

Fire Flows and Infill Housing



CASE STUDY | DECEMBER 2023



1. Background

In most older Edmonton neighbourhoods, fire protection infrastructure was built to a previous standard appropriate at that time, but is no longer reflective of current standards for fire flows. When redevelopment of these areas occurred, it was assumed that it would require infrastructure upgrades to meet current standards. However, infrastructure upgrades are costly, and may be a significant barrier to developing infill homes. Furthermore, evidence is proving that density and fire flows are not linearly correlated.

Policy/program

Fire Flows and Infill Housing

Municipality

City of Edmonton AB (2021 population: 1,010,899)

Gentle Density Types Involved

The City is permitting a range of gentle density/missing middle infill throughout the community.

Historically, infill developers have provided all of the water infrastructure required to serve a new development and/or upgrade an existing area. In particular, the “first-in” infill developer had to pay for public infrastructure that benefits the area. However, the City has recognized that upgrades that improve fire protection in core, mature, and established areas benefit the entire neighbourhood. An agreement has been reached on a methodology to share costs between infill developers, ratepayers, and the City of Edmonton. The City has also developed a mechanism to assess the existing fire flows on a site by site basis to determine if additional fire flow infrastructure is actually needed for an infill development. This site by site assessment has proven to be effective in understanding that there is not a requirement for additional, costly infrastructure in many cases, thereby resulting in significant avoided costs.

Current Fire Flow Policy

The City of Edmonton Design Construction Standards includes Volume 4 that regulates water infrastructure, including hydrant spacing/frequency and available fire flows/capacity. Zoning bylaws dictate the level of fire flows required for the type of development, which can include requiring upgrading/expanding infrastructure to service additional density/dwellings. These standards were developed based on the highest need buildings within a zone, which is often much higher than what is actually needed. Furthermore, a zoning-based approach to assessing fire flows can potentially be a deterrent and financial barrier to infill development, and moreover, may require unnecessary infrastructure development and costs.

Since 1991, the City has applied the [Water Supply for Public Fire Protection Guide](#) by the Fire Underwriters Survey (FUS) to inform the fire flows and hydrant spacing with their Design and Construction Standards. This document provides guidance for municipalities for calculating required fire flows for any specific building.

Part 1 describes the areas that FUS reviews when assessing the adequacy and reliability of water supply infrastructure for fire insurance grading purposes.

Part 2 provides guidance in calculating required fire flows for buildings, which are then used in the community risk assessment and review of water distribution system.

In order to apply the FUS guide to infill developments, the City has developed the Infill Fire Protection Assessment program to understand existing available fire flow capacities on a site-specific basis.

2. Key Players

- City of Edmonton Fire Safety
- Epcor (utility)



Photo credit: City of Edmonton Fleet and Facility Services

3. Description of policy/program/project

Infill Fire Protection Assessment (IFPA)

In 2019 the City and EPCOR (Edmonton utility providing water and energy services) created the Infill Fire Protection Assessment (IFPA), a new site-specific review process to determine whether water infrastructure for on-street fire protection is needed for rezoning, subdivision and development permit applications. During the review of an application, EPCOR may condition water infrastructure upgrades for the highest use permitted in the Zoning Bylaw. Conditions are based on the City of Edmonton Construction and Design Standards (the Standards). Fire Rescue Services can subsequently complete a more detailed review to address deficient hydrant spacing and fire flows, of which the primary assessment tool is the Fire Underwriters Survey.

The outcome of the assessment either:

- Establishes / confirms the need for water infrastructure upgrades; or
- Provides a technical basis to ease the upgrades conditioned by EPCOR should the fire flows and hydrant spacing be found to be sufficient for the subject site.



4. Outcomes

This new process can potentially eliminate or reduce large financial barriers for projects that are critical for completion. Since 2019, the Fire Rescue Services review team has reviewed approximately 1,200 files and has adjusted the water infrastructure upgrades for 86% of the files reviewed, resulting in an average cost savings of approximately \$180,000 per project and a total avoided cost of over \$197M. The IFPA process allows for outcome/form-based policies for fire flow regulation (i.e., based on the specific needs of the development rather than the zoning), and allows designers/developers to build homes to existing fire flows rather than automatically requiring upgrades to fire flow systems with increased density/infill.

The IFPA is part of the development permitting process and could result in requiring reduced fire flow capacity, either by more precisely prescribing fire flows regardless of zone, or by encouraging building design features which reduce the amount of firefighting water (such as fire sprinklers, construction materials, building compartmentalization, and spatial separation).

The most effective feature for reducing firefighting requirements are sprinkler systems. The [Home Fire Sprinkler Coalition \(Canada\)](#) has produced a resource that provides information about residential sprinkler systems, including comparisons of sprinklered vs non-sprinklered homes, and costs and incentives for installing.

By applying the IFPA process, design standards for fire flows no longer apply for existing neighbourhoods. Applicants need to understand the existing available fire flow and then demonstrate that the required fire flows for what is being built will not exceed the available fire flow. If there is no site-based solution for ensuring the required fire flow does not exceed the available fire flow, the applicant will then need to upgrade the infrastructure, and depending on the situation, may apply for the [infill fire protection cost share program](#). This program provides a methodology to share costs between infill developers, ratepayers and the City, recognizing that some upgrades that improve fire protection in established areas benefit more than just that development project.

5. Lessons learned

- The success rate of the IFPA program clearly demonstrates that the Volume 4 Water Standard in the [City of Edmonton Design Construction Standards](#) requires a higher level of water supply than is actually needed for fire protection of modern developments. By considering fire protection more carefully, significant efficiencies in water infrastructure can be found without decreasing fire safety.
- It has been shown that new multi-residential buildings are outfitted with best-in-class fixtures and building mechanical systems that will reduce average water use.
- Compared to single detached residential housing, multi-residential water consumption per dwelling unit is lower and less seasonal in nature.
- As areas densify by increasing the average number of units per hectare, average dwelling unit water consumption tends to decrease.
- To date, the vast majority of IFPAs have shown that existing fire flow infrastructure meets new infill projects. This is due to:
 - » More efficient building design
 - » The fact that most existing requirements are based on worst buildings and most buildings do not require that level of fire protection



6. Next Steps

The City is now working to further automate the IFPA process to provide more information and resources to landowners, developers, and builders to ensure transparency around infrastructure capacity, well prior to land development applications. They have also set mandatory review periods for fire flow standards to ensure that future versions of the standard are informed by trends in building construction.

7. Resources

Is there a web-based version of this we can link to?
or make the google doc publicly accessible?

| [Guideline: Assessing Fire Flows for Land Development Applications](#) (draft) - This document is intended to assist non-technical and moderately technical users in understanding why and how fire flows are assessed. This document is currently a draft and will be regularly updated.

| [National Fire Protection Association's sprinkler protection standard](#) designed for one and two-family dwellings, which can include rowhomes and, in some jurisdictions, stacked rowhomes as well.

| The Stantec [Fire Flow Tool](#) – This was developed by Thames Water in London to provide complete information on the capacity for fire flows throughout the entire water network. It is the benchmark that the City is striving for in terms of sharing available fire flow information publicly.