CITY OF YREKA

701 Fourth Street, Yreka, California 96097

NOTICE OF AVAILABILITY OF REPORT RELATING TO: Amendment of Yreka Municipal Code Section 11.23.050 Water System Fees, sections (b) and (c)

[Approved Fire Sprinkler Systems]

FOR THE

City OF YREKA

Date: August 21, 2012

SUBJECT: Notice Of Report Relating to Amendment of Yreka Municipal Code Section 11.23.050 Water System Fees, sections (b) and (c) [Approved Fire Sprinkler Systems] for The City Of Yreka.

CONTACT PERSON: LIZ CASSON, City Clerk, City of Yreka (530)841-2386

LOCATION OF REPORT: City Hall, City of Yreka, 701 Fourth Street, Yreka, California 96097

This is to advise that a REPORT RELATING TO: Amendment of Yreka Municipal Code Section 11.23.050 Water System Fees, sections (b) and (c) [Approved Fire Sprinkler Systems] FOR THE CITY OF YREKA is available for viewing at the City of Yreka location referenced above.

Liz Casson
City Clerk, City of Yreka

CITY OF YREKA
NOTICE OF PUBLIC HEARING

NOTICE IS HEREBY GIVEN that the City Council of the City of Yreka will hold a public hearing on September 6, 2012, at 6:30 p.m., to consider an amendment to Yreka Municipal Code Section 11.23.050 Water System Fees, sections (b) and (c) by Ordinance 830.

The 2010 California Residential Code requires a residential fire sprinkler system in new single family residential construction. The City of Yreka is proposing an amendment to Yreka Municipal Code (YMC) Section 11.23.050 Water System Fees. The modification would modify the Water System Fees to include the rates for new construction with an approved Fire Sprinkler System pursuant to the California Residential Code.

The public is invited to review and comment on the proposed modification between the hours of 8:00 am and 5:00 pm Monday through Friday at the front counter of City Hall. Yreka City Hall is located at 701 Fourth Street in the City of Yreka.

If you have any questions or comments, or wish to review the information relating to the ordinance change, please feel free to contact Liz Casson, City Clerk, Yreka City Hall, 701 Fourth Street, Yreka, CA 96097, or by telephoning (530)841-2386.

August 21, 2012

Liz Casson
City Clerk
City of Yreka

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PROOF OF POSTING

I, the undersigned, hereby declare, as follows:

1. I am employed by the City of Yreka as the City Clerk;

2. I personally posted the attached Notice of Availability of Report for the City of Yreka, Government Code Section 66006 by placing a true copy thereof on the City bulletin board reserved for public notices maintained by the City at City Hall located at 701 Fourth Street, Yreka, California, on August 21, 2012, at 3:45 AM/PM.

I declare under penalty of perjury, under the laws of the State of California, that the foregoing is true and correct and that this Declaration was executed on August 16 2012 at Yreka, California.

Liz Casson

CITY OF YREKA
CITY COUNCIL AGENDA MEMORANDUM

To:	Yreka City Council
Prepared by:	Mary Frances McHugh, City Attorney
	For Steven W. Baker, City Manager
AGENDA TITLE:	Introduction of Ordinance 830 Amending Section 11.23.050 of the Yreka Municipal Code Relating to Developer Impact Fees for Fire Sprinkler Systems in Single Family Residences
Meeting date:	August 2, 2012

Recommendation and Requested Action: Waive reading and introduce Ordinance 830 Amending Section 11.23.050 of the Yreka Municipal Code Relating to Developer Impact Fees for Fire Sprinkler Systems in Single Family Residences.

Discussion: The 2010 California Residential Code requires residential fire sprinkler systems in new single family residential construction. These fire protection systems are dedicated systems and serve only that purpose. Staff has identified changes which can be made in Chapter 11.23 of the Yreka Municipal Code to reflect the new law requiring fire sprinklers. The Draft Ordinance enclosed outlines those changes.

In effect, a standby fire sprinkler system (FSS) needs either two meters or installation of a meter large enough to accommodate the water flow for the FSS. Admittedly, the FSS would only operate in the event of fire. Staff surveyed other jurisdictions on available approaches and reported to Council for direction on February 16, 2012. A copy of the Staff Report for that meeting is enclosed.

The approach which avoids requiring a separate fire line for this service, and provides the service by over-sizing the domestic meter for installed, approved fire sprinkler systems (e.g. instead of a ¾" meter, a 1" meter is installed) was discussed with the Council on February 16th. This approach is incorporated into the Draft Ordinance and will avoid penalizing persons who would otherwise be able to have adequate domestic service with the smaller meter size by allowing installation of a meter which will be large enough for the standby fire water, but charging the fee only for the size the Plumbing Code requires for the occupancy. Accordingly, the household equivalent ratios will be the same for: a 1-inch meter installed with an approved fire sprinkler system or a ¾" meter installed with an approved FSS for single family residential homes constructed with a 1-inch meter installed for the structure.

The 2010 California Plumbing Code does not permit installation of a 5/8" meter any longer, therefore, the minimum meter size will be ¾" with approved Fire Sprinkler System for 1 household equivalent. This should apply to new construction only, and the Ordinance addresses existing uses of 5/8" meters [new section 11.23.050(c)(4)]. The Ordinance also includes requirements relating to backflow preventer devices and annual inspections [new section 11.23.050(c)(3)].

Fiscal Impact: The difference in the meter sizes confers a benefit on the City because of the standby water which is thus available for fire suppression. Making a finding of this benefit will justify the

offsetting revenue. The cost difference between the meter sizes is approximately $1,690 per house (3/4" inch line) and $4,571 per house (1" inch line).

Attachments:
Ordinance 830 (Draft);
Staff Report for Meeting Date 2-16-12 with The National Fire Protection Association publication entitled Integration of Residential Sprinklers with Water Supply Systems, a Survey of Twenty U.S. Communities, published September 2009
Building Official Information 1-24-12: East Bay Municipal Utility District, Applying for Combination Water and Fire (Dual Service)
Staff Report for Meeting Date 1-19-12
Building Official Information 11-21-11: National Fire Sprinkler Association, Inc., *Water Purveryor's Guide to Fire Sprinklers in Single Family Dwellings*

P:\DOCUMENTS_ADVICE\ADVICE\8-2-12 STAFF REPORT RE DIFS FIRE SPRINKLER SYSTEM AND ORD AMENDMENT.DOC

DRAFT
8-10-12

ORDINANCE NO. 830

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF YREKA AMENDING SECTION 11.23.050(c) OF THE YREKA MUNICIPAL CODE, RELATING TO DEVELOPER IMPACT FEES FOR FIRE SPRINKLER SYSTEMS IN SINGLE FAMILY RESIDENCES

BE IT ORDAINED by the City Council of the City of Yreka as follows:

SECTION 1- FINDINGS. The City Council of the City of Yreka hereby finds as follows:

Currently, the 2010 California Building Code requires private fire protection in new single family residential construction. Ideally, the customer would have a separate fire line for this service, however, instead of having a separate fire service line, the service may be provided by over-sizing the domestic meter (e.g. instead of a ¾" meter, a 1" meter is installed). In this situation a number of cost allocation and equity issues arise related to the existing impact fee.

The City Council finds that fire sprinkler installations reduce fire risk, improve fire protection in the community and thus confer a benefit to the City of Yreka. The City Council takes this action after having reviewed and considered The National Fire Protection Association publication entitled *Integration of Residential Sprinklers with Water Supply Systems, a Survey of Twenty U.S. Communities*, published September 2009. The City Council specifically finds that this action is warranted to avoid "double charging" a customer who must install a dual service system. Based upon the recommendation made by staff in connection with evaluating a system development charge, and the fact that at the present time there is no generally accepted approach to this issue, the City Council finds it is in the best interests of the City of Yreka to make the amendments set forth in Section 2 of this ordinance, which will limit the charge for the meter size of a single family residence with an approved fire suppression system to the size needed for the household's domestic water consumption.

SECTION 2. Section **11.23.050(c) of Chapter 11.23** of the Yreka Municipal Code, **Water System Fees** is amended to read as follows:

(a) Fee Purposes. *No change.*

(b)Definitions. For the purposes of this section:
(1) "AWWA" means the American Water Works Association.
(2) "Household equivalent" means any premises served by a standard five-eighths-inch domestic water meter. Typically, this would include single-family residences, duplex dwelling units and small commercial businesses served by a standard five-eighths-inch meter. Household equivalents for larger meters: three-fourths inch, one inch, one and one-half inches, two inches, three inches, four inches, six inches and eight inches, have been computed using the ratio of the larger meter's AWWA rated capacity to the AWWA rated capacity of a standard five-eighths-inch meter. *Household equivalents for three-quarter-inch with approved Fire Sprinkler System and one inch with approved Fire Sprinkler System are established for the purpose of creating water and fire service (a dual service) connection for single family residences. An approved Fire Sprinkler System is defined as one which satisfies the requirements of the currently adopted and effective California Residential Code.*

(c) Fee Schedule. *No change.*

(1) Water System Fee. Each applicant for a building or encroachment permit for premises as defined in this chapter shall pay the current fee, per household equivalent, based on the meter size, or if no meter is installed, the water service pipe size, as follows:

(A) Assessment of Household Equivalents.

Domestic Meter Size or Fire Pipe Size	**Household Equivalent Ratio**
5/8"	1*
3/4 " single family residential home with approved Fire Sprinkler System	*1*
1 " single family residential home with approved Fire Sprinkler System	*1*
¾"	1.5
1"	2.5
1 ½"	5
2"	8
3"	16
4"	25
6"	50
8"	80

**subject to Building Official approval.*

(B) *No change.*
(2) *No change.*

(3) When a larger meter is installed (as long as it does not exceed the minimum necessary) to provide fire sprinkler protection in a single family residence, the system fee shall be based on the meter size necessary to meet the domestic demand, not the actual size of the meter installed.

(4) If a backflow prevention device is required due to the installation of a fire sprinkler system, it shall be inspected yearly by a certified backflow inspector, which shall be subject to any fee for such inspection as established by resolution of the City Council.

(5) Exemption. This section shall not apply to any existing single family residence with a 5/8" water meter service, unless that there are alterations, renovation or expansion of an existing residential building where additional dwelling units are created or there is expansion of the existing residence which is more than fifty percent of the square footage of the existing structure.

SECTION 3. Exemption from CEQA. The City Council finds, pursuant to Title 14 of the California Code of Regulations, Section 15061(b)(3) that this ordinance is exempt from the requirements of the California Environmental Quality Act (CEQA) in that it is not a Project which has the potential for causing a significant effect on the environment.

SECTION 4. Validity. If any section, subsection, part, clause, sentence or phrase of this Ordinance or the application thereof is for any reason held to be invalid or unconstitutional by a decision of any

court of competent jurisdiction, the validity of the remaining portions of this Ordinance, the application thereof, shall not be effected thereby but shall remain in full force and effect, it being the intention of the City Council to adopt each and every section, subsection, part, clause, sentence phrase regardless of whether any other section, subsection, part, clause, sentence or phrase or the application thereof is held to be invalid or unconstitutional.

SECTION 5. Mandatory Duty Savings Clause. By the use of such words as "shall" and "must" herein the City Council does not intend to create a mandatory duty upon the city. In imposing duties in this ordinance the City is assuming an undertaking only to promote the general welfare. It is not assuming, nor is it imposing on its officers and employees, an obligation for breach of which it is liable in money damages to any person who claims that such breach proximately caused injury.

SECTION 6. Effective Date. This ordinance shall be in full force and effect sixty (60) days from and after the date of its adoption.

SECTION 7. Posting And Publication. The City Clerk is directed to cause a copy of the full text of this ordinance to be published once in an adjudicated newspaper of general circulation in the City of Yreka within fifteen (15) days after adoption of this ordinance. In lieu of publication of the full text of the Ordinance within fifteen (15) days after its passage, a summary of the Ordinance may be published at least five (5) days prior to and fifteen (15) days after adoption by the City Council and a certified copy shall be posted in the office of the City Clerk, pursuant to Section 26933(c)(1) of the Government Code.

SECTION 8. Codification. The City Clerk is directed and authorized to instruct the publisher of the City of Yreka Municipal Code that codification of this Ordinance is limited to Section 2.

Introduced at a regular meeting of the City Council held August 2, 2012, and adopted as an Ordinance of the City of Yreka at a regular meeting of the City Council held on August 16, 2012, by the following vote:

AYES:
NOES:
ABSENT:

_____
Mayor

Attest:

By:_____
Liz Casson, City Clerk

Approved as to form:

By: _____
Mary Frances McHugh,
City Attorney

\\GOLDNUGGET\USERS\MARYFRANCES\MY DOCUMENTS\DOCUMENTS_ORDINANCES\AMEND DEVELOPER IMPACT FEE ORD - FIRE SPRINKLER SYSTEMS 1-10-12.DOC revised 8-10-12

CITY OF YREKA
CITY COUNCIL AGENDA MEMORANDUM

To:	Yreka City Council
Prepared by:	Mark Schmitt, Building Official, Fire Marshal
Agenda title:	Residential Fire Sprinklers
Meeting date:	February 16, 2012

Discussion:

The introduction of residential fire sprinklers to the California Residential Code has created the need to address several issues concerning the methods of installing and billing for water service in the City. I have performed extensive research and reached some revised conclusions on the issues.

For reference, I have included " Integration of Residential Sprinklers with Water Supply Systems," a survey of twenty U. S communities, published in September 2009 by the National Fire Protection Agency (NFPA). To clarify my points, I will refer to page numbers from this survey:

- Which is recommended—one meter or two meters?

  The majority of the communities I researched opted for the single-meter approach. Page 13, Table 5 shows that 16 of 20 communities favor the one-meter approach. In addition, the policy of the East Bay Municipal Utility District (EBMUD) allows a dual service (one meter) for residential supply, billing customers based only on the meter size required to meet domestic needs.

- What is the risk of unauthorized water usage?

  With meter installation at the sidewalk, unauthorized water use will not be an issue.

- Will service fees on sprinkler systems raise water rates?

  (Page 21) Ninety percent of the communities surveyed required no increase in monthly fees. Typically, installation of fire sprinklers requires an increase in meter size; however, most communities charge based only on the meter size required to meet domestic needs, so there was no increase in cost to its customers.
  Cities also based Impact and Connection Fees on the meter size required to meet domestic needs.

- Is there a liability to the City associated with water service suspensions or terminations?

(Pages 28-29, Table 15). Liability was not an issue for the majority of communities. A sentence or two in the water service agreement addressed this issue by serving notice that sprinkler systems will be non-operational upon service disconnect.

- Some cities required backflow devices and yearly inspections to protect the public water supply from infiltration by antifreeze systems.

Although there is not unanimous agreement among cities on these issues, I have made my recommendations based on two things: research of how other communities have addressed these issues, and what is best for the City and the Citizens of Yreka.

Recommendation: That the City Council consider and discuss the following policies regarding residential fire sprinklers:

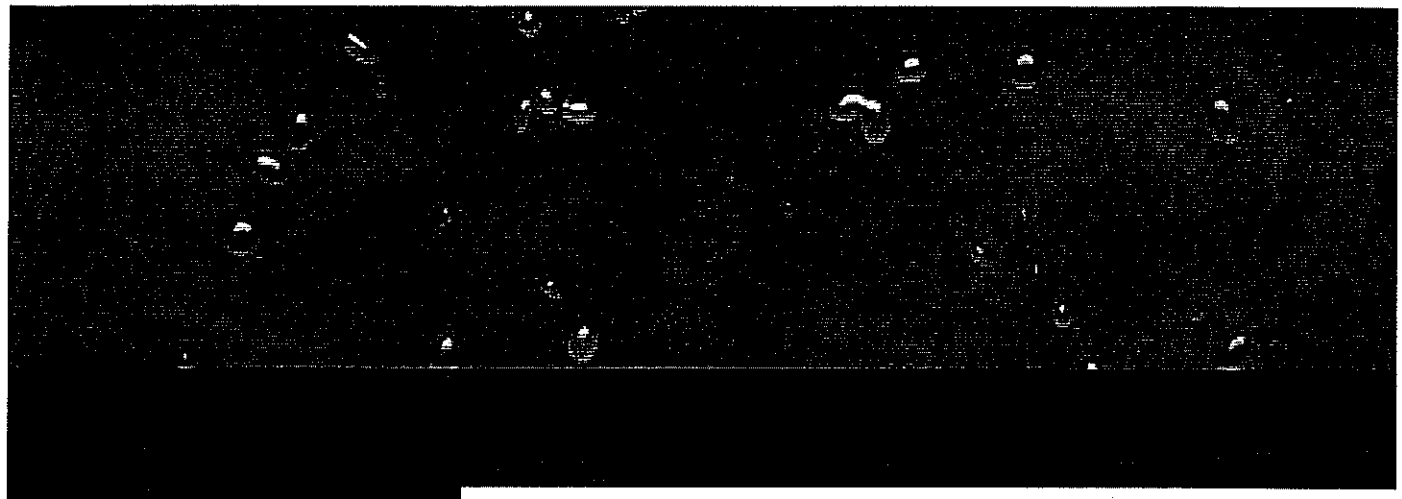
1. Require one water meter (with dual service connection).
2. Require backflow prevention devices to be inspected yearly. (fee?)
3. Base Impact and Connection fees on the meter size required for domestic needs only.
4. Amend water service agreement to reflect the loss of fire sprinkler function upon water shut-off. (Disclosure & disclaimer of liability)
5. Charge no new service fees for sprinkler installation. Confine costs to a one-time fee for the larger meter required to service the sprinkler and residential needs.

If the City Council agrees with these recommendations the necessary changes will be prepared for future council action.

Foster / Mercier

Specific variables on each project will need to be addressed case by case -

Approved by: _____
Steven Baker, City Manager



Integration of Residential Sprinklers with Water Supply Systems

A Survey of Twenty U.S. Communities

September 2009

NFPA®

The National Fire Protection Association
The authority on fire, electrical and building safety.

Prepared by:
Newport Partners, LLC
Davidsonville, MD

Acknowledgements

The project team gratefully acknowledges the input and cooperation of these twenty communities:

- Aberdeen, MD
- Annapolis, MD
- Avondale, AZ
- Celina, TX
- Clarendon Hills, IL
- Cottonwood, AZ
- Galt, CA
- Glenwood, IL
- Libertyville, IL
- Monterey, CA
- Montpelier, VT
- Nolensville, TN
- Northbrook, IL
- Northstar Community, CA
- Ojai, CA
- Paradise Valley, AZ
- Piperton, TN
- Redmond, WA
- University Park, TX
- Westminster, MD

Staff from the building department, fire service, and public works department of these communities was extremely helpful in describing how residential fire sprinkler ordinances work in their jurisdictions. Additionally, we would like to thank many other communities which provided us with background information regarding their local fire sprinkler ordinance.

Executive Summary

Residential fire sprinklers are becoming more widely adopted in new U.S. homes based on model building codes like the 2009 IRC and NFPA 5000, as well as community level initiatives to add sprinklers to homes. Like any significant change to the way homes are constructed, concerns exist as to how sprinklers can be effectively integrated with other existing systems in the home – particularly the home's water supply system. Local requirements regarding the connection of residential sprinklers to the water supply system can potentially have significant implications on sprinkler system design, operation, cost and maintenance.

The purpose of this research was to develop objective data which characterizes the manner in which residential fire sprinklers are integrated with local water supply systems in communities with a sprinkler ordinance. This study explored these issues in detail through interviews with twenty communities where residential sprinklers are required in all new homes. The interviews were conducted with a mix of local water providers, building departments and fire service staff to better understand sprinkler requirements and common practices.

The communities, which have had a sprinkler ordinance in place subsequent to 1999, have generally developed practical solutions for sprinkler integration with the water supply system. While sprinklers are still a fairly recent development in all of these communities, water supply integration practices and requirements have been put into place, and there are no examples of insurmountable problems or issues. In fact, design problems or any significant added costs have not resulted from water supply integration issues in most communities. Rather, water suppliers, building departments and fire service have developed practical approaches to meet the needs of both residential sprinklers and the local water supply. Major findings are noted below.

Sprinkler System Design: For those design issues where communities could reasonably adopt different approaches, such as whether or not to meter fire sprinkler flow, they have done just that. These decisions are sometimes based on technical factors, while in other cases communities try to stay consistent with nearby jurisdictions and thus adopt the same provisions. In fact communities in the same state generally adopt fairly uniform requirements on items like metering the flow to sprinklers, which makes the ordinance more predictable for stakeholders. More unusual design requirements, such as dual water service lines or dual water meters, are rare and typically driven by a local issue which would not apply in most other areas.

Cost Impacts on Sprinkler Systems which Result from Water Supply Integration: No cost impact resulted from sprinkler-induced changes to water meter size, the need for additional water meters, or changes to tap size in eleven of the twenty communities. These communities also did not have higher monthly service fees from the water

supplier for homes with sprinklers. Further, in the other communities where one or more of these factors did add cost (and the cost could also be calculated based on available data) the average added cost was about $400. In many cases, the occurrence and magnitude of a cost impact depends on what design practices were in place prior to the ordinance taking effect.

Cost implications for the items mentioned above are often intertwined with other local design practices and fee structures. For example, in one community the increase in the water connection fee from one domestic meter size to the next jumped by thousands of dollars. To avoid this much higher fee builders have developed a different sprinkler system connection scheme which does not increase the domestic water meter size (or the connection fee) but instead uses a second water meter to meter the flow to the sprinklers. This fee structure was not intended to penalize fire sprinklers (and pre-dates the ordinance), yet it has had an impact on system design.

Sprinkler System Administration Issues: The potential liability associated with shutting off domestic water supply to a residence (thus thereby disabling the fire sprinkler water supply) has received some discussion in communities with a sprinkler ordinance, but has generally not been a major concern given that the sprinkler system is primarily designed for life safety, and homes without domestic water supply are deemed uninhabitable.

Inspections of backflow devices in sprinkler systems are required in communities where state law requires such inspections (unless the system design does not involve a backflow prevention device) and where the community's ordinance requires this type of device. To overcome the challenges in administering these regular inspections, community approaches range from penalties for non-compliance, to tax assessment incentives for compliance, to moving toward system designs which avoid the need for backflow prevention devices all together.

In terms of "lost water" due to lower accuracy of larger domestic water meters (necessitated by the sprinkler system) or water theft from sprinkler systems, these were not reported to be significant issues in the communities.

As states and communities begin to adopt the residential sprinkler ordinances based on model building codes, it will be necessary to develop their particular approach for integrating sprinklers with the local water supply. The results of this study indicate that a range of reasonable approaches will work, while states/communities can leverage some flexibility to deal with issues of particular concern. Approaches which satisfy the needs of builders, water suppliers, and fire service are certainly within reach, and ideally communities can draw from this research to better understand key issues and form their particular strategy.

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Tables and Figures

I. Introduction

The purpose of this research was to develop objective data which characterizes the manner in which residential fire sprinklers are integrated with local water supply systems in communities with a sprinkler ordinance. The requirements of local water purveyors and building departments regarding the connection of residential sprinklers to the water supply system can potentially have significant implications on sprinkler system design, operation, cost and maintenance. This study explored these issues in detail to better understand how they are addressed in communities where residential sprinklers are required in all new homes.

This research is important because residential fire sprinklers are poised to become widely adopted in new U.S. homes based on model building codes such as the 2009 International Residential Code (IRC) and National Fire Protection Association (NFPA) 5000. Like any significant change to the way homes are constructed, there are a variety of issues that arise with the 2009 IRC now requiring residential fire sprinklers in new townhomes (2009) and one- and two-family dwellings (2011). The most effective approach to rationally addressing such issues and helping the industry move forward is objective research that identifies the significance of concerns and the best means for reconciling these concerns.

Twenty communities with residential fire sprinkler ordinances in effect were identified and contacted as part of this research. Interviews were conducted with water providers, building departments and fire service staff to gain an understanding of how sprinklers are integrated with the municipal water supply and the underlying reasons for these practices.

II. Research Methodology

Given the complexity of this topic and the variability in how different communities have addressed the implementation of residential sprinklers, a logical methodology was developed to evenly collect and analyze data from the communities. The steps involved in conducting this research study are described below.

A. Literature Review and Interview Guide

As an initial task, the project team conducted a literature review to gain a clear understanding of the most significant integration issues between residential sprinklers and the local water supply system. This literature review is included as Appendix A.

Based on this assessment of the key issues and concerns, the project team then developed an interview guide. The objective of this interview guide was to objectively identify and document (through a phone interview format) how communities manage the integration of residential sprinklers with the water supply to the home. The guide was designed for use with water purveyor staff, public works staff, local fire service officials and building departments who were contacted to understand a community's issues. The interview guide was completed in March 2009, and is included in this report as Appendix B. The interview guide served as a data collection tool during the interviews, and while it was not typically read verbatim the topics included in the guide were covered in each discussion.

B. Community Selection Criteria

The research scope called for identifying twenty communities to allow a broad spectrum of communities to be selected and assessed. The communities were selected based on several factors as listed in Table 1 and described below.

Table 1: Parameters for community inclusion in study

Requirements	Considerations
Residential fire sprinkler ordinance • All new single-family dwellings o Zero square footage • Enacted subsequent to 1999	Geographical location Water purveyor organizational structure Number of homes built since ordinance enacted

- **All New Single-Family Dwellings**: This research was focused on fire sprinkler water supply integration issues once sprinklers were applied on a broad scale in a community. Therefore only communities with a residential fire sprinkler ordinance were considered. The residential fire sprinkler ordinance needed to apply to all new single-family dwellings in the jurisdiction, regardless of square footage or location. Some fire sprinkler ordinances are structured to apply to buildings over a certain square footage, height or stories while other ordinances only apply to buildings located outside a fire response time zone or within a designated zone in a community. Ordinances that apply to all new dwellings despite square footage are often called zero-ordinances, for zero square footage.

  One example of a community with a square footage- and location-based sprinkler ordinance that prevented it from being included in the study is Altamonte Springs, FL. Altamonte Springs requires all new homes built within the activity district to have fire sprinklers regardless of size, while for new homes outside the activity district only those over 3,500 square feet are required to have fire sprinklers. Overall, the research team had to pass over several dozen communities due to ordinances that did not apply to all new homes in the community.

- **Recently Enacted Ordinance**: The community's residential fire sprinkler ordinance must have been placed into effect subsequent to 1999. This time limitation was enacted because some of the interview questions probed how sprinklers were handled *prior* to the ordinance taking effect. Thus, including communities with long-standing ordinances, such as 20 years, would make it unlikely that this type of information would have been recalled. At the other extreme, the research team encountered a few communities which had passed an ordinance *very* recently (e.g. 1 month prior) and had practically no experience implementing it. These communities were not included due to the very limited experience with how the ordinance was working.

- **Geographic Location**: The geographic location of the communities was also a contributing factor in identifying participants. To the extent possible, the research team sought to incorporate communities from different regions of the U.S. This effort was relatively successful, however in a large number of states it is unlikely that there are any communities which meet the research criteria since residential fire sprinklers are still uncommon in many areas. Thus the selected communities

tended to be grouped together in a subset of states in different parts of the country.

- **Type of Water Supplier**: The organizational structure of the water supplier was considered when selecting communities to participate in the study. Water suppliers can generally be classified as public or private. Public water suppliers are usually managed by the public works department or have appointed boards making them more similar to a non-profit organization than a city division or department. Private water suppliers can be found across the country but are more common in the western part of the United States. The water supplier organizational structure was identified for each participating community and is listed in Table 2.

  It should also be noted that this study did not focus on sprinkler design and integration with on-site water supplies (well water). While these issues are important in many cases and may be prevalent in some communities, the focus of this study was sprinkler integration with municipal water supply systems.

Overall, dozens of communities were researched and contacted in the course of the community selection process. Based on the criteria listed above, the large majority of these communities were not included in the study. The most common factor preventing a community from inclusion in the study was that it only required sprinkler systems for homes of a certain square footage. In other cases, a given community had no fire sprinkler ordinance or a very recent ordinance and had little or no experience in applying it. Conversely, any community which was contacted and found to meet the selection criteria was subsequently interviewed and included in the study.

C. Interview Participants

The objective interviews were conducted over the phone with key groups related to fire sprinklers in residential dwellings. The key groups interviewed and typical job titles of interviewees are listed below.

- Building Department: Building inspector or code official
- Fire Service: Fire marshal or fire inspector
- Water Provider: Public works supervisor or account/region manager

On two occasions an individual from the water wholesaler was interviewed. In these two cases the water was supplied by a municipality that bought water from a wholesaler. The wholesaler was contacted to see if any additional requirements are placed on the community by the water wholesaler in relation to fire sprinkler integration.

For each of the twenty communities, at least two of the key groups identified above were interviewed. A total of 46 separate interviews were conducted for this research project. The key groups contacted for each community are listed in Table 2.

D. Interview Format and Findings

The interviews were conducted over the phone using a standardized interview guide (see Appendix B) and supplemented by email as needed to clarify responses and to obtain documents.

The interview guide and issues discussed during the interview were developed after conducting an extensive literature review (see Appendix A). The literature review focused on identifying issues related to integrating sprinklers to the water supply system for homes. The key issues from this review which were probed in the interview are listed below, in the order in which they are discussed.

- Whether sprinkler water flow is captured by a water meter
- Whether two water service lines are required
- Concern over unauthorized use of water from fire sprinklers
- Accuracy of water meters
- Costs associated with any changes in water meter size
- Impact on monthly service fees for water service
- Impact on domestic water consumption rates
- Change in water service tapping fee
- Liability associated with water service suspensions or terminations
- Reported water contaminations from sprinkler system backflow
- Post-occupancy inspection requirements
- Any changes made to the ordinance after it went into effect

The findings to these issues are discussed in greater detail in subsequent sections of the report.

III. Community Overview

The map below (Figure 1) shows the twenty communities included within the study while Table 2 provides key community data on the jurisdictions included in the survey.

Figure 1: Map of communities included in research study

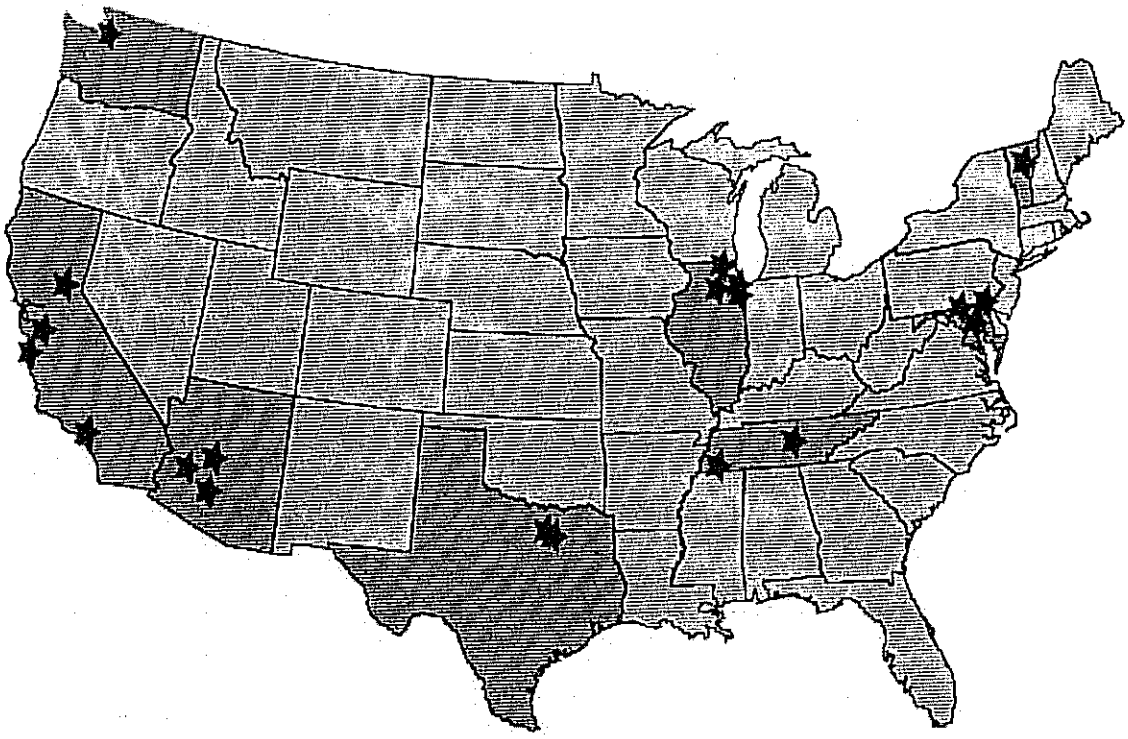


Table 2: Key community data on the communities included in study				
Community	Year of Ordinance Taking Effect	Sprinkler Ordinance Type	Water Supplier Structure	Key Groups Contacted
Aberdeen, MD	2006	NFPA 13D	Public	Fire Service Public Works
Annapolis, MD*	2007	NFPA 13D or 13R with amendments	Public	Building Department Fire Service Water Provider
Avondale, AZ	2005	NFPA 13D with amendments	Public	Building Department Fire Service
Celina, TX	2008	NFPA 13D or 13R with amendments	Public	Fire Service Water Provider
Clarendon Hills, IL	2000	NFPA 13D with amendments	Public	Building Department Fire Service Water Provider Water Wholesaler
Cottonwood, AZ	2004	NFPA 13D with amendments	Public	Fire Service Water Provider
Galt, CA	2008	NFPA 13D	Public	Fire Service Water Provider
Glenwood, IL	2007	NFPA 13D	Public	Fire Service Water Provider
Libertyville, IL	2005	NFPA 13D or 13R with amendments	Public	Building Division Fire Service
Monterey, CA	2004	NFPA 13D	Private	Fire Service Water Provider
Montpelier, VT	2004	NFPA 13D or 13R	Public	Building Department Fire Service
Nolensville, TN	2006	NFPA 13D or 13R	Public	Building Department Fire Service Water Provider
Northbrook, IL	2007	NFPA 13D	Public	Fire Service Water Provider
Northstar Community, CA	2003	NFPA 13D	Public	Fire Service Water Provider
Ojai, CA – *County Wide Ordinance*	2006	NFPA 13D	Private	Building Official Fire Service Water Provider
Paradise Valley, AZ	2005	NFPA 13D with amendments	Private and Public	Building Official Water Provider
Piperton, TN	2007	NFPA 13D	Public	Fire Service Water Provider
Redmond, WA	2007	NFPA 13D and 13R	Public	Building Department Fire Service
University Park, TX	2008	NFPA 13D with amendments	Public	Building Department Fire Service Water Wholesaler
Westminster, MD – *County Wide Ordinance*	2006	NFPA 13D with amendments	Public	County Building Department Water Provider

* Annapolis is located in Anne Arundel County, which recently (2009) passed a zero square footage fire sprinkler ordinance, but Annapolis required fire sprinklers systems in homes before the county ordinance was enacted.

IV. Research Findings

The interview guide covered issues related to how residential fire sprinkler systems are integrated with the water supply system to a home. For many of these issues, there are a variety of options which a community can select as their standard practice or requirement. These options carry implications for the design, cost, operation and maintenance of sprinkler systems. Key findings on each issue are presented below along with a summary of the underlying issue.

A. Approach to Metering Water Flow to Sprinklers

Communities are nearly evenly divided with their approach to metering the water flow to sprinklers. Eleven require or typically use designs in which sprinkler flow is metered, and the other nine allow and typically use designs in which sprinkler flow is <u>not</u> captured by the water meter. In many cases these positions are supported by a mix of technical and operations-related issues, while some communities adopted the approach of a neighboring community.

Whether the flow to the sprinkler system is captured by the home's water meter is important because it affects the sprinkler system design. Also, this issue triggers several related factors which affect system design and cost, as illustrated by Table 3. Many of these related issues were included in the interview guide and are discussed further down in the report.

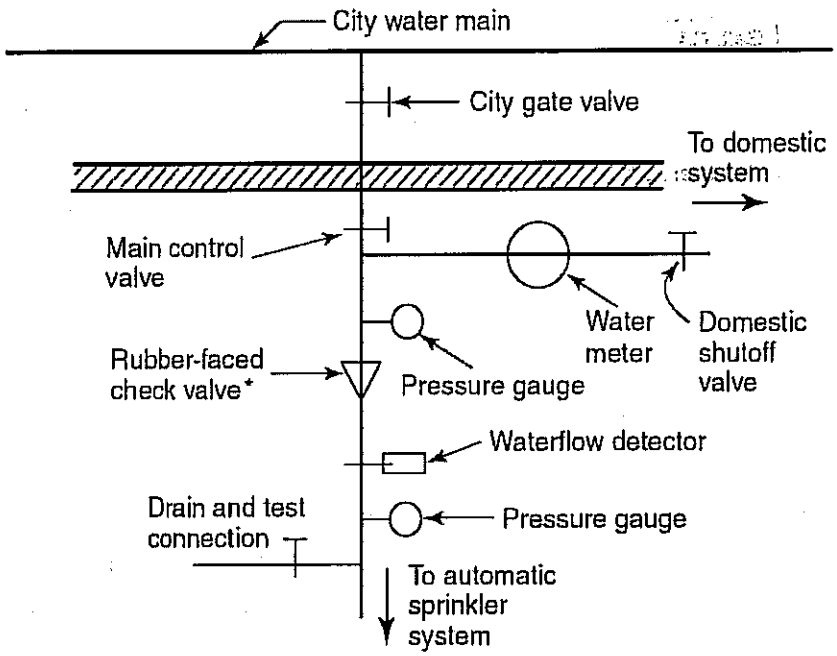
Table 3: Issues associated with whether or not sprinkler flow is metered

Issues of concern for systems where sprinkler flow is <u>not</u> metered	Issues of concern for systems where sprinkler flow is metered
• Unauthorized water use	• Meter accuracy • Meter costs • Increased peak flow capacity • Type of meter

The communities surveyed based their sprinkler ordinance on NFPA 13D – "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes." Some communities also added amendments to NFPA 13D. NFPA 13D allows for the water flow to residential fire sprinkler systems to be either

metered or unmetered. The "preferable" NFPA 13D arrangement is to have the sprinkler water flow unmetered to avoid any restrictions which could possibly be introduced by the meter (Figure 2). Other configurations in NFPA 13D do show system layouts where water flow to the sprinklers is metered if that is a community's requirement. In these cases, the standard requires that the flow characteristics of the meter are to be included in the hydraulic calculations for the system.

Figure 2: "Preferable Arrangement" from NFPA 13D-2007, in which water flow to the sprinklers is not metered



* Rubber-faced check valves are optional.

Detailed results from the interview question on this issue are listed in Table 4.

Table 4: Do communities require sprinkler system designs that meter the water flow to the sprinkler system?		
Response	**Communities**	**Typical Reasons or Justifications**
Yes – Sprinkler flow is metered	Aberdeen, MD Annapolis, MD Avondale, AZ Cottonwood, AZ [redacted] Nolensville, TN [redacted] Paradise Valley, AZ Piperton, TN Redmond, WA University Park, TX*	• Modeled on neighboring community's ordinance for the sake of consistency • Used same approach as multi-family dwellings
No or Does Not Matter – Sprinkler flow does not have to be captured by the meter	Celina, TX Clarendon Hills, IL [redacted] Glenwood, IL Libertyville, IL Montpelier, VT Northbrook, IL [redacted] Westminster, MD	• Did not want to restrict water flow with the meter • Adopted approach of a neighboring community for consistency

* University Park homes typically install a meter on the fire sprinkler flow, but it is not required.

In those communities where sprinkler flow is metered (11), consistency was often a key factor in adopting this approach. Specifically the communities expressed an interest in being consistent with the ordinance of a neighboring community or consistent with the way sprinklers have been previously addressed in commercial buildings or residential buildings prior to implementing a residential fire sprinkler ordinance.

As examples of consistency between communities, all four Illinois communities do not require fire sprinkler flow to be metered, while all three Arizona and both Tennessee communities do meter the sprinkler flow. A few other examples of communities which *do* meter the sprinkler flow are:

Aberdeen, MD– Townhomes have required fire sprinklers since the mid-1980s and that water flow was metered, so they went with the townhouse approach when their ordinance expanded to cover single-family detached homes.

Avondale, AZ– Modeled their ordinance and acceptable sprinkler designs on Scottsdale, AZ, a neighboring community. When developing the sprinkler requirement the city met with all the stakeholders to find a system design that would work. The stakeholders wanted consistent requirements so that builders

and contractors did not have to vary their approach based on the location of the project.

Preventing theft of water as an underlying reason for metering sprinkler flow was not a common response among those communities where metering is required.

On the other side of the issue, communities that *do not* meter the fire sprinkler service often stated that they wanted to limit the disturbances or obstructions in the water supply line running to the fire sprinklers.

B. Requirements for Dual Service Lines or Water Meters

Most communities do not require dual water service lines (one for domestic use and one for sprinklers) or dual water meters. In the few communities (four) where these practices are typical or required, underlying factors include municipal connection fees being tied to the size of the domestic water meter and a desire to be able to shut off domestic supply without interrupting sprinkler service flow.

Overall this finding is important because it further illustrates how local sprinkler designs are closely intertwined with local issues and fee structures for new construction projects.

Table 5: Do homes with sprinkler systems have two meters or service lines for a residence – one for the sprinkler system supply and one for domestic water supply?		
	Communities	**Typical Reasons or Justifications**
Yes – Dual service lines are required, but a meter is only installed on the domestic line	Northstar, CA	• Allows them to maintain sprinkler system operation when domestic service is shut off
Yes – Dual service lines - each with a water meter - are typically installed	University Park, TX	• A separate line and meter for fire sprinklers is installed in conjunction with the lawn irrigation water supply to avoid sewer charges on the water used for lawn irrigation • Using a dedicated service line and meter for the fire sprinklers avoids the need for backflow valves and periodic inspections
Yes – Single service line with two meters is required	Monterey, CA*	• Want a separate water meter for domestic supply for the flexibility to limit domestic flow in the future if necessary
Yes – Single service line with two meters is typically installed	Redmond, WA	• Connection fees are based on the size of the domestic water meter and are significantly higher for a larger meter; thus builders opt to separately meter the two systems which keeps the domestic meter size smaller (and the connection fee lower)
No – Dual service lines or two meters are not required or typically installed	Aberdeen, MD Annapolis, MD Avondale, AZ Celina, TX Clarendon Hills, IL Cottonwood, AZ Galt, CA Glenwood, IL Libertyville, IL Montpelier, VT Nolensville, TN Northbrook, IL Ojai, CA Paradise Valley, AZ Piperton, TN Westminster, MD	• No direct need or incentive to use dual service lines or meters

* Monterey has moved to separate meters for fire and domestic service, but no new homes have been built under the newly enacted dual water meter requirement.

Of the four communities that typically install two lines or two meters, only one *requires* dual service lines and only one *requires* two meters on a single supply line. The other two communities that commonly design systems in this manner do so because of other cost issues not directly related to fire sprinkler systems and are discussed below.

University Park, Texas typically installs two lines with a water meter on each line. The local water provider does not charge sewer fees on water used for irrigation. By supplying and metering the flow to the lawn irrigation and fire sprinklers separately from the domestic supply, any sewer charges for lawn irrigation water are avoided. Thus homeowners avoid sewer fees on the water they use for lawn irrigation. Even before the fire sprinkler ordinance took effect, many homes opted for the dual service line and meter strategy to avoid sewer charges on irrigation water.

Systems in Redmond, Washington typically have a unique water supply configuration because the connection fee pricing structure gives builders an incentive to install two smaller water meters instead of one larger one. The connection fee in Redmond is based on the size of the domestic water meter, and the fee difference between a 5/8" meter and a 1" meter for a new home in the City of Redmond is over $14,000. Therefore, builders have opted for a sprinkler connection design that reduces the domestic water meter size. The connection design typically installed involves a 2" water supply line which provides both domestic and fire water service to two homes. Each home will use a ¾" water line for domestic water feeding into a 5/8" meter and a 1" water line and meter for the fire sprinkler service for each home. Under the above scenario, a home will pay for two meters (5/8" and 1") and one tap fee (5/8"), although there is actually only one 2" tap servicing two homes. This configuration also avoids a larger domestic water meter, thereby avoiding the jump in connection fees. It should be noted that connection fees of this magnitude could also represent a new construction impact fee which uses the water meter size as a proxy for the size of the new building. This unique system configuration is discussed further in subsequent sections of the report.

C. Unauthorized Water Usage from Residential Sprinklers

In those communities where sprinkler flow is not metered (and thus there could be potential for unauthorized use from the sprinkler), there are no reports that water theft from sprinklers is a significant concern or problem.

As the provider of a commodity, water purveyors have a natural concern about people illegally tapping into water lines to obtain water which is not metered or paid for. Residential fire sprinkler systems, and in particular designs in which water flow to the sprinklers is not captured by a water meter, could present an opportunity for unauthorized use.

However, no respondent could recall any instance of individuals stealing water from a residential fire sprinkler system, metered or not metered. The following quote is a typical response.

> **Monterey, CA**- "We have never really had any backflow issues or unauthorized water use from sprinklers. I have been here 41 years and tapping into our hydrants is a bigger issue than domestic use."

Table 6: For those communities where sprinkler system flow is not typically metered, is there a concern about unauthorized water use from the sprinkler system?

	Communities	Reasons why the issue is/is not seen as relevant.
The unauthorized water use issue has not been a significant topic of discussion	Celina, TX Galt, CA Glenwood, IL Montpelier, VT	• Not many systems installed • Water theft is not an issue in the community
The unauthorized water use issue has come up in discussions, but has not resulted in any specific policies or practices	Clarendon Hills, IL Libertyville, IL Northbrook, IL Northstar, CA Westminster, MD	• Shutoff happens infrequently and occupants are barred from living in a home without water supply if shutoff does occur • Shut-off valve is before split between sprinklers and domestic supply
The unauthorized water use issue has come up in discussions, and has resulted in specific policies or practices	None	

This finding does not dismiss the concern of unauthorized water use for water suppliers, but it does illustrate that the existence of a fire sprinkler ordinance in a community (and where sprinklers are not metered) does not significantly increase the risk in the views of water suppliers and building departments.

D. Accuracy of Larger Domestic Meters

The communities surveyed are not significantly concerned or affected by the issue of residential fire sprinklers driving the use of larger, less accurate water meters. In several of the communities where this could be a potential issue, the use of sprinklers does not create the need for a larger water meter. In three communities the accuracy of larger meters was deemed acceptable, while in two others the fire sprinkler flow was metered separately so the domestic meter size was not impacted by the sprinklers.

The accuracy of water meters is affected by the size of the meter as well as the flow rate. Stakeholders in residential sprinkler discussions have expressed concern that if a water service line supplying both domestic and fire sprinklers is metered and also requires a larger water meter to accommodate the fire sprinkler flow rates, then the meter's accuracy at measuring the lower flows typical of domestic use will suffer. This reduced accuracy of the larger meter could then lead to discrepancies in accounting for the water supplied to buildings.

The community interviews revealed that of the eight communities that have a single water service line with one meter for both the fire sprinkler and domestic flow, half of these did not see an increase in the typical meter size with the advent of the sprinkler ordinance. In other words, the typical meter size in a new home was the same with or without sprinklers in these communities. In these scenarios because the presence of the sprinkler system did not drive the use of a larger water meter, any potential meter accuracy issues are beyond the impact of the sprinkler system.

For example, many communities either require 1" water meters on all new homes (e.g., Annapolis, MD enacted this requirement prior to their sprinkler ordinance) or require homes over a certain square footage to install a 1" meter (e.g., Cottonwood, AZ). Even communities that do not meter the fire sprinkler flow indicated that new homes commonly have 1" or larger water meters solely for the domestic water flow, as the quote below illustrates.

> **Libertyville, IL**– "We only do 1" and 1 ½" lines.... even if we didn't have sprinklers it would still be the same size."

Specific responses on this issue are noted in Table 7 below.

Table 7: For communities where the fire sprinkler service line is required to be metered, has there been concern or discussion about the ability of the water meters used to accurately measure the domestic flow rates which the meters will typically experience?		
	Communities	**Reasons why the issue is/is not seen as relevant.**
Metering the fire service line typically does not increase the water meter size	Annapolis, MD Avondale, AZ Ojai, CA Paradise Valley, AZ	• System designs do not typically exceed previous water meter size used prior to the sprinkler ordinance
The increase in meter size (from metering sprinkler flow) has not resulted in discussions on meter accuracy	Aberdeen, MD Cottonwood, AZ Nolensville, TN	• Market has responded and has made better meters
The increase in meter size (from metering sprinkler flow) has resulted in discussions on meter accuracy, but has not resulted in any specific policies or practices	Piperton, TN	• Water supplier is concentrating more on automated leak detection in its supply system to residences, as this issue is deemed more significant
The meter on the fire sprinkler service line does not measure domestic water use	Monterey, CA Redmond, WA University Park, TX	• There are two meters on the home, so any accuracy issues on the domestic meter are beyond the sprinkler system's scope of impact

Thus in several of the communities (four) where the sprinkler flow must be metered, this design requirement does not drive the need for a larger-than-usual water meter. And in those communities where metering sprinkler flow *has* increased the typical meter size (four), the concern over meter accuracy has been limited (three), or discussions on the topic have not resulted in any specific changes to design requirements or meter specifications (one).

E. Increase in Water Meter Cost

The research found that three-quarters of the communities surveyed *did not* experience an increase in the cost of purchasing water meters because of the residential fire sprinkler ordinance.

Water providers and communities generally charge customers more for larger water meters. If the fire sprinkler water flow is metered, the cost of purchasing a potentially larger, or even an additional, water meter could increase system costs for the builder and homeowner. Of the twenty communities surveyed, eleven communities typically meter the fire sprinkler supply line (this was a *requirement* in ten communities and the

common practice in the eleventh). Conversely, nine communities do not meter flow to the fire sprinklers and therefore the domestic meter size (and price) is not impacted by the fire sprinklers.

In those eleven communities where sprinkler flow is metered, only four stated that the common domestic water meter size increased from either $^5/_8$" or ¾" up to 1" as the result of a sprinkler ordinance taking effect. The price differences between the typical "pre-ordinance" meter and the meter size used once sprinklers became mandatory in these four communities are $105, $120, $200 and $500. (Note: These figures were calculated using meter prices at the time the study was conducted, not meter prices at the time of enactment). Thus, for these four communities the average price of a larger domestic water meter (necessitated by the need to meter sprinkler flow) was about $230.

Table 8: For communities that typically meter the fire service line, has this resulted in an increased price for the water meter(s)?

	Communities	Typical Reasons or Justifications
Yes – Sprinkler system requirements typically result in a larger meter, which are more expensive	Aberdeen, MD Cottonwood, AZ Nolensville, TN Piperton, TN	• Moved from $^5/_8$" to 1" meter • Moved from ¾" to 1" meter
Yes – Resulted in the purchase of a second water meter for the sprinkler system	Redmond, WA	• Commonly use a 1" meter on the sprinkler line branch
No – Water meters are free	Monterey, CA	
No – The second water meter was already commonly purchased prior to the sprinkler ordinance	University Park, TX	• Commonly used a 1 ½" water meter dedicated to lawn irrigation systems prior to fire sprinkler ordinance. Now fire sprinkler flow is on this same meter.
No – The water meter size (and thus the price) is the same	Annapolis, MD Avondale, AZ Ojai, CA Paradise Valley, AZ	• All our homes had 1" or larger lines before the ordinance • System designs do not commonly exceed previous water supply line size

In the one community (Redmond, Washington) that commonly involves the purchase of an additional meter, it is important to note that two meters are not required by the ordinance. The connection fee pricing structure is based on the size of the meter on the domestic water flow line, and a jump in the size of the domestic meter can increase this

fee by thousands of dollars. Thus it is cheaper in Redmond to branch the water supply line into two separately metered lines. This way an individual will only pay the connection fee associated with a 5/8" domestic water meter, instead of the fee associated with a 1" domestic water meter. This saves the builder approximately $14,000 for a new home in the City of Redmond. At the same time, the cost to purchase the second meter for the fire sprinkler service line is $500 (and no connection fees are charged for a separately metered fire line).

Builders in University Park, Texas commonly install two metered water lines to avoid sewer charges on water used for irrigation. This was a common practice prior to the sprinkler ordinance in this community. Thus, when this second service line also became the means to supply and meter the sprinkler system, it was determined that the sprinkler ordinance did not drive the need for another meter since it was already common practice.

In December 2008 the Monterey Peninsula Water Management District mandated that residential fire sprinkler service lines split from the domestic water service line and be metered separately. Prior to this requirement homes would use a single water service line that branched after the water meter. Both the domestic and fire sprinkler water line meters are provided to the homeowner or builder free of charge by the water purveyor. Meters were provided free of charge before the design change mentioned above.

The following tables list the meter prices for the communities included in this study.

Table 9: Meter prices in communities where meter costs increased due to larger/additional meters

	Water Meter Size Changed				Standalone Meter	
Meter Size	**Aberdeen**	**Cottonwood**	**Nolensville**	**Piperton**	**Monterey**	**Redmond**
5/8"		$275	$3,000*		Meters are provided free of charge.	N/A
¾"	$370-$400*	N/A	N/A	$185		$425
1"	$580*	$400	$3,500*	$305		$500
1 ¼"						N/A
1 ½"						$730

No Change in Domestic Meter Size (Includes communities that don't meter fire sprinkler supply lines)														Stand-alone Meter
Meter Size	**Annapolis**	**Avondale**	**Celina**	**Clarendon Hills**	**Galt**	**Glenwood**	**Libertyville**	**Montpelier**	**North-brook**	**Northstar**	**Ojai**	**Paradise Valley**	**West-minster**	**University Park∞**
5/8"		N/A	N/A			$300		No fee, city owns the meter	N/A	Contractor provides meter		$1,442*		
¾"		$450	$800*			$300			$110		$1,500*[a]	$1,442*	$300	
1"	$1,800*	$530	$850*	$303.98	$400	$300	$330		$145		$1,500*[a]	$1,893*	$355	$450*
1 ¼"		N/A		N/A		$300	N/A		N/A			N/A		N/A
1 ½"		$750		$303.98		$300	$465		$290			$2,322*		$1,525 or $1,675*

* Includes both the tap fee and meter price

[a] Prices start at $1,500 and go up, but a quote is needed for each job from the local office

˙ Prices are approximations; exact prices couldn't be obtained for hypothetical dwelling

∞ Homes typically purchased a domestic meter and a 1 ½" meter for fire/irrigation service prior to the sprinkler ordinance

F. Service Fees on Sprinkler Systems

Homes with local water service typically pay a monthly charge to cover administrative fees associated with providing water service. Ninety percent of the communities surveyed did not experience an increase in monthly service fees with the advent of residential sprinklers. For the two communities where higher service fees typically resulted from the use of sprinklers in homes, the average monthly cost impact was $6.05.

Service fees are a concern because of the potential for sprinkler systems to incur a monthly charge even though the sprinklers will rarely, if ever, draw water from the local supply system. For this study, a service fee was interpreted to mean the minimum amount a homeowner has to pay for service even if no water usage occurred for the month.

Only two communities in the study have an increase in service fees as a result of homes having sprinklers. In both of these communities new homes typically have two water meters – which triggers the higher fee. One community requires two meters, while in the other community two meters are typically installed due to the connection fee structure in place (see discussion above in Sections B and E). While the presence of a second meter did trigger a higher service fee for a home in these communities, water providers from both communities charge a reduced service fee for the meter on the fire sprinkler service line (see Table 11).

For those communities where service fees did not increase as a result of homes having sprinkler systems, this was due to several factors including:

- Some water providers implemented policies that have kept monthly service fees at pre-sprinkler ordinance levels, such as the City of Cottonwood
- About one-half of the communities charge the same monthly fee for multiple sized water meters, so even if sprinklers drive the need for a larger meter the service fee does not increase
- In many of the communities the domestic water meter size or tap size did not change, nor was there a need for a second meter, so monthly fees did not increase

It appears that citizens in communities that require all new homes to have fire sprinkler systems will not necessarily face increased monthly fees. It is also evident that water providers are willing to reduce monthly fees if the fire sprinkler system flow requirements are the only reason for the increased fee (as recommended by the AWWA Research Foundation and KIWA[1]). Table 10 lists the responses to this interview topic, while Table 11, which follows, lists the monthly service fees for the communities included in this study.

Table 10: Are homes with fire sprinklers commonly assessed a higher standby/monthly fee compared to a comparable home without fire sprinklers?

	Communities	Typical Reasons or Justifications
Yes – But the standby/monthly fee on the dedicated fire sprinkler line is reduced	Monterey, CA Redmond, WA	• Fee is reduced because it is a fire sprinkler line
No – Homes have typically installed a second meter on the lawn irrigation line, even prior to the sprinkler ordinance. Because this line was metered there was already an associated monthly fee. Now this line also supplies the sprinkler system	University Park, TX	• Pay monthly fee for second service line/meter for irrigation and fire sprinkler water service
No – Homes with sprinklers pay the same standby/monthly fee rate as other homes	Aberdeen, MD Annapolis, MD Avondale, AZ Celina, TX Clarendon Hills, IL Cottonwood, AZ* Galt, CA Glenwood, IL Libertyville, IL Montpelier, VT Nolensville, TN Northbrook, IL Northstar, CA Ojai, CA Paradise Valley, AZ Piperton, TN Westminster, MD	• Service fee is based on domestic demands even if meter size is increased due to fire sprinklers* • Meter and tap size are not impacted by sprinklers, so fee is not impacted either • Service fee same for multiple meter sizes, so even if the meter is larger due to sprinklers - the service fee is the same

** Cottonwood charges a monthly fee based on a 5/8" meter to homes that actually use a 1" meter – ONLY IF they use the 1" meter due to sprinkler demands. However, if home is required to have a 1" meter because of home size or fixture demands, then the occupant pays the service fee for a 1" meter.*

[1] AWWA Research Foundation and KIWA. (2002). *Impacts of Fire Flow on Distribution System Water Quality, Design, and Operation.* Published by AWWA Research Foundation and American Water Works Association.

The following table lists the monthly fee a water customer pays for having a water service. The monthly fee has numerous names including, standby, base and service fees. Sometimes the monthly fee includes a certain amount of water usage while others do not; therefore, a home's monthly bill is dependent upon the monthly fee plus the fee attached to water consumption.

Table 11: Monthly standby, base or service fees

	Communities Where Water Meter Size Changed as a Result of Sprinklers				Communities Where a Fee is Charged on Both Meters (Domestic and Fire Service)					No Fee on Dedicated Sprinkler Line
Meter Size	Aberdeen^	Cottonwood*	Nolensville	Piperton	Monterey		Redmond		University Park	Northstar
					Domestic	Fire Service	Domestic	Fire Service		
5/8"	$13.26	$23.59	$12.04		$7.24	N/A	N/A	N/A	$9.35	
¾"	$13.26	N/A	$12.04	$13.50	$10.86	N/A	$10.97	$3.30	$9.35	
1"	$13.26	$28.00	$12.04	$13.50	$18.11	$8.15	$22.03	$3.95	$10.25	$27.99
1 ¼"					N/A	N/A	$40.47	$6.25	N/A	$27.99
1 ½"					$36.21	$12.23	$62.60	$9.00	$13.35	$27.99

No Change in Meter Size (Includes communities that do not meter fire sprinkler supply lines)												
Meter Size	Annapolis	Avondale	Celina	Clarendon Hills	Galt	Glenwood	Libertyville	Montpelier	Northbrook	Ojai	Paradise Valley	Westminster^
5/8"		N/A	N/A			$7.43	$11.35	N/A	Only pay a usage fee of $4.20 per thousand.	$29.20	$4.64	
¾"		$10.12	$12.60			$7.43	$11.35	$7.29		$43.80	N/A	$19.45
1"	$12.60	$1818	$12.60	$10.00	$2.12	$7.43	$11.35	$7.29		$73.00	$5.21	$19.45
1 ¼"	N/A	N/A	$12.60	N/A	$3.95	$7.43	$11.35			N/A		$19.45
1 ½"	$12.60	$32.68	$12.60	$15.00		$7.43	$11.35			$146.00		$19.45

** If sprinkler water flow requirement is the only reason for 1" meter, occupant is charged 5/8" fee.*

^ This fee also includes the sewer fee.

G. Domestic Water Consumption Rates

In the twenty communities surveyed, there were no instances where residents paid higher rates for domestic water consumption because a larger domestic meter was installed in the home to accommodate the sprinkler system.

Water customers are billed for the amount of water that they use. With the introduction of residential sprinkler ordinances in communities, there has been some concern that if domestic water meters increase in size due to the sprinkler system, then this larger meter would trigger a different (and more expensive) rate schedule for homeowners. However, this research found that none of the twenty communities surveyed applied higher domestic consumption rates to homes with sprinklers. This was true for all of the communities, even in those instances where the domestic meter size was indeed larger due to the need to meter sprinkler flow.

Table 12: Are homes that saw their domestic water meter size increase due to sprinklers billed at a higher rate for domestic water consumption compared to a home with a smaller meter and no fire sprinklers?

	Communities	Typical Reasons or Justifications
Yes – Homes with sprinklers pay higher water usage rates if their domestic water meter is larger		
No – Homes with sprinklers typically pay the same domestic water usage rates as other homes, even if the domestic meter is larger due to the sprinklers	Aberdeen, MD Cottonwood, AZ Nolensville, TN Piperton, TN	• Charge same rate for residential water usage regardless of meter size

The table above illustrates that higher domestic consumption rates are not an issue in those communities where the domestic water meter size increases due to fire sprinklers. For the remainder of the twenty communities, sprinklers did not impact the domestic water meter size so any concern over higher domestic usage rates did not apply.

H. Tapping Fee Increases

Three-quarters of the communities surveyed did not see an increase in tapping fees because the home had a fire sprinkler system. Of the five which did see an increase in tap fee, four of these were due to a larger tap size and one was due to a requirement of dual service lines (and thus a second tap).

When a new home taps into the water supply line, or water main, a tapping fee is commonly charged. The tapping fee varies based on the community and tapping procedures. Some communities do not charge a tapping fee and instead the builder hires a contractor to actually tap into the water main. Other communities charge a flat tapping fee regardless of the water line size, while others base the fee on site characteristics such as charging more for tapping under sidewalks or roads.

This research found that fifteen of the twenty communities surveyed did not see an increase in tapping fees because a home had a fire sprinkler system. This finding is strongly driven by two common scenarios:

- Homes with sprinklers typically have the same size tap as non-sprinklered homes did in the past, thus the tap fee was the same
- Homes with sprinklers do indeed have larger tap sizes, but the community's fee structure does not charge a higher fee for this larger tap

Table 13 highlights a few different scenarios which lead to no change in tap fees in homes with sprinklers, but the two factors listed above account for ten of the communities where the tap fee *did not increase*.

For those five communities where sprinklers did result in a *higher* tap fee, this occurred for two reasons:

- Sprinklered homes have larger service lines than non-sprinklered homes did in the past, and a higher tap fee results from the larger line.
- A second, additional tap fee is incurred because homes with sprinklers are required to have a separate water service line for the fire sprinklers. Note that the community with this requirement does not charge a monthly service fee on this line or require it to be metered.

The average additional tap fee cost, based on the available data from these communities, was $576.

Table 13: How are the water service line tapping fees handled for homes with sprinklers?		
	Communities	**Typical Reasons or Justifications**
No tapping fee	Avondale, AZ Galt, CA	
Sprinklered homes generally have the same size tap as non-sprinklered homes did in the past, so the tapping fees are the same	Annapolis, MD Celina, TX Glenwood, IL Libertyville, IL Northbrook, IL Ojai, CA Paradise Valley, AZ	• Most homes had 1" or larger taps before sprinkler requirement
Sprinklered homes have larger taps than non-sprinklered homes did in the past, but do not have a higher tapping fee	Aberdeen, MD Cottonwood, AZ Piperton, TN	• Tap fee is same for ¾" and 1" • Tap fee is same for 5/8" and 1" • Connection fee is set for residential dwellings and is not based on water supply line size
Sprinkled homes commonly installed two water service lines before ordinance; therefore, second tap fee is not a direct result of sprinkler systems	University Park, TX	• 1 ½" line for both the fire sprinkler and irrigation systems and separate 1" domestic line
Sprinklered homes have two meters, but tap fee is based on the domestic meter size. And the domestic water meter size did not change because of sprinklers, so there is no impact on the tap fee	Monterey, CA Redmond, WA	
Sprinklered homes have larger service lines than non-sprinklered homes did in the past, and therefore a higher tap fee	Clarendon Hills, IL Montpelier, VT Nolensville, TN Westminster, MD	• 1" tap but ¾" meter, because sprinkler line branches before water meter
Sprinklered homes are required to have dual service lines, and therefore incur a new second tap fee	Northstar, CA	

Table 14: Tap fees from communities surveyed

Meter Size	Communities Where Tap Size Increased							Separate Service Line for Sprinklers Tap Fee	
	Aberdeen	Clarendon Hills	Cottonwood	Montpelier	Nolensville	Piperton	Westminster	Northstar	University Park
5/8"	$8,400		$1,500	Quote is required	$3,000*				
3/4"	$8,400					$3,250	$800		
1"	$8,400	$251.39	$1,500		$3,500*	$3,250	$850	$1,389.98	$450*
1 1/4"		$616.03						$1,389.98	N/A
1 1/2"								$1,389.98	$1,525 or $1,675*

Meter Size	Sprinkler Line Does Not Impact Tap Fee									Two Meters, Single Line No Tap Fee			
										Monterey		Redmond	
	Annapolis	Avondale	Celina	Galt	Glenwood	Libertyville	Northbrook	Ojai	Paradise Valley	Domestic Line	Fire Sprinkler Line	Domestic Line	Fire Sprinkler Line
5/8"		No tap fee is charged	N/A	No tap fee is charged	$1,500		N/A		$1,442*	Quote is required – but meter size didn't change	No tap fee is charged	N/A	No tap fee is charged
3/4"			$800*		$1,500		N/A	$1,500*[a]	$1,442*			$9,876	
1"	$1,800*^		$850*		$1,500	$355	$200	$1,500*[a]	$1,893*			$24,434	
1 1/4"	N/A				$1,500	N/A	N/A		N/A			N/A	
1 1/2"	$2,250*^				$1,500	$475	$200		$2,322*			$48,696	

* Includes tap fee and meter price.

^ $400 credit if tap installed by applicant.

[a] Prices start at $1,500 and go up, but a quote is needed for each job from the local office.

I. Liability Concerns from Water Shut-Off

Potential liability associated with shutting off domestic water supply to a residence (and thereby also disabling the fire sprinkler water supply) has received some discussion in communities with sprinkler ordinances, but has generally not been a major concern. Only two communities have developed any specific policy or design requirement to address this issue. In most of the communities the concern was limited because sprinklers are viewed as a life safety system and homes may not legally be inhabited once domestic water supply is turned off, and also because water turn-off scenarios are rare.

A fire sprinkler system is a life safety device. However, sprinklers depend on water flow to control a fire. This research found that there is generally not great concern about the potential liability if a fire occurs in a home that has had the water service suspended. Most respondents indicated that this issue is not a major concern for their community because:

- Homes where the water supply has been shut-off are deemed uninhabitable and occupants are not permitted in the dwelling.
- Water shut-off issues are rare in the community, so the issue does not come up.

Of the two communities that indicated that they have developed specific policies to address the issue of liability, the specific policies were:

- Developed a water supply design where the fire sprinkler supply water bypasses the shut-off valve, so the sprinkler systems are still active even when domestic supply is shut off.
- Modified their water service termination letters to mention that the fire sprinkler system will become inactive once water service is terminated.

Table 15 shows the distribution of community perspectives on this issue. The responses are only presented for those communities where fire sprinklers are not supplied by a dedicated service line.

Table 15: For those communities where dual service lines not required or typically installed, how has the liability associated with turning off the domestic water supply to a residence (due to maintenance or failure to pay) been handled?		
	Communities	**Typical Reasons or Justifications**
The liability issue has not been a significant topic of discussion	Avondale, AZ Celina, TX Clarendon Hills, IL Cottonwood, AZ Glenwood, IL Libertyville, IL Montpelier, VT Ojai, CA Westminster, MD	• Home is inhabitable if water service is suspended • Sprinklers are primarily a life safety device not property protection • Treat same way as commercial buildings • Water shut-offs are uncommon
The liability issues has come up in discussions, but has not resulted in any specific policies or practices	Annapolis, MD Monterey, CA Northbrook, IL Piperton, TN Redmond, WA	• Stayed with same process before ordinance • Home is inhabitable if water service is suspended
The liability issue has come up in discussions, and has resulted in specific policies or practices	Aberdeen, MD Galt, CA	• Developed sprinkler design to bypass the shut-off valve • Include mention in water termination notification letter

Not discussed for Nolensville, TN. and Paradise Valley, AZ.
Dual service line communities are: Northstar, CA. and University Park, TX.

Lastly, the location of the main shut-off valve determines if the fire sprinkler system is still operational even if domestic service has been terminated. Most main shut-off valves are located near the street and single service line systems usually split the sprinkler supply lines inside the home and/or as close to the meter as possible. Therefore, just because a community does not meter the fire sprinkler water flow does not necessarily mean the fire sprinkler system will be operational when domestic water service is suspended.

J. Potential Water Quality Issues from Fire Sprinklers

Of the 46 subjects interviewed for this survey, none have heard of a water contamination issue associated with residential fire sprinkler systems in their community.

Water providers and users are always concerned about water quality. Water supply connections for a residential fire sprinkler system, just like any other connection, need to be designed in a manner that prevents water quality problems. The primary issue of

concern for residential sprinkler systems is preventing standing water in sprinkler system pipes from flowing back ("backflow") from the sprinkler supply piping into the potable water supply. Preventing backflow from the sprinklers is typically addressed through the use of a backflow prevention device (see Figure 2) or a design which avoids this issue (e.g. a "combination system" in which domestic supply and sprinklers share supply lines).

This research study found that of the 46 subjects interviewed for this survey, no individual has heard of a water contamination issue associated with fire sprinkler systems in their community.

Table 16: Have any water contamination or backflow issues resulted from a residential sprinkler system in the community?

	# of Communities	Details on Any Incidents
Yes		
No, or none that the respondents were aware of	20	

During the interviews it was mentioned that using a combined system (or a flow-through design), where fire sprinklers and domestic water supply within the home use the same supply piping, is a good design strategy to avoid standing water in fire sprinkler supply lines. By avoiding standing water these systems can mitigate water quality hazards in the view of these respondents.

K. Backflow Devices & Inspections

About one-half of the communities surveyed do require periodic inspections of backflow devices. For the other half which do not have requirements for regular inspections, a common reason is their use of system designs which avoid the need for a backflow device.

Backflow from fire sprinkler systems, described in Section J above, is addressed in residential sprinkler systems in various ways. In some system configurations, fire sprinkler system backflow is prevented through the use of a check valve, an RPZ valve, or similar device which prevents water from flowing "backwards." Communities often stipulate the exact requirements for backflow prevention devices, as NFPA 13D is flexible on the need for this feature (e.g. in Figure 2 above the check valve is optional).

Periodic inspection of this device (typically on an annual cycle) is used to help ensure that it is in proper working order.

About half (nine) of the communities in this study do have requirements for regular inspections of the backflow prevention device. Many of the communities have this requirement due to state law requiring inspection of backflow prevention devices. However it should be noted that in some cases, a community in a state with an inspection law may actually not have annual inspections because their typical system design does not incorporate backflow prevention devices (e.g. Monterey, CA). Thus no inspection is necessary. Also, states with inspection laws require that backflow inspectors be certified by the state (Table 18).

The interviews revealed that for a few communities the inspections have been somewhat challenging due to the administrative effort to manage the process and ensure that the inspections are indeed being completed as required. Access to homes is the underlying issue.

In terms of solutions, some communities simply notify homeowners that their annual inspection is due soon and require that they (the homeowners) arrange for such an inspection. The homeowner then selects a certified inspector, completes the inspection, and submits the inspection certificate to the community. Penalties such as water service termination could be used as an incentive to promote responsiveness by the homeowners.

Another solution can be seen in the approach used by Montpelier, Vermont. Montpelier does not actually require inspections by incentivizes homeowners to have them done. In this community, the city offers a ten percent reduction in the property assessment value to homes with fire sprinklers when calculating the property taxes. Occasionally the homeowner needs to submit paper work to justify the ten percent property assessment reduction. The paper work is reviewed to see if the backflow valves have been regularly inspected.

In one final example of alternative approaches to handle backflow device inspections, one community (Nolensville, TN) has actually changed its ordinance to require combination systems. In a combined system, since the supply piping is shared between the domestic supply and fire sprinkler systems, the issue of standing water in sprinkler pipes flowing back into the domestic lines is avoided. Thus no inspections are required.

While in many all of the communities a combination system would be permitted, in Nolensville they will become the standard.

Table 17: Are regular inspections required for backflow prevention devices on the sprinkler system?

	Communities	Typical Reasons or Justifications
Yes – Regular inspections are required	Celina, TX Clarendon Hills, IL Glenwood, IL Libertyville, IL Northbrook, IL Northstar, CA Ojai, CA Redmond, WA University Park, TX	• Required by state law • Systems have antifreeze in them and require annual servicing and backflow valve inspections
No – Regular inspections are not required	Aberdeen, MD Annapolis, MD Avondale, AZ Cottonwood, AZ Galt, CA Monterey, CA Montpelier, VT Nolensville, TN Paradise Valley, AZ Piperton, TN Westminster, MD	• Use a system design (e.g., combination systems) where a backflow device is not part of the system • After the initial test it is up to homeowner ensure that testing/inspection take place • Have not started an annual inspection program • Not required by 13D

Table 18: For those communities where regular inspections are required, who is permitted to perform the inspection?

	# of Communities	Typical Reasons or Justifications
Local Plumbing Inspector	0	
Certified Inspector	9	State Law
Fire Sprinkler Contractor	0	
Third-Party Inspector	0	
Homeowner	0	

L. *Changes to Sprinkler Ordinance Following its Enactment*

Overall the communities surveyed were relatively comfortable with their fire sprinkler ordinance language as drafted and it appears that these communities enacted sprinkler ordinances that have been manageable to work within.

Each of the communities was asked about any changes which might have been made to the terms of their original sprinkler ordinance. Four of the twenty communities surveyed mentioned that they have modified the original ordinance. Most of the changes relate to sprinkler system design (Table 19). As one example, Nolensville, TN now requires a combination system configuration to avoid the need for backflow prevention devices. In another instance, Northstar, CA has eliminated the requirement for fire department notification when the sprinkler system activates, in response to resistance on the monthly fee which was assessed for this service. This service is still available as an option.

Most of the respondents indicated that they based their original sprinkler ordinance off a neighboring community's ordinance. Based on the relatively low level of post-enactment changes it appears that these communities enacted sprinkler ordinances that have been manageable.

Table 19: What changes have been made to the residential fire sprinkler ordinance since the sprinkler ordinance was passed?

Ordinance Change	Communities	Typical Reasons or Justifications
Now require a combination system to avoid the need to use and subsequently inspect backflow prevention devices	Nolensville, TN	• Eliminates the need to inspect backflow devices annually
Allow for a sprinkler system that alerts fire department to be an option - instead of mandatory	Northstar, CA	• This issue is a trade-off between a faster response time for home owner versus monthly fee
Adjust design standards so that lawn irrigation systems work even when domestic service is shut off by occupants when they are away	Avondale, AZ	• Community has lots of 2nd homeowners who turn off water when they are gone but still want to water the yard
Adjusted water supply designs to require two meters; one for domestic and one for fire sprinkler service	Monterey, CA	• Want to have the capability to restrict domestic flow at the meter without simultaneously affecting fire system flow

V. Conclusions

This research study was conducted to gather objective data on how residential fire sprinklers are integrated with local water supply systems. Objective interviews with twenty communities with a residential sprinkler ordinance for all new homes has revealed that overall, these towns have arrived at practical solutions for bringing sprinklers into homes. These solutions satisfy:

- the needs of builders for consistent and reasonable design requirements,
- the needs of water suppliers to integrate sprinklers with their system without negative or unintended consequences, and
- the needs of the fire service to provide reliable and effective sprinkler systems in homes.

Based on very minor changes to the original ordinances adopted by the communities (which have had the ordinance in place an average of 3 years), major problems or headaches associated with the ordinance's introduction have been rare or nonexistent.

While some flexibility exists in how a community might chose to integrate sprinklers with local water supply (e.g., whether the water flow to sprinklers must be metered), groups of communities located in the same state have generally adopted consistent provisions. This adds uniformity and predictability to the regional landscape, making sprinkler requirements the same in one town as they are in a neighboring town. And assuming that the earlier adopters have constructed reasonable ordinances, this practice eases the adoption "learning curve" for newer communities and also can help to formulate appropriate state-level provisions.

Major conclusions from the community response are noted below:

Sprinkler System Design

- For those design issues where communities could reasonably adopt different approaches, such as whether or not to meter fire sprinkler flow, they have done just that. These decisions are sometimes based on technical factors while in other cases communities try to stay consistent with nearby communities and thus adopt the same provisions. Communities in the same area/state generally adopt the same provisions for consistency.

- For more unusual design requirements, such as dual water service line or dual water meter requirements, such instances were rare. And in the cases where such requirements did exist there was usually a local issue of concern driving the requirement (e.g. dual water meters in Monterey due to concerns about being able to control domestic water use in the future).

Cost Impacts on Sprinkler Systems which Result from Water Supply Integration

- No cost impact resulted from sprinkler-induced changes to water meter size, the need for additional water meters, or changes to tap size in eleven of the twenty communities. These communities also did not have higher monthly service fees from the water supplier for homes with sprinklers. Further, in the other communities where one or more of these factors added cost (and the cost could also be calculated based on available data) the average added cost was about $400, which includes a $1400 data point for an additional water tap in the average (Northstar, CA). In many cases, the occurrence and magnitude of a cost impact depends on what design practices were in place prior to the ordinance taking effect. Table 20 on the following page contains a summary table of these cost impacts.
- Cost implications for the items mentioned above get intertwined with other local design practices and fee structures. For example, in one community it was common practice to use two meters and two service lines prior to the fire sprinkler ordinance in order to separately supply and meter lawn irrigation water. Thus when fire sprinklers came along they could "piggyback" on this common design without creating additional costs over common practice.

  In another community the increase in the water connection fee from one meter size to the next jumped by thousands of dollars. To avoid this much higher fee builders have developed a different sprinkler system connection scheme which does not increase the domestic water meter size (or the connection fee) but instead uses a second water meter. This fee structure was not intended to penalize fire sprinklers (and pre-dates the ordinance), yet it has had an impact on system design.
- No community reported that homes with sprinkler systems which end up with larger domestic water meters (due to the sprinklers) are subject to higher consumption rates for domestic water consumption.

Table 20: Summary of cost impacts from water supply integration

Community	Total Increase in Meter Costs	Total Increase in Monthly Service Fee	Increase in Tap Fee	Total Added Costs from Water Supply Integration Issues
Aberdeen, MD	$180 to $200*	$0	$0	~$190
Annapolis, MD	$0	$0	$0	$0
Avondale, AZ	$0	$0	No tap fee is charged	$0
Celina, TX	$0	$0	$0	$0
Clarendon Hills, IL	$0	$0	$364.64	$365
Cottonwood, AZ	$125	$0	$0	$125
Galt, CA	$0	$0	No tap fee is charged	$0
Glenwood, IL	$0	$0	$0	$0
Libertyville, IL	$0	$0	$0	$0
Monterey, CA	Meters are provided free of charge.	$8.15	$0	$8
Montpelier, VT	No fee, city owns the meter	$0	Quote is required	N/A
Nolensville, TN	$500*	$0	$500*	$500*
Northbrook, IL	$0	$0	$0	$0
Northstar Community, CA	$0	$0	$1,389.98	$1400
Ojai, CA	$0	$0	$0	$0
Paradise Valley, AZ	$0	$0	$0	$0
Piperton, TN	$120	$0	$0	$120
Redmond, WA	$500	$3.95	$0	$504
University Park, TX	$0	$0	$0	$0
Westminster, MD	$0	$0	$50	$50

* Prices are approximations; exact prices couldn't be obtained for hypothetical dwelling

* Price includes both the tap fee and meter price, therefore total increase is $500 for tap and meter together not separately or $500 for each.

Sprinkler System Administration Issues

- The potential liability associated with shutting off domestic water supply to a residence (and thereby also disabling the fire sprinkler water supply) has received some discussion in communities with sprinkler ordinances, but has generally not been a major concern. The main underlying reasons are that homes without domestic water supply in place are deemed uninhabitable and sprinklers are a life safety device, water shut-offs in a given community are rare, or the system design allows for domestic shut-off without disabling sprinklers. For communities where this is a sensitive issue, there are two examples where communities have developed a proactive response.
- Inspections of backflow devices in sprinkler systems are required in communities where state law requires such inspections (unless the system design does not involve a backflow prevention device). To overcome the challenges in administering these inspections, community approaches range stiff penalties for non-compliance, to tax assessment incentives for compliance, to moving toward system designs which avoid the need for backflow prevention.
- In terms of "lost water" due to lower accuracy of larger domestic water meters (necessitated by the sprinkler system) or water theft from sprinkler systems, these were not reported to be significant issues in the communities.

As states and communities begin to adopt model building codes which require residential sprinklers or introduce sprinklers through other mechanisms, it will be necessary to develop their particular approach for integrating sprinklers with the local water supply. The results of this study indicate that a range of reasonable approaches will work, while communities or groups of communities can leverage some flexibility to deal with any issues of particular concern. Approaches which satisfy the needs of builders, water suppliers, and fire service are certainly within reach, and ideally communities can take from this research to help understand key issues and form their particular strategy.

Appendix A – Literature Review

Appendix A: Literature Review of Issues Related to Water Purveyors from the Adoption of Residential Sprinkler Systems

Introduction

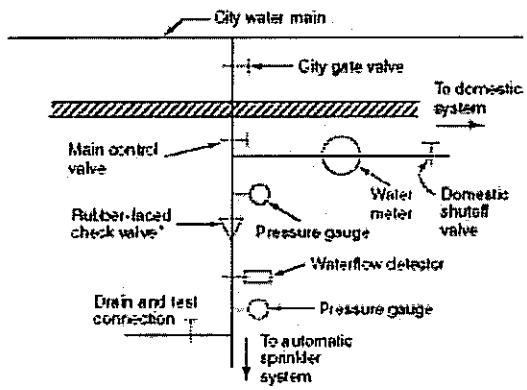
The International Code Council will issue a new set of residential building codes which will require sprinkler systems in all new single-family dwellings in 2011. Community leaders, home builders, sprinkler contractors, and water purveyors will be able to develop sensible policies that do not drastically increase the cost of sprinkler systems by having a clear understanding of the issues and concerns of their local water purveyor. The following sections of this paper provide a brief overview of the most significant issues associated with residential sprinkler systems that impact water purveyors. Future research will involve interviewing stakeholders in communities that currently have residential sprinkler system ordinances to identify the strategies used to overcome the issues identified in this paper.

Metering

- **Larger meters, which are sometimes required in homes with sprinklers, could increase the amount of water a purveyor cannot account for because larger meters are less accurate at measuring lower flow rates than smaller meters.** *(National Fire Sprinkler Association, Inc 2006; Voluntary Residential Fire Sprinkler Systems Technical Advisory Group: Meeting Minutes, July 15, 2008; Voluntary Private Residential Fire Sprinkler Systems Final Report 2008)*
- **The larger meters needed when metering fire sprinkler supply lines could cost more to purchase than smaller meters needed to meter only the domestic water supply and are sometimes assigned commercial usage rates.** *(Dewar 2006; AWWA Research Foundation and KIWA 2002; Oregon Building Codes Division 2008; Schunk 2008; Washington Water Utilities Council 2008)*
- **Metering sprinkler lines is seen by some water purveyors as way to deter/detect unauthorized water use.** *(Washington Water Utilities Council Guide 2008)*
- **Larger meters allow for more water usage in all uses, decreasing the water purveyor's ability to forecast and plan for water usage, especially during peak times.** *(Schunk, 2008; Gilman,White & Hardiman 2001; Washington Water Utilities Council 2008; Voluntary Private Residential Fire Sprinkler Systems Final Report 2008; Washington Water Utilities Council 2008; Oregon Building Codes Division 2008)*
- **There are a limited number of meter manufacturers capable of providing meters listed for fire service.** *(National Fire Sprinkler Association, Inc 2006; Voluntary Residential Fire Sprinkler Systems Technical Advisory Group: Meeting Minutes, July 15, 2008; Washington Water Utilities Council 2008)*

This list of meter-related issues is significant because depending on how these issues are handled within a community, the overall cost of a residential sprinkler system can be greatly impacted. Before each of these issues is discussed below, it is important to note that several of these issues are impacted by how and where the water meter is integrated with the domestic and fire sprinkler water systems of the home.

NFPA 13D Preferable Arrangement



Extracted from: National Fire Sprinkler Association, Inc (2006) Water Purveyor's Guide to Fire Sprinklers in Single Family Dwellings, p. 8.

System configuration options provided in NFPA Standard 13D allow sprinkler system flow to be either metered or not metered. For example, this diagram shows Standard 13D's Preferable Arrangement for a sprinkler system with regard to the water meter, while 13D also shows two other "Acceptable Arrangements" in which the sprinkler flow is metered (National Fire Sprinkler Association, Inc 2006).

Depending on whether the sprinkler flow is captured in metered flow or not, several issues related to the water meter may or may not be relevant. The chart below illustrates this concept, and is then followed by descriptions of the various meter-related issues.

Issues of Concern for Systems where Sprinkler Flow is not Metered (e.g. NFPA 13D Preferable Arrangement)	Issues of Concern for Systems where Sprinkler Flow is Metered
• Unauthorized water use	• Meter accuracy • Meter costs • Increased peak flow capacity • Durability • Type of meter

Metering Configuration of Water Supply Flow to a Residential Sprinkler System and the Associated Water Suppliers Issues

Meter Accuracy

Probably the biggest concern of water purveyors when sprinkler flow is metered is the fact that 1" or larger meters are less accurate in measuring the low-flow rates characteristic of residential usage, compared to the ¾" or 5/8" inch meters commonly installed in residential dwellings without sprinkler systems (National Fire Sprinkler Association, Inc 2006). Water purveyors are concerned about the accuracy of meter readings because of the requirement to account for all the water they supply. Water purveyors are able to account for some variance between the actual water supplied and the water billed for through a leakage rate credit, but water purveyors fear that the larger meters required for homes with fire sprinklers will increase the amount of unaccounted-for water. If a water purveyor exceeds the allowable leakage rate a penalty may be imposed by the agency which regulates the purveyor. If a community, region, or state determines to meter the water in residential sprinkler systems, one option is to adjust upward the allowable leakage rate for purveyors, as recommended in Washington State's TAG's final report (Voluntary Private Residential Fire Sprinkler Systems Final Report 2008; Voluntary Residential Fire Sprinkler Systems Technical Advisory Group: Meeting Minutes, July 15, 2008).

Meter Costs

Water purveyors often charge customers more for a 1" water meter than for a ¾" water meter. It is understandable that larger meters cost more than smaller meters, but occasionally the meter pricing structure is not based on material/product costs, but rather on the potential for water withdrawal of the meter. One-inch water meters have commonly been classified as a commercial meter size; therefore, customers who purchase 1" or larger water meters could also be charged commercial customer usage rates instead of residential usage rates (Dewar 2006; Schunk 2008; Washington Water Utilities Council 2008). A possible solution to the meter cost issue is to not assess "the full charge for an "up-sized" meter installed only to meet the technical requirements of a mandated sprinkling system" (Oregon Building Codes Division 2008, p.11). The rationale for this solution is supported in AWWA Research Foundation and KIWA's book *Impacts of Fire Flow on Distribution System Water Quality, Design, and Operation* (2002), which recommends that the "[d]isincentives for installation of sprinkler systems, such as water meter surcharges for sprinklered buildings should be removed" (p.150).

Unauthorized Water Use

Another issue which water purveyors are concerned about is how to prevent or detect residents from tapping into a residential sprinkler system if the water supply line feeding the sprinklers is not metered (e.g., "free" water). This issue is particularly important for a dwelling that has had the domestic water service terminated over a payment issue. "In general, utilities have opted to meter the separate fire service so that any unauthorized use can be detected" (Washington Water Utilities Council Guide 2008, p.8). No reports or numbers have been offered by stakeholders on how common unauthorized water use is; therefore, research into the unauthorized use of water sprinkler system water is necessary to fully evaluate this issue.

A simple, cost-effective solution to detection and prevention is to place a flow sensor on an unmetered sprinkler line. The sensor will detect unauthorized water use and can be integrated with alarms and alerting devices, so that if water is flowing through sprinkler supply lines an alert of some type is generated.

It should also be noted that the unauthorized water use concern is only relevant to system designs in which the sprinkler supply water is not metered; in many instances sprinkler supply water *will* be metered which nullifies this issue.

Increased Peak Flow Capacity

Residential units with fire sprinklers need larger water supply lines to accommodate design sprinkler flow rates (on the order of 28 gallons per minute to accommodate two sprinklers), compared to dwellings without sprinklers (Gilman, White & Woodward 2001). Homes without sprinkler systems are typically sized with supply lines capable of drawing between 5-7 gallons per minute. "It is recognized by water purveyors that an enlarged meter for a RFSS [residential fire sprinkler system] will also result in higher flows to the property during peak times associated with lawn irrigation and fixture loading" (Voluntary Private Residential Fire Sprinkler Systems Final Report 2008, p.14). The potential for greater water usage decreases a water purveyor's accurarcy in predicting and planing for water usage, especially during peak times.

To illustrate, homes that do not have the sprinkler system metered can only withdrawal a maximum of 7 gallons per minute for domestic use while homes that do have the sprinkler

system supply lines metered (and thus have a larger water meter) could withdrawal 7, 9, or even 13 gallons per minute for domestic use (Schunk 2008; Washington Water Utilities Council 2008). "For most utilities the sizing of the standard service line and meter is, in part, a means to limit peak demands on the system; and increasing the size of a single-service configuration to address fire sprinkler flow allows the potential for a greater peak demand" (Washington Water Utilities Council 2008, p.8). However, when discussing residential sprinkler system legislation in Oregon, homebuilders "argued there was no evidence that a larger water meter installed to meet the technical pressure requirements of a sprinkler system translated to more water used" (Oregon Building Codes Division 2008, p.10). In addition to the debate on the water usage impact of larger meters used in conjunction with sprinkler systems, a related question is how to allocate the cost for the potential of higher peak flows in the form of fees or other charges.

Type of Meter

There is a concern that not enough competition within the meter manufacturing market exists to provide adequate options to water purveyors and customers when selecting water meters. The number of companies offering meters listed for fire service is even more limited. This fact has been recognized by the National Fire Safety Association, who endorses the use of meters not listed for fire service because meters listed for fire service "will increase the cost" (National Fire Sprinkler Association, Inc 2006, p.4). The availability of meter types could become an issue as more purveyors demand meters capable of transmitting water data via radio signals or other methods for remote monitoring and billing purposes (Voluntary Residential Fire Sprinkler Systems Technical Advisory Group: Meeting Minutes, July 15, 2008; Washington Water Utilities Council 2008).

Water Purveyor Fees

- **Fees are inconsistent among water purveyors and justifications for fees are not always easily attributed to costs stemming from sprinkler systems.**
  (Residential Fire Sprinkler/Water Supply Task Force 2008; Wood 1995; Voluntary Private Residential Fire Sprinkler Systems Final Report 2008)

The charging of standby and service fees is an issue that will need to be addressed, in coordination with the water purveyor, at the local level by each community (Residential Fire Sprinkler/Water Supply Task Force 2008). A survey of Florida water purveyors "revealed that 20 water utility agencies in Broward County and Palm Beach County do not charge a standby

water fee/user fee" (Wood 1995, p.182) for residences with sprinkler systems. The same study in Florida also found that if the standby fees directly attributed to sprinkler systems were eliminated and the loss of revenue was transferred to all customers, every water bill would increase by $0.52 (Wood 1995).

A 2008 survey of water purveyors in Washington State found that the majority of water purveyors charge a fee from $0 to $250 to provide water service for residential sprinkler systems. But, 21 water purveyors that operate in jurisdictions that require residential sprinkler systems reported charging a fee over $1,000. However, the survey also found only 14 water purveyors that operate in jurisdictions that require residential sprinkler systems reported the cost to provide service to residential sprinkler systems to be over $1,000. This survey clearly indicates that some water purveyors could be charging fees in excess of the cost to provide the service to sprinklered homes. The water purveyors who responded to the Washington survey indicated that the main costs to the purveyor are related to developing storage capacity, covering the cost of the second connection, and providing ready capacity (Voluntary Private Residential Fire Sprinkler Systems Final Report 2008).

Below is a list, compiled by the United States Fire Administration (USFA), of the common reasons for charging additional fees to customers with residential sprinklers:

- Administrative costs
- Mapping of connections and street valves
- Annual inspection and maintenance of street valves
- Actual water used for inspection and flushing fire sprinkler systems
- Estimate for water that could be used if the building caught fire
- Charges to maintain fire flow capability for the entire system
- Contingency funding for the eventual replacement of pipes and valves (Wood 1995, p.177)

Water Supply

- **Water purveyor is unable to handle the increased fire flow demands and storage capacity needed to accommodate sprinkler systems.**
  (Voluntary Private Residential Fire Sprinkler Systems Final Report 2008; Washington Water Utilities Council 2008; Automatic Sprinklers: A 10 Year Study 1997)

Some water purveyors are worried about the ability to provide adequate pressure and water flow to communities and neighborhoods that require residential sprinkler systems. Washington

State surveyed water purveyors throughout the state and found that some purveyors felt their system was too small to handle the mass implementation of sprinkler systems and "several were concerned about the potential fire flow exceeding system capability" (Voluntary Private Residential Fire Sprinkler Systems Final Report Appendix A 2008, p.22). This issue is of particular concern for purveyors who are not currently providing service to fire hydrants (Washington Water Utilities Council 2008).

Scottsdale, AZ was one of the first communities in America to implement a community wide residential sprinkler system ordinance. In 1997, the city released *Automatic Sprinklers: A 10 Year Study* which indicated that the water purveyor and fire department were able to accommodate growth *better* because the sprinkler system requirement reduced the overall fire flow requirements and limited the number of fire stations and firefighters needed to handle the growth. Further research is needed to explore the issue of long-term growth benefits directly attributed to sprinkler requirements in order to offer guidance to other communities.

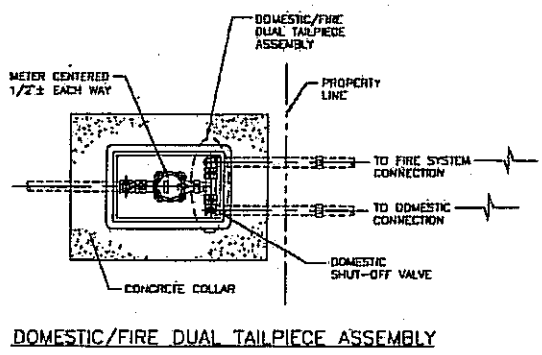
Liability

- **If the water service has been shut off to a residence and a fire occurs and the sprinklers do not activate - could the water purveyor be held responsible?** *(NAHB Research Center 1995; Voluntary Private Residential Fire Sprinkler Systems Final Report 2008; Washington Water Utilities Council Guide 2008; Las Vegas Valley Water District 2007; Dewar 2001; Voluntary Residential Fire Sprinkler Systems Technical Advisory Group: Meeting Minutes, July 15, 2008)*

Water purveyors are concerned that if water service had been shut off to a dwelling when a fire occurred and the fire sprinklers did not activate, then the water purveyor could be held responsible (NAHB Research Center 1995; Voluntary Private Residential Fire Sprinkler Systems Final Report 2008; Washington Water Utilities Council Guide 2008; Las Vegas Valley Water District 2007; Dewar 2001; Voluntary Residential Fire Sprinkler Systems Technical Advisory Group: Meeting Minutes, July 15, 2008). The suspension of water service to a residence generally occurs due to failure to pay bills, regularly scheduled maintenance, or emergency shut off due to line breaks and other unforeseen circumstances.

One remedy to this liability concern is to require that two water service lines enter the house from the municipal water supply – one for sprinkler water and one for domestic water. Another design option, implemented by the Las Vegas Valley Water District, is to use a dual tailpiece assembly that branches the sprinkler line from the domestic line after the water meter but has a shut-off valve on the domestic line because it provides "a means of shutting off the domestic supply without impacting the service to the residential fire sprinkler systems" (Las Vegas Valley Water District 2007, p.1). While these designs allow the domestic supply to be shut down while still maintaining flow to the sprinkler system, these approaches can add considerable cost to the overall system compared to the NFPA 13D Preferred Arrangement discussed earlier.

Las Vegas' Dual Tailpiece Assembly



DOMESTIC/FIRE DUAL TAILPIECE ASSEMBLY

Extracted from: Las Vegas Valley Water District. (2007). Residential Fire Service Tail Pieces Assemblies p.1.

Water purveyors typically view terminating water service over a payment issues as a last option. However, if the customer knows their sprinkler system will also become inactive when water service is disconnected (which is the case with single-supply line designs) it could serve as a bigger incentive to address the payment issue (Washington Water Utilities Council Guide 2008).

Further research is needed into how the liability issue is handled by jurisdictions currently requiring sprinkler systems in residential and commercial buildings. From a cost-effectiveness standpoint, it is desirable that alternative solutions to requiring dual service lines (one for domestic, one for sprinklers) to all homes with sprinklers are developed.

Health

- **Residential sprinkler systems introduce another connection that needs attention to prevent backflow and other cross-contamination occurrences.**
  (Quinn, Marcantonio & Hardiman 2009; Gilman,White & Hardiman 2001; Residential Fire Sprinkler/Water Supply Task Force 2008; Voluntary Private Residential Fire Sprinkler

Systems Final Report 2008; Dewar 2006; NAHB Research Center 1995; Schunk 2008; Voluntary Residential Fire Sprinkler Systems Technical Advisory Group: Meeting Minutes, July 15, 2008; Besner, Servais & Camper 2005)

- **The quality of water could be impacted by dead ends and longer residence time in larger pipes.**
  (Washington Utilities Council Guide 2008; National Fire Sprinkler Association, Inc 2006; Besner, Servais & Camper 2005; Hickey 2008 V.II; Home Fire Sprinkler Coalition 2008; AWWA Research Foundation and KIWA 2002; Dewar 2006)

Water purveyors are under strict EPA regulations to provide safe potable water. Residential fire sprinkler systems introduce another connection to the water distribution system that needs attention. The main health concern associated with sprinkler systems is preventing water already in the sprinkler system from back-flowing into the domestic water supply line. Similar to the health concerns stemming from any connection to the water supply system, water purveryors and city officials are concerned about sprinkler system cross-contamination issues and require backflow valves on some sprinkler designs (Quinn, Marcantonio & Hardiman 2009; Gilman, White & Hardiman 2001; Residential Fire Sprinkler/Water Supply Task Force 2008; Voluntary Private Residential Fire Sprinkler Systems Final Report 2008; Dewar 2006; NAHB Research Center 1995; Schunk 2008; Voluntary Residential Fire Sprinkler Systems Technical Advisory Group: Meeting Minutes, July 15, 2008). But an investigation of 84 wet-pipe sprinkler systems showed "that total coliforms were mostly absent from those systems and that the main risk of microbial contamination of the distribution system through backflow remains directly linked to the intrusion of sewage or raw water" (Besner, Servais & Camper 2005, p.34).

There is also a concern that sprinkler systems combined with domestic water systems require pipes with "a larger diameter than normally used to serve only domestic uses. The greater volume of water in these pipes can lead to a higher loss rate of residual chlorine at points of use, due to a longer residence time for the water within the warmth of the home. Further, if copper piping is used there could also be greater potential for copper corrosion, affecting Lead and Copper Rule (LCR) compliance" (Washington Utilities Council Guide 2008, p.3). No studies were obtained that confirmed this hypothesis and "[r]esearch sponsored by the United States Fire Administration and conducted by Worcester Polytechnic Institute showed that water that sits for long periods of time in fire sprinkler systems is not hazardous as long as the pipe is an approved potable piping material" (National Fire Sprinkler Association, Inc 2006, p.6).

Fully sprinklered communities, neighborhoods, and developments may actually *reduce* water quality concerns because "[i]f the required fire flows can be reduced, then it may be possible to reduce the pipe diameter necessary to deliver such flows and in turn improve water quality" (AWWA Research Foundation and KIWA 2002, p.xix; Home Fire Sprinkler Coalition 2008; Residential Fire Sprinkler/Water Supply Task Force 2008).

> *"Typically, electing to provide fire flows and fire hydrants results in increased water supply pipe diameters, leading to higher capital costs and greater provision for reliability and redundancy in the distribution system. It may also, however, have some negative water quality implications.This oversizing to meet what some consider to be relatively infrequent fire events can result in increased water resident times in larger size pipe, thus increasing the possibility of residual disinfectant loss, and enhancing the formation of disinfection byproducts and bacterial growth in the water mains. Larger diameter pipes also result in lower water flow velocities in the water system that lead, in turn, to the deposit of sediments." (Hickey 2008 V.II, p.119)*

Water purveyors and regulatory officials will need to balance water supply quality with preventive costs passed on to homebuyers and builders. However, no evidence has been presented that indicates sprinkler systems pose a greater risk for cross-contamination than garden hose connections or sewage lines. For more detail, Dewar's report titled *Fire Protection System Water Supply Issues: A White Paper* (2006) presents a concise overview on addressing backflow and contamination.

Maintenance

- **Backflow valves require annual testing and maintenance that water customers ultimately pay for either directly through a one-time maintenance charge or indirectly through a service fee.**
  (Washington Water Utilities Council Guide 2008; Voluntary Residential Fire Sprinkler Systems Technical Advisory Group: Meeting Minutes, July 15, 2008; Voluntary Private Residential Fire Sprinkler Systems Final Report 2008; Dewar 2006; Gilman, White & Woodward 2001)

Backflow valves require testing and maintenance that water customers ultimately pay for either directly through a one-time maintenance charge or indirectly through a service fee (Washington

Water Utilities Council Guide 2008; Voluntary Private Residential Fire Sprinkler Systems Final Report 2008; Dewar 2006; Gilman, White & Woodward 2001; Voluntary Residential Fire Sprinkler Systems Technical Advisory Group: Meeting Minutes, July 15, 2008). Valve inspections are typically performed by the water purveyor, but jurisdictions could allow homeowners or plumbers to inspect backflow valves if certain procedures are followed, typically NFPA 25 (Dewar 2006). Depending on which one of these approaches is adopted, physical access to the house and the backflow valve is an important consideration that can add costs to and complicate the inspection process.

While the cost of backflow valve inspections can be significant, as entire sub-divisions are built with residential sprinkler systems fewer fire hydrants could be needed and "the comparable cost in maintenance to a design with the usual number of hydrants would be much less" (Gilman, White & Woodward 2001, p.9; Dewar 2006). Thus, the added cost for backflow valve inspections could be partially offset by savings in hydrant upkeep.

Communities that have implemented residential fire sprinkler requirements have also explored the idea of adjusting the testing frequency of backflow devices from one year to two or three years (Voluntary Residential Fire Sprinkler Systems Technical Advisory Group: Meeting Minutes, July 15, 2008). The inspection and maintenance of backflow valves is important and each community will need to work with their water purveyor to develop an inspection strategy that is cost-effective, maintains the quality of the water, and ensures each sprinkler system is operational.

Reclaimed Water

- **Water supply issues could increase the use of reclaimed water for fire suppression activities.**
  (AWWA Research Foundation and KIWA 2002; Hickey 2008 V.I)

Reclaimed water is being used in fire hydrants but not residential sprinkler systems. As the cost of accessing, cleaning, and disinfecting water continues to rise the use of reclaimed or non-potable water for residential sprinkler systems may be explored. Although dual water supplies, one for potable and one for non-potable, for sprinkler systems is not a pressing issue today it will become a consideration, particularly in communities facing water shortages and that are

already exploring non-potable water distribution systems for irrigation and toilet flushing (AWWA Research Foundation and KIWA 2002; Hickey 2008 V.I).

Conclusion

Fire sprinkler systems will soon be required in all news homes, per the 2009 International Residential Building Code. This paper provides stakeholders with an understanding of the issues that could impact water purveyors with the mass implementation of residential sprinkler systems. Water purveyors are responsible for providing safe water to citizens and adequate flow and pressure to support fire suppression activities. Water purveyors, city officials, and the home construction industry will need guidance to develop local solutions that addresses the issues presented in this paper and the needs of their community.

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Appendix B – Interview Guide

Appendix B: Interview Template for Residential Sprinkler Systems & Water Purveyor Issues Research

CITY, STATE

Sprinkler Information
Year Ordinance Enacted: Special Details of Ordinance: (e.g. "13D+", only applied to certain building types) Water Purveyor Name: Water Purveyor Structure: (Public, private, non-profit, etc) *If community has multiple water purveyors, note others here.*

Interview Template

Date:	
Time:	
Interviewer:	
Contact Info:	

Questions:

Objective: Identifying the interviewee:
What is your **name and title**?
How long have you been in your **position**? - List general role/responsibilities - Other notes

Objective: Gain an understanding of the local sprinkler ordinance.
We understand that sprinklers have been required in [community] since [year]. Can you describe how the implementation of sprinklers on a broad scale played out? Probe issues related to water supply

Objective: To discover how specific issues that commonly affect the water purveyor are handled and addressed.
The sprinkler system design requirements in [community] require [cite requirements – 13D or 13D+] – is this correct? Are multi-purpose systems allowed to be used?
Within your community's design requirements for sprinkler systems, are any of the

following design details REQUIRED?

- The water flow through a home's sprinkler system MUST be captured by the home's water meter. Y/N *[check this response against the multi-purpose system response]*

- Houses must have 2 separate water service lines entering the home Y/N?

- Sprinklers systems (those which are not multi-purpose) must have a backflow valve. Y/N

For [community], we understand that water supply is handled by [purveyor]. Is this correct?

- Is the water supplier; public, private, non-profit?

- Are there differences in metering, costs, and fees among them?

(Ask following questions for each water purveyor involved, if more than one)

For [purveyor name], can you generally describe how residential sprinklers are handled in terms of fees, service lines requirements, and metering requirements?

Broad question – let them expand as much as possible in their reply

Compared to a house WITHOUT sprinklers, is a home WITH sprinklers assessed with any additional fees related to the water service? These could be standby fees or any other type of recurring fee.

- What kind of fee?

- How much is it?

- How much more is it than a non-sprinklered home?

Probe rationale

What about **tapping fees?** Has the cost for a new home to tap into the water supply line changed for homes with sprinkler systems?

- If yes, why and how much?

Probe rationale behind any increases

IF SPRINKLER WATER MUST BE METERED:

Primary Issues

- What is the typical size of this meter?

- Has the availability of meters suited for this application been a problem?

- Because of this larger meter size, would a residence pay for its water use based on a different fee schedule than a non-sprinklered home?

- About how much more does this meter cost than the meter which would have been used if sprinkler flow was not metered? (E.g., 13D's Preferable Arrangement).
    - Is there a pricing sheet for meters?

Secondary Issues (more qualitative)

- Has there been any discussion on the potential for larger meters to not be as accurate measuring the low flows typical of residences?

- Has there been any change to the water purveyor's leakage allowance?

- Have the larger water meters which result from capturing sprinkler flow given rise to any other issues with operating the water supply system?

IF SPRINKLER WATER <u>DOES NOT</u> HAVE TO BE METERED

How was the potential for **unauthorized water use** addressed?

- Are you aware of any cases locally where a resident tried to tap into the sprinkler line for domestic use?

IF HOUSES ARE <u>NOT</u> REQUIRED TO HAVE 2 SEPARATE SERVICE LINES

How are liability issues handled (e.g. water service is shut off and then a fire occurs and sprinklers do not operate)?

- Are you aware of any cases locally where a home's sprinklers were disabled due to a service shut-off, and a fire occurred at the residence?

Objective: Investigate the impact of the sprinkler ordinance has had on the community since passage.
Are **regular inspections** required for sprinkler systems? - Note frequency – annual? - What components do these inspections cover (e.g. backflow valves, meters, sprinkler heads)? - Who conducts these inspections? - How are they paid for? One-time charge or included in bill, service fee?
Have any water **contamination or backflow issues** resulted from a residential sprinkler system in the community?
Has the sprinkler ordinance had any **impacts on operating costs** on the fire department?
Has the implementation of residential sprinklers had a positive effect on the ability of the water supplier to meet fire flow requirements?
Have any **changes been made to the ordinance** since it was passed? - If so, why? - Who proposed the change?

Objective: Probe whether the sprinkler-related requirements explored above were handled in a drastically different manner BEFORE the community adopted a sprinkler

ordinance.
For the sprinkler requirements we discussed here – were any of these issues handled in a much different way prior to [community] adopting its ordinance? E.g. – were meter issues handled the same way? Were fees for sprinklered home about the same? Look for any flags and probe the issues further.

Are there other contacts we should talk to about [community] sprinkler requirements and how they have been integrated with the water supply system?

- Contact info?
- Why?

Thank you for your time.

Applying for Combination Water and Fire Service (Dual Service)

Single-Family Residential and Duplex Connections

Effective July 1, 2011

Disclaimer Notice

Applicants for water service will find this information helpful in understanding the process of applying for a new combination water and fire service (dual service). These charges and fees are presented only as guidelines for estimating costs. Final quotations will ***not*** be issued until a properly completed application is submitted.

All applications for water service are subject to review and approval by the District.

All requests for preliminary estimates or quotations ***must*** include an address, accurate location of the parcel to be served, and the proposed use of the premises.

The following factors may increase your final cost:

- Front foot charges
- Contaminated soil conditions
- Annexation fees
- Availability of an existing water main

EAST BAY
MUNICIPAL UTILITY DISTRICT

What is Dual Service?

A Dual Service is a combination service for domestic use and fire protection that may be granted for single-family residences or each dwelling unit of a duplex. Other multi-family residences and commercial buildings require a separate fire service. A dual service may have a larger meter than a standalone domestic service to meet the flow demand for fire prevention. The System Capacity Charge (SCC) will be based upon the meter size necessary to meet domestic requirements only. A Dual Service Application must be completed and signed by the Fire Marshal before a dual service will be granted.

New Regulation requires Sprinkler System for Single-Family Residential Dwelling Unit

The California Building Code (CBC) requires automatic fire sprinkler systems in all new construction of one- and two-family dwellings (including townhomes).

Appointments

Scheduling appointments in advance will assure a representative will be available to see you and will help avoid unnecessary delays. Appointments to speak in person with a New Business representative may be obtained by calling (510) 287-1008.

Information you will need to provide EBMUD as part of your application for water service

- ❑ Water Service Application Packet
- ❑ Application for Dual Service and fire sprinkler plans signed by a representative from the local fire protection agency.
- ❑ Completed hydrant/fire service form signed by a representative from the local fire protection agency
- ❑ Applicant and/or name of owner and mailing address
- ❑ Address of property to be served
- ❑ Site plans
- ❑ Proposed meter location
- ❑ Assessor's parcel number
- ❑ Building permit number *or* grading permit number
- ❑ Name, address and telephone number of plumbing contractor
- ❑ Total flow (in GPM) required to serve domestic and fire sprinkler demands
- ❑ Number of meters required
- ❑ Existing site environmental data (if available)

Application Process

Step	Responsible Party	Action
1	Applicant	Completes the Water Service Application, Application for Dual Service, Hydrant/Fire Service form, Meter Size Work Sheet, Applicant checklist, Water Efficiency Requirements checklist and returns with plans to: East Bay Municipal Utility District, New Business Office 375 11th Street Oakland, CA 94607-4240
2	New Business Office	Calculates the cost of the service(s) and sends quote to applicant.
3	Applicant	Pays installation fee, in person or by mail. **Note:** Appointments may be scheduled to arrange payment in person by calling (510) 287-1008.
4	New Business Office	Applies for a city/county/state encroachment permit for street work at your location.
5	New Business Office	Upon receipt of encroachment permit, delivers work orders to the EBMUD Service Center in your area to schedule installation. **Note:** Applicant must pay all outstanding charges before job will be scheduled.

Installation Time

Installation of your new service will generally be completed within 6 to 8 weeks after receipt of your payment.

Backflow Prevention

A backflow prevention device may be required for dual service. Our Backflow Prevention Unit will assist you in determining if a backflow prevention device is required. Information can be obtained by calling (510) 287-0874.

Water Conservation Review

Applicants for residential water use must provide self certification of compliance with water efficiency requirements for developments of 2 units or less and must supply water usage plans for all developments of 3 units or more for review by our Water Conservation Department. Water service shall not be furnished to any Applicant for new or expanded service unless all the applicable water-efficiency measures are installed at Applicant expense as described in Section 31 of the Regulations Governing Water Service to Customers. Applicants for smaller services are encouraged to take advantage of this free plan review. Information can be obtained by calling 1-866-40-EBMUD (1-866-403-2683).

Service Costs

The cost you pay for service is dependent upon the size of the water meter, type of service, and location of the property to be served. The total cost will be the sum of the following components:

- Installation fee
- System Capacity Charge (SCC)
- Wastewater Capacity Fee*
- Front foot charges*
- Contaminated soils*
- Account fee
- Annexation fees*

**when applicable*

Installation Fee for Lateral Oversizing for Fire Flow Capacity

The installation fee covers the cost of installing a standard 1-1/2" service lateral and is based upon the meter size of the water meter.

Size	Paved Cost	Unpaved Cost
1"	$5,378	$2,621
1½"	$5,484	$2,706

Meter Size Calculation

The Meter Size Work Sheet is used to determine the domestic demand for your property and the System Capacity Charge (SCC). Meter size is based on the number of household fixtures multiplied by the fixture unit. Each plumbing fixture is given a fixture unit valued based upon the Uniform Plumbing Code. The unit count for each fixture is determined by multiplying the number of each fixture type by the appropriate fixture unit in the multiplier column.

Front Foot Charges

If the main serving your parcel was paid for by a prior Applicant, your final costs may include reimbursement for the portion of the main fronting your parcel.

System Capacity Charge – Effective August 15, 2011

A System Capacity Charge (SCC) is assessed to recover costs associated with the additional demand to EBMUD's water system incurred by providing service to your property. The charge will be based on the following factors:

- Meter size and/or domestic demand
- Location of the property to be served (SCC region)

Adjusted System Capacity Charge for Dual Service

The System Capacity Charge (SCC) will be based upon the meter size necessary to meet domestic requirements only. Adjustments are made for low-pressure and residential fire services. When a large meter is installed (upon District approval) to compensate for low-pressure or to provide fire protection capacity, the SCC is based on the meter size necessary to meet the domestic demand, not the actual size of the meter installed.

Example: The SCC for a 1-1/2" dual service meter installed to serve a residential fire protection and domestic demand system for a residence with a safe intermittent domestic demand of 30 gallons per minute (3/4" meter) in Region 1 would be $13,920. (Residential SCC Region 1, 3/4" meter)

SCC credits are given when the size of an existing meter is increased, or when one or more meters are replaced with new services on the same premises. The SCC credit is based on the size of the service that is being increased or replaced, or number of dwelling units serviced. This amount is credited towards the SCC for the new service connection(s).

Note: No cash credits or refunds are given. The SCC credit remains with the property and is not transferable to other premises.

Determination of SCC Region

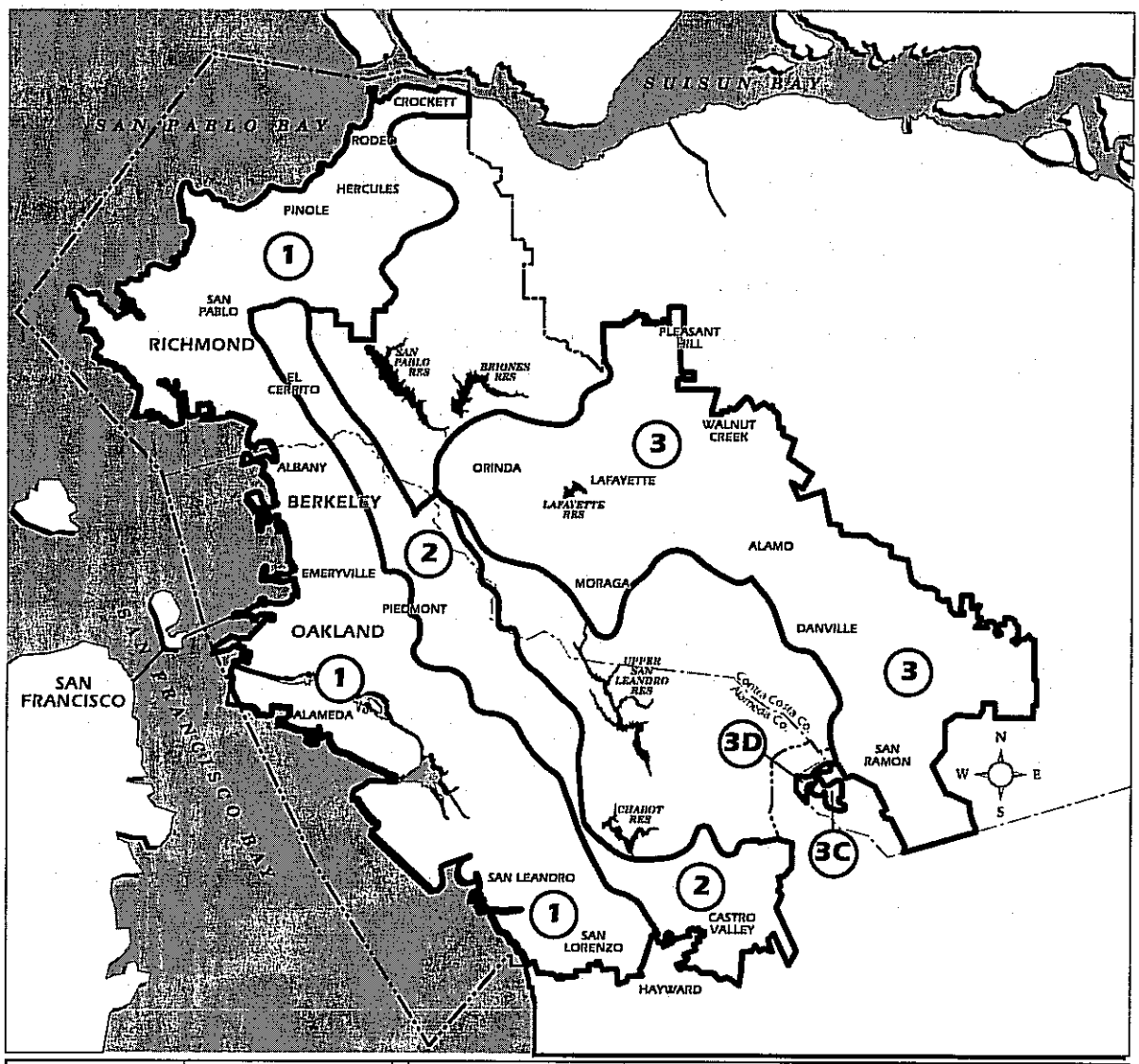
The New Business Office will determine within which region your property is located. Regional designations may vary within a geographical area due to elevation and pressure zone changes. The SCC Regions map provides an approximate description of these regions.

To determine an estimated SCC for your project, locate the general area of your project on the SCC Regions map then look up the SCC by meter size in the chart located below.

Single Family Residential Accounts in Principal Regions

Meter Size (inches)	Principal Regions		
	1	2	3
3/4	13,920	22,410	29,830
1	23,200	37,350	49,720
1 1/2	46,400	74,700	99,440

System Capacity Charge (SCC) Regions



	Alameda County Regions	
	1	2
Alameda	●	
Albany	●	
Berkeley	●	●
Castro Valley		●
Emeryville	●	
Hayward*	●	●
Oakland	●	●
Piedmont	●	●
San Leandro	●	●
San Lorenzo	●	

	Contra Costa County Regions				
	1	2	3	3-C	3-D
Alamo-Blackhawk			●		
Danville			●		
El Cerrito	●	●			
Hercules		●			
Lafayette			●		
Moraga			●		
Orinda			●		
Pinole	●				
Pleasant Hill*			●		
Richmond	●	●			
Rodeo-Crockett	●				
San Pablo	●				
San Ramon			●	●	●
Walnut Creek*			●		

*City not entirely served by EBMUD.

General Description of Principal Regions

Region	General Description
1	Central Area (gravity zones West-of-Hills)
1	El Sobrante and north (pumped zones)
2	South of El Sobrante to vicinity of Highway 24 (pumped zones)
2	South from vicinity of Highway 24 (pumped zones)
2	Castro Valley Area (pumped zones)
2	North Oakland Hill Area (pumped zones, formerly 4-A)
3	Orinda-Moraga-Lafayette Area (pumped zones)
3	San Ramon Valley and Walnut Creek (pumped zones)

Single-Family Residential Accounts in Additional Regions

Meter Size (inches)	Additional Regions	
	3-C	3-D
3/4	$74,040	$82,230
1	123,400	137,050
1 1/2	246,800	274,100

Commercial and Industrial in Additional Regions

Meter Size (inches)	Additional Regions	
	3-C	3-D
5/8	n/a	$82,230
3/4	n/a	82,230
1	n/a	137,050
1 1/2	n/a	274,100
2	n/a	438,560

Wastewater Capacity Fee

A Wastewater Capacity Fee will be collected if the property to be served is located in any of the following cities:

- Oakland
- Berkeley
- Albany
- El Cerrito
- Alameda
- Emeryville
- Piedmont
- Kensington
- Richmond (applies only to property within Stege Sanitation District.)

The standard residential fee is $1,235 per single-family dwelling.

Sample Calculation

Example 1

The cost to install a 1" meter for Dual Service at a 3/4" domestic demand to serve a single-family residence in West Oakland under Paved Conditions would be calculated as follows:

Installation fee	**$5,378**
System Capacity Charge Region 1, 3/4" meter	**13,920**
Wastewater Capacity Fee	**1,235**
Account fee	**34**
Total	**$20,567**

Example 2

The cost to install a 1" meter for Dual Service at a 3/4" domestic demand to serve a single-family residence in West Oakland under Unpaved Conditions would be calculated as follows:

Installation fee	**$2,621**
System Capacity Charge Region 1, 3/4" meter	**13,920**
Wastewater Capacity Fee	**1,235**
Account fee	**34**
Total	**$17,810**

Note: *All fees are reviewed periodically and are subject to adjustment.*

Groundwater and Soil Contamination Issues

Before District crews are allowed to excavate for any new service or main extension, an investigation is done to determine if groundwater will be encountered during excavation and whether the soil or groundwater is contaminated. Applicants must submit any known, existing information regarding site soil and groundwater conditions with their application.

If the District determines that sampling is necessary to adequately characterize soil and groundwater conditions, the Applicant will be responsible for the actual cost of sampling and analyses unless the job is based on a fixed rate and no evidence of contamination is found. The Applicant will also be responsible for increased disposal costs due to the presence of groundwater within the maximum trench depth or due to contamination of soil or groundwater. If the contamination poses a threat to drinking water quality, water distribution piping or appurtenances, or worker health and safety, the Applicant may be required to remediate the site before services will be installed.

Brochure Produced By

Administration Department
New Business Office
Joseph M. Callahan, *Customer Services Manager*

CITY OF YREKA
CITY COUNCIL AGENDA MEMORANDUM

TO:	Yreka City Council
Prepared by:	Mary Frances McHugh, City Attorney
Date:	January 11, 2012
AGENDA TITLE:	Discussion/Possible Action – Direction to Staff re Amending Section 11.23.050(c) Yreka Municipal Code re Water System Fees relating to Developer Impact Fees for Fire Sprinkler Systems in Single Family Residences and to Schedule Public Hearing Pursuant to Government Code Section 66016, et seq.
MEETING DATE:	January 19, 2012

Background: The State of California adopted the IRC fire sprinkler requirement in 2009 and it became effective in the State on January 1, 2011, as part of the 2010 California Residential Building Code. This regulation applies to new construction. Since June of this year, City staff have been studying the following issues for recommendation of action by the Council: (1) How to have the Developer Impact Fees reflect this regulation; and (2) how to implement the requirement without creating undue burden upon the property owner.

Discussion: Installation of a fire suppression/sprinkler system contemplates having water available for fire suppression independent of the customer consumptive water supply. This can be done by either "upsizing" the supply line to the home or, having a separate fire line for this service. A survey of similarly sized jurisdictions as well as larger ones revealed that a typical single family residence could not accommodate both the regular water supply and the fire supply on less than a 1" water line, but that a single family residential consumer frequently did not need a 1" supply for normal, everyday use. The concern is the fairness of requiring a property owner to pay the greater amount of connection fee for a supply line that would not be used except perhaps once in the lifetime of the property.

The City's Building Official has attended several regional meetings related to this issue and brought the suggestions from those meetings back for consideration. Staff has resolved the question of how the water service is delivered to the property so that water is available for fire suppression and resolved any inequities which may relate to regular water consumption. The preferred method is installation of a U-joint at the street lateral with two meter connections, one for consumption, the other for fire service. This configuration will allow both services to be metered, but prevent unregulated access to water, and, allow for shut off of domestic service without jeopardizing fire suppression. There will need to be the establishment of a nominal fire suppression charge to cover costs of maintenance, which can be done at the time of the next water rate study. Under this configuration, the domestic meter would be the only meter subject to the development impact fee.

Approved by: _____
Mary Frances McHugh, City Attorney

Briggs / Mercier
Need Bldg Official
Show costs to Consumer

What would loss to City be?
Is there a stimulus?

The next step then is the modification of the Developer Impact Fee Ordinance to reflect the appropriate domestic meter size for a single family residential use. Staff is recommending creating a new meter size/household equivalent of ¾ inch with a 1 Household Equivalent ratio if the ¾ inch service is an approved fire sprinkler system, and, creating a new meter/size equivalent of 1" for 1HE ratio with approved fire sprinkler system. (See draft ordinance). This modification is similar to actions of other jurisdictions in our area. This modification will address the concern of fairness in the setting of the fee.

Because this would be a modification of a development fee, which is governed by California Government Code Section 66000, et seq., there are public hearing and notice procedures which are required. The proposed fee and its justification must be made available for public review at least 10 days prior to the meeting at which the Council makes the change of the fee. The change of the fee must be by either ordinance or resolution, and can only occur after a public hearing is held at which oral or written presentations can be made, as part of a regularly scheduled meeting; and, notice of the public hearing must be published twice over the 10 days prior to the Council meeting [Gov. 66018(a)].

In addition, this is an opportunity to cleanup a portion of Ordinances 792 and 799 by deleting the 5/8ths inch domestic meter size/household equivalent ratio because it no longer meets any current building standards. These are standards for new/remodeled construction. This will not affect the water rates which currently include the 5/8ths inch meter size in the minimum rate, which should remain unchanged because many existing properties have that size meter.

Fiscal Impact: Cost of publication of public hearing notice: approximately $75.00; cost of publication of ordinance: approximately $75.00; cost of codification of ordinance: approximately $200.00

Environmental Review: none required.

Attachments: Draft Ordinance

Recommendation and Requested Action:
Direct Staff to prepare an Ordinance Amending Section 11.23.050(c) Yreka Municipal Code re Water System Fees relating to Developer Impact Fees for Fire Sprinkler Systems in Single Family Residences, and to publish any necessary report required by Government Code Section 66016(a), and Schedule Public Hearing Pursuant to Government Code Section 66016, et seq. for February 16, 2012, and order publication of Notice of Public Hearing

NATIONAL FIRE SPRINKLER ASSOCIATION, INC.

Water Purveyor's Guide to Fire Sprinklers in Single Family Dwellings

Fire sprinklers have long been used in commercial buildings and large residential occupancies to provide economical life safety and property protection in those buildings. Starting in 1976, the National Fire Protection Association (NFPA) has made available a special, low cost, design and installation standard (NFPA 13D) to bring this important technology into one and two-family dwellings and manufactured homes. Every year, approximately 300,000 fires occur in homes in the United States resulting in thousands of deaths. These deaths can be prevented by the installation of a fire sprinkler system in each home.

In addition to their life safety abilities, fire sprinklers also offer the water purveyor a cost effective method of managing their water usage. During a fire in a home that does not have a fire sprinkler system, the fire department will use thousands of gallons of water to fight that fire. In a home with a fire sprinkler system, a few hundred gallons are all that the sprinkler system and the fire department will need. This efficient use of water translates into significant savings for the water purveyor.

This guide will provide a water purveyor with information on the topics that need to be addressed in preparing a jurisdiction for fire sprinklers in single-family dwellings. Although there is general information provided on all sprinkler systems this guide will concentrate on fire sprinkler system for one- and two-family dwellings, manufactured homes and townhouses. In order to save space, this guide will refer to "single family dwellings" or "homes" to make a distinction between this kind of building and a larger multi-family building like an apartment building or multi-unit condominium. In all cases, the rules that apply to single family dwellings or homes also apply to two-family dwellings, manufactured homes and townhouses that are built with sufficient separation to be considered individual homes or two-family buildings.

Model Codes

The following model codes contain requirements for fire sprinkler systems in new homes.

- The *International Building Code,* 2003 and 2006 editions, require sprinkler protection for all residential occupancies. This code is typically used for larger residential occupancies such as hotels, apartments, dormitories or condominiums, but it could also be used for single family dwellings units as well (R-3 occupancies), which would be required to be sprinklered due to this provision.

- The *International Fire Code,* 2003 and 2006 editions, also requires sprinkler protection for all residential occupancies.

- The *International Residential Code*, 2006 edition, has a residential sprinkler requirement in the appendix which allows a state or community to adopt language requiring sprinkler protection for single family dwelling units.

- NFPA 101, *Life Safety Code,* 2006 edition, now requires sprinkler protection for all new single family dwelling units.

- NFPA 5000, *Building Construction and Safety Code,* 2006 edition, now requires sprinkler protection for all new single family dwelling units.

- NFPA 1, *Uniform Fire Code,* 2006 edition, references NFPA 101 for the residential sprinkler requirement.

Sprinkler Standards

The following standards address the installation requirement for sprinklers in residential occupancies.

- NFPA 13, *Standard for the Installation of Sprinkler Systems,* can be used for sprinkler systems in any residential occupancy. It is typically used in large apartment and hotel buildings.
    - NFPA 13 uses a density/area method of determining the total flow and pressure for the sprinkler system. For example, in many residential occupancies a minimum water density of 0.1 gpm/sq ft is required over an area of 1500 sq ft. Other options exist including the use of residential sprinklers with a 4-sprinkler design.
    - Residential occupancies are typically considered Light Hazard.
    - The maximum system pressure is usually 175 psi, although some equipment is rated for higher pressure.
    - The minimum operating pressure for a sprinkler is 7 psi, or the pressure needed to obtain the minimum flow, or the pressure corresponding to the sprinkler manufacturer's listing, whichever is greater.

- NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height,* can be used in residential occupancies up to 4 stories in height. NFPA 13R has a high level of life safety with a lesser level of property protection than NFPA 13.
    - NFPA 13R uses up to 4 flowing sprinklers to determine the flow and pressure demand of the system. For example 4 sprinklers flowing 13 gpm each would produce a total system demand of approximately 52 gpm.
    - The minimum flow for each sprinkler is determined by the manufacturer's listing, which is dependent on the area that the sprinkler is listed to cover. At no time is the flow allowed to be less than 0.05 gpm per sq ft of coverage area.

- The domestic water demand must be added to this flow if the system is part of a combined domestic/fire protection system. Tables are provided to estimate the domestic water demand.
- The maximum system pressure is 175 psi, although some equipment is rated for higher pressure.
- The minimum operating pressure for a sprinkler is 7 psi, or the pressure needed to obtain the minimum flow, or the pressure corresponding to the sprinkler manufacturer's listing, whichever is greater.

- NFPA 13D, *Standard for the installation in Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes,* is a reasonable life safety standard for providing fire sprinkler protection in homes.
  - Wet pipe systems only
  - NFPA 13D uses up to 2 sprinklers flowing to determine the pressure and flow of the sprinkler system. For example 2 sprinklers flowing 13 gpm each would produce a total system demand of approximately 26 gpm.
  - Figure A.6.2 (a) illustrates the preferred arrangement for piping arrangement and meter location. In this case the meter would only be used on the domestic water line and therefore should not be subject to the scope of our residential fire meter project.
  - Figure A.6.2. (b) Illustrates an acceptable arrangement with 2 water lines, one for the domestic and one for the sprinkler system. Only the domestic water line is metered.
  - Figure A.6.2 (c) illustrates an acceptable arrangement with a meter on the combined domestic/fire protection water line. This should be the only illustration that would require a meter that would restrict the water to the sprinkler system.
  - The minimum flow for each sprinkler is determined by the manufacturer's listing, which is dependent on the area that the sprinkler is listed to cover. At no time is the flow allowed to be less than 0.05 gpm per sq ft of coverage area.
  - If the house is a duplex and the water supply combines the domestic/fire protection then 5 gpm must be added to the total demand.
  - The maximum system pressure is 175; unless nonmetallic pipe is used in multipurpose domestic/fire protection systems then the working pressure can be 130 psi. (See 5.2.1.2 and 5.2.1.3)
  - The minimum operating pressure for a sprinkler is 7 psi, or the pressure needed to obtain the minimum flow, or the pressure corresponding to the sprinkler manufacturer's listing, whichever is greater.
  - Plans and calculations are not required by the standard, although many local jurisdictions do require them.
  - The sprinkler contractor is required to provide the home owner with inspection, testing and maintenance information

AWWA policies and research

The following residential fire sprinkler policy statement was adopted by the AWWA Board of Directors on February 4, 1996, and was reaffirmed on June 13, 2004.

> "The American Water Works Association (AWWA) recognizes the increasing use of residential fire sprinkler systems and encourages that they be designed by licensed or accredited professionals and installed by licensed fire sprinkler contractors or properly trained personnel. The design of a system requires communication with the utility so that available water pressures and flow to the residential fire system can be determined and the design can meet the utility's requirements."

AWWA Research Foundation has published the following report: *Impact of Fire Flow on Distribution System Water Quality, Design, and Operation.* This report concludes the following:

> "Water-efficient fire suppression technologies exist that use less water than conventional standards. In particular, the universal application of automatic sprinkler systems provides the most proven method for reducing loss of life and property due to fire, while at the same time providing faster response to the fire and requiring significantly less water than conventional fire-fighting techniques. It is recommended that the universal application of automatic fire sprinklers be adopted by local jurisdictions."

Residential Fire Meters

As a general rule a fire protection water line should not have any devices in line that could restrict the flow of water (for example a meter). If this were true in all cases we would not need to develop standards for fire meters. But recognizing that combined domestic/fire protection water lines may need metering then this should be the only time such meters should be used. The scope of these efforts should not be to mandate fire service meters on dedicated fire protection lines. Meters on fire lines should have a minimal friction loss. These meters should be able to fail safely in the full flow position and an increase in sediment in the water should not affect the meter. The meter should be able to continue to flow under various failed conditions. These meters do not necessarily need to be listed for fire service, as this will increase the cost. This concept is recognized by both NFPA 13D and NFPA 13R, which allows the sprinkler system to be connected to a reliable waterworks system.

There are residential fire meters being manufactured although there is no universal standard guiding their construction. Underwriters Laboratories is in the process of releasing a document on residential fire meters (SUBJECT 327A, OUTLINE OF INVESTIGATION FOR INFERENTIAL TYPE RESIDENTIAL FLOW METERS).

The manufactures of small meters have used construction criteria for residential fire meters which is similar to that for existing fire meters over 3 inches in diameter. Some of the concerns for the use of these meters included; using dirty water under high flow conditions, endurance versus accuracy, 3rd party certification, and any increase in cost.

Although friction loss tables can be used to estimate pressure loss in average meters, actual friction loss from the manufacturer should be used because true values vary between manufacturers and sizes. The following table is taken from NFPA 13D and shows the average friction loss in psi through some common meter sizes. Note that at a flow of 26 gpm, common for many NFPA 13D systems, the friction loss in a 5/8 inch meter is prohibitive and in a ¾ inch meter may be too high to be acceptable. Also note that in some circumstances, the two sprinkler design requirements of NFPA 13D might make flows in excess of 31 gpm mandatory, leaving little choice except a 1 inch meter.

Pressure Loss (psi)

Meter Sizes (inch)	Flow (gpm) 18	23	26	31	39	52
5/8	9	14	18	26	†	†
3/4	4	8	9	13	†	†
1	2	3	3	4	6	10
1½	††	1	2	2	4	7
2	††	††	††	1	2	3

NOTE: For SI units, 1 gpm = 3.785 L/min; 1 in. = 25.4 mm; 1 psi = 0.0689 bar.
† Above maximum rated flow of commonly available meters.
†† Less than 1 psi (0.689 bar).

AWWA Reference Material on Meters:

M6, *Water Meters - Selection, Installation, Testing, and Maintenance*
M22, *Sizing Water Service Lines and Meters*
C703, *Fire Service Meters,* covers fire meters 3 inches and larger.

See the discussion on arrangements of systems later in this guide for a more detailed discussion of meter sizes and arrangements.

Recommended Backflow Protection

The water purveyor needs to provide safe and reliable drinking water to all customers, and therefore needs to address all types of cross-connections. In most cases the water purveyor also needs to provide water for fire fighting operations throughout the community while at the same time continuing to address future development of the community and expansion of the total system demand.

Backflow preventers should not be necessary on small residential systems with the same components as domestic systems or on small residential systems integrated with domestic systems. Research sponsored by the United States Fire Administration and conducted by Worcester Polytechnic Institute showed that water that sits for long periods of time in fire sprinkler systems is not hazardous as long as the pipe is an approved potable piping material. The following is a summary of documents that require a backflow protection device or provide guidance for their installation.

NFPA 1, *Uniform Fire Code,* requires the installation of backflow devices to protect the public water supply from contamination and they must comply with NFPA 13 or NFPA 24, *Private Fire Mains,* and the plumbing code. Backflow prevention devices must be inspected, tested, and maintained in accordance with NFPA 25, *Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.*

The *Uniform Plumbing Code* recommends the following protection for fire systems as appropriate (see Section 603.4.18); Double Check Valve Assembly, Double Check Detector Assembly, Reduced Pressure Backflow Preventer or Reduced Pressure Detector Assembly. A Reduced Pressure Backflow Preventer or Detector Assembly is only required when a system is within 1700 feet of a non potable water source and a fire department connection is provided or if there is an additive is in the system.

The *International Plumbing Code* (§P608.16.4) requires that the potable water supply connected to an automatic fire sprinkler or standpipe system be protected against backflow by using a double check-valve assembly or a reduced pressure principle backflow preventer as appropriate. Additives or a nonpotable water source (§P608.16.4.1) require a reduced pressure principle backflow preventer. Examples could include chemical additives, antifreeze, or connections to a nonpotable secondary water supply assuming there is a fire department connection. Backflow protection is not required when a fire protection system is part of the water distribution system and there is no fire department connection nor is backflow required on deluge, preaction or dry pipe systems.

AWWA Manual M-14, *Recommended Practice for Backflow Prevention and Cross-Connection Control,* 3rd Edition provides the following information on backflow prevention and fire protection systems. The recommended backflow protection is based on the degree of hazard presented by the system, either low hazard or high hazard. A low hazard (non-health hazard) is a potential cross-connection involving any substance that generally would not be a health hazard but would constitute a nuisance or be aesthetically

objectionable if introduced in the potable water supply. A high hazard (health hazard) is a potential cross-connection involving any substance that could, if introduced into the potable water supply, cause death or illness, spread disease, or has a high probability of causing such effects.

The following AWWA M14 requirements are generally for new systems. Existing systems usually do not require additional backflow protection if they already have some form of acceptable directional flow-control protection in place (ex: single check valve or alarm check valve) until the system is substantially altered. Requiring additional backflow prevention on existing systems can have a detrimental effect on the hydraulic capability of the system as well as the cost.

AWWA M-14 recommends two approaches for backflow protection on commercial fire sprinkler systems. The 1st approach recommends a double check valve assembly (DCV) on all systems, unless there is a risk of a high hazard cross-connection, in which case a reduced-pressure zone principal backflow prevention assembly (RPZ) is recommended. The 2nd approach is to assess each type of system individually. For this approach, M-14 provides guidance on the following types of fire-suppression systems:

Wet-Pipe Fire Sprinkler Systems usually have stagnated water that may not be acceptable to drinking water standards. For new systems a DCV is recommended on closed (nonflow-through) systems, unless there is a risk of a high hazard, in which case a PRZ or air gap is suggested. For existing systems with a low hazard of cross-connection an existing modern UL listed alarm check valve (containing no lead) can continue to be used to control the direction of flow. Existing systems that have an alarm check valve that contains lead should consider protection using a DCV. If the existing system is significantly modified then the backflow protection should also be reexamined. A fire department connection may also present a potential source of contamination based on the fire departments water supply and if additives are used.

Dry-Pipe Nonpressurized Fire-Suppression Systems (Deluge) are open to the atmosphere and generally do not require backflow protection unless chemicals will be added when water flows, in which case a RPZ is suggested.

Dry-Pipe Pressurized and Preaction Fire-Suppression Systems typically are pressurized with air or nitrogen. Preaction systems may or may not be pressurized. A DCV is recommended unless there is a risk of a high hazard (e.g. chemicals) in which case a RPZ or air gap is recommended.

Residential, Single-Family Fire Sprinkler Systems do not require backflow assemblies on systems that are constructed of approved potable material and are designed to flow water so it does not become stagnate. A DCV is suggested on other systems unless there is a risk of a high hazard cross connection in which case a RPZ or air gap is recommended

Other fire-suppression systems designs can vary and the level of backflow protection should be based on the type of cross-connection and the degree of hazard. The local plumbing code could regulate systems connected to private plumbing systems.

Antifreeze is permitted by NFPA 13, NFPA 13R and NFPA 13D for use in fire sprinkler systems. Only "Food Grade" (pure 95% grade Glycerin or Propylene Glycol) antifreeze is currently allowed to be used in fire sprinkler systems that are connected to any potable water source. When CPVC pipe is used in a fire sprinkler system, the only antifreeze that is allowed to be used is glycerin.

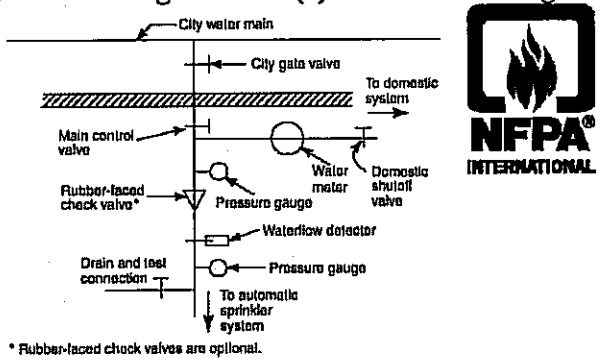
Backflow preventer approvals include the following organizations:

- The Foundation for Cross-Connection Control & Hydraulic Research at the University of Southern California
- Underwriters Laboratories - listed (classified) for friction loss and body strength
- Factory Mutual - Friction loss and body strength

NFPA13D Installation Arrangements

NFPA 13D expresses a preference for arranging the connection to a public water supply in Figure A.6.2 (shown below). The connection includes a single supply from the water main into the house. Once inside the house, the water delivery is split so that the domestic system is isolated from the fire sprinkler system. The water meter is only installed on the domestic portion, and therefore does not need to be included in the hydraulic calculations for the fire sprinkler system, and does not need to have any special requirements as far as the sprinkler system is concerned.

NFPA 13D Figure A.6.2 (a) Preferable Arrangement



The advantage to the configuration shown in Figure A.6.2(a) is that the only shut-off valve for the fire protected system also shuts off water to the domestic system. This encourages people to keep their sprinkler systems operational.

There has been significant discussion about the use of water meters on sprinklered lines. Some water purveyors want the fire sprinkler portion of the system to have a water meter, however, this practice should be discouraged on systems with waterflow alarms. Fire

sprinkler systems are closed systems that do not have outlets where the homeowner can readily take water. A fire sprinkler system with a waterflow alarm will warn purveyors if an occupant of a home inappropriately attempts to take water. Given all of the problems that water meters bring to fire protection (excess friction loss, flow restriction, increased cost) it would be better to do without them. In the long run, the fire sprinkler systems will save water purveyors money by reducing the amount of water used in fighting fires in homes. The elimination of the meter on the fire sprinkler portion of the system is a small price to pay for the life safety and water savings that the sprinkler's provide.

Figure A.6.2(b) of NFPA 13D shows another acceptable arrangement. This arrangement uses two separate supply lines from the water main into the building, one for the domestic usage and one for the fire sprinkler system. The domestic line contains a water meter while the fire sprinkler line does not. See the discussion above for justification on not putting a meter on the fire sprinkler line. This arrangement is not preferred because of the additional cost of the second supply line into the house. The homeowner should not have to pay for two separate lines.

NFPA 13D Figure A.6.2 (b) Acceptable Arrangement with Valve Supervision – Option 1

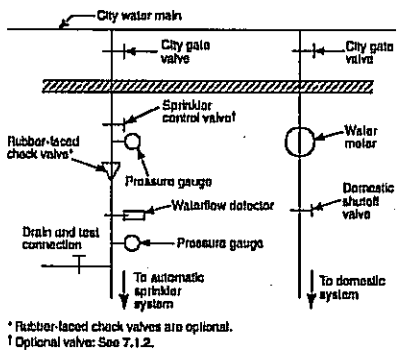
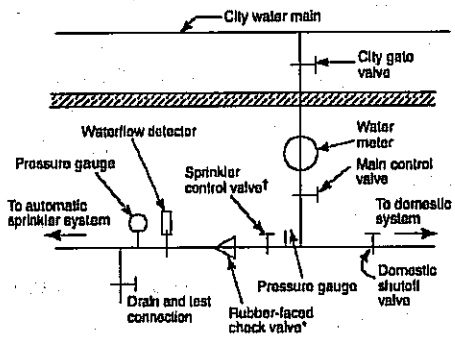


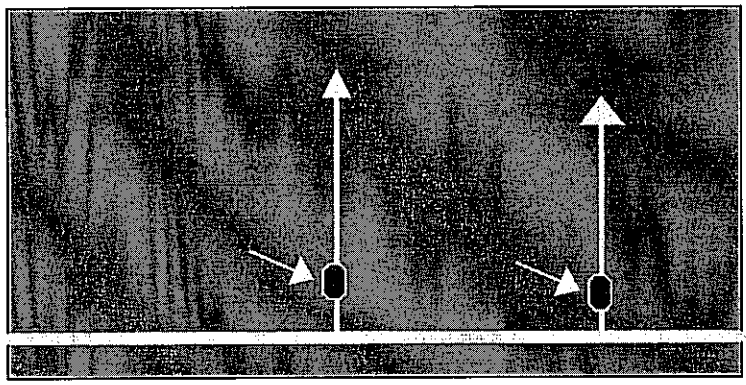
Figure A.6.2(c) of NFPA 13D shows another acceptable arrangement. This is actually similar to the preferred arrangement shown in Figure A.6.2(a), but includes a water meter on the main supply for both the fire sprinkler and the domestic water systems. While this is acceptable, the cost of the larger meter is considerable and the meter will need to be of a type that will not cause problems for the fire sprinkler system. The friction loss of the meter will need to be included in the hydraulic calculations of the fire sprinkler system.

NFPA13D Figure A.6.2(c) Acceptable Arrangement with Valve Supervision – Option 2



* Rubber-faced check valves are optional.
† Optional valve: See 7.1.2.

The following figure, showing a separate domestic service and fire protection service, each with its own meter is not referenced in NFPA 13D and is not considered acceptable for fire protection.



Hydraulic Requirements

NFPA 13D: (1-2 sprinkler design area)

- The design must include the flow and pressure for the most demanding pair of sprinklers in the same room. If all of the rooms in the home can be protected by a single sprinkler, then the design is just for a single sprinkler.
- Sprinklers are listed with a minimum flow discharge to cover a specific area. The flow is not permitted to be less then 0.05 gpm/sq ft. The flow is up to the manufacturer to declare and is different for each models of sprinkler. The manufacturer must prove that the flow from the sprinkler will control a severe fire in tests performed by independent laboratories. Examples of listed residential sprinklers are the Reliable model R3516 recessed pendent sprinkler listed to cover a 12 ft by 12 ft area at a minimum flow of 13 gpm at 7 psi and a Tyco model TY2596 concealed pendent sprinkler is listed to cover a 20 ft x 20 ft area at a minimum flow of 24 gpm and a minimum pressure of 32.7 psi.

NFPA 13R: (1-4 sprinkler design area)

- The design covers all of the sprinklers in the most demanding room up to a maximum of four sprinklers. If all of the rooms are protected with less than four sprinklers, the design will be for all of the sprinklers in the most demanding single room.
- Sprinklers are listed with a minimum flow discharge to cover a specific area. The flow is not permitted to be less then 0.05 gpm/sq ft. The flow is up to the manufacturer to declare and is different for each models of sprinkler. The manufacturer must prove that the flow from the sprinkler will control a severe fire in tests performed by independent laboratories. Examples of listed residential sprinklers are the Reliable model R3516 recessed pendent sprinkler listed to cover a 12 ft by 12 ft area at a minimum flow of 13 gpm at 7 psi and a Tyco model TY2596 concealed pendent sprinkler is listed to cover a 20 ft x 20 ft area at a minimum flow of 24 gpm and a minimum pressure of 32.7 psi.

NFPA 13: (4 sprinkler design area)

- When using residential sprinklers, the design area includes the four hydraulically most demanding sprinklers regardless of how many sprinklers are in the most demanding room. If the most demanding room does not have four sprinklers, additional sprinklers are added from adjacent rooms.
- The minimum required discharge from each sprinkler must be per the listing requirements of the sprinkler (see examples above) which are not permitted to be below 0.1 gpm/sq ft over the design area.

Rural water supply options

The majority of fire sprinkler systems use a public water main as the source of water supply. In rural and suburban areas without public mains, fire sprinklers are the most affordable and economic form of fire protection. In rural communities, where fire departments are farther away, and response times are often affected by the number of volunteers that can be assembled, a fire can destroy most of a building before the fire department ever arrives. Once the fire department arrives, water must be obtained from somewhere to fight the fire. Whenever a building is constructed, consideration needs to be given to how much water will be needed to fight a fire in that building. The water must be either available at the sight, or the fire department must be capable of delivering the water in a timely fashion. Calculating how much water will be needed is a function of the building's construction, size, use, contents and the fire protection systems installed.

In sprinklered buildings, the Required Fire Flow is generally the demand for the fire sprinkler system, which is much less than the demand of an unsprinklered building. This can save a community hundreds of thousands of dollars in construction costs and fire department operating budgets.

Rural water supply options include the following for supplying water to a fire sprinkler system when a public main is not available:

- Elevated tank
- Storage tank with a pump
- Pressure tank
- Underground well

Each of the options has advantages in certain situations. For all of these options, the two critical things to consider are:

1) Is the capacity of the water supply large enough to provide the demand of the sprinkler system over the required duration?
2) Is the method of obtaining water pressure adequate to provide the minimum necessary pressure at the highest, most remote sprinkler in the system?

There are a number of formulas and methods for determining the needed fire flow for a subdivision of homes. The Uniform Fire Code and NFPA 1142 each contain tables that provide the needed fire flow calculated by considering the most demanding building in a subdivision. Each of these fire flow calculation methods contains significant reductions for fully sprinklered buildings and communities, which will help save the water purveyor in the development and maintenance costs of their own mains and distribution systems.

Water Department Fees

Many water purveyors require people that make connections to their water mains to pay "standby fees" in order to maintain their connections, even if they use little or no water. The justification for these fees is that the water purveyor makes the water available, and incurs some cost in doing so, making it logical that the person with the connection pay for the fact that the water was available for use. While this practice makes sense with many types of voluntary connections, it does not make sense with fire sprinkler systems.

Consider two identical homes right next door to each other; one with a fire sprinkler system, the other without. If a fire occurs in the home with a fire sprinkler system, the amount of water used to fight that fire will be tremendously less than the amount of water used to fight the fire that would occur in the unsprinklered home. Yet, if standby fees were being charged for the sprinklered home, the person spending their own money to save the water department money would be expected to pay an extra standby fee, while the person wasting the water purveyor's money (without the fire sprinkler system) is encouraged to continue the waste by not having to pay a standby fee.

Rather than charge standby fees, water purveyors are encouraged to build a fee structure based on the Required Fire Flow necessary to fight a fire in the building. A fee structure based on the fire flow would get everyone who relies on water for fire protection to pay for it, rather than allow people without sprinkler systems to skate by without paying their fair share. At the same time, such a fee structure would recognize the fact that less water is used in sprinklered buildings by charging people with sprinklered buildings less. This

would be a fair way to share the cost of fire protection in a community without penalizing building owners who install fire sprinkler systems. This fee structure could actually increase the revenue for the water purveyor.

Scottsdale, Arizona, has been a sprinklered community for more than 15 years and has more than 50 percent of the homes protected with fire sprinkler systems. According to the Scottsdale Report, there was less water used in fires in the homes with sprinklers. Sprinkler systems discharged an average of 341 gallons of water/fire as compared to 2,935 gallons of water/fire released by firefighter hoses. Many water departments and communities have recognized this savings by developing incentives for the installation of fire sprinkler systems. The following are some examples of incentives:

- California AB 2943 – Water Charges: Residential Fire Sprinkler Systems. Under existing law, local water suppliers impose charges for water service in accordance with various requirements. This bill would prohibit a local water supplier that supplies water to retail customers from imposing or increasing water charges solely due to the installation of a residential fire sprinkler system. The bill was referred to the State Assembly Committee on Local Government on March 30, 2006.

- The City of Altamonte Springs, FL allows a 40% credit against the water connection charge for residential occupancies which have a sprinkler system installed.

- The Kentucky Public Service Commission ordered all utilities that currently access a minimum monthly bill for fire protection services to file a new rate structure and to eliminate standby fees.

- The City of Erie, PA has made a decision to provide a rate relief which would provide a 67% decrease for sprinkler standby fees and a 35% for sprinkler connections of 2 inches or less.

- M31, *Distribution System Requirements for Fire Protection,* mentions that water utilities can levy a one-time capital recovery fees or annual standby charges for fire protection systems. These charges should be based on the actual cost to provide the service.

- M1, *Principals of Water Rates, Fees, and Charges,* recognizes that sprinklers can reduce fire demands by faster, more efficient extinguishing of fires. In additi0n, private sprinkler connections use significantly less water than hydrants for fire fighting; as a result, they may reduce actual fire demands, because water is typically supplied only in the area if the fire. Accordingly, it is argued, there should be no additional charges for private fire service.

Maintenance

NFPA 13D, section A.4.2.1 provides information on residential sprinkler maintenance. It is the responsibility of the building owner for properly maintaining a sprinkler system. They should understand how the sprinkler system operates. A minimum monthly maintenance program should include the following:

(1) Visual inspection of all sprinklers to ensure against obstruction of spray.
(2) Inspection of all valves to ensure that they are open.
(3) Testing of all waterflow devices.
(4) Testing of the alarm system, where installed. (Note that where it appears likely that the test will result in a fire department response, notification to the fire department should be made prior to the test.)
(5) Operation of pumps, where employed. (See NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection.*)
(6) Checking of the pressure of air used with dry systems.
(7) Checking of water level in tanks.
(8) Special attention to ensure that sprinklers are not painted either at the time of installation or during subsequent redecoration. When sprinkler piping or areas next to sprinklers are being painted, the sprinklers should be protected by covering them with a bag, which should be removed immediately after painting is finished.

The most important thing that a homeowner needs to remember is what NOT to do to a sprinkler system. Do not hang objects from the sprinklers or the pipe. Do not paint, coat or obstruct the sprinklers. And do not turn off the control valve. These simple rules will ensure that the sprinkler system is functional for years to come.