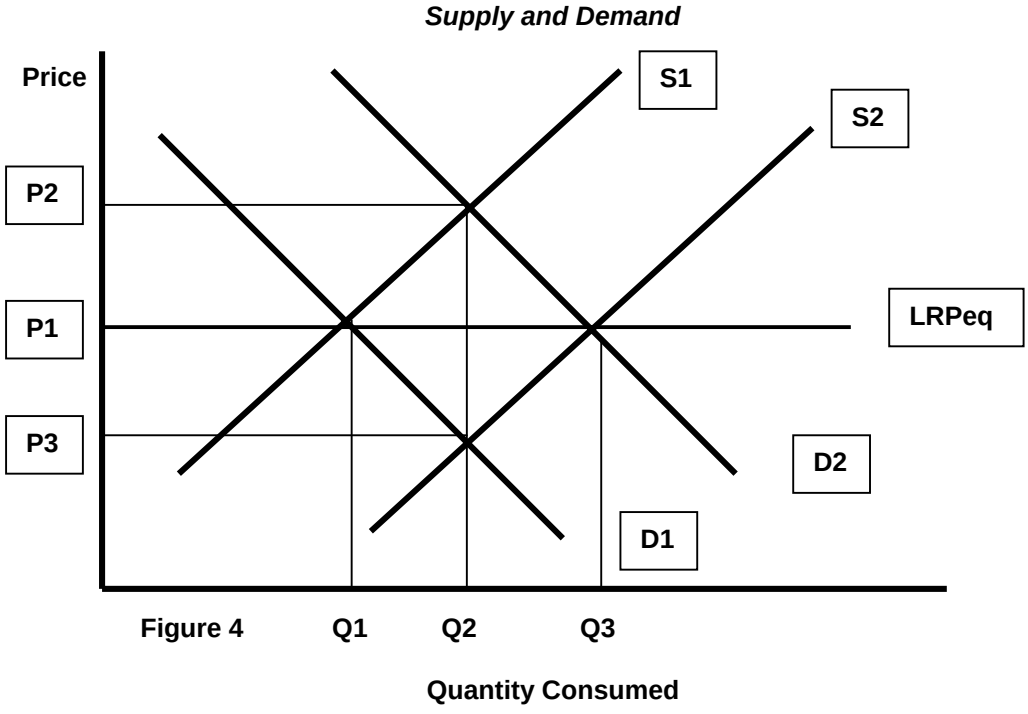


Figure 4

Assuming that some market shock such as increased income or tax incentives causes the demand to shift from D1 to D2. Due to an inelastic supply in the short run (it takes time for construction to react to the demand shift), the price of housing increases from P1 to P2 in response to the increased demand, which also causes the change quantity consumed from Q1 to Q2. Homebuilders, seeing that the long run equilibrium price (LRPeq) is below the current market price, increase production to take advantage of the increased price. As new housing stock enters the market, the supply cure shifts from S1 to S2 at which time the market is again at its long run equilibrium prices. As the prices lower towards equilibrium, consumption increases to Q3. Thus, new construction results from a price that exceeds the long run replacement cost of housing. It therefore can be argued that a 1% increase in price could be beneficial to the developer (Brickley, 1997)

If the housing stock is being produced at the D2-S2 level of long run price equilibrium as shown in Figure 4 and the demand shifts to D1 because of new tax law changes or decreases in disposable income or other negative demand drivers, the homebuilder has few options to survive. The homebuilder has the option of maintaining the higher price level in hopes of finding one with excess disposable income or lowers the price towards P3. Because many actions external to the construction process may cause a negative shift in demand, it is good business practice for the homebuilder to take every action possible to keep construction cost down. ***We suggest that it is the uncertainty of the future housing market that is the foundation of the developer's resistance to adding fire sprinklers, not the fear that a simple 1% added cost will chase away potential buyers. This***

uncertainty in no sense of the imagination justifies opposing life safety systems.

While the impact of a price change is the most substantive issue addressed herein, we will also discuss other factors impacting demand.

B. Demographic Changes and Population Shifts. Demographic changes account for shifts, and sometimes shocks, in the supply and demand for housing. In the short run, population increases may be managed with a relatively fixed housing inventory, but only with a corresponding increase in prices as envisioned from a demand curve shift. In the long run, demographic changes or population increases, especially under conditions of rising real income, is one of, if not the most significant factor in determining the level of new construction, or the supply side of the economic picture (Smith, 1969).

A 1% increase in the cost of constructing the house, even with the assumption that the homebuilder passes this cost on to the consumer in a price increase, will have little to no bearing with respect to the *population factor* underlying the demand for housing. Some states may be experiencing some small areas or regions of negative demographic change. Florida is a rapid growth state with some counties listed in the top ten fastest growth regions of the country. Rapid population growth areas are faced with a fixed market in the short run because of the length of time it takes homebuilders to respond with new housing stock to meet this increase in demand is often considered the long run. The homebuilder's dilemma is to identify the correct volume of new construction to meet population increase created demands. Of concern is making a distinction between demand for new housing

supplies based on population increases or shocks caused by other factors such as tax or income changes (Alm, 1994). If a homebuilder overbuilds because of shock induced demand, a market can become over built, which means a greater supply than needed during aftershock - larger supply means lower prices.

Demographic changes also impact demand for housing. Demographic movement of older age groups has some impact on the ability of the homebuyer to meet mortgage rates. Population increases causes an increase in demand for housing or a shift of the demand curve as shown in Figure 4. With this shift in demand comes an increase in price in the short run. A 1% increase in price to install the fire sprinkler system would be part of, or easily absorbed in, the price increase resulting from changes in population.

C. Income. Income is another underlying factor impacting demand for housing. What we are seeking is a measurement of the sensitivity of demand for new housing to changes in disposable income, which happens to be a definition of income elasticity of demand. All else being equal, an increase in income increases the demand for housing (Follain, 1992). The sudden increase in income cause a shock resulting in a demand curve shift as shown in Figure 4 (Alm, 1994).

Simple logic suggests that a 1% increase in price will have no bearing on the sensitivity of a buyer who comes to the new home with an increased handful of disposable income. The increased income is the force that is causing the potential homebuyer to seek a new home. Now the homebuyer must distinguish between the many unique and comfort features offered in the housing stock. We suggest that the homebuyer will view the smoke detector as a necessity and, given factual

information, will also view the fire sprinkler system as a necessity. Builders are attempting to portray the fire sprinkler systems as anything other than a necessity, thereby causing the homebuyer to judge if the increased income should be disposed on a fire sprinkler system. But, is the potential buyer given the same option of installing other life safety items such as roofing tie downs and earthquake bracing? No, government has established construction standards that must be met for the sole purpose of protecting the homebuyer. The Orange County Fire Authority (OCFA) has established a 6,000 square foot threshold for residential occupancy fire protection. In essence, OCFA is telling the public if they have a structure greater than 6,000 square feet, there is a great chance that first responding fire services will be faced with a fire greater than their suppression capabilities; that additional fire suppression forces must respond to help control the fire; and, the time it will take for the additional responding units to arrive is such that any occupant still in the structure will not survive. With the potential of an 82% reduction in fire deaths, the fire sprinkler system should be viewed as a necessity.

D. Cost and availability of credit. This is the substantive issue with which the Orange County Builders need to focus their concerns for it is the mortgage rate that dictates the house I buy, not the 1% cost increase coming from installing fire sprinklers. Credit variables have a strong influence upon the demand for housing since this demand for most families is quite sensitive to down payments and monthly payment requirements (Smith, 1969). These payments depend upon the nominal purchase price, the mortgage interest rate, the loan to value ratio, and the amortization term of the mortgage. Smith suggests in his study that the main

influence of these credit variables come to bear when the potential homebuyer makes the economic distinction between renting and buying housing, not in distinguishing between housing features (Smith, 1969). He suggests that although more stringent credit terms could reduce the demand for housing, this demand is not absolutely eliminated as much of this is demand being shifted to rental housing (Smith, 1969). Smith continues with the observation that more stringent credit terms will reduce the overall quality of housing services demanded.

Often the homebuyer seeks property that is beyond their capabilities to afford. Instead of seeking a home that is within budget, the dream home financially out of reach or slightly out of reach is sought, this is the American way. When the homebuyer attempts to make the dream house affordable, the necessity of various comfort features within the home is questioned. Often with eliminating or reducing many of the comfort features within the home, the property is still not within budget. Typically there are a number of special features that impact the cost of a new house much greater than the 1% cost increase of a fire sprinkler system. We suggest that many homebuilders view the fire sprinkler system as a special feature that could be deleted when the potential homebuyer attempts to make non-affordable housing affordable. The mindset of the homebuyer and the homebuilder must change to categorize the fire sprinkler system to be as much a necessity as a ground fault circuit interpreter and a smoke detector.

E. The cost of rental housing. The demand for owner-occupied housing depends on the annual cost of its only substitute, rental housing. Demand for rental housing is a function of income and the rental price. When market shocks occur

such as tax credits or income increases, the rental market suffers as renters seek to purchase their own home. The rental market is quick to raise or lower its rent to offset and changes in tax benefits partially to retain its base of renters (Alm, 1994).

One study argues that the elasticity of demand with respect to price for new housing and for rent is practically identical - no significant statistical distinction (Housing Market, 1992). This suggests that a 1% increase in the price of the new home will have very little impact on deciding whether to buy or rent housing. Many new rental properties, at least those three-stories and above built in Florida, are protected with fire sprinkler systems.

F. Consumer preferences. Some of the studies on supply and demand of housing address consumer preferences as location and site. One study suggests that there exists very different housing markets in coastal verses non-coastal locations and that supply and demand elasticity is different between regions (Abraham, 1996). This study also argues that a distinction must be made between metropolitan and urban housing markets to eliminate any potential data bias. This study suggests that consumer preference helps drive prices high in coastal and MSA's housing creating bubbles or periods of unsupportable high prices - bubbles which occasionally burst causing a rapid decline in prices (Abraham, 1996). A 1% increase in the price of a new home, condominium or townhouse from adding a fire sprinkler system would hardly be the focus of concern as many other factors come into play when considering consumer preferences.

Consumer preference is often a factor when determining comfort features of the new home. We must argue that, given factual information on residential fires,

and obtaining a clear picture of fires rapid spread through a home, that the consumer preference will be in strongly in favor of fire sprinkler systems.

G. The Glitter Factor. We shared the *elasticity of demand* literature that clearly indicates that a 1% increase in construction costs will not chase away potential new homebuyers. We suggested that the amount of monthly income that the potential homebuyer can use for housing is the decisive factor. And directed correlated to the amount of money brought to the table is the current home loan interest rates. A potential homebuyer may be able to afford a $100,000 house at today's interest rate. Should the interest rate increase and the amount of money available for monthly payments remains constant, the sales price of the affordable home will reduce for this potential homebuyer. And conversely, should the interest rate decrease, the homebuyer can now afford a more expensive home with their monthly payment. If the potential homebuyer comes to the sale with sufficient money to buy a $100,000 new home at the higher spending limit based upon current interest rates, then all they can afford is a $100,000 home. The substantive issue is that fire sprinkler systems can be installed in the $20,000 new home, the $200,000 new home or any value of home. What the homebuilder wants is a home that will attract the potential homebuyer to choose its new home over the competing new homebuilder and the existing home seller. To make the new home "more sellable," the homebuilder wants to add as much "glitter" to distinguish its home from the competition.

Most new homebuilders have failed to realize that a residential fire sprinkler systems is in fact a the wanted "glitter" that will distinguish its home from the

competition. As reported herein earlier, the National Institute of Science and Technology reports that there will be an 82% reduction in fire deaths in our nation should fire sprinkler systems be placed in residential occupancies. The flaw with this statistic is the remaining 18% of fire deaths not reduced are in fact those occurring outside of the residential setting. Thus, the new homebuilder could easily report that the residential fire sprinkler system installed in its new home will provide almost certain life safety, a very sellable or “glitter” item particularly those homebuyers with young children. While we will not argue that hot tubs, upgraded countertops in kitchens and bathrooms, unique architectural designs, and many other creative features add glitter to the home and make it more sellable. But the want of adding more glitter should not lead to eliminating proven life safety residential fire sprinkler systems. The simple solution is that the residential fire sprinkler system should be considered and promoted as not only an essential life safety system, but also the glitter that they are by the homebuilder. Millions of fire service leaders in the United States recognize the life safety benefits of residential fire sprinklers, the same recognition by the homebuilder is past due.

IV. THE INSURANCE ISSUE.

There are insurance savings for fire sprinklered properties over those not sprinklered. The insurance savings can be substantial. There are hundreds of individual considerations that are visited when analyzing property insurance rating for a specific property. Insurance grading of the fire protection system within a property is not automatic. In fact, over 60% of those who have fire sprinkler systems who read this paper the first time are not be receiving insurance credit for fire sprinkler systems.

Many fully sprinklered properties remain on the insurance roles as a non-sprinklered property simply because somebody did not request that the property be graded. There are various procedures that must be followed before a property is graded with many insurance carriers requesting field inspection fees to recover its costs. The Insurance Services Organization (ISO), Commercial Risk Services surveys property and formulates a list for its member insurance companies to use in determining rates.

A. THE BASE RATE

While base rates differ little between insurance companies, particularly if they all subscribe to a single grading service, there are enough peculiarities in the overall insurance picture for a property that would warrant insurance shopping should your rates become excessive. We will discuss modifications later in this paper but first, the base rate. Commercial Risk Services reported insurance base rate range for a hotel constructed similar to our example hotel as follows:

Hotel Occupancies Insurance Base Rate Per $100 Insured

	Non-Sprinklered	Sprinklered
Building	.257 - .285	.088 - .097
Contents	.512 - .569	.303 - .334

Please understand that these figures reflect non-combustible materials used in construction and a reasonably effective fire suppression force with a reasonable response time to this property location. Multi-story wood frame constructed properties located miles from a responding fire department may have a base rate above these average parameters.

Using the minimum rate for each category, the insurance picture for an $11.25 high rise hotel would be:

Insurance	Non-Sprinklered	Sprinklered
Building	$28,912.50	$ 9,900.00
Contents	$10,240.00	$ 6,060.00
Total	$39,152.50	$15,960.00
Annual Insurance Savings		**$23,192.50**

A new constructed or retrofitted hotel, assuming that it is fully protected with an automatic fire sprinkler system will have saved $23,192.50 per year over the rate that would have been charged had the building been non-sprinklered. Again, new and retrofitted existing properties will not receive this insurance savings unless a fire sprinkler grading request has been made to the insurance company.

B. THE MODIFICATIONS

After the base rate is determined, the insurance carrier modifies the base rates to determine that which will be the final rate. The modification may be a credit or a debit added to the base rate. It is the modification of the base rate that really distinguishes one insurance company from others. Please understand that an insurance company has discretion to grant or not grant modifications. One type of modification is known as "Company Deviation." While Company Deviation is intended to provide proper credit for fire safe communities, this modification factor is often used by the insurance company to remain competitive. Company Deviation is normally no more than ten percent. A "Package Discount" is one type of modification that is easily understood. A Package Discount may be granted if the insurance company is writing most or all of the other lines of coverage. A moderate average package discount would be approximately

twenty percent. Another variable available at the insurance company's discretion is based upon the total premium generated on the risk and is known as a "Size Credit." This is usually no more than fifteen percent. And, additionally, most insurance companies have what is referred to as an "Individual Risk Premium Modification Plan (IRPM)." This underwriting tool permits the insurance company underwriter to debit or credit the premium based on the individual risk characteristics not contemplated in other modifications. Modification rates for IRPM are established and permitted by the State Insurance Commissioner. During a IRPM evaluation, management, employees, the physical condition and maintenance of the property, and other features are analyzed and credit or debit established. For example, an insurance underwriter may visit a property and ask to discuss property safety with management. If management says that they are too busy to discuss safety, the underwriter can debit the property up to 15%. On the other hand, if management shows a keen interest on life and property safety, the modification can be a 15% credit. The IRPM is often used to adjust the insurance premium to reflect past history of the property. The typical range of IRPM credit to debit allowed is as follows:

Management	*Employees*	*Location*	*Safety*	*Building*	*Protection*
15 to 15	11 to 11	10 to 10	10 to 10	7 to 7	2 to 2

In viewing how these modifications may impact the hotel used as an example, we have computed the following modifications assuming the best case scenario for each modification:

	Non-Sprinklered	Sprinklered
THE HOTEL	0.257	0.088
Less 10% Company Deviation	0.231	0.079
Less 20% Package Discount	0.185	0.063
Less 15% Size Credit	0.157	0.054
Less 10% IRPM	Not Allowed	0.049

While these figures reflect the ideal insurance scenario, real application of modifications sometimes result in debits greater than credits. IRPM is often related to the underwriter's vision of liability potential for the property. An indication of such is the fact that insurance underwriters will not give a positive IRPM on non-sprinklered properties.

Having described some of the insurance industry polices, let me share some real world examples. Restaurants in Monterey's city owned prestigious Fisherman's Wharf are required to carry insurance. Restaurant insurance rates, based upon high payouts for fire losses, are high. Restaurants not protected with fire sprinklers pay a base rate of $1.54 per $100 insured before modifications discussed above are applied. This means a $500,000 restaurant would pay $7,700 annual for fire insurance. A restaurant protected by a fire sprinkler system is faced with a base rate of $0.27 per $100. The $500,000 restaurant, again before modifications are applied, would be charged $1,350 annually for fire insurance. This would mean a $6,350 annual savings for sprinklered over the non-sprinklered restaurant. Assuming the building and contents cost $100 per square foot to construct, (low estimate) the restaurant size would be approximately

5,000 square feet. And further assuming the installation cost of the fire sprinkler system is $2.00 per square foot, the installation cost of the fire sprinkler system would be $10,000. The insurance saving would pay for the installation of the fire sprinkler system in under 2-years. Please understand that we qualified this savings as figures before modifications are applied. If the restaurateur has all its insurance coverage with the same insurer, this plus other modifications can easily reduce the initial non-sprinkler rate by half. But correspondingly, the same modifications would have a similar reduction should it be applied to a fire sprinkler protected building. Thus the recovery of the cost for installing the fire sprinkler system would be longer but there will always be recovery as there the insurance rate for fire sprinkler protected property is always lower than non-sprinkler protected property.

Of course, the larger the building, the greater the insurance savings. Also at issue is the type of risk involved. Hotels and restaurants have higher insurance rates than does residential occupancies. I can say however, that I am experiencing a 10% reduction in my homeowner's policy as a result of my single-family home fire sprinkler system from my insurance carrier, State Farm Insurance. This is an additional 10% to the 10% already received for dead bolts and smoke detection. I computed my payback, or the recovery of the costs of retrofitting a fire sprinkler system in my 3,800 square foot home from insurance savings as 14.5 years.

C. Water Damage Myth.

Left unchecked, fire causes complete and far-reaching destruction of property. In the restaurant example we used, the insurance company charges a base rate of $1.54 per $100 insured for non-sprinkler protected property verses $0.27 per $100

insured for sprinkler protected property, a significant difference. In all cases, in all occupancies, commercial or residential, base rates for non-sprinkler protected property is always higher than fire sprinkler protected property. Insurance companies realize that replacing a water soaked carpet is a hundred fold less expensive than repairing structural fire damage. Fire sprinklers keeps the fire in check and fire damage is kept at a minimum, particularly structural fire damage. The $0.27 base rate for fire sprinkler protected restaurants is the insurance company's assessment of its risk of paying to repair fire and water damage in a fire sprinkler protected property. Typically, $0.04 - $0.08 of the $0.27 base rate is in place specifically to address repair of water damage.

Some fire sprinkler naysayers argue that accidental discharge of water is an issue of concern of the insurance company. Again a small percentage of the base rate for fire sprinkler property is in place to repair water damage. Should there be a history of accidental discharge, then the insurance company would charge higher rates than they currently do. Factory Mutual, a nationally recognized testing laboratory reports the chance of an accidental discharge from a sprinkler is of odds that rival winning the California State Lottery. There are reported instances of water discharge as a result of an intentional act. Again, the base rate factors in expected water damage caused by intentional acts. In some cases, where conditions exist where fire sprinkler system tampering is a greater risk, the insurance company may increase the base rate through the modification process.

There have been renegade insurance carriers in the past that failed to make a rate distinction between fire sprinkler protected and non-protected property. For the most part, insurance companies make such a rate distinction. All major insurance

companies who write property insurance offer a rate reduction for fire sprinkler protected property. Because of a significant reduction in expected fire losses afforded by fire sprinkler systems, an insurance company must provide a rate reduction for fire sprinkler protected property to remain competitive in the insurance market. The simple solution should an insurance carrier not make a rate distinction for fire sprinkler protected property is to deal with an insurance carrier who does.

And some states have experienced confusion created by independent insurance agents who may not be fully cognizant of the rates available for fire sprinkler protected properties available from the insurance companies they represent. Any insurance agent who represents that fire sprinkler systems will increase the cost of insurance does so in conflict with the major insurance carriers. The simple solution here is to obtain information directly from the insurance company. By doing so, the independent insurance agent will become enlightened as to how insurance companies recognize the benefits of fire sprinkler systems.

V. GOVERNMENT'S ROLE IN FIRE SAFETY.

We have proven that the price-elasticity of demand is inelastic and, therefore, the impact of a 1% price increase of a new home will have a negligible effect on the sale of the property. If so, why do we have challenges to fire sprinkler ordinances for new housing? There is a valid concern that increased cost of construction during periods of declining demand may prove costly to the homebuilder. We suggest that it is the fear of higher construction costs during declining periods of demand that is the basis of the homebuilder's resistance to install fire sprinklers. Forward looking forecasting models can provide data that will bring some comfort that the market will

be stable when the construction of the home is completed, but not with certainty. Government needs to revisit its community fire protection role and mission.

It is not known to what extent the Orange County Fire Authority and other Orange County governmental entities have addressed things that can help the developer comply with a fire sprinkler ordinance or at least make its compliance more viable. Accordingly, I have added this section for the purposes of initiating thought. It is expected that some, if not all of these issues have already been addressed.

A recent meeting of a city commission in Northeast Florida included discussion on the repeal of a fire sprinkler ordinance. My presentation before the commission focused on infrastructure exceptions and alternatives and other incentives in an effort to encourage city leadership to buy into a cooperative *fire safe community* plan. I explained that developer incentives to install fire sprinklers can be generated by allowing the water supply to be tapped on the users side of the water meter instead of a costly water main tap, that a much less expensive cross-connection protection valve could be specified and that hydrant spacing could be extended - all code allowed actions. During testimony of others, an attorney representing the developer leaned over and whispered that they had asked for these code allowed exceptions but were denied and that if they were allowed the exceptions they would not have challenged to fire sprinkler ordinance. The city commission finally visited these infrastructure issues and kept the fire sprinkler ordinance intact.

The city water department wanted a distinctive tap of the water main for each fire sprinkler system even though the code will allow tapping on the user's side of the water meter when the water supply is adequate at that point to operate the fire

sprinkler system. Its rationale - shutting off water for non-payment of the water bill would also shut down the fire sprinkler system thereby creating liability concerns for the city. When asked how many times each month does the water department turnoff water for non-payment - nobody knew. I suspect that a person who has enough insight to install a fire sprinkler system in a house will also have enough insight to pay the water bill.

You can kill a roach with a fly swatter or you can use a double-barrel shotgun. The cross-connection protection demanded by this city was equivalent to that double-barrel shotgun. While we agree that a cross-connection protection is important to prevent the back siphoning of contaminated water into the drinking water supply, demanding a $5,000 valve is overstating the needs when a $600 valve meets cross-connection code requirements.

Each hydrant costs $3,500 to install. Many code officials allow farther distances between hydrants because fire sprinklers significantly reduce the volume of water that is needed for firefighting - farther distances means less hydrants or less cost - but not this city. Had this city recognized these code allowed exceptions, the installation of a fire sprinkler system would be economically viable for the developer. But even more perplexing, had this city recognized code allowed exceptions and alternatives, governmental infrastructure and operational cost would also be reduced.

Yet another governmental entity has an unalterable water supply policy that is hampering a developer's interest to install fire sprinklers in a new single-family development of 104 homes. The water purveyor has plans to install 5/8 inch water meters for the domestic water supply for each home. The friction loss and water flow

of the 5/8 inch meter when compared to available water pressures produces a water volume and pressure below that required to operate the fire sprinkler system. When confronted with this situation, typically a 3/4-inch meter that has greater water flow volume and less friction loss is installed. But this political jurisdiction does not allow the installation of a 3/4 inch water meter - its policy calls for a 1 inch meter as the next step up from the 5/8 inch meter. While the 1 inch meter is more than what is needed, its installation to provide proper water supply and pressure for the fire sprinkler system is an acceptable alternative up to the point of realization that with the 1 inch meter comes a $1,000 impact fee. The impact fee was established under the premise that one who needs a 1 inch meter will be consuming more of the limited resource (water) thereby causing a greater impact on the utilities than one who uses a 5/8 inch meter. But the 1 inch meter is not being installed because of a need for greater consumption - it is being installed to ensure the fire sprinkler system will have adequate water pressure and volume to operate. And, the fire suppression impact on the water purveyor is typically thousands of times greater when fighting fires in non-sprinklered property verses sprinklered property. This water purveyor needs to revisit its impact fees and its prohibition on 3/4 inch water meters.

Government needs to look for innovative ways to promote community fire safety. A community fire safety plan requires the input and support of the fire department, water department, building and zoning departments and city management. Some jurisdictions provide tax incentives for fire sprinkler property, which is justified because fire sprinklers significantly reduce fire suppression needs.

But simply accepting code allowed exceptions for fire sprinklers often would offset installation costs.

VI. CONCLUSIONS.

We must do better in finding solutions to minimize the United States fire problem. A residential fire sprinkler system is the answer. Homebuilders must recognize community needs and encourage the installation of fire sprinkler systems in new housing stock. Over one million families each year could move into fire safe environments. While we recognize the uncertainty of housing markets and the risk homebuilders take when building homes during market demand swings, homebuilders must do the right thing for the community and the homebuyer by revisiting its resistance to residential fire sprinklers.

The most important finding in this study is that there exists a very inelastic demand coefficient for the price of new housing. This means that the expected 1% increase in price for adding a fire sprinkler system will cause an insignificant change in consumption of homes. ***This does not support the homebuilder's contention that the added cost of installing fire sprinklers results in the loss of potential homebuyers.*** It is the mortgage rate that dictates the dollar value of a house, condominium, or townhouse one can afford, not the cost of the fire sprinkler system. Fire sprinkler systems can be found in housing of all values and prices. It is also clear that homebuilders must recognize that residential fire sprinklers are a life saving *necessity* of every new home, condominium, and townhouse and become the catalyst and leader to move the United States towards the path to fire safe communities.

Insurance reductions for fire sprinkler protected property is always lower than that of non-sprinkler protected properties. Insurance agents who say differently do not reflect facts available by contacting the main office of the insurance carriers. All major insurance companies who write property fire insurance offer a reduced rate for fire sprinkler protected property. Water damage is a very minor concern of the insurance company when compared to potential fire losses, particularly structural damages caused by fire.

Government must take a strong and far-reaching role in community fire safety. Government's mission must be such that all division leaders have the opportunity and responsibility to make fire safe communities become reality. Water departments, fire departments, building departments, and city or county management must look outside of their realm, understand the needs of other divisions, and seek ways to make residential fire sprinklers a main point within the fire safe community. Fire sprinklers typically reduce fire suppression costs thereby justifying tax incentives, which have been applied by many communities as a fire sprinkler incentive. Code allowed infrastructure options coupled with tax incentives will more than offset the expense of installing fire sprinkler systems. This will also be the needed incentive to motivate homebuilders to include fire sprinklers in their new buildings with interest instead of continually challenging the need to protect new home buyers from the tragedy of fire. The fire safe community of the future will be lead by a coalition of homebuilders, governmental officials, fire officials, and others interested in community fire safety.

It is time to begin efforts to minimize the U.S. fire death rate. With NIST's estimated 82% reduction in fire deaths by adding fire sprinklers where we sleep, there is no better way that through residential fire sprinklers.

About the author: Buddy Dewar was graduated from Florida Atlantic University with a Bachelors of Science in Economics with concentration in Econometrics – quantitative economic analysis. Buddy Dewar also was graduated from Nova Southeastern University with a Master in Business Administration and is a member of the International Honor Society Sigma Beta Delta in recognition of his academic achievements. He has a distinguished fire service career, which includes working as a firefighter, fire officer, and fire chief, Superintendent of the Florida State Fire College, and Director of Florida's State Fire Marshal's Office. While directing Florida's State Fire Marshal's Office, he successfully lobbied for progressive fire safety laws that can be linked to current reductions in the fire death rate in Florida. Buddy has served on numerous national and state committees and commissions and has often been recognized by his peers by being elected chair of these groups. Buddy is a frequently sought after public speaker known for his entertaining presentations. Buddy currently is serving as Director of the Regional Operations for the National Fire Sprinkler Association. He was the first person to serve a two-year term as President of the Florida State Firefighters' Association. He has received numerous awards for his fire service and his programs have been featured in People Magazine.

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Appendix F

FIREFighting IN CANADA | CANADIAN FIREFIGHTER AND EMS QUARTERLY

Building bridges

Winnipeg union, management forge new relationship

Written by Jay Shaw

Relationships are funny things. Psychologists, sociologists and academics have studied relationships and the problems that certain types of relationships create. The management/union relationship is one that has been extensively examined. There are courses on how to beat the union, how to beat management and how to win in negotiations without the other side knowing it has lost. There are numerous Canadian examples in which fire-service relationships with management are about as sweet as a bag of lemons.

Union president Alex Forrest (left) and Winnipeg Fire Paramedic Service Chief Jim Brennan have worked together to build a stronger department. They have succeeded in repairing a strained relationship and acquiring new SCBA and turn-out gear, and implementing a tiered response system. *Photo by Bob Poole*

For close to a decade firefighters in Winnipeg had a sour relationship with management that created numerous problems. Over several years and through one of the worst tragedies in the Canadian fire service in 2007, Winnipeg's union/management relationship evolved into a

partnership that is, arguably, the envy of Canadian fire departments. Getting there wasn't easy.

Here's how it happened.

It was 1998, and an idea was reborn that would save money and provide better service in Winnipeg. Medical calls were going up and costs were skyrocketing. To ease the strain and create efficiencies, the Winnipeg Fire Department was disbanded by order of council. The amalgamation of all fire/rescue and EMS services was ordered and the operation was eventually named the Winnipeg Fire Paramedic Service. The concept made sense and looked promising in its simplicity – do more for less while creating a faster, smoother service to meet the needs of the new millennium.

But somebody forgot to tell the employees who, what, where, why and when. Planning focused on macro initiatives such as stations, equipment and dispatch. Other issues that may have seemed insignificant to management but were paramount to employees, such as lockers, beds and bathrooms, were never properly addressed or completely resolved. Nobody consulted anyone about how two different cultures were supposed to work side by side when they barely knew anything about each other. This caused considerable strife. Firefighters and paramedics wore the same uniforms but differed in skills, culture and history. Bickering was inevitable and relations that were already strained turned bitter and resentful.

Winnipeg Fire Paramedic Service members Capt. Ray Riddolls (left), Ed Pidwirny, Karl Hanzmann, acting Lt. Don Troschuk, Phil Moharb and Chad Moroz with Chief Jim Brennan and union president Alex Forrest. *Photo by Bob Poole*

The president of the United Fire Fighters of Winnipeg, Local 867, was then, and still is, Alex Forrest. He described the relationship between labour and administration as dysfunctional.

"At one point we had over 57 grievances on the table and there was no end in sight," Forrest said.

Winnipeg Fire and Paramedic Chief Jim Brennan, who at the time was the deputy chief of support services, remembers those days as "progressively getting really bad, where the attitude eventually became, OK, we'll just see you in court."

As things got worse, both sides seemed to dig in their heels deeper and employee resentment became the norm. More energy was exerted fighting and planning individual battle strategies than on fixing everyday operational concerns.

Deputy Chief Brennan was tagged by former chief Wes Shoemaker as the "conscience of management". He recalls wondering on many occasions why management was fighting some grievances that were unrelated to the core issue of amalgamation, such as taking senior fire officers out of scope. "With so many items on the table " Brennan would often

think, “We’re going to lose!”

Brennan and Forrest admit that both sides made mistakes. Brennan says a management error was to rely on consultants, people who really didn’t know much about the local scene.

“We tended to look outwards and say the way to do this is to copy another city, and that was wrong,” he says. “We would have done better to look at what we needed to do here and get it done, instead of looking for models to copy all over North America.

“The other thing we did wrong was that no one gave a lot of definition to anything. For example, the union would ask how many firefighters do you need cross trained as paramedics and management would reply, well we need a cadre. What the heck does that mean? To problem solve you need to be very specific and say things clearly, like we need 231.”

Forrest believes the union didn’t fully understand the impact of culture and how changing the name of the Winnipeg Fire Department would affect the membership and the day-to-day life in fire halls.

“We threw a lot of issues on the pile when we really should have concentrated on the biggest issue that faced this city in 15 years and that’s the increase in EMS calls,” he says.

Brennan and Forrest estimate that over the years millions of dollars were spent on lawyers and consultants during this negative period.

Things started to change in December 2006 when the former chief moved on and Brennan was made interim fire and paramedic chief. Forrest and Brennan never really had strained relations, due to Brennan’s support-services portfolio that kept him out of the mud for most of the battles. They began a working relationship that was on solid ground for the first time in years.

Winnipeg Mayor Sam Katz, who has witnessed the changes in both the department and the union / management relationship, says the fire service and its relationships with the union is healthy.

”I am very proud of the accomplishments that both the firefighters and paramedics have achieved under the leadership of Chief Brennan,” he says. “The whole team is working well, and that just wasn’t the case before.

Brennan, who was raised in Northern Ireland and immigrated to Canada in 1977, was very aware of cultural issues, as he had watched his country go through some rough times. Brennan was raised in a segregated community of Catholics and Protestants, where 3,000 people were killed and more than 40,000 wounded.

I lived through much of that,” he said. “When you have experience like that you tend to understand the impacts of culture very well. I understand why people get upset over a crest or a name. So for me, I did not have to feel like I was giving up concessions (to the union).”

Photo by Bob Poole

■ Tragedy spurs change

On Sunday, Feb. 4, 2007, on one of the coldest days of the year, the Winnipeg department lost captains Harold Lessard and Tom Nichols in a horrific house fire that injured four others, two of them critically. Brennan and Forrest met at the emergency room of the St. Boniface General Hospital where one of the captains was taken.

"We supported each other and went to the families together to tell them what had occurred," Forrest remembers.

At that moment, the two became one unit that would lead their teams over the next few weeks through the challenging task of respectfully honouring the families' wishes in a way that allowed a very public story to be shared with the city and country.

Imagine helping two families plan private funerals along with a public memorial for 10,000 that would allow a city to grieve along with thousands of firefighters and EMS personnel from all over North America, and do it in week, with two members still in critical condition, while keeping your own emotions in check.

With the clearance of doctors, one of the injured firefighters who was badly burned and faced months of recovery was moved to the 15,000-seat MTS Centre for the memorial service. Hospital staff practically created a hospital ward to facilitate a firefighter paying his respects to his fallen brothers. The military was brought in to help a march of thousands through the streets of Winnipeg. With lots of help from both teams, Brennan and Forrest pulled off a sincere and respectful tribute.

In the next six months Brennan became the full-time chief and, for the first time in the 125-year history of the Winnipeg Fire Department, a paramedic was at the wheel. In short order, there were considerable positive changes and both sides learned valuable lessons from a tragedy that devastated an organization. Both leaders allowed trust to be the cornerstone of a business relationship that had one goal – to serve the public the best way possible.

"We used to spend our time fighting and preparing for the battles," Forrest says. "Now we're spending time to understand the other person's position, trying to find a win-win situation."

Forrest admits that it's sometimes difficult to envision solutions to problems when two sides have opposing views but he has learned to look hard at issues and identify and understand both sides' goals, which has led to a better working relationship.

Morale at the Winnipeg Fire Paramedic Service is high and the two sectors have learned to work together under the direction of Chief Jim Brennan, shown here with paramedics (left) Brent Tierney and Bevan Barkman. *Photo by Bob Poole*

Thirty months after Brennan was hired as interim chief the Winnipeg Fire Paramedic Service with its two branches – The Winnipeg Fire Department and the Winnipeg Emergency Medical Services – is effective and efficient and the union / management relationship is healthy and strong.

The accomplishments are considerable and include the first negotiated contract in many years between the United Fire Fighters of Winnipeg, Local 867, and management, new SCBA and turn-out gear, increases in occupational disease coverage and multiple new pieces of apparatus along with increased staffing in areas that were deemed not up to par in response times. In addition, the city has committed to build a new station and re-build three more in the next few years. Credit is due to Brennan and Forrest, their teams and a strengthened relationship with the provincial government that has contributed to many of the positive changes.

The crown jewel is a new tiered response system that properly identifies and dispatches the right resources to the right calls. This is possible by having licensed paramedic firefighters on 37 apparatus for the first time, thereby expanding the deployable resources while saving money. Some of those savings are being used to increase the training level of medics to include one ALS paramedic on every ambulance by the end of 2010. Without this new system the city would have had to immediately buy and staff 10 more ambulances at a cost of $8.5 million.

“No one is saying that additional transport ambulances will not be needed as the population ages and grows but the immediacy of improved response times and increased dispatch flexibility are significant gains,” Brennan says.

Another positive: the service has turned its energy to customer-focused initiatives such as a thrombolytic therapy program that has reduced the death rate in certain cardiac emergencies to two per cent from eight per cent.

These numbers are all the evidence needed to support the benefits of open communication. Brennan can boast the best response times of licensed paramedics in Canada with a four-minute response 90 per cent of the time because Winnipeg’s fire trucks are getting to the scene quickly. “We used to send the closest ambulance, now we send the most appropriate unit whether BLS or ALS, as warranted,” he says.

“While we have focused upon the improved relationship between firefighters and their administration it is important to understand that paramedic union leaders of the period were also deeply instrumental in resolving a difficult period in the service’s history,” Brennan says. “Without their full and sincere co-operation the outcomes may well have been different.”

Brennan and Forrest know that the tragedy of Feb. 4, 2007, laid the groundwork for success;

dropping the ball when the whole country was watching was not an option. They admit that being forced to deal with the deaths sped up a warming process that led to advances in the service.

It's clear to observers that Brennan and Forrest have developed and consistently demonstrate the leadership skills and characteristics necessary to work through difficult times and institute change. Both praise their teams for working through those challenges. Still, Brennan and Forrest recognize that they will not always see eye to eye; when that happens, they put the issue aside and come back to it later with a fresh perspective.

Strong union / management relations allow departments to tackle other initiatives, such as Winnipeg's recent bid to host the World Police & Fire Games in 2015. Brennan says the economic spin off for the city would have been in the $70-million range had the bid succeeded. "This type of project could never have been done without good labour relations," he says.

Brennan and Forrest hope to leave a legacy of improved labour relations that will serve the next generation of leaders. In labour relations it's natural for both sides to think the best way to achieve goals is to win battles. In Winnipeg, it's not about winning; it's about advancing joint initiatives that make sense operationally and financially.

Jay Shaw has been involved with emergency services and health care for 15 years as registered orthopaedic technologist, a rural ambulance attendant, a DND firefighter and, for the last seven years, a firefighter in Winnipeg. Shaw is enrolled in the bachelor of fire and life safety studies at the JIBC and is finishing his primary care paramedic training. He is also the life safety specialist, instructing fire and medical programs for the Southern Manitoba Academy of Response Training. Contact him at jayshaw@mts.net