



## Exhibit 8 Fire Protection Design Requirements

*This completed exhibit must be submitted for all projects that will be served by the City of Savannah public water system.*

SPR #: \_\_\_\_\_ PROJECT NAME: \_\_\_\_\_ DATE: \_\_\_\_\_  
LOCATION: \_\_\_\_\_

Will the project include a sprinkler system?    Yes \_\_\_\_\_    No \_\_\_\_\_

**If yes, the following additional requirements apply:**

1. The system must be designed in accordance with the current National Fire Protection Association (NFPA) Standard 13 and NFPA 25, and/or other appropriate NFPA standards as adopted and amended by the Georgia State Office of the Fire Marshal.
2. The Applicant must submit the following to the City of Savannah Office of the Fire Marshal:
  - a. A complete set of project plans.
  - b. Detailed water demand hydraulic calculations, including: average daily demand; instantaneous peak demand; and fire flow demand (based on Insurance Services Office (ISO) guidelines for fire protection).
  - c. A copy of the reports for all flow testing / pressure monitoring conducted, clearly indicating the specific measurements used to determine the Available Fire Flow.
  - d. All other design calculations used in completing Exhibit 4.
3. *If the sprinkler system includes a booster pump or the use of chemicals, a Reduced Pressure Zone (RPZ) type backflow preventer must be installed on the water service lateral that will supply the system, in accordance with the City of Savannah's specifications and details.*

**All Applicants (answering Yes or No to the above question) shall provide calculations for Needed Fire Flow (NFF) and Available Fire Flow (AFF), and ensure that hydrant(s) are within the appropriate distance of the project, as follows:**

**NEEDED FIRE FLOW (NFF) CALCULATION:**

*The following calculation of Needed Fire Flow is based on the Insurance Services Office (ISO) publication "Guide for Determination of Needed Fire Flow." In order to complete Exhibit 8, the preparer shall obtain a copy of this document and become familiar with the information provided therein. No part of the following discussion should be considered to contradict the ISO guide, unless otherwise noted. A copy of this publication may be obtained on-line at:*

**<https://www.isomitigation.com/siteassets/downloads/guide-determinerequiredfireflow.pdf>**

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To estimate the amount of water needed to fight a fire in an individual, nonsprinklered building, ISO uses the formula:

$$NFF_i = (C_i) \times (O_i) \times [1 + (X + P)_i]$$

Where:

- NFF<sub>i</sub> = the needed fire flow in gallons per minute (GPM)
- C<sub>i</sub> = a factor related to the type of construction
- O<sub>i</sub> = a factor related to the type of occupancy
- X = a factor related to the exposure buildings
- P = a factor related to the communication between buildings

To calculate the needed fire flow of a building, the Applicant will need to determine the predominant type (class) of construction, size (effective area) of the building, predominant type (class) of occupancy, exposure from the property, and the factor for communication to another building.

The Applicant will provide the values of the factors C, O, X, and P, and the results of the NFF calculation. *Should future changes to the project design (whether by choice or to comply with Municipal, State, or Federal regulation), impact the values provided and the NFF, a revised Exhibit 8 shall be provided and the Owner may be responsible for any modifications to the water system that may be required.*

**(For 1- & 2-family dwellings ≤ 2 stories in height and properties with an approved sprinkler system, NFF is discussed in #5)**

1. Construction Factor (C):

The portion of the NFF attributed to the construction and area of the proposed building is determined by the following formula:

$$C_i = 18 \times F \times (A_i)^{0.5}$$

Where:

- F = Coefficient related to the class of construction:
  - = 1.5 for Construction Class 1 (Frame)
  - = 1.0 for Construction Class 2 (Joisted Masonry)
  - = 0.8 for Construction Class 3 (Non-combustible) and Construction Class 4 (Masonry Non-combustible)
  - = 0.6 for Construction Class 5 (Modified Fire Resistive) and Construction Class 6 (Fire Resistive)

A<sub>i</sub> = Effective area

Note: Refer to the ISO NFF Guidance for a detailed description on how to calculate the Construction Factor when the building Construction Class is mixed.

Construction Class Coefficient (F) = \_\_\_\_\_

Effective Area (A<sub>i</sub>) = \_\_\_\_\_ square feet

Calculated Construction Factor (C<sub>i</sub>) = \_\_\_\_\_ gallons/minute (GPM)

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The value of  $C_i$  shall not be < 500 GPM or > 8,000 GPM for Construction Class 1 & 2 or > 6,000 GPM for Construction Class 3, 4, 5, and 6 or a 1-story building of any class of construction. The calculated value of  $C_i$  shall be rounded to the nearest 250 GPM.

2. Occupancy Factor ( $O_i$ ):

The factors below reflect the influence of the occupancy in the subject building on the needed fire flow:

<u>Occupancy Combustibility Class</u>	<u>Occupancy Factor (<math>O_i</math>)</u>
C-1 (Noncombustible)	0.75
C-2 (Limited-combustible)	0.85
C-3 (Combustible)	1.00
C-4 (Free-burning)	1.15
C-5 (Rapid burning)	1.25

Occupancy Factor ( $O_i$ ) = \_\_\_\_\_

3. Exposure (X) and Communication (P) Factors:

These factors reflect the influence of adjoining or connected buildings on the NFF. An exposure building has a wall 100 feet or less from a wall of the subject building. A communicating building has a passageway to the subject building. X and P are developed for each applicable adjoining ( $\leq 100$  ft away) or communicating (joined by passageway) building. For calculating  $NFF_i$ , the term  $(X + P)_i$  is used, which is the sum of the exposure factor for the most at-risk exposed building (i.e. – the highest value of X) and the communication factor of the most at-risk communicating building (i.e. – the highest value of P). These may be the same or different buildings. The maximum value of  $(X + P)_i$  is 0.60.

Exposure Factor (X) = \_\_\_\_\_ (Maximum value of all Exposure Factors)

Communication Factor (P) = \_\_\_\_\_ (Maximum value of all Communication Factors)

*The Applicant shall provide a sketch (requires no more detail than that provided in Example 3 of the ISO NFF guidance document, <http://www.isomitigation.com/downloads/ppc3001.pdf>). Include all X and P factors determined, not just the largest ones provided above.*

4. Calculation of Needed Fire Flow (NFF):

$$NFF_i = (C_i) \times (O_i) \times [1 + (X + P)_i]$$

NFF<sub>i</sub> = \_\_\_\_\_ GPM

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5. Additional Considerations:

Additional considerations for the calculating of needed fire flow are as follows:

- a. When the subject building or exposure buildings have wood-shingle roof covering that can contribute to spreading fires (as determined by the local Fire Marshal), 500 GPM is added to the NFF.
- b. The maximum needed fire flow is 12,000 GPM. The minimum is 500 GPM.
- c. The final calculation of needed fire flow is rounded to the nearest 250 GPM if less than 2,500 GPM and to the nearest 500 GPM if greater than 2,500 GPM
- d. For 1- and 2-family dwellings not exceeding 2 stories in height, the following needed fire flows shall be used:

Distance between Buildings (feet)	Needed Fire Flow (GPM)
Over 100	500
31 – 100	750
11 – 30	1,000
10 or less	1,500

- e. For other types of habitational buildings, the maximum needed fire flow is 3,500 GPM.
- f. Required fire flow for properties with an approved sprinkler system consists of the flow required for the sprinkler system plus the required hose-stream allowance, or 500 GPM, whichever is greater.

AVAILABLE FIRE FLOW (AFF) CALCULATION:

The Available Fire Flow (AFF) must be calculated based on hydrant flow testing and supplemental hydraulic analyses. The AFF will represent the fire flow that is available from the public water system at the existing or proposed hydrant(s) nearest to the proposed facility at a residual pressure of 20 psi.

The following formula, which was developed by the ISO, can be used to adjust the data from a hydrant flow test to determine the available fire flow at that location at 20 psi:

$$Q_{20} = Q_t \times \frac{(P_s - P_{20})^{0.54}}{(P_s - P_t)^{0.54}}$$

Where:

- Q<sub>20</sub> = Available fire flow at a residual pressure of 20 psi (GPM)
- Q<sub>t</sub> = Hydrant flow during test (GPM)
- P<sub>s</sub> = Static pressure measured before hydrant flow test (psi)
- P<sub>20</sub> = 20 psi (desired residual pressure)
- P<sub>t</sub> = Residual pressure measured during hydrant flow test (psi)

Hydrant Flow Rate during Test (Q<sub>t</sub>): \_\_\_\_\_ GPM  
 Static Pressure before Flow Test (P<sub>s</sub>): \_\_\_\_\_ psi  
 Residual Pressure during Flow Test (P<sub>t</sub>): \_\_\_\_\_ psi  
 Calculated Available Fire Flow (Q<sub>20</sub>): \_\_\_\_\_ GPM

**Flow testing / pressure monitoring shall only be conducted with Water Distribution Department staff present to operate the system, (i.e. - open hydrants and valves).** To coordinate observation and facility operation by City staff, please contact the Director of the Water Distribution and Conveyance Department, James Laplander at [jlaplander@savannahga.gov](mailto:jlaplander@savannahga.gov). Include the phrase "Request for Water System Fire Flow Test" in the e-mail subject line. Please also include a sketch showing the water system in the area, the location of the proposed flow and pressure hydrant(s), and reply contact information.

As the results of flow testing may vary significantly with instantaneous water demand, it shall be the responsibility of the Design Professional to ensure that sufficient water system testing / monitoring is conducted to get an accurate representation of the available water supply during critical flow conditions.

Testing shall be completed per the requirements of the most recent edition of AWWA Manual M17 - Installation, Field Testing, and Maintenance of Fire Hydrants. Testing shall be conducted during periods of high demand, based on the nature of the service area (residential, commercial, institutional, or industrial) and available City pumping (demand) data; however this may not be representative of flow availability under all possible conditions. For instances where flow availability is critical, 24-hr pressure monitoring is recommended. The hydrant(s) used during flow testing (where flow and residual pressure are measured) and pressure monitoring shall be clearly indicated on the water utility plans.

If the calculated AFF ( $Q_{20}$ ) for a single hydrant is insufficient to meet the NFF, the test may be repeated by measuring flows and pressures using multiple hydrants within 600 LF (as defined below) of the project site. Should proposed hydrants be needed to meet the NFF, the  $Q_{20}$  from this hydrant(s) may be determined by water system modeling using the results of hydrant flow testing from the nearest existing hydrant.

If the AFF is insufficient to meet the NFF, the Design Professional shall modify the building / site design to reduce the NFF and / or include water system upgrades to raise the AFF. Provided that the City has met its obligation to provide the minimum 1,000 GPM at 20 psi, the cost of the water system upgrades shall be borne by the Developer. Project design submittals shall clearly show how proposed water system upgrades will raise the AFF.

#### HYDRANT DISTRIBUTION REQUIREMENTS:

As the conditions during the hydrant test may not be the same as when fire flow is needed, a hydrant distribution requirement must also be met.

The hydrant distribution in the vicinity of a proposed facility must be sufficient to ensure that the NFF can be delivered. A 1,000 GPM credit is applied for each existing or proposed hydrant within 1,000 feet of the facility. This hydrant flow rate is based on ISO criteria given the fact that the City of Savannah Fire Department responds to all fires with at least one pumper truck and engines that carry a minimum of 1,000 feet of 5" hose.

The distance from the hydrant to the proposed facility must be measured as the fire hose can be laid by apparatus (i.e., along roads and driveways as a vehicle would drive). Only 50 feet of the distance can be cross-country where the fire hose would be laid by hand at the hydrant. ***The hydrants used to meet the hydrant distribution requirements shall be clearly indicated on the water and sewer utility plans.***

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HYDRANT DISTRIBUTION SUMMARY FOR PROPOSED FACILITY

LOCATION OF FIRE HYDRANT * (EXISTING OR PROPOSED)	DISTANCE FROM HYDRANT TO PROPOSED FACILITY (FEET)	FIRE FLOW CREDIT (GALLONS/MINUTE)
TOTAL FIRE FLOW CREDIT (GALLONS/MINUTE)		

\* None of the selected fire hydrants shall impede necessary traffic flow (as determined by the City of Savannah Office of the Fire Marshall) while being used by the fire department to combat a fire.

No portion of a building may be more than 500 feet from a hydrant as measured by an approved route around the exterior of the facility or building. This distance may be increased to 600 feet for group R-3 and group U occupancies (see International Fire Code for group definitions) and for buildings equipped throughout with an approved automatic sprinkler system installed in accordance with IFC Section 903.3.1.1 or 903.3.1.2. The fire apparatus access road shall extend to within 150 feet of all portions of the facility and all portions of the exterior walls of the first story of the building in accordance with the International Fire Code as adopted and amended by the Georgia State Office of the Fire Marshal.

Prepared Under the Supervision of: \_\_\_\_\_

GA PE #: \_\_\_\_\_

Date: \_\_\_\_\_