

NFPA®

1142

Standard on
Water Supplies for Suburban
and Rural Firefighting

2022



NFPA® 1142

Standard on Water Supplies for Suburban and Rural Firefighting

2022 Edition



NFPA, 1 Batterymarch Park, Quincy, MA 02269-9101
An International Codes and Standards Organization



Documents
Document Sharing Hub

IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA® STANDARDS

NFPA® codes, standards, recommended practices, and guides (“NFPA Standards”), of which the document contained herein is one, are developed through a consensus standards development process approved by the American National Standards Institute. This process brings together volunteers representing varied viewpoints and interests to achieve consensus on fire and other safety issues. While the NFPA administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy of any information or the soundness of any judgments contained in NFPA Standards.

The NFPA disclaims liability for any personal injury, property, or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, or reliance on NFPA Standards. The NFPA also makes no guaranty or warranty as to the accuracy or completeness of any information published herein.

In issuing and making NFPA Standards available, the NFPA is not undertaking to render professional or other services for or on behalf of any person or entity. Nor is the NFPA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

The NFPA has no power, nor does it undertake, to police or enforce compliance with the contents of NFPA Standards. Nor does the NFPA list, certify, test, or inspect products, designs, or installations for compliance with this document. Any certification or other statement of compliance with the requirements of this document shall not be attributable to the NFPA and is solely the responsibility of the certifier or maker of the statement.

REVISION SYMBOLS IDENTIFYING CHANGES FROM THE PREVIOUS EDITION

Text revisions are shaded. A **Δ** before a section number indicates that words within that section were deleted and a **Δ** to the left of a table or figure number indicates a revision to an existing table or figure. When a chapter was heavily revised, the entire chapter is marked throughout with the **Δ** symbol. Where one or more sections were deleted, a **•** is placed between the remaining sections. Chapters, annexes, sections, figures, and tables that are new are indicated with an **N**.

Note that these indicators are a guide. Rearrangement of sections may not be captured in the markup, but users can view complete revision details in the First and Second Draft Reports located in the archived revision information section of each code at www.nfpa.org/docinfo. Any subsequent changes from the NFPA Technical Meeting, Tentative Interim Amendments, and Errata are also located there.

REMINDER: UPDATING OF NFPA STANDARDS

Users of NFPA codes, standards, recommended practices, and guides (“NFPA Standards”) should be aware that these documents may be superseded at any time by the issuance of a new edition, may be amended with the issuance of Tentative Interim Amendments (TIAs), or be corrected by Errata. It is intended that through regular revisions and amendments, participants in the NFPA standards development process consider the then-current and available information on incidents, materials, technologies, innovations, and methods as these develop over time and that NFPA Standards reflect this consideration. Therefore, any previous edition of this document no longer represents the current NFPA Standard on the subject matter addressed. NFPA encourages the use of the most current edition of any NFPA Standard [as it may be amended by TIA(s) or Errata] to take advantage of current experience and understanding. An official NFPA Standard at any point in time consists of the current edition of the document, including any issued TIAs and Errata then in effect.

To determine whether an NFPA Standard has been amended through the issuance of TIAs or corrected by Errata, visit the “Codes & Standards” section at www.nfpa.org.

ADDITIONAL IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA® STANDARDS

Updating of NFPA Standards

Users of NFPA codes, standards, recommended practices, and guides (“NFPA Standards”) should be aware that these documents may be superseded at any time by the issuance of a new edition, may be amended with the issuance of Tentative Interim Amendments (TIAs), or be corrected by Errata. It is intended that through regular revisions and amendments, participants in the NFPA standards development process consider the then-current and available information on incidents, materials, technologies, innovations, and methods as these develop over time and that NFPA Standards reflect this consideration. Therefore, any previous edition of this document no longer represents the current NFPA Standard on the subject matter addressed. NFPA encourages the use of the most current edition of any NFPA Standard [as it may be amended by TIA(s) or Errata] to take advantage of current experience and understanding. An official NFPA Standard at any point in time consists of the current edition of the document, including any issued TIAs and Errata then in effect.

To determine whether an NFPA Standard has been amended through the issuance of TIAs or corrected by Errata, visit the “Codes & Standards” section at www.nfpa.org.

Interpretations of NFPA Standards

A statement, written or oral, that is not processed in accordance with Section 6 of the Regulations Governing the Development of NFPA Standards shall not be considered the official position of NFPA or any of its Committees and shall not be considered to be, nor be relied upon as, a Formal Interpretation.

Patents

The NFPA does not take any position with respect to the validity of any patent rights referenced in, related to, or asserted in connection with an NFPA Standard. The users of NFPA Standards bear the sole responsibility for determining the validity of any such patent rights, as well as the risk of infringement of such rights, and the NFPA disclaims liability for the infringement of any patent resulting from the use of or reliance on NFPA Standards.

NFPA adheres to the policy of the American National Standards Institute (ANSI) regarding the inclusion of patents in American National Standards (“the ANSI Patent Policy”), and hereby gives the following notice pursuant to that policy:

NOTICE: The user’s attention is called to the possibility that compliance with an NFPA Standard may require use of an invention covered by patent rights. NFPA takes no position as to the validity of any such patent rights or as to whether such patent rights constitute or include essential patent claims under the ANSI Patent Policy. If, in connection with the ANSI Patent Policy, a patent holder has filed a statement of willingness to grant licenses under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license, copies of such filed statements can be obtained, on request, from NFPA. For further information, contact the NFPA at the address listed below.

Law and Regulations

Users of NFPA Standards should consult applicable federal, state, and local laws and regulations. NFPA does not, by the publication of its codes, standards, recommended practices, and guides, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

NFPA Standards are copyrighted. They are made available for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of safe practices and methods. By making these documents available for use and adoption by public authorities and private users, the NFPA does not waive any rights in copyright to these documents.

Use of NFPA Standards for regulatory purposes should be accomplished through adoption by reference. The term “adoption by reference” means the citing of title, edition, and publishing information only. Any deletions, additions, and changes desired by the adopting authority should be noted separately in the adopting instrument. In order to assist NFPA in following the uses made of its documents, adopting authorities are requested to notify the NFPA (Attention: Secretary, Standards Council) in writing of such use. For technical assistance and questions concerning adoption of NFPA Standards, contact NFPA at the address below.

For Further Information

All questions or other communications relating to NFPA Standards and all requests for information on NFPA procedures governing its codes and standards development process, including information on the procedures for requesting Formal Interpretations, for proposing Tentative Interim Amendments, and for proposing revisions to NFPA standards during regular revision cycles, should be sent to NFPA headquarters, addressed to the attention of the Secretary, Standards Council, NFPA, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101; email: stds_admin@nfpa.org.

For more information about NFPA, visit the NFPA website at www.nfpa.org. All NFPA codes and standards can be viewed at no cost at www.nfpa.org/docinfo.

Copyright © 2021 National Fire Protection Association®. All Rights Reserved.

NFPA® 1142

Standard on

Water Supplies for Suburban and Rural Firefighting

2022 Edition

This edition of NFPA 1142, *Standard on Water Supplies for Suburban and Rural Firefighting*, was prepared by the Technical Committee on Wildland and Rural Fire Protection. It was issued by the Standards Council on May 24, 2021, with an effective date of June 13, 2021, and supersedes all previous editions.

This edition of NFPA 1142 was approved as an American National Standard on June 13, 2021.

Origin and Development of NFPA 1142

This document originally was issued in 1968 as a tentative document titled NFPA 25, *Recommended Practices for Water Supply Systems for Rural Fire Protection*. It was reissued in 1969 without the tentative status. In 1975, the document was changed to a standard and renumbered and retitled as NFPA 1231, *Standard on Water Supplies for Suburban and Rural Fire Fighting*.

The standard continued to be maintained and enhanced with 1984, 1989, and 1993 editions. The 1999 edition was renumbered as NFPA 1142, in keeping with the committee's plan to group all its documents within a number range.

The 2001 edition incorporated much of the information about the design of dry hydrants, formerly found in the annexes, into the requirements to encourage improved design and performance.

The 2007 edition was completely revised to better organize the requirements in the standard and to better differentiate between alternative water supplies for firefighting and municipal-type water systems. The material in Annex A on designing dry hydrant systems was reorganized and updated into a separate Annex I. The other annexes were reviewed and updated to reflect current practices.

In the 2012 edition of NFPA 1142, the Technical Committee updated several definitions to be consistent with the *NFPA Glossary of Terms*. Substantial changes in the 2012 edition included new material with guidance on bridge access to water sources, clarification of the working space surrounding dry hydrants, and additional annex material regarding water eductors and ejectors.

In the 2017 edition, the technical committee developed new text for alternative methods, modifications to the standard, and unit and formula consistency. The committee added text for alternative water supplies from storage tanks; however, the committee also specified that the storage tanks needed to be inspected and maintained in accordance with NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*. It was clarified that before combustibles can be brought to the site location, water supplies for fire protection systems need to be established. The technical committee removed significant text and tables relative to fire flow requirements, and instead opted to use the Verisk Analytics website (ISO) information. Finally, Annex J, Geospatial Support for Water Supply Planning, was added.

The 2022 edition incorporates several updates and clarifications with particular focus on water availability and availability studies.

Technical Committee on Wildland and Rural Fire Protection

Rick L. Swan, Chair

IAFF Local 2881/CDF Fire Fighters, VA [L]
Rep. International Association of Fire Fighters

Gregory A. Bartlett, Brandon University, Rural Policy Learning Commons, Canada [SE]

Nicholas Bartlett, Lawrence Berkeley National Laboratory, CA [U]

Randall K. Bradley, Tracy Fire Department/South County Fire Authority, CA [E]

Vernon Champlin, Castle Rock Fire and Rescue Department, CO [E]

Erik W. Christiansen, Exponent, Inc., CA [SE]

David Doudy, Town Of Dolores, CO [E]

Robert Ferrell, WSRB, WA [I]

James P. Gogolski, Hoover Treated Wood Products, OH [M]

Michael J. Gollner, University of California, CA [RT]

Daniel Gorham, Insurance Institute for Business & Home Safety (IBHS), SC [I]

Donald J. Griego, State of New Mexico, NM [E]

Bill Hendricks, Safer Building Solutions, CA [M]

Kelly Johnston, Wildland Professional Solutions, Canada [SE]

Justice J. Jones, Austin Fire Department, TX [U]

Jeremy A. Keller, Macochee Joint Ambulance District, OH [E]

Wesley M. Keller, Pennsylvania Bureau of Forestry, PA [U]

Robert J. Kowalski, Nationwide Insurance Companies, OH [I]

Troy A. Lumley, South McCreary Fire & Rescue, KY [E]

Alexander Maranghides, National Institute of Standards & Technology (NIST), MD [RT]

Mark A. Novak, Vail Fire and Emergency Service, CO [E]
Rep. International Association of Fire Chiefs

Steve Oaks, Retired-Santa Barbara County Fire Marshal, CA [SE]

Amy Ray Solaro, East Fork Fire Protection District, NV [E]

Clifford C. Roberts, Marsh Risk Consulting, FL [I]

Ernie Schmidt, 3M Company, MN [M]

Deborah L. Shaner, Shaner Life Safety, CO [SE]

Albert Simeoni, Worcester Polytechnic Institute, MA [RT]

David P. Tyree, American Wood Council, CO [M]

William J. Watters, Verisk Analytics/Insurance Services Office, Inc., NJ [I]

Ken Wettstein, National Volunteer Fire Council, CO, [U]
Rep. National Volunteer Fire Council

Chris White, Anchor Point Group, CO [SE]

Alternates

Paul Acosta, Colorado State Fire Fighters Association, CO [U]
(Alt. to Ken Wettstein)

Hubert Biteau, Exponent, Inc., GA [SE]
(Alt. to Erik W. Christiansen)

Nelson P. Bryner, National Institute of Standards & Technology (NIST), MD [RT]
(Alt. to Alexander Maranghides)

Rolland M. Crawford, Crawford Specialty Group, LLC, GA [SE]
(Alt. to Steve Oaks)

Mike Eckhoff, Hoover Treated Wood Products, CO [M]
(Alt. to James P. Gogolski)

Faraz Hedayati, Insurance Institute for Business & Home Safety (IBHS), SC [I]
(Alt. to Daniel Gorham)

Barry D. Chase, NFPA Staff Liaison

Vladimir Ignatenko, American International Group, Inc. (AIG), CA [I]

(Voting Alt.)

Kevin P. Kuntz, Verisk Analytics/Insurance Services Office, Inc., PA [I]
(Alt. to William J. Watters)

Schelly Olson, Grand Fire Protection District, CO [E]
(Alt. to Mark A. Novak)

James L. Urban, Worcester Polytechnic Institute, MA [RT]
(Alt. to Albert Simeoni)

This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This committee shall have the primary responsibility for documents on fire protection in wildland, rural, and suburban areas.

Contents

Chapter 1 Administration	1142- 4	7.2 Water Use Agreements.	1142- 11
1.1 Scope.	1142- 4	7.3 Identifying Water Sources.	1142- 11
1.2 Purpose.	1142- 4	7.4 Fire Hose Connections.	1142- 11
1.3 Application.	1142- 4	7.5 Access to Water Sources.	1142- 11
1.4 Equivalency.	1142- 4	7.6 Mobile Water Supply Training.	1142- 11
1.5 Alternatives.	1142- 4	7.7 Records.	1142- 11
1.6 Modifications.	1142- 4		
1.7 Units and Formulas.	1142- 4	Chapter 8 Dry Hydrants	1142- 11
Chapter 2 Referenced Publications	1142- 4	8.1 Chapter Scope.	1142- 11
2.1 General.	1142- 4	8.2 Planning and Permits.	1142- 11
2.2 NFPA Publications.	1142- 4	8.3 Dry Hydrant Design.	1142- 11
2.3 Other Publications.	1142- 5	8.4 Dry Hydrant Locations.	1142- 12
2.4 References for Extracts in Mandatory Sections.	1142- 5	8.5 Strainer Clearance.	1142- 12
Chapter 3 Definitions	1142- 5	8.6 Installation Procedure for Dry Hydrant System.	1142- 12
3.1 General.	1142- 5	8.7 Inspection, Testing, and Maintenance of Dry Hydrants.	1142- 12
3.2 NFPA Official Definitions.	1142- 5	8.8 Records for Dry Hydrants.	1142- 12
3.3 General Definitions.	1142- 5	Annex A Explanatory Material	1142- 12
Chapter 4 Calculating Minimum Water Supplies	1142- 6	Annex B Alternative Water Supply	1142- 24
4.1 General.	1142- 6	Annex C Mobile Water Supply Apparatus	1142- 28
4.2 Structures Without Exposure Hazards.	1142- 7	Annex D Large-Diameter Hose	1142- 37
4.3 Structures with Exposure Hazards.	1142- 7	Annex E Portable Pumps	1142- 40
4.4 Structures with Automatic Sprinkler Protection.	1142- 7	Annex F Automatic Sprinkler Protection	1142- 43
4.5 Structures with Other Automatic Fire Suppression Systems.	1142- 7	Annex G Municipal-Type Water System	1142- 44
4.6 Water Delivery Rate to the Fire Scene.	1142- 7	Annex H Calculating Minimum Water Supplies	1142- 44
4.7 Other Uses.	1142- 7	Annex I Dry Hydrant Design	1142- 51
Chapter 5 Classification of Occupancy Hazard	1142- 7	Annex J Geospatial Support for Water Supply Planning	1142- 59
5.1 General.	1142- 7	Annex K Informational References	1142- 63
5.2 Occupancy Hazard Classification Number.	1142- 7	Index	1142- 65
Chapter 6 Classification of Construction	1142- 9		
6.1 General.	1142- 9		
6.2 Construction Classification Number.	1142- 9		
6.3 Classification of Types of Building Construction.	1142- 9		
Chapter 7 Water Supply	1142- 11		
7.1 Approved Water Supply.	1142- 11		

NFPA 1142

Standard on

Water Supplies for Suburban and Rural Firefighting

2022 Edition

IMPORTANT NOTE: This NFPA document is made available for use subject to important notices and legal disclaimers. These notices and disclaimers appear in all publications containing this document and may be found under the heading “Important Notices and Disclaimers Concerning NFPA Standards.” They can also be viewed at www.nfpa.org/disclaimers or obtained on request from NFPA.

New editions of NFPA codes, standards, recommended practices, and guides (i.e., NFPA Standards) are released on scheduled revision cycles. This edition may be superseded by a later one, or it may be amended outside of its scheduled revision cycle through the issuance of Tentative Interim Amendments (TIAs). An official NFPA Standard at any point in time consists of the current edition of the document, together with all TIAs and Errata in effect. To verify that this document is the current edition or to determine if it has been amended by TIAs or Errata, please consult the National Fire Codes® Subscription Service or the “List of NFPA Codes & Standards” at www.nfpa.org/docinfo. In addition to TIAs and Errata, the document information pages also include the option to sign up for alerts for individual documents and to be involved in the development of the next edition.

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced and extracted publications can be found in Chapter 2 and Annex K.

Chapter 1 Administration

1.1 Scope.

1.1.1 This standard identifies a method of determining the minimum requirements for alternative water supplies for structural firefighting purposes in areas where the authority having jurisdiction (AHJ) determines that adequate and reliable water supply systems for firefighting purposes do not otherwise exist.

1.1.2 An adequate and reliable municipal-type water supply is one that is sufficient every day of the year to control and extinguish anticipated fires in the jurisdiction, particular building, or building group served by the water supply.

1.2* Purpose. The purpose of this standard is to assist the AHJ to establish the minimum water supply necessary for structural firefighting purposes in those areas where it has been determined that there is no water or inadequate water for firefighting.

1.3 Application.

1.3.1 This standard does not address fireground operational procedures dealing with the rate or method of water application.

1.3.2* This standard does not apply to the calculation of an adequate amount of water for large, special fire protection problems, such as bulk flammable liquid storage, bulk flammable gas storage, large varnish and paint factories, some plastics manufacturing and storage, aircraft hangars, distilleries, refineries, lumberyards, grain elevators, large chemical plants, coal mines, tunnels, subterranean structures, and warehouses using high rack storage for flammables or pressurized aerosols.

1.3.3 This standard does not exclude the use of this water for other firefighting or emergency activities.

1.4 Equivalency. Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety in place of those prescribed by this standard, provided technical documentation is submitted to the AHJ to demonstrate equivalency and the system, method, or device is approved for the intended purpose.

1.5 Alternatives. The specific requirements of this standard shall be permitted to be altered by the AHJ to allow alternative methods that will secure equivalent fire safety, but in no case shall the alternative afford less fire safety, in the judgment of the AHJ, than that which would be provided by compliance with the provisions contained in this standard.

1.6 Modifications. The AHJ is authorized to modify any of the provisions of this standard upon application in writing by the owner, a lessee, or a duly authorized representative where there are practical difficulties in the way of carrying out the provisions of the standard, provided that the intent of the standard shall be complied with, public safety secured, and substantial justice done.

1.7 Units and Formulas. In this standard, values for measurement in U.S. units are followed by equivalents in SI units. Either set of values can be used, but the same set of values (either U.S. units or SI units) shall be used consistently.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2022 edition.

NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, 2022 edition.

NFPA 13R, *Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies*, 2022 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2020 edition.

NFPA 220, *Standard on Types of Building Construction*, 2021 edition.

NFPA 285, *Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components*, 2019 edition.

NFPA 1963, *Standard for Fire Hose Connections*, 2019 edition.

2.3 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 1, *Fire Code*, 2021 edition.

NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, 2022 edition.

NFPA 101®, *Life Safety Code*®, 2021 edition.

NFPA 1140, *Standard for Wildland Fire Protection*, 2022 edition.

NFPA 1600®, *Standard on Continuity, Emergency, and Crisis Management*, 2019 edition.

NFPA 1901, *Standard for Automotive Fire Apparatus*, 2016 edition.

NFPA 1911, *Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Emergency Vehicles*, 2017 edition.

NFPA 1925, *Standard on Marine Fire-Fighting Vessels*, 2018 edition.

NFPA 1961, *Standard on Fire Hose*, 2020 edition.

NFPA 5000®, *Building Construction and Safety Code*®, 2021 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Shall. Indicates a mandatory requirement.

3.2.4 Should. Indicates a recommendation or that which is advised but not required.

3.2.5 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word “shall” to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase “standards development process” or “standards development activities,” the term “standards” includes all NFPA Standards,

including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1 Alternative Water Supply. Water supplies provided to meet the minimum fire flow/duration requirements where no municipal-type water system exists or to supplement an inadequate municipal-type water supply.

3.3.2 Automatic Aid. A plan developed between two or more fire departments for immediate joint response on first alarms.

N 3.3.3* Availability. The average fraction of time for any given year that a defined usable volume is exploitable for structural firefighting purposes.

N 3.3.4* Availability Study. An evaluation of a water source performed by a qualified professional to assess the overall availability, inclusive of all adverse weather, seasonal variations, and operational conditions, of a defined usable volume of water.

3.3.5 Building. Any structure used or intended for supporting or sheltering any use or occupancy. [101, 2021]

3.3.6 Construction Classification Number. A series of numbers from 0.5 through 1.5 that are mathematical factors used in a formula to determine the total water supply requirements.

3.3.7 Dry Hydrant. An arrangement of pipe permanently connected to a water source other than a piped, pressurized water supply system that provides a ready means of water supply for firefighting purposes and that utilizes the drafting (suction) capability of a fire department pump.

3.3.8 Dwelling. Any detached building, or any part of a townhouse, back-to-back townhouse, or stacked townhouse structure that is separated from the remainder of the townhouse structure with fire resistance rated assemblies in accordance with local building code, that contains no more than two dwelling units intended to be used, rented, leased, let, or hired out to be occupied or that are occupied for habitation purposes. [13D, 2022]

3.3.9 Dwelling Unit. One or more rooms arranged for complete, independent housekeeping purposes, with space for eating, living, and sleeping; facilities for cooking; and provisions for sanitation. [5000, 2021]

3.3.10 Eductor. A device that uses the Venturi principle to siphon a liquid in a water stream. [1925, 2018]

3.3.11 Ejector. A siphon device used to fill an engine's tank when the water source is below or beyond the engine's drafting capability.

3.3.12* Exposure Hazard. A structure within 50 ft (15.24 m) of another building and 100 ft² (9.3 m²) or larger in area.

3.3.13* Fire Department. An organization providing fire suppression, rescue, and related activities.

3.3.14* Large Diameter Hose. A hose of 3½ in. (90 mm) or larger size. [1961, 2020]

3.3.15 Lift. The vertical height that water must be raised during a drafting operation, measured from the surface of a static source of water to the centerline of the pump intake. [1911, 2017]

3.3.16 Minimum Water Supply. The quantity of water required for fire control and extinguishment.

3.3.17 Mobile Water Supply Apparatus (Tanker, Tender). A vehicle designed primarily for transporting (pickup, transporting, and delivering) water to fire emergency scenes to be applied by other vehicles or pumping equipment. [1901, 2016]

Δ 3.3.18 Municipal-Type Water System. A system having water pipes servicing fire hydrants and designed to furnish, over and above domestic consumption, a minimum of 250 gpm (950 L/min) at 20 psi (138 kPa) residual pressure for a 2-hour duration. [1140, 2022]

3.3.19* Mutual Aid/Assistance Agreement. A prearranged agreement between two or more entities to share resources in response to an incident. [1600, 2019]

3.3.20 Occupancy Hazard Classification Number. A series of numbers from 3 through 7 that are mathematical factors used in a formula to determine total water supply requirements.

N 3.3.21 Qualified Person. A person that has the experience and training to perform a given task, as acceptable to the AHJ.

N 3.3.22 Qualified Professional. A registered professional engineer, hydrologist, geologist, soil conservationist, federal surface water specialist, or similarly qualified person.

N 3.3.23 Recognized Water Supply. A legally and physically accessible water source demonstrated to furnish a minimum flow rate of 250 gpm (950 L/min) for a 2-hour duration from a defined usable volume, as demonstrated by means of an availability study.

3.3.24 Reducer. A fitting used to connect a small hose line or pipe to a larger hose line or pipe.

3.3.25 Rural. Those areas that are not unsettled wilderness or uninhabitable territory but are sparsely populated with densities below 500 persons per square mile.

3.3.26 Structure. That which is built or constructed; an edifice or building of any kind, or any piece of work artificially built up or composed of parts joined together in some definite manner.

3.3.27* Suburb or Suburban. Those moderately inhabited areas with population densities of at least 500 persons per square mile but less than 1000 persons per square mile.

N 3.3.28* Usable Volume. The portion of a water source's total capacity that is available to support structural firefighting, considering the method of extraction, including required equipment clearances, as well as points of access.

3.3.29 Water Delivery Rate. The minimum amount of water per minute (in gpm or L/min), required by this standard or the AHJ, to be delivered to the fire scene via mobile water supply apparatus, hose lines, or a combination of both.

3.3.30* Water Supply Officer (WSO). The fire department officer or designee responsible for providing water for firefighting purposes.

Chapter 4 Calculating Minimum Water Supplies

4.1 General.

4.1.1 Prior to calculating the minimum water supply for a structure, the structure shall be surveyed to obtain the following information:

- (1) Occupancy hazard
- (2) Type of construction
- (3) Structure dimensions (length, width, and height)
- (4) Exposures, if any

4.1.1.1 For new construction, plans shall be submitted to the fire department or the AHJ for determination of the minimum water supply required before construction is started.

4.1.1.2 Changes made in the structural design, dimensions, occupancy, or contents of a planned or existing structure that affect the occupancy hazard or the construction type shall require that the structure be resurveyed to determine if changes are necessary in the minimum water supply required.

4.1.1.3 If there are changes in automatic fire suppression systems in a structure that would affect the protection afforded, the property owner(s) shall notify the AHJ in writing of such changes, including temporary impairment.

4.1.2* The methodology in this chapter shall be used to calculate the required minimum water supply necessary for structural firefighting purposes.

4.1.3* The minimum requirements shall be subject to increase by the AHJ to compensate for particular conditions such as the following:

- (1) Limited fire department resources
- (2) Extended fire department response time or distance
- (3) Potential for delayed discovery of the fire
- (4) Limited access
- (5) Hazardous vegetation
- (6) Structural attachments, such as decks and porches
- (7) Unusual terrain
- (8) Special uses and unusual occupancies

4.1.4 The AHJ shall be permitted to specify how the water supplies required in this document are provided, giving consideration to local conditions and need.

4.1.5 For the purpose of calculating minimum water supply requirement, a structure shall be considered an exposure hazard under the following conditions:

- (1) It is 100 ft² (9.3 m²) or larger in area and is within 50 ft (15.24 m) of another structure.
- (2) The structure, regardless of size, is of occupancy hazard classification 3 or 4 as determined in Chapter 5 and is within 50 ft (15.24 m) of another structure.

4.2 Structures Without Exposure Hazards.

4.2.1* For structures with no exposure hazards, the minimum water supply, in gallons (liters), shall be determined by calculating the total enclosed volume, in cubic feet (cubic meters), of the structure, including any attached structures, dividing by the occupancy hazard classification number as determined from Chapter 5, and multiplying by the construction classification number as determined from Chapter 6 as follows:

[4.2.1]

$$WS_{\min} = \frac{VS_{\text{tot}}}{OHC}(CC)$$

where:

$WS_{\min}$ = minimum water supply in gal (For results in L, multiply by 3.785.)

VS_{tot} = total volume of structure in ft³ (If volume is measured in m³, multiply by 35.3.)

OHC = occupancy hazard classification number

CC = construction classification number

4.2.2 The minimum water supply required for any structure without exposure hazards shall not be less than 2000 gal (7600 L).

4.3 Structures with Exposure Hazards.

4.3.1* For structures with unattached structural exposure hazards, the minimum water supply, in gallons (liters), shall be determined by calculating the total enclosed volume, in cubic feet (cubic meters), of the structure, dividing by the occupancy hazard classification number as determined from Chapter 5, multiplying by the construction classification number as determined from Chapter 6, and multiplying by 1.5 as follows:

[4.3.1]

$$WS_{\min} = \frac{VS_{\text{tot}}}{OHC}(CC) \times 1.5$$

where:

$WS_{\min}$ = minimum water supply in gal (For results in L, multiply by 3.785.)

VS_{tot} = total volume of structure in ft³ (If volume is measured in m³, multiply by 35.3.)

OHC = occupancy hazard classification number

CC = construction classification number

4.3.2 The minimum water supply required for a structure with exposure hazards shall not be less than 3000 gal (11,355 L).

4.4* Structures with Automatic Sprinkler Protection.

4.4.1 The AHJ shall be permitted to reduce the water supply required by this standard for manual firefighting purposes when a structure is protected by an automatic sprinkler system that fully meets the requirements of NFPA 13, NFPA 13D, or NFPA 13R. (See Annex F.)

4.4.2 If a sprinkler system protecting a building does not fully meet the requirements of NFPA 13, NFPA 13D, or NFPA 13R, a water supply shall be provided in accordance with this standard.

4.5 Structures with Other Automatic Fire Suppression Systems. For any structure fully or partially protected by an automatic

fire suppression system other than as specified in Section 4.4, the AHJ shall determine the minimum water supply required for firefighting purposes.

4.6 Water Delivery Rate to the Fire Scene.

4.6.1 The minimum water supply determined using Sections 4.2 through 4.5 shall be delivered in accordance with Table 4.6.1.

Table 4.6.1 Water Delivery Rate

Total Water Supply Required		Water Delivery Rate	
gal	L	gpm	L/min
<15,000	<56,780	250	950
15,001–22,500	56,785–85,170	500	1,900
22,501–30,000	85,175–113,560	750	2,850
>30,000	>113,560	1,000	3,800

4.6.2 The AHJ shall be permitted to adjust the water delivery rate, giving consideration to local conditions and need.

4.6.3 The minimum water delivery rate shall not be less than 250 gpm (950 L/min).

4.7 Other Uses. Water supplies developed to meet this standard shall be permitted to be used for fighting fires in other than structures or for use during other emergency activities.

Chapter 5 Classification of Occupancy Hazard

5.1 General.

5.1.1 This chapter shall be used to determine the occupancy hazard classification number used in the calculation of water supply requirements in Chapter 4.

5.1.2 Where more than one occupancy is present in a structure, the occupancy hazard classification number for each occupancy shall be determined separately, and the classification number for the most hazardous occupancy shall be used for the entire structure.

5.2* Occupancy Hazard Classification Number.

5.2.1 Occupancy Hazard Classification Number 3.

5.2.1.1* Occupancy hazard classification number 3 shall be used for severe hazard occupancies.

5.2.1.2 Occupancies having conditions similar to the following shall be assigned occupancy hazard classification number 3:

- (1) Cereal or flour mills
- (2) Combustible hydraulics
- (3) Cotton picking and opening operations
- (4) Die casting
- (5) Explosives and pyrotechnics manufacturing and storage
- (6) Feed and gristmills
- (7) Flammable liquid spraying
- (8) Flow coating/dipping
- (9) Linseed oil mills
- (10) Manufactured homes/modular building assembly
- (11) Metal extruding
- (12) Plastic processing
- (13) Plywood and particleboard manufacturing

- (14) Printing using flammable inks
- (15) Rubber reclaiming
- (16) Sawmills
- (17) Solvent extracting
- (18) Straw or hay in bales
- (19) Textile picking
- (20) Upholstering with plastic foams

5.2.2 Occupancy Hazard Classification Number 4.

5.2.2.1* Occupancy hazard classification number 4 shall be used for high hazard occupancies.

5.2.2.2 Occupancies having conditions similar to the following shall be assigned occupancy hazard classification number 4:

- (1) Barns and stables (commercial)
- (2) Building materials supply storage
- (3) Department stores
- (4) Exhibition halls, auditoriums, and theaters
- (5) Feed stores (without processing)
- (6) Freight terminals
- (7) Mercantiles
- (8) Paper and pulp mills
- (9) Paper processing plants
- (10) Piers and wharves
- (11) Repair garages
- (12) Rubber products manufacturing and storage
- (13) Warehouses, such as those used for furniture, general storage, paint, paper, and woodworking industries

5.2.3 Occupancy Hazard Classification Number 5.

5.2.3.1 Occupancy hazard classification number 5 shall be used for moderate hazard occupancies, in which the quantity or combustibility of contents is expected to develop moderate rates of spread and heat release. The storage of combustibles shall not exceed 12 ft (3.66 m) in height.

5.2.3.2 Occupancies having conditions similar to the following shall be assigned occupancy hazard classification number 5:

- (1) Amusement occupancies
- (2) Clothing manufacturing plants
- (3) Cold storage warehouses
- (4) Confectionery product warehouses
- (5) Farm storage buildings, such as corn cribs, dairy barns, equipment sheds, and hatcheries
- (6) Laundries
- (7) Leather goods manufacturing plants
- (8) Libraries (with large stockroom areas)
- (9) Lithography shops
- (10) Machine shops
- (11) Metalworking shops
- (12) Nurseries (plant)
- (13) Pharmaceutical manufacturing plants
- (14) Printing and publishing plants
- (15) Restaurants
- (16) Rope and twine manufacturing plants
- (17) Sugar refineries
- (18) Tanneries
- (19) Textile manufacturing plants
- (20) Tobacco barns
- (21) Unoccupied buildings

5.2.4 Occupancy Hazard Classification Number 6.

5.2.4.1 Occupancy hazard classification number 6 shall be used for low hazard occupancies, in which the quantity or

combustibility of contents is expected to develop relatively low rates of spread and heat release.

5.2.4.2 Occupancies having conditions similar to the following shall be assigned occupancy hazard classification number 6:

- (1) Armories
- (2) Automobile parking garages
- (3) Bakeries
- (4) Barber or beauty shops
- (5) Beverage manufacturing plants/breweries
- (6) Boiler houses
- (7) Brick, tile, and clay product manufacturing plants
- (8) Canneries
- (9) Cement plants
- (10) Churches and similar religious structures
- (11) Dairy products manufacturing and processing plants
- (12) Doctors' offices
- (13) Electronics plants
- (14) Foundries
- (15) Fur processing plants
- (16) Gasoline service stations
- (17) Glass and glass products manufacturing plants
- (18) Horse stables
- (19) Mortuaries
- (20) Municipal buildings
- (21) Post offices
- (22) Slaughterhouses
- (23) Telephone exchanges
- (24) Tobacco manufacturing plants
- (25) Watch and jewelry manufacturing plants
- (26) Wineries

5.2.5 Occupancy Hazard Classification Number 7.

5.2.5.1 Occupancy hazard classification number 7 shall be used for light hazard occupancies, in which the quantity or combustibility of contents is expected to develop relatively light rates of spread and heat release.

5.2.5.2 Occupancies having conditions similar to the following shall be assigned occupancy hazard classification number 7:

- (1) Apartments
- (2) Colleges and universities
- (3) Clubs
- (4) Dormitories
- (5) Dwellings
- (6) Fire stations
- (7) Fraternity or sorority houses
- (8) Hospitals
- (9) Hotels and motels
- (10) Libraries (except large stockroom areas)
- (11) Museums
- (12) Nursing and convalescent homes
- (13) Offices (including data processing)
- (14) Police stations
- (15) Prisons
- (16) Schools
- (17) Theaters without stages

Chapter 6 Classification of Construction

6.1 General.

6.1.1 This chapter shall be used to determine the construction classification number used in the calculation of water supply requirements in Chapter 4.

6.1.2 Where more than one type of construction is present in a structure, the classification number for each type of construction shall be determined separately, and the higher construction classification number shall be used for the entire structure.

6.2* Construction Classification Number.

6.2.1 The construction classification number shall be as shown in Table 6.2.1 based on the construction of the structure as determined in accordance with Section 6.3.

6.2.2 For dwellings, the maximum construction classification number shall be 1.0.

6.3 Classification of Types of Building Construction.

6.3.1* Classification of types of building construction shall be in accordance with 6.3.3 through 6.3.7 and Table 6.3.1.

Table 6.2.1 Construction Classification Number

Construction Type	Classification Number
Type I (442 or 332)	0.5
Type II (222, 111, or 000)	0.75
Type III (211 or 200)	1.0
Type IV (2HH)	0.75
Type V (111 or 000)	1.5

6.3.2 If the type of construction of the structure has been determined using NFPA 220 that type of construction shall be permitted to be used in lieu of determining the type of construction in accordance with 6.3.3 through 6.3.7.

6.3.3 Type I (442 or 332) Construction.

6.3.3.1 Type I (442 or 332) construction shall be those types in which the fire walls, structural elements, walls, arches, floors, and roofs are of approved noncombustible or limited-combustible materials.

6.3.3.2 Structural members shall have fire resistance ratings not less than those specified in Table 6.3.1.

Table 6.3.1 Fire Resistance Ratings for Type I through Type V Construction (hr)

	Type I		Type II			Type III		Type IV	Type V	
	442	332	222	111	000	211	200	2HH	111	000
Exterior Bearing Walls										
Supporting more than one floor, columns, or other bearing walls	4	3	2	1	0	2	2	2	1	0
Supporting one floor only	4	3	2	1	0	2	2	2	1	0
Supporting a roof only	4	3	1	1	0	2	2	2	1	0
Interior Bearing Walls										
Supporting more than one floor, columns, or other bearing walls	4	3	2	1	0	1	0	2	1	0
Supporting one floor only	3	2	2	1	0	1	0	1	1	0
Supporting roofs only	3	2	1	1	0	1	0	1	1	0
Columns										
Supporting more than one floor, columns, or other bearing walls	4	3	2	1	0	1	0	H*	1	0
Supporting one floor only	3	2	2	1	0	1	0	H*	1	0
Supporting roofs only	3	2	1	1	0	1	0	H*	1	0
Beams, Girders, Trusses, and Arches										
Supporting more than one floor, columns, or other bearing walls	4	3	2	1	0	1	0	H*	1	0
Supporting one floor only	2	2	2	1	0	1	0	H*	1	0
Supporting roofs only	2	2	1	1	0	1	0	H*	1	0
Floor Construction	2	2	2	1	0	1	0	H*	1	0
Roof Construction	2	1½	1	1	0	1	0	H*	1	0
Interior Nonbearing Walls	0	0	0	0	0	0	0	0	0	0
Exterior Nonbearing Walls[†]	0	0	0	0	0	0	0	0	0	0

Note: Shaded columns indicate those members that are permitted to be of approved combustible material.

*"H" indicates heavy timber members; see 6.3.6 for requirements.

[†]Exterior nonbearing walls meeting the conditions of acceptance of NFPA 285 are permitted to be used.

6.3.4 Type II (222, 111, or 000) Construction.

6.3.4.1 Type II (222, 111, or 000) construction shall be those types not qualifying as Type I construction in which the fire walls, structural elements, walls, arches, floors, and roofs are of approved noncombustible or limited-combustible materials.

6.3.4.2 Structural members shall have fire resistance ratings not less than those specified in Table 6.3.1.

6.3.5 Type III (211 or 200) Construction.

6.3.5.1 Type III (211 or 200) construction shall be that type in which exterior walls and structural members that are portions of exterior walls are of approved noncombustible or limited-combustible materials.

6.3.5.2 Fire walls, interior structural elements, walls, arches, floors, and roofs shall be permitted to be entirely or partially constructed of wood of smaller dimensions than required for Type IV construction or of approved noncombustible, limited-combustible, or other approved combustible materials.

6.3.5.3 In addition, structural members shall have fire resistance ratings not less than those specified in Table 6.3.1.

6.3.6 Type IV (2HH) Construction.

6.3.6.1 Type IV (2HH) construction shall be that type in which fire walls, exterior walls, and interior bearing walls and structural elements that are portions of such walls are of approved noncombustible or limited-combustible materials.

6.3.6.1.1 Other interior structural elements, arches, floors, and roofs shall be of solid or laminated wood without concealed spaces and shall comply with the allowable dimensions of 6.3.6.5 through 6.3.6.10.

6.3.6.1.2 In addition, structural members shall have fire resistance ratings not less than those specified in Table 6.3.1.

6.3.6.2 Interior columns, arches, beams, girders, and trusses of approved materials other than wood shall be permitted, provided they are protected to provide a fire resistance rating of not less than 1 hour.

6.3.6.3 Certain concealed spaces shall be permitted in accordance with 6.3.6.7.4.

6.3.6.4 All dimensions in 6.3.6.5 through 6.3.6.10 shall be considered nominal.

6.3.6.5 Columns.

6.3.6.5.1 Wood columns supporting floor loads shall be not less than 8 in. (200 mm) in any dimension.

6.3.6.5.2 Wood columns supporting only roof loads shall be not less than 6 in. (150 mm) in width and not less than 8 in. (200 mm) in depth.

6.3.6.6 Beams.

6.3.6.6.1 Wood beams and girders supporting floor loads shall be not less than 6 in. (150 mm) in width and not less than 10 in. (250 mm) in depth.

6.3.6.6.2 Wood beams and girders and other roof framing supporting only roof loads shall be not less than 4 in. (100 mm) in width and not less than 6 in. (150 mm) in depth.

6.3.6.7 Arches.

6.3.6.7.1 Framed or glued laminated arches that spring from grade or the floor line and timber trusses that support floor loads shall be not less than 8 in. (200 mm) in width or depth.

6.3.6.7.2 Framed or glued laminated arches for roof construction that spring from grade or the floor line and do not support floor loads shall have members not less than 6 in. (150 mm) in width and not less than 8 in. (200 mm) in depth for the lower half of the member height, and not less than 6 in. (150 mm) in depth for the upper half of the member height.

6.3.6.7.3 Framed or glued laminated arches for roof construction that spring from the top of walls or wall abutments, and timber trusses that do not support floor loads, shall have members not less than 4 in. (100 mm) in width and not less than 6 in. (150 mm) in depth.

6.3.6.7.4 Spaced members shall be permitted to be composed of two or more pieces not less than 3 in. (75 mm) in thickness where blocked solidly throughout their intervening spaces or where such spaces are tightly closed by a continuous wood cover plate not less than 2 in. (50 mm) in thickness that is secured to the underside of the members.

6.3.6.8 Splice Plates. Splice plates shall be not less than 3 in. (75 mm) in thickness.

6.3.6.9 Floors. Floors shall be constructed of spline or tongue-and-groove plank not less than 3 in. (75 mm) in thickness that is covered with 1 in. (25 mm) tongue-and-groove flooring, laid crosswise or diagonally to the plank, or with ½ in. (12.5 mm) wood structural panel; or they shall be constructed of laminated planks not less than 4 in. (100 mm) in width, set close together on edge, spiked at intervals of 18 in. (460 mm), and covered with 1 in. (25 mm) tongue-and-groove flooring, laid crosswise or diagonally to the plank, or with ½ in. (12.5 mm) wood structural panel.

6.3.6.10 Roof Decks. Roof decks shall be constructed of spline or tongue-and-groove plank not less than 2 in. (50 mm) in thickness; or of laminated planks not less than 3 in. (75 mm) in width, set close together on edge, and laid as required for floors; or of 1½ in. (28.5 mm) thick interior wood structural panel (exterior glue); or of approved noncombustible or limited-combustible materials of equivalent fire durability.

6.3.7 Type V (111 or 000) Construction. Type V (111 or 000) construction shall be that type in which exterior walls, bearing walls, columns, beams, girders, trusses, arches, floors, and roofs are entirely or partially of wood or other approved combustible material smaller than material required for Type IV construction. In addition, structural members shall have fire resistance ratings not less than those specified in Table 6.3.1.

Chapter 7 Water Supply

7.1 Approved Water Supply.

7.1.1* Any water supply source used to meet the requirements of this standard shall be of a quality approved by the AHJ.

7.1.2 Where required by the AHJ, the minimum water supply shall be available prior to combustibles being brought on site.

7.1.3 Water storage tanks shall be inspected, tested, and maintained in accordance with NFPA 25.

7.1.4 The water supply source shall be maintained and accessible on a year-round basis.

7.1.5 In locations where adequate municipal-type water systems are not provided and additional fire protection is needed, minimum water supplies shall be established in, or transportable to, the designated area.

7.1.6 Unless otherwise permitted by the AHJ, all approved nonpressurized water supply sources shall be accessible using dry hydrants that meet the requirements of this standard.

7.1.7 Water supply sources shall maintain a usable volume that is consistent with the minimum capacity and delivery requirements prescribed in this standard and that is of adequate availability, as demonstrated by an availability study.

N 7.1.7.1 The availability study shall consider all relevant adverse weather conditions or seasonal variations, corresponding, at a minimum, to a 20-year recurrence interval (5 percent annual exceedance probability), or an equivalent measure acceptable to the AHJ.

N 7.1.7.2 The availability study shall consider significantly adverse operational events and conditions applicable to the method of extraction, including those related to access, equipment reliability, and maintenance practices.

N 7.1.7.3 The total average availability on an annual basis shall be no less than 95 percent, or an equivalent measure acceptable to the AHJ.

N 7.1.8 Where required by the AHJ, a recognized water supply shall be provided in lieu of the minimum water supply, as determined in Chapter 4.

7.2* Water Use Agreements. If a private water supply source is to be used to meet the requirements of this standard, a legal agreement establishing access to and use of the water source shall be recorded.

7.3 Identifying Water Sources. A water source indicator approved by the AHJ shall be erected at each water point identifying the site for fire department emergency use.

7.4 Fire Hose Connections. Any fitting provided at a water source to permit a fire apparatus to connect to the water source shall be approved by the AHJ and shall conform to NFPA 1963.

7.5* Access to Water Sources. Roads providing a means of access to any required water supply shall be constructed and maintained in accordance with the following:

- (1) Roadways shall have a minimum clear width of 12 ft (3.7 m) for each lane of travel.
- (2) Turns shall be constructed with a minimum radius of 100 ft (30.5 m) to the centerline.

- (3) The maximum sustained grade shall not exceed 8 percent.
- (4) All cut-and-fill slopes shall be stable for the soil involved.
- (5) Bridges, culverts, or grade dips shall be provided at all drainageway crossings; roadside ditches shall be deep enough to provide drainage with special drainage facilities (tile, etc.) at all seep areas and high water-table areas.
- (6) The surface shall be treated as required for year-round travel.
- (7) Erosion control measures shall be used as needed to protect road ditches, cross drains, and cut-and-fill slopes.
- (8)* Where turnarounds are utilized during firefighting operations, they shall be designed with a diameter of 120 ft (36.5 m) or larger, as required, to accommodate the equipment of the responding fire department.
- (9) Load-carrying capacity shall be adequate to carry the maximum vehicle load expected.
- (10) The road shall be suitable for all-weather use.
- (11) When a bridge is required to be used as part of a fire apparatus access road, it shall be constructed and maintained in accordance with nationally recognized standards. [1:18.2.3.5.5.1]
- (12) The bridge shall be designed for a live load sufficient to carry the imposed loads of fire apparatus. [1:18.2.3.5.5.2]
- (13) Vehicle load limits shall be posted at both entrances to bridges where required by the AHJ. [1:18.2.3.5.5.3]

Δ 7.6* Mobile Water Supply Training. The AHJ shall determine what training is required of the fire department personnel involved in mobile water supply operations.

7.7 Records.

7.7.1* A record of each water supply shall be prepared and periodically updated.

7.7.2 The records shall be retained in accordance with the record retention policy of the jurisdiction or state.

7.7.3 Records developed to meet the requirements of this standard shall be retained for a minimum of 3 years after the agreement, facility, or equipment is no longer used for its original purpose.

Chapter 8 Dry Hydrants

Δ 8.1* Chapter Scope. This chapter covers the planning, permitting, design, installation, inspection, and maintenance of dry hydrants.

8.2 Planning and Permits. The planning, permitting, and design processes shall be completed before the actual construction begins.

8.2.1 Planning shall be coordinated among public and private entities that could be impacted by the installation of a dry hydrant.

8.2.2* Required permits to install a dry hydrant shall be obtained prior to installation.

8.3* Dry Hydrant Design.

Δ 8.3.1* The AHJ shall approve all aspects of the dry hydrant design and construction, including the type of materials, pipe

size, system fittings to be used, and qualifications of the installers.

8.3.2* As a minimum, Schedule 40 pipe and component fittings shall be used.

8.3.3* All dry hydrant systems shall be designed and constructed to provide a minimum flow of 1000 gpm (3800 L/min) at draft.

8.3.4* The water supply source for the dry hydrant shall provide, on a year-round basis, the required quantity of water, as determined in Chapter 4, and the minimum flow as required in 8.3.3.

8.3.5* Dry hydrant systems shall be designed and constructed so that slope and piping configurations do not impede drafting capability.

8.3.6* All exposed surfaces and all underground metal surfaces shall be protected to prevent deterioration.

8.3.7* A minimum number of elbows shall be used in the piping system.

8.3.8 Suction hose connection(s) shall be compatible with the fire department's hard suction hose size and shall conform to NFPA 1963. The connection(s) shall include a protective cap. The cap and adapter shall be of materials that minimize rust and galvanic corrosion.

8.3.9 Dry hydrant system piping shall be supported and/or stabilized using approved engineering design practices.

8.3.10 Stabilization, pipe restraints, or equivalent protection shall be employed at elbows, joints, and other system stress points.

8.3.11 In addition to strength of materials and structural support criteria, design shall specify appropriate aggregates and soil materials to be used to backfill/cover piping during installation.

8.3.12 All connections shall be clean, and the appropriate sealing materials shall be used according to manufacturer's specifications so as to ensure that all joints are airtight.

8.3.13* System strainers shall be constructed to permit required fire flow.

8.4* Dry Hydrant Locations.

8.4.1 A minimum of 3 ft (0.9144 m) of clear, unobstructed space shall be provided around the dry hydrant.

8.4.2* Dry hydrants shall be located so that they are accessible under all weather conditions.

8.4.3 The dry hydrant system and access to the site shall be developed in a manner that allows the fire department pump to connect to the hydrant using not more than 20 ft (6 m) of hard suction hose.

8.4.4 Dry hydrants shall be located a minimum of 100 ft (30 m) from any structure.

8.4.5 No parking or other obstacles shall be allowed within 20 ft (6 m) of the access side of the hydrant.

8.4.6* Dry hydrants shall be protected from damage by vehicular and other perils, including freezing and damage from ice and other objects.

Δ 8.4.7* Dry hydrant locations shall be made visible from the main roadway by reflective marking and signage approved by the AHJ.

8.4.8 All identification signs shall be approved by the highway authority prior to installation if they are to be located on the right-of-way or are subject to state laws.

8.5* Strainer Clearance.

8.5.1 There shall be not less than 2 ft (0.6 m) of water above the strainer and not less than 1 ft (0.3 m) below the strainer, unless otherwise authorized by the AHJ.

Δ 8.5.2 Placement of the strainer shall be established in consideration of the availability study in accordance with 7.1.7 to ensure the availability of water.

8.6* Installation Procedure for Dry Hydrant System. The AHJ shall ensure that the installation meets all design criteria.

8.7 Inspection, Testing, and Maintenance of Dry Hydrants.

8.7.1* Dry hydrants shall be inspected at least quarterly and maintained as necessary to keep them in good operating condition.

8.7.2 Thorough surveys shall be conducted, to reveal any deterioration in the water supply situation in ponds, streams, or cisterns.

8.7.3 Vegetation shall be cleared for a minimum 3 ft (0.9 m) radius from around hydrants.

8.7.4 The reflective material marking the hydrant and signage shall be inspected at least annually to verify that it is being maintained in accordance with 8.4.7.

8.7.5 Hydrant risers shall be protected from ultraviolet (UV) degradation by painting or other measures.

8.7.6* The hydrants shall be flow tested at least annually with an approved pump to ensure that the minimum design flow is maintained.

N 8.7.7 Inspection, testing, and maintenance of dry hydrants shall be performed by a qualified person.

8.8* Records for Dry Hydrants. The AHJ shall maintain, in a safe location, maps and records of each dry hydrant installation and the subsequent tests, inspections, maintenance, and repairs to the dry hydrant.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.2 In some areas, water supply systems have been installed for domestic water purposes only. These systems could be equipped with hydrants that might not have the volume, pressure, and duration of flow needed for adequate firefighting purposes. Where such conditions exist, this standard and annex should be applied in water supply matters.

A.1.3.2 Locations such as these require individual evaluations to determine the minimum water supply to protect the hazards present.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase “authority having jurisdiction,” or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.3.3 Availability. Factors that can reduce the availability of a defined usable volume of water include adverse weather conditions and seasonal variations (e.g., drought, freezing temperatures, and flooding). Additionally, based on the method of extraction, adverse operational conditions, including those as a result of reliability issues and maintenance practices, might need to be considered. Consideration should be given as to how accessibility can vary or be precluded during certain times of the year.

A.3.3.4 Availability Study. There are many different types of bodies of water that can be used as water sources for alternative water supplies. Therefore, one type of study cannot apply to all water sources.

In some instances, a detailed analysis is required. In other instances, the fire department's methods of operation and the limitations of those operations can be reviewed in conjunction with the historical low-water records for the water source to determine if an acceptable amount of water can be acquired.

The following types of water sources and evaluation methods provide additional guidance on the recognition and recertification process.

Impounded Ponds. These very small reservoirs are created by damming minor perennial or intermittent streams. A typical example would be a small pond created for livestock or irrigation purposes on an agricultural property. Water supply levels in these ponds can be highly dependent on runoff from the feeding watershed, although some inputs from direct precipitation and groundwater infiltration are possible. These are further differentiated from other types of reservoirs by the fact that the water level is not actively managed, although a maximum water level can be maintained by means of pipe outlets or

spillways. Significant water loss can occur through evaporation, transpiration, and irrigation.

These ponds can be effectively modeled by using the United States Department of Agriculture's (USDA) Natural Resources Conservation Service's (NRCS) Reservoir Operations (RESOP), the Soil, Plant, Atmosphere, Water (SPA-W) program, or other similar water-budget methods. The main parameters of these programs to be considered include the inflow of water sources such as ground wells, precipitation, and runoff from watershed areas, as well as the outflow caused by evaporation, transpiration, seepage, irrigation, and livestock demands. High storage and low storage limitations of the pond should not be dismissed in the evaluation. The low water stage storage elevation should be identified and compared to the fire department's methods of operation to determine the recognition status.

For initial recognition, estimates of minimum usable volume and allowable extraction rates and durations should be obtained from a qualified professional. Special attention should be given to the impacts of freezing and drought on usable water volume and accessibility. Documentation of how the water will be extracted (e.g., dry hydrants or pumping apparatus) and access permission should be provided by the fire department. Regular annual recertification of these sources is done by visually observing low water occurrences. This process is critical, due to their small size and dynamic nature. Volume must be re-assessed, and documentation of annual dry hydrant flow tests and extended periods of low water stage storage events must be documented, maintained, and evaluated for continued recognition by the fire department.

Irrigation Wells. Drawing from groundwater, these systems have an effectively unlimited volume, but the flow rate and duration will vary. Data concerning the flow rate, flow duration, and any potential limitations should be obtained from the results of a well drawdown test or an analysis from a ground water flow model. For initial recognition, the availability of the water source and pumping operations, estimates of the minimum usable volume, allowable extraction rates and durations should be evaluated by a qualified professional. The recertification of the sources should be based on the performance of the wells, or as determined by the AHJ. A well that produces plenty of water, recovers quickly, and has a small drawdown might need only routine checks. Other wells might need to be monitored constantly.

Large Inland Lakes. Some very large lakes occurring far from the coast, such as the Great Lakes, have characteristics of both post-glacial water bodies and inland seas. These massive freshwater lakes are unique in terms of volume and stability and generally represent excellent sources of fire protection water. Some features, such as a long and gradually-tapering littoral zone, can make the installation of dry hydrants challenging when considering beach areas for supply sources. Where deep inlets exist or have been created, local depth profiles may be excellent for dry hydrant installations. It is difficult to consider these lakes in a general fashion because, like the sea, their characteristics are highly dependent on local littoral conditions. Detailed bathymetric data is often readily available from National Oceanic and Atmospheric Administration (NOAA) and state agencies to facilitate local assessments. The volume of these lakes is essentially unlimited, but accessibility can still be an issue due to tidal influences or during freezing conditions. Special attention should be paid to the location and viability of

any dry hydrants or other drafting points used for access. Volume will likely require recertification, but the documentation of annual flow tests for any dry hydrants should be provided in order to ensure continued serviceability.

Large Reservoirs. These are large-scale water bodies created by the impoundment of one or more major perennial streams. The dams used to create these reservoirs are typically large-scale, and can often include significant amounts of concrete, although some parts can be of earthen construction. These large, deep-water bodies, have water column zonation like natural lakes. This category is meant to capture those large reservoirs created by the Tennessee Valley Authority (TVA), United States Army Corps of Engineers, and similar agencies. These are generally multi-use reservoirs that supply drinking and irrigation water, provide recreation, and provide protection from floods. Active management of water levels is the hallmark of this category, and full-time staff is normally involved in managing these reservoirs and dams. Modeling of depth for fire protection purposes will be simplified by the fact of this active and intentional management. Accessibility can still be an issue when water levels are lowered, or during freezing conditions. Documentation of volume estimates can be provided by the owning agency, but special attention should be paid to the location and viability of any dry hydrants or other drafting points used for access. Volume will likely not require recertification, but documentation of annual flow tests for any dry hydrants should be provided to ensure continued serviceability.

Seawater. In coastal areas, the ocean can represent an abundant and readily accessed source of fire protection water. Volume is not an issue, although depth can be highly variable due to local tidal and littoral characteristics. Due to highly variable local conditions, it is difficult to consider maritime areas in a general way. Detailed bathymetric and tide data is often readily available from NOAA and state agencies to facilitate local assessments. Special attention should be paid to the location and viability of any dry hydrants or other drafting points used for access. Documentation of annual flow tests for any dry hydrants should be provided to ensure continued serviceability.

Storage Tanks. The initial recognition of the availability study should include an examination of the design and installation by a qualified professional. This should be done to include an assessment of the filling mechanism's reliability and flow capacities. Recertification should include the verification of regular flow testing to ensure that the capability of the source has not declined due to corrosion, encrustation, or siltation. Recertification should also include an examination of the filling mechanism to ensure that it is still valid.

Streams. These are naturally-occurring water bodies that convey runoff and groundwater from higher to lower elevations within a watershed. Many streams have been dramatically modified from their natural conditions, but all still follow the same general course from headwaters to outlets. Included in this category are water bodies bearing diverse local names: river, creek, branch, run, brook, and fork, among others. Since there is no universally-accepted naming convention, and because the size and flow of streams varies considerably along their course, they are all grouped together under the term "stream." Streams can be perennial with a base flow at all times, or intermittent with seasonal periods of no flow. Water volume and flow is maintained by a combination of overland runoff and groundwater inputs. The flow can be highly variable in many streams due to seasonal fluctuations in precipitation. Extraction of

water for industrial or irrigation purposes could reduce flow considerably over expected volumes.

Only perennial streams should be considered for recognition, since intermittent and ephemeral streams have no flow at certain times. For perennial streams, overall volume is essentially infinite, but the rate at which it can be extracted can be dictated by the flow. Where available, low-flow estimates from the United States Geological Survey (USGS) StreamStats model, as interpreted by a qualified professional, should be used to determine the suitability of a proposed draft site for recognition. Where StreamStats low-flow estimates are not available, local conservation district or USDA NRCS staff should be able to provide reliable estimates in gaged reaches of the stream. In ungaged reaches, a qualified hydrologist will be required. Dry hydrants can be installed in the stream bed or mounted on bridges over the stream. In the case of bridge-mount dry hydrants that are stowed out of the water, documentation of ice-free conditions during an extended cold period should be provided. Specialized dry hydrant components can operate in low-depth conditions and can allow for successful installations in somewhat shallow stream reaches. Although stream volume is essentially infinite, the usable flow will dictate the frequency of the recertification interval. Any major new withdrawals from the stream, such as those done for new irrigation systems, should trigger an early recertification assessment. Exploitable volumes and flow duration must be determined by a qualified professional. Documentation of annual flow tests for any dry hydrants should also be provided to ensure continued serviceability.

A.3.3.12 Exposure Hazard. If a structure is a Class 3 or Class 4 occupancy hazard, it is an exposure hazard if within 50 ft (15.24 m) of another building, regardless of size.

A.3.3.13 Fire Department. The AHJ and the fire department having jurisdiction can be the same agency. The term *fire department* includes any public, governmental, private, industrial, tribal, or military organization engaging in this type of activity.

A.3.3.14 Large Diameter Hose. Supply hose is designed to be used at operating pressures not exceeding 185 psi (1275 kPa). Attack hose is designed for use at operating pressures up to at least 275 psi (1895 kPa).

A.3.3.19 Mutual Aid/Assistance Agreement. Often the request for such aid to be rendered comes only after an initial response has been made and the emergency incident status has been determined.

A.3.3.27 Suburb or Suburban. Suburban areas can include populous towns or large villages or be located outside the official limits of a densely settled city of 2500 to 50,000 people per census block, or those areas that interface with the outer rim of an urban cluster (UC). Suburban communities usually exist within commuting distance of urban areas but exhibit their own jurisdictional autonomy.

A.3.3.28 Usable Volume. Usable volume is typically the portion of water storage that is above the required clearance level of a strainer and below the maintained or historically low stage storage elevation of the water body. Note that the accessibility to the usable volume can be greatly influenced by fluctuating water boundaries (e.g., shorelines) as well as the fire department's methods of operation.

A.3.3.30 Water Supply Officer (WSO). Many progressive rural fire departments depend on a water supply officer (WSO). The

WSO is the individual who implements the water supply pre-fire planning. The work of a properly trained and equipped WSO makes it possible for the officer supervising the actual fire attack to operate on the basis of reliable water supply information, to coordinate the attack with the available water supplies, and to avoid diverting his or her attention from the attack to the logistics of backing it up with an adequate water supply.

The WSO's overall responsibilities are to determine water supply requirements of the targeted structures, to plan availability of and access to water sources, and to ensure sufficient water is provided at each fire site. The WSO should maintain and have available a complete set of files, including locations of water sources and lists of available automatic and mutual aid mobile water supply apparatus. Modern technology in computers makes it feasible for even a relatively low-budget department to reduce this data to electronic files that can be maintained at the fire alarm communication center and provided at the scene of every fire.

The WSO participates in the pre-fire planning and in calculating the water supply requirements for the various buildings in the area under the department's jurisdiction. To satisfy these water supply requirements, the WSO should survey the district and the surrounding areas for available water for firefighting purposes. Water supplies might exist on the property to be protected or might need to be transported. The WSO should develop preplans and see that the fire department is kept aware of all the water supplies available to the entire area. The WSO maintains close coordination with the fire department training officer and provides assistance in joint water supply training sessions with neighboring fire departments. The WSO should make periodic inspections of all water supplies and structural changes in the department's jurisdiction.

A list of all apparatus, equipment, and personnel available to the WSO's department should be developed. Arrangements should be developed for specific apparatus and personnel to respond under an automatic aid agreement (first alarm response) or a mutual aid agreement (called as needed). Needs will be dictated by the nature of the structure(s) involved and the quantity of water required.

At the fire scene, the WSO's duty is to maintain continuous fire streams by establishing several water-hauling facilities, assembling water-carrying equipment of automatic and mutual aid departments, and calculating estimated arrival times of mobile water supply apparatus, through a thorough knowledge of available water supplies throughout a wide area of fire department jurisdiction.

Developing and sustaining large fire flow requires the use of several water sources as well as several drop tanks where water can be dumped. Therefore, reliable and effective communication is necessary in directing mobile water supplies so that time is not lost at the fill and the dump points. To obtain water supply efficiency, a radio frequency separate from that used for the fireground operations should be assigned to the WSO and the water supply site and the mobile water supply apparatus. The WSO will also require efficient communication with the incident commander.

The WSO (or designee) meets with property owners and others to secure their permission to use the water supply, to develop an all-weather road to the supply, and to install dry hydrants. The installation of roads to, or dry hydrants in, navigable water or wetlands might require a permit from appropri-

ate local, state, or national agencies. The WSO should also consult with the owner in the design of a water source on a property to be protected.

A.4.1.2 Information needed to compute the minimum water supplies that should be collected during building surveys includes the following:

- (1) Area of all floors, including attics, basements, and crawl spaces
- (2) Height between floors or crawl spaces and in the attics from floor to ridgepole
- (3) Construction materials used in each building, including walls, floors, roofs, ceilings, interior partitions, stairs, and so forth
- (4) Occupancy(ies) of buildings
- (5) Exposures to the structure from other buildings or yard storage and separation distances
- (6) Fire protection systems — automatic and manual protection systems, hydrants, yard mains, and other protection facilities
- (7) On-premises water supplies, including natural and constructed sources of water

A.4.1.3 The water supply for firefighting purposes, as specified in Chapter 4, is considered the minimum water supply. The AHJ could determine that a municipal-type water supply is warranted (*see Annex G*). This determination might be made as a result of on-site survey of buildings by the fire department having jurisdiction or by review of architectural plans of proposed construction and planned development.

A.4.2.1 Annex H provides tables with precalculated minimum water supplies by occupancy hazard and construction classification where no exposures are present.

A.4.3.1 See Annex H for sample calculations for structures with exposure hazards.

A.4.4 The following information on permitted reductions of fire flow and other fire flow provisions is based on NFPA 1, Section 18.4.

One- and Two-Family Dwellings. The minimum fire flow and flow duration requirements for one- and two-family dwellings having a fire flow area that does not exceed 5000 ft² (334.5 m²) should be at 1000 gpm (3785 L/min) or 500 gpm (1900 L/min) when an approved automatic sprinkler system is installed throughout and/or separated from other buildings by a minimum of 30 ft (9.1 m). The minimum fire flow duration is 1 hour.

A reduction in required fire flow of 50 percent is permitted where the building is provided with an approved automatic sprinkler system.

A reduction in the required fire flow of 25 percent is also permitted where the building is separated from other buildings by a minimum of 30 ft (9.1 m).

The reduction for an approved automatic sprinkler system and/or separated from other buildings cannot reduce the required fire flow to less than 500 gpm (1900 L/min).

Fire flow and flow duration for dwellings having a fire flow area in excess of 5000 ft² (334.5 m²) cannot be less than that specified for buildings other than one- and two-family dwellings.

Buildings Other Than One- and Two-Family Dwellings. The minimum fire flow and flow duration for buildings other than one- and two-family dwellings should not be less than 1000 gpm (3785 L/min) or 600 gpm (2270 L/min) when the building is protected throughout by an approved automatic sprinkler system and quick response sprinklers are utilized throughout.

A reduction in the required fire flow of 75 percent is permitted when the building is protected throughout by an approved automatic sprinkler system.

A reduction in the required fire flow of 75 percent is permitted when the building is protected throughout by an approved automatic sprinkler system, which utilizes quick response sprinklers throughout. The resulting fire flow should not be less than 600 gpm (2270 L/min).

A.5.2 The occupancy hazard classification number is a mathematical factor to be used in calculating minimum water supplies. The lowest occupancy hazard classification number is 3, and it is assigned to the highest hazard group. The highest occupancy hazard classification number is 7, and it is assigned to the lowest hazard group.

A.5.2.1.1 In severe hazard occupancies, the quantity or combustibility of contents is expected to develop very high rates of spread and heat release.

A.5.2.2.1 In high hazard occupancies, the quantity or combustibility of contents is expected to develop high rates of spread and heat release.

A.6.2 The construction classification number is a mathematical factor to be used in calculating minimum water supplies. The slowest burning or lowest hazard type of construction, fire-resistive, is construction classification 0.5. The fastest burning or highest hazard type of construction, wood frame, is construction classification 1.5.

A.6.3.1 The types of construction include five basic types designated by roman numerals as Type I, Type II, Type III, Type IV, and Type V. This system of designating types of construction also includes a specific breakdown of the types of construction through the use of arabic numbers. These numbers follow the roman numeral notation where identifying a type of construction (e.g., Type I-442, Type II-111, Type III-200).

The arabic numbers following each basic type of construction (e.g., Type I, Type II) indicate the fire resistance rating requirements for certain structural elements as follows:

- (1) First arabic number: Exterior bearing walls
- (2) Second arabic number: Columns, beams, girders, trusses and arches, supporting bearing walls, columns, or loads from more than one floor
- (3) Third arabic number: Floor construction

Specific fire resistance ratings are found in Table 6.3.1, and additional information is found in NFPA 220.

A.7.1.1 Although most water is acceptable for firefighting purposes, there might be suspended particulates or contaminants that could prove harmful to the fire pump systems or firefighting agents being used and should be avoided.

A.7.2 During pre-fire planning, the fire department should make arrangements with the owners of water supplies to use the water during an emergency. Such agreements should be made in writing in close cooperation with legal counsel.

The agreements should identify who will build, service, and maintain necessary access roads to the supplies, including such functions as snow plowing in certain areas of the country. Figure A.7.2 shows a sample water usage agreement.

A.7.5 Most artificial lakes are constructed with heavy earth-moving equipment. In order for the property owner to construct a roadway for fire department use, the AHJ should make the property owner aware of the needs of the fire department while the heavy equipment is still on the job.

Accessibility should always be considered. Many recreational lakes are provided with access by roads, driveways, and boat-launching ramps and are available for fire department use. Some large lakes, formed by a dam on a river, might have been constructed for such purposes as to generate power, for flood control, or to regulate the flow of a river. During certain periods of the year (droughts, drawdowns, etc.), such bodies of water can have very low water levels. The water under such conditions might not be accessible to the fire department for drafting by the fire department pumping unit, even where a paved road for boat launching has been provided and extended into the water at normal water levels for several feet or meters. Under such conditions, other provisions should be made to make the water supply fully accessible to the fire department.

A.7.5(8) Where a 120 ft (36.5 m) diameter turnaround or other means for the mobile water supply apparatus to exit the water supply location is not feasible, a large underground pipe transmission line can be laid from the water supply to the highway and the mobile water supply apparatus filled on the highway right-of-way. However, a turnaround or looped facility could still be needed if the mobile water supply apparatus needs to return to the fire scene over the same roads used to reach the water supply site.

■ A.7.6 The training of fire department personnel involved in mobile water supply is essential to ensure a safe and efficient operation at fire scenes involving mobile water supply operations. NFPA 1001, NFPA 1451, and Section C.9 should be consulted to develop a training program focused on mobile water supply operations.

■ A.7.7.1 The records could include, but might not be limited to, the following:

- (1) Location of the water supply source
- (2) Access and water usage agreement(s) for private water supplies (if applicable)
- (3) Inspection, testing, and maintenance documentation
- (4) Plans and design specifications for the original installation
- (5) Unique characteristics of the water supply source that could impact fire department operations

SAMPLE WATER USAGE AGREEMENT

It is understood by the owner(s) and the _____ government (hereinafter called the _____ Fire Department) that this agreement is subject to the following conditions:

1. The owner(s) are permitted to terminate this agreement by written notice if the _____ Fire Department breaches any terms and conditions contained in this agreement.
2. Neither this agreement nor any right or duty in whole or in part by the owner(s) under the agreement will be assigned, delegated, or subcontracted without the written consent of the owner(s).
3. All items placed on the property of the owner(s) by the _____ will remain the property of the _____. If this agreement is terminated, the owner(s) will permit the _____ adequate time to remove said property and return the land to its natural state.
4. Any and all debris that is created by and during the establishment of the drafting site will be disposed of by the _____.
5. No cutting or trimming of trees will be done on the property of the owner(s) unless the _____ Fire Department states that such cutting is/will be necessary to provide uninterrupted and clear travel to the site; however, in no case will such cutting be actually completed without prior approval of the owner(s).
6. The _____ will maintain the area covered by this agreement in a safe condition at all times. This maintenance will also include the groundskeeping around the site.
7. The _____ agrees to save, keep harmless, defend, and indemnify the owner(s) and all its officers, employees, and agents, against any and all liability claims, costs of whatever kind and nature, for injury and death of any person or persons, and for loss or damage to any property occurring in connection with or in any way incidental to or arising out of the occupancy, use, service, operation, or performance of work in connection with this agreement or omissions of the _____'s employees, agents, or representatives. THIS PROVISIO DOES NOT AND WILL NOT APPLY TO ANY EVENTS INVOLVING AN ACTUAL FIRE IN THE STRUCTURE(S) OF THE OWNER(S).
8. The owner(s) as well as any heirs, executors, administrators, and assigns do hereby remise, release, and forever discharge the _____ and any officer, agent, or employee thereof of any liability at law to any person, firm, or legal entity for any act of omission, or any injuries, damages, or deaths claimed to have arisen from the [describe the work to be performed at the site] unless the act of omission amounts to willful misconduct. This waiver is entered into for and in consideration of the drafting site and access roadway. The sufficiency of this consideration is acknowledged by the owner's(s') signature(s) below.
9. The owner(s) grant the rights to the _____ and _____ Fire Department to enter the property cited in this agreement only for the express purpose as stated by owner(s).

(Owner)

(_____ Fire Dept.)

(Owner)

(_____ Road Supt.)

(Date)

(Head of local government)

Attorney (ies)]

▲ FIGURE A.7.2 Sample Water Usage Agreement.

A.8.1 Factors to consider when determining the need and location for a dry hydrant system should include, but not be limited to, the following:

- (1) Current and future population and building trends
- (2) Property values protected
- (3) Potential for loss
- (4) Proximity to structures [e.g., not closer than 100 ft (30 m) from a structure it is designed to protect]
- (5) Fire history of the area protected
- (6) Current water supply systems
- (7) Potential water supply sources and reliability (i.e., constructed or natural)
- (8) Cost of project
- (9) Other factors of local concern

The Volunteer Fire Assistance program provides grants to rural fire departments for training, organizing, and equipment serving communities with a population of 10,000 or less. The U.S. Forest Service sponsors and funds this program, which is delivered by the State Forester in each state.

Grants may be available through the State Forester's office on a cost-sharing basis. It is appropriate to seek funding from the Volunteer Fire Assistance program for material for dry hydrants since rural fire departments provide much of the initial attack on wildland fires. More information about the Volunteer Fire Assistance program can be found on the USDA Forest Service website at www.fs.fed.us/fire/partners/vfa/. Click on VFA Desk Guide. Contact your local State Forester's office for application procedures. The name and contact information for State Foresters can be found on the National Association of State Foresters website at stateforesters.org.

A.8.2.2 Permits to install a dry hydrant should be obtained from the AHJ. These can include local, state, and federal agen-

cies charged with fire protection, zoning, water, environmental protection, agriculture and resource conservation, among others.

A.8.3 Since there might be resources available to assist in the planning and installation of dry hydrants, it is desirable to identify and consult with the persons responsible for those resources early in the process.

A.8.3.1 Factors including local topography, climatic conditions, and access to materials will determine the design characteristics of each installation. Distance to the water combined with the difference in elevation between the hydrant head and the water source, and the desired flow, in gpm (L/min) will affect the pipe size that should be used.

Local preferences and experience, along with access to materials, will determine the type of pipe and fittings best suited for the job. In some parts of the country, brass and bronze caps and suction hose connections, along with iron, steel, and bituminous cement pipe and fittings, are being used for dry hydrant installations.

A.8.3.2 Many fire service hose appliance manufacturers now offer pre-manufactured and pre-assembled PVC suction screens, hydrant heads, and supports that come ready to attach to the pipe [see Figure A.8.3.2(a)].

Figure A.8.3.2(b) is an example of a dry hydrant installation showing a minimum 6 in. (150 mm) pipe and screen. Installations can involve larger pipes and screens.

A.8.3.3 System design requirements should allow for required fire flow, atmospheric pressure, lift, vapor pressure, length of required pipe run, coefficient of materials (C factor), piping configuration, and other design factors that approved engineering practices would necessitate.

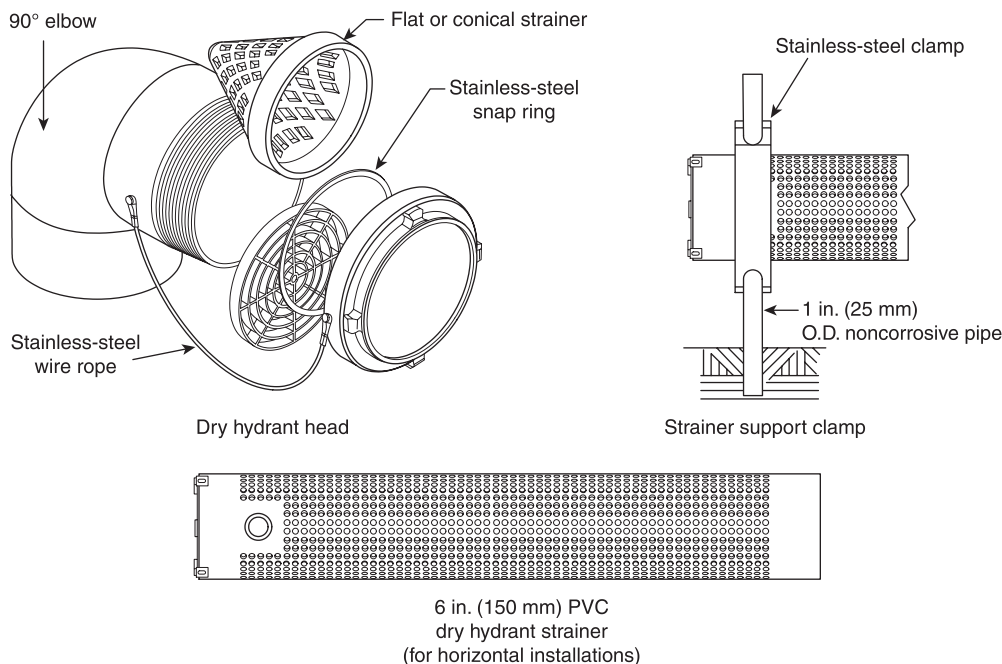


FIGURE A.8.3.2(a) Commercially Available Dry Hydrant Components.